Measurement Guide

Spectrum Analyzer

MS2090A Field Master Pro™
MS2080A Field Master™
MS2070A Field Master™
MS27201A Remote Spectrum Monitor

Spectrum Analyzer	**Included**
Wi-Fi	**Option 5**
Preamplifier	**Option 8**
Interference Finder	**Option 24**
Zero-Span IF Output	**Option 89**
Gated Sweep	**Option 90**
Coverage Mapping	**Option 431**
IQ Capture/Streaming	**Option 124/126 and 125/127**
Electromagnetic Field (EMF) Measurement	**Option 444**
AM/FM Modulation Measurement	**Option 509**

Note	Not all instrument models offer every option or every measurement within a given option. Port terminologies may differ according to the instrument. Refer to the Technical Data Sheet of your instrument for available options and supported measurements.

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Chapter 1 — General Information

1-1 Introduction

This measurement guide describes the spectrum analyzer measurement functions of the Anritsu Field Master Series and Remote Spectrum Monitor instruments. Basic spectrum analyzer functions are included with all Anritsu spectrum analyzers. Advanced functions are available only when the related option is installed and activated. Refer to Section 1-2 "Option Descriptions" for references regarding the discussion of the supported option. Refer to Chapter 2 for an overview of the spectrum analyzer interface. Refer to Chapter 3 for discussion on the spectrum analyzer setup and measurement settings.

Related Manuals

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

http://www.anritsu.com/en-us/test-measurement/products/ms2080a

http://www.anritsu.com/en-us/test-measurement/products/ms2070a

https://www.anritsu.com/en-US/test-measurement/products/ms2720xa

Product Information, Compliance, and Safety

Read the Product Information, Compliance, and Safety Guide for important safety, legal, and regulatory notices before operating the equipment:

- Field Master Series – PN: 10100-00069
- Remote Spectrum Monitor – PN: 10100-00064

User Guide

For a complete overview of the instrument hardware and system functions, refer to your instrument user guide. The user guide provides information on the following topics:

- Listing of all related documentation such as measurement guides, programming and maintenance manuals.
- Instrument Care, maintenance and calibration.
- External Connections to the top and side panels.
- Power Requirements and Battery Information.
- System settings such as Wi-Fi, GNSS/GPS, date/time, language settings, etc.
- Other advanced settings and tools such as file management, screenshot settings, port setup, and option configuration.
- Diagnostics and software updates.

1-2 Option Descriptions

This section provides a brief overview of the available options covered in this guide.

Note	Not all instrument models offer every option. Some options are available as a time-limited trial. For example, Coverage Mapping option is offered as a 90-day time-limited option by ordering Option 9431. The option start time begins when the user first activates the option. Please refer to the Technical Data Sheet of your instrument for information on purchasing and activating time-limited options.

Wi-Fi (Option 5)

Wi-Fi is available as an option for MS2070A Field Master.

Preamp (Option 8)

Preamplifier is available as an option for MS2070A Field Master.

Interference Analyzer (Option 24)

The interference analyzer option includes several features for finding and analyzing interfering signals. This option adds advanced measurement setups to the basic spectrum analyzer. It additionally adds an Interference Analyzer mode for displaying signal data on maps to aid in geo-locating interfering signals. Refer to the sections below for information on each measurement:

- "Interference Finder (Option 24)"
- "AM/FM Audio (Requires Option 24 or Option 509)"
  - "AM/FM Modulation Measurement (Option 509)"
- "IA Spectrum Analyzer (Option 24)"
  - "Interference Map"
  - "Interference Polar"

Zero Span IF Output (Option 89)

Zero span IF output adds an IF output connector to the top panel and additional menu controls to the FREQ/SPAN menu. Refer to "Zero Span IF Output (Option 89)" for information about using this feature.

Gated Sweep (Option 90)

Gated sweep is used for advanced sweep setups and adds additional menu controls to the SWEEP menu. Refer to "Gated Sweep (Option 90)".

IQ Capture and Streaming (Options 124/126 and 125/127)

This feature attains the magnitude/phase or real/imaginary raw data components of a waveform and either saves the data to a file on internal memory or external USB storage media, or streams the data out of the Data, USB, or Ethernet ports. Refer to "IQ CAPTURE Menu (Option 124/126)" and "IQ STREAMING Menu (Option 125/127)". Refer to Field Master Series and Remote Spectrum Monitors IQ Capture/Streaming Measurement Guide (PN: 10580-00490)

Coverage Mapping (Option 431)

Refer to "Coverage Mapping (Option 431)"section for more information.

EMF Measurement (Option 444)

Refer to "Electromagnetic Field (EMF) Measurements (Option 444)" section for more information.

AM/FM Modulation Measurement (Option 509)

The AM/FM modulation measurement evaluates the quality of the baseband signal retrieved from the modulated signal. The graphical representation of the baseband signal indicates the pattern of modulation depth/deviation versus frequency and time.

Other Options and Features

For descriptions of other options and features not covered in this guide, refer to your instrument user guide or the product page for a comprehensive list of available documentation.

1-3 Document Conventions

The following conventions are used throughout the instrument documentation set.

User Interface Navigation

The user interface consists of menus, buttons, toolbars, and dialog boxes. Elements in navigation paths are separated as follows: MARKER > PEAK SEARCH > NEXT PEAK.

Illustrations

Screen-captured images contained in this document are provided as examples. The chapters included in this measurement guide provide information on advanced measurement features, instrument settings and menu overviews, for a featured option. The actual displays, screen menus, and measurement details may differ based on the instrument, model, firmware version, installed options, and current instrument settings.

1-4 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 — Spectrum Analyzer Overview

2-1 Introduction

This chapter provides an overview of the spectrum analyzer user interface and describes the main graphical displays and menus presented in the spectrum analyzer measurement mode.

2-2 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 2-1. 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.

Note that not all analyzers are included in all instruments.Refer to your instrument's technical data sheet.

Figure 2-1. Example Analyzers

RF Spectrum View

RF 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.

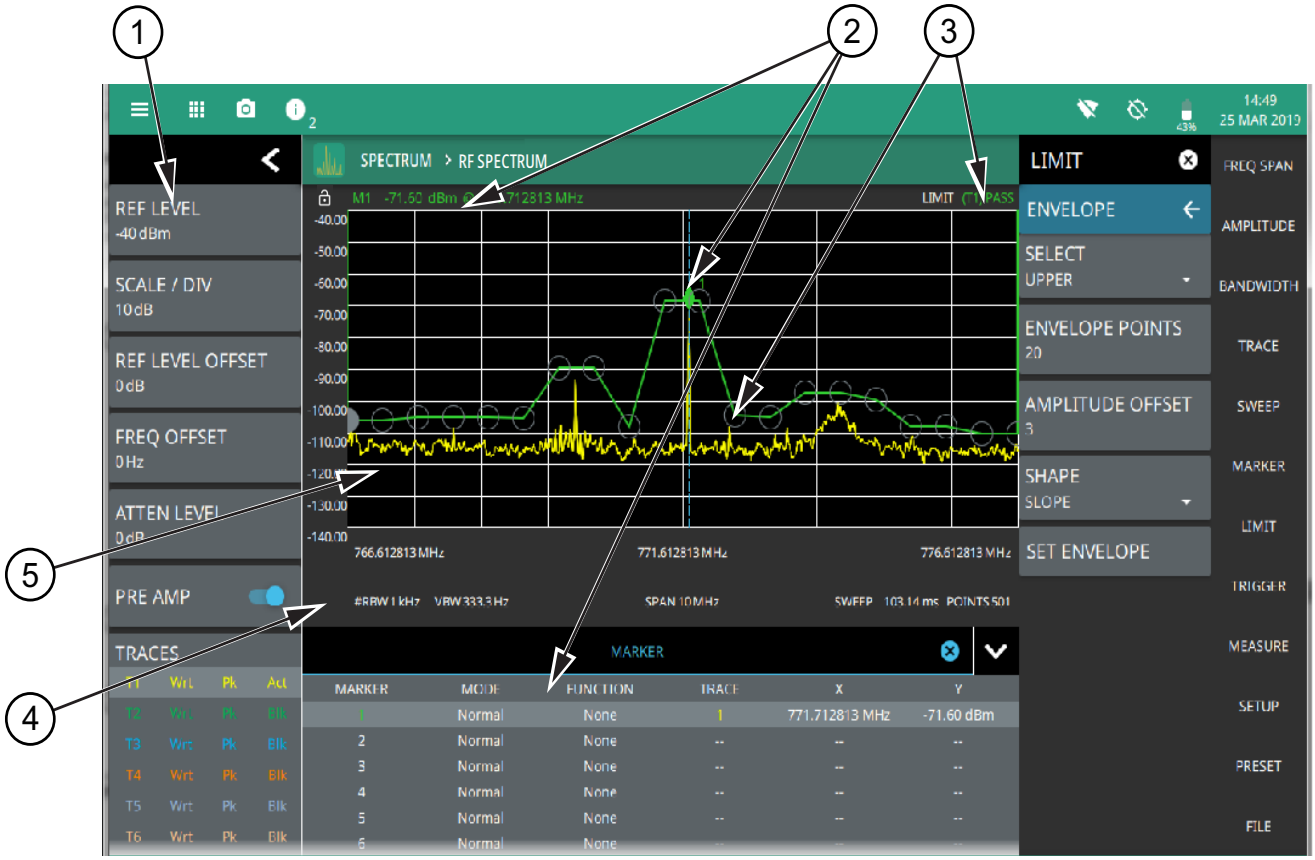


Figure 2-2. RF Spectrum View (1 of 2)

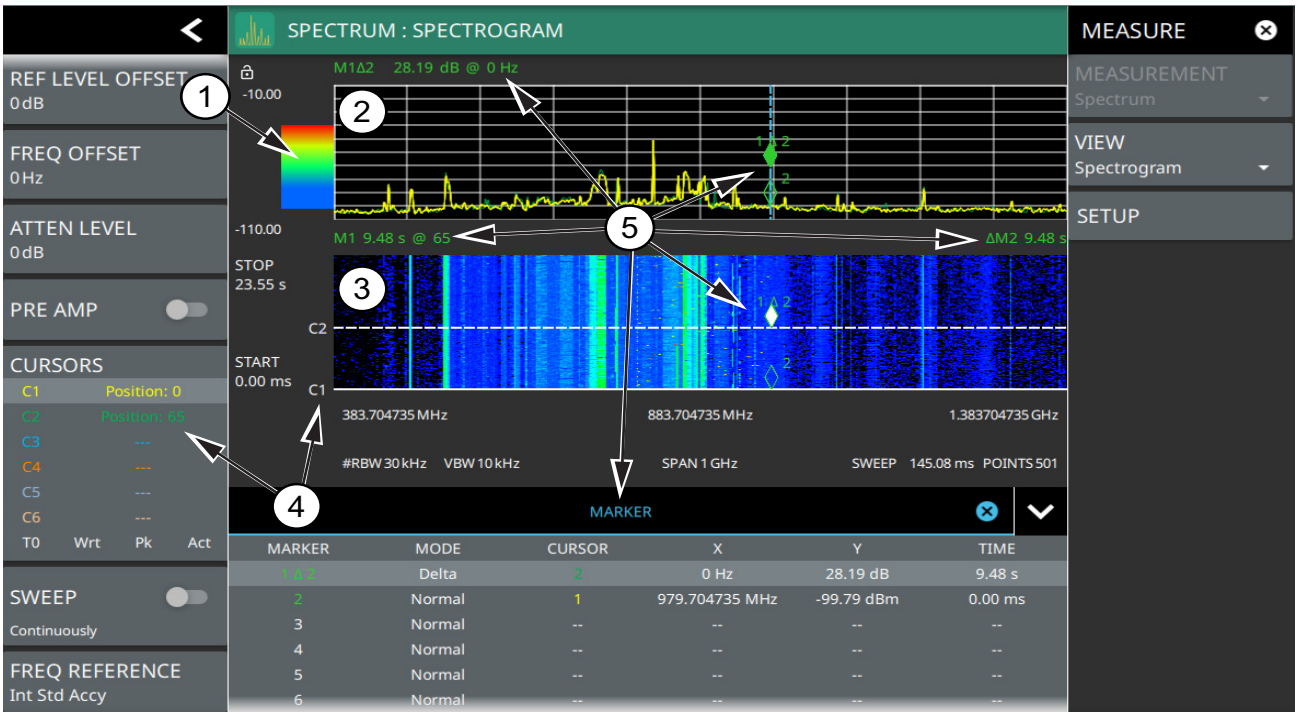
1. **Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. Refer to the "Status Panel" on page 2-6, for more information.
2. **Markers:** Markers are displayed as green diamonds on the trace to which 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 3-7 "Setting Trace 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. Selecting 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, Rolling Min or Max Hold, T1-T2, T2-T2. Traces can have Peak, RMS/Average, Negative, Sample, or Normal detectors. Traces can be set to Active, Hold/View, or Blank.

Figure 2-2. RF 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 “SETUP Menu (Spectrogram View)” on page 3-112 for more information on setting up the Spectrogram view.



1. **Color Bar:** The color bar is used to adjust the colors displayed at different amplitude levels. The color bar shown here represents the range of colors that will be displayed. This bar can be dragged up or down to adjust the coverage area. If signals or noise is outside of the color bar range, then black is displayed. The color bar top and bottom setting, and the overall hue to the color range is set via the “SETUP Menu (Spectrogram View)” on page 3-112, which can be opened by pressing the color bar.
2. **Spectrum Window:** The upper display area shows spectrum trace data in the frequency domain. Up to six traces can display data from different times depending on how the corresponding cursors are set in the spectrogram display below. Note that the spectrum display shows trace amplitude (vertical axis) data in the time (horizontal axis) domain.
3. **Spectrogram Window:** The lower display area shows spectrogram trace data in the time (vertical axis), frequency (horizontal axis), and amplitude (color) domains. The bottom of the spectrogram displays the current sweep at the current time (0 ms) or position 0. When a sweep completes, the entire display is shifted up and the new trace is added to the bottom of the spectrogram. The spectrogram holds 142 sweeps (cursor positions) and the stop time reflects the time taken to complete all of the sweeps.
4. **Cursors (C1 to C6):** Cursor information for the currently set cursor type (time or position) is shown in the status panel. Cursors are shown on the spectrogram as white lines at the currently set cursor time or position. Refer to “Spectrogram with Cursors and Markers” on page 3-46.
5. **Markers:** Marker and marker data are shown in a variety of locations. Markers can be placed on different cursors to help you compare measurements at different points in time as well as frequency. Refer to “Spectrogram with Cursors and Markers” on page 3-46.

Figure 2-3. Spectrogram View

2-3 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 3-3 “Setting Frequency Parameters”.
AMPLITUDE	**AMPLITUDE:** Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 3-4 “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 3-4 “Setting Amplitude Parameters”.
TRACE	**TRACE:** Provides trace/cursor and detection-related controls to set trace/cursor behaviors, presets, and access to the trace/detector settings table. Refer to Section 3-7 “Setting Trace Parameters”.
SWEEP	**SWEEP:** Provides controls for sweep behaviors, number of measurement points, and gated sweep settings (Option 90). Refer to Section 3-8 “Setting Sweep Parameters”.
MARKER	**MARKER:** Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 3-9 “Setting Up Markers”.
LIMIT	**LIMIT:** Provides controls for setting up limit lines and limit alarms. Refer to Section 3-10 “Setting Up Limit Lines”.
TRIGGER	**TRIGGER:** Controls the trigger source, delay and holdoff, and trigger slope settings. Refer to Section 3-11 “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 3-12 “Setting Up Advanced Measurements”.
SETUP	**SETUP:** Measurement controls for setting up advanced measurements. Refer to “Setting Up Advanced Measurements” on page 3-56).
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 3-24 “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 3-116.

Figure 2-4. Main Menu

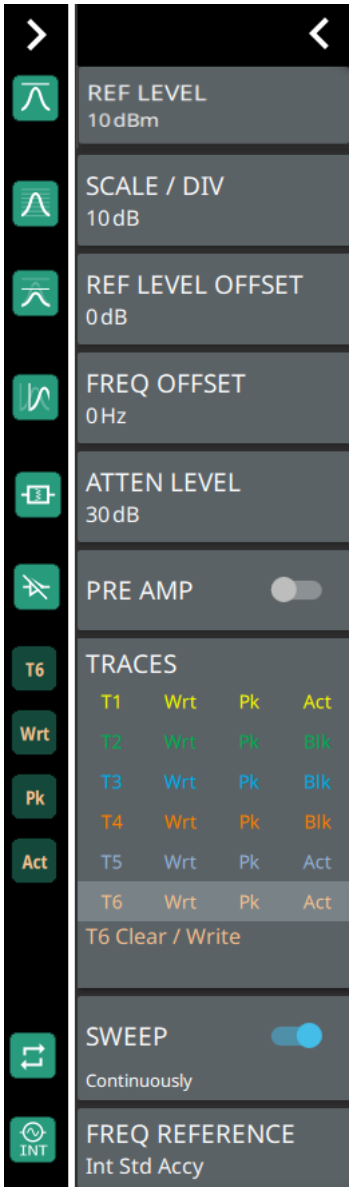
Using Menus

Instrument setup, control, and measurement functions are performed through the use of menus. Menu behaviors are summarized below:

- Selecting a main menu button opens an associated menu.
- The name of the button pressed in the main menu is reflected in the title bar of the resulting menu.
- Menu buttons can change for various measurement settings, instrument setup parameters, and measurement views.
- Selecting the corresponding main menu button for a menu closes the menu.
- Touching status data, a parameter field, or label in the display area opens the corresponding menu and the associated keypad for editing that parameter setting.
- Selecting Accept, Cancel, or the X in the upper right corner closes the menu or keypad.

2-4 Status Panel

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



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

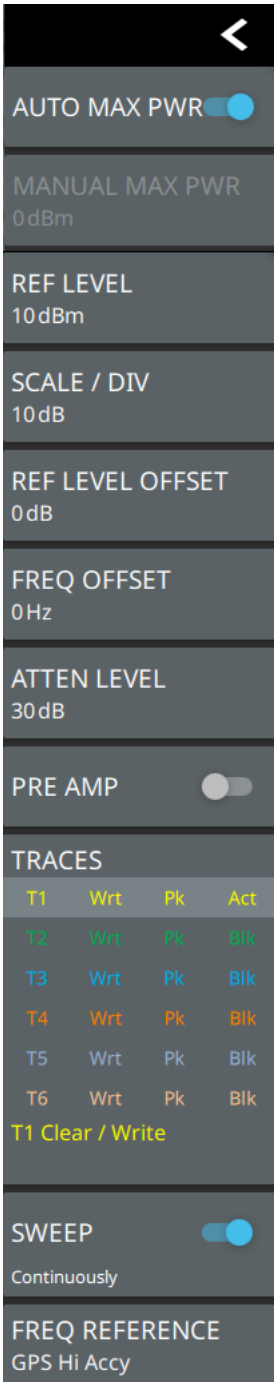
TRACES/CURSORS: Displays the current status of up to six traces or cursors in a quick-view summary. When the measurement view is set to Normal (Spectrum), trace information is displayed in this area. When the measurement view is set to Spectrogram, cursor information is displayed in this area. Cursors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

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 2-5. Spectrum Analyzer Status Panel with Minimized Status Panel Icons



Selecting 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.

AUTO MAX PWR: Displays in SEM measurements only. Enabling this automatically calculates the reference channel power.

MANUAL MAX PWR: Displays in SEM measurements only. Used to manually enter the reference channel power.

Refer to Section 3-16 “Spectrum Emission Mask” on page 3-72.

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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 2-6. Spectrum Analyzer Status Panel

Refer to Chapter 3 for SPA measurement setup.

Chapter 3 — Spectrum Analyzer Measurements

3-1 Introduction

The purpose of this chapter is to provide a starting point for making basic spectrum measurement setups. This chapter describes general instrument setup, including setting up frequency, bandwidth, amplitude, span, limit lines, and markers. After measurements are taken, refer to "File Management" section of Instrument Overview chapter of the user guide and Section 3-25 "Saving and Recalling Measurements" on page 3-114 for a detailed 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, 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 3-12 through Section 3-22 cover field measurements and additional smart measurements provided by various options.

3-2 Connecting a Signal Source

The basic setup starts with connecting a signal source to the RF IN port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured. For direct conducted measurements, ensure the RF source does not over power the input of the analyzer.

Note	For connector panels descriptions and torque specifications, refer to the product user guide. For RF input power limitations, refer to the product technical data sheet.

After an RF source is connected to the input connector, follow the sections below for setting up the measurement parameters.

3-3 Setting Frequency Parameters

Frequency-related parameters are set using the "FREQ / SPAN Menu" on page 3-6. 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. Select FREQ SPAN on the main menu.
2. Select 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. Select the appropriate frequency unit to terminate the entry or press ACCEPT to terminate the entry with the current frequency unit.
5. Select 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. Select 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 (refer to the user guide for view the relevant graphs).

Entering a Center Frequency

1. Select FREQ SPAN on the main menu.
2. Select 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 and right edge of the menu.
4. Select 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.

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 2-4 "Status Panel"). To remove a frequency offset, open the FREQ SPAN menu and set FREQUENCY OFFSET to 0 Hz. You can also access this parameter directly from the left side status panel.

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

Setting the Span

1. Select FREQ SPAN on the main menu.
2. Select 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. Select 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 3-7). 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 (Option 89)" on page 3-7.

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 used.

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

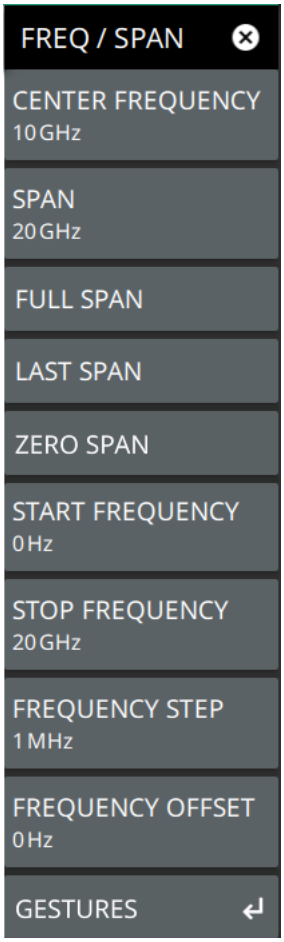
"Inverted" means that the IF is spectrally inverted from the input (as the input frequency goes higher, the IF goes lower).
"Not Inverted" means that the IF is not spectrally inverted (as the input frequency goes higher, the IF goes higher).

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



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.

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. Selecting 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: Selecting this button sets the span to cover the entire tunable spectrum of the instrument.

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

ZERO SPAN: Sets the analyzer to zero span and enables the "FREQ / SPAN Zero Span Menu" on page 3-7.

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. Selecting the plus (+) or minus (–) control moves the start frequency in steps defined by the FREQUENCY STEP value.

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

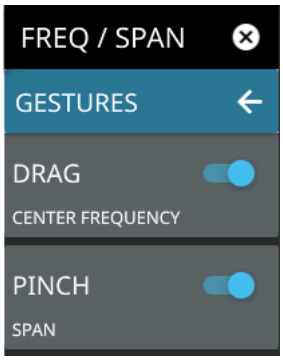
FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (–) control.

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

GESTURES: Opens the "GESTURES Menu" on page 3-6.

Figure 3-1. FREQ / SPAN Menu

GESTURES Menu



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.

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

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

Figure 3-2. GESTURES Menu

FREQ / SPAN Zero Span Menu

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.

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. Selecting 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: Selecting this button sets the span to cover the entire tunable spectrum of the instrument.

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

ZERO SPAN: Sets the analyzer to zero span and enables the "FREQ / SPAN Zero Span Menu" on page 3-7.

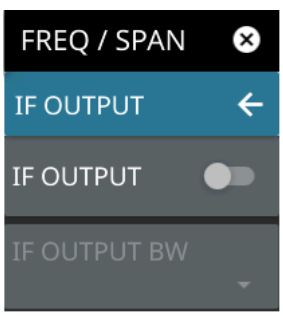
FREQUENCY STEP: Sets the frequency step value used for the plus (+) or minus (–) control.

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

IF OUTPUT: Opens the "IF OUTPUT Menu (Option 89)" on page 3-7. Requires Option 89.

Figure 3-3. FREQ / SPAN Menu

IF OUTPUT Menu (Option 89)



IF OUTPUT: Toggles the top panel IF output on or off. When IF output is on, the IF OUTPUT BW button becomes active.

IF OUTPUT BW: When IF output is on, this button provides a list of IF output bandwidth settings.

Figure 3-4. IF OUTPUT Menu

3-4 Setting Amplitude Parameters

The amplitude scale corresponds to the y-axis display. The instrument supports both log units (such as dBm and dBV) and linear units of scale (such as volts or watts). Amplitude-related parameters are set using the "AMPLITUDE Menu" on page 3-11.

Setting Amplitude Units

This setting allows you to set the y-axis graticule units and applies to most of the spectrum analyzer measurements, including markers, traces, and limit lines. To change the amplitude units:

1. Select AMPLITUDE > Y AXIS UNIT.
2. Select the desired y-axis amplitude units from the following:

- Logarithmic:
  - Spectrum analyzer measurements: dBm (default), dBV, dBmV, dBµV, or dBA
  - Field strength and EMF measurements (Option 444): dBm/m^2, dBW/m^2, dBV/m, dBmV/m, dBµV/m
- Linear:
  - Spectrum analyzer measurements: Volt (scalable to V, mV, µV, nV), Watt (scalable to W, mW, µW, nW, pW, fW), and A (scalable to A, mA, µA, nA)
  - Field strength and EMF measurements (Option 444): V/m, W/m^2, W/cm^2, A/m

When switching amplitude units, the following parameters are affected as described below:

- Reference level is converted directly from the current unit into the new unit and scaled appropriately. For example, if the current units are dBm and ref level is set to –30 dBm, when changing the units to volts, the ref level is converted to 0.00707 V and scaled to 7.07 mV.
- The reference level offset is always entered in dB. When linear units are selected, the dB offset is converted to an offset to match the selected units and applied to the measurement displays.
- When changing from log units to log units, scaling (dB/div) remains unchanged. When changing from log units to linear units, scaling is not applicable in linear units.
- When a linear unit is selected, the top graticule line is set to the value of the converted reference level and the bottom line of the graticule is set to zero. The remaining graticule lines are calculated by dividing the reference level into 10 equal parts. For example, if the ref level is 5 mv, the graticule lines will be labeled as follows (from top to bottom): 5.00, 4.50, 4.00, 3.50, 3.00, 2.50, 2.00, 1.50, 1.00, 0.00.
- Trace in a "HOLD / VIEW" mode will be scaled to match the newly selected units.
- Marker amplitudes will be scaled to match the newly selected units.
- Limit line points will be directly converted and displayed in the newly selected amplitude units.
- Trigger levels will be converted to the newly selected units.
- Measurements and setups will be converted to the newly selected units.
- Save and recall will retain the units configuration.
- Power cycle will retain the current units configuration.

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 3-10). 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.

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 operation and allows you to set the y-axis graticule scale for log-based units only.

1. Select AMPLITUDE > SCALE/DIV.
2. Enter the desired number of units per division.

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 always in dB, even if linear amplitude units are selected. 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. Select 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 3-11.
- 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 3-16.
- Use trace averaging if VBW is already set to 1 Hz. Refer to "Setting Trace Parameters" on page 3-19.

Preamplifier

The preamplifier can be turned on and off by toggling PRE AMP via the status panel or the AMPLITUDE menu. Figure 3-5 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.

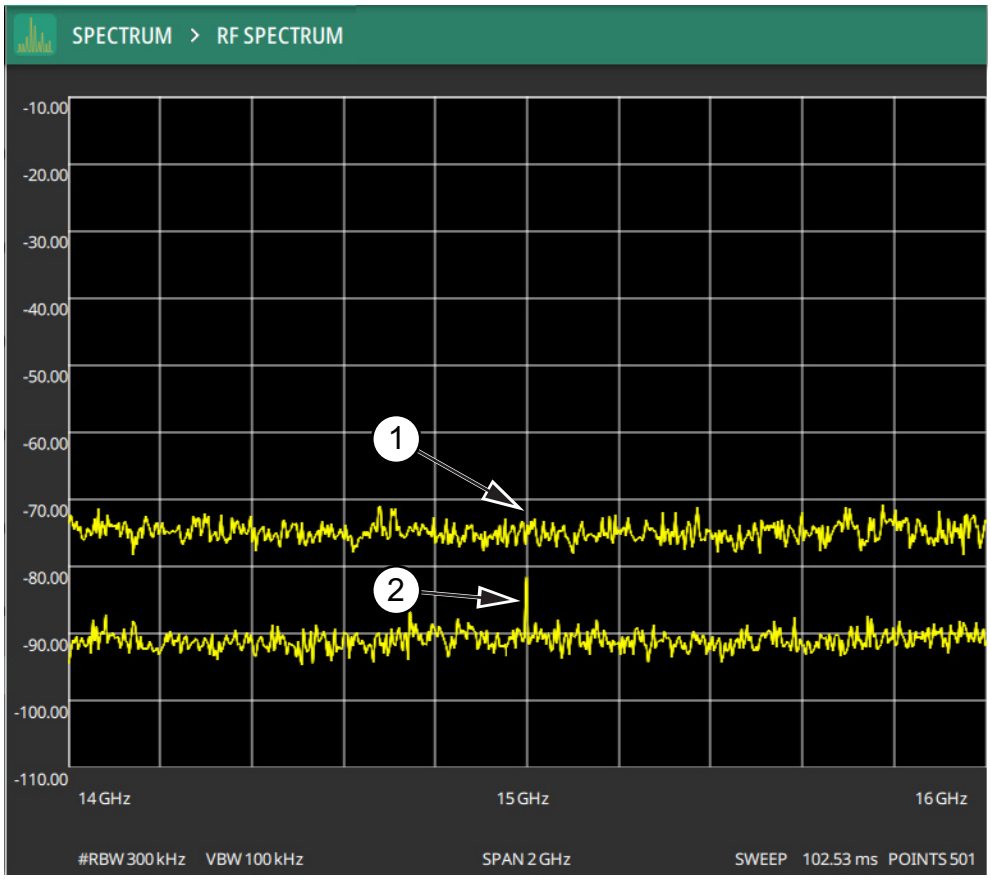


Figure 3-5. 1. Preamplifier Off
2. Preamplifier On

Indications of Excessive Signal Level

The Field Master Series 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 3-6). 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 3-6. ADC Overrange

AMPLITUDE Menu

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. Selecting the plus (+) or minus (–) control increments the value by 10. The plus/minus (+/-) button on the keypad toggles between positive and negative values.

AUTO REF LEVEL: Auto reference level automatically adjusts the reference level to place the highest signal amplitude at about two graticule lines from the top based on the position of the trace at the time the button is pressed.

SCALE/DIV: The scale can be set from 1 dB per division to 15 dB per division. The default setting is 10 dB. Selecting the plus (+) or minus (–) control changes the value by 1. SCALE/DIV is not available when linear y-axis amplitude units are selected.

Y AXIS UNIT: Selects the y-axis amplitude units. Available units are:

Logarithmic:

- Spectrum analyzer measurements: dBm (default), dBW, dBV, dBmV, dBµV, or dBA
- Field strength and EMF measurements (Option 444) dBm/m^2, dBW/m^2, dBV/m, dBmV/m, dBµV/m

Linear:

- Spectrum analyzer measurements: Volt (scalable to V, mV, µV, nV), Watt (scalable to W, mW, µW, nW, pW, fW), and A (scalable to A, mA, µA, nA)
- Field strength and EMF measurements (Option 444): V/m, W/m^2, W/cm^2, A/m

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 and will always be presented in dB units. Selecting 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 3-9.

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 3-10.

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.

ATTEN LEVEL: When auto attenuation is off, the attenuation value can be set manually to a resolution of 5 dB. Selecting the plus (+) or minus (–) control increments the value by 10.

FIELD STRENGTH: Opens the "AMPLITUDE FIELD STRENGTH Menu" on page 3-13. Refer to Section 3-5 "Field Strength" on page 3-12 for a description of the measurement.

GESTURES: Select GESTURES to lock the reference level by toggling the DRAG button on/off.

Figure 3-7. AMPLITUDE Menu

3-5 Field Strength

The field strength measurement is selected using the RF Spectrum mode. The field strength measurement is used in conjunction with an Anritsu antenna that has known antenna factors. Users can also import custom antenna factors for antennas not listed in the standard antenna selection list. When the field strength measurement is enabled, an additional plot is shown at the bottom of the display, indicating the selected antenna factor over the currently set frequency span. The field strength measurement is a measure of the RF power density that automatically compensates for the selected antenna factor. If an antenna is not selected, then the antenna gain is assumed to be 0 dB over the entire measurement range and the measurement can be manually compensated for using the "Antenna Calculations" on page 3-15, or to otherwise convert from one unit of measure to another.

1. When the field strength measurement is enabled (2), all amplitude units are converted to display field strength in the selected units.
2. The field strength measurement and antenna is selected from the AMPLITUDE menu.
3. The ANTENNAS dialog is displayed when ANTENNA is selected from the FIELD STRENGTH menu (2).
4. The antenna factor profile (in dB) is plotted across the currently set sweep range for the selected antenna.

Figure 3-8. Field Strength Measurement

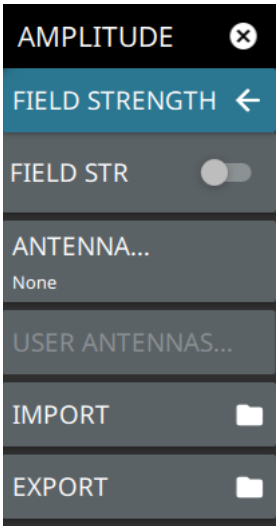
Frequency and level settings for many interfering signals can be set as follows:

1. Set up the measurement frequency and bandwidth.
2. Select the AMPLITIDE and set up the amplitude parameters.
3. Select the FIELD STRENGTH button and enable FIELD STR.
4. Select the ANTENNA button and select the antenna being used for the measurement.

