User Guide

Spectrum Master™ MS276xA

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
MS2760A-0145 - 9 kHz to 145 GHz
MS2760A-0170 - 9 kHz to 170 GHz

MS2762A-0032 - 6 GHz to 32 GHz
MS2762A-0044 - 6 GHz to 44 GHz
MS2762A-0050 - 6 GHz to 50 GHz
MS2762A-0070 - 6 GHz to 70 GHz
MS2762A-0090 - 6 GHz to 90 GHz
MS2762A-0110 - 6 GHz to 110 GHz
MS2762A-0145 - 6 GHz to 145 GHz
MS2762A-0170 - 6 GHz to 170 GHz

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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.

Compliance Notifications

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, the product data sheet, and its declaration of conformity on https://www.anritsu.com.

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, LVD, RoHS, and RED directives of the European Union (EU).

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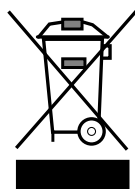
Equipment Marked with the crossed-out Wheelie Bin symbol complies with the European Parliament and Council Directive 2012/19/EC (the "WEEE Directive") in the European Union.

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.

UKCA Conformity Marking

Anritsu affixes the UKCA Conformity marking onto its conforming products in accordance with the United Kingdom conformity assessment body (CAB) in order to indicate that these products conform to the market of Great Britain (England, Wales, and Scotland).

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)	×	〇	×	〇	〇	〇
机壳、支架 (Chassis)	×	〇	×	×	〇	〇
其他（电缆、风扇、 连接器等） (Appended goods)	×	〇	×	×	〇	〇

〇：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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这个标记是根据 2016/1/21 公布的「电子信息产品污染控制管理办法」以及 SJ/T 11364-2014「电子信息产品污染控制标识要求」的规定，适用于在中国销售的电子信息产品的环保使用期限。仅限于在遵守该产品的安全规范及使用注意事项的基础上，从生产日起算的该年限内，不会因产品所含有害物质的泄漏或突发性变异，而对环境污染，人身及财产产生深刻地影响。

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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The following trademark acknowledgments are listed for one or more of the products listed on the title page.

- Windows is a registered trademark of Microsoft Corporation.
- 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/ms276xa

PN: 10580-00427 Rev. M

Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Chapter 1 — General Information

1-1 Scope of Manual

This manual provides general information, as well as installation and operating information for the Anritsu MS276xA Spectrum Master Ultraportable Spectrum Analyzers and Spectrum Master User Interface Software.

1-2 Introduction

This chapter contains general information about the Anritsu MS276xA family of spectrum analyzers and software. It includes the following information:

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

1-3 Document Conventions

The following conventions are used throughout the MS276xA documentation set.

User Interface

The MS276xA user interface consists of menus, buttons, toolbars, and dialog boxes.

User Interface Navigation

Elements in navigation paths are separated as such: MARKER > PEAK SEARCH > NEXT PEAK.

1-4 Software and Documentation

All software and documentation for the MS276xA spectrum analyzer are available online on 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; Anritsu recommends users check http://www.anritsu.com to ensure you have the latest versions.

Refer to the *MS276xA 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:

- MS276xA 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 Flyer

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   Instrument Identification

All Anritsu spectrum analyzers are assigned a unique seven-digit serial number, such as "0701016". The serial number is printed on a label 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. When identifying a frequency option for the MS276xA, that option number is appended after the model number, for example: MS2762A-0170.

1-7   Instrument Description

The Anritsu MS276xA are innovative mmWave spectrum analyzers delivering basic spectrum analysis capabilities in an unimaginably small form-factor. They do this well below the price point of traditional spectrum analyzers. They connect to and communicate with a PC via USB. They can measure signals at frequencies as low as 9 kHz and up to 170 GHz. They are ideal for the testing of many mmWave applications such as 802.11ad, wireless backhaul, automotive radar, radio astronomy, and other extremely high frequency applications.

The MS2760A models utilize mixer based conversion for lower frequencies and sampler based conversion above 6.15 GHz. The MS2762A models are purely sampler based with the initial frequency starting at 6 GHz. The sampler-based portion of the MS276xA exploits Anritsu's patented Non-Linear Transmission Line Technology (NLTL), a sampling technology in a customized Radio Frequency Integrated Circuit (RFIC). The MS276xA family employs software algorithms to reduce or eliminate unwanted image responses. While most images are effectively removed, some low-level image responses close to the noise floor might be seen when making multi-toned or modulated signal measurements. These effects can be more noticeable when measuring modulated signals with wide bandwidth, while simultaneously sweeping across a broadband. For broadband analysis of active DUTs, the MS276xA performance is best when the DUT signal is CW, or very narrow BW in nature.

Note	The MS276xA uses a USB 3.0 Type C interface for PC and remote communication and requires USB 3.0 as a power source.

Status Indicator and Connectors

Connectors and status indicator for the Spectrum Master are shown below in Figure 1-1.

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 0.9 N·m (8lbf·in) 50 GHz and 70 GHz Instruments: V Connector (1.85 mm), male 50 Ω, torque 0.9 N·m (8lbf·in) 90 GHz and 110 GHz Instruments: W Connector (1.00 mm), male 50 Ω, torque 0.45 N·m (4lbf·in) 145 GHz and 170 GHz Instruments: 0.8 mm Connector, male 50 Ω, torque 0.45 N·m (4lbf·in) For the MS2760A, max RF input level is +30 dBm (1 W) CW. For the MS2762A, max RF input level is +18 dBm (63 mW) CW.

Figure 1-1.   Spectrum Master Connectors and Status Indicator

1-8   Instrument Care and Preventive Maintenance

Instrument care and preventive maintenance consist of proper operation in a suitable environment and occasional cleaning of the instrument, and inspecting and cleaning the RF connectors and all accessories before use. Clean the instrument body with a soft, lint-free cloth dampened with water or water and a mild cleaning solution.

Caution	To avoid damaging the display or case, do not use solvents or abrasive cleaners.

Caution	Do not operate or store the Spectrum Master in extreme environments. Refer to the instrument Technical Data Sheet for the specified operating and storage conditions.

Connector Care

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of the female connectors and the pins of the male connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are undamaged, gauge the connectors to confirm that the dimensions are correct. Visually inspect the test port cable(s). The test port cable should be uniform in appearance and not stretched, kinked, dented, or broken.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the connectors. The recommended torque settings are given in Figure 1-1, "Spectrum Master Connectors and Status Indicator" on page 1-3. Inadequate torque settings can affect measurement accuracy. Over-tightening connectors can damage the cable, the connector, the instrument, or all of these items.

Visually inspect connectors for general wear, cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can harm the instrument. Connection of cables carrying an electrostatic potential, excess power, or excess voltage can damage the connector, the instrument, or both.

Connecting Procedure

1. Carefully align the connectors. The male connector center pin must slip concentrically into the contact fingers of the female connector.

2. Holding alignment, push connectors straight together. Do not twist or screw them together. A slight resistance can usually be felt as the center conductors mate.

3. To tighten, turn the connector nut, not the connector body. Major damage can occur to the center conductor and to the outer conductor if the connector body is twisted.

4. If you use a torque wrench, initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

   Relieve any side pressure on the connection (such as from long or heavy cables) in order to assure consistent torque. Use an open-end wrench to keep the connector body from turning while tightening the connector nut with the torque wrench.

   Do not over-torque the connector nut.

Disconnecting Procedure

1. If a wrench is needed, use an open-end wrench to keep the connector body from turning while loosening with a second wrench.

2. Complete the disconnection by hand, turning only the connector nut.

3. Pull the connectors straight apart without twisting or bending.

ESD Caution

The Spectrum Master, like other high performance instruments, is susceptible to electrostatic discharge (ESD) damage. Coaxial cables and antennas often build up a static charge, which (if allowed to discharge by connecting directly to the instrument without discharging the static charge) might damage the Spectrum Master input circuitry. Instrument operators must be aware of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. Because these apply to the Spectrum Master, Anritsu recommends that any static charges that might be present be dissipated before connecting coaxial cables or antennas to the instrument. This might be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the Spectrum Master. It is important to remember that the operator might also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

1-9   Calibration and Verification

The Spectrum Master comes fully calibrated from the factory and there are no field-adjustable components. Anritsu recommends annual calibration and performance verification by local Anritsu service centers. Accredited calibration to ISO17025 and ANSI/NCSL Z540-1 are available and can include a calibration certificate, test report, and uncertainty data. Contact Anritsu sales and service centers for more information.

1-10   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 MS276xA 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 7.5 cm 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.

1-11   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 MS276xA spectrum analyzers and software, including:

- Hardware and software requirements for the Anritsu Spectrum Master software
- Procedure for installing the Spectrum Master software

2-2 Hardware and Software Requirements

These 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 10 and Windows 11, (64-bit required for all versions)
- 100 MB hard-disk free space
- Display resolution 1024 × 768
- SuperSpeed USB 3.0 (required)

2-3 Installing the MS276xA Software and Drivers

The Spectrum Master application and drivers must be installed before using the Spectrum Master MS276xA instrument. Follow these steps as a guide for proper installation:

1. Go to http://www.anritsu.com and type MS276xA into the search. Find the Spectrum Master MS276xA software from the Downloads section and download the MS276xA installer .exe file.

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

Note	The figures in this section are example dialogs that display during the installation process. The actual version and time stamp you see might be different.
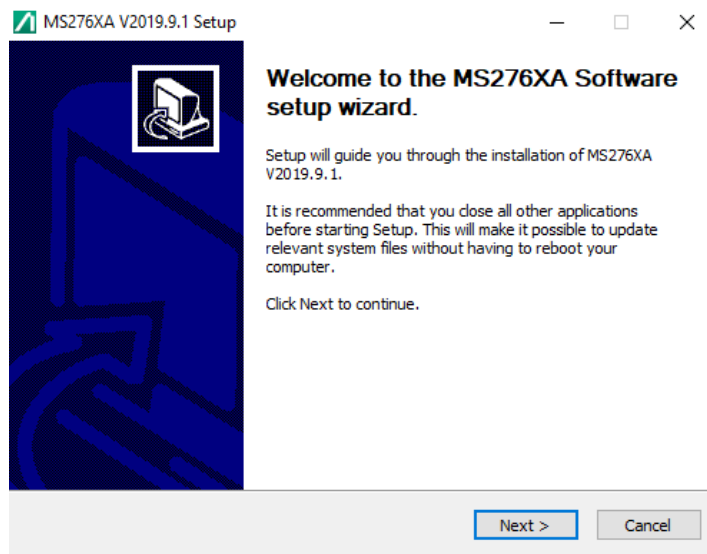
Figure 2-1. Anritsu Welcome Screen

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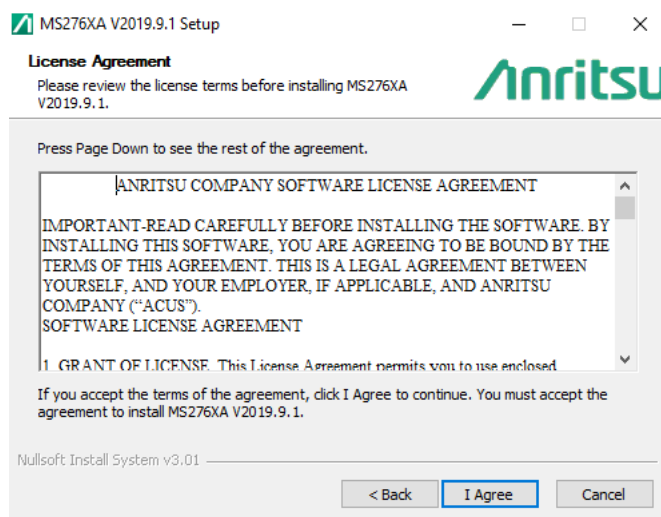
Figure 2-2.   Spectrum Master License Agreement

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

5. Select the desired options to be installed.

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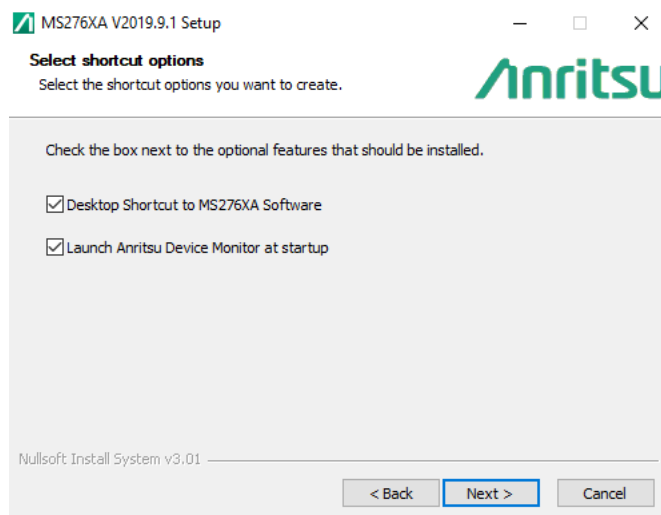
Figure 2-3.   Select Shortcut Options Dialog

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

Note	If you choose not to have the Device Monitor launch after installation, you will have to launch it manually before the MS276xA will connect to the software.
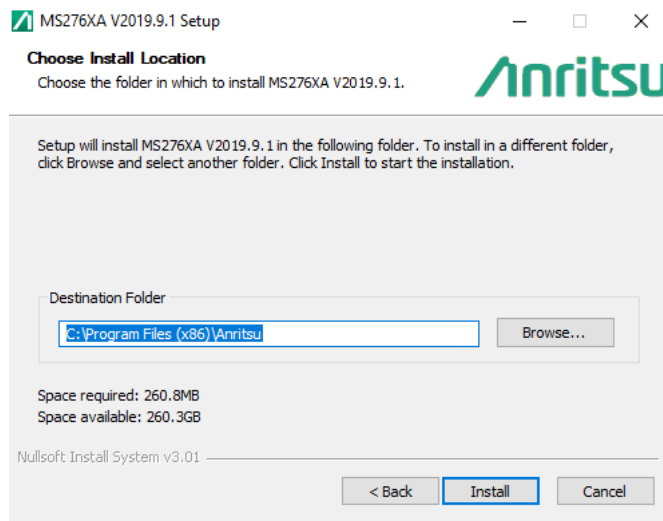
Figure 2-4.   Choose Install Location Dialog

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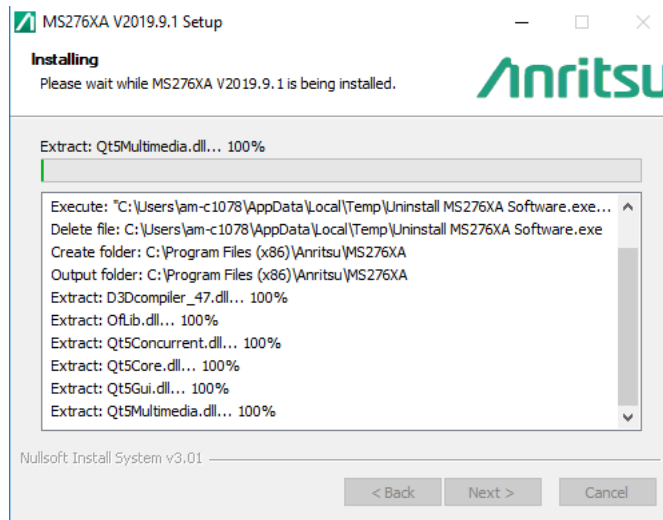
Figure 2-5.   Installing Dialog

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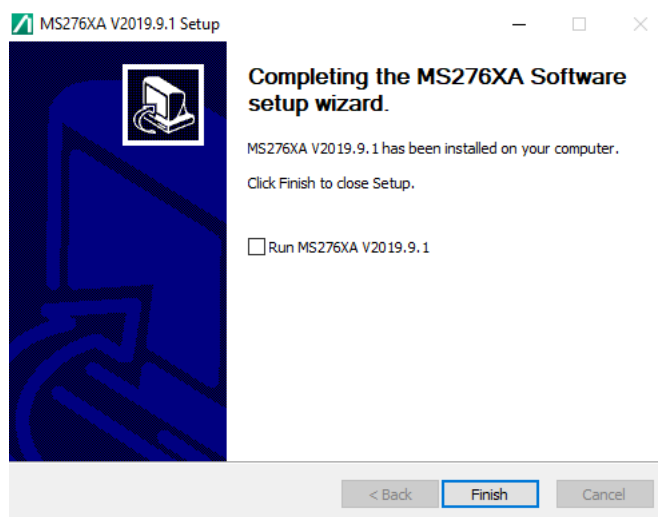
Figure 2-6. Anritsu Spectrum Master Installation Complete

During the first installation, the following dialog may display and can be closed. It has no bearing on the installation process or functionality of the MS276xA.
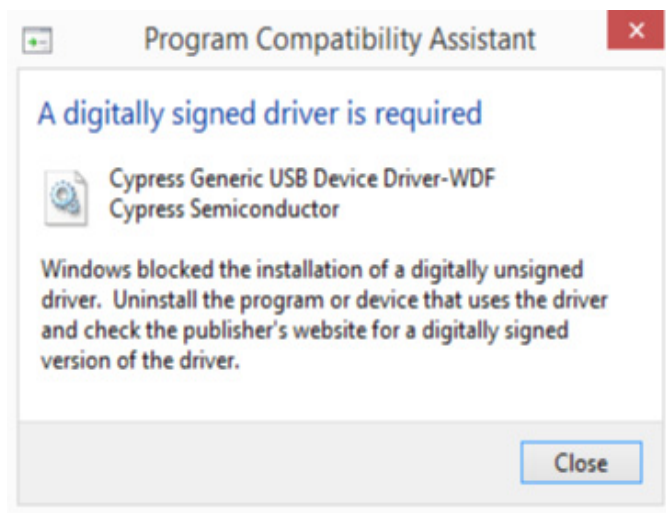
Figure 2-7. Installation Driver Dialog

2-4   Connecting to a Personal Computer, Laptop, or Tablet

1. Confirm that the Anritsu Device Monitor is running before attaching the MS276xA 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.
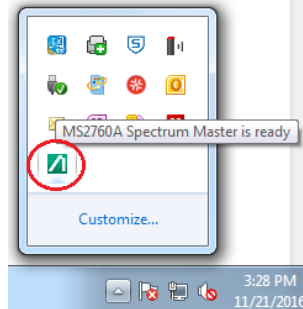
Figure 2-8.   Anritsu Device Monitor Displayed.

3. Attach the mini-connector of the USB cable to the MS276xA.

4. Attach the standard connector of the USB cable to a USB 3.0 super speed (SS) port on the personal computer, laptop, or tablet. USB 3.0 PC ports are typically blue in color. See Figure 2-9.

Figure 2-9.   USB Ports

5. The MS276xA will go through this initialization process and display status updates. This process typically completes in about 10 to 15 seconds. After the final update "MS276XA-0XXX Spectrum Master is ready" message displays, you may then run the MS276XA application software.
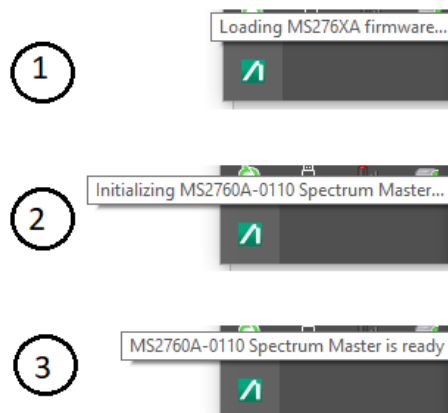
Figure 2-10.   Initialization Process after Connection

6.   Run the MS276xA Software.

Figure 2-11.   MS276xA Connection to Tablet

2-5   Mounting the Hardware

The MS276xA can be mounted onto a tripod or installed into a rack mount or other custom bracket. The back of the instrument has a typical 1/4-20 x 5.0 mm long threaded tripod mount (compatible with most commercial and consumer tripods) that provides a convenient field setup. Each side of the instrument has two M2.5 x 0.45 mm threaded bracket mounts for modular or permanent installations. Refer to the MS276xA TDS for detailed outline drawings and dimensions.

Warning	The mounting screw lengths must not exceed 1/4-20 x 5.0 mm long or M2.5 x 6.4 mm long. Do Not over tighten the screws or allow them to penetrate into the instrument as damage could result.

Figure 2-12.   MS276xA Mounted to 1/4-20 Tripod (shows alternate M2.5 x 6.4 mm mounting screws)

Chapter 3 — Graphical User Interface Overview

3-1 Introduction

The MS276xA Spectrum Master software controls the spectrum analyzer and can be run from a Windows-based desktop PC, laptop, or tablet via USB 3.0 connectivity. The MS276xA Spectrum Master software controls all instrument functions and primary operation is through the touch screen display. The figure below identifies the main display areas, which are each described in more detail later in this chapter.
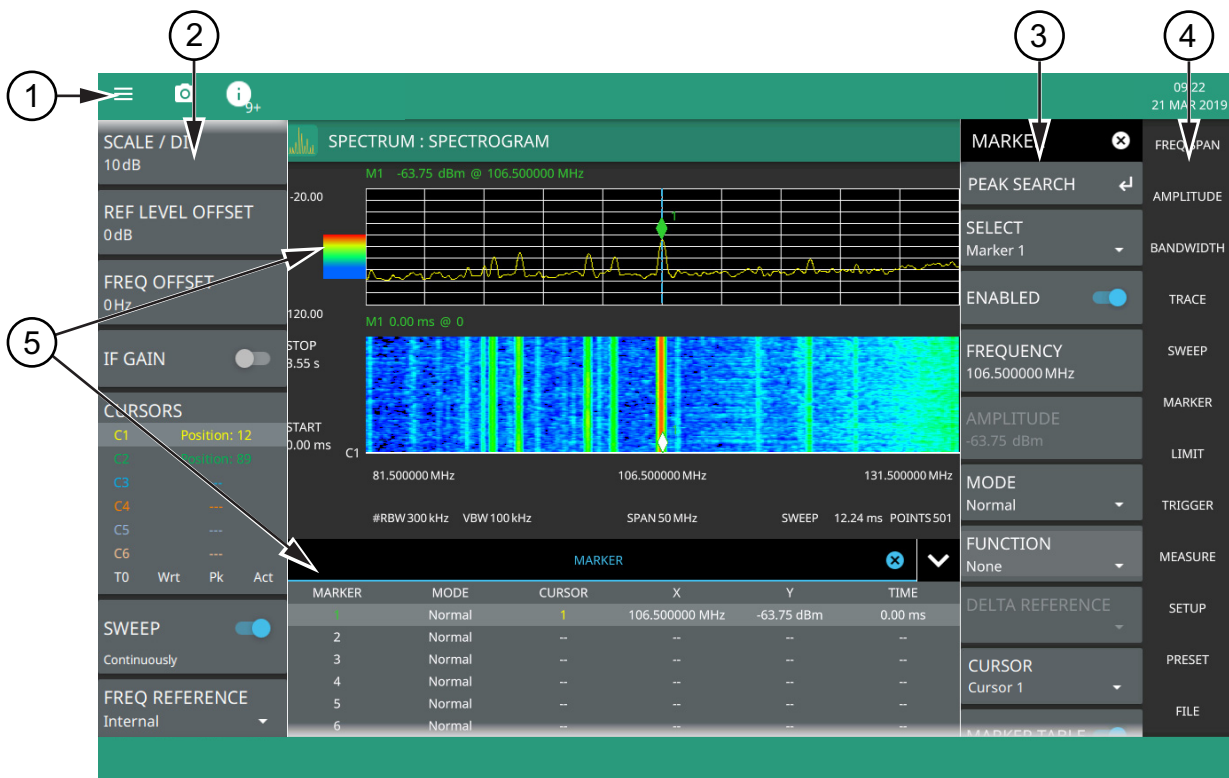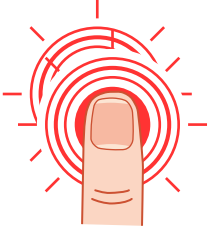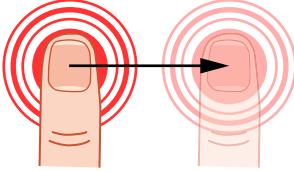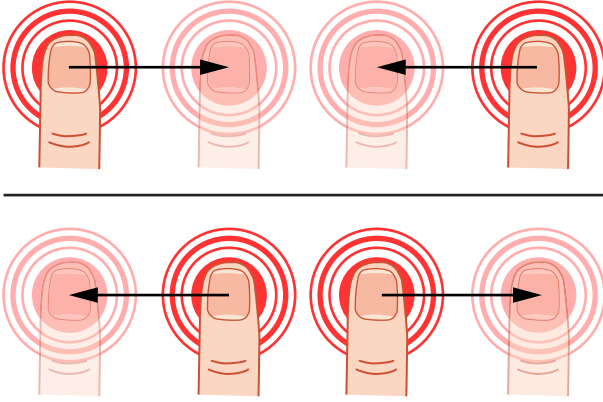
1. The title bar provides access to the system settings and informational dialogs.

