User Guide

S820E Microwave Site Master™

Cable and Antenna Analyzer
Featuring Classic and Advanced Modes

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Chapter 1 — General Information

1-1 Introduction

This chapter provides a general overview and information about frequency range, additional documents, preventive maintenance, and annual verification requirements for the Anritsu Handheld Site Master S820E.

Additional Documents

The following documents provide additional information about the Site Master S820E Cable and Antenna Analyzer.

- Handheld Instruments Product Information, Compliance, and Safety Guide (10100-00065). Provides important safety, legal, and regulatory notices. Read this guide *before* operating the equipment.
- Site Master S820E Technical Data Sheet (11410-00650). Includes general specifications, detailed measurement specifications for all available measurement modes, ordering information, and a list of available accessories.
- Site Master S820E Programming Manual (10580-00344). Includes an overview of the compatible SCPI commands used to remotely access the Site Master S820E.
- Site Master S820E Product Brochure (11410-00726). Includes an overview of the of the Site Master S820E instrument, ordering information, and accessories information.
- Site Master S820E Maintenance Manual (10580-00345). Includes general information on the instrument, test equipment required, a replaceable parts list, and verification procedures including frequency accuracy, return loss, and dynamic range.

These documents along with additional application notes and white papers covering cable and antenna analysis are available from the Anritsu website via the Site Master S820E product page:

http://www.anritsu.com/en-us/test-measurement/products/s820e

Document Conventions

Main menus and keypad buttons are shown in the user guide using a **Sans Serif Bold** typeface. Main menus are the six buttons that are displayed at the bottom of the touchscreen. Submenus and submenu buttons are displayed on the right side of the touchscreen display and are shown in the user guide using Sans Serif Regular typeface.

Menu and button locations may be described in this document by their path:

Measurement > VSWR

The line above reads as "Press the Measurement main menu button, then press the VSWR submenu button."

Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

Contacting Anritsu for Sales and Service

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

From there, you can select the latest sales, select service and support contact information in your country or region, 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.

Example URL for Site Master S820E: http://www.anritsu.com/en-us/test-measurement/products/s820e

1-2 Instrument Description

The Microwave Site Master S820E is a handheld cable and antenna analyzer designed to make measurements in the field on both coaxial cable and waveguide transmission lines. Cable and antenna analyzer measurements include 1-port Return Loss, Cable Loss, VSWR, Distance-To-Fault (DTF), Transmission, Smith Chart, and phase measurements. The S820E also performs 2-port transmission and cable loss measurements (using an external sensor for applications in which the ends of the device are physically separated by a distance longer than is reachable with normal test port cables, such as aircraft communication cables embedded within the body of the aircraft). VNA mode measurements include S-Parameter measurements S_{11}, S_{21}, S_{12}, S_{22}. In addition to the cable and antenna measurements and VNA mode measurements, the instrument includes a high accuracy power meter mode utilizing Anritsu external USB sensors (sold separately).

The bright, high-resolution, 800 x 600 pixel 8.4 inch color display provides easy viewing in a variety of lighting conditions. The combination of a resistive touchscreen plus keypad enables you to navigate menus with the touchscreen and to enter text or numbers directly. A user-editable EZ Name Matrix allows you to configure complex sweep names quickly, saving hours of valuable time daily. The Site Master is equipped with factory installed Li-Ion batteries typically delivering more than 4 hours of battery life when fully charged.

The internal memory is large enough to store more than 2,000 files. Files can be any combination of measurement files, setup files, or screen shots. Files can also be saved or copied to a connected USB flash drive. Measurements can be transferred to a PC using the supplied USB cable or with a USB flash drive.

The use of folders (with no more than 300 files per folder) is advisable when storing a large number of files within the Site Master internal memory. When navigating through folders with larger numbers of files, the sorting process can take noticeably longer and can delay the display of those files.

Included with the S820E is Line Sweep Tools (LST), a PC-based software program than can be used to create reports, view and organize data, analyze historical data, edit markers and limit lines, rename traces, and trace analysis. Refer to Chapter 13 for a brief overview of Line Sweep Tools.

Anritsu easyTest Tools provides a library of commands and a drag-and-drop interface for creating test sequences. The Windows XP, Windows Vista, and Windows 7 compatible software is available on the Anritsu website.

- A developer creates an easyTest test sequence (`.ett`) file on a PC. The file is copied to the S820E using a USB flash drive.
- When the file is run using the easyTest icon on the Menu Shortcut screen, the S820E displays instructions one step at a time to the operator, simplifying the process of operating the instrument and completing assigned tasks.

easyTest Tools Help (which includes a Quick Start Topic), full use instructions, and sample `.ett` files are included with the software. After installing easyTest Tools on a PC, start the application and choose Help for additional information.

Refer to Chapter 13 for a brief overview of easyTest Tools.

Available Options

The Microwave Site Master S820E Technical Data Sheet (part number 11410-00650) contains a list and a description of available options, including standard or premium calibrations and extended warranties.

The Technical Data Sheet is available on the Anritsu website: http://www.anritsu.com

Table 1-1. Microwave Site Master S820E Frequency Options

Model Option	Frequency Range	RF Ports
S820E-0708	1 MHz to 8 GHz	Type N(f)
S820E-0714	1 MHz to 14 GHz	Type N(f)
S820E-0720	1 MHz to 20 GHz	Ruggedized K(m)
S820E-0730	1 MHz to 30 GHz	Ruggedized K(m)
S820E-0740	1 MHz to 40 GHz	Ruggedized K(m)

Other Options

Option S820E-440 adds VNA Mode to the Microwave Site Master. For additional option configuration information, refer to “Option Configuration” on page 11-15.

Battery Information

The battery that is supplied with the Site Master may need charging before use. It can be charged using either the AC-DC Adapter or the DC adapter. Refer to “Status Tool Bar” on page 2-20 for a description of battery symbols. The batteries are typically charged in the instrument.

Note	Use only Anritsu Company approved batteries, adapters, and chargers with this instrument. The batteries will charge at a faster rate when the instrument is turned off or is set to standby mode. Charging the batteries while the instrument is running requires a longer time to reach a full charge. To prolong the useful battery life, the internal charging circuit monitors battery temperature. Normal charging occurs when the battery temperature is between 0 °C and 45 °C. Charging is paused if the internal battery temperature is beyond this range.

Caution	When using the Automotive power outlet adapter, always verify that the supply is rated for a minimum of 60 Watts at 12 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

Refer to Chapter 12, “Battery Replacement” for additional information on replacing the batteries.

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

1-3 Instrument Care and Preventive Maintenance

Site Master preventive maintenance consists of cleaning the instrument and inspecting and cleaning the RF connectors on the instrument and all accessories. Clean the Site Master with a soft, lint-free cloth dampened with water or water plus a mild cleaning solution.

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

Clean the RF connectors with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. If you are unsure whether the connectors are undamaged, then gauge the connectors to confirm that the dimensions are correct.

Carefully inspect the test port cable. The cable should be uniform in appearance, and not stretched, kinked, dented, or broken. A defective test port cable is the most common cause of unreliable or erratic measurements. Extra care should be exercised to ensure that the test port cable remains in good condition.

ESD Caution

The Site Master, like other high performance instruments, is susceptible to electrostatic discharge (ESD) damage. Coaxial cables and antennas may build up a significant static charge, which may damage the Site Master. To prevent ESD damage, you are advised to connect a short to either end of the cable before connecting the cable to the Site Master. If no short is available, then a termination (load) may be used. Site Master operators must always be aware of the potential for ESD damage and take all necessary precautions. Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686; which pertain to ESD and ESDS devices, equipment, and practices. Remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

RF Input Warning

The Anritsu Site Master is a sensitive measuring instrument designed to measure low power levels. Avoid damaging this sensitive circuitry by observing the maximum input levels printed on the instrument connector labeling and specified in the product technical data sheet.

Typical maximum input is +23 dBm (±50 VDC). The maximum RF input could be less if additional features, such as a preamplifier, are in use. Review the product technical data sheet or Anritsu website for recommended components and accessories that can help you protect your instrument. These include a variety of adapters, attenuators, filters, and RF detection accessories.

1-4 Calibration and Annual Verification

The Cable and Antenna Analyzer requires user-performed calibration before making measurements. Calibration can be quickly and easily performed using several calibration options. Calibration components are sold separately. Refer to Chapter 4, “Calibration, CAA” for additional information.

Note	Anritsu recommends allowing the S820E to warm up for 10 minutes to typical operating temperature before calibrating. The instrument will require a new calibration if the internal instrument temperature changes more than ±10 ºC after calibration.

Anritsu recommends an annual calibration and performance verification of the Site Master by local Anritsu service centers.

The Site Master is self-calibrating and there are no field-adjustable components. The external calibration components are crucial to the integrity of the user calibration. As a result, they must be verified periodically to ensure performance conformity. This is especially important if the calibration components have been accidentally dropped or over-torqued.

Contact information for Anritsu Service Centers is available at:

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

1-5 Secure Environment Workplace

This section describes the types of memory in the Site Master, how to delete stored user files that are in the internal memory, and recommended usage in a secure environment workplace.

Site Master Memory Types

The instrument contains non-volatile disk-on-a-chip memory, EEPROM, and volatile DRAM memory. The instrument does not have a hard disk drive or any other type of volatile storage memory.

EEPROM : This memory stores the model number, serial number, and calibration data for the instrument. Also stored here are the user-set operating parameters such as frequency range. During the master reset process, all operating parameters that are stored in the EEPROM are set to standard factory default values.

RAM Memory : This is volatile memory used to store parameters needed for the normal operation of the instrument along with current measurements. This memory is reset whenever the instrument is power cycled. Standby mode does not reset this memory.

External USB Flash Drive (not included with the instrument): This memory can be selected as the destination for saved files. You can also copy the contents of the internal memory to the external flash memory for storage or data transfer. The external USB flash drive can be reformatted or sanitized using software on a PC.

Refer to Chapter 10, “File Management” for additional information on saving and copying files to the USB flash drive.

Note	The screen images on your instrument or computer may vary from what is shown in this User Guide.

Erase All User Files in Internal Memory

Perform a Master Reset:

1. Press the **Preset** (**1**) button.
2. Press the Reset drop down submenu then press the Reset button. Select Master Reset and read the description on the screen (Figure 1-1).

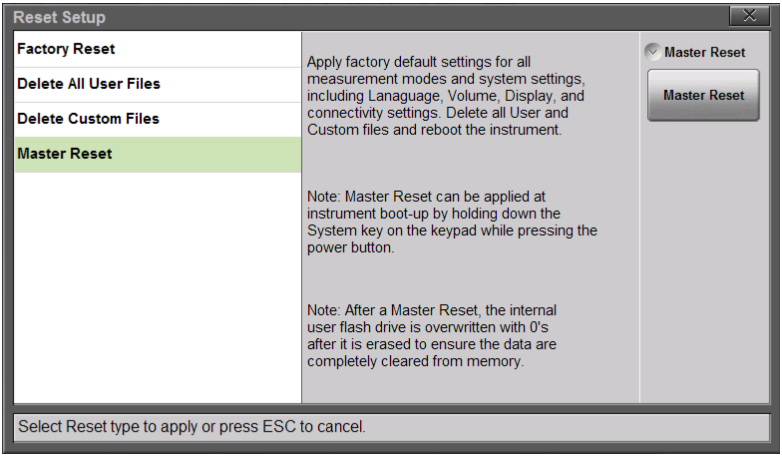


Figure 1-1. Master Reset

3. To erase all user files in internal memory, press the Master Reset button. A dialog box is displayed, warning that all settings will be returned to factory default values and that all user files will be deleted (Figure 1-2). Deleted files cannot be recovered.

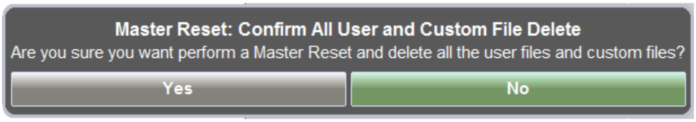


Figure 1-2. Master Reset Confirmation

4. Press Yes to complete the master reset and reboot the instrument.
5. The instrument is now reset.

Refer to the "Preset Menu" on page 11-26 for additional information on reset options.

Usage in a Secure Environment

Note	Not all USB flash drives are compatible with the S820E. Anritsu recommends performing a full FAT 32 long format prior to using with the instrument. Some USB devices may not be recognized even after formatting, and in these cases, the device must be replaced with another type.

Set the Site Master to save files to an external USB flash drive:

1. Attach the external flash drive and turn on the instrument.
2. Press the **File (7)** button, then Save.

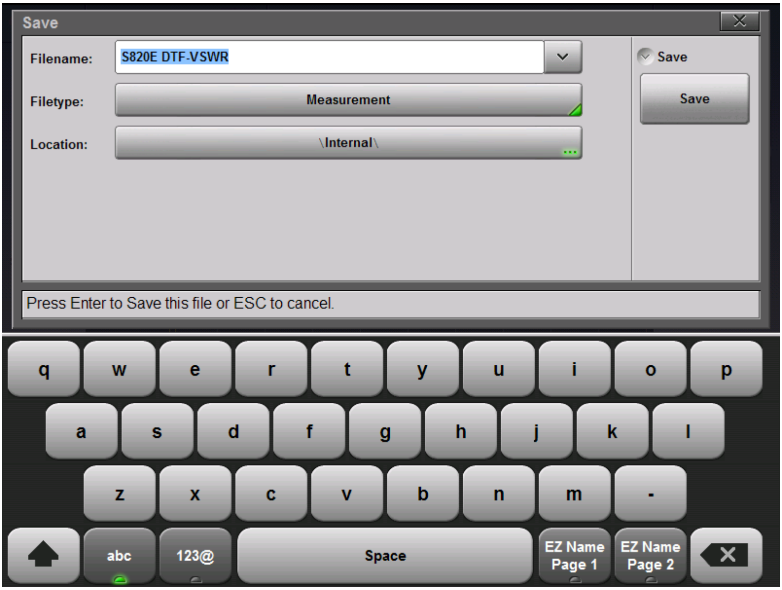


Figure 1-3. Choosing a Storage Drive – Step 2

3. Press the Location button then double tap on the word DRIVE or press the **Left Arrow** key until the external USB drive is displayed.

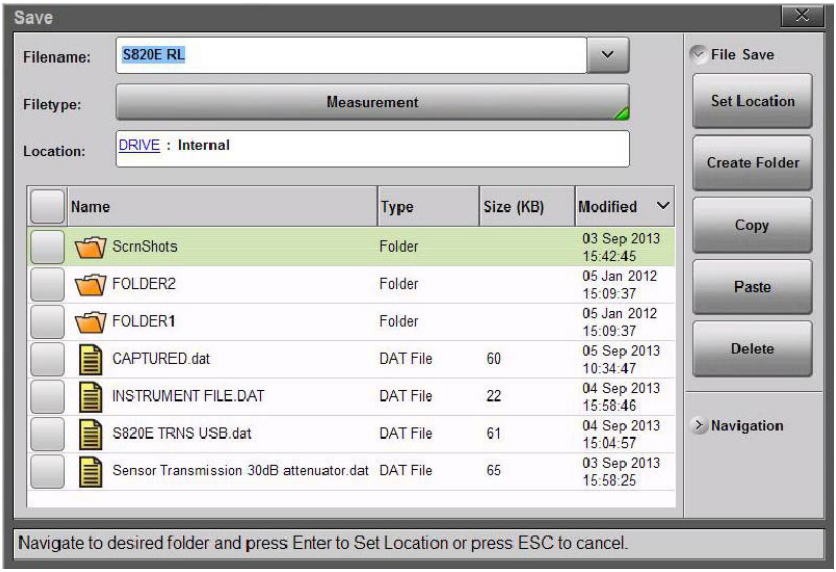


Figure 1-4. Choose a Storage Drive – Step 3

4. Double tap on USB, or highlight USB by using **Arrow** keys or by touching the screen, then press **Enter** or press the **Right Arrow** key. The Location breadcrumb changes to DRIVE : USB.

