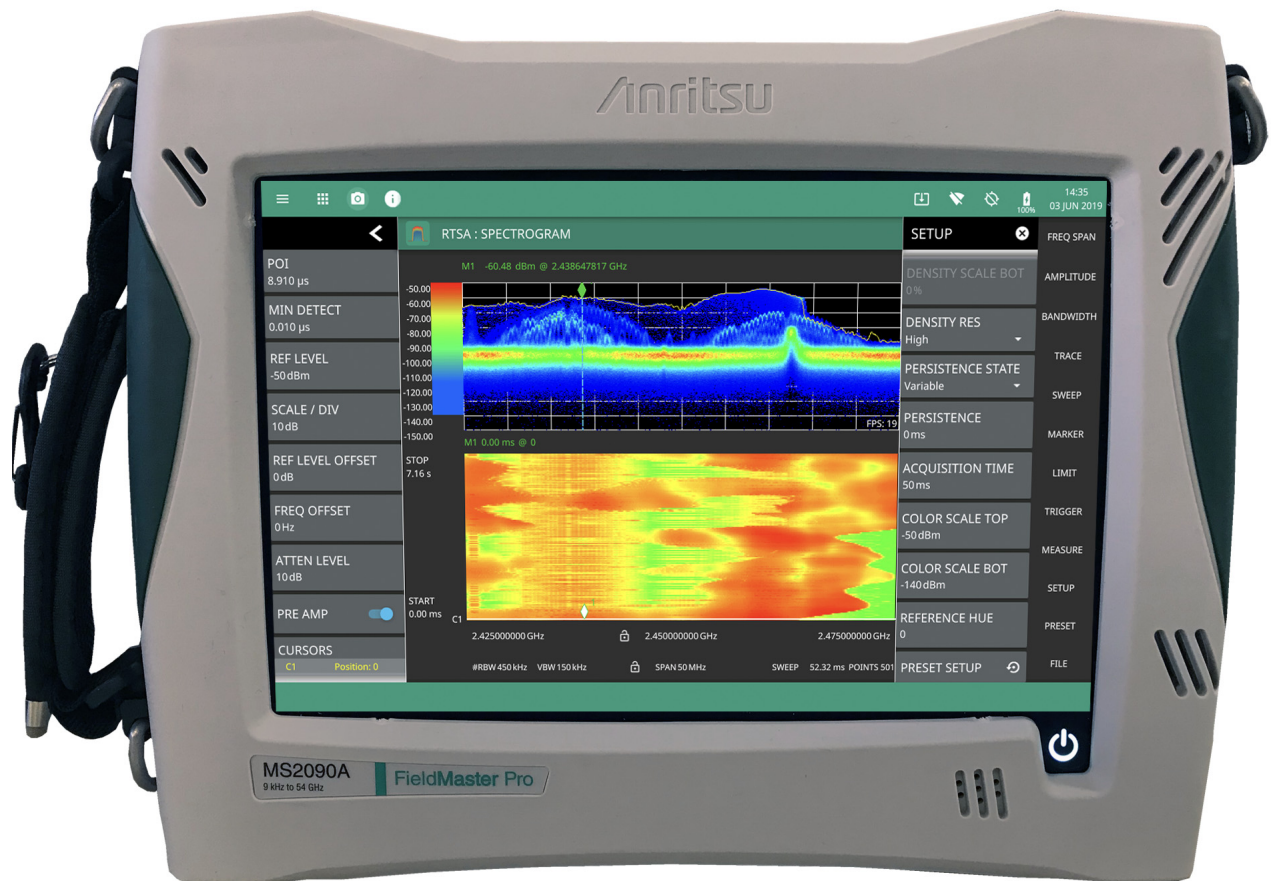


User Guide

Field Master Pro™ MS2090A

Spectrum Analyzer

MS2090A-0709 9 kHz to 9 GHz (Option 709)
MS2090A-0714 9 kHz to 14 GHz (Option 714)
MS2090A-0720 9 kHz to 20 GHz (Option 720)
MS2090A-0726 9 kHz to 26.5 GHz (Option 726)
MS2090A-0732 9 kHz to 32 GHz (Option 732)
MS2090A-0743 9 kHz to 43.5 GHz (Option 743)
MS2090A-0754 9 kHz to 54 GHz (Option 754)



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Chapter 1 — General Information

1-1 Introduction

The MS2090A Field Master Pro User Guide is part of a set of manuals that cover all of the instrument functions and their use. This manual covers the instrument overview, system functions, and other common features, along with a brief guide to basic measurement concepts and setups. Most instrument operations are covered in specific chapters of this manual as listed below. Remote programming is covered in the programming manual.

Before You Begin

- Read the *Field Master Pro MS2090A Information, Compliance, and Safety Guide* (PN: 10100-00069) for important safety, legal, and regulatory notices before operating the equipment.
- Charge the instrument battery using the supplied battery charger until fully charged.
- Review [Section 1-2 “Instrument Description” on page 1-2](#) and [Section 1-4 “Instrument Care and Preventive Maintenance” on page 1-4](#).
- [Chapter 2, “Instrument Overview”](#) provides information on the physical instrument, connectors, and other hardware interfaces.
- [Chapter 3, “Spectrum Analyzer Measurements”](#) provides information on the software user interface, such as instrument settings, measurement features, and menu overviews, for the spectrum analyzer.
- [Chapter 4, “Real-Time Spectrum Analyzer Measurements”](#) provides information on the software user interface, such as instrument settings, measurement features, and menu overviews, for the real-time spectrum analyzer.
- [Chapter 5, “5G Measurements”](#) provides information on the software user interface, such as instrument settings, measurement features, and menu overviews, for the 5G analyzer.

Additional Documentation

Table 1-1. Related Manuals

Document Part Number	Description
10100-00069	Important Product Information, Compliance, and Safety Notices
11410-01000	MS2090A Field Master Pro Technical Data Sheet
10580-00445	SCPI Programming Manual

For additional information and literature covering your product, visit the product page of your instrument and select the Library tab:

<http://www.anritsu.com/en-US/test-measurement/products/ms2090a>

1-2 Instrument Description

The MS2090A Field Master Pro is a synthesizer-based handheld signal analyzer that provides quick and accurate measurement results. The instrument is designed for monitoring, measuring, and analyzing signal environments. Measurements can easily be made by using the main instrument functions: frequency, span, amplitude, and bandwidth. A 10.1" capacitive touchscreen enables fast, easy data entry.

Typical measurements include in-band interference and transmit spectrum analysis, plus cell site and 802.11a/b/g interference testing. Options are available for RF, advanced demodulation, and over-the-air (OTA) measurement. A full range of marker capabilities (such as peak, center, and delta functions) are provided for faster, more comprehensive analysis of displayed signals. Upper and lower multi-segmented limit lines are available to create quick, simple pass/fail measurements.

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of up to 1000 measurement setups and up to 1000 traces. Measurements and setups can be stored internally on the instrument or on a USB flash drive for later recall

Note

Not all after-market USB drives are compatible with Field Master Pro. The USB drive must contain a single partition using FAT32 format.

1-3 Document Conventions

The following conventions are used throughout the MS2090A documentation set.

Instrument Identification

When identifying a frequency option for the MS2090A, that option number is appended after the model number; example: MS2090A-0709.

User Interface

The MS2090A 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.

Available Models

Table 1-2 lists the frequency options available with the MS2090A Field Master Pro.

Table 1-2. Field Master Pro Frequency Options

Model	Frequency Range
MS2090A-0709	Signal Analyzer, 9 kHz to 9 GHz
MS2090A-0714	Signal Analyzer, 9 kHz to 14 GHz
MS2090A-0720	Signal Analyzer, 9 kHz to 20 GHz
MS2090A-0726	Signal Analyzer, 9 kHz to 26.5 GHz
MS2090A-0732	Signal Analyzer, 9 kHz to 32 GHz
MS2090A-0743	Signal Analyzer, 9 kHz to 43.5 GHz
MS2090A-0754	Signal Analyzer, 9 kHz to 54 GHz

Available Options

Available options for the Field Master Pro are listed in Table 1-3.

Table 1-3. Available Options^a

Option	Description
MS2090A-0031	GPS Receiver (requires external GPS antenna)
MS2090A-0089	Zero Span IF Output
MS2090A-0090	Gated Sweep
MS2090A-0103	50 MHz Analysis Bandwidth
MS2090A-0104	100 MHz Analysis Bandwidth
MS2090A-0199	Real Time Spectrum Analyzer
MS2090A-0888	5G NR Downlink Measurements (requires GPS option MS2090A-0031)
MS2090A-xxxx-0097	Accredited Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.
MS2090A-xxxx-0098	Standard Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate.
MS2090A-xxxx-0099	Premium Calibration to ISO17025 and ANSI/NCSL Z540-1. Includes calibration certificate, test report, and uncertainty data.

a. xxxx is the frequency option number of the instrument.

1-4 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 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.

Ventilation and Cooling

The Field Master Pro provides active cooling of the internal components to prevent damage from overheating. The airflow vents on the edges and bottom of the instrument must be kept clear and unobstructed while the instrument is powered on. When using the Field Master Pro on a desktop or bench, the tilt bail can be used or the instrument can be placed flat on its back to facilitate increased airflow.

Caution Do not operate or store the Field Master Pro 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 N(f) connectors and the pins of the N(m) 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 Type-N connectors. The recommended torque is 12 lbf · in to 15 lbf · in (1.36 N · m to 1.70 N · m). 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. Align and 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 with the torque wrench.

Do not over-torque the connector.

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 Field Master Pro, 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) may damage the Field Master Pro 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 Field Master Pro, it is recommended that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the instrument. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the Field Master Pro. It is important to remember that the operator may 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.

1-5 Calibration and Verification

The Field Master Pro 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.

1-6 Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:

<http://www.anritsu.com/contact-us>

Chapter 2 — Instrument Overview

2-1 Introduction

This chapter provides an overview of the Anritsu MS2090A Field Master Pro. It describes the instrument hardware features, touch screen display, general system settings and instrument configurations, and the connector panels. For detailed information on the instrument's user interface and functions, refer to one of the following sections:

- [Chapter 3, “Spectrum Analyzer Measurements”](#)
 - [Section 3-6 “Making Spectrum Analyzer Measurements”](#)
 - [Section 3-18 “Occupied Bandwidth”](#)
 - [Section 3-17 “Channel Power”](#)
 - [Section 3-19 “Adjacent Channel Power”](#)
 - [Section 3-20 “Spectrum Emission Mask”](#)
- [Chapter 4, “Real-Time Spectrum Analyzer Measurements”](#)
 - [Section 4-6 “Making RTSA Measurements”](#)
- [Chapter 5, “5G Measurements”](#)
 - [Section 5-11 “5G NR Summary”](#)
 - [Section 5-12 “5G Channel Power”](#)
 - [Section 5-13 “5G Occupied Bandwidth”](#)
 - [Section 5-14 “5G EIRP”](#)

2-2 Instrument Front Panel

The Field Master Pro uses a touch screen for data input. The menus can vary depending on the current measurement configuration, installed options, and selected instrument function.



1. Touch Screen Display
2. [“Top Connector Panel” on page 2-3](#)
3. Shoulder Strap D-Ring Mount
4. Fan Ventilation Ports
5. [“Side Connector Panel” on page 2-5](#)
6. Battery Cover (see [“Replacing the Battery” on page 2-9](#))
7. Power LED/Button and Battery Charge LED (see [Section 2-6 “Turning On the MS2090A Field Master Pro”](#))
8. Handle and Stylus

Figure 2-1. Front Panel Overview

2-3 Connector Panels

The MS2090A Field Master Pro uses two connector panels to provide for all physical IO. These panels use a variety of connector types intended for their purpose.

RF Connectors

The main RF input connector can be Type N, Type K, or Type V, depending on the frequency option that is installed. These are ruggedized 50 Ω connectors. Type N connectors are female and Type K and V are male. Additional IO is provided with the SMA and SMB style connectors. The SMA connectors are 50 Ω female and the SMB connectors are 50 Ω jack slip-on connectors.

Caution To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the connectors. Do not overtighten the connector. The recommended torque for Type K and V is 8 lbf·in (0.9 N·m or 90 N·cm). The recommended torque for Type N is 12 lbf·in (1.35 N·m or 135 N·cm).

Top Connector Panel

Figure 2-2 shows the top connector panel on the MS2090A.

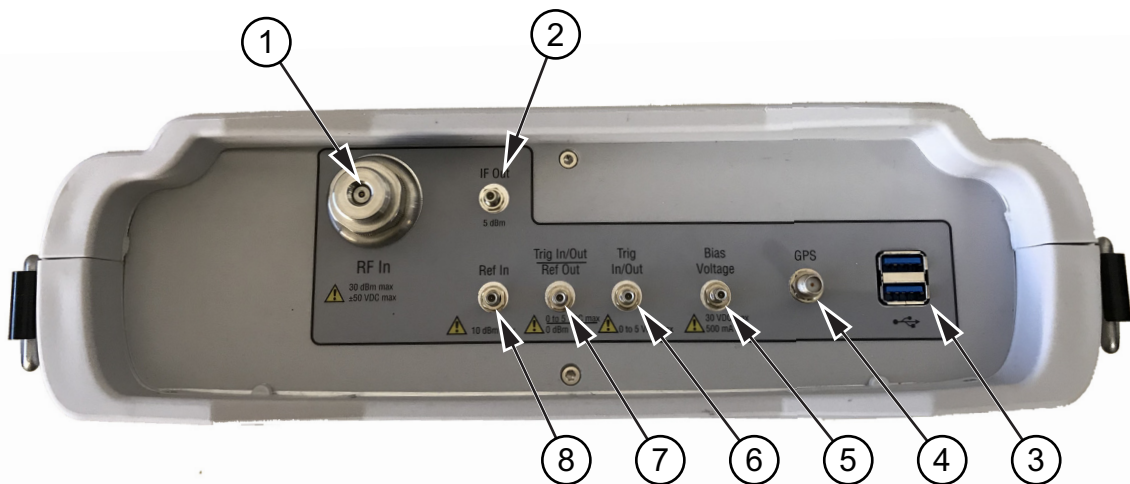


Figure 2-2. Test Panel Connectors

1. RF In Port

This is a 50 Ω ruggedized connector of the following:

- Type N female with options 709, 714, and 720
- Type K male with options 26, 32, and 43
- Type V male with option 754

To prevent damage to your instrument, do not try to mate incorrect connector types or use pliers or a plain wrench to tighten the connector. Do not overtighten the connector. The recommended torque for Type K and V is 8 lbf in (0.9 N·m or 90 N·cm). The recommended torque for Type N is 12 lbf in (1.35 N·m or 135 N·cm).

2. IF Out

This 50 Ω SMB jack connector provides internal IF output. The nominal frequency range is 325 MHz with FFT capture bandwidth \leq 32 MHz and 300 MHz with FFT capture bandwidth = 100 MHz. The nominal RF output level is -4 dBm with a 10 MHz, -20 dBm input, and with 0 dB input attenuation and preamp off. The spectrum can be inverted in certain RF input bands. Refer to [“Zero Span IF Output \(Option 89\)”](#) on page 3-9. This is a slip-on connector that should seat with a click.

Note	The 5G Capture feature may be more suitable for down-conversion measurements. The 5G Capture is calibrated and the spectrum does not have frequency errors or inversions. Refer to “FILE Menu” on page 5-40.
-------------	--

3. USB Interface – Type A

The Field Master Pro has three Type A USB connectors that accept USB storage devices for saving measurements, setup data, and screen images. Two connectors are located on the top panel and one more is located in the side panel.

4. GPS Antenna Connector

The GPS antenna connection on the Field Master Pro is type SMA female. This connector also provides 5.0/3.3 VDC for an active GPS antenna. To prevent damage to your instrument, do not use pliers or a wrench to tighten the connector.

5. Bias Voltage

The power supply is set up to provide 1 V to 34 V with a resolution of 0.1 V. The maximum current is 1 A, but with at total maximum power of 15 W.

6. Trigger In/Out

A TTL signal that is applied to the external trigger 50 Ω SMB jack input connector causes a single sweep to occur. In spectrum analysis, triggering is generally used in zero span, and triggering occurs on the rising edge of the signal. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives. This is a slip-on connector that should seat with a click.

7. Trigger In/Out / Ref Out (10 MHz)

This port can be configured as a trigger in/out as above or as a reference output. The reference output port is a 50 Ω SMB male connector that provides 10 MHz at approximately -7 dBm to 0 dBm. This is a slip-on connector that should seat with a click.

8. Ref In

The external reference input port is a 50 Ω SMB jack connector that provides for input of an external frequency reference. Refer to your Technical Data Sheet for valid frequencies. This is a slip-on connector that should seat with a click. The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Side Connector Panel

Figure 2-3 shows the MS2090A side connector panel.

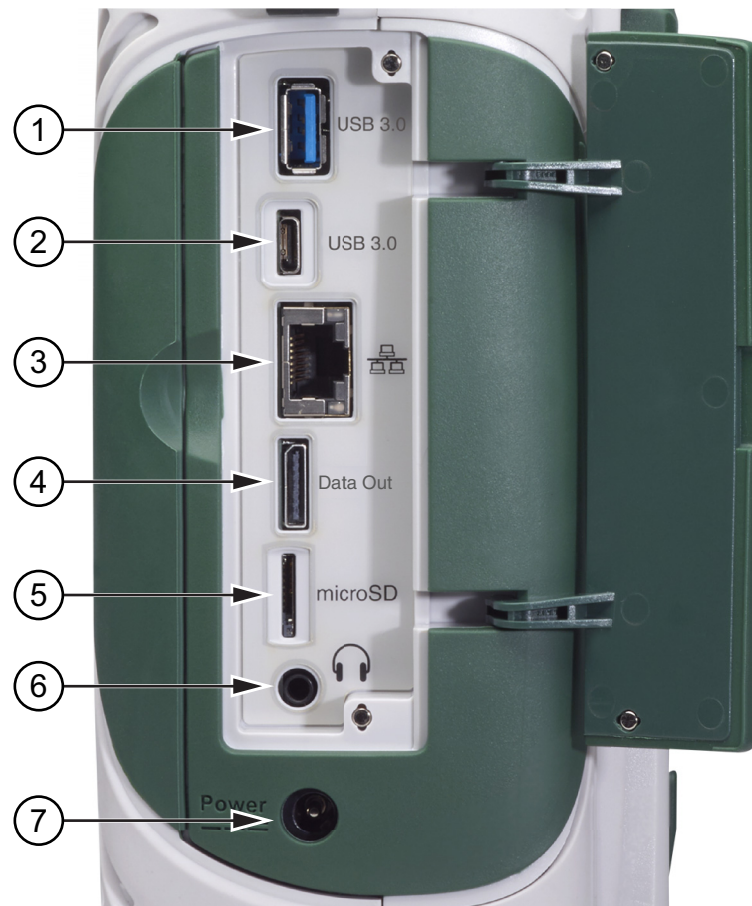


Figure 2-3. Side Panel Connectors

1. USB Interface – Type A

The Field Master Pro has three Type A USB connectors that accept USB storage devices for saving measurements, setup data, and screen images. Two connectors are located on the top panel and one more is located in the side panel.

2. USB Interface – Type C

The USB Type-C interface is not yet enabled. The interface will be used to connect the Field Master Pro directly to a PC.

3. LAN Connection

The RJ-45 connector is used to connect the Field Master Pro to a local area network or directly to a PC with an Ethernet crossover cable. Integrated into this connector are two LEDs which illuminate as follows:

- LED 1 Off: 10 Mbit/s LAN connection
- LED1 Orange: 100 Mbit/s LAN connection
- LED1 Green: 1000 Mbit/s LAN connection
- LED 2 Amber/Yellow: On or blinking indicates LAN traffic

4. Data Out Port

The Data Out port is not yet enabled. This is a multi-purpose, hot pluggable input/output (I/O) interface. These connectors are designed to fit all popular mechanical architectures and support Generation 1 PCIe data rates at 2.5 Gbps through Generation 2 data rates at 5.0 Gbps.

Note	The Data Out port is not currently active. Functionality will be added via an upcoming software update.
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5. MicroSD

The Micro Secure Digital slot is a small expansion slot located on the side panel. The slot accepts industry standard MicroSD storage cards and can be used for storing measurements, setup data, and screen images similar to USB storage devices.

Note	The MicroSD slot is not currently active. Functionality will be added via an upcoming software update.
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6. Headset Jack

Note	The headset jack is not yet enabled. Functionality will be added via an upcoming software update.
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The 3-wire headset jack provides audio output from the built-in sounds generated by the instrument. The jack accepts a 3.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones.

7. External Power

This is a 2.5 mm by 5.5 mm barrel connector, 15 VDC, 5 A, center positive. The external power connector is used to power the unit and for battery charging. An orange blinking LED power button indicates that the instrument battery is being charged by the external charging unit. The indicator is a steady green when the battery is fully charged.

Warning	When using the AC-DC Adapter, always use a three-wire power cable that is connected to a three-wire power line outlet. If power is supplied without grounding the equipment in this manner, the user is at risk of receiving a severe or fatal electric shock.
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Refer to [“Turning On the MS2090A Field Master Pro”](#) on page 2-10.

2-4 Tilt Bail Stand

The attached tilt bail can be used for desktop operation. The tilt bail provides a backward tilt for improved stability and air flow. To deploy the tilt bail, pull the bottom of the tilt bail away from the back of the instrument. To store the tilt bail, push the bottom of the bail towards the back of the instrument and snap the bail into the clips on the back of the instrument.



Figure 2-4. Tilt Bail Stand

2-5 Battery Information

The batteries that are supplied with the Field Master Pro may need charging before use. They can be charged using either the provided AC-DC adapter or the DC adapter. Refer to “Battery Status” for a description of the battery status and information panel. The batteries can be charged in the instrument or removed for charging in an optional battery charger. The batteries are installed at the factory and can be replaced by the user. Refer to the next section for information on removing the batteries. Battery status is shown in “[Battery Information](#)” on page 2-36.

Note

Use only Anritsu-approved batteries, adapters, and chargers with this instrument. The batteries will charge at a faster rate when the instrument is turned off. To prolong the useful battery life, the internal charging circuit monitors the battery temperature. Normal charging occurs when the battery temperature is between 0 °C and 45 °C. Charging is paused if the internal battery temperature is outside this range.

Caution

When using the automotive cigarette lighter adapter, always verify that the supply is rated for a minimum of 75 Watts @ 15 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, discontinue use immediately.

Note

Anritsu Company recommends removing the battery for long-term storage of the instrument.

Replacing the Battery

The battery can be replaced without the use of tools. The battery compartment door is located on the lower right side of the instrument (when you are facing the measurement display). To remove the battery:

1. Push in and slide the battery door tab to disengage it.
2. Remove the battery door.
3. Pull straight out on the lanyard to remove the battery pack from the instrument.

Note

When inserting the battery, the battery contacts should face up and slide in first. If the battery door does not close tightly, the battery may be inserted incorrectly.



Figure 2-5. Battery Removal

2-6 Turning On the MS2090A Field Master Pro

The Anritsu MS2090A Field Master Pro is capable of approximately two hours of continuous operation from a fully charged, field-replaceable battery (refer to “[Battery Information](#)” on page 2-8). The instrument can also be operated from a 15 VDC source (which will simultaneously charge the battery). This can be achieved with either the Anritsu AC-DC adapter or the automotive power adapter, which can be purchased as an optional accessory. Refer to the instrument Technical Data Sheet for more options and accessories.

Caution	When using the Automotive Power Adapter, always verify that the supply is rated for a minimum of 75 Watts @ 15 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, discontinue use immediately.
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To turn on the Field Master Pro, briefly press the power button on the lower right of the touchscreen (see [Figure 2-1 on page 2-2](#)).

The Field Master Pro takes approximately 60 seconds to complete power-up and to load the instrument software. At the completion of this process, the instrument is ready for use.

Note	Keep the fan inlet and exhaust ports clear of obstructions at all times for proper ventilation and cooling of the instrument.
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Power/Charge LED Indicators

The power/charge LED is integrated with the power button. The LED has the following indicators:

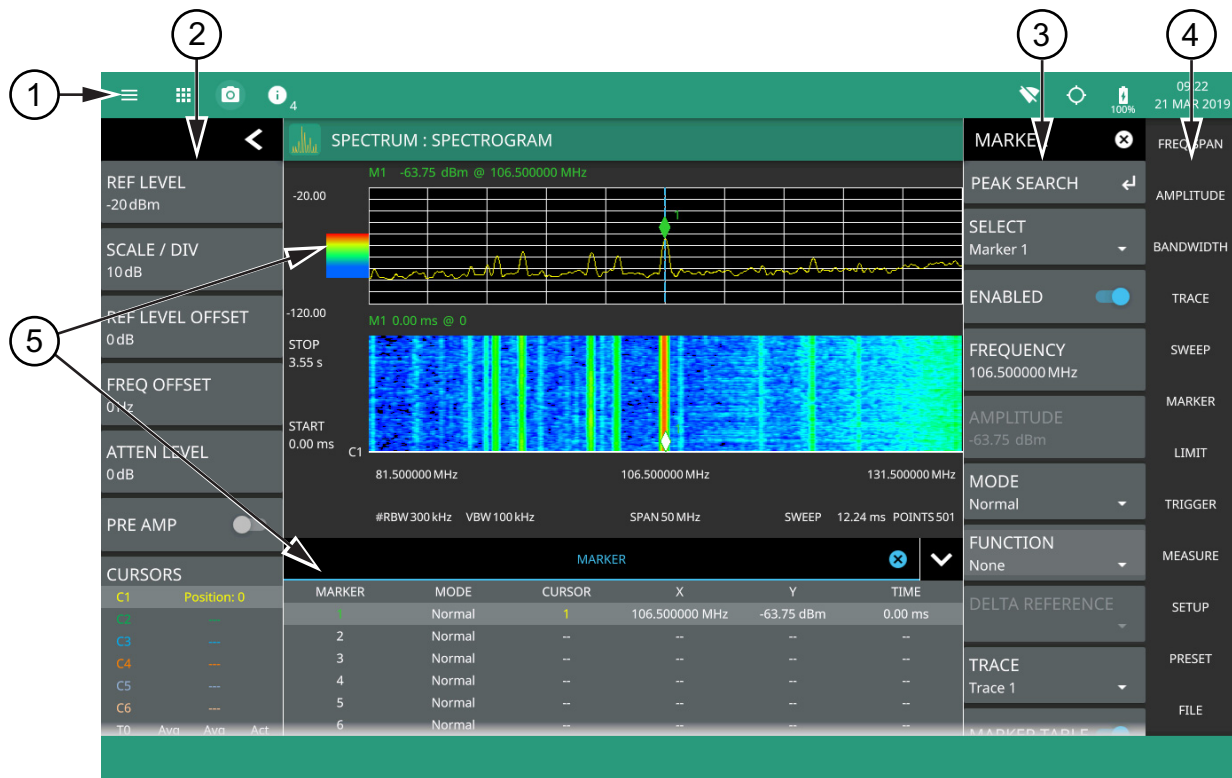
- Solid white when the instrument is on or booting up.
- Slowly blinks orange when the instrument is off and connected to an external power source, and the battery is charging.
- Solid green when the instrument is off and connected to an external power source, and the battery is fully charged.
- Solid red when the instrument is off and connected to an external power source, and the battery is NOT installed or has a fault.

Shutting Down and Restarting

To shut down or restart the instrument, briefly press the power button (a shutdown dialog will be displayed), then select RESTART INSTRUMENT or POWER OFF. The current setup is saved when the instrument is shut down or is restarted. Once the instrument shuts down, it will either power off completely (if running on batteries) or it will go into a low power state (if running on external power).

2-7 GUI Overview

The MS2090A Field Master Pro software controls all instrument functions. The software runs locally on the instrument 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 quick access to the system settings and informational dialogs.
2. The status and trace panel is 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, ACP, and SEM 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 2-6. GUI Overview (sample display elements)

Operating the Touch Screen

Field Master Pro 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.


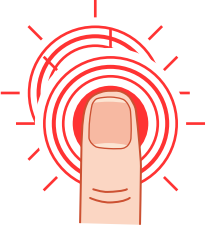
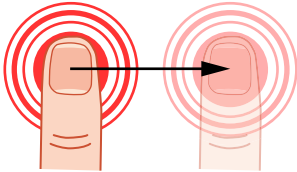
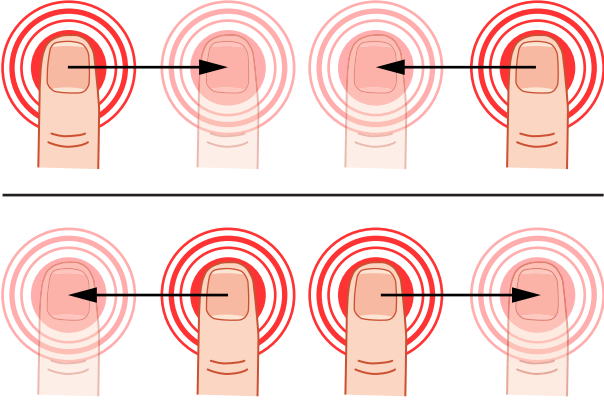
	<p>Single Press: Most controls require a single press or tap. Touch the screen briefly and then release.</p>
	<p>Double Press: Some controls require a double press or tap. This action is similar to a double mouse click. If a second press is not detected in a certain time period, the action is dismissed or considered a single press.</p>
	<p>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.</p>
	<p>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.</p>

Figure 2-7. 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 Field Master Pro.








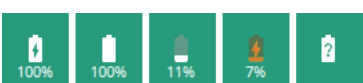








	The 3-line icon provides quick access to system information, settings, file management, and built-in diagnostic tools. Refer to Section 2-10 “System Menu” on page 2-20 .
	The 9-dot icon provides access for selecting the analyzers. Refer to Section 2-9 “Selecting the Analyzer” on page 2-19 .
	The camera icon will capture a screen image and save it to a file. Refer to “Screenshot Setup” on page 2-28 .
	The notification icon provides access to informational and error messages. If displayed, the number indicates the number of notifications. Refer to “Notifications” on page 2-21 and Appendix A, “Instrument Messages and Troubleshooting” .
	The software update icon is displayed when the instrument detects a valid software package. Pressing this icon opens an updated dialog to select the software to install. Refer to Section 2-14 “Software Update” on page 2-38 .
	The wireless networking icon shows connection status (no connection, weak connection, strong connection) and relative signal strength. Pressing the icon opens the Wi-Fi settings menu. Refer to “Wi-Fi Settings” on page 2-26 .
	The GPS icon shows connection status (no connection, no fix, good fix, using last good fix). Pressing the icon opens the GPS/GNSS settings menu. Refer to “GPS/GNSS Settings” on page 2-27 .
	The battery icon shows the current battery charge state and indicates that the battery is charging with a lightning bolt. A question mark (?) indicates that the battery is not installed or has a malfunction. Touching the icon opens the battery information dialog. Refer to “Battery Information” on page 2-36 .
	The close icon is used to close menus and other dialogs.
	The chevron will expand and collapse the status and table displays. A similar chevron on the virtual keyboard may be for capital letters or to scroll through key sets.
	Toggle icon will enable and disable the feature. When highlighted in blue, the item 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 edit icon allows editing of a feature or label.
	The enter icon accepts an entry. A similar icon is found on menu buttons to indicate an additional menu.
	Gesture lock and unlock icons indicate when the drag and pinch gestures have been toggled on or off. Refer to “GESTURES Menu” on page 3-13 .

Figure 2-8. 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, access the appropriate menu or control, then enter data using the data entry control 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 types of data, if an entry is out of range or is otherwise invalid, Field Master Pro will shade 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 by using either the drop-down selection next to the data entry window, or with the unit terminators to the left of the keypad.

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.

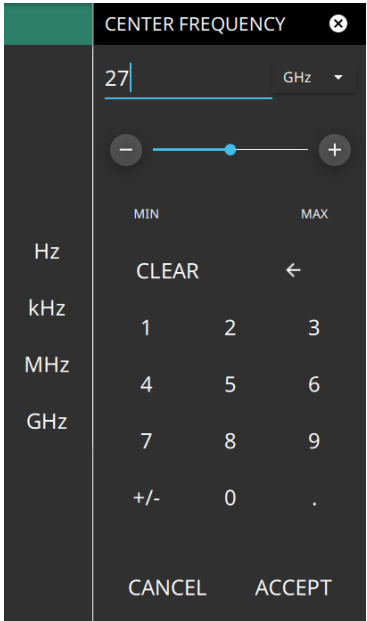
	<p>The keypad typically provides controls to:</p> <ul style="list-style-type: none"> • Enter new values directly, such as frequency entries in Hz, kHz, MHz, or GHz. There are two places on the keypad to enter unit terminators when applicable, on left side pop-out that occurs as frequency keypad entries are selected, or on the top right corner drop-down of 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. Once 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. • Left arrow to backspace and delete the entry • 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. Pressing CANCEL will restore settings back to the state they were in before the keypad opened, even if changes from the +/- controls are already reflected in the data display. • ACCEPT to operate with the settings displayed on the keypad.
---	--

Figure 2-9. Touchscreen Keypads

A physical keyboard connected via USB 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 a list. 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.

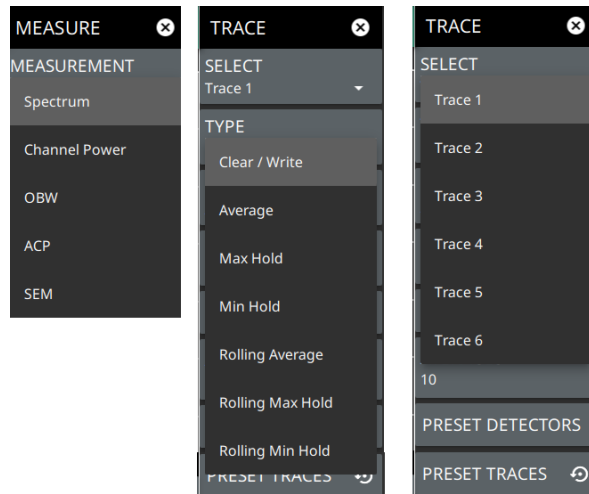
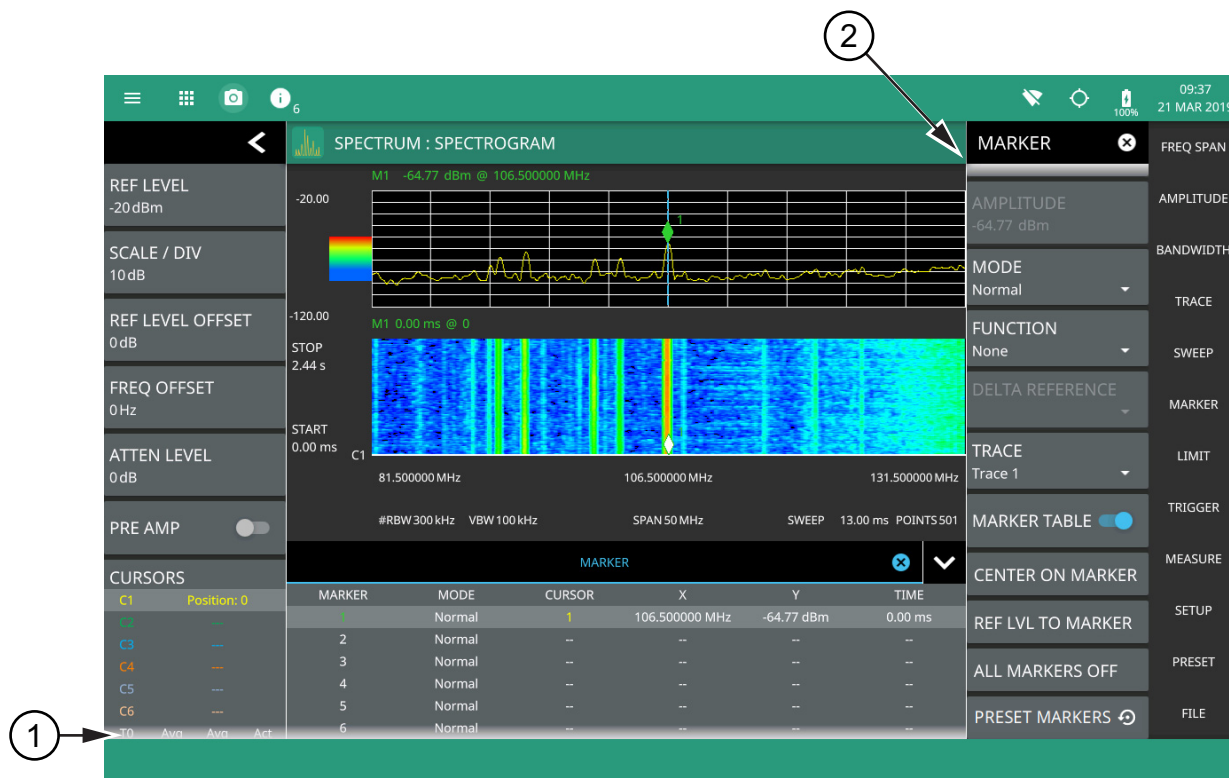


Figure 2-10. Touch Screen Keypads

To cancel the selection, touch somewhere else on the display or close 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 below. 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 2-11. 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 dark shade.

Text Entry and EZ Keyboard

When an instrument function requires you to enter text, such as entering an Ethernet hostname, a touch screen alphabetic keyboard is displayed. See [Figure 2-12](#). Press the “?123” key to switch to the digits and symbols keyboard. Use the left arrow key (backspace) to delete the character to the left of the insertion point. The insertion point can be moved to a touched position in the data entry field. You can enable caps lock by double tapping the shift key.

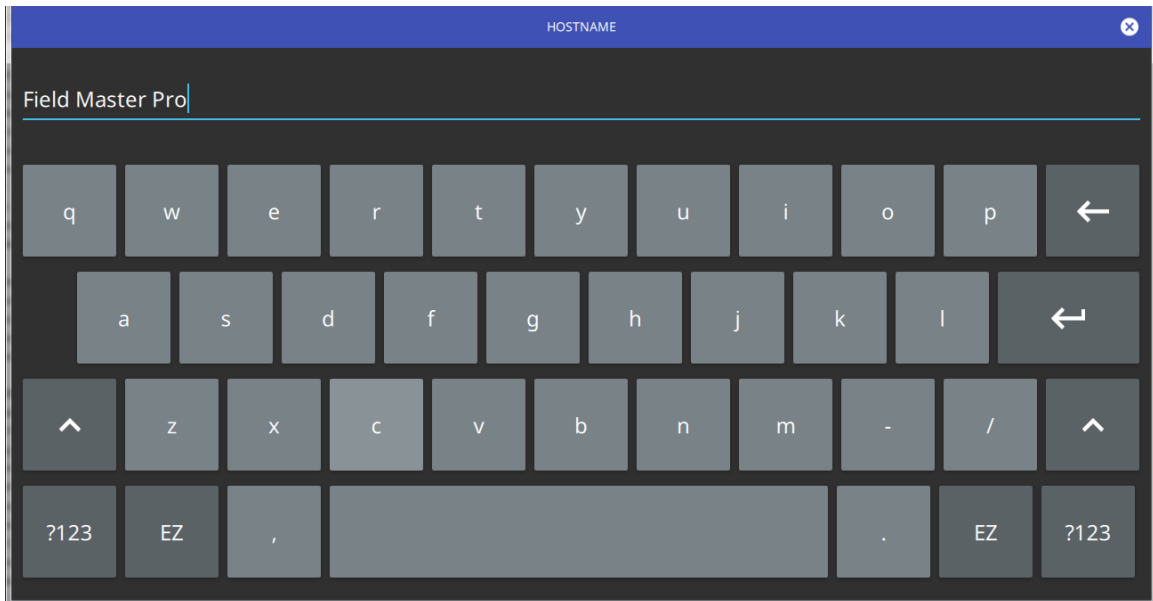


Figure 2-12. Touch Screen Keyboard

The EZ key switches to a configurable EZ keyboard, illustrated below.

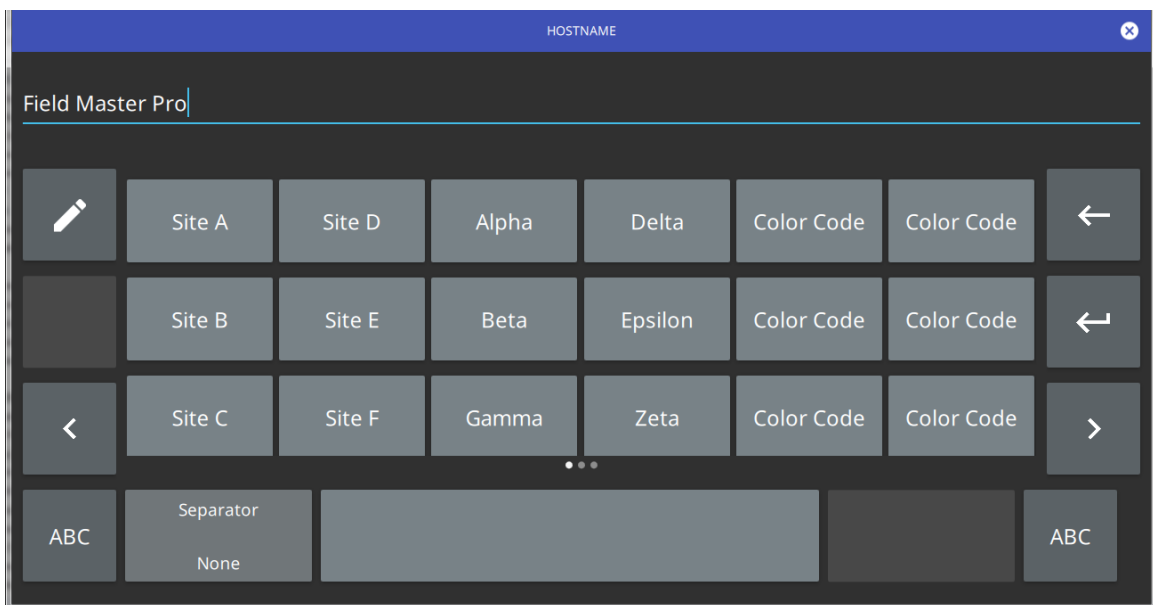


Figure 2-13. Touch Screen EZ Keyboard

Use the EZ keyboard to enter frequently used text strings with a single screen tap. The EZ keyboard is initially populated with default values. Each key enters the entire string as shown on the key. For convenience, you can set an automatic Separator character to be placed between each EZ key string.

To change a key's value:

1. Press the pencil (edit) key. The EZ keys will become highlighted.

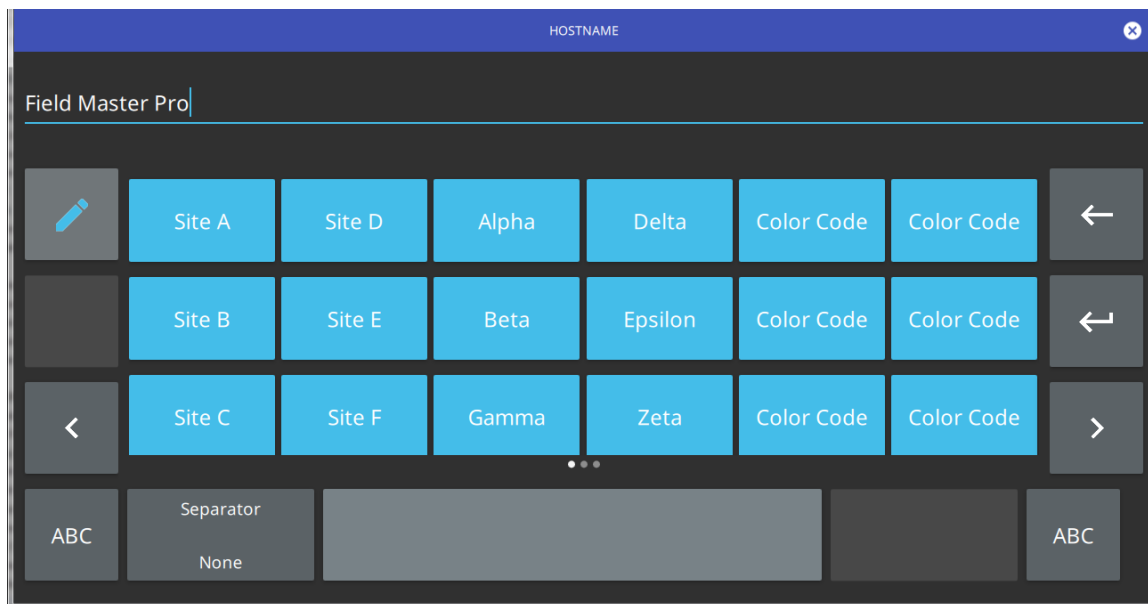


Figure 2-14. Touch Screen EZ Keyboard

2. Press the key to be edited. This will display the standard keyboard for entering a new EZ key value.

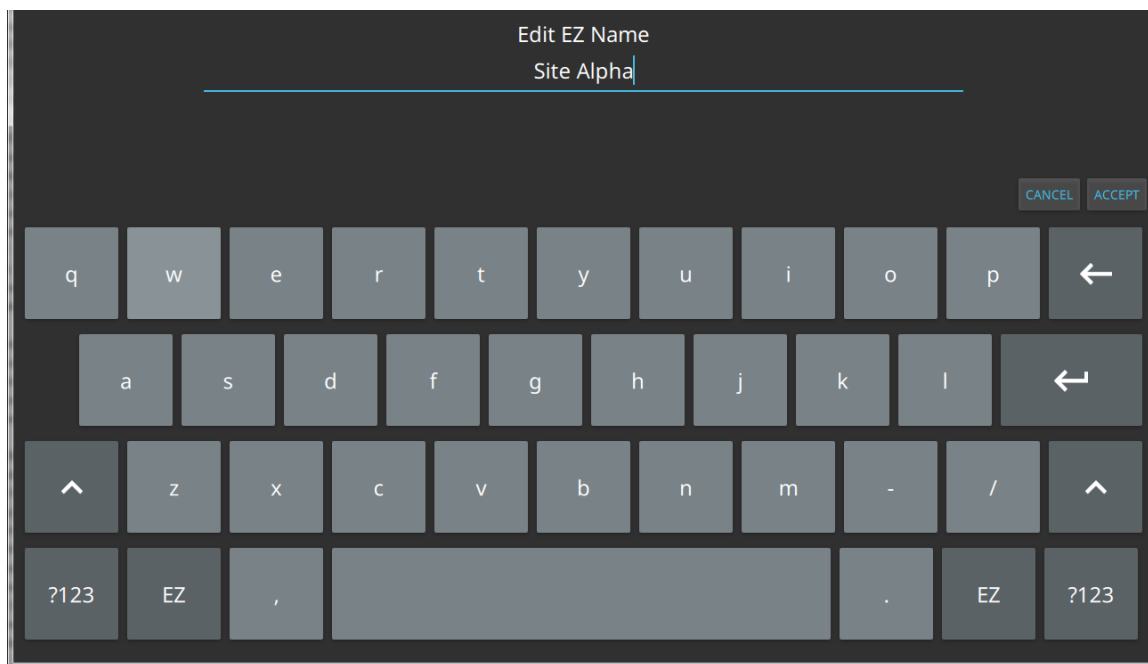


Figure 2-15. Touch Screen EZ Keyboard

3. Enter the new value, then press ACCEPT to assign the new value to the EZ key, or press CANCEL.

2-8 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 touched.



1. Press the 3-line icon to display the [System Menu](#). The instrument model with frequency option and its serial number are also displayed.
2. The 9-dots icon is used for [Selecting the Analyzer](#).
3. Press the camera icon to capture a screen shot 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.
4. Notifications are generated when an error is detected or an activity such as a screen shot has taken place. The number of unread notifications appears next to the icon. Press the icon to display the [Notifications](#) list.
5. Displayed when a USB device contains an installable software package. Pressing the icon launches the “[Software Update](#)” on page 2-38.
6. Press the wireless networking icon to display the [Wi-Fi Settings](#).
7. Press the GPS icon to view the [GPS/GNSS Settings](#).
8. Press the battery icon to open the [Battery Information](#) and view battery charge state and capacity.
9. The right side of the instrument title bar displays the system date and time. Pressing this field opens the [Date Time Settings](#).