2. The status and trace panel are used to show common settings and controls, and to provide trace and cursor information. The information displayed on this panel depends on the current measurement and view settings. Refer to the appropriate chapter in this guide for information about this panel.

3. Menus are used to configure measurement settings such as frequency, amplitude, and bandwidth, and to enable measurement modes and views such as Spectrogram view, OBW, and ACP measurements.

4. The main menu provides access to setting menus and other instrument controls.

5. The upper area typically displays graphical data such as spectrum trace and spectrogram plots. The lower area typically displays tabular measurement data such as marker data, demodulation results, or other measurement data depending on the selected measurement.

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

Operating a Touchscreen

If using a touchscreen display, Spectrum Master uses common touch gestures to achieve a variety of operations. These include interactions on hot areas by pressing, double pressing (or tapping), dragging, and pinching.
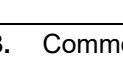
	Single Press: Most controls require a single press or tap. Touch the screen briefly and then release.
	Double Press: Some controls require a double press or tap. This action is similar to a double mouse click. If a second press is not detected in a certain time period, the action is dismissed or considered a single press.
	Press and Drag: Some items can be dragged to a new location. This action is accomplished by pressing and holding the item lightly while dragging it to a new location, then releasing. You can drag items such as markers, limit line nodes, and the center frequency by dragging the trace to the left or right.
	Pinch: Some items can be reduced or expanded. This action is accomplished by simultaneously pressing the item with two fingers and holding the item lightly when dragging the fingers in closer together or out farther apart, and then releasing. You can pinch items in or out, such as the frequency span by touching and holding the trace in two positions, and then dragging your fingers closer together to narrow the span or dragging your fingers farther apart to widen the span.

Figure 3-2.   Touch Screen Gestures

Common GUI Controls

In addition to the touch gestures described in the previous section, the following lists the most common controls that you will encounter when working with the Spectrum Master.

	☰	The 3-line icon provides access to system information, settings, file management. Refer to Section 3-3 "System Menu" on page 3-9.
	📷	The camera icon will capture a screen image and save it to a file. Refer to "Screenshot Setup" on page 3-10.
	ⓘ 9+	The notification icon provides access to informational and error messages. If displayed, the number indicates the number of notifications. Refer to "Notifications" on page 3-11 and Appendix A, "SCPI Error Table".
	⊗	The Close icon closes menus and dialogs.
	‹	The Chevron expands and collapses the status and table displays. A similar chevron on the virtual keyboard may be for capital letters or to scroll through key sets.
	⬤━	The Toggle icon enables or disables the associated feature. When highlighted in blue, the feature is enabled.
	▼	The Drop-down icon exposes a list of items from which to choose.
	⟳	The Refresh icon will restart a process, such as a sweep or averaging count.
	↩	The Preset icon brings up the Preset submenu.
	⏎	The Enter icon accepts an entry. A similar icon is found on menu buttons to indicate additional menus.
	🔒 🔓	Gesture lock and unlock icons indicate when the drag and pinch gestures have been toggled on or off. See Figure 4-6, "FREQ / SPAN Menu" on page 4-10 for information about gestures.

Figure 3-3. Common GUI Controls

Data Entry

User input can be in the form of numeric values for instrument or measurement settings, selected values from a preset list, or alphanumeric text when entering file names, for example.

To view or change a parameter value:

1. Access the appropriate menu or control.

2. Enter data using the data entry controls or attached physical keyboard. Some items can be accessed directly on the annotated display by touching their value.

Invalid Entries
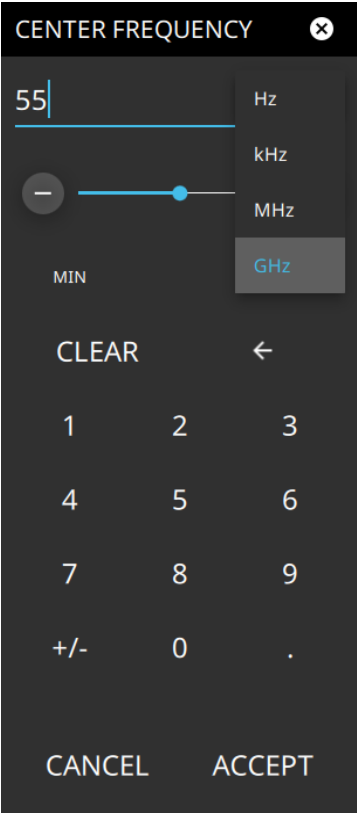
When setting parameters or entering other data, if an entry is out of range or is otherwise invalid, the Spectrum Master shades the background display and may provide a message indicating an invalid range. In this case, clear or cancel the entry and enter a valid value or change the units using the drop-down selection in the data entry window.
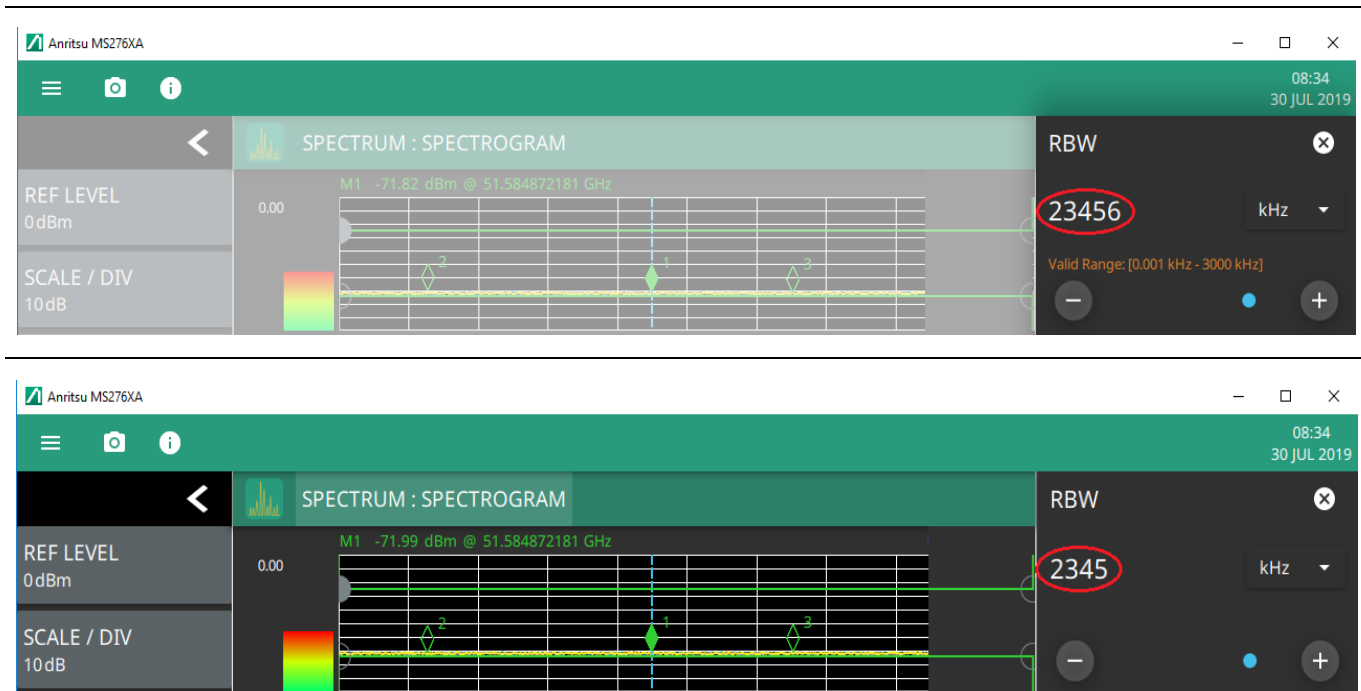
Figure 3-4.   Invalid (top) and Valid Numeric (bottom) Entries

Numeric Values

To modify a numeric parameter setting that is displayed on a menu or annotated field, press the item to make it active and to display the numeric keypad data entry control. Use the touch screen to enter or change the value.

The keypad typically provides controls to:

- Select an appropriate unit, such as frequency entries in Hz, kHz, MHz, or GHz, on the top, right corner drop-down of the entry field.
- Enter values directly with the keypad or keyboard numberpad after clicking in the entry field.
- Drag a parameter value within its settable range using a sliding control.
- Increment the parameter value up or down. At each end of the slider are plus (+) and minus (−) controls that increment the parameter value. Most parameters have a fixed increment, such as bandwidth that follows a 1:3:10 sequence and span that follows a 1:2:5:10 sequence. In the case of frequency, you can set a custom frequency step increment value. After the entry is complete, press the desired unit or press ACCEPT to complete the entry.
- Set the parameter to the maximum or minimum possible value.
- CLEAR the entire entry.
- Backspace to delete all or part of the entry.

Press CANCEL to terminate any entries made for that particular setting. Note that pressing the "X" to close the keypad is the same as pressing CANCEL. Canceling restores the settings to the state they were in before the keypad opened, even if changes are already reflected in the data display.

Press ACCEPT to operate with the settings displayed on the keypad.

Figure 3-5.   Touchscreen Keypads

If using a tablet, a physical keyboard (connected via USB, Bluetooth, etc.) can also be used to enter values in a similar manner and the keyboard ENTER key used to accept the new value.

Selection Lists

Some parameters and instrument functions are selectable from lists. These list boxes display the available selections and value limits as applicable. Use the touch screen to scroll through the list and select the desired entry.
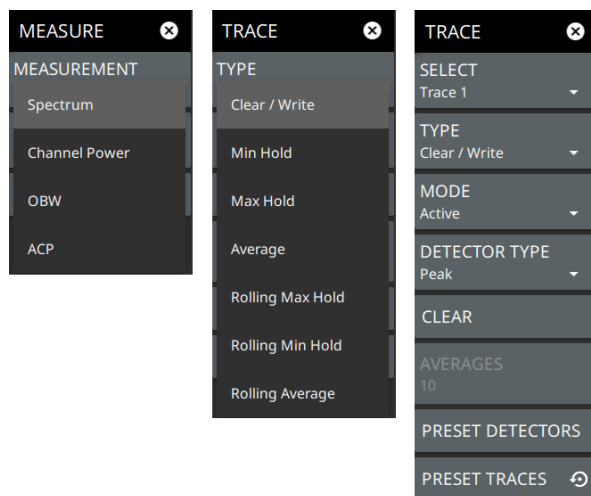
Figure 3-6.   Selection Lists

To cancel selection, touch or click any where away from the menu.

Scroll Indication

In some cases, menus, status panels, or other lists contain more information than can be displayed in the available area. In these cases, the top or bottom of the panel will have a fade-to-white appearance as shown Figure 3-7. You can scroll the control to move it up or down and expose the hidden information.
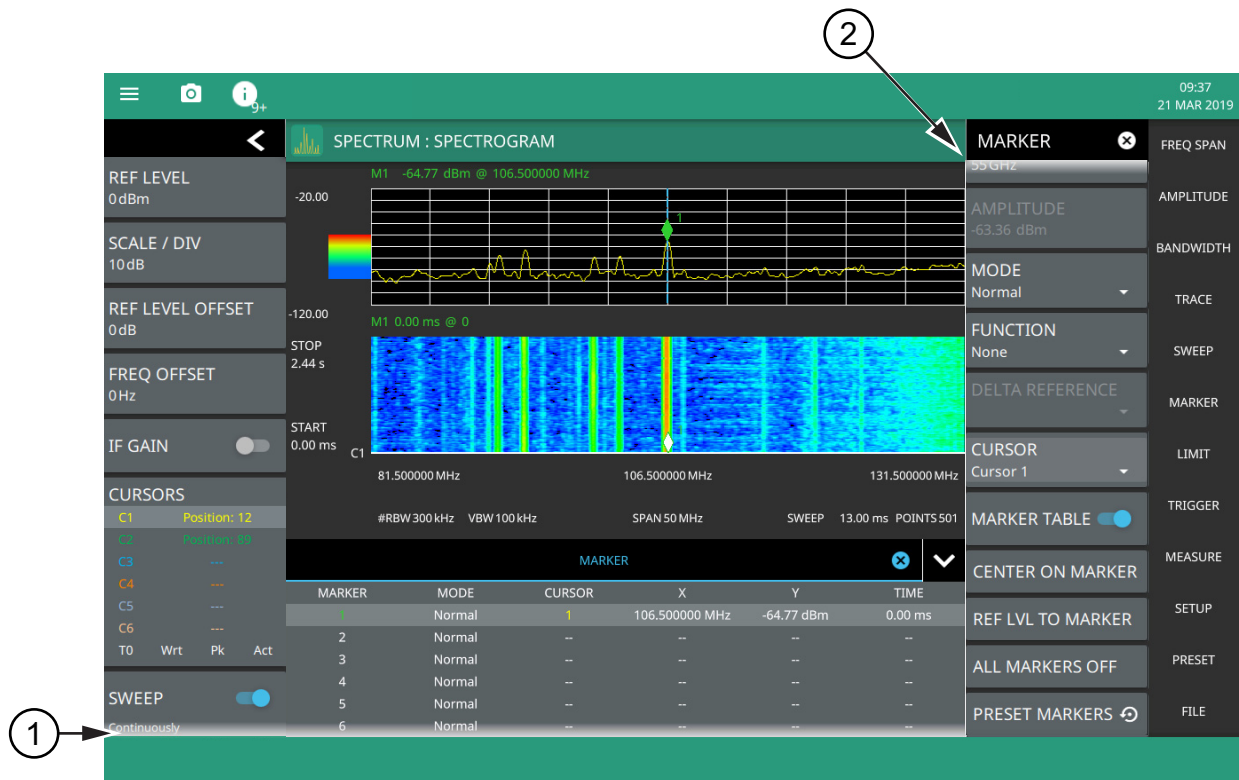
1. The fade-to-white at the bottom of the status panel and marker table here indicates that there is more information below the display area. The panel can be scrolled by dragging it upward to expose more information.

2. The fade-to-white at the top of the menu here indicates that there is more information above the display area. The menu can be scrolled by dragging it downward to expose the information.

Figure 3-7.   Scroll Indication

Note	If the display is set to another color theme, the fade effect remains the same but the color may fade to a darker shade.

3-2   Title Bar

The title bar is located at the top of the interface screen. It displays icons that provide access to information and user actions as described below. All of the icons are active and will open the appropriate menu or item when pressed.
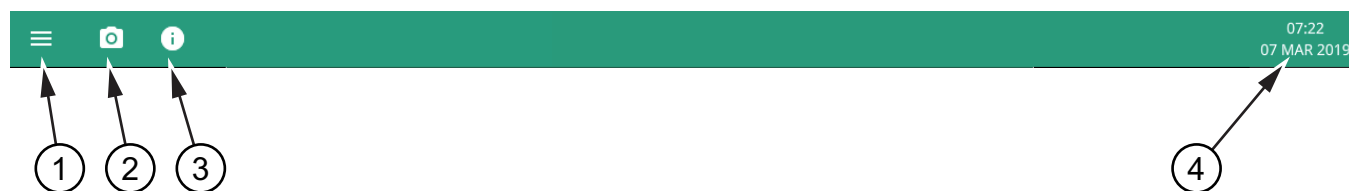
1. Displays the System Menu. The instrument model with frequency option, its serial number, and IP address are also displayed.

2. Captures a screenshot of the current display. The image file is saved in PNG format with the following naming scheme: screenshot_yymmdd_hhmmss.png (year, month, day, hour, minute, second). Using the Screenshot Setup, you can set the screen capture region, color theme, annotations, and destination directory.

3. Notifications are generated when an error is detected or an activity such as a screenshot has taken place. The number of unread notifications appears next to the icon. Press the icon to display the Notifications list.

4. Displays the current date and time.

Figure 3-8.   Title Bar

3-3   System Menu
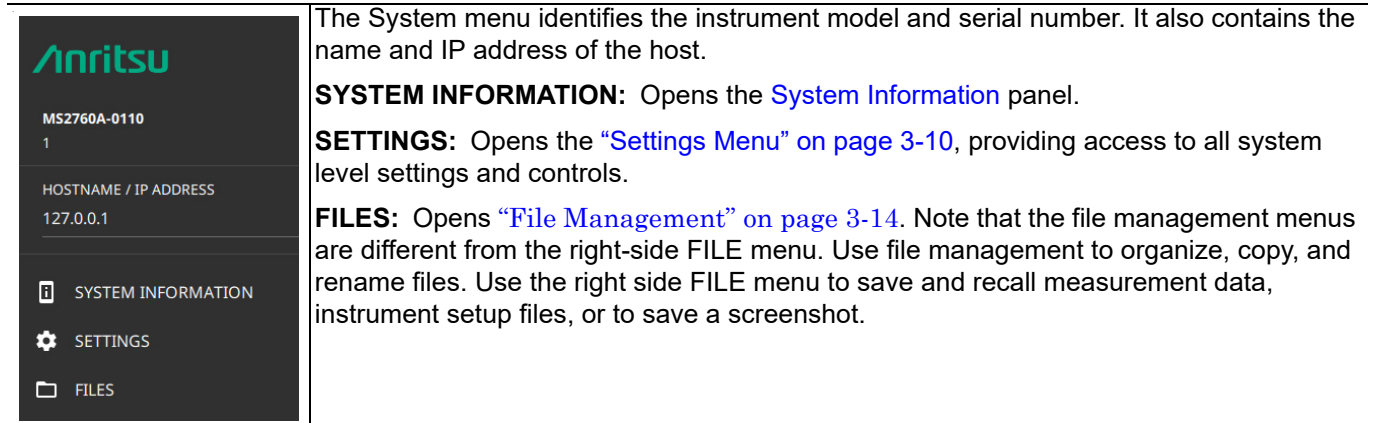
The System menu identifies the instrument model and serial number. It also contains the name and IP address of the host.

SYSTEM INFORMATION: Opens the System Information panel.

SETTINGS: Opens the "Settings Menu" on page 3-10, providing access to all system level settings and controls.

FILES: Opens "File Management" on page 3-14. Note that the file management menus are different from the right-side FILE menu. Use file management to organize, copy, and rename files. Use the right side FILE menu to save and recall measurement data, instrument setup files, or to save a screenshot.

Figure 3-9.   System Menu

System Information

The System Information panel shows information about connection.
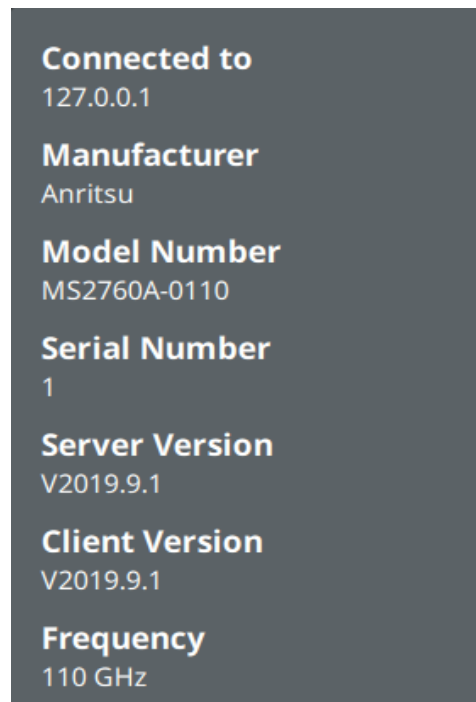
Figure 3-10. System Information

The information fields in this panel are:

- Connected to: The IP address of the server to which the instrument is connected.
- Manufacturer: The manufacturer of the instrument.
- Model Number: The model number of the instrument.
- Serial Number: The serial number of the instrument.
- Server version: The version number loaded onto the device or computer.
- Client version: The software version loaded onto the instrument.
- Frequency: The maximum frequency capability of the instrument.

3-4   Settings Menu

The System Settings menu provides access to the instrument display and screenshot settings..

DISPLAY: Opens the Display Settings.

SCREENSHOT: Opens the Screenshot Setup.
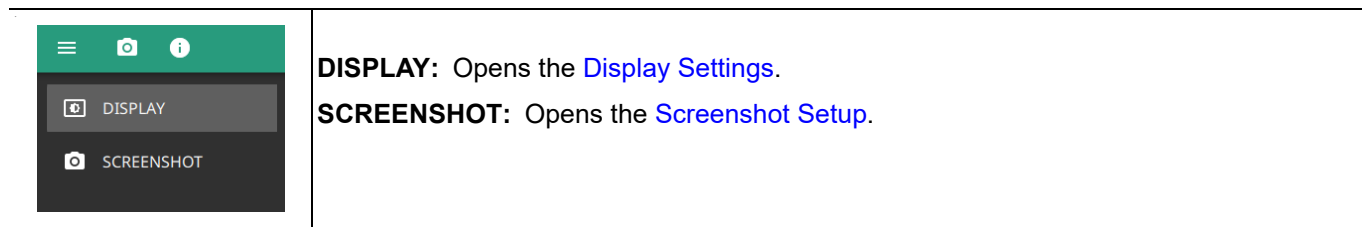
Figure 3-11. Settings Menu

Display Settings

The DISPLAY settings allow you to set the display to the Default or to the Light color scheme, the latter of which might be more suitable for viewing in bright ambient light conditions.
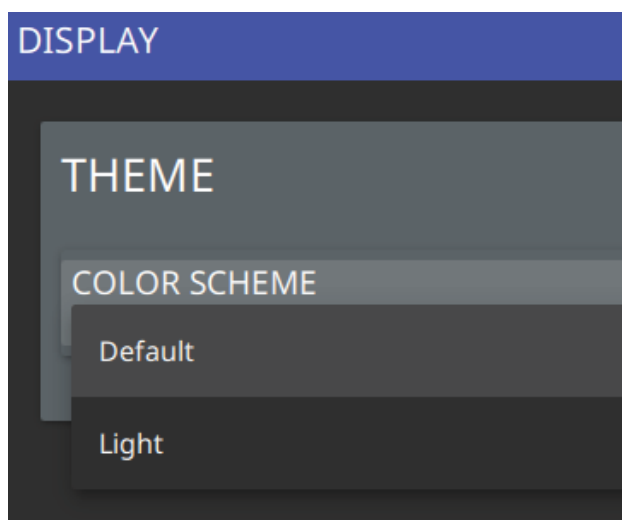
Figure 3-12. Display Settings

Screenshot Setup

1. Access the System menu (3-line icon in the upper left corner).

2. Press SETTINGS to access the instrument settings menu, then select SCREENSHOT to open the SCREENSHOT setup menu.
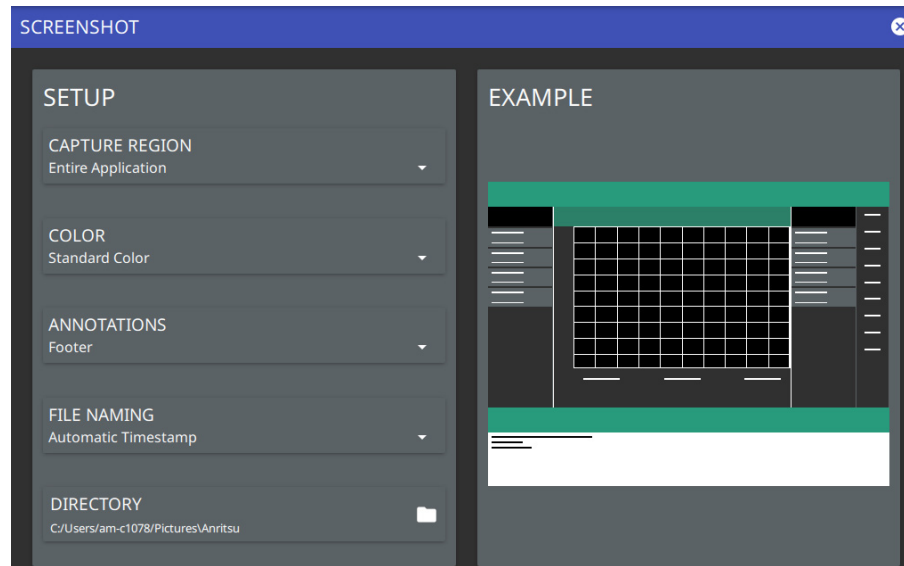
Figure 3-13. Screenshot Setup

SCREENSHOT setup lets you configure these interface settings:

- Capture region: entire application window or its graph area only
- Color: standard or printer-friendly
- Annotations: may be placed at top (header) or bottom (footer) of captured image
- File Naming: whether timestamp naming or manual naming is followed
- Directory: directory path to destination folder where the file is to be saved

3-5 Notifications

The notification area is where all dynamic notifications are presented. These notifications are generally information messages to the user and not hardware failure messages.
Refer to Appendix A, "SCPI Error Table" for more information.
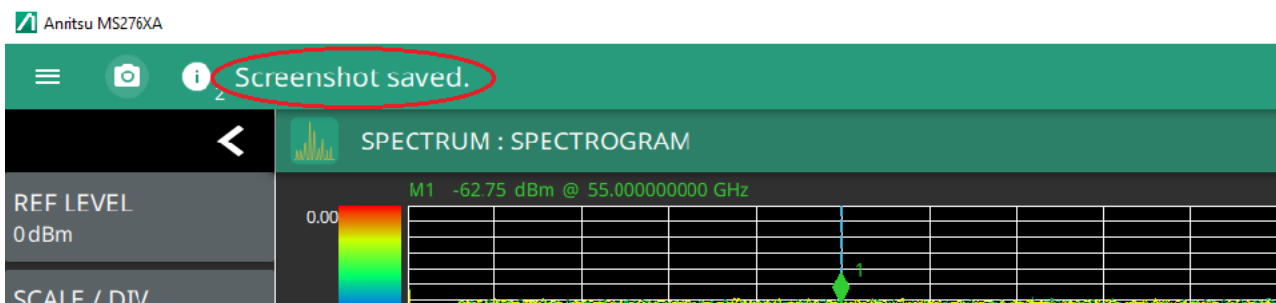
Figure 3-14. Notifications

3-6   Saving and Recalling Measurements

The Spectrum Master can save measurement setups, native trace and CSV trace data, limit line setups, and screenshots. You can recall setup, native trace, and limit line files. Refer to "File Management" on page 3-14 for other file operations such as copy, move, and directory management.