Field strength is a constant measurement; after it is turned on, it remains on until FIELD STR is toggled off.

AMPLITUDE FIELD STRENGTH Menu

The FIELD STRENGTH menu is available in AMPLITUDE > FIELD STRENGTH. Once the field strength measurement is enabled, the FIELD STRENGTH menu can be quickly accessed by tapping on the Antenna factor display area below the spectrum window.



FIELD STR: Toggles the field strength measurement on or off. When toggled on, the trace detector type is set to RMS/Avg and the antenna factor profile is displayed.

ANTENNA: Displays the antenna selection dialog (see Figure 3-8 on page 3-12).

USER ANTENNAS...: Displays a list of user antennas. User antenna files are imported as comma separated value files. The file can contain multiple antennas and must conform to the following:

- Each antenna name must be unique, contain alpha-numeric characters only, and must be on a single line.
- Frequency must be in MHz.
- Antenna factors must be in dB.

IMPORT: Imports a user antenna file (.csv).

EXPORT: Exports a user antenna data file (.csv). If none exist, exports an example user antenna data file with instructions on how to create a usable antenna data file.

Figure 3-9. FIELD STRENGTH Menu

Example User Antenna Data

To create a list of custom antenna factors, use the following steps:

1. Export the existing USER ANTENNAS csv file by pressing the EXPORT button in the FIELD STRENGTH menu.
2. From the FILES menu, move the exported file to a USB memory device and then to a computer for editing.
3. If this is the first time exporting the file, read the instructions at the top of the file, then delete those rows:

```
**
This is an EXAMPLE. Make sure to REPLACE and DELETE all existing content in
this file, including these instructions.
Accepted criteria:
Each Antenna name must be unique, contain alpha-numeric characters only, and
must be on a single line
Frequency must be in MHz
Factors must be in dB
Please use the following examples as a guide:
**
```

4. Name each custom antenna and add cal factors below, per the instructions in the header:

```
Antenna_Example1
1920  35.886
1930  35.931
1940  35.976
1950  36.021
1960  36.065
1970  36.109
1980  36.153
Antenna_Example2
2110  36.706
2120  36.747
2130  36.788
2140  36.828
2150  36.869
2160  36.909
2170  36.949
```

5. Save the file to a USB memory device and insert it into the instrument.
6. Select the IMPORT button in the FIELD STRENGTH menu and select the new file from the USB drive.
7. Select USER ANTENNAS… button to view the list of imported antennas.

Antenna Calculations

This section provides a list of various antenna calculations to convert from one unit of measure to another.

Definitions

P = power in watts

V = voltage level in volts

R = resistance in ohms

Note that 1 mW = 10^{-3} W and 1 µV = 10^{-6} V

E = field strength in V/m

H = magnetic field strength in A/m

Z_0 = characteristic impedance of vacuum, 120π ohm ~ 377 ohm

P_d = Power density in W/m^2

r = distance from antenna in meters

AF = antenna factor, ratio of incident electromagnetic field to the output voltage

A_e = antenna equivalent area

g = antenna gain as power ratio

G = antenna gain in dBi

C_0 = speed of light in vacuum, 299,792,458 m/s

Equations

$P = V^2/R$

$V_{dB\mu V} = P_{dBm} + 107$ dB

$A_e = g(\lambda^2/4\pi)$

$G = 10*\log(g)$

$g = 10^{G/10} = (9.73/\lambda 10^{AF/20})^2$

$f = C_0/\lambda$

$P_r = A_e P_d$

$P_d = P_t G_t/(4\pi r^2)$ (Power density at a point)

$P_d = E^2/Z_0 = E^2/120\pi = Z_0 H^2$

$E = Z_0 H = \sqrt{(P_d 120\pi)}$

$AF = 20*\log(9.73/\lambda\sqrt{g})$

The field strength equations are only valid in the far field, where electric and magnetic fields are related by the characteristic impedance of free space.

3-6 Setting Bandwidth Parameters

Bandwidth parameters are set using the "BANDWIDTH Menu" on page 3-18.

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. Zero span is used for noise and noise-like measurements that are usually wider than the RBW. The RBW is ideally set to be as wide as the bandwidth of the signal you are measuring.

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. Therefore, 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. Select 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. Select BANDWIDTH on the main menu.
2. Select 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.

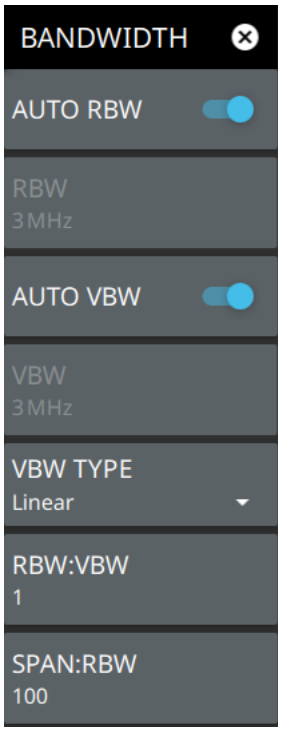
Auto coupling VBW links the video bandwidth to the resolution bandwidth so that VBW varies in proportion to RBW. If manual VBW coupling is selected, the VBW label at the bottom of the graph is prefixed with the "#" symbol and video bandwidth is set independently of resolution bandwidth.

By default, the RBW/VBW ratio is set to 3 and can be changed as follows:

1. Select BANDWIDTH on the main menu.
2. Select RBW/VBW and enter the desired value.

The RBW range varies with instrument features. Refer to "BANDWIDTH Menu" on page 3-18 and check your technical data sheet for the bandwidth range of your instrument.

BANDWIDTH Menu



AUTO RBW: When toggled on, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the SPAN:RBW button. When toggled off (manual), the RBW label at the left edge of the x-axis will be preceded by the “#” symbol.

RBW: The current resolution bandwidth is displayed under the RBW button. 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.

AUTO VBW: When toggled on, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW:VBW button. When toggled off (manual), the VBW label at the left edge of the x-axis will be preceded by the “#” symbol.

VBW: The current video bandwidth is displayed under the VBW button. 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.

VBW TYPE: Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean).

RBW:VBW: This parameter displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, press this button and use the keypad or the slider controls.

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.

Note: When Quasi-Peak marker is set, RBW and VBW are automatically set to meet the CISPR specification. See “Marker Functions” on page 3-45.

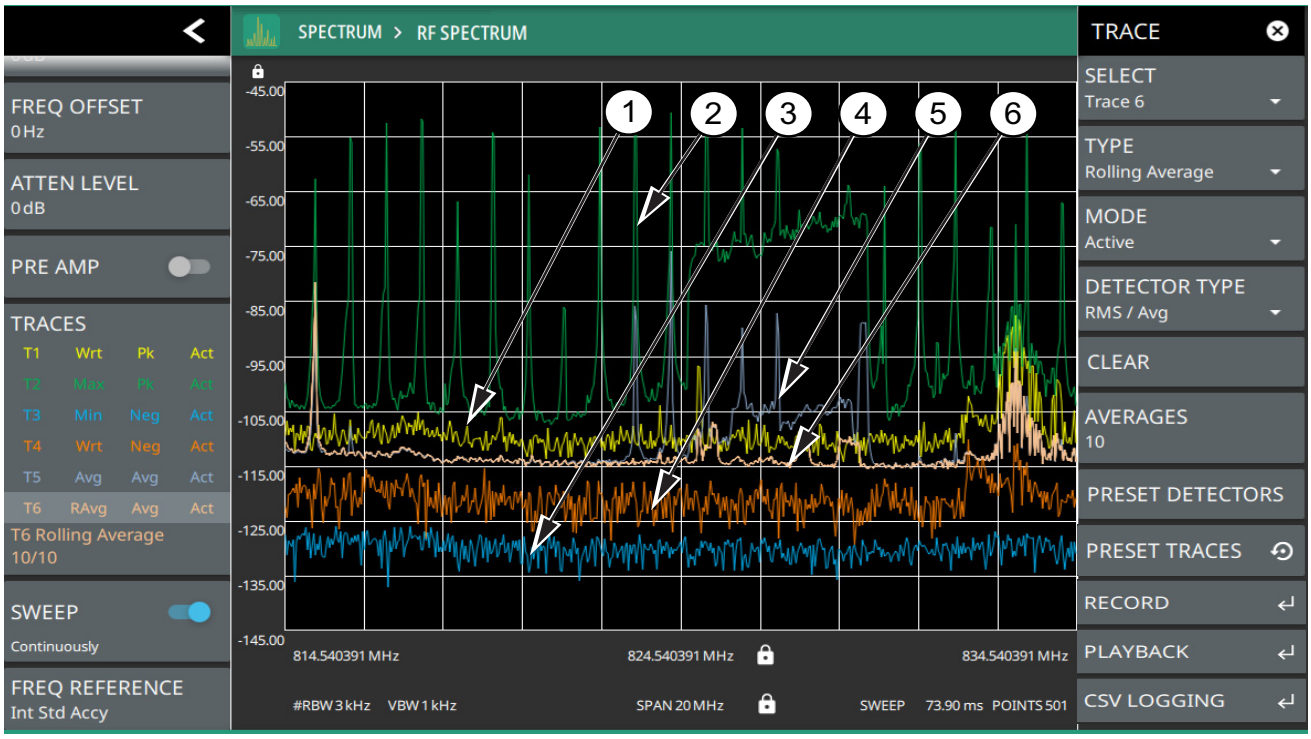
Figure 3-10. BANDWIDTH Menu

3-7 Setting Trace Parameters

Field Master Series 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 RF 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 3-27 and "" on page 3-28.

Traces in RF Spectrum View

The figure below shows all six traces enabled on a signal, each with a different trace or detector type setting. The left side status panel shows a trace setup summary table. Touching one of the trace rows in the table will enable the trace and open the TRACE menu.

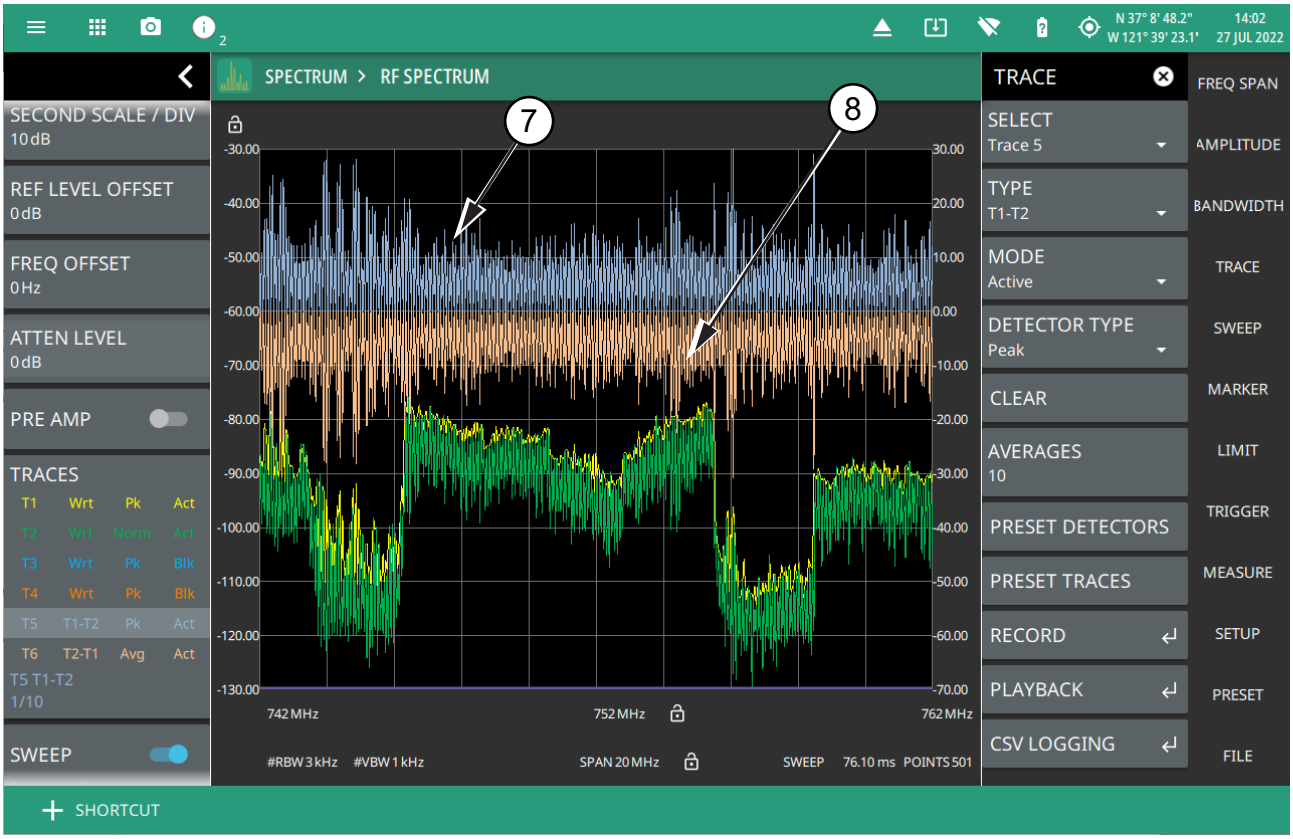


1. Clear/Write and Peak Detection: This is the default trace setting. The trace is cleared during each sweep and the largest measurement point is used for each display point.
2. Max Hold and Peak Detection: Each trace point retains its maximum value and the largest measurement point is used for each display point.
3. Min Hold and Negative Detection: Each trace point retains its minimum value and the smallest measurement point is used for each display point.
4. Clear/Write and Negative Detection: Trace points are cleared during each sweep and the smallest measurement point is used for each display point.
5. Average and RMS/Average Detection: The trace points are an average of 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.
6. Rolling Average: The rolling average of the last N traces, where N is the AVERAGES setting.

Figure 3-11. Traces – RF Spectrum View

Trace Math in RF Spectrum View

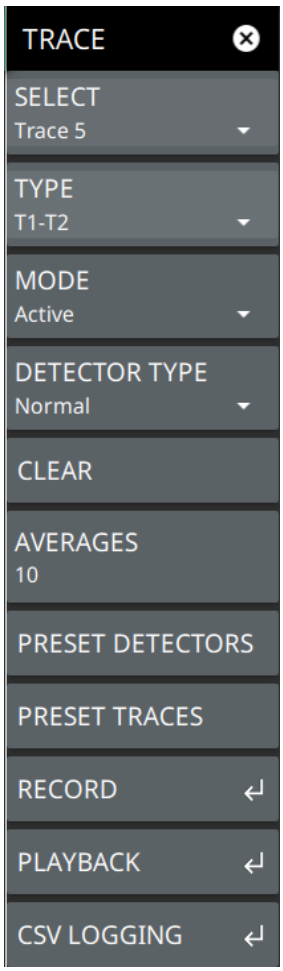
The figure below shows the instrument with trace 5 and 6 enabled on a signal, each with a different trace or detector type setting. The left side status panel shows a trace setup summary table. Touching one of the trace rows in the table will enable the trace and open the TRACE menu. In trace math, the T2-T1 or T1-T2 operation performs a division of the linear powers (watts) of trace 2 divided by trace 1 and vice versa, this is equivalent to the subtraction of the log powers (dBm). The operation does not change depending on the amplitude units and the resulting math trace is always in dB. When a math trace enabled, a secondary Y axis appears on the right side of the trace window. Most measurements are incompatible with dB values and will stop updating when a math trace is the active trace. Limit lines on math traces interpret their values as (dB).



7. T1-T2: Appears only when Trace 5 is enabled. When selected displays the difference between T1 and T2, in addition to the second Y axis on the right hand side.
8. T2-T1: Appears only when Trace 6 is enabled. When selected displays the difference between T2 and T1, in addition to the second Y axis on the right hand side.

Figure 3-12. Traces – RF Spectrum View

TRACE Menu (Spectrum View)



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.

TYPE: Selects one of the following types of traces:

- **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- **Average:** The exponential 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.
- **T1-T2:** This option appears only when Trace 5 is enabled.
- **T2-T1:** This option appears only when Trace 6 is enabled.

MODE: Selects one of the following trace modes:

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

Figure 3-13. 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.
- **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. Only available in zero span and RSSI measurements. When Sample detector is selected, all traces must use sample detection.
- **Normal:** Shows random noise and signal data depending on the nature of the sampled data. If the signal both rises and falls during the sampling interval (random noise), then odd-numbered sampling intervals display the maximum value and even-numbered sampling intervals display the minimum value. Odd-numbered sampling intervals will display the peak value of the previous even-numbered sampling interval when the peak there is higher. If the signal only rises or only falls during the sampling interval (signal), then only the peak value is displayed, and Normal detection is then equivalent to Peak detection.

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.

RECORD: Opens the "TRACE RECORD Menu" on page 3-33.

PLAYBACK: Opens the "TRACE PLAYBACK Menu" on page 3-34.

CSV LOGGING: Opens the "TRACE CSV LOGGING Menu" on page 3-35.

Figure 3-13. TRACE Menu (2 of 2)

Trace Detector Types

The figure below illustrates how the available detector types determine a trace data point from the sampled data.

Peak

Shows the maximum amplitude of sampled data for each display point, assuring that a narrow peak is not missed.

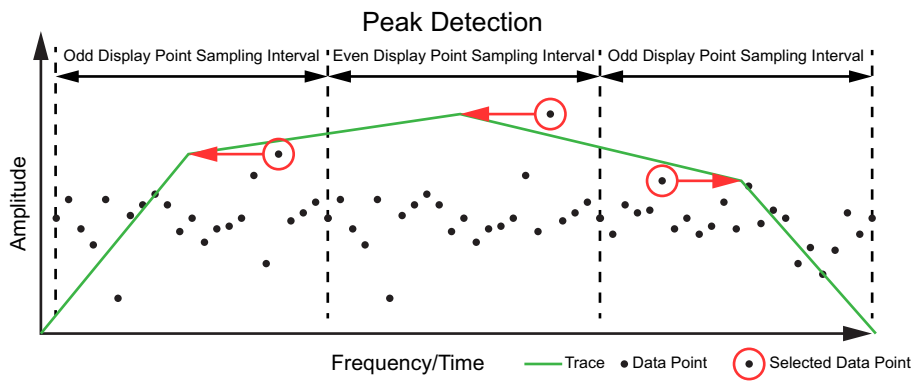


Figure 3-14. Peak Detector Type

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.

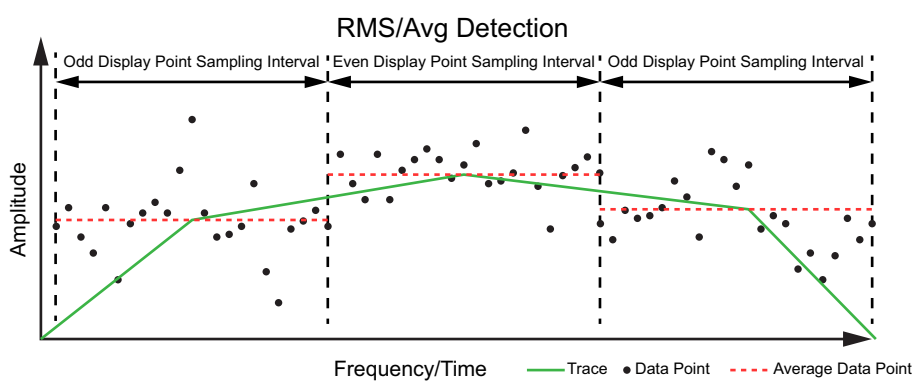


Figure 3-15. RMS/Avg Detector Type

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.

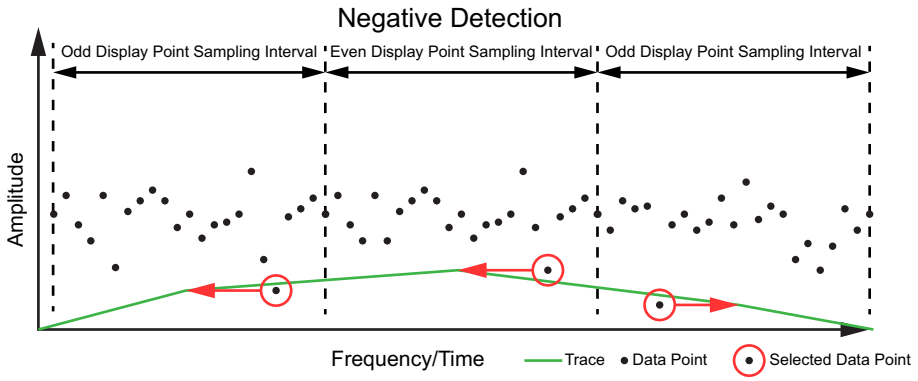


Figure 3-16. Negative Detector Type

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. Only available in zero span and RSSI measurements.

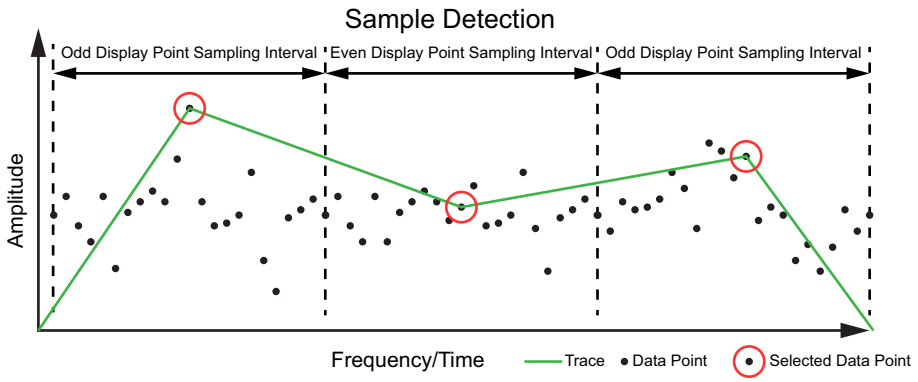


Figure 3-17. Sample Detector Type

Note	When Sample detector is selected, all traces must use sample detection.

Normal

Shows random noise and signal data depending on the nature of the sampled data. If the signal both rises and falls during the sampling interval (random noise), then odd-numbered sampling intervals display the maximum value and even-numbered sampling intervals display the minimum value. Odd-numbered sampling intervals will display the peak value of the previous even-numbered sampling interval when the peak there is higher. If the signal only rises or only falls during the sampling interval (signal), then only the peak value is displayed, and Normal detection is then equivalent to Peak detection.

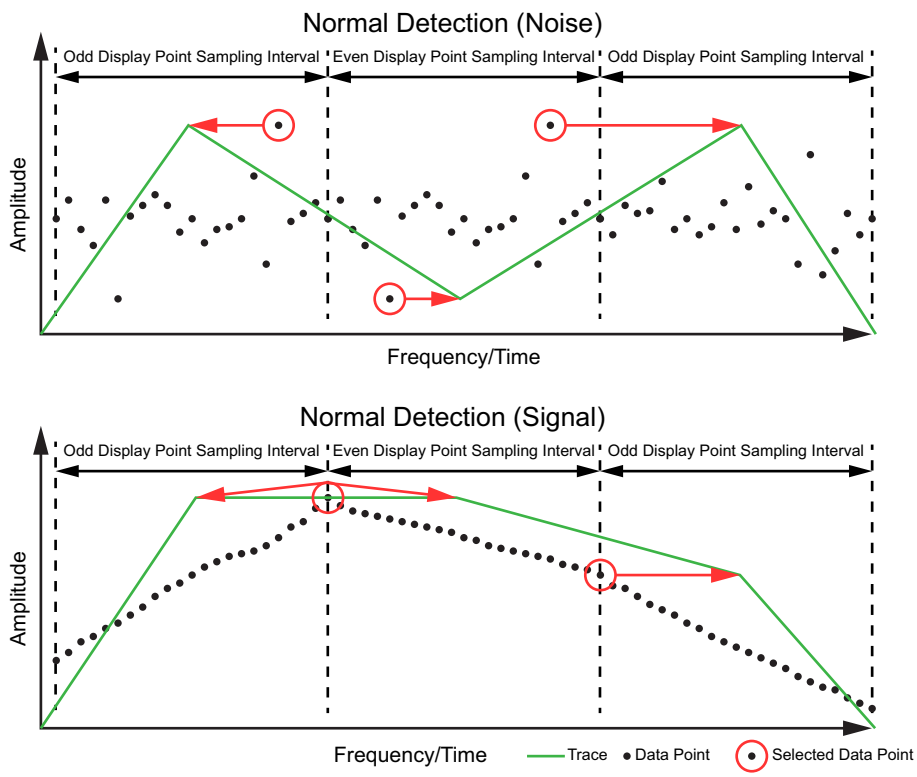
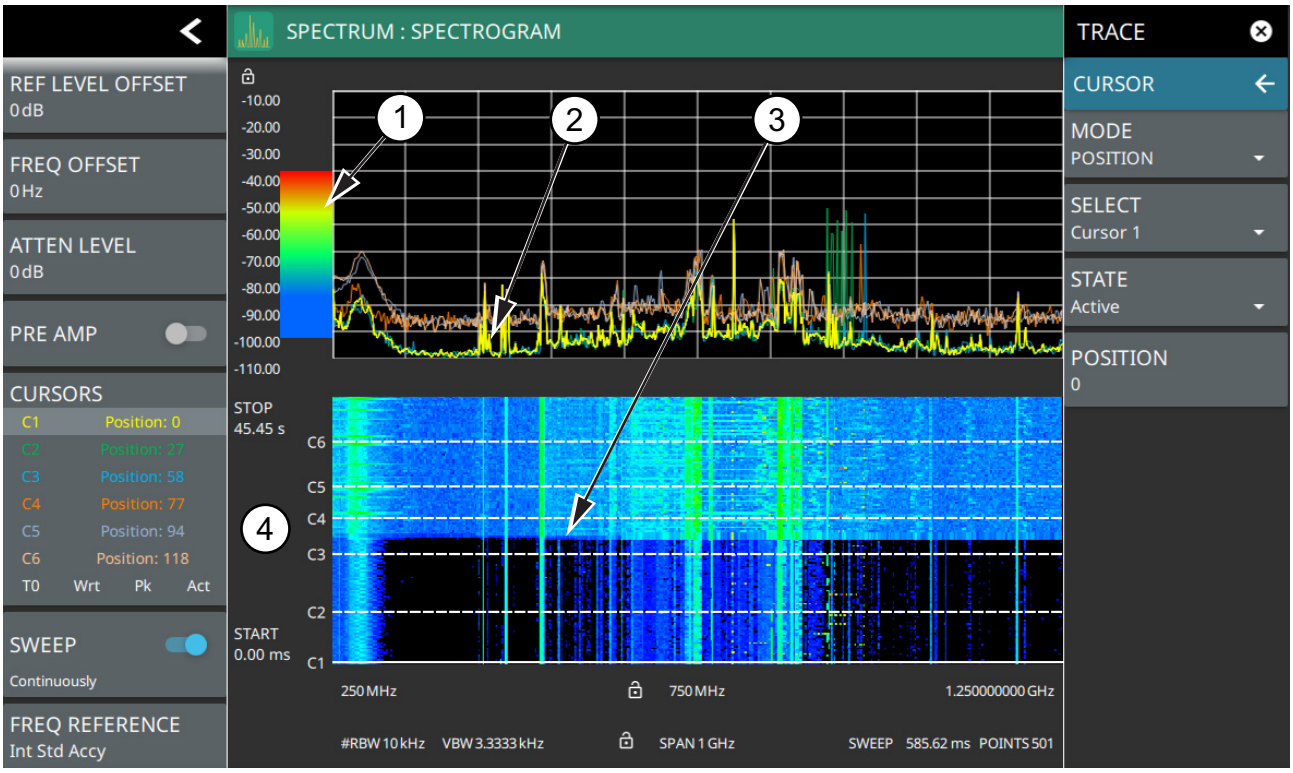


Figure 3-18. Normal Detector Type

Cursors in Spectrogram View

The figure below shows the instrument 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.

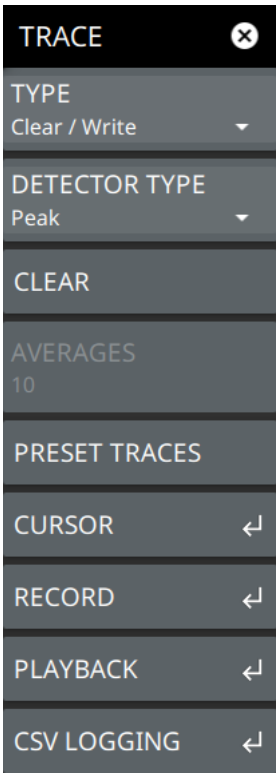


1. Color Bar settings are used to adjust the colors displayed at different amplitude levels. The color bar shown here represents the range of colors that will be displayed. This bar can be dragged up or down to adjust the coverage area. If signals or noise is outside of the color bar range, then black 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 3-112.
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 "" on page 3-28. 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 3-19. Cursors – Spectrogram View

TRACE Menu (Spectrogram View)

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



TYPE: Selects one of the following types of traces:

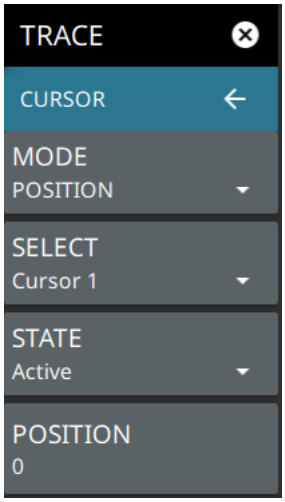
- **Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- **Average:** The exponential average of all N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- **Max Hold:** Represents the maximum value since 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.

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 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. Only available in zero span and RSSI measurements. When Sample detector is selected, all traces must use sample detection.
- **Normal:** Normal detector type also referred to as Rosenfell, shows the random noise than positive peak and avoids the missed-signal problem of the Sample Mode. Should the signal both rise and fall within the bucket interval, then the algorithm classifies the signal as noise. An odd-numbered data point displays the maximum value encountered during its bucket. An even-numbered data point displays the minimum value encountered during its bucket. If the signal is NOT classified as noise (does NOT rise and fall) then Normal is equivalent to positive peak.

	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:** Presets the selected detector type. **PRESET TRACES:** Presets cursor and trace setup to Clear/Write, Active, with Peak Detector. **CURSOR:** Opens the “” on page 3-28. **RECORD:** Opens the “TRACE RECORD Menu” on page 3-33. **PLAYBACK:** Opens the “TRACE PLAYBACK Menu” on page 3-34. **CSV LOGGING:** Opens the “TRACE CSV LOGGING Menu” on page 3-35.

TRACE CURSOR Menu



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. See the descriptions of POSITION and TIME below.

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 3-46.

STATE: Selects one of the following cursor states:

- **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 state, the data will be blanked from the screen. In order to see data again, set the trace state to active.
- **Blank**: Does not display the trace and is not updating. It is the same as if the trace was off.

POSITION: Available when a position cursor is selected. You can change the sweep position index of the selected spectrogram cursor in relation to the number of total sweeps in the spectrogram. The number of sweeps in the spectrogram is based on the size of the spectrogram window, so the sweep index changes when changing the spectrogram cursor position index. The spectrum view also displays the currently selected trace on top of any other traces. A position of 0 (zero) represents the most recent (or live) trace. Entry into this field is disabled when the spectrogram cursor mode is set to Time.

TIME: Available when a time cursor is selected. You can change the time index of the selected spectrogram cursor in relation to the start and stop time displayed in the spectrogram. The time in the spectrogram is based on the size of the spectrogram window, so the time changes when changing the spectrogram cursor time index. The spectrum view also displays the currently selected trace on top of other traces. A time of 0 (zero) represents the most recent (or live) trace. Entry into this field is disabled when the spectrogram cursor mode is set to Position.

Figure 3-20. TRACE / CURSOR Menu (Spectrogram View)

Trace Recording, Playback, and CSV Logging

In spectrum analyzer mode, the instrument supports recording and playing back of trace data. Recordings are actually made on sample data (not just trace points) so during playback, users can set different trace types or detectors for deeper analysis of the data. Trace recording and playback is accomplished by sequentially recording, then drawing, an entire trace through a recording session. (Not by “sweeping” through all the trace points). Recordings can be initiated on both the instrument or from the PC software when connected to an instrument. The files are saved as .fmrec on the instrument internal memory and must be played back on the instrument. The recorded file contains instrument setup information so it can be recalled from any mode and automatically configure the instrument settings for playback. The recorded trace data includes time and GNSS (GPS) information. If recording starts while the instrument is in spectrogram, recording starts with the next available sample and excludes all of the traces previously captured traces in the waterfall. During playback, the spectrogram is built from the replayed traces and an indication of the current trace count and total session trace count (i.e., 33/85) is shown at the right side of the trace display. This count increments during trace playback.

Figure 3-21 shows a recorded trace session during playback. When the playback menu is opened, playback controls are shown at the bottom of the screen.

