Measurement Guide

Common Public Radio Interface Analyzer

for Anritsu RF and Microwave Handheld Instruments

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

Part Number: 10580-00415
Revision: D
Published: September 2016

Trademark Acknowledgments

BTS Master is a trademark of Anritsu Company. CPRI is a trademark of Nokia Networks. Acrobat is a registered trademark of Adobe Corporation.

Notice

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

Updates

Updates, if any, can be downloaded from the Anritsu Website at:
http://www.anritsu.com

For the latest service and sales contact information in your area, please visit:
http://www.anritsu.com/contact-us

Notes On Export Management

This product and its manuals may require an Export License or approval by the government of the product country of origin for re-export from your country.

Before you export this product or any of its manuals, please contact Anritsu Company to confirm whether or not these items are export-controlled.

When disposing of export-controlled items, the products and manuals need to be broken or shredded to such a degree that they cannot be unlawfully used for military purposes.

Product Information, Compliance, and Safety

Read the Handheld Instruments Product Information, Compliance, and Safety Guide (PN: 10100-00065) for important safety, legal, and regulatory notices before operating the equipment. For additional information and literature covering your product, visit the product page of your instrument and select the Download Library tab.

Table of Contents

Chapter 1 — General Information

1-1 Introduction

This measurement guide describes the Common Public Radio Interface (CPRI) analyzer test and measurement functions of Anritsu RF and Microwave Handheld Instruments. Basic spectrum analyzer functions are documented in the Spectrum Analyzer Measurement Guide. Other functions are available only when the related option is installed and activated. These features are documented in their respective Measurement Guides. Refer to the instrument User Guide for a list of options and their related manuals.

Screen captured images contained in this document are provided as examples. Illustrations of menu maps, or menu trees, may show submenu keys that display only under certain conditions. The actual displays, screen menus, and measurement details may differ based on instrument model, firmware version, installed options, and current instrument settings.

1-2 Selecting a Measurement Mode

To switch from the current measurement mode, or application, to another:

1. Press the **Shift** front panel key, followed by **Mode** (**9**). The Mode Selector dialog opens.
2. Use the arrow keys or rotary knob, or tap the touch screen to highlight the desired measurement mode. The list of available applications depends on the options that are installed and activated on your instrument. See Figure 1-1.
3. Press **Enter**.

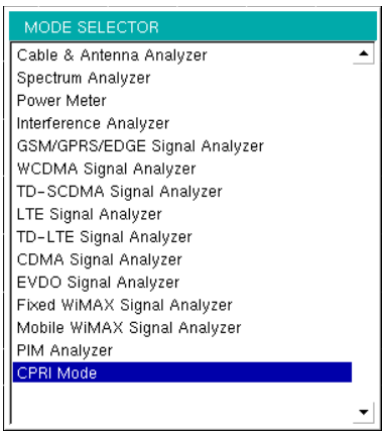


Figure 1-1. Mode Selector Dialog Box

On instruments that have a front panel **Menu** key, an alternate method of changing the measurement mode is to press **Menu**, then press the appropriate application icon on the touch screen.

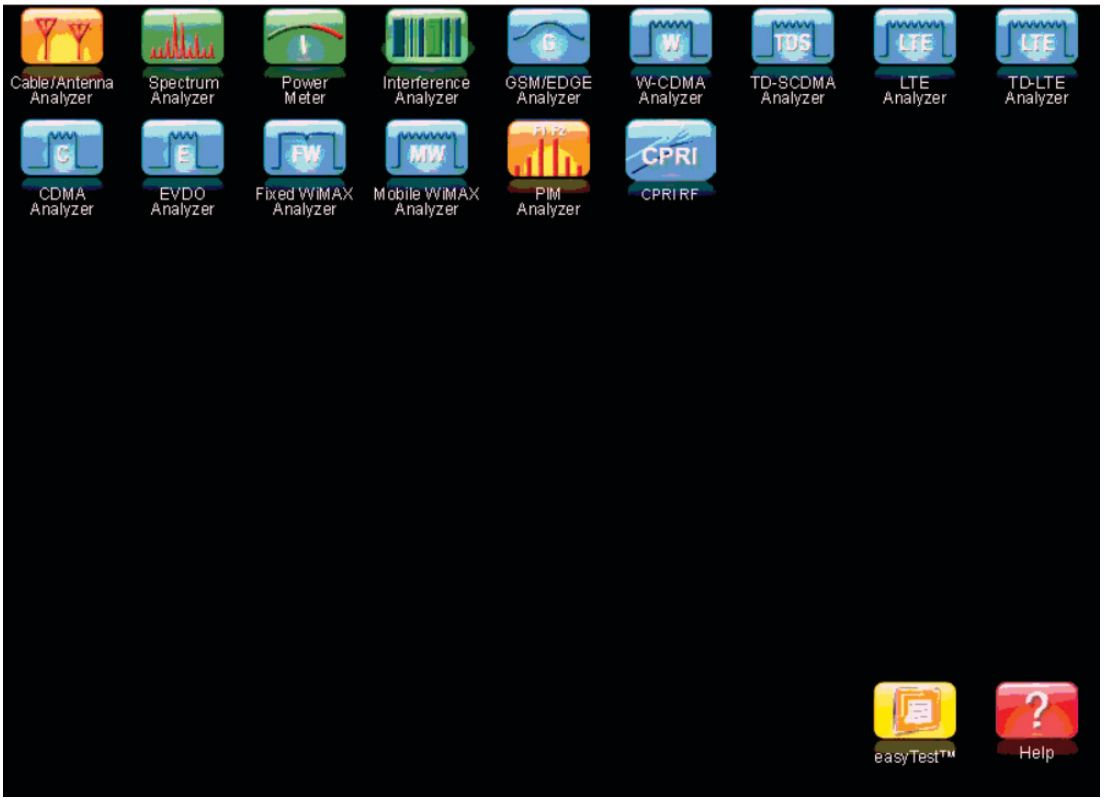


Figure 1-2. Menu Key Screen – Application Icons and User-Defined Shortcuts

1-3 Contacting Anritsu

To contact Anritsu, please visit:

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

On this page, you can find links to sales, service, and support contact information for your country or region. You can also provide online feedback, complete a "Talk to Anritsu" form to have your questions answered, or obtain other services offered by Anritsu.

Updated product information can be found on the Anritsu website:

http://www.anritsu.com/

Search for the product model number. The latest documentation is on the product page, under the Library tab.

Chapter 2 — CPRI Analyzer

2-1 Introduction

The Common Public Radio Interface (CPRI) is a protocol standard for wireless communications between remote radio heads, also referred to as Radio Equipment (RE), and the Radio Equipment Controller (REC). The main differences with traditional RF signals are summarized in Table 2-1.

Table 2-1. CPRI Signal Characteristics (Compared to RF)

RF	CPRI
Analog	Digital
Absolute measurements	Relative measurements
dBm	dB
Specific center frequency	Base Band 0 Hz
Absolute power levels	Relative power levels
Full Span capable	Max Span = Carrier BW + 50%

The CPRI Analyzer option (Option 751) allows users to make RF-based measurements over a fiber optic CPRI link to look for interference problems affecting a Remote Radio Head (RRH). This is accomplished by tapping into the fiber link between the RRH and BBU (Base Band Unit), using an optical splitter to connect the RRH and BBU to the Anritsu test instrument. The instrument will decode the CPRI protocol IQ data and convert it to RF data.

Note

Depending on your Anritsu test instrument model, Option 751 may have a single or dual SFP ports. Option 750 has a single SFP port and does not support the display of Layer 2 alarms and SFP data.

Screen displays vary with the installed option and instrument model being used. The screen captures illustrated in this document are examples and may differ from your instrument display.

Two types of CPRI measurements are available:

- Spectrum mode is typically used to test the CPRI link in real time.
- Spectrogram mode lets users monitor for intermittent interference over a specifiable recording time.

These CPRI Analyzer test and measurement functions can be performed from ground level, eliminating the risk and costs of climbing towers. Figure 2-1 illustrates a typical connection configuration for CPRI RF testing with an Anritsu test instrument.

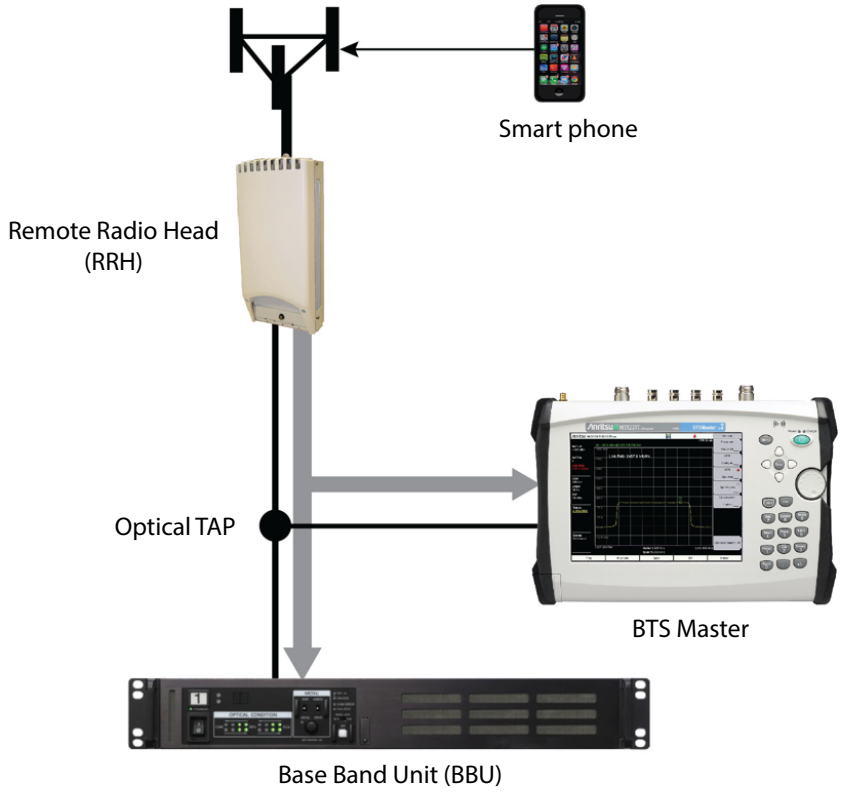


Figure 2-1. Connection Configuration for CPRI RF Testing with Anritsu Test Instrument

2-2 Setup Requirements and Checklist

Following is a list of accessories and questions to be answered prior to setting up a CPRI connection for testing:

- SFP optical transceiver used to connect the measurement device must match the link rate of SFPs on the BBU and RRH. Different options are available from Anritsu, with single or dual SFP ports.
- Optical splitter or TAP (Test Access Point), Single Mode or Single/Multi Mode
- Optical cables
- What is the bandwidth of LTE carrier?
- Who is the network equipment manufacturer (NEM)?
- What is the CPRI line rate (or link rate)?
- Is the fiber optic connection Single Mode (Yellow) or Multi Mode (Orange)?

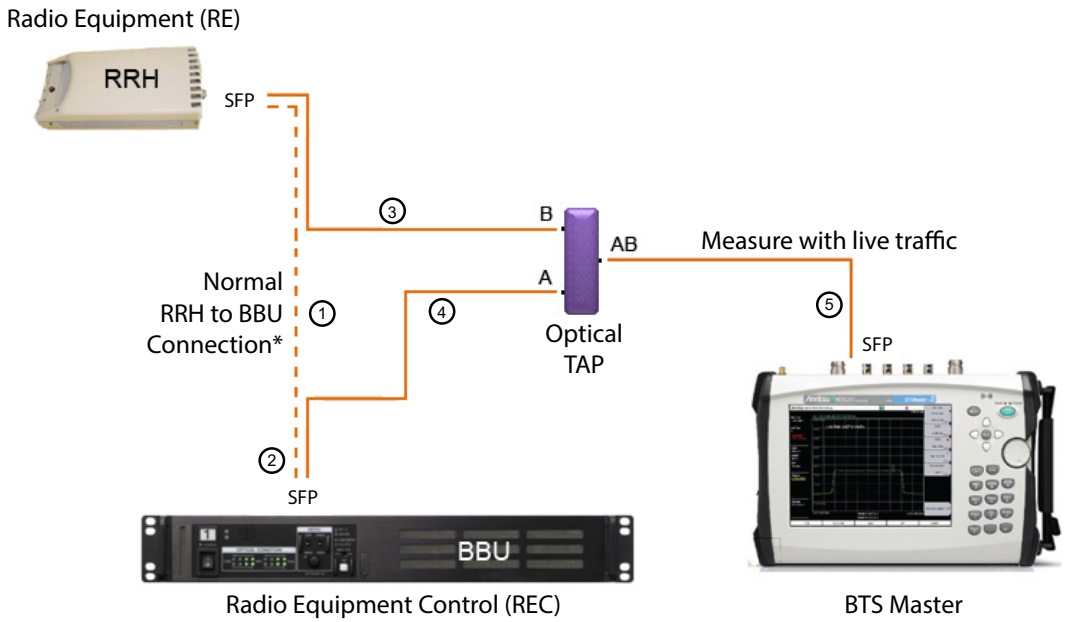
Required accessories are available from Anritsu Company. Refer to the instrument Technical Data Sheet.

2-3 Typical CPRI Connection

1. Lock down the RRH before disconnecting the fiber optic cable.
2. Disconnect the fiber cable from the BBU.
3. Connect the RRH to Port B on the optical TAP.
4. Connect a 3-meter LC/LC Duplex Jumper from Port A on the optical TAP to the BBU.
5. Use a compatible SFP transceiver and Simplex fiber cable to connect the Anritsu test instrument to Port AB on the optical TAP.

   Port A Out from Port AB is the downlink BBU spectrum.

   Port B Out from Port AB is the uplink RRH spectrum.
6. If a dual port option is installed on the instrument, you can optionally connect it to another RE, using a second SFP port. However, you can only test one CPRI link at a time.
7. When all connections are complete, unlock the RRH.
8. Perform measurements using live traffic.



* Lock down the Radio before disconnecting fiber from BBU

Figure 2-2. Connecting CPRI Link to Anritsu Test Instrument

Warning

Laser radiation may be present at fiber optic cable connectors and ports. This laser radiation could present a nominal ocular hazard from either direct viewing or by diffuse reflection. Do not view the emitted laser radiation directly or indirectly because permanent blindness may result.

2-4 CPRI Parameters

When monitoring traffic over the CPRI link, the Anritsu test instrument will extract the IQ data, modulate it into the proper baseband frequency, and process the signal into data points to be plotted on the instrument screen. The CPRI parameters described in the following sections are needed for the CPRI Analyzer to process and display the data correctly. Note that configurations may be different for the uplink and downlink. The uplink spectrum represents mobile phone LTE data. The downlink spectrum is the display spectrum of BBU LTE control channel to RRH.

All CPRI IQ data is at baseband frequency (0 Hz). During CPRI configuration, you must enter the correct center frequency or channel number. The operating frequency range for CPRI Analyzer mode can either be set manually, or the desired radio preset can be selected from the Radio Presets menu or the Auto Detect menu. After selecting a Signal Standard from the Signal Standard list, all frequency-related parameters for the standard are automatically set to the appropriate values. You can then set a valid band in the Channel Editor dialog box. A custom channel list can also be created to allow up to 20 independent channels to be defined.

Note

If you know the equipment manufacturer (such as Alcatel-Lucent, Ericsson, or Huawei) and the IQ bit width of the CPRI signal, you may select the appropriate radio preset and let the application auto-detect the line rate, the carrier bandwidth, and any available antenna carriers (AxC). Refer to "CPRI Parameter Automatic Detection" on page 2-5.

To select CPRI parameter settings without the aid of a radio preset, refer to the "CPRI Config Menu" on page 2-41.

Line Rate

Line Rate is the speed of the CPRI link. Table 2-2 lists the selectable line rates and associated rate numbers, 1 through 7.

Table 2-2. CPRI Line Rates

CPRI Rate	Line Rate (Mbit/s)
1	614.4
2	1228.8
3	2457.6
4	3072.0
5	4915.2
6	6144.0
7	9830.4

AxC Container/Carrier

Antenna Container mapping determines the location of IQ data for a given carrier (that is, the signal). AxC Container numbers are specific to the bandwidth or carrier. The selectable value range is 0 through 10.

Mapping = 1 means 1 carrier/signal per AxC
Mapping = 3 means 2 interleaved carriers are combined in 1 AxC

The CPRI AxC contains the IQ data used to generate the RF spectrum. The data includes the LTE carrier plus 50% dummy data, which appears as noise floor on either side of the spectrum. The maximum span is approximately 50% greater than the carrier bandwidth. For example, if the LTE carrier bandwidth is 10 MHz, the maximum span will be about 15 MHz.

CPRI Bandwidth

This is the bandwidth of the LTE carrier that is transmitted via CPRI. Supported LTE carrier bandwidths are 5 MHz, 10 MHz, 15 MHz, and 20 MHz.

IQ Bit Width

This is the IQ bit width, or sample width, for downlink and uplink. Selectable values are 10, 12, 15, and 16.

Reserve Bits

The reserve (or stuffing) bits are vendor-specific and are used with IQ bit width to align sample frequencies to the basic frame frequency. Reserve bits can be set at 0 through 10. For LTE, 0 and 6 are the most common reserve bit values.

CPRI Aggregation

Aggregation is common with some LTE equipment manufacturers. It refers to the aggregation of smaller carriers to make one large carrier within one AxC. For example, two 5 MHz carriers can be aggregated to make a single 10 MHz carrier.

2-5 CPRI Parameter Automatic Detection

Use the Auto Detect feature when you have limited information on the CPRI link to be tested. The test instrument will search for potentially matching signals based on either of the following:

- a radio preset associated with a specific equipment manufacturer (Alcatel-Lucent, Ericsson, or Huawei) and the CPRI IQ bit width (12-bit or 15-bit)
- custom settings for IQ bit width, number of reserve bits, and aggregation condition

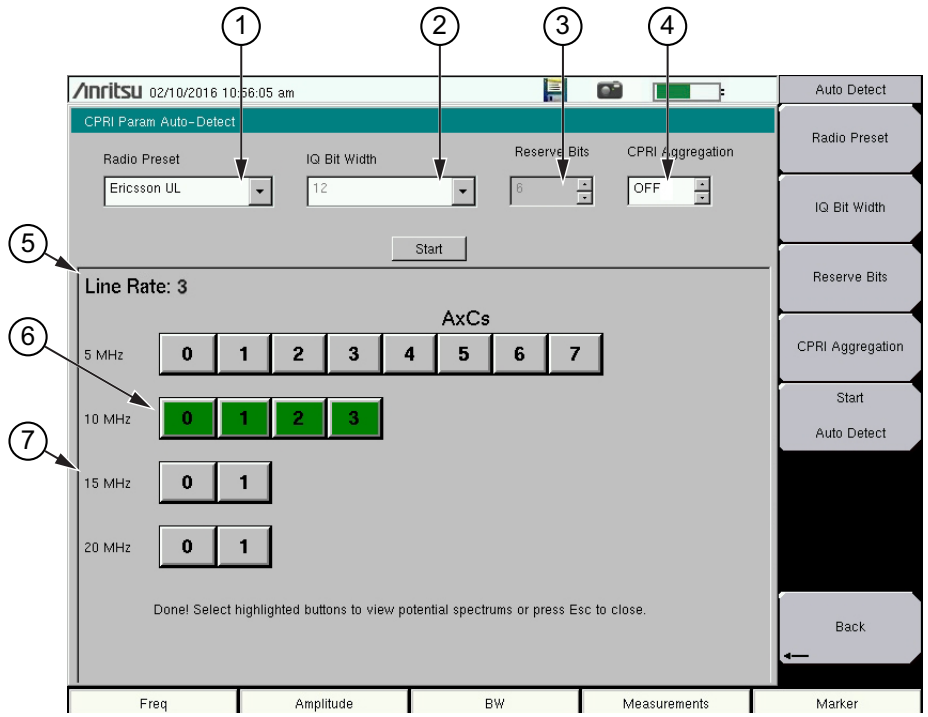
To choose a radio preset, press the **Measurements** key, then press CPRI Configure, followed by Radio Presets and the appropriate key for the RRH vendor. Refer to "Radio Presets Menu" on page 2-42. Presets are available for uplink (RRH to BBU) and downlink (BBU to RRH).