Saving a Measurement

To save a measurement or setup:

1. Press FILE > SAVE AS...
2. If desired, change the destination.
3. Enter the desired file name using the keyboard.
4. Select the type of file to save from the Save as type selection list.
5. Press SAVE to save the file.

After a file has been saved, the QUICK SAVE feature can be used to quickly save the same type of file with an incrementing number appended to the end of the original file name. Refer to Figure 3-15 on page 3-13 for more information about QUICK SAVE.

Recalling a Measurement

You can recall a saved setup (*stp), native trace measurement (*.rsm), and a limit line (*.lim). When recalling a setup, the instrument setup and operating state will be restored as it was when the setup was saved. When recalling a trace measurement, the instrument setup and on-screen measurement data will be restored as it was when the trace data was saved.

To recall a measurement or setup:

1. Press FILE > RECALL...
2. Select the file location.
3. Select the desired file from the displayed list. You can use the file type filter to shorten the list if needed.
4. Press OPEN to recall the file.

When a trace measurement is recalled, the trace or sweep state will be set to hold. To restore active measurements, set TRACE > MODE > Active.

FILE Menu

The file menu in Figure 3-15, "FILE Menu" shows all possible selections. The available selections vary depending on the selected measurement and view. Refer to

QUICK SAVE: saves a setup file immediately with the name shown in the 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 AS: Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. You can save the following:

- Setup: Saves the current instrument setup (stp file type).
- Trace: Saves the measurement point (trace) data and the current instrument setup (rsm file type).
- Trace CSV: Saves the visible trace point data in comma separated value format (csv file type). This format is useful for further analysis using other software tools.
- Limit: Saves the current limit line point data (lim file type).
- Screenshot: Saves a screenshot of the current measurement (png file type).

RECALL: Opens the Recall File dialog to retrieve a file from a desired location. Only supported files will be displayed depending on the currently set measurement. When trace data are recalled, the instrument will change the settings to match the settings of the saved trace. The data will be recalled to the appropriate trace. That trace will be in a Hold mode. To exit the recalled data, simply change the trace mode back to Active.

SAVE ON EVENT: Opens the "SAVE ON EVENT Submenu" on page 3-13.

BROWSE FILES: Opens "File Management" on page 3-14.

Figure 3-15. FILE Menu

SAVE ON EVENT Submenu

SAVE ON EVENT saves the current trace data to a folder named with the current date and time (yyyymmddhhmmss) for various criteria.

LIMIT CROSSED: When enabled, measurement trace data are automatically saved when the trace crosses a limit line that has been specified in the Limit menu. If SINGLE is selected, the first event will be saved and the event will be set to OFF. If CONTINUOUS is selected, each event will continue to be saved.

SWEEP END: When enabled, measurement trace data are automatically saved after the current sweep is completed. If SINGLE is selected, the first sweep will be saved and the event will be set to OFF. If CONTINUOUS is selected, each sweep will continue to be saved.

INTERVAL: A save will occur periodically. Set the desired period by entering the time.

CLEAR ALL EVENTS: Press this button to turn off all save events at once.

Figure 3-16. SAVE ON EVENT Menu

File Management

1. Access the System menu (3-line icon in the upper left corner).

2. Press FILES to access the File Explorer.

Figure 3-17. Files Management

All file operations available in File Explorer are available here (move, copy delete, etc.). For help in opening saved files refer to "Saving and Recalling Measurements" on page 3-12.

3-7   Presetting the Analyzer

The preset menu sets certain settings to the default state. Preset only affects the current analyzer settings, such as those for the spectrum analyzer. Preset does not affect user files or system settings.

PRESET Menu

The PRESET menu restores settings to their default values. User data are not affected by the preset function.

PRESET TRACES: Presets all values on the TRACES menu to default values.

PRESET MARKERS: Presets all values on the MARKER menu to default values. All markers will be disabled.

PRESET LIMITS: Presets all values on the LIMITS menu to default values. All limit lines will be disabled.

PRESET SETUP: Presets all values on the SETUP menu to default values.

PRESET ALL: Presets all of the current analyzer settings to default values.

Figure 3-18. PRESET Menu

Chapter 4 — Spectrum Analyzer Measurements

4-1 Introduction

This chapter gives a brief overview of the MA276xA and assists you in your first uses of the instrument. It also provides a starting point for making basic measurement setups. It describes general instrument setup, including selecting the analyzer and setting up frequency, bandwidth, amplitude, span, limit lines, and markers. After measurements are taken, refer to "File Management" on page 3-14 and Section 4-20 "Saving and Recalling Measurements" for instruction in saving, recalling, and managing measurement files. For detailed information about other specific measurements, refer to the appropriate chapter in this guide.

This chapter includes sections that describe resolution bandwidth, video bandwidth, and sweep. For example, in the Spectrum Master, Resolution Bandwidth (RBW) 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 some time 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.

Spectrum analyzer measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. Section 4-15 through Section 4-18 cover field measurements including brief examples demonstrating channel power, occupied bandwidth, and adjacent channel power testing.

4-2   Spectrum Analyzer GUI Overview

This section illustrates the main graphical displays and menus presented for the spectrum analyzer.

Spectrum View

Spectrum view is the default view and is suitable for viewing signals in the frequency domain where signal amplitude, bandwidth, and harmonic qualities can be studied. Select spectrum view from MEASURE > VIEW > Normal. The sample display below is set up with a single trace enabled and with a marker and the upper limit line envelope set.

Figure 4-1.   Spectrum Analyzer: Spectrum View (1 of 2)

1. **Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings.

2. **Markers:** Markers are displayed as green diamonds on the trace to which they are assigned. The active marker is shown as a solid green diamond with a dashed vertical line. The marker amplitude and frequency are displayed in green text on the top left edge of the display. In this example, a marker is shown at the signal peak with the marker table enabled. Double-tap the marker to open a quick-access menu (refer to "Marker Quick-Access Menu" on page 4-29.

3. **Limit Lines:** Limit lines are shown as red (failing) or green (passing) lines with gray circles for each limit line point. Limit lines can be set up point-by-point or by using the envelope feature to quickly set a sloped or square envelope. The currently selected limit line point is shaded gray. When limit lines are enabled, a pass/fail status is shown in the upper right of the window. If the trace crosses the limit, the trace color will turn red and the limit will indicate a failure. The limit is only applied to the active trace (refer to Section 4-9 "Setting Trace and Cursor Parameters"), which is indicated next to the pass/fail.

4. **Measurement Settings:** The x-axis shows the start, center, and stop frequencies. The y-axis displays the amplitude of the graticule lines. RBW/VBW, span, sweep time, and number of trace point settings are shown along the bottom of the spectrum display. If either resolution bandwidth or video bandwidth is set to manual, the "#" symbol will precede its label. If an offset frequency is entered, the offset value is displayed in the left side status panel. Pressing any of the editable parameters opens the keypad to edit the value directly. Information-only displays cannot be changed.

5. **Multiple Trace Display:** Each trace has a unique color and each can be set to Clear/Write, Average, Min or Max Hold, Rolling Average, or Rolling Min or Max Hold. Each trace can have Peak, RMS/Average, or Negative detectors. Traces can be set to Active, Hold/View, or Blank.

Figure 4-1. Spectrum Analyzer: Spectrum View (2 of 2)

Spectrogram View

Spectrogram view is useful for identifying intermittent signals and for providing historical signal data in a comprehensive view. It provides a multi-dimensional "waterfall" display representing frequency, time, and amplitude. Frequency and time are shown on a typical two-dimensional scale while amplitude is displayed in the color dimension. The color is set by adjusting the color range of the color bar.

Select Spectrogram view from MEASURE > VIEW > Spectrogram. After Spectrogram view is selected, the color bar can be configured from the SETUP menu. Refer to Section 4-14 "Measurement Setup for the Spectrum Measurement Type" on page 4-39 for more information on setting up the Spectrogram view.
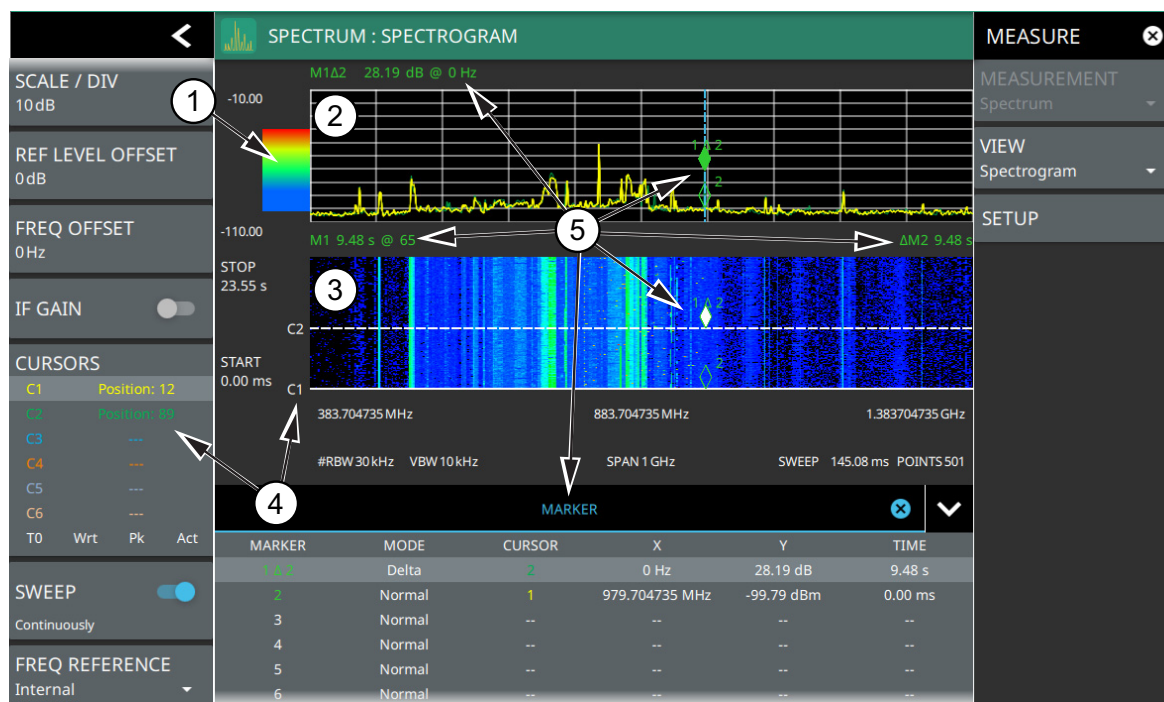
1. **Color Bar:** The color bar is used to adjust the colors displayed at different amplitude levels. The color bar shown here represents the range of colors that will be displayed. This bar can be dragged up or down to adjust the coverage area. If signals or noise is outside of the color bar range, then black is displayed. The color bar top and bottom setting, and the overall hue to the color range is set via the "SETUP Menu (Spectrogram View)" on page 4-39, which can be opened by pressing the color bar.

2. **Spectrum Window:** The upper display area shows spectrum trace data in the frequency domain. Up to six traces can display data from different times depending on how the corresponding cursors are set in the spectrogram display below. Note that the spectrum display shows trace amplitude (vertical axis) data in the time (horizontal axis) domain.

3. **Spectrogram Window:** The lower display area shows spectrogram trace data in the time (vertical axis), frequency (horizontal axis), and amplitude (color) domains. The bottom of the spectrogram displays the current sweep at the current time (0 ms) or position 0. When a sweep completes, the entire display is shifted up and the new trace is added to the bottom of the spectrogram. The spectrogram holds 142 sweeps (cursor positions) and the stop time reflects the time taken to complete all of the sweeps.

4. **Cursors (C1 to C6):** Cursor information for the currently set cursor type (time or position) is shown in the status panel. Cursors are shown on the spectrogram as white lines at the currently set cursor time or position. Refer to "Cursors in Spectrogram View" on page 4-21.

5. **Markers:** Marker and marker data are shown in a variety of locations. Markers can be placed on different cursors to help you compare measurements at different points in time as well as frequency. Refer to "Spectrogram with Cursors and Markers" on page 4-30.

Figure 4-2.   Spectrum Analyzer: Spectrogram View

4-3   Main Menu

The main menu is the primary access point for all instrument controls and measurement selections. The main function for each main menu button is described below.

FREQ SPAN AMPLITUDE BANDWIDTH TRACE SWEEP MARKER LIMIT TRIGGER MEASURE SETUP PRESET FILE	**FREQ SPAN:** Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 4-6 "Setting Frequency Parameters". **AMPLITUDE:** Provides access to all amplitude-related settings including reference level, and graticule scale. Refer to Section 4-7 "Setting Amplitude Parameters". **BANDWIDTH:** Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 4-8 "Setting Bandwidth Parameters". **TRACE:** Provides access to controls to set trace behaviors, presets, and access to the trace/detector settings table. When in Spectrogram view, also provides spectrogram cursor controls. Refer to Section 4-9 "Setting Trace and Cursor Parameters". **SWEEP:** Provides controls for sweep behaviors, number points, and minimum capture time. Refer to Section 4-10 "Setting Sweep Parameters". **MARKER:** Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 4-11 "Setting Up Markers". **LIMIT:** Provides controls for setting up limit lines and limit alarms. Refer to Section 4-12 "Setting Up Limit Lines". **TRIGGER:** Controls the trigger source, delay and holdoff, and trigger slope settings. Refer to Section 4-13 "Setting Up Triggering". **MEASURE:** Used to select measurements such as spectrum, channel power, occupied bandwidth, adjacent channel power, and opens the spectrogram. Refer to Section 4-14 "Measurement Setup for the Spectrum Measurement Type". **SETUP:** Measurement controls for setting up advanced measurements. This menu always displays setting options for the current active measurement (refer to Section 4-15 "Setting Up Advanced Measurements"). When in Spectrogram view, provides access to the spectrogram color SETUP menu (refer to "SETUP Menu (Spectrogram View)" on page 4-39). **PRESET:** Opens the PRESET menu with selective trace, marker, limits, and measurement setup commands, or an all-inclusive Preset All command. Refer to Section 4-19 "Presetting the Analyzer". **FILE:** Used to save and recall instrument setups and measurements, limit lines, and screen images. Also provides access to save on event controls. Refer to "FILE Menu" on page 4-49 and "File Management" on page 3-14.

Figure 4-3.   Main Menu

Using Menus

The behaviors of the main menu and the submenus are summarized here:

- When a button in the main menu is pressed, the associated submenu opens.
- The name of the button pressed in the main menu is reflected in the title bar of the submenu.
- Instrument setup, control, and measurement functions are performed through the use of submenus.
- The buttons within the submenus can change for various measurement settings, instrument setup parameters, and measurement views.
- Pressing the corresponding main menu button for a submenu closes the submenu and returns to the main menu.

- Touching status data, a parameter field, or label in the display area opens the corresponding submenu and the associated keypad for editing that parameter setting.
- The keypad closes when Accept or Cancel is pressed or, when the X is pressed.
- The submenu closes when the its main menu button is pressed again or by pressing the X in the top right corner.

4-4   Status Panel

The status panels and features illustrated in this section are unique to the spectrum analyzer and to the particular measurement and view that are selected. Below is the spectrum analyzer status panel that covers basic spectrum, spectrogram, channel power, occupied bandwidth, and adjacent channel power measurements (selected via MEASURE > MEASUREMENTS menu).

Pressing any of these parameters opens the associated menu with a keypad that allows you to conveniently change the parameter value. These are the same settings found in the right-side menus.

REF LEVEL: Sets the reference level of the top graticule line. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location.

SCALE/DIV: Sets the graticule scale/division.

REF LEVEL OFFSET: Compensates for the presence of external input attenuation or gain.

Refer to Section 4-7 "Setting Amplitude Parameters" on page 4-11.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 4-6 "Setting Frequency Parameters" on page 4-8.

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.

TRACES/CURSORS: Displays the current status of up to six traces or cursors in a quick-view summary. When the measurement view is set to Normal (Spectrum), trace information is displayed in this area. When the measurement view is set to Spectrogram, cursor information is displayed in this area. Cursors are only available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) shows the settings of the trace used to fill the spectrogram. The reference trace settings are applied to all traces and cursors while in Spectrogram view. Pressing a trace or cursor in the summary panel activates the trace or cursor and opens the TRACE menu. It allows you to select and set up an individual trace or cursor as desired. Refer to Section 4-9 "Setting Trace and Cursor Parameters" on page 4-17.

SWEEP: Toggles the sweep setting between continuously ON or sweep once OFF. Refer to Section 4-10 "Setting Sweep Parameters" on page 4-24.

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.

Figure 4-4.   Spectrum Analyzer Status Panel

4-5 Making Spectrum Analyzer Measurements

Initial Setup

Connect a signal source to the RF In port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured.

Figure 4-5. Spectrum Master Setup

4-6   Setting Frequency Parameters

Frequency-related parameters are set using the "FREQ / SPAN Menu" on page 4-10. 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 measurement. The center frequency and span can be specified, the start and stop frequencies can be entered.

Entering Start and Stop Frequencies

The frequency settings are displayed along the bottom of the spectrum or spectrogram graph. These parameters can be accessed directly or via the FREQ SPAN menu.

1. Press FREQ SPAN on the main menu.

2. Press START FREQUENCY to open the start frequency parameter entry keypad.

3. Enter the desired start frequency. When entering a frequency with the keypad, available frequency units (GHz, MHz, kHz, and Hz) will be displayed along the left edge of the menu.

4. Press the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.

5. Press STOP FREQUENCY to open the stop frequency parameter entry keypad.

6. Enter the desired stop frequency. When entering a frequency with the keypad, available frequency units (GHz, MHz, kHz, and Hz) will be displayed along the left edge of the menu.

7. Press the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.

Note	To quickly move the start or stop frequency value up or down, press the + or – slider controls to increment the frequency by the set FREQUENCY STEP. You can also drag the frequency using the slider.

The center frequency will be set to exactly the middle of the start and stop frequencies. The current settings are shown along the bottom of the spectrum or spectrogram graph (see Figure 3-1 on page 3-1).

Entering a Center Frequency

1. Press FREQ SPAN on the main menu.

2. Press CENTER FREQUENCY to open the center frequency parameter entry keypad.

3. Enter the desired center frequency. When entering a frequency with the keypad, available frequency units (GHz, MHz, kHz, and Hz) will be displayed along the left edge of the menu.

4. Press the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.

Note	To quickly move the center frequency value up or down, press the + or - slider controls to increment the center frequency by the set FREQUENCY STEP. You can also drag the center frequency using the slider or by dragging the trace directly.

The current settings are shown along the bottom of the spectrum or spectrogram graph (see Figure 3-1 on page 3-1).

Using Offset Frequency

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.

When enabled, the offset value is displayed at the left of the screen in the status panel (see Section 4-4 "Status Panel"). To remove a frequency offset, open the FREQ SPAN menu and set FREQUENCY OFFSET to 0 Hz. You can also access this parameter directly from the left side status panel.

Note	Offset frequency apply to start, stop, center, and marker frequencies.

Setting the Span

1. Press FREQ SPAN on the main menu.

2. Press SPAN to open the span frequency parameter entry keypad.

3. Enter the desired span frequency. When entering a frequency with the keypad, available frequency units (GHz, MHz, kHz, and Hz) will be displayed along the left edge of the menu.

4. Press the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.

5. To select full span, press the FULL SPAN. Selecting full span overrides any previously set start and stop frequencies.

Note	To quickly move the span value up or down, press the + or - slider controls to increment the span in a 1:2:5 sequence. You can also drag the span using the slider or by pinching the trace in or out.

FREQ / SPAN Menu
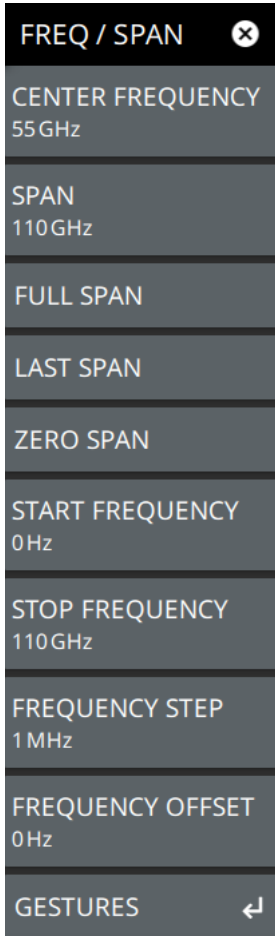
FREQ / SPAN ✕

CENTER FREQUENCY
55 GHz

SPAN
110 GHz

FULL SPAN

LAST SPAN

ZERO SPAN

START FREQUENCY
0 Hz

STOP FREQUENCY
110 GHz

FREQUENCY STEP
1 MHz

FREQUENCY OFFSET
0 Hz

GESTURES ↵

CENTER FREQUENCY: Sets the center frequency of the sweep range. The current span setting will remain constant or will be adjusted to accommodate the start and stop frequency range of the instrument.

SPAN: Sets the sweep frequency range. The current center frequency will remain constant and the start and stop frequencies will be adjusted to accommodate the new range. Pressing the plus (+) or minus (–) control increments the span value in a 1:2:5 sequence. The span can also be changed by pinching the trace in or out.

FULL SPAN: Pressing this button sets the span to cover the entire tunable spectrum of the instrument. This button also restores Start and Stop frequency buttons and the Gestures button.

LAST SPAN: Pressing this button returns the span to the previously set span value. If the previous span was set with Zero Span, then the appropriate buttons are removed.

ZERO SPAN: Pressing this button sets 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).