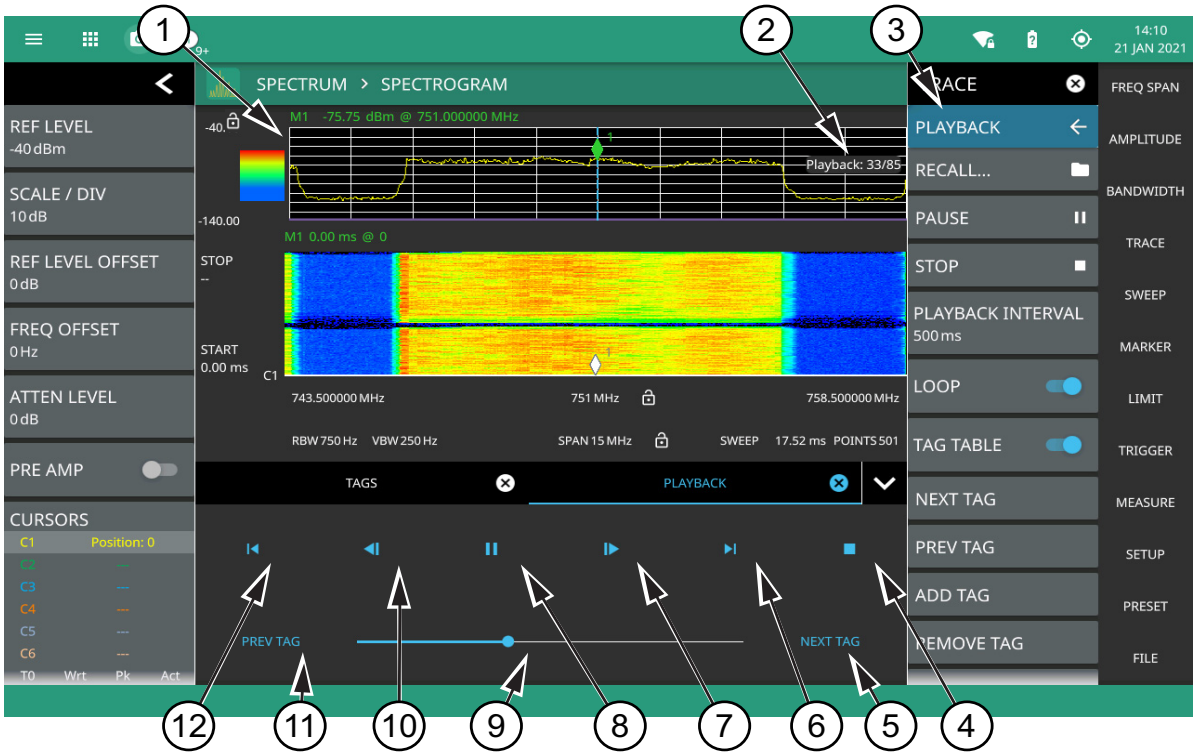
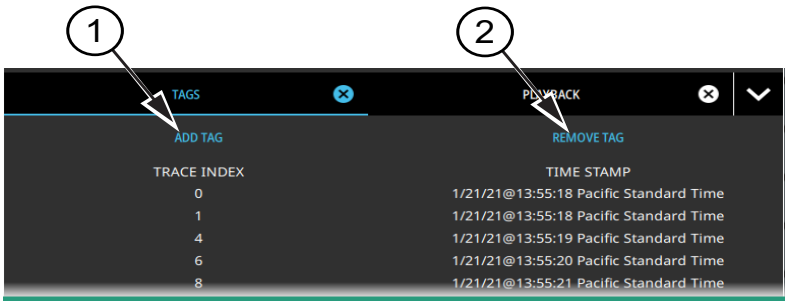


Figure 3-21. Trace Record and Playback (1 of 2)

1. Recorded trace and spectrum waterfall. 2. Shows either the Recording or Playback indicator. 3. Trace playback menu.TRACE RECORD Menu, TRACE PLAYBACK Menu, or TRACE CSV LOGGING Menu. 4. Stops the current trace playback session and restores live data display from the RF input. 5. Steps to the next tagged trace in the recorded session. Untagged traces will be skipped. 6. Increments the trace index by 142 to the next set of spectrogram traces. 7. Increments the trace index by 1 to the next trace in the sequence.	8. Starts playback of the selected trace recording. During playback, the button changes to the PAUSE button, allowing pausing of the playback. 9. Playback location indicator/slider - can be used to drag playback forward and backward. 10. Decrements the trace index by 1 to the previous trace in the sequence. 11. Steps to the previous tagged trace in the recorded session. Untagged traces will be skipped. 12. Decrements the trace index by 142 to the previous set of spectrogram traces.

Figure 3-21. Trace Record and Playback (2 of 2)

Tags are associated with individual traces, allowing scrolling through a sequence of tags and skipping forward or backward past untagged traces. All tagged traces can be viewed in a TAGS table (Figure 3-22), similar to a marker table. Users can add or remove tags from traces. To know which tag is being removed, look at the trace index in the display panel and correlate it to the trace index in the tag table.



1. Add tag button	2. Remove tag button

Figure 3-22. Tags Table

Other features with trace recording and playback:

- If settings that would invalidate the record or playback state are changed (i.e., frequency and amplitude settings, or changing analyzer modes), the current recording/playback session will end (recordings will be saved).
- Markers and limits can be enabled on playback traces just as with live data.
- Measurements such as channel power, OBW, ACP, or interference finder (Option 24) can be enabled on playback traces; all other measurements are blocked.
- New recordings can be made during playback to capture smaller segments of the previous recording.
- To save a .fmspa or .fmrtsa file at any point, it must be done in playback and while paused.

CSV Logging

CSV logging provides much of the same functionality as trace recording described above, but a CSV log cannot be replayed. CSV logging allows continuous recording of either live trace data or playback trace data to a CSV file with frequency and amplitude information for all traces captured during the logging period. When the log recording is stopped, a .csv file is automatically created and saved. CSV logging can also be set to automatically record a recording or playback session. When AUTO LOG is set to either Record or Playback, a CSV log is simultaneously recorded with the record or playback session. When the session is paused, CSV logging is paused. When the session is stopped, CSV logging is stopped and saved.

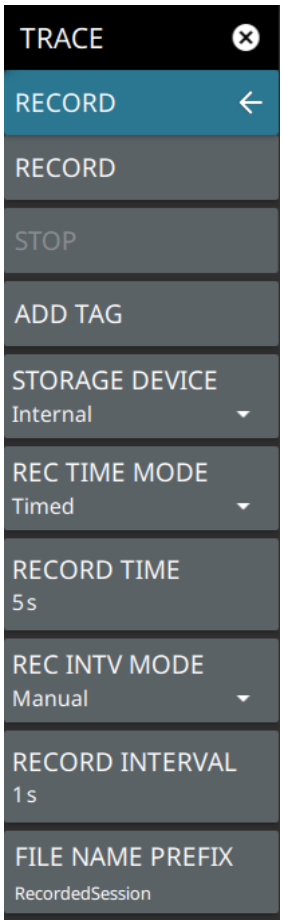
CSV file format:

Header then trace data horizontally with time and GNSS (GPS) stamps. The header includes:

```
Model
Serial
Firmware version
Application
Points
Center frequency
Span
RBW
VBW
Preamp on/off
Attenuation
Detector
Ref level offset
```

TRACE RECORD Menu

The trace recording feature is accessed via the TRACE > RECORD menus. This feature allows you to record a trace for future playback on the instrument or PC application.



RECORD: Starts a trace recording session and saves traces and setup data to a record file (.fmrec). Files will be saved to the “Playback” folder on the selected storage device (below). When recording is initiated, this button changes to PAUSE so you can temporarily stop the recording while leaving the recording session open.

STOP: Stops the active trace recording session. When pressed, a dialog will ask to either keep or discard the recording data.

ADD TAG: Tags the currently recorded trace. This marks the trace for easy searching in the playback tag table. Tags can be added during recording, when the recording is paused, and during playback.

STORAGE DEVICE: Selects the target location for the trace recording. This will be to internal storage or to a connected external USB storage device.

REC TIME MODE: Sets the recording time mode to Auto or Timed. Automatic recording continues until the STOP button is pressed or until memory is full. Manual recording uses a set RECORD TIME. The recording session ends after that time is complete or the stop button is pressed, whichever comes first.

RECORD TIME: Sets the recording time session when the record time mode is set to manual.

REC INTV MODE: Sets the time interval mode (time between recording a trace) to automatic or manual. Automatic will record every trace the analyzer captures. Manual will record one trace every x seconds, where x is the RECORD INTERVAL set below. If the interval time is lower than the sweep time, every trace will be recorded.

RECORD INTERVAL: Sets the recording time interval when the record interval mode is set to manual. Recording stops at the end of the record time or when manually stopped.

FILE NAME PREFIX: Adds a custom file name prefix to the record file (.fmrec). The default prefix is “RecordedSession” and will be appended with a date and time stamp, such as: “Traces_20201216T062419.135.fmrec.”

Figure 3-23. TRACE RECORD Menu

TRACE PLAYBACK Menu

The trace playback feature is accessed via the TRACE > PLAYBACK menus. This feature allows you to play back a recorded trace (.fmrec) file on the instrument or PC application.

A playback session must be started by first recalling a previously recorded session.

RECALL: Opens the file manager so you can select a recorded trace file for playback. The recorded files are typically stored in the Playback folder on the internal or external storage device. Once a trace is recalled, the instrument is set up to match the settings from when the trace was recorded and the PLAYBACK menu will need to be accessed to play the recalled file.

PLAY/PAUSE: Starts playback of the selected trace recording. During playback, the button changes to the PAUSE button, allowing pausing of the playback.

STOP: Stops the current trace playback session and restores live data display from the RF input.

PLAYBACK INTERVAL: Sets the trace playback interval. The playback interval is the sequential trace playback rate, which is the time a trace is displayed before sequencing to the next trace in the recording.

LOOP: When toggled on, the playback plays the trace samples in a loop until stopped. When toggled off, playback pauses at the end of the session. Select STOP to return to live traces or drag the slider back to the beginning and press PLAY to play the session again.

TAG TABLE: Toggles the tag table at the bottom of the screen.

NEXT TAG: Steps to the next tagged trace in the recorded session. Untagged traces will be skipped.

PREV TAG: Steps to the previous tagged trace in the recorded session. Untagged traces will be skipped.

ADD TAG: Adds a tag to the current trace. Tags are automatically saved to the file.

REMOVE TAG: Removes the tag from the current trace. Tags are automatically removed from the saved file.

SKIP FWD: Increments the trace index by 142 to the next set of spectrogram traces.

SKIP BACK: Decrements the trace index by 142 to the previous set of spectrogram traces.

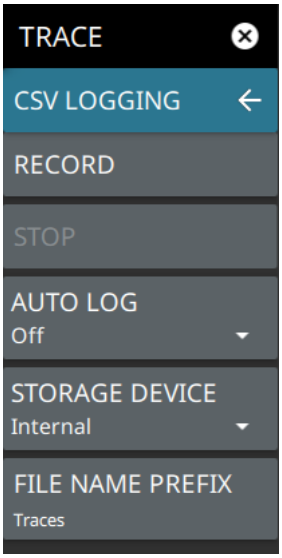
NEXT TRACE: Increments the trace index by 1 to the next trace in the sequence.

PREV TRACE: Decrements the trace index by 1 to the previous trace in the sequence.

Figure 3-24. TRACE PLAYBACK Menu

TRACE CSV LOGGING Menu

The trace CSV capture feature is accessed via the TRACE > CSV CAPTURE menus. This feature allows you to capture trace data in comma separated value (.csv) format.



RECORD: Starts a recording session and saves trace and setup data to a CSV file (.csv). Files will be saved to the “PlaybackCsv” folder on the selected storage device (below). When recording is initiated, this button changes to PAUSE so you can temporarily stop the recording while leaving the recording session open.

STOP: Stops the active trace recording session. When pressed, a dialog will ask to either keep or discard the recording data.

AUTO LOG: Select one of the following automatic recording options (CSV recording will start automatically with Record or Playback selected – no need to press RECORD in the CSV menu. Manual CSV logging can be done independent of this setting.):

- Record: Simultaneously saves csv log data during a trace recording.
- Playback: Simultaneously saves csv log data during a recorded trace playback.
- Off: No auto logging selected.

STORAGE DEVICE: Selects the target location for the trace logging. This will be to internal storage or to a connected external USB storage device.

FILE NAME PREFIX: Adds a custom file name prefix. The default prefix is “Traces” and will be appended with a date and time stamp, such as: “Traces_20201216T062419.135.csv.”

Figure 3-25. TRACE CSV LOGGING Menu

3-8 Setting Sweep Parameters

Sweep parameters are set using the "SWEEP Menu" on page 3-37.

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

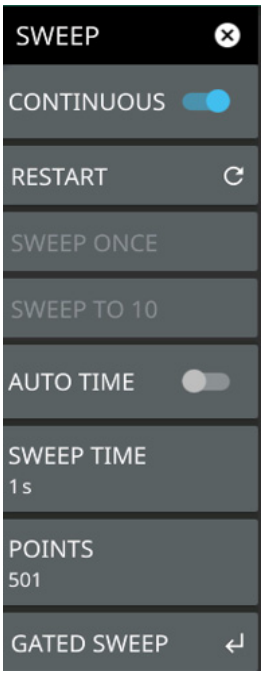
The number of points sets the number of display points in the trace that are generated from the measurement data.

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

SWEEP Menu



CONTINUOUS: Toggles between continuous sweep and single sweep. When the toggle is off, the instrument is in single sweep. In single sweep, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep. The current state of the instrument is displayed in the status panel. With average/hold number (in TRACE menu) set to 1, or averaging is off, or no trace in trace average or hold, a single sweep is equivalent to a single measurement. A single sweep is taken after the trigger condition is met and the analyzer stops sweeping 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.

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

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

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

AUTO TIME: Toggle this button off to manually set the sweep time using the numeric entry keypad.

SWEEP TIME: This button is available when the span is set to ZERO SPAN. Sets the sweep time. Alternately press the # symbol next to the Sweep field at the bottom of the SPA graticule, when AUTO TIME is toggled off.

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.

GATED SWEEP: Opens the “GATED SWEEP Menu” on page 3-39.

Figure 3-26. 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 Series can use the GNSS (GPS) timing signal as the gating trigger event. This will allow you to synchronize measurements with GNSS (GPS) synchronized communication signals. Set up gated sweep from the "GATED SWEEP Menu" on page 3-39.

To set up the instrument for gated sweep measurements:

1. Select SWEEP > GATED SWEEP.
2. 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 Series supports a GNSS (GPS) and external trigger gate source.
3. Select one of the available FRAME TIME durations. The frame time sets the total measurement cycle time.
4. Set the GATE DELAY time. The gate delay sets the time from the triggering event to when the instrument starts sweeping and collecting data.
5. Set the GATE LENGTH time. The gate length sets the time for data capture and analysis.
6. If desired, enable PWR VS TIME (refer to "POWER VS TIME Display" on page 3-40).

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.

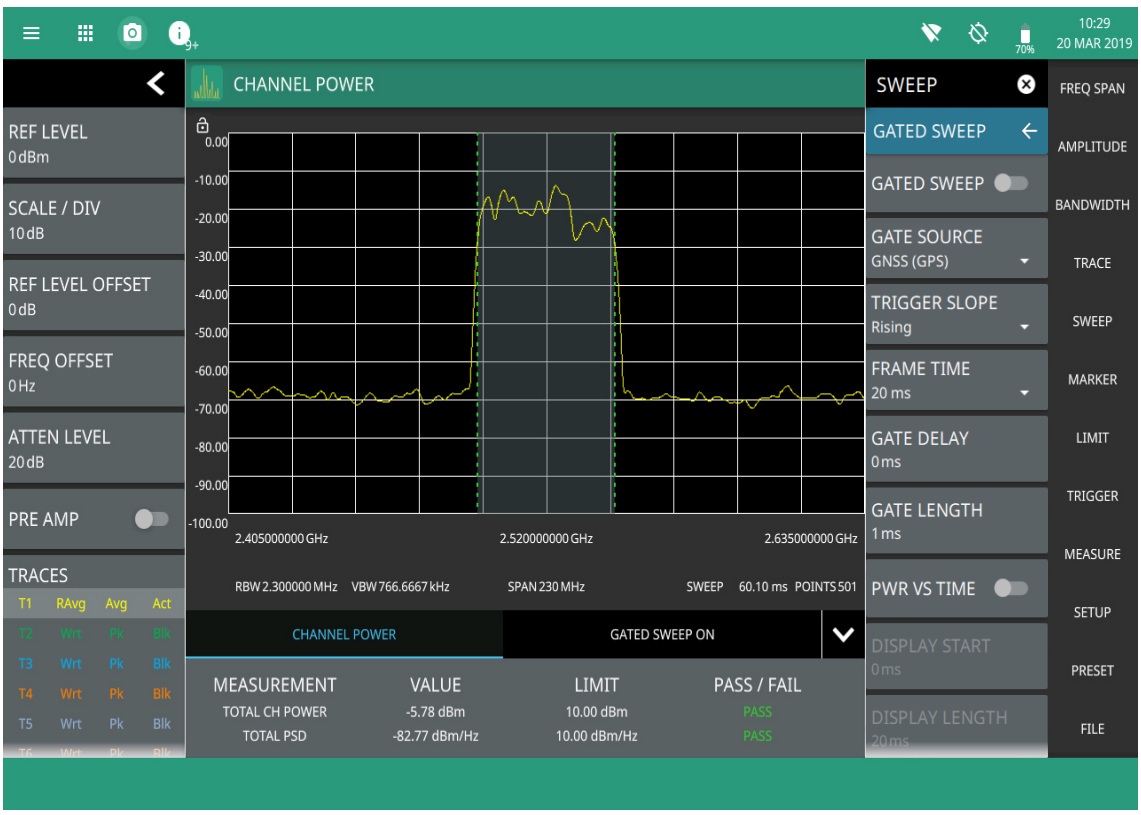
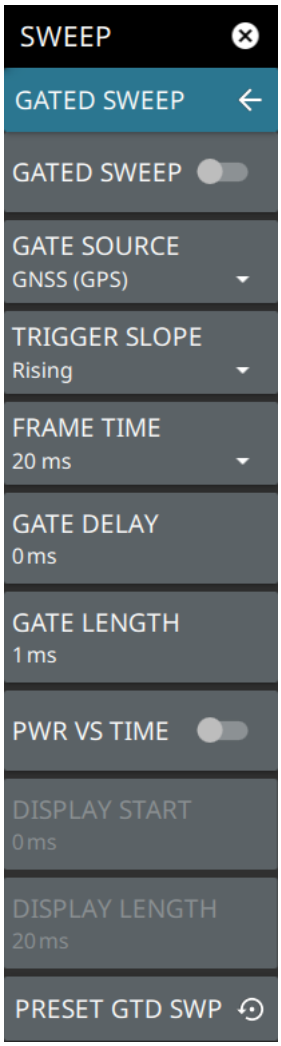


Figure 3-27. Gated Sweep Measurement

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



GATED SWEEP: Toggles gated sweep on or off.

GATED SOURCE: Selects the trigger source for the gated sweep.

- **GNSS (GPS):** This setting synchronizes the trigger source to the GPS PPS.
- **External 1 or 2:** Sets the gate reference based on input from the External 1 or External 2 port. Only Field Master Pro and Remote Spectrum Monitor instruments have two external ports.

TRIGGER SLOPE: Select either rising or falling trigger slope.

FRAME TIME: Selects the frame time duration of 10 ms, 20 ms, or 1 s.

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.

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.

PWR VS TIME: Enables the "POWER VS TIME Display" on page 3-40.

DISPLAY START: When POWER VS TIME is enabled, sets the start of the graticule display.

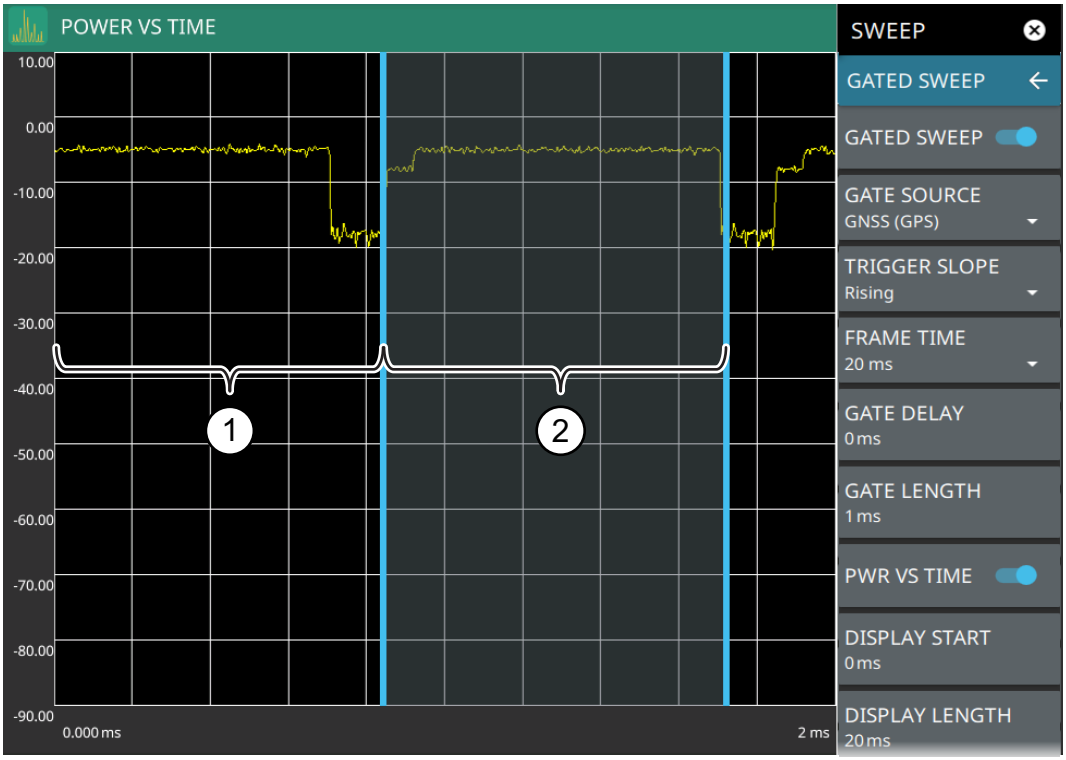
DISPLAY LENGTH: When POWER VS TIME is enabled, sets the time length of the graticule display.

PRESET GTD SWP: Presets gated sweep settings to default values.

Figure 3-28. 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 3-29).



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.

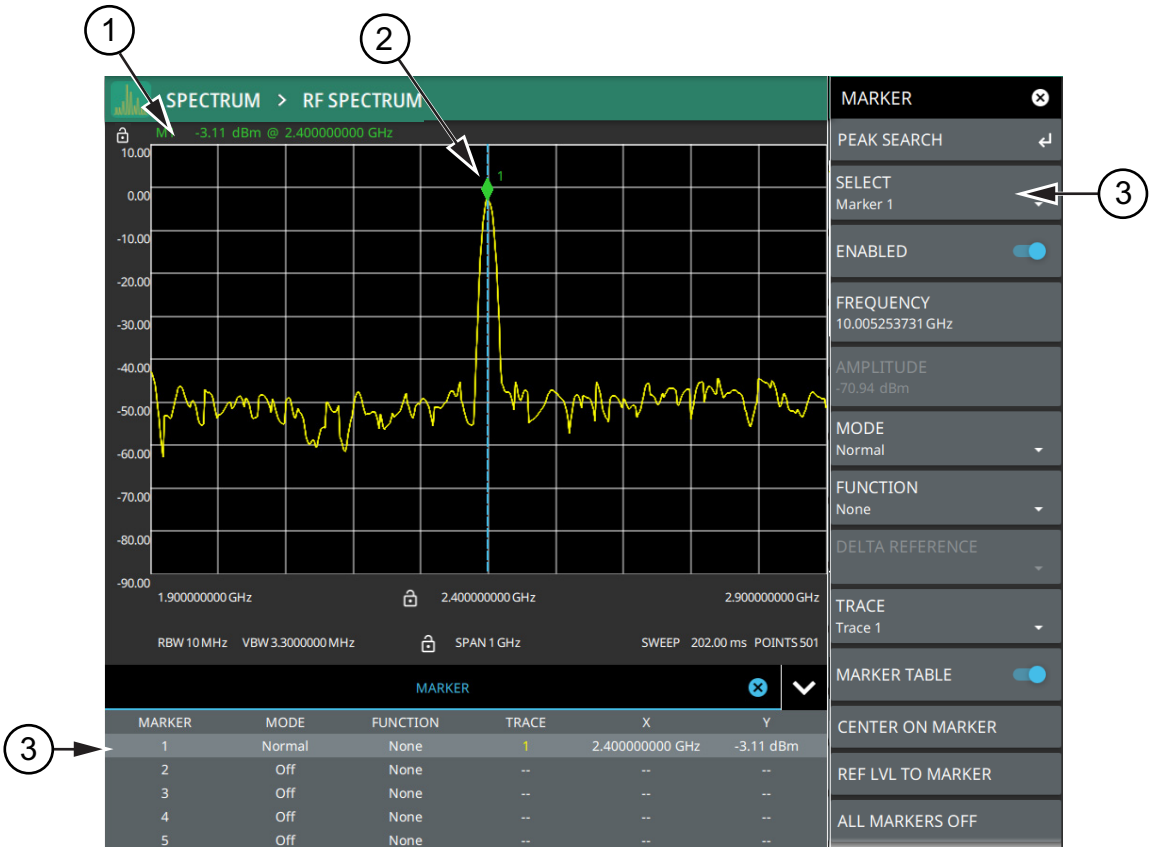
Figure 3-29. Power vs. Time Display

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.

3-9 Setting Up Markers

Marker parameters are set using the "MARKER Menu" on page 3-43. Refer to the figure below when working with this section.



1. RF 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 3-30. Marker Menu and Marker Table

Placing a Normal Marker

1. Select 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 3-44). 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.

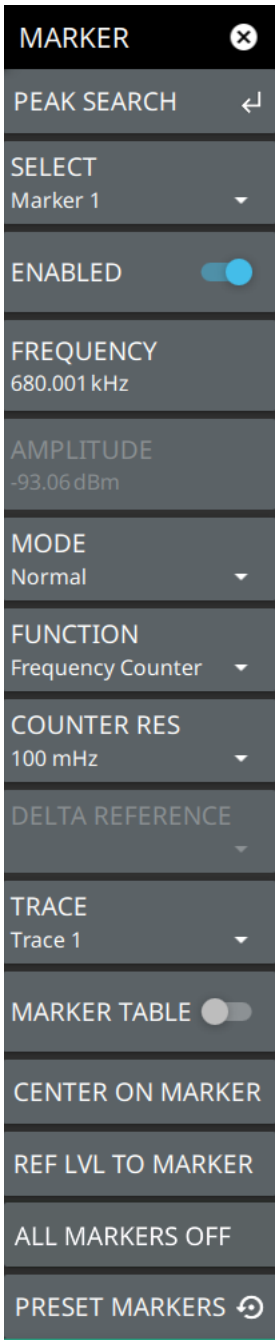
Placing a Delta Marker

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 1. To set a delta marker and its reference:

1. Activate either a normal or fixed marker and place it in a reference location as described previously.
2. Activate a delta marker using MARKER > SELECT > Marker #, then select MODE > Delta.
3. Place the active delta marker by doing one of the following:
   a. Enter a new FREQUNCY 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 3-44).

A delta marker is labeled with a green delta symbol between each marker number. For example, delta Marker 2 relative to Marker 1 is displayed as "2Δ1". If another marker is desired to be the reference marker, select the delta marker as the active marker and then use DELTA REFERENCE > Marker # to select the desired reference marker number.

MARKER Menu



PEAK SEARCH: Opens the "MARKER PEAK SEARCH Menu" on page 3-44.

SELECT: Turns on the selected marker if it is off or makes it the active marker if it is already turned on. Selecting 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. Selecting the MARKER menu button thereafter opens the MARKER menu to the current active marker, which is displayed in the upper left-hand corner of the screen. When a marker is turned on, it is a normal marker positioned at the center frequency of the selected trace.

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

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

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

MODE: Select marker preference:

- **Normal:** A Normal marker is also known as a tracking marker. The frequency is fixed but the amplitude value varies from sweep to sweep.
- **Delta (Δ):** A Delta (Δ) marker displays the delta frequency and amplitude between itself and a reference marker. If Marker 1 is selected to be a Delta marker, then Marker 2 is turned on as a reference marker for Marker 1 and it becomes a 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: Sets the function of the currently selected marker to None, Noise, Frequency Counter, or Quasi-Peak. For more information about using marker functions, refer to "Marker Functions" on page 3-45.

COUNTER RESOLUTION: Available when the marker function is set to Frequency Counter. This setting adjusts the frequency counter marker resolution to 1 Hz, 100 mHz, 10 mHz, or 1 mHz. Lower resolutions will result in greater peak accuracy, but a slower sweep.

Figure 3-31. MARKER Menu (1 of 2)

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

MARKER TABLE: Toggle on or off the marker table displayed below the screen. Refer to "Marker Table" on page 3-47.

CENTER ON MARKER: Sets the center frequency to the currently active marker's frequency value.

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

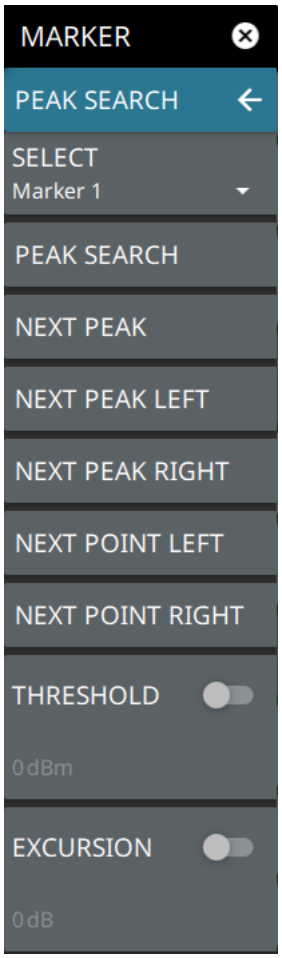
ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position once re-enabled.

PRESET MARKERS: Presets marker selections to default values.

Figure 3-31. MARKER Menu (2 of 2)

MARKER PEAK SEARCH Menu

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



PEAK SEARCH: Returns to the main MARKER menu.

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

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

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

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

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

NEXT POINT LEFT: Moves the selected marker one display point to the left of its current position. Useful for fine tuning the position of a marker.

NEXT POINT RIGHT: Moves the selected marker one display point to the right of its current position. Useful for fine tuning the position of a marker.

THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a peak.

EXCURSION: If turned on, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.

Figure 3-32. 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 amplitude units/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. Frequency Counter markers are not available in zero span.

Quasi-Peak Marker

Quasi-Peak markers are designed to provide a weighted average amplitude for pulsed or high AM content signals. Typically, the result from a Quasi-Peak measurement will be lower than the same signal measured with a peak detector. When a marker function is set to Quasi-Peak, the resolution bandwidth and video bandwidth are automatically set and the amplitude is evaluated at the marker frequency according to the CISPR 16-1-1 specification.

Quasi-Peak markers can only be applied to signals below 1 GHz. Quasi-Peak markers are not available in zero span. Typically, when using Quasi-Peak markers, the amplitude axis is set to dBµV. This is set via: AMPLITUDE > Y AXIS UNIT > dBµV.

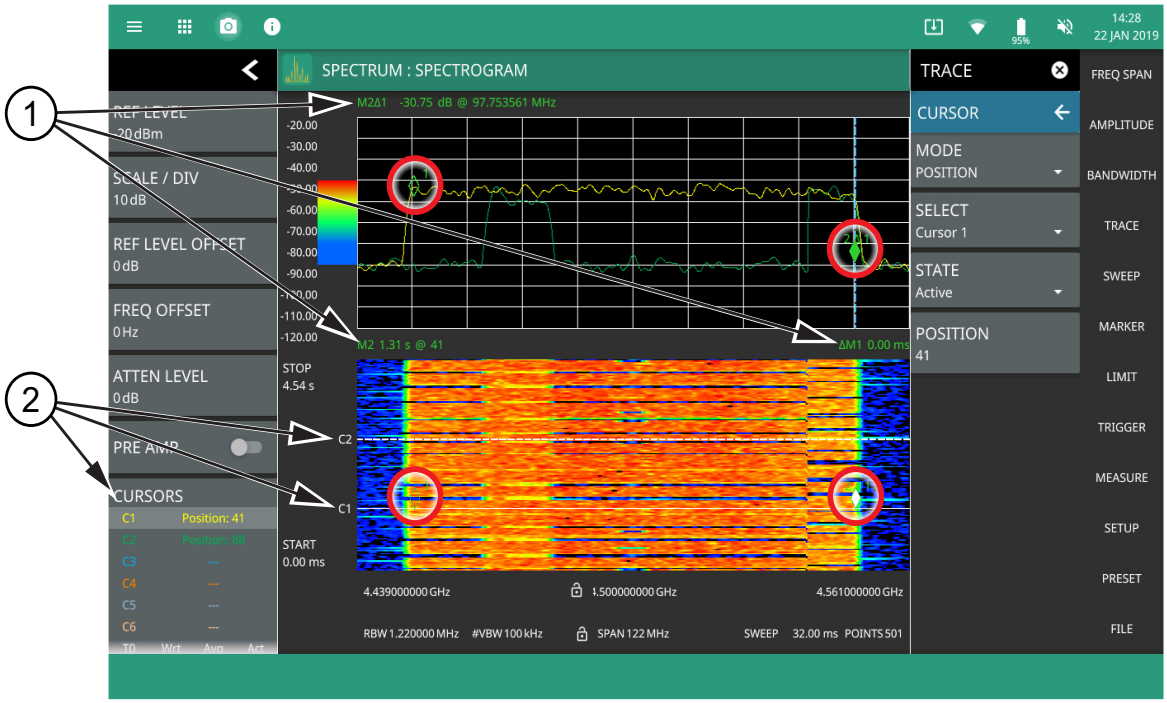
One or more markers can be enabled to apply the Quasi-Peak function. If the Quasi-Peak marker is set on a signal, at the end of each sweep the analyzer tunes to the position of each marker and remeasures the marker amplitude applying the CISPR time constants and filters. The CISPR filter of 200 Hz, 9 kHz, or 120 kHz is applied automatically depending on the marker frequency as follows:

- Band A: 9 kHz to < 150 kHz, 200 Hz filter
- Band B: 150 kHz to < 30 MHz, 9 kHz filter
- Band C&D: 30 MHz to 1 GHz, 120 kHz filter

Note	The functionality of frequency counter and quasi-peak marker functions is disabled in AM/FM Audio measurement, so only the user set marker frequency value will be displayed.