To enter custom settings instead of a radio preset, press **Measurements**, then CPRI Configure followed by Radio Presets, then Advanced. Refer to "Advanced Menu" on page 2-43.

Alternatively, you can select a radio preset or custom settings from the Auto Detect screen by pressing **Measurements**, then CPRI Configure and Auto Detect. See Figure 2-3. On this screen, the IQ Bit Width and Reserve Bits can be changed only when Custom Settings, and not a vendor-specific preset, is selected as the Radio Preset value. CPRI Aggregation can be turned on or off for an Ericsson or custom preset. Note that the radio preset in Figure 2-3 is Ericsson UL, and other parameter values are consequently fixed, except for CPRI Aggregation.

To start the CPRI parameter automatic detection, press the Start Auto Detect key. The CPRI Analyzer will determine the line rate automatically and highlight in color any available AxC (Antenna Container/Carrier) in the specific carrier bandwidth. More than one button may be highlighted. The results of Auto Detect provide a smaller number of potentially matching signals out of the possible results for a specific line rate. You must check each highlighted button until you find the desired signal.

When you press a highlighted button in the results area, the Auto Detect screen closes, and the signal trace is displayed.



1.	Radio Preset drop-down list (vendor preset or custom settings)
2.	IQ Bit Width (10, 12, 15, or 16)
3.	Reserve Bits (0 to 10)
4.	CPRI Aggregation (Off/On)
5.	Line Rate setting (1 through 7)
6.	Antenna Containers (0 through 10 for each IQ Bit Width)
7.	LTE Carrier Bandwidth (5 MHz, 10 MHz, 15 MHz, or 20 MHz)

Figure 2-3. CPRI Parameter Auto-Detect Screen

2-6 CPRI Measurement Display

Two measurement display modes are available: spectrum and spectrogram. The spectrum mode displays signals as a waveform in a traditional spectrum analyzer view (see Figure 2-4). A spectrogram is a three-dimensional representation of frequency, time, and power. Color is used to represent the relative power levels (see Figure 2-5). The figures below show display screens on an Anritsu BTS Master MT8220T loaded with Option 751. The screens and menus on your instrument may differ slightly.

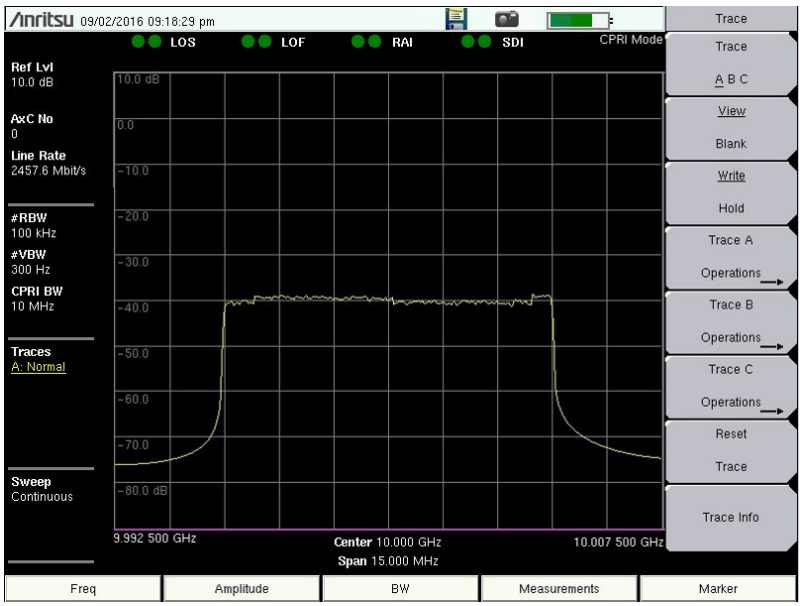


Figure 2-4. CPRI Spectrum Display

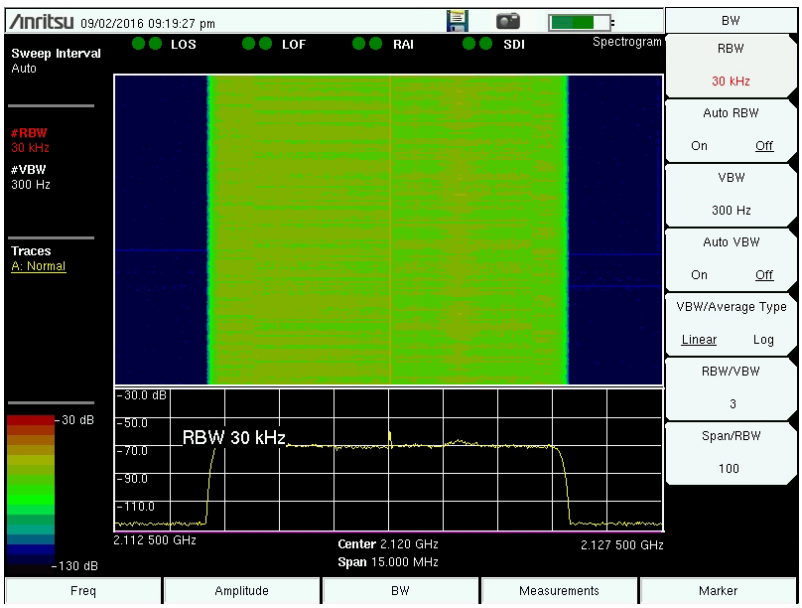


Figure 2-5. CPRI Spectrogram Display

2-7 CPRI Configuration Example

The primary application for CPRI RF is to check for interference on the RRH-to-BBU uplink. The easiest way to configure the Anritsu instrument for CPRI testing is to use one of the radio presets provided with the CPRI application. Refer to "CPRI Parameter Automatic Detection" on page 2-5.

If no radio preset is available for the RRH being used, or you don't know who the equipment manufacturer is, you can still employ the Auto Detect feature to automatically determine and apply the appropriate configuration settings. This requires entering custom settings for the IQ bit width, number of reserve bits, and aggregation condition. Set these parameters via the Auto-Detect dialog in Figure 2-6 or the "Advanced Menu" on page 2-43.

A third configuration method is to manually enter the CPRI line rate, the LTE carrier bandwidth, and the AxC Container/Carrier. Refer to "CPRI Parameters" on page 2-4.

Following is an example of configuring the Anritsu instrument for CPRI testing on the RRH or uplink LTE signal (Port B Out from Port AB on the optical TAP), using one of the available uplink radio presets.

1. If your test instrument is not yet in CPRI measurement mode, press the front panel **Menu** key, then press the CPRI RF application icon.
2. Press the **Measurements** main menu key at the bottom of the touch screen.
3. Press the CPRI Configure submenu key.
4. Only if a dual port option is installed, press SFP Port Selection to select Port 1 or Port 2.
5. Press Auto Detect.
6. Press Radio Preset and select the desired radio manufacturer and uplink/downlink type from the drop-down list, then press **Enter**.
7. If the preset is Ericsson, turn the rotary knob to set CPRI aggregation on or off.

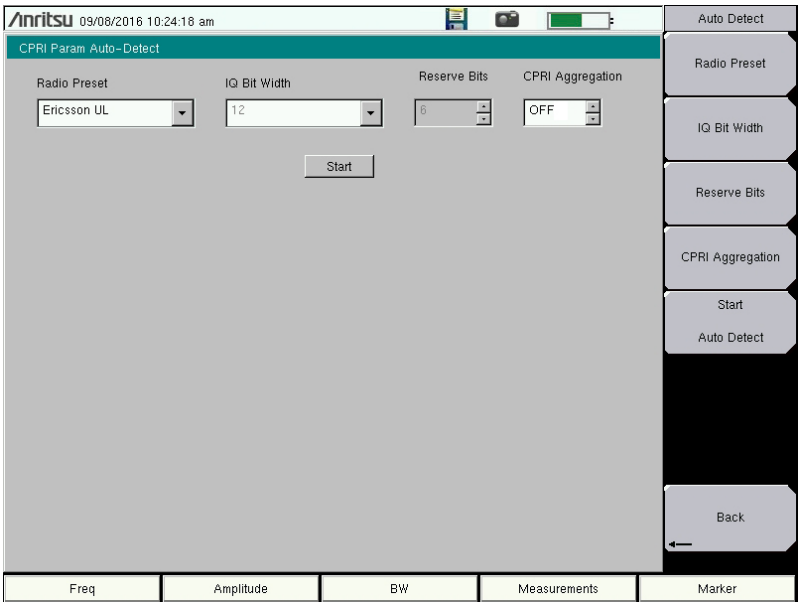


Figure 2-6. CPRI Parameter Auto-Detect Dialog

8. Press the Start button or the Start Auto Detect submenu key.
9. The line rate is determined automatically. Antenna Carriers (AxC) that are available for selection are displayed in color. See Figure 2-7.
10. Press one of the highlighted AxC's.

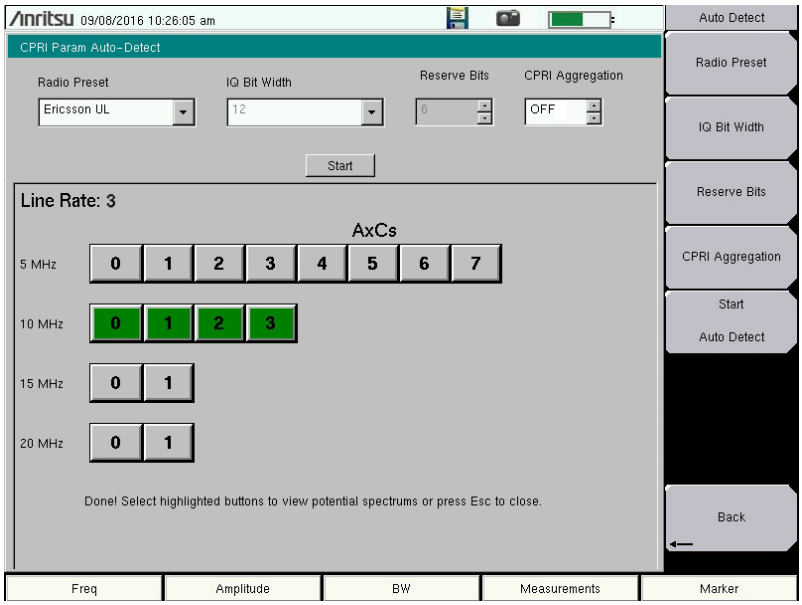


Figure 2-7. Line Rate and Available Antenna Carriers

11. A Spectrum view similar to Figure 2-8 is displayed.

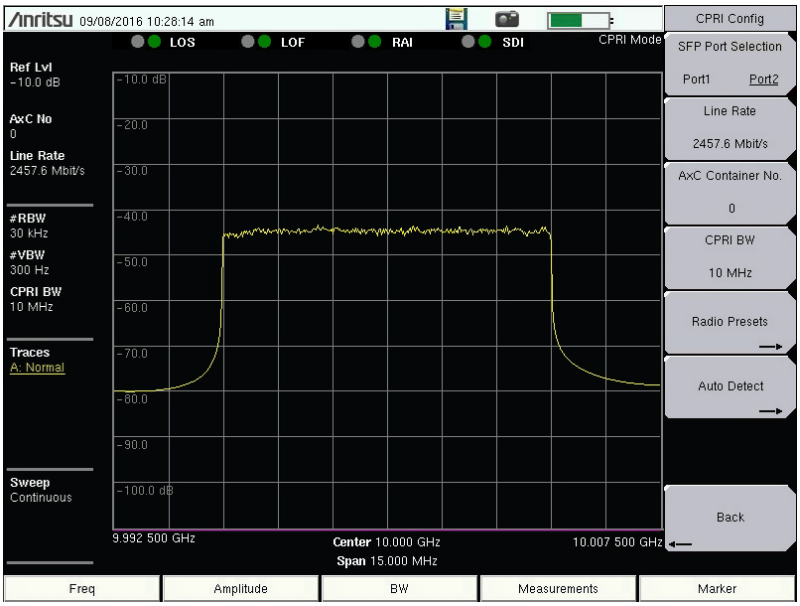


Figure 2-8. Sample Spectrum Display

12. To change the view to spectrogram, press the **Measurements** main menu key, then press Spectrogram.

Refer to the Spectrum Analyzer Measurement Guide for details on Spectrum Analyzer and Interference Analyzer (Spectrogram) functions.

The connection status of SFP Port 1 and Port 2 is displayed on the instrument screen as colored dots above the trace window. Green indicates a good connection, red indicates an error, and gray (no color) means no connection. In the example above, Port 1 has no connection.

- LOS – Loss of Signal
- LOF – Loss of Frame
- RAI – Remote Alarm Indication, returned to sender as a response to LOS or LOF
- SDI – SAP (Service Access Point) Defect Indication, when any of LOS, LOF, or RAI is detected

2-8 Base Band Unit Emulation (Option 760)

The Base Band Unit Emulation feature in the CPRI RF application is available with Option 760. It provides RRH test functionalities through the CPRI measurement interface, allowing you to test the RRH connectivity before the BBU is actually installed.

Note	Option 760 requires CPRI Analyzer Option 751 and may not be supported on all instrument models. Refer to your instrument's Technical Data Sheet for option availability.

You can send an LTE waveform pattern and have the RRH transmit it over the air, thereby verifying the transmit functionality. LTE waveforms are available for different bandwidths: 5 MHz, 10 MHz, 15 MHz, and 20 MHz.

The BBU RF test performs RRH-based measurements and displays the results for Return Loss (RL) and Voltage Standing Wave Ratio (VSWR). Return Loss measures the reflected power of the system in decibels (dB). VSWR is the ratio of voltage peaks to voltage valleys caused by reflections. You can set the return loss limit and VSWR limit to detect any transmission problem between the instrument, RRH, and antenna system.

Prior to running BBU RF tests, you must select and initialize the RRH. BBU scripts are included with Option 760 and are specific to an RRH model. They contain commands required to perform actions such as RRH initialization or to get VSWR or SFP data. If necessary, you can reload the scripts or download new scripts from an external USB drive to the Anritsu instrument's internal memory, as described in "BBU Script Download".

BBU Script Download

Script files are included with the Option 760 firmware. Follow this procedure only if you need to reload them, or download different scripts. To download scripts from a USB storage device to the Anritsu test instrument:

1. Insert a USB drive containing the script files into the test instrument USB port. The script folder must be named `BBUEmulationScripts` and reside in the root directory of the USB storage drive.
2. With the instrument running in CPRI Mode, press the **Measurements** main menu key at the bottom of the touch screen, then press BBU Emulation.
3. Press Script Manager followed by USB Download. An error message is displayed if no USB drive is connected or no properly named BBU script directory is found. Refer to "Script Manager Menu" on page 2-32.
4. Select the scripts from the list and press Copy Selected To Internal Memory.

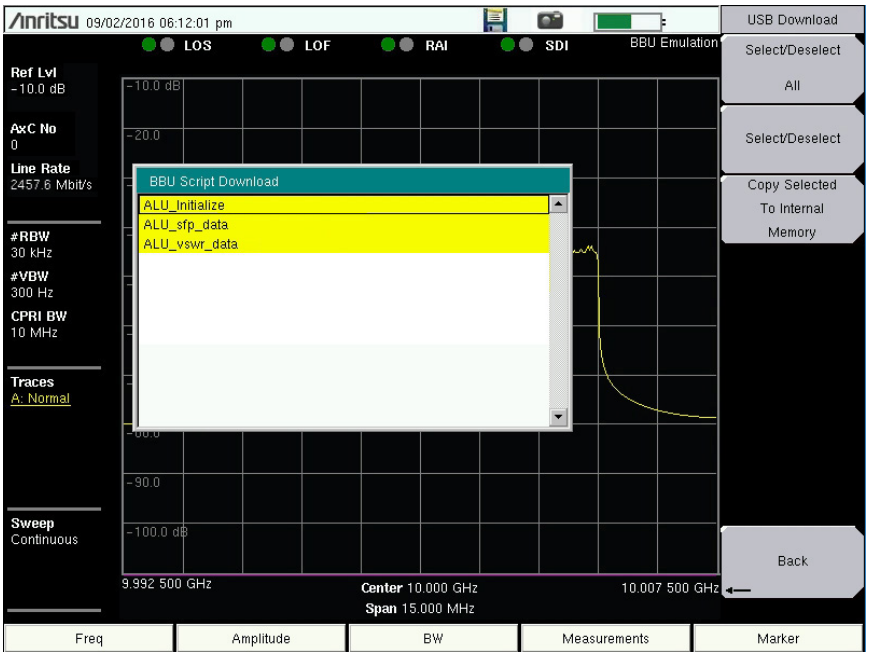


Figure 2-9. BBU Scripts Download Screen

5. Press Back to return to the BBU Emulation menu.

LTE Waveform Download

To download LTE waveforms from USB to the Anritsu test instrument:

1. Insert a USB drive containing the waveform files into the test instrument USB port. The waveform folder must be named `AN_LTE_Waveforms` and reside in the root directory of the USB storage drive. Files must be contained in subfolders named for the bandwidths: `5MHz`, `10MHz`, `15MHz`, and `20MHz`.
2. With the instrument running in CPRI Mode, press **Measurements**, then BBU Emulation.

3. Press Waveform USB Download.

   An error message is displayed if no USB drive is connected or no properly named waveform directory is found.

4. Select a bandwidth from the list, then press **Enter**.

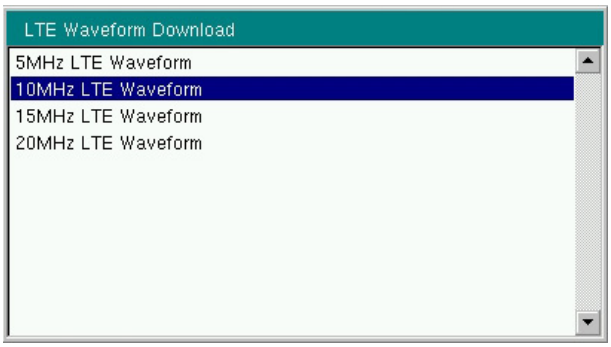


Figure 2-10. LTE Waveform Bandwidth List

5. Scroll through the list associated with the chosen bandwidth and press Select/Deselect to highlight waveforms, then press Copy Selected To Internal Memory.