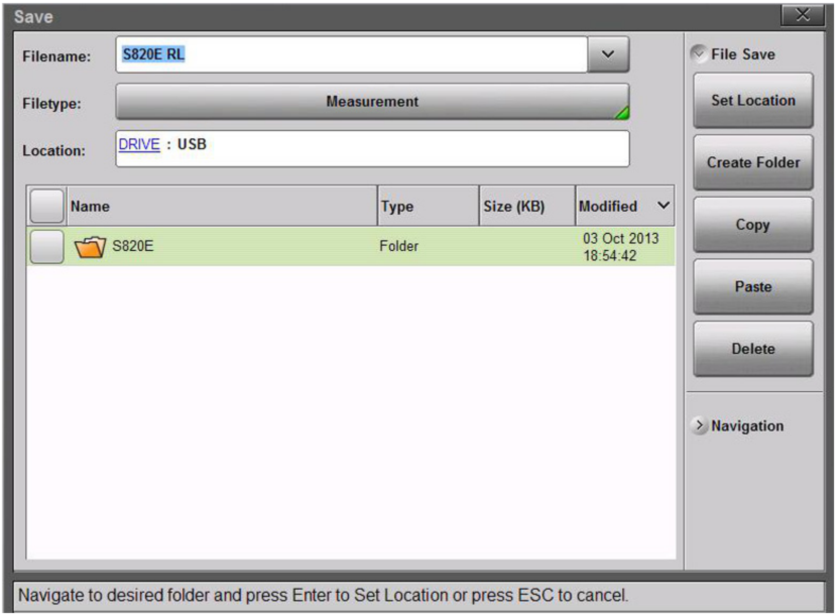


Figure 1-5. Choose a Storage Drive – Step 4

5. Press the Set Location submenu key. The external USB flash drive is now the default location for saving files.

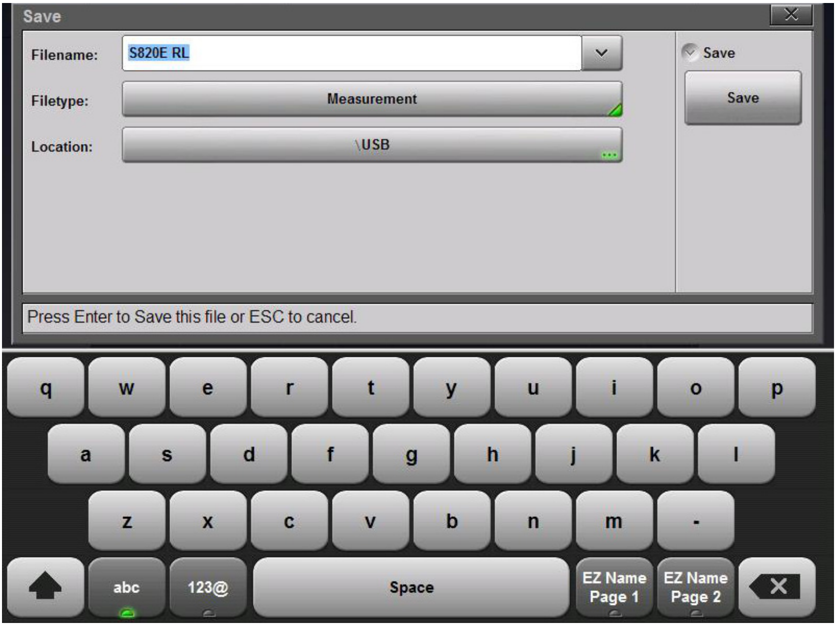


Figure 1-6. Choose a Storage Drive – Step 5

Note	Refer to Chapter 10, "File Management" for more detailed information.

Chapter 2 — Instrument Overview

2-1 Introduction

This chapter provides an overview of the Anritsu Site Master S820E. The intent of this chapter is to acquaint you with the instrument and its general functionality. For detailed line sweeping information, refer to Chapter 3 for Advanced mode or Chapter 5 for Classic mode or Chapter 6 for VNA mode. User calibration for cable and antenna sweeping is described in Chapter 4. High Accuracy External USB Power Meter operation is described in Chapter 9.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

2-2 Turning On the Site Master

The Anritsu Site Master S820E is capable of approximately 4 hours of continuous operation from a fully charged battery.

The Site Master can also be operated from a 12 VDC source (which also simultaneously charges the battery). This can be achieved with either the Anritsu AC-DC Adapter or the Automotive power outlet adapter.

Caution	When using the Automotive power outlet adapter, always verify that the supply is rated for a minimum of 60 Watts at 12 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

To turn on the Site Master, press the green **On/Off** button on the front panel (Figure 2-5 on page 2-13). The Site Master takes approximately 90 seconds to complete initial power up and load the application software.

Momentarily pressing the **On/Off** button when the Site Master is operating places the instrument into standby mode. A message "Going into Standby Mode" is displayed, and the touchscreen display turns off. The green power LED slowly pulses when the instrument is in standby mode. Press the **On/Off** button momentarily again to restore the instrument to standard operation.

One minute of inactivity causes the Site Master to enter reduced power mode. In this mode the display screen brightness is reduced. Touching any portion of the screen or any keypad press while in reduced power mode instantly restores screen brightness.

Press and hold the **On/Off** button until the shut down popup window appears. The current settings are saved, and the instrument shuts down.

Note	If the instrument appears non-responsive or will not power down using the standard shutdown procedure, then disconnect the external power supply, and then press and hold the power button for 10 to 15 seconds to force an instrument shutdown. Note that the current settings will not be saved.

2-3 External Power On

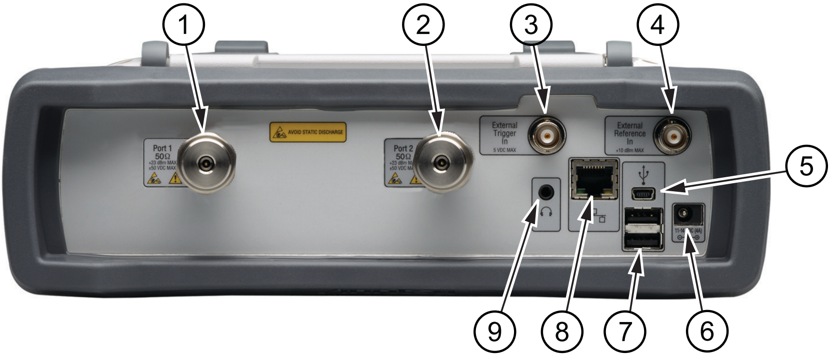
The When DC Applied setting in the Power-On menu allows the Site Master to restart automatically when external DC power is applied to the connector.

When this feature is enabled, the Site Master in the off state will turn on when external DC power is applied. The instrument turns off when external power is removed, even if a battery is installed. This is useful for high-reliability remote operation, where the instrument may need to be rebooted using a remotely-controlled power switch.

If the instrument is turned on with the power switch, then external power is removed, the instrument will continue to run until the battery is depleted. It will come on and the battery will begin recharging when external power is applied. This state is useful when the instrument is in a location where the power source may be interrupted.

2-4 Test Panel Connector Overview

The test panel for the Site Master S820E is shown in Figure 2-1.



1.	Port 1, Type N, Female (Options 0708, 0714) or Ruggedized K, Male (Options 0720, 0730, 0740) 50 ohm impedance. Maximum input is +23 dBm at ±50 VDC. Torque to 12 lbf·in or 1.4 N·m (N connector) or to 8 lbf·in or 0.90 N·m (K connector).
2.	Port 2, Type N, Female (Options 0708, 0714) or Ruggedized K, Male (Options 0720, 0730, 0740) 50 ohm impedance. Maximum input is +23 dBm at ±50 VDC. Torque to 12 lbf·in or 1.4 N·m (N connector) or to 8 lbf·in or 0.90 N·m (K connector).
3.	External Trigger In, Type BNC(f), 50 ohm A sweep is triggered on the rising edge of a TTL signal. Maximum input is +5 VDC.
4.	External Reference In, Type BNC(f), 50 ohm Auto-detects a 10 MHz external reference. When active the Measurement Setting for Freq Ref displays “External”. Maximum input is +10 dBm.
5.	USB Interface – Type Mini-B (version 2.0) The USB 2.0 Mini-B connector can be used to connect the Site Master directly to a PC.

Figure 2-1. S820E Test Panel Connector (1 of 2)

6.	External Power, 5.5 mm Barrel Connector The external power connector is used to power the instrument and for battery charging. Input is 11 VDC to 14 VDC at up to 4.0 A. When using the AC-DC Adapter, always use a grounded three-wire power cable that is connected to a three-wire power line outlet. Failure to use properly grounded electrical equipment may result in severe or potentially fatal injury.
7.	USB Interface – Type A (version 2.0) The Site Master has two Type A USB 2.0 connectors that accept USB Flash Memory devices for storing or transferring measurements, setups, and screen shots. USB sensors that are used for 2-port cable loss measurements and high accuracy power meter measurements and certain USB peripheral devices (such as a USB GPS module, USB mouse, or USB keyboard) may also be supported.
8.	RJ45 connector (10/100 Ethernet) Used to connect the Site Master to a local area network. When the instrument is connected to a network, the instrument obtains an IP address via DHCP, or a static IP address can be set by the user. Refer to “Status Menu” on page 11-18 for information about obtaining the IP address of the instrument.
9.	Headset Jack The jack accepts a 3.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones. The speaker output is diverted to the headphone when the headphone is plugged into this jack.

Figure 2-1. S820E Test Panel Connector (2 of 2)

2-5 Front Panel Overview

The Site Master menu-driven interface is easy to use and requires little training. The Site Master uses a touchscreen, keypad, **Arrow** keys, and rotary knob for data input. The menu and submenu keys vary depending upon the selected mode of operation.

The number keypad keys are dual purpose, depending upon the current instrument state. The dual-purpose keys are labeled with a number on the key and the alternate function printed above the key. The numeric keys function when there is an active parameter entry dialog box open. The **Esc** key is used for aborting data entry and closing menus. The rotary knob, the four **Arrow** keys, and the keypad can also be used to change the value of most active parameters.

Note	The Site Master is also compatible with a standard corded USB mouse. Plugging the mouse into one of the USB ports on the Site Master automatically displays the mouse cursor arrow on the display. Mouse input can then be used in combination with touchscreen entry. If the mouse cursor is not displaying, then confirm that the Cursor button (in the **Touchscreen** (**0**) menu) is turned On.

Front Panel Keys

Menu Key

Press the **Menu** key to open the Menu screen. Select the desired operating mode by touching one of the large mode icons in the top row or by touching one of the user-created shortcuts below. User-created shortcuts may include measurement setups, submenu key, or easyTest Tools scripts. Shortcuts can be added, deleted, or moved as described below.

Measurement mode icons are pre-installed and cannot be moved or deleted. The smaller shortcut icons are easily created or deleted by the user.

Help for the Menu Shortcut screen is available by pressing the Help Shortcut icon in the lower-right corner of the display when the menu screen is active.

The shortcut icons on the left of the Menu screen are available for direct access in all modes except Classic. When in classic mode, shortcuts are available only by pressing the **Menu** key.

Create a Menu Shortcut for a Submenu Key

Press and hold down any submenu key to add a shortcut to the Menu screen. After a few seconds the Menu screen is automatically displayed showing the available locations for the shortcut. Select an unused location to store the new shortcut.

Create a Menu Shortcut for a Setup File

Press **File** (**7**) then the Recall submenu key to display saved files. Locate the desired setup file (`.stp`) to shortcut and then, using the touchscreen, press and hold on the file name until the Menu screen is displayed. Select an unused location to save the setup file shortcut icon.

User-defined shortcuts stay in memory until deleted. To delete or move a shortcut button, press the **Menu** key, then press and hold the shortcut until the Customize Shortcut dialog box (Figure 2-2) appears. This dialog box provides options to delete or move the shortcut. If Move is selected, then a green rectangle outlines the shortcut button. Touch the new location where the button is to be placed. If the location is empty, then the outlined button moves there. If the location contains a button already, then the two buttons swap locations.

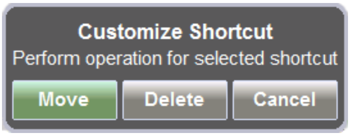
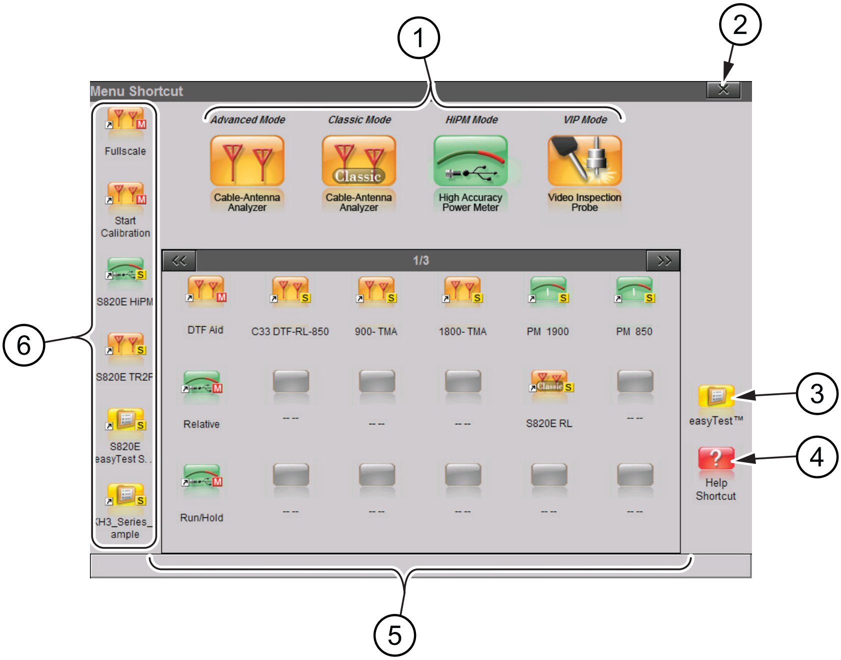


Figure 2-2. Customize Shortcut

If a file (with an assigned shortcut) is moved or deleted, then that shortcut icon becomes nonfunctional and must be removed manually. If a nonfunctional shortcut is pressed, then a message is displayed: "Error Recalling File..."

Figure 2-3 shows the **Menu** key screen with shortcut icons for the installed measurement modes. Touch one of the icons in the top row to change measurement modes.



1.	Installed Applications (Measurement Modes)
2.	Close Box
3.	Icon to Launch easyTest. Refer to Chapter 13.
4.	Help for Menu Screen
5.	Installed Setup and Menu Shortcuts (Screen 1 of 3)
6.	Shortcuts Displayed in All Menus (not available in Classic Mode)

Figure 2-3. Menu Key Screen, Icons for Installed Applications and Shortcuts

Note	Shortcuts for both menu buttons and setup files can be deleted as a group under the **Preset** Menu > Reset submenu. Select Delete Custom Files, then select the Menu Shortcuts checkbox. Press the Delete Custom Files button. Refer to “Preset Menu” on page 11-26 for additional information.

Esc Key

Press this key to cancel any setting that is currently being made or to close the currently dialog box.

Enter Key

Press this key to finalize data input or select a highlighted item from a list.

Shift Key

During file management functions the shift button toggles the on-screen keyboard between upper case and lower case characters. It may also be used for saving screen shots. To save a screen shot, press and hold the **Shift** while then pressing (one at a time) the period (**.**) key, then the **+/–** key. Refer also to Section 11-6 “Screen Shot Capture” on page 11-12.

Arrow Keys

The four arrow keys (around the **Enter** key) are used to scroll up, down, left, or right. The **Up/Down** arrow keys can often be used to change a value or to change a selection from a list. This function is similar to the function of the rotary knob. The **Left/Right** arrow keys can be used to move markers and the **Up/Down** arrow keys can also be used to move limit lines.

In Video Inspection Probe (VIP) mode, use the arrow keys to pan a captured image. Refer to Chapter 14.

Number Keypad

The Number keypad has two functions: The primary function is number entry. The secondary function of the number keypad is to list various menus. See “Keypad Menu Keys (1 to 9)” below.

Rotary Knob

Turning the rotary knob changes numerical values, scrolls through selectable items from a list, and moves markers or limit lines. In VIP mode, use the rotary knob to zoom in and out on a captured image.

Keypad Menu Keys (1 to 9)

Not all Menus are active in various measurement modes. If any one of these menus is available in a specific instrument mode of operation, then it can be called from the number keypad. It may also be available from a main menu key or a submenu key (Table 2-1 on page 2-10).

Table 2-1. Site Master Keypad Functions (1 of 2)

Menu	Description
Touchscreen 0	Opens the touchscreen control menu for access to the touchscreen calibration function, Cursor On/Off selection, and Lock On/Off selection. Refer to "Touchscreen Menu" on page 11-3.
Preset 1	Opens the Preset/Reset submenus for resetting the Site Master back to default settings, deleting custom files, and updating instrument firmware. Refer to "Preset Menu" on page 11-26 for additional information.
Calibrate 2	Opens the Calibration submenus to provide access to the user calibration functions. Refer to "Calibration, CAA" on page 4-1 for additional information.
Sweep 3	Displays the Sweep menu to adjust Sweep Type. Sweep settings are displayed left of the graph. Function varies by measurement mode. Refer to "Sweep Menu" on page 3-67 for Cable-Antenna mode.
Measure 4	Displays the Measurement menu to select the measurement type when the S820E is in Cable-Antenna mode. Refer to "Measurement Menu" on page 3-55 for additional information.
Trace 5	Displays the Trace menu and provides access to the available trace functions (mode dependent). Refer to "Trace" on page 3-47 for detailed instructions.
Limit 6	Displays the Limit menu to set user-defined limits. Limit Alarms and Pass/Fail messages may be activated to indicate when a limit has been exceeded by the active measurement. Refer to "Limit Menu" on page 3-65 for Advanced Cable-Antenna mode, to "Limit Menu" on page 5-8 for Classic Cable-Antenna mode, and to "Limit Menu" on page 9-25 for High Accuracy Power Meter mode.

Table 2-1. Site Master Keypad Functions (2 of 2)

Menu	Description
File 7	Allows you to save, recall, copy, and delete files in internal memory or an external USB flash drive. Refer to “File Management” on page 10-1.
System 8	Opens the System menu and provides access to System Information, System Setups, and Diagnostic tools. Refer to “System Operations” on page 11-1 for additional information.
Mode 9	Displays the Mode Selector dialog box to allow you to easily switch between available measurement modes. See Figure 2-4.