START FREQUENCY: Sets the start frequency of the sweep range. The center frequency and span will be adjusted to accommodate the new start and current stop frequencies. Pressing the plus (+) or minus (–) control moves the start frequency in steps defined by the FREQUENCY STEP value.

STOP FREQUENCY: Sets the stop frequency of the sweep range. The center frequency and span will be adjusted to accommodate the current start and new stop frequencies. Pressing the plus (+) or minus (–) control moves the start frequency in steps defined by the FREQUENCY STEP value (set lower in this menu).

FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (–) control.

FREQUENCY OFFSET: The frequency offset value accounts for frequency conversions outside of the analyzer. The offset frequency value is added to the start, stop, center, fixed marker, and normal marker frequencies. Pressing the plus (+) or minus (–) control moves the offset frequency in steps defined by the FREQUENCY STEP value.

GESTURES: Opens the GESTURES submenu.

Figure 4-6.   FREQ / SPAN Menu
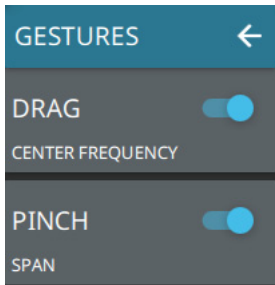
GESTURES ←

DRAG ⬤
CENTER FREQUENCY

PINCH ⬤
SPAN

DRAG: Toggles the touchscreen drag feature on or off. When off, the center frequency will not change when dragging the spectrum display. This can be useful when dragging markers.

PINCH: Toggles the touchscreen pinch feature on or off. When toggled off, the span frequency will not change when pinching the spectrum display. This can be useful when dragging markers.

Note, that the Drag and Pinch features can also be toggled on/off by touching the locks under the display.

Figure 4-7.   GESTURES Submenu

4-7   Setting Amplitude Parameters

Amplitude-related parameters are set using the "AMPLITUDE Menu" on page 4-13.

Setting Amplitude Reference Level

The amplitude reference level is typically an absolute reference level set at the top of the graticule for the power level being measured. Signal levels above this set value will be outside of the display range and might overdrive and saturate the input circuit. To set the current amplitude reference level:

1. To automatically set an optimum reference level, press AMPLITUDE > AUTO REF LEVEL.

2. To manually set the reference level, press AMPLITUDE > REF LEVEL, then enter the desired reference level in dBm.

Note	Select AUTO REF LEVEL to help ensure that harmonics and spurs are not introduced into the measurements.

Setting Amplitude Range and Scale

This setting applies to most analyzer modes of instrument operation and allows you to set the y-axis graticule scale.

1. Press AMPLITUDE > SCALE/DIV and enter the desired number of units per division (dB/division).

2. Set the desired y-axis amplitude units. Currently, dBm is the only available selection.

Reference Level Offset for External Loss or External Gain

To obtain accurate measurements, you can compensate for any external attenuation or gain by using a reference level offset. The compensation factor is in dB. External attenuation can be created by using an external cable or an external high power attenuator. External gain is typically from an amplifier.

To adjust the reference or amplitude level for either gain or loss:

1. Press AMPLITUDE > REF LEVEL OFFSET.

2. Enter a positive dB value to account for gain or enter a negative dB value to account for loss.

3. The new reference level offset value will be displayed on the instrument and the y-axis and trace amplitude is adjusted accordingly.

IF Gain

The IF Gain can be turned on and off by toggling IF GAIN via the status panel or the AMPLITUDE menu. Figure 4-8 shows the noise floor with the IF Gain off (1) and on (2). Note that when the IF Gain is turned on, the noise floor drops by typically 15 to 20 dB. The Reference Level must be -10 dBm or lower for the IF Gain to function.
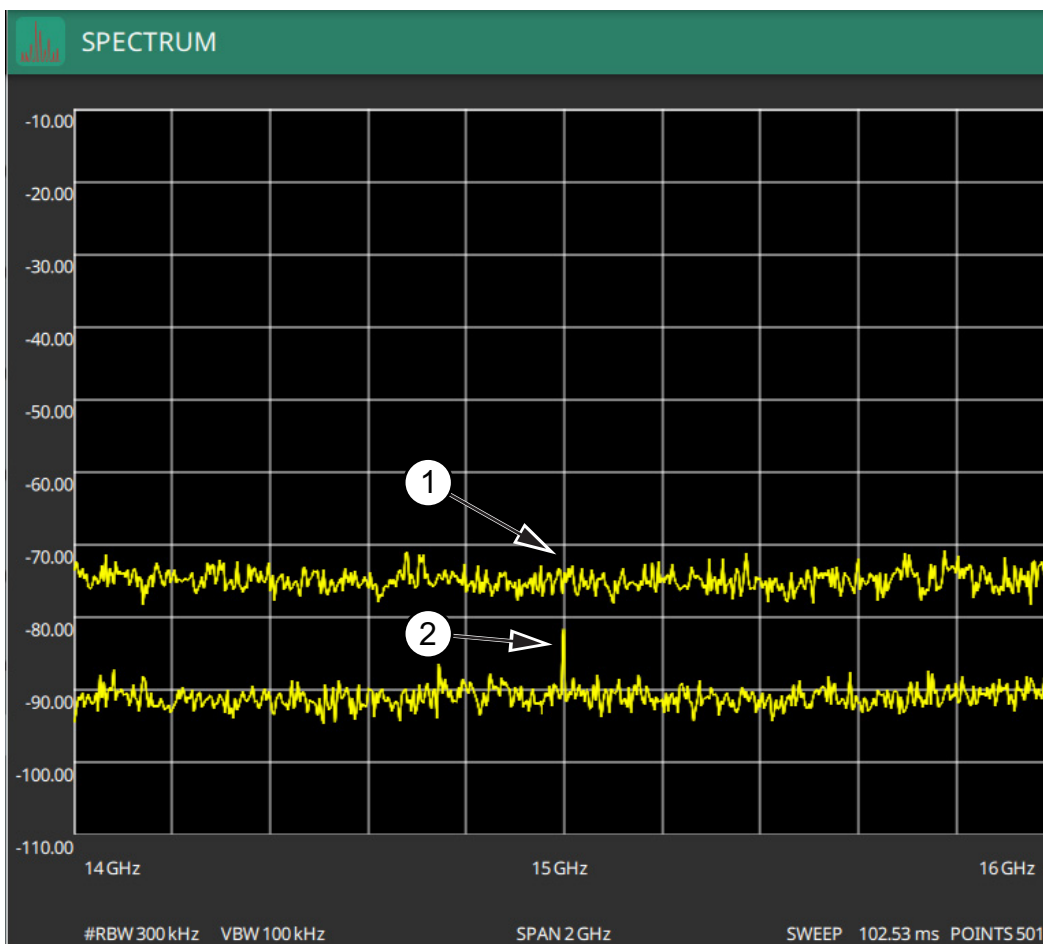
Figure 4-8.   1. IF Gain Off
2. IF Gain On

AMPLITUDE Menu

AMPLITUDE ⊗ OFFSET REF LEVEL 10 dBm AUTO REF LEVEL SCALE / DIV 10 dB Y AXIS UNIT dBm ▾ REF LEVEL OFFSET -10 dB IF GAIN ⬤ IMAGE REJECT Normal ▾	**OFFSET REF LEVEL:** The reference level is the top graticule line on the measurement display. If the reference level offset is not zero, the offset reference level is displayed at this location. Pressing the plus (+) or minus (–) control increments the value by 10. The plus/minus (+/-) button on the keypad toggles between positive and negative values. **AUTO REF LEVEL:** Auto reference level automatically adjusts the reference level to place the highest signal amplitude at about two graticule lines from the top based on the position of the trace at the time the button is pressed. **SCALE/DIV:** The scale can be set from 1 dB per division to 15 dB per division. The default setting is 10 dB. Pressing the plus (+) or minus (–) control increments the value by 1. **Y AXIS UNIT:** Displays the y-axis amplitude units in dBm. **REF LEVEL OFFSET:** Reference level offset compensates for the presence of external input attenuation or gain. The offset is applied to all amplitude related parameters and to measurements such as the y-axis scale and marker measurements. The default offset value is 0 dB. Pressing the plus (+) or minus (–) control increments the value by 10. The plus/minus (+/-) button on the keypad toggles between positive and negative values. Refer to "Reference Level Offset for External Loss or External Gain" on page 4-11. **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 MS276XA employs special image rejection algorithms to reduce or eliminate spurs and images in the receiver. Under normal operation, the analyzer will take two IF samples (a high side and a low side) and compare the two to reduce or eliminate unwanted spurs or images. This setting selects an image reject algorithm of Normal, High Only, or Low Only. Normal is the combination of both the high-side and the low-side IF samples, which provide the benefit of spur/image rejection. The High Only and Low Only settings offer no image rejection and only show the results from the single IF sample obtained (either high or low). High Only or Low Only settings results in faster overall sweep speed, but with no spur or image reduction at all. In Zero Span, the Low Only setting is automatically selected unless IMAGE REJECT is set to High Only.

Figure 4-9. AMPLITUDE Menu

4-8   Setting Bandwidth Parameters

Bandwidth parameters are set using the .

Resolution Bandwidth

Resolution Bandwidth (RBW) 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 some time 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 might now be measurable.

Video Bandwidth

Spectrum analyzers typically use another type of filtering after the detector that is called video filtering. This filter also affects the noise on the display, but in a different manner than does 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 (VBW) 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. 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 3 MHz.

Setting Frequency Bandwidth

1. Press BANDWIDTH on the main menu.

2. Toggle AUTO RBW or AUTO VBW (or both) off to manually change values. If using Auto, refer to the following sections.

3. Set the RBW and VBW to achieve the desired resolution and sweep characteristics. Lower values increase resolution and reduce noise, but at the expense of measurement (sweep) speed.

4. Set the VBW TYPE to Logarithmic (geometric mean) or Linear (arithmetic mean).

Setting Bandwidth Auto Coupling

Both resolution bandwidth and video bandwidth can be coupled to the frequency span automatically, or set manually. When set to Auto RBW, the instrument automatically adjusts the RBW 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 BANDWIDTH on the main menu.

2. Press SPAN:RBW and change the coupling value, and then press ACCEPT to enter the value.

When auto-coupling between the span and RBW is selected (AUTO RBW is toggled on), the bandwidth parameter is displayed normally at the bottom of the graph. If manual RBW is selected (AUTO RBW is toggled off), the bandwidth label at the bottom of the graph is prefixed with the '#' symbol, and resolution bandwidth is set independently of the span.

Auto coupling VBW links the video bandwidth to the resolution bandwidth so that VBW varies in proportion to RBW. If manual VBW coupling is selected, the VBW label at the bottom of the graph is prefixed with the "#" symbol and video bandwidth is set independently of resolution bandwidth.

By default, the RBW/VBW ratio is set to 1 and can be changed as follows:

1. Press BANDWIDTH on the main menu.

2. Press RBW/VBW and enter the desired value.

The RBW range varies with instrument features. Refer to "BANDWIDTH Menu" on page 4-16 and check your technical data sheet for the bandwidth range of your instrument.

BANDWIDTH Menu

BANDWIDTH ⊗ AUTO RBW 🔵 RBW 3 MHz AUTO VBW 🔵 VBW 3 MHz VBW TYPE Linear ▾ RBW:VBW 1 SPAN:RBW 100 RBW FILTER Nutall ▾	**AUTO RBW:** When toggled on, 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 toggled off (manual), the RBW label at the left edge of the x-axis will be preceded by the "#" symbol. **RBW:** The current resolution bandwidth is displayed under the RBW button. After AUTO RBW is toggled off, the RBW can be changed using the keypad or the slider controls. 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 resolution bandwidth range. **AUTO VBW:** When toggled on, 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 toggled off (manual), the VBW label at the left edge of the X-axis will be preceded by the "#" symbol. **VBW:** The current video bandwidth is displayed under the VBW button. After AUTO VBW is toggled off, the VBW can be changed using the keypad or slider controls. 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. **VBW TYPE:** 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 slider controls. **SPAN:RBW:** Displays the ratio between the span and the resolution bandwidth. The default value is 100, meaning that the span will be 100 times the resolution bandwidth. To change the ratio, press this button and use the keypad or slider controls. **RBW FILTER:** Allows you to select between the Flat Top window and the Nutall RBW filter type.

Figure 4-10. BANDWIDTH Menu

4-9 Setting Trace and Cursor Parameters

Spectrum Master can display up to 6 traces simultaneously. Traces can be enabled from the TRACE menu by selecting the trace from the available selections, or you can select a trace in the Status panel to make it active. Each trace can have a separate trace type, mode, and detector. When working with traces in normal spectrum view, refer to "TRACE Menu (Spectrum View)" on page 4-18. When working with traces and cursors in Spectrogram view, refer to "TRACE Menu (Spectrogram View)" on page 4-22 and "TRACE CURSOR Menu (Spectrogram View)" on page 4-23.

Traces in Spectrum View

The graphic in Figure 4-11, "Traces in Spectrum View" shows the MS276xA with all six traces enabled on a signal, each with a different trace or detector type setting. The left side status panel shows a trace setup summary table. Touching one of the trace rows in the table will enable the trace and open the TRACE menu.
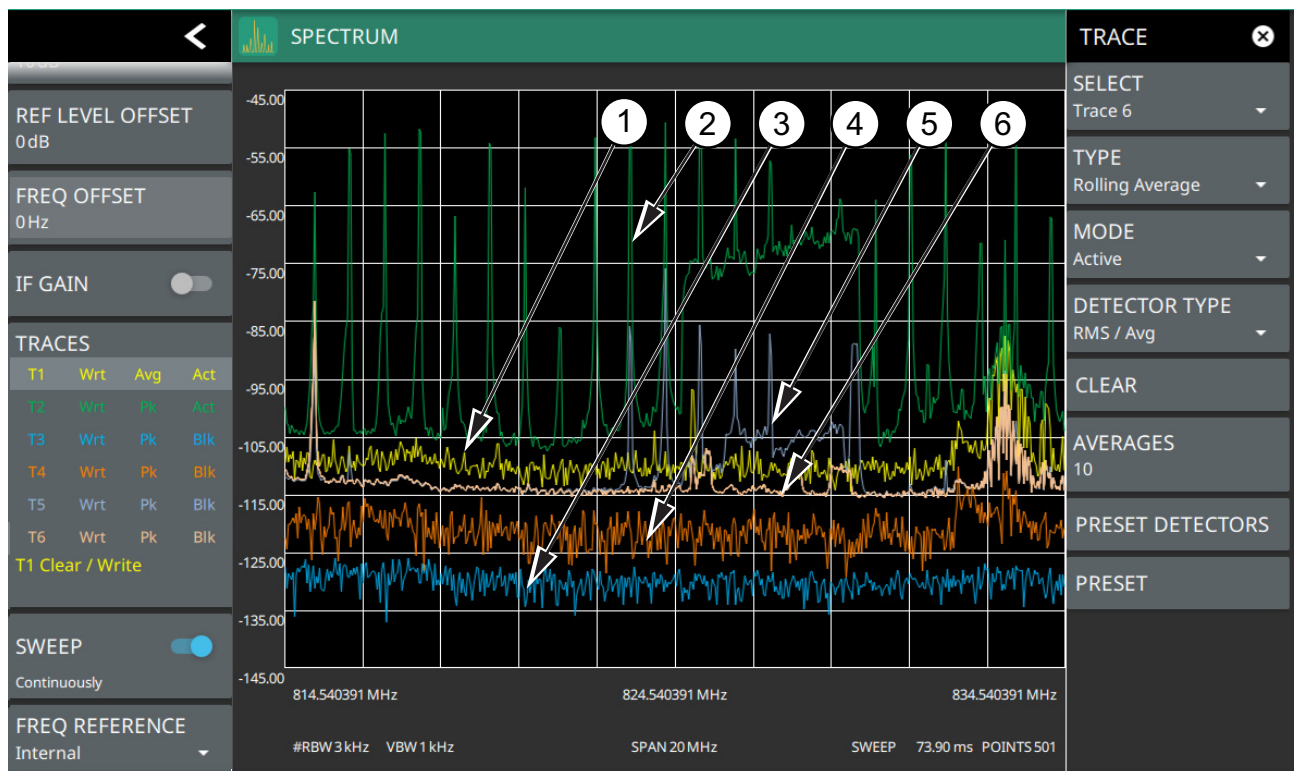
1. Clear/Write and Peak Detection: This is the default trace setting. The trace is cleared during each sweep and the largest measurement point is used for each display point.

2. Max Hold and Peak Detection: Each trace point retains its maximum value and the largest measurement point is used for each display point.

3. Min Hold and Negative Detection: Each trace point retains its minimum value and the smallest measurement point is used for each display point.

4. Clear/Write and Negative Detection: Trace points are cleared during each sweep and the smallest measurement point is used for each display point.

5. Average and RMS/Average Detection: The trace points are an average of all previous N sweeps, where N is the AVERAGES setting. RMS/Average detection depends on the video bandwidth type setting (BANDWIDTH > VBW TYPE): When 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 Logarithmic, the traditional average of log (power) is displayed.

6. Rolling Average: The average of the last N traces, where N is the AVERAGES setting.

Figure 4-11. Traces in Spectrum View

TRACE Menu (Spectrum View)

TRACE ⊗

SELECT
Trace 1 ▾

TYPE
Clear / Write ▾

MODE
Active ▾

DETECTOR TYPE
Peak ▾

CLEAR

AVERAGES
10

PRESET DETECTORS

PRESET TRACES ↺
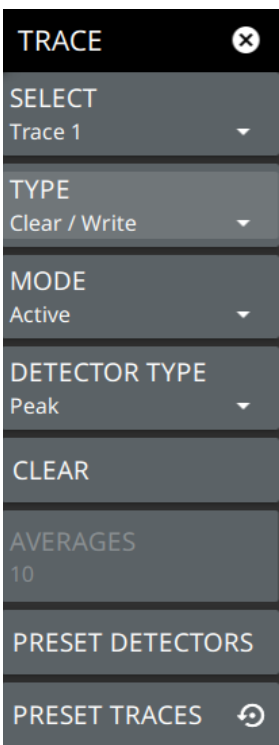
SELECT: Selects traces 1 through 6. Selecting a trace that is off turns the trace on. The trace type will be Clear/Write, the trace mode will be Active, and the detector type will be Peak. Selecting a trace will draw the trace on top of all other traces. This feature is not available in the spectrogram measurement view because all spectrogram data are created from a single 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 N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- **Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Average:** Is the rolling average of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Max Hold:** Is the maximum rolling average value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Rolling Min Hold:** Is the minimum value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.

TRACE MODE: Selects one of the following trace modes:

- **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. If the frequency or bandwidth settings are changed while a trace is in hold/view mode, the data will be blanked from the screen. In order to see data again, set the trace mode to active.
- **Blank:** Does not display the trace and is not updating. It is the same as if the trace was off.

Figure 4-12. TRACE Menu (1 of 2)

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 (see "Trace Detector Types" on page 4-20).

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

- **RMS/Avg:** In the default 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 lowest amplitude 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.

CLEAR: Clears the currently active trace data.

AVERAGES: Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes.

PRESET DETECTORS: Sets all trace detectors to Peak.

PRESET TRACES: Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.

Figure 4-12. TRACE Menu (2 of 2)

Trace Detector Types

The figure below shows the available detector types:
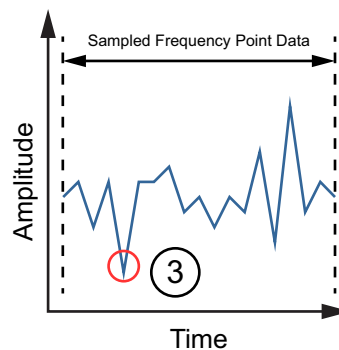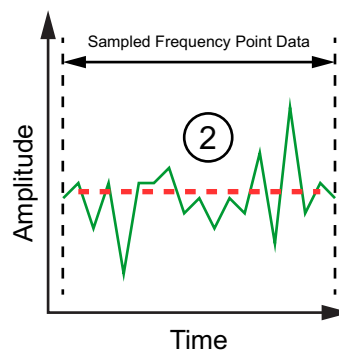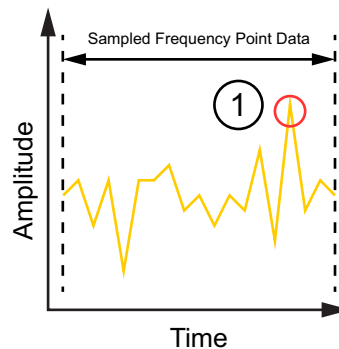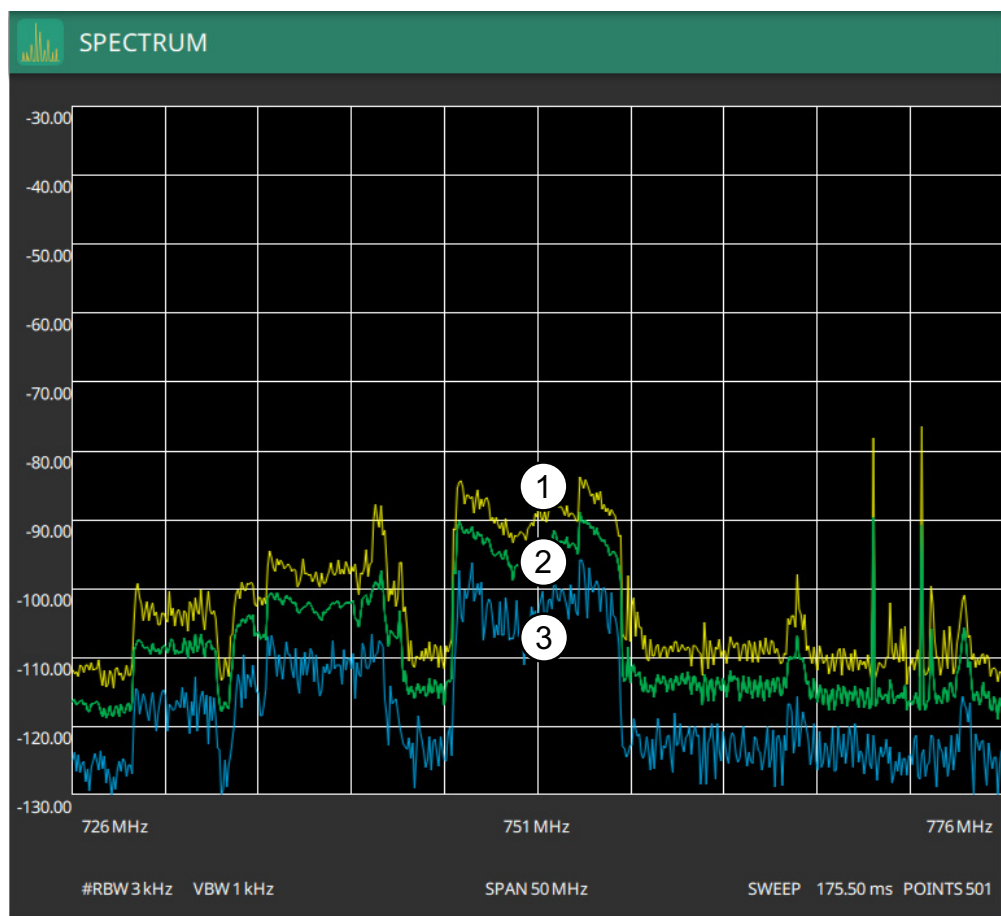
1. Yellow trace set to Peak detection.