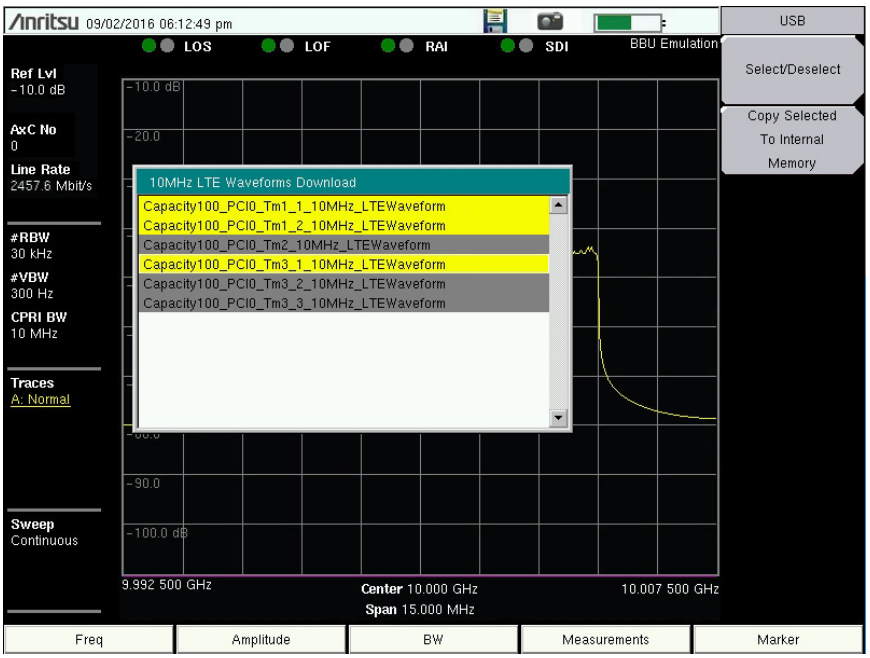


Figure 2-11. LTE Waveforms Download

6. Repeat Step 3 through Step 5 as needed to download waveforms of different bandwidths.

BBU Test

To run a BBU test, follow the steps described below. It is assumed that BBU scripts and LTE waveform patterns have been downloaded to the Anritsu instrument internal memory, as described in the previous sections.

1. Follow instructions in the "CPRI Configuration Example" on page 2-8 to set up the Anritsu instrument for the RRH you plan to test.
2. From the CPRI mode Measure menu, press BBU Emulation. The Anritsu instrument's SFP port will go from slave to master mode.
3. If not connected, connect the instrument SFP to the RRH slave port using a suitable fiber cable.
4. Press Select Initialize RRH to start auto-negotiating the line rate with the RRH and establish a CPRI connection to the passive layer.

   If multiple radios are connected in a daisy chain, the Anritsu instrument assigns an IP address to each, using its built-in DHCP server. It may take a few minutes for the instrument to gather RRH IP information, then a pop-up window is displayed, listing the RRHs that responded.

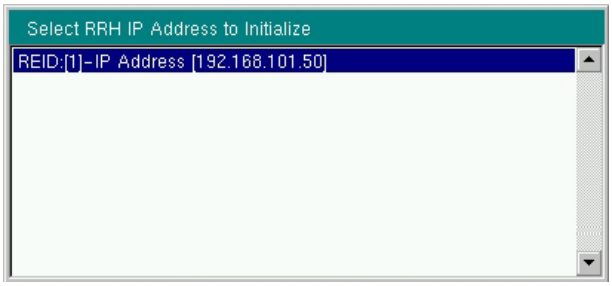


Figure 2-12. RRH IP Address List

5. Choose the desired IP address from the displayed list, then press **Enter**.
6. Press BBU Test. Note that this key is active only after you have initialized the RRH in the step above.
7. Optionally, press RRH SFP Data and the appropriate submenu key to view information on the RRH SFP. See Figure 2-40 and Figure 2-41 on page 2-35. Press Back to return to the BBU Test menu.
8. Press BBU RF Test, then LTE Waveforms.

9. Press Select Radio Type and choose from the list the carrier configuration that matches the radio type and bandwidth of the signal you want to transmit through the RRH. Press Select.

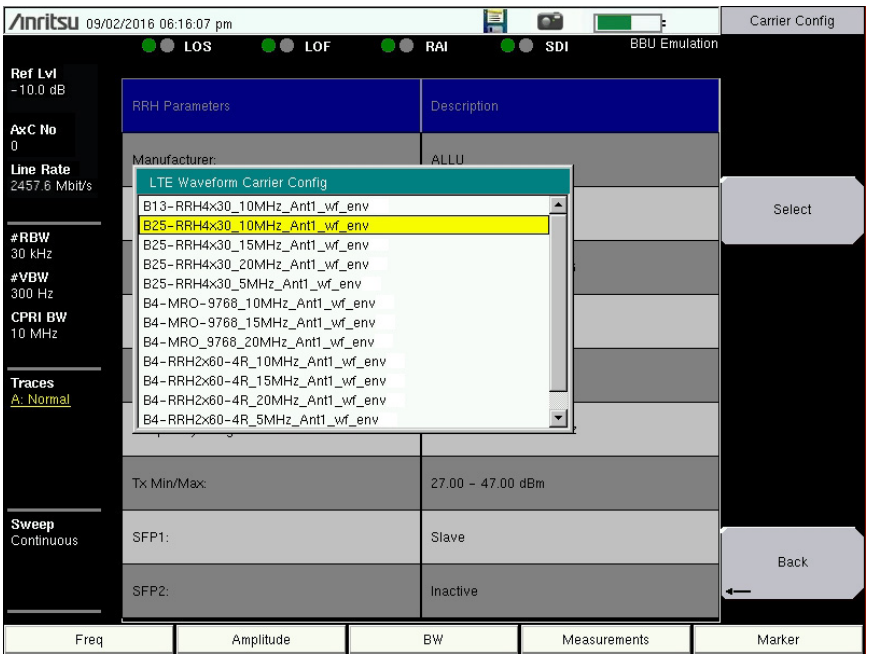


Figure 2-13. LTE Waveform Carrier Configuration

10. Optionally, press the Center Frequency key under the LTE Waveforms menu and adjust the carrier frequency of the radio. The frequency defaults to the center frequency of the selected RRH transmit band.

11. You may also adjust the transmit power from the RRH using the Output Power key. The default power is 3 dB below the maximum output power of the RRH being tested.

12. Press Apply Changes to update the RRH configuration.

13. Press Select Waveform and select a bandwidth from the list, then press **Enter**.

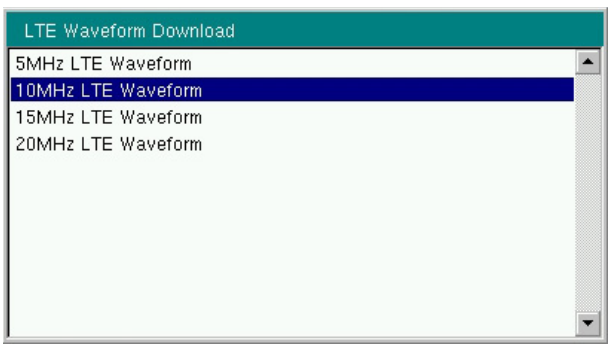


Figure 2-14. LTE Waveform Bandwidth List

14. Scroll to the waveform corresponding to the radio type selected earlier, then press Select/Deselect to highlight it. One waveform pattern may be transmitted at a time.

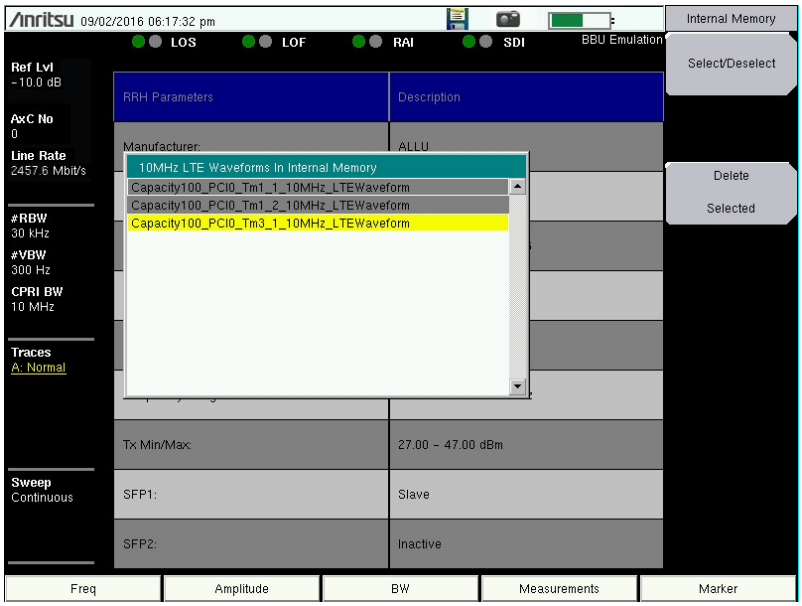


Figure 2-15. LTE Waveform Select

15. Press the **Enter** key to load the selected waveform.

16. Wait for the message indicating that loading was successful, at which point the Play Waveform key on the LTE Waveforms menu will become active.

17. Press Play Waveform to turn on the transmitter and send the waveform to the RRH.

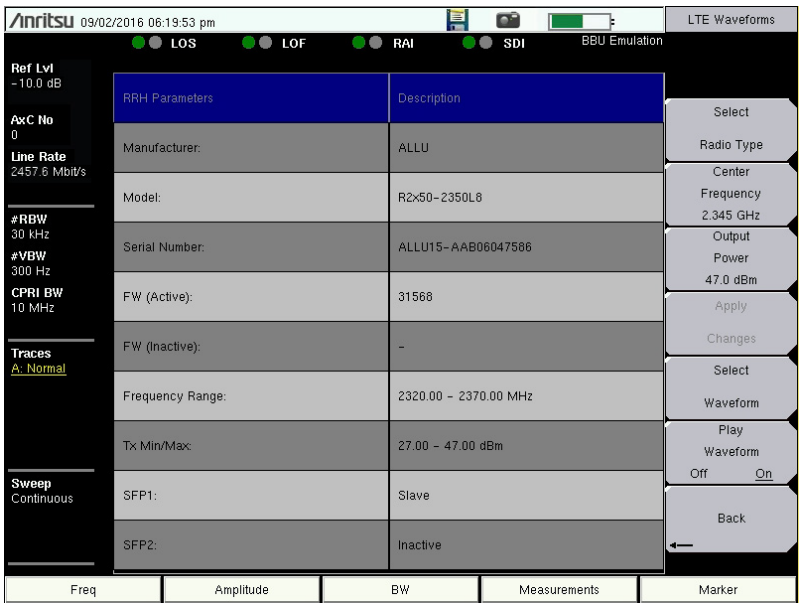


Figure 2-16. Play Waveform

18. Stand in front of the desired antenna with a spectrum analyzer and you should see the waveform transmitting from the antenna.

19. Press Back to return to the BBU RF Test menu, then press Return Loss/VSWR. Provided the RRH is transmitting, test results are displayed on the instrument screen.

Figure 2-17. Return Loss/VSWR Measurement Results

20. You can optionally change the return loss limit and VSWR limit and press Measure to run the test again.

2-9 CPRI Analyzer Menu Map

Figure 2-18 and Figure 2-19 illustrate the CPRI Analyzer main menu map, showing all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances. Additional menus and submenus are shown on the next pages.

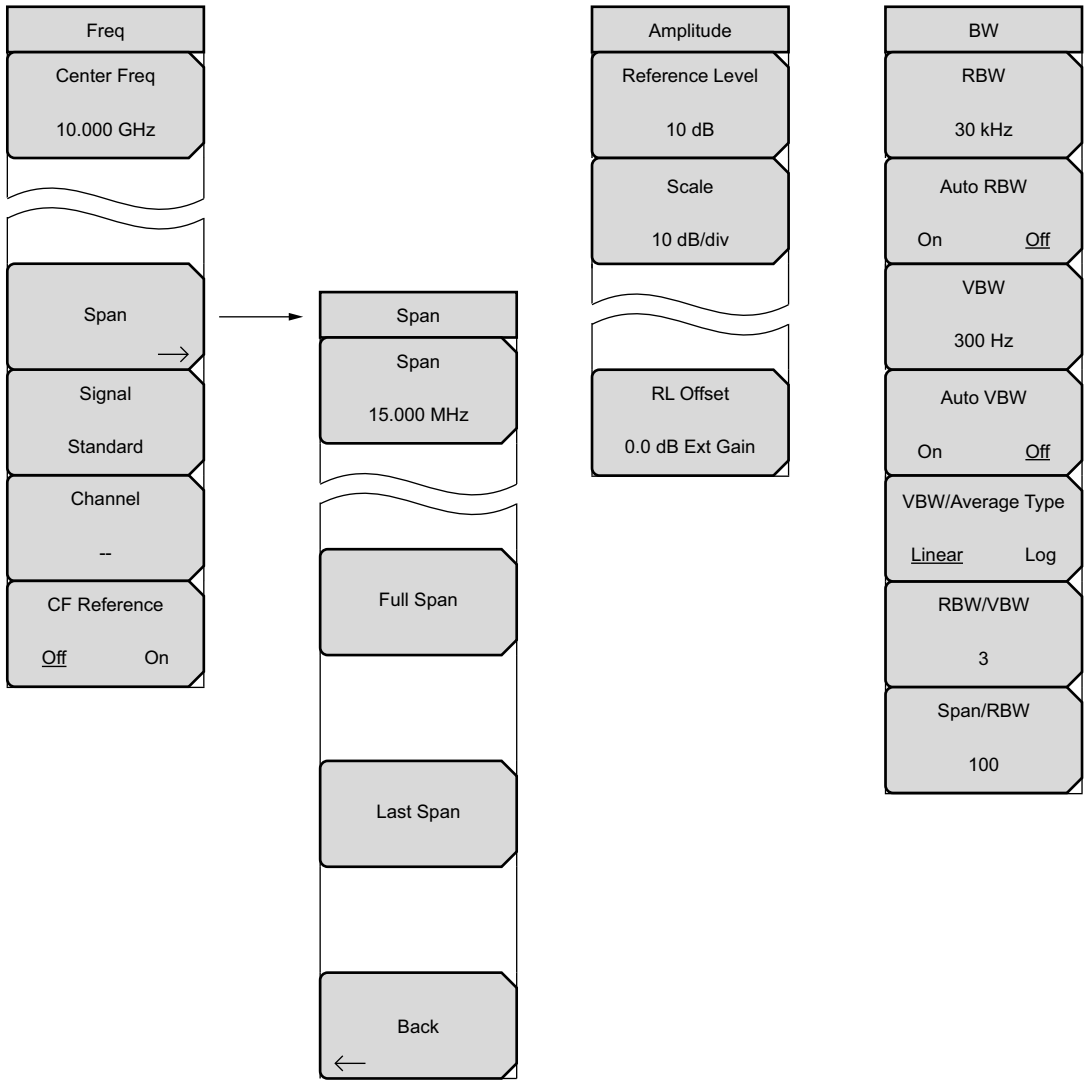


Figure 2-18. Main Menu Map (1 of 2)

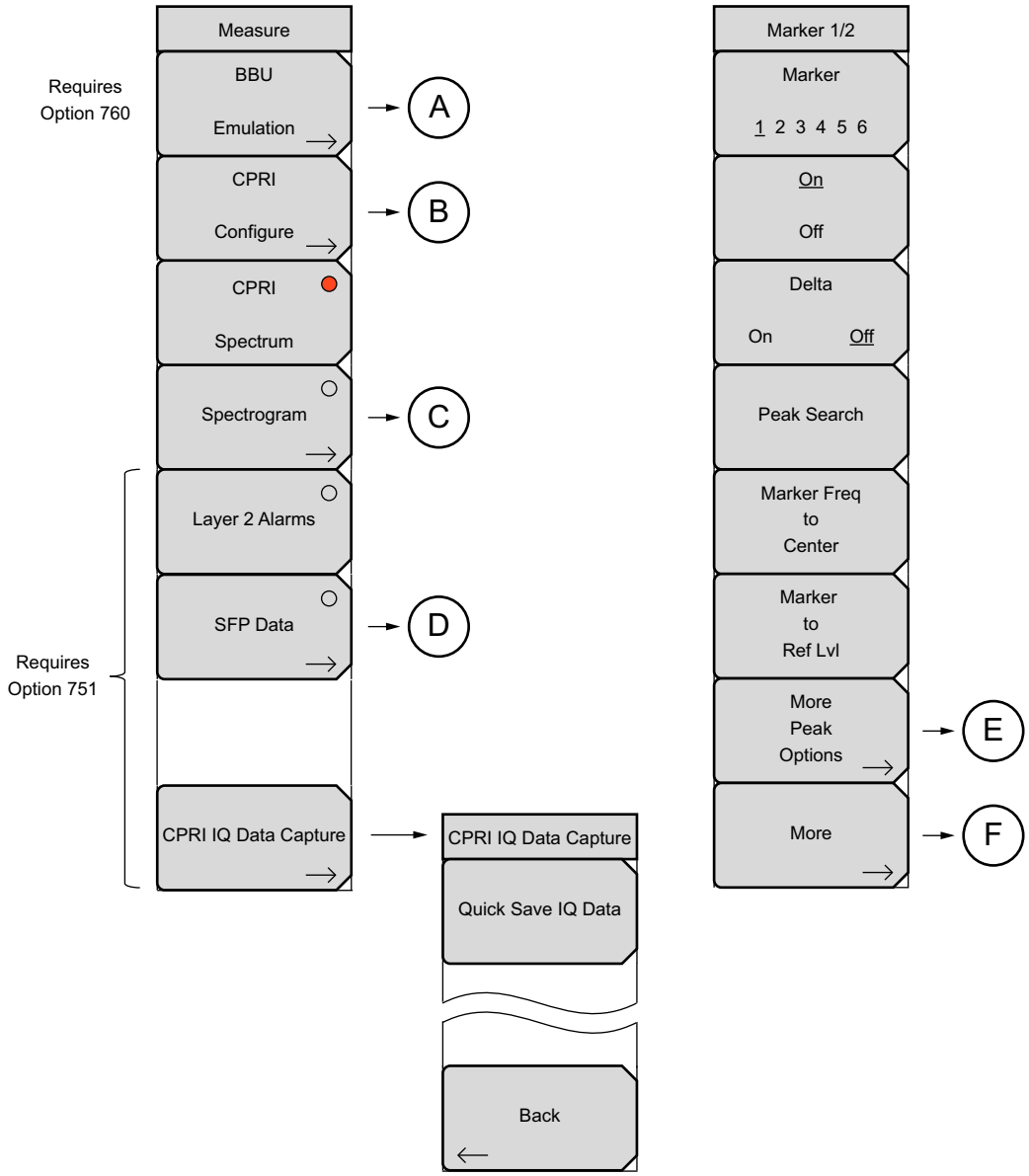


Figure 2-19. Main Menu Map (2 of 2)

Measurements Menu Map

Figure 2-20 through Figure 2-22 show the CPRI Analyzer Measurements menu and submenus.