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 3-33. 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. Select 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 3-34. Marker Table

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

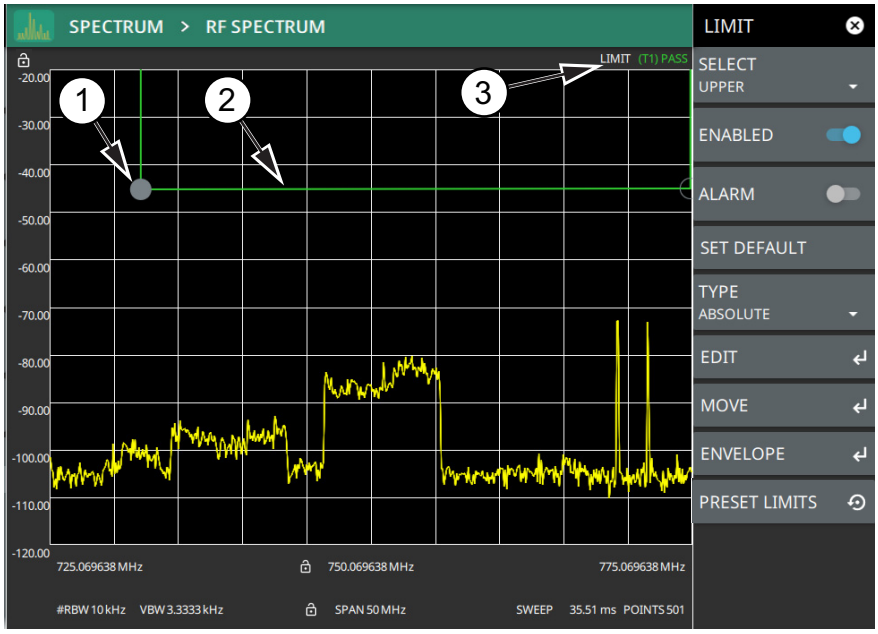
The currently selected marker's value is shown at the top left of the spectrum window with its current amplitude and frequency values.

The selected marker is highlighted on the trace display.

3-10 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 3-25 “Saving and Recalling Measurements” on page 3-114).

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 3-50.



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 3-35. Simple Limit Line

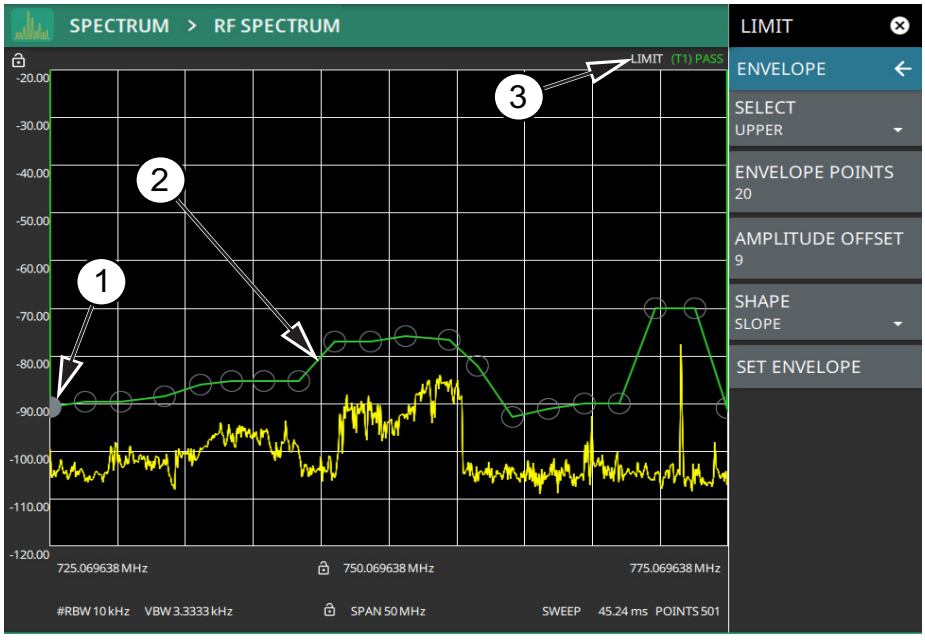
Simple Limit Line

1. Select 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. Select MOVE to open the “LIMIT MOVE Menu”.
   b. Enter either an X-OFFSET frequency value or Y-OFFSET amplitude value.
   c. Select 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 3-53. 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.

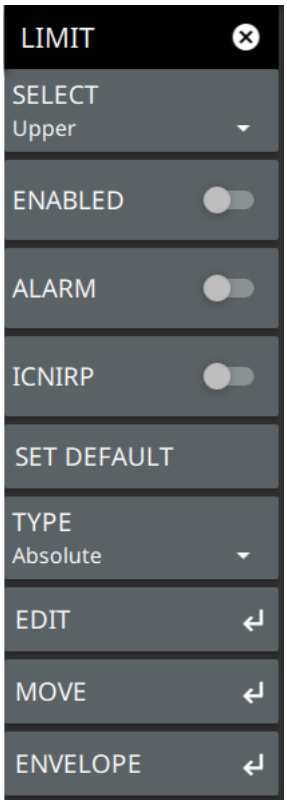
Figure 3-36. Envelope Limit Line

To set up a limit line envelope:

1. Select LIMIT > ENVELOPE.
2. Select either Upper or Lower limit line.
3. Set the number of limit envelope points.
4. Set the amplitude offset.
5. Select the envelope shape of Square or Slope.
6. Select SET ENVELOPE to generate the limit line envelope.

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

LIMIT Menu



SELECT: Selects UPPER or LOWER limit line for editing.

ENABLED: Displays the selected limit when toggled on.

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

ICNIRP: This button is only available in Electromagnetic Field (EMF) Measurements (Option 444). Toggles the International Commission on Non-Ionizing Radiation Protection limit line. The ICNIRP limit takes precedence over a custom limit for EMF measurements. To set a custom limit for EMF measurements, enable the regular limit above and toggle ICNIRP off. When ICNIRP limit is toggled off, the regular upper limit setting is used to evaluate pass/fail results for EMF measurements. Both ICNIRP and custom limits are evaluated on trace 2, which is the isotropic result.

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

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

EDIT: Opens the “LIMIT EDIT Menu” on page 3-51.

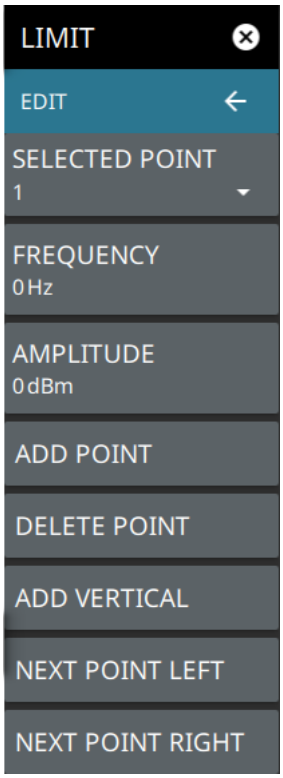
MOVE: Opens the “LIMIT MOVE Menu” on page 3-52.

ENVELOPE: Opens the “LIMIT ENVELOPE Menu” on page 3-53.

PRESET LIMITS: Presets the limit lines to default values.

Figure 3-37. LIMIT Menu

LIMIT EDIT Menu



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

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

AMPLITUDE: Sets the amplitude of a limit line inflection point. The amplitude of each inflection point can also be individually set. By default, when a new point is added it takes the amplitude value that is on the limit line at the frequency where the point was added. Use the keypad (using +/- to set a negative value) or the plus (+) or minus (–) control to increment the value. The unit of the amplitude limit is the same as the current vertical amplitude unit (for example, dBm).

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

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

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

NEXT POINT LEFT: Select this button to select the inflection point that is immediately to the left of the active point, making this newly selected point active for editing or deletion. With each button press, the active point becomes that point to the left of the previously active point, until the newly selected active point becomes the left-most point on the screen.

NEXT POINT RIGHT: Select this button to select the limit point immediately to the right of the active point, making this newly selected point active for editing or deletion. With each button press, the active point becomes that point to the right of the previously active point, until the newly selected active point becomes the right-most point on the screen.

Figure 3-38. LIMIT EDIT Menu

LIMIT MOVE Menu

CENTER: Selecting this button moves the center of the existing limit line to the center frequency of the measurement. The span of the existing limit line is not changed. Use this button as an easy way to move an existing limit line to the center of the sweep. This button has no action if no limit line is turned on.

X-OFFSET: Allows you to adjust the frequency of the limit line. All inflection points will be moved by the value entered here when using the LEFT or RIGHT buttons. Select X-OFFSET and enter a value using the keypad.

LEFT: Selecting this button moves all inflection points to the left by the X-OFFSET value.

RIGHT: Selecting this button moves all inflection points to the right by the X-OFFSET value.

Y-OFFSET: Allows you to adjust the amplitude of the limit line. All inflection points will be moved by the value entered here when using the UP or DOWN buttons. Select Y-OFFSET and enter a value using the keypad.

UP: Selecting this button moves all inflection points up by the Y-OFFSET value.

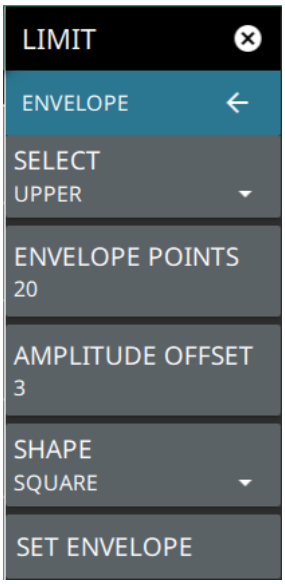
DOWN: Selecting this button moves all inflection points down by the Y-OFFSET value.

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

TO MARKER 1: Moves the limit line center position to the frequency and specified amplitude offset of Marker 1. Marker 1 must be enabled.

Figure 3-39. LIMIT MOVE Menu

LIMIT ENVELOPE Menu



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

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

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

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

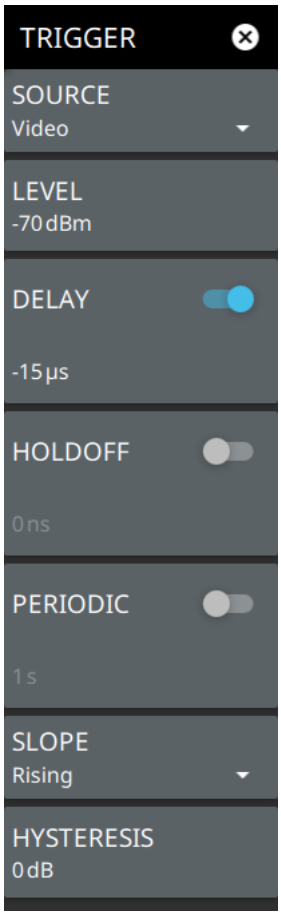
SET ENVELOPE: Select this button to generate the envelope using the set characteristics. If the default results are not satisfactory, you can make adjustments to the amplitude and frequency of each inflection point, and you can add or delete inflection points.

Figure 3-40. LIMIT ENVELOPE Menu

3-11 Setting Up Triggering

The TRIGGER menu is not available in regular swept frequency spectrum measurements. Trigger parameters for zero span are set using the “” on page 3-55. IQ Trigger (Option 124/126) is set using the “IQ TRIGGER Menu” on page 3-61.

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. When enabled, the trigger level will be indicated graphically on the display with a horizontal VIDEO line. A new sweep is started when the input video level meets the value set via the LEVEL button. The level can also be adjusted by dragging the VIDEO line up or down. 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 SMA 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 or falling edges. Use the hysteresis setting below to adjust the sensitivity of the trigger level.

DELAY: Available only when the trigger source is set to External or Video. When toggled on, the delay value sets the amount of time that the analyzer waits to begin a measurement after a trigger signal is received. Negative trigger delay effectively moves the trace to the right so you can observe the activity before the trigger event.

HOLDOFF: Available only when the trigger source is set to External or Video. When toggled 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 toggled on, the instrument waits the set time to start a sweep.

SLOPE: Used when the trigger source is set to External or Video. Sets the trigger slope to rising or falling edge.

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 3-42). 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 3-41. TRIGGER Menu in Zero Span

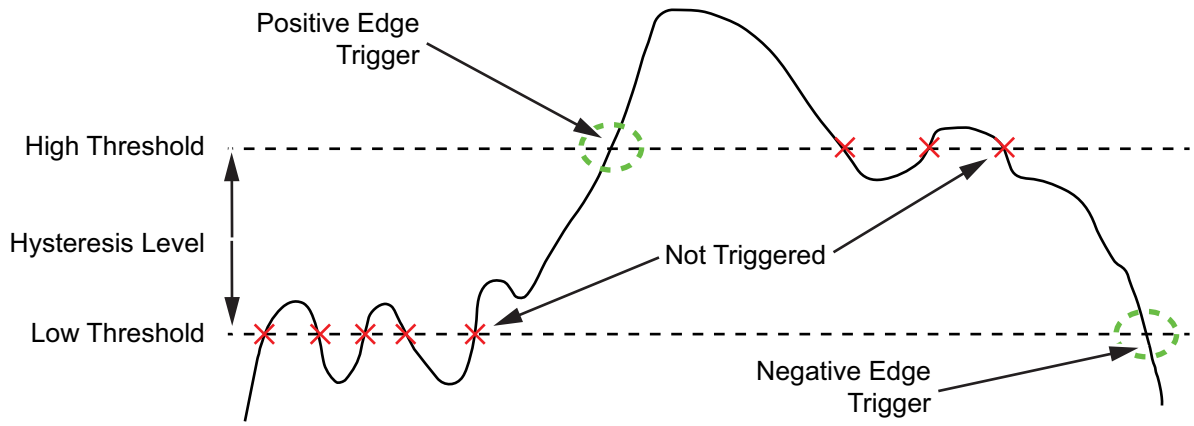


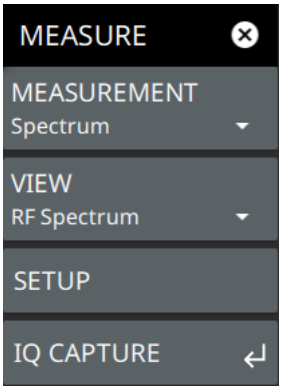
Figure 3-42. Trigger Levels and Hysteresis

3-12 Setting Up Advanced Measurements

Refer to Section 3-3 to Section 3-11 for basic information on setting up a spectrum measurement. This section provides setup information for making swept spectrum measurements. The Field Master Series features smart measurements that make setup easy. The following sections present brief examples demonstrating the use of these measurements.

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

MEASURE Menu



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

- **Spectrum:** Displays the frequency domain spectrum measurement.
- **Channel Power:** The channel power table and channel lines are added to the measurement display. Refer to Section 3-13 “Channel Power” on page 3-63.
- **OBW:** The occupied bandwidth table and channel lines are added to the measurement display. Refer to Section 3-14 “Occupied Bandwidth” on page 3-66.
- **ACP:** The ACP table and channel lines are added to the measurement display. Refer to Section 3-15 “Adjacent Channel Power” on page 3-69.
- **SEM:** The spectrum emissions mask table and a spectrum mask is added to the measurement display. Refer to Section 3-16 “Spectrum Emission Mask” on page 3-72.
- **Interference:** Available when Option 24 is installed. The input parameters and channel measurements tables, max/min level lines, and total channel power signal indicator are added to the measurement display. Refer to Section 3-17 “Interference Finder (Option 24)” on page 3-76.
- **EMF Measurement:** Available when Option 444 is installed. The EMF measurement and information tables are added to the measurement display. Refer to Section 3-18 “Electromagnetic Field (EMF) Measurements (Option 444)” on page 3-80.
- **Coverage Mapping:** Available when Option 431 is installed. Coverage mapping provides signal strength measurements on the instrument display and will plot color-coded signal values on an interactive map. Refer to Section 3-19 “Coverage Mapping (Option 431)” on page 3-85.
- **AM/FM Audio:** Available when Option 24 is installed. The AM/FM Audio provides audio demodulation capability. Refer to Section 3-20 “AM/FM Audio (Requires Option 24 or Option 509)” on page 3-97.
  Also available when Option 509 is installed. Refer to Section 3-21 “AM/FM Modulation Measurement (Option 509)” on page 3-100.
- **C/I:** Carrier-to-Interference is the ratio of power in an RF carrier to the noise power in the channel. Carrier-to-interference ratio indicates the difference in amplitude between the desired radio frequency carrier and the noise in a portion of the spectrum. Refer to Section 3-22 “Carrier-to-Interference” on page 3-106
- **Coverage Mapping:** Available when Option 431 is installed. The coverage map and information tables are added to the measurement display. Refer to Section 3-19 “Coverage Mapping (Option 431)” on page 3-85.

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

- **RF Spectrum**: RF Spectrum View
- **Spectrogram:** When Spectrogram view is selected, a Spectrogram view is added to the display. Spectrogram is only available when the MEASUREMENT is set to Spectrum.
- **All Measurements:** This view is only available when AM/FM Modulation Measurement (Option 509) is installed. The measurement displays audio spectrum, RF spectrum, audio time domain and audio results.

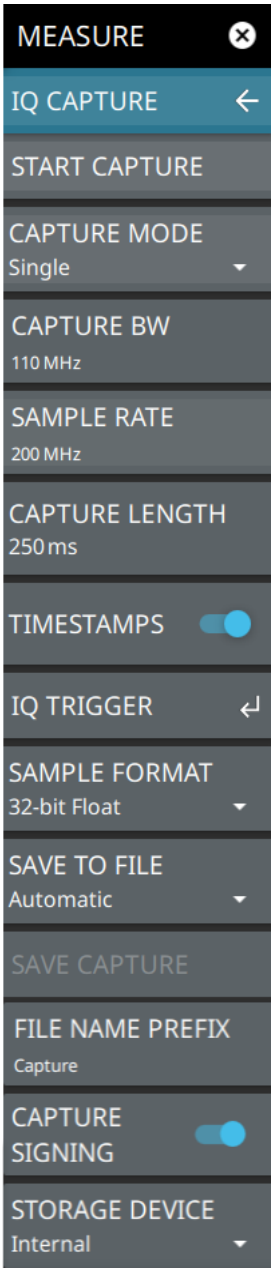
SETUP: Opens the SETUP menu for the measurement and view selected above, except for RF SPECTRUM mode.

IQ CAPTURE: Opens the “IQ CAPTURE Menu (Option 124/126)” on page 3-58.

Refer to the IQ Capture/Streaming Measurement Guide (10580-00490) for more information on IQ Capture and Streaming.

Figure 3-43. MEASURE Menu

IQ CAPTURE Menu (Option 124/126)



START/STOP CAPTURE: Touch this button to execute an IQ capture. When a capture is initiated, this button changes to STOP CAPTURE and can be touched to stop the continuous captures. Note that the captured data will still be saved unless the CANCEL SAVE button below is touched. Check the IQ status table at the bottom of the display.

CANCEL SAVE: This button appears after a capture has been initiated. Touch this button to present a dialog that allows you the choice to cancel the IQ capture save and discard the captured data, or to continue with the capture and save the data.

CAPTURE MODE: Selects the IQ capture mode:

- **Single** for a one-time capture to internal or external (USB) storage
- **Continuous** for capture to internal or external (USB) storage. Automatically initiates a new capture once the previous capture is saved.
- **Streaming** for continuous IQ data streaming out of the Ethernet, USB, or Data Out port (refer to "IQ STREAMING Menu (Option 125/127)" on page 3-59).

CAPTURE BW: IQ capture bandwidth is the frequency range of data to be collected for the duration of the IQ length. IQ capture bandwidth and sampling rate are linked and are selected from the same dialog.

SAMPLE RATE: Sets the IQ sampling rate of data to be collected for the duration of the IQ length. IQ sampling rate and capture bandwidth are linked and are selected from the same dialog.

CAPTURE LENGTH: Sets the duration of the waveform data capture. The maximum allowable capture period is dependent on available space on the selected storage device.

TIMESTAMPS: Toggles data collection timestamps on or off.

IQ TRIGGER: Opens the "IQ TRIGGER Menu" on page 3-61.

SAMPLE FORMAT: Sets the sampling bit format (32-bit floating decimal, 32-, 16-, 10-, or 8-bit integers).

SAVE TO FILE: Toggles automatic or manual file saving. When set to manual, touch the SAVE CAPTURE button to save the next completed IQ capture.

SAVE CAPTURE: Saves captured data to a file when SAVE TO FILE is set to Manual.

FILE NAME PREFIX: Sets the file name prefix of the capture file. Files are stored a "Captures" folder internally or to USB storage media. File naming contains the following:

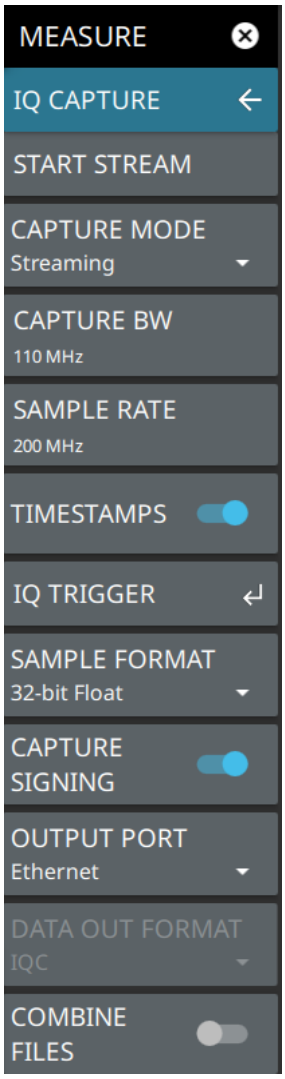
prefix_year-month-day-time-##_capturetime in ns_number in scientific notation.dgz or .dgzm.

CAPTURE SIGNING: IQ files will not be signed for use with MS280005A, when toggled off.

STORAGE DEVICE: Sets the capture file save location. You can select Internal or one of the available USB ports when storage media is detected.

Figure 3-44. IQ CAPTURE Menu

IQ STREAMING Menu (Option 125/127)



START STREAM: Touch this button to start IQ data streaming from the selected output port. When streaming is initiated, this button changes to STOP STREAM and can be touched to stop the stream.

CAPTURE MODE: Selects the IQ capture mode:

- **Single** for a one-time capture to internal or external (USB) storage (refer to "IQ CAPTURE Menu (Option 124/126)" on page 3-58)
- **Continuous** for capture to internal or external (USB) storage (refer to "IQ CAPTURE Menu (Option 124/126)" on page 3-58)
- **Streaming** for continuous IQ data streaming out of the Ethernet, USB, or Data Out port.

CAPTURE BW: IQ capture bandwidth is the frequency range of data to be collected for the duration of the IQ length. IQ capture bandwidth and sampling rate are linked and are selected from the same dialog.

SAMPLE RATE: Sets the IQ sampling rate of data to be collected for the duration of the IQ length. IQ sampling rate and capture bandwidth are linked and are selected from the same dialog.

TIMESTAMPS: Toggles data collection timestamps on or off (Refer to the IQ Capture/Streaming Measurement Guide, PN: 10580-00490).

IQ TRIGGER: Opens "IQ TRIGGER Menu" on page 3-61

SAMPLE FORMAT: Sets the sampling bit format (32-bit floating decimal, 32-, 16-, 10-, or 8-bit integers).

CAPTURE SIGNING: IQ files will not be signed for use with MS280005A, when toggled off.

OUTPUT PORT: Selects the output port to stream the IQ data.

DATA OUTPUT FORMAT: Selects the data out format of IQC or PCIe. IQC is the default format and is intended for use with the MA25424A IQ Data Converter (Refer to the IQ Capture/Streaming Measurement Guide, PN: 10580-00490). PCIe is intended for use with the MA25101A IQ Streaming PCIe kit (refer to the MA25101A User Guide, PN: 10580-00476). Note that changing to PCIe will require the application to reload and the analyzer will be unresponsive during that time.

COMBINE FILES: IQ streams are captured in individual files that are combined once the stream stops. When this toggle is on, files will be concatenated by the instrument at the end of the stream into one file. This can be time consuming depending on the stream time. You can also save the streams as individual files and use the "IQ Streaming Tool" on page 3-62 to combine the files.

Figure 3-45. IQ STREAMING Menu

Once the IQ Capture menu is accessed, the IQ CAPTURE table is displayed at the bottom of the screen.

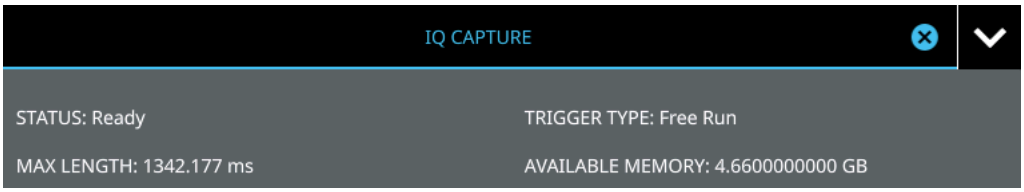


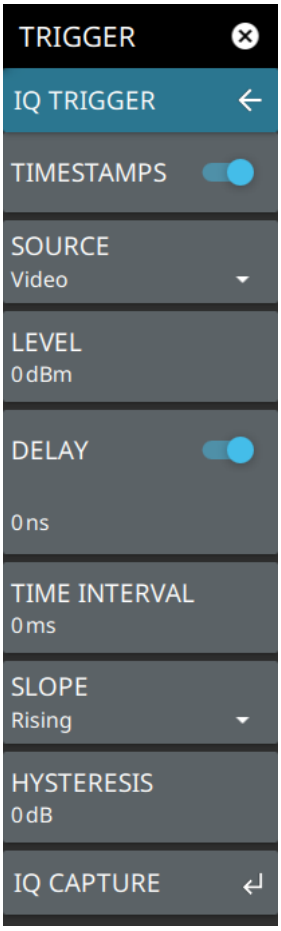
Figure 3-46. IQ CAPTURE Table

The IQ CAPTURE table provides the following:

- STATUS: Current status of the IQ Capture. When a capture is in process, “Saving (xx%)” will be shown with an X to stop the current capture. When streaming is in process, the status will show “Streaming.”
- TRIGGER TYPE: Indicates the currently selected IQ trigger type.
- WAITING FOR TRIGGER: Indicates the capture has been started but is waiting for a trigger to initiate.
- MAX LENGTH: Indicates how long a capture can be with the current settings and available storage.
- AVAILABLE MEMORY: Indicates how much storage space is available on the target device (internal or external).

IQ TRIGGER Menu

Note	Trigger commands are shared between IQ capture and zero span, so these two functions are mutually exclusive.



TIMESTAMPS: toggles data collection timestamps on or off (Refer to the IQ Capture/Streaming Measurement Guide, PN: 10580-00490).

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

- **External 1 or 2:** A TTL signal applied to the selected External Trigger MCX input connector causing a single capture. After the capture is complete, if mode is single, the capture will stop waiting for triggers until capture is started again. If mode is continuous, once the capture is saved, it will look for the next trigger event to initiate another capture. Any trigger made during the capturing or saving period will be ignored.
- **Free Run:** When trigger is free run (or manual), a trigger is only initiated when the START CAPTURE button is pressed or when a remote command is sent.
- **Video:** Sets the video trigger level. When RF energy is detected above that level, a capture is initiated. Note that the user must first press START CAPTURE before the analyzer will begin looking for the trigger.

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

DELAY: Sets the IQ trigger delay when the trigger source is not set to Free Run. IQ trigger delay can be set to positive and negative values. A negative value includes data from the specified time before the trigger event.

TIME INTERVAL: Used to set a periodic trigger event. The analyzer waits the user defined amount of time between trigger events.

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 3-42). 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.

IQ CAPTURE: Returns to the "IQ CAPTURE Menu (Option 124/126)" on page 3-58.

Figure 3-47. IQ TRIGGER Menu

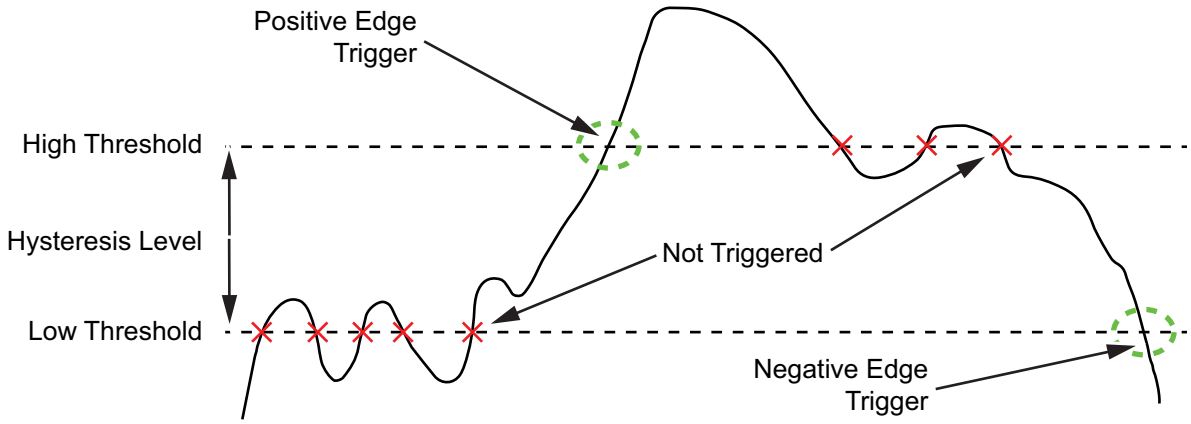


Figure 3-48. Trigger Levels and Hysteresis

IQ Streaming Tool

The IQ STREAMING menu allows you to concatenate an existing IQ metadata file (.dgzm) with a session of IQ data files (.dgz) that were streamed to a USB device after the stream operation is complete. The data files must all come from the same stream session.

1. Access the System menu (3-line icon in the upper left corner).
2. Select TOOLS to access the instrument tools menu, then select IQ STREAMING.

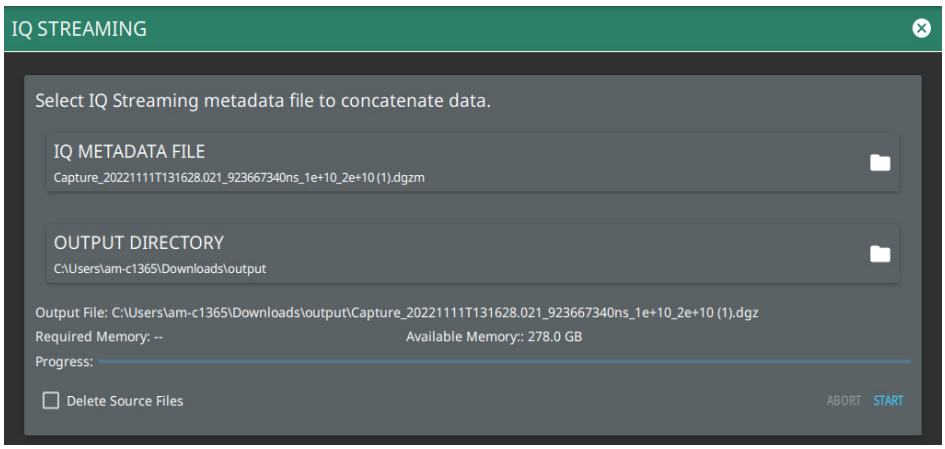


Figure 3-49. IQ Streaming Tool

1. Touch IQ METADATA FILE and then select the metadata file that you wish to concatenate with IQ data streams. All of the data stream files in the selected directory will be concatenated with the metadata file.
2. Touch the OUTPUT DIRECTORY and select the destination for the concatenated files. If desired, select Delete Source Files.
3. Select START to begin the concatenation. The progress bar will indicate relative progress.

Note	Concatenating files can be time consuming depending on the streaming parameters and time. The process can be much faster if performed on a PC using your instrument PC application. Refer to the PC software chapter of the product's user guide for details on using this application.

3-13 Channel Power

Channel power measurements are set up using the "SETUP Menu (Channel Power)" on page 3-65. 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. The status panel provides quick access to common spectrum analyzer settings. See "STATUS PANEL (Channel Power)" on page 3-64.
2. Dashed vertical lines and a shaded region define the main channel integration bandwidth.
3. All channel power measurement parameters are set via the SETUP menu.
4. Channel power measurement results are shown in a table at the bottom of the display.

Figure 3-50. Channel Power Measurement

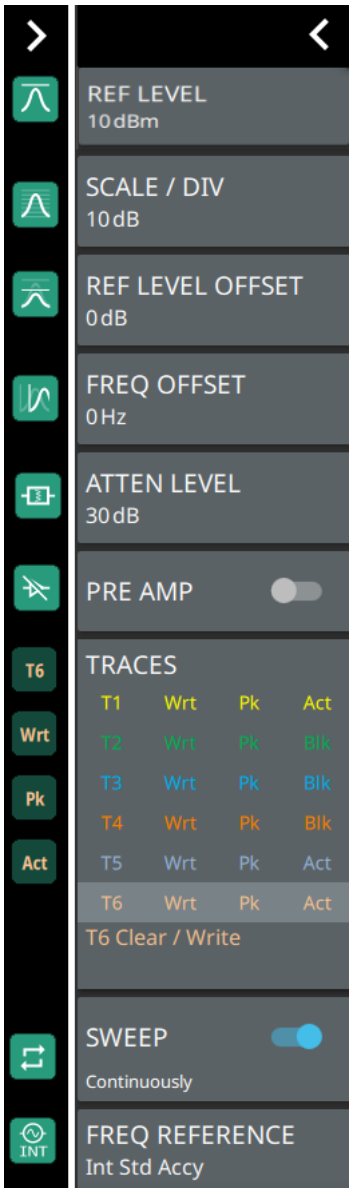
Frequency and span settings for many signal standards can be set as follows:

1. Select MEASURE on the main menu.
2. Select Channel Power from the MEASUREMENT button.
3. Select SETUP and then do the following:
   - Set the channel INTEGRATION BW (bandwidth).
   - Select PSD UNITS (Hz or MHz).
   - Toggle and set the 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.

STATUS PANEL (Channel Power)

Below is the status panel with the corresponding minimized status panel icons for channel power measurement.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-51. Status Panel with Minimized Status Panel Icons (Channel Power)

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.