2. Green trace set to RMS/Ave detection.

3. Blue trace set to Negative detection.

Figure 4-13. Trace Detector Types

Cursors in Spectrogram View

The screenshot in Figure 4-14 shows the MS276xA with all six cursors enabled on a signal. Cursors are shown on the spectrogram as white lines. The active cursor is a solid white line and other cursors show as dashed white lines. Cursors can be directly selected and dragged to position on the display or set via the TRACE > CURSOR menu. Cursors and their settings can also be accessed via the left side status panel by touching a cursor in the CURSORS table. The START time is the most recently completed sweep and the beginning of the spectrogram display. The STOP time is the total time length of the spectrogram, essentially the amount of time it takes for all completed sweeps to progress from the bottom to the top of the spectrogram window. The stop time will vary depending on the sweep speed, which can be faster or slower depending on settings such as span and RBW.
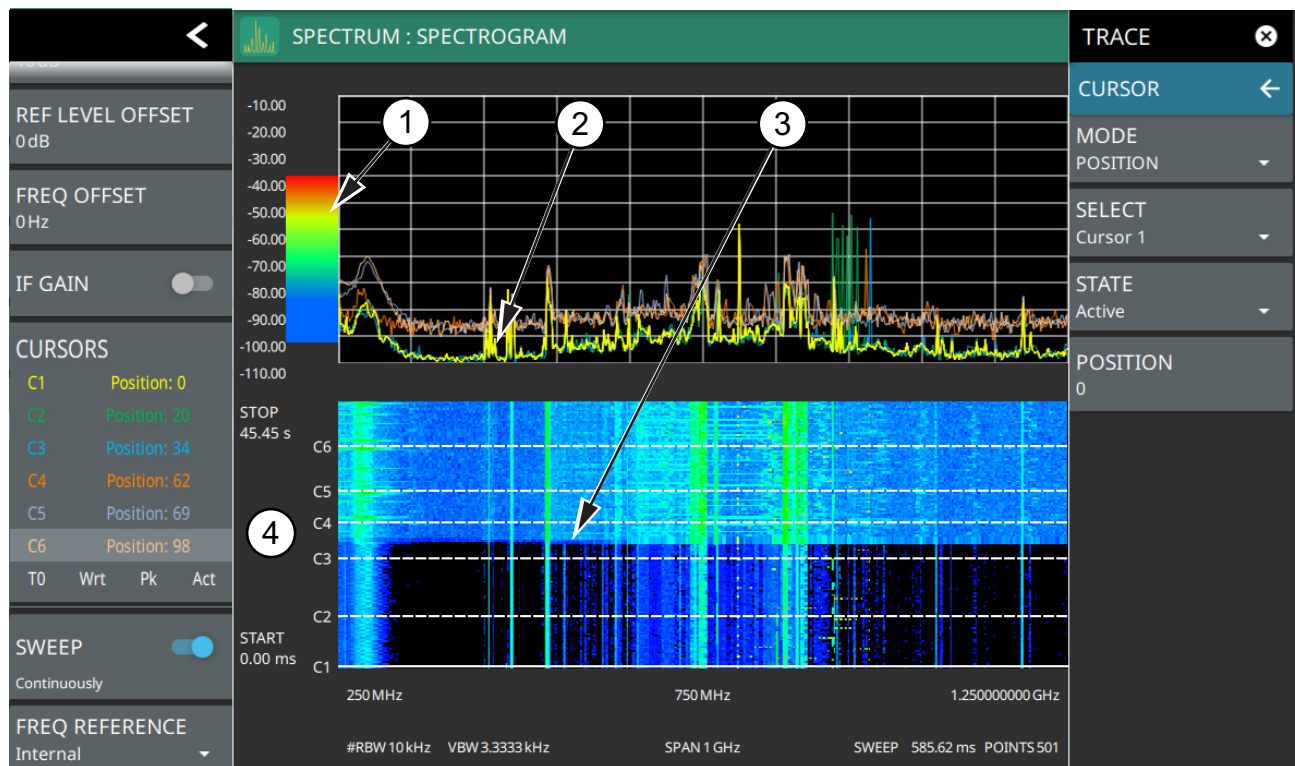
1. Color Bar settings are used to adjust the colors displayed at different amplitude levels. The color bar shown here represents the range of colors that will be displayed. This bar can be dragged up or down to adjust the coverage area. If signals or noise is outside of the color bar range, then black is displayed. The color bar top and bottom setting, and the overall hue to the color range is set via the "SETUP Menu (Spectrogram View)" on page 4-39.

2. The traces shown in Spectrogram view are updated when the data in the spectrogram lands on the associated cursor. The traces show sweep data from that respective point in time. The bandwidth and amplitude settings in the example above were changed. Traces 1 through 3 reflect the changed settings while traces 4 through 6 are showing sweep data from earlier points in time. To freeze the spectrogram, stop the instrument from sweeping by toggling off Sweep Continuously.

3. The transition in the spectrogram here shows when the amplitude and bandwidth settings were changed.

4. The spectrogram START and STOP times shown here represent the full duration of all 142 sweeps shown in the spectrogram window. Cursors 1 through 6 are positioned throughout the spectrogram and can be dragged or set to a new time or position using the "TRACE CURSOR Menu (Spectrogram View)" on page 4-23. Cursors can also be selected via the left side status menu CURSORS table. The bottom of the table shows the reference trace (T0) and its settings. The reference trace setting apply to all traces shown in the spectrum display.

Figure 4-14. Spectrogram View

TRACE Menu (Spectrogram View)

When the Spectrogram view is selected (MEASURE > VIEW > Spectrogram), the TRACE and SETUP menus are updated with spectrogram and cursor setup controls.

TRACE ⊗ **TYPE** Clear / Write ▾ **DETECTOR TYPE** Peak ▾ **CLEAR** **AVERAGES** 10 **PRESET TRACES** ↻ **CURSOR** ↵	**TYPE:** Selects one of the following types of traces: • **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace. • **Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table. • **Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table. • **Average:** The average of all N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table. • **Rolling Max Hold:** Is the maximum rolling average value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table. • **Rolling Min Hold:** Is the minimum value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table. • **Rolling Average:** Is the rolling average of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.

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 (see "Trace Detector Types" on page 4-20).

- **Peak:** This method causes the highest amplitude measurement point to be shown for each display point, assuring that a narrow peak is not missed.
- **RMS/Avg:** In the default 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. High Only or Low Only settings results in faster overall sweep speed, but with no spur or image reduction at all.
- **Negative:** This method causes the lowest amplitude 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.

CLEAR: Clears the currently active trace data.

AVERAGES: Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes.

PRESET TRACES: Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.

CURSOR: Opens the "TRACE CURSOR Menu (Spectrogram View)" on page 4-23.

Figure 4-15. TRACE Menu (Spectrogram View)

TRACE CURSOR Menu (Spectrogram View)
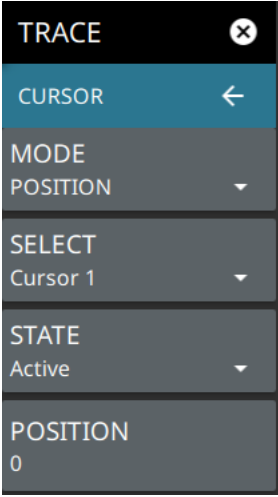
TRACE ⊗ CURSOR ← **MODE** POSITION ▼ **SELECT** Cursor 1 ▼ **STATE** Active ▼ **POSITION** 0	**MODE:** Every trace captured in the spectrogram has a time and a position index. Set the location of the spectrogram cursor based on either the time index or the position index. When position is selected, you 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. • **POSITION:** Available when a position cursor is selected. You can 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 on top of any other traces. 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. • **TIME:** Available when a time cursor is selected. You can 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 on top of other traces. 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. **SELECT:** Used to add additional cursors or to set the active cursor on the spectrogram. The active cursor also displays the associated trace on top of other traces in the spectrum display. For more information, refer to "Spectrogram with Cursors and Markers" on page 4-30. **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. **POSITION/TIME:** This button sets the position or time value for the trace.

Figure 4-16. TRACE / CURSOR Menu (Spectrogram View)

4-10   Setting Sweep Parameters

Sweep parameters are set using the .

Single/Continuous

When the Continuous toggle is pressed, the instrument toggles between single sweep and continuous sweep. In single sweep setting, the instrument waits until SWEEP ONCE is pressed or another setting is selected.

Trace Points

The number of trace points is the number of display points in the trace generated from the measurement data. The default number of points is 501; the range is settable from 10 to 10,001 points.

Sweep Limitations

With some spectrum analyzers, the user has control over sweep time (the elapsed time of each sweep, also referred to as scan time). An analyzer cannot be swept arbitrarily fast while maintaining its specified accuracy, therefore, it will have a sweep rate limitation depending upon the resolution bandwidth, video bandwidth, and frequency range selected. The sweep rate is not usually chosen by the user, but is determined by the frequency range swept divided by the sweep time. The limitation on sweep rate comes from the settling or response time of the resolution and video bandwidth filters. If an analyzer is swept too quickly, the filters do not have time to respond, and the measurement is inaccurate. Under such conditions, the analyzer display tends to have a "smeared" look to it, with the spectral lines being wider than normal and shifted to the right and at a lower amplitude than is correct.

Anritsu Spectrum Master is 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 RBW and VBW, the sweep speed automatically changes to the fastest sweep speed that will yield accurate results. The sweep speed will be faster for a wide RBW or VBW and slower for a narrow RBW or VBW. Regardless of the minimum sweep time, the instrument will never sweep faster than the RBW and VBW settings will allow. The instrument is designed to ensure that no uncalibrated measurement conditions will occur.

SWEEP Menu
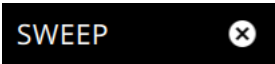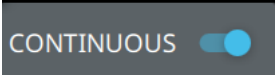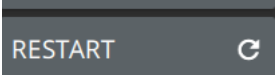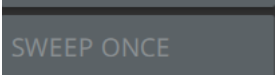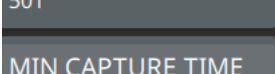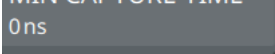
CONTINUOUS: Toggles between continuous sweep and single sweep. When the toggle is off, the instrument is in single sweep. In single sweep, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep. The current state of the instrument is displayed in the status panel. With average/hold number (in TRACE 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 after that sweep has completed. To take one more sweep without resetting the average count, press the SWEEP ONCE button. This sweep control is also available in the status panel.

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

SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE triggers a single measurement sweep.

SWEEP TO N: When sweep is set to single sweep and trace type is set to average, rolling average, rolling max hold, or rolling min hold, SWEEP TO N triggers N consecutive measurement sweeps, where N is the number of averages set in the TRACE menu. Each time the button is pressed, it will restart the average count, then sweep N times. This button has no function when the instrument is in continuous sweep.

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. The minimum setting is 10 and the maximum setting is 10001.

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 might 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.

Figure 4-17. SWEEP Menu

4-11 Setting Up Markers

Marker parameters are set using the . Refer to the figure below when working with this section.

1. Normal spectrum view marker information display.

2. Marker located on trace. The active marker is indicated with solid green fill, other markers will show with a hollow fill, fixed markers show as a green X. The dashed vertical line is attached to the active marker and facilitates touch operations. Either the marker or the line can be dragged into position, and either can be double tapped to open a number of peak search options.

3. Selected marker in the MARKER menu and in the MARKER table. The marker table shows all of the marker parameters and measurement values. You can edit marker parameters from the marker table as well as from the MARKER menu.

Figure 4-18. Marker Table and Marker Settings Panels

Placing a Normal Marker

1. Press MARKER to display markers. If markers were off, Marker 1 will automatically be made active at the current center frequency.

2. Select another marker using MARKER > SELECT, then select one of 12 available markers. If the marker was off, the marker will be made active and placed at the center frequency. If the marker was on, it will be made the active marker. You can enable all 12 markers and place them separately on traces, cursors, or set them as a fixed marker at a static frequency and amplitude.

3. Place a marker by first selecting it as the active marker, then do one of the following:

    a. Enter a new FREQUENCY value from the MARKER menu. The frequency can be entered manually or adjusted by using the slider or the + and – buttons to move the marker to the left and right.

    b. Drag the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position).

    c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to "MARKER PEAK SEARCH Menu" on page 4-29). Some peak search functions can be accessed by double-tapping the marker or the blue marker line.

Placing a Fixed Marker

Fixed markers are set up the same as normal markers above, but are set to Fixed using the MODE button. In addition to setting a fixed frequency, you can set a fixed amplitude. Fixed markers are typically used as a reference marker when measuring amplitude differences relative to an absolute value.

Placing a Delta Marker

When a marker is in delta mode, its position data are relative to its reference marker. To set a delta marker and its reference:

1. Activate a marker and place it in a reference location.

2. Select another marker using MARKER > SELECT.

3. Set the second marker's mode to Delta.

    • When a marker is set as a delta marker, the next active, lower-numbered normal marker will automatically be used as the reference marker.

    • When there is no active, lower-numbered normal marker, the next lower-numbered marker is activated and used as the reference marker.

    • When the reference marker is disabled, the delta marker changes to a normal marker.

    • When marker 1 is the only active marker and its mode is changed to Delta, marker 2 will be turned on as the reference for marker 1.

4. Place the active delta marker by:

    a. Entering a new FREQUENCY value.

    b. Dragging the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position).

    c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to "MARKER PEAK SEARCH Menu" on page 4-29).

A delta marker is labeled with a green delta symbol between the each marker number. For example, delta Marker 2 relative to Marker 1 (the reference marker) is displayed as "2Δ1".

MARKER Menu

MARKER ⊗
PEAK SEARCH ↵
SELECT Marker 1 ▾
ENABLED 🔵
FREQUENCY 55 GHz
AMPLITUDE -70.60 dBm
MODE Normal ▾
FUNCTION None ▾
DELTA REFERENCE ▾
TRACE Trace 1 ▾
MARKER TABLE ⚪
CENTER ON MARKER
REF LVL TO MARKER
ALL MARKERS OFF
PRESET MARKERS ↺

PEAK SEARCH: Opens the "MARKER PEAK SEARCH Menu" on page 4-29.

SELECT: Turns on the selected marker if it is off or makes it the active marker if it is already turned on. Pressing the MARKER menu button for the first time will turn on Marker 1 as a normal marker at the center frequency, and open the MARKER menu. Pressing the MARKER menu button 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.

ENABLED: Enables the selected marker. When the toggle is off, the marker is disabled and not shown on the screen.

FREQUENCY: Displays the marker frequency. For delta markers, the frequency is relative to the reference marker. Change the marker frequency by dragging it to the desired location. You can also change the marker frequency by pressing the FREQUENCY button and changing it manually using the keypad controls.

AMPLITUDE: Displays the current marker amplitude. When the marker mode is set to Normal or Delta, the amplitude is set by the trace. In that case, the amplitude is not settable by the user. The button is grayed out, but the value is still updating with every sweep. If the marker is a Fixed marker, the amplitude value can be changed by dragging the marker to the desired location or by directly entering the amplitude using the keypad control.

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, 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, which are defined by the user and not related to the trace or sweep data.

FUNCTION: Sets the function of the currently selected marker to None, Noise or Frequency Counter. For more information about using marker functions, refer to "Marker Functions" on page 4-30.

DELTA REFERENCE: Selects the Reference marker for a Delta marker. A Delta marker cannot be its own reference. Only Fixed and Normal markers might be used as a reference for Delta markers.

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

MARKER TABLE: Toggles on or off the marker table displayed below the screen. Refer to "Marker Table" on page 4-31.

CENTER ON MARKER: Sets the center frequency to the currently active marker's frequency value. Not applicable in Zero Span mode.

REF LVL TO MARKER: Sets the reference level to the currently active marker's amplitude value.

ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position after it is re-enabled.

PRESET MARKERS: Presets marker selections to default values.

Figure 4-19. MARKER Menu

MARKER PEAK SEARCH Menu

Note	Double-tapping a marker opens a quick peak search menu with some of the below features.

PEAK SEARCH: Returns to the main MARKER menu.

SELECT: If the selected marker is off, it will be turned on and the selected marker positioned at the peak of Trace 1. If the selected marker is on, then it will become 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.

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.

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.

THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a 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 4-20. PEAK SEARCH Menu

Marker Quick-Access Menu

A right-click or double-click on a marker displays the quick-access menu. It gives immediate access to the several Peak Search functions. Refer to the text in Figure 4-20, "PEAK SEARCH Menu" for details about these functions.
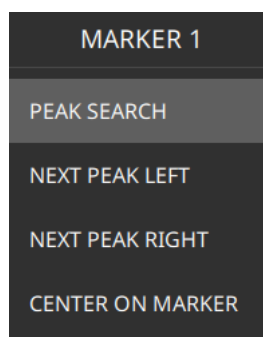
Figure 4-21. Marker Quick-Access Menu

Marker Functions

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.

Spectrogram with Cursors and Markers

In the spectrum window, markers are shown as hollow green diamonds on the trace to which they are assigned. Active markers have a solid fill with a vertical dashed line that can be used to drag the marker position. The dashed line matches the trace color to which the marker is assigned. In the spectrogram window, markers are shown as hollow green diamonds on the cursor to which they are assigned. The active marker is shown with white fill and its time and position values are displayed in green text at the upper left side of the display. In this example, the active marker is set to Cursor C2 and is measuring a change of amplitude between two different points in time. Markers can be placed on different cursors to help you compare measurements at different points in time as well as frequency
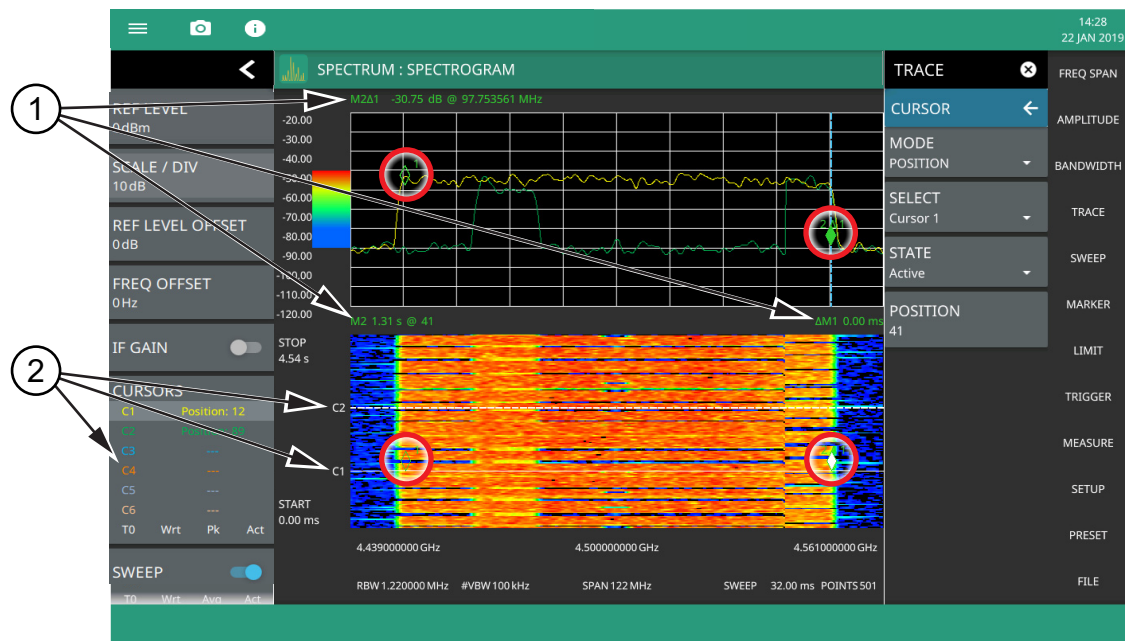
Figure 4-22. Spectrogram with Cursors and Markers

1. **Markers:** Displays the selected marker value. Marker values at the top of the spectrum display will show the current frequency and amplitude values of the active marker and its type. In this case, Marker 2 is set to a delta marker relative to Marker 1. Marker values at the top of the spectrogram window show the current time or position of the active marker (left) and other marker information such as delta time (right). In this case, Marker 2 is active and is at position 41 and has a relative time delta of 0 ms. Note that you can set a marker on any cursor to measure relative time differences between signal events as well as frequency and amplitude differences. Markers displayed on traces and cursors (encircled in red) show as green diamonds with the active marker in white fill.

2. **Cursors:** Cursors are shown on the spectrogram as white dashed lines. The active cursor is a solid white line. Cursors can be directly selected and dragged to position on the display or set via the TRACE > CURSOR menu. Cursors and their settings can also be accessed via the status panel. The start time is the most recent completed sweep and the beginning of the spectrogram. The stop time is the total time length of the spectrogram, essentially the amount of time it takes for a completed sweep to get from the bottom to the top of the spectrogram diagram with the current settings.

Figure 4-22. Spectrogram with Cursors and Markers

Marker Table

The marker table display is useful for displaying the parameters for many markers. The examples shown are for the regular Spectrum view (1) and for Spectrogram view (2). Both marker tables show the marker mode and corresponding X and Y values. In spectrum view, the marker table shows the marker function and trace to which it is selected. In Spectrogram view, the marker table shows the time value and the cursor to which it is selected. The selected marker is displayed with a highlighted background. Table controls are located on the right of the header. Press the down or up arrow to collapse or expand the table, press X to close the table.
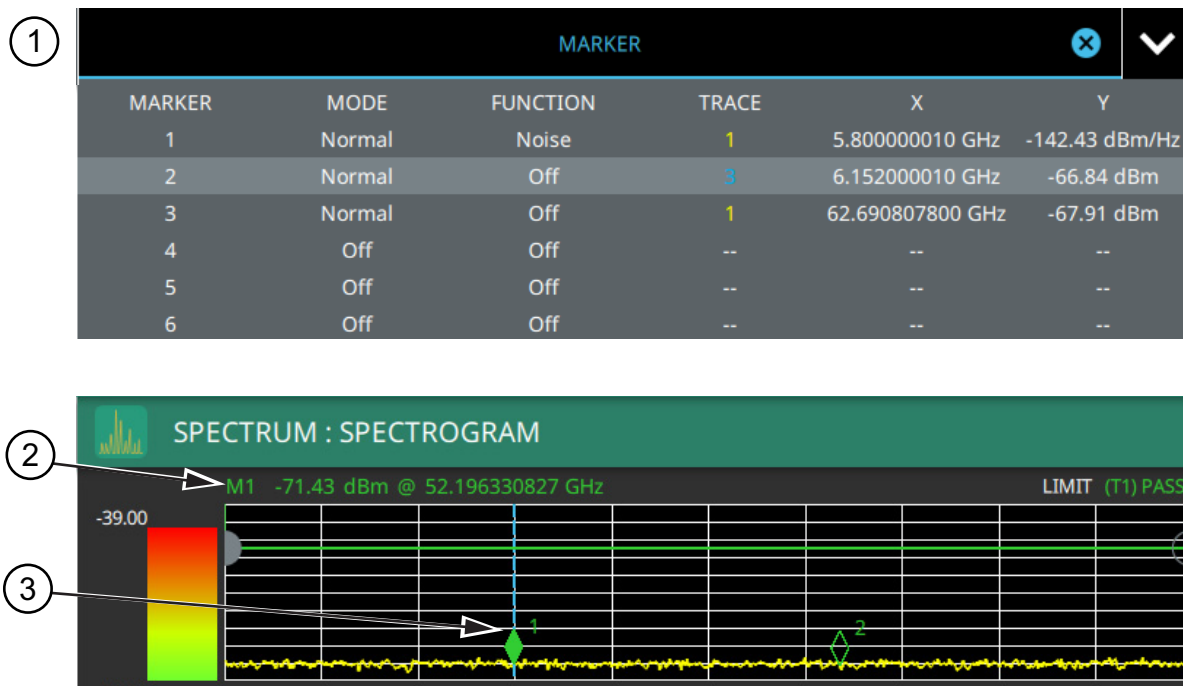
Figure 4-23. Marker Table

You can select and change a marker's parameters by selecting the marker from either the MARKER menu or the MARKER table.

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

The selected marker is highlighted on the trace display.

4-12   Setting Up Limit Lines

Limit lines allow you to monitor when trace data cross a defined line. Two types of limit lines can be specified: lower limit lines and upper limit lines. Limit lines can be used for visual reference, pass/fail criteria, and to trigger a save on event. By using save on event, a signal that crosses a limit line can be automatically saved (refer to Section 4-20 "Saving and Recalling Measurements" on page 4-48).