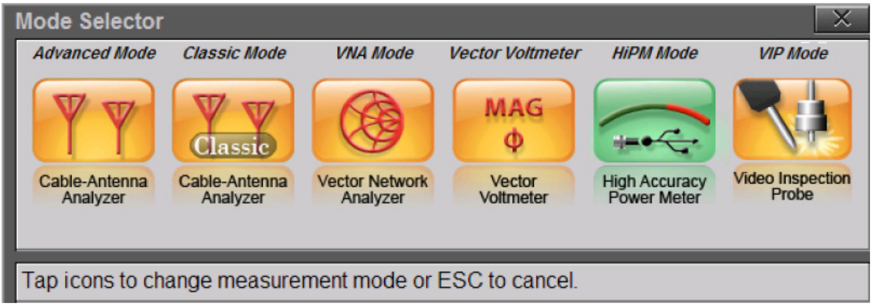


Figure 2-4. Mode Selector

LED Indicators

Power LED

The Power LED is solid green when the instrument is on, and slowly pulses when the Site Master is in standby mode.

Charge LED

The LED is green when the Site Master is on and the battery is fully charged. The LED is orange when the battery is charging, and is off when the Site Master has no external power.

Press the battery icon  at the top of the screen to view the current battery charge.

Front Panel Interface

Figure 2-5. Site Master Instrument Overview (1 of 2)

1.	Status Tool Bar
2.	Port 1
3.	System Function Tool Bar (not available in “Classic” mode)
4.	Port 2
5.	Menu Key
6.	Rotary Knob
7.	Enter Key and Arrow Keys
8.	Esc Key
9.	Number Keypad and Menu Keys
10.	Charge LED
11.	On/Off/Standby Button
12.	Power LED
13.	Submenu Keys
14.	Main Menu Keys

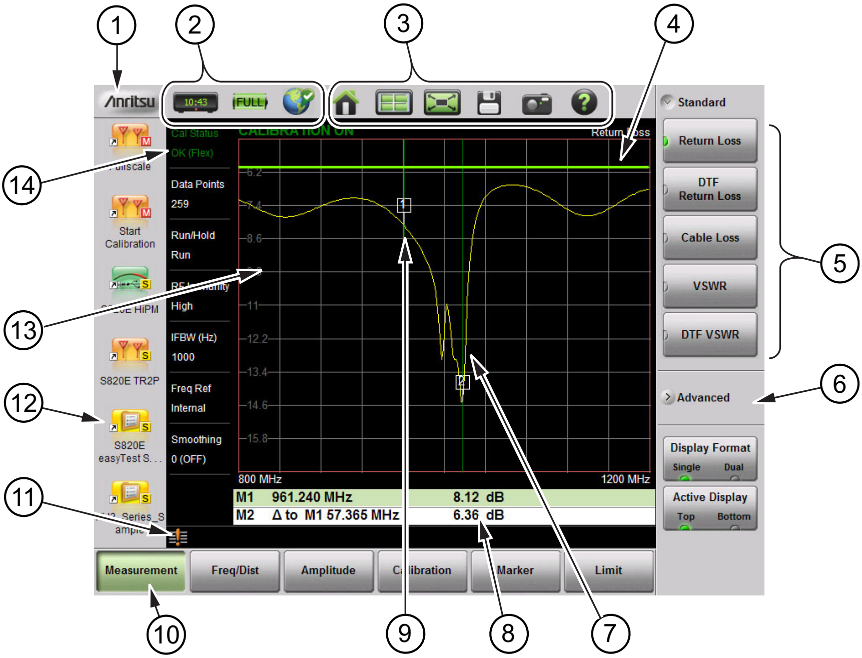
15.	Warning and Status Area
16.	Shortcut Tool Bar (not available in “Classic” mode)
17.	Measurement Settings Summary (touchscreen menu shortcuts)

Figure 2-5. Site Master Instrument Overview (2 of 2)

2-6 Touchscreen Display Overview

Note	Screen captured images are provided as examples. The image and measurement details shown on your instrument may differ from the examples in this measurement guide.

Figure 2-6 illustrates some of the Site Master user interface features.



1.	Anritsu Logo. Displays the System Status dialog screen when pressed. Press **Esc** or to close. Refer to the “Status Menu” on page 11-18 for additional information.
2.	Status Tool Bar. Refer to “Status Tool Bar” on page 2-20 for information on each icon.
3.	System Function Tool Bar. Shortcuts to various system functions. See “System Function Tool Bar” on page 2-24 for information on each icon. Not displayed in Classic Mode.
4.	User-defined Limit Line.
5.	Expanded submenu. Expanded submenus display the function buttons.

Figure 2-6. Site Master Display Overview (1 of 2)

6.	Collapsed submenu. Pressing a collapsed submenu causes it to expand as shown in row 5. Refer to “Submenu Keys” on page 2-16.
7.	Active trace sweeping between Start Frequency (F1) and Stop Frequency (F2).
8.	Marker Table. Refer to “Markers” on page 3-40.
9.	Marker 1.
10.	Main Menu keys with Measurement selected. Refer to “Main Menu Keys” on page 2-16.
11.	Warning and Status Area.
12.	User-defined Shortcuts. Refer to “Menu Key” on page 2-6. Not displayed in Classic Mode.
13.	Graph, a 10 x 10 grid showing the active trace.
14.	Instrument Settings Summary provides a selection of Measurement Information pertaining to the current, active trace, or traces. May also be used as a touchscreen shortcut to submenus.

Figure 2-6. Site Master Display Overview (2 of 2)

Main Menu Keys

The main menu keys are horizontally arranged along the lower edge of the touchscreen. The main menu key functions change based on the instrument mode. The instrument mode is set with the **Mode** (**9**) key, the **Menu** key, or the mode selector icon  (icon not available in Classic mode). The main menu keys generate function-specific submenus.

Submenu Keys

These submenu keys are arranged along the right-hand edge of the touchscreen. The submenu keys change based on the selected Main Menu or Keypad Menu key.

Several submenus may be displayed in the submenu block area. Press any collapsed submenu title to expand the submenu and display the submenu buttons. Press one of the submenu buttons to make a selection or set a parameter.

In Figure 2-7, the **Measurement** main menu is selected (Green depressed state) and the DTF Return Loss measurement button is selected (Green semicircle).

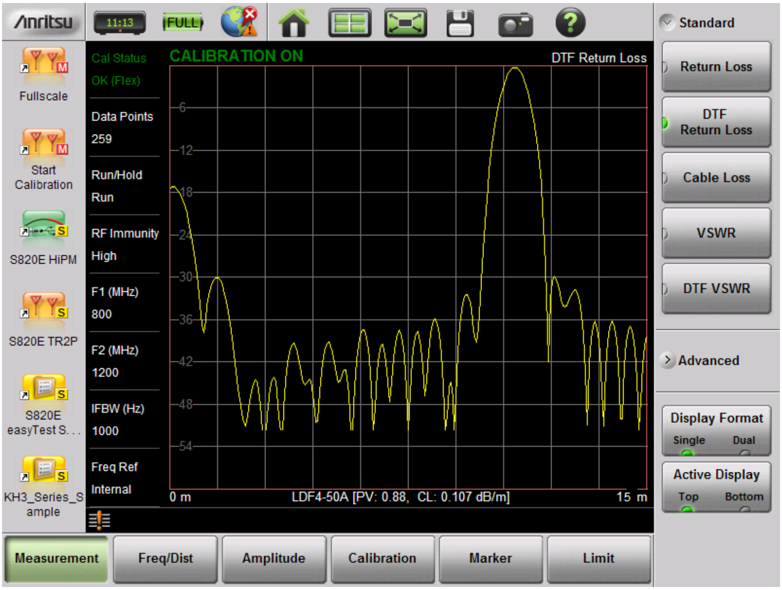


Figure 2-7. Distance to Fault Measurement

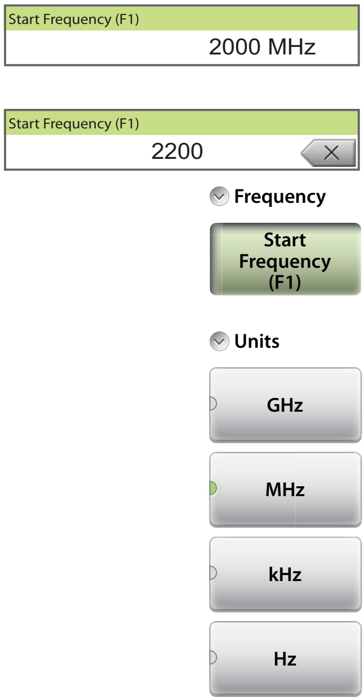
Submenu Button Types

The Site Master interface uses several submenu button types. Each is described in Table 2-2.

Table 2-2. Submenu Button Examples (1 of 2)

<table>
<tr><th>Button Description</th><th>Button Example</th></tr>
<tr><td>1. Numeric Entry

example:
Start Frequency (F1) button in the Freq/Dist menu.

Opens an “Edit Parameter Window”. Change the current value using the rotary knob, Up/Down Arrow keys, or number keypad. Using the keypad displays terminator buttons (in frequency units). Press one of the buttons to complete the entry, or press the Esc key to cancel the entry. Press  to delete the last number entered. Entering a value beyond the range of the instrument sets the parameter to the maximum or minimum value.</td><td>
</td></tr>
<tr><td>2. Toggle

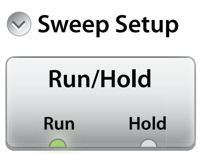
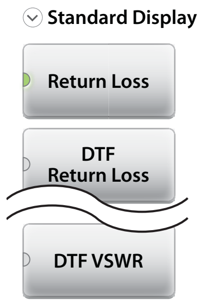
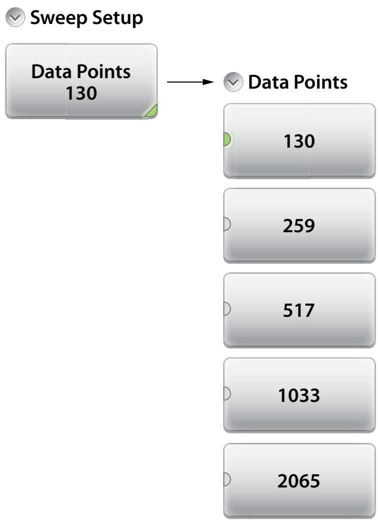
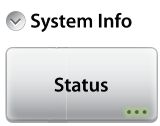
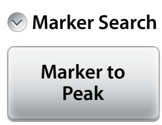
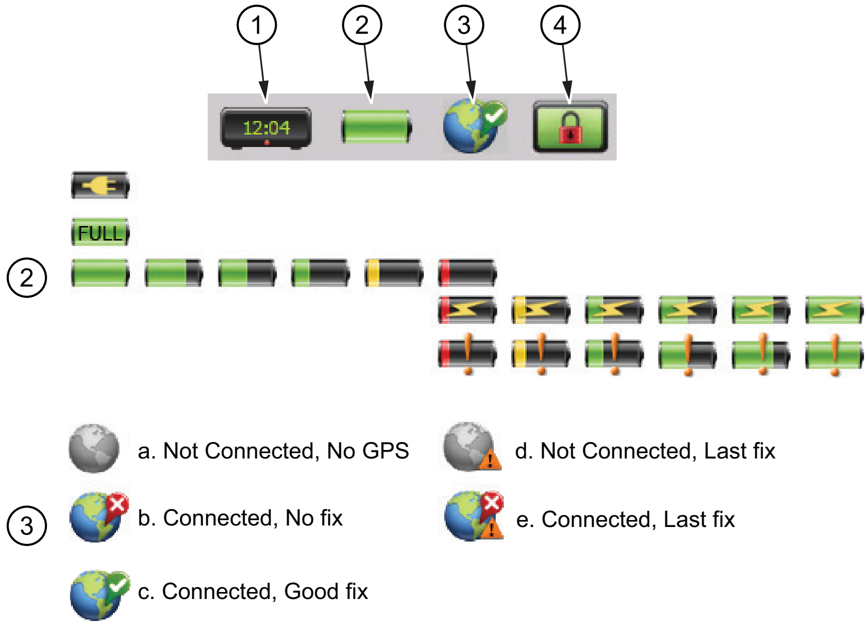
Each press of the button cycles between the available states. The active state is indicated by the glowing green semicircle at the bottom of the button.</td><td>
</td></tr>
</table>

Table 2-2. Submenu Button Examples (2 of 2)

Button Description	Button Example
3. **Parameter Value** *example:* **Measurement** main menu. This button type is used when several options are available for the parameter. The current selection is indicated by the glowing green semicircle at the left of a button.	
4. **Submenu Selection** *example:* Data Points button in the **Sweep** (**3**) menu. The current value is displayed below the button name. Pressing the button displays a submenu of the available values. Press one of the buttons to select a new value. Press **Esc** to cancel. **Submenu Selection** buttons are indicated by the glowing green triangle in the lower-right corner of the button.	
5. **Dialog** Pressing this button displays a dialog box or a list box. Press **Esc** to clear the dialog or list box. **Dialog** buttons are indicated by the 3 dots within a glowing green background in the lower-right corner of the button.	
6. **Action** Pressing an **Action** button triggers the function that is displayed on the submenu button.	

Status Tool Bar

The Status Tool Bar includes icons to display the current time and date, battery charge, GPS status, and screen lock state. Tap one of the icons for additional information. Figure 2-8 shows the icons that are displayed in the Status Tool Bar area.



1.	Clock icon. Press to set the current date, time, and time zone. Refer to "Date/Time" on page 11-15.

Figure 2-8. Status Tool Bar Icons

2.	Battery icon. Press to view battery and charge status. Press **Esc** to close. The first row shows the icon when the Site Master is plugged into the AC adapter or car charger and the battery is not detected. The second row shows the battery icon when the battery is fully charged and the Site Master is plugged into the AC adaptor or car charger. The third row of battery icons show the charge level from 100 % to 2 % when the Site Master is running on battery power. The lightning bolt is displayed when the Site Master is charging from an AC adapter or the car charger and the battery is not fully charged yet. The fourth row shows the battery level from 2 % to 100 % under this condition. An exclamation point is displayed when the battery charging has paused, either due to the ambient temperature being too high or too low to safely charge the battery, or due to a fault in the battery. The exact cause is displayed in the battery dialog under charge status. The last row shows the battery level from 2 % to 100 % under this condition. The battery will resume charging automatically as soon as the pause conditions have changed. Refer to Chapter 12, “Battery Replacement” for additional information.
3.	GPS icon. Press to view the current GPS information (Figure 2-9) obtained from an external USB-based GPS module. The icon indicates the status of the GPS module and location fix. After capturing a good fix, location data are saved with measurements (Figure 2-10) and screen captures. GPS status icon states: a. GPS module (H/W) is not connected. Connect an Anritsu approved GPS module. b. H/W connected without a current location fix. Module attempts to establish a location fix during this state. c. H/W connected with a current location fix. d. H/W not connected, instrument using last saved location fix. Pressing Reset button places GPS in state “a.” e. H/W connected, GPS fix lost, using last saved location fix. Pressing Reset button places GPS in state “c.”

Figure 2-8. Status Tool Bar Icons (Continued)

4.	Touchscreen Lock icon. The Lock icon is displayed when the touchscreen is locked (**Touchscreen** (**0**) > Lock) or (**Touchscreen** (**0**) > 1). When locked, the touchscreen will not register user input. You may lock the screen in order to use the instrument exclusively with a USB mouse or with the Arrow Cursor control. Unlock by using the keypad only: Press (**Touchscreen** (**0**) > 1). When the Touchscreen Control window is displayed, press the 1 key on the number keypad to toggle the setting to Off. The touchscreen could also be locked if it was registering unintended input that was not resolved with a touchscreen calibration. This scenario may happen after touchscreen damage. The Site Master can continue to be used to make measurements and save files (even with touchscreen damage) by using a USB mouse or turning on the Arrow Cursor control. Refer to “Touchscreen Menu” on page 11-3 for additional information.

Figure 2-8. Status Tool Bar Icons (Continued)

Caution	Use only Anritsu-approved batteries, adapters, and chargers with this instrument.