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

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

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

PSD LIMIT: If the power spectral density limit is on, 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.

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

Figure 3-52. SETUP Menu (Channel Power)

3-14 Occupied Bandwidth

Occupied bandwidth measurements are set up using the "STATUS PANEL (Occupied BW)" on page 3-67. 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. The status panel provides quick access to common spectrum analyzer settings. See "STATUS PANEL (Occupied BW)" on page 3-67.
2. Dashed vertical lines and a shaded region define the main channel.
3. All occupied bandwidth measurement parameters are set via the SETUP menu.
4. Occupied bandwidth measurement results are shown in a table at the bottom of the display.

Figure 3-53. Occupied Bandwidth Measurement

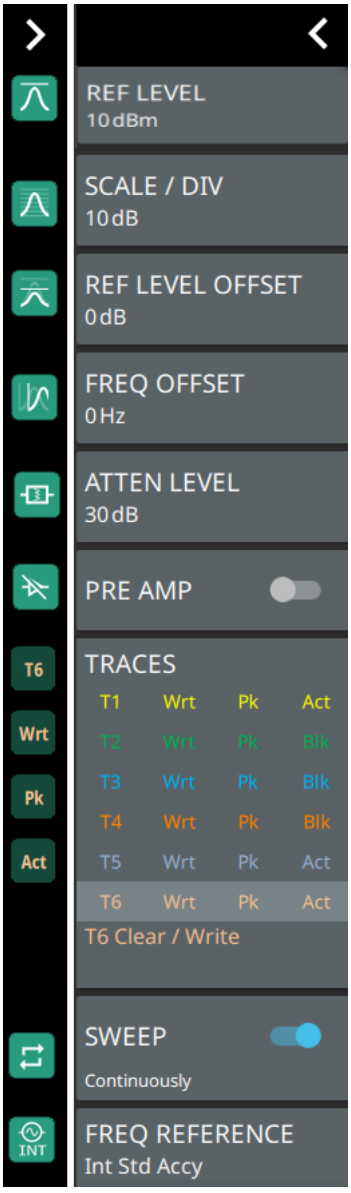
Frequency and span settings for many signal standards can be set as follows:

1. Select MEASURE on the main menu.
2. Select OBW from the MEASUREMENT button.
3. Select 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.

STATUS PANEL (Occupied BW)

Below is the status panel with the corresponding minimized status panel icons for occupied bandwidth measurement.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

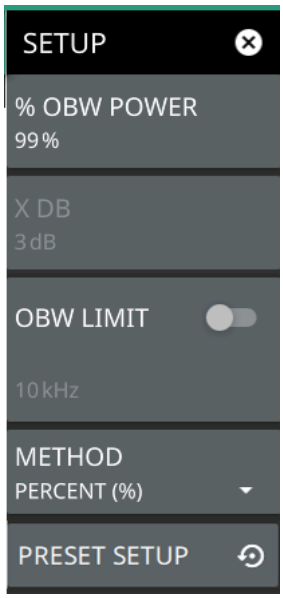
SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-54. Status Panel with Minimized Status Panel Icons (Occupied Bandwidth)

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.



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

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

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

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

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

Figure 3-55. SETUP Menu (Occupied BW)

3-15 Adjacent Channel Power

Adjacent Channel Power (ACP) measurements are set up using the "SETUP Menu (ACP)" on page 3-71. 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 3-63) along with the adjacent transmit channels that have been configured in the SETUP menu.

1. The status panel provides quick access to common spectrum analyzer settings. See "STATUS PANEL (ACP)" on page 3-70.
2. Green integration bandwidth edge of lower alternate channels.
3. Red integration bandwidth edge of lower adjacent and alternate channels.
4. Blue integration bandwidth edge of lower main and adjacent channels.

Figure 3-56. Adjacent Channel Power Ratio Measurement

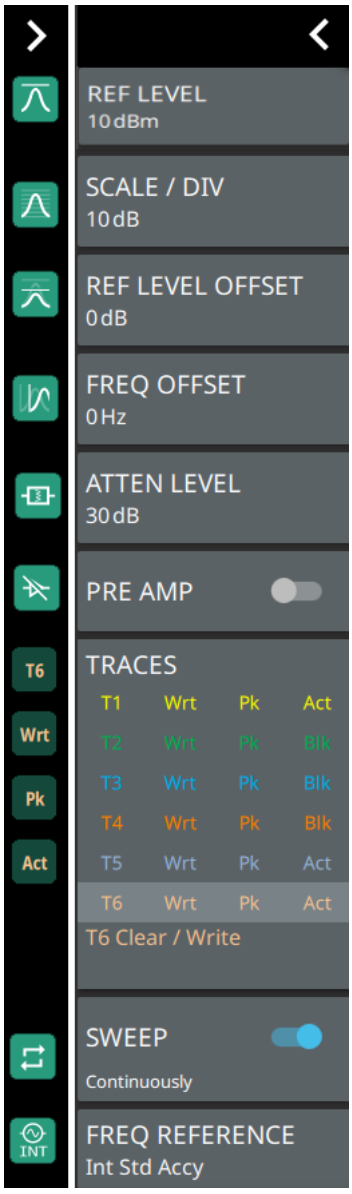
Frequency and span settings for many signal standards can be set as follows:

1. Select MEASURE on the main menu.
2. Select ACP from the MEASUREMENT button.
3. Select 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.

STATUS PANEL (ACP)

Below is the status panel with the corresponding minimized status panel icons for adjacent channel power measurement.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

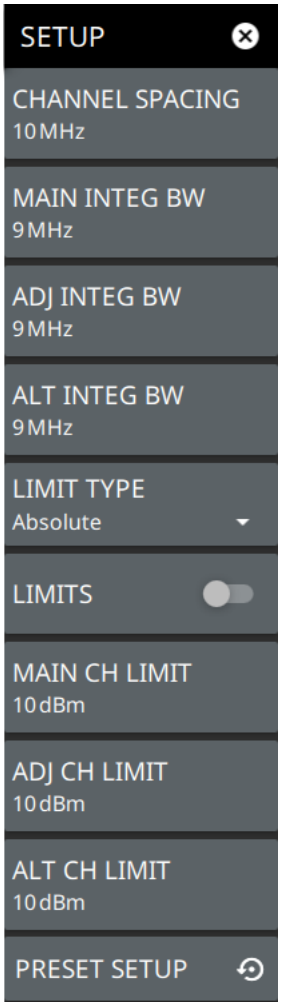
SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-57. Status Panel with Minimized Status Panel Icons (Adjacent Channel Power)

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.



CHANNEL SPACING: Sets the channel frequency spacing (center channel to center channel).

MAIN INTEG BW: Sets the range of integration used in calculating the power within the channel. The integration bandwidth (IBW) is displayed as two vertical dashed lines for each channel.

ADJ INTEG BW: Sets the range of integration bandwidth used in calculating the power in the adjacent channel.

ALT INTEG BW: Sets the range of integration used in calculating the power in the alternate channel.

LIMIT TYPE: Selects Absolute or Relative for the limit evaluation.

LIMITS: Turns on or off the use of ACP limits.

MAIN CH LIMIT: Sets the main channel limit.

ADJ CH LIMIT: Sets the adjacent channel limit.

ALT CH LIMIT: Sets the alternate channel limit.

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

Figure 3-58. SETUP Menu (ACP)

3-16 Spectrum Emission Mask

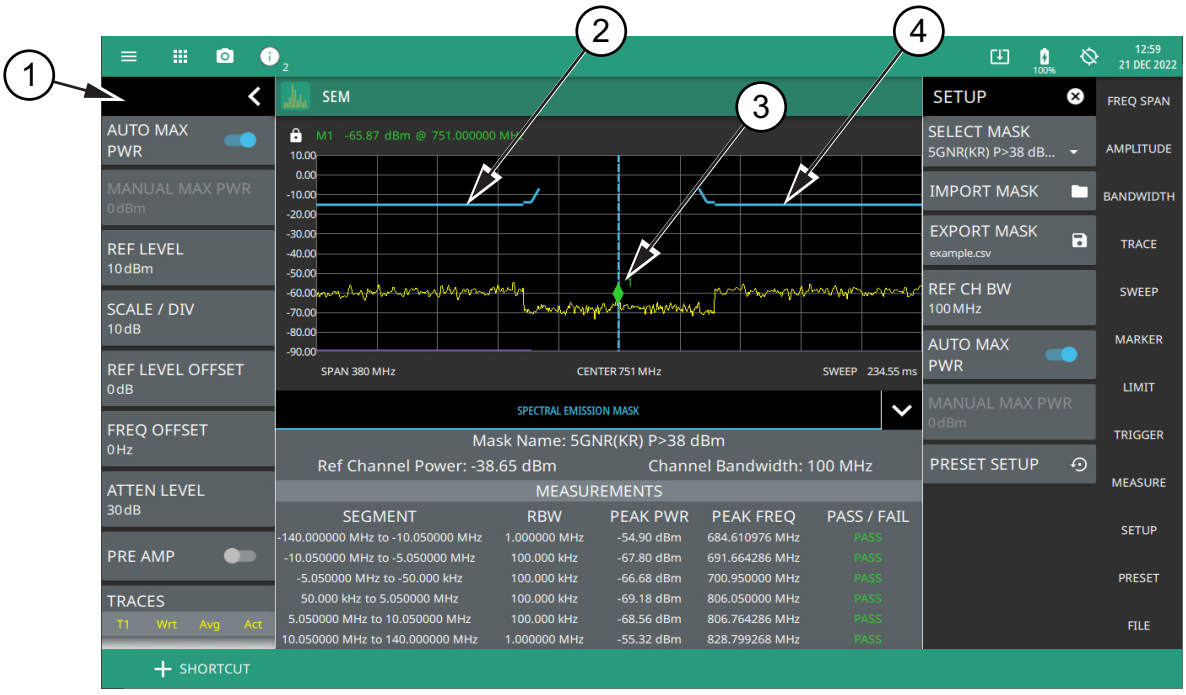
The spectrum emission mask (SEM) measurement is a relative measurement method to identify the power level of out-of-band spurious emissions outside of the in-channel bandwidth signal. The SEM measures the power ratio between in-band and adjacent channels. The SEM measurement then identifies the emissions 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 3-75. 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 3-59.



1. The status panel provides quick access to common spectrum analyzer settings. See “STATUS PANEL (SEM)” on page 3-74.
2. SEM Mask
3. Spectrum Emission
4. SEM Mask

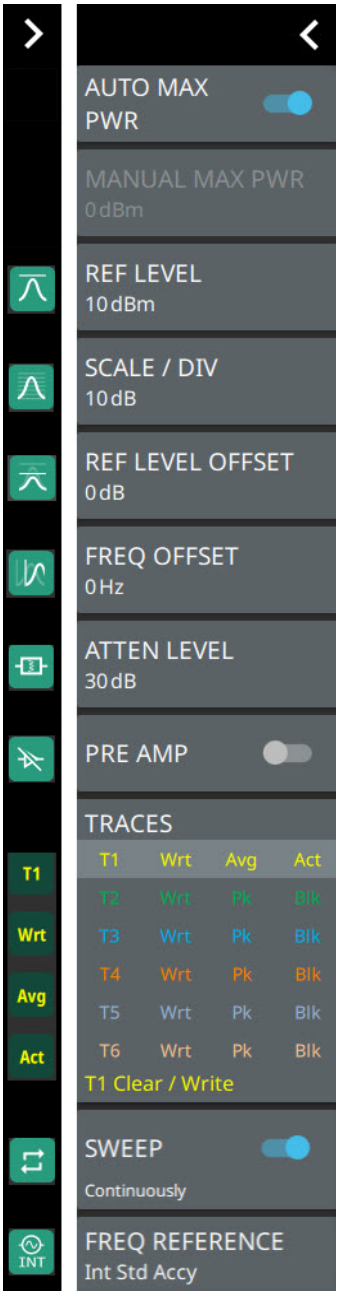
Figure 3-59. SEM Measurement

Spectrum Emission Mask Measurement Basic 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.

STATUS PANEL (SEM)

Below is the status panel with the corresponding minimized status panel icons that is unique only to spectral emission mask measurement.



AUTO MAX PWR: Toggle auto maximum power to set the maximum power automatically.

MANUAL MAX PWR: Enables when Auto Max Power is toggled.

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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-60. Status Panel with Minimized Status Panel Icons (SEM)

SETUP Menu (SEM)

SELECT MASK: Selects the desired upper or lower emission mask:

- 5GNR(KR) P < 38 dB
- 5GNR(KR) P > 38 dB
- Custom

IMPORT MASK: Used to import a custom user mask.

EXPORT MASK: Exports an example user mask as a comma separated value file (see "Example Custom Signal Emission Mask" on page 3-75) or exports the currently selected custom mask.

REF CH BW: Sets the reference channel bandwidth for the measurement.

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.

MANUAL MAX PWR: Used to manually enter the reference channel power for masks that have limits dependent on main channel power.

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

Figure 3-61. SETUP Menu (SEM)

Example Custom Signal Emission Mask

To create a custom SEM, use the following steps:

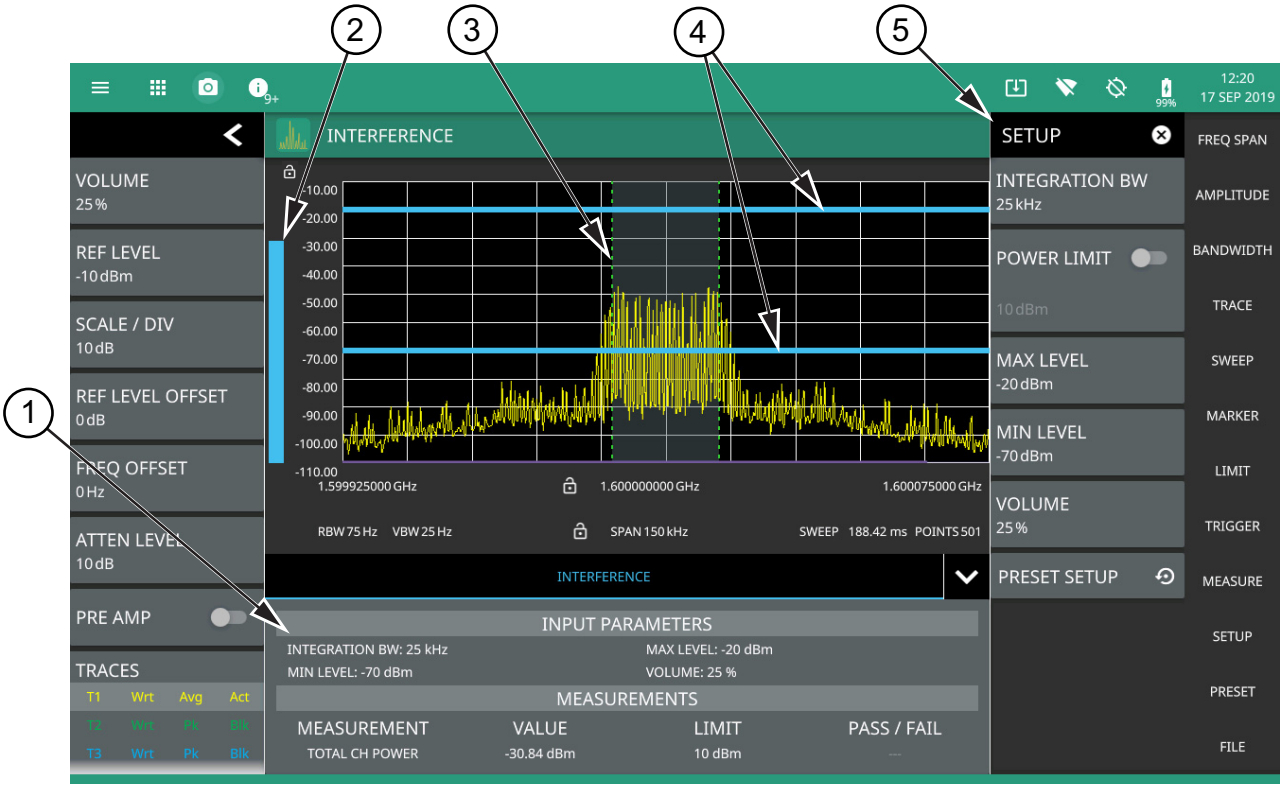
1. Export the existing mask as a csv file by pressing the EXPORT MASK button in the SEM SETUP menu.
2. From the FILES menu, move the exported file to a USB device and then to a computer for editing.
3. If this is the first time exporting the file, the following data should be in the file:

```
# Example Custom Signal Emission Mask
# Start Frequency, Stop Frequency, RBW, VBW, Is Start Amplitude Relative, Is Stop Amplitude Relative, Start Amplitude, Stop Amplitude
-3.5e6, -2.1e6, 100e6, 100e6, 0, 0, -9.5, -9.5
-2.1e6, -0.7e6, 100e6, 100e6, 0, 0, -9.5, 0.5
0.7e6, 2.1e6, 100e6, 100e6, 0, 0, 0.5, -9.5
2.1e6, 3.5e6, 100e6, 100e6, 0, 0, -9.5, -9.5
```

4. Change each of the values as desired. Note that the values must be entered in the listed order of the file header.
5. Save the file to a USB device and insert it into the instrument.
6. Select the IMPORT MASK button in the SEM SETUP menu and select the new file from the USB drive. The file name of the imported mask file will be displayed on the EXPORT MASK button.
7. Select the SELECT MASK button and select Custom.

3-17 Interference Finder (Option 24)

The interference finder measurement is set up using the "SETUP Menu (Interference Finder)" on page 3-79. The interference finder measurement is used in conjunction with a directional antenna to locate the direction of an interfering signal. This test measures the integrated power of a received signal over a specified frequency range. During the measurement, the instrument emits an audio tone that coincides with the power of the received signal. As the antenna is pointed toward the signal source, the signal level increases further into the set MAX and MIN level, and the audio increases in pitch. An example of a frequency modulated interfering signal is shown in the figure below.



1. The status panel provides quick access to common spectrum analyzer settings. See "STATUS PANEL (Interference Finder)" on page 3-78.
2. Interference setup parameters and measurement results are shown in a table at the bottom of the display.
3. A vertical bar corresponds to the received signal strength within the integration bandwidth.
4. Dashed vertical lines and a shaded region define the received channel integration bandwidth.
5. Horizontal blue lines define the audio response range for the measurement.
6. All signal power measurement parameters are set via the SETUP menu.

Figure 3-62. Interference Measurement

Frequency and level settings for many interfering signals can be set as follows:

1. Select MEASURE on the main menu.
2. Select Interference from the MEASUREMENT button.
3. Select SETUP and then do the following:
   - Set the signal INTEGRATION BW (bandwidth).
   - Toggle and set the POWER LIMIT if you wish to see pass/fail test results.
   - Set the MAX LEVEL and MIN LEVEL for the audio pitch response of the measurement. Note that these settings can also be dragged into position using the indicator bars in the display panel.

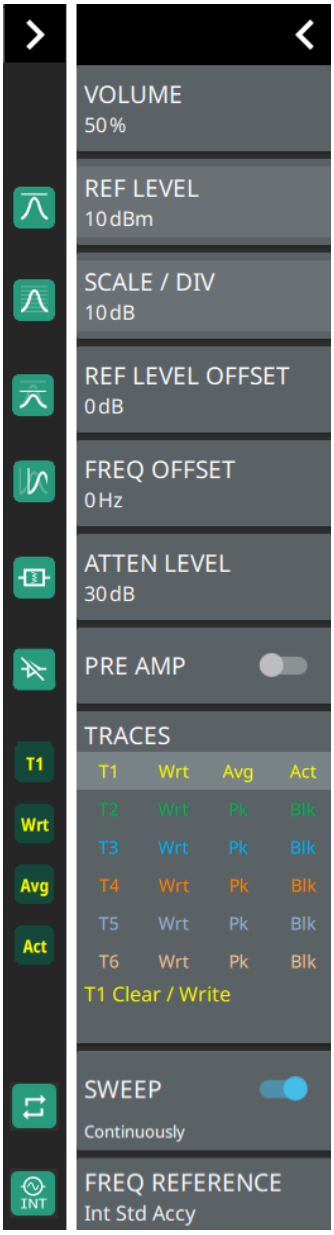
- Set the desired volume level. Note that the audio level can also be set from the left side status menu.

Interference Finder (Option 24) is a constant measurement; after it is turned on, it remains on until a different measurement is selected or the sweep is paused. Signal power and a corresponding audio pitch is calculated at the end of each sweep.

Note	Some directional antennas have a narrower null than their forward beam width; therefore, it may be more precise to find the null at the back of the directional antenna to determine the direction of the interfering signal. In this case, you would look for the lowest signal level and the corresponding audio would have the lowest pitch.

STATUS PANEL (Interference Finder)

Below is the status panel with the corresponding minimized status panel icons for interference measurement.



VOLUME: Sets the volume level for the audio response of the measurement. Note that the system volume can affect the range of this setting.

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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

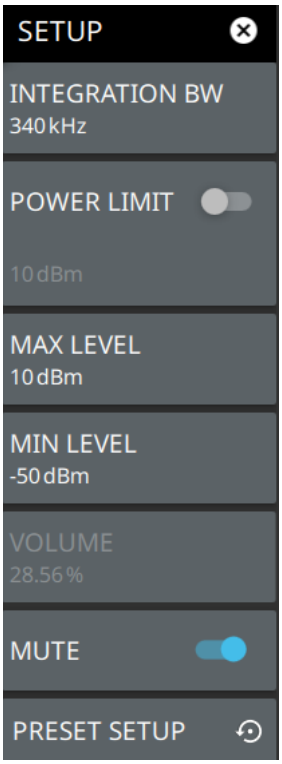
SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-63. Status Panel with Minimized Status Panel Icons (Interference Finder)

SETUP Menu (Interference Finder)

The interference finder SETUP menu is available in MEASURE > MEASUREMENT > Interference > SETUP. Once the interference measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.



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

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.

MAX LEVEL: Sets the upper level for the audio response of the measurement. This setting is useful for adjusting the resolution of the tone changes. Power levels above the MAX LEVEL will continue to emit sound an increasingly higher pitch.

MIN LEVEL: Sets the lower level for the audio response of the measurement. The MIN LEVEL also functions as a squelch. Power below this level will not emit a sound.

VOLUME: Sets the volume level for the audio response of the measurement. Note that the system volume can affect the range of this setting. Refer to Section 3-17 “Interference Finder (Option 24)” on page 3-76.

MUTE ALL: Mutes the volume of the instrument.

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

Figure 3-64. SETUP Menu (Interference Finder)

3-18 Electromagnetic Field (EMF) Measurements (Option 444)

This section describes the Electromagnetic Field (EMF) measurement functions available with Option 444. Option 444 must be used in conjunction with an Anritsu isotropic antenna at a frequency range that is within specification of the instrument and antenna used. Refer to your technical data sheet for compatible antennas.

For broadband EMF Meter compliance testing, refer to EMF Meter measurement guide (10580-00489).

Note	EMF measurements require that an Anritsu EMF isotropic antenna is connected to the analyzer and that the frequency range and span is set within the operating range of the antenna.

Connecting the Antenna

1. Connect the antenna RF connector to the **RF In** port on the instrument. See Figure 3-65. The antenna connector must be *finger* tight.
2. Connect the antenna USB connector to one of the top panel USB Type A ports.
3. Set up a spectrum analyzer measurement for your signal and bandwidth of interest. The frequency range and span must be set within the operating range of the antenna.
4. While in Spectrum Analyzer mode, press MEASURE > MEASUREMENT > EMF Measurement.

The instrument is now ready to set up and start an EMF measurement.

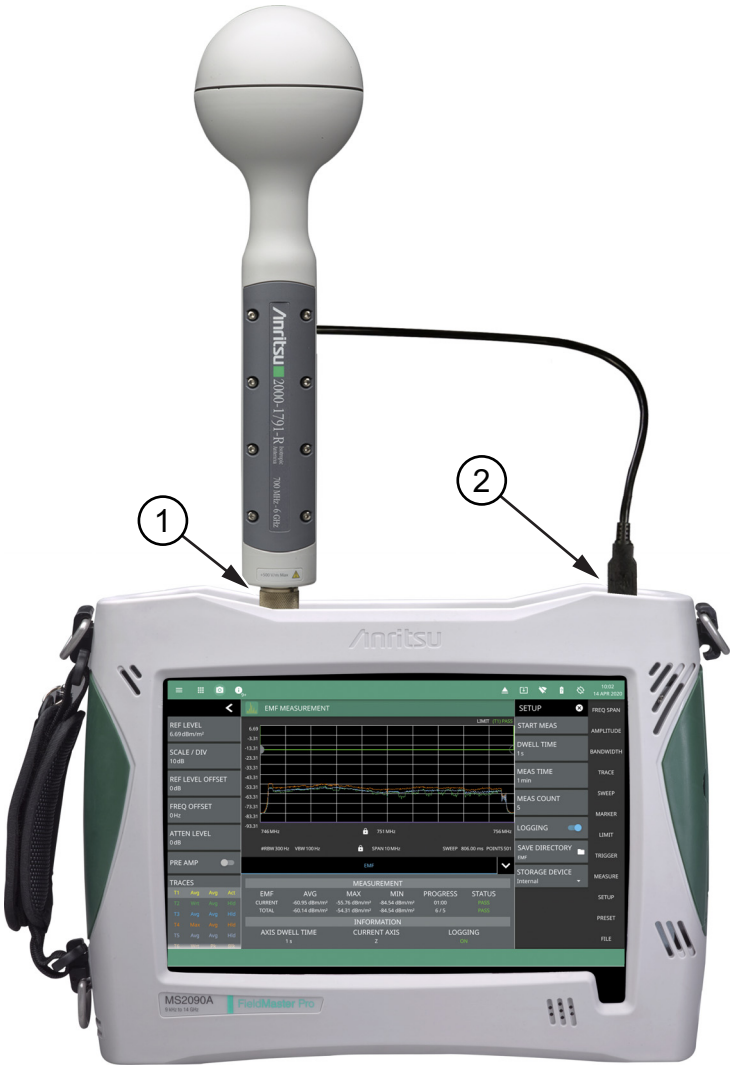
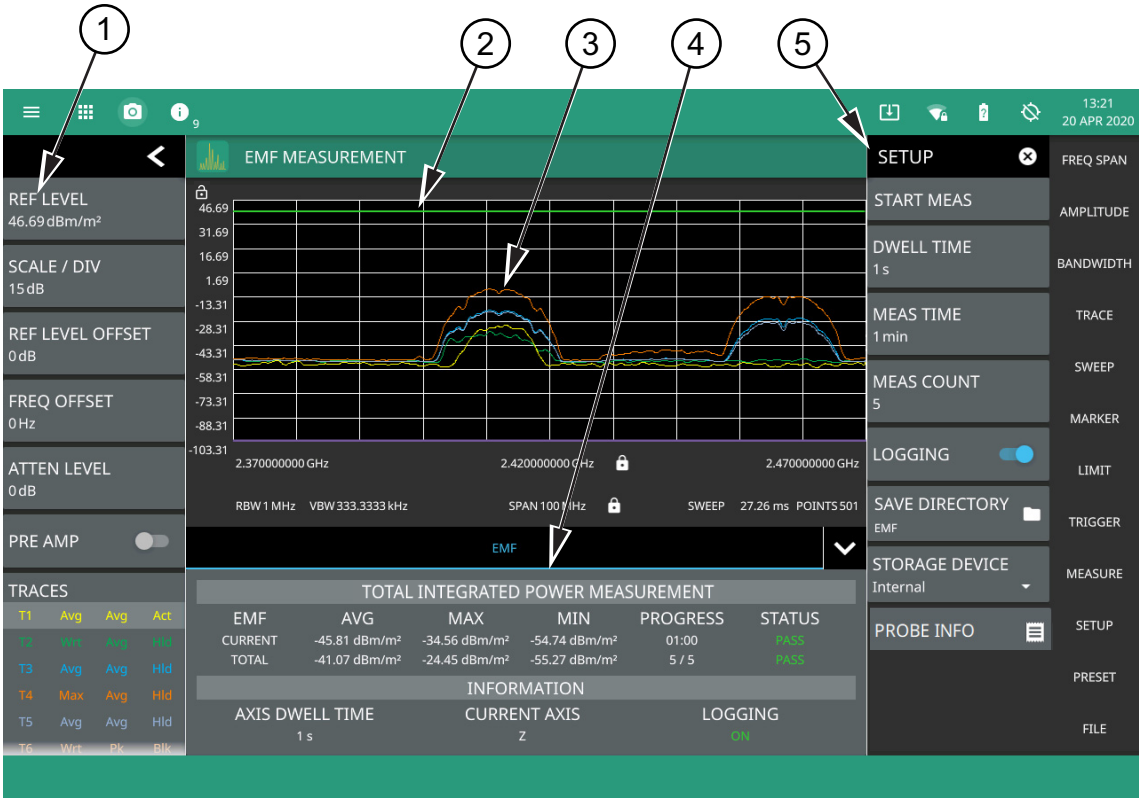


Figure 3-65. Isotropic Antenna Connection

EMF measurements are set up using the "STATUS PANEL (EMF Measurement)" on page 3-83. After completing the data collection for the three axes (X, Y, and Z), the isotropic result is calculated and displayed. In addition to the traces displayed on the user interface (axis sweep data, current isotropic result, and average and max isotropic result), the max, min, and average of the total integrated power of the isotropic result over time is computed and displayed in the table below the graph region. The CURRENT values are calculated over the elapsed measurement time and the TOTAL values are calculated over the entire measurement time and total number of measurements.



1. The status panel provides quick access to common spectrum analyzer settings. See "STATUS PANEL (EMF Measurement)" on page 3-83.
2. EMF measurement pass/fail status uses a limit line for the test criteria. You can use either a custom limit line or toggle the International Commission on Non-Ionizing Radiation Protection limit. Either limit supports the same features as in the spectrum analyzer mode. See "LIMIT Menu" on page 3-50.
3. The trace display area shows traces for the following measurements in units/m^2:
   - Trace 1: Current axis sweep data
   - Trace 2: Current isotropic result
   - Trace 3: Average isotropic result
   - Trace 4: Maximum isotropic result
   - Trace 5: Total average isotropic result

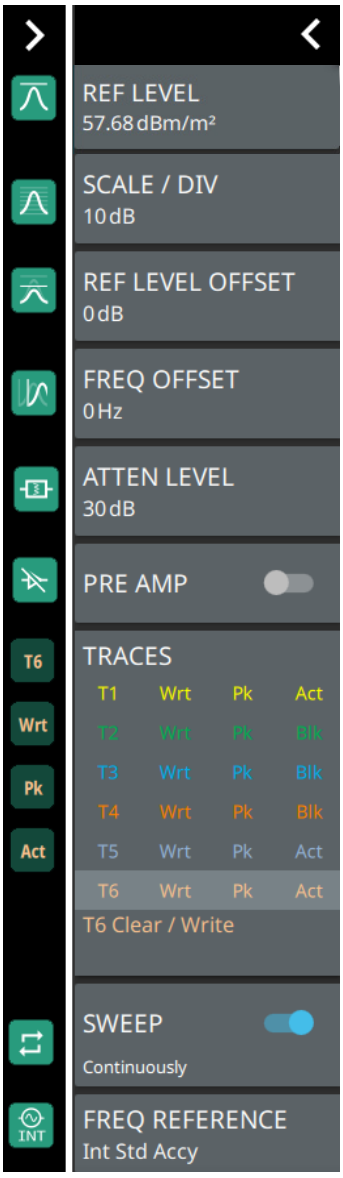
Note that trace detectors and trace averaging are disabled for the EMF measurement.

4. Tabular measurement data shows the current and total EMF measurement results, the current test progress, and the pass/fail status. The information area shows the axis dwell time, the current axis being measured, and the data logging state.
5. Use the SETUP menu to configure the EMF measurement settings. See "STATUS PANEL (EMF Measurement)" on page 3-83.

Figure 3-66. EMF Measurement

STATUS PANEL (EMF Measurement)

Below is the status panel with the corresponding minimized status panel icons for EMF measurement.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

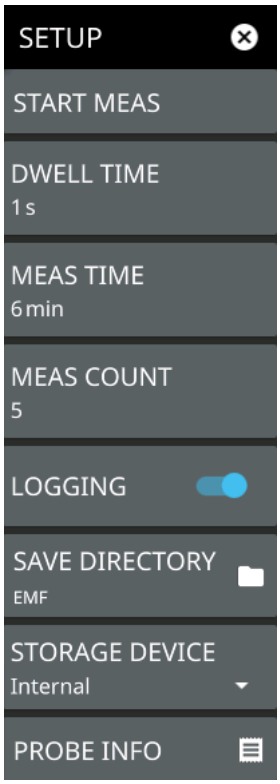
SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-67. Status Panel with Minimized Status Panel Icons (EMF measurement)

SETUP Menu (EMF Measurement)

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



START MEAS: Initiates an EMF measurement. Once the measurement is started, all UI interface is locked until the measurement is complete. A pop-up control appears that allows you to immediately stop the measurement. Note that a valid antenna must be connected and a supported frequency range must be set before a measurement can be started. Note that the START MEAS button also appears on the MEASURE menu and provides the same functionality.

DWELL TIME: Specifies the time to sweep on each of the three isotropic antenna axis (X, Y, and Z). The sweeps are then averaged and saved for further computation. Note that if the sweep time is longer than the dwell time setting, the sweep time will determine the time spent on each axis (a complete sweep must be completed before moving to the next axis).

MEAS TIME: Sets the duration of each EMF measurement from one minute up to 30 minutes. The default is 6 minutes. The measurement time includes all of the sweeps for each axis, which repeats until the total measurement time is completed. For example, if the axis dwell time is set to 1 second (and the sweep time is 1 second or less) and the measurement time is set to 1 minute, you will get one complete isotropic result after 3 seconds, and approximately 20 isotropic results at the end of the one-minute measurement.