Figure 2-16. Title Bar

2-9 Selecting the Analyzer

The instrument analyzers are selected from the 9-dot icon. To select an analyzer, press the 9-dot icon in the title bar to display the available analyzers, illustrated in [Figure 2-17](#). Simply touch the desired icon to load the new analyzer. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.

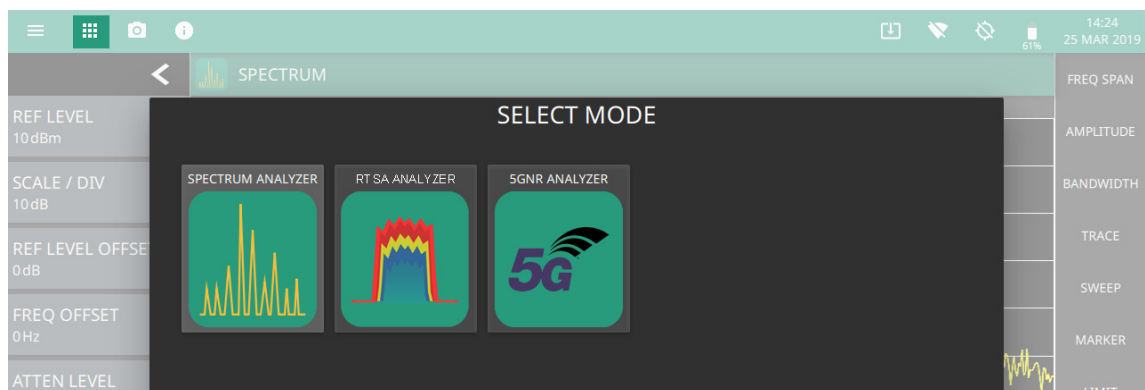
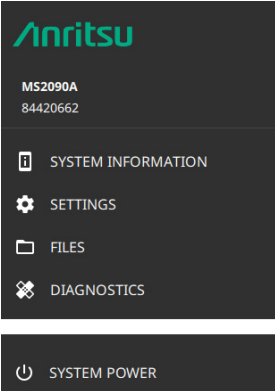


Figure 2-17. Example Analyzers

2-10 System Menu



The System menu identifies the instrument model and serial number.

SYSTEM INFORMATION: Opens the [System Information](#) panel showing instrument, software, and network connection details.

SETTINGS: Opens the “[Settings Menu](#)” on page 2-22, providing access to all system level settings and controls.

FILES: Opens “[File Management](#)” on page 2-34. 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.

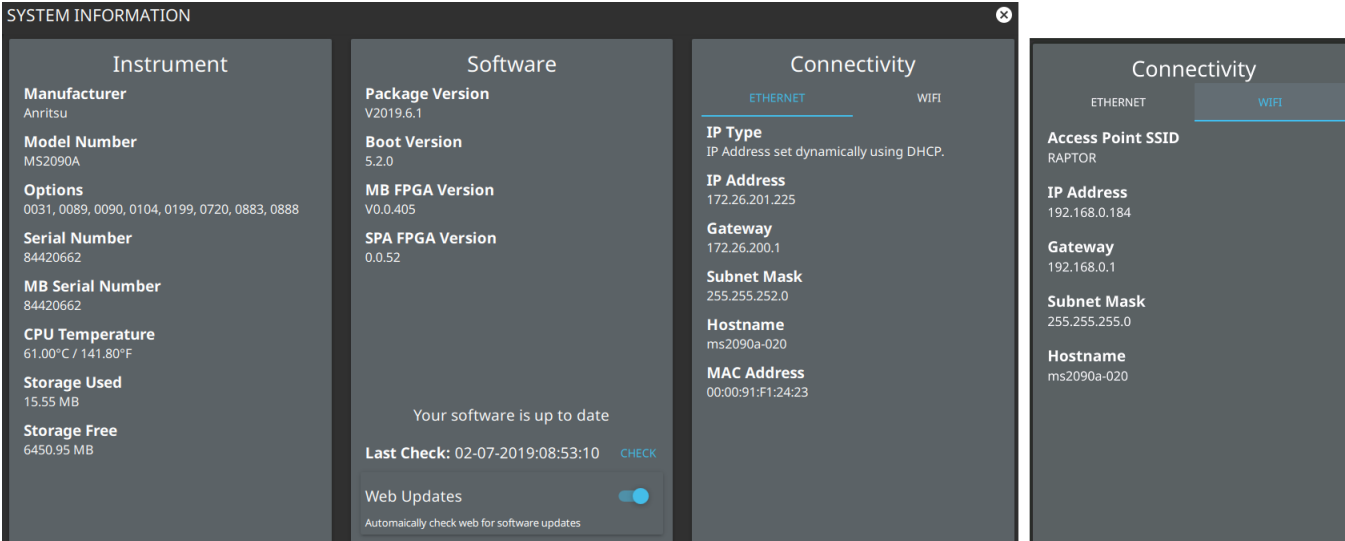
DIAGNOSTICS: Opens “[Diagnostics](#)” on page 2-36.

SYSTEM POWER: Opens a dialog to RESTART or POWER OFF the instrument.

Figure 2-18. System Menu

System Information

The System Information panel shows all information about the instrument hardware, software, and connectivity. From here, you can also toggle software update checking when connected to the Internet and start a software update when one is available. If web updates are toggled on, the instrument will automatically check for updates once every 24 hours or when the user presses the "CHECK" button.



SYSTEM INFORMATION

Instrument	Software	Connectivity (ETHERNET)	Connectivity (WIFI)
Manufacturer Anritsu Model Number MS2090A Options 0031, 0089, 0090, 0104, 0199, 0720, 0883, 0888 Serial Number 84420662 MB Serial Number 84420662 CPU Temperature 61.00°C / 141.80°F Storage Used 15.55 MB Storage Free 6450.95 MB	Package Version V2019.6.1 Boot Version 5.2.0 MB FPGA Version V0.0.405 SPA FPGA Version 0.0.52 Your software is up to date Last Check: 02-07-2019:08:53:10 CHECK Web Updates <input checked="" type="checkbox"/> Automatically check web for software updates	IP Type IP Address set dynamically using DHCP. IP Address 172.26.201.225 Gateway 172.26.200.1 Subnet Mask 255.255.252.0 Hostname ms2090a-020 MAC Address 00:00:91:F1:24:23	Access Point SSID RAPTOR IP Address 192.168.0.184 Gateway 192.168.0.1 Subnet Mask 255.255.255.0 Hostname ms2090a-020

Figure 2-19. System Information

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 [“Self Test” on page 2-37](#) and [Appendix A, “Instrument Messages and Troubleshooting”](#) for more diagnostic information.

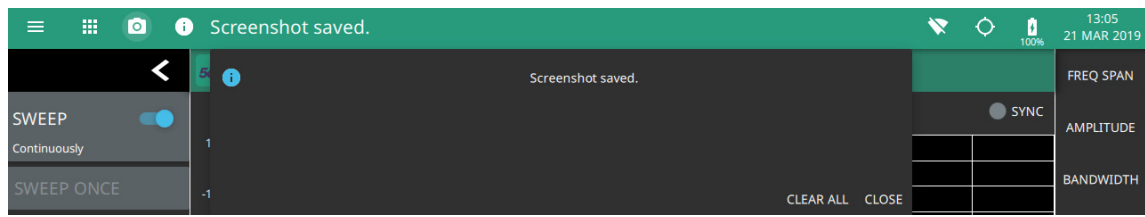
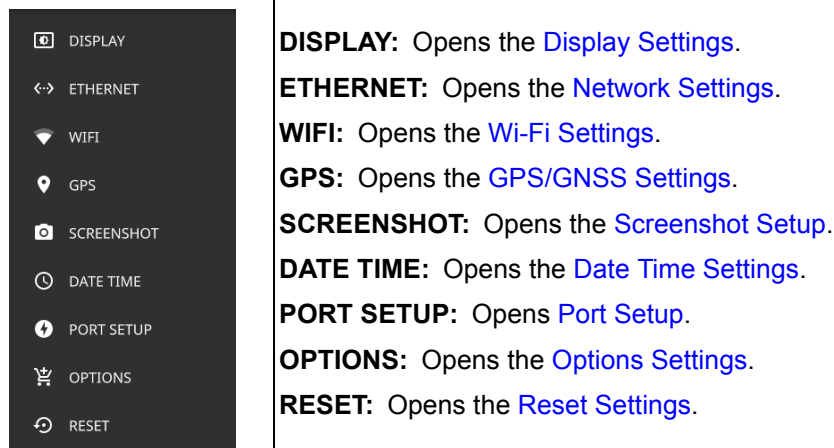


Figure 2-20. Notifications

2-11 Settings Menu

The system settings menu provides access to all instrument system-level settings such as network, GPS/GNSS, date and time, and display.



DISPLAY: Opens the [Display Settings](#).

ETHERNET: Opens the [Network Settings](#).

WIFI: Opens the [Wi-Fi Settings](#).

GPS: Opens the [GPS/GNSS Settings](#).

SCREENSHOT: Opens the [Screenshot Setup](#).

DATE TIME: Opens the [Date Time Settings](#).

PORT SETUP: Opens [Port Setup](#).

OPTIONS: Opens the [Options Settings](#).

RESET: Opens the [Reset Settings](#).

Figure 2-21. Settings Menu

Display Settings

The DISPLAY settings allow you to adjust the display brightness and to set the amount of idle time before the screen automatically dims to conserve battery life. The DIM DISPLAY AFTER button provides up to 15 minute idle time settings. Or you can select Never so the display will remain illuminated for as long as the instrument remains powered on.

You can also set the display to a Default or Light color scheme, which may be more suitable for viewing in bright ambient conditions.

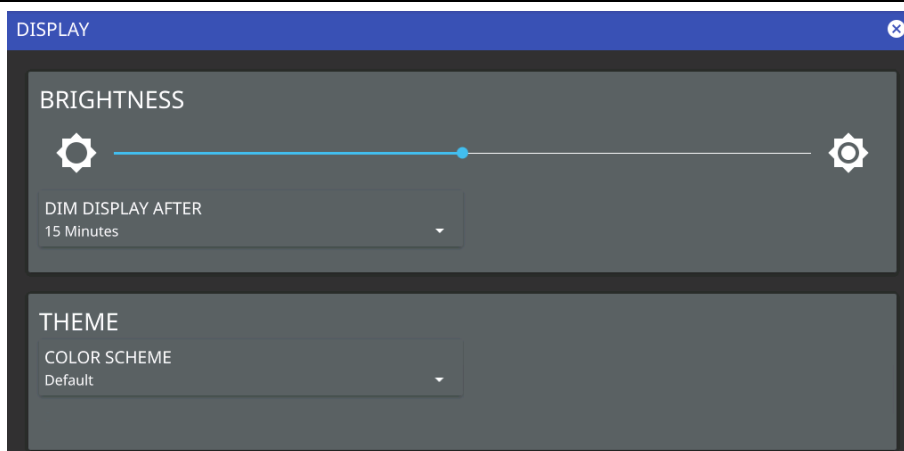


Figure 2-22. Display Settings

Network Settings

The MS2090A uses Ethernet or WLAN (Wi-Fi) to communicate remotely with a controller. Most instrument functions (except power on/off) can be controlled via a network connection to a PC connected directly (with an Ethernet cross-over cable or Wi-Fi peer-to-peer) or through a network. The instrument software supports the TCP/IP raw socket network protocol.

Ethernet networking uses a bus or star topology in which all of the interfacing devices are connected to a central cable called the bus, or are connected to a hub. Ethernet uses *Carrier Sense Multiple Access/Collision Detection* (CSMA/CD) access method to handle simultaneous transmissions over the bus. This standard enables network devices to detect simultaneous data channel usage, called a *collision*, and provides for a contention protocol. When a network device detects a collision, the CSMA/CD standard dictates that the data is retransmitted after waiting a random amount of time. If a second collision is detected, the data is again retransmitted after waiting twice as long. This is known as exponential back off.

Wi-Fi uses a similar star topology in which all of the interfacing devices are connected to an access point. Wi-Fi uses *Carrier Sense Multiple Access/Collision Avoidance* (CSMA/CA) access method to handle simultaneous transmissions. CSMA/CA doesn't detect collisions but rather avoids them through the use of a control message. If the control message collides with another control message from another node, it means that the medium is not available for transmission and the back-off algorithm is applied before attempting another transmission.

The TCP/IP setup requires the following:

- **IP Address:** Every computer and electronic device in a TCP/IP network requires an IP address. An IP address has four numbers (each between 0 and 255) separated by periods. For example: 128.111.122.42 is a valid IP address.
- **Subnet Mask:** The subnet mask distinguishes the portion of the IP address that is the network ID from the portion that is the station ID. The subnet mask 255.255.0.0, when applied to the IP address given above, would identify the network ID as 128.111 and the station ID as 122.42. All stations in the same local area network should have the same network ID, but different station IDs.
- **Default Gateway:** A TCP/IP network can have a gateway to communicate beyond the LAN identified by the network ID. A gateway is a computer or electronic device that is connected to two different networks and can move TCP/IP data from one network to the other. A single LAN that is not connected to another LAN requires a default gateway setting of 0.0.0.0. If you have a gateway, then the default gateway would be set to the appropriate value of your gateway.
- **Ethernet Address:** An Ethernet address, or *Media Access Control* (MAC) address, is a unique 48-bit value that identifies a network interface card to the rest of the network. Every network card has a unique Ethernet address permanently stored into its memory.
- Remote programming and operation between the instrument and remote program is accomplished via a TCP/IP raw socket connection to port 9001. The remote program must establish a TCP/IP raw socket connection at port 9001 to the MS2090A.
- The remote program may connect to the instrument IP address or to its HOSTNAME (Ethernet only). If using DHCP instead of a static IP, using the HOSTNAME may be more reliable for finding an instrument on a network.
- You may need to contact your network administrator to ensure network security policies, anti-virus, and firewall settings do not block access to the controlling computer and its ports.

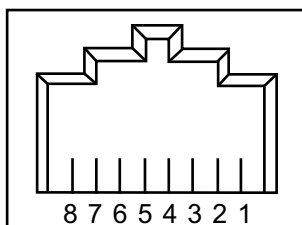
The MS2090A can be configured for *Dynamic Host Configuration Protocol* (DHCP), an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use.

To determine if a network is set up for DHCP, connect the instrument to the network and select DHCP protocol. Power cycle the instrument. If the network is set up for DHCP, the assigned IP address should be displayed in the network settings.

Ethernet Connection

Interface between the instrument and other devices on the network is via a category five (CAT-5) interface cable connected to a network. This cable uses four twisted pairs of insulated copper wires terminated into an RJ45 connector. CAT-5 cabling is capable of supporting frequencies up to 100 MHz and data transfer speeds up to 1 Gbps, which accommodates 1000Base-T, 100Base-T, and 10Base-T networks. CAT-5 cables are based on the EIA/TIA 568 Commercial Building Telecommunications Wiring Standard developed by the Electronics Industries Association. A pinout diagram is shown in [Table 2-1](#).

Table 2-1. 8-pin Ethernet RJ45 Connector Pinout Diagram



Pin	Name	Description	Wire Color
1	TX+	Transmit data (> +3 volts)	White/Orange
2	TX-	Transmit data (< -3 volts)	Orange
3	RX+	Receive data (> +3 volts)	White/Green
4	-	Not used (common termination)	Blue
5	-	Not used (common termination)	White/Blue
6	RX-	Receive data (< -3 volts)	Green
7	-	Not used (common termination)	White/Brown
8	-	Not used (common termination)	Brown

Integrated into the RJ45 connector are two LEDs that illuminate as follows:

- LED 1 Off: 10 Mbit/s LAN connection
- LED1 Orange: 100 Mbit/s LAN connection
- LED1 Green: 1000 Mbit/s LAN connection
- LED 2 Amber/Yellow: On or blinking indicates LAN traffic

The instrument IP address and its HOSTNAME are set via the System menu (upper left corner) and accessing the ETHERNET or WIFI settings menu.

Note

Wi-Fi does not support connections using HOSTNAME; use IP addressing to establish a wireless network connection.

TCP/IP connectivity requires setting up the parameters described at the beginning of this section. The following is a brief overview of how to set up a general LAN connection on the MS2090A.

Note

You may need to consult your network documentation or network administrator for assistance in configuring your network setup.

Ethernet Settings

Refer to “[Network Settings](#)” on page 2-23 for general network setup and information.

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **ETHERNET** to view the current network settings (IP address, **HOSTNAME**, etc.).

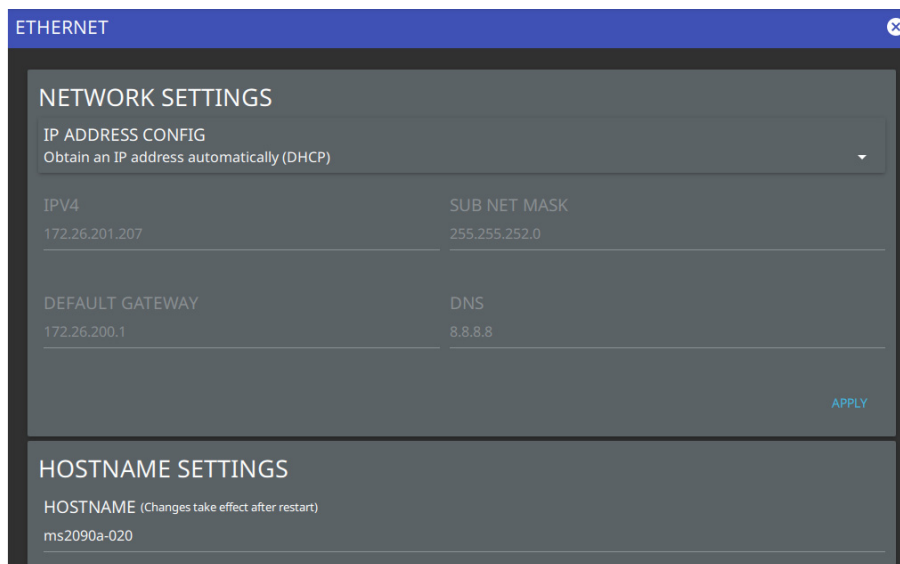


Figure 2-23. Ethernet Settings

The instrument IP address can be set automatically using DHCP or manually by entering the desired IP address, gateway address, and subnet mask.

Note

If an active Ethernet cable is connected to the instrument while it is turned on, a reboot may be required to establish a DHCP connection. If the port becomes inactive, verify that an active Ethernet cable is attached to the instrument, then cycle the instrument power off and on.

Wi-Fi Settings

Refer to “[Network Settings](#)” on page 2-23 for general network setup and information.

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **WIFI** to display the current network settings (IP address, **HOSTNAME**, etc.).

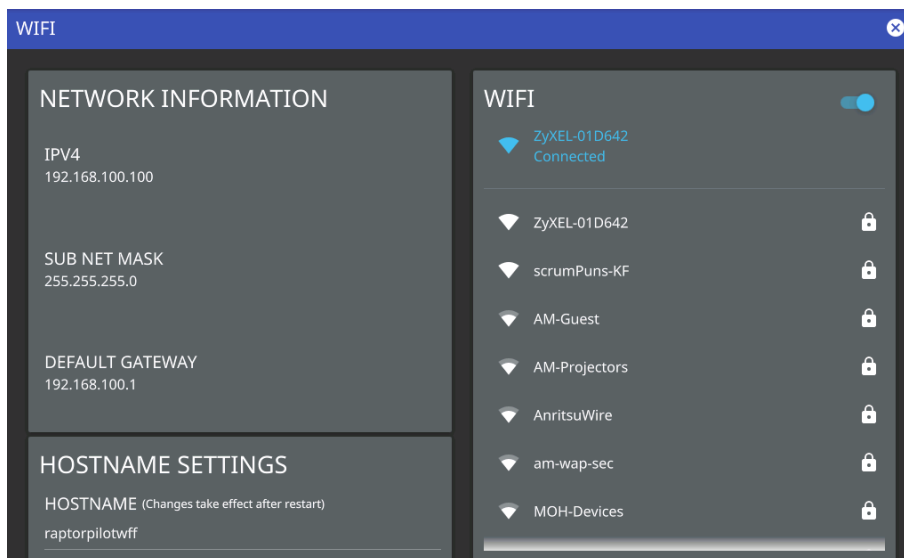


Figure 2-24. Wi-Fi Settings

The instrument IP, subnet mask, and gateway address are managed by the access point or wireless router.

Note

An active Wi-Fi connection to an access point must be established in order to enable DHCP.

If Wi-Fi becomes inactive, cycle the instrument power off and on, then verify that the Wi-Fi device is connected to an access point.

Field Master Pro is not able to connect to networks that require sign-in through web servers.

3. Enable the Wi-Fi radio by toggling it on from the right-side panel, then select an access point from the list.
4. When an access point is selected, the keyboard will display for you to enter the access point key (or password).
5. The access point will display below the toggle as the active connection.

GPS/GNSS Settings

The MS2090A Field Master Pro is available with a built-in global positioning receiver feature (Option 31) that can provide latitude, longitude, altitude, and UTC timing information. This option also enhances frequency reference oscillator accuracy. When the global positioning receiver is actively locked to satellites, this information is saved with all saved measurements.

Note

The MS2090A Field Master Pro Data Sheet provides a list of the options and measurements that require GPS (Option 31). In addition to having Option 31 installed, a GPS antenna is required. Refer to the instrument Technical Data Sheet for compatible GPS antennas.

The MS2090A supports the following global positioning satellite systems:

- **GPS:** The United States Global Positioning System (GPS). GPS is currently the world's most utilized satellite navigation system.
- **GNSS:** Global Navigation Satellite System, a term used worldwide. This term includes GPS, GLONASS, Galileo, and Beidou. Accessing multiple satellites provides increased accuracy, redundancy, and availability at all times.

Activating the GPS Feature

Attach the GPS antenna to the GPS connector on the top of the instrument.

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **GPS** to open the GPS settings and info window.

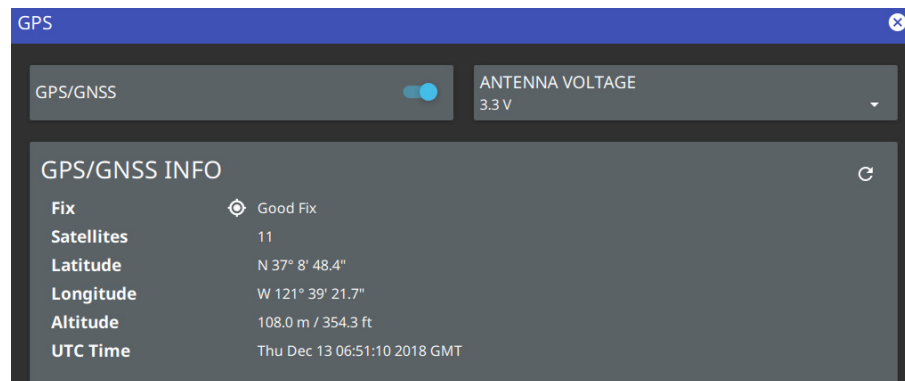


Figure 2-25. GPS Settings

3. Activate the GPS by sliding the **GPS/GNSS** toggle switch to on.
4. Set **ANTENNA VOLTAGE** to 3.3 or 5.0V.
5. When the GPS receiver has established a “good fix”, the GPS icon is displayed with a center dot and the following information is kept updated:
 - Fix status
 - Tracked satellites
 - Latitude
 - Longitude
 - Altitude
 - UTC timing information

After GPS location fix is attained, the internal reference oscillator begins to correct its frequency to match the GPS standard. After the internal frequency is adjusted to match the GPS standard, the status is indicated by “GPS High Accuracy” showing in the Status menu, which is displayed on the left side of the measurement display. When the GPS feature is not enabled, the reference source displays either “Internal Standard Accuracy” or a user-selected external reference frequency in the Status menu.

Within three minutes of satellite acquisition, the reference oscillator will have an accuracy of better than 25 ppb (parts per billion). The OCXO internal standard accuracy is ± 0.3 PPM. The correction factor applied to the internal OCXO allows the instrument to maintain GPS frequency accuracy for three days at better than 50 ppb, even when the instrument is obstructed from receiving signals from the GPS satellites.

In order to acquire data from the GPS satellites, you must have line-of-sight to the satellites, or the antenna must be placed outside with no obstructions.

If no GPS is connected for at least three days, the Frequency Reference annotation reads Int Std Accy.

When GPS is connected, with a fix, and the tuning process has completed (which may take a few minutes), the Frequency Reference annotation shows GPS Hi Accy. If GPS is subsequently lost (for example, GPS is turned off, disconnected, or there is no signal due to physical obstruction), the instrument goes back to Int Hi Accy after a few moments. If GPS remains disconnected for three consecutive days, whether the instrument is on or off, the instrument reverts to Int Std Accy.

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.

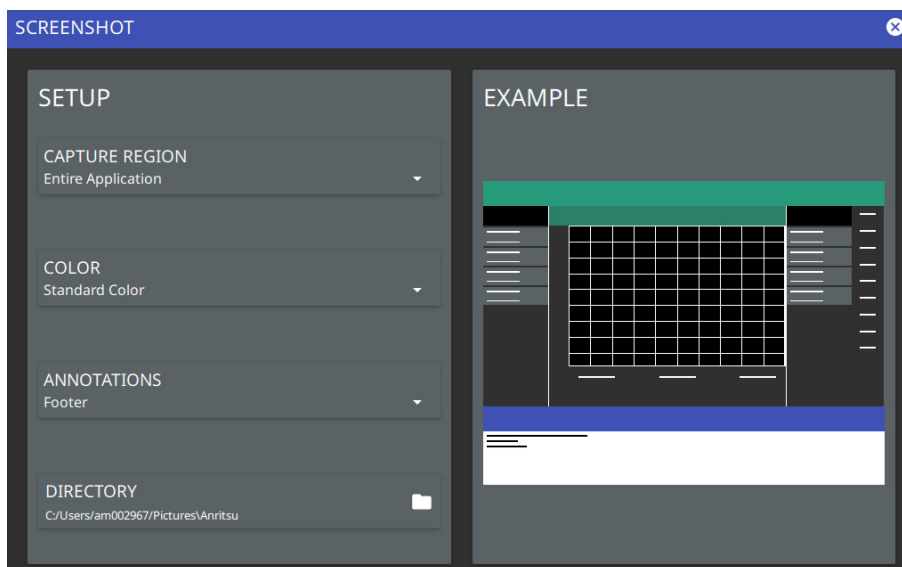


Figure 2-26. Screenshot Setup

Screenshot setup lets you configure the following:

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

Note Screenshots can be previewed on the instrument display from [“File Management” on page 2-34](#).

Date Time Settings

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **DATE TIME** to display the current date and time settings.

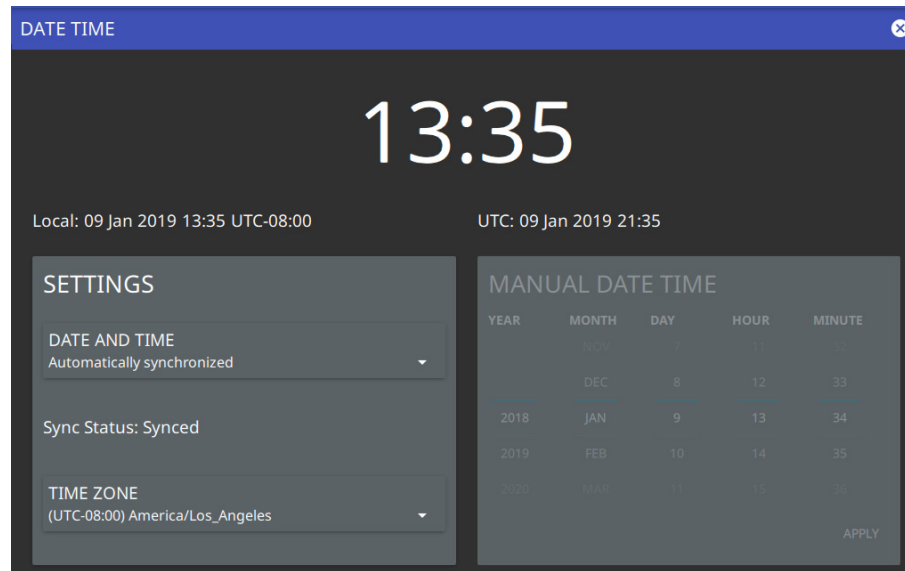


Figure 2-27. Date Time Settings

The Date Time setup lets you set the current date and time and the time zone.

- **Date and Time:** Manually set or automatically synchronized. When synchronized (Sync Status: Synced), the system uses the network time; if the instrument also has a GPS location fix, the system will determine and use the more accurate of the two, between network and GPS time. Select Manually set to activate the **MANUAL DATE TIME** window. Here you can scroll to a selectable year, month, day, hour, and minute.
- **Time Zone:** Lists the selectable time zones.

Port Setup

The Port Setup menu allows you to configure the external ports.

Bias Voltage

Bias Voltage setup provides controls to set the voltage level and to monitor the precise voltage and current, and trip state.

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **PORT SETUP** to display the top panel bias voltage output settings.

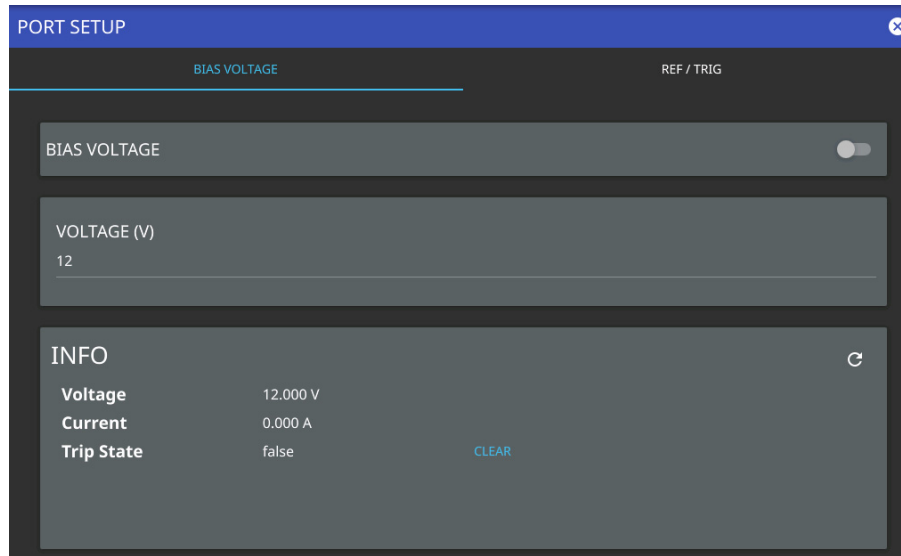


Figure 2-28. Bias Voltage Port Settings

3. Manually set the voltage in the range of 0 V to 34 V.
4. Toggle the bias voltage on or off.

Reference and Trigger

The reference and trigger setup provides controls to set the functionality of the configurable top panel reference and trigger ports.

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu, then select **PORT SETUP > REF / TRIG** to display the top panel reference and trigger port settings.

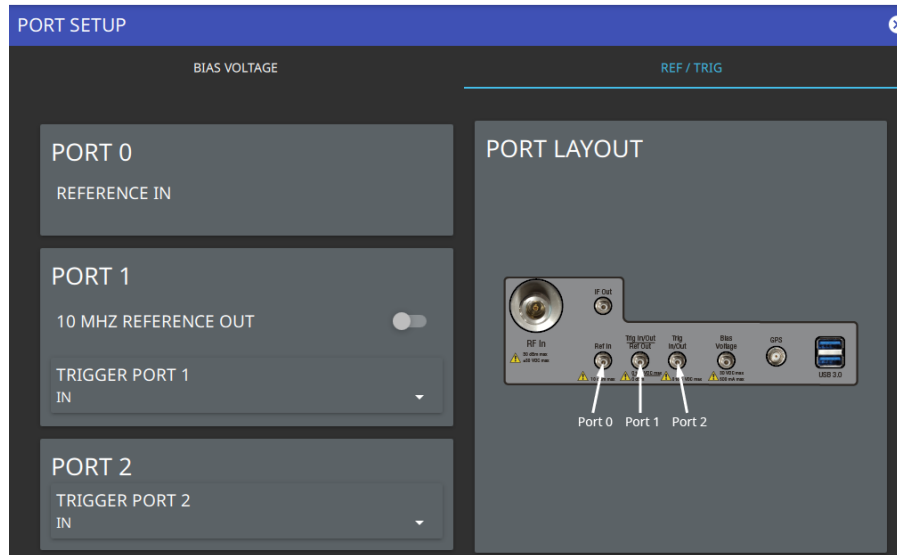


Figure 2-29. Reference/Trigger Port Settings

Note PORT 0 is always a reference in port.

3. To set PORT 1 as a reference output, toggle 10 MHz REFERENCE OUT on. Otherwise, PORT 1 can be selected as a trigger input or trigger output by using the drop-down selection.
4. Use the drop-down selections to select PORT 2 as a trigger input or trigger output.

Options Settings

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu.
3. Select **OPTIONS** to display the lists of currently installed software options on the left pane and those that are available for installation on the right pane.

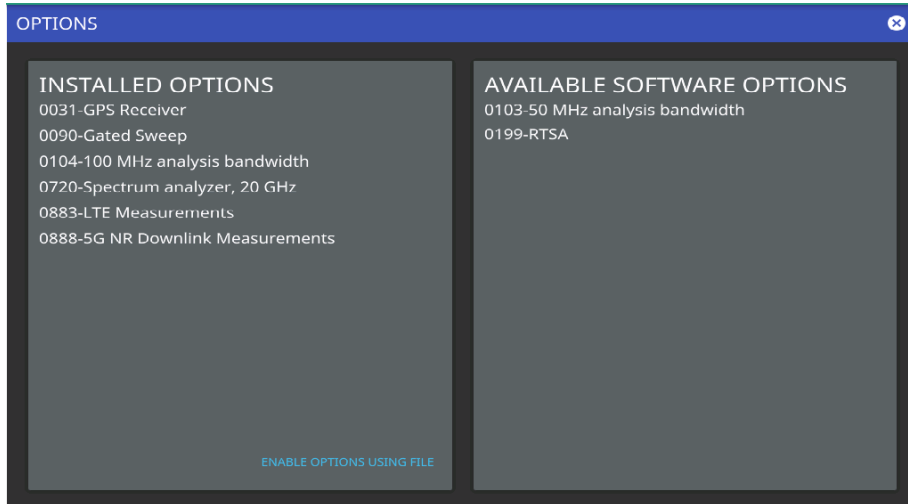


Figure 2-30. Options Settings

Some options can be installed using only a software file. Others may require additional hardware. Contact your local sales or service representative for information on installing new options.

Reset Settings

1. Access the System menu (3-line icon in the upper left corner).
2. Press **SETTINGS** to access the instrument settings menu.
3. Select **RESET** to open the Reset menu.

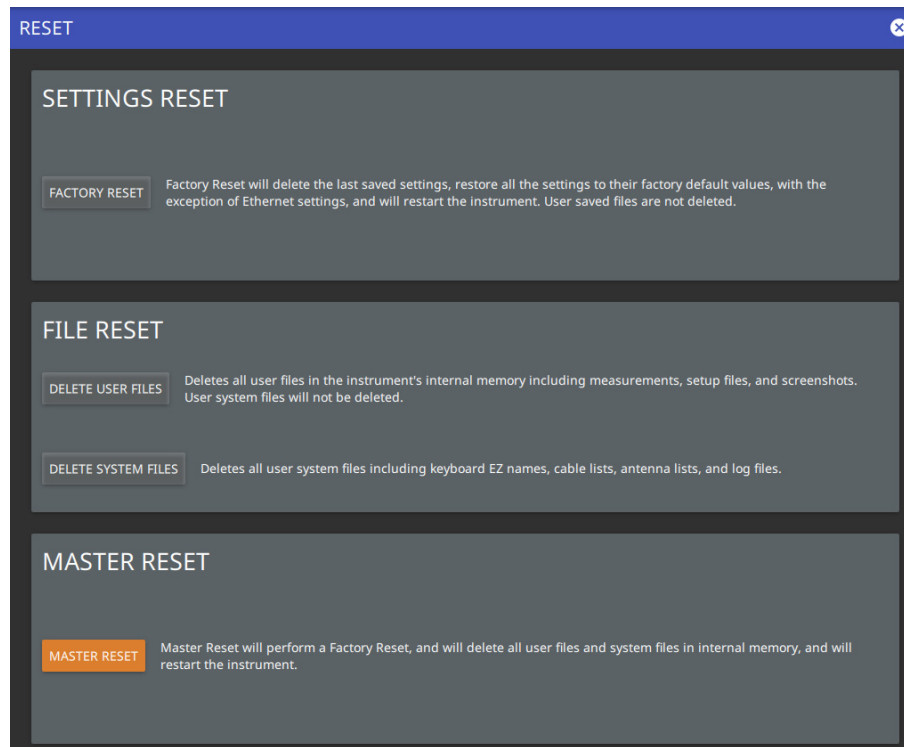


Figure 2-31. Reset Settings

The following reset options are available:

SETTINGS RESET

- **FACTORY RESET:** Restores the instrument to the factory default settings for all measurement modes and system settings, including language and the display and audio settings. Ethernet settings and user files are not affected. The instrument will automatically restart.

FILE RESET

- **DELETE USER FILES:** Deletes all user files from the instrument's internal memory, including measurement, setup, and screenshot files. System files are not affected.
- **DELETE SYSTEM FILES:** Deletes all user system files from the instrument's internal memory, including keyboard EZ names, cable and antenna lists, and log files. Other user files are not affected.

MASTER RESET

- **MASTER RESET:** Performs a Factory Reset as described above and deletes all user files and system files from the instrument's internal memory. The instrument will automatically restart.

2-12 File Management

1. Access the System menu (3-line icon in the upper left corner).
2. Press FILES to access the instrument file management menu.



Figure 2-32. File Management Menu

File Locations

Displays the available memory locations. Touch the location that you want to access and the available files will be displayed on the right side. You can touch the column headers to change the sort order.

File Management Operations

All file operations are selected via the following icons:










3-Dots 	Use the 3-dots menu to refresh the displayed folder contents or to close the file management menus.
New Folder 	Use the New Folder icon to create a new directory in the current memory location. When pressed, the virtual keyboard is displayed, allowing you to enter a new directory name.
Select 	The Select icon enables checkboxes next to your folder and file names. You can then select multiple files to move, copy, or delete.
Clipboard 	The Clipboard icon displays the number of items that you have selected and copied to the clipboard. Use this icon to paste the copied items to the destination folder.
Edit 	Use the Edit icon to change file or folder names. Select the item you wish to edit, then press Edit to display the virtual keyboard and edit the item's name.
Delete 	Use the Delete icon to remove files or folders from memory. Select the item you wish to delete, then press Delete to remove the item. Caution: The item will be permanently deleted and cannot be recovered.
Cut 	Use the Cut icon to move files or folders. Select the items you wish to move, then press Cut to store the items on the clipboard. Navigate to the new location and press the Clipboard icon to paste the items. The moved items are deleted from the source location.
Copy 	Use the Copy icon to select files and folders to copy to a new location. Select the items you wish to copy, then press Copy to store the items on the clipboard. Navigate to the new location and press the Clipboard icon to paste the items. Copies of the items remain in the source location.
USB Eject 	Use the USB Eject icon to properly dismount the USB memory device before removing it from the instrument port. Failing to properly eject the device could cause data corruption.

Figure 2-33. File Management Icons

Previewing Screenshots

While in File Manager, you can preview screenshots on the instrument display simply by touching the screenshot file name. While the preview is displayed, you can use the controls to:

- Cycle forward and backward through each screenshot in the directory.
- Rename the file by selecting RENAME, then use the keypad to enter a new filename.
- Delete the file by selecting DELETE and then confirming your choice.
- Copy the file, then close the preview dialog and navigate to the desired location, then touch the Paste icon at the top of the File Manager.

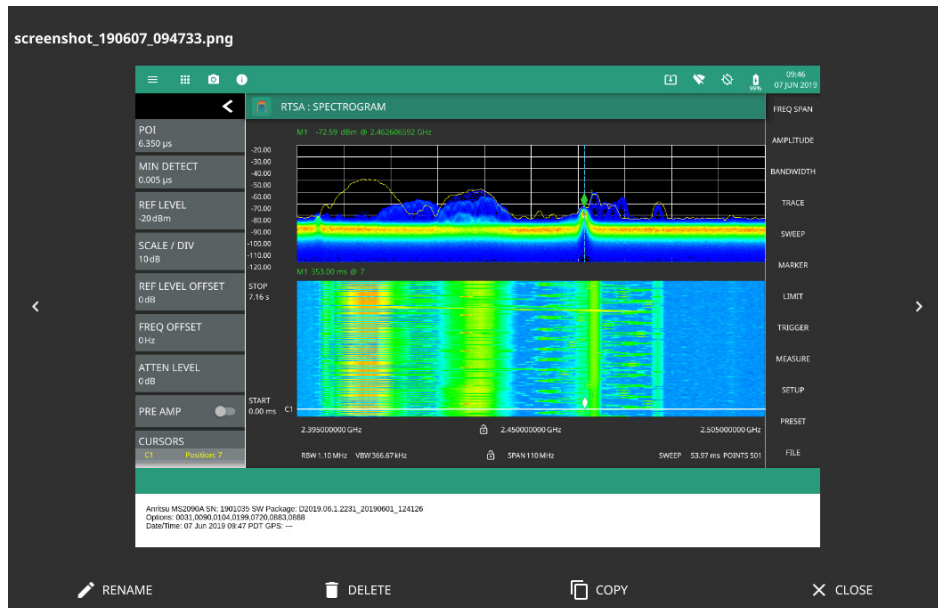
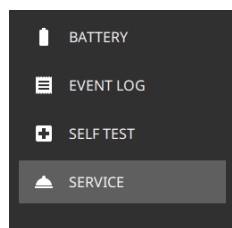


Figure 2-34. Screenshot Preview

2-13 Diagnostics

1. Access the System menu (3-line icon in the upper left corner).
2. Press DIAGNOSTICS to access the instrument diagnostics menu, then select the diagnostic menu that you wish to open.



Battery: Opens [Battery Information](#).

Event Log: Opens the [Event Log](#).

Self Test: Opens the [Self Test](#).

Service: Opens the [Service Mode](#).

Figure 2-35. Diagnostics Menu

Battery Information

The battery information menu shows the available battery information. The relative charge indicates the charge level that the battery is capable of storing. The maximum charge shows the relative capacity of the battery compared to the design capacity. Advanced information can be expanded by touching Advanced.



Figure 2-36. Battery Information

Event Log

The event log allows you to save the event log as a file. This log file is a binary file that may be used by customer service.

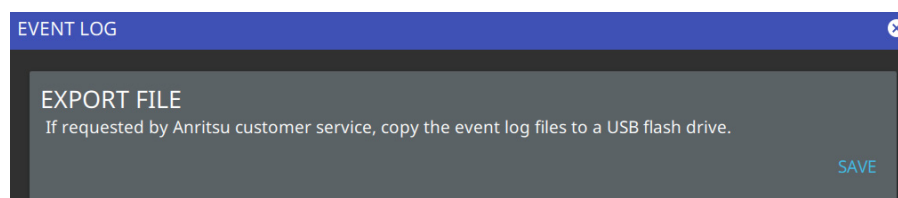


Figure 2-37. Event Log

Self Test

Self test is run when the self test feature is accessed. Basic system results are shown initially. The individual test result can be displayed with test data and a pass/fail status by touching the desired system or application. The self test results can be saved to a file for future reference. Refer to [Appendix A, “Instrument Messages and Troubleshooting”](#) for more information.



Figure 2-38. Self Test

Service Mode

The service mode is for Anritsu customer service use only.

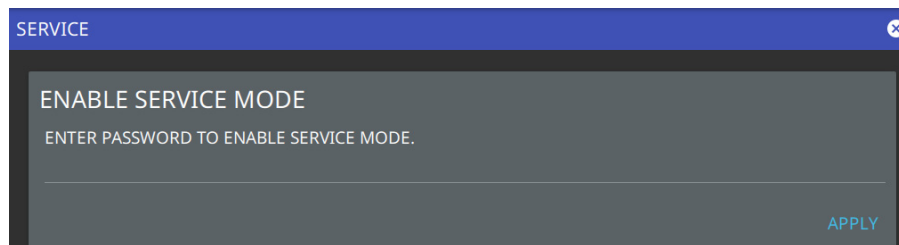


Figure 2-39. Service Mode

2-14 Software Update

To update your Anritsu instrument software, use a high quality USB memory device with at least 1 GB of free space and FAT32 file system format.

1. Insert the USB memory device into your PC or laptop.
2. From a browser, go to the following Anritsu products page:
<http://www.anritsu.com/en-US/test-measurement/products/ms2090a>
3. On the product page, click **Downloads** and select **Drivers/Firmware/Software**.
4. Select the software update for your product and download it to the USB memory device.
5. Insert the USB memory device into the one of the MS2090A USB ports.

Installing the Software

1. Start the software update via one of the two ways below (see [Figure 2-40](#)):
 - Access the upper left **System Menu** (3-line icon), then press **SYSTEM INFORMATION > SOFTWARE UPDATE**.
 - Press the software update icon from the **Title Bar**.
2. Select the latest available update from the drop-down selections and press **Install**.
 - A dialog will appear stating **Software Update in Progress**.
3. When the installation is complete, see [“Verify the Software Update”](#).

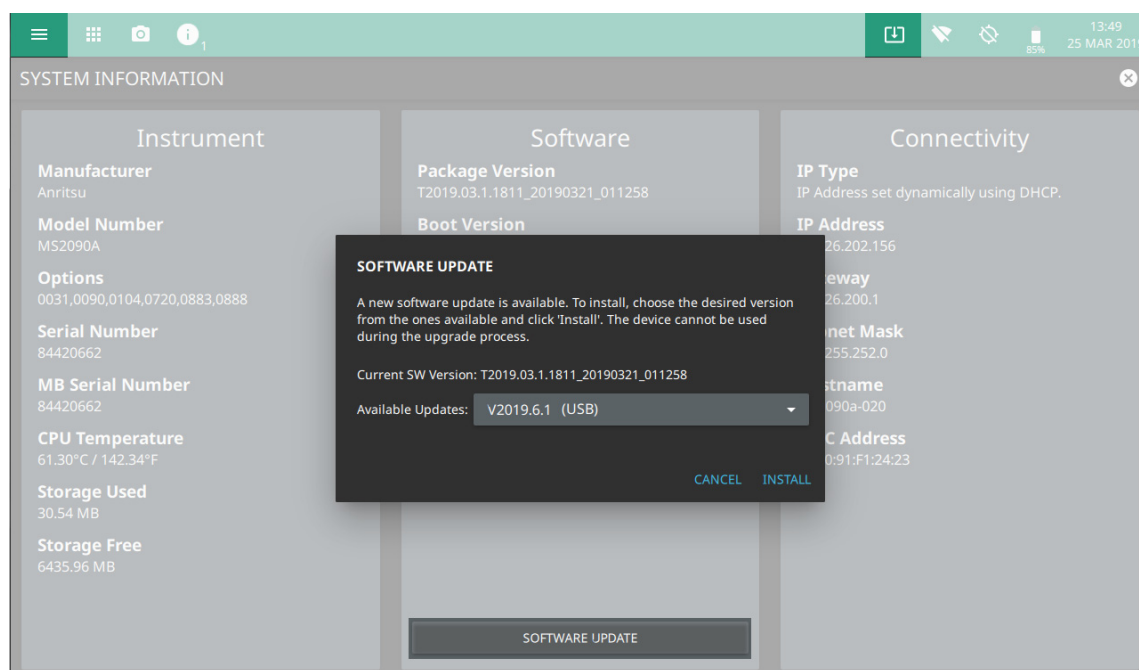


Figure 2-40. Updating the Software

Verify the Software Update

1. Once the software update is complete, power off the MS2090A.
2. Power on the MS2090A
3. Press the System menu icon (3-line icon) from the MS2090A to display the **System Menu**.
4. Select the **System Information** menu (see [Figure 2-41](#)).