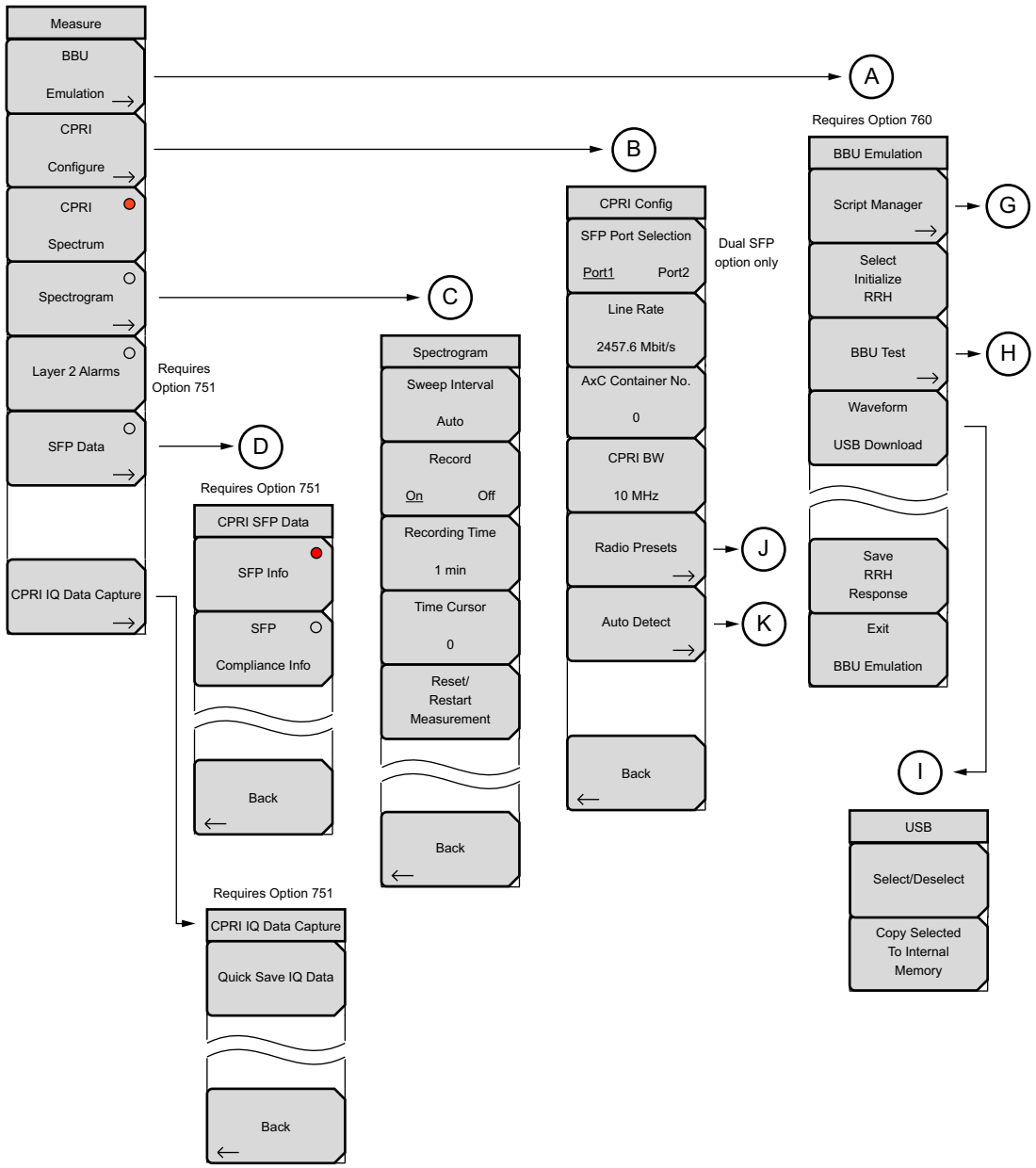


Figure 2-20. Measurements Menu Map (1 of 3)

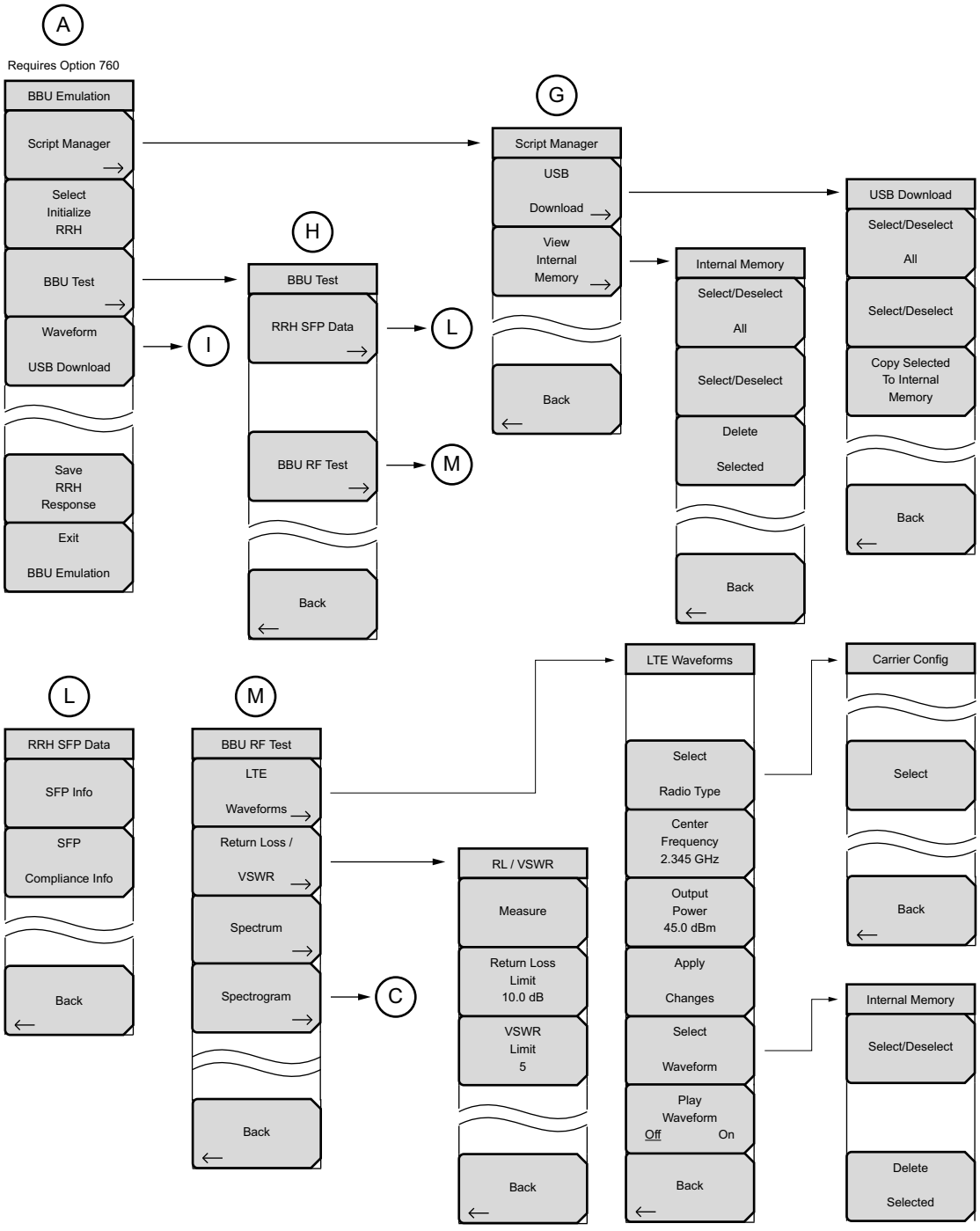


Figure 2-21. Measurements Menu Map (2 of 3)

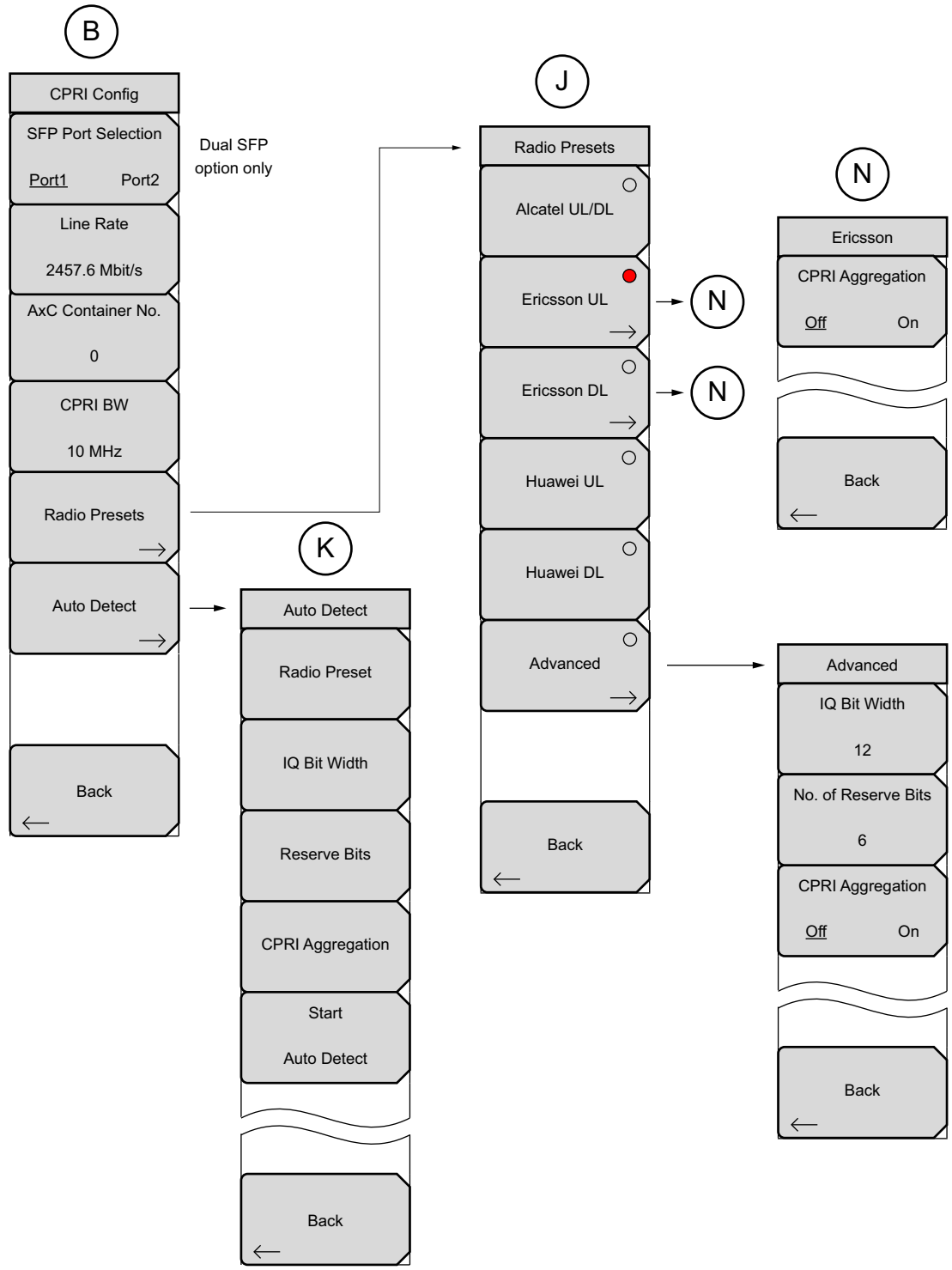


Figure 2-22. Measurements Menu Map (3 of 3)

Marker Menu Map

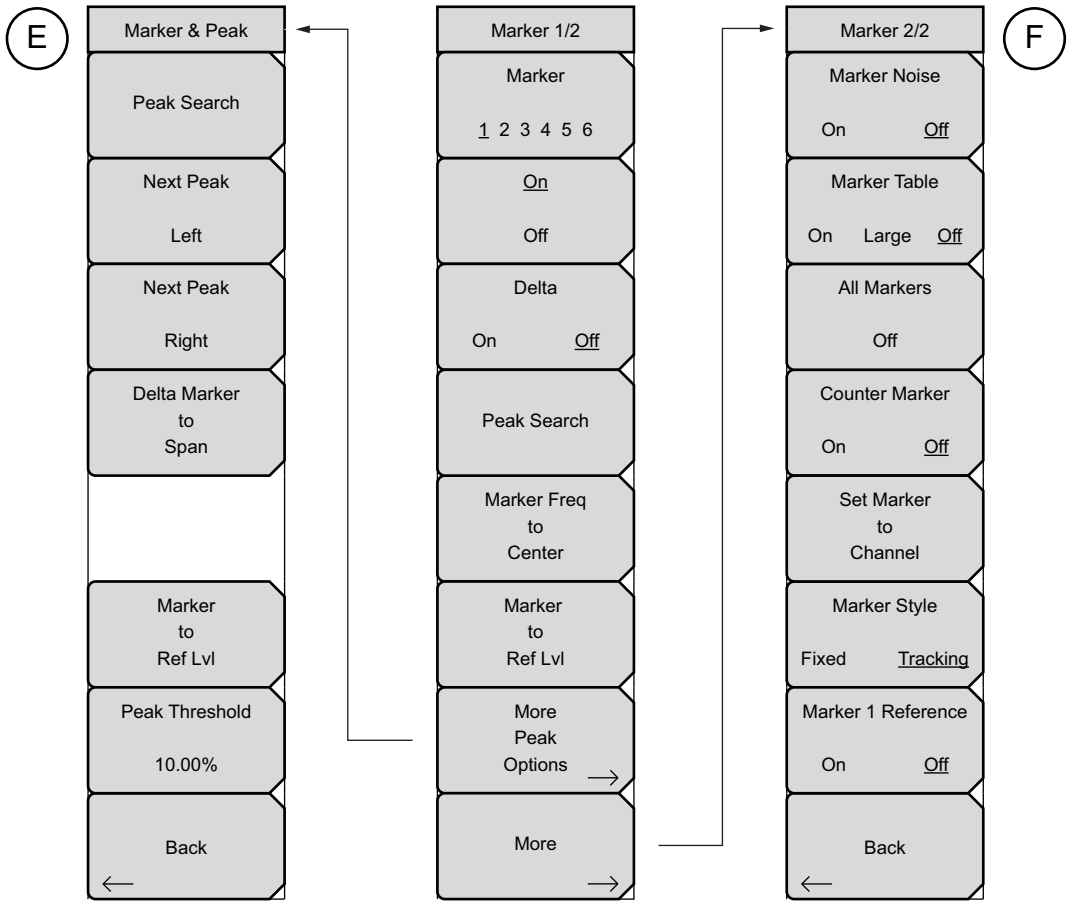


Figure 2-23. Marker Menus

Sweep Menu

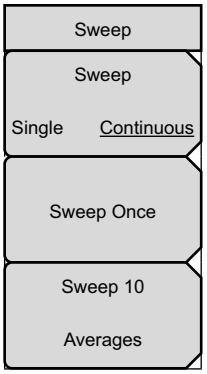


Figure 2-24. Sweep Submenu Keys

Trace Menus

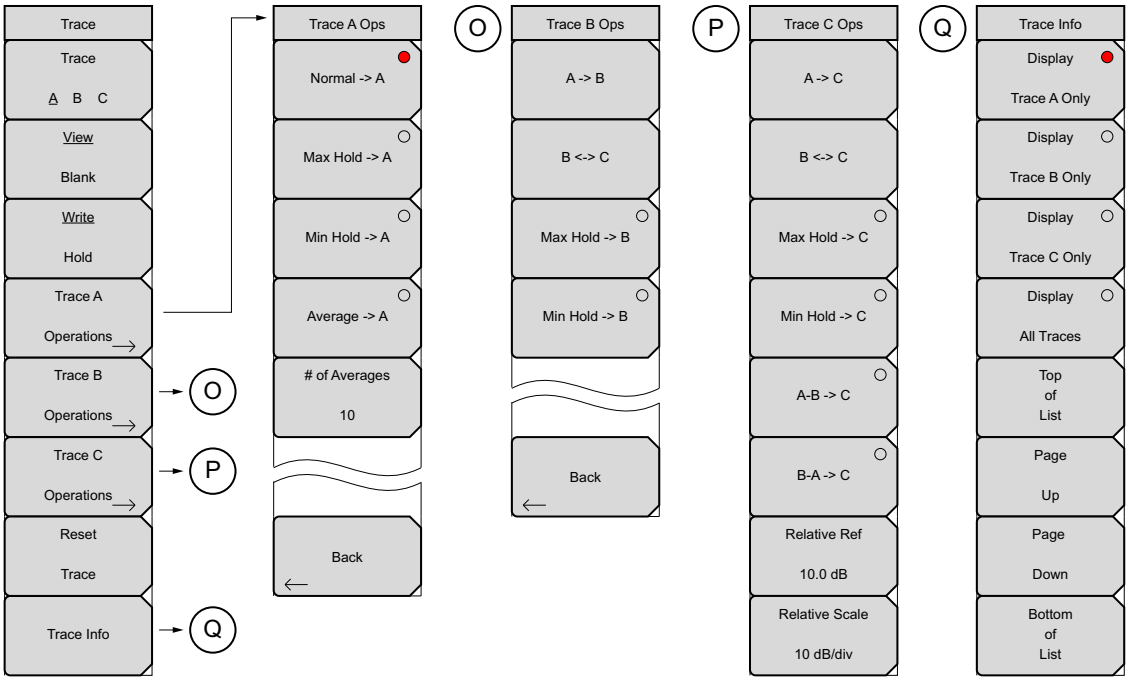


Figure 2-25. Trace Submenu Keys

Limit Menus

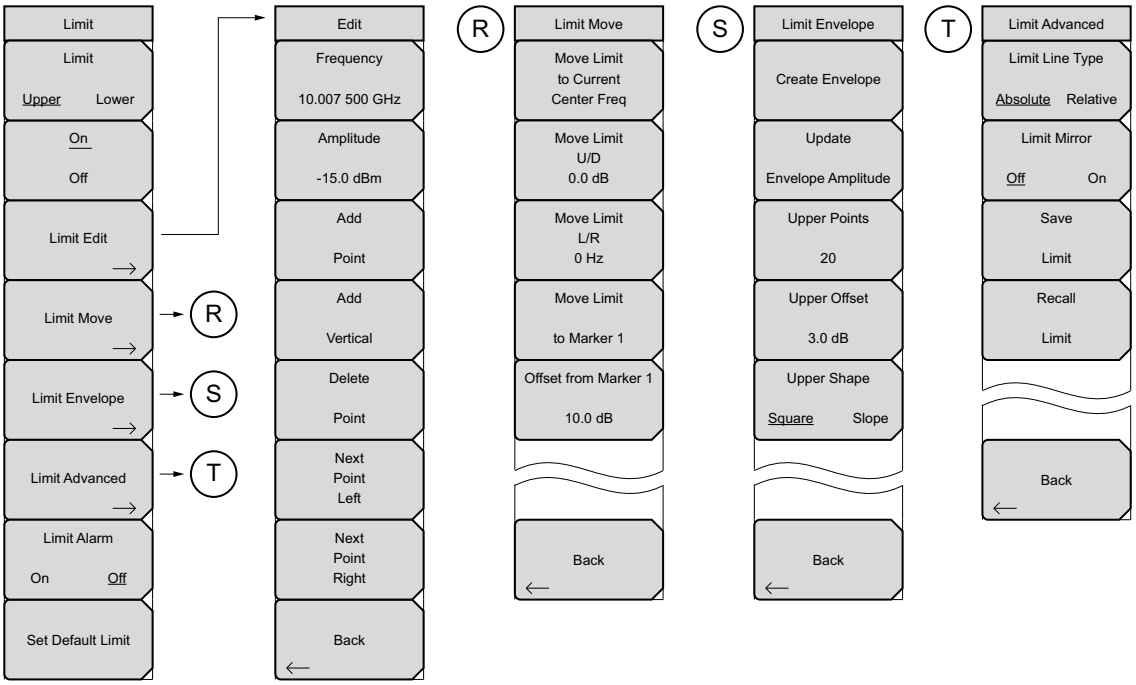
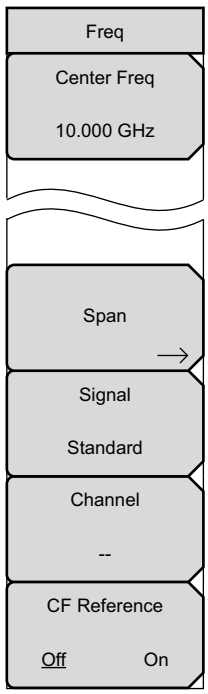


Figure 2-26. Limit Submenu Keys

2-10 Freq Menu

Key Sequence: **Freq**.



Center Freq: Press this submenu key, then enter the desired frequency using the numeric keypad, the arrow keys, or the rotary knob. If entering a frequency with the keypad, the submenu key labels will change to GHz, MHz, kHz, and Hz. Press the appropriate Units key. Pressing the **Enter** key selects MHz as the default frequency unit.

To allow the CPRI signal to move off center (pan), adjust the center frequency to a different value. Depending on the value entered, this may automatically adjust the frequency span, as there cannot be panning without zooming.

Span: Press this submenu key to display the "Span Menu" on page 2-26.