The CURRENT row in the summary table at the bottom of the screen displays a running average of the isotropic results, and the max and min of the computed total integrated power of the isotropic results every 3 s. The displayed values are computed from all measurements completed thus far within the measurement time. At the end of the measurement time, the CURRENT row is cleared and the TOTAL row is updated with the max, min, and running average of all isotropic results (20 in this example).

MEAS COUNT: Sets the number of EMF measurements (set in MEAS TIME) to complete from 1 up to 10,000. The EMF test is fully executed when the specified number of measurements have completed.

LOGGING: Logging is toggled on by default. This must be selected prior to starting the EMF measurement for the results to be logged. Each log file can hold 21 measurements for a maximum of 10,000 measurements total. All files for a measurement run will be stored in the same folder with the year, month, day, measurement time and number.

SAVE DIRECTORY: Sets the directory of where the log folders are created.

STORAGE DEVICE: Sets the storage location of either Internal memory or an externally connected storage device.

PROBE INFO: Displays the details of the connected isotropic antenna, for e.g. frequency range, hardware revision etc.

Figure 3-68. SETUP Menu (EMF Measurement)

3-19 Coverage Mapping (Option 431)

Coverage Mapping (Option 431) provides signal strength mapping on the instrument display and will plot color-coded signal values at GNSS (GPS) coordinates for the following measurements:

- **Channel Power:** The total power within the set channel bandwidth.
- **Spectral Density:** The measure of the signal power content versus frequency.
- **RSSI:** The received signal strength indicator mode represents the amount of the received power level of the radio signal, after antenna and cable gains/losses.

Note	The Coverage Mapping option for outdoor signal mapping requires an active GPS antenna to be connected to the instrument. Offline maps will need to be uploaded to the instrument if an Internet connection is not available. Refer to "Map Tool" on page 3-93. Indoor coverage mapping does not require GNSS (GPS).

Refer to the previous sections in this chapter for details and menu overviews of general spectrum analysis measurements including setting up frequency and bandwidth parameters, sweep settings, trigger types, attenuator options, and preamp settings. Once the basic measurement is set up, select the coverage mapping measurement via MEASURE > MEASUREMENT > Coverage Mapping. Once coverage mapping is selected, start the mapping measurement via MEASURE > START MEAS.

Refer to "Outdoor Coverage Mapping" on page 3-86 and Figure 3-69, "Coverage Mapping (Outdoor)" on page 3-86 for an overview of outdoor coverage mapping and the user interface.

Refer to "Indoor Coverage Mapping" on page 3-88 and Figure 3-70, "Coverage Mapping (Indoor)" on page 3-88 for an overview of indoor coverage mapping and the user interface.

The "SETUP Menu (Coverage Mapping)" on page 3-91 is common to both map types.

Outdoor Coverage Mapping

With a valid GNSS (GPS) signal, the instrument identifies the current location on the displayed map with a location pin. As the location changes during a measurement, colored-coded dots corresponding to the received signal strength/power are placed at distance or time intervals. Using GNSS (GPS) for latitude, longitude, and altitude, data is automatically saved for each location. The instrument logs data automatically based on either a set time or distance interval. If there is no map available when making the measurements, it is still possible to save all of the data to a KML file and then combine the data with a map using other third party tools that can work with KML data. You may also recall a map after taking the data without having to save and recall the measurement data. See Figure 3-69, “Coverage Mapping (Outdoor)” on page 3-86 for an overview of the outdoor coverage mapping interface.

	When selecting outdoor coverage mapping and the GNSS (GPS) is off or is turned off, GNSS (GPS) will be enabled with a notification dialog. Aborting the GNSS (GPS) fix from the dialog does not allow the instrument to start a coverage mapping measurement.
Note	When saving CSV and KML files map point measurement data, the saved data is cumulative of all data points on the map or measurements since the map points were last cleared.
	Ensure to save and clear current measurement points once the maximum number of measurement points are reached.

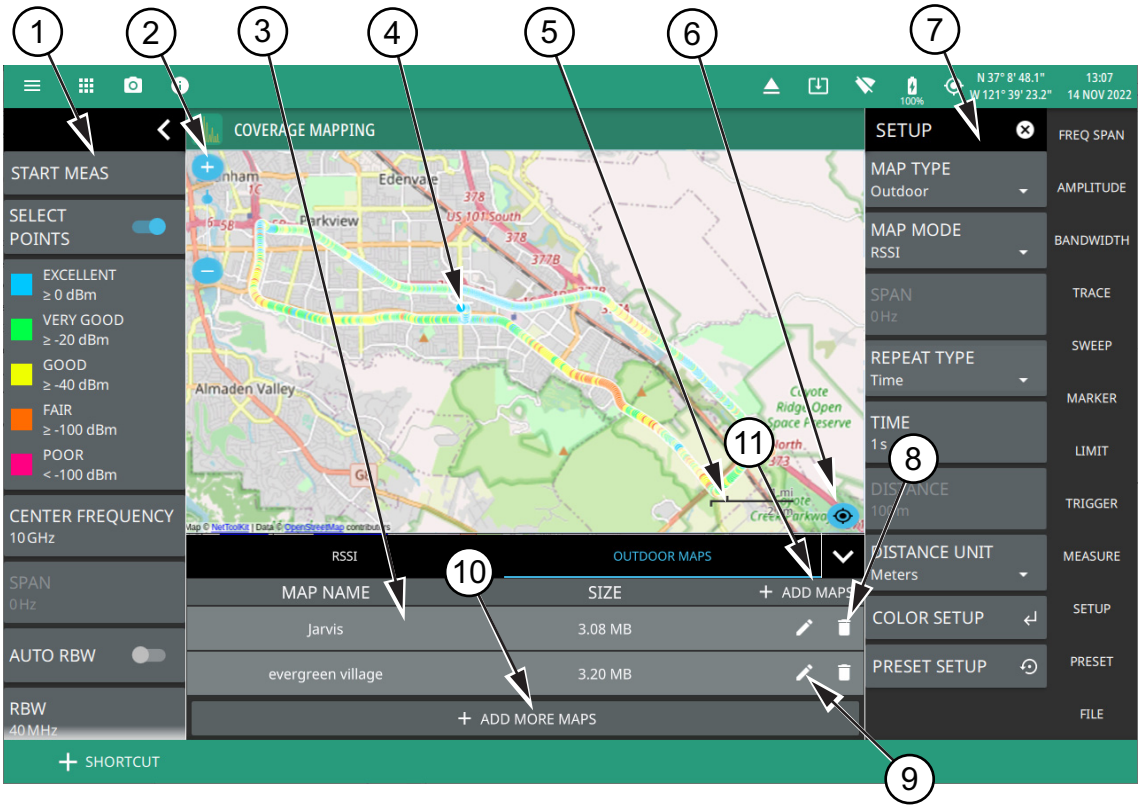


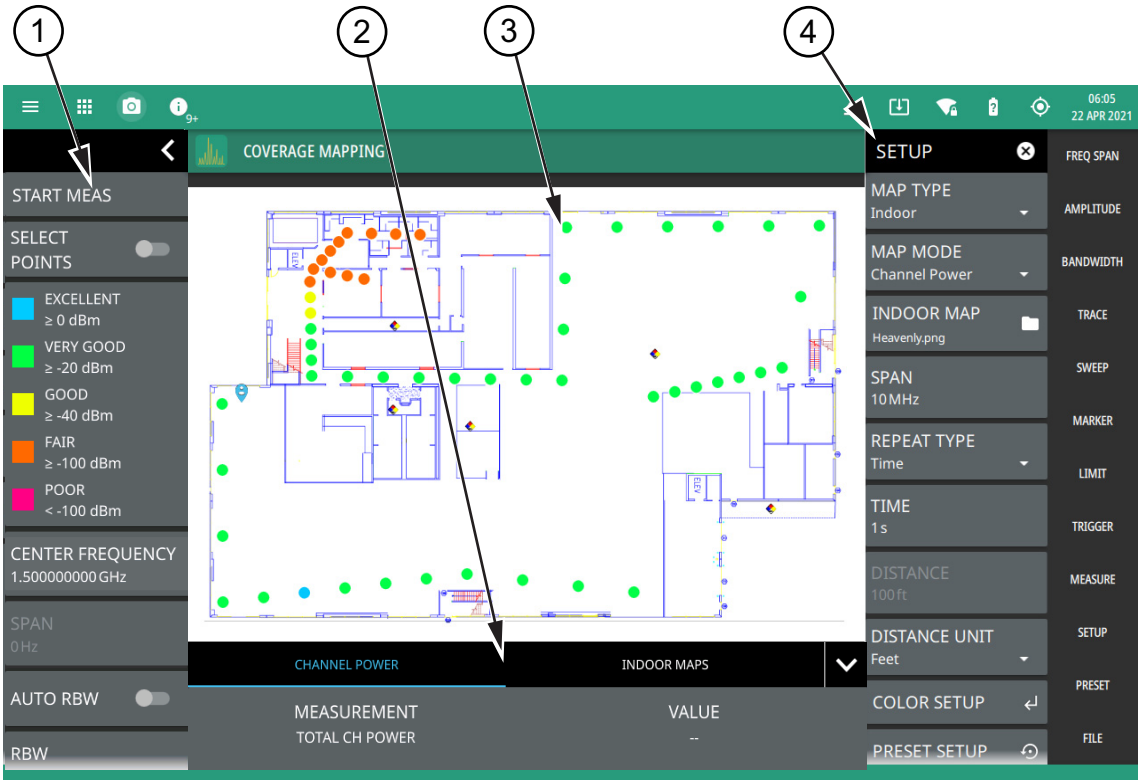
Figure 3-69. Coverage Mapping (Outdoor) (1 of 2)

1. The coverage mapping status panel provides quick access to common settings and allows you to start and stop a coverage mapping measurement. A color-coded signal-strength legend is shown at the bottom of the panel. See “Map Tool” on page 3-93.
2. Select map zoom tool to increase (+) or decrease (-) zoom level. You can also drag the zoom level indicator up or down, or you can pinch to change zoom level.
3. Tabular measurement data shows the current measurement, measurement value in addition to the list of the created region names.
4. The map display area shows map data for the current area and color-coded dots corresponding to the signal colors that are set up for the recorded measurement data.
5. Map scale shows length for both imperial (miles) and metric (kilometers) units.
6. Re-centering tool centers the current location on the map.
7. Select SETUP menu to configure coverage mapping measurement settings. See “SETUP Menu (Coverage Mapping)” on page 3-91.
8. Select pencil icon to edit or rename the saved name of the available map.
9. Select trash can icon to delete the unwanted map (s).
10. Select + ADD MORE MAPS to open “Map Tool” of Tools menu.
11. Select + ADD MAPS to add maps.

Figure 3-69. Coverage Mapping (Outdoor) (2 of 2)

Indoor Coverage Mapping

Indoor coverage mapping does not use a GNSS (GPS) signal to identify the current location, but rather relies on the user to touch the location pin to where they are located on a building floor plan, or map, that is shown on the instrument display. As the location pin is moved from point to point during a measurement, the map is annotated with dots that are colored-coded to the received signal strength/power. The instrument logs data automatically based on either a set time or distance interval. You may save and recall the measurement as a PNG file or save just the measurement data. See Figure 3-70, “Coverage Mapping (Indoor)” on page 3-88 for an overview of the indoor coverage mapping interface.

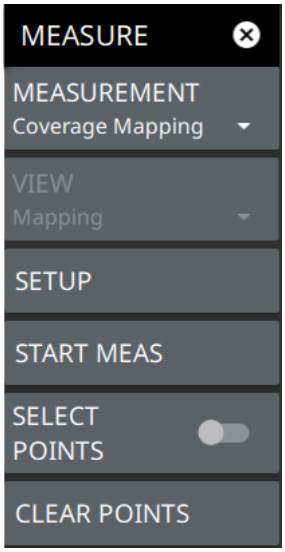


1. The coverage mapping status panel provides quick access to common settings and allows you to start and stop a coverage mapping measurement. A color-coded signal-strength legend is shown at the bottom of the panel. See “STATUS PANEL (Coverage Mapping)” on page 3-90.
2. Tabular measurement data shows the current measurement, measurement value and the list of saved regions.
3. The map display area shows map data for the current area and color-coded dots that correspond to the signal colors that are set up for the recorded measurement data.
4. The SETUP menu is where the coverage mapping measurement settings are configured. See “SETUP Menu (Coverage Mapping)” on page 3-91.

Figure 3-70. Coverage Mapping (Indoor)

MEASUREMENT Menu (Coverage Mapping)

The coverage mapping measurement SETUP menu is available in MEASURE > MEASUREMENT > Coverage Mapping > SETUP. Once the coverage mapping measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.



MEASUREMENT: Selects the current measurement.

VIEW: Only the Mapping view is available.

SETUP: Opens the "SETUP Menu (Coverage Mapping)" on page 3-91.

START MEAS: Initiates a coverage mapping measurement. Note that a GPS antenna must be connected and enabled before measurement data can be recorded.

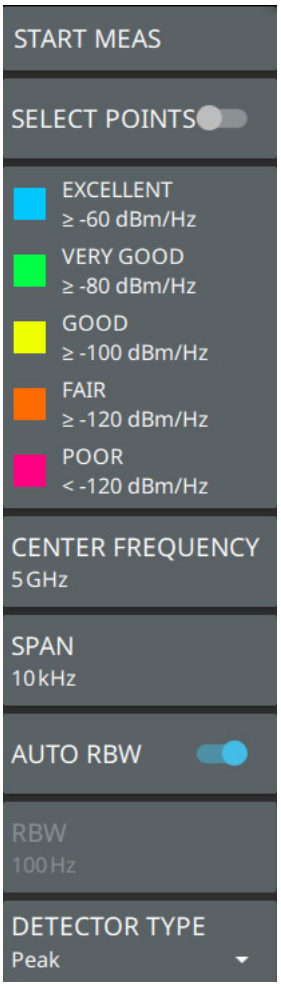
SELECT POINTS: Clears all measurement points from the map.

CLEAR POINTS: Clears all measurement points from the map.

Figure 3-71. MEASUREMENT Menu (Coverage Mapping)

STATUS PANEL (Coverage Mapping)

The status panel illustrated in Figure 3-72 is unique to the coverage mapping measurement.



START MEAS: Initiates a coverage mapping measurement. A valid GPS antenna must be connected to the instrument and enabled for a measurement data to be recorded. Note that the START MEAS button also appears on the "MEASUREMENT Menu (Coverage Mapping)" on page 3-89 and provides the same functionality.

SELECT POINTS: Toggle this button to view the value and signal quality of the current measurement. This button appears only in indoor coverage mapping.

Color-Coded Legend: This legend shows the colors that are assigned for each power level threshold. The power levels can be set using the "COLOR SETUP Menu (Coverage Mapping)" on page 3-92.

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.

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. Selecting 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.

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.

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.

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).

Figure 3-72. STATUS Panel (Coverage Mapping)

SETUP Menu (Coverage Mapping)

The coverage mapping SETUP menu is available in MEASURE > MEASUREMENT > Coverage Mapping > SETUP. Once coverage mapping is selected, start the mapping measurement via MEASURE > START MEAS. Once the coverage mapping measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

MAP TYPE: Selects indoor or outdoor coverage mapping:

- **Indoor Map:** The indoor map type is used to select the image/map for mapping from the instrument File system. This image is usually a building floor plan or campus layout drawing.
- **Outdoor Map:** The outdoor map is used to view the signal strength within a selected region of the outdoor map.

MAP MODE: Selects the measurement type for the map:

- **Channel Power:** The total power within the set channel bandwidth (SPAN).
- **Spectral Density:** The measure of the signal power content versus frequency.
- **RSSI:** The received signal strength indicator mode represents the amount of the received power level of the radio signal, after antenna and cable gains/losses

Note that field strength measurements can be selected from the Amplitude menu. When field strength is enabled, each measurement is adjusted per m^2 based on antenna factors.

INDOOR MAP: When indoor map type is selected above, this button is available and is used to select the image/map for mapping from the instrument File system. This image is usually a building floor plan or campus layout drawing.

SPAN: Sets the current frequency span. For channel power and spectral density measurements, the span is equal to the integration bandwidth. This setting is not available in the RSSI map mode.

PSD UNITS: Selects the spectral density units as either Hz or MHz. This option is enabled only if Map Mode is set to Spectral Density and Field Strength option is enabled in Amplitude menu.

REPEAT TYPE: Selects when a map data point is recorded. The repeat type can be set to a time interval or distance interval. For indoor coverage mapping, time interval will evenly distribute measurement points between two selected positions; distance interval will plot a single point for every position selected by the user.

TIME: When the repeat type is Time, sets the time duration for recording map data points.

DISTANCE: When the repeat type is Distance, sets the distance between recording map data points. When using an indoor map type, the distance mode only marks the data points to where the user drags the location pin.

DISTANCE UNIT: Selects distance units of Meters or Feet.

COLOR SETUP: Opens the "COLOR SETUP Menu (Coverage Mapping)" on page 3-92.

PRESET SETUP: Sets all coverage mapping setup parameters to default, including color setup.

Figure 3-73. SETUP Menu (Coverage Mapping)

COLOR SETUP Menu (Coverage Mapping)

The coverage mapping measurement COLOR SETUP menu is available in MEASURE > MEASUREMENT > Coverage Mapping > SETUP > COLOR SETUP. Once the coverage mapping measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

EXCELLENT: Sets the power level threshold for the EXCELLENT color.

VERY GOOD: Sets the power level threshold for the VERY GOOD color.

GOOD: Sets the power level threshold for the GOOD color.

FAIR: Sets the power level threshold for FAIR color.

POOR: Sets the power level threshold for the POOR color.

See “Outdoor Coverage Mapping” on page 3-86 for the color-coded legend.

Figure 3-74. COLOR SETUP Menu (Coverage Mapping)

Map Tool

The Map tool includes an embedded, low detail world base map. The MAP TOOL provides access to downloadable, high detail map tiles for offline use during signal mapping. The map tiles that you download have the same detail that is accessible through an active Internet connection. The map tool can be used directly on the instrument or with the instrument PC software. Files downloaded to the instrument are automatically saved for offline coverage mapping. Files downloaded using the PC software can be exported to a USB drive or directly to an instrument via the instrument IP address or hostname. All tiles are saved to a single map file on the instrument. To manage storage, see "Map Tile Usage and Memory" on page 3-96. Go to upper left system menu (3 line icon) to access the MAP TOOL and select TOOLS>MAP TOOL.

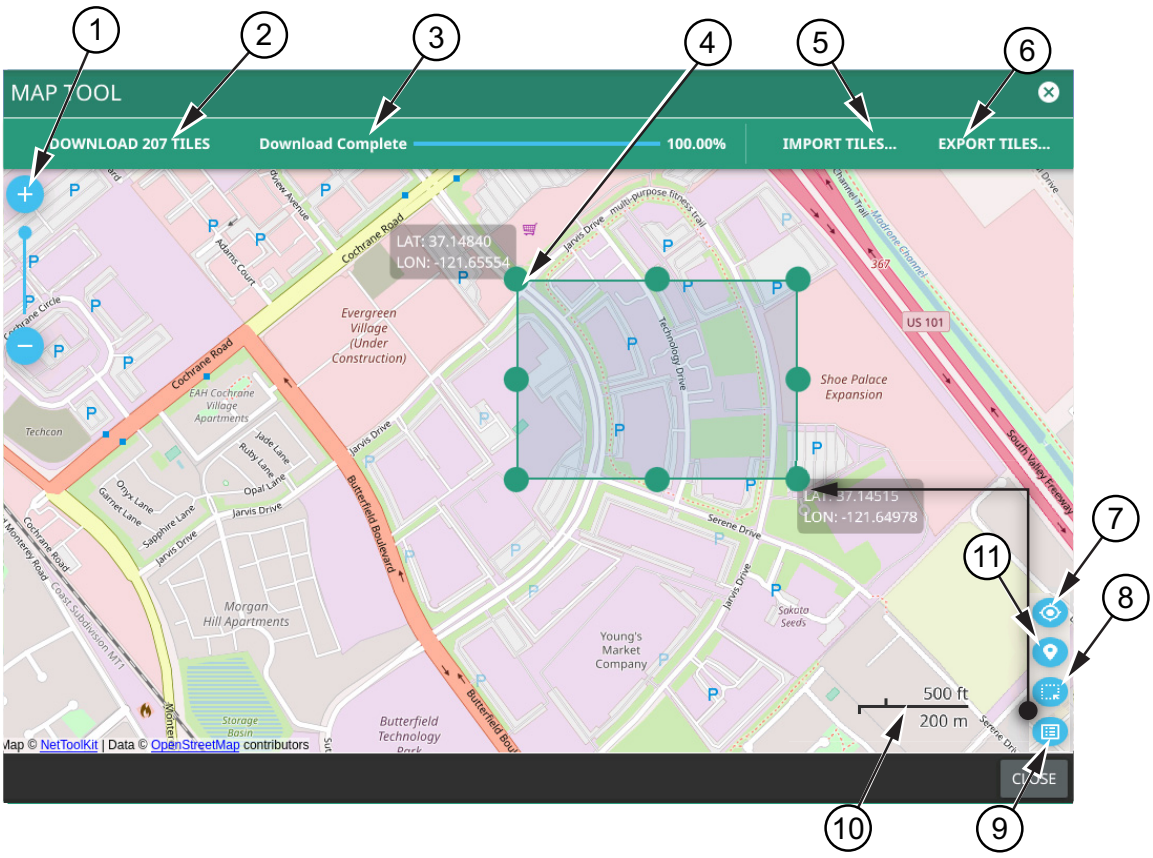


Figure 3-75. MAP TOOL (1 of 2)

1. The map zoom tool is used to increase (+) or decrease (-) zoom level. You can also drag the zoom level indicator up or down, or you can pinch to change zoom level.
2. Indicates the number of map tiles that will be downloaded for the currently selected area. Touch this button to download the map tiles and add them to the current map tile storage. Refer to “Map Tile Usage and Memory” on page 3-96.
3. Indicates the map tile download progress once the DOWNLOAD ### TILES button is touched. Download times can be long depending on the number of tiles that were generated and the Internet connection speed.
4. The selection area is displayed when toggled on using the selection tool (8). This defines the map tile generator area. The area can be dragged to the desired size using the handles (dots) on the sides and corners. The handle on the side allows you to move just that side, and the handles on the corners allow you to move the corner.
5. IMPORT TILES opens the file system so you can select previously downloaded tiles from internal or external memory.
6. EXPORT TILES opens the file system so you can export downloaded tiles. In the PC application upload icon initiates connection to an instrument and uploads them to the instrument internal storage area (Figure 3-77).
7. Re-centering tool to center map on current GNSS (GPS) position. A GPS antenna is required for this icon to appear
8. Selection tool when touched selects a desired area on the map.
9. Select Map list icon to view a table of user created maps with their size. You can also edit the name of the map or delete an unwanted map. Refer to “Outdoor Coverage Mapping” for more information.
10. Map scale shows length for both imperial (miles) and metric (kilometers) units
11. Location pin icon when selected displays all the saved map names.

Figure 3-75. MAP TOOL (2 of 2)

Downloading and Importing/Uploading Map Tiles

1. Touch and drag the map to the desired area, then use the zoom tools in the upper left to show an area that is centered and is a little larger than the area that you wish to conduct your signal mapping measurements.
2. Touch the selection tool in the lower right, then drag the green box over an area from the upper left to lower right. The selected boundary edges are indicated with latitude and longitude, and the numbers of map tiles that will be downloaded is shown at the top. The green dots can be used as handles to drag an edge or a corner to cover the desired area.
3. Once the desired area is selected, touch DOWNLOAD ### TILES to download the tile set.
4. Enter a name for the map, and press CONTINUE. Select the location pin icon to view the saved map (s). Note that all the saved maps can be viewed in a tabular form in Coverage Mapping measurement mode.

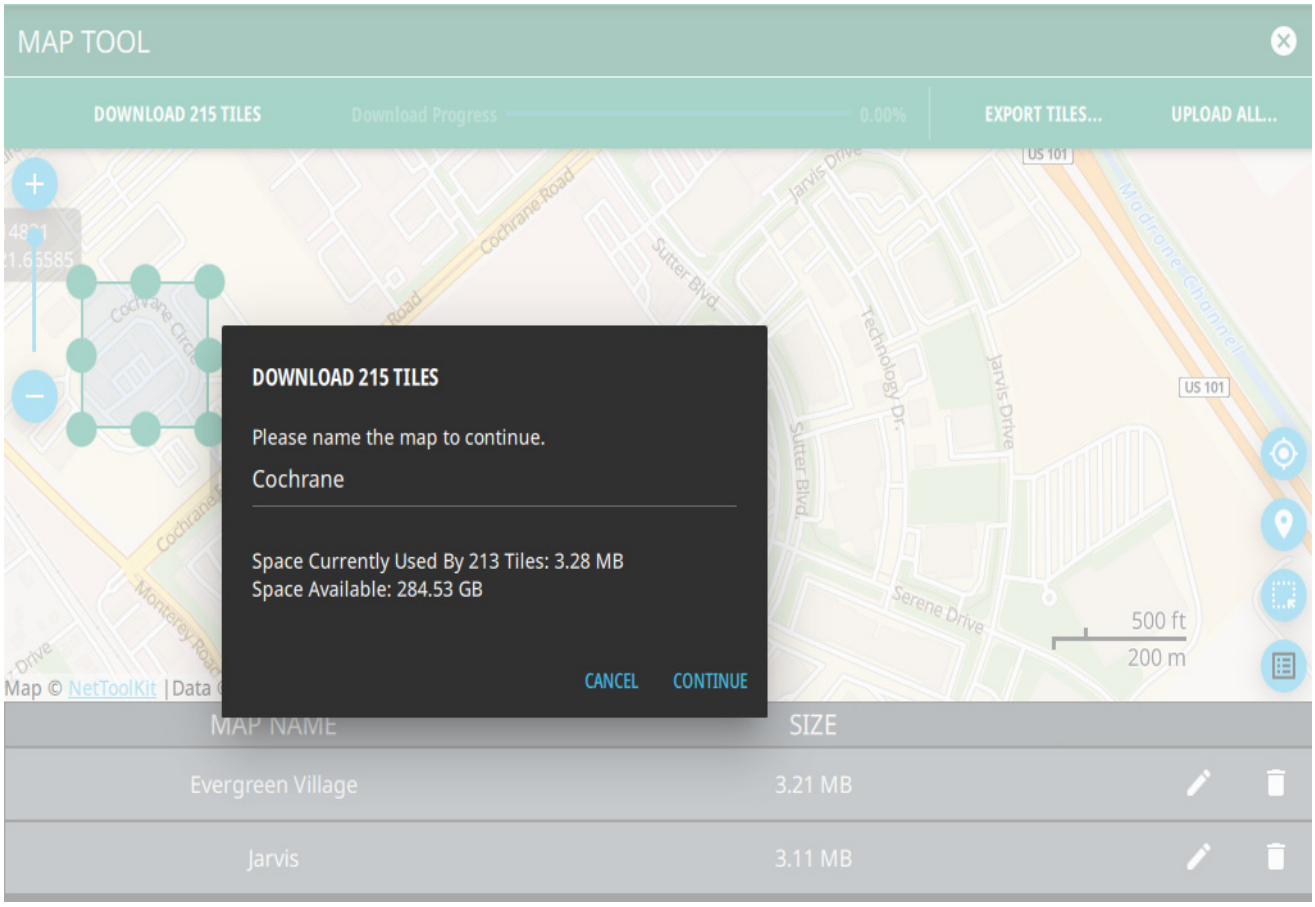


Figure 3-76. Download ### Tiles Dialog

5. If you are using the PC software, click upload icon from the list of available maps to upload the specific map tiles to the instrument. You will see a dialog to enter the instrument IP address for the upload. If not automatically detected, enter the instrument IP address, then touch the upload icon. If more than one map is available, then click UPLOAD ALL... button on the top right corner of the screen, to upload all the maps.

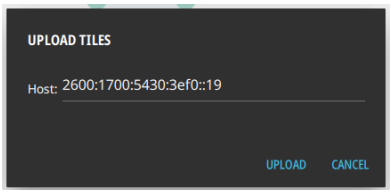


Figure 3-77. UPLOAD TILES Dialog

Map Tile Usage and Memory

The instrument can store up to as many tiles as the instrument's memory. Each time tiles are generated or uploaded to the instrument, they are added to the existing tile storage. Once full, no more map tiles can be added and existing tiles will need to be deleted to make space. Delete tiles from the Settings > MAPS menu, accessed from the top left System menu icon.

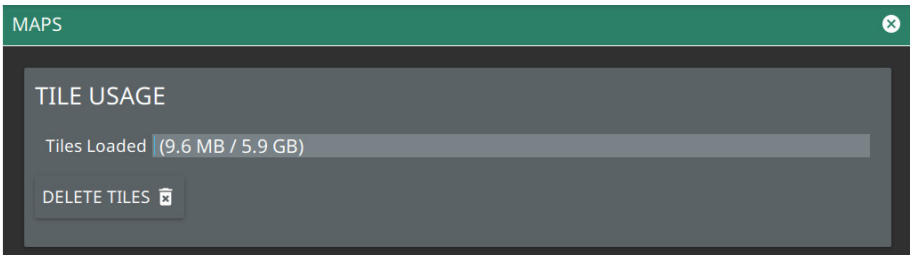


Figure 3-78. System Settings Map Menu

3-20 AM/FM Audio (Requires Option 24 or Option 509)

This section describes the AM/FM audio demodulation capability (available with Option 24) and key characteristics of analog amplitude modulation (AM) and frequency modulation (FM). The AM/FM audio measurement provides the following features:

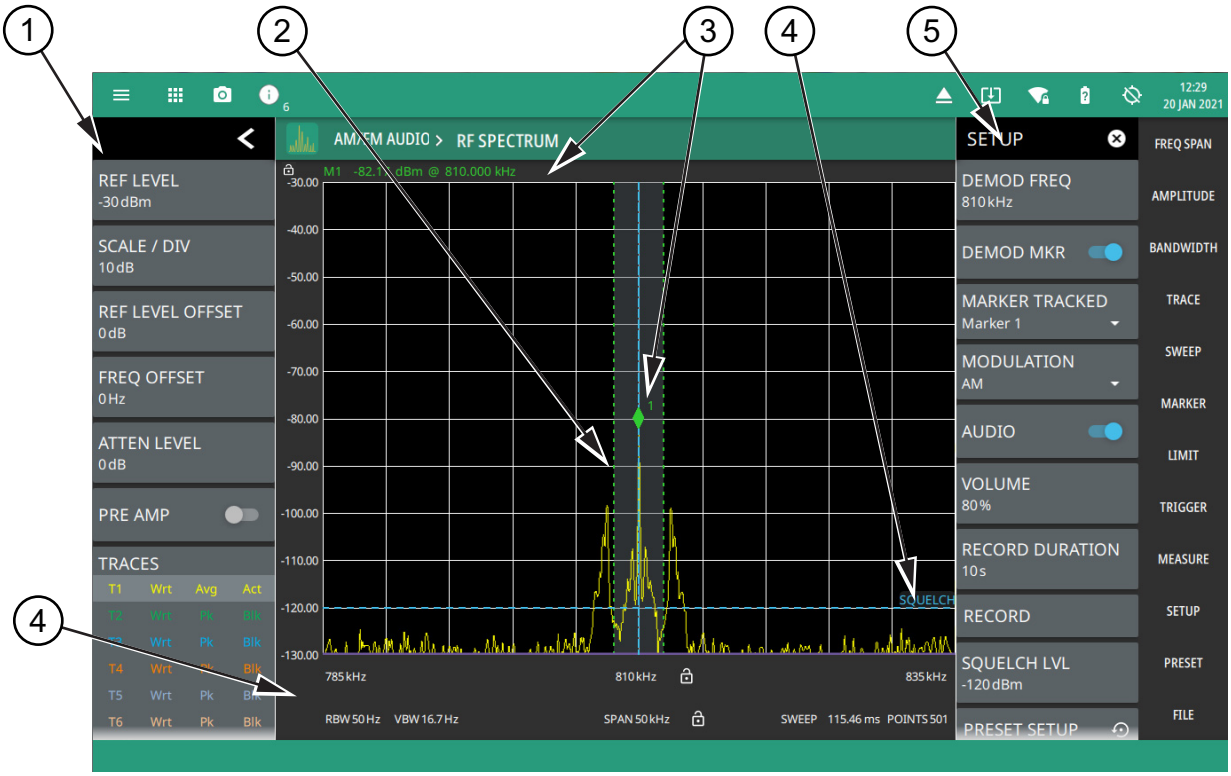
- Ability to listen to audio and sweep trace data simultaneously with built-in speaker or headphone. See Figure 3-79.
- Selectable demodulation frequency with ability to tie frequency to markers.
- Record audio to WAV file
- Selectable modulation modes such as:
  - AM
  - Upper sideband (US Band)
  - Lower sideband (LS Band)
  - Narrowband FM
    - 6.25 kHz
    - 12.5 kHz
    - 25 kHz
  - FM Wideband

Refer to the previous sections in this chapter for details and menu overviews of general spectrum analysis measurements including setting up frequency and bandwidth parameters, sweep settings, trigger types, attenuator options, and preamp settings. Once the basic measurement is set up, select the AM/FM Audio measurement via MEASURE > MEASUREMENT > AM/FM AUDIO. Select a desired measurement view via MEASURE > VIEW.

Note	The AM/FM Audio measurement (Option 24 or Option 509) remains unresponsive when PCIe is selected as Data Out Format in IQ streaming mode. Refer to "IQ STREAMING Menu (Option 125/127)" on page 3-59.

AM/FM Audio – RF Spectrum View

The RF spectrum view displays the carrier signal power of the demodulated AM/FM audio signal in frequency domain.Toggle DEMOD MARKER button to identify the peak value of the carrier power. You can also record the audio signal by setting the duration time. Make sure to toggle on the Audio button to listen to the signal by adjusting the volume accordingly.