5. Verify the Software Package Version displayed is the most current version installed.

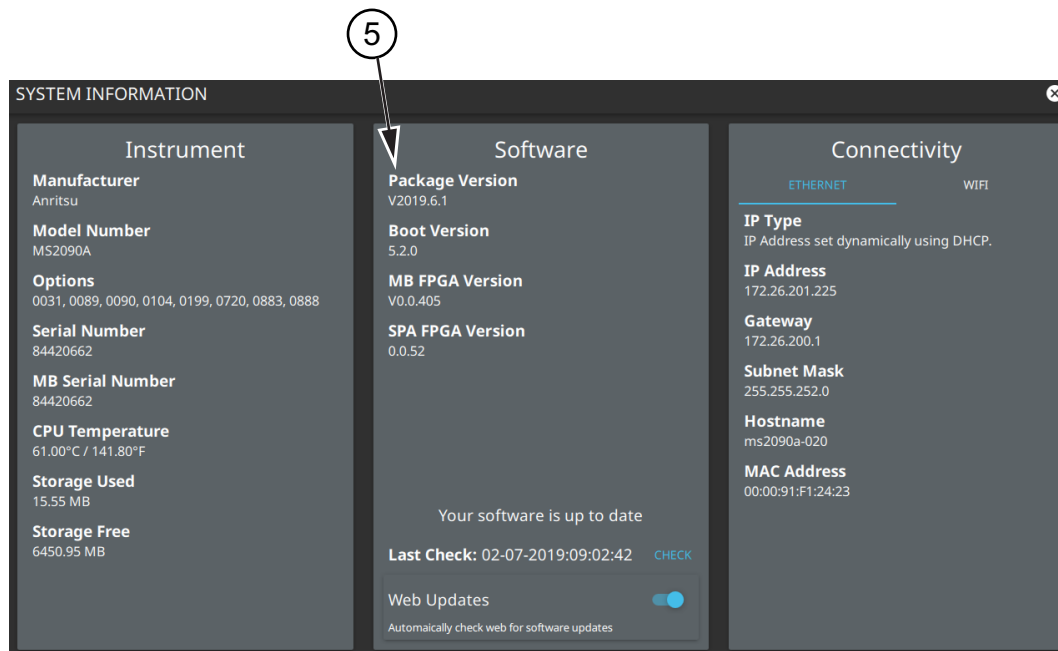


Figure 2-41. System Information

Chapter 3 — Spectrum Analyzer Measurements

3-1 Introduction

This chapter gives a brief overview of the Anritsu Field Master Pro spectrum analyzer and is intended to assist you in your first use of the instrument. The purpose of this chapter is to provide a starting point for making basic measurement setups. This chapter 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 [Section 2-12 “File Management”](#) and [Section 3-22 “Saving and Recalling Measurements”](#) for a description of saving, recalling, and managing measurement files. For detailed information about other specific measurements, refer to the appropriate chapter in this guide.

This spectrum analyzer measurements chapter includes sections that describe resolution bandwidth, video bandwidth, sweep, and attenuator functions. For example, in the Field Master Pro, resolution bandwidth is determined by the intermediate frequency (IF) filter bandwidth. The spectrum analyzer traces the shape of the IF filter as it tunes past a signal. If more than one IF filter is used in a spectrum analyzer, then the narrowest one dominates and is considered the resolution bandwidth.

Spectrum analyzer measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. [Section 3-16](#) through [Section 3-20](#) cover field measurements including brief examples demonstrating channel power, occupied bandwidth, adjacent channel power, and spectral emissions mask testing.

3-2 Selecting the Analyzer

The instrument analyzers are selected from the 9-dot icon or the current measurement icon. To select an analyzer, press the 9-dot icon in the title bar or the current measurement icon to display the available analyzers, illustrated in [Figure 3-1](#). Simply touch the desired icon to load the new analyzer. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.

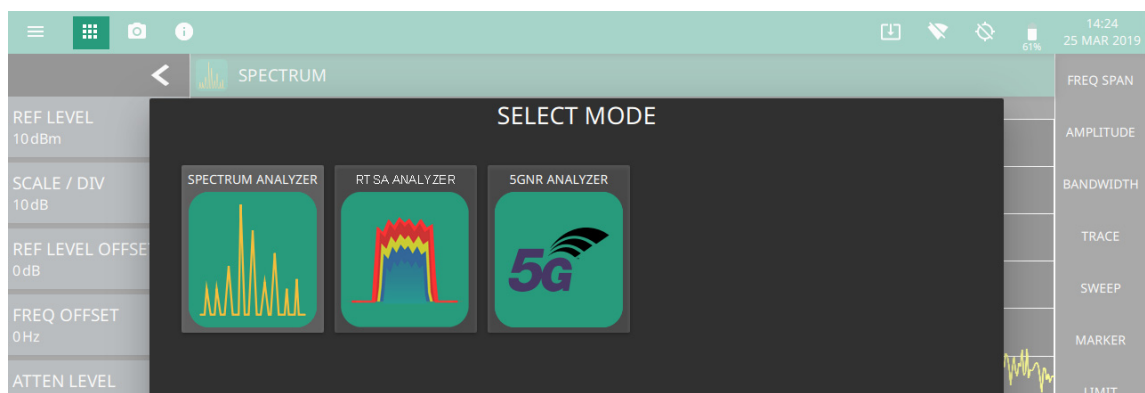


Figure 3-1. Example Analyzers

3-3 Spectrum Analyzer GUI Overview

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

Normal Spectrum View

Normal 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 3-2. Normal Spectrum View (1 of 2)

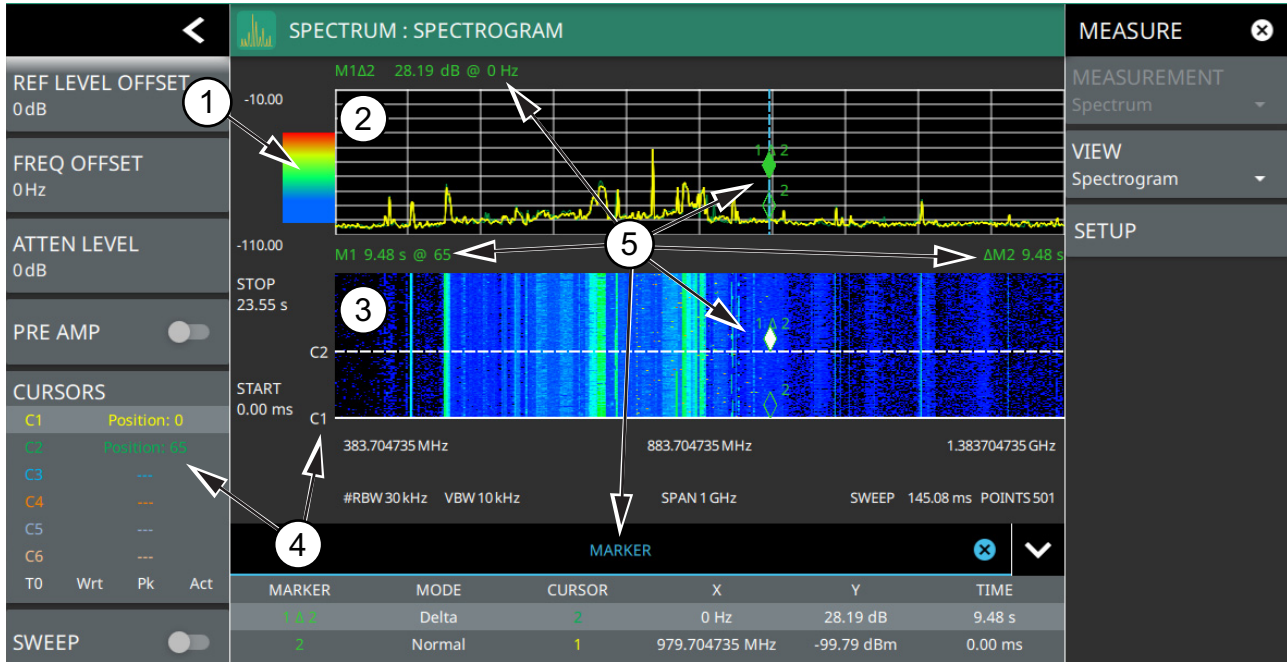
-
1. **RTSA Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings.
 2. **Markers:** Markers are displayed as green diamonds on the trace to which they are assigned. The active marker is shown as a solid green diamond with a dashed vertical line. The marker amplitude and frequency will be 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 peak search menu.
 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 in 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 (see [Section 3-10 “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 3-2. Normal 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. Once Spectrogram view is selected, the color bar can be configured from the SETUP menu. Refer to [Section 3-15 “Measurement Setup” on page 3-47](#) for more information on setting up the Spectrogram view.



- 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 3-47](#), which can be opened by pressing the color bar.
- 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.
- 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.
- 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 3-24](#).
- Markers:** Marker and marker data is 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 3-37](#).

Figure 3-3. Spectrogram View

3-4 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	FREQ SPAN: Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 3-7 “Setting Frequency Parameters” .
AMPLITUDE	AMPLITUDE: Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 3-8 “Setting Amplitude Parameters” .
BANDWIDTH	BANDWIDTH: Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 3-9 “Setting Bandwidth Parameters” .
TRACE	TRACE: Provides trace- and detection-related 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 3-10 “Setting Trace and Cursor Parameters” .
SWEEP	SWEEP: Provides controls for sweep behaviors, number of measurement points, and gated sweep settings (with Option 90). Refer to Section 3-11 “Setting Sweep Parameters” .
MARKER	MARKER: Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 3-12 “Setting Up Markers” .
LIMIT	LIMIT: Provides controls for setting up limit lines and limit alarms. Refer to Section 3-13 “Setting Up Limit Lines” .
TRIGGER	TRIGGER: Controls the trigger source, delay and holdoff, and trigger slope settings. Refer to Section 3-14 “Setting Up Triggering” .
MEASURE	MEASURE: Used to select measurements such as spectrum, channel power, occupied bandwidth, adjacent channel power, spectral emissions mask, and opens the spectrogram. Refer to Section 3-15 “Measurement Setup” .
SETUP	SETUP: Measurement controls for setting up advanced measurements. This menu always displays setting options for the current active measurement (refer to Section 3-16 “Setting Up Advanced Measurements”). When in Spectrogram view, provides access to the spectrogram color SETUP menu (refer to “SETUP Menu (Spectrogram View)” on page 3-47).
PRESET	PRESET: Opens the PRESET menu with selective trace, marker, limits, and measurement preset commands, or an all inclusive analyzer preset command. Refer to Section 3-21 “Presetting the Analyzer” .
FILE	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 3-60 and Section 2-12 “File Management” .

Figure 3-4. Main Menu

Using Menus

When a button in the main menu is pressed, the associated menu opens. The name of the button pressed in the control panel is reflected in the title bar of the menu. Instrument setup, control, and measurement functions are performed through the use of menus. The buttons within the menus may change for various measurement settings, instrument setup parameters, and measurement views. Pressing the main menu button after a menu has been opened will close the menu. Touching status data, a parameter field, or label in the display area opens the associated settings menu for editing that parameter setting. The menu will close when the menu button is pressed again or by pressing the X in the top right corner.

3-5 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 is selected. Below is the spectrum analyzer status panel that covers basic spectrum, spectrogram, channel power, occupied bandwidth, adjacent channel power, and spectral emissions mask measurements (selected via MEASURE > MEASUREMENTS menu).

	<p>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.</p>																								
<p>AUTO MAX PWR <input checked="" type="checkbox"/></p>	<p>AUTO MAX PWR: Displays in SEM measurements only. Enabling this automatically calculates the reference channel power.</p>																								
<p>MANUAL MAX PWR 0 dBm</p>	<p>MANUAL MAX PWR: Displays in SEM measurements only. Used to manually enter the reference channel power.</p>																								
<p>REF LEVEL 10 dBm</p>	<p>Refer to Section 3-20 “Spectrum Emission Mask” on page 3-55.</p> <p>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.</p>																								
<p>SCALE / DIV 10 dB</p>	<p>AUTO REF LEVEL: Automatically adjusts the reference level.</p> <p>SCALE/DIV: Sets the graticule scale/division.</p>																								
<p>REF LEVEL OFFSET 0 dB</p>	<p>REF LEVEL OFFSET: Compensates for the presence of external input attenuation or gain.</p>																								
<p>FREQ OFFSET 0 Hz</p>	<p>Refer to Section 3-8 “Setting Amplitude Parameters” on page 3-14.</p> <p>FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-7 “Setting Frequency Parameters” on page 3-8.</p>																								
<p>ATTEN LEVEL 30 dB</p>	<p>ATTEN LEVEL: When auto attenuation is off, sets input attenuation.</p>																								
<p>PRE AMP <input type="checkbox"/></p>	<p>PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-8 “Setting Amplitude Parameters” on page 3-14.</p>																								
<p>TRACES</p> <table border="1"> <tr> <td>T1</td> <td>Wrt</td> <td>Pk</td> <td>Act</td> </tr> <tr> <td>T2</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T3</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T4</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T5</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T6</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> </table> <p>T1 Clear / Write</p>	T1	Wrt	Pk	Act	T2	Wrt	Pk	Blk	T3	Wrt	Pk	Blk	T4	Wrt	Pk	Blk	T5	Wrt	Pk	Blk	T6	Wrt	Pk	Blk	<p>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.</p> <p>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) will show you 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 pressed 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 3-10 “Setting Trace and Cursor Parameters” on page 3-20.</p>
T1	Wrt	Pk	Act																						
T2	Wrt	Pk	Blk																						
T3	Wrt	Pk	Blk																						
T4	Wrt	Pk	Blk																						
T5	Wrt	Pk	Blk																						
T6	Wrt	Pk	Blk																						
<p>SWEEP <input checked="" type="checkbox"/> Continuously</p>	<p>SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-11 “Setting Sweep Parameters” on page 3-27.</p>																								
<p>FREQ REFERENCE GPS Hi Accy</p>	<p>FREQ REFERENCE: Indicates the current frequency reference source of Internal High Accuracy (used after GPS has lost sync, but while the internal clock still has good GPS reference), Internal Standard Accuracy, External, or GPS Hi Accuracy (requires GPS).</p>																								
<p></p>	<p>The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.</p>																								

Figure 3-5. Spectrum Analyzer Status Panel

3-6 Making Spectrum Analyzer Measurements

Initial Setup

- Connect a signal source to the RF port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured.
 - Select the spectrum analyzer. Refer to [“Selecting the Analyzer” on page 3-1](#).
 - Connect the input signal or antenna to the RF In test port. For connector descriptions, refer to [“Connector Panels” on page 2-3](#).
-



Figure 3-6. Field Master Pro Setup

3-7 Setting Frequency Parameters

Frequency-related parameters are set using the “[FREQ / SPAN Menu](#)” on page 3-11. 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 2-6 on page 2-11](#)).

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 2-6 on page 2-11](#)).

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 3-5 “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.

Zero Span IF Output (Option 89)

Zero Span IF output effectively allows the spectrum analyzer to be used as a receiver front-end, converting the input signal at the spectrum analyzer RF In connector to a signal centered at the IF output frequency. You can then process the IF signal in a way that meets your needs. That may mean using an A-to-D converter or some other signal processing method.

Zero Span IF Output provides an IF signal of 325 MHz with FFT capture bandwidth ≤ 32 MHz and 300 MHz with FFT capture bandwidth = 100 MHz. The nominal RF output level is -4 dBm with a 10 MHz, -20 dBm input, and with 0 dB input attenuation and preamp off. The spectrum can be inverted in certain RF input bands. The IF output signal is present only when the spectrum analyzer span is set to **ZERO SPAN** and the **IF OUTPUT** is toggled on (see [“FREQ / SPAN Zero Span Menu”](#) on page 3-12). You can select the IF output bandwidth of 750 kHz, 7.5 MHz, 14 MHz, 30 MHz, or 100 MHz using the [“IF OUTPUT Menu”](#) on page 3-12.

Note The selectable bandwidth values may differ among instrument models and options.

Table 3-1.

Selected IF Filter Bandwidth	IF Output Frequency
100 MHz	300 MHz
30 MHz	325 MHz
14 MHz	325 MHz
7.5 MHz	325 MHz
750 kHz	325 MHz

The normal IF BW uses analog bandpass filters in the normal RBW chain. By changing the RBW, different filter bandwidths are selected. While the IF bandwidth is influenced by the selection of RBW filters, the digital RBW filters themselves are not employed.

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

Table 3-2. IF Inversion Bands

RF Band	Start Frequency (MHz)	Stop Frequency (MHz)	Spectrum Inversion
1	0	5350	Y
2	5350	7200	Y
3	7200	9200	Y
4	9200	11100	N
5	11100	13000	N
6	13000	16500	N
7	16500	20400	Y
8	20400	26950	Y
9	26950	33810	Y
10	33810	39900	Y
11	39900	47000	N
12	47000	54000	N

"Inverted" means that the IF is spectrally inverted from the input (as the input frequency goes higher, the IF goes lower).

"Not Inverted" means that the IF is not spectrally inverted (as the input frequency goes higher, the IF goes higher).

You need to take frequency inversion into account when processing the IF signal. Assuming that the IF has been processed to yield I and Q data, inversion is easily done by swapping I and Q.

A residual frequency offset of the IF may exist compared to the RF due to the resolution of the first and second local oscillators. This offset is usually on the order of several kHz, but may be up to 10 kHz or so. To determine the residual offset, you need a second spectrum analyzer or a frequency counter.

1. Attach a signal source (or antenna) to the spectrum analyzer and set the center frequency to the center of the signal being received.
2. Set Zero Span from the FREQ/SPAN menu, and then press IF OUTPUT and enable the IF output.
3. Attach a second spectrum analyzer to the IF Out port and set the center frequency to 300 (or 325) MHz.
4. Set the span of the second spectrum analyzer to 100 kHz with the resolution needed to be able to measure an offset that may be 25 kHz or less.
5. Measure the frequency of the IF signal to see how far the signal is offset from 300 (or 325) MHz.

FREQ / SPAN Menu

FREQ / SPAN ×	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. The center frequency can also be dragged on the display when gestures are not toggled off.
CENTER FREQUENCY 10 GHz	
SPAN 20 GHz	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 when gestures are not toggled off.
FULL SPAN	FULL SPAN: Pressing this button sets the span to cover the entire tunable spectrum of the instrument.
LAST SPAN	LAST SPAN: Pressing this button returns the span to the previously set span value.
ZERO SPAN	ZERO SPAN: Sets the analyzer to zero span and enables the “ FREQ / SPAN Zero Span Menu ” on page 3-12.
START FREQUENCY 0 Hz	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 20 GHz	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 1 MHz	FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (–) control.
FREQUENCY OFFSET 0 Hz	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 ↵	GESTURES: Opens the “ GESTURES Menu ” on page 3-13.

Figure 3-7. FREQ / SPAN Menu

FREQ / SPAN Zero Span Menu

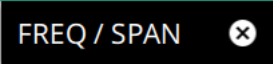
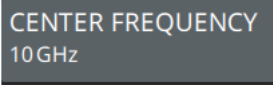
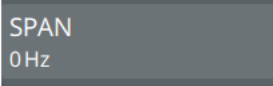
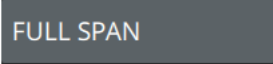
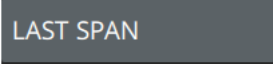

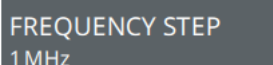
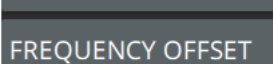


	<p>CENTER FREQUENCY: Sets the center frequency of the sweep range. The current span setting will remain constant or will be adjusted to accommodate the start and stop frequency range of the instrument. The center frequency can also be dragged on the display when gestures are not toggled off.</p>
	<p>SPAN: 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 when gestures are not toggled off.</p>
	<p>FULL SPAN: Pressing this button sets the span to cover the entire tunable spectrum of the instrument.</p>
	<p>LAST SPAN: Pressing this button returns the span to the previously set span value.</p>
	<p>ZERO SPAN: Sets the analyzer to zero span and enables the “FREQ / SPAN Zero Span Menu” on page 3-12.</p>
	<p>FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (-) control.</p>
	<p>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.</p>
	<p>IF OUTPUT: Opens the “IF OUTPUT Menu” on page 3-12. Requires Option 89.</p>
	
	

Figure 3-8. FREQ / SPAN Menu

IF OUTPUT Menu




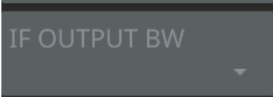
	<p>IF OUTPUT: Toggles the top panel IF output on or off. When IF output is on, the IF OUTPUT BW button becomes active.</p>
	<p>IF OUTPUT BW: When IF output is on, this button provides a list of IF output bandwidth settings.</p>
	
	

Figure 3-9. IF OUTPUT Menu

GESTURES Menu

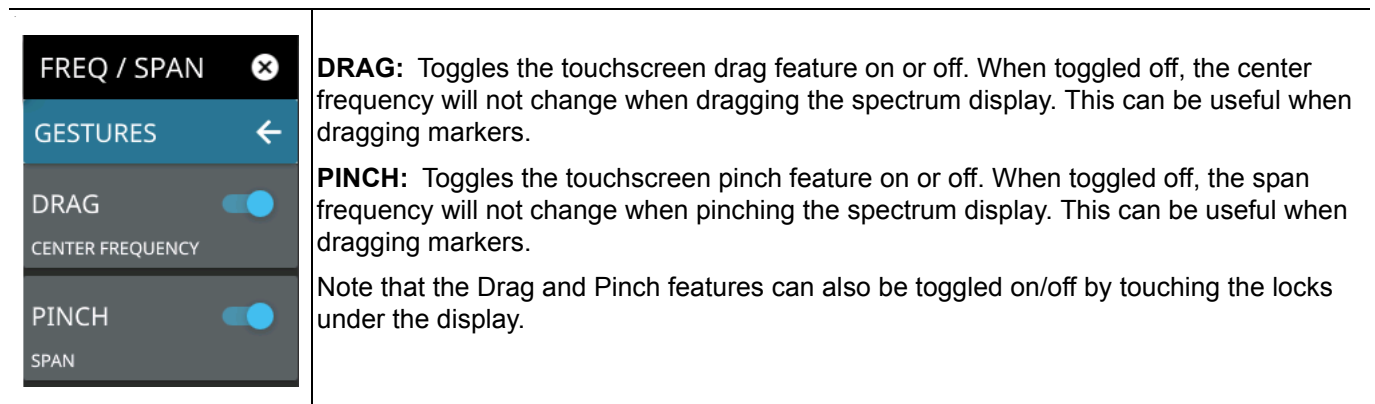


Figure 3-10. GESTURES Menu

3-8 Setting Amplitude Parameters

Amplitude-related parameters are set using the [“AMPLITUDE Menu” on page 3-16](#).

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 may overdrive and saturate the input circuit (refer to [“Indications of Excessive Signal Level” on page 3-15](#)). 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 ATTEN coupling of the attenuator setting and 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.

Attenuator Functions

The spectrum analyzer includes a step attenuator at the RF input. This attenuator is used to reduce large signals to levels that make best use of the analyzer's dynamic range. By default, the auto attenuation automatically adjusts the attenuator as a function of the reference level. In the **AMPLITUDE** menu, the **ATTEN LEVEL** allows manual adjustment of the input attenuation. When auto attenuation is selected, both the reference level and the attenuation are increased. The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

- Decrease the reference level and attenuation. Refer to [“AMPLITUDE Menu” on page 3-16](#).
- Turn on the preamplifier.
- Reduce RBW and or VBW (RBW/VBW = 10 is often optimal for this purpose). Refer to [“Setting Bandwidth Parameters” on page 3-17](#).
- Use trace averaging if VBW is already set to 1 Hz. Refer to [“Setting Trace and Cursor Parameters” on page 3-20](#)

Preamplifier

The preamplifier can be turned on and off by toggling PRE AMP via the status panel or the AMPLITUDE menu. [Figure 3-11](#) shows the noise floor with the preamplifier off (1) and on (2). Note that when the preamplifier is turned on, the noise floor drops significantly and a low-level signal is exposed. In order to use the preamplifier, the attenuation must be lower than 20 dB. If the preamplifier is turned on when the attenuation is greater than or equal to 20 dB, the attenuation will automatically drop to 10 dB. When AUTO ATTEN is toggled on, the REF LEVEL must be set to -40 dBm or lower to enable the preamplifier.

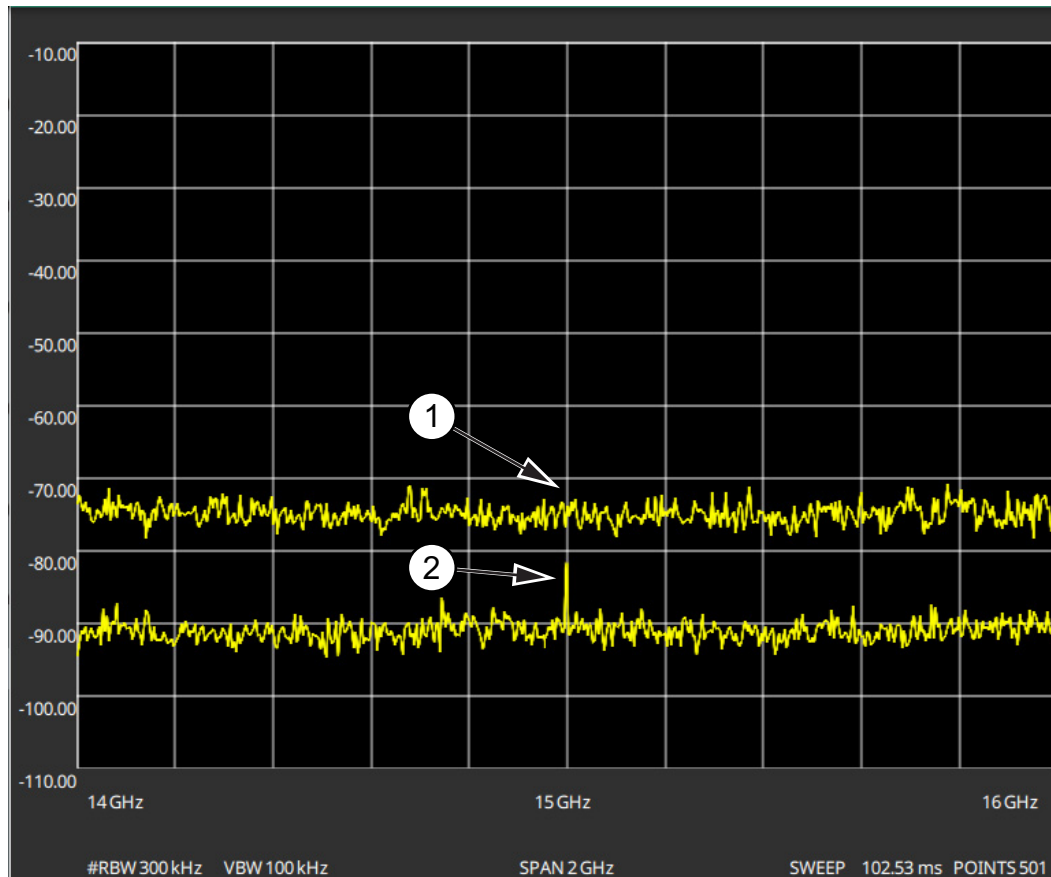


Figure 3-11. 1. Preamplifier Off
2. Preamplifier On

Indications of Excessive Signal Level

The Field Master Pro has built-in features to help prevent input overload. These include auto attenuation and reference level. The instrument will also indicate when a received signal is too high for the current setup by displaying an “ADC Overrange” notification in the title bar ([Figure 3-12](#)). Before proceeding with the measurements, adjust the reference level, the attenuation level, and disable the preamplifier if necessary. Adjusting the resolution bandwidth and frequency range may also help when measuring small signals that are near large signals.



Figure 3-12. ADC Overrange

AMPLITUDE Menu

AMPLITUDE ✕	<p>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.</p>
REF LEVEL 10 dBm	<p>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.</p>
AUTO REF LEVEL	<p>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.</p>
SCALE / DIV 10 dB	<p>Y AXIS UNIT: Displays the y-axis amplitude units in dBm.</p>
Y AXIS UNIT dBm ▼	<p>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 3-14.</p>
REF LEVEL OFFSET 0 dB	<p>PRE AMP: Turns the low-noise front-end preamplifier on or off. To ensure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than –40 dBm. The preamplifier cannot be turned on if auto attenuation is on and the reference level is above –40 dBm. Refer to “Preamplifier” on page 3-15.</p>
PRE AMP <input type="checkbox"/>	<p>AUTO ATTEN: Input attenuation can be either tied to the reference level (on) or manually selected (off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.</p>
AUTO ATTEN <input checked="" type="checkbox"/>	<p>ATTEN LEVEL: When auto attenuation is off, the attenuation value can be set manually to a resolution of 5 dB. Pressing the plus (+) or minus (–) control increments the value by 10.</p>
ATTEN LEVEL 30 dB	

Figure 3-13. AMPLITUDE Menu

3-9 Setting Bandwidth Parameters

Bandwidth parameters are set using the [“BANDWIDTH Menu”](#) on page 3-19.

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 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 10 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 3 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 3-19](#) and check your technical data sheet for the bandwidth range of your instrument.

BANDWIDTH Menu





BANDWIDTH 	<p>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.</p>
AUTO RBW 	<p>RBW: The current resolution bandwidth is displayed under the RBW button. Once 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.</p>
RBW 3 MHz	<p>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.</p>
AUTO VBW 	<p>VBW: The current video bandwidth is displayed under the VBW button. Once 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.</p>
VBW 3 MHz	<p>VBW TYPE: Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean).</p>
VBW TYPE Linear 	<p>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.</p>
RBW:VBW 1	<p>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.</p>
SPAN:RBW 100	

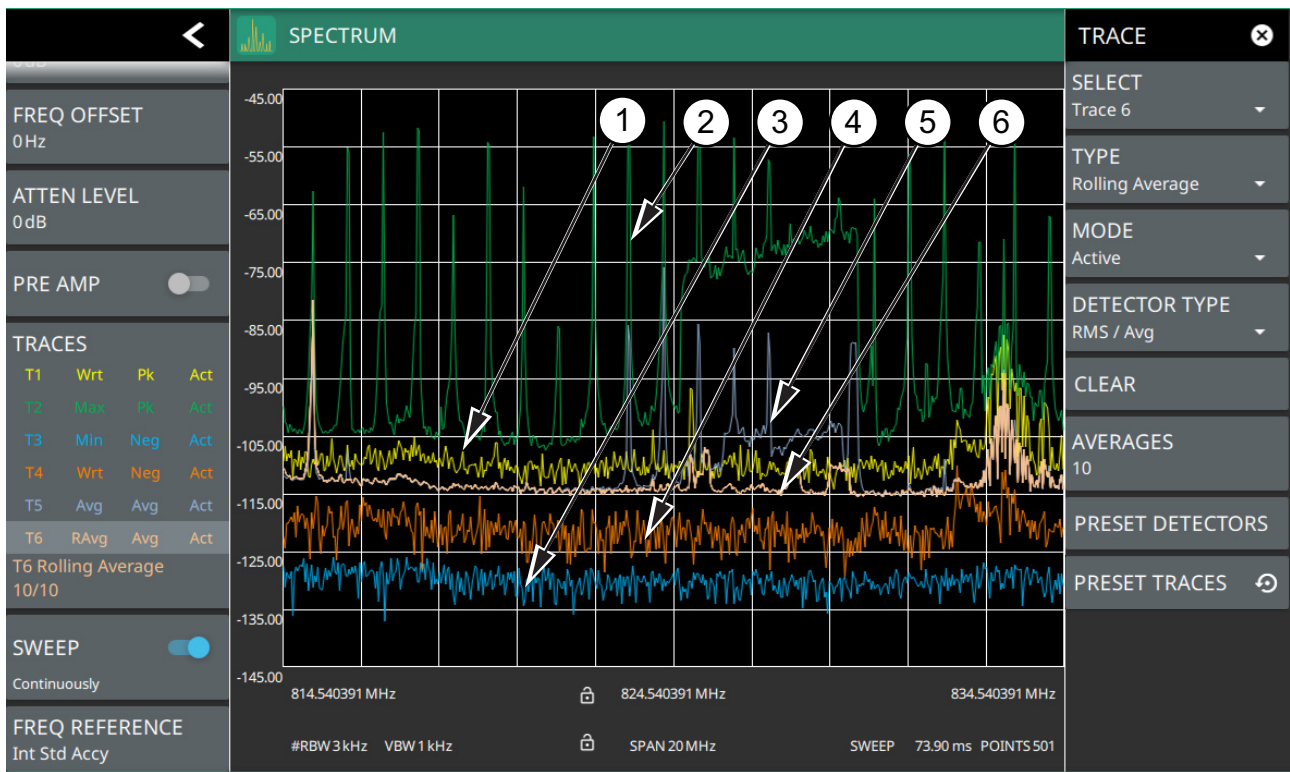
Figure 3-14. BANDWIDTH Menu

3-10 Setting Trace and Cursor Parameters

Field Master Pro 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 3-21. When working with traces and cursors in Spectrogram view, refer to “TRACE Menu (Spectrogram View)” on page 3-25 and “TRACE CURSOR Menu” on page 3-26.

Traces in Spectrum View

The screenshot below shows the MS2090A 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. & 6. Average and RMS/Average Detection: The trace points are an average of the 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.

Figure 3-15. Traces in Spectrum View

TRACE Menu (Spectrum View)

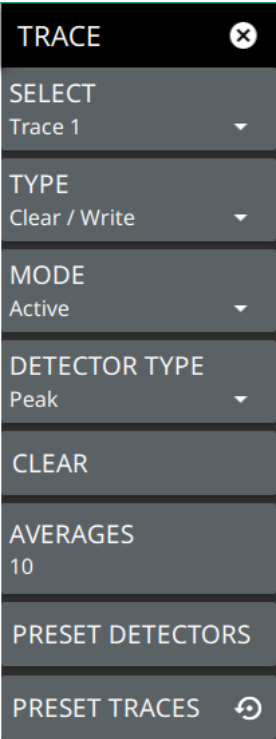
	<p>SELECT: Selects traces 1 through 6. Selecting a trace that is off turns the trace on. The trace type will be Clear/Write, the trace mode will be Active, and the detector type will be Peak. Selecting a trace will draw the trace on top of all other traces. This feature is not available in the spectrogram measurement view because all spectrogram data is created from a single trace.</p> <p>TYPE: Selects one of the following types of traces:</p> <ul style="list-style-type: none"> • 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. <p>TRACE MODE: Selects one of the following trace modes:</p> <ul style="list-style-type: none"> • 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 3-16. TRACE Menu (1 of 2)

DETECTOR TYPE: Selects one of the available 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 showing each display point (see [“Trace Detector Types” on page 3-23](#)).

- **Peak:** Shows the maximum amplitude of sampled data 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 shows the linear average amplitude of sampled data for each display point, before converting to display units. When VBW/AVERAGE type is set to Log, this method shows the traditional average of log (power), such as dBm, for each display point, before converting to display units. Not available in ZERO SPAN.
- **Negative:** Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring 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.

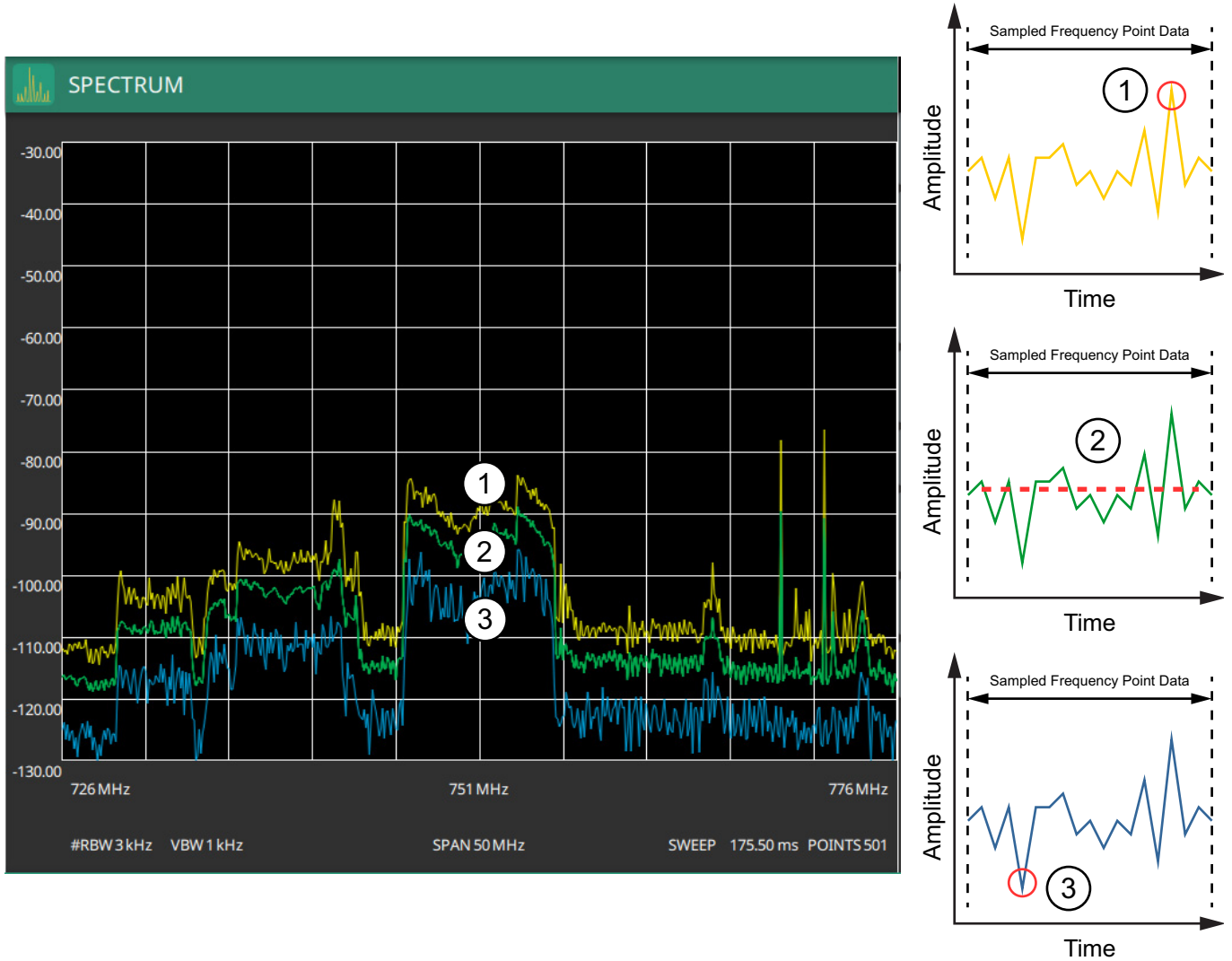
PRESET DETECTORS: Sets all trace detectors to Peak.

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

Figure 3-16. TRACE Menu (2 of 2)

Trace Detector Types

The figure below shows the available detector types:

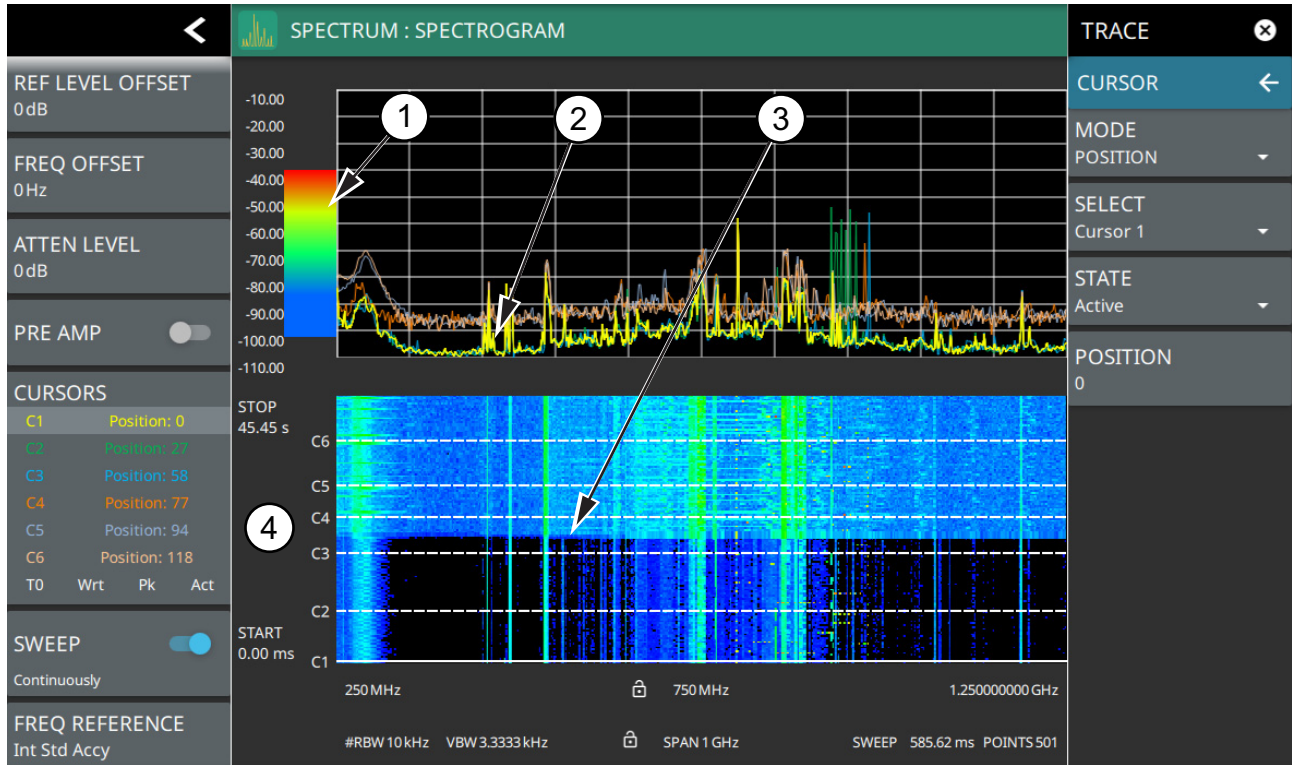


1. Yellow trace set to Peak detection.
2. Green trace set to RMS/Ave detection.
3. Blue trace set to Negative detection.

Figure 3-17. Trace Detector Types

Cursors in Spectrogram View

The screenshot below shows the MS2090A 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 3-47.
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”](#) on page 3-26. 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 applies to all traces shown in the spectrum display.

Figure 3-18. Spectrogram View

TRACE Menu (Spectrogram View)

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

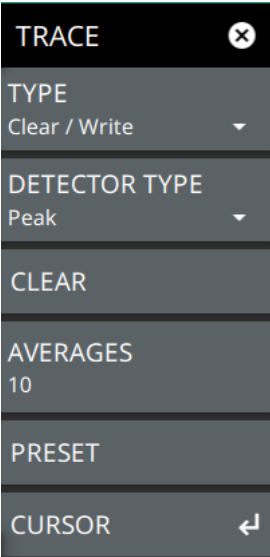
	<p>TYPE: Selects one of the following types of traces:</p> <ul style="list-style-type: none"> • Clear/Write: Clears the trace after each sweep is complete and writes a new trace. • Average: The average of all N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the 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. <p>DETECTOR TYPE: Selects one of the available 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 showing each display point (see “Trace Detector Types” on page 3-23).</p> <ul style="list-style-type: none"> • Peak: Shows the maximum amplitude of sampled data 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 shows the average amplitude of sampled data for each display point. When VBW/AVERAGE type is set to Log, this method shows the traditional average of log (power), such as dBm, for each display point. • Negative: Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring modulated signals to see if some frequencies are not being used. • Sample: Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements. <p>CLEAR: Clears the currently active trace data.</p> <p>AVERAGES: Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes.</p> <p>PRESET: Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.</p> <p>CURSOR: Opens the “TRACE CURSOR Menu” on page 3-26.</p>
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Figure 3-19. TRACE Menu (Spectrogram View)

TRACE CURSOR Menu

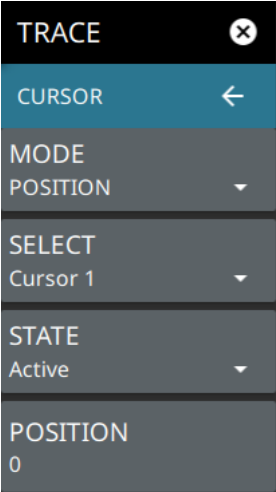
	<p>MODE: Every trace captured in the spectrogram has a time and a position index. Set the location of the spectrogram cursor based on either the time index or the position index. When position is selected, you can change the position index of the cursor from the POSITION button. If Time is selected, you can set the time index of the cursor from the TIME button.</p> <p>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 3-37.</p> <p>STATE: Selects one of the following cursor states:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>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.</p>
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Figure 3-20. TRACE / CURSOR Menu (Spectrogram View)

3-11 Setting Sweep Parameters

Sweep parameters are set using the [“SWEEP Menu”](#) on page 3-28.

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 points sets the number of display points in the trace that are generated from the measurement data.

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, but 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 Field Master Pro 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


	<p>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 once 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.</p> <p>RESTART: The restart function restarts the current sweep or measurement from the start frequency.</p> <p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE triggers a single measurement sweep.</p> <p>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.</p> <p>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.</p> <p>SWEEP TIME: This button is available when the span is set to ZERO SPAN. Sets the sweep time.</p> <p>GATED SWEEP: Opens the “GATED SWEEP Menu” on page 3-30.</p>
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Figure 3-21. SWEEP Menu

Gated Sweep (Option 90)

Gated sweep is only available on instruments with Option 90 installed. Gated sweep allows you to synchronize your sweep with an event so that the analyzer collects data at the appropriate time. This is useful for measuring signals in the time domain such as pulsed RF, time multiplexed, or burst modulated signals. Field Master Pro can use the GPS timing signal as the gating trigger event. This will allow you to synchronize measurements with GPS synchronized communication signals. Set up gated sweep from the **“GATED SWEEP Menu”** on page 3-30.

To set up the instrument for gated sweep measurements, press SWEEP > GATED SWEEP and set the following:

1. Select the GATE SOURCE. The gate source selected determines the trigger source from which the gate is controlled. Not all instrument models and options support all triggering selections, so your choices may vary. Field Master Pro supports a GPS gate source.
2. Select one of the available FRAME TIME durations. The frame time sets the total measurement cycle time.
3. Set the GATE DELAY time. The gate delay sets the time from the triggering event to when the instrument starts sweeping and collecting data.
4. Set the GATE LENGTH time. The gate length sets the time for data capture and analysis.
5. If desired, enable PWR VS TIME (refer to **“POWER VS TIME Display”** on page 3-31.)

Below is an example of a gated sweep applied to a channel power measurement. The signal level shown varies cyclically with time and would not be measurable without gated sweep.

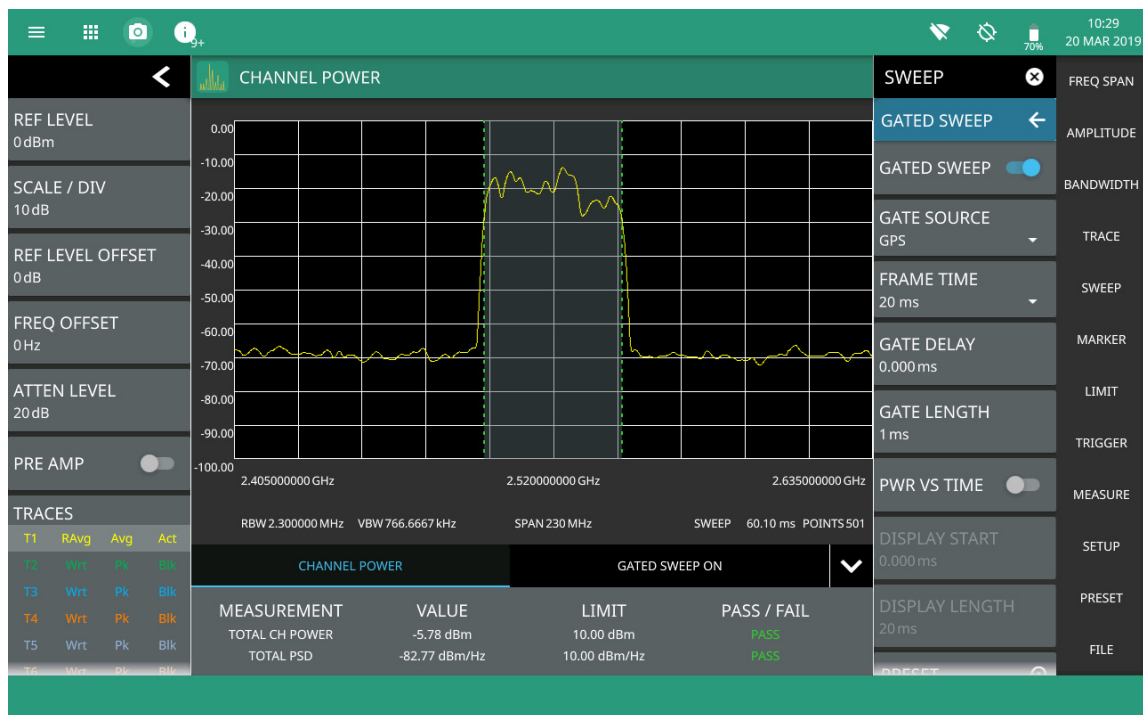


Figure 3-22. Gated Sweep Measurement

The channel power and gated sweep display panels at the bottom can be tapped to directly open either the Channel Power SETUP menu or the GATED SWEEP menu.