Each limit line can consist of a single segment, or as many as 40 segments across the entire frequency span of the instrument. 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. Limit line parameters are set using the "LIMIT Menu" on page 4-34.
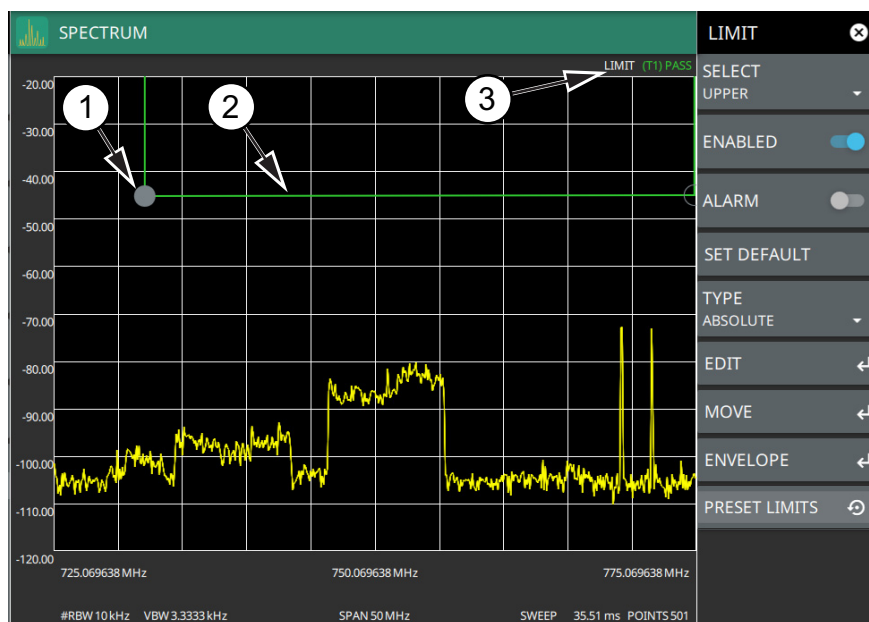
1. Limit points are shown as gray circles. The active point is filled in gray. Points can be dragged into position or set discretely using the frequency and amplitude settings in the "LIMIT EDIT Menu".

2. The limit line shown here is a simple upper limit line. The limit line color is green when the trace does not cross the limit line, and the limit line color turns red when the trace crosses it.

3. The limit test pass/fail status is also shown in green or red color at the top of the display. The limit test is applied to the active trace, indicated here by T1.

Figure 4-24. Simple Limit Line

Simple Limit Line

1. Press LIMIT on the main menu.

2. Select UPPER or LOWER limit.

3. Toggle the selected limit line on using the ENABLED toggle.

4. To change the frequency or amplitude level of the limit line:

    a. Press MOVE to open the "LIMIT MOVE Menu"

    b. Enter either an X-OFFSET frequency value or Y-OFFSET amplitude value.

    c. Press LEFT, RIGHT, UP, or DOWN to move the limit line the by the value entered above.

You can set up either an upper or lower limit line, or both by repeating the procedure above.

Limit Line Envelope

Limit line envelope parameters are set using the "LIMIT ENVELOPE Menu" on page 4-37. The limit line envelope feature is a quick way to generate an envelope using the existing trace as a reference. You can set the envelope to square or slope and you can set the limit line offset from the trace when creating the envelope. After the envelope limit line is set, you can manually edit the limit line by dragging the points or by using the "LIMIT EDIT Menu" and "LIMIT MOVE Menu".
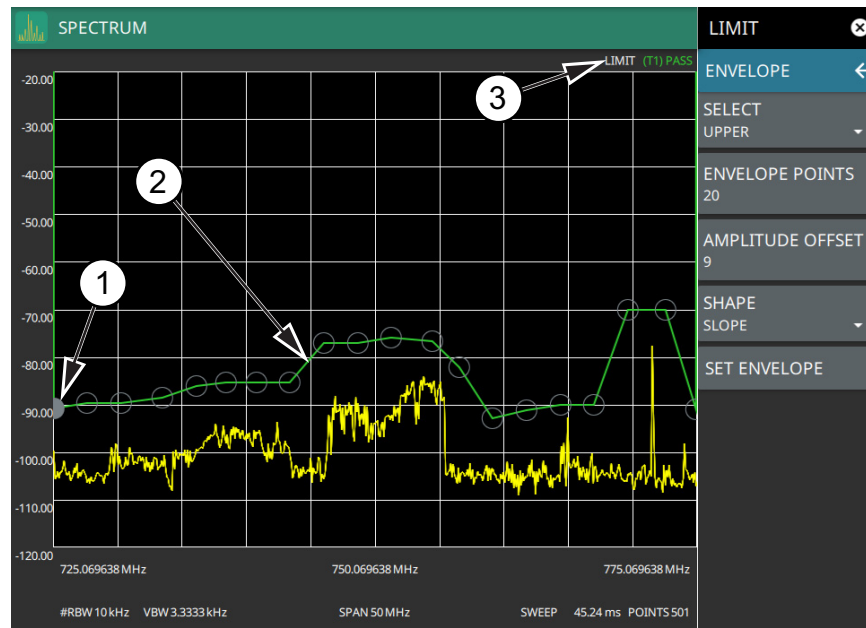
1. Limit points are shown as gray circles. The active point is filled in gray. Points can be dragged into position or set discretely using the frequency and amplitude settings in the "LIMIT EDIT Menu".

2. The limit line shown here is a simple, upper limit line. The limit line color is green when the trace does not cross the limit line, and the limit line color turns red when the trace crosses it.

3. The limit test pass/fail status is also shown in green or red color at the top of the display. The limit test is applied to the active trace, indicated here by T1.

Figure 4-25. Envelope Limit Line

To set up a limit line envelope:

1. Press LIMIT > ENVELOPE.

2. Select either Upper or Lower limit line.

3. Set the number of limit envelope points.

4. Set the amplitude offset (in dB).

5. Select the envelope shape of Square or Slope.

6. Press SET ENVELOPE to generate the limit line envelope.

You can set up either an upper or lower limit line, or both by repeating the procedure above. To create a more complex limit line, use the "LIMIT EDIT Menu" to work with individual limit line points.

LIMIT Menu

SELECT: Selects UPPER or LOWER limit line for editing.

ENABLED: Displays the selected limit when toggled on.

ALARM: This setting is for toggling the alarm function on or off for the currently active limit line. When on, an alarm beep will occur when a data point exceeds the limit. Audio functionality will be added via an upcoming software update.

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.

TYPE: Use to set the selected limit line as absolute or 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 selecting the desired state.

EDIT: Opens the "LIMIT EDIT Menu" on page 4-35.

MOVE: Opens the "LIMIT MOVE Menu" on page 4-36.

ENVELOPE: Opens the "LIMIT ENVELOPE Menu" on page 4-37.

PRESET LIMITS: Presets the limit lines to default values.

Figure 4-26. LIMIT Menu

LIMIT EDIT Menu

LIMIT ⊗

EDIT ←

SELECTED POINT
1 ▾

FREQUENCY
0 Hz

AMPLITUDE
0 dBm

ADD POINT

DELETE POINT

ADD VERTICAL

NEXT POINT LEFT

NEXT POINT RIGHT

SELECTED POINT: Displays the limit line point number. Press to select a different point from the displayed list.

FREQUENCY: Sets the frequency of a limit line inflection point. The frequency of each point in a limit line can be individually set. When a new point is added, it takes the value that is halfway between two existing points, or it takes 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 or the left and 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 the amplitude value that is on the limit line at the frequency where the point was added. Use the keypad (using +/- to set a negative value) or the plus (+) or minus (−) control to increment the value. The unit of the amplitude limit is the same as the current vertical amplitude unit (for example, dBm).

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 button 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. 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. Use the FREQUENCY and AMPLITUDE buttons to make adjustments to the selected point.

DELETE POINT: Press this button to delete the selected point.

ADD VERTICAL: Press this button to add an inflection point below the currently selected point.

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 button 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 button 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.

Figure 4-27. LIMIT EDIT Menu

LIMIT MOVE Menu

LIMIT ⊗ MOVE ← CENTER X-OFFSET 0 Hz LEFT RIGHT Y-OFFSET 0 dB UP DOWN MARKER 1 OFFSET 0 dB TO MARKER 1	**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. Use this button as an easy way to move an existing limit line to the center of the sweep. This button has no action if no limit line is turned on. **X-OFFSET:** Allows you to adjust the frequency of the limit line. All inflection points will be moved by the value entered here when using the LEFT or RIGHT buttons. Press X-OFFSET and enter a value using the keypad. **LEFT:** Pressing this button moves all inflection points to the left by the X-OFFSET value. **RIGHT:** Pressing this button moves all inflection points to the right by the X-OFFSET value. **Y-OFFSET:** Allows you to adjust the amplitude of the limit line. All inflection points will be moved by the value entered here when using the UP or DOWN buttons. Press Y-OFFSET and enter a value using the keypad. **UP:** Pressing this button moves all inflection points up by the Y-OFFSET value. **DOWN:** Pressing this button moves all inflection points down by the Y-OFFSET value. **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. **TO MARKER 1:** Moves the limit line center position to the frequency and specified amplitude offset of Marker 1. Marker 1 must be enabled.

Figure 4-28. LIMIT MOVE Menu

LIMIT ENVELOPE Menu

SELECT: Press this button to select UPPER or LOWER for envelope design.

ENVELOPE POINTS: This sets the desired number of envelope points.

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

SHAPE: Use to choose whether the upper or lower envelope will be with flat tops (SQUARE setting) and vertical lines, 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.

SET ENVELOPE: Press this button to generate the envelope using the set characteristics. If the default results are not satisfactory, you can make adjustments to the amplitude and frequency of each inflection point, and you can add or delete inflection points.

Figure 4-29. LIMIT ENVELOPE Menu

4-13   Setting Up Triggering

Trigger parameters are set using the "TRIGGER Menu (Available in Zero Span)" on page 4-38.

TRIGGER Menu (Available in Zero Span)
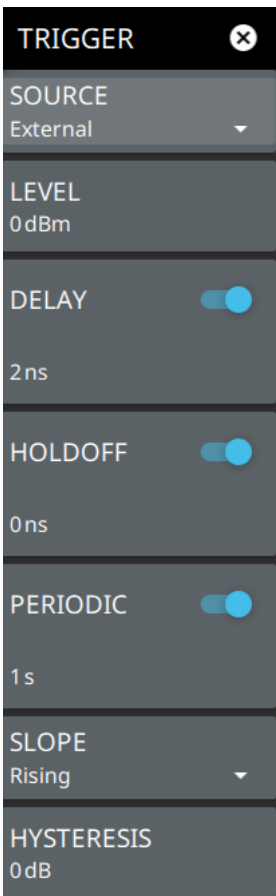
SOURCE: The SOURCE button offers several triggering options depending on which view mode the instrument is set:

- **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.
- **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.

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.

PERIODIC: Used to set a periodic sweep trigger. When set to On, the instrument waits the set time to start a sweep. The sweep trigger period can be set from 1 μs to 5 s.

SLOPE: 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: 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 in Figure 4-31). 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 change will be required to cause a trigger.

Figure 4-30. TRIGGER Menu

Figure 4-31. Trigger Levels and Hysteresis

4-14 Measurement Setup for the Spectrum Measurement Type

Refer to "Making Spectrum Analyzer Measurements" on page 4-7 for basic information on setting up a spectrum measurement.

Select MEASURE>MEASUREMENT>Spectrum for this section.

SETUP Menu (Normal View)

Select VIEW>Normal.

There are no advanced measurement setups for the basic spectrum analyzer measurement.
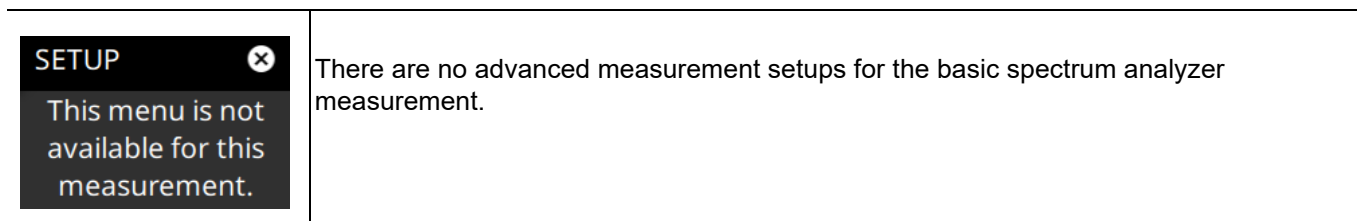
Figure 4-32. SETUP Menu (Spectrum)

SETUP Menu (Spectrogram View)

Select VIEW>Spectrogram.

COLOR SCALE TOP: Defines the amplitudes where the top color on the color setup bar are applied. Any measurement above this amplitude will appear black on the spectrogram window.

COLOR SCALE BOT: 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 spectrogram window.

REFERENCE HUE: Allows you to shift the color range of the spectrogram.

PRESET SETUP: Presets the color setup settings.

Figure 4-33. SETUP Menu (Spectrogram View)

4-15 Setting Up Advanced Measurements

The spectrum analyzer features smart measurements for setting up these advanced measurement: occupied bandwidth (OBW), channel power, and adjacent channel power (ACP) tests. The following sections present brief examples demonstrating the setup of these measurements.

From the MEASURE>MEASUREMENT>Spectrogram menu, select one of the desired measurements.
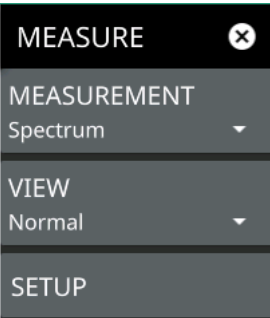
MEASUREMENT: Selects the desired measurement type from the following list:

- **Spectrum:** Displays the frequency domain spectrum measurement.
- **Channel Power:** The CHANNEL POWER table and channel lines are added to the measurement display.
- **OBW:** The OCCUPIED BANDWIDTH table and channel lines are added to the measurement display.
- **ACP:** The ACP table and channel lines are added to the measurement display.

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

- **Normal** Spectrum View. Refer to "Measurement Setup for the Spectrum Measurement Type" on page 4-39.
- **Spectrogram** selects Spectrogram view. When selected, a Spectrogram view is added to the display. Spectrogram is only available when the MEASUREMENT is set to Spectrum. Refer to "Channel Power" on page 4-41 through "Adjacent Channel Power" on page 4-45 for details about these advanced measurements.
- **Setup** The SETUP menu described below is available when MEASUREMENT is set to Spectrum and View is set to Spectrogram.
- **COLOR SCALE TOP:** Defines the amplitudes where the top color on the color setup bar are applied. Any measurement above this amplitude will appear black on the spectrogram window.
- **COLOR SCALE BOT:** 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 spectrogram window.
- **REFERENCE HUE:** Allows you to shift the color range of the spectrogram.

SETUP: For set up see "SETUP Menu (Spectrogram View)" on page 4-39.

Figure 4-34. MEASURE Menu

4-16   Channel Power

Channel power measurements are set up using the "SETUP Menu (Channel Power)" on page 4-42. The 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.

1. Channel power measurement results are shown in a table at the bottom of the display.

2. Dashed vertical lines and a shaded region define the main channel.

3. All channel power measurement parameters are set via the SETUP menu.

Figure 4-35. Channel Power Measurement

Frequency and span settings for many signal standards can be set as follows:

1. Press MEASURE on the main menu.

2. Select Channel Power from the MEASUREMENT button.

3. Press SETUP and then do the following:

   - Set the channel INTEGRATION Bandwidth.
   - Select PSD units (dBm/Hz or dBm/MHz).
   - Toggle power limit and PSD limit testing if you wish to see pass/fail test results.

Channel Power is a constant measurement; after it is turned on, it remains on until a different measurement is selected or the sweep is paused. Channel Power is calculated at the end of each sweep.

SETUP Menu (Channel Power)

The channel power SETUP menu is available in MEASURE > MEASUREMENT > Channel Power > SETUP. After the channel power measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

INTEGRATION BW: Specifies the range of integration used in calculating the power in the channel. The integration bandwidth (IBW) is displayed as the shaded region between the bandwidth start and stop thresholds (dashed green lines).

PSD UNITS: Sets the unit bandwidth for power spectral density. The available units are dBm/Hz and dBm/MHz.

POWER LIMIT: The power limit is the threshold value used to determine whether the actual measured channel power will pass or not. If the measured channel power exceeds the set power limit, the channel power test fails; otherwise, the test passes. Pass/fail test results are shown in the measurement results table.

PSD LIMIT: If the power spectral density limit is on, it is the threshold value used to determine whether the actual measured PSD will pass or not. If the measured PSD exceeds the PSD Limit, the PSD test fails; otherwise the test passes.

PRESET SETUP: Sets all channel power setup parameters to default. Turns off limits.

Figure 4-36. SETUP Menu (Channel Power)

4-17   Occupied Bandwidth

Occupied Bandwidth (OBW) measurements are set up using the . 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 on 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.
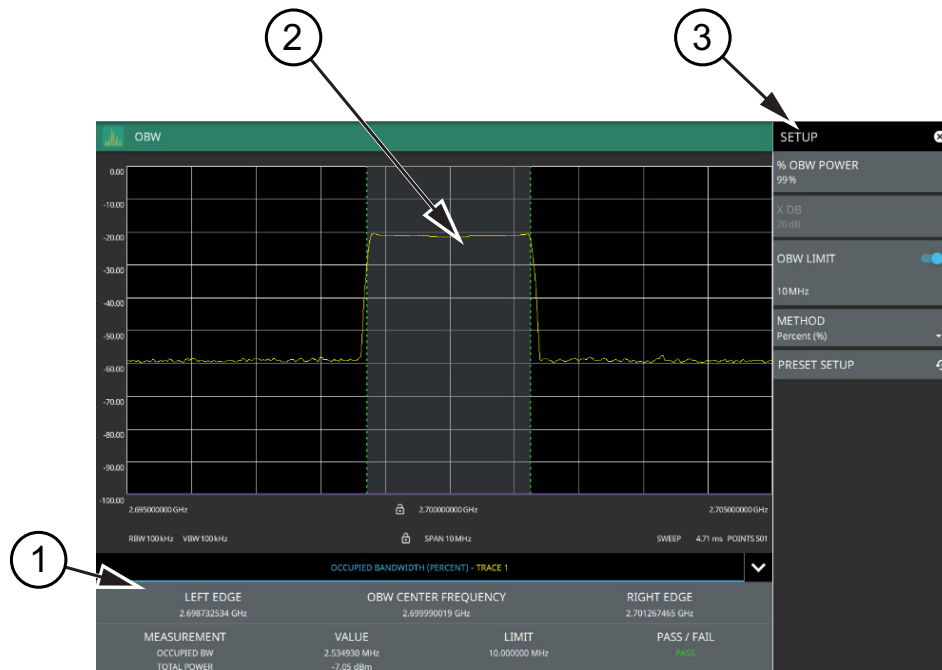
1. Occupied bandwidth measurement results are shown in a table at the bottom of the display.

2. Dashed vertical lines and a shaded region define the main channel.

3. All occupied bandwidth measurement parameters are set via the SETUP menu.

Figure 4-37. Occupied Bandwidth Measurement

Frequency and span settings for many signal standards can be set as follows:

1. Press MEASURE on the main menu.

2. Select OBW from the MEASUREMENT button.

3. Press SETUP and then do the following:

   - Set the % OBW power or set X DB (dBc) power value

   - Select the METHOD (Percent (%) or dBc (X DB)

   - Toggle OBW limit testing if you wish to see pass/fail test results

Occupied bandwidth is a constant measurement; after it is turned on, it remains on until a different measurement is selected or the sweep is paused. OBW is calculated at the end of each sweep.

SETUP Menu (Occupied BW)

The occupied bandwidth SETUP menu is available in MEASURE > MEASUREMENT > OBW > SETUP. After the OBW measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum display.

% OBW POWER: Sets the percentage of the total power that is measured within the occupied bandwidth for the current measurement. The resulting occupied bandwidth and total power values are displayed in the measurements results table.

X dB: Sets the x dB value used for the "x dB bandwidth" measurement. The occupied bandwidth is the frequency range between two points on the signal that are x dB down from the highest signal point within the OBW span.

OBW LIMIT: Enables limit checking at the specified frequency. The limit test results show as a green PASS or a red FAIL in the measurement table.

METHOD: Select the measurement method to be PERCENT (%) or X (dB).

PRESET SETUP: Sets all OBW setup parameters to default. Turns off limits.

Figure 4-38. SETUP Menu (Occupied BW)

4-18   Adjacent Channel Power

Adjacent Channel Power (ACP) measurements are set up using the . ACP is a measure of the power that leaks into adjacent transmit channels. The ACP measurement measures the power present in the transmit channel (refer to) along with the adjacent transmit channels that have been configured in the SETUP menu.
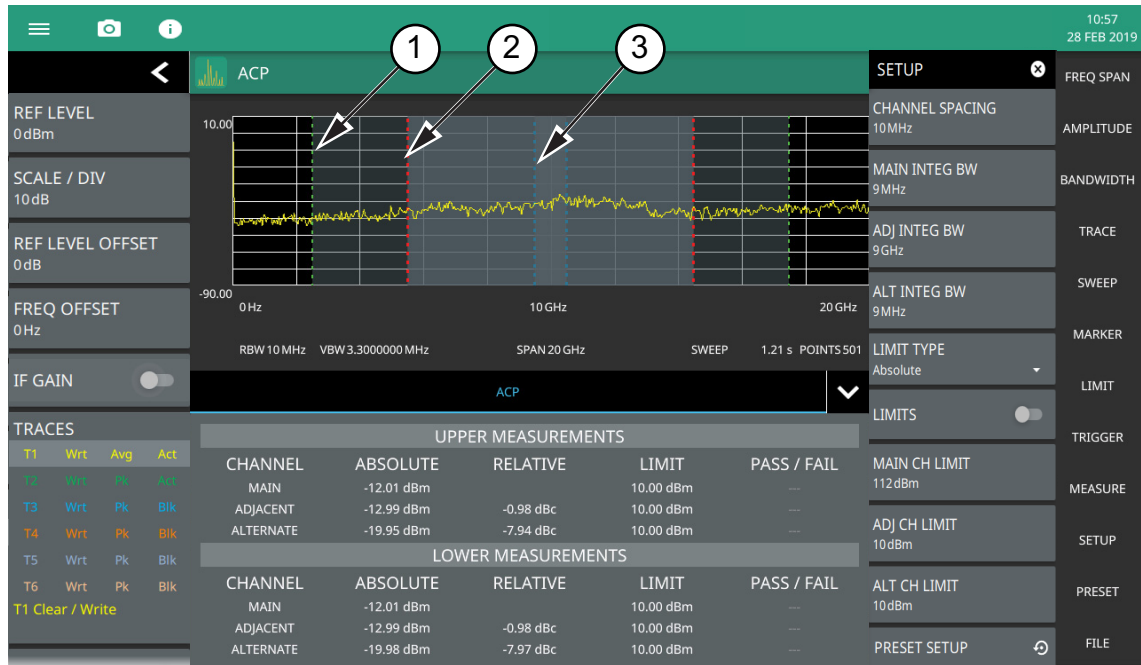
1. Green integration bandwidth edge of lower alternate channels.

2. Red integration bandwidth edge of lower adjacent and alternate channels.

3. Blue integration bandwidth edge of lower main and adjacent channels.

Figure 4-39. Adjacent Channel Power Ratio Measurement

Frequency and span settings for many signal standards can be set as follows:

1. Press MEASURE on the main menu.

2. Select ACP from the MEASUREMENT button.

3. Press SETUP and then adjust these settings:

    • Channel spacing

    • Main integration bandwidth

    • Adjacent integration bandwidth

    • Alternate integration bandwidth

    • Limit testing

    • Main channel limit

    • Adjacent channel limit

    • Alternate channel limit

ACP is a constant measurement; after it is turned on, it remains on until a different measurement is selected or the sweep is paused. ACP is calculated at the end of each sweep.