Signal Standard: Press this submenu key to display the Signal Standards list box. Use the touch screen, arrow keys, or rotary knob to highlight a signal standard, then press **Enter** to select.

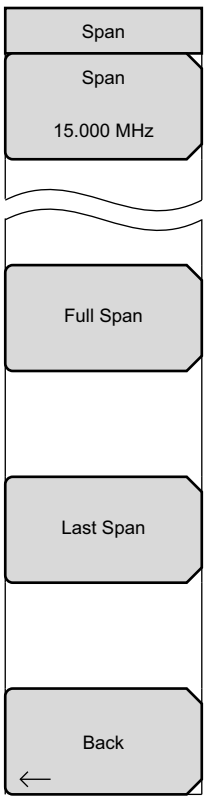
Channel: After selecting a signal standard, press this submenu key to display the Channel Editor dialog box. Enter a valid band.

CF Reference: Press this submenu key to toggle the center frequency reference setting On or Off.

Figure 2-27. Frequency Menu

2-11 Span Menu

Key Sequence: **Freq** > Span



Span: This submenu key shows the current value for span in units of GHz, MHz, kHz, or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys, or the rotary knob to increase or decrease the frequency span. If the span is changed using the arrow keys or rotary knob, the span changes in steps of 0.5 MHz. If entering a span with the keypad, the submenu key labels will change to GHz, MHz, kHz, and Hz. Press the appropriate Units key. Pressing the **Enter** key selects MHz as the default frequency unit.

Use the frequency span to zoom in to the CPRI signal. A span setting of 0 Hz (or zero span) is not allowed in CPRI mode. The maximum span is the carrier bandwidth + 50%. The minimum span is 10 kHz. If you attempt to set a span of less than 10 kHz, the instrument will apply the default minimum span of 10 kHz.

Full Span: Pressing this submenu key sets the span to cover the entire tunable spectrum of the instrument.

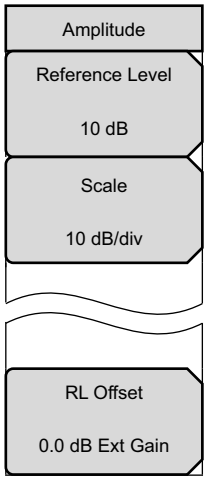
Last Span: This submenu key returns the span to the most recent span value immediately before a change was made.

Back: Returns to the “Freq Menu” on page 2-25.

Figure 2-28. Span Menu

2-12 Amplitude Menu

Key Sequence: **Amplitude**



Reference Level: The reference level is the top grid line on the measurement display and can be set from +30 dBm to –150 dBm. A value may be entered from the keypad. Use the **+/–** key for a minus sign. After entering the value, press the dB submenu key or the **Enter** key. The arrow keys and rotary knob also change the reference level value. The reference level value may be modified by the reference level offset value to compensate for an external attenuator or amplifier.

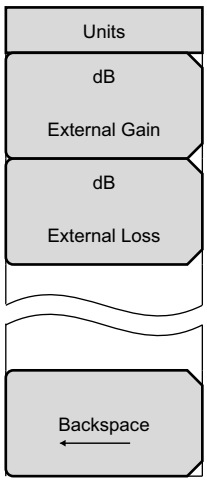
Scale: The scale can be set in 1 dB steps from 1 dB per division to 15 dB per division. The value can be changed using the keypad, the rotary knob, or the arrow keys.

RL Offset: RL Offset compensates for the presence of external input attenuation or gain. Use the numeric keypad to enter a positive value to compensate for gain or loss, then press the appropriate submenu key (dB External Gain or dB External Loss). The new RL Offset value is displayed on the button.

Figure 2-29. Amplitude Menu

2-13 Units of External Gain or Loss

Key Sequence: **Amplitude** > RL Offset > **Keypad** Entry



These units are for RL Offset Gain or Loss.

dB External Gain: Enter a value with the numeric keypad, then press this submenu key for external gain.

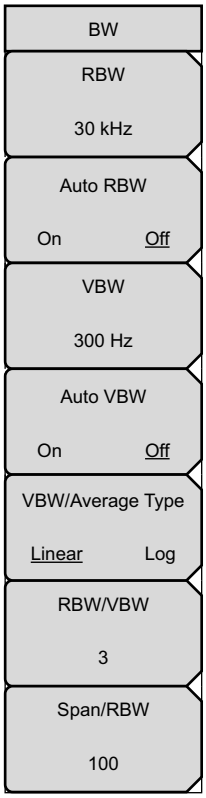
dB External Loss: Enter a value with the numeric keypad, then press this submenu key for external loss.

Backspace: Press this submenu key to delete the last digit entered.

Figure 2-30. Units Menu for External Gain or Loss

2-14 BW (Bandwidth) Menu

Key Sequence: **BW**



RBW: The current resolution bandwidth value is displayed in this submenu key. The RBW can be changed using the keypad, the arrow keys, or the rotary knob. The value range is 300 Hz to 1 MHz. Available settings are: 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, and 1 MHz.

The RBW value changes automatically when the frequency span is changed and Auto RBW is on. In this case, the new RBW value is an approximation selected out of the valid settings listed above, based on the current ratio of span to resolution bandwidth. Manually changing the resolution bandwidth turns off the Auto RBW setting.

Auto RBW On/Off: This parameter controls the coupling state of RBW to the frequency span. When Auto RBW is set to on, the instrument adjusts the RBW value automatically, based on the current frequency span and the ratio of span to RBW, as specified by the Span/RBW setting. To disassociate RBW from the span, turn off Auto RBW.

VBW: The current video bandwidth value is displayed in this submenu key. The VBW can be changed using the keypad, arrow keys, or the rotary knob. The value range is 30 Hz to 1 MHz. Available settings are: 30 Hz, 100 Hz, 300 Hz, 1 kHz, 3 kHz, 10 kHz, 30 kHz, 100 kHz, 300 kHz, and 1 MHz.

The VBW value changes automatically when RBW is changed and Auto VBW is on, in which case VBW is set at one of the valid frequencies listed above, as determined by the ratio RBW/VBW. Manually changing the video bandwidth turns off Auto VBW.

Auto VBW On/Off: This parameter sets the coupling state of the video bandwidth to the resolution bandwidth. When Auto VBW is on (the default), the instrument adjusts the VBW value anytime RBW changes. VBW is then determined by the ratio of resolution bandwidth to video bandwidth, which is an integer value specified by the RBW/VBW setting. To disassociate VBW from RBW, turn off Auto VBW.

VBW/Average Type: Toggles between Linear averaging (arithmetic mean) and Logarithmic averaging (geometric mean). Linear is the default setting.

RBW/VBW: This submenu key displays the ratio between resolution bandwidth and video bandwidth. This parameter is effective only when Auto VBW is on. The default value is 3. To change the ratio, press this key and use the numeric keypad, arrow keys, or the rotary knob to select a new ratio.

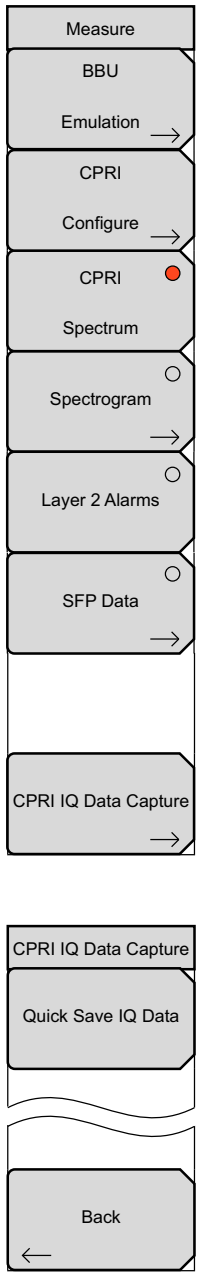
Span/RBW: This submenu key displays the ratio between the span width and RBW. This ratio is in effect only when Auto RBW is on. The default value is 100, meaning that the span width is approximately 100 times the resolution bandwidth. The value is approximate because resolution bandwidth filters come in discrete steps while span width can be set to any value up to the maximum span of the instrument. To change the ratio, press this key and use the numeric keypad, arrow keys, or the rotary knob.

Figure 2-31. Bandwidth Menu

2-15 Measure Menu

Key Sequence: **Measurements**

or: **Shift** > **Meas** (**4**)



BBU Emulation: This submenu key opens the "BBU Emulation Menu (Option 760 Only)" on page 2-31.

CPRI Configure: This submenu key opens the "CPRI Config Menu" on page 2-41.

CPRI Spectrum: Press this key to set the measurement type to Spectrum.

Spectrogram: Press this key to set the measurement type to Spectrogram and display the "Spectrogram Menu" on page 2-45.

Layer 2 Alarms: This submenu key is present only when Option 751 is installed. Press the key to display the SFP port alarm status and the Tx and Rx optical power levels. See Figure 2-33 on page 2-30 for an example of a dual port display. "Pass" status is shown as green; "Fail" is red. Colors may appear differently depending on the display settings. No color means there is no connection at the SFP port.

SFP Data: This submenu key is present only with Option 751. Press the key to open the "SFP Data Menu" on page 2-46.

CPRI IQ Data Capture: This submenu key is present only with Option 751. Press the key to access the IQ Data Capture function described below.

Quick Save IQ Data: Insert a USB storage drive into the Anritsu test instrument before pressing this key to initiate a waveform data capture. The IQ data is saved in a date and time labeled text file at the root level of the USB drive. The file name is of the form `CpriIQStreamDataYYYYMMDDHHMMSS.txt`.

The instrument will display a message if there is no USB device connected or not enough space is available.

Figure 2-32. Measure Menu

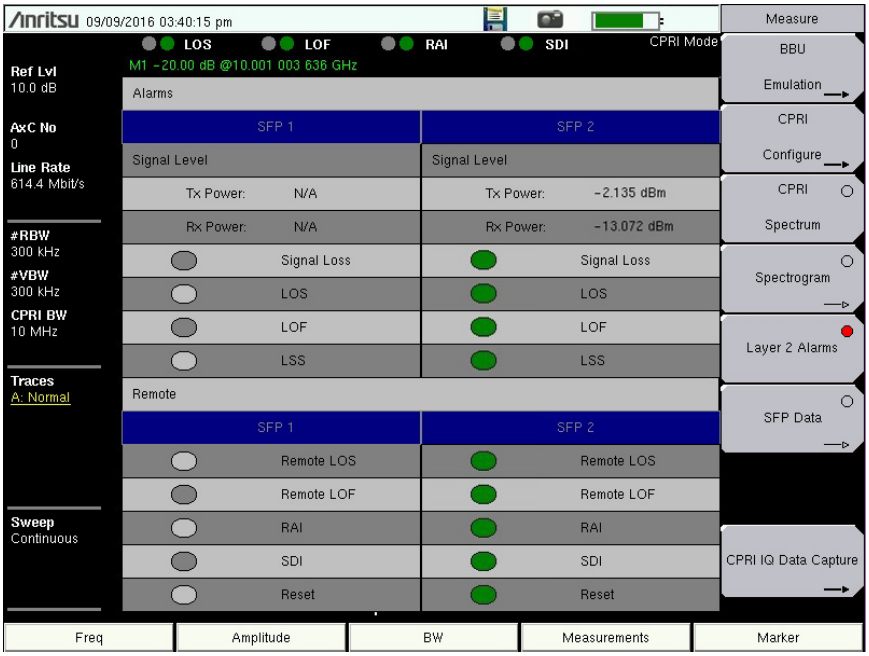
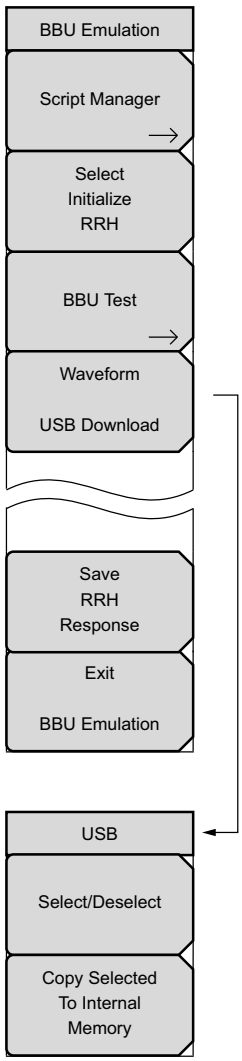


Figure 2-33. Layer 2 Alarms Screen (Dual Port Option Is Shown)

2-16 BBU Emulation Menu (Option 760 Only)

Key Sequence: **Measurements** > BBU Emulation



Script Manager: Press this key to open the "Script Manager Menu" when you want to download, view, or delete BBU scripts from internal memory.

Select Initialize RRH: Press this key to start line rate negotiation with the remote radio head. If multiple RRHs are connected, the Anritsu instrument assigns an IP address to each. It may take a few minutes before a list of RRHs with their allocated IP addresses is displayed. Select a radio from the list and press **Enter** to initialize. BBU tests can only be performed after RRH initialization. Refer to "BBU Test" on page 2-13.

BBU Test: This submenu key is active only after RRH initialization has completed. It opens the "BBU Test Menu" on page 2-34.

Waveform USB Download: Press this key when you need to copy LTE waveform patterns to the Anritsu test instrument. The source folder must be named AN_LTE_Waveforms and reside in the root directory of the USB storage drive. Waveform files must be contained in subfolders named for the bandwidths: 5MHz, 10MHz, 15MHz, and 20MHz.

An error message is displayed if no USB drive is connected or no properly named waveform directory is found. Refer to "LTE Waveform Download" on page 2-11.

After you highlight a bandwidth on the list that appears and press **Enter**, the USB submenu shown below on the left opens, and you can select and copy the desired waveforms.

Save RRH Response: Press this key to save the script response from the RRH. The data can be used for troubleshooting purposes and is saved in a text file in the folder named `usr`, in the root directory of the USB storage drive. The folder `usr` is automatically created if it does not yet exist. The file name pattern is `SavedScriptResponses_yyyy_mm_dd_hh_mm_ss.txt`. An error message is displayed if no USB device is connected.

Exit BBU Emulation: Exits BBU Emulation mode and returns to the "Measure Menu" on page 2-29.

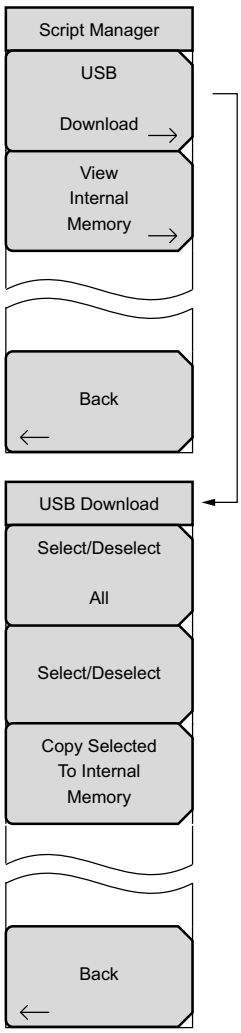
Select/Deselect: Use the arrow keys or rotary knob to scroll through the list of LTE waveforms and press this key to select (highlight) individual files. See Figure 2-11 on page 2-12. Multiple waveforms may be selected in this manner.

Copy Selected To Internal Memory: Press this key to copy the highlighted waveforms to the instrument internal memory, then return to the LTE Waveforms menu. Files with the same name will be overwritten.

Figure 2-34. BBU Emulation Menu (Option 760 Only)

2-17 Script Manager Menu

Key Sequence: **Measurements** > BBU Emulation > Script Manager



USB Download: Press this key to open the USB Download menu shown below on the left and display the list of script files found on the connected USB drive (see Figure 2-36). This key only works when a USB drive containing a valid BBU script directory (named BBUEmulationScripts) is inserted in the instrument USB port.

Note that BBU scripts are included with Option 760. Only use this key if you need to reload the scripts or download other scripts.

View Internal Memory: This submenu key opens the Internal Memory menu and displays the list of BBU scripts loaded in internal memory. From the menu, you can select and delete script files. See Figure 2-37.

Back: Returns to the "BBU Emulation Menu (Option 760 Only)".

Select/Deselect All: Press this key to select or deselect all script files contained in the BBU script directory on the USB drive. See Figure 2-36.

Select/Deselect: Use the arrow keys or rotary knob to scroll through the list of BBU scripts and press this key to select (highlight) individual files. Multiple scripts may be selected in this manner.

Copy Selected To Internal Memory: Press this key to copy the highlighted script or scripts to the instrument internal memory, then return to the Script Manager menu. Files with the same name will be overwritten.

Back: Returns to the Script Manager menu.

Figure 2-35. Script Manager Menu

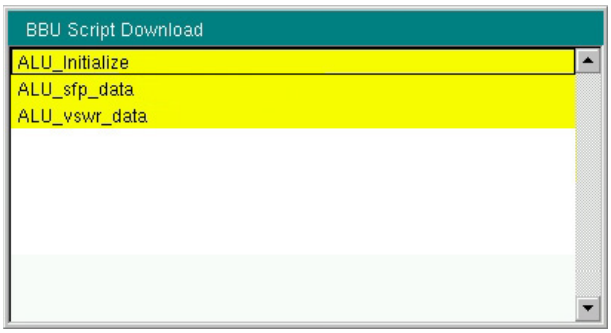
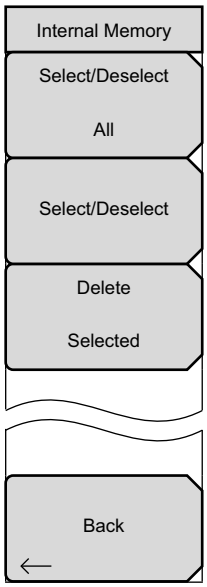


Figure 2-36. BBU Script Download List



Select/Deselect All: Press this key to select or deselect all script files currently loaded in the instrument internal memory.

Select/Deselect: Use the arrow keys or rotary knob to scroll through the list of internal scripts and press this key to select (highlight) individual files. See Figure 2-38. Multiple scripts may be selected in this manner.

Delete Selected: Press this key to delete the highlighted script or scripts from internal memory, then return to the Script Manager menu.

Back: Returns to the "Script Manager Menu" on page 2-32.

Figure 2-37. Internal Memory Menu

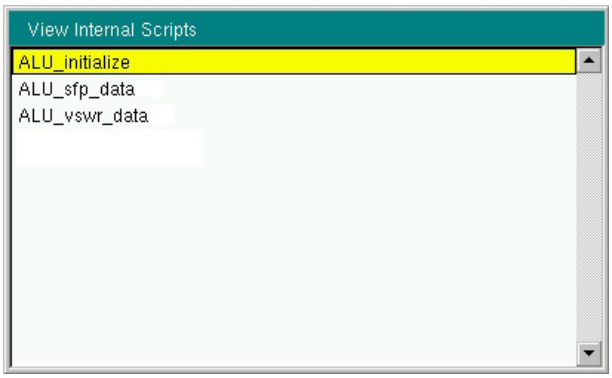
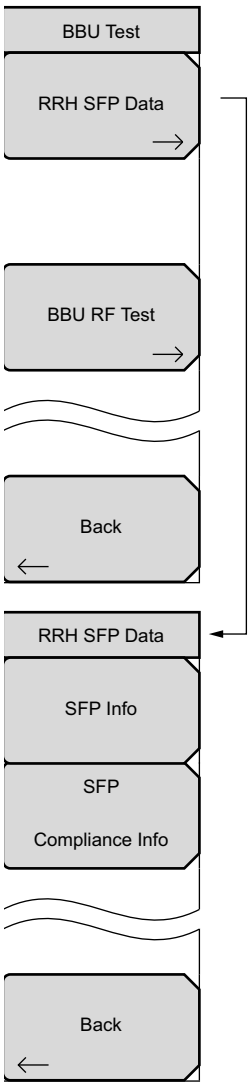


Figure 2-38. View Internal Scripts

2-18 BBU Test Menu

Key Sequence: **Measurements** > BBU Emulation > BBU Test



RRH SFP Data: Press this key to open the RRH SFP Data submenu illustrated below.