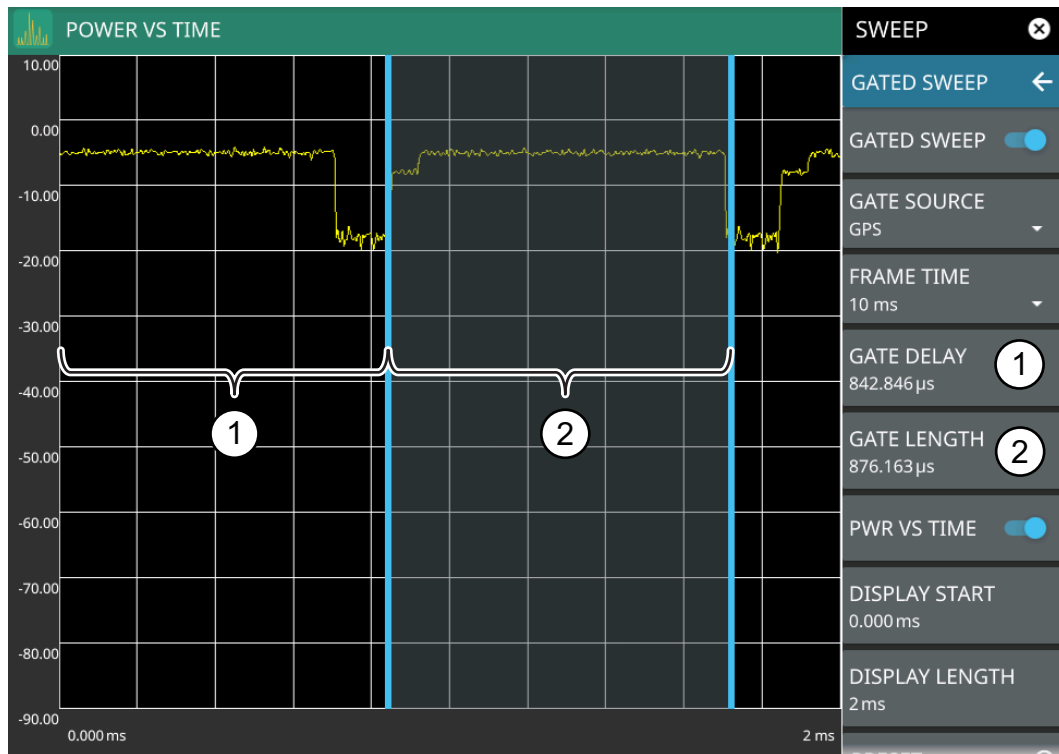
GATED SWEEP Menu

<p>The screenshot shows the GATED SWEEP menu with the following items from top to bottom:</p> <ul style="list-style-type: none"> SWEEP (with a close icon) GATED SWEEP (with a back arrow) GATED SWEEP (with a toggle switch) GATE SOURCE (set to GPS) FRAME TIME (set to 20 ms) GATE DELAY (set to 0.000 ms) GATE LENGTH (set to 1 ms) PWR VS TIME (with a toggle switch) DISPLAY START (set to 0.000 ms) DISPLAY LENGTH (set to 20 ms) PRESET GTD SWP (with a refresh icon) 	<p>GATED SWEEP: Toggles gated sweep on or off.</p> <p>GATED SOURCE: Selects the trigger source for the gated sweep. The gate source is fixed to GPS.</p> <ul style="list-style-type: none"> • External: This setting designates the trigger source as an external signal that is input via the Trig In/Out connector. • GPS: The GPS trigger source is valid only on instrument models with 20 MHz IF Bandwidth available. • IF Pwr: When choosing IF Power as the trigger source, enter the trigger power level. <p>FRAME TIME: Selects the frame time duration of 10 ms, 20 ms, or 1 s.</p> <p>GATE DELAY: Sets the start of the gated sweep. When “POWER VS TIME Display” is enabled, the gate delay is indicated by the blue left border of the power vs time display. You can also drag the entire gate to set the desired gate delay.</p> <p>GATE LENGTH: Sets the length of the gated sweep. When “POWER VS TIME Display” is enabled, the gate length is indicated by the width between the blue borders of the power vs time display. You can also drag the right blue border to set the desired gate length.</p> <p>PWR VS TIME: Enables the “POWER VS TIME Display” on page 3-31.</p> <p>DISPLAY START: When POWER VS TIME is enabled, sets the start of the graticule display.</p> <p>DISPLAY LENGTH: When POWER VS TIME is enabled, sets the time length of the graticule display.</p> <p>PRESET GTD SWP: Presets gated sweep settings to default values.</p>
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Figure 3-23. GATED SWEEP Menu

POWER VS TIME Display

When power vs time is enabled, a time-domain graph is presented. This graph is a useful visual aid when setting up the GATE DELAY (1) and GATE LENGTH (2) times as you can simultaneously view the signal level within the set frame and relative to your gate delay and length. The display is enabled using the PWR VS TIME toggle setting and should be disabled after setting up the gate delay and length parameters. The gate delay and length are represented by the width of the displayed shaded area flanked with blue lines (see [Figure 3-24](#)).



1. Set the gate delay by dragging the left blue setting line or entering a value directly. The full time scale is shown along the bottom and the gate delay time will be displayed at the top center of the graticule when it is being adjusted.
2. Set the gate length by dragging the right blue setting line or entering a value directly. The full time scale is shown along the bottom and the gate length will be displayed at the top center of the graticule when it is being adjusted.

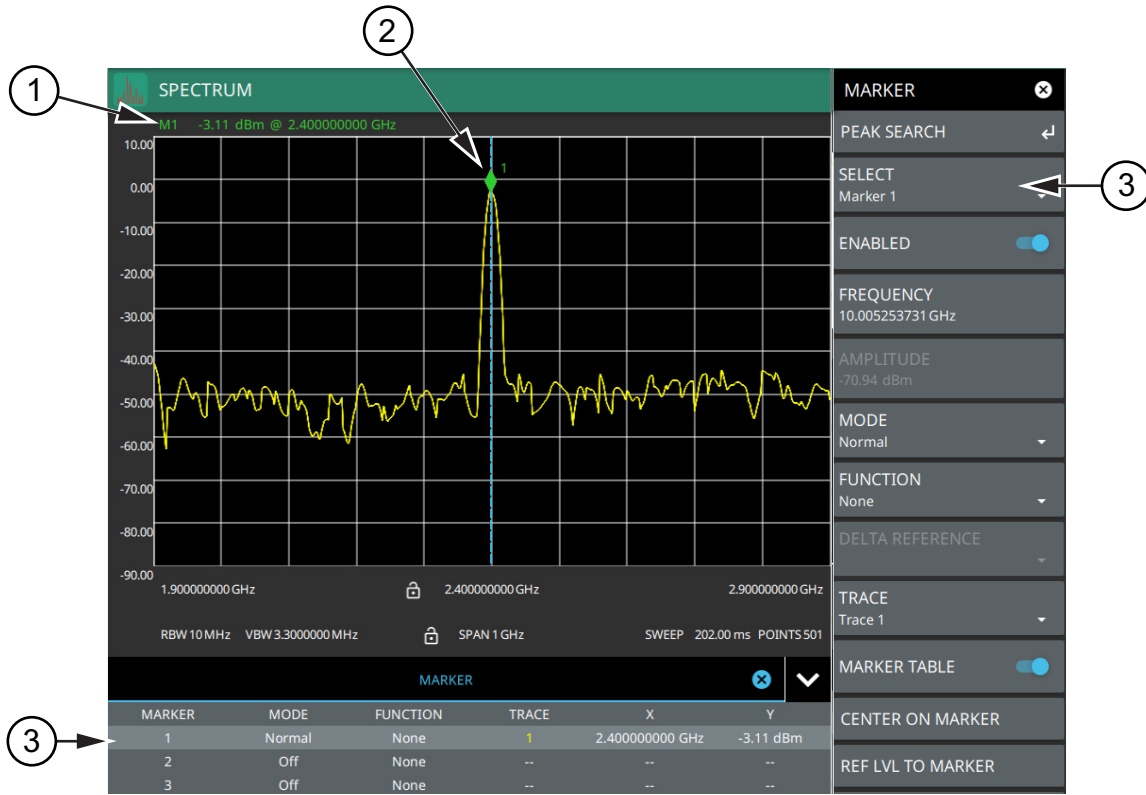
Figure 3-24. Power vs. Time Display

If the blue gate delay and length setting lines are set outside of the displayed graticule scale, you will see “< Gate Start” and “Gate Stop >” messages at the edge of the display indicating where the blue setting lines are located.

Once the gate has been set up, you can apply gating to the spectrum by toggling GATED SWEEP on. Gating will continue to be applied when you access other measurements and functions of the spectrum analyzer until gated sweep is toggled off or an unsupported instrument configuration is selected.

3-12 Setting Up Markers

Marker parameters are set using the “MARKER Menu” on page 3-34. 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 3-25. 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 3-35). 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 delta marker is on, its position data is relative to its reference marker. For example, if marker 2 is set as a delta marker, the delta reference is set to Marker 3. To set a delta marker and its reference:

1. Activate a marker and place it in a reference location as described previously.
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 lower marker number will automatically be used as the reference marker. If no lower number marker is available, the next higher number marker will be turned on and used as a normal marker for the reference. If the reference marker is disabled, the delta marker will be changed to a normal marker.
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 3-35).

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

MARKER Menu

MARKER	PEAK SEARCH: Opens the “MARKER PEAK SEARCH Menu” on page 3-35.
PEAK SEARCH	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.
SELECT Marker 2	ENABLED: Enables the selected marker. When the toggle is off, the marker is disabled and not shown on the screen.
ENABLED	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.
FREQUENCY 10.182884111 GHz	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.
AMPLITUDE -39.61 dBm	MODE: Select marker preference:
MODE Normal	<ul style="list-style-type: none"> • 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 Normal marker at the same location. The Reference marker can then be switched to a Fixed 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 Off	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 3-36.
DELTA REFERENCE 	DELTA REFERENCE: Selects the Reference marker for a Delta marker. A Delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.
TRACE Trace 1	TRACE: Selects the trace number to which the marker is currently attached.
MARKER TABLE	MARKER TABLE: Toggle on or off the marker table displayed below the screen. Refer to “Marker Table” on page 3-38.
CENTER ON MARKER	CENTER ON MARKER: Sets the center frequency to the currently active marker's frequency value.
REF LVL TO MARKER	REF LVL TO MARKER: Sets the reference level to the currently active marker's amplitude value.
ALL MARKERS OFF	ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position once re-enabled.
PRESET MARKERS	PRESET MARKERS: Presets marker selections to default values.

Figure 3-26. MARKER Menu

MARKER PEAK SEARCH Menu

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

MARKER ✕	PEAK SEARCH: Returns to the main MARKER menu.
PEAK SEARCH ←	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.
SELECT Marker 1 ▾	PEAK SEARCH: Moves the selected marker to the highest peak.
PEAK SEARCH	NEXT PEAK: Moves the selected marker to the next highest peak regardless of location.
NEXT PEAK	NEXT PEAK LEFT: Moves the selected marker to the next peak left of its current position.
NEXT PEAK LEFT	NEXT PEAK RIGHT: Moves the selected marker to the next peak right of its current position.
NEXT PEAK RIGHT	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 LEFT	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.
NEXT POINT RIGHT	THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a peak.
THRESHOLD ☐	EXCURSION: If turned on, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.
0 dBm	
EXCURSION ☐	
0 dB	

Figure 3-27. PEAK SEARCH Menu

Marker Functions

Noise Markers

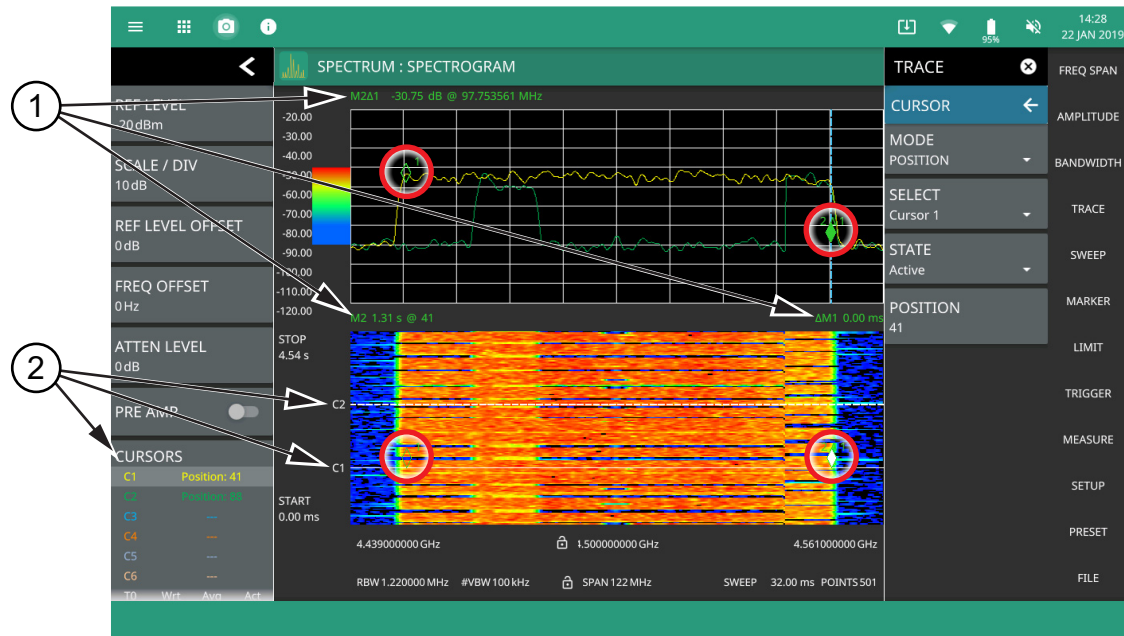
Noise Markers use an averaging routine applied to multiple data-point groups to calculate the readout, which is typically comparable to using 1 Hz bandwidth filtering. Because the noise marker routine uses groups of data points for the calculation, the noise marker should not be placed in close proximity 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.

Frequency Counter Marker

Sets the frequency counter for the selected marker. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. When counter marker is enabled, a higher resolution digital signal processing is used within the region of the counter marker to determine a more precise frequency. Using counter marker in association with marker to peak will result in the frequency of the signal peak to a much higher displayed resolution. Note that frequency accuracy is affected by the RBW setting, and sweep times may be longer when using counter marker because of the additional signal processing.

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



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 3-28. Spectrogram with Cursors and Markers

Marker Table

The marker table display is useful for displaying many marker parameters at once. 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.

①

MARKER						
MARKER	MODE	FUNCTION	TRACE	X	Y	
1	Normal	Noise	1	5.800000010 GHz	-142.43 dBm/Hz	
2	Normal	Off	3	6.152000010 GHz	-66.84 dBm	
3	Normal	Off	1	62.690807800 GHz	-67.91 dBm	
4	Off	Off	--	--	--	
5	Off	Off	--	--	--	
6	Off	Off	--	--	--	

②

MARKER						
MARKER	MODE	CURSOR	X	Y	TIME	
1	Normal	1	5.800000010 GHz	-145.47 dBm/Hz	0.00 ms	
2	Normal	3	6.152000010 GHz	-68.24 dBm	9.33 s	
3	Normal	1	62.690807800 GHz	-70.54 dBm	0.00 ms	
4	Off	--	--	--	--	
5	Off	--	--	--	--	
6	Off	--	--	--	--	

Figure 3-29. Marker Table

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

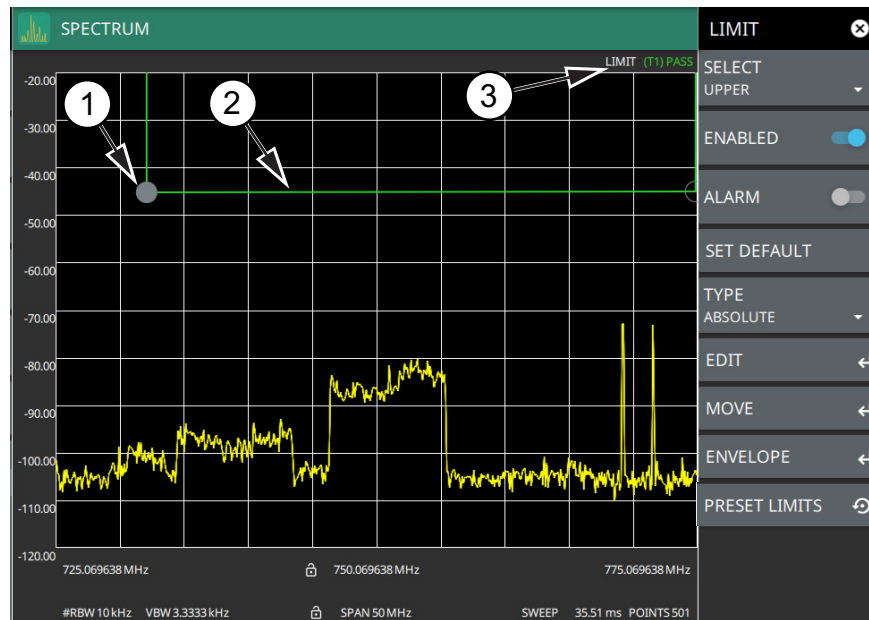
The currently selected marker's value is shown at the top left of the spectrum window with its current amplitude and frequency values.

The selected marker is highlighted on the trace display.

3-13 Setting Up Limit Lines

Limit lines allow you to monitor when trace data crosses 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 3-22 “Saving and Recalling Measurements”](#) on page 3-58).

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 3-41.



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 3-30. Simple Limit Line

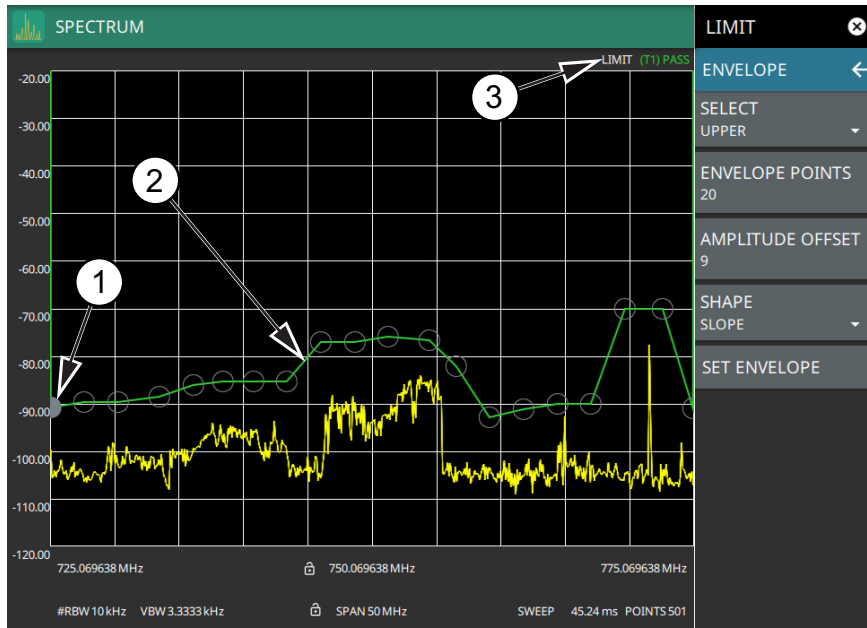
Simple Limit Line

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 3-44. 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. Once 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 an upper envelope 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 3-31. 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

LIMIT ✕	SELECT: Selects UPPER or LOWER limit line for editing.
SELECT UPPER ▾	ENABLED: Displays the selected limit when toggled on.
ENABLED ⏻	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.
ALARM ⏻	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.
SET DEFAULT	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 pressing the desired state.
TYPE ABSOLUTE ▾	EDIT: Opens the “LIMIT EDIT Menu” on page 3-42.
EDIT ↶	MOVE: Opens the “LIMIT MOVE Menu” on page 3-43.
MOVE ↶	ENVELOPE: Opens the “LIMIT ENVELOPE Menu” on page 3-44.
ENVELOPE ↶	PRESET LIMITS: Presets the limit lines to default values.
PRESET LIMITS ↻	

Figure 3-32. LIMIT Menu

LIMIT EDIT Menu

LIMIT ✕	SELECTED POINT: Displays the limit line point number. Press to select a different point from the displayed list.
EDIT ←	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 .
SELECTED 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).
FREQUENCY 0 Hz	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.
AMPLITUDE 0 dBm	DELETE POINT: Press this button to delete the selected point.
ADD POINT	ADD VERTICAL: Press this button to add an inflection point below the currently selected point.
DELETE 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.
ADD VERTICAL	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.
NEXT POINT LEFT	
NEXT POINT RIGHT	

Figure 3-33. LIMIT EDIT Menu

LIMIT MOVE Menu

LIMIT ✕	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.
MOVE ←	
CENTER	
X-OFFSET 0 Hz	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	LEFT: Pressing this button moves all inflection points to the left by the X-OFFSET value.
RIGHT	RIGHT: Pressing this button moves all inflection points to the right by the X-OFFSET value.
Y-OFFSET 0 dB	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	UP: Pressing this button moves all inflection points up by the Y-OFFSET value.
DOWN	DOWN: Pressing this button moves all inflection points down by the Y-OFFSET value.
MARKER 1 OFFSET 0 dB	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	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 3-34. LIMIT MOVE Menu

LIMIT ENVELOPE Menu

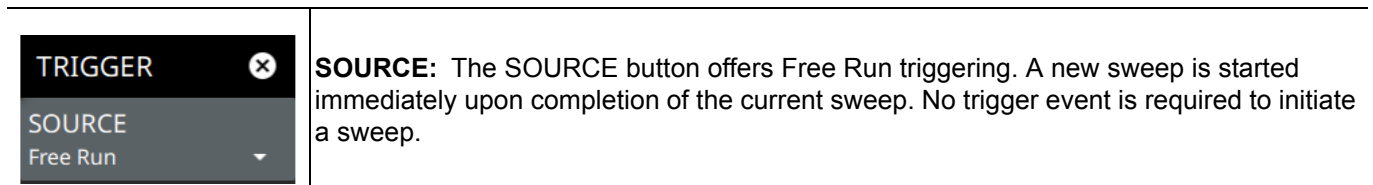
LIMIT ✕	SELECT: Press this button to select UPPER or LOWER for envelope design.
ENVELOPE ←	ENVELOPE POINTS: This sets the desired number of envelope points.
SELECT UPPER ▾	AMPLITUDE OFFSET: Use to define how far away from the trace to place the upper or lower envelope. The limits are ± 100 dB. For an 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.
ENVELOPE POINTS 20	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.
AMPLITUDE OFFSET 3	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.
SHAPE SQUARE ▾	
SET ENVELOPE	

Figure 3-35. LIMIT ENVELOPE Menu

3-14 Setting Up Triggering

Trigger parameters are set using the “[TRIGGER Menu](#)” on page 3-45.

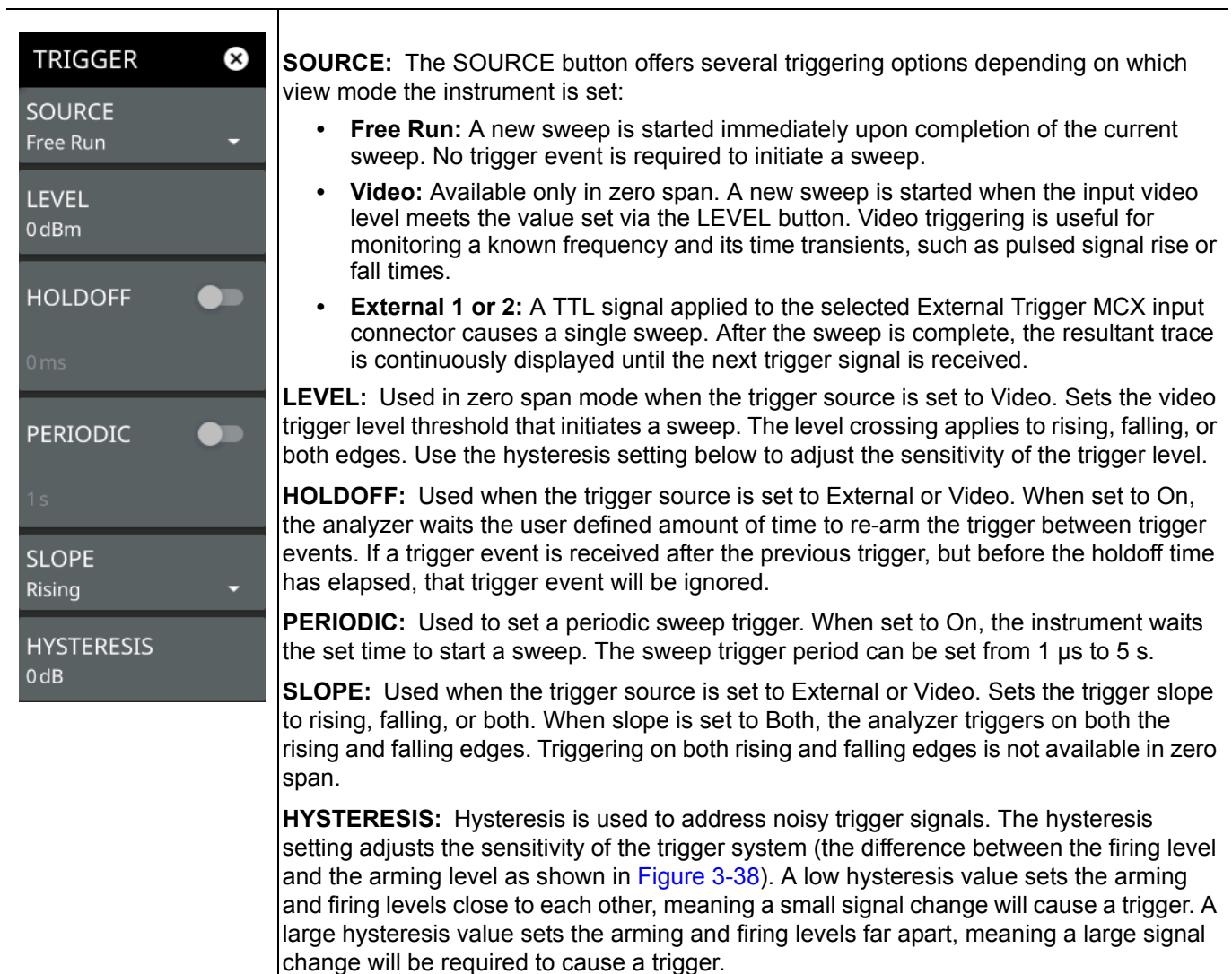
TRIGGER Menu



SOURCE: The SOURCE button offers Free Run triggering. A new sweep is started immediately upon completion of the current sweep. No trigger event is required to initiate a sweep.

Figure 3-36. TRIGGER Menu

TRIGGER Menu in Zero Span



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

- **Free Run:** A new sweep is started immediately upon completion of the current sweep. No trigger event is required to initiate a sweep.
- **Video:** Available only in zero span. A new sweep is started when the input video level meets the value set via the LEVEL button. Video triggering is useful for monitoring a known frequency and its time transients, such as pulsed signal rise or fall times.
- **External 1 or 2:** A TTL signal applied to the selected External Trigger MCX input connector causes a single sweep. After the sweep is complete, the resultant trace is continuously displayed until the next trigger signal is received.

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

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 μ s 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: Hysteresis is used to address noisy trigger signals. The hysteresis setting adjusts the sensitivity of the trigger system (the difference between the firing level and the arming level as shown in [Figure 3-38](#)). 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 3-37. TRIGGER Menu in Zero Span

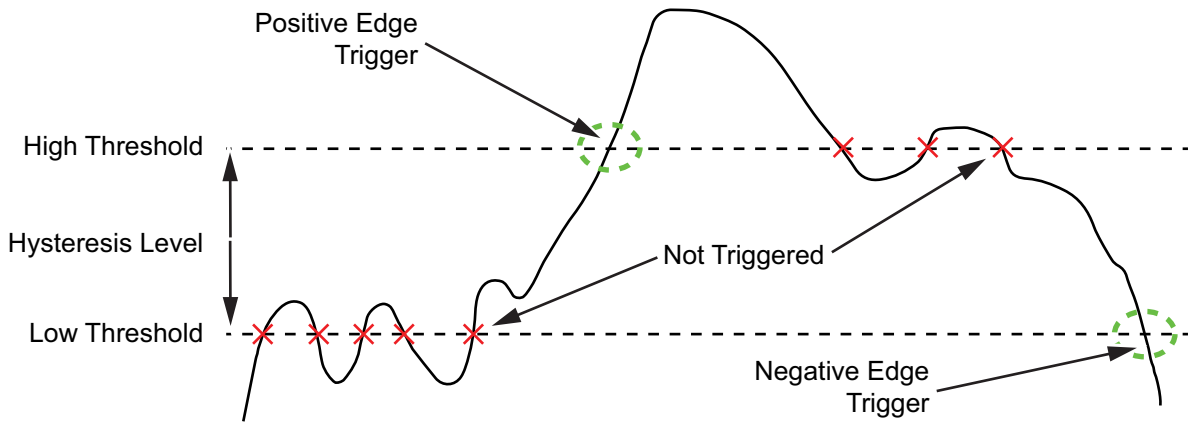


Figure 3-38. Trigger Levels and Hysteresis

3-15 Measurement Setup

Refer to “[Making Spectrum Analyzer Measurements](#)” on page 3-7 for basic information on setting up a spectrum measurement.

SETUP Menu (Spectrum View)

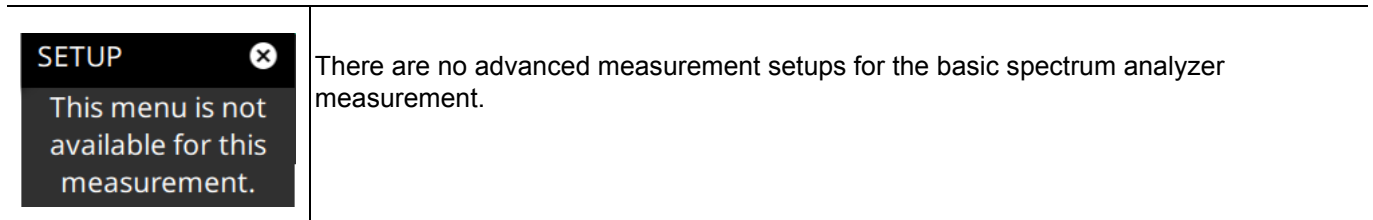


Figure 3-39. SETUP Menu (Spectrum)

SETUP Menu (Spectrogram View)

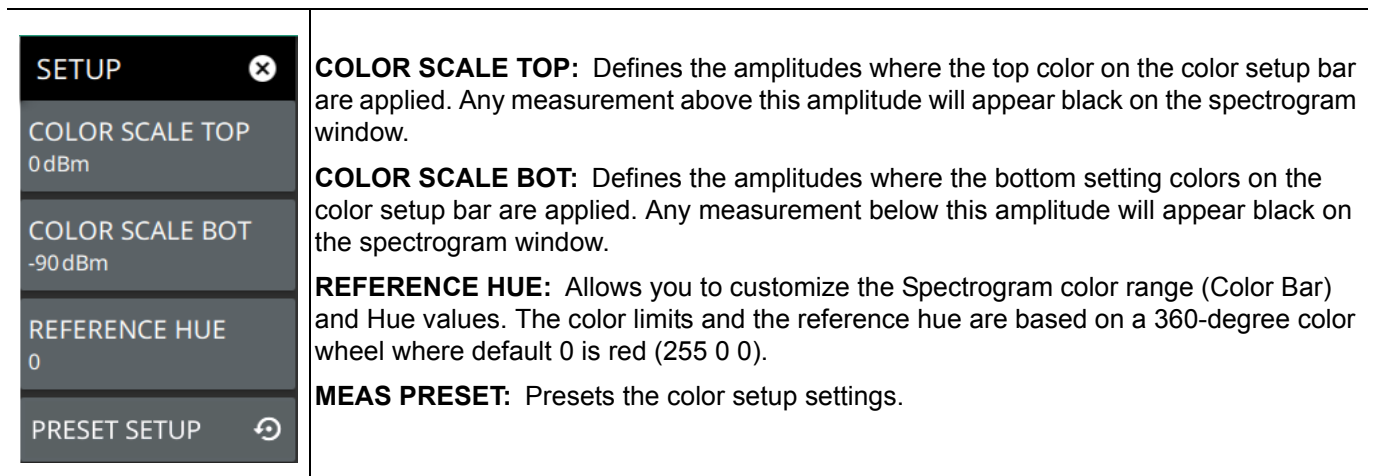


Figure 3-40. SETUP Menu (Spectrogram View)

3-16 Setting Up Advanced Measurements

The spectrum analyzer features smart measurements for setting up occupied bandwidth, channel power, adjacent channel power, and spectral emission mask tests. The following sections present brief examples demonstrating the use of these measurements.

From the MEASURE menu, select one of the desired measurements.

MEASURE Menu (Spectrum)

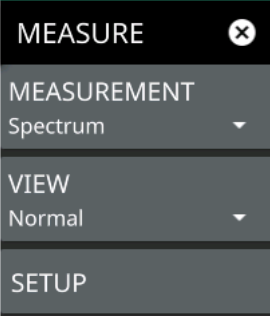
 <p>MEASURE ✕</p> <p>MEASUREMENT Spectrum ▾</p> <p>VIEW Normal ▾</p> <p>SETUP</p>	<p>MEASUREMENT: Selects the desired measurement type from the following list:</p> <ul style="list-style-type: none"> • Spectrum: Displays the frequency domain spectrum measurement. • Channel Power: The CHANNEL POWER table 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. • SEM: The SPECTRUM EMISSIONS MASK table and a spectrum mask is added to the measurement display. <p>VIEW: Selects the desired measurement view from the following list:</p> <ul style="list-style-type: none"> • Normal Spectrum View • 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. <p>Setup: •The SETUP menu described below is available when MEASUREMENT is set to Spectrum and View is set to Spectrogram</p> <ul style="list-style-type: none"> • COLOR SETUP: Allows you to customize the Spectrogram color range (Color Bar) and Hue values. The color limits and the reference hue are based on a 360-degree color wheel where default 0 is red (255 0 0). • 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.
--	--

Figure 3-41. MEASURE Menu

3-17 Channel Power

Channel power measurements are set up using the “[SETUP Menu \(Channel Power\)](#)” on page 3-50. 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 3-42. 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. Once the channel power measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.


	<p>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).</p> <p>PSD UNITS: Sets the unit bandwidth for power spectral density. The available units are dBm/Hz and dBm/MHz.</p> <p>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.</p> <p>PSD LIMIT: If the power spectral density limit is on, the PSD Limit 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.</p> <p>PRESET SETUP: Sets all channel power setup parameters to default. Turns off limits.</p>
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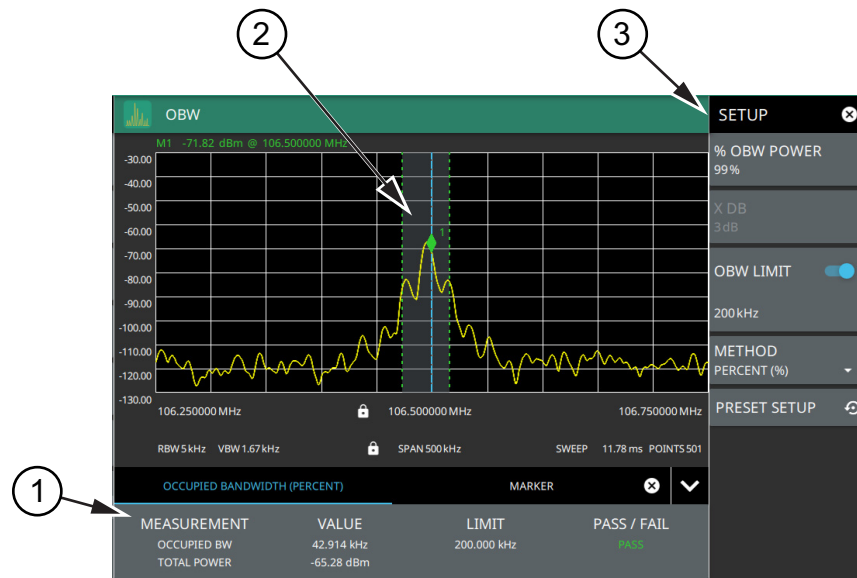
Figure 3-43. SETUP Menu (Channel Power)

3-18 Occupied Bandwidth

Occupied bandwidth measurements are set up using the “[SETUP Menu \(Occupied BW\)](#)” on page 3-52.

Occupied Bandwidth (OBW) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation depending 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 3-44. 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)

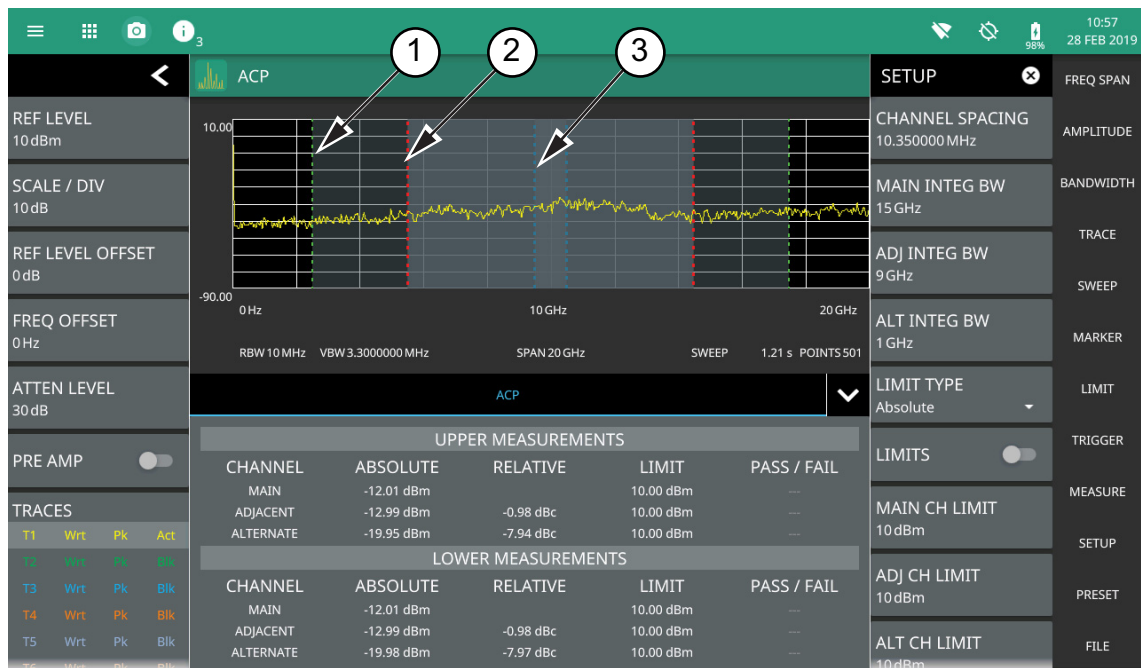
The occupied bandwidth SETUP menu is available in MEASURE > MEASUREMENT > OBW > SETUP. Once the OBW measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum display.

	<p>% 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.</p> <p>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.</p> <p>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.</p> <p>METHOD: Select the measurement method to be PERCENT (%) or X (dB).</p> <p>PRESET SETUP: Sets all OBW setup parameters to default. Turns off limits.</p>
--	---

Figure 3-45. SETUP Menu (Occupied BW)

3-19 Adjacent Channel Power

Adjacent Channel Power (ACP) measurements are set up using the “[SETUP Menu \(ACP\)](#)” on page 3-54. Adjacent channel power 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 “[Channel Power](#)” on page 3-49) 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 3-46. 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 do the following:
 - Channel spacing
 - Main integration bandwidth
 - adjacent integration bandwidth
 - alternate integration bandwidth
 - Limit testing
 - Main channel limit
 - adjacent channel limit
 - alternate channel limit

Adjacent 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. 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. Once 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: Sets the channel frequency spacing (center channel to center channel).
CHANNEL SPACING 10 MHz	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.
MAIN INTEG BW 9 MHz	ADJ INTEG BW: Specifies the range of integration bandwidth used in calculating the power in the adjacent channel.
ADJ INTEG BW 9 MHz	ALT INTEG BW: Specifies the range of integration used in calculating the power in the alternate channel.
ALT INTEG BW 9 MHz	LIMIT TYPE: Selects Absolute or Relative for the limit evaluation.
LIMIT TYPE Absolute 	LIMITS: Turns on or off the use of ACP limits.
LIMITS 	MAIN CH LIMIT: Sets the main channel limit.
MAIN CH LIMIT 10 dBm	ADJ CH LIMIT: Sets the adjacent channel limit.
ADJ CH LIMIT 10 dBm	ALT CH LIMIT: Sets the alternate channel limit.
ALT CH LIMIT 10 dBm	PRESET SETUP: Sets all ACP setup parameters to default. Turns off limits.
PRESET SETUP 	

Figure 3-47. SETUP Menu (ACP)

3-20 Spectrum Emission Mask

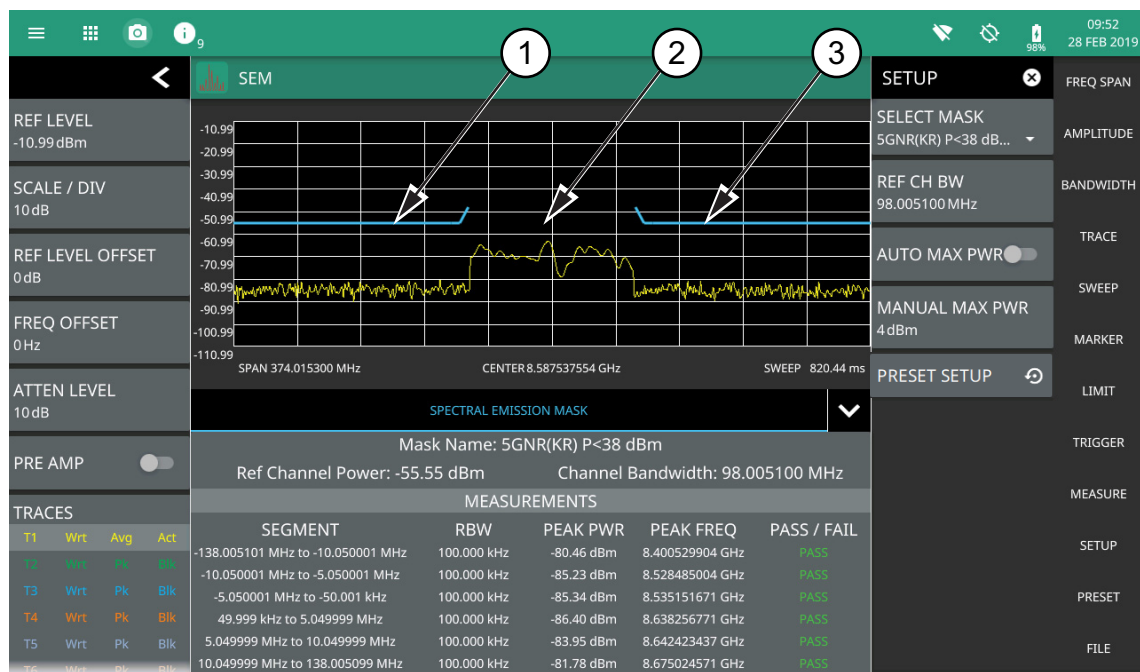
The spectrum emission mask (SEM) measurement is a relative measurement method to identify the power level of out-of-band spurious emissions outside of the in-channel bandwidth signal. The SEM measures the power ratio between in-band and adjacent channels. The SEM measurement then identifies the emissions that interfere with other channels. Then, the spurious signal levels of pairs of offset frequencies are identified and related to the carrier power.

The spectral emission mask measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP base station conformance testing document. There is support for 5GNR masks which are automatically built based on the current carrier frequency/channel and BW values. Masks with the (KR) designation in the title are built according to Korean regulator standards for FR1 signals. The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

Measurement parameters are set up using the “[SETUP Menu \(SEM\)](#)” on page 3-56. Selecting the SEM measurement does the following:

- Disables all other measurements
- Adds a predefined 5GNR emission mask
- Sets the span to the mask width
- Sets the detection method to RMS

A spectrum emission mask measurement showing the 5GNR P<38 dBm mask setting is illustrated in [Figure 3-48](#).



1. SEM Mask
2. Spectrum Emission
3. SEM Mask

Figure 3-48. SEM Measurement

Spectrum Emission Mask Measurement Setup

1. Select MEASURE > MEASUREMENT > SEM from the right side menu.
2. Select SETUP and select upper or lower mask (5GNR P>38 dBm or 5GNR P<38 dBm).
3. Enter the reference channel bandwidth.
4. Toggle AUTO MAX PWR or set MANUAL MAX POWER.
5. The SEM measurement results are displayed in a table with pass/fail results.

SETUP Menu (SEM)

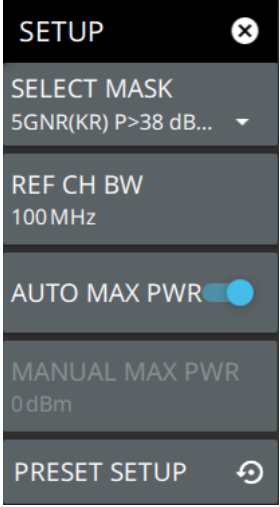
	<p>SELECT MASK: Selects the desired upper or lower emission mask:</p> <ul style="list-style-type: none"> - 5GNR P < 38 dB - 5GNR P > 38 dB <p>REF CH BW: Specifies the reference channel bandwidth for the measurement.</p> <p>AUTO MAX PWR: Toggles automatic max power. Some segments in the mask are dependent on the main channel power. Enabling this automatically calculates the reference channel power by measuring the channel power of the center channel bandwidth. When disabled, the reference power must be entered manually below.</p> <p>MANUAL MAX PWR: Used to manually enter the reference channel power for masks that have limits dependent on main channel power.</p> <p>PRESET SETUP: Presets all values on the SETUP menu to default values.</p>
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Figure 3-49. SETUP Menu (SEM)

3-21 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 or for the 5G analyzer. Preset does not affect user files or system settings such as networking settings. For other reset options, such as a complete factory reset of the instrument, refer to [Chapter 2, “Reset Settings” on page 2-33](#). To recover from system software faults, refer to [Appendix A, “Instrument Messages and Troubleshooting”](#).

PRESET Menu


PRESET 	PRESET TRACES: Presets all trace settings to default values.
PRESET TRACES	PRESET MARKERS: Presets all marker settings to default values. Turns off all markers.
PRESET MARKERS	PRESET LIMITS: Presets all values on the LIMIT menu to default values. Turns off all limit lines.
PRESET LIMITS	PRESET SETUP: Presets all values on the SETUP menu to default values.
PRESET SETUP	PRESET MODE: Presets all of the current analyzer settings to default values.
PRESET MODE	

Figure 3-50. PRESET Menu

3-22 Saving and Recalling Measurements

The Field Master Pro 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 [Section 2-12 “File Management”](#) on page 2-34.