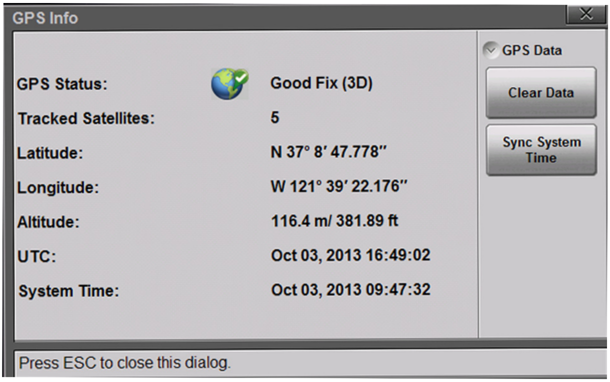


Figure 2-9. GPS Info

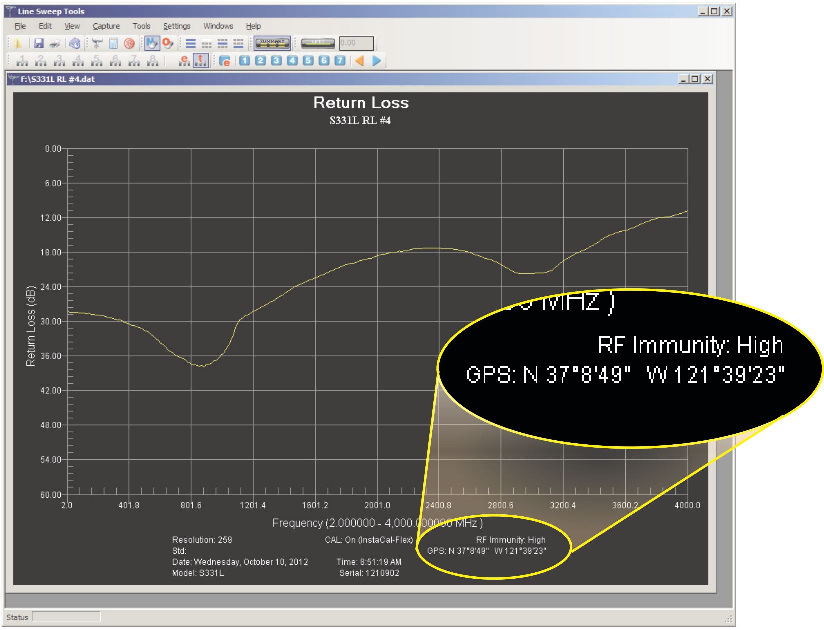
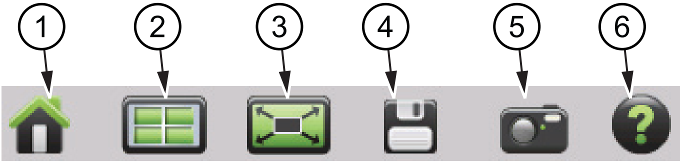


Figure 2-10. Location Data Saved in Measurement File

System Function Tool Bar

The System Function Tool Bar icons allow quick access to functions that are not measurement specific. Figure 2-11 shows the icons that are displayed in the Status Tool Bar Area (Not available in Classic mode).



1.	Preset icon. Opens the **Preset** (**1**) Menu. See “Preset Menu” on page 11-26 for additional information.
2.	Mode Selector icon. Press to change measurement mode (including switching between *Advanced* and *Classic* Cable-Antenna Analyzer mode). Tap an icon (Figure 2-12 on page 2-25) to change modes or press **Esc** to cancel.
3.	Full Screen icon. Sets the display to full screen view mode (hides all of the tool bars, shortcut icons, and menus). Full screen view increases the view size of the graph. Press **Esc** to return to the standard view. Measurement menus are not available in Full screen mode. Refer to Figure 2-13 on page 2-26 for a comparison of the two views.
4.	Save icon. Shortcut to open the **File** (**7**) > Save menu. See “Save Files” on page 10-3 for additional information.
5.	Screen Capture icon. Press to capture and save an image of the current screen. The file is automatically saved to internal memory in the `ScrnShots` folder. The file is automatically named based on the measurement type and saved in Portable Network Graphics (`.png`) format. Refer to “Screen Shot Capture” on page 11-12 for examples and details on the image capture options (capture size, background color, and header/footer).
6.	Help icon. Shortcut to open the **Help** menu . See “Help Menu” on page 11-5 for additional information.

Figure 2-11. System Function Tool Bar Icons

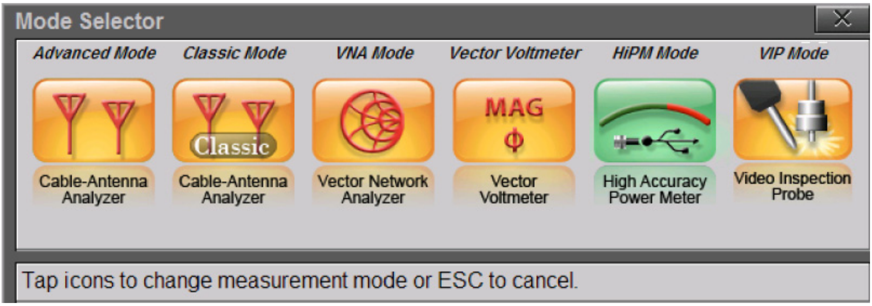
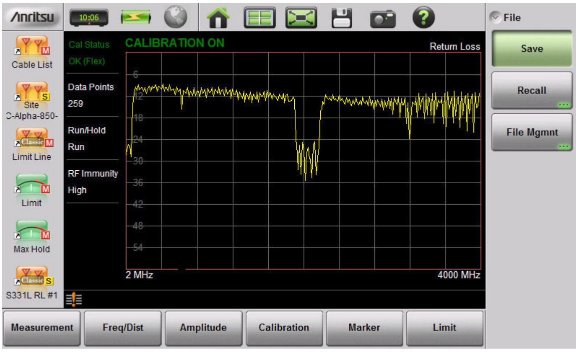
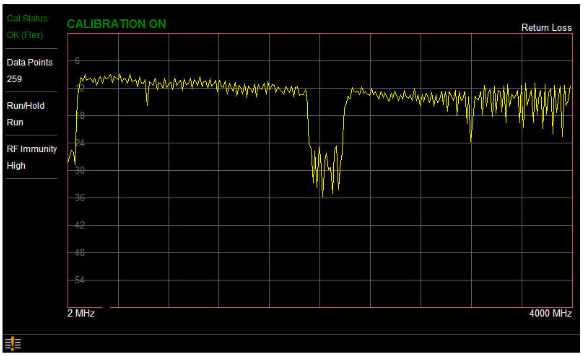


Figure 2-12. Mode Selector



Standard View



Full Screen View

Figure 2-13. Comparison of Standard Mode vs. Full Screen Mode

Dual Display Format

The S820E Microwave Site Master can display two different measurements simultaneously by setting the Display Format to Dual and then selecting the measurement to display.

Note	Advanced measurements can be combined with Standard measurements. Not all measurement combinations may be supported by Line Sweep Tools. Refer to the Line Sweep Tools Help menu for more information.

Different Amplitudes, Limit Lines, and Markers can be set for each display. If the Marker Table is turned On in Dual Display Mode, then the markers for only the active display are shown in the table.

Setting Single or Dual Display

1. Press the **Measurement** main menu key.
2. Toggle the Display Format submenu key so that it is set to Dual.

Saving Measurements in Dual Display

When saving a file while in dual display mode, both traces are saved in a single measurement file. The default filename will contain references to both trace types, but you can change the name, as with any file. Refer to "File Name" on page 10-4.

3. Change the active measurement by toggling the Active Display key or touching the display directly. The red outline around the graph indicates the active display.

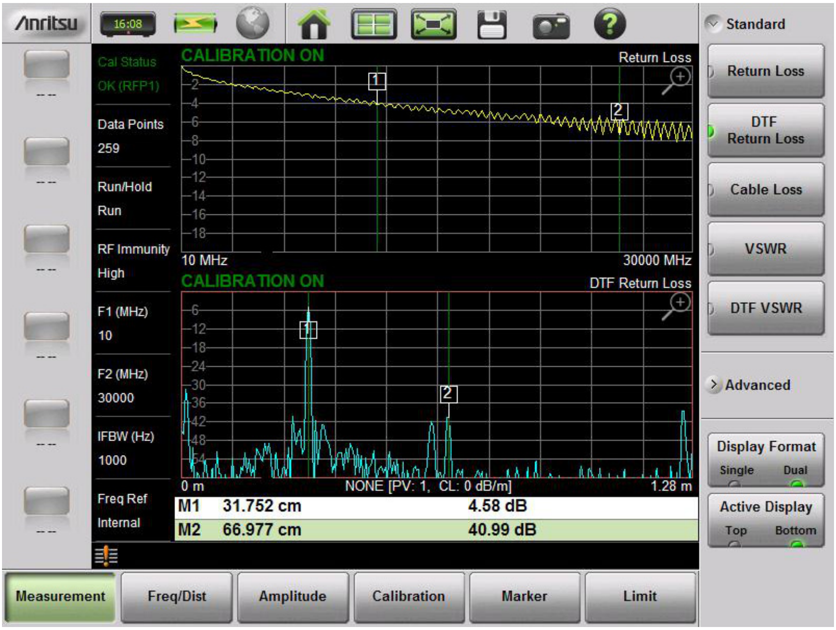


Figure 2-14. Dual Display Format with Bottom Display Active

4. To maximize either the top display or bottom display while still in Dual display format, tap the magnifying glass symbol in the upper-right corner of either graph. The graph maximizes, and the magnifying glass symbol changes from a (+) to a (–).

5. Figure 2-15 on page 2-28 shows the Bottom graph maximized. Tapping on the magnifying glass restores the dual display.

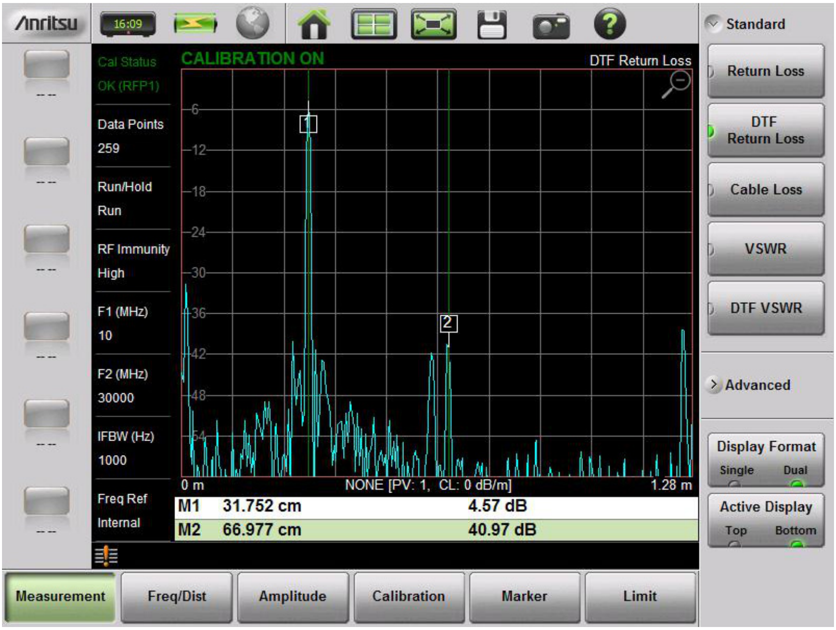


Figure 2-15. Dual Display Format with Bottom Display Maximized

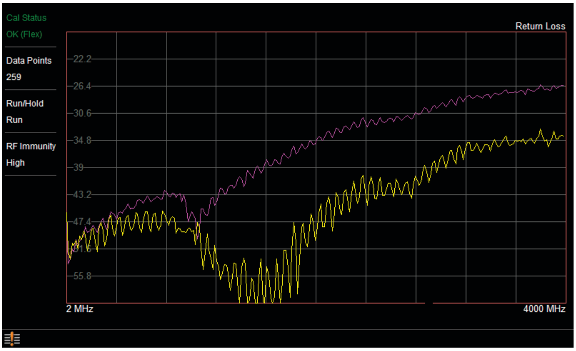
Display Modes

In addition to the standard color display, the Site Master S820E offers the following Color Schemes:

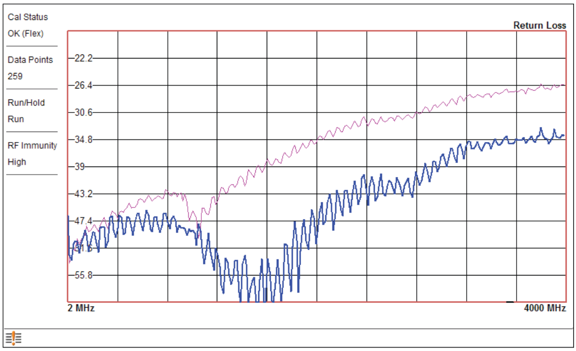
Daytime for challenging daytime viewing conditions requiring increased contrast and brightness.

Nighttime optimized for night-time viewing with decreased contrast and brightness.

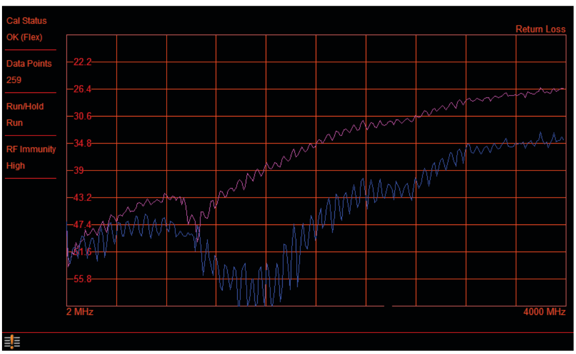
To change the display mode, **System** (**8**) > System Setups > Display/Audio and select one of the Color Schemes. Press **Enter** to set or **Esc** to cancel the display mode change.



Standard



Daytime



Nighttime

Figure 2-16. Site Master Color Schemes in Full Screen Mode

2-7 Calibration

The following symbols and indicators indicate the instrument status or condition on the display.

Calibration Symbols

The current calibration status and type is displayed in the upper-left of the screen when in Cable-Antenna Analyzer mode. The three status messages are described next.

Cal Status OK (Cal Type)

The Microwave Site Master has a valid calibration being applied. It is not possible to change the frequency range after calibration without performing another calibration. Note that the CALIBRATION OFF message can indicate different calibration conditions.

Cal Status -- CALIBRATION OFF

The Site Master has not yet been calibrated (–). Perform a calibration before making measurements.

Cal Status OFF CALIBRATION OFF

The Site Master has been calibrated, but Cal Correction is Off (**OFF**). The calibration correction has been turned Off by the user or by the recalled setup. Set the Cal Correction to On, or start a new calibration.

Cal Status OFF CALIBRATION OFF (↕°C)

The Site Master has been calibrated, but the instrument temperature has drifted more than ±10 °C since the last valid calibration was performed (**°C**). A new calibration is required.

For calibration procedures refer to Chapter 4.

2-8 Soft Carrying Case

The Site Master can be operated while in the soft carrying case. On the back of the case is a large storage pouch for accessories and supplies.

To install the instrument into the soft carrying case:

1. The front panel of the case is secured with hook-and-loop fasteners. Fully close the front panel of the case. When closed, the front panel supports the shape of the case while you are inserting the Site Master.
2. Place the soft carrying case face down on a stable surface, with the front panel fully closed and laying flat.

Note	The soft case has two zippers near the back. The zipper closer to the front of the case opens to install and remove the instrument. The zipper closer to the back of the case opens an adjustable support panel (tilt bail panel) that can be used to provide support for improved stability and air flow while the instrument is in the case. This support panel also contains the storage pouch.

3. Open the zippered back of the case.
4. Insert the instrument face down into the case, taking care that the connectors are properly situated in the case top opening. You may find it easier to insert the connectors first, then pull the corners over the bottom of the Site Master.
5. Close the back panel and secure it with the zipper to secure the Site Master.

The soft carrying case includes a detachable shoulder strap, which can be connected to the D-rings of the case.

Caution	The soft case has panel openings for the fan inlet and exhaust ports. Do not block the air flow through the panels when the instrument is operating.

Figure 2-17. Instrument Inserted into the Soft Carrying Case

2-9 Tilt Bail Stand

A Tilt Bail is attached to the back of the Site Master for desktop operation. The tilt bail provides two settings of backward tilt for improved stability. To deploy the tilt bail, pull the bottom of the tilt bail away from the back of the instrument. To store the tilt bail, push the bottom of the bail towards the back of the instrument until it attaches to the Site Master.

Note	Do not use the tilt bail while the instrument is in the soft case. The soft case has an adjustable tilt bail panel in the back zipper.

Figure 2-18. Tilt Bail Extended (different model shown)

Chapter 3 — Cable and Antenna Measurements

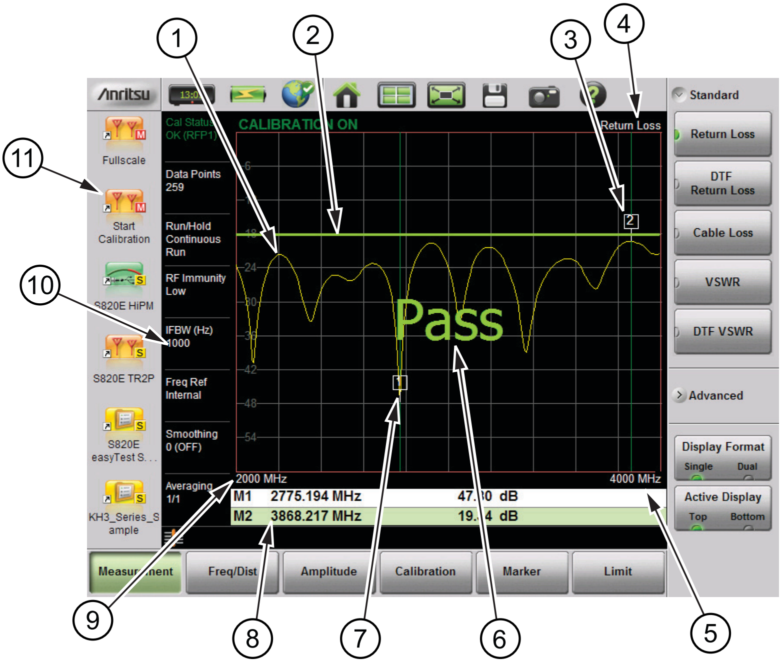
3-1 Introduction

This chapter provides an overview of Cable and Antenna measurements and how to set up the instrument and perform basic line sweeps.