SETUP Menu (ACP)

The Adjacent Channel Power SETUP menu is available in MEASURE > MEASUREMENT > ACP > SETUP. After the ACP measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

|	
SETUP ⊗	
CHANNEL SPACING 10MHz	**CHANNEL SPACING:** Specifies the channel frequency spacing (center channel to center channel).
MAIN INTEG BW 9MHz	**MAIN INTEG BW:** Specifies the range of integration used in calculating the power within the channel. The integration bandwidth (IBW) is displayed as two vertical dashed lines for each channel.
ADJ INTEG BW 9GHz	**ADJ INTEG BW:** Specifies the range of integration bandwidth used in calculating the power in the adjacent channel.
ALT INTEG BW 9MHz	**ALT INTEG BW:** Specifies the range of integration used in calculating the power in the alternate channel.
LIMIT TYPE Absolute ▾	**LIMIT TYPE:** Selects Absolute or Relative for the limit evaluation.
LIMITS ◯	**LIMITS:** Turns on or off the use of ACP limits.
MAIN CH LIMIT 112dBm	**MAIN CH LIMIT:** Sets the main channel limit.
ADJ CH LIMIT 10dBm	**ADJ CH LIMIT:** Sets the adjacent channel limit.
ALT CH LIMIT 10dBm	**ALT CH LIMIT:** Sets the alternate channel limit.
PRESET SETUP ↺	**PRESET SETUP:** Sets all ACP setup parameters to default. Turns off limits.

Figure 4-40. SETUP Menu (ACP)

4-19   Presetting the Analyzer

The PRESET menu sets certain settings to the default state. Preset only affects the current analyzer settings, user files, or system settings.

PRESET Menu

PRESET TRACES: Presets all trace settings to default values.

PRESET MARKERS: Presets all marker settings to default values. Turns off all markers.

PRESET LIMITS: Presets all values on the LIMIT menu to default values. Turns off all limit lines.

PRESET SETUP: Presets all values on the SETUP menu to default values.

PRESET ALL: Presets all of the current analyzer settings to default values.

Figure 4-41. PRESET Menu

4-20 Saving and Recalling Measurements

The Spectrum Master can save measurement setups, native trace and CSV trace data, limit-line setups, and screenshots. You can recall setup, native trace, and limit line files. For other file operations such as copy, move, and directory management, refer to "File Management" on page 3-14.

Saving a Measurement

To save a measurement or setup:

1. Press FILE > SAVE AS...
2. If desired, change the location of the destination.
3. Enter the desired file name.
4. Select the type of file to save from the selection list.
5. Press SAVE to save the file.

After a file has been saved, the QUICK SAVE feature can be used to quickly save the same type of file with an incrementing number appended to the end of the original file name.

Recalling a Measurement

You can recall saved setups, native trace measurements, and limit lines. When recalling a setup, the instrument setup and operating state will be restored as it was when the setup was saved. When recalling a trace measurement, the instrument setup and on-screen measurement data will be restored as it was when the trace data was saved.

To recall a measurement or setup:

1. Press FILE > RECALL...
2. Select the file location from the Recall File window.
3. Sort by file type filter to rearrange the list if needed.
4. Select the desired file from the displayed list.
5. Press OPEN to recall the file.

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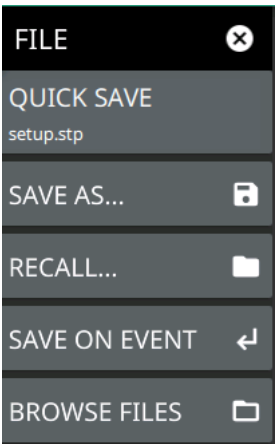
QUICK SAVE: saves a setup file immediately with the name shown in the button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved.

SAVE AS: Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. You can save the following:

- Setup: Saves the current instrument setup (stp file type).
- Trace: Saves the measurement point (trace) data and the current instrument setup (.rsm).
- Trace CSV: Saves the visible trace point data in comma separated value format (csv file type). This format is useful for further analysis using other software tools.
- Limit: Saves the current limit line point data (lim file type).
- Screenshot: Saves a screenshot of the current measurement (png file type).

RECALL: Opens the Recall File dialog to retrieve a file from a desired location. Only supported files will be displayed depending on the currently set measurement. When trace data are recalled, the instrument will change the settings to match the settings of the saved trace. The data will be recalled to the appropriate trace. That trace will be in a Hold mode. To exit the recalled data, simply change the trace mode back to Active. Refer to "Recalling a Measurement" on page 4-48.

SAVE ON EVENT: Opens the "SAVE ON EVENT Menu" on page 4-49.

BROWSE FILES: Opens the Windows file explorer. Refer to "File Management" on page 3-14.

Figure 4-42. FILE Menu

SAVE ON EVENT Menu

SAVE ON EVENT saves the current trace data to a folder named with the current date and time (yyyymmddhhmmss).
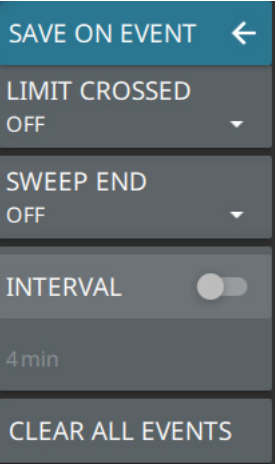
LIMIT CROSSED: When enabled, measurement trace data are automatically saved when the trace crosses a limit line that has been specified in the LIMIT menu. If SINGLE is selected, the first event will be saved and the event will be set to off. If CONTINUOUS is selected, each event will continue to be saved until the user turns it off or the memory is full.

SWEEP END: When enabled, measurement trace data are automatically saved after the current sweep is completed. If SINGLE is selected, the first sweep will be saved and the event will be turned off. If CONTINUOUS is selected, each sweep will continue to be saved until the user turns it off or the memory is full.

INTERVAL: A save will occur periodically. Set the desired period by entering the time.

CLEAR ALL EVENTS: This button will clear all set events.

Figure 4-43. SAVE ON EVENT Menu

Chapter 5 — Programming with SCPI

5-1 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.

5-2 Remote Programming Setup and Interface

The MS276xA software is an example of a remote programming application that is running locally on the PC controlling the MS276xA instrument. Using SCPI commands sent via a TCP/IP raw socket connection, the MS276xA software communicates to the Anritsu Device Monitor, which handles the USB communication between the PC and the MS276xA instrument. Your remote application will connect to the Device Manager in the same way. Below are a list of requirements for establishing a local or remote connection to the MS276xA:

- The MS276xA software and the Anritsu Device Manager must be installed on the controlling PC, laptop, or tablet, and the MS276xA must be connected via USB3.0 to the controlling computer (see Chapter 2, "Installation" for installation details). It is not necessary for the MS276xA software to run, only that the instrument is connected via the Anritsu Device Monitor.

- Remote programming and operation between the instrument and remote program are accomplished via a TCP/IP raw socket connection to port 59001.59001 is the default port number.
  This number can be modified by changing the port.txt file located here: My Documents > Anritsu > DeviceMonitor. The port used should show up in the Device Details window.

- The remote program must establish a TCP/IP raw socket connection at port 59001 to the PC to which the MS276xA is connected. If the remote application is running from the local controlling PC, the IP address is `localhost` or `127.0.0.1`; otherwise, the IP of the controlling computer must be specified.

- You might need to contact your network administrator to ensure network security policies, antivirus, and firewall settings do not block access to the controlling computer and its ports.

5-3 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, 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 MS276xA are covered in this manual.

Command Names

Typical SCPI commands consist of one or more keywords, parameters, and punctuation marks. 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 errors.

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 short form is presented in upper case and the long form in lower case. For example, the long form of the command keyword to control the instrument display is `:DISPlay`. If the short form is not used, the entire long form of the keyword must be used.

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 parameter settings 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 5-1. 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 5-7).
;	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.

Table 5-1.   Notational Conventions

|	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 5-3).

Command Terminators

The new line character (ASCII 10) or a semi-colon 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 might 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 5-2.   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) Values can be specified for parameters of type NR3, with +/- 9.9e37 representing +/- infinity (INFinity|NINFinity), and 9.91e37 representing Not-A-Number (NAN).
<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 contain amplitude. The frequency information for each point is given by:

```
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 5-1.
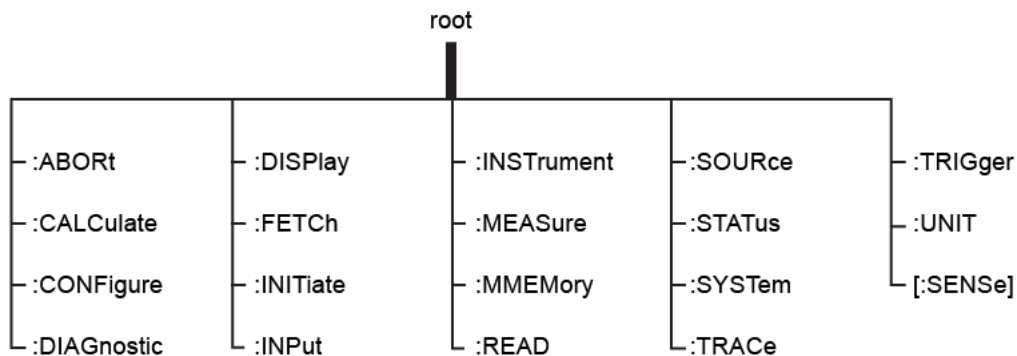
Figure 5-1.   SCPI Command Tree

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 might 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 .
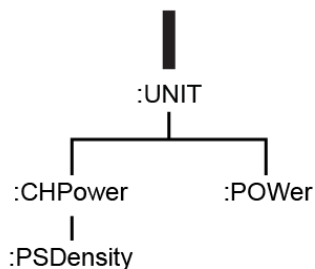
Figure 5-2.   SCPI :Sample :UNIT Subsystem

5-4   SCPI Command Types

The MS276xA 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. See also Section 6-1 "Common Commands".

SCPI Required Commands

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

Table 5-3.   SCPI Required Commands

`:STATus`
`:SYSTem`

SCPI Optional Commands

Optional SCPI commands comprise the majority of the MS276xA 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 5-4.   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.

5-5 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 arguments.

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 59001 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?
```

5-6   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 publication:

- The command name, see "Command Names" on page 5-1
- The path from the subsystem root command, see "Hierarchical Command Structure" on page 5-4
- The query form of the command (if applicable), see "Query Commands" on page 5-4
- The command title
- A description of the command's function and purpose
- The data parameters used as arguments for the command, see "Data Parameters" on page 5-3
  This might include the parameter type and the available parameter choices.

Refer to "MS276xA Commands" on page 6-1 for a listing of the programming commands.

Refer to Appendix A, "SCPI Error Table" for SCPI error definitions.

Refer to Appendix B, "Alphabetical SCPI Command List" for an alphabetical listing of all supported SCPI commands for this instrument.

Chapter 6 — MS276xA Commands

Note	References in these commands to files or memory refer to the device on which the spectrum analyzer software is running (PC, tablet, etc.) and not the Spectrum Master Ultraportable instrument. The only MSUS that may be manipulated is "Internal." Date and time parameters may only be queried.

6-1 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.

*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.

*IDN?

Title: Identify

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

*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.

*RST

Title: Reset

Description: This command sets the instrument into a known state that is ready for SCPI command processing. Setting the instrument into a known state includes the following steps:

1. All applications beside the default application of the particular model will be turned off.

2. Settings for all applications (regardless of an application being active) are preset to default values.

3. System settings excluding settings associated with client connections (like ethernet addresses or DNS) are preset to default values.

4. Pending operations are aborted and the pending operation flag will be reset. The instrument will be forced into the operation complete command idle state (OCIS) and the operation complete query idle state (OQIS) before the pending operation flag is reset.

*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.

*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.

6-2   System Commands

:DIAGnostic:MEMory?

Title: Used Memory

Description: This command returns the total memory available on the instrument, the free memory, and the memory used by the backend process in kB.

If the instrument runs into an error while retrieving system memory data, "nan,nan,nan" will be returned as the response and a "-100" (SCPI command error) will be placed in the SCPI error queue.

:INSTrument:CATalog:ACTive?

Title: List Active Applications

Description: This command queries all active applications. The response is returned as a comma delimited list of application names. The application names are the same as those returned by the INSTrument:CATalog:FULL? query or used as parameters to the INSTrument:SELect command.

If no applications are currently active, this query will return NONE.

:INSTrument:CATalog:FULL?

Title: Query Available Applications

Description: This query returns a list of string - number pairs. The string contains the name of the available application. The immediately following NR1-formatted number is its associated application number. All response data elements are comma separated.

If no application is available, a null string followed by a zero is returned.

: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.

Parameter 1: Directory. Use "/" as a directory separator. Note that this parameter should NOT be an empty string. To access the root directory, pass in "/" as the first parameter.

Parameter 2: MSUS (Use :MMEMory:CATalog:MSUSs query command to retrieve the list of available storage devices).

For example:

MMEMory:CATalog:DIRectory? "/", "USB0"

The response is formatted as follows: <total space used on MSUS>,<total space available on MSUS>,{<file entry1>},..{<file entryN>} 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, formatted as follows: <Device Name 1>,<Device Name 2>,...<Device Name N>

For example, sending:

MMEMory:CATalog:MSUSs?

could return:

Internal,USB0

:**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.

For example:

MMEMory:CDIRectory "/example_folder"

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).

For example:

MMEMory:COPY "/example_file.ext", "Internal", "/example_file.ext", "USB0"

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)

For example:

MMEMory:CREate:DIRectory "/example_folder", "USB0"

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.

For example:

MMEMory:DELete:DIRectory "/example_folder", "USB0"

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.

For example:

MMEMory:DELete:FILe "/example_folder/example_file.ext", "USB0"

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:CATalog:MSUSs? for information on obtaining the list of available devices.

For example:

MMEMory:LOAD:STATe 0,"/example_setup_file", "Internal"

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 and setup. After recall all traces will have update state turned off, but sweeping will continue with the recalled setup. This means that traces will retain the recalled measurement data until the trace update state is turned on. 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:CATalog:MSUSs? for information on obtaining the list of available devices.

For example:

MMEMory:LOAD:TRACe "ALL", "/example_measurement_file", "Internal"

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: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

For example:

MMEMory:MSIS "Internal"

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:CATalog:MSUSs? for information on obtaining the list of available devices.

For example:

MMEMory:STORe:STATe 0,"/example_setup_file", "Internal"

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 measurement data along with 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. 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:CATalog:MSUSs? for information on obtaining the list of available devices.

For example:

MMEMory:STORe:TRACe "ALL", "/example_measurement_file", "Internal"

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>

:SYSTem:COMMunicate:LAN:CONFig:CURRent?

Title: Current LAN Configuration

Description: This command queries the current ethernet configuration of the device.

:SYSTem:DATE <numeric_value>,<numeric_value>,<numeric_value>
:SYSTem:DATE?

Title: System Date

Description: This command sets and queries the system's internal calendar. Changing the system date does not affect the system time zone (if time zone is available). The three parameters for this command are <year>,<month> and <day>. The query response message shall consist of three fields separated by commas: <year>,<month>,<day>.

The year shall be entered as a four-digit number, including century and millennium information. This shall not be affected by a *RST command. Note: Some products only support the query version of this command.

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

: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.

: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 will all be deleted.

: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.

:SYSTem:FIRMware:VERSion?

Title: Firmware Version

Description: This command queries the device firmware version.

:SYSTem:LOG:ERRor?

 Title: System Error Log

 Description: This command retrieves the error log. The log is encrypted and can be saved to a file and sent to Anritsu Service if required.

:SYSTem:OPTions?

 Title: Query Options

 Description: This command retrieves the options that are currently set. The response is returned in "/" delimited form.

:SYSTem:OPTions:CONFig?

 Title: Option Configuration

 Description: This command returns a quoted string of characters readable only by Anritsu Customer Service. Only instrument configuration information is returned. No setup information is included.

:SYSTem:OPTions:UPGRade <string>

 Title: Option Upgrade

 Description: This command upgrades the options of the device with a valid license key provided as a quoted string parameter. The device must be reboot immediately after this command for the installation of the new options to complete. The device must not be powered off while the command is executing. The recommended way to restart the device safely is sending the *RST command after this command.

 This command might report the following error code: -200 : The command failed to complete. Detailed eror message will be provided in the response of :SYStem:ERRor[:NEXT]? command.

 Parameter(s): <string>

:SYSTem:PRESet

 Title: Preset

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

:SYSTem:TIME <numeric_value>,<numeric_value>,<numeric_value>
:SYSTem:TIME?

 Title: System Time

 Description: This command sets and queries the system's internal clock. Changing the system time does not affect the system time zone (if time zone is available). The three parameters for this command are <hour>,<minute> and <second>. The query response message shall consist of three fields separated by commas: <hour>,<minute>,<second>. Note: Some products only support the query version of this command.

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

6-3　SPA Commands

`: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.

`:CALCulate<n>:LIMit<n>:COMMent <string>`
`:CALCulate<n>:LIMit<n>: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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate\<n>:LIMit\<n>:CONTrol[:DATA] \<numeric_value> {HZ | KHZ | MHZ | GHZ}, {\<numeric_value> {HZ | KHZ | MHZ | GHZ}}, ...
:CALCulate\<n>:LIMit\<n>: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 1 MHz, 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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate<n>:LIMit<n>:CONTrol:MODE <ABSolute|RELative>`
`:CALCulate<n>:LIMit<n>: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>

Query Return: ABS|REL

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

Default Value: ABSolute

`:CALCulate<n>:LIMit<n>: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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>: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>

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>: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).

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate<n>:LIMit<n>: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).

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate<n>:LIMit<n>:LOWer[:DATA] <numeric_value> {DBM},`
`{<numeric_value> {DBM}}, ...`
`:CALCulate<n>:LIMit<n>: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 Suffix Range:	1, Default = 1
LIMit Suffix Range:	1-10, Default = 1

`:CALCulate<n>:LIMit<n>:LOWer:MODE <ABSolute|RELative>`
`:CALCulate<n>:LIMit<n>: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>
Query Return:	ABS|REL
CALCulate Suffix Range:	1, Default = 1
LIMit Suffix Range:	1-10, Default = 1
Default Value:	ABSolute

:CALCulate\<n\>:LIMit\<n\>: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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate\<n\>:LIMit\<n\>:LOWer:STATe \<0 | 1 | ON | OFF\>
:CALCulate\<n\>:LIMit\<n\>: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\>

Query Return: 0 | 1

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

Default Value: OFF

`:CALCulate<n>:LIMit<n>:NAME <string>`
`:CALCulate<n>:LIMit<n>: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 Suffix Range:	1, Default = 1
LIMit Suffix Range:	1-10, Default = 1

`:CALCulate<n>:LIMit<n>:STATe <0 | 1 | ON | OFF>`
`:CALCulate<n>:LIMit<n>: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>
Query Return:	0 | 1
CALCulate Suffix Range:	1, Default = 1
LIMit Suffix Range:	1-10, Default = 1
Default Value:	OFF

`:CALCulate<n>:LIMit<n>:TRACe<n>:CHECk <0 | 1 | ON | OFF>`
`:CALCulate<n>:LIMit<n>:TRACe<n>:CHECk?`

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 Suffix Range:	1, Default = 1
LIMit Suffix Range:	1-10, Default = 1
TRACe Suffix Range:	1-6, Default = 1

:CALCulate\<n>:LIMit\<n>:UPPer[:DATA] \<numeric_value> {DBM},
{\<numeric_value> {DBM}}, ...
:CALCulate\<n>:LIMit\<n>: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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

:CALCulate\<n>:LIMit\<n>:UPPer:MODE \<ABSolute|RELative>
:CALCulate\<n>:LIMit\<n>: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>

Query Return: ABS|REL

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

Default Value: ABSolute

`:CALCulate<n>:LIMit<n>: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 Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate<n>:LIMit<n>:UPPer:STATe <0 | 1 | ON | OFF>`
`:CALCulate<n>:LIMit<n>: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>

Query Return: 0 | 1

CALCulate Suffix
Range: 1, Default = 1

LIMit Suffix Range: 1-10, Default = 1

Default Value: OFF

`:CALCulate<n>: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.

CALCulate Suffix
Range: 1, Default = 1

`: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

`: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

`: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

`: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

`:CALCulate:ACPower:LIMit:FAIL?`

Title: ACPR Limit Fail

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

`: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>

Query Return: ABS|REL

Default Value: ABSolute

: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

: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

`: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:LIMit<n>: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.

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate:LIMit<n>:LOWer:ENVelope:CREate`

Title: Create Lower Limit Envelope

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

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate:LIMit<n>:LOWer[:TRACe]:POINts?`

Title: Lower Limit Points

Description: This command queries the lower 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. Points which are not covered by the limit will be 'inf'.

LIMit Suffix Range: 1-10, Default = 1

`:CALCulate:LIMit<n>:UPPer:ENVelope:CREate`

Title: Create Upper Limit Envelope

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

LIMit Suffix Range: 1-10, Default = 1

:CALCulate:LIMit<n>: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. Points which are not covered by the limit will be 'inf'.

LIMit Suffix Range: 1-10, Default = 1

: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: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 point for the limit envelope.

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 20

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>
Query Return:	SQU|SLOP
Default Value:	SQUare

`:CALCulate:MARKer<n>:FUNCtion <OFF|NOISe|FCOunter>`
`:CALCulate:MARKer<n>: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|FCOunter>
Query Return:	OFF|NOIS|FCO
MARKer Suffix Range:	1-12, Default = 1
Default Value:	OFF

`:CALCulate:MARKer<n>:MAXimum`

Title:	Maker Move To Highest Peak
Description:	Moves the marker X value to the point in the marker's assigned trace that has the highest peak.
MARKer Suffix Range:	1-12, Default = 1

`:CALCulate:MARKer<n>: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 highest peak to the LEFT of the current X position of the marker.
MARKer Suffix Range:	1-12, Default = 1

`:CALCulate:MARKer<n>: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.
MARKer Suffix Range:	1-12, Default = 1

:CALCulate:MARKer<n>: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 highest peak to the RIGHT of the current X position of the marker.

MARKer Suffix
Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MODE <POSition|DELTa|FIXed>
:CALCulate:MARKer<n>:MODE?

Title: Marker Mode

Description: Select 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.

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

Query Return: POS|DELT|FIX

MARKer Suffix
Range: 1-12, Default = 1

Default Value: POSition

:CALCulate:MARKer<n>:MOVE:LEFT

Title: Marker Move To Left

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

MARKer Suffix
Range: 1-12, Default = 1

:CALCulate:MARKer<n>:MOVE:RIGHt

Title: Marker Move To Right

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

MARKer Suffix
Range: 1-12, Default = 1

:CALCulate:MARKer<n>:REFerence <numeric_value>
:CALCulate:MARKer<n>: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

MARKer Suffix
Range: 1-12, Default = 1

Default Value: 0

Range: 0 to 12

:CALCulate:MARKer<n>[:SET]:CENTer

Title: Marker Set Center

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

MARKer Suffix
Range: 1-12, Default = 1

:CALCulate:MARKer<n>[:SET]:RLEVel

Title: Marker Set Reference Level

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

MARKer Suffix
Range: 1-12, Default = 1

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

Title: Marker State

Description: Turns the selected marker on or off.

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

Query Return: 0 | 1

MARKer Suffix
Range: 1-12, Default = 1

Default Value: OFF

:CALCulate:MARKer<n>:TRACe <numeric_value>
:CALCulate:MARKer<n>:TRACe?

Title: Marker Trace

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

Parameter(s): <numeric_value>

Query Return: Numeric

MARKer Suffix
Range: 1-12, Default = 1

Default Value: 1

Range: 1 to 6

`:CALCulate:MARKer<n>:X <numeric_value> {HZ | KHZ | MHZ | GHZ}`
`:CALCulate:MARKer<n>:X?`

Title:	Marker Position
Description:	Sets the marker frequency.
Parameter(s):	<numeric_value> {HZ	KHZ	MHZ	GHZ}
Query Return:	Numeric (Hz)
MARKer Suffix Range:	1-12, Default = 1
Default Value:	200000000000 Hz
Default Unit:	Hz
Range:	-400000000000 Hz to 300000000000 Hz

`:CALCulate:MARKer<n>:X <numeric_value> {PS | NS | US | MS | S | MIN | HR}`
`:CALCulate:MARKer<n>:X?`

Title:	Marker Position Zero Span
Description:	Sets the marker time.
Parameter(s):	<numeric_value> {PS	NS	US	MS	S	MIN	HR}
Query Return:	Numeric (ms)
MARKer Suffix Range:	1-12, Default = 1
Default Value:	29999.99 ms
Default Unit:	ms
Range:	-1000 ms to 61670 ms

`:CALCulate:MARKer<n>:Y <numeric_value> {DBM}`
`:CALCulate:MARKer<n>:Y?`

Title:	Marker Value
Description:	Set/Get the marker Y value. The user defined Y maker value will be applied only if the marker is in Fixed mode.
Parameter(s):	<numeric_value> {DBM}
Query Return:	Numeric (dBm)
MARKer Suffix Range:	1-12, Default = 1
Default Value:	10 dBm
Default Unit:	dBm
Range:	-250 dBm to 130 dBm

`:CALCulate:MARKer:AOFF`

Title:	Marker All Off
Description:	Turns all markers off.