Saving a Measurement

To save a measurement or setup, refer to [Figure 3-51](#):

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

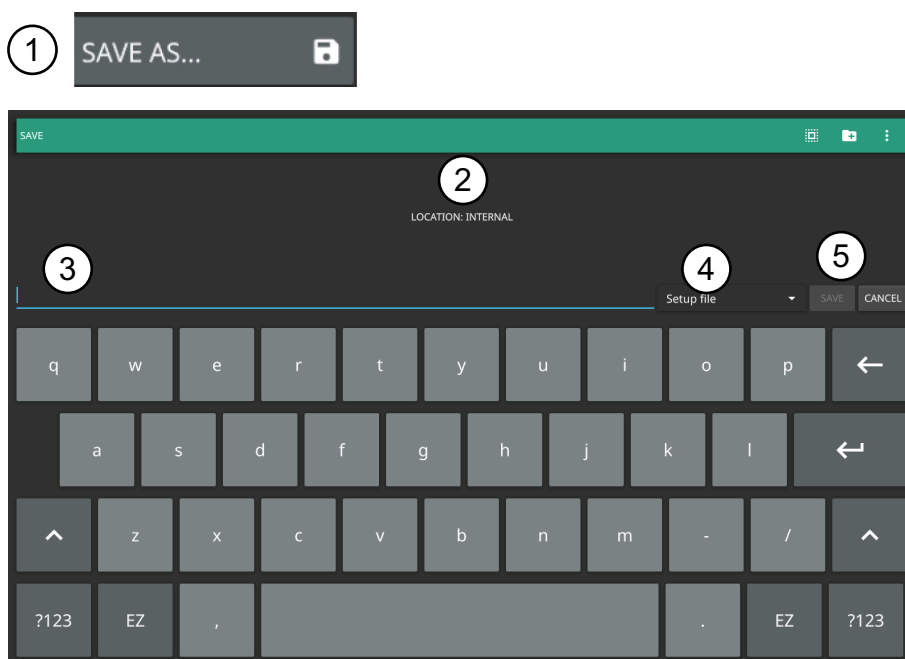


Figure 3-51. File Save Dialog

Once 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 a saved setup, native trace measurement, and a limit line. 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, refer to [Figure 3-52](#):

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

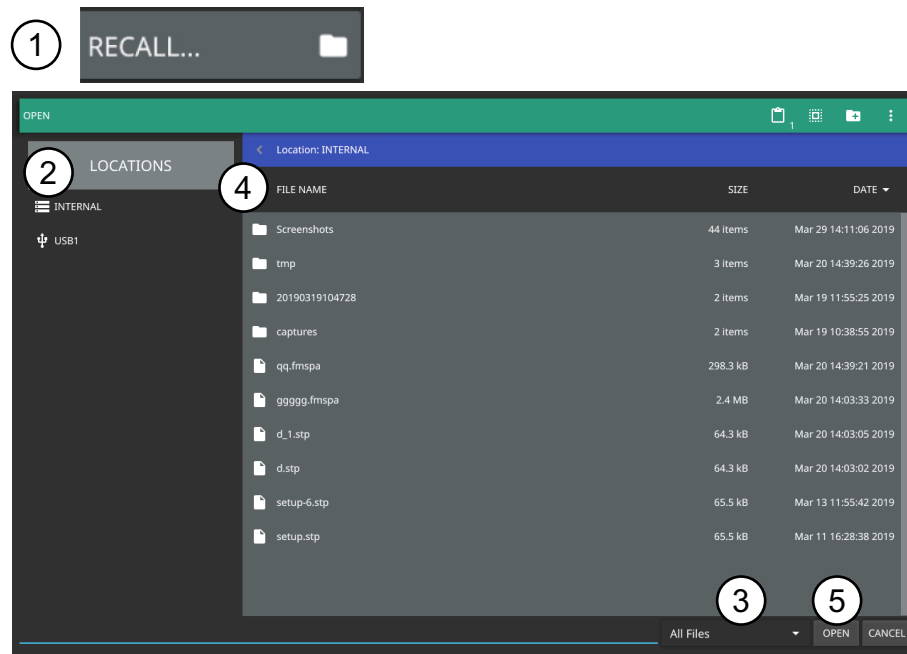


Figure 3-52. File Open Dialog

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

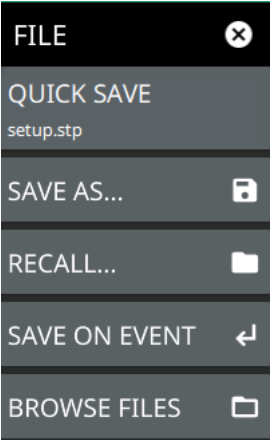
	<p>QUICK SAVE: saves a setup file immediately with the name shown in the button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved.</p> <p>SAVE AS: Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. You can save the following:</p> <ul style="list-style-type: none"> • Setup: Saves the current instrument setup (stp file type). • Trace: Saves the measurement point (trace) data and the current instrument setup (fmspa 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). <p>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 is 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.</p> <p>SAVE ON EVENT: Opens the “SAVE ON EVENT Menu” on page 3-60. This feature is not available in the 5G analyzer.</p> <p>BROWSE FILES: Opens “File Management” on page 2-34.</p>
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Figure 3-53. FILE Menu

SAVE ON EVENT Menu

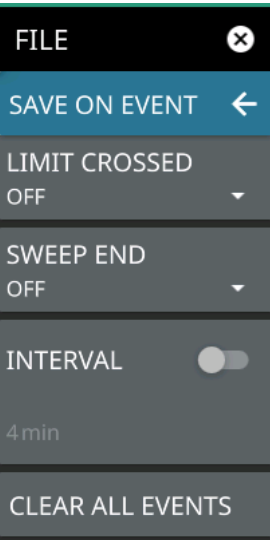
	<p>Save on event saves the current trace data to a folder named with the current date and time (yyyymmddhhmmss).</p> <p>LIMIT CROSSED: When enabled, measurement trace data is automatically saved when the trace crosses a limit line that has been specified in the LIMIT menu. If SINGLE is selected, the 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.</p> <p>SWEEP END: When enabled, measurement trace data is 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.</p> <p>INTERVAL: A save will occur periodically. Set the desired period by entering the time.</p> <p>CLEAR ALL EVENTS: Press this button to turn off all save events at once.</p>
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Figure 3-54. SAVE ON EVENT Menu

Chapter 4 — Real-Time Spectrum Analyzer Measurements

4-1 Introduction

This chapter gives a brief overview of the Anritsu Field Master Pro real-time spectrum analyzer and is intended to assist you in your first use of the instrument. The purpose of this chapter is to provide a starting point for making basic measurement setups. This chapter 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 [Section 2-12 “File Management”](#) and [Section 4-18 “Saving and Recalling Measurements”](#) for a description of saving, recalling, and managing measurement files. For detailed information about other specific measurements, refer to the appropriate chapter in this guide.

This real-time spectrum analyzer measurements chapter includes sections that describe resolution bandwidth, , and attenuator functions. For example, in the Field Master Pro, resolution bandwidth is determined by the intermediate frequency (IF) filter bandwidth. The spectrum analyzer traces the shape of the IF filter as it tunes past a signal. If more than one IF filter is used in a spectrum analyzer, then the narrowest one dominates and is considered the resolution bandwidth.

Real-time spectrum analyzer measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. [Section 4-16](#) covers field measurements including brief examples demonstrating channel power, occupied bandwidth, adjacent channel power, and spectral emissions mask testing.

4-2 Selecting the Analyzer

The instrument analyzers are selected from the 9-dot icon or the current measurement icon. To select an analyzer, press the 9-dot icon in the title bar or the current measurement icon to display the available analyzers, illustrated in [Figure 4-1](#). Simply touch the desired icon to load the new analyzer. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.

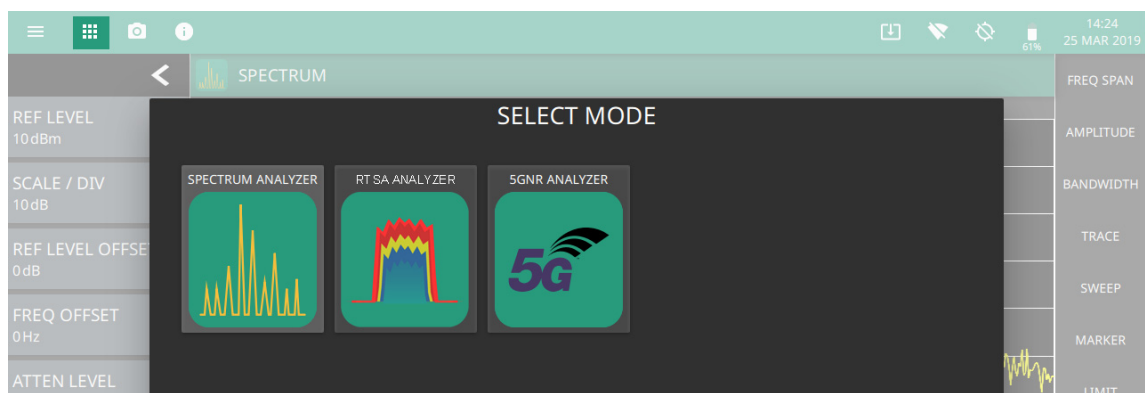


Figure 4-1. Example Analyzers

4-3 RTSA GUI Overview

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

Normal RTSA View

Normal RTSA 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 normal 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.

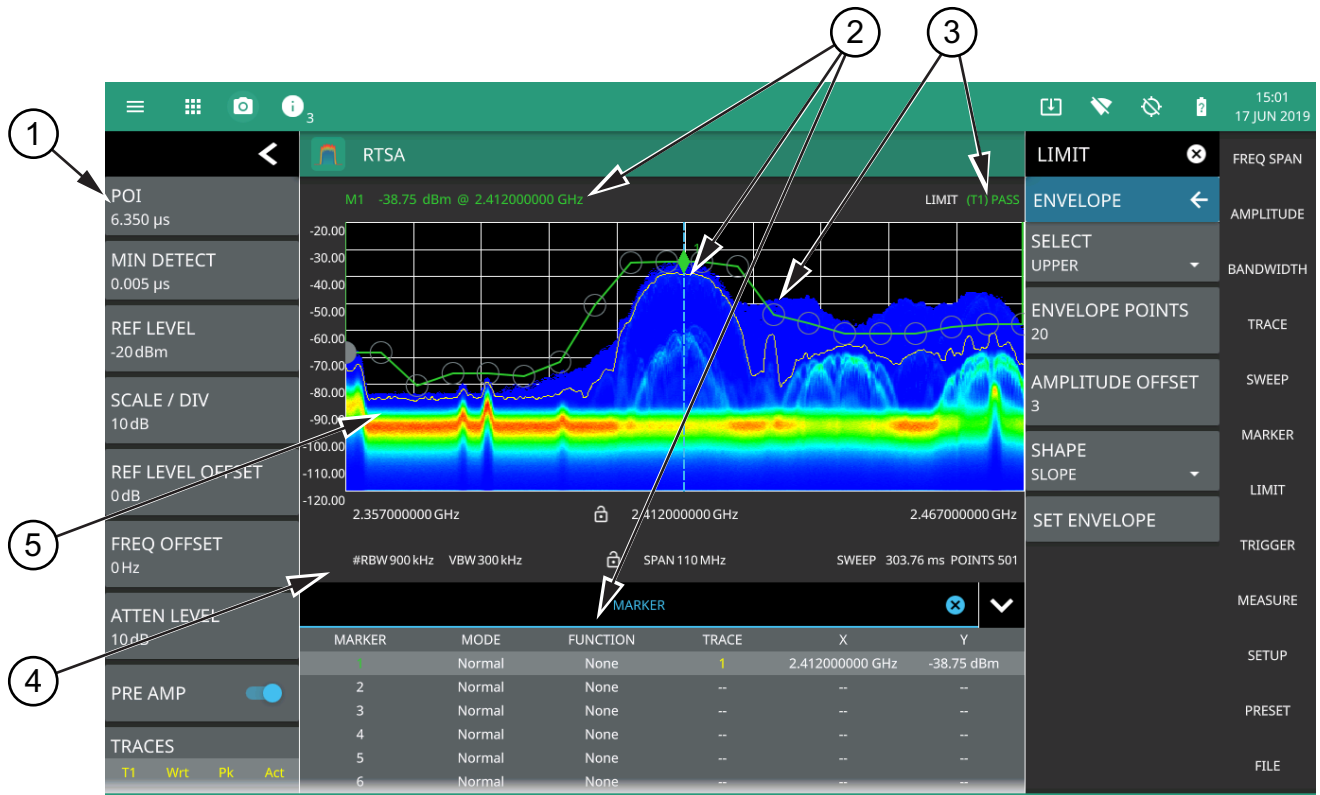


Figure 4-2. RTSA Normal View (1 of 2)

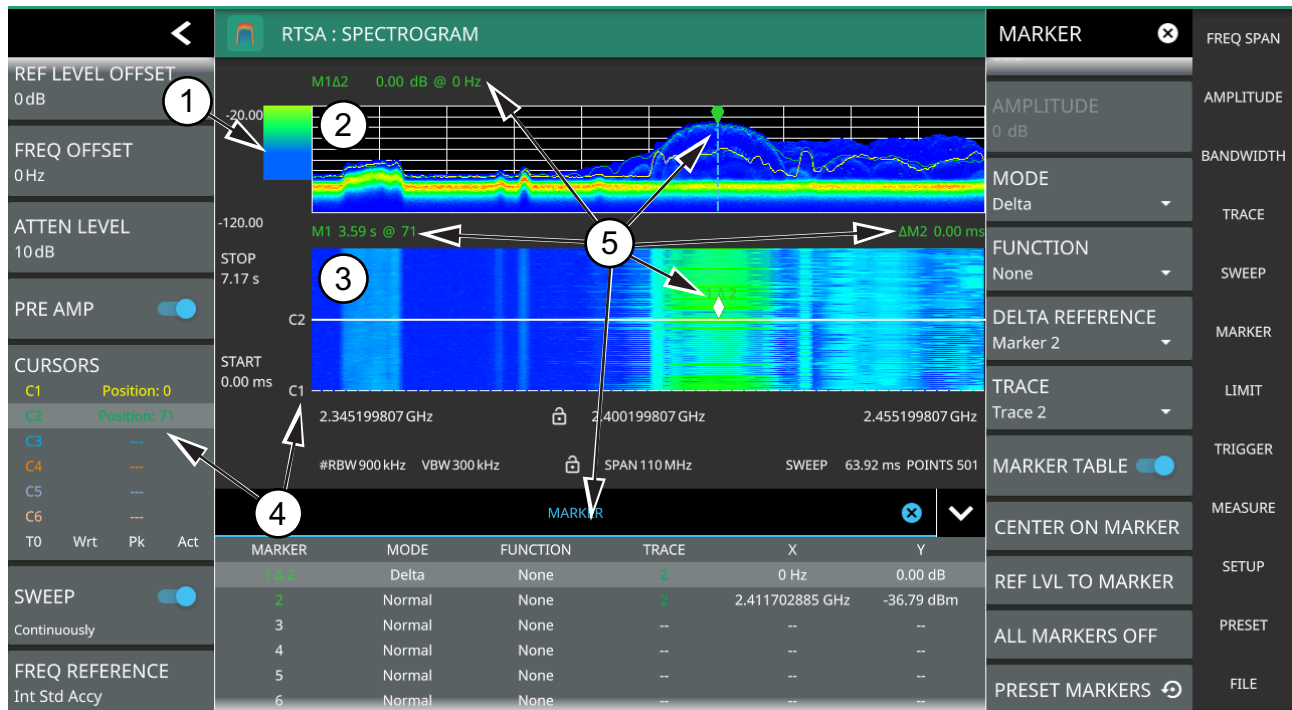
-
1. **Spectrum Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings.
 2. **Markers:** Markers are displayed as green diamonds on the trace to which they are assigned. The active marker is shown as a solid green diamond with a dashed vertical line. The marker amplitude and frequency will be 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 peak search menu.
 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 in 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 (see [Section 4-10 “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 4-2. RTSA Normal 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. Once Spectrogram view is selected, the color bar can be configured from the SETUP menu. Refer to [Section 4-15 “Measurement Setup” on page 4-40](#) for more information on setting up the Spectrogram view.



- 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](#)” on page 4-40, which can be opened by pressing the color bar.
- 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.
- 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.
- 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 4-22.
- Markers:** Marker and marker data is 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 4-31.

Figure 4-3. RTSA Spectrogram View

4-4 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	FREQ SPAN: Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 4-7 “Setting Frequency Parameters” .
AMPLITUDE	AMPLITUDE: Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 4-8 “Setting Amplitude Parameters” .
BANDWIDTH	BANDWIDTH: Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 4-9 “Setting Bandwidth Parameters” .
TRACE	TRACE: Provides trace- and detection-related 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 4-10 “Setting Trace and Cursor Parameters” .
SWEEP	SWEEP: Provides controls for sweep behaviors. Refer to Section 4-11 “Setting Sweep Parameters” .
MARKER	MARKER: Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 4-12 “Setting Up Markers” .
LIMIT	LIMIT: Provides controls for setting up limit lines and limit alarms. Refer to Section 4-13 “Setting Up Limit Lines” .
TRIGGER	TRIGGER: Controls the trigger source, delay and holdoff, and trigger slope settings. Refer to Section 4-14 “Setting Up Triggering” .
MEASURE	MEASURE: Used to select measurements such as spectrum, channel power, occupied bandwidth, adjacent channel power, spectral emissions mask, and opens the spectrogram. Refer to Section 4-15 “Measurement Setup” .
SETUP	SETUP: Measurement controls for setting up advanced measurements. This menu always displays setting options for the current active measurement (refer to Section 4-16 “Setting Up Advanced Measurements”). When in Spectrogram view, provides access to the spectrogram color SETUP menu (refer to “SETUP Menu” on page 4-40).
PRESET	PRESET: Opens the PRESET menu with selective trace, marker, limits, and measurement preset commands, or an all inclusive analyzer preset command. Refer to Section 4-17 “Presetting the Analyzer” .
FILE	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 4-45 and Section 2-12 “File Management” .

Figure 4-4. Main Menu

Using Menus

When a button in the main menu is pressed, the associated menu opens. The name of the button pressed in the control panel is reflected in the title bar of the menu. Instrument setup, control, and measurement functions are performed through the use of menus. The buttons within the menus may change for various measurement settings, instrument setup parameters, and measurement views. Pressing the main menu button after a menu has been opened will close the menu. Touching status data, a parameter field, or label in the display area opens the associated settings menu for editing that parameter setting. The menu will close when the menu button is pressed again or by pressing the X in the top right corner.

4-5 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 is selected. Below is the spectrum analyzer status panel that covers basic spectrum, spectrogram, channel power, occupied bandwidth, adjacent channel power, and spectral emissions mask measurements (selected via MEASURE > MEASUREMENTS menu).

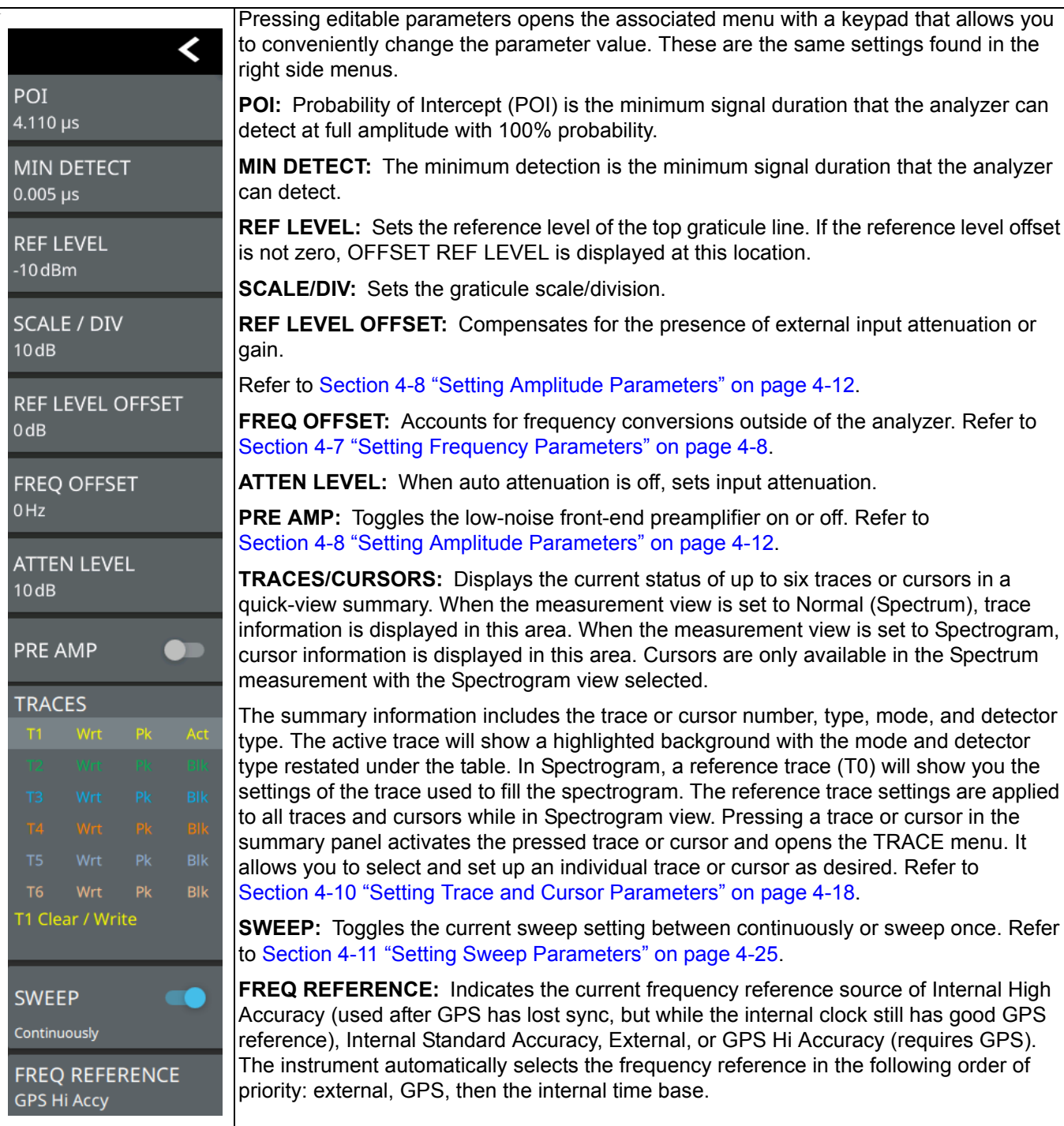


Figure 4-5. Spectrum Analyzer Status Panel

4-6 Making RTSA Measurements

Initial Setup

- Connect a signal source to the RF port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured.
 - Select the spectrum analyzer. Refer to [“Selecting the Analyzer” on page 4-1](#).
 - Connect the input signal or antenna to the RF In test port. For connector descriptions, refer to [“Connector Panels” on page 2-3](#).
-

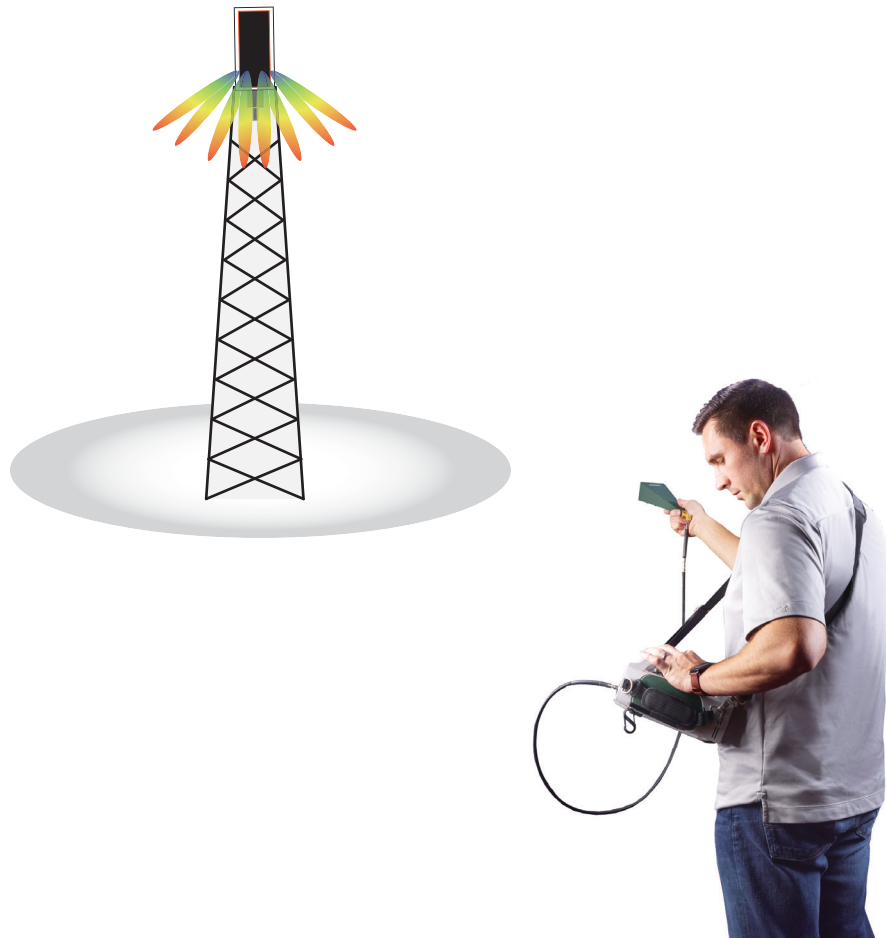


Figure 4-6. Field Master Pro Setup

4-7 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 2-6 on page 2-11](#)).

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 2-6 on page 2-11](#)).

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 4-5 “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 ✕	<p>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.</p>
CENTER FREQUENCY 10.005253731 GHz	<p>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.</p>
SPAN 110 MHz	<p>FULL SPAN: Pressing this button sets the span to cover the entire tunable spectrum of the instrument.</p>
FULL SPAN	<p>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.</p>
START FREQUENCY 9.950253731 GHz	<p>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).</p>
STOP FREQUENCY 10.060253731 GHz	<p>FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (–) control.</p>
FREQUENCY STEP 1 MHz	<p>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.</p>
FREQUENCY OFFSET 0 Hz	<p>GESTURES: Opens the “GESTURES Menu” on page 4-11.</p>
GESTURES ↩	

Figure 4-7. FREQ / SPAN Menu

GESTURES Menu

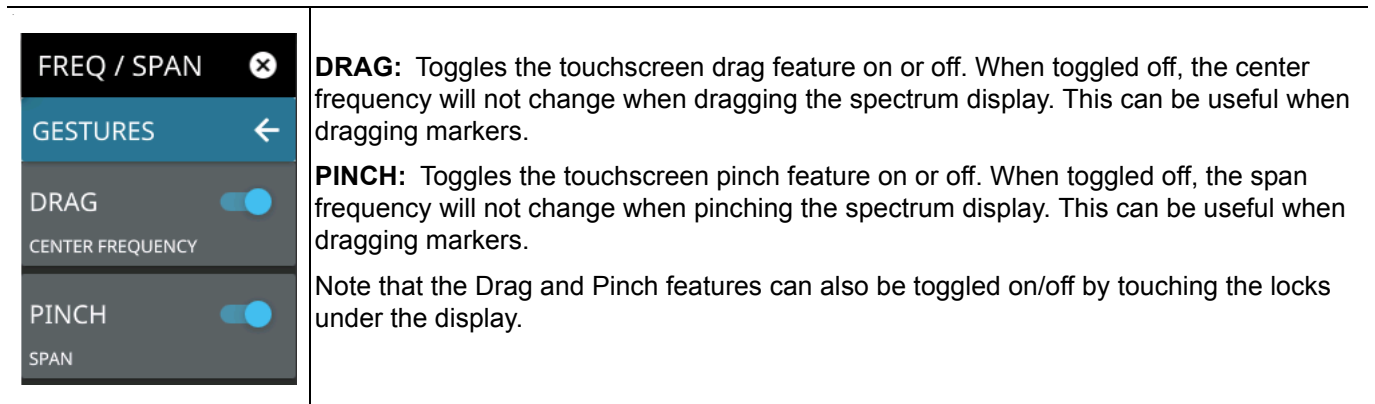


Figure 4-8. GESTURES Menu

4-8 Setting Amplitude Parameters

Amplitude-related parameters are set using the [“AMPLITUDE Menu” on page 4-14](#).

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 may overdrive and saturate the input circuit (refer to [“Indications of Excessive Signal Level” on page 4-13](#)). 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 ATTEN coupling of the attenuator setting and 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.

Attenuator Functions

The spectrum analyzer includes a step attenuator at the RF input. This attenuator is used to reduce large signals to levels that make best use of the analyzer's dynamic range. By default, the auto attenuation automatically adjusts the attenuator as a function of the reference level. In the `AMPLITUDE` menu, the `ATTEN LEVEL` allows manual adjustment of the input attenuation. When auto attenuation is selected, both the reference level and the attenuation are increased. The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

- Decrease the reference level and attenuation. Refer to [“AMPLITUDE Menu” on page 4-14](#).
- Turn on the preamplifier.
- Reduce RBW and or VBW (RBW/VBW = 10 is often optimal for this purpose). Refer to [“Setting Bandwidth Parameters” on page 4-15](#).
- Use trace averaging if VBW is already set to 1 Hz. Refer to [“Setting Trace and Cursor Parameters” on page 4-18](#)

Preamplifier

The preamplifier can be turned on and off by toggling PRE AMP via the status panel or the AMPLITUDE menu. [Figure 4-9](#) shows the noise floor with the preamplifier off (1) and on (2). Note that when the preamplifier is turned on, the noise floor drops significantly and a low-level signal is exposed. In order to use the preamplifier, the attenuation must be lower than 20 dB. If the preamplifier is turned on when the attenuation is greater than or equal to 20 dB, the attenuation will automatically drop to 10 dB. When AUTO ATTEN is toggled on, the REF LEVEL must be set to -40 dBm or lower to enable the preamplifier.

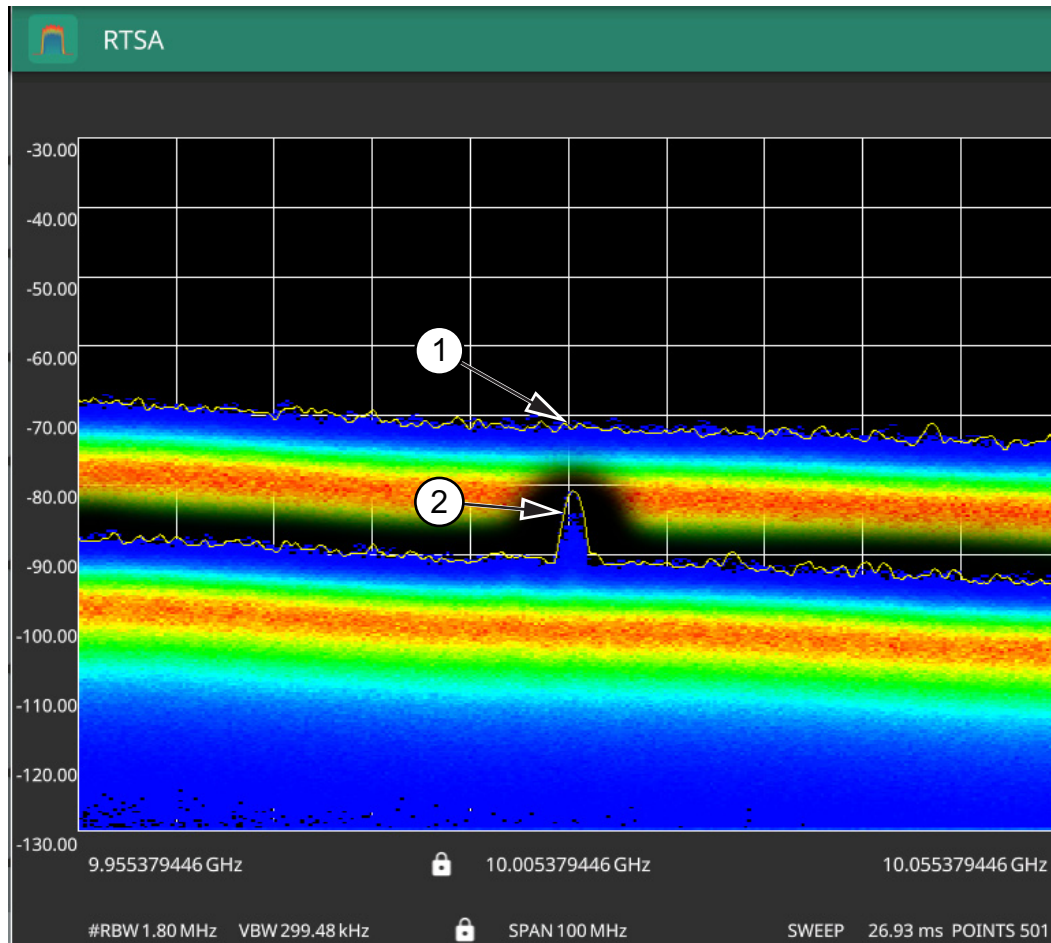


Figure 4-9. 1. Preamplifier Off
2. Preamplifier On

Indications of Excessive Signal Level

The Field Master Pro has built-in features to help prevent input overload. These include auto attenuation and reference level. The instrument will also indicate when a received signal is too high for the current setup by displaying an “ADC Overrange” notification in the title bar ([Figure 4-10](#)). Before proceeding with the measurements, adjust the reference level, the attenuation level, and disable the preamplifier if necessary. Adjusting the resolution bandwidth and frequency range may also help when measuring small signals that are near large signals.



Figure 4-10. ADC Overrange

AMPLITUDE Menu





AMPLITUDE 	<p>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.</p>
REF LEVEL 10 dBm	<p>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.</p>
AUTO REF LEVEL	<p>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.</p>
SCALE / DIV 10 dB	<p>Y AXIS UNIT: Displays the y-axis amplitude units in dBm.</p>
Y AXIS UNIT dBm 	<p>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 4-12.</p>
REF LEVEL OFFSET 0 dB	<p>PRE AMP: Turns the low-noise front-end preamplifier on or off. To ensure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than –40 dBm. The preamplifier cannot be turned on if auto attenuation is on and the reference level is above –40 dBm. Refer to “Preamplifier” on page 4-13.</p>
PRE AMP 	<p>AUTO ATTEN: Input attenuation can be either tied to the reference level (on) or manually selected (off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.</p>
AUTO ATTEN 	<p>ATTEN LEVEL: When auto attenuation is off, the attenuation value can be set manually to a resolution of 5 dB. Pressing the plus (+) or minus (–) control increments the value by 10.</p>
ATTEN LEVEL 30 dB	

Figure 4-11. AMPLITUDE Menu

4-9 Setting Bandwidth Parameters

Bandwidth parameters are set using the [“BANDWIDTH Menu”](#) on page 4-17.

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.

Setting Frequency Bandwidth

1. Press BANDWIDTH on the main menu.
2. Toggle AUTO RBW off to manually change values. If using Auto, refer to the following sections.
3. Set the RBW to achieve the desired resolution and measurement characteristics. Lower values increase resolution and reduce noise, but at the expense of measurement speed. Note that the RTSA will limit RBW settings based on span settings.

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.

The RBW range varies with instrument features. Refer to [“BANDWIDTH Menu” on page 4-17](#) and check your technical data sheet for the bandwidth range of your instrument.

BANDWIDTH Menu

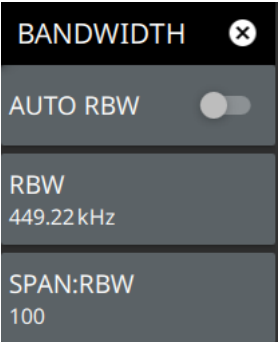
 <p>BANDWIDTH <input type="checkbox"/></p> <p>AUTO RBW <input type="checkbox"/></p> <p>RBW 449.22 kHz</p> <p>SPAN:RBW 100</p>	<p>AUTO RBW: When toggled on, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the SPAN:RBW button. When toggled off (manual), the RBW label at the left edge of the x-axis will be preceded by the “#” symbol.</p> <p>RBW: The current resolution bandwidth is displayed under the RBW button. Once 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.</p> <p>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.</p>
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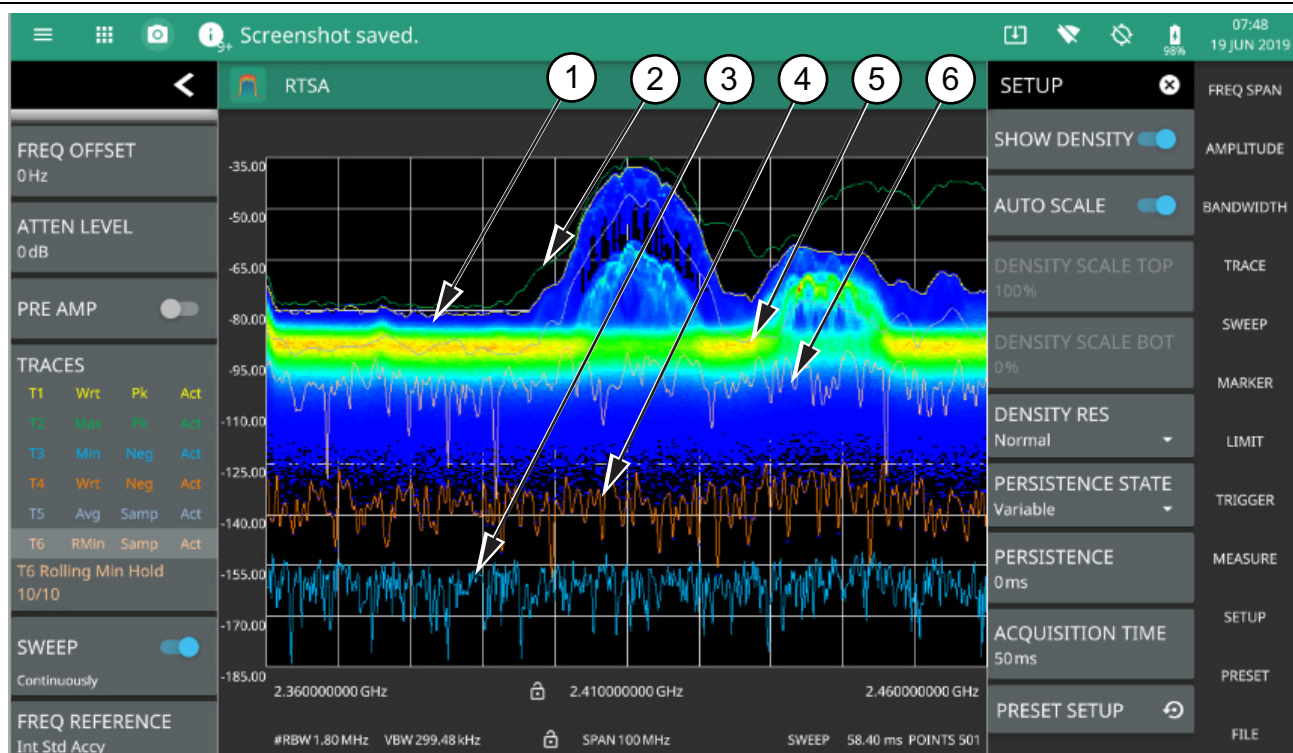
Figure 4-12. BANDWIDTH Menu

4-10 Setting Trace and Cursor Parameters

Field Master Pro 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 (Normal View)” on page 4-19. When working with traces and cursors in Spectrogram view, refer to “TRACE Menu (Spectrogram View)” on page 4-23 and “TRACE CURSOR Menu” on page 4-24.

Traces in Normal View

The screenshot below shows the MS2090A 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 Sample Detection: The trace points are an average of the previous N sweeps, where N is the AVERAGES setting. Sample detection uses the median measurement point.
6. Rolling Min Hold and Sample Detection: The trace points are the minimum of the average of the previous N sweeps, where N is the AVERAGES setting. Sample detection uses the median measurement point.

Figure 4-13. Traces in Spectrum View

TRACE Menu (Normal View)

TRACE ✕	<p>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 is created from a single trace.</p> <p>TYPE: Selects one of the following types of traces:</p> <ul style="list-style-type: none"> • 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. <p>MODE: Selects one of the following trace modes:</p> <ul style="list-style-type: none"> • 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.
SELECT Trace 1 ▾	
TYPE Clear / Write ▾	
MODE Active ▾	
DETECTOR TYPE Peak ▾	
CLEAR	
AVERAGES 10	
PRESET DETECTORS	
PRESET TRACES ↺	

Figure 4-14. TRACE Menu (1 of 2)

DETECTOR TYPE: Selects one of the available 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 showing each display point (see [“Trace Detector Types”](#) on page 4-21).

- **Peak:** Shows the maximum amplitude of sampled data for each display point, assuring that a narrow peak is not missed.
- **Negative:** Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring modulated signals to see if some frequencies are not being used.
- **Sample:** Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements.

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.

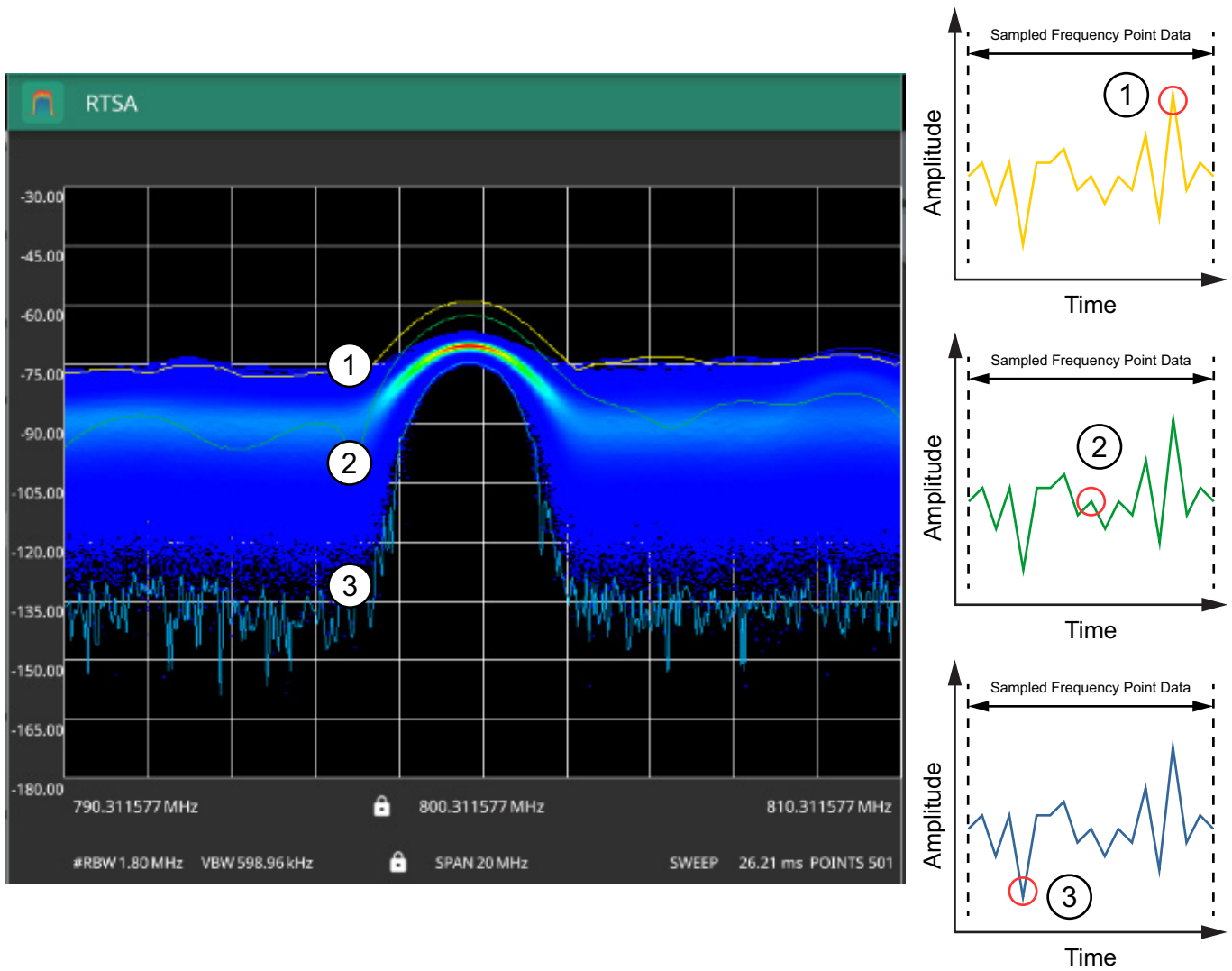
PRESET DETECTORS: Sets all trace detectors to Peak.

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

Figure 4-14. TRACE Menu (2 of 2)

Trace Detector Types

The figure below shows the available detector types:

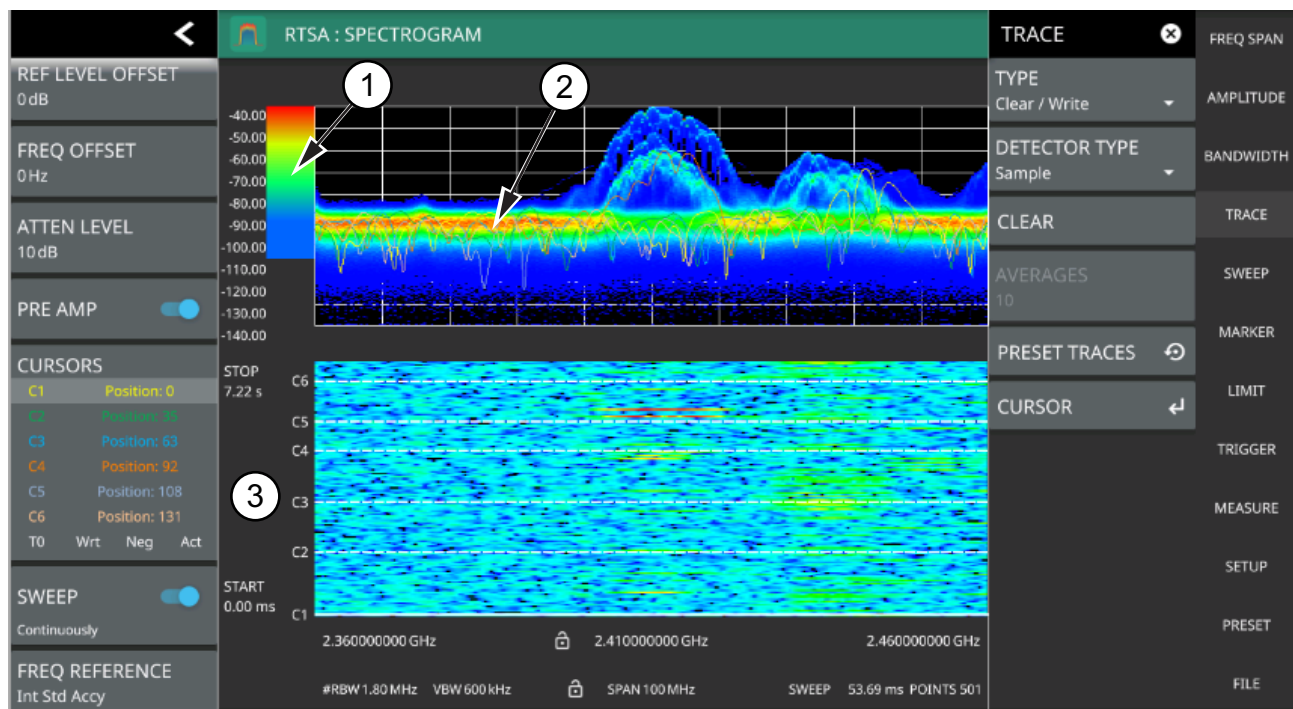


1. Yellow trace set to Peak detection.
2. Green trace set to Sample detection.
3. Blue trace set to Negative detection.

Figure 4-15. Trace Detector Types

Cursors in Spectrogram View

The screenshot below shows the MS2090A 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](#)” on page 4-40.
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 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](#)” on page 4-24. 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 4-16. Spectrogram View

TRACE Menu (Spectrogram View)

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

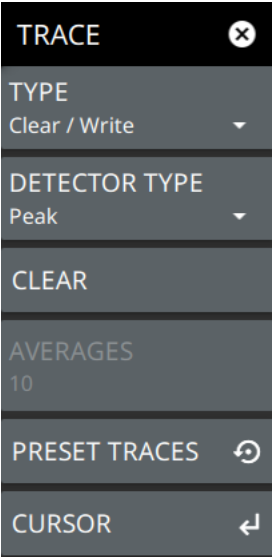
	<p>TYPE: Selects one of the following types of traces:</p> <ul style="list-style-type: none"> • Clear/Write: Clears the trace after each sweep is complete and writes a new trace. • Min Hold: Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel TRACES 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. <p>DETECTOR TYPE: Selects one of the available 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 showing each display point (see “Trace Detector Types” on page 4-21).</p> <ul style="list-style-type: none"> • Peak: Shows the maximum amplitude of sampled data for each display point, assuring that a narrow peak is not missed. • Negative: Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring modulated signals to see if some frequencies are not being used. • Sample: Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements. <p>CLEAR: Clears the currently active trace data.</p> <p>AVERAGES: Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes.</p> <p>PRESET TRACES: Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.</p> <p>CURSOR: Opens the “TRACE CURSOR Menu” on page 4-24.</p>
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Figure 4-17. TRACE Menu (Spectrogram View)

TRACE CURSOR Menu

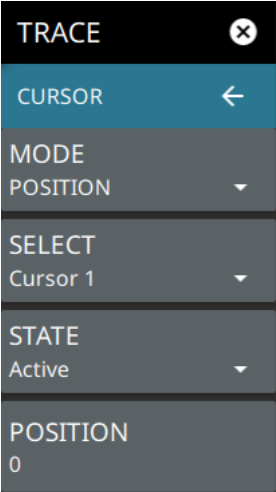
	<p>MODE Position/Time: Every trace captured in the spectrogram has a time and a position index. Set the location of the spectrogram cursor based on either the time index or the position index. When position is selected, you can change the position index of the cursor from the POSITION button. If Time is selected, you can set the time index of the cursor from the TIME button.</p> <p>SELECT: Used to add up to six 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 4-31.</p> <p>STATE: Selects one of the following cursor states:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>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.</p>
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Figure 4-18. TRACE / CURSOR Menu (Spectrogram View)

4-11 Setting Sweep Parameters

Sweep parameters are set using the “[SWEEP Menu](#)” on page 4-25.