Note	Use the **Menu** key and confirm that the instrument is in Cable-Antenna Analyzer Advanced mode (*not Classic mode*). In Classic mode, **Classic Mode** is clearly displayed at the top of the instrument screen in the System Function Tool Bar.

Figure 3-1 illustrates a typical Cable and Antenna Return Loss measurement.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.



1.	Active Trace (Yellow)
2.	Limit Line (Green when Passing)
3.	Marker 2 (Marker to Peak)
4.	Measurement Type
5.	Stop Frequency (F2)
6.	Pass Message (Active trace is below the limit line in Return Loss measurement)
7.	Marker 1 (Marker to Valley)
8.	Marker Table
9.	Start Frequency
10.	Measurement Details (also Menu Shortcuts)
11.	User-defined Setup and Menu Shortcuts (not available in Classic mode)

Figure 3-1. Cable and Antenna Display Overview

3-2 Standard Measurements

The following sections describe the typical line sweep measurements that are used to analyze the performance of a transmission feed line system including Return Loss, Cable Loss, and DTF.

Note	Anritsu recommends using phase-stable test port cables when making measurements. Attach the cables to the port connectors of the Microwave Site Master and calibrate at the open end of the cables.

3-3 Return Loss or VSWR Measurement

Return Loss measures the reflected power of the system in decibels (dB). This measurement can also be taken in the Standing Wave Ratio (SWR) mode, which is the ratio of voltage peaks to voltage valleys caused by reflections.

System Return Loss measurement verifies the performance of the transmission feed line system with the antenna connected at the end of the transmission line. Figure 3-2 and Figure 3-3 show a sample antenna measured using Return Loss and using VSWR.

Device Under Test: Feed line with Antenna

1. Press the **Measurement** main menu key, under the Standard submenu, select Return Loss or VSWR.
2. Press the **Freq/Dist** main menu key and enter the start and stop frequencies.
3. Press the **Amplitude** main menu key and enter the top and bottom values for the display or press Fullscale.
4. Press the **Calibration** main menu key and perform a calibration of the instrument. Anritsu suggests using a phase-stable test port cable. See Chapter 4 for details.
5. Connect the Site Master to the Device Under Test using the calibrated phase-stable test port cable.
6. Press the **Marker** main menu key and set the appropriate markers as described in “Markers” on page 3-40.
7. Press the **Limit** main menu key to enter and set the limit line as described in “Limit Lines” on page 3-34.
8. Press **File** (**7**) then Save to save the measurement to memory. Refer to Chapter 10 for details on setting the save location.

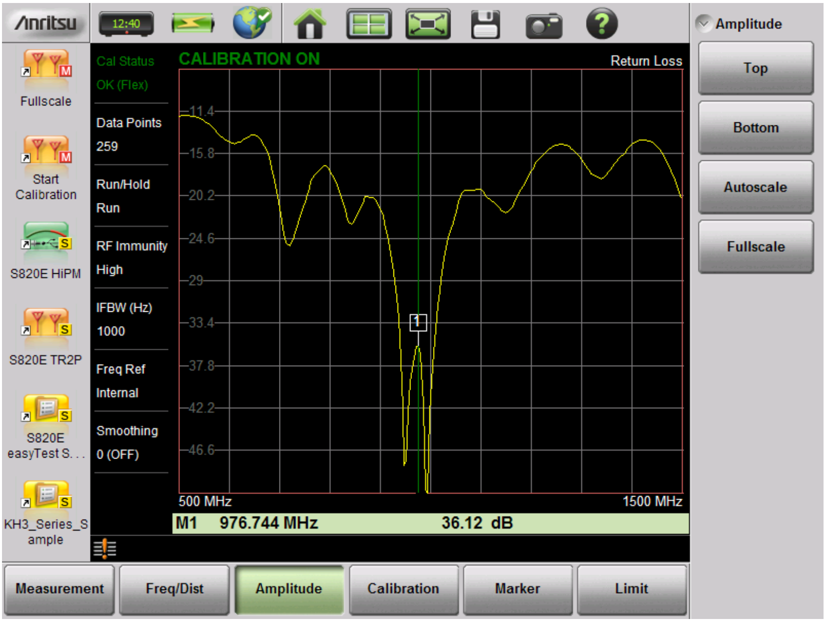


Figure 3-2. Antenna Return Loss Trace

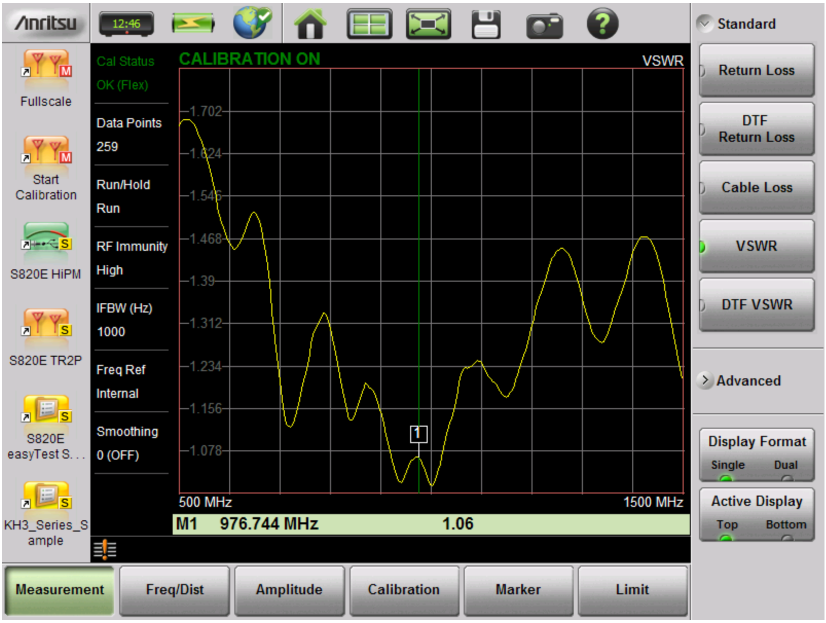


Figure 3-3. Same Antenna Trace in VSWR

3-4 Cable Loss Measurement

The transmission feed line insertion loss test verifies the signal attenuation level of the cable system in reference to the specification. The average cable loss of the frequency range is displayed on the screen in the measurement settings summary area.

Device Under Test: Transmission Feed line with Short

1. Press the **Measurement** main menu key, under the Standard submenu, select Cable Loss.
2. Press the **Freq/Dist** main menu key and enter start and stop frequencies.
3. Press the **Amplitude** main menu key and enter top and bottom values for the display or press Full Scale.
4. Press the **Calibration** main menu key to start calibration of the instrument. Anritsu suggests using a phase-stable test port cable. See Chapter 4 for details.
5. Connect the Site Master to the Device Under Test using the calibrated phase-stable test port cable.
6. Press the **Limit** main menu key to enter and set the limit line as described in “Limit Lines” on page 3-34. This limit line is used only for visual reference and not a pass/fail guide. The pass/fail determination is based on the average cable loss.
7. Press **File** (**7**) then Save to save the measurement to memory. Refer to “Save Files” on page 10-3 for details on setting the save location.

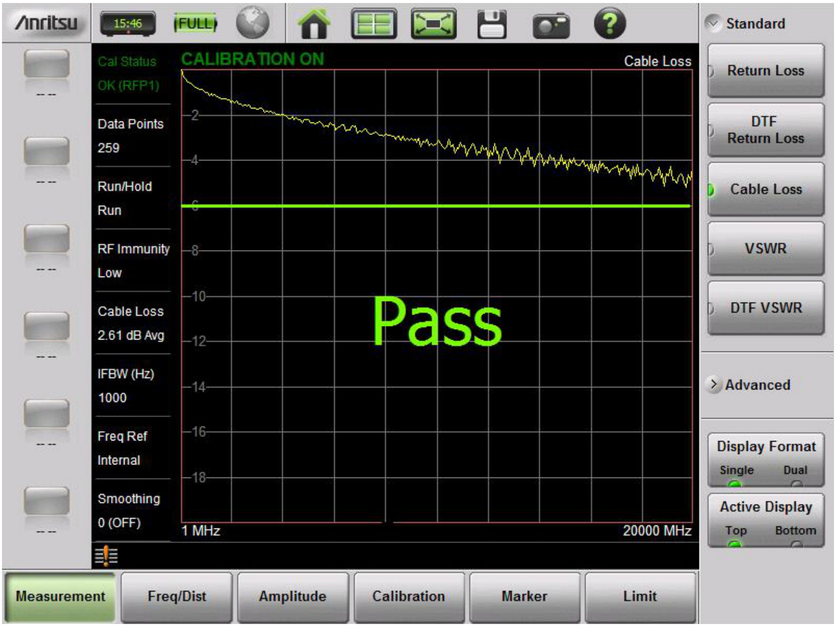


Figure 3-4. Cable Loss Measurement

3-5 Distance-To-Fault (DTF)

DTF reveals the precise fault location of components in the transmission line system. This test helps to identify specific problems in the system, such as connector transitions, jumpers, kinks in a cable, moisture intrusion, or mechanical damage.

The first step is to measure the distance of a cable, this measurement can be made with an open or a short connected at the end of the cable. The peak indicating the end of the cable should be between 0 dB and 5 dB. An open or short should not be used when DTF is used for troubleshooting the system because the open/short reflects most of the RF energy from the Site Master. The true value of a connector might be misinterpreted, or a good connector might look like a failing connector.

A 50 Ω load is the best termination for troubleshooting DTF problems because it will be 50 Ω over the entire frequency range. The antenna can also be used as a terminating device, but the impedance of the antenna will change over different frequencies because the antenna is typically designed to have only 15 dB or better return loss in the passband of the antenna.

DTF measurement is a frequency domain measurement, and the data are transformed to the time domain. The distance information is obtained by analyzing how much the phase is changing when the system is swept in the frequency domain. Frequency selective devices such as TMAs (Tower Mounted Amplifiers), duplexers, filters, and quarter wave lightning arrestors change the phase information (distance information) if they are not swept over the correct frequencies. Care needs to be taken when setting up the frequency range whenever a TMA is present in the path.

Using DTF Aid

Because of the nature of the measurement, maximum distance range and distance resolution is dependent upon the frequency range and number of data points. DTF Aid (**Freq/Distance** > Distance > DTF Aid) shown in Figure 3-5 explains how the parameters are related.

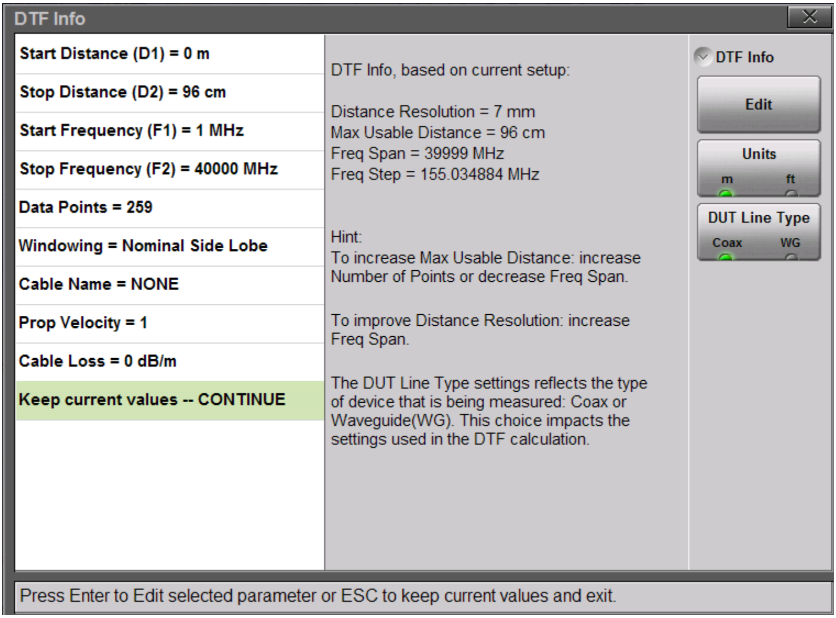


Figure 3-5. DTF Aid

If the cable or waveguide is longer than the Max Usable Distance displayed, then the only way to improve the horizontal range is to reduce the frequency span or to increase the number of data points. Similarly, the distance resolution is inversely proportional to the frequency range and the only way to improve the distance resolution is to widen the frequency span.

Note	When determining the frequency range, consider all in-line frequency selective devices.

Transmission Line Selection

The Microwave Site Master 820E is capable of measuring either coaxial cable or waveguide feeder lines. Selecting the correct coaxial or waveguide type is critical for accurate DTF measurements. Incorrect propagation velocity (PV) (or Cut Off Frequency in the case of waveguide) values affect the distance accuracy, and inaccurate attenuation values affect the accuracy of the amplitude values.

Selecting the line type or creating a custom type is described in the following sections.

Cable List

The Microwave Site Master S820E is equipped with a built-in, predefined cable list (**Freq/Dist** > DTF Setup > Cable List), which includes most of the common cables that are currently in use. After the correct cable has been selected, the instrument updates the propagation velocity and the cable attenuation values to correspond with the cable. For setups with several different cables types, choose the main feeder cable.

Note	If the Cable list button is not displaying, then toggle DUT Line Type to Coax

For cables not on the list, select NONE and manually enter the Prop Velocity and Cable Loss in DTF Aid or the DTF Setup submenu.

Note	Custom cable settings that are entered manually are not saved when the instrument is preset, reset, or turned Off.

Custom Cables can be created and uploaded to the instrument by using Line Sweep Tools (LST). Instructions for using the LST Cable Editor are available in the LST software Help menu. The latest version of LST is available from the Anritsu website: http://www.anritsu.com

The name, propagation velocity, and cable loss of the selected cable is displayed below the graph during distance measurements (**Measurement** > DTF Return Loss or DTF VSWR) as shown in (Figure 3-6).

Waveguide List

The Site Master S820E is equipped with a built-in, predefined waveguide list (**Freq/Dist** > DTF Setup > Waveguide List) including most of the common waveguides currently in use.

Note	If the Waveguide list button is not displaying, then toggle DUT Line Type to WG

After the correct waveguide has been selected, the instrument updates the Cutoff Frequency and the waveguide attenuation values to correspond with the waveguide. For setups with several different types, choose the main feeder waveguide.

For waveguides not on the list, select NONE and manually enter the Waveguide Loss and Cutoff Freq in DTF Aid or the DTF Setup submenu.

Note	Custom waveguide settings that are entered manually are not saved when the instrument is preset, reset, or turned off.

Custom waveguides can be created and uploaded to the instrument using Line Sweep Tools (LST). Instructions for using the LST Waveguide Editor are available in the software's Help menu. The latest version of LST is available from the Anritsu website: http://www.anritsu.com

The name, cutoff frequency, and waveguide loss of the selected cable is displayed below the graph during distance measurements (**Measurement** > DTF Return Loss or DTF VSWR).

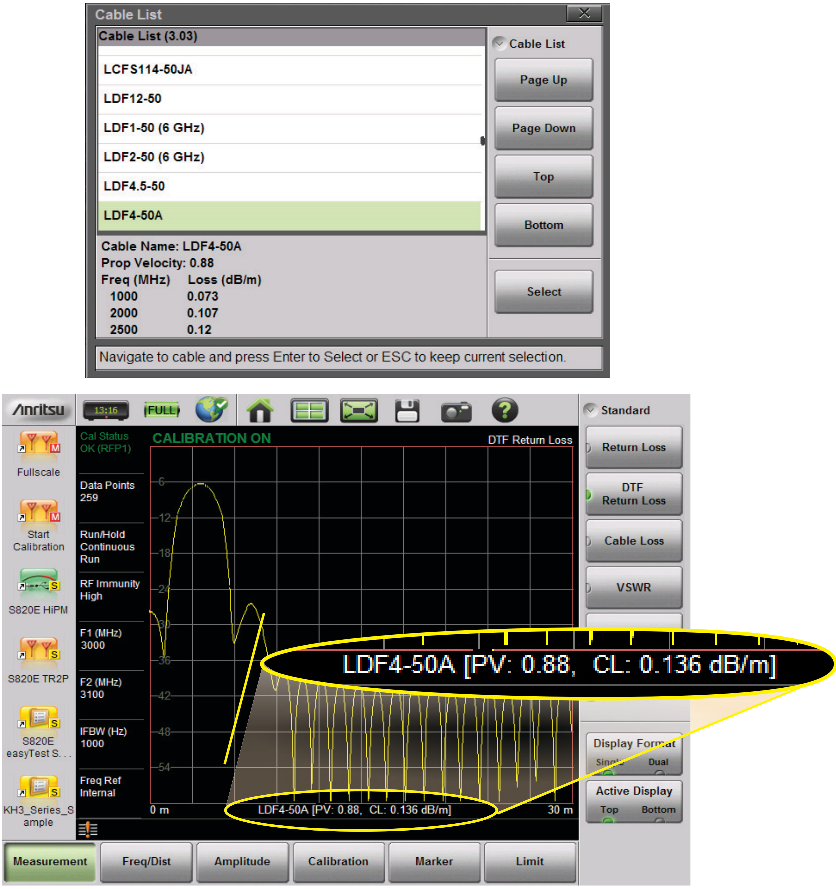


Figure 3-6. Cable List Selection Displayed Under the Graph

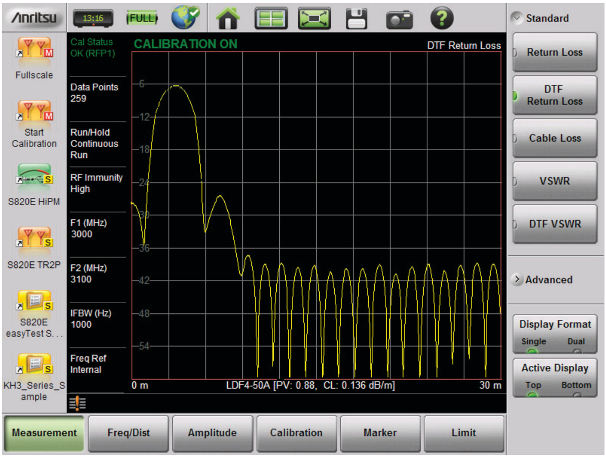
Distance Resolution

Distance resolution is the ability of the Site Master to separate two closely spaced discontinuities. If the resolution is 5 meters and two faults are 3 meters apart, then the Site Master will not be able to show both faults until the resolution is improved by widening the frequency span.