BBU RF Test: This submenu key opens the "BBU RF Test Menu" on page 2-36.

Back: Returns to the "BBU Emulation Menu (Option 760 Only)".

SFP Info: Press this submenu key to display a table that lists the signal data and vendor information at the SFP port or ports. See Figure 2-40.

SFP Compliance Info: Press this submenu key to display the transceiver compliance information for the SFP port or ports. See Figure 2-41.

Back: Returns to the BBU Test menu.

Figure 2-39. BBU Test Menu

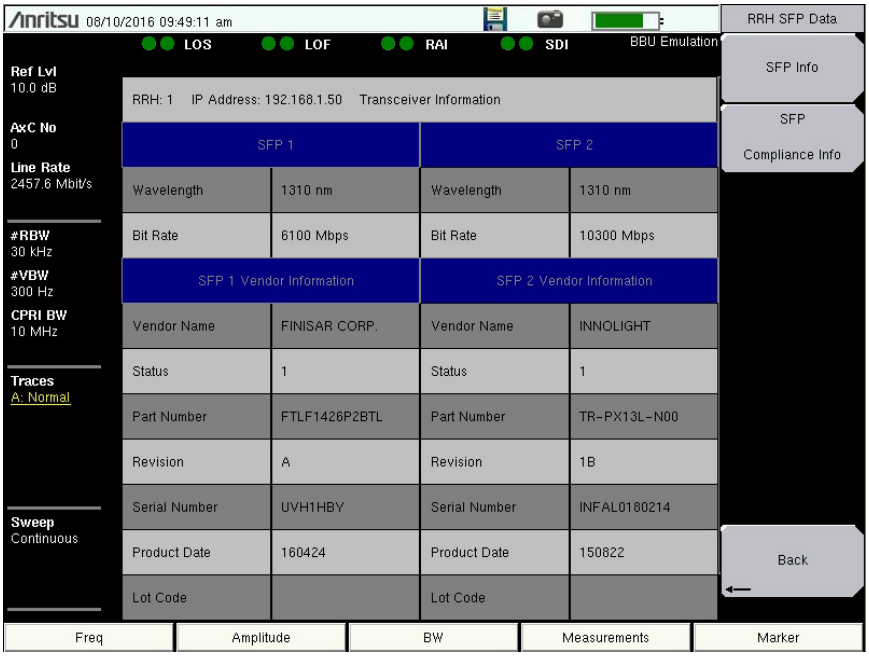


Figure 2-40. RRH SFP Info Screen

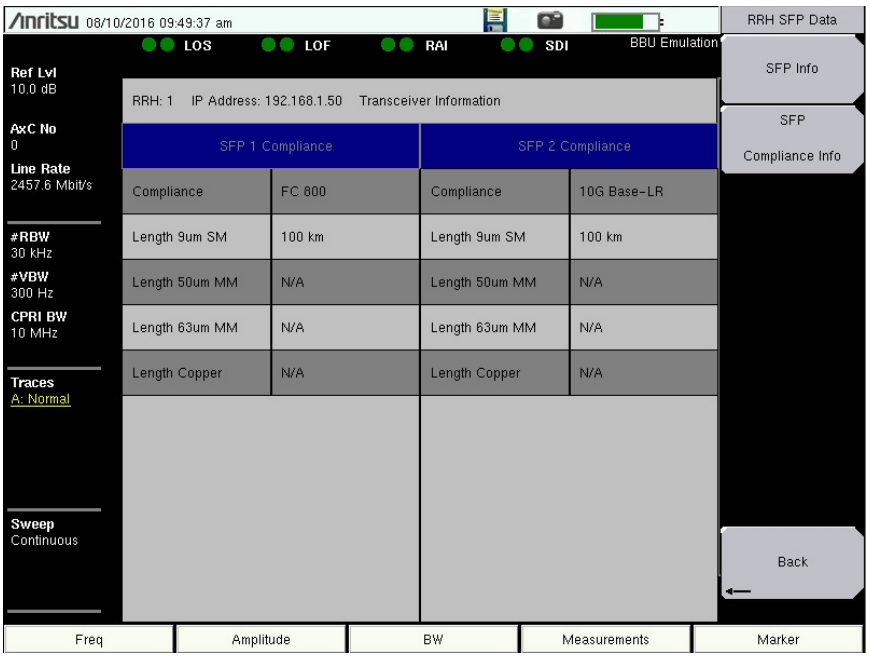
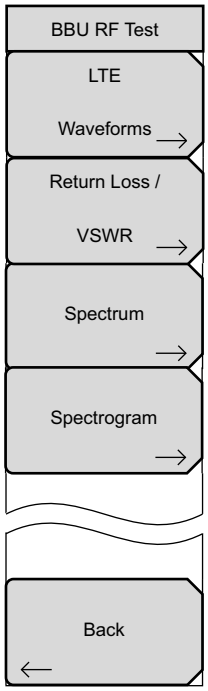


Figure 2-41. RRH SFP Compliance Info Screen

2-19 BBU RF Test Menu

Key Sequence: **Measurements** > BBU Emulation > BBU Test > BBU RF Test



LTE Waveforms: This key opens the "LTE Waveforms Menu" on page 2-37.

Return Loss/VSWR: Press this key to perform RRH-based measurements and display the results for Return Loss and VSWR. See Figure 2-49 on page 2-40. The "LTE Waveforms Menu" also opens.

Spectrum: Press this key to set the measurement type to Spectrum.

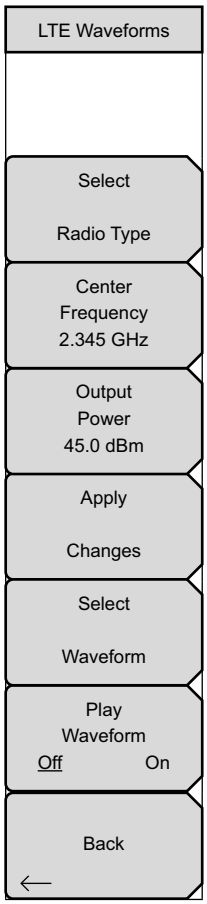
Spectrogram: Press this key to set the measurement type to Spectrogram and display the "Spectrogram Menu" on page 2-45.

Back: Returns to the "BBU Test Menu" on page 2-34.

Figure 2-42. BBU RF Test Menu

2-20 LTE Waveforms Menu

Key Sequence: **Measurements** > BBU Emulation > BBU Test > BBU RF Test > LTE Waveforms



Select Radio Type: Press this key to open the Carrier Config submenu shown in Figure 2-44 and display the list of radio types.

Center Frequency: Press this key and use the rotary knob or numeric keypad to adjust the carrier frequency of the radio. When using the keypad, press one of the Units keys (GHz, MHz, kHz, or Hz) to enter the value. The default is the center frequency of the RRH.

Output Power: Press this key and use the rotary knob or numeric keypad to change the transmit power from the RRH. When using the keypad, press the dBm Units key to enter the value. An entered value that is out of range is ignored. The default is 3 dBm below the RRH maximum output power.

Apply Changes: Press this key to update the RRH configuration with the new center frequency and power settings.

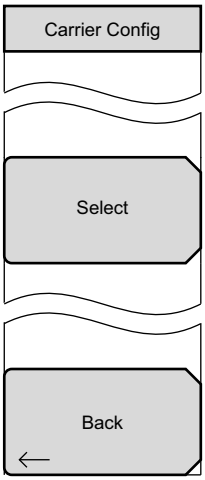
The Apply Changes key must be pressed every time frequency or output power is changed. Play Waveform is disabled until Apply Changes has occurred.

Select Waveform: Press this key to display a list of bandwidths for the waveforms loaded in the instrument internal memory (see Figure 2-10 on page 2-12). Select a bandwidth, then press **Enter** to display the Internal Memory submenu shown in Figure 2-46 and a list of LTE waveforms of the selected bandwidth. From the menu, you can select and delete waveform files. See Figure 2-47 on page 2-39.

Play Waveform
Off On: This key is active only after an LTE waveform has been selected and loaded. Press the key (On) to transmit the waveform to the RRH.

Back: Returns to the "BBU RF Test Menu" on page 2-36.

Figure 2-43. LTE Waveforms Menu



Select: Use the arrow keys or rotary knob to scroll through the list and highlight the file that matches the radio type and the bandwidth of the signal you want to transmit through the RRH, then press Select. See Figure 2-45.

Back: Press this key to cancel and return to the LTE Waveforms menu.

Figure 2-44. Carrier Config Menu

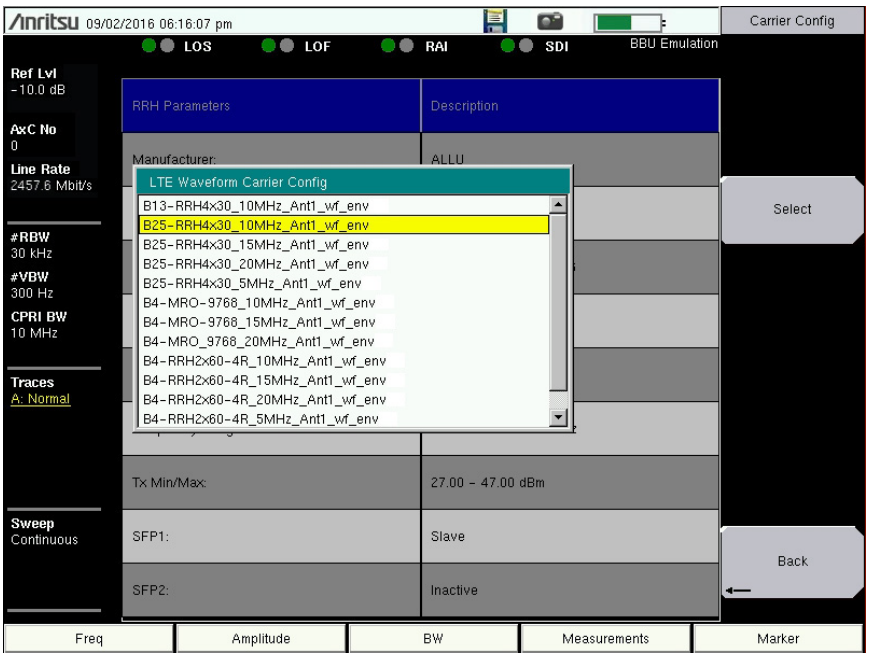


Figure 2-45. LTE Waveform Carrier Configuration

Internal Memory Select/Deselect Delete Selected	**Select/Deselect:** Use the arrow keys or rotary knob to scroll through the list of LTE waveforms and press this key to select (highlight) the desired file. See Figure 2-47. Multiple waveforms may be selected for deletion in this manner. However, only one waveform can be transmitted to the RRH at a time by pressing Select/Deselect, then **Enter**. **Delete Selected:** Press this key to delete the highlighted waveforms from the instrument internal memory, then return to the LTE Waveforms menu.

Figure 2-46. Internal Memory Menu

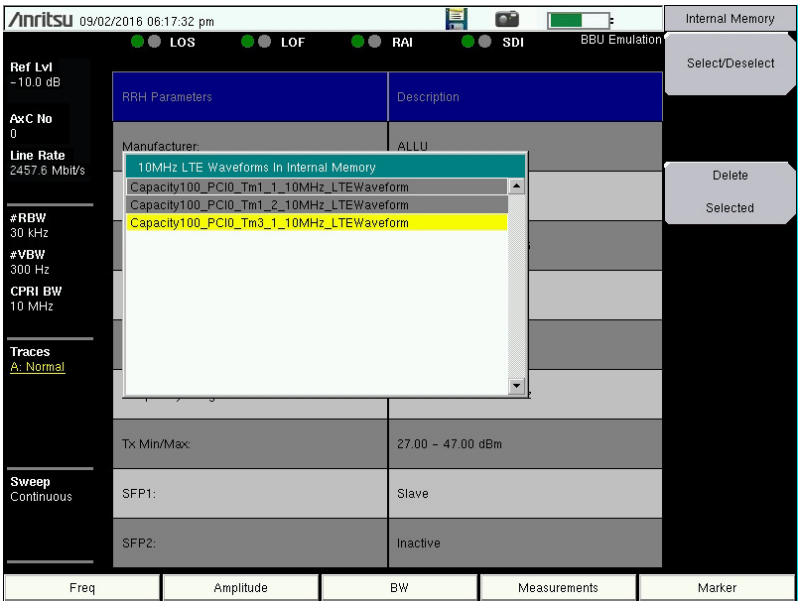
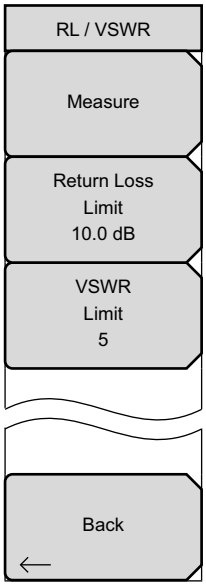


Figure 2-47. LTE Waveforms in Internal Memory

2-21 RL/VSWR Menu

Key Sequence: **Measurements** > BBU Emulation > BBU Test > BBU RF Test > Return Loss/VSWR



Measure: Press this key to perform RRH-based measurements and display the results for Return Loss and VSWR. See Figure 2-49.

Return Loss Limit: Press this key, then use the numeric keypad, the arrow keys, or the rotary knob to set the return loss limit (in dB). The test Pass/Fail status is determined by the measured return loss and the specified limit.

VSWR Limit: Press this key, then use the numeric keypad, the arrow keys, or the rotary knob to set the VSWR limit. The test Pass/Fail status is determined by the measured VSWR and the specified limit.

Back: Returns to the "BBU RF Test Menu" on page 2-36.

Figure 2-48. RL/VSWR Menu

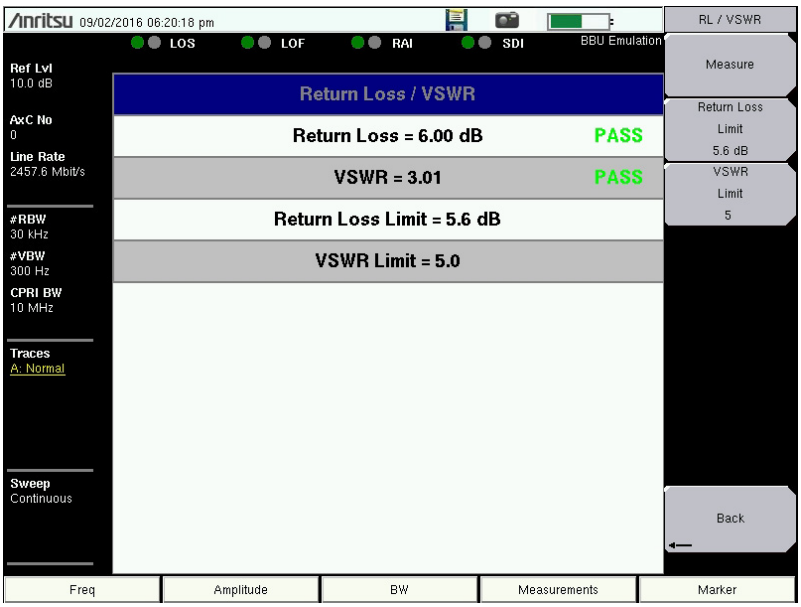
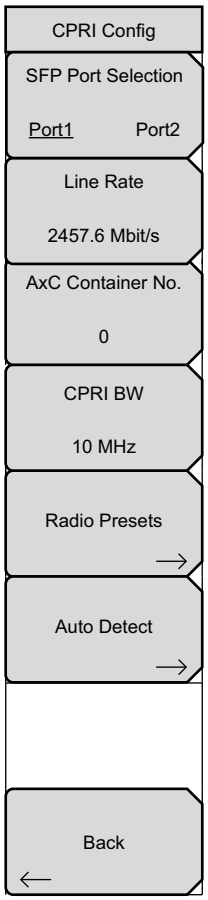


Figure 2-49. Return Loss/VSWR Measurement Results

2-22 CPRI Config Menu

Key Sequence: **Measurements** > CPRI Configure



SFP Port Selection: Press this submenu key to toggle between SFP Port 1 and Port 2, depending on which CPRI signal you wish to measure. This key is present only with dual SFP port options.

Line Rate: Press this submenu key to display the Select Line Rate list box. Use the touch screen, arrow keys, or rotary knob to highlight the CPRI link line rate, then press **Enter**. Selectable line rates are:

Line Rate 1 = 614.4 Mbit/s
Line Rate 2 = 1228.8 Mbit/s
Line Rate 3 = 2457.6 Mbit/s
Line Rate 4 = 3072.0 Mbit/s
Line Rate 5 = 4915.2 Mbit/s
Line Rate 6 = 6144.0 Mbit/s
Line Rate 7 = 9830.4 Mbit/s)

AxC Container No.: Press this submenu key, then use the rotary knob, the arrow keys, or the numeric keypad to set the AxC container number (0 through 10).

CPRI BW: This is the LTE carrier bandwidth. Press this submenu key to display the Select Bandwidth list box. Use the touch screen, arrow keys, or rotary knob to highlight the LTE carrier bandwidth, then press **Enter**. Selectable values are 5 MHz, 10 MHz, 15 MHz, and 20 MHz.

Radio Presets: Press this submenu key to display the "Radio Presets Menu" on page 2-42.

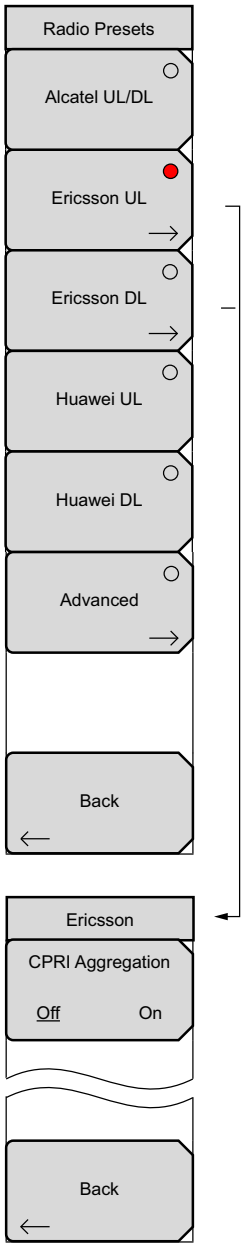
Auto Detect: Press this submenu key to display the "Auto Detect Menu" on page 2-44.

Back: Returns to the "Measure Menu" on page 2-29.

Figure 2-50. CPRI Configure Menu

2-23 Radio Presets Menu

Key Sequence: **Measurements** > CPRI Configure > Radio Presets



Press one of the vendor-specific submenu keys to select a radio preset. For custom settings, press the Advanced key.

Alcatel UL/DL: Press this key to select the radio preset for Alcatel-Lucent uplink/downlink.

Ericsson UL: Press this key to select the radio preset for Ericsson uplink (RRH to BBU). Under the Ericsson menu that opens, press the CPRI Aggregation key as needed to turn aggregation on or off.

Ericsson DL: Press this key to select the radio preset for Ericsson downlink (BBU to RRH). Under the Ericsson menu that opens, press the CPRI Aggregation key as needed to turn aggregation on or off.

Huawei UL: Press this key to select the radio preset for Huawei uplink (RRH to BBU).

Huawei DL: Press this key to select the radio preset for Huawei downlink (BBU to RRH).

Advanced: Press this submenu key to display the "Advanced Menu" on page 2-43, where you can specify custom settings for the IQ bit width and the number of reserve bits, and turn CPRI aggregation on or off. Use these settings when you do not have a specific vendor preset.

Back: Returns to the "CPRI Config Menu" on page 2-41.