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 before updating the trace display. In single sweep, the RTSA trace is held, but the density display is continuously updated, even when CONTINUOUS is toggled off. See “[SETUP Menu](#)” on page 4-40.

SWEEP Menu

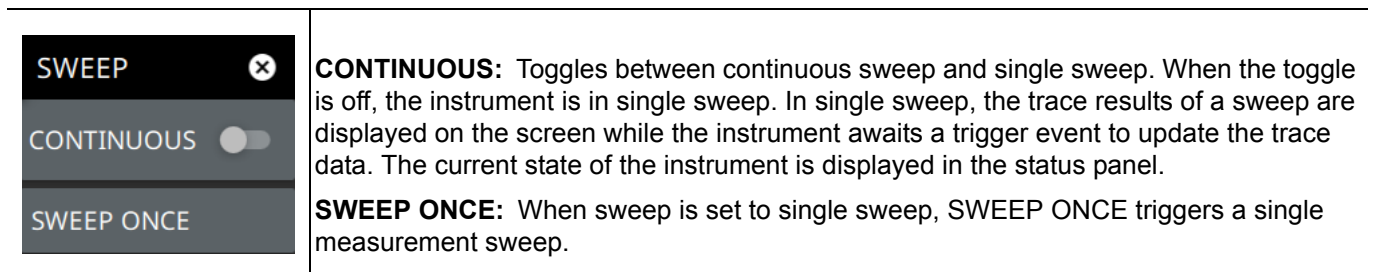
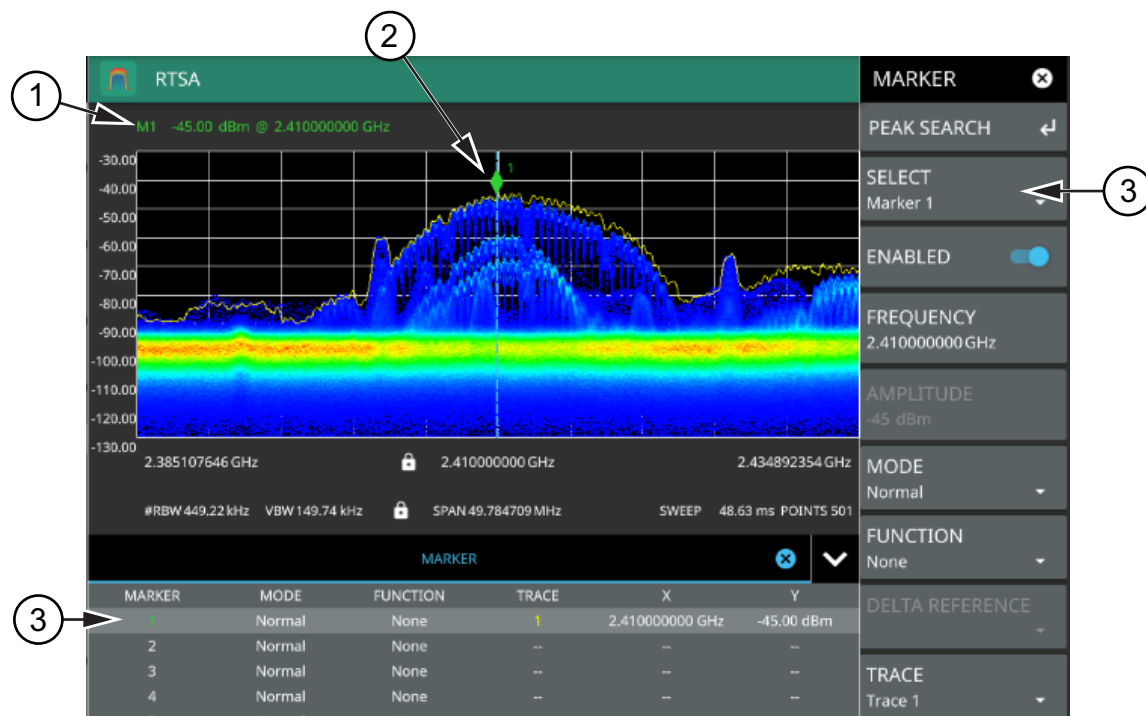


Figure 4-19. SWEEP Menu

4-12 Setting Up Markers

Marker parameters are set using the “MARKER Menu” on page 4-28. 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 4-20. 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 delta marker is on, its position data is relative to its reference marker. For example, if marker 2 is set as a delta marker, the delta reference is set to Marker 3. To set a delta marker and its reference:

1. Activate a marker and place it in a reference location as described previously.
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 lower marker number will automatically be used as the reference marker. If no lower number marker is available, the next higher number marker will be turned on and used as a normal marker for the reference. If the reference marker is disabled, the delta marker will be changed to a normal marker.
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 is displayed as "1 Δ 2".

MARKER Menu











MARKER 	PEAK SEARCH: Opens the “MARKER PEAK SEARCH Menu” on page 4-29.
PEAK SEARCH 	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.
SELECT Marker 2 	ENABLED: Enables the selected marker. When the toggle is off, the marker is disabled and not shown on the screen.
ENABLED 	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.
FREQUENCY 10.182884111 GHz	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.
AMPLITUDE -39.61 dBm	MODE: Select marker preference:
MODE Normal 	<ul style="list-style-type: none"> • 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: 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 Off 	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 	DELTA REFERENCE: Selects the Reference marker for a Delta marker. A Delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.
TRACE Trace 1 	TRACE: Selects the trace number to which the marker is currently attached.
MARKER TABLE 	MARKER TABLE: Toggle on or off the marker table displayed below the screen. Refer to “Marker Table” on page 4-32.
CENTER ON MARKER	CENTER ON MARKER: Sets the center frequency to the currently active marker's frequency value.
REF LVL TO MARKER	REF LVL TO MARKER: Sets the reference level to the currently active marker's amplitude value.
ALL MARKERS OFF	ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position once re-enabled.
PRESET MARKERS 	PRESET MARKERS: Presets marker selections to default values.

Figure 4-21. MARKER Menu

MARKER PEAK SEARCH Menu

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

MARKER ✕	PEAK SEARCH: Returns to the main MARKER menu.
PEAK SEARCH ←	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.
SELECT Marker 1 ▾	
PEAK SEARCH	PEAK SEARCH: Moves the selected marker to the highest peak.
NEXT PEAK	NEXT PEAK: Moves the selected marker to the next highest peak regardless of location.
NEXT PEAK LEFT	NEXT PEAK LEFT: Moves the selected marker to the next peak left of its current position.
NEXT PEAK RIGHT	NEXT PEAK RIGHT: Moves the selected marker to the next peak right of its current position.
NEXT POINT LEFT	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	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 ☐ 0 dBm	THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a peak.
EXCURSION ☐ 0 dB	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 4-22. PEAK SEARCH Menu

Marker Functions

Noise Markers

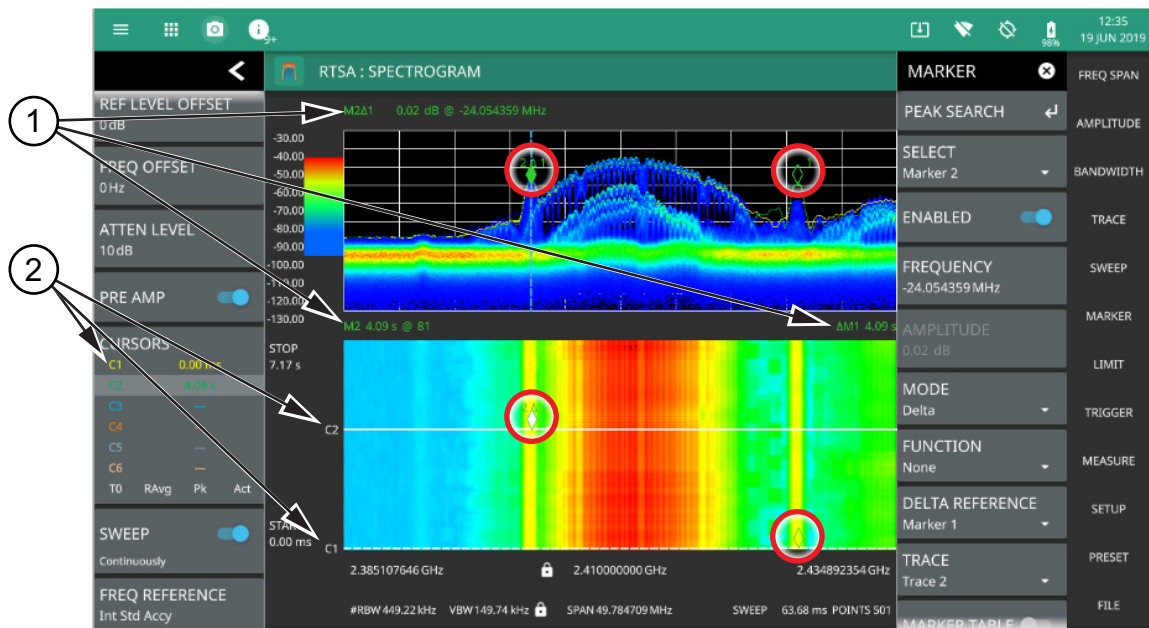
Noise Markers use an averaging routine applied to multiple data-point groups to calculate the readout, which is typically comparable to using 1 Hz bandwidth filtering. Because the noise marker routine uses groups of data points for the calculation, the noise marker should not be placed in close proximity 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.

Frequency Counter Marker

Sets the frequency counter for the selected marker. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. When counter marker is enabled, a higher resolution digital signal processing is used within the region of the counter marker to determine a more precise frequency. Using counter marker in association with marker to peak will result in the frequency of the signal peak to a much higher displayed resolution. Note that frequency accuracy is affected by the RBW setting, and sweep times may be longer when using counter marker because of the additional signal processing.

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



- 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.
- 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 4-23. Spectrogram with Cursors and Markers

Marker Table

The marker table display is useful for displaying many marker parameters at once. 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.

①

MARKER						
MARKER	MODE	FUNCTION	TRACE	X	Y	
1	Normal	Noise	1	5.800000010 GHz	-142.43 dBm/Hz	
2	Normal	Off	3	6.152000010 GHz	-66.84 dBm	
3	Normal	Off	1	62.690807800 GHz	-67.91 dBm	
4	Off	Off	--	--	--	
5	Off	Off	--	--	--	
6	Off	Off	--	--	--	

②

MARKER						
MARKER	MODE	CURSOR	X	Y	TIME	
1	Normal	1	5.800000010 GHz	-145.47 dBm/Hz	0.00 ms	
2	Normal	3	6.152000010 GHz	-68.24 dBm	9.33 s	
3	Normal	1	62.690807800 GHz	-70.54 dBm	0.00 ms	
4	Off	--	--	--	--	
5	Off	--	--	--	--	
6	Off	--	--	--	--	

Figure 4-24. Marker Table

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

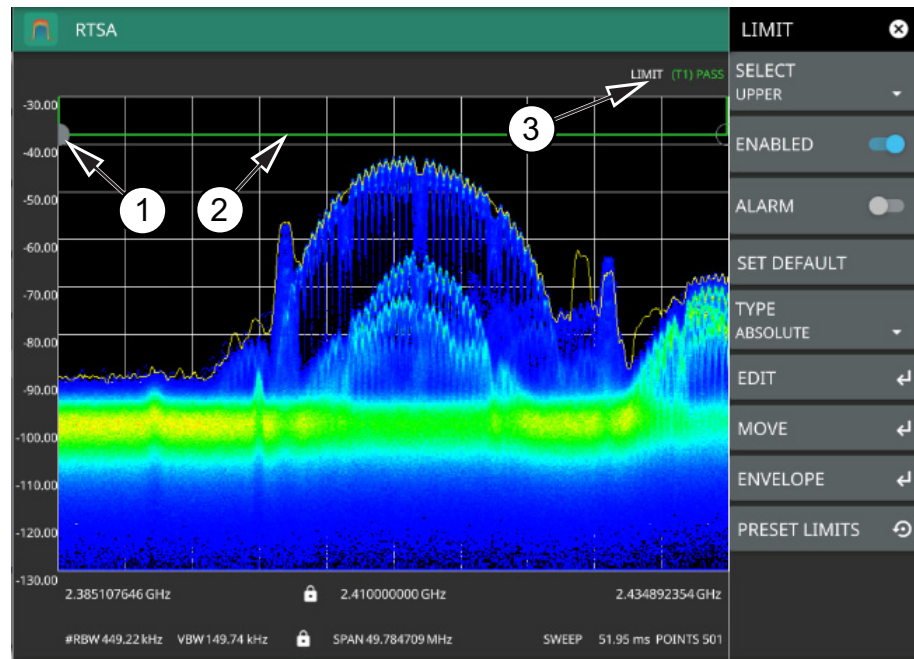
The currently selected marker's value is shown at the top left of the spectrum window with its current amplitude and frequency values.

The selected marker is highlighted on the trace display.

4-13 Setting Up Limit Lines

Limit lines allow you to monitor when trace data crosses 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 4-18 “Saving and Recalling Measurements”](#) on page 4-43).

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 4-35.



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. Simple Limit Line

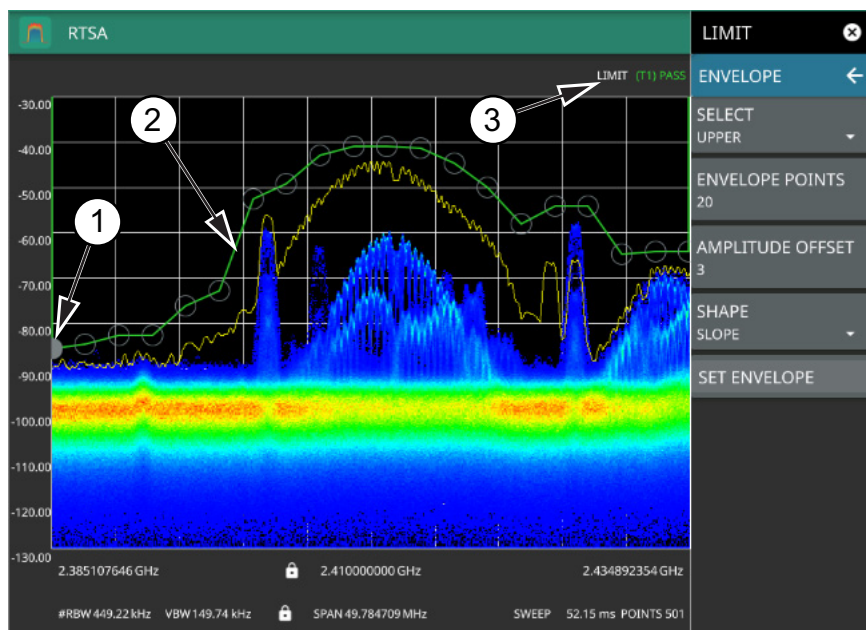
Simple Limit Line

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 4-38. 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. Once 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 an upper envelope 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 4-26. 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

LIMIT ✕	SELECT: Selects UPPER or LOWER limit line for editing.
SELECT UPPER ▾	ENABLED: Displays the selected limit when toggled on.
ENABLED ⏻	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.
ALARM ⏻	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.
SET DEFAULT	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 pressing the desired state.
TYPE ABSOLUTE ▾	EDIT: Opens the “LIMIT EDIT Menu” on page 4-36 .
EDIT ↶	MOVE: Opens the “LIMIT MOVE Menu” on page 4-37 .
MOVE ↶	ENVELOPE: Opens the “LIMIT ENVELOPE Menu” on page 4-38 .
ENVELOPE ↶	PRESET LIMITS: Presets the limit lines to default values.
PRESET LIMITS ↻	

Figure 4-27. LIMIT Menu

LIMIT EDIT Menu

LIMIT ✕	SELECTED POINT: Displays the limit line point number. Press to select a different point from the displayed list.
EDIT ←	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 .
SELECTED 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).
FREQUENCY 0 Hz	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.
AMPLITUDE 0 dBm	DELETE POINT: Press this button to delete the selected point.
ADD POINT	ADD VERTICAL: Press this button to add an inflection point below the currently selected point.
DELETE 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.
ADD VERTICAL	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.
NEXT POINT LEFT	
NEXT POINT RIGHT	

Figure 4-28. LIMIT EDIT Menu

LIMIT MOVE Menu

LIMIT ✕	<p>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.</p> <p>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.</p> <p>LEFT: Pressing this button moves all inflection points to the left by the X-OFFSET value.</p> <p>RIGHT: Pressing this button moves all inflection points to the right by the X-OFFSET value.</p> <p>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.</p> <p>UP: Pressing this button moves all inflection points up by the Y-OFFSET value.</p> <p>DOWN: Pressing this button moves all inflection points down by the Y-OFFSET value.</p> <p>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.</p> <p>TO MARKER 1: Moves the limit line center position to the frequency and specified amplitude offset of Marker 1. Marker 1 must be enabled.</p>
MOVE ←	
CENTER	
X-OFFSET 0Hz	
LEFT	
RIGHT	
Y-OFFSET 0dB	
UP	
DOWN	
MARKER 1 OFFSET 0dB	
TO MARKER 1	

Figure 4-29. LIMIT MOVE Menu

LIMIT ENVELOPE Menu

LIMIT ✕	SELECT: Press this button to select UPPER or LOWER for envelope design.
ENVELOPE ←	ENVELOPE POINTS: This sets the desired number of envelope points.
SELECT UPPER ▾	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.
ENVELOPE POINTS 20	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.
AMPLITUDE OFFSET 3	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.
SHAPE SQUARE ▾	
SET ENVELOPE	

Figure 4-30. LIMIT ENVELOPE Menu

4-14 Setting Up Triggering

TRIGGER Menu

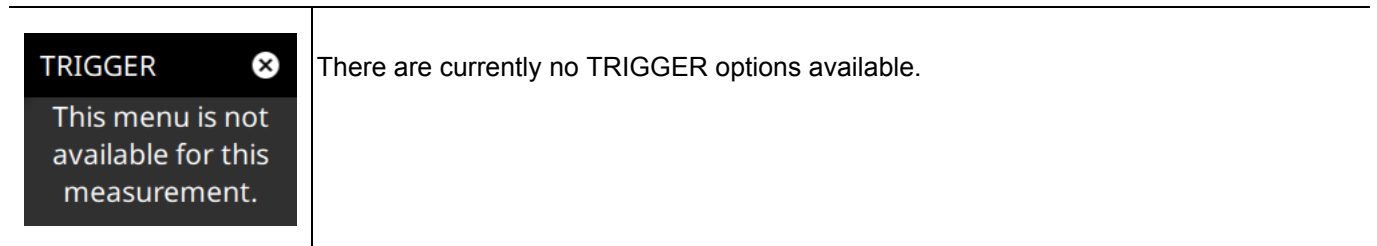


Figure 4-31. TRIGGER Menu

4-15 Measurement Setup

Refer to “[Making RTSA Measurements](#)” on page 4-7 for basic information on setting up a spectrum measurement.

SETUP Menu

SETUP ✕	
SHOW DENSITY <input type="checkbox"/>	SHOW DENSITY: Toggles the density display on or off. Density displays the relative time density of a signal in a color scale ranging from blue to red. Signals that persist longer or more often during the acquisition time are indicated in red color. Brief transient signals are shown in blue color.
AUTO SCALE <input type="checkbox"/>	AUTOSCALE: When toggled on, automatically adjusts the DENSITY SCALE TOP and DENSITY SCALE BOT settings of the density display based on the amplitude of the signal.
DENSITY SCALE TOP 49.50 %	DENSITY SCALE TOP: Sets the percentage of signal time for the top (red) density scale.
DENSITY SCALE BOT 0 %	DENSITY SCALE BOT: Sets the percentage of signal time for the bottom (blue) density scale. Any signal that appears at a rate lower than the DENSITY SCALE BOT setting will not appear in the density plot.
DENSITY RES Normal ▾	DENSITY RES: Density resolution sets the FFT size of the RTSA capture. Normal resolution sets a 512 point FFT; High resolution sets a 1024 point FFT. Higher resolution gives finer frequency detail to the density display, but increases POI. Lower resolution will result in a lower POI, but gives less frequency detail to the density display.
PERSISTENCE STATE Variable ▾	PERSISTENCE STATE: Toggles the persistence state between Variable or Infinite.
PERSISTENCE 0 ms	Infinite persistence means the density plot will not fade away after a signal is no longer present. It is useful for seeing very fast and infrequent signals. Variable persistence sets a user defined time for the density colors to fade. Longer persistence values can be used to best illustrate the signals being observed.
ACQUISITION TIME 50 ms	PERSISTENCE: Sets the decay time of the density display.
COLOR SCALE TOP -30.91 dBm	ACQUISITION TIME: The acquisition time sets the update interval for each spectrum trace, spectrogram line, and density display. During the acquisition interval, spectral data from multiple FFTs of the input signal are taken and combined. The acquisition time is adjustable to allow resolving multiple, brief signal events in time and to observe longer term behaviors.
COLOR SCALE BOT -60.91 dBm	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 (shown only in Spectrogram).
REFERENCE HUE 0	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 (shown only in Spectrogram).
PRESET SETUP ↺	REFERENCE HUE: Allows you to customize the Spectrogram color range (Color Bar) and Hue values. The color limits and the reference hue are based on a 360-degree color wheel where default 0 is red (255 0 0) (shown only in Spectrogram).
	PRESET SETUP: Presets the color setup settings.

Figure 4-32. SETUP Menu (Spectrogram View)

4-16 Setting Up Advanced Measurements

The spectrum analyzer features smart measurements for setting up occupied bandwidth, channel power, adjacent channel power, and spectral emission mask tests. The following sections present brief examples demonstrating the use of these measurements.

From the MEASURE menu, select one of the desired measurements.

MEASURE Menu (Spectrum)

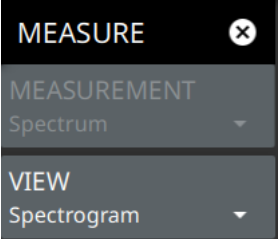
 <p>The screenshot shows a dark-themed menu with the following items:</p> <ul style="list-style-type: none">MEASURE (with a close button 'x')MEASUREMENT (dropdown menu) with 'Spectrum' selected.VIEW (dropdown menu) with 'Spectrogram' selected.	<p>MEASUREMENT: There is no Measurement menu available.</p> <p>VIEW: Selects the desired measurement view from the following list:</p> <ul style="list-style-type: none">• Normal Spectrum View• 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.
---	---

Figure 4-33. MEASURE Menu

4-17 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 or for the 5G analyzer. Preset does not affect user files or system settings such as networking settings. For other reset options, such as a complete factory reset of the instrument, refer to [Chapter 2, “Reset Settings” on page 2-33](#). To recover from system software faults, refer to [Appendix A, “Instrument Messages and Troubleshooting”](#).

PRESET Menu

PRESET ✕	PRESET TRACES: Presets all trace settings to default values.
PRESET TRACES	PRESET MARKERS: Presets all marker settings to default values. Turns off all markers.
PRESET MARKERS	PRESET LIMITS: Presets all values on the LIMIT menu to default values. Turns off all limit lines.
PRESET LIMITS	PRESET SETUP: Presets all values on the SETUP menu to default values.
PRESET SETUP	PRESET MODE: Presets all of the current analyzer settings to default values.
PRESET MODE	

Figure 4-34. PRESET Menu

4-18 Saving and Recalling Measurements

The Field Master Pro 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 [Section 2-12 “File Management” on page 2-34](#).

Saving a Measurement

To save a measurement or setup, refer to [Figure 4-35](#):

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

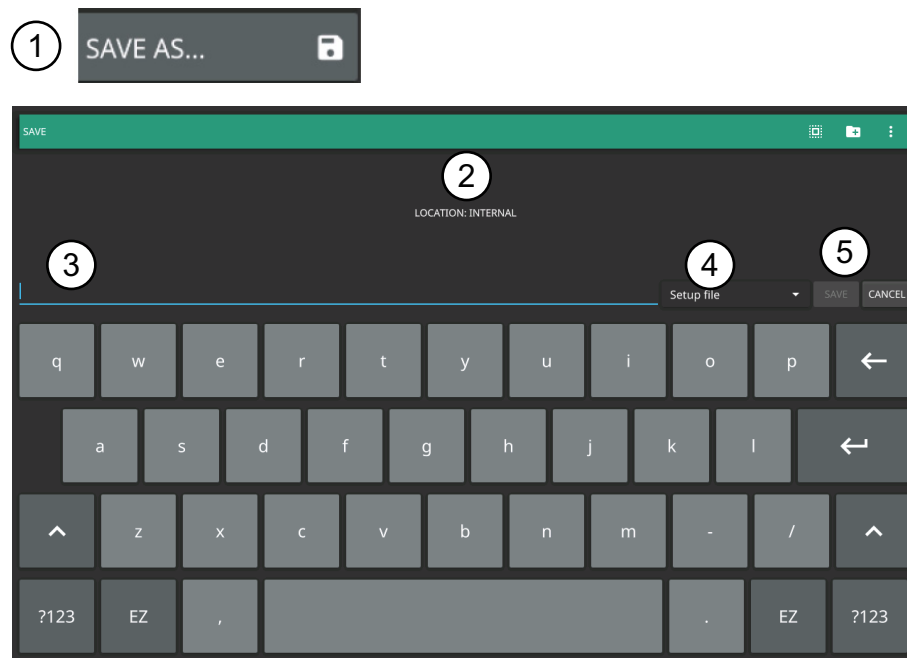


Figure 4-35. File Save Dialog

Once 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 a saved setup, native trace measurement, and a limit line. 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, refer to [Figure 4-36](#):

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

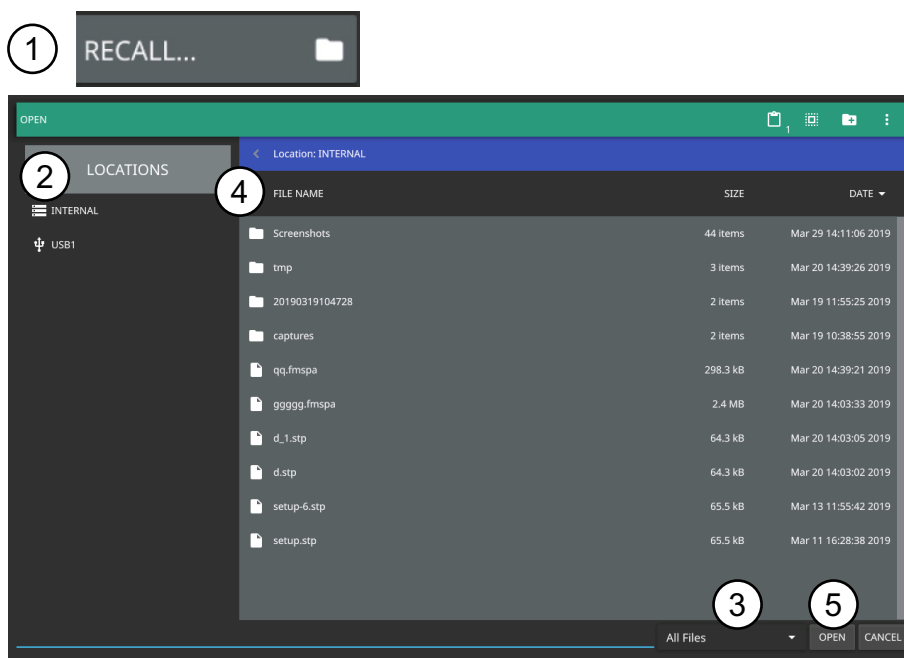


Figure 4-36. File Open Dialog

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

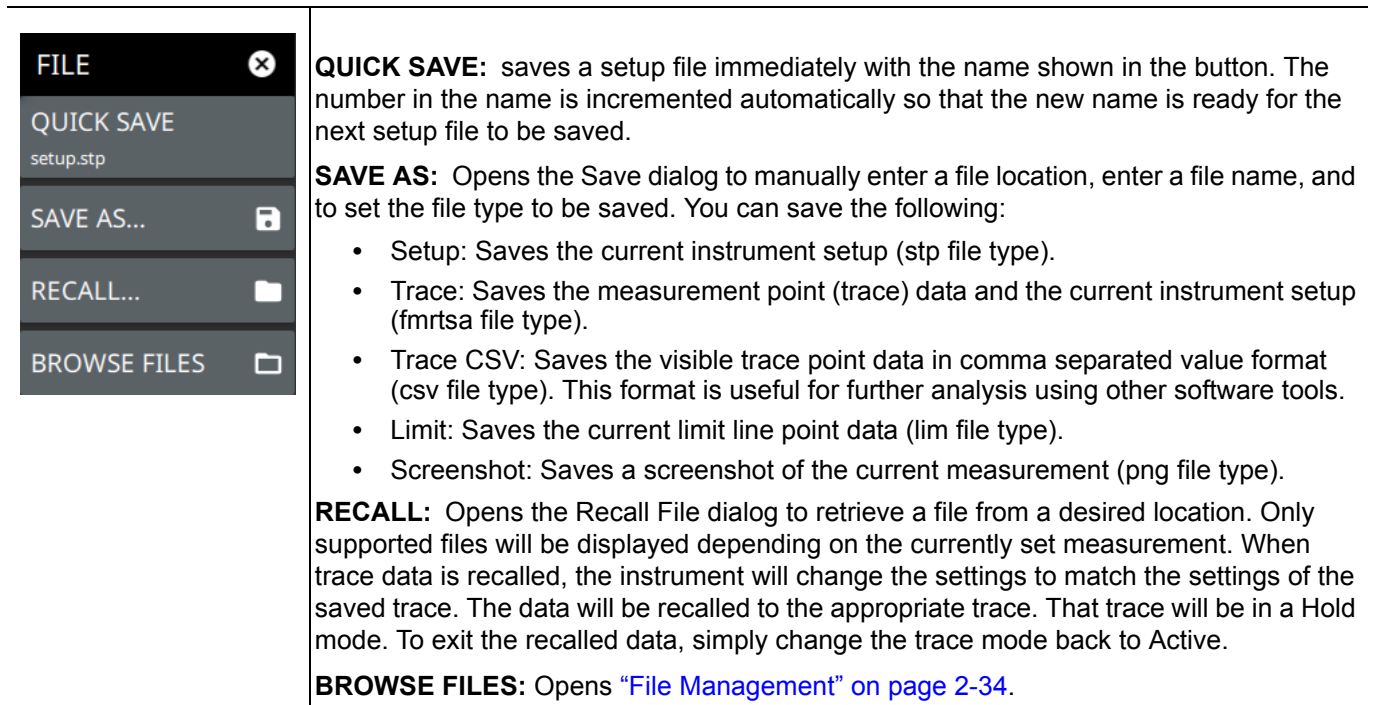


Figure 4-37. FILE Menu

Chapter 5 — 5G Measurements

5-1 Introduction

This chapter gives a brief overview of the Anritsu Field Master Pro 5G analyzer and its measurement capabilities. The purpose of this chapter is to provide a starting point for making 5G measurements. This chapter describes measurement setup, including selecting the analyzer and setting up frequency, bandwidth, amplitude, span, and markers. After measurements are taken, refer to [Section 5-16 “Saving and Recalling Measurements”](#) for a description of saving, recalling, and managing measurement files. For detailed information about other specific measurements, refer to the appropriate chapter in this guide.

A basic understanding of the measurement concepts presented in [Chapter 3, “Spectrum Analyzer Measurements”](#) is recommended before performing the procedures in this chapter. 5G measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. [Section 5-4](#) through [Section 5-9](#) explain general setup procedures and settings. [Section 5-10](#) through [Section 5-14](#) provide example 5G measurements that are available in the 5G analyzer.

5G measurement setups typically conform to the 3GPP and device manufacturer standards. They can be configured manually or based on the band selection and accompanying ARFCN and GSCN assignments. Field Master Pro is designed to make setting up your measurement as easy as possible. Simply refer to the specification for the measurement and base station settings that you are testing, select the measurement, and enter the base station measurement setup parameters.

5-2 Selecting the Analyzer

The instrument analyzers are selected from the 9-dot icon or the current measurement icon. To select an analyzer, press the 9-dot icon in the title bar or the current measurement icon to display the available analyzers, illustrated in [Figure 5-1](#). Simply touch the desired icon to load the new analyzer. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.

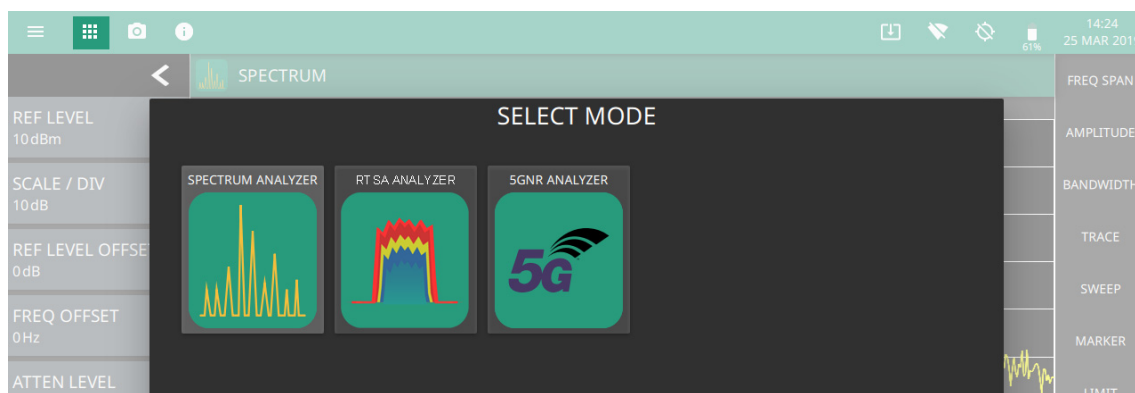


Figure 5-1. Example Analyzers

5-3 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	FREQ SPAN: Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 5-4 “Setting Frequency and Band Parameters” on page 5-3.
AMPLITUDE	AMPLITUDE: Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 5-5 “Setting Amplitude” on page 5-6.
BANDWIDTH	BANDWIDTH: Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 5-6 “Setting Bandwidth Parameters” on page 5-9.
TRACE	TRACE: Provides trace- and detection-related 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 5-7 “Setting Trace Parameters” on page 5-10.
SWEEP	SWEEP: Provides controls for sweep behaviors, number of measurement points, and gated sweep settings (with Option 90). Refer to Section 5-8 “Setting Sweep Parameters” on page 5-12.
MARKER	MARKER: Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 5-9 “Setting Up Markers” on page 5-16.
LIMIT	LIMIT: Not used in the 5G analyzer.
TRIGGER	TRIGGER: Not used in the 5G analyzer.
MEASURE	MEASURE: Used to select measurements such as 5G NR summary, channel power, occupied bandwidth, and equivalent isotropic radiated power. Refer to “MEASURE Menu (5G)” on page 5-21.
SETUP	SETUP: Measurement controls for setting advanced measurements. Section 5-10 “5G Measurement Setup” on page 5-21
PRESET	PRESET: Opens the PRESET menu with selective trace, marker, limits, and measurement preset commands, or an all inclusive analyzer preset command. Refer to Section 5-15 “Presetting the Analyzer” on page 5-37.
FILE	FILE: Used to save and recall instrument setups and measurements. Refer to Section 5-16 “Saving and Recalling Measurements” on page 5-38.

Figure 5-2. Main Menu

Using Menus

When a button in the main menu is pressed, the associated menu opens. The name of the button pressed in the control panel is reflected in the title bar of the menu. Instrument setup, control, and measurement functions are performed through the use of menus. The buttons within the menus may change for various measurement settings, instrument setup parameters, and measurement views. Pressing the main menu button after a menu has been opened will close the menu. Touching status data, a parameter field, or label in the display area opens the associated settings menu for editing that parameter setting. The menu will close when the menu button is pressed again or by pressing the X in the top right corner.

5-4 Setting Frequency and Band Parameters

Frequency and band parameters are set using the “[FREQUENCY Menu](#)” on [page 5-4](#). The channel center frequency can be set manually. When set to manual band, the ARFCN and GSCN are unassigned. When a predefined band is selected, the center frequency and SSB offset must be set by the ARFCN and GSCN, respectively.

Configuring the Band

The band settings are displayed in the left side status panel and can be directly accessed from those controls. These parameters can also be accessed via the **FREQ SPAN** menu.

1. Press **FREQ SPAN > BAND CONFIG**.
2. Select a band from the **BAND** selection list. When a band is selected, the **ARFCN**, **GSCN**, and **CHANNEL BW** setting can be accessed.
3. Set the **ARFCN**, **GSCN**, **CHANNEL BW** according to the specification.
4. Select a subcarrier spacing.
5. Select the mapping pattern:
 - P1 for the 3GPP Phase 1 standard, March 2018.
 - P2 for the 3GPP Phase 2 standard, September 2018.
 - Auto to use the most recent standard.

FREQUENCY Menu

The FREQUENCY menu is available in all 5G measurements.







FREQUENCY 	BAND CONFIG: Opens the “BAND CONFIG Menu” below.
BAND CONFIG 	CENTER FREQUENCY: Sets the center frequency of the measurement channel. Changing the center frequency sets the band to MANUAL.
CENTER FREQUENCY 2.570000000 GHz	CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. Refer to “Options Settings” on page 2-32.
CHANNEL BW 20 MHz 	SSB OFFSET: SSB is the synchronous signal block. The SSB offset sets the frequency offset between the SSB and the center frequency of the channel. Negative values result in an offset lower than the center frequency. Positive values result in an offset higher than the center frequency.
SSB OFFSET 2.850000 MHz	SUBCARRIER SPACING: Sets the subcarrier spacing. The available input range is dependent on the selected band.
SUBCARRIER SPACING 15 kHz 	MAPPING PATTERN: Select which mapping pattern: P1 for the 3GPP Phase 1 standard, March 2018. P2 for the 3GPP Phase 2 standard, September 2018. Auto selects the most recent standard.
MAPPING PATTERN Auto 	GESTURES: Opens the “GESTURES Menu” on page 5-5. Not shown in 5GNR Summary measurement.
GESTURES 	

Figure 5-3. FREQUENCY Menu (5G Measurements)

BAND CONFIG Menu

The BAND CONFIG menu is available in all 5G measurements.

FREQUENCY ✕	<p>BAND: Select MANUAL or one of the predefined bands. Selecting MANUAL disables ARFCN and GSCN settings. Selecting a predefined band activates ARFCN and GSCN settings.</p> <p>ARFCN: ARFCN is the absolute radio frequency channel number. The ARFCN is a unique identification number assigned to each radio channel within a communications spectrum. The ARFCN can be used to calculate the center frequency of the radio channel. The available input range is dependent on the selected band.</p> <p>CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. Refer to “Options Settings” on page 2-32.</p> <p>GSCN: GSCN is the global synchronization raster channel. The GSCN identifies the mapping/offset of the synchronous signal block (SSB). The available input range is dependent on the selected band.</p>
BAND CONFIG ←	
BAND 38 ▾	
ARFCN 514000	
CHANNEL BW 20 MHz ▾	
GSCN	

Figure 5-4. BAND CONFIG Menu (5G Measurements)

Note The instrument must properly sync to and decode the signal to which the center frequency (or ARFCN), SSB offset (or GSCN), and subcarrier spacing are set to correctly match the 5G NR signal under test.

GESTURES Menu

FREQ / SPAN ✕	<p>DRAG: Toggles the touchscreen drag feature on or off. When toggled off, the center frequency will not change when dragging the spectrum display. This can be useful when dragging markers.</p> <p>Note that the Drag feature can also be toggled on/off by touching the locks under the display.</p>
GESTURES ←	
DRAG 🔴 CENTER FREQUENCY	

Figure 5-5. GESTURES Menu

5-5 Setting Amplitude

Amplitude-related parameters are set using the [“AMPLITUDE Menu” on page 5-8](#).

Setting Amplitude Parameters

The MS2090A 5G measurement has two different types of amplitude settings, one for the IQ capture used to decode the signal, and one for the display. The amplitude range refers to the amplitude level used to capture the data. 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 may overdrive and saturate the input circuit (refer to [“Indications of Excessive Signal Level” on page 5-7](#)). To set the current amplitude reference level:

1. To automatically set optimum settings, press **AMPLITUDE > AUTO RANGE**. The instrument will dynamically update the attenuation and preamp settings for the capture. **AUTO RANGE** helps ensure that harmonics and spurs are not introduced into the measurements while giving enough power to accurately decode the signal. When auto range is on, the amplifier and preamp cannot be set manually and the reference level is only used to adjust the top end of the y-axis of the plot or graph.
2. To manually set the range and reference level, press **AMPLITUDE > REF LEVEL**, then enter the desired reference level in dBm, or use the **AUTO REF LEVEL** (available when **AUTO RANGE** is disabled). This will set the attenuation and preamp for both the plot and the capture.

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 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 reference level is adjusted accordingly.

Attenuator Functions

The spectrum analyzer includes a step attenuator at the RF input. This attenuator is used to reduce large signals to levels that make best use of the analyzer's dynamic range. Normally, the input attenuation automatically adjusts as a function of reference level. In the **AMPLITUDE** menu, the **ATTEN LEVEL** allows manual adjustment of the input attenuation. When auto attenuation is selected, both the reference level and the attenuation are increased. The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

- Decrease the reference level and attenuation. Refer to [“AMPLITUDE Menu” on page 5-8](#).
- Turn on the preamplifier.

For RF-based measurements:

- Reduce RBW and or VBW (RBW/VBW = 10 is often optimal for this purpose). Refer to [“Setting Bandwidth Parameters” on page 5-9](#).
- Use trace averaging if VBW is already set to 1 Hz.

Indications of Excessive Signal Level

The Field Master Pro has built-in features to help prevent input overload. These include auto attenuation and reference level. The instrument will also indicate when a received signal is too high for the current setup by displaying an “ADC Overage” notification in the title bar (Figure 5-6). Before proceeding with the measurements, adjust the reference level, the attenuation level, and disable the preamplifier if necessary. Adjusting the resolution bandwidth and frequency range may also help when measuring small signals that are near large signals.



Figure 5-6. ADC Overage

AMPLITUDE Menu

The AMPLITUDE menu is available in all 5G measurements.

AMPLITUDE ✕	<p>AUTO RANGE: The instrument will dynamically update the attenuation and preamp settings for the measurement. Auto range helps ensure that harmonics and spurs are not introduced into the measurements.</p>
AUTO RANGE <input type="checkbox"/>	<p>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 menu location. If auto range is enabled, the reference level is graphical only and will have no impact on attenuation or preamp.</p>
REF LEVEL -30 dBm	<p>AUTO REF LEVEL: Auto reference level will change the reference value so as to place the highest signal amplitude at about two graticule lines from the top. This feature is not available when auto range is enabled.</p>
AUTO REF LEVEL	<p>SCALE/DIV: The scale can be set from 1 dB per division to 15 dB per division. The default setting is 10 dB.</p>
SCALE / DIV 10 dB	<p>AUTO ATTEN: Input attenuation can be either tied to the reference level (on) or manually selected (off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required. Auto attenuation is not available when auto range is enabled.</p>
AUTO ATTEN <input type="checkbox"/>	<p>ATTEN LEVEL: Manually sets the attenuation level. This feature is not available when auto range or auto attenuation is enabled.</p>
ATTEN LEVEL 0 dB	<p>REF LEVEL OFFSET: Reference level offset compensates for the presence of external input attenuation or gain. The default offset value is 0 dB. The reference level on the Y-axis will reflect the new offset value. For example, if the reference level was 0 dBm and an offset value of -10 dB is applied, the offset reference level will be 10 dBm.</p>
REF LEVEL OFFSET 0 dB	<p>PRE AMP: Turns the low-noise front-end preamplifier on or off. To ensure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than -40 dBm. The preamplifier cannot be turned on if auto attenuation is on and reference level is above -40 dBm.</p>
PRE AMP <input checked="" type="checkbox"/>	

Figure 5-7. AMPLITUDE Menu (5G Measurements)

5-6 Setting Bandwidth Parameters

BANDWIDTH Menu

The BANDWIDTH menu is only available for RF-based measurements. See the [“5G Measurement Setup”](#) on page 5-21.

BANDWIDTH ✕	<p>AUTO RBW: When toggle 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.</p>
AUTO RBW ☐	
RBW 1 MHz	<p>RBW: The current resolution bandwidth is displayed under the RBW button. 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.</p>
AUTO VBW ☐	
VBW 1 MHz	<p>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.</p>
VBW TYPE Linear ▾	<p>VBW: The current video bandwidth is displayed under the VBW button. 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.</p>
RBW:VBW 3	<p>VBW TYPE: Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean).</p>
SPAN:RBW 100	<p>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.</p>
	<p>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.</p>

Figure 5-8. BANDWIDTH Menu (5G RF Measurements)

5-7 Setting Trace Parameters

Traces are not used in 5GNR Summary measurements. Just as in the spectrum analyzer, Field Master Pro can display up to 6 traces simultaneously in 5G RF-based measurements (refer to [Section 5-10 “5G Measurement Setup”](#)). Traces can be enabled from the TRACE menu by selecting the trace from the available selections, or you can select a trace in the left side status panel to make it active. Each trace can have a separate trace type, mode, and detector. When working with traces in a 5G spectrum measurement, refer to the [“TRACE Menu” on page 5-10](#).

TRACE Menu

The TRACE menu is only available for RF-based measurements. Refer to [Section 5-10 “5G Measurement Setup”](#).

TRACE ✕	<p>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 is created from a single trace.</p> <p>TYPE: Selects one of the following types of traces:</p> <ul style="list-style-type: none"> • 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. <p>TRACE MODE: Selects one of the following trace modes:</p> <ul style="list-style-type: none"> • 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.
SELECT Trace 1 ▼	
TYPE Clear / Write ▼	
MODE Active ▼	
DETECTOR TYPE Peak ▼	
CLEAR	
AVERAGES 10	
PRESET DETECTORS	
PRESET TRACES ↺	

Figure 5-9. TRACE Menu (5G RF Measurements) (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 3-23](#)).

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

Figure 5-9. TRACE Menu (5G RF Measurements) (2 of 2)

5-8 Setting Sweep Parameters

When setting up a 5GNR Summary measurement, sweep parameters are set using the “[SWEEP Menu – Summary Measurements](#)” on page 5-12. When setting up a 5GNR RF measurement, sweep parameters are set using the “[SWEEP Menu – RF Measurements](#)” on page 5-12.