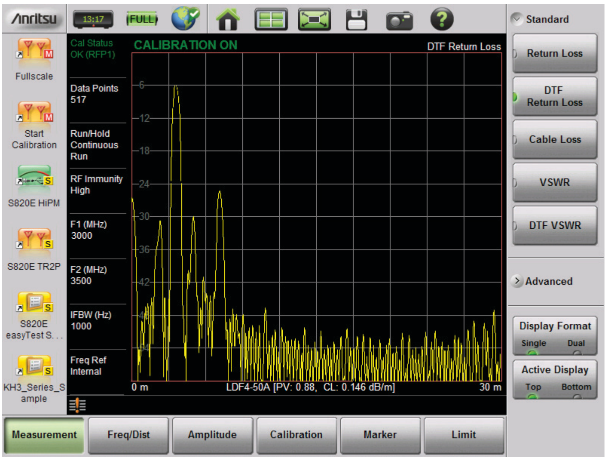
Distance Resolution (m) = 1.5 x 10^8 x PV / ΔF (in Hz)

with Rectangular Windowing applied.

Figure 3-7 is an example of the same DTF measurement with a 100 MHz span versus a 500 MHz span. The increased span provides additional detail that several unique issues may affect the first 10 meters of the cable. This detail was not available in the narrower span.



100 MHz Span



500 MHz Span

Figure 3-7. DTF Measurements at 100 MHz vs. 500 MHz

Windowing

The theoretical requirement for inverse FFT is for the data to extend from zero frequency to infinity. Side lobes appear around a discontinuity because the spectrum is cut off at a finite frequency. Windowing reduces the side lobes by smoothing out the sharp transitions at the beginning and the end of the frequency sweep. As the side lobes are reduced, the main lobe widens, thereby reducing the resolution.

In situations where a small discontinuity may be close to a large one, side lobe reduction windowing helps to reveal the discrete discontinuities. If distance resolution is critical, then reduce the windowing for greater signal resolution.

If two or more signals are very near to each other, then spectral resolution is important. In this case, use Rectangular Windowing for the sharpest main lobe (the best resolution).

In summary:

- Rectangular Windowing provides best spatial distance resolution for revealing closely spaced events, but the side lobes close to any major event (large reflection) may mask smaller events which are close to the major event. Excellent choice if you suspect multiple faults of similar amplitudes close together.
- Nominal Side Lobe Windowing provides very good suppression of close-in side lobes, but compromises spatial distance resolution compared to Rectangular windowing. Closely spaced events may appear as a single event, often non-symmetrical in shape. Excellent overall choice for most typical antenna system sweeps.
- Low Side Lobe Windowing provides excellent suppression of close-in side lobes, but spatial distance resolution is worse than Nominal Side Lobe. The additional suppression of side lobes may be useful in locating very small reflection events further away from large events. *This is not often used for field measurements.*
- Minimum Side Lobe Windowing provides the highest suppression of side lobes but the worst spatial distance resolution. It can be useful for finding extremely small events spaced further apart than the distance resolution. *This is not typically used for field measurements.*

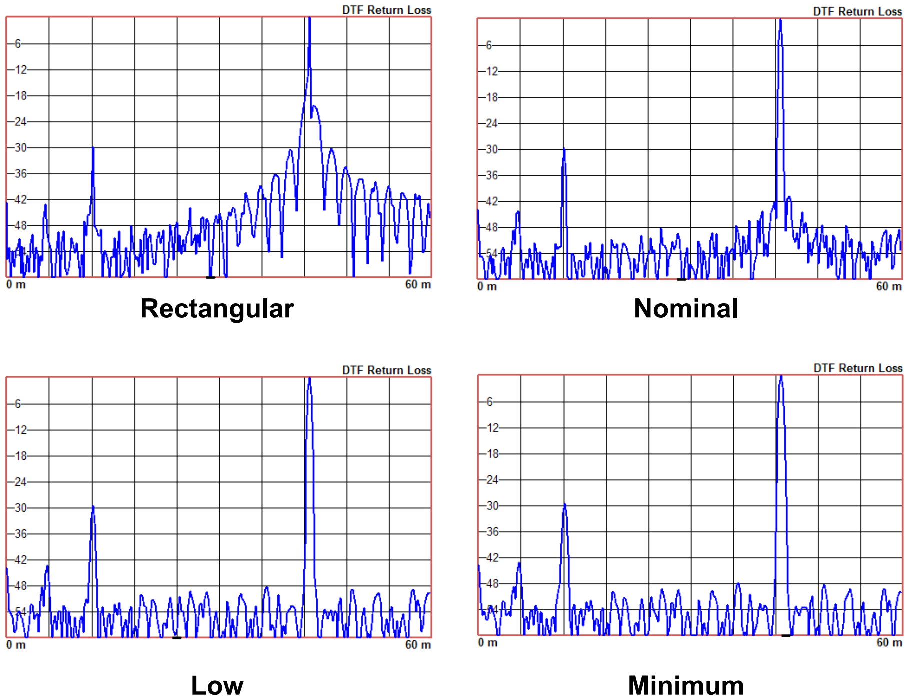


Figure 3-8. Effects of Windowing on a Sample Trace

DMax (Maximum Usable Distance)

DMax is the maximum horizontal distance that can be analyzed. The Stop Distance cannot exceed DMax. If the cable is longer than DMax, then DMax needs to be improved by increasing the number of data points or by lowering the frequency span (ΔF). Note that the data points can be set to 130, 259, 517, 1033, or 2065 (**Sweep** > Data Points).

DMax = (Data points – 1) x Distance Resolution

DTF Measurement Examples

1. Press the **Measurement** main menu key and select DTF Return Loss or DTF VSWR.
2. Press the **Freq/Dist** main menu key.
3. Press the Distance submenu key and then select DTF Aid. Use the touchscreen, rotary knob, or **Up/Down Arrow** keys to navigate through all the DTF parameters.
    - **l.** Highlight a parameter in the DTF Aid table to edit and then press Edit or **Enter** to display a parameter for editing.
    - **m.** Edit all required parameters and then highlight Keep current values – CONTINUE and press **Enter**.

Note	If Stop Distance is greater than DMax, then increase the number of data points or reduce the frequency span accordingly.

4. Connect a phase-stable Test Port cable to the RF Out/Reflect In connector on the Site Master. Press the **Calibration** main menu key to start calibration of the instrument. Refer to Chapter 4 for details.
5. Connect the Site Master to the Device Under Test using the calibrated phase-stable test port cable.

Example 1 – DTF with a Short to Measure Cable Length

To measure the length of a cable, DTF measurements can be made with an open or a short connected at the end of the cable. The peak indicating the end of the cable should be between 0 dB and 5 dB. In Figure 3-9 on page 3-19 the cable end is at 15 meters.

The cable end was found by selecting Marker 3 (**Marker** > Select M(1-8) > M3) then using searching for the trace peak (**Marker** > Marker Search > Marker to Peak).

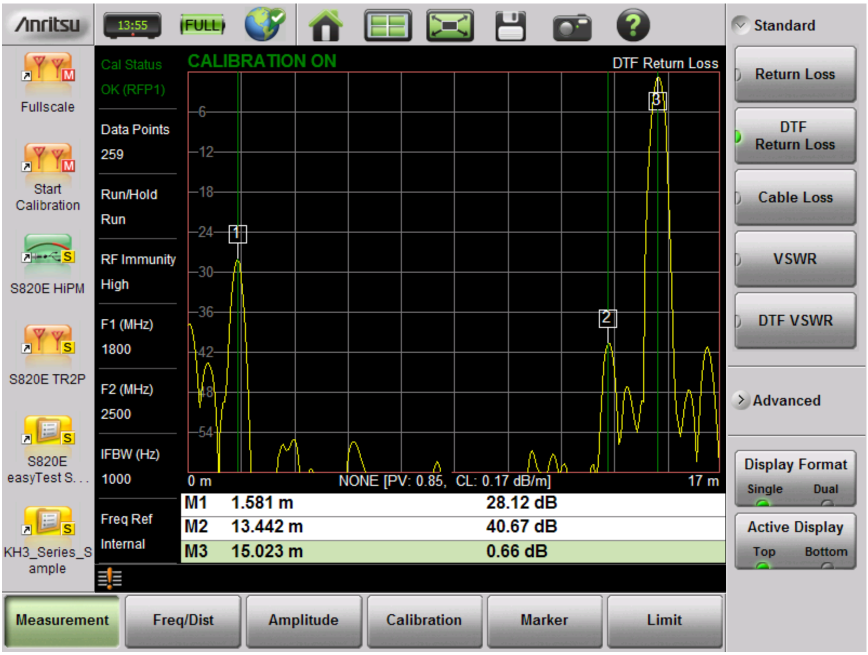


Figure 3-9. DTF Return Loss with Short at End of Cable (15 m)

Note	In Figure 3-9, M1 and M2 are jumper cable connections. The peak beyond the end of the cable at M3 is the return reflection of the M2 peak.

Example 2 – DTF Transmission Line Test

The Distance-To-Fault transmission line test verifies the performance of the transmission line assembly and its components and identifies the fault locations in the transmission line system. This test determines the return loss value of each connector pair, cable component and cable to identify the problem location. This test can be performed in the DTF-Return Loss or DTF-VSWR mode. Typically, for field applications, the DTF-Return Loss mode is used. Figure 3-10 on page 3-20 shows the failure with the antenna still attached.

To perform this test, disconnect the antenna and connect the load at the end of the transmission line (Figure 3-11 on page 3-21).

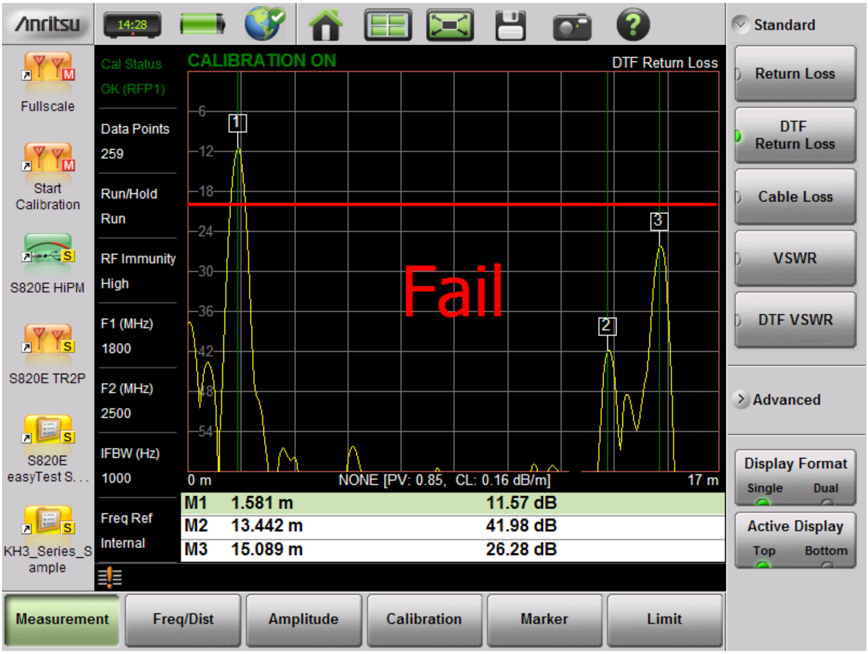


Figure 3-10. DTF Return Loss Measurement (Antenna at 15 m)

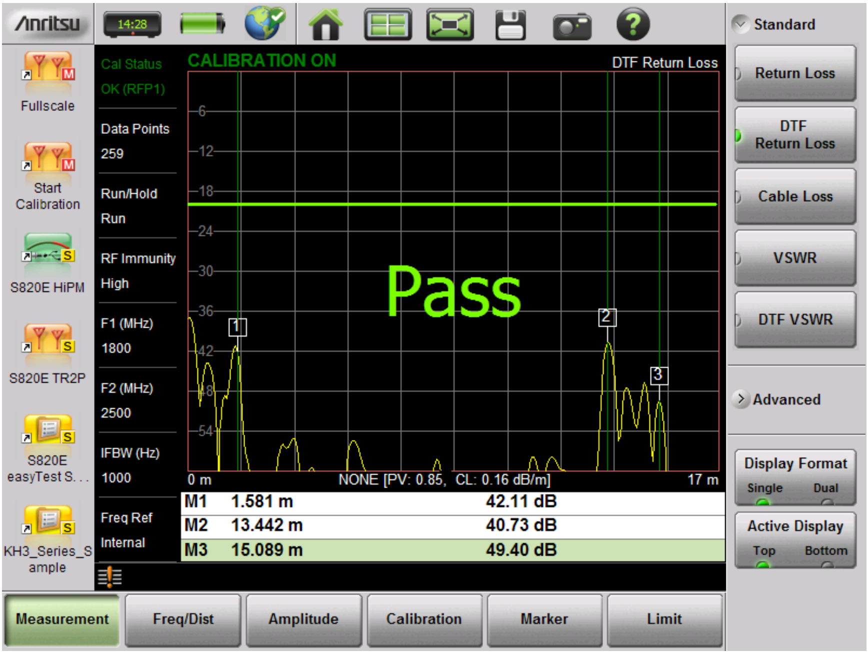


Figure 3-11. Failing DTF Return Loss Measurement (Load at 15 m)

The jumper connector at 1.5 m was found to be loose and dirty. After cleaning and tightening to specification, another DTF measurement showed that the connector now passed the carrier 20 dB specification, indicated by the limit line.

Figure 3-12 shows the same system with the antenna reattached. The reflection of the jumper connector is now reduced to 41.18 dB.

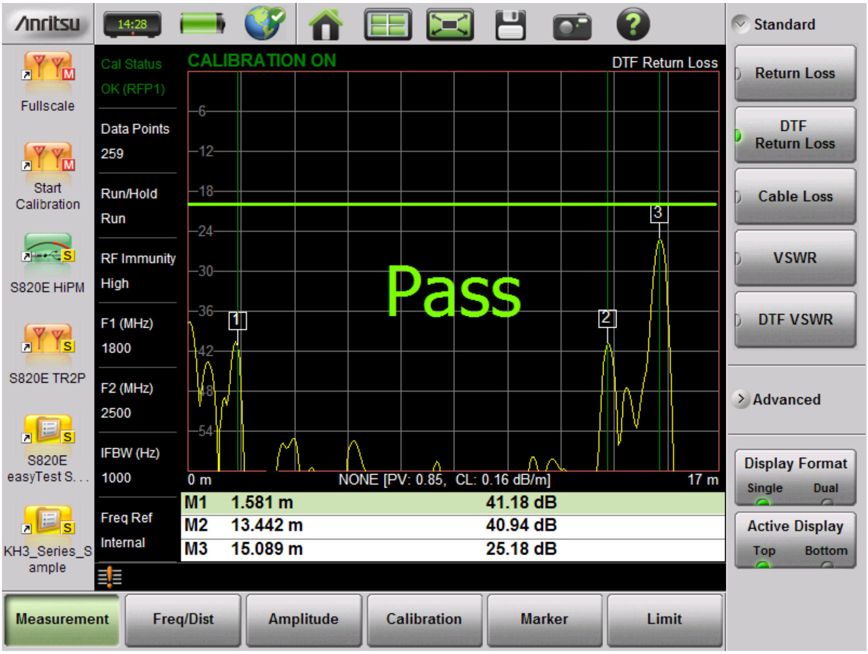


Figure 3-12. DTF Return Loss Measurement (Antenna at 15 m)

3-6 Advanced Measurements

Transmission Measurements

The S820E can measure insertion loss of cables (or other 2-port devices) using three different methods. If you have access to connect only one end of the cable to the instrument, then you must perform either One Port Testing using Cable Loss - One Port mode, or two port Transmission measurements using an external USB sensor.