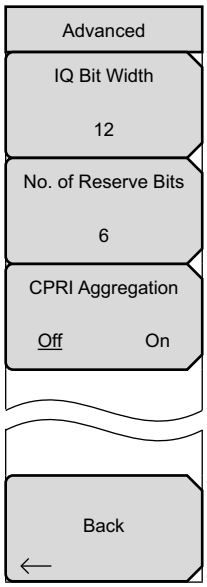
CPRI Aggregation
Off On: Press this submenu key to toggle CPRI aggregation Off or On. Refer to "CPRI Aggregation" on page 2-5.

Back: Returns to the "Radio Presets Menu".

Figure 2-51. Radio Presets Menu

2-24 Advanced Menu

Key Sequence: **Measurements** > CPRI Configure > Radio Presets > Advanced



IQ Bit Width: Press this key to display the Select IQ Width list box. Selectable values are: 10, 12, 15, and 16. Use the touch screen, arrow keys, or rotary knob to highlight the desired IQ bit width, then press **Enter**.

No. of Reserve Bits: Press this submenu key, then use the numeric keypad, the arrow keys, or the rotary knob to set the number of reserve bits (or stuffing bits). The available range of values is 0 through 10. For LTE, 0 and 6 are common reserve bit values.

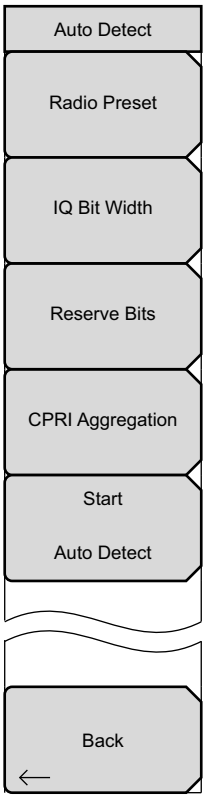
CPRI Aggregation
Off On: Press this submenu key to toggle CPRI aggregation Off or On. Refer to "CPRI Aggregation" on page 2-5.

Back: Returns to the "Radio Presets Menu" on page 2-42.

Figure 2-52. Advanced Menu

2-25 Auto Detect Menu

Key Sequence: **Measurements** > CPRI Configure > Auto Detect



Radio Preset: Press this submenu key to display the drop-down list of presets, then use the **Up/Down** arrow keys or the rotary knob or press the touch screen to make the selection.

Custom Settings
Ericsson UL
Ericsson DL
Alcatel UL
Alcatel DL
Huawei UL
Huawei DL

IQ Bit Width: Press this submenu key to display the drop-down list of selectable bit widths: 10, 12, 15, or 16. This parameter can be changed only when Custom Settings, and not a vendor-specific preset, is selected as the Radio Preset value.

Reserve Bits: Press this submenu key, then use the rotary knob or the **Up/Down** arrow keys to set the number of reserve bits, from 0 to 10. For LTE, 0 and 6 are the most common reserve bit values. This parameter can be changed only when Custom Settings is selected as the Radio Preset value.

CPRI Aggregation: Press this submenu key, then use the rotary knob or the **Up/Down** arrow keys to set the Aggregation parameter On (1) or Off (0). For a single carrier, the Aggregation value is 0. For multiple carriers, the Aggregation value is 1.

This parameter can be changed only when Custom Settings or Ericsson UL or Ericsson DL is selected as the Radio Preset value.

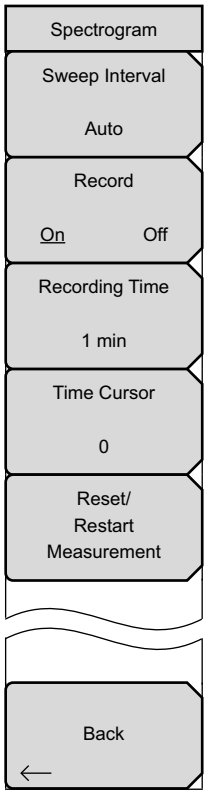
Start Auto Detect: After you have either selected a Radio Preset or entered custom settings for IQ Bit Width, Reserve Bits, and Aggregation, press this submenu key to initiate automatic detection of a matching CPRI signal. Refer to “CPRI Parameter Automatic Detection” on page 2-5.

Back: Returns to the “CPRI Config Menu” on page 2-41.

Figure 2-53. Auto Detect Menu

2-26 Spectrogram Menu

Key Sequence: **Measurements** > Spectrogram



Sweep Interval: Press this key, then use the numeric keypad, the arrow keys, or the rotary knob to set the sweep interval in min, s, ms, or µs. The Auto setting is equivalent to a zero value. The currently active trace must be set to Max Hold, Min Hold, or Average for the sweep interval to have an effect.

Record
On Off: Press this key to start (On) or cancel (Off) recording. When turning on recording, measurement data is recorded for the specified Recording Time, then saved in internal memory in a date and time labeled folder. The file name is of the form `CPRI_SPGyyyymmddhhmmss.cpri`.

The Record setting automatically turns off at the end of the timed measurement.

Recording Time: Press this submenu key to set the recording time in units of hour, min, s, ms, or µs. One minute is the minimum time setting, and it is the default setting when Record is set to on. This key is displayed only when Record is set to on.

Time Cursor: Press this submenu key, then use the numeric keypad, the arrow keys, or the rotary knob to set the time cursor value.

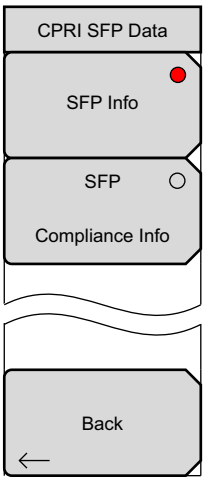
Reset/Restart Measurement: Press this submenu key to clear the display and restart the measurement.

Back: Returns to the “Measure Menu” on page 2-29 or to the “BBU RF Test Menu” on page 2-36.

Figure 2-54. Spectrogram Menu

2-27 SFP Data Menu

Key Sequence: **Measurements** > SFP Data



This submenu is present only when Option 751 is installed in your instrument.

SFP Info: Press this submenu key to display a table that lists the signal data and vendor information at the SFP port or ports. See Figure 2-56.

SFP Compliance Info: Press this submenu key to display the transceiver compliance information for the SFP port or ports. See Figure 2-57 on page 2-47.

Back: Returns to the "Measure Menu" on page 2-29.

Figure 2-55. CPRI SFP Data Menu

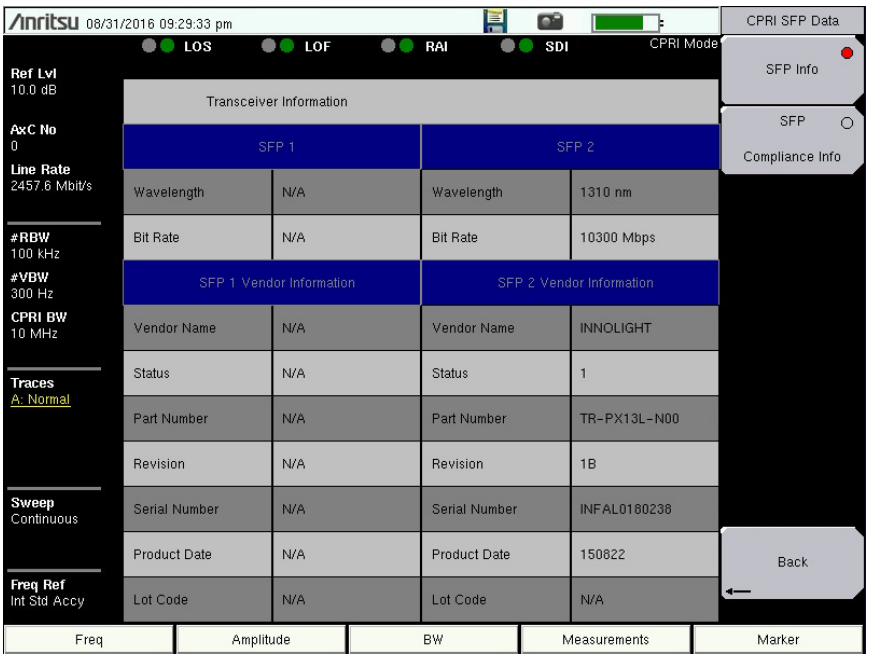


Figure 2-56. SFP Info Screen (Dual Port Option)

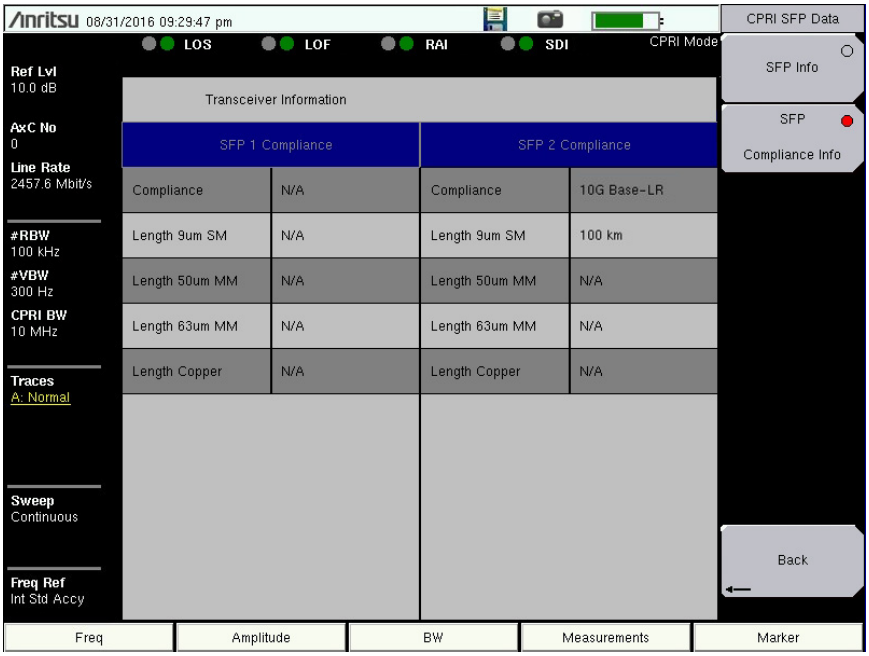


Figure 2-57. SFP Compliance Info Screen (Dual Port Option)

2-28 Marker Menu

Key Sequence: **Marker**

Press the **Marker** main menu key to open the Marker menu. The instrument is equipped with six markers. Any or all markers can be employed simultaneously.

Marker: Press to select which marker (1, 2, 3, 4, 5, 6) is active using the touch screen. The active marker is underlined.

On/Off: Turns the selected marker underlined in the Marker submenu key On or Off.

Delta On/Off: Turns on a delta marker and prompts for a delta offset frequency, either positive or negative from the frequency of the currently active marker.

Peak Search: This key places the currently active marker on the highest signal amplitude currently displayed on screen.

Marker Freq to Center: Causes the amplitude of the currently active marker to become the reference level, which is the top horizontal line of the display.

Marker to Ref Level: Causes the amplitude of the currently active marker to become the reference level, which is the top horizontal line of the display.

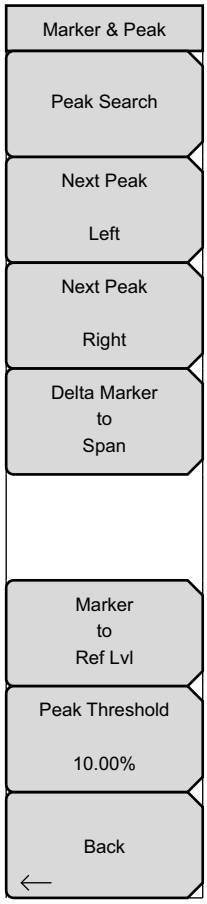
More Peak Options: Brings up a secondary menu of submenu keys for more peak searching options. See the “More Peak Options (Marker & Peak) Menu” on page 2-49.

More: Opens a submenu of additional Marker options. See the “Marker (2/2) Menu” on page 2-50.

Figure 2-58. Marker Menu

2-29 More Peak Options (Marker & Peak) Menu

Key Sequence: **Marker >** More Peak Options



Peak Search: Places the currently active marker on the highest amplitude signal currently on screen.

Next Peak Left: From the current position of the active marker, the instrument searches to the left (toward lower frequencies) for a peak signal that rises at least a certain amount above the average noise level. If no such peak is found, the marker is placed at the left end of the trace. The Peak Threshold key allows the user to specify the performance of peak searching.

Next Peak Right: From the current position of the active marker, the instrument searches to the right (toward higher frequencies) for a peak signal that rises at least a certain amount above the average noise level. If no such peak is found, the marker is placed at the right end of the trace. The Peak Threshold submenu key allows the user to specify the performance of peak searching.

Delta Marker to Span: Sets the total span width to the value of the delta marker. If the delta marker is zero, the span is set to zero span. If the delta marker value is set to less than 10 Hz, the span will be set to 10 Hz. If no delta marker is turned on, no change is made.

Marker to Ref Lvl: Sets the reference level (top graticule line) to the amplitude of the currently active marker.

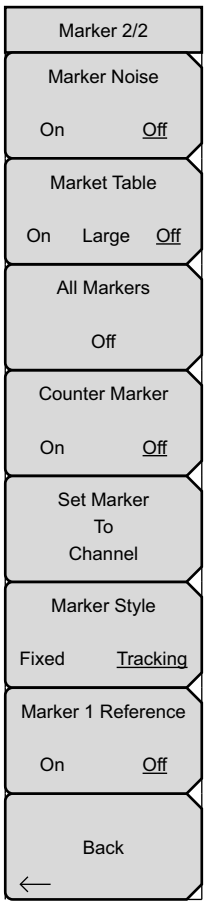
Peak Threshold: Allows the user to specify how far above the average noise floor a signal must rise before it is considered a peak.

Back: Returns to the “Marker Menu” on page 2-48.

Figure 2-59. Marker & Peak Menu

2-30 Marker (2/2) Menu

Key Sequence: **Marker >** More



Marker Noise On/Off: Turns the markers into noise markers with units of dBm/Hz. When this option is selected, the detection method is automatically changed to RMS and the displayed value is compensated for the noise bandwidth of resolution bandwidth filter.

Marker Table On/Large/Off: Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered for them. If Large is selected, a large screen display opens underneath the graph that displays both frequency and amplitude for the active marker in large type.

All Markers Off: Turns off all markers.

Counter Marker On/Off: Sets the frequency counter mode for the active marker. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. Using Counter Marker in association with Marker to Peak will result in the exact frequency of the peak to a resolution of 0.001 Hz.

Set Marker To Channel: If a signal standard has been selected, pressing this key brings up a dialog box to select a channel. Select a channel number for the current signal standard, and the active marker will be set to the center frequency of the channel.

If no signal standard has been selected, a message “No standard selected. Press Enter or Escape to Continue.” is displayed. Press either button to leave the settings as they were before the key was pressed.

Marker Style: This key changes the behavior of the reference markers. If Fixed is selected, reference markers stay at the amplitude they were at when the associated delta marker was turned on. If Tracking is selected, the amplitude of the reference marker changes as the signal amplitude is changed. Note that the reference marker tracks the amplitude, not the frequency of a signal.

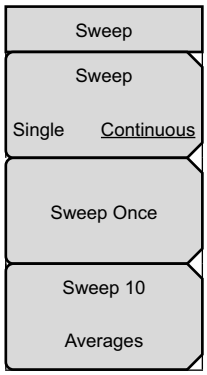
Marker 1 Reference: Selects whether Marker 1 is the reference for all six delta markers, or whether each of the six reference markers has an associated delta marker.

Back: Returns to the “Marker Menu” on page 2-48.

Figure 2-60. Marker (2/2) Menu

2-31 Sweep Menu

Key Sequence: **Shift** > **Sweep** (**3**)



Sweep Single/Continuous: This submenu key toggles between continuous sweep and single sweep. In single sweep mode, the results of a sweep are displayed on the screen while the instrument awaits a trigger event to start a new sweep.

Sweep Once: When Sweep is set to Single, Sweep Once triggers a single measurement sweep. This key has no function when the instrument is in continuous sweep mode.

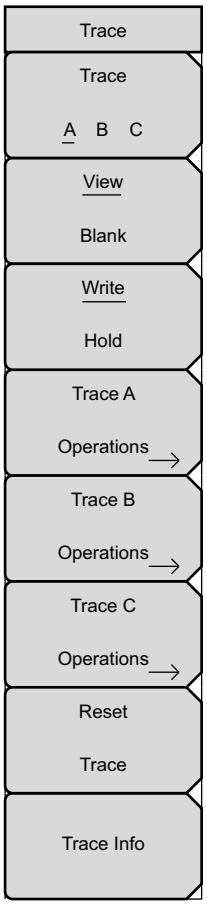
Sweep # Averages: Sweeps the number of times set using the # of Averages button under the Trace A Ops menu. Trace A must be set to Averaging (**Shift** > **Trace** (**5**) key > Trace A Operations > Average->A) for this menu to function. Each trace is displayed using the exponential average of each sweep.

Figure 2-61. Sweep Menu

2-32 Trace Menu

Key Sequence: **Shift** > **Trace** (**5**)

The instrument is capable of displaying up to three traces, one with live data, and the other two either with stored data or trace math data.



Trace
A B C: Sets trace A, B, or C as the active trace. Each press of this key increments through trace A, B, and C. The active trace is underlined.

View/Blank: Displays or hides the active trace.

Write/Hold: Selects between holding the current swept trace on the screen or continually sweeping and updating the displayed measurement. This is not applicable to Trace B or Trace C unless trace math involving Trace A is active.

Trace A Operations: Lists the Trace A Ops menu to select an operation that can be applied to Trace A. See “Trace A Ops Menu” on page 2-54.

Trace B Operations: Lists the Trace B Ops menu to select an operation that can be applied to Trace B. See “Trace B Ops Menu” on page 2-55.

Trace C Operations: Lists the Trace C Ops menu to select an operation that can be applied to Trace C. See “Trace C Ops Menu” on page 2-56.

Reset Trace: Resets the trace averaging, Max Hold or Min Hold, and restarts the sweep.

Trace Info: Stops the current trace and displays a summary table of trace parameters and current settings. See Figure 2-63 on page 2-53. Press **Enter** or **Esc** to clear the table from the display and restart the trace.

> **Display:** Press the appropriate key to display trace information for Trace A Only, Trace B Only, Trace C Only, or All Traces.
>
> **Top of List:** Press this submenu key to jump to the top of the Trace Info table.
>
> **Page Up:** Press this key to skip up through the table.
>
> **Page Down:** Press this key to skip down through the table.
>
> **Bottom of List:** Press this submenu key to jump to the bottom of the table.

Figure 2-62. Trace Menu

Trace Info Message Box

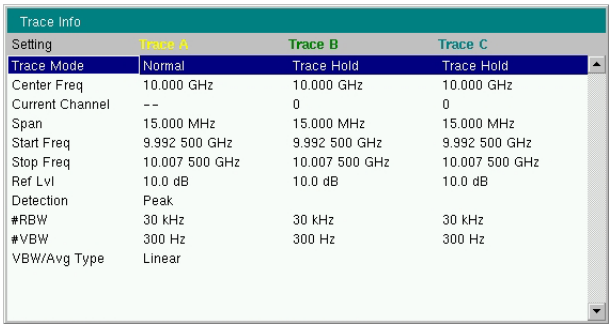
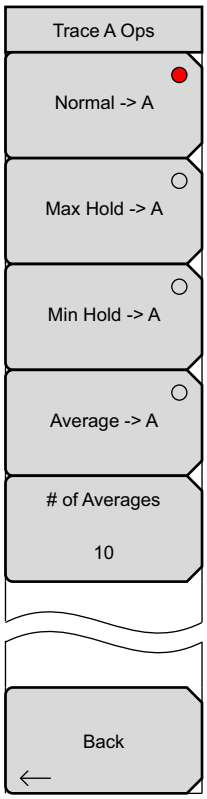


Figure 2-63. Trace Info Message Box

2-33 Trace A Ops Menu

Key Sequence: **Shift** > **Trace** (**5**) > Trace A Operations



Normal -> A: Displays data for the current trace sweep.