SWEEP Menu – Summary Measurements


	<p>CONTINUOUS: Toggles between continuous sweep and 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 once 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.</p> <p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE triggers a single measurement sweep.</p> <p>HOLD: Hold will hold the current data display while the analyzer continues to capture and analyze data in the background.</p>
--	--

Figure 5-10. SWEEP Menu - 5GNR Summary Measurements

SWEEP Menu – RF Measurements

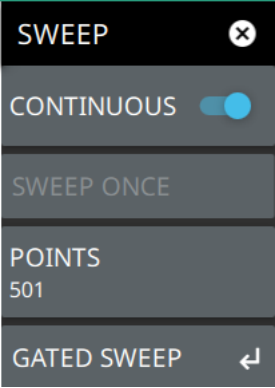
	<p>CONTINUOUS: Toggles between continuous sweep and single sweep. In single sweep, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep. The current state of the instrument is displayed in the status panel. With average/hold number (in TRACE 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 once 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.</p> <p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE triggers a single measurement sweep.</p> <p>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.</p> <p>GATED SWEEP: Opens the “GATED SWEEP Menu” on page 5-14.</p>
--	--

Figure 5-11. SWEEP Menu - 5G RF Measurements

Gated Sweep (Option 90)

Gated sweep is only available on instruments with Option 90 installed and only when an RF-based measurement is selected (Channel Power, OBW, EIRP, etc.). Gated sweep allows you to synchronize your sweep with an event so that the analyzer collects data at the appropriate time. This is useful for measuring signals in the time domain such as pulsed RF, time multiplexed, or burst modulated signals. Field Master Pro can use the GPS timing signal as the gating trigger event. This will allow you to synchronize measurements with GPS synchronized communication signals. Set up gated sweep from the “[GATED SWEEP Menu](#)” on page 5-14.

To set up the instrument for gated sweep measurements, press SWEEP > GATED SWEEP and set the following:

1. Select the GATE SOURCE. The gate source selected determines the trigger source from which the gate is controlled. Not all instrument models and options support all triggering selections, so your choices may vary. Field Master Pro supports a GPS gate source.
2. Select one of the available FRAME TIME durations. The frame time sets the total measurement cycle time.
3. Set the GATE DELAY time. The gate delay sets the time from the triggering event to when the instrument starts sweeping and collecting data.
4. Set the GATE LENGTH time. The gate length sets the time for data capture and analysis.
5. If desired, enable PWR VS TIME (refer to “[POWER VS TIME Display](#)” on page 5-15.)

Below is an example of a gated sweep applied to a channel power measurement. The signal level shown varies cyclically with time and would not be measurable without gated sweep.

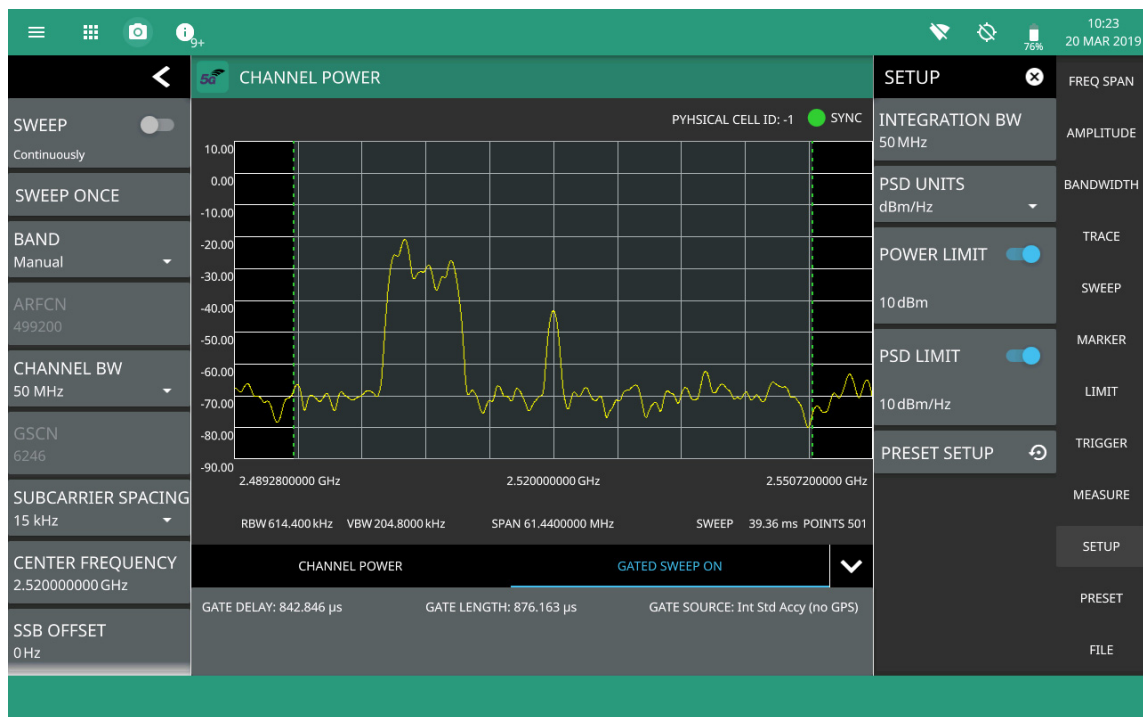


Figure 5-12. Gated Sweep Measurement

The channel power and gated sweep display panels at the bottom can be tapped to open either the Channel Power SETUP menu or the GATED SWEEP menu.

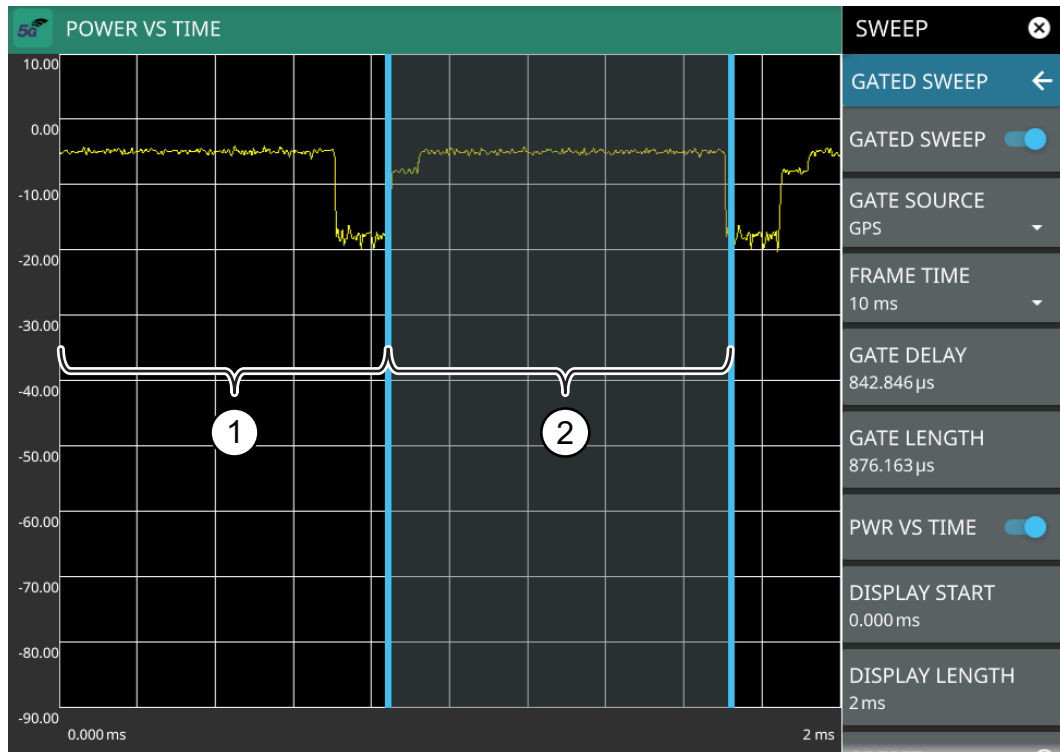
GATED SWEEP Menu

<p>The screenshot shows the GATED SWEEP menu with the following items from top to bottom:</p> <ul style="list-style-type: none"> SWEEP (with a close icon) GATED SWEEP (with a back arrow) GATED SWEEP (with a toggle switch) GATE SOURCE (set to GPS) FRAME TIME (set to 20 ms) GATE DELAY (set to 0.000 ms) GATE LENGTH (set to 1 ms) PWR VS TIME (with a toggle switch) DISPLAY START (set to 0.000 ms) DISPLAY LENGTH (set to 20 ms) PRESET GTD SWP (with a refresh icon) 	<p>GATED SWEEP: Toggles gated sweep on or off.</p> <p>GATED SOURCE: Selects the trigger source for the gated sweep. GPS is the only selectable source at this time.</p> <ul style="list-style-type: none"> • GPS: The GPS trigger source is valid only on instrument models with 20 MHz IF Bandwidth available. <p>FRAME TIME: Selects the frame time duration of 10 ms, 20 ms, or 1 s.</p> <p>GATE DELAY: Sets the start of the gated sweep. When “POWER VS TIME Display” is enabled, the gate delay is indicated by the blue left border of the power vs time display. You can also drag the entire gate to set the desired gate delay.</p> <p>GATE LENGTH: Sets the length of the gated sweep. When “POWER VS TIME Display” is enabled, the gate length is indicated by the width between the blue borders of the power vs time display. You can also drag the right blue border to set the desired gate length.</p> <p>PWR VS TIME: Enables the “POWER VS TIME Display” on page 5-15.</p> <p>DISPLAY START: When Power vs Time is selected, sets the start of the graticule display.</p> <p>DISPLAY LENGTH: When Power vs Time is selected, sets the time length of the graticule display.</p> <p>PRESET: Presets gated sweep settings to default values.</p>
---	--

Figure 5-13. GATED SWEEP Menu

POWER VS TIME Display

When power vs time is enabled, a time-domain graph is presented. This graph is a useful visual aid when setting up the GATE DELAY (1) and GATE LENGTH (2) times as you can simultaneously view the signal level within the set frame and relative to your gate delay and length. The display is enabled using the PWR VS TIME toggle setting and should be disabled after setting up the gate delay and length parameters. The gate delay and length are represented by the width of the displayed shaded area flanked with blue lines (see Figure 5-14).



1. Set the gate delay by dragging the left blue setting line. The full time scale is shown along the bottom and the gate delay time will be displayed at the top center of the graticule when it is being adjusted.
2. Set the gate length by dragging the right blue setting line. The full time scale is shown along the bottom and the gate length will be displayed at the top center of the graticule when it is being adjusted.

Figure 5-14. Power vs. Time Display

If the blue gate delay and length setting lines are set outside of the displayed graticule scale, you will see “< Gate Start” and “Gate Stop >” messages at the edge of the display indicating where the blue setting lines are located.

Once the gate has been set up, you can apply gating to the spectrum by toggling GATED SWEEP on. Gating will continue to be applied when you access other measurements and functions of the spectrum analyzer until gated sweep is toggled off or an unsupported instrument configuration is selected.

5-9 Setting Up Markers

Markers are not used in 5G NR Summary measurements. Marker parameters are set using the “[MARKER Menu](#)” on page 5-18. 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.
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 5-15. 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.
 - 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 5-19).

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 delta marker is on, its position data is relative to its reference marker. For example, Delta Marker 3 displays x-axis and y-axis data relative to Marker 3. To set a delta marker and its reference:

1. Activate a marker and place it in a reference location as described previously.
2. Select another marker using **MARKER > SELECT**, then select one of 12 available markers.
3. Set the second marker's MODE to Delta.
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 5-19).

A delta marker is labeled with a green delta symbol between the each marker number. For example, delta Marker 2 relative to Marker 1 is displayed as "1Δ2".

MARKER Menu











MARKER 	PEAK SEARCH: Opens the “MARKER PEAK SEARCH Menu” on page 5-19.
PEAK SEARCH 	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.
SELECT Marker 2 	ENABLED: Enables the selected marker.
ENABLED 	FREQUENCY: Displays the marker frequency. For delta markers, the frequency is relative to the reference marker. Change the marker frequency by pressing on the marker and dragging it to the desired location. You can also change the marker frequency by touching the value to open the keypad.
FREQUENCY 10.182884111 GHz	AMPLITUDE: Displays the current marker amplitude. 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.
AMPLITUDE -39.61 dBm	MODE: Select marker preference:
MODE Normal 	<ul style="list-style-type: none"> • 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 Off 	MARKER 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 5-20.
DELTA REFERENCE 	DELTA REFERENCE: Selects the reference marker for a delta marker. A delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.
TRACE Trace 1 	TRACE: Selects the trace number to which the marker is currently attached.
MARKER TABLE 	MARKER TABLE: Toggle on or off the marker table displayed below the screen. Refer to “Marker Table” on page 5-20.
CENTER ON MARKER	CENTER ON MARKER: Sets the center frequency to the currently active marker’s frequency value.
REF LVL TO MARKER	REF LVL TO MARKER: Sets the reference level to the currently active marker’s amplitude value.
ALL MARKERS OFF	ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position once re-enabled.
PRESET MARKERS 	PRESET: Presets marker selections to default values.

Figure 5-16. MARKER Menu

MARKER PEAK SEARCH Menu

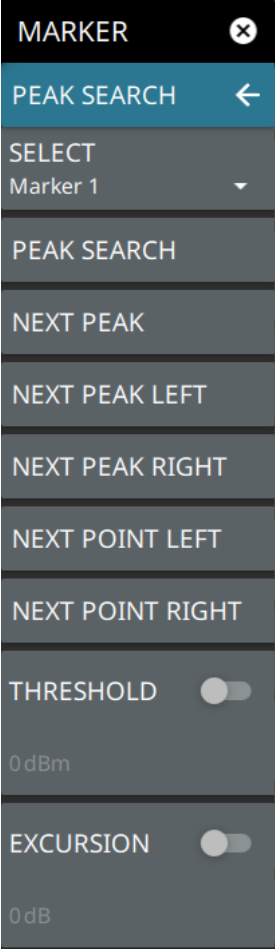
	<p>SELECT: If the selected marker is off it will be turned on and the selected marker positioned at the peak of Trace 1. If the selected marker is on, then it will become the active marker and any subsequent actions in the PEAK SEARCH menu will apply to the selected marker. If no markers are on, pressing the PEAK SEARCH button on the control panel will turn on Marker 1 at the peak of Trace 1. Pressing the PEAK SEARCH button also opens the PEAK SEARCH menu.</p> <p>PEAK SEARCH: Moves the selected marker to the highest peak.</p> <p>NEXT PEAK: Moves the selected marker to the next highest peak regardless of location.</p> <p>NEXT PEAK LEFT: Moves the selected marker to the next peak left of its current position.</p> <p>NEXT PEAK RIGHT: Moves the selected marker to the next peak right of its current position.</p> <p>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.</p> <p>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.</p> <p>THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a peak.</p> <p>EXCURSION: If turned on, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.</p>
--	--

Figure 5-17. PEAK SEARCH 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.

Frequency Counter Marker

Sets the frequency counter for the selected marker. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. When counter marker is enabled, a higher resolution digital signal processing is used within the region of the counter marker to determine a more precise frequency. Using counter marker in association with marker to peak will result in the frequency of the signal peak to a much higher displayed resolution. Note that frequency accuracy is affected by the RBW setting, and sweep times may be longer when using counter marker because of the additional signal processing.

Marker Table

The Marker table display is useful for displaying many marker parameters at once. The example shown is for the 5G Channel Power measurement. The marker table shows the marker mode and corresponding X and Y values, and the trace 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.

CHANNEL POWER			MARKER			
MARKER	MODE	FUNCTION	TRACE	X	Y	
1	Normal	Noise	1	5.80000010 GHz	-142.43 dBm/Hz	
2	Normal	Off	3	6.15200010 GHz	-66.84 dBm	
3	Normal	Off	1	62.690807800 GHz	-67.91 dBm	
4	Off	Off	--	--	--	
5	Off	Off	--	--	--	
6	Off	Off	--	--	--	

Figure 5-18. Marker Table

1. You can select and change a marker's parameters by selecting the marker from either the MARKER menu or the MARKER table.
2. The currently selected marker's value is shown at the top left of the spectrum window with its current amplitude and frequency values.
3. The selected marker is highlighted on the trace display.

5-10 5G Measurement Setup

5G NR base station validation qualifies the performance of gNB base stations with essential measurements that are in full compliance with 3GPP TS 38.104 V15. The 5G analyzer features smart measurements that make configuring these measurements and views for 5G compliance testing easy:

- 5G NR summary with multi beam and single beam views
 - frequency error
 - time offset
 - cell/sector ID
 - modulation quality
 - synchronization signal block (SSB)
- Occupied Bandwidth (OBW)
- Channel Power (CP)
- Equivalent Isotropic Radiated Power (EIRP)
 - unwanted emissions

MEASURE Menu (5G)

	<p>MEASUREMENT: Selects the desired measurement type from the following list:</p> <ul style="list-style-type: none"> • 5G NR Summary: Displays the current beam measurement status in a quick-view summary that includes the PCI summary, sync signal (SS), and channel summary. See “5G NR Summary” on page 5-22. • Channel Power: Provides an RF channel power measurement that includes the total channel power, power spectral density (PSD), and pass/fail compliance testing. “5G Channel Power” on page 5-27. • OBW – Provides an RF occupied bandwidth measurement that includes the occupied bandwidth, total power, and pass/fail compliance testing. “5G Occupied Bandwidth” on page 5-30. • EIRP – Provides an EIRP display that includes the input parameters setup and measurement status. “5G EIRP” on page 5-33. <p>VIEW: When the measurement is 5G NR Summary, you can select the type of view:</p> <ul style="list-style-type: none"> • Multi Beam: Displays eight beam power levels and summaries on a total of eight summary pages. See “5G NR Summary Multi Beam View” on page 5-22. • Single Beam: Displays a total of 64 individual summary views for each beam. See “5G NR Summary Single Beam View” on page 5-24. <p>SETUP: Opens one of the measurement SETUP menus:</p> <ul style="list-style-type: none"> • “SETUP Menu (5G NR Summary)” on page 5-26 (not used) • “SETUP Menu (5G Channel Power)” on page 5-28 • “SETUP Menu (5G OBW)” on page 5-31 • “SETUP Menu (5G EIRP)” on page 5-35
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Figure 5-19. 5G MEASURE Menu

The following 5G SETUP menus can be accessed directly via the SETUP or MEASURE menus after the desired measurement has been selected. The setup menu depends on the current measurement and view selected.

5-11 5G NR Summary

5G NR summary measurements are used for compliance testing of 5G networks and can evaluate active antenna systems for beamforming profiles and dynamic physical layer attributes of the transmitted signal. This section illustrates a sample 8-beam 5G NR summary measurement.

5G NR Summary Multi Beam View

The following measurement is set up to display 5G NR summary data in a multi beam view. In multi beam view, a maximum of eight beams can be displayed at once on a single page. Field Master Pro can capture data for as many as 64 beams in a total of eight pages.

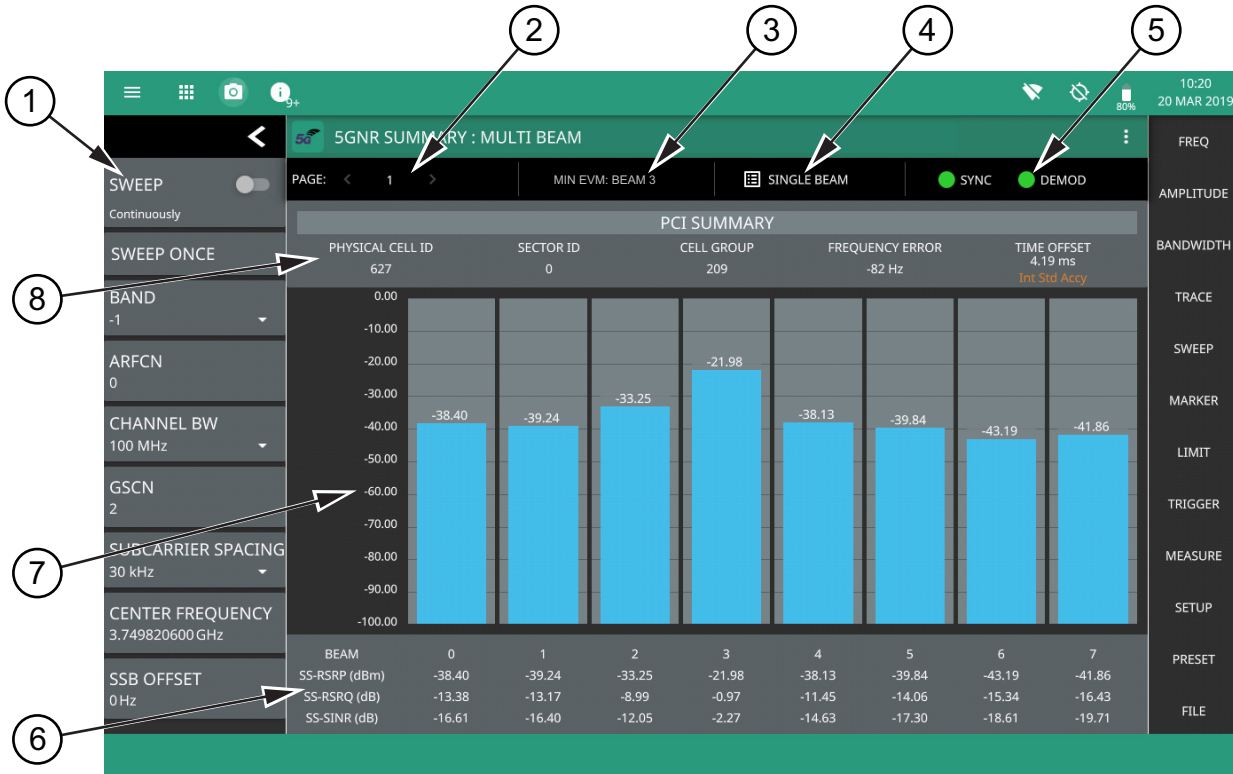


Figure 5-20. 5G NR Summary – Multi Beam View (1 of 2)

-
1. **5G Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See “[Status Panel \(5GNR Summary\)](#)” on page 5-26.
 2. **PAGE:** This field indicates the current multi beam page. A maximum of eight pages (numbered 1 through 8) with eight beams (numbered 0 to 63) on each page can be displayed in multi beam view. You can cycle through the pages using the left/right (</>) arrows or touch the number to select the desired page.
 3. **MIN BEAM:** This field shows which beam measures the lowest error vector magnitude (EVM).
 4. **SINGLE/MULTI BEAM:** This field shows the current view setting. Touch this field to toggle between SINGLE BEAM or MULTI BEAM views. You can also change the view setting from the MEASURE menu.
 5. **SYNC/DEMODO:** Valid 5G measurements require the signal synchronization and demodulation. The indicators here blink green when the received signal is synchronized and properly demodulated, indicating that you have a valid measurement.
 6. **Summary Data:** For each beam, the following synchronization signal summary data is displayed:
 - SS-RSRP: Secondary synchronization signal reference signal received power measured in dBm.
 - SS-RSRQ: Secondary synchronization signal reference signal received quality measured in dB.
 - SS-SINR: Secondary synchronization signal-to-noise and interference ratio measured in dB.
 7. **Beam Display:** This area shows the received signal strength of each beam as a vertical bar. The top of the bar is annotated with the maximum signal strength (in dBm). The number of beams displayed depends on how many beams are defined by the band configuration. From 1 to 8 beams can be displayed at once on a page. When more than 8 beams are measured, additional beams can be accessed from additional pages. The beams are numbered from 0 up to 63. If you touch a beam, the view changes to display the selected beam in single beam view.
 8. **PCI Summary:** This area shows the physical cell ID summary data, including the sector ID, cell group number, frequency error, and time offset. Also noted is the instrument’s reference clock accuracy of Internal, External, or GPS high accuracy (requires GPS).
-

Figure 5-20. 5GNR Summary – Multi Beam View (2 of 2)

5G NR Summary Single Beam View

5G NR summary measurements in single beam view provides the same information as the multi beam view with added measurements as described in [Figure 5-21](#).

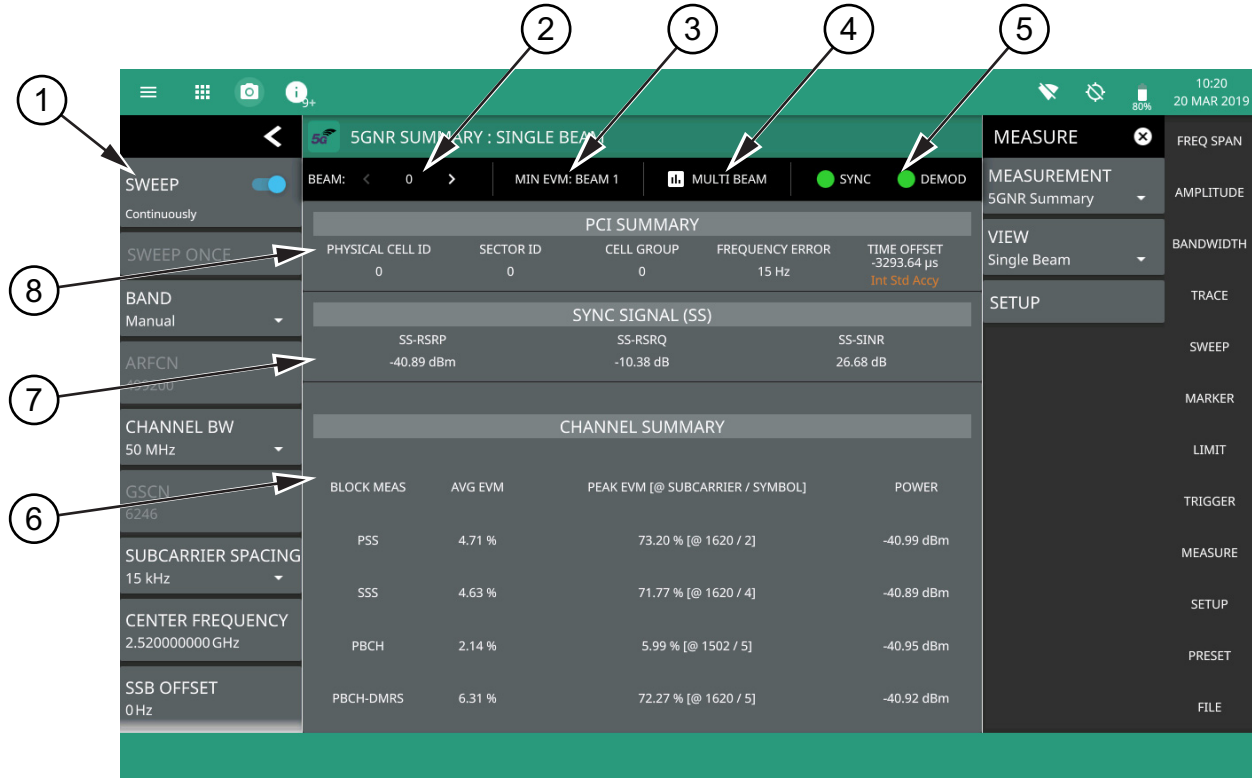


Figure 5-21. 5G NR Summary – Single Beam View (1 of 2)

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1. **5G Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See “[Status Panel \(5G NR Summary\)](#)” on page 5-26.
 2. **BEAM:** This field indicates the current beam summary page. A maximum of 64 beams (numbered 0 to 63) can be individually displayed in single beam view. You can cycle through the beam pages using the left/right (</>) arrows or touch the number to select the desired beam.
 3. **MIN EVM BEAM:** This field shows which beam measures lowest error vector magnitude (EVM).
 4. **SINGLE/MULTI BEAM:** This field shows the current view setting. Touch this field to toggle between SINGLE BEAM or MULTI BEAM views. You can also change the view setting from the MEASURE menu.
 5. **SYNC/DEMODO:** Valid 5G measurements require the signal synchronization and demodulation. The indicators here blink green when the received signal is synchronized and properly demodulated, indicating that you have a valid measurement.
 6. **Channel Summary:** For the current beam, shows the average error vector magnitude (EVM), peak EVM (@ subcarrier/symbol) and received power in dBm for each block measurement:
 - PSS: The primary synchronization signal provides the primary frame boundary (i.e., the position of the first symbol in the frame).
 - SSS: Similar to PSS, the secondary synchronization signal provides the secondary subframe boundary.
 - PBCH: This is the physical broadcast channel, the main purpose of which is to carry the broadcast master information block.
 - PBCH-DMRS: In 5G NR measurements, the PBCH decoding relies on a demodulation reference signal (DMRS, which is a physical layer reference signal used for decoding) rather than a cell specific reference signal (CRS).
 7. **Sync Signal (SS) Summary Data:** Shows the following synchronization signal summary data for the current beam:
 - SS-RSRP: Secondary synchronization signal reference signal received power measured in dBm.
 - SS-RSRQ: Secondary synchronization signal reference signal received quality measured in dB.
 - SS-SINR: Secondary synchronization signal-to-noise and interference ratio measured in dB.
 8. **PCI Summary:** This area shows the physical cell ID summary data, including the sector ID, cell group number, frequency error, and time offset. Also noted is the instrument’s reference clock accuracy of Internal, External, or GPS high accuracy (requires GPS).
-

Figure 5-21. 5G NR Summary – Single Beam View (2 of 2)

SETUP Menu (5G NR Summary)

SETUP menu is not available in MEASURE > MEASUREMENT > 5G NR Summary.

Status Panel (5G NR Summary)

The status panels illustrated in this section are unique to the current analyzer and to the particular measurement and view that is selected.

Figure 5-22 shows the 5G status panel that covers the 5G NR summary measurements.


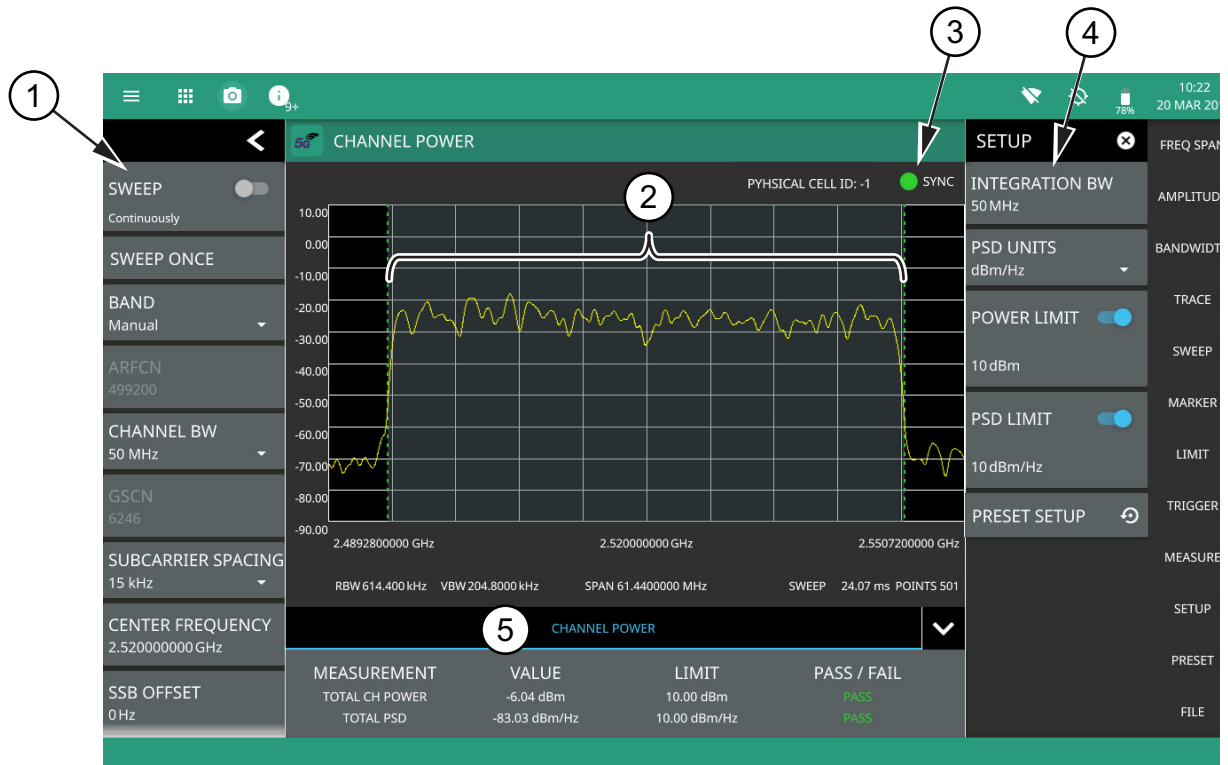
	<p>SWEEP: Toggles the current sweep setting between continuously or sweep once.</p>
<p>SWEEP <input checked="" type="checkbox"/></p> <p>Continuously</p>	<p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.</p>
<p>SWEEP ONCE</p>	<p>BAND: Select MANUAL or one of the predefined bands. Selecting MANUAL disables ARFCN and GSCN settings. Selecting a predefined band activates ARFCN and GSCN settings.</p>
<p>BAND</p> <p>Manual</p>	<p>ARFCN: ARFCN is the Absolute Radio Frequency Channel Number. The ARFCN is a unique identification number assigned to each radio channel within a communications spectrum. The ARFCN can be used to calculate the center frequency of the radio channel. The available input range is dependent on the selected band.</p>
<p>ARFCN</p> <p>0</p>	<p>CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. Refer to “Options Settings” on page 2-32.</p>
<p>CHANNEL BW</p> <p>100 MHz</p>	<p>GSCN: GSCN is the Global Synchronization Raster Channel. The GSCN identifies the mapping of the synchronous signal block (SSB). The available input range is dependent on the selected band.</p>
<p>GSCN</p> <p>2</p>	<p>SUBCARRIER SPACING: Sets the subcarrier spacing. The available input range is dependent on the selected band.</p>
<p>SUBCARRIER SPACING</p> <p>30 kHz</p>	<p>CENTER FREQUENCY: When the band is set to MANUAL, sets the center frequency of the measurement channel. Changing the center frequency sets the band to MANUAL.</p>
<p>CENTER FREQUENCY</p> <p>10 GHz</p>	<p>SSB OFFSET: SSB is the Synchronous Signal Block. The SSB Offset sets the frequency offset between the SSB and the overall resource block.</p>
<p>SSB OFFSET</p> <p>0 Hz</p>	<p>FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GPS Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.</p>
<p>FREQ REFERENCE</p> <p>Int Std Accy</p>	

Figure 5-22. Status Panel (5G NR Summary Measurement)

5-12 5G Channel Power

Channel power measurements are one of most common measurements for a radio transmitter. This test measures the output power of a transmitter within the specified channel bandwidth. 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.

The channel power measurement is a test performed to measure the power transmitted within a specified frequency or channel bandwidth. The total RF power and power spectral density (PSD) is determined from a channel power measurement. An example of a channel power measurement is shown in [Figure 5-23](#).



- 5G Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(5G Channel Power\)”](#) on page 5-29.
- Channel Power:** Channel power is integrated over the shaded region where the dashed green lines indicate the upper and lower frequency thresholds.
- SYNC:** Valid 5G channel power measurements require signal synchronization. The indicator here blinks green when the received signal is synchronized, indicating that you have a valid measurement.
- SETUP Menu:** The channel power settings are configured in the SETUP menu. See [“SETUP Menu \(5G Channel Power\)”](#) on page 5-28.
- Channel Power Summary:** This area shows the channel power measurement summary data and pass/fail test results, when enabled:
 - The total channel power value and the test limit are expressed in dBm with a pass/fail result.
 - The total PSD limit is expressed in dBm with a pass/fail result.
 - Tapping this summary area opens the Channel Power SETUP menu.

Figure 5-23. 5G Channel Power Measurement

SETUP Menu (5G Channel Power)

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


 <p>SETUP [X]</p> <p>INTEGRATION BW 10.350000 MHz</p> <p>PSD UNITS dBm/Hz [v]</p> <p>POWER LIMIT [ON] 10 dBm</p> <p>PSD LIMIT [ON] 10 dBm/Hz</p> <p>PRESET SETUP [Refresh]</p>	<p>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).</p> <p>PSD UNITS: Sets the unit bandwidth for power spectral density (PSD). The available units are dBm/Hz and dBm/MHz.</p> <p>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.</p> <p>PSD LIMIT: If the power spectral density limit is on, the PSD limit 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.</p> <p>PRESET: Presets the SETUP menu to default settings.</p>
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Figure 5-24. 5G SETUP Menu (Channel Power)

Status Panel (5G Channel Power)

The status panels illustrated in this section are unique to the current analyzer and to the particular measurement and view that is selected.

Figure 5-25 shows the 5G status panel that covers the 5G channel power measurements.

<div style="display: flex; justify-content: space-between; align-items: center;"> ← </div> <div style="padding: 5px;"> <p>SWEEP ●</p> <p>Continuously</p> </div>	<p>SWEEP: Toggles the current sweep setting between continuously or sweep once.</p>																								
<div style="padding: 5px;"> <p>SWEEP ONCE</p> </div>	<p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.</p>																								
<div style="padding: 5px;"> <p>BAND</p> <p>Manual ▾</p> </div>	<p>BAND: Select MANUAL or one of the predefined bands. Selecting MANUAL disables ARFCN and GSCN settings. Selecting a predefined band activates ARFCN and GSCN settings.</p>																								
<div style="padding: 5px;"> <p>ARFCN</p> <p>0</p> </div>	<p>ARFCN: ARFCN is the Absolute Radio Frequency Channel Number. The ARFCN is a unique identification number assigned to each radio channel within a communications spectrum. The ARFCN can be used to calculate the center frequency of the radio channel. The available input range is dependent on the selected band.</p>																								
<div style="padding: 5px;"> <p>CHANNEL BW</p> <p>100 MHz ▾</p> </div>	<p>CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. Refer to “Options Settings” on page 2-32.</p>																								
<div style="padding: 5px;"> <p>GSCN</p> <p>2</p> </div>	<p>GSCN: GSCN is the Global Synchronization Raster Channel. The GSCN identifies the mapping of the synchronous signal block (SSB). The available input range is dependent on the selected band.</p>																								
<div style="padding: 5px;"> <p>SUBCARRIER SPACING</p> <p>30 kHz ▾</p> </div>	<p>SUBCARRIER SPACING: Sets the subcarrier spacing. The available input range is dependent on the selected band.</p>																								
<div style="padding: 5px;"> <p>CENTER FREQUENCY</p> <p>10 GHz</p> </div>	<p>CENTER FREQUENCY: When the band is set to MANUAL, sets the center frequency of the measurement channel. Changing the center frequency sets the band to MANUAL.</p>																								
<div style="padding: 5px;"> <p>SSB OFFSET</p> <p>0 Hz</p> </div>	<p>SSB OFFSET: SSB is the Synchronous Signal Block. The SSB Offset sets the frequency offset between the SSB and the overall resource block.</p>																								
<div style="padding: 5px;"> <p>TRACES</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="color: yellow;">T1</th> <th style="color: yellow;">Wrt</th> <th style="color: yellow;">Avg</th> <th style="color: yellow;">Act</th> </tr> </thead> <tbody> <tr> <td style="color: green;">T2</td> <td style="color: green;">Wrt</td> <td style="color: green;">Pk</td> <td style="color: green;">Blk</td> </tr> <tr> <td style="color: blue;">T3</td> <td style="color: blue;">Wrt</td> <td style="color: blue;">Pk</td> <td style="color: blue;">Blk</td> </tr> <tr> <td style="color: orange;">T4</td> <td style="color: orange;">Wrt</td> <td style="color: orange;">Pk</td> <td style="color: orange;">Blk</td> </tr> <tr> <td style="color: grey;">T5</td> <td style="color: grey;">Wrt</td> <td style="color: grey;">Pk</td> <td style="color: grey;">Blk</td> </tr> <tr> <td style="color: grey;">T6</td> <td style="color: grey;">Wrt</td> <td style="color: grey;">Pk</td> <td style="color: grey;">Blk</td> </tr> </tbody> </table> <p style="color: yellow; font-size: small;">T1 Clear / Write</p> </div>	T1	Wrt	Avg	Act	T2	Wrt	Pk	Blk	T3	Wrt	Pk	Blk	T4	Wrt	Pk	Blk	T5	Wrt	Pk	Blk	T6	Wrt	Pk	Blk	<p>TRACES: Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace or cursor will show a highlighted background with the mode and detector type restated under the table. Touching a trace in the summary panel opens the TRACE menu. It allows you to select and set up an individual trace as desired.</p>
T1	Wrt	Avg	Act																						
T2	Wrt	Pk	Blk																						
T3	Wrt	Pk	Blk																						
T4	Wrt	Pk	Blk																						
T5	Wrt	Pk	Blk																						
T6	Wrt	Pk	Blk																						
<div style="padding: 5px;"> <p>FREQ REFERENCE</p> <p>Int Std Accy</p> </div>	<p>FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GPS Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.</p>																								

Figure 5-25. Status Panel (5G Channel Power Measurement)

5-13 5G Occupied Bandwidth

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

- % Integrated Power Method: The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.
- X dB 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.

An Occupied Bandwidth measurement using the % integrated power is shown in [Figure 5-26](#). The occupied bandwidth here is the bandwidth containing 99% of the total channel power. This is calculated from 0.5 % of the total mean power below the lower frequency limit and 0.5% above its upper frequency limit of the signal. Alternatively, the measurement can be set up to use the X dB method where the occupied bandwidth is determined from the upper and lower bandwidth edges that are X dB down from the total mean power of the signal.

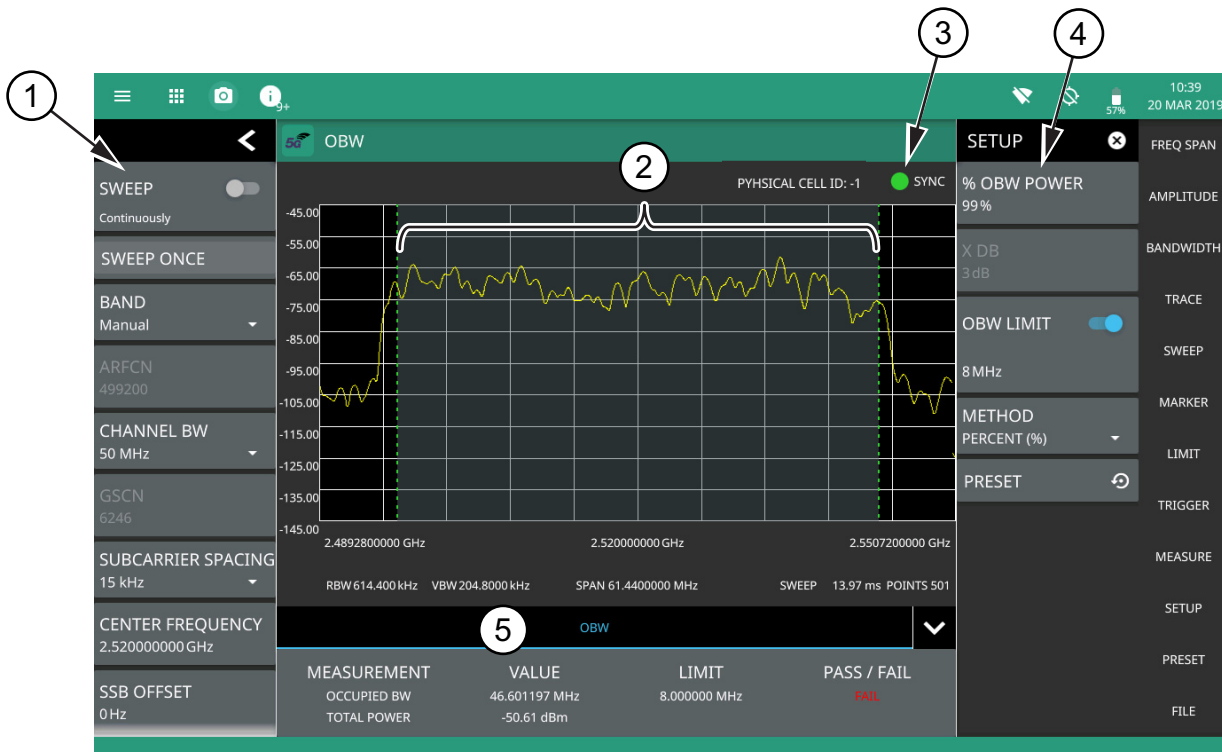


Figure 5-26. 5G Occupied Bandwidth Measurement (1 of 2)

1. **5G Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(5G OBW\)” on page 5-32](#).
2. **Occupied Bandwidth:** Occupied bandwidth is integrated over the shaded region where the dashed green lines indicate the upper and lower frequency thresholds. The analyzer will determine and track the occupied bandwidth of the signal within the current span.
3. **SYNC:** Valid 5G occupied bandwidth measurements require signal synchronization. The indicator here blinks green when the received signal is synchronized, indicating that you have a valid measurement.
4. **SETUP Menu:** The occupied bandwidth settings are configured in the SETUP menu. See [“SETUP Menu \(5G OBW\)” on page 5-31](#).
5. **OBW Summary:** This area shows the occupied bandwidth measurement summary data and pass/fail test results, when enabled:
 - The occupied bandwidth value and the test limit are expressed in frequency units with a pass/fail result.
 - The transmit signal frequency error is expressed in frequency units.
 - The total power is integrated over the measured bandwidth and is expressed in dBm.
 - Tapping this summary area opens the OBW SETUP menu.

Figure 5-26. 5G Occupied Bandwidth Measurement (2 of 2)

SETUP Menu (5G OBW)

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

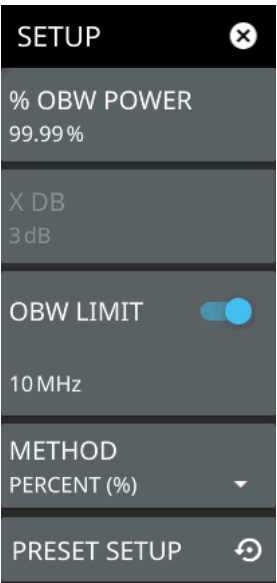
	<p>% OBW POWER: Sets the percentage of the total power that is measured within the occupied bandwidth for the current measurement. The resulting occupied bandwidth and total power values are displayed in the measurements results table.</p> <p>X dB: Sets the x dB value used for the "x dB bandwidth" measurement. 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.</p> <p>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.</p> <p>METHOD: Select the measurement method to be PERCENT (%) or X (dB).</p> <p>PRESET: Presets the SETUP menu to default settings.</p>
---	---

Figure 5-27. 5G SETUP Menu (OBW)

Status Panel (5G OBW)

The status panels illustrated in this section are unique to the current analyzer and to the particular measurement and view that is selected.

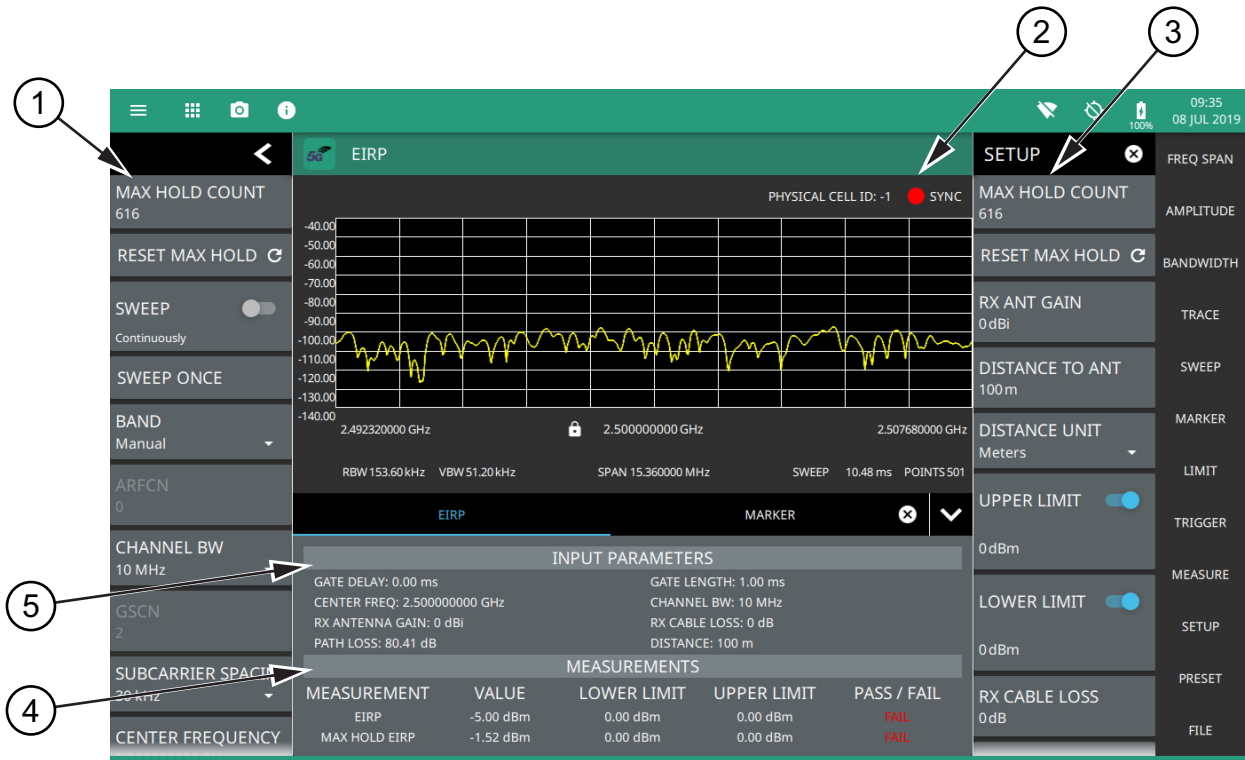
Figure 5-28 shows the 5G status panel that covers the 5G OBW measurements.