For One Port Testing, the other end of the cable must be terminated in a short or open to provide a full reflection of the signal. This method provides accurate results when the cable loss is less than 10 dB.

When the cable loss values are higher than 10 dB, then the two-port method must be used to obtain accurate results. If you are able to connect both ends of the cable to Port 1 and Port 2 of the Site Master (either directly or through a port extension cable), then you can use the 2-port Transmission method. If you are able to connect only one end of the cable to the Site Master, then you can use the Transmission measurement with External Sensor.

Press the Advanced submenu key to access the following measurements.

Transmission (2-Port)

The S820E provides the capability to perform 2-port vector-corrected transmission measurements. These measurements are used to verify the performance of amplifiers and duplexers, as well as to verify antenna isolation. The excellent dynamic range also makes this measurement suitable for repeaters. When access is available to both ends of a cable or waveguide, the 2-port transmission measurement provides the most accurate method to measure the attenuation in the cable or waveguide. Figure 3-13 is a 2-Port transmission measurement example for a WR-62 waveguide.

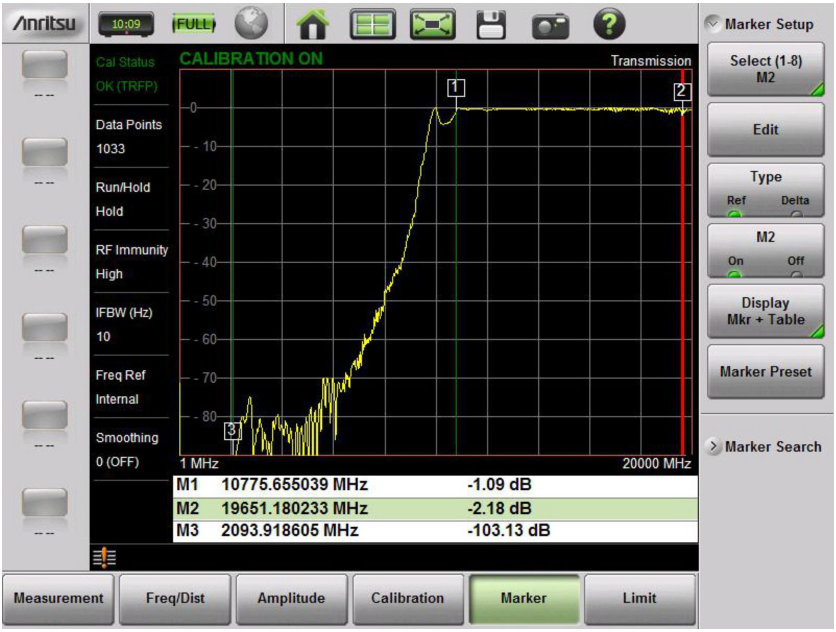


Figure 3-13. 2-Port Transmission Measurement Example, Waveguide

Figure 3-14 is a 2-Port transmission cable loss measurement example.

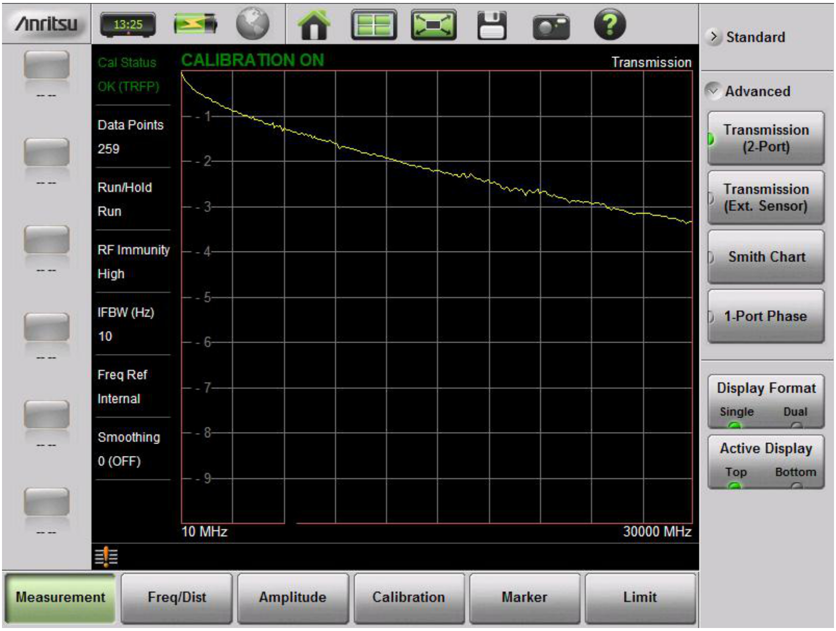


Figure 3-14. 2-Port Transmission Cable Loss Measurement Example

Transmission (Ext. Sensor)

If you are able to connect only one end of the cable to the Site Master, then you can use the Transmission measurement with External Sensor. For this measurement, you connect the cable under test to Port 1 of the Site Master, and you connect a USB transmission sensor or power sensor to the other end of the cable. USB extenders can be used for long cable runs. This measurement provides accurate results of cable loss up to 30 dB. This is a scalar measurement, providing only magnitude data (no phase) and, therefore, does not use vector error correction for its calibration steps. Instead, it uses a sensor reference calibration. Figure 3-15 is a Cable Loss Measurement Example of an External Sensor Transmission.

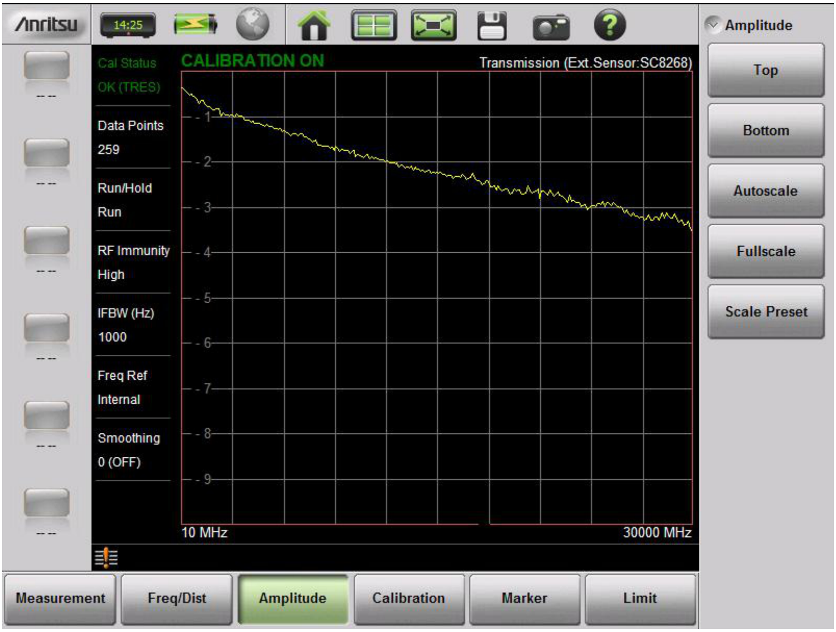


Figure 3-15. External Sensor Transmission Measurement Example

When performing both transmission and return loss measurements on the same cable, for best results, the return loss should be measured with a good-quality termination at the end of the cable.

Figure 3-16 shows a comparison between measurements made using both 2-Port and External Scalar Transmission methods. The 2-Port Transmission measurement will always produce the most accurate results. Even with 20 dB of loss, however, the External Sensor Transmission measurement produces results that are comparable, as shown in the figure.

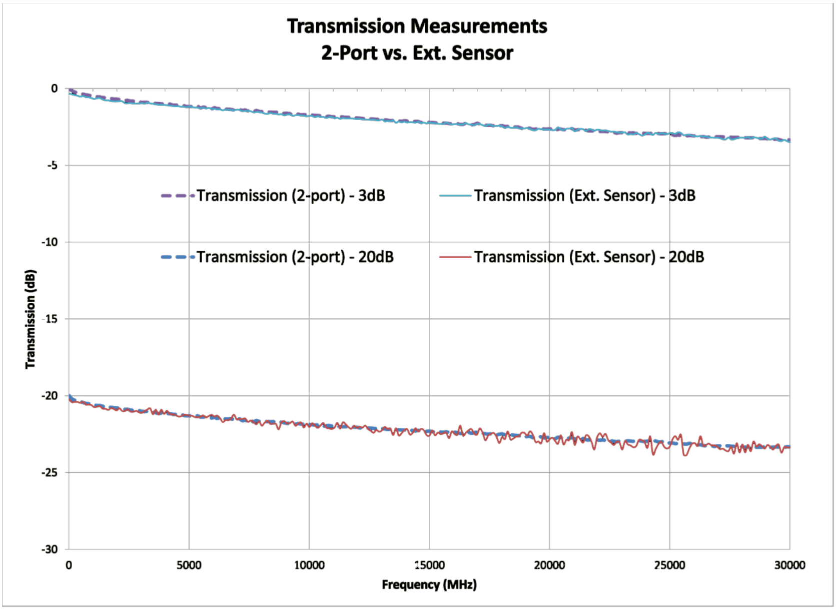


Figure 3-16. Transmission Measurements Compared

Note	The external USB sensors that are supported by the S820E for transmission measurements are the SC8268 Transmission Sensor and the USB power sensors that are listed in the S820E Technical Data Sheet.

Smith Chart

The Smith Chart is a graphical tool for plotting impedance data versus frequency. It converts the measured reflection coefficient data into impedance data and displays it in a manner that makes the Smith Chart a useful tool for determining and tuning input match. This complex impedance plot reveals which matching elements (capacitance, inductance) are necessary to match a device under test to the reference impedance (which can be set to either 50 ohms or 75 ohms). Markers can be used to read the real and imaginary parts of the complex impedance.

1-Port Phase

The S820E can display the phase of the reflection measurements at Port 1. The Phase display range is from –450 degrees to +450 degrees.

The 1-port phase measurement is most useful when making relative measurements (comparing the phase of one device to the phase of another) by utilizing the Trace Math function (Trace – Memory).

3-7 Measurement Setup

This section briefly describes how to setup the Cable and Antenna parameters, markers, and limit lines.

Frequency

Setting up the Measurement Frequency using Start and Stop Frequencies

1. Press the **Freq/Dist** main menu key then Frequency if the menu is collapsed.
2. Press the Start Freq (F1) submenu key and enter the start frequency using the **Up/Down Arrow** keys, rotary knob or keypad. When using the keypad, the button labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key to complete the entry.
3. Press Stop Freq (F2) and enter the stop frequency.

Distance

1. Press the **Freq/Dist** main menu key and then Distance if the menu is collapsed.
2. Press the Start Distance (D1) submenu key and enter the start distance using the **Up/Down Arrow** keys, rotary knob or keypad. When entering a distance using the keypad, press the unit key to complete the entry.
3. Press Stop Distance (D2) and enter the stop distance.

DTF Aid

Refer to "DTF Measurement Examples" on page 3-18.

Amplitude

Setting the Amplitude using Top and Bottom Keys

1. Press the **Amplitude** main menu key.
2. Press the Top submenu key and use the keypad, rotary knob, or the **Up/Down Arrow** keys to edit the top scale value. Press **Enter** to set.
3. Press the Bottom key and use the keypad, rotary knob, or the **Up/Down Arrow** keys to edit the bottom scale value. Press **Enter** to set.

Setting the Amplitude using Autoscale

The instrument automatically sets the top and bottom scales to display the current measurement.

1. Press the **Amplitude** main menu key
2. Press the Autoscale submenu key

Setting the Amplitude using Fullscale

To automatically set the scale to the default setting, press the Scale Preset key.

1. Press the **Amplitude** main menu key.
2. Press the Scale Preset submenu key.

The instrument automatically sets the top and bottom scales to the default values based on the measurement type.

Scale Preset does not default to the maximum allowable scale range. To set the scale to a range greater than the Scale Preset range, either press the Fullscale key to get the maximum settings available for the measurement, or manually enter the value when the parameter entry window is open by using the **Arrow** keys, the rotary knob, or the number keypad.

Refer to "Amplitude Menu" on page 3-61 for additional information.

Sweep

The **Sweep** menu include keys to set Data Points, Run/Hold, Sweep Type, RF Immunity, RF Pwr In Hold, Source Power, IFBW, Smoothing, and Sweep Averaging.

Data Points

The number of data points can be set to 130, 259, 517, 1033, or 2065 data points. This can be changed before or after calibration, with one exception (refer to the **Note** on page 3-31). The default setting is 259. This is recommended for most measurements. Additional data points slow down the sweep speed but are helpful in DTF, because they enable increased distance coverage for the same distance resolution.

1. Press the **Sweep** (**3**) menu key then press Data Points.
2. Select 130, 259, 517, 1033, or 2065 data points.

Refer to “Sweep Menu” on page 3-67 for additional information about the **Sweep** menu and submenus.

Note	Setting Data Points to 2065 can invalidate an active Standard Cal correction that was performed with a lower number of data points. If this occurs, then a new calibration is recommended before making measurements. To prevent this from occurring, set the number of data points to 2065 before performing any calibration. If this step is done before calibrating, then you may freely switch between any number of data points after calibrating.

Run/Hold

Controls if the instrument is actively sweeping the frequency range. When Sweep Trigger Type is set to Single mode, this key also provides a single sweep trigger.

1. Press the **Sweep** (**3**) menu key.
2. Toggle the Run/Hold key.

Sweep Trigger Type

The Sweep Trigger submenu key sets the type of trigger that initiates a sweep. The trigger can be internal (single or continuous) or external. Continuous is the default setting.

In continuous sweep mode, a new sweep is triggered automatically at the end of each sweep. In single sweep mode, each sweep is activated by the Run/Hold key. In external trigger mode, each sweep is activated by a TTL signal at the External Trigger In connector.

1. Press the **Sweep** (**3**) menu key.
2. Toggle the Sweep Trigger key through Single, Continuous, and External Trigger.

RF Immunity

The instrument defaults to RF Immunity Low. When set to High, RF Immunity protects the instrument from stray signals generated by nearby or co-located transmitters that can affect frequency and DTF measurements. The algorithm that is used to improve instrument ability to reject unwanted signals may slow down the sweep speed if interferers are detected. If the instrument is used in an environment where immunity is not an issue, then the RF Immunity key can be set to Low to optimize sweep speed. Use this feature with caution, because the introduction of an interfering signal might be mistaken for a problem with the antenna or cable run. If Immunity is set to Low during a normal Return Loss or VSWR measurement, then the instrument will be more susceptible to interfering signals. Interfering signals can make the measurement look better or worse than it really is.

1. Press the **Sweep** (**3**) menu key.
2. Toggle RF Immunity between High and Low.

RF Pwr In Hold

This setting determines if the RF output power at the RF Out/Reflect In port stays On or is turned Off when the instrument Run/Hold setting is toggled to Hold. When RF Pwr In Hold is set to Off, the power at the port is turned off when the instrument is placed in Hold mode and is not sweeping. Power at the port is resumed when the Run/Hold setting is toggled back to Run. This is useful when you may not want a signal radiating out of the port at all times.

Smoothing

This function sets the level of smoothing applied to a frequency domain measurement trace. A level of 0 % turns smoothing OFF. Levels 1 % through 20 % turn smoothing ON and set the smoothing percentage (the higher the level, the higher the percentage of smoothing applied to the trace). Smoothing is a trace averaging process that reduces or removes ripples from frequency swept data. This is especially useful when making 1-port cable loss measurements with a short at the other end of the cable. The ripple that is usually present in this kind of measurement can be removed with smoothing, thereby resulting in a more accurate average cable loss frequency response trace. Care should be taken when applying smoothing in order to not remove ripples that are inherent parts of the data (as opposed to measurement artifacts).

Sweep Averaging

This function sets the trace averaging process to use the measurement values of the same point in a set number of sweeps (refer to "Data Points" on page 3-30). For settings greater than 1, the Measurement Information displays the current sweep number (since entering the setting) followed by the setting value. For example, if you set the averaging value to 100, then you would see the first number counting from 1 up to 100 as the sweeps are completed. Thereafter, the values would be displayed continuously as 100/100.

A Sweep Averaging setting of 1 means that only one point is used in the averaging calculation, which means that no averaging is being done. The Averaging value that is displayed in the Measurement Information area (item 14 in Figure 2-6 on page 2-15) is "--" when Sweep Averaging is set to 1.

Source Power

The RF power radiated from Port 1 or Port 2 can be adjusted to be either High (nominally –3 dBm) or Low (nominally –20 dBm). The High power setting (default) is optimized in order to maximize the dynamic range of the measurement. The Low power setting must be used whenever the device under test cannot be operated with high power input signals, such as with high gain amplifiers. Care must be taken when making a transmission measurement on an amplifier in order to prevent damage or excessive distortion in the amplifier under test. Take extra caution to ensure that the output of the amplifier under test does not exceed the maximum rated input to the ports on the S820E analyzer.

IFBW

The Intermediate Frequency Bandwidth (IFBW) setting allows users to optimize instrument measurement speed versus dynamic range performance. Lower IFBW values provide higher dynamic range at the expense of measurement speed. Higher IFBW settings provide faster measurement speed at the expense of dynamic range. The default setting is 1 kHz, maximum is 100 kHz, and minimum is 10 Hz.

Limit Lines

Limit lines are used for visual reference or for pass/fail criteria using the limit alarm and pass/fail message setting. Pressing either the **Limit** (**6**) key or the **Limit** main menu key displays the Limit menu.

Overview of limit lines:

- Each measurement has a unique limit line.
- The color of the limit line changes to red when a measurement trace exceeds a limit.
- Select the **Limit** main menu key before trying to move a limit line using the touchscreen.
- Limits set beyond the current amplitude range are displayed at either the top or bottom of the graph.
- The last (most recent) limit line amplitude is stored when a limit line is turned off.
- Limit Preset turns off the limit line display, limit amplitude, limit alarm, and the Pass/Fail message.

Limit Line Functions

1. Press **Limit** (**6**), then press the Active Limit key (if necessary) to choose Upper or Lower, then press the Limit State key to turn On a measurement-specific limit line.

   The limit line can be set as a single or a segmented limit. A single limit line extends over the entire displayed range of the sweep, independent of the start/stop settings of the sweep. For a single limit line, the amplitude for the start and stop points is the same. A segmented limit line can be divided into connected or disconnected segments with different start/stop x and y values.

Note	Both the Upper and Lower limit lines for a trace must be of the same type: either both are Single, or both are Segmented.

2. Press Move Active Limit to set the limit line value by using the **Up/Down Arrow** keys, rotary knob, or number keypad.

Note	Limit lines cannot be moved by using the touchscreen.

Limit Line Segments

3. For segmented limit lines, press Edit Segments to display the Segments menu. A table displays active limit lines and segments.

4. Tap on a limit line segment and then choose to Add, Edit, or Delete the segment. For editing purposes, consider a single, full-span limit line as a single segment. Press the Close submenu key or the escape (**ESC**) key to close the Edit Segments menu and return to the Limit menu.

Upper limit lines and segments are labeled with a “U”, and Lower limit lines and segments are labeled with an “L”. Limit lines are displayed in green so long as the limits are not reached or exceeded. When a limit is exceeded (upper or lower), the limit line or segment turns red (Figure 3-17). Any portion of the measurement trace touching or exceeding a limit also turns red, while portions of the trace within limits remain in the default yellow color. When Segmented Limits are used, the trace color does not change when a limit is exceeded.

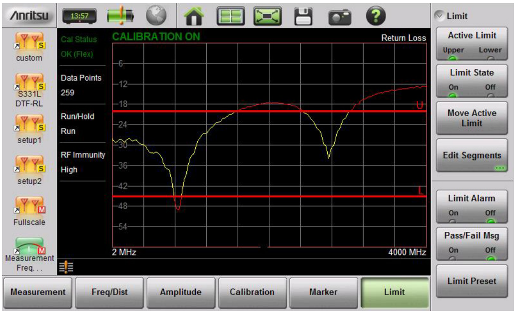


Figure 3-17. Limit Lines and Trace Showing Fail Colors

When editing a segmented limit line, a table is displayed with each segment in a separate row (Figure 3-18). The type is displayed as U or L. The Start and Stop settings are displayed as **Start(x1,y1)** and **Stop(x2,y2)**. In a Return Loss measurement, for example, the x-axis is in units of frequency, and the y-axis is in units of dB.

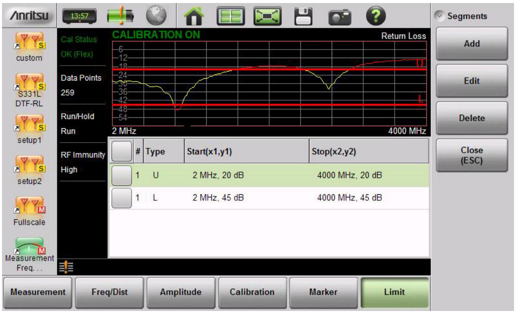


Figure 3-18. Table of Limit Lines (or Segments)

When adding or editing a segmented limit line, a dialog box (Figure 3-19) provides setting choices. You can choose Upper or Lower, then enter the x-axis and y-axis values for the segment Start and Stop. Differing y-axis values result in a sloping line segment.

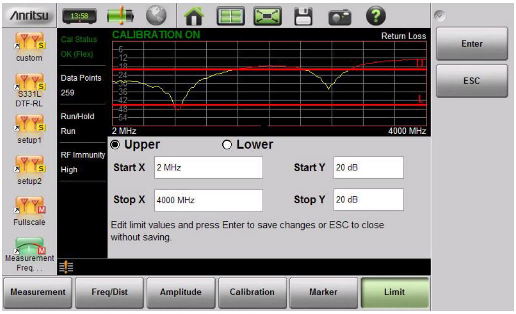


Figure 3-19. Segment Editing Dialog Box

Figure 3-20 shows a sequence of creating limit line segments for a filter measurement.

Figure 3-20. Creating Limit Line Segments

Figure 3-21 shows the result of moving limit line segments. Note that when moving upper or lower segments, all upper segments or all lower segments are moved by the same amplitude value, meaning that all upper or lower segments will move simultaneously. To change the value of a single segment, use the Edit Segments function.

Figure 3-21. Moving Limit Line Segments

Limit Alarm

1. Press the Limit Alarm key to turn On or Off the audible Limit Alarm.
2. Adjust the volume of the limit alarm by pressing **System** (**8**), then System Setups. Press the Display/Audio key and then Volume. Adjust the volume with the **Up/Down Arrow** keys, rotary knob, or the touchscreen. Press Enter to apply the new setting.

Pass/Fail Messages

Figure 3-22 shows the Pass/Fail message. Note that in the Fail message, Upper (U) or Lower (L) or both (U,L) are displayed. To change the size and location of the Pass/Fail message, (when the Limit menu is displayed) tap the small circled arrow in the lower-right corner of the large format message box. The circled arrow is in the upper-left corner when the message is in small format.

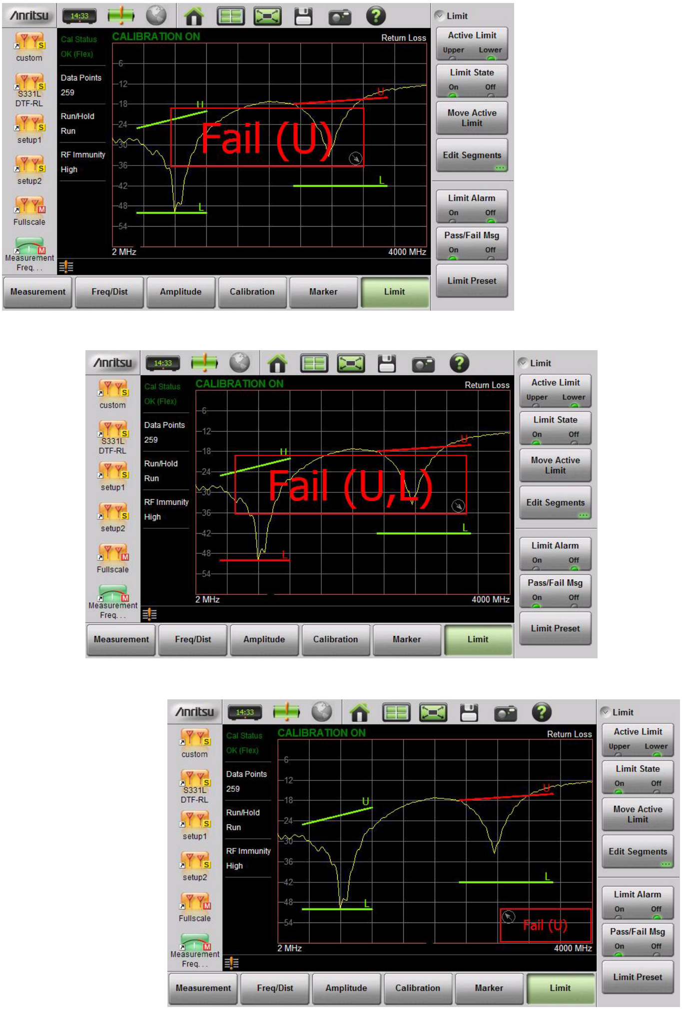


Figure 3-22. Pass/Fail Message Turned On

Markers

Markers can be applied to active or recalled measurements. The instrument supports eight markers. Marker information is stored in measurement files and setup files and is displayed when either file type is recalled. Pressing the **Marker** main menu key displays the marker menu.

Overview of Markers

- Frequency measurements (Return Loss, Cable Loss, and VSWR) have common markers. Distance measurements (DTF Return Loss and DTF VSWR) also have common markers.
- Press and hold on a marker to select and display the amplitude and frequency/distance information. Drag a marker to move it.
- The selected marker displays a vertical red line and has its value displayed in the highlighted row in the marker table. Select a marker to edit by using the touchscreen or the Select (1-8) marker button.
- Selected markers can be quickly dragged to a new location using the touchscreen or can be moved by double tapping on the display, by using the **Arrow** keys, or by using the rotary knob.
- Markers can be selected (and moved) outside of the **Marker** menu. Tap on a marker (thin green vertical line) to make it active and ready for moving.
- Markers set beyond the current frequency or distance range are displayed at either the left or right of the graph.
- If the frequency (F1 or F2) or distance (D1 and D2) parameters are moved inside a current marker location, then the out of range (---> or <----) indicator is displayed, and marker values in the Table are blanked (--). See Figure 3-23 for an example of markers beyond the current span.
- Markers beyond the current span cannot be edited.
- Marker location and type are stored when the marker is turned off.
- Marker Preset restores the markers to their default state. All markers are turned off except for Marker 1 which is set to the middle of the sweep. Previous marker information is not saved.

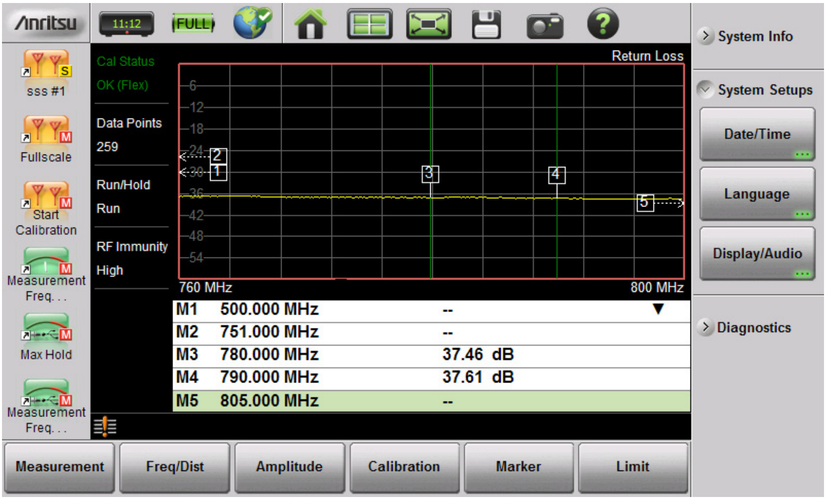


Figure 3-23. Markers 1, 2, and 5 are Out of Range

Select, Activate, and Place a Marker / Delta Marker

1. Press the **Marker** main menu key. One of the markers is automatically selected. Select a different marker with the Select(1–8) button or the touchscreen (refer to “Overview of Markers” on page 3-40). Press one of the Marker buttons to turn the marker on and to make the marker active. The active marker has a red vertical line.
2. Press the Edit submenu key, and use the **Up/Down Arrow** keys, the keypad, the rotary knob, or the touchscreen to move the marker.
3. Markers 2 through 8 can be set as deltas to a reference marker. Use the Type key to set the marker type as Reference or Delta marker. Figure 3-24 on page 3-42 illustrates using a delta marker to estimate the passband of a filter.

Marker Table

The Marker Table is displayed below the sweep window. The table is automatically sized to display all markers that are turned on. The table displays marker frequency/distance, amplitude, and delta information for delta markers. To display the marker table:

Press the **Marker** main menu key then Display. Select Mkr + Table.

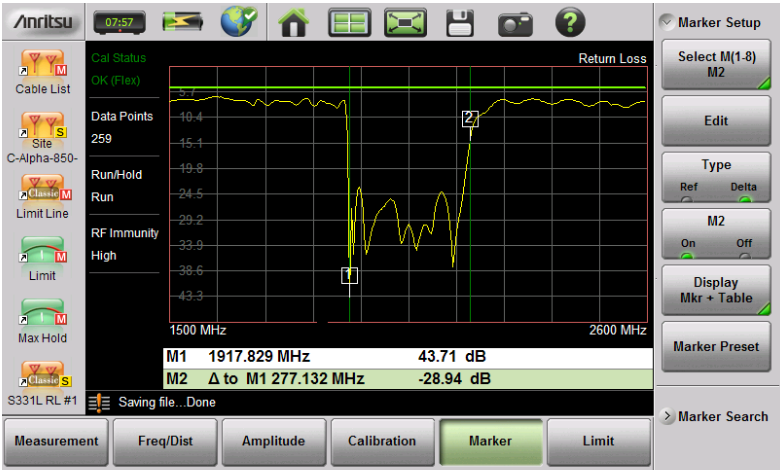


Figure 3-24. Delta Marker 2 and Marker Table

Marker Search

All of the cable and antenna measurements include markers that can automatically find trace peak and trace valley.

1. Press the **Marker** main menu key then Marker Setup. Select the marker to be used for peak or valley.
2. Press Marker Search.
3. Press Marker To Peak to set the marker to the peak of the measurement, or press Marker To Valley to set the marker to the valley of the measurement.

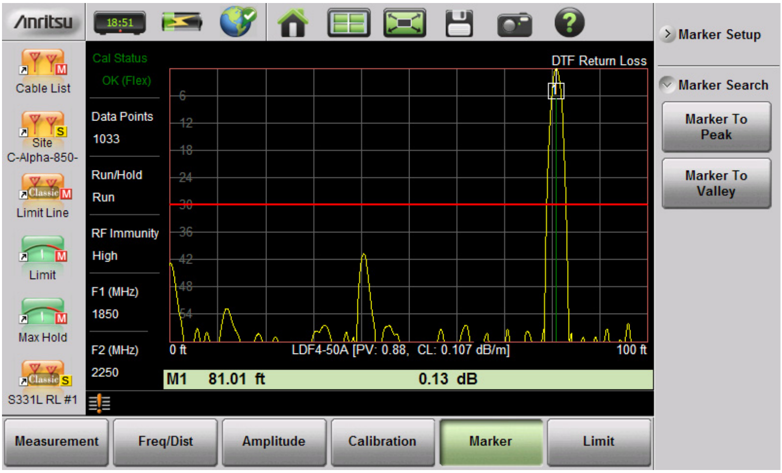


Figure 3-25. Marker Search, Marker 1 Set to Peak

Peak Between Markers

Another marker search option is to select the peak or valley between two Markers instead of the entire displayed frequency or distance span.

Markers 5 and 7 can be used to find the peak or valley between Marker 1 and Marker 2.

Markers 6 and 8 can be used to find the peak or valley between Marker 3 and Marker 4.

1. Press the **Marker** main menu key and set the locations for Marker 3 and Marker 4. Refer to "Select, Activate, and Place a Marker / Delta Marker" on page 3-41 for details.
2. Select Marker 5.
3. Press Marker Search and select Peak between M1 & M2 or Valley Between M1 & M2. Marker 5 then moves to the peak or valley between M1 and M2.
4. In Figure 3-26 on page 3-44, Marker 5 moved to the valley bounded by M1 and M2 instead of the lowest point (48 dB) to the left of Marker 1. The valley search would also work if M1 and M2 were set and then turned off.

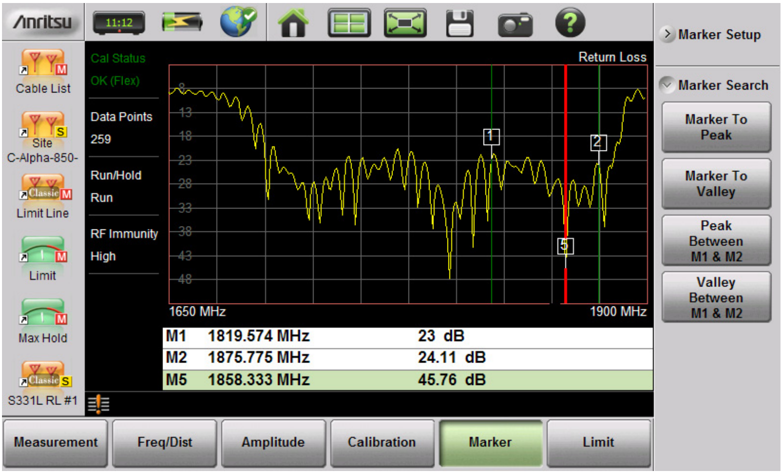


Figure 3-26. Bounded Marker Search

Note	Searching for peaks or valleys turns on any required markers and places them in the default locations.

Tracking Markers

A tracking marker is set to a peak or to a valley. As the peak (or valley) varies in the measurement trace, the tracking marker stays at the peak (or valley).

Any marker can be set for tracking from the Marker Search menu. When set to Tracking, the marker number is displayed inside a triangle rather than a rectangle. For a Tracking marker set for Marker To Peak, the apex of the triangle points upward. For a Tracking marker set for Marker To