`:CALCulate:MARKer:APReset`

        Title: Marker Preset

    Description: Presets all markers to their preset values.

`:CALCulate:MARKer[:DATA]:ALL?`

        Title: All Marker Data

    Description: Returns the last stored X and Y values of all markers. The response format is (marker1.x, marker1.y), (marker2.x, marker2.y), ... (markern.x, markern.y). Returns (0,nan) if the marker has never been turned on or the marker is preset.

`:CALCulate:MARKer:PEAK:EXCursion <numeric_value> {DB}`
`: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> {DB}

    Query Return: Numeric (dB)

    Default Value: 0 dB

    Default Unit: dB

        Range: 0 dB to 200 dB

`: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: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 300000000000 Hz

:CALCulate:OBW:LIMit:FAIL?

Title: OBW Limit Fail

Description: This command queries the result of a limit check

on occupied bandwidth power

: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

:CALCulate:PEAK:COUNt <numeric_value>
:CALCulate:PEAK:COUNt?

Title: Peak Count

Description: The desired number of peaks to be reported by FETC:PEAK? query.

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 1

Range: 1 to 6

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

Title:	Peak Threshold Level
Description:	Sets the threshold level which peak powers must exceed to be reported by FETC:PEAK? query.
Parameter(s):	<numeric_value> {DBM}
Query Return:	Numeric (dBm)
Default Value:	0 dBm
Default Unit:	dBm
Range:	-150 dBm to 30 dBm

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

Title:	Peak Threshold State
Description:	Turn ON|OFF the threshold that peak powers must exceed to be reported by PEAKS? query.
Parameter(s):	<0	1	ON	OFF>
Query Return:	0	1
Default Value:	OFF

`:CONFigure:ACPower`

Title:	Configure Adjacent Channel Power Ratio
Description:	Configures and enables the default adjacent channel power ratio measurement. Disables channel power and occupied bandwidth measurements. 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.

`:CONFigure:CHPower`

Title:	Configure Channel Power
Description:	Configures and enables the default channel power measurement. Disables ACPR and occupied bandwidth measurements. 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.

`:CONFigure:OBWidth`

Title:	Configure Occupied Bandwidth
Description:	Configures and enables the default occupied bandwidth measurement. Disables channel power and ACPR measurements. 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.

: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.

: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.

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 501

Range: 10 to 4001

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

Title: Display View

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

Parameter(s): <NORMal|SPECtrogram>

Query Return: NORM|SPEC

Default Value: NORMal

: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.

: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: -90 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 formatted as below

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 formatted 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:HISTory:ELAPsed? <numeric_value>

Title: Spectrogram History Elapsed

Description: Provides the time values for the specified index in spectrogram history. Returns a negative value if the specified index is invalid.

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>

Query Return: BOTT|TOP|FULL

Default Value: BOTTom

`: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:SCALe:PDIVision <numeric_value> {PS | NS | US | MS | S | MIN | HR}`
`:DISPlay:VIEW:SPECtrogram:SCALe:PDIVision?`

Title: Spectrogram Per Division

Description: Identifies the scale of the spectrogram's grid spacing.

Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR}

Query Return: Numeric (ms)

Default Value: 1000 ms

Default Unit: ms

Range: 1000 ms to 100000 ms

`: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>

Query Return: POS|TIME

Default Value: POSition

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <numeric_value>
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Title: Scale Per Division

Description: Set or query the scale per division setting of trace graph. This command doesn't change any behavior in the backend, but will be included in save/recall operations.

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 10

Range: 1 to 15

: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).

Note that this may cause a change in attenuation if the automatic input attenuation coupling is enabled. For the purpose of coupling, the actual reference level (without the offset applied) is used, though this command will always reflect the display value.

For example, suppose a starting reference level offset of 0 dB and a reference level of 10 dBm. If the offset is set to 20 dB, the display reference level will be set to 10 dBm - 20 dB = -10 dBm; no attenuation change will occur. Likewise, if the starting reference level offset is 20 dB and the (display) reference level is set to 0 dBm, the display reference level will remain at 0 dBm, though the (actual) reference level value used in auto attenuation coupling is 0 dBm + 20 dB = 20 dBm.

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: 10 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 the actual reference level used for auto attenuation coupling, or 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

`: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 (see [:SENSe]:CHPower:STATe) then, the instrument will indicate error -400 and return the string "nan,nan,nan,nan,nan,nan,nan,nan,nan"

`: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 (see [:SENSe]:CHPower:STATe) then, the instrument will indicate error -400 and return the string "nan,nan"

`:FETCh:CHPower:CHPower?`

Title: Fetch Channel Power

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 (see [:SENSe]:CHPower:STATe) then, the instrument will indicate error -400 and return the string "nan,nan"

`: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 (see [:SENSe]:CHPower:STATe) then, the instrument will indicate error -400 and return the string "nan,nan"

:FETCh:OBWidth<n>?

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. The channel power and occupied bandwidth measurements will be calculated regardless of CHP:STAT and OBW:STAT settings.

Using suffix 3 will return the same results as 1, plus the start, center, and end frequencies of the occupied bandwidth.

For all 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.

OBWidth Suffix
Range: 1-3, Default = 1

: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.

:FORMat[:TRACe][:DATA] <ASCii|INTeger|REAL>,[<numeric_value>]
:FORMat[:TRACe][:DATA]?

Title: Trace Data Format

Description: This command specifies the format in which data is returned in TRAC:DATA queries. The optional numeric parameter is needed for REAL format only. It defines the length of the floating point number in bits. Valid values are 32 and 64. If the optional numeric parameter is omitted, the default length of REAL data is set to 64 bits.

ASCii format returns the data in comma-separated ASCII format. The units are the current measurement units.

INTeger,32 values are signed 32-bit integers in little-endian byte order. This format returns the data in 4-byte blocks. The values are scaled by 1000, so if the current measurement units are dBm the integer values would be mdBm. For example, if the measured result was -12.345 dBm, that value would be sent as -12345.

REAL,32 values are 32-bit floating point numbers conforming to the IEEE 754 standard in little-endian byte order. This format returns the data in 4-byte binary format. The units are the current measurement units.

REAL,64 values are 64-bit floating point numbers conforming to the IEEE 754 standard in little-endian byte order. This format returns the data in 8-byte binary format. The units are the current measurement units.

Parameter(s): <ASCii|INTeger|REAL>,[<numeric_value>]

Query Return: ASC|INT|REAL

Default Value: ASCii

: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.

`:INITiate[:IMMediate]:ALL`

Title: Initiate Average Count Sweep

Description: Initiates sweep until all active traces reach its average count

`:INSTrument:REMote:STATe <0 | 1 | ON | OFF>,<string>`
`:INSTrument:REMote:STATe?`

Title: RemoteSpectrumAnalyzerId

Description: This command can be used to indicate the device is being used by someone. The set command takes two parameters:

- a boolean to indicate whether the device is being used

- a string to indicate the identification of someone currently using the device.

When a value of 1 is passed into the boolean parameter (indicating the device being used), the identification string parameter must be non-empty; otherwise, a scpi error will be generated.

When no longer being used, these settings should be cleared with a boolean parameter of zero. The string paramter does not matter because it will automatically be set to the empty string.

The query command returns the current values of the boolean and the string settings. The remote identification string setting is empty only if it has never been set or has been cleared via this command.

Both settings will be reset after a reboot.

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

`: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.

`: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.

`: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. It is a combination of the commands :CONFigure:CHPower; :READ:CHPower:CHPower?

To measure both channel power and channel power density use MEASure: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:CHPower?

: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. It is a combination of the commands :CONFigure:CHPower; :READ:CHPower:DENSity?

To measure both channel power and channel power density use MEASure: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:DENSity?

: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.

For example:

MMEMory:LOAD:LIMit "ALL","/example_limit_file", "USB1"

The model of the device that the limit was saved in must match the model of the the device to load in; otherwise, the load will be rejected.

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

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

Title: Load RAM

Description: Store data to RAM from a file. This command takes three parameters

1. data block size: that needs to be stored in bytes (must be a word aligned)

2. offset: in bytes from start of RAM address to store data at

3. filename: name of the file without the full path. Contents of this file will be copied over to RAM

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

:MMEMory:STOEvent:CLEarall

Title: Clear All Save On Event

Description: Turns off all save on event types that are active.

`: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>

Query Return: CONT|SING

Default Value: CONTinuous

`: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> {PS | NS | 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 occured when :MMEMory:STOEvent:LIMit:MODE is set to INTerval.

Parameter(s):   <numeric_value> {PS | NS | 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 contiue to save at every end of sweep until the set time interval has expired.

Parameter(s): <CONTinuous|SINGle|INTerval>

Query Return: CONT|SING|INT

Default Value: CONTinuous

: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> {PS | NS | 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> {PS | NS | 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[: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.

For example:

MMEMory:STORe:LIMit "ALL","/example_limit_file", "USB1"

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>

:MMEMory:STORe:RAM <numeric_value>,<numeric_value>,<string>

Title: Store RAM

Description: Load data from RAM to a file. This command takes three parameters

1. data block size: that needs to be loaded in bytes (must be a word aligned)

2. offset: in bytes from start of RAM address to load from

3. filename: name of the file without the full path. This is the destination file where the contents of RAM are copied over

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

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

Title: Store Trace in CSV

Description: This command saves the current trace to CSV file in 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:CATalog: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>

: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 the equivalent of the command sequence :ABORT; :INITiate; :FETCh:ACPower?

The channel power measurement must be the active measurement (specified by the command :CONFigure:ACPower).The instrument should be in the single sweep mode.

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 or if :INITiate:CONTinuous is set to ON(continuous sweep) it returns a string "nan,nan,nan,nan,nan,nan,nan,nan,nan"

: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 the equivalent of the command sequence: ":ABORT; :INITiate; :FETCh:CHPower?"

The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).The instrument should be in the single sweep mode. 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, or if :INITiate:CONTinuous is set to ON(continuous sweep), it returns a string "nan,nan".

:READ:CHPower:CHPower?

Title: Read Channel Power

Description: Triggers a new channel power measurement and returns the channel power result: channel power. It is the equivalent of the command sequence ":ABORT; :INITiate; :FETCh:CHPower:CHPower?"

The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).The instrument should be in the single sweep mode. Data returned is: channel power.

If the measurement is not active, the instrument will indicate error -400 and return the string "nan,nan". If :INITiate command fails, or if :INITiate:CONTinuous is set to ON(continuous sweep), it returns a string "nan,nan".

:READ:CHPower:DENSity?

Title: Read Channel Power Density

Description: Triggers a new channel power measurement and returns the results: channel power density. It is the equivalent of the command sequence :ABORT; :INITiate; :FETCh:CHPower:DENSity? The channel power measurement must be the active measurement (specified by the command :CONFigure:CHPower).The instrument should be in the single sweep mode. Data returned is: 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, or if :INITiate:CONTinuous is set to ON(continuous sweep), it returns a string "nan,nan"

[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent <numeric_value> {HZ | KHZ | MHZ | GHZ}
[:SENSe]:ACPower:BANDwidth|BWIDth:ADJacent?

Title: Adjacent CHPWR 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 400000000000 Hz

`[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate <numeric_value> {HZ | KHZ | MHZ | GHZ}`

`[:SENSe]:ACPower:BANDwidth|BWIDth:ALTernate?`

Title:	Adjacent CHPWR 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 400000000000 Hz

`[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN <numeric_value> {HZ | KHZ | MHZ | GHZ}`

`[:SENSe]:ACPower:BANDwidth|BWIDth:MAIN?`

Title:	Adjacent CHPWR 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 400000000000 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 400000000000 Hz

[:SENSe]:ACPower:STATe <0 | 1 | ON | OFF>
[:SENSe]:ACPower: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|RAVerage>
[: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|RAVerage>

Query Return: NORM|MIN|MAX|AVER|RMAX|RMIN|RAV

Default Value: NORMal

[:SENSe]:BANDwidth|BWIDth[:RESolution] <numeric_value> {HZ | KHZ | MHZ | GHZ}
[:SENSe]:BANDwidth|BWIDth[:RESolution]?

Title: RBW Zero Span

Description: Sets the resolution bandwidth.

Note that using this command turns the automatic resolution bandwidth setting OFF.

In Zero Span, the range will change to allow a mininum of 5 KHz to the maximum of 20 MHz.

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

Query Return: Numeric (Hz)

Default Value: 3000000 Hz

Default Unit: Hz

Range: 5000 Hz to 20000000 Hz

[: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: 10 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-05 to 1

[:SENSe]:BANDwidth|BWIDth:SHAPe <FLATtop|NUTall>
[:SENSe]:BANDwidth|BWIDth:SHAPe?

Title:	RBW Filter Type
Description:	This command sets the RBW filter type, Flat Top window or Nutall.
Parameter(s):	<FLATtop|NUTall>
Query Return:	FLAT|NUT
Default Value:	FLATtop

[:SENSe]:BANDwidth|BWIDth:VIDeo <numeric_value> {HZ | KHZ | MHZ | GHZ}
[:SENSe]:BANDwidth|BWIDth:VIDeo?

Title:	VBW Zero Span
Description:	Sets the video bandwidth.
	Note that using this command turns the automatic video bandwidth setting OFF.
	In Zero Span, the range will change to allow a mininum of 5 KHz to the maximum of 20 MHz.
	The Default value will also change to 3 MHz.
Parameter(s):	<numeric_value> {HZ	KHZ	MHZ	GHZ}
Query Return:	Numeric (Hz)
Default Value:	3000000 Hz
Default Unit:	Hz
Range:	5000 Hz to 20000000 Hz

[: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:	1000000 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: 0.333333333333333

Range: 1e-05 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>

Query Return: LIN|LOG

Default Value: LINear

[: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 decoupled 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 decoupled 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> {PS | NS | 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> {PS | NS | US | MS | S | MIN | HR}

　　Query Return: Numeric (ms)

　　Default Value: 0 ms

　　　Default Unit: ms

　　　　　　Range: 0 ms to 10000 ms

`[:SENSe]:CAPTure:TIMe:ACTUal?`

　　　　　　　Title: Actual Capture Time

　　Description: Returns actual time spent taking samples for each portion of the spectrum. The query version of this command reports the setting value in milliseconds.

　　Query Return: Numeric (ms)

　　Default Value: 0 ms

　　　Default Unit: ms

　　　　　　Range: 0 ms to 11000 ms

`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration <numeric_value> {HZ | KHZ | MHZ | GHZ}`
`[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration?`

　　　　　　　Title: CHPWR 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 400000000000 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]: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: 3000000000 Hz

Default Unit: Hz

Range: -99999999995 Hz to 299999999995 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.

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

Query Return: Numeric (Hz)

Default Value: 0 Hz

Default Unit: Hz

Range: -10000000000 Hz to 10000000000 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.

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

Query Return: Numeric (Hz)

Default Value: 400000000000 Hz

Default Unit: Hz

Range: 10 Hz to 400000000000 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.

`[: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.

`[: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: -100000000000 Hz to 299999999990 Hz

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

Title: Frequency Step

Description: Set or query the step size to gradually increase or decrease frequency value. This command doesn't change any behavior in the backend but will be included in save/recall operations.

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

Query Return: Numeric (Hz)

Default Value: 1000000 Hz

Default Unit: Hz

Range: 1000 Hz to 1000000000 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: 6000000000 Hz

Default Unit: Hz

Range: -99999999990 Hz to 300000000000 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>

Query Return: NLOW|NHIG|NORM

Default Value: 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>

Query Return: XDB|PERC

Default Value: 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:IF:GAIN:STATe <0 | 1 | ON | OFF>`
`[:SENSe]:POWer:IF:GAIN:STATe?`

Title: IF Gain State

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: Sweep Time

Description: Sets the value of the minimum sweep time parameter. The sweep will complete in the shortest time possible greater than the specified time. To sweep as fast as possible, enter the minimum value allowed for the sweep time. Applies to zero span sweeps only.

Parameter(s): <numeric_value> {PS | NS | US | MS | S | MIN | HR}

Query Return: Numeric (ms)

Default Value: 30000 ms

Default Unit: ms

Range: 0.02 ms to 60000 ms

: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

:TRACe<n>:DETector[:FUNCtion] <POSitive|RMS|NEGative|SAMPle>
:TRACe<n>: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. SAMPle detection selects one of the associated measurement points to display. This command will be ignored when spectrogram is enabled by DISPlay:VIEW. In zero span and RTSA mode the SAMPle detection replaces RMS detection.

Parameter(s): <POSitive|RMS|NEGative|SAMPle>

Query Return: POS|RMS|NEG|SAMP

TRACe Suffix
    Range: 1-6, Default = 1

Default Value: POSitive

:TRACe<n>:DISPlay[:STATe] <0 | 1 | ON | OFF>
:TRACe<n>: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>

Query Return: 0 | 1

TRACe Suffix
    Range: 1-6, Default = 1

Default Value: ON

:TRACe<n>: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.

TRACe Suffix
    Range: 1-6, Default = 1

:TRACe<n>:DISPlay:VIEW:SPECtrogram:POSition <numeric_value>
:TRACe<n>: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>

Query Return: Numeric

TRACe Suffix
    Range: 1-6, Default = 1

Default Value: 0

    Range: 0 to 600

:TRACe\<n\>:DISPlay:VIEW:SPECtrogram:TIME \<numeric_value\>
:TRACe\<n\>:DISPlay:VIEW:SPECtrogram:TIME?

Title: Spectrogram Trace Time

Description: The command select the spectrogram history trace base on elapsed time from the newest trace.

Parameter(s): \<numeric_value\>

Query Return: Numeric (ms)

TRACe Suffix
Range: 1-6, Default = 1

Default Value: 0 ms

Default Unit: ms

Range: 0 ms to 100000000 ms

:TRACe\<n\>:SWEep:COUNt[:CURRent]?

Title: Trace Sweep Count

Description: The trace sweep count returns current sweep count which can be useful for multiple-sweep measurements like average and min/max hold.

Query Return: Numeric

TRACe Suffix
Range: 1-6, Default = 1

Default Value: 0

Range: 0 to 4000000000

:TRACe\<n\>:TYPE
\<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage\>
:TRACe\<n\>: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. This command will be ignored when spectrogram is enabled by DISPlay:VIEW.

Parameter(s): \<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage\>

Query Return: NORM|MIN|MAX|AVER|RMAX|RMIN|RAV

TRACe Suffix
Range: 1-6, Default = 1

Default Value: NORMal

`:TRACe<n>:UPDate[:STATe] <0 | 1 | ON | OFF>`
`:TRACe<n>:UPDate[:STATe]?`

Title: Trace Update State

Description: The trace update state detemine whether the trace is update in every sweep.

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

Query Return: 0 | 1

TRACe Suffix
Range: 1-6, Default = 1

Default Value: ON

`:TRACe:CLEar <numeric_value>`

Title: Trace Clear

Description: This command clears the trace's history and current sweep data. Trace history refers to the previous trace data used to calculate trace types such as min/max hold and averaging.

Parameter(s): <numeric_value>

`:TRACe:CLEar:ALL`

Title: All Traces Clear

Description: This command clears the trace history and current sweep data for all traces. Trace history refers to the previous data used to calculate trace types such as min/max hold and averaging.

`: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. The binary block 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 depends on the current data format setting (FORMat[:TRACe][:DATA]). 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[:DATA]:ALL?

Title: Trace Data All

Description: This command transfers trace data from the instrument to the controller for all traces with display state ON (see Trace Display State commands). The traces are returned back to back with no delimiter between traces using the same IEEE definite length arbitrary block response of the Trace Data command. However, after the usual header this command includes additional header information to support parsing the following data. This additional header consists of a two byte integer indicating the number of display points per trace as well as a two byte trace flags value. The bits in the two byte trace flags value are mapped to a trace number and indicate whether that trace is included in the following data. Bit 0 is the least significant bit and is unused. Bits 1 through N are mapped to traces 1 through N. If the bit value is 1, the trace data for that trace is included in the following data. If the bit value is 0, the trace data for that trace is not included in the following data. For example, a trace flags value of 0x4C indicates that trace data for traces 2, 3, and 6 are included in the following data. The traces are returned in increasing order. The format of the data follows the Trace Data Format setting.

: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.

:TRACe:SELect <numeric_value>
:TRACe:SELect?

Title: Select Trace

Description: The selected trace will be used by operations that use a single trace. The max number of traces available to select is model specific.

To display the trace, see TRACe<n>:DISPlay[:STATe]

To update the trace state, see TRACe<n>:UPDate[:STATe]

Parameter(s): <numeric_value>

Query Return: Numeric

Default Value: 1

Range: 1 to 6

:TRACe:SPECtrogram:DETector[:FUNCtion] <POSitive|RMS|NEGative|SAMPle>
:TRACe:SPECtrogram:DETector[:FUNCtion]?

Title: Spectrogram Detector Type

Description: Sets the detection method for the spectrogram 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. SAMPle detection selects one of the associated measurement points to display. This command will be ignored when spectrogram is disabled by DISPlay:VIEW. In RTSA mode the SAMPle detection replaces RMS detection.

Parameter(s): <POSitive|RMS|NEGative|SAMPle>

Query Return: POS|RMS|NEG|SAMP

Default Value: POSitive

:TRACe:SPECtrogram:TYPE
<NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage>
:TRACe:SPECtrogram:TYPE?

Title: Spectrogram 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. This command will be ignored when spectrogram is disabled by DISPlay:VIEW.

Parameter(s): <NORMal|MINimum|MAXimum|AVERage|RMAXimum|RMINimum|RAVerage>

Query Return: NORM|MIN|MAX|AVER|RMAX|RMIN|RAV

Default Value: NORMal

: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:

OkStatus = 0x0

ADCOverrange = 0x1

Saturation = 0x2

SLOLockFailure = 0x4

LO1LockFailure = 0x8

LO2LockFailure = 0x10

TGLOLockFailure = 0x20

LimitFailure = 0x40

OverpowerFailure = 0x1000

DeviceAccessFailure = 0x10000 Failed to communicate with the device.

EPROMFailure = 0x20000 Failed to access device EEPROM.

DataTransIrregular = 0x40000 Data transfer irregular.

NoCalibration = 0x80000 Data is not calibrated.

Parameter(s): <numeric_value>

:TRIGger[:SEQuence]:ATRigger <numeric_value> {PS | NS | 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> {PS | NS | 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> {PS | NS | 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> {PS | NS | US | MS | S | MIN | HR}

Query Return: Numeric (ms)

Default Value: 0 ms

Default Unit: ms

Range: -1000 ms to 1670 ms

: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> {PS | NS | US | MS | S | MIN | HR}
:TRIGger[:SEQuence]:HOLDoff?

Title: Trigger Holdoff

Description: The trigger holdoff 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> {PS | NS | 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 external trigger signal.

Parameter(s): <POSitive|NEGative|ANY>

Query Return: POS|NEG|ANY

Default Value: POSitive

:TRIGger[:SEQuence]:SOURce <EXT|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. Values with a number in them are only available on instruments with more than one trigger port.

Parameter(s): <EXT|EXT1|EXT2|IMMediate|VIDeo>

Query Return: EXT|EXT1|EXT2|IMM|VID

Default Value: IMMediate

: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

`: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>
Query Return:	DBMH	DBMM
Default Value:	DBMHz

`:UNIT:POWer <DBM>`
`:UNIT:POWer?`

Title:	Measurement Units
Description:	Sets the default amplitude units for input, output and display.
Parameter(s):	<DBM>
Query Return:	DBM
Default Value:	DBM

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

Anritsu

10580-00427   M

Anritsu utilizes recycled paper and environmentally conscious inks and toner.