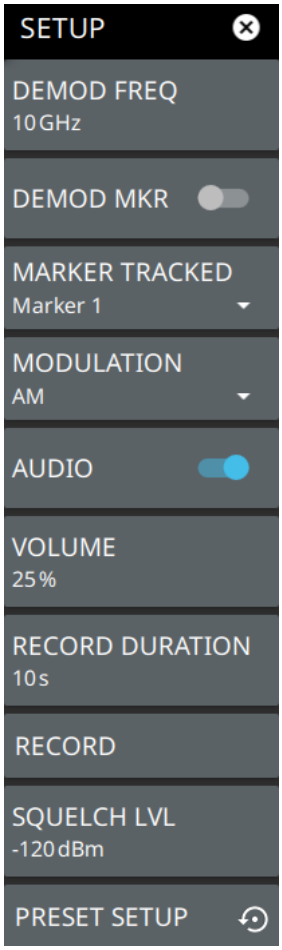


1. The status panel provides quick access to common spectrum analyzer settings. See “STATUS PANEL (AM/FM Audio)” on page 3-105.
2. The trace display area can show multiple traces, each with a unique color. Each trace can be set to Clear/Write, Average, Min or Max Hold, Rolling Average or Rolling Min, or Max Hold. Each trace can have Peak, RMS/Average, or Negative detectors. Traces can be set to Active, Hold/View, or Blank. Refer to “Setting Trace Parameters” on page 3-19. The shaded vertical section marked with green dashed line illustrate the demodulation channel bandwidth.
3. The demodulation marker is the same as a regular marker and can be applied to any trace using the Marker Menu. Refer to “Setting Up Markers” on page 3-41.
4. Current frequency, bandwidth, and sweep settings. Refer to “Setting Frequency Parameters” on page 3-2, “Setting Amplitude Parameters” on page 3-8, “Setting Bandwidth Parameters” on page 3-16.
5. The SETUP menu is where the AM/FM demodulation settings are configured. See “SETUP Menu (AM/FM Audio RF Spectrum)” on page 3-99.

Figure 3-79. AM/FM Audio (RF Spectrum)

SETUP Menu (AM/FM Audio RF Spectrum)

The default view of AM/FM Audio measurement is RF spectrum view. The AM/FM audio demodulation SETUP menu is available in MEASURE > MEASUREMENT > AM/FM Audio > SETUP.



DEMOD FREQ: Sets the audio demodulation frequency.

DEMOD MKR: Toggles the tracked marker on and sets the demod frequency to track the marker frequency. Use the "MARKER Menu" on page 3-43 to adjust the marker parameters.

MARKER TRACKED: Selects which marker to track. When DEMOD MKR is enabled, the demodulated frequency tracks the indicated marker.

MODULATION: Selects the modulation type to demodulate the RF signal. Available modulation types are AM, US Band (upper sideband), LS Band (lower sideband), FM Narrowband (6.25 12.5 and 25 kHz), and FM Wideband.

AUDIO: Toggles the demodulated audio output (sound) on or off. The demodulation frequency must be within the current sweep for audio demodulation. Slide ON the toggle button to listen to the audio signal. Note that AM/FM audio demodulation cannot be used in conjunction with IQ Streaming or when the IQ streaming output port is set to Data Out.

VOLUME: Sets the percentage of audio output volume.

RECORD DURATION: Sets the audio recording time. The maximum recording time is approximately 27 hours, depending on available storage.

RECORD: Starts audio recording. Recorded audio files (.wav) are saved to the Waves folder. Audio will be recorded for the recording duration or will stop when AUDIO is toggled off.

SQUELCH LVL: Sets the RF threshold level for audio playback. This is typically used with weak or intermittent signals to mute the static sound when the signal is below the squelch threshold.

PRESET SETUP: Presets all the AM/FM audio setup parameters.

Figure 3-80. SETUP Menu (AM/FM Audio – RF Spectrum)

Note	For simultaneous audio demodulation and trace sweep, the set span must not be greater than the maximum capture bandwidth based on the installed bandwidth option (No option: 20 MHz; Option 103: 55 MHz; Option 104: 110 MHz) and the tuning range must not cross more than one internal local oscillator tuning points. These conditions will be indicated by a transient status message at the top of the display.

3-21 AM/FM Modulation Measurement (Option 509)

The AM/FM modulation measurement evaluates the quality of the baseband signal retrieved from the modulated signal. The graphical representation of the baseband signal indicates the pattern of modulation depth/deviation versus frequency and time.

The AM/FM audio provides quantitative measurements of analog radio transmitters using amplitude and frequency modulation. In addition to numeric results, AM/FM modulation measurement provides a new audio spectrum display and audio demodulated signal vs time (oscilloscope) display.

The ALL MEASUREMENTS view consists of the graphical representations of AUDIO SPECTRUM, AUDIO TIME DOMAIN, RF SPECTRUM in addition to AUDIO RESULTS table.

The audio spectrum displays the frequency spectrum of the demodulated audio signal.

The audio time domain provides an oscilloscope style display of the demodulated audio signal in amplitude versus time.

The RF spectrum display is the standard RF spectrum of the modulated carrier.

The audio results table consists of several numerical measurements such as SINAD (Signal-to-Noise and Distortion) ratio, THD (Total Harmonic Distortion), depth and deviation.

The ALL MEASUREMENTS view is available only if Option 509 is installed. See Figure 3-81.

To select All Measurements view navigate to MEASURE>MEASUREMENT>AM/FM AUDIO>VIEW>ALL MEASUREMENTS.

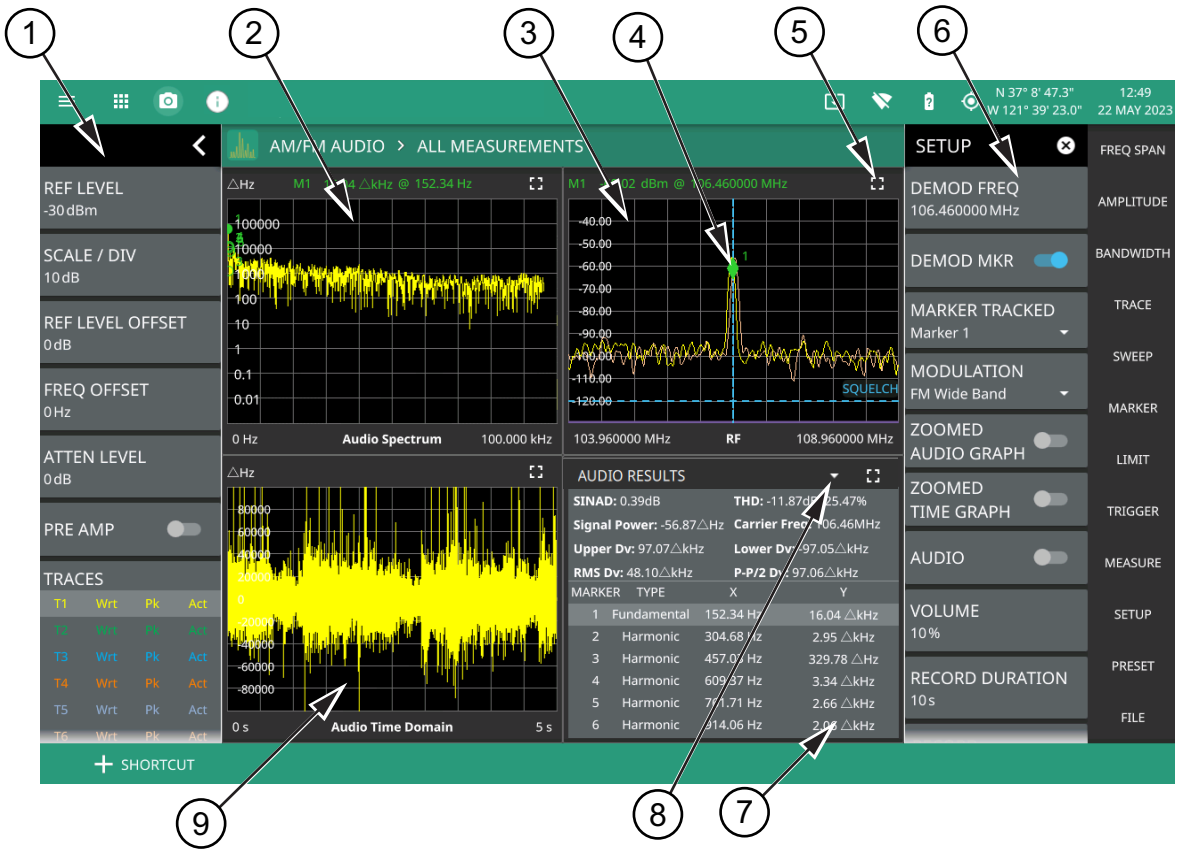


Figure 3-81. AM/FM Audio – All Measurements View

1. The status panel provides quick access to common spectrum analyzer settings. See “STATUS PANEL (AM/FM Audio)” on page 3-105.
2. The audio spectrum displays the frequency spectrum of the demodulated audio signal. It displays depth (%) in amplitude modulation, and deviation (Hz) in frequency modulation.
3. The RF spectrum graph represents the minimized view of the RF spectrum view.
4. The demodulation marker is used to select the audio signal in the RF frequency domain. Toggle on DEMOD MKR button to analyze the audio signal.
5. The full screen icon displays the maximized view of the selected graph with audio results table displayed at the bottom. Touch exit full screen icon to exit the full screen view. Note that when the audio results table is viewed in full screen the corresponding graphs are not displayed at the bottom of the screen.
6. The SETUP menu is where the AM/FM demodulation settings are configured. See “SETUP Menu (AM/FM Audio – All Measurements View)” on page 3-104.
7. The audio results displays several numerical measurements such as SINAD (Signal-to-Noise and Distortion Ratio), THD (Total Harmonic Distortion), AM depth, FM deviation etc. It also includes the fundamental and harmonic markers in addition to X and Y axes coordinates of the marker locations.
8. This drop-down menu allows you to switch between marker table and audio results display. Note that Marker Table is only visible when MARKER TABLE is toggled on in MARKER menu.
9. The audio time domain graph also referred as oscilloscope, represents the AM depth (%) or FM deviation (Hz) of the audio signal versus time.

Figure 3-81. AM/FM Audio – All Measurements View

AM/FM Metrics

Field Master Series and Remote Spectrum Monitor instruments automatically detect the highest power audio tone which is used as the fundamental tone for the audio signal in Signal-to-noise and distortion (SINAD) measurement, therefore it is not required to define the frequency of the fundamental tone. SINAD is the ratio of the total channel power relative to the unwanted signal power. Higher the value of SINAD, the better the quality of the audio signal.

SINAD ratio measures AM/FM modulation distortion. It is calculated as the ratio of the channel power relative to the power of the fundamental tone using a notch filter.

SINAD ratio (dB) is expressed in logarithmic term as follows:

$$\text{SINAD} = \frac{S + D + N}{D + N}$$

Where, S = Signal Power, D = Distortion, N = Noise.

Distortion is defined as all signals in the demodulation bandwidth other than the wanted tone used to modulate the transmitter under test, including spurious and sidebands created by non linearity in the transmitter modulator. Refer to the graphical representation of SINAD measurement as shown in Figure 3-82.

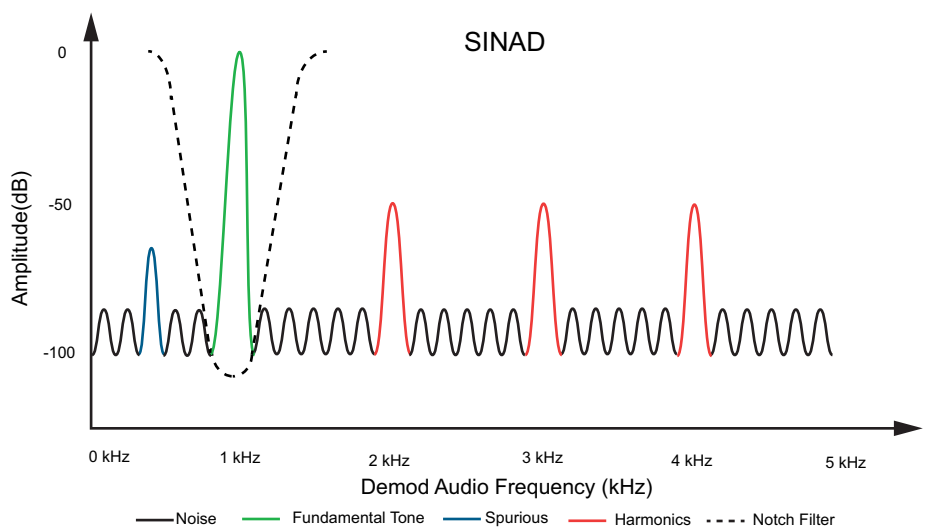


Figure 3-82. SINAD Measurement

Total harmonic distortion (THD) measurement extracts the total harmonic distortion component from the noise component in the total unwanted signal. The isolated distortion component is useful to troubleshoot the root causes of the modulation distortion.

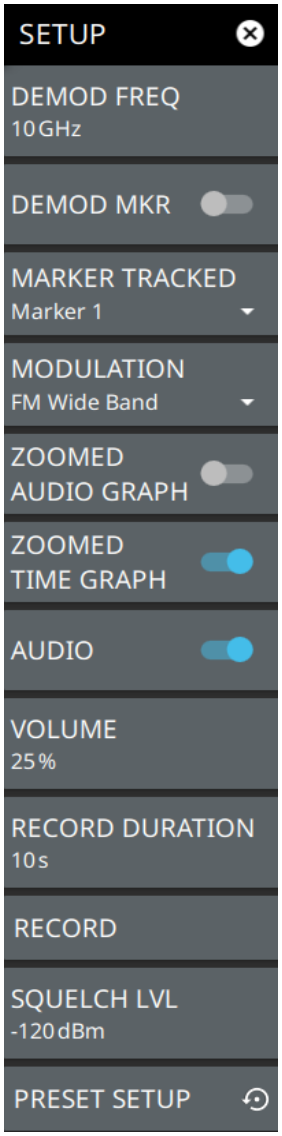
$$THD = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \ldots + V_n^2}}{V_1}$$

Where, V_n = RMS value of the nth harmonic voltage, n = 10, V_1 = RMS value of the fundamental component.

Note	Total harmonic distortion is calculated based on maximum of 10 harmonics. For the selected AM/FM modulation mode, the frequency of harmonics beyond the bandwidth of the audio signal is not measured.

SETUP Menu (AM/FM Audio – All Measurements View)

The AM/FM audio demodulation SETUP menu is available in MEASURE > MEASUREMENT > AM/FM Audio > SETUP.



DEMOD FREQ: Sets the audio demodulation frequency.

DEMOD MKR: Toggles the tracked marker on and sets the demod frequency to track the marker frequency. Use the "MARKER Menu" on page 3-43 to adjust the marker parameters.

MARKER TRACKED: Selects which marker to track. When DEMOD MKR is enabled, the demodulated frequency tracks the indicated marker.

MODULATION: Selects the modulation type to demodulate the RF signal. Available modulation types are AM, US Band (upper sideband), LS Band (lower sideband), FM Narrowband (6.25 12.5 and 25 kHz), and FM Wideband.

ZOOMED AUDIO GRAPH: Displays zoomed audio spectrum graph when toggled on, only available in FM modulation. Only available in Wideband FM mode. The full span Audio Spectrum shows 96 kHz of spectrum to include the mono audio, 19 kHz sub carrier, left and right stereo channels. The zoomed graph shows 20 kHz audio spectrum for closer analysis of the combined left/right channels.

ZOOMED TIME GRAPH: Displays zoomed audio time domain graph when toggled on. Zoomed time domain audio graph is used to view a signal modulated with an ideal sine wave to detect distortion.

AUDIO: Toggles the demodulated audio output (sound) on or off. The demodulation frequency must be within the current sweep for audio demodulation. Note that AM/FM audio demodulation cannot be used in conjunction with IQ Streaming or when the IQ streaming output port is set to Data Out.

VOLUME: Sets the percentage of audio output volume or mutes the audio.

RECORD DURATION: Sets the audio recording time. The maximum recording time is approximately 27 hours, depending on available storage.

RECORD: Starts audio recording. Recorded audio files (.wav) are saved to the Waves folder. Audio will be recorded for the recording duration or will stop when AUDIO is toggled off.

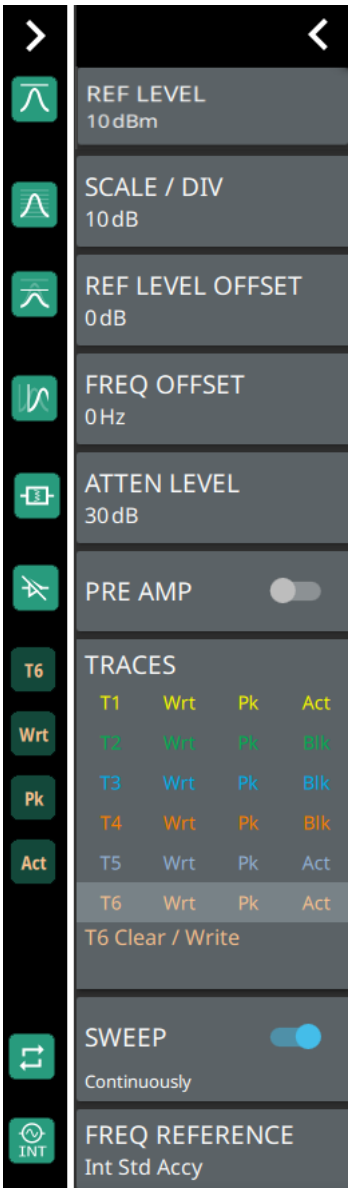
SQUELCH LVL: Sets the RF threshold level for audio playback. This is typically used with weak or intermittent signals to mute the static sound when the signal is below the squelch threshold.

PRESET SETUP: Presets all the AM/FM audio setup parameters.

Figure 3-83. SETUP Menu (AM/FM Audio – ALL MEASUREMENTS)

STATUS PANEL (AM/FM Audio)

Below is the status panel with the corresponding minimized status panel icons for AM/FM audio measurement. The status panel holds good for Option 24 and Option 509.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-84. Status Panel with Minimized Status Panel Icons (AM/FM audio)

3-22 Carrier-to-Interference

Carrier-to-interference (C/I) measurement is the ratio of the total RF power in the defined integration bandwidth, including transmitter power, noise, interference and distortion, to the power in the channel when the transmitter is turned off.

This measurement is commonly required in satellite downlink testing and land mobile radio (LMR) system testing. In order to complete this measurement the carrier power should be turned off in a controlled way.

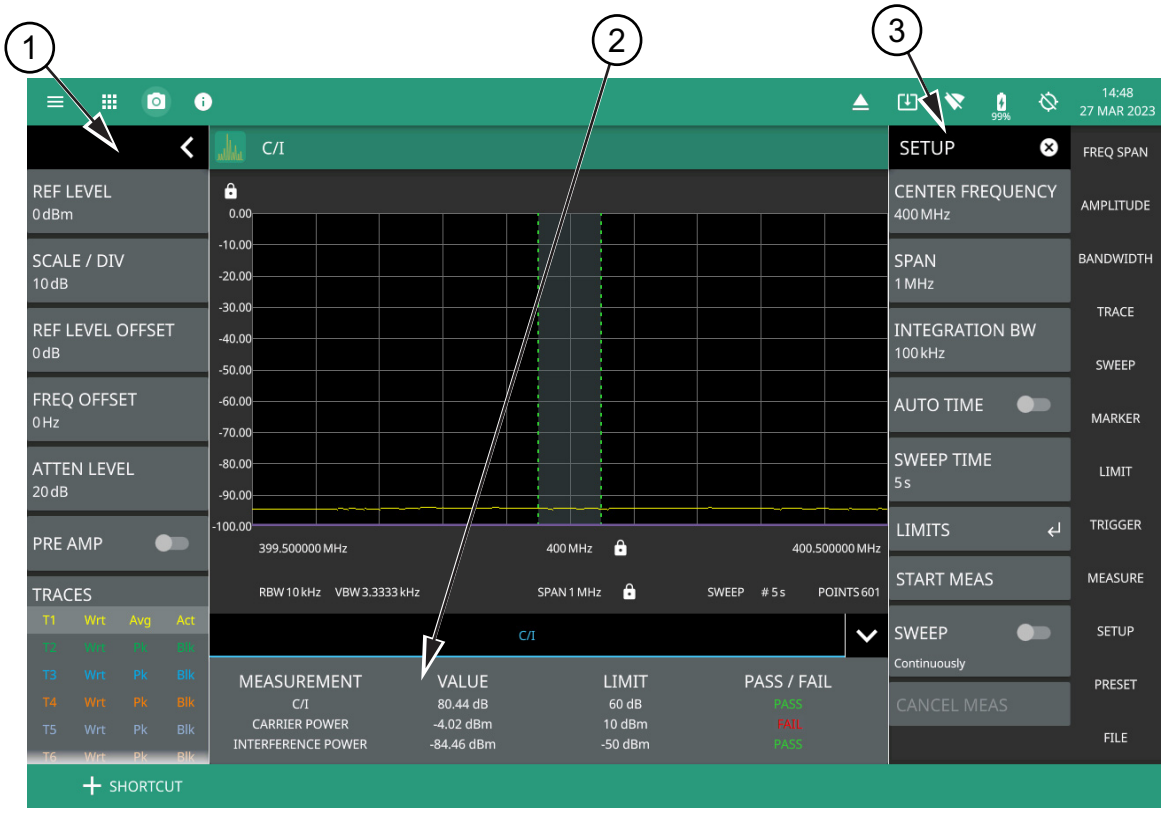
The C/I ratio is calculated as:

C/I = Carrier Power – Interference Power

The C/I can be measured by following the instructions below:

1. Select C/I under MEASUREMENT drop-down of MEASURE menu.
2. Select the SETUP menu.
3. Set the center frequency to the wanted transmitter's center frequency value.
4. Set the span that enables a view of the full carrier channel with some additional margin.
5. Set the integration bandwidth for the measurement. This will typically be the channel bandwidth for the signal standard under test.
6. Toggle on AUTO TIME to perform a single sweep at the maximum rate for measuring power when the transmitter is on and off. Toggle off AUTO TIME when the noise, interference and distortion has a significant time dependency. By setting a slow sweep time, the noise and interference from time variable signals can be integrated in the measurement.
7. Connect the RF input to the signal under test with the wanted transmitter ON.
8. Start the measurement by selecting START MEAS.
9. When prompted, select CONTINUE to measure the carrier power.
10. To measure noise, interference and distortion over the same integration bandwidth turn off the transmitter without disconnecting the RF connection.
11. Select CONTINUE to measure the noise, interference and distortion in the channel.
12. Select FINISH to complete the measurement, or CANCEL to stop the measurement.
13. Verify the measurement values such as Carrier power (transmitter ON), Interference power (Noise, Interference and distortion (transmitter OFF), and the C/I ratio displayed in the C/I table.

Note	The C/I measurement is performed in a single sweep mode. To enable continuous sweep, toggle on SWEEP Continuously button.



1. Status panel provides quick access to all the spectrum analyzer menu settings. See “STATUS PANEL (C/I)” on page 3-109.
2. The C/I table shows the carrier-to-interference ratio (dB), carrier power and interference power measured in dBm.The Pass/Fail status is populated only if the limits are toggled on in LIMITS menu.
3. The SETUP menu is where the C/I settings are configured. See “SETUP Menu (C/I)” on page 3-110.

Figure 3-85. Carrier-to-Interference measurement

The power in the interference part of the measurement can result from different sources:

- Adjacent Channel Power overlapping into the wanted channel

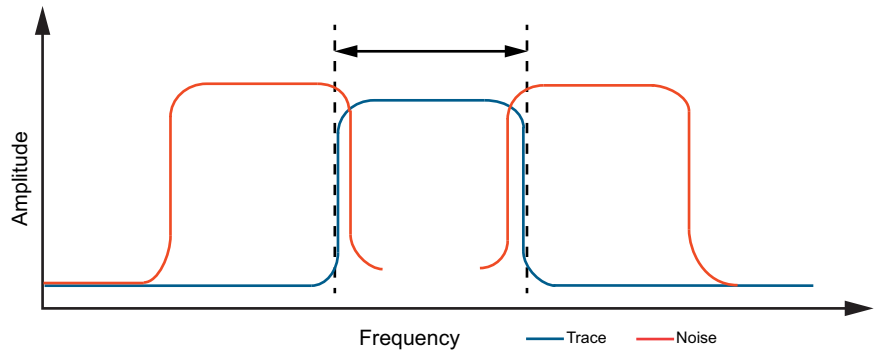


Figure 3-86. Adjacent Interference

- Broadband Noise

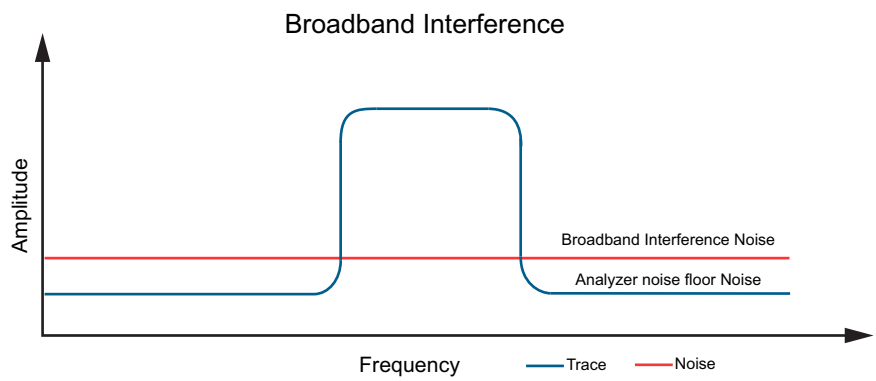


Figure 3-87. Broadband Noise

- Power from Intermittent or frequency hopping noise

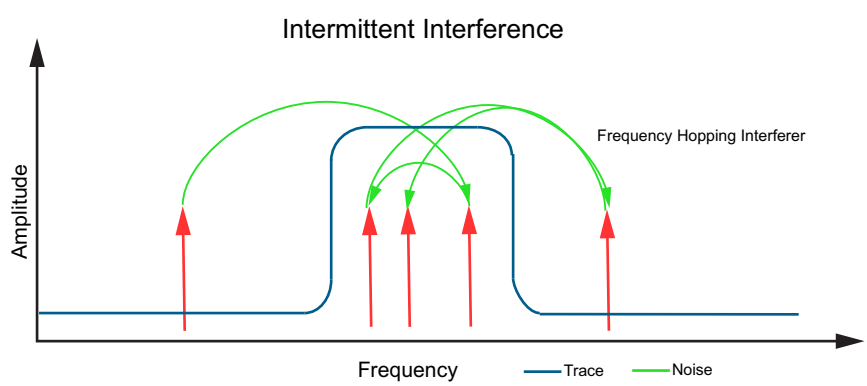
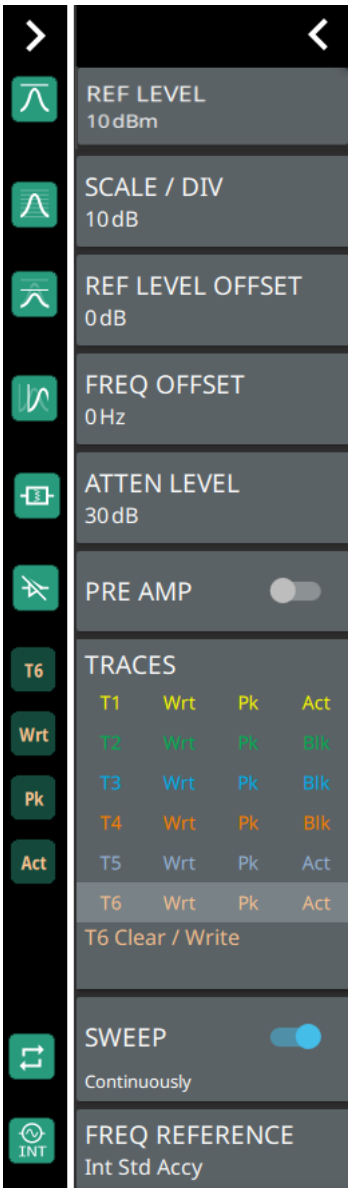


Figure 3-88. Intermittent Interference

STATUS PANEL (C/I)

Below is the status panel with the corresponding minimized status panel icons for C/I measurement.



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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

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 RF 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 available in the Spectrum measurement with the Spectrogram view selected.

The summary information includes the trace or cursor number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. In Spectrogram, a reference trace (T0) 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. Selecting a trace or cursor in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

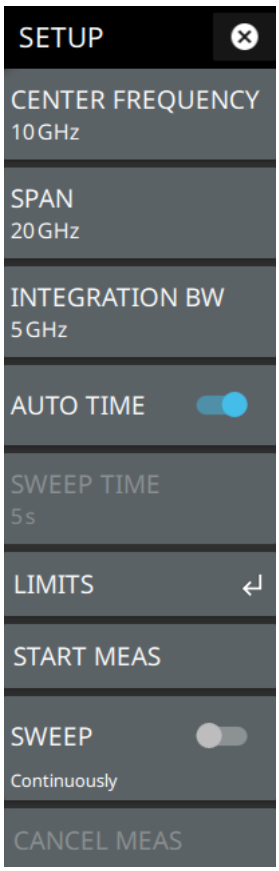
SWEEP : Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

Figure 3-89. Status Panel with Minimized Status Panel Icons (C/I)

SETUP Menu (C/I)

The C/I SETUP menu is available in MEASURE > MEASUREMENT > C/I > SETUP.



CENTER FREQUENCY: Sets the center frequency of the sweep range.

SPAN: Sets the sweep frequency range. Selecting 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.

INTEGRATION BW: Sets 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).

AUTO TIME: Toggle this button off to manually set the sweep time using the numeric entry keypad.

SWEEP TIME: Allows to set full manual sweep time range to measure the intermittent or frequency hopping noise.

LIMITS: Opens "LIMITS Menu".Toggle on the C/I, carrier power and interference power limit buttons to verify the PASS/FAIL status of the measured values with respect to the set limits.

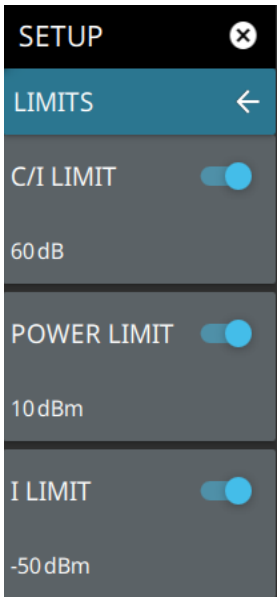
START MEAS: Starts the wizard or sequence of message windows to measure carrier power followed by noise power.

SWEEP CONTINUOUSLY: Toggle on to enable continuous sweep. Toggle off to freeze the signal or stop the instrument from sweeping.

CANCEL MEAS: Cancels the measurement of carrier power and/or interference power.

Figure 3-90. SETUP Menu (C/I Measurement)

LIMITS Menu



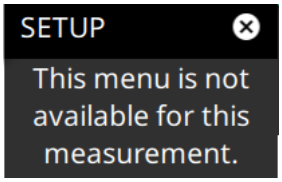
C/I LIMIT: Sets the carrier-to-interference ratio limit in dB. Enter the desired C/I ratio (dB) limit value using the numeric keypad.

POWER LIMIT: Sets the desired value of the carrier power limit. Enter the desired carrier power (dBm) limit value using the numeric keypad.

I LIMIT: Sets the desired value of the interference power limit. Enter the desired interference power (dBm) limit value using the numeric keypad

Figure 3-91. SETUP Menu (C/I Measurement)

3-23 SETUP Menu



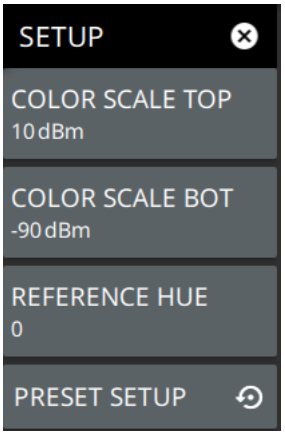
There are no advanced measurement setups for the basic spectrum analyzer measurement.

Figure 3-92. SETUP Menu (Spectrum)

Refer to the sections below for additional setup menus when using advanced measurements:

- "SETUP Menu (Channel Power)" on page 3-65
- "SETUP Menu (Occupied BW)" on page 3-68
- "SETUP Menu (ACP)" on page 3-71
- "SETUP Menu (SEM)" on page 3-75
- "SETUP Menu (EMF Measurement)" on page 3-84
- "SETUP Menu (Interference Finder)" on page 3-79
- "SETUP Menu (Coverage Mapping)" on page 3-91
- "SETUP Menu (AM/FM Audio RF Spectrum)" on page 3-99
- "SETUP Menu (AM/FM Audio – All Measurements View)" on page 3-104
- "SETUP Menu (C/I)" on page 3-110

SETUP Menu (Spectrogram View)



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 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).

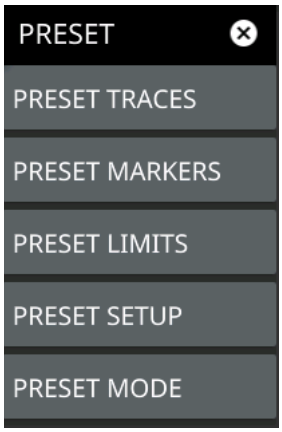
PRESET SETUP: Presets the color setup settings.

Figure 3-93. SETUP Menu (Spectrogram View)

3-24 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 5GNR 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 “Reset Settings” section of the product’s user guide. To recover from system software faults, refer to the product’s user guide for more information.

PRESET Menu



PRESET TRACES: Presets all trace settings to default values.

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

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

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

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

Figure 3-94. PRESET Menu

3-25 Saving and Recalling Measurements

The instrument 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 the product's user guide for more information on file management.

Saving a Measurement

To save a measurement or setup, refer to Figure 3-95:

1. Select 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. Select SAVE to save the file.

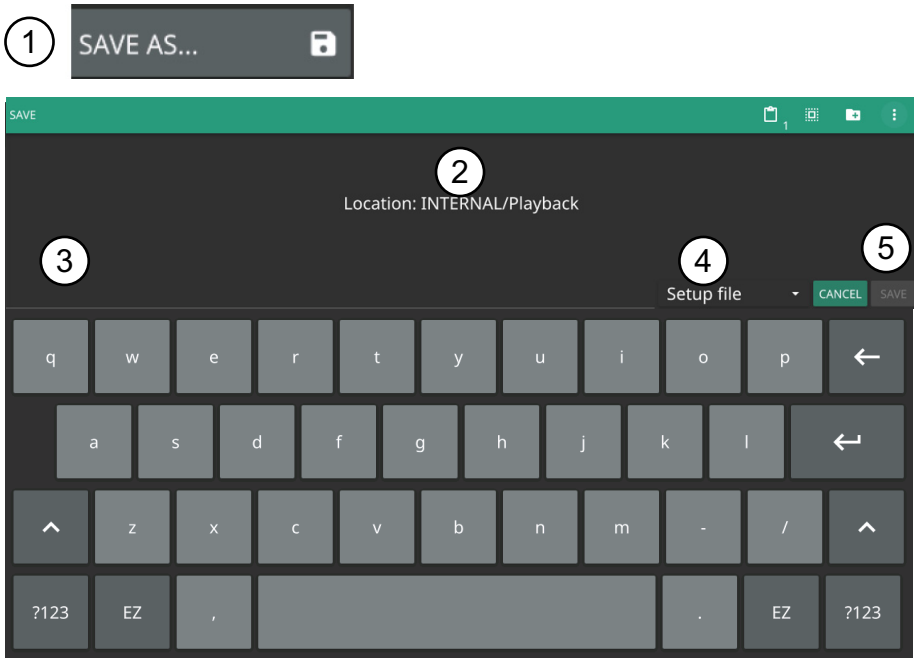


Figure 3-95. File Save Dialog

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 3-96:

1. Select 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. Select OPEN to recall the file.

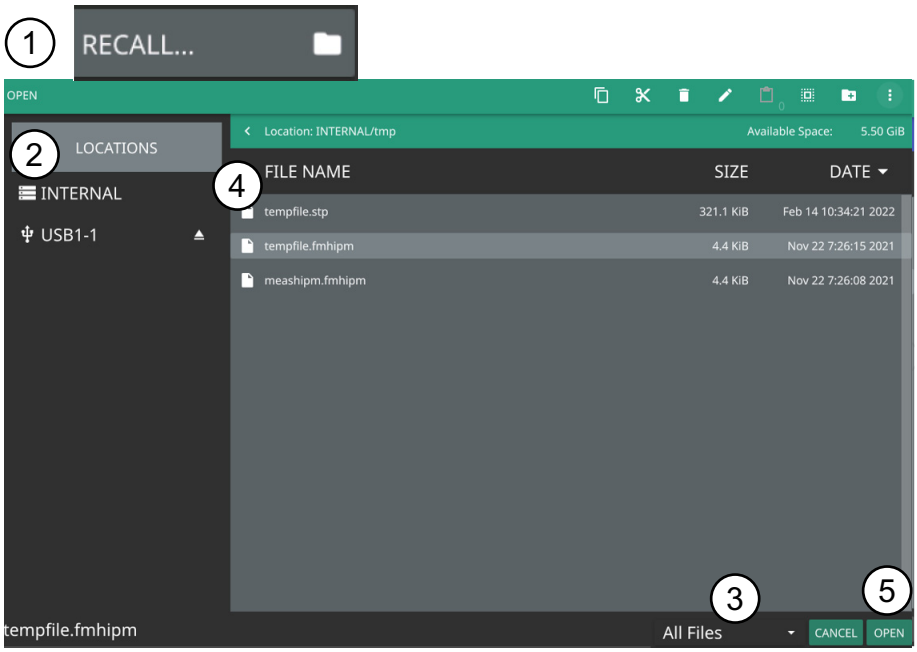


Figure 3-96. File Open Dialog

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

FILE Menu

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

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

- Setup: Saves the current instrument setup (stp file type).
- Trace: Saves the measurement (trace or point data) and the current instrument setup (fmspa file type).
- CSV: Saves the visible trace point or map point measurement data (Option 431, Coverage Mapping) in comma separated value format (csv file type). This format is useful for further analysis using other software tools. Note that the saved map point data is cumulative of all data points on the map or measurement data since the map points were last cleared.
- KML: Saves measurement data in Keyhole Markup Language format, including the instrument model number, installed options, sample data with GNSS (GPS) coordinates, if GNSS (GPS) is installed (Option 431, Coverage Mapping only (Indoor Map)). Note that the saved data is cumulative of all data points on the map or measurements since the map points were last cleared.
- Limit: Saves the current limit line point data (lim file type).
- Screenshot: Saves a screenshot of the current measurement (png file type).
- Trace + Screenshot: Saves both the current measurement and screenshot files (both fmspa and png file types).
- KML: Saves coverage mapping data points in Keyhole Markup Language format (kml file type).

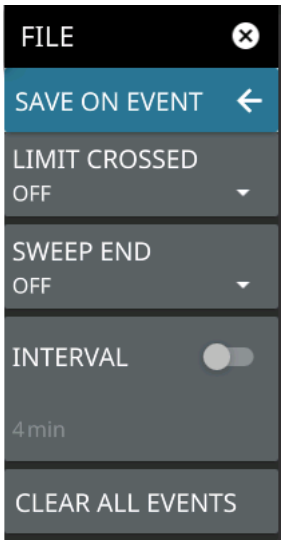
RECALL: Opens the Recall File dialog to retrieve a file from a desired location. Only supported files will be displayed depending on the currently set measurement. When trace data is recalled, the instrument will change the settings to match the settings of the saved trace. The data will be recalled 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.

SAVE ON EVENT: Opens the “SAVE ON EVENT Menu” on page 3-117.

BROWSE FILES: Opens File Management screen. For more information refer to the product’s user guide.

Figure 3-97. FILE Menu

SAVE ON EVENT Menu



Save on event saves the current trace data to a folder named with the current date and time (yyyymmddhhmmss).

LIMIT CROSSED: When enabled, measurement trace data 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.

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.

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

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

Figure 3-98. SAVE ON EVENT Menu

Chapter 4 — IA Spectrum Analyzer (Option 24)

4-1 Introduction

The Interference Analyzer (IA) spectrum analyzer and MA2700A handheld InterferenceHunter™ are the ideal solution for anyone conducting coverage testing of RF and microwave communications systems, including 5G and LTE networks.

The Interference Analyzer (IA) spectrum analyzer application assists you in finding the source of interfering signals with the use of MA2700A handheld InterferenceHunter, GPS receiver, and directional antenna. Note that it is required to enable the GPS receiver in the GPS settings of the instrument. Refer to GPS/GNSS settings of the product's user guide. With the MA2700A, a vector line to an interfering signal can be added to a map in the instrument with a click of the trigger on the handle.

A basic understanding of the measurement concepts presented in Chapter 2, "Spectrum Analyzer" is recommended before performing the procedures in this chapter. Refer to the instrument's user guide to get a better understanding of the user interface and for additional information system operations. Refer to the following sections for a better understanding of the spectrum analyzer application:

- Section 2-2 "Selecting the Analyzer" on page 2-1
- Section 2-3 "Main Menu" on page 2-5
- Section 2-4 "Status Panel" on page 2-6
- Section 3-3 "Setting Frequency Parameters" on page 3-2
- Section 3-4 "Setting Amplitude Parameters" on page 3-8
- Section 3-5 "Field Strength" on page 3-12
- Section 3-6 "Setting Bandwidth Parameters" on page 3-16
- Section 3-7 "Setting Trace Parameters" on page 3-19
- Section 3-8 "Setting Sweep Parameters" on page 3-36
- Section 3-9 "Setting Up Markers" on page 3-41
- Section 3-10 "Setting Up Limit Lines" on page 3-48
- Section 3-17 "Interference Finder (Option 24)" on page 3-76
- Section 3-20 "AM/FM Audio (Requires Option 24 or Option 509)" on page 3-97
- Section 3-21 "AM/FM Modulation Measurement (Option 509)" on page 3-100
- Section 3-24 "Presetting the Analyzer" on page 3-113

IA Spectrum analyzer application includes the use of additional functions beyond frequency, span, amplitude, and marker functions. Refer to Section 4-3 through Section 4-5 to cover field measurements and additional smart measurements provided by these newly added modes such as interference map and interference polar.

4-2 Making IA Spectrum Analyzer Measurements

Initial Setup

- Connect a signal source to the RF In port of the instrument. For over-the-air measurements, connect an antenna that is appropriate for the frequency range to be measured. For connector descriptions, refer to Connector Panel section of the product's user guide.
- Connect the MA2700A handheld InterferenceHunter, GPS receiver and a directional antenna (e.g. Yagi antenna) to the instrument. Enable the GPS settings.
- Select the IA spectrum analyzer. Refer to "Selecting the Analyzer" on page 2-1.

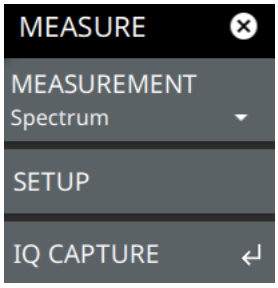
Figure 4-1. Field Master Series Measurement Setup

4-3 Setting Up Advanced Measurements

Refer to "Making IA Spectrum Analyzer Measurements" on page 4-2 for basic information on setting up a IA spectrum measurement. This section provides setup information for making swept spectrum measurements. The Field Master Series analyzer features smart measurements that make setup easy. The following sections present brief examples demonstrating the use of these measurements.

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

MEASURE Menu



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

- **Spectrum:** Displays the frequency domain spectrum measurement.
- **AM/FM Audio:** Available when Option 24 is installed. The AM/FM Audio provides audio demodulation capability. Refer to Section 3-20 "AM/FM Audio (Requires Option 24 or Option 509)" on page 3-97.
- **Interference:** Available when Option 24 is installed. The input parameters and channel measurements tables, max/min level lines, and total channel power signal indicator are added to the measurement display. Refer to Section 3-17 "Interference Finder (Option 24)" on page 3-76.
- **Interference Map:** This technique is used to geo-locate the interfering signals that may be from a few hundred yards to a few miles away, with respect to user's current location. Refer to Section 4-4 "Interference Map" on page 4-4.
- **Interference Polar:** This technique is used to geo-locate the polar plot of the interfering signals that may be from a few hundred yards to a few miles away, with respect to user's current location. Refer to Section 4-5 "Interference Polar" on page 4-8.

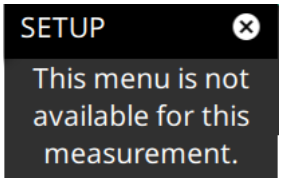
SETUP: Opens the "SETUP Menu (Spectrum)" on page 4-3 for the measurement and view selected above.

IQ CAPTURE: Opens the "IQ CAPTURE Menu (Option 124/126)" on page 3-58.

Refer to the IQ Capture/Streaming Measurement Guide for discussion of IQ Capture and Streaming, PN: 10580-00490.

Figure 4-2. MEASURE Menu

SETUP Menu (Spectrum)



There are no advanced measurement setups for the basic IA spectrum analyzer measurement.

Figure 4-3. SETUP Menu (Spectrum)

Refer to the sections below for additional setup menus when using advanced measurements:

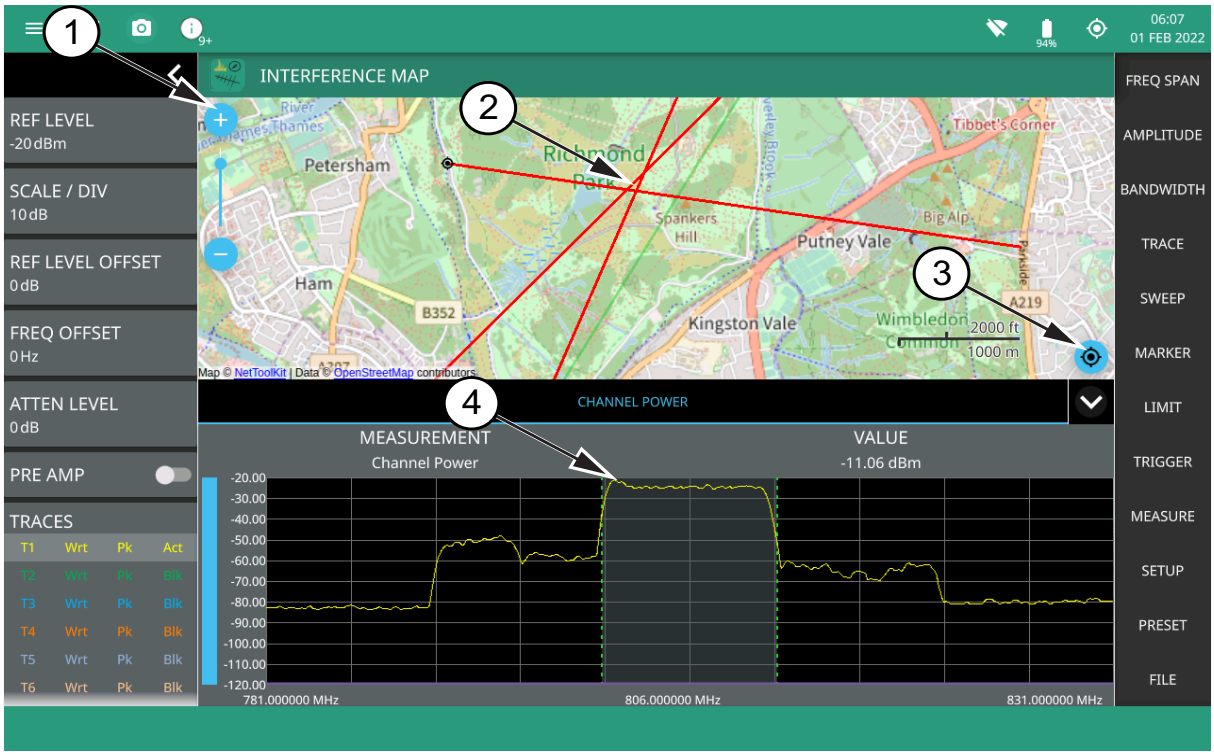
- "SETUP Menu (Interference Finder)" on page 3-79
- "SETUP Menu (AM/FM Audio RF Spectrum)" on page 3-99
- "SETUP Menu (AM/FM Audio – All Measurements View)" on page 3-104
- "SETUP Menu (Interference Map)" on page 4-7
- "SETUP Menu (Interference Polar)" on page 4-10

4-4 Interference Map

This section describes the Interference Map capability and key characteristics of Interference Map measurement mode. This technique is used to geo-locate interfering signals with respect to the user's current location. The user is required to travel with the instrument connected with a GPS receiver, directional antenna and the MA2700A InterferenceHunter to more than one location to capture the triangulation of the interfering signals. The resulting geo-location of the intersecting signals will get captured in the map.

The interfering signal is located by following the steps below:

1. Select System menu (3-line icon in the upper left corner), go to SETTINGS > GPS, and toggle on the GPS/GNSS.
2. Select System menu, go to TOOLS > MAP TOOL to download a digital map of the current location. Note that Internet connection is required to download the map tiles of the selected location. Ensure to have either an Ethernet or a Wi-Fi connection.
3. Connect the GPS, MA2700A handheld InterferenceHunter and suitable directional antenna (for e.g. Yagi antenna) to the instrument.
4. Select MEASURE > MEASUREMENT> Interference Map.
5. Set up the frequency and span in order to view the signal of interest on the spectrum display. Ensure not to make the span too wider, as this slows down the instrument's response in locating the interfering signal.
6. Select SETUP>INTEGRATION BW and set an appropriate integration bandwidth to measure the channel power of the signal of interest.
7. Select SETUP> VOLUME to increase the instrument's volume in order to listen for max channel power.
8. Slowly point the directional antenna in the direction leading to max channel power, either press the trigger on MA2700A when pointing in the direction of the maximum power or press PLACE LINE under SETUP menu. Refer to Section "SETUP Menu (Interference Map)".
9. Notice that moving the directional antenna will mark a red line on the map, which signifies the direction of max power.
10. To view the interference signal, change the current location to another nearby different location (~1 mile/km).
11. Repeat Step 6 through Step 8 and drop a second red line on the map by clicking the trigger on MA2700A.
12. Similarly change the current location to another nearby location and repeat Step 6 through Step 8 to drop a third line on the map. The three lines should intersect at an approximate location of the signal of interest.

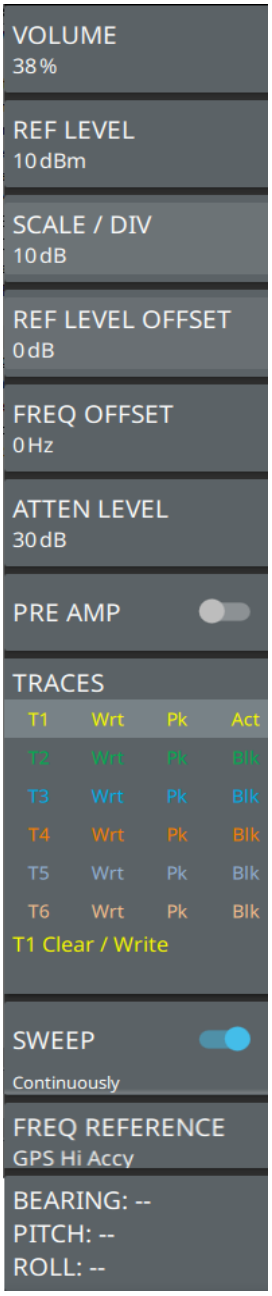


1. The map zoom tool is used to increase (+) or decrease (-) zoom level. You can also drag the zoom level indicator up or down, or you can pinch to change zoom level.
2. Triangulation of all the three interference signals.
3. Re-centering tool to center map on current GPS position. A GPS is required for this icon to appears.
4. Max channel power.

Figure 4-4. Interference Map Measurement

STATUS Panel (Interference Map and Interference Polar)

This Status panel is unique to Interference Map and Interference Polar measurement modes (selected via MEASURE > MEASUREMENT menu) of IA Spectrum Analyzer.



VOLUME: Sets the audio output volume.

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

Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

REF LEVEL OFFSET: Sets the reference level offset in dB units. This setting can compensate for the presence of external input attenuation or gain.

FREQ OFFSET: Accounts for frequency conversions outside of the analyzer. Refer to Section 3-3 “Setting Frequency Parameters” on page 3-2.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 3-4 “Setting Amplitude Parameters” on page 3-8.

TRACES: Displays the current status of up to six traces or cursors in a quick-view summary. When the measurement view is set to Spectrum mode trace information is displayed in this area.

The summary information includes the trace number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. Selecting a trace in the summary panel activates the pressed trace or cursor and opens the TRACE menu, allowing you to select and set up an individual trace or cursor as desired. Refer to Section 3-7 “Setting Trace Parameters” on page 3-19.

SWEEP: Toggles the current sweep setting between continuously or sweep once. Refer to Section 3-8 “Setting Sweep Parameters” on page 3-36.

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). The instrument automatically selects the frequency reference in the following order of priority: external, GPS, then the internal time base.

BEARING: Direction the MA2700A is pointing (shown in red).

PITCH (vertical level): Indicates the front-to-back orientation.

ROLL (horizontal level): Indicates the side-to-side orientation.

Figure 4-5. Status Panel (Interference Map)

SETUP Menu (Interference Map)

The Interference Map SETUP menu is available in MEASURE > MEASUREMENT > Interference Map> SETUP.

BEARING SOURCE: Selects the bearing source either as antenna or manual. If antenna is selected the electronic compass from the MA2700A InterferenceHunter is used to find the direction of the peak signal. If MANUAL is selected an external compass must be used to find the direction of the power signal.

MANUAL BEARING: Allows the user to manually enter the number of degrees from true north direction of the peak signal. In this case, a magnetic compass or a compass App installed in a smart phone can be used to find the direction of the peak signal.

Note that if an antenna that is less than 6 GHz range is used, then an external magnetic compass may be used to find the signal direction. The eCompass in MA2700A does not support in locating high frequency signals. Manual bearing feature is very useful when triangulating signals greater than 6 GHz, as the user is allowed to enter the bearing manually.

PLACE LINE: Places the bearing line data in red on the map, alternatively press the trigger on the MA2700A InterferenceHunter to place the red line on the map.

CLEAR LAST LINE: Clears the lastly placed line.

CLEAR ALL LINES: Clears all the bearing line data from the map.

MAX LEVEL: Sets the upper level for the audio response of the measurement. This setting is useful for adjusting the resolution of the tone changes. Power levels above the MAX LEVEL will continue to emit sound an increasingly higher pitch.

MIN LEVEL: Sets the lower level for the audio response of the measurement. The MIN LEVEL also functions as a squelch. Power below this level will not emit a sound.

VOLUME: Adjusts the audio output volume.

MUTE: Mutes the instrument volume.

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

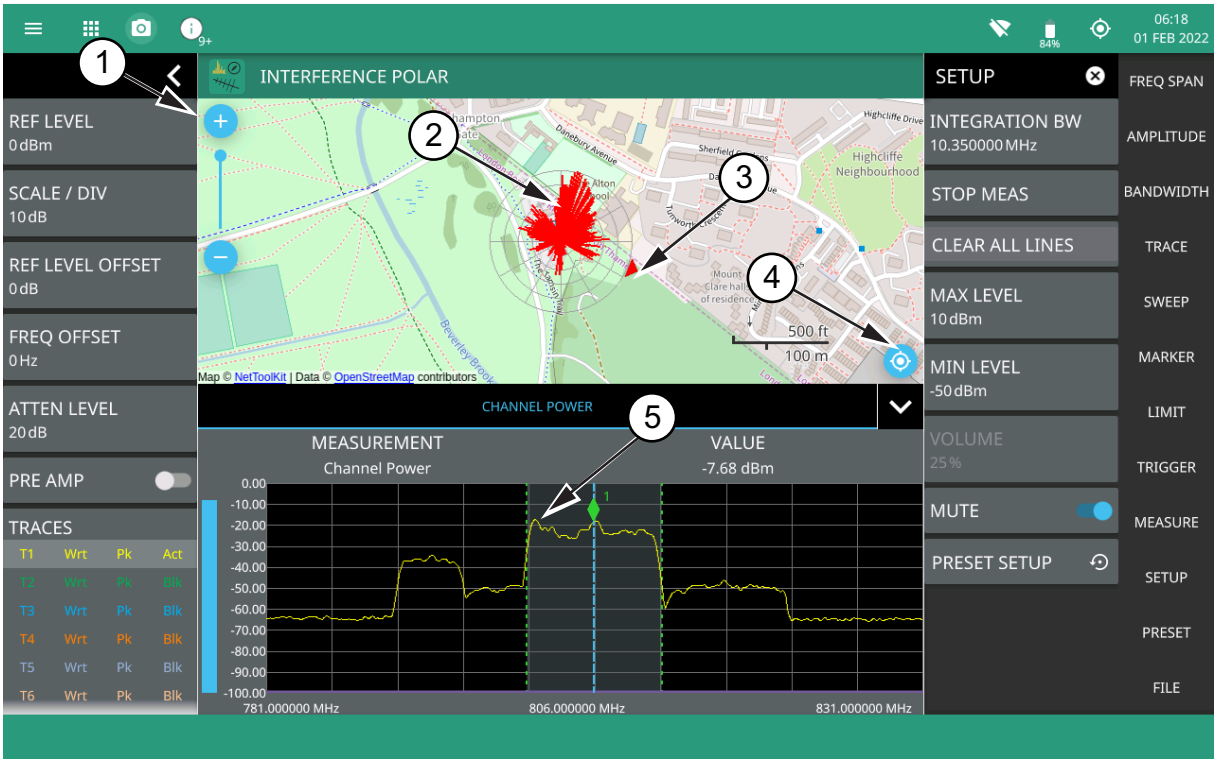
Figure 4-6. SETUP Menu (Interference Map)

4-5 Interference Polar

This section describes the Interference Polar capability and key characteristics of Interference Polar measurement mode. This is an alternative technique to geo-locate a potentially interfering signal without having to go to multiple locations. The user stands at a fixed location and makes a full rotation along with the MA2700A handheld InterferenceHunter and a directional antenna through 360º. A polar plot of the signal strength in all directions is displayed on the map.

The polar plot of the interfering signal is located by following the steps below:

1. Select System menu, go to SETTINGS > GPS, and toggle GPS/GNSS on.
2. Select System menu, go to TOOLS > MAP TOOL to download a digital map of the current location. Note that Internet connection is required to download the map tiles of the selected location. Ensure to have either an Ethernet or a Wi-Fi connection.
3. Connect the GPS, MA2700A handheld InterferenceHunter and suitable directional antenna (for e.g. Yagi antenna) to instrument.
4. Select MEASURE > MEASUREMENT > Interference Polar.
5. Set up the frequency and span in order to view the signal of interest on the spectrum display. Ensure not to make the span too wider, as this slows down the instrument's response in locating the interfering signal.
6. Select SETUP > INTEGRATION BW and set an appropriate integration bandwidth to measure the channel power of the signal of interest.
7. Select SETUP > VOLUME to increase the instrument's volume in order to listen for max channel power.
8. Select SETUP menu and press START MEAS and slowly make a full rotation in clock-wise direction holding the directional antenna to complete 360º. Refer to Section "SETUP Menu (Interference Polar)" on page 4-10.
9. Notice that the rotation of the antenna places series of red lines to create a polar plot of the signal in every direction. The direction of maximum signal strength indicates the transmitter that is the source of the interfering signal.

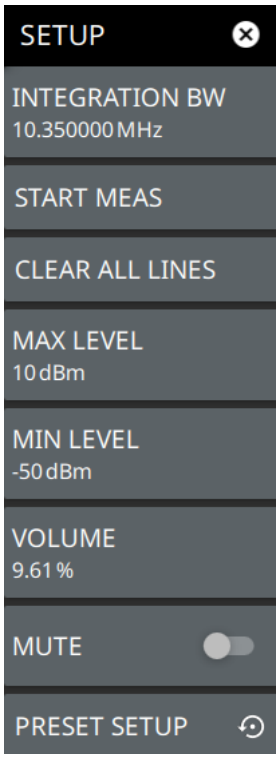


1. The map zoom tool is used to increase (+) or decrease (-) zoom level. You can also drag the zoom level indicator up or down, or you can pinch to change zoom level.
2. Interference signal.
3. Direction of bearing degrees.
4. Re-centering tool to center map on current GPS position. A GPS is required for this icon to appear.
5. Max channel power.

Figure 4-7. Interference Polar Measurement

SETUP Menu (Interference Polar)

The Interference Polar SETUP menu is available in MEASURE > MEASUREMENT > Interference Polar > SETUP.



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

START MEAS/STOP MEAS: Stay in one location and slowly your turn yourself around holding the antenna in the front to complete a full 360º rotation. This measures a plot of signal strength in every direction, called a polar plot. Select STOP MEAS to stop locating the signal.

CLEAR ALL LINES: Clears all the red lines on the map.

MAX LEVEL: Sets the upper level for the audio response of the measurement. This setting is useful for adjusting the resolution of the tone changes. Power levels above the MAX LEVEL will continue to emit sound an increasingly higher pitch.

MIN LEVEL: Sets the lower level for the audio response of the measurement. The MIN LEVEL also functions as a squelch. Power below this level will not emit a sound.

VOLUME: Sets the audio output volume.

MUTE: Mutes the instrument volume.

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

Figure 4-8. SETUP Menu (Interference Polar)

4-6 Saving and Recalling Measurements

The Field Master Series can save measurement setups, native trace and CSV trace data, limit line setups, and screenshots. You can recall setup, native trace, and limit line files. For other file operations such as copy, move, and directory management, refer to File Management section of the product's user guide.

Saving a Measurement

To save a measurement or setup, refer to Figure 4-9:

1. Select 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. Select SAVE to save the file.

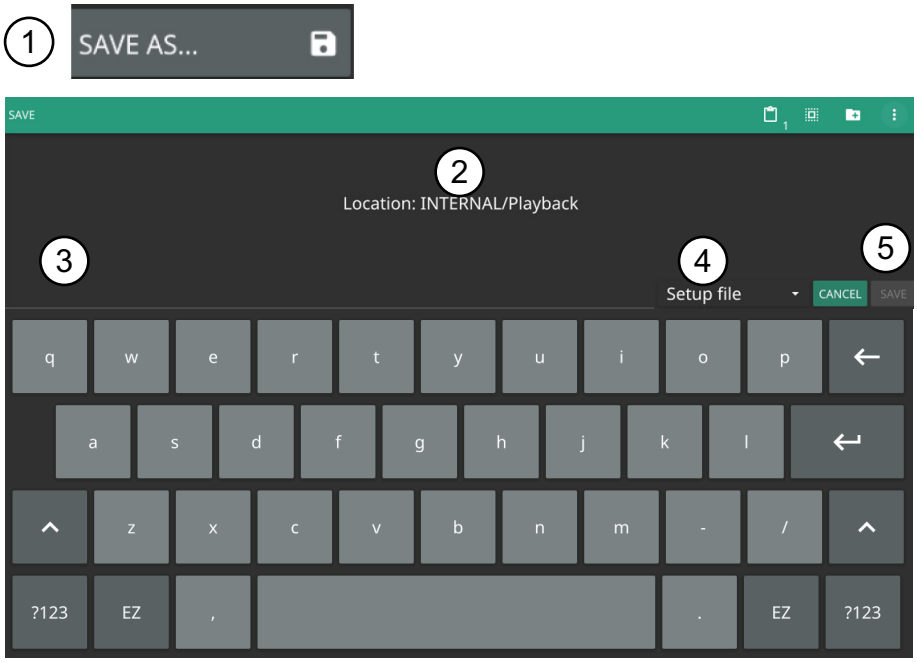


Figure 4-9. File Save Dialog

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 4-10:

1. Select 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. Select OPEN to recall the file.

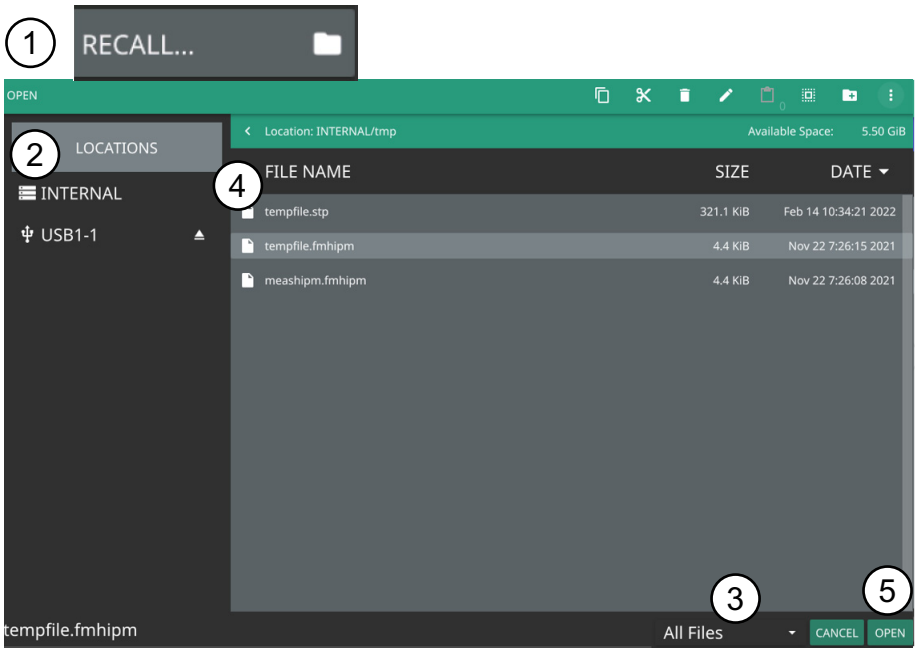


Figure 4-10. File Open Dialog

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

FILE Menu

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

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

- Setup File: Saves the current instrument setup file (stp file type).
- Trace File: Saves the measurement (trace or point data) and the current instrument setup (fmiasp file type).
- Trace CSV File: Saves the visible trace point or map point measurement data in comma separated value format (csv file type). This format is useful for further analysis using other software tools. Note that the saved map point data is cumulative of all data points on the map or measurement data since the map points were last cleared.
- Limit File: Saves the current limit line point data (lim file type).
- Screenshot: Saves a screenshot of the current measurement (png file type).
- Trace + Screenshot: Saves both the current measurement and screenshot files (both fmiasp, and png file types).

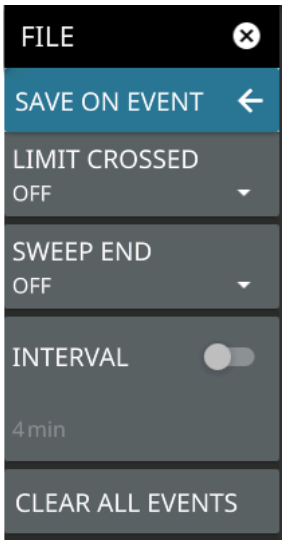
RECALL: Opens the Recall File dialog to retrieve a file from a desired location. Only supported files will be displayed depending on the currently set measurement. When trace data is recalled, the instrument will change the settings to match the settings of the saved trace. The data will be recalled 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.

SAVE ON EVENT: Opens the "SAVE ON EVENT Menu" on page 4-14. This feature is not available in the 5GNR/LTE analyzer.

BROWSE FILES: Opens the file management screen. Refer to the product's user guide for more information.

Figure 4-11. FILE Menu

SAVE ON EVENT Menu



Save on event saves the current trace data to a folder named with the current date and time (yyyymmddhhmmss).

LIMIT CROSSED: When enabled, measurement trace data 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.

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.

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

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

Figure 4-12. SAVE ON EVENT Menu

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