Max Hold -> A: Shows the cumulative maximum value of each display point over many trace sweeps.

Min Hold -> A: Shows the cumulative minimum value of each display point over many trace sweeps.

Average -> A: Shows an exponential average of a number of traces, determined by the # of Averages key.

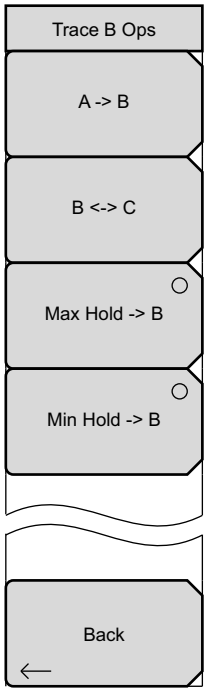
# of Averages: Sets the number of traces for use in calculating the average display value. The number used for averaging ranges from 1 to 65535.

Back: Returns to the “Trace Menu” on page 2-52.

Figure 2-64. Trace A Ops Menu

2-34 Trace B Ops Menu

Key Sequence: **Shift** > **Trace** (**5**) > Trace B Operations



A -> B: Copies the contents of Trace A into Trace B. Doing so overwrites the previous contents of Trace B.

B <--> C: Swaps the contents of Traces B and C.

Max Hold -> B: Shows the cumulative maximum value of each display point over many trace sweeps.

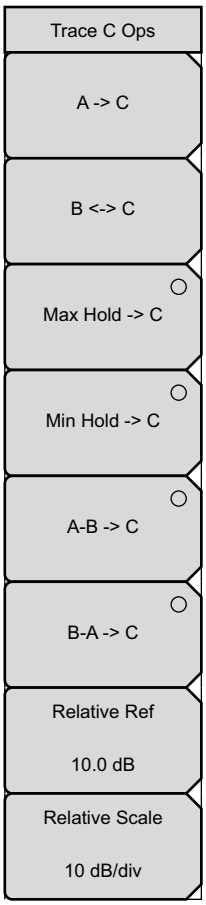
Min Hold -> B: Shows the cumulative minimum value of each display point over many trace sweeps.

Back: Returns to the "Trace Menu" on page 2-52.

Figure 2-65. Trace B Ops Menu

2-35 Trace C Ops Menu

Key Sequence: **Shift** > **Trace** (**5**) > Trace C Operations



A -> C: Copies the contents of Trace A into Trace C. Doing so overwrites the previous contents of Trace C.

B <--> C: Swaps the contents of Trace B and Trace C.

Max Hold -> C: Shows the cumulative maximum value of each display point over many trace sweeps.

Min Hold -> C: Shows the cumulative minimum value of each display point over many trace sweeps.

A - B -> C: Subtracts the value of Trace B from Trace A and places the results in Trace C. This function is very useful for observing the changes in values of live Trace A compared to a trace stored in Trace B.

When trace math is active, a relative scale shows on the right side of the graph, and is associated to Trace C. This allows the user to optimize the display of Trace C without affecting the display of Trace A and Trace B.

B - A -> C: Subtracts the value of Trace A from Trace B and places the results in Trace C. This function is very useful for observing the changes in values of live Trace A compared to a trace stored in Trace B. When trace math is active, a relative scale shows on the right side of the graph, and is associated to Trace C. This allows the user to optimize the display of Trace C without affecting the display of Trace A and Trace B.

Relative Ref: Sets the value applied to the top graticule for the relative scale that appears on the right side of the graph when trace math is active. Change this value by using the rotary knob, up or down arrows, or entering the value on the numeric keypad and pressing the dB submenu key or the **Enter** key. This entry is valid only when trace math is active

Relative Scale: Sets the value applied to the scaling of the relative scale that appears on the right side of the graph when trace math is active. Change this value by using the rotary knob, up or down arrows, or entering the value on the numeric keypad and pressing the dB submenu key or the **Enter** key. This entry is valid only when trace math is active.

Back: Returns to the “Trace Menu” on page 2-52.

Figure 2-66. Trace C Ops Menu

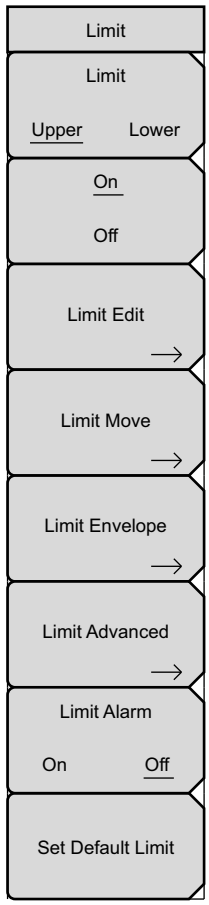
2-36 Limit Menu

Key Sequence: **Shift** > **Limit** (**6**)

The **Limit** menu keys are shown in the following figures.

Two types of limit lines can be specified, lower limit lines and upper limit lines. Limit lines can be used for visual reference only, or for pass/fail criteria by using the limit alarm (Figure 2-67). Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line. By using save-on-event, a signal that exceeds the limit alarm can be automatically saved. For details, see the User Guide for your instrument.

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 Upper/Lower: This submenu key selects which limit line will be active for editing. The limit line that is currently selected for editing is underlined.

On/Off: This submenu key turns the active limit (upper or lower) on or off.

Limit Edit: This submenu key displays the "Edit Menu (Limit)" on page 2-58 that allows creating or editing of single or multi-segment limit lines. The currently active limit point is marked by a red circle on the display.

Limit Move: Press this submenu key to display the "Limit Move Menu" on page 2-60.

Limit Envelope: A limit envelope is very useful when you want to easily detect new signals in the presence of other preexisting signals. Use the limit envelope function to automatically create upper or lower limit lines that are based upon the on-screen measured spectrum analysis values. Refer to Figure 2-72 for an example limit envelope. Press this submenu key to open the "Limit Envelope Menu" on page 2-61.

Limit Advanced: Press this submenu key to open the Limit Advanced submenu key menu. The advanced limit line section offers several useful functions. In this section, you can create either an absolute limit line (which is one based upon the frequencies that are entered for each inflection point) or a relative limit line (which is based upon the delta frequencies between the center frequency and the inflection points). Both types of limit lines can be saved and recalled. Press this submenu key to open the "Limit Advanced Menu" on page 2-63.

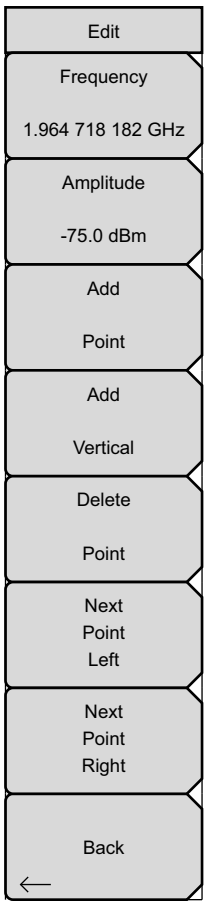
Limit Alarm On/Off: Pressing this submenu key toggles the alarm function ON and OFF for the currently active limit line. When ON, an alarm beep will occur when a data point exceeds the limit.

Set Default Limit: Pressing this submenu key 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.

Figure 2-67. SPA Limit Menu

2-37 Edit Menu (Limit)

Key Sequence: **Shift** > **Limit** (**6**) > Limit Edit



Frequency: Press this submenu key to set the frequency of a limit line inflection point. The frequency of each inflection point in a limit line can be individually set. When a new point is added, it takes on a value halfway between two existing points, or it takes on the stop frequency of the current sweep if no point is higher in frequency than the one being added. See the Add Point submenu key description for more details. Use the keypad, the left or right arrow keys, or the rotary knob to change the frequency of an inflection point. The left or right arrows move the inflection point by 5% of the span.

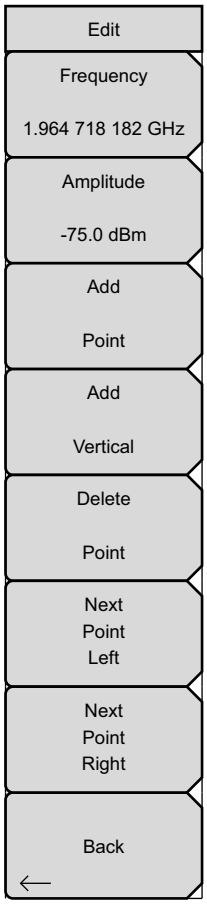
Amplitude: Press this submenu key to set the amplitude of a limit line inflection point. The amplitude of each inflection point can also be individually set. By default, when a new point is added, it takes on the amplitude that is on the limit line at the frequency where the point was added. Use the keypad (using the **+/–** key to set a negative value), the up or down arrow keys, or the rotary knob to move the point to the desired value. The unit of the amplitude limit is the same as the current vertical amplitude unit. See the Add Point submenu key description for details. The up or down arrows move the amplitude by 5% of the screen height.

Add Point: Press this submenu key to add a limit line inflection point. The precise behavior of this submenu key depends upon which inflection point is active at the time the key is pressed. If the active limit point is somewhere in the middle of a multi-segment limit line, a new limit point is added that is halfway between the currently active point and the point immediately to its right. The amplitude of the inflection point will be such that it falls on the limit line. For example, if a limit point exists at 2.0 GHz with an amplitude of –30 dBm, and if the next point is 3.0 GHz with an amplitude of –50 dBm, then the added point will be at 2.5 GHz with an amplitude of –40 dBm. The frequency and amplitude values of the new point can be adjusted as needed with the Frequency and Amplitude submenu keys.

If the last limit point is active (assuming it is not at the right edge of the display), 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.

Figure 2-68. Limit Edit Menu (1 of 2)

Edit Menu (Continued)



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

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

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

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

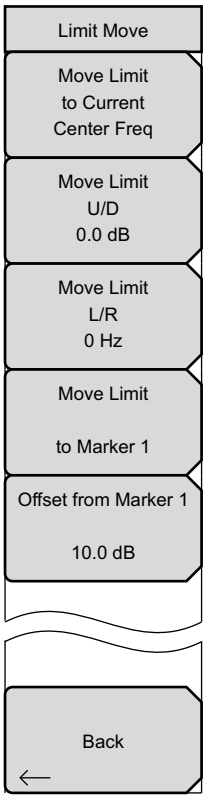
Next Point Right: Press this submenu key to select the limit point immediately to the right of the active point, making this newly selected point active for editing or deletion. With each key press, the active point becomes that point to the right of the previously active point, until the newly selected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

Back: Press this submenu key to return to the “Limit Menu” on page 2-57.

Figure 2-69. Limit Edit Menu (2 of 2)

2-38 Limit Move Menu

Key Sequence: **Shift** > **Limit** (**6**) > Limit Move



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

Move Limit U/D: If the limit line is flat, use this submenu key to move the limit line to an absolute power point in dBm. If the limit line is not flat, use this submenu key to move the limit line up or down by the selected number of dB. Use the keypad to enter the desired value. The entire line moves by the amount that is entered. The limit line can also be moved by using the rotary knob. Turn the rotary knob clockwise to move the line to higher power levels. The up or down arrows move the limit line by 5% of the screen height. The left or right arrows move the limit line by 0.2% of the screen height or 0.2 dB when the scale is set to 10 dB/division. The submenu key displays a zero value after the limit line has been moved.

Move Limit L/R: Pressing this submenu key allows you to adjust the frequencies of the limit line. All inflection points are moved by the value entered. The rotary knob can also be used to make this adjustment. Turn the rotary knob clockwise to move the limit line to higher frequencies. The left or right arrows move the limit line by 5% of the span while the up or down arrows move the line by one display pixel. The submenu key displays a zero value after the limit line has been moved.

Move Limit to Marker 1: Press this submenu key to move the frequency and amplitude of the center frequency of the limit line to the frequency and amplitude of Marker 1 (assuming that the Offset from Marker 1 submenu key is set to 0 dB).

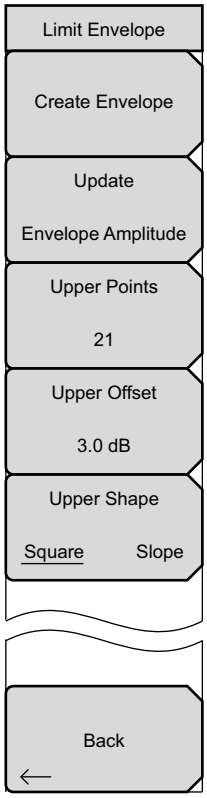
Offset from Marker 1: Press this submenu key to set a limit line offset value from Marker 1 amplitude. This feature moves the limit line amplitude and frequency as needed to place the center of the limit line the user-specified number of dB from the position of Marker 1. Positive values place the limit line above Marker 1, and negative values place the limit line below Marker 1.

Back: Press this submenu key to return to the “Limit Menu” on page 2-57.

Figure 2-70. Limit Move Menu

2-39 Limit Envelope Menu

Key Sequence: **Shift** > **Limit** (**6**) > Limit Envelope



Create Envelope: Press this submenu key to generate the envelope using the Limit Envelope 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.

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

Upper Points (if Upper Limit is selected)
Lower Points (if Lower Limit is selected)**:** Use this submenu key to define how many inflection points you want for the selected upper or lower limit envelopes. The value can be between 2 and 41. Note that the upper and lower limit lines do not need to have the same number of points.

Upper Offset (if Limit is toggled to Upper)
Lower Offset (if Limit is toggled to Lower)**:** This submenu key is used to define how far away from the measured signal the upper or lower envelope will be placed. The limits are ± 100 dB. For an upper envelope, usually the value will be positive in order to place the envelope above the signal. For a lower envelope, the value will usually be negative in order to place the envelope below the signal.

Upper Shape Square/Slope (if Limit is toggled to Upper)
Lower Shape Square/Slope (if Limit is toggled to Lower)**:** Press this submenu key to choose whether the default for the upper or lower envelope will be with flat tops (Square setting) and reasonably vertical lines to change level or whether the envelope will have sloped lines (Slope setting) between adjacent inflection points. When the square envelope type is selected, two inflection points are used for each horizontal segment. You can toggle between a square envelope and a sloped envelope by pressing this submenu key. Figure 2-72 is an example of a Square Limit Envelope.

Back: Press this submenu key to return to the “Limit Menu” on page 2-57.

Figure 2-71. Limit Envelope Menu

Square Limit Envelope Example

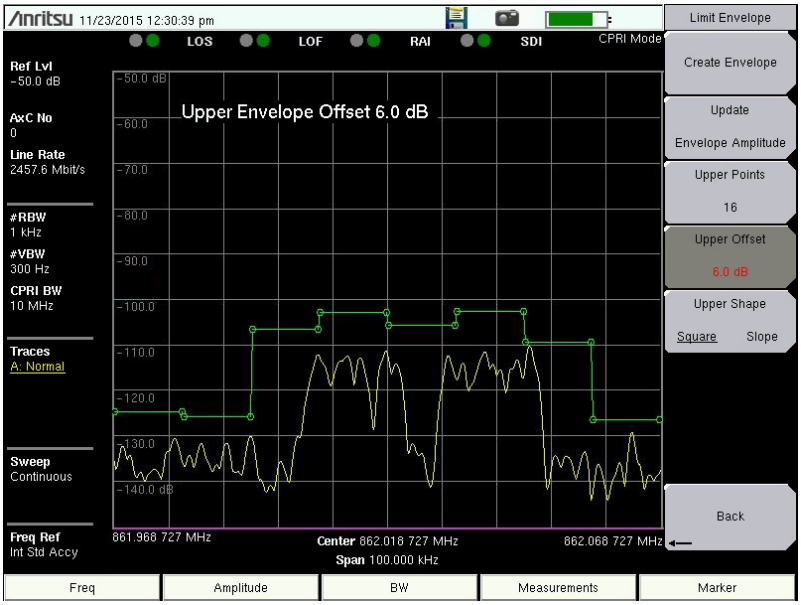


Figure 2-72. Square Limit Envelope

Sloped Limit Envelope Example

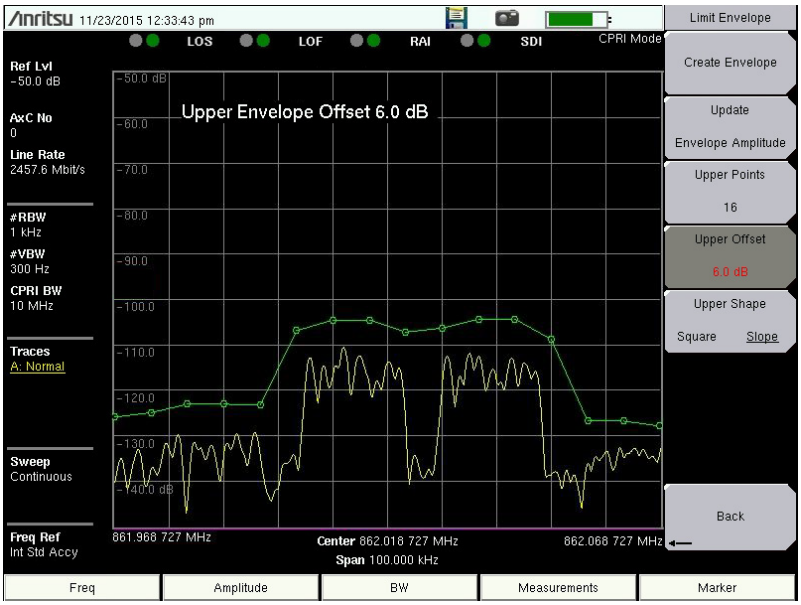
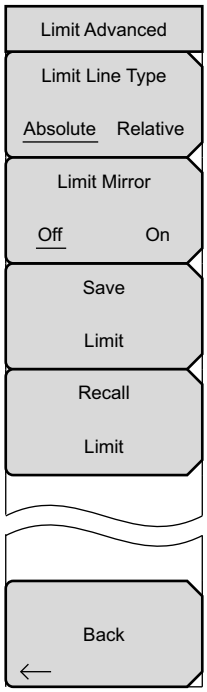


Figure 2-73. Sloped Limit Envelope

2-40 Limit Advanced Menu

Key Sequence: **Shift** > **Limit** (**6**) > Limit Advanced



Limit Line Type Absolute/Relative: Press this submenu key to choose to have either limit line be absolute or be relative. This submenu key 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 toggling with this submenu key.

Limit Mirror Off/On: Press this submenu key to turn the Limit Mirror feature On and Off.

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

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

Leave Limit Mirror off until half of the limit line is built, then turn on Limit Mirror. The other half of the limit line is built automatically.

Save Limit: Pressing this submenu key opens a dialog to save the current upper and lower limit lines. You can enter a name for the saved limit line or apply the name suggested by the instrument (which is based on a previously saved name). Press **Esc** to cancel the save operation.

Recall Limit: Pressing this submenu key opens a dialog box to recall a saved limit line. The dialog box presents a list of saved limit lines. Highlight the desired limit line and press **Enter**. Press **Esc** to cancel.

If the saved limit is a relative limit, it will be centered about the current center frequency. If the saved limit is an absolute limit, it will be recalled to the frequency at which it was created.

If you recall an absolute limit and it is off screen, you will see the left or right limit off-screen indicator on the edge of the screen.

Back: Press this submenu key to return to the “Limit Menu” on page 2-57.

Figure 2-74. Limit Advanced Menu

Index

O

R

S

T

W

Anritsu

10580-00415

D

Anritsu utilizes recycled paper and environmentally conscious inks and toner.

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