<div style="display: flex; justify-content: space-between; align-items: center;"> < </div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> SWEEP ● </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">Continuously</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px; opacity: 0.5;"> SWEEP ONCE </div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> BAND </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">Manual ▾</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> ARFCN </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">0</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> CHANNEL BW </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">100 MHz ▾</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> GSCN </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">2</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> SUBCARRIER SPACING </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">30 kHz ▾</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> CENTER FREQUENCY </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">10 GHz</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> SSB OFFSET </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">0 Hz</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> TRACES </div> <table style="width: 100%; font-size: 0.7em; color: #ccc; margin-bottom: 5px;"> <thead> <tr> <th style="color: #00aaff;">T1</th> <th style="color: #00aaff;">Wrt</th> <th style="color: #00aaff;">Avg</th> <th style="color: #00aaff;">Act</th> </tr> </thead> <tbody> <tr> <td style="color: #00aaff;">T2</td> <td style="color: #00aaff;">Wrt</td> <td style="color: #00aaff;">Pk</td> <td style="color: #00aaff;">Blk</td> </tr> <tr> <td style="color: #00aaff;">T3</td> <td style="color: #00aaff;">Wrt</td> <td style="color: #00aaff;">Pk</td> <td style="color: #00aaff;">Blk</td> </tr> <tr> <td style="color: #00aaff;">T4</td> <td style="color: #00aaff;">Wrt</td> <td style="color: #00aaff;">Pk</td> <td style="color: #00aaff;">Blk</td> </tr> <tr> <td style="color: #00aaff;">T5</td> <td style="color: #00aaff;">Wrt</td> <td style="color: #00aaff;">Pk</td> <td style="color: #00aaff;">Blk</td> </tr> <tr> <td style="color: #00aaff;">T6</td> <td style="color: #00aaff;">Wrt</td> <td style="color: #00aaff;">Pk</td> <td style="color: #00aaff;">Blk</td> </tr> </tbody> </table> <div style="font-size: 0.8em; color: #00aaff; margin-bottom: 5px;">T1 Clear / Write</div> <div style="background-color: #444; color: white; padding: 5px; margin-bottom: 5px;"> FREQ REFERENCE </div> <div style="font-size: 0.8em; color: #ccc; margin-bottom: 5px;">Int Std Accy</div>	T1	Wrt	Avg	Act	T2	Wrt	Pk	Blk	T3	Wrt	Pk	Blk	T4	Wrt	Pk	Blk	T5	Wrt	Pk	Blk	T6	Wrt	Pk	Blk	<p>SWEEP: Toggles the current sweep setting between continuously or sweep once.</p> <p>SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.</p> <p>BAND: Select MANUAL or one of the predefined bands. Selecting MANUAL disables ARFCN and GSCN settings. Selecting a predefined band activates ARFCN and GSCN settings.</p> <p>ARFCN: ARFCN is the absolute radio frequency channel number. The ARFCN is a unique identification number assigned to each radio channel within a communications spectrum. The ARFCN can be used to calculate the center frequency of the radio channel. The available input range is dependent on the selected band.</p> <p>CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. Refer to “Options Settings” on page 2-32.</p> <p>GSCN: GSCN is the Global Synchronization Raster Channel. The GSCN identifies the mapping of the synchronous signal block (SSB). The available input range is dependent on the selected band.</p> <p>SUBCARRIER SPACING: Sets the subcarrier spacing. The available input range is dependent on the selected band.</p> <p>CENTER FREQUENCY: When the band is set to MANUAL, sets the center frequency of the measurement channel. Changing the center frequency sets the band to MANUAL.</p> <p>SSB OFFSET: SSB is the Synchronous Signal Block. The SSB Offset sets the frequency offset between the SSB and the overall resource block.</p> <p>TRACES: Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace or cursor will show a highlighted background with the mode and detector type restated under the table. Touching a trace in the summary panel opens the TRACE menu. It allows you to select and set up an individual trace as desired.</p> <p>FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GPS Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.</p>
T1	Wrt	Avg	Act																						
T2	Wrt	Pk	Blk																						
T3	Wrt	Pk	Blk																						
T4	Wrt	Pk	Blk																						
T5	Wrt	Pk	Blk																						
T6	Wrt	Pk	Blk																						

Figure 5-28. Status Panel (5G OBW Measurement)

5-14 5G EIRP

In antenna measurements, EIRP is equivalent isotropic radiated power. The measured radiated power in a single direction is known as the EIRP. EIRP is especially valuable for over-the-air power measurements of 5G signals, which utilize beamforming for signal transmission, unlike older wireless technologies, which are typically radiated omnidirectionally. EIRP gives a better reflection of atmospheric energy of the beam than a typical channel power measurement. Integrating EIRP in a 360 degree sphere around a beamforming transmitter would give the total radiated power (TRP). Note the EIRP should only be measured in the far field, where beams are fully formed. An EIRP measurement with the normal spectrum view is shown in [Figure 5-29](#)



- 5G Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(5G EIRP\)”](#) on page 5-36.
- SYNC:** Valid 5G occupied bandwidth measurements require signal synchronization. The indicator here blinks green when the received signal is synchronized, indicating that you have a valid measurement.
- SETUP Menu:** The EIRP settings are configured in the SETUP menu. See [“SETUP Menu \(5G EIRP\)”](#) on page 5-35.
- EIRP Measurement Summary:** This area shows the measurement results summary with pass/fail test results, when enabled:
 - The EIRP value and upper/lower test limits are expressed in dBm with a pass/fail result.
 - The max hold EIRP value and upper/lower test limits are expressed in dBm with a pass/fail result.
 - Tapping this summary area opens the OBW SETUP menu.
- EIRP Input Parameters:** This area shows the input parameters for the measurement:
 - Gate delay and length parameters are applied when gated sweep is enabled (requires Option 90). See [“Gated Sweep \(Option 90\)”](#) on page 5-13.
 - The frequency and band parameters are configured in the BAND CONFIG menu. See [“BAND CONFIG Menu”](#) on page 5-5.
 - Receiver antenna gain parameters are configured in the EIRP SETUP menu. See [“SETUP Menu \(5G EIRP\)”](#) on page 5-35.

Figure 5-29. 5G EIRP Normal View

An EIRP measurement with the quick view is shown in [Figure 5-30](#). This simplified view provides a conceptual visual of the EIRP measurement and displays the summary measurement data and input parameters. The adjustable parameters can be touched directly to change their value. Set up the measurement parameters using the [“BAND CONFIG Menu”](#) on page 5-5 and [“SETUP Menu \(5G EIRP\)”](#) on page 5-35.

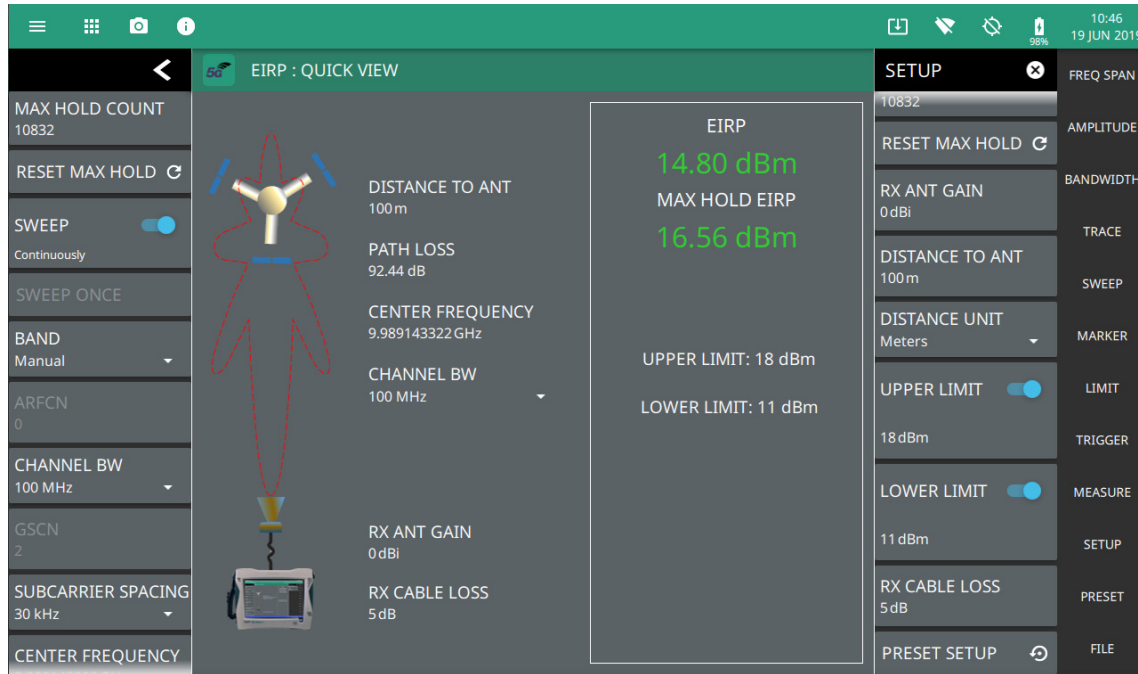


Figure 5-30. 5G EIRP Quick View

SETUP Menu (5G EIRP)

The EIRP SETUP menu is available in MEASURE > MEASUREMENT > EIRP > SETUP. Once the EIRP measurement is selected in the normal view, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum display.

SETUP ✕	MAX HOLD COUNT: Displays the total number of measurement sweeps since the measurement was started. This function will continue to count as long as the instrument is sweeping. Finding the boresight of a beam may be difficult in the field. Providing a hold of the max EIRP reading allows a user to sweep an area and store the highest measured transmitted power.
MAX HOLD COUNT 159	RESET MAX HOLD: Resets the MAX HOLD COUNT to 1.
RESET MAX HOLD ↺	RX ANT GAIN: Sets the antenna gain value from 0 dBi to 999 dBi with a resolution of 0.01 dB. For the most accurate reading, any cable loss between the antenna and the instrument should be subtracted from the RX ANT GAIN.
RX ANT GAIN 0 dBi	DISTANCE TO ANT: Sets the straight line distance between the antenna and signal source. The range can be set from 1 m to 1000 m (approximately 3.3 ft to 3300 ft) with a resolution of 0.01 (m or ft).
DISTANCE TO ANT 100 m	DISTANCE UNIT: Sets the distance unit of measure to Meters or Feet.
DISTANCE UNIT Meters ▾	UPPER LIMIT: Enables the pass/fail compliance test for the upper radiated power. Once enabled, the settable range is –99 dBm to 100 dBm.
UPPER LIMIT ☑ 18 dBm	LOWER LIMIT: Enables the pass/fail compliance test. Once enabled, the settable range is –99 dBm to 100 dBm.
LOWER LIMIT ☑ 0 dBm	RX CABLE LOSS: Sets the cable loss parameter in dB/m.
RX CABLE LOSS 0 dB	PRESET: Presets the SETUP menu to default settings.
PRESET SETUP ↺	

Figure 5-31. SETUP Menu (EIRP)

Status Panel (5G EIRP)

The status panels illustrated in this section are unique to the current analyzer and to the particular measurement and view that is selected. [Figure 5-32](#) shows the 5G status panel that covers the 5G EIRP measurements.

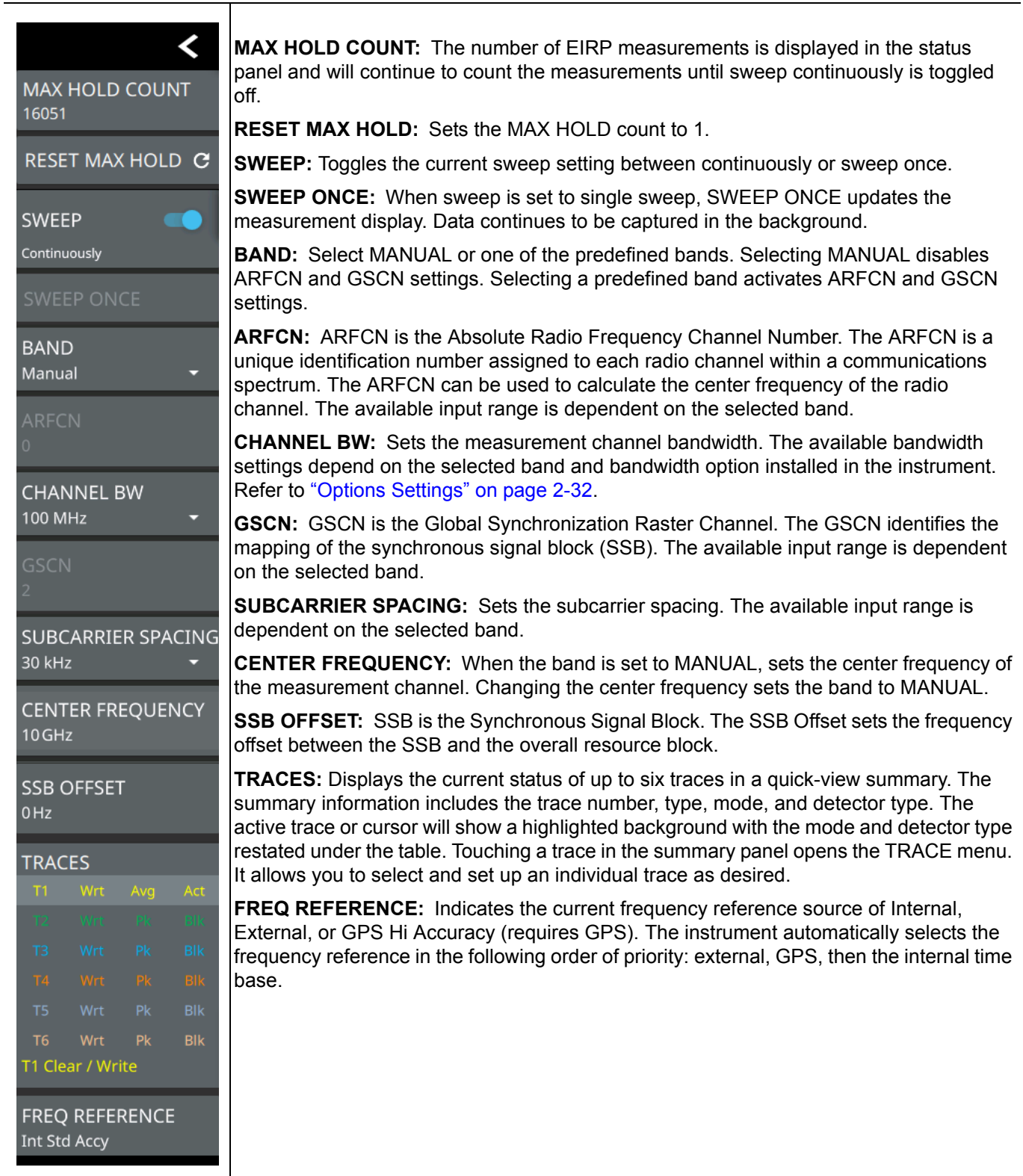


Figure 5-32. Status Panel (5G EIRP Measurements)

5-15 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 or for the 5G analyzer. Preset does not affect user files or system settings such as networking settings. For other reset options, such as a complete factory reset of the instrument, refer to [Chapter 2, “Reset Settings” on page 2-33](#). To recover from system software faults, refer to [Appendix A, “Instrument Messages and Troubleshooting”](#).

PRESET Menu

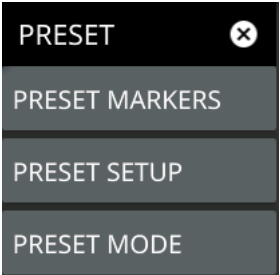
 <p>PRESET ✕</p> <p>PRESET MARKERS</p> <p>PRESET SETUP</p> <p>PRESET MODE</p>	<p>PRESET MARKERS: Presets all values on the MARKER menu to default values. Not available in 5G NR Summary measurement.</p> <p>PRESET SETUP: Presets all values on the SETUP menu to default values. Not available in 5G NR Summary measurement.</p> <p>PRESET MODE: Presets all of the current analyzer settings to default values.</p>
---	---

Figure 5-33. PRESET Menu

5-16 Saving and Recalling Measurements

The Field Master Pro 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 [Section 2-12 “File Management” on page 2-34](#).

Saving a Measurement

To save a measurement or setup, refer to [Figure 5-34](#):

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

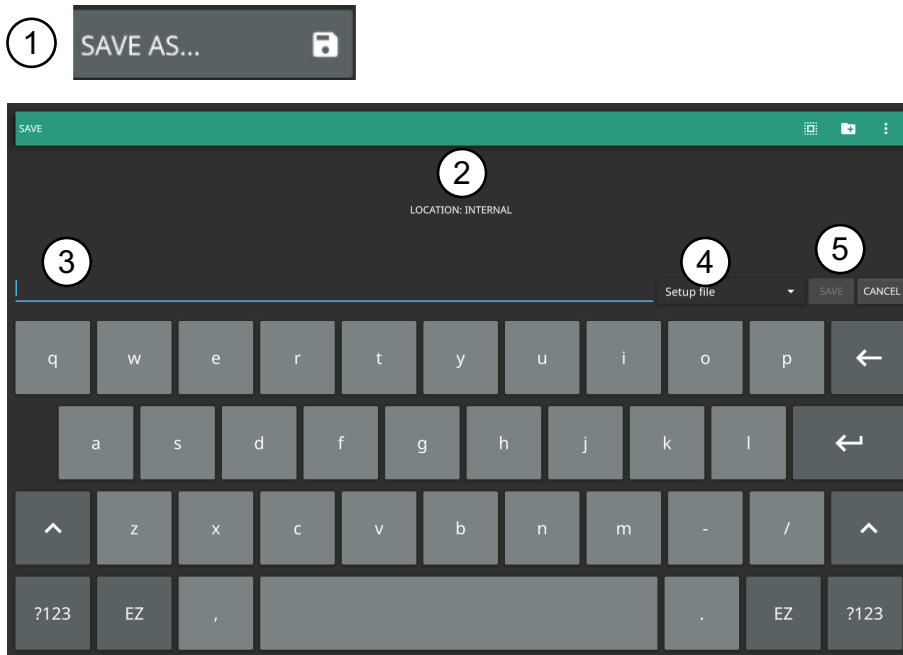


Figure 5-34. File Save Dialog

Once 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 a saved setup, native trace measurement, and a limit line. 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, refer to [Figure 5-35](#):

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

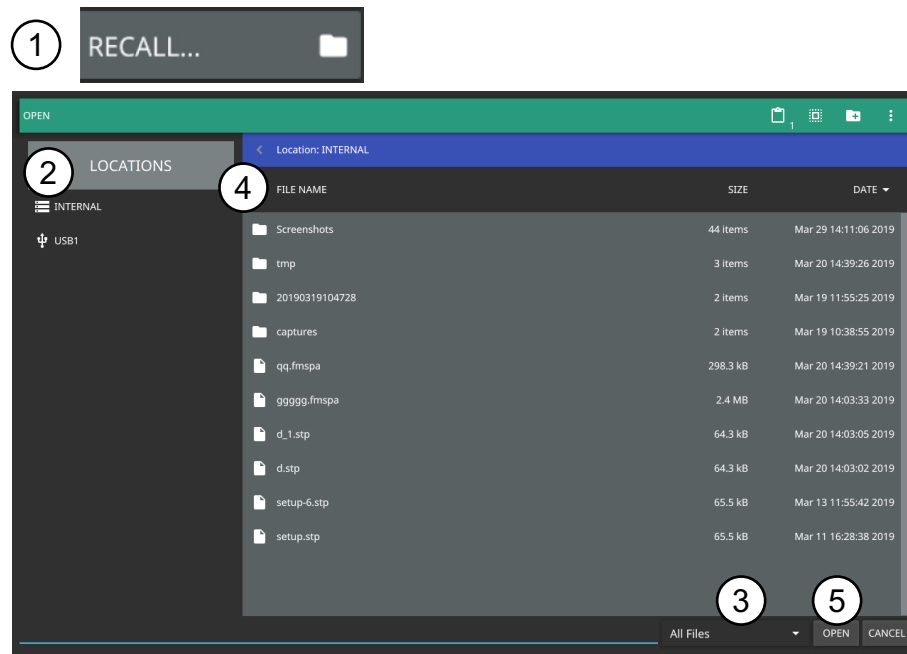


Figure 5-35. File Open Dialog

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

- For a 5G NR summary measurement, disable SWEEP > HOLD
- For an RF-based measurement, set TRACE > MODE > Active

FILE Menu

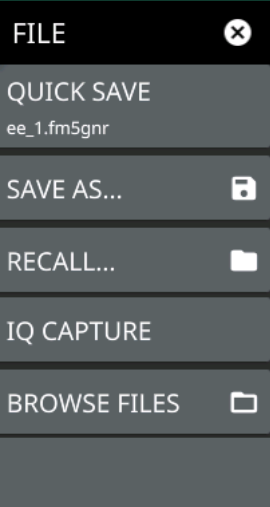
	<p>QUICK SAVE: saves a setup file immediately with the name shown in the button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved.</p> <p>SAVE AS: Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. You can save the following:</p> <ul style="list-style-type: none">• Setup: Saves the current instrument setup (stp file type).• Trace: Saves the measurement point (trace) data and the current instrument setup (fm5gnr 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.• Screenshot: Saves a screenshot of the current measurement (png file type). <p>RECALL: Opens the Recall File dialog to retrieve a file from a desired location.</p> <p>IQ CAPTURE: Initiates a digitized IQ file capture. IQ captures are saved to the internal storage space in the captures folder (bin file type). This feature is meant to help identify 5G NR signal characteristics during early development and is not available in the spectrum analyzer.</p> <p>BROWSE FILES: Opens “File Management” on page 2-34.</p>
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Figure 5-36. FILE Menu

Appendix A — Instrument Messages and Troubleshooting

A-1 Introduction

This appendix provides a list of instrument messages and their meaning and procedures for a full system recovery. If any error condition persists, contact your local Anritsu Service Center (<http://www.anritsu.com/contact-us>).

Field Master Pro displays the following message types:

- [Self-Test Messages](#), indicating self-test pass or fail conditions.
- [File Management Messages](#), relating to the system (three-bar) menu FILES actions.
- [Informational Messages](#), such as notification of a screen capture.
- [Warning Messages](#), such as an ADC over-range warning.
- [Error Messages](#), such as an internal instrument fault.

Messages have the following display characteristics:

- Transient messages appear briefly and then fade away.
- Persistent messages remain on the display and require user intervention to correct the condition.
- Some messages are logged but not displayed, such as messages in the event log.
- Messages may be displayed either in the toolbar or in a pop-up window.

Procedures to recover from system software faults can be found in [Section A-7 “System Recovery”](#) on page A-12.

A-2 Self-Test Messages

Field Master Pro has built-in diagnostics that allow you to run a built-in self test. The test results can be viewed on the screen and saved to a log file. To run self test, use the 3-line menu to access DIAGNOSTICS, then select SELF TEST and RUN SELF TEST. Below is a sample list of self tests with passing results:

TEST DATE: 2019-03-21 09:51:47 MDT

OVERALL STATUS : PASS

SYSTEM : OVERALL STATUS : PASS

System voltage : 13.00 V, 4.00 V ,15.01 V (PASS)

System power : 32.2083 W

External current : 2.50 A, 2.50 A ,2.32 A (PASS)

Battery current : 4.00 A, 4.00 A ,0.18 A (PASS)

+0.85V LP core supply : 0.85 V, 0.09 V ,0.85 V (PASS)

+3.3V LP supply : 3.30 V, 0.33 V ,3.25 V (PASS)

+1.8V LP Vaux supply : 1.80 V, 0.18 V ,1.82 V (PASS)

+1.8V LP IO supply : 1.80 V, 0.18 V ,1.81 V (PASS)

+0.85V FP core supply : 0.85 V, 0.09 V ,0.85 V (PASS)

+1.8V DDR PLL supply : 1.80 V, 0.18 V ,1.81 V (PASS)

+0.85V PS transceiver AVCC : 0.85 V, 0.09 V ,0.85 V (PASS)

+1.8V PS transceiver AVTT : 1.80 V, 0.18 V ,1.83 V (PASS)

+2.5V DDR SODIMM supply : 2.50 V, 0.25 V ,2.49 V (PASS)

+1.2V DDR SODIMM supply : 1.20 V, 0.12 V ,1.20 V (PASS)

+0.85V FPGA core supply : 0.85 V, 0.09 V ,0.86 V (PASS)

+0.9V transceiver AVCC supply : 0.90 V, 0.09 V ,0.90 V (PASS)

+1.2V transceiver AVTT supply : 1.20 V, 0.12 V ,1.21 V (PASS)

+1.0V Ethernet supply : 1.00 V, 0.10 V ,0.99 V (PASS)

+1.8V FPGA supply : 1.80 V, 0.18 V ,1.79 V (PASS)

+2.5V FPGA supply : 2.50 V, 0.25 V ,2.48 V (PASS)

+3.3V FPGA supply : 3.30 V, 0.33 V ,3.29 V (PASS)

+5.0V USB/misc supply : 5.00 V, 0.50 V ,5.00 V (PASS)

+3.9V analog supply : 3.90 V, 0.39 V ,3.96 V (PASS)

+5.7V analog supply : 5.70 V, 0.57 V ,5.67 V (PASS)

-5.7V analog supply : -5.70 V, 0.57 V , -5.26 V (PASS)

+12.8V analog supply : 12.80 V, 1.28 V ,12.82 V (PASS)

+24.0V analog supply : 24.00 V, 2.40 V ,23.92 V (PASS)

Backlight voltage : 22.00 V, 4.40 V ,19.56 V (PASS)

Backlight current : 0.20 A, 0.20 A ,0.18 A (PASS)

12.0V for fan : 12.00 V, 1.20 V ,12.00 V (PASS)
CPU Temperature : 61.0 C
Motherboard Temperature : 46.5 C
Fan speed, percent of full speed : 7 %
Fan speed : 2638 RPM
Temperature at Reference : 45.3 C

SPA : OVERALL STATUS : PASS

+12VG : 12.00 V, 1.20 V ,11.90 V (PASS)
+5V_PREAMP : 5.00 V, 0.50 V ,4.99 V (PASS)
+5VA : 5.00 V, 0.50 V ,5.02 V (PASS)
+5VG : 5.00 V, 0.50 V ,4.99 V (PASS)
+5VH : 5.00 V, 0.50 V ,5.02 V (PASS)
+5VI : 5.00 V, 0.50 V ,5.05 V (PASS)
+5V_VCO : 5.00 V, 0.50 V ,5.09 V (PASS)
+5VM : 5.00 V, 0.50 V ,5.01 V (PASS)
+5VP : 5.00 V, 0.50 V ,5.05 V (PASS)
+5V_SAW : 5.00 V, 0.50 V ,4.99 V (PASS)
+3V3_HBPA : 3.30 V, 0.33 V ,3.31 V (PASS)
+3V3_IF : 3.30 V, 0.33 V ,3.29 V (PASS)
+3V6 : 3.60 V, 0.36 V ,3.55 V (PASS)
+3V3_CAL : 3.30 V, 0.33 V ,3.36 V (PASS)
+3V3G : 3.30 V, 0.33 V ,3.33 V (PASS)
+3V3H : 3.30 V, 0.33 V ,3.29 V (PASS)
+3V3M : 3.30 V, 0.33 V ,3.32 V (PASS)
+3V3P : 3.30 V, 0.33 V ,3.33 V (PASS)
ADC_AVDD3_3V3 : 3.30 V, 0.33 V ,3.33 V (PASS)
+3V3IFA : 3.30 V, 0.33 V ,3.33 V (PASS)
+3V3DET : 3.30 V, 0.33 V ,3.35 V (PASS)
+3V3IFC : 3.30 V, 0.33 V ,3.37 V (PASS)
+3V3IFD : 3.30 V, 0.33 V ,3.35 V (PASS)
+3V3IF_OUT : 3.30 V, 0.33 V ,3.33 V (PASS)
SPARE : 0.00 V, 1.00 V ,0.00 V (PASS)
-5V : -5.00 V, 0.50 V , -5.13 V (PASS)
+24VH : 24.00 V, 2.40 V ,24.18 V (PASS)
+3V3D : 3.30 V, 0.33 V ,3.27 V (PASS)
+2V5D : 2.50 V, 0.25 V ,2.50 V (PASS)
ADC_AVDD2_2V5 : 2.50 V, 0.25 V ,2.50 V (PASS)
ADC_AVDD1_1V25 : 1.25 V, 0.13 V ,1.25 V (PASS)

ADC_DRVDD_1V25 : 1.25 V, 0.13 V ,1.25 V (PASS)
DCM Not Available For This Option : 0.00 V, 0.00 V ,0.00 V (PASS)
Thermal Sensor 1 (Mid-band 1st IF) : 35.00 C, 90.00 C ,44.75 C (PASS)
Thermal Sensor 2 (Mid-band 2nd IF) : 35.00 C, 90.00 C ,46.00 C (PASS)
Thermal Sensor 3 (Low-band RF) : 35.00 C, 90.00 C ,42.00 C (PASS)
DCM Temperature Not Available For This Option : 0.00 C, 0.00 C ,0.00 C (PASS)
ADC Thermal Sensor : 35.00 C, 90.00 C ,39.93 C (PASS)

If any self test fails, try resetting the instrument with a master reset and reboot, and run the test again. If the condition persists, contact your local Anritsu Service Center (<http://www.anritsu.com/contact-us>).

A-3 File Management Messages

File management functions (accessed by via 3-line icon > FILES) are used to organize, copy, and rename files. The following messages are displayed in a persistent dialog when using the file manager features.

Cannot access File or Directory

User does not have permission to access the file or directory.

Cannot copy/move items: no write permission on folder

User does not have permission to access the file or directory.

Cannot move items: origin and destination folders are the same

When attempting to move a file to the same location.

Could not remove the directory/file

The file cannot be deleted.

Error creating new folder

A folder cannot be created.

File or Directory does not exist

When attempting to access a file or directory that does not exist.

Path or url may not exist or cannot be read

The file location cannot be accessed.

Rename error

The file or directory cannot be renamed.

There is no space to copy

There is not enough space to copy the file.

A-4 Informational Messages

Battery Over Charge Temperature

In Toolbar, Not Logged, Persistent

External reference detected - switching reference source to external

In Toolbar, Logged, Transient

External reference disconnected – switching reference source to GPS

In Toolbar, Logged, Transient

External reference disconnected – switching reference source to internal

In Toolbar, Logged, Transient

External reference disconnected – switching reference source to Internal High

In Toolbar, Logged, Transient

File Does Not Exist

In Toolbar, Not Logged, Transient

File Recall Failed

In Toolbar, Not Logged, Transient

File Recalled Successfully

In Toolbar, Not Logged, Transient

File Save Failed

In Toolbar, Not Logged, Transient

File Saved Successfully

In Toolbar, Not Logged, Transient

File successfully saved as: filename

When saving a file (e.g., trace, setup).

GPS reference detected - acquiring GPS

In Toolbar, Logged, Transient

GPS reference acquired - switching reference source to GPS

In Toolbar, Logged, Transient

GPS reference disconnected – switching reference source to Internal

In Toolbar, Logged, Transient

GPS reference no longer available – switching reference source to Internal High

In Toolbar, Logged, Transient

Internal High reference no longer valid – switching frequency reference source to Internal

In Toolbar, Logged, Transient

Internal High reference no longer valid – switching time reference source to Internal

In Toolbar, Logged, Transient

Limit recall initiated

When a limit setup file is selected for recall.

Memory Full

Popup, Not Logged, Transient

Preset Completed

In Toolbar, Not Logged, Transient

Presetting Instrument

In Toolbar, Not Logged, Transient

Rebooting Instrument

In Toolbar, Not Logged, Transient

Recall initiated

When a file is selected for recall.

Reset Completed

In Toolbar, Logged, Transient

Resetting Instrument

In Toolbar, Logged, Transient

Screenshot saved.

When saving a screenshot is successful.

Self test Passed

In Toolbar, Logged, Transient

Self test Failed

In Toolbar, Logged, Transient

Software update files found on USB

In Toolbar, Not Logged, Transient

Stopped saving sweeps after sweep complete.

When the save on event triggers are disabled after end-of-sweep.

Stopped saving sweeps after limit crossing.

When the save on event triggers are disabled after a limit fails.

Successfully saved file on limit crossing
Successfully saved file on sweep complete
Successfully saved file on interval

When a save on event trigger causes a file to be saved.

The selected mode is not yet available.

When an unavailable mode is selected.

Trace copied to memory**Trace cleared from memory****USB drive x ejected**

In Toolbar, Not Logged, Transient

A-5 Warning Messages

ADC Overrange

In Toolbar, Logged, Persistent

Battery Fault

In Toolbar, Logged, Transient

Battery level is critically low. Automatic shutdown is imminent.

Popup, Logged, Persistent

Battery level low.

Popup, Logged, Persistent

Battery Low warning

Pop-up Window, Logged, Persistent: Requires User Intervention

This message is sent once per low battery charge condition per boot cycle per charge cycle. A low battery charge condition is defined as the battery charge being at or below 10%.

Booted from backup SW slot. Reinstall SW to clear this message.

Popup, Logged, Persistent

Failed to recall limit

When the limit setup file selected for recall could not be accessed.

Failed to save file: filename

When any other error occurred while trying to save a file.

Failed to save screenshot. Device may be full.

When saving a screenshot fails.

IF Gain Calibration is off

In Toolbar, Logged, Persistent

IF Shape Calibration is off

In Toolbar, Logged, Persistent

Limit recall initiated

When a limit setup file is selected for recall.

Not enough available space to save file: filename

When the entire file could not be written.

Recall file does not exist

When the file selected for recall could not be accessed.

Reference Level Calibration is off

In Toolbar, Logged, Persistent

Restart required for new settings to take effect.

Persistent. When hostname or options (in the Debug menu) are changed.

Shutdown Battery Level Reached

Pop-up Window, Logged, Persistent: Requires User Intervention

Sent after a **Battery Low** warning. A shutdown will occur when the battery charge is or below 5%.

Shutdown Temperature Reached

Popup, Logged, Persistent

Simulated Test Signal data being displayed

In Toolbar, Logged, Persistent

Temperature High Warning

In Toolbar, Logged, Persistent

The selected mode is not yet available.

When an unavailable mode is selected.

A-6 Error Messages

Command Error

In Toolbar, Logged, Persistent

Could not lock to external reference - check connection and try again

In Toolbar, Logged, Transient

Failed to connect to hardware

Persistent. When the connection to the hardware (server) could not be established.

Failed to recall limit

When the limit setup file selected for recall could not be accessed.

Failed to save file: filepath/filename

When any other error occurred while trying to save a file or when the connection to the hardware (server) is broken.

Failed to save screenshot. Device may be full.

When saving a screenshot fails.

HW communication problem

In Toolbar, Logged, Persistent

Not enough available space to save file: filepath/filename

When the entire file could not be written.

Out of Range

In Toolbar, Not Logged, Transient

PLL Unlock Error (x)

In Toolbar, Logged, Persistent

Query Error

In Toolbar, Not Logged, Transient

Recall file does not exist

When the file selected for recall could not be accessed.

SPA FPGA Programming Error

In Toolbar, Logged, Persistent

Unexpected software exception. Reboot required.

When the instrument software requires a reboot due to unknown error, Persistent

A-7 System Recovery

This section can be referred to in the event the MS2090A does not boot properly and the normal attempts to restart the instrument have failed.

Introduction

If the MS2090A fails to boot properly, a second boot attempt will load a recovery menu as shown in [Figure A-1](#). This menu is only displayed when the instrument fails a normal boot process. A failure to boot properly might not indicate a problem. A boot disruption, such as removing power before the instrument can complete the boot process, will initiate a recovery menu on the next boot. Press the REBOOT INSTRUMENT button once the recovery menu loads.

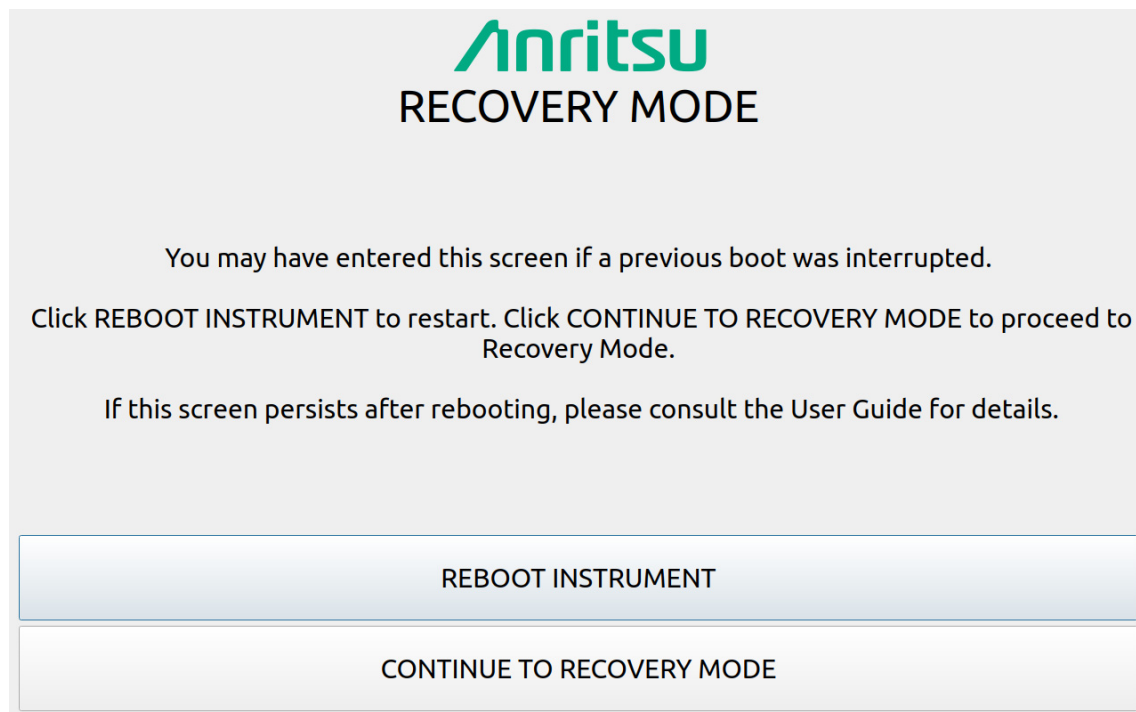
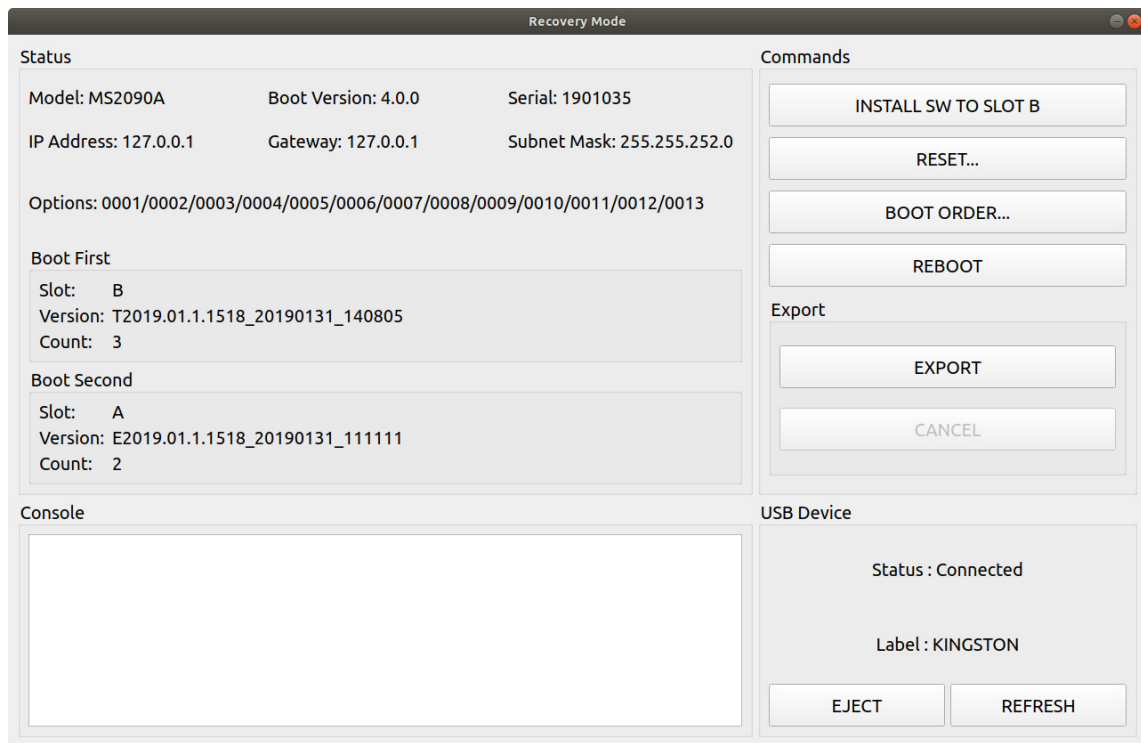


Figure A-1. Recovery Mode

If boot failure continues, a system recovery can be performed by pressing CONTINUE TO RECOVERY MODE.

The Recovery Mode menu (Figure A-2) shows the instrument information and provides a variety of reset options:

- Press REBOOT to reboot the instrument without any further action.
- Refer to “Reset” on page A-14 for information about various reset options.
- Refer to “Boot Order” on page A-15 to select a different boot order.
- Refer to “Install SW to SLOT X” on page A-14 to reload or update the system software.



1. Status: Shows the Model, Boot Version, Serial Number of the MS2090A, IP Address, Gateway, Subnet Mask.
2. Options: Shows the Options currently installed.
3. Boot First: Shows the Slot, Version, and Count in the Boot First position.
4. Boot Second: Shows the Slot, Version, and Count in the Boot Second position.
5. Console: Provides a readout of the reboot activity.
6. Commands: Choose the command method to restart the instrument:
 - INSTALL SOFTWARE TO SLOT B: Indicates which slot will be overwritten as described in “Install SW to SLOT X”
 - RESET: Provides the RESET dialog as shown in “Reset” on page A-14.
 - BOOT ORDER: Provides the Boot Order dialog as shown in “Boot Order” on page A-15.
 - REBOOT: Reboots the instrument.
7. Export: Choose to EXPORT or CANCEL to cancel the export.
8. USB Device: This section provides:
 - Status: The USB memory device is connected or unconnected.
 - Label: The Manufacturer of the USB memory stick.
 - EJECT: Select to eject and remove the USB memory stick.
 - REFRESH: Select to reconnect to the USB memory stick.

Figure A-2. Recovery Mode

Install SW to SLOT X

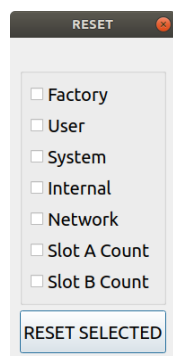
The recovery mode shows two slots (A and B). These slots contain different system software packages that are installed. Each slot contains the following information:

- Slot name (A,B): Boot version package (A or B).
- Slot count (3,2,1): The count indicates how many unsuccessful boot attempts before the slot is marked as unbootable. Every failed attempt decrements the value until it reaches 0 (unbootable). This count can be reset to 3 using the “Reset” menu.
- Slot version: The version represents the software package version available in the slot.

If a user chooses to install a new software package, they may do so by inserting a USB memory device with the system software file (.raub) and pressing “Install SW to SLOT X.” The X will be replaced with a B or A depending on which slot is to be overwritten. You will not be able to select which system software file will be installed from the attached USB, it will always install the first one found.

Reset

The recovery RESET dialog is shown in [Figure A-3](#). Here you can reset the MS2090A from the choices shown. Once selected, press the RESET SELECTED button.



Factory: Performs a Factory reset, which deletes last saved settings files for all applications.

User: Performs a User reset, which deletes all user setup, measurement, csv, limit, screenshot, IQ captures, and user calibration files.

System: Performs a Factory reset and also deletes event and error logs.

Internal: For service use only. Performs an Internal reset, which deletes non-volatile system files, except for critical files such as the serial number, options, and network configuration. Does not take effect until the next boot.

Network: Performs a Network reset, which deletes manual Ethernet settings and reverts the networking to DHCP. All saved Wireless networks will also be lost.

Slot A Count: Resets Slot A Count to 3. This is used for the recovery mode countdown.

Slot B Count: Resets Slot B Count to 3. This is used for the recovery mode countdown.

RESET SELECTED: Resets the MS2090A by the method chosen.

Figure A-3. RESET Dialog

Boot Order

The order of which slot is booted first can be changed from the BOOT ORDER menu (shown in [Figure A-4](#)). Selecting Swap will change the sequence order of the reboot: Slot A or Slot B. Once selected, select Close and then reboot the instrument.

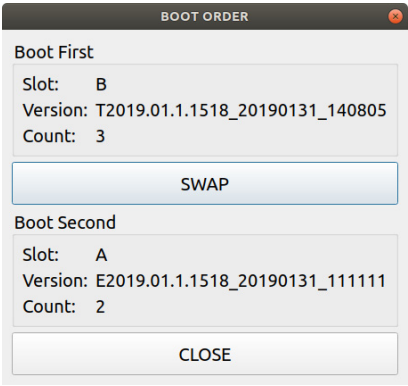
	<p>Boot First: Provides the first boot version to boot.</p> <ul style="list-style-type: none"> • Slot: Provides the slot designated location. • Version: Provides the boot version number. • Count: Boot attempts with this version. <p>SWAP: Swap Slot A and Slot B in the boot sequence.</p> <p>Boot Second: Provides the first boot version to boot.</p> <ul style="list-style-type: none"> • Slot: Provides the slot designated location. • Version: Provides the boot version number. • Count: Boot attempts with this version. <p>Close: Closes the BOOT ORDER dialog.</p>
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Figure A-4. BOOT ORDER

Appendix B — Software Option Upgrades

B-1 Introduction

Upgrading software options on MS2090A consists of two main steps:

1. Export and send the unit's configuration file to Anritsu.
2. Import the new license file provided by Anritsu

B-2 Exporting a Software Configuration File

Exporting the configuration file:

1. Insert a USB memory device.
2. Open the System menu from the upper left 3-bar icon.
3. Navigate to Settings > Options menu.
4. Touch SAVE CONFIG at the lower left of INSTALLED OPTIONS.
5. Save the configuration file to a USB memory device, preserving the default filename. The filename will be in the format of MS2090A_XXXXXXX.config on the USB drive when the operation is complete.
6. Email the file to [Anritsu] (example@example.com).

B-3 Importing Software License

Importing a new license file:


1. After receiving a new license file from Anritsu, place the file on the USB memory device in the top (root) level, not in any directory.
2. Open the System menu from the upper left 3-bar icon.
3. Navigate to Settings > Options menu
4. Touch ENABLE OPTIONS USING FILE at the lower right of INSTALLED OPTIONS.

The instrument will search for a valid license file on the USB memory device and apply the changes to the system.

5. Reboot the instrument and ensure all changes are applied.

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Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA
<http://www.anritsu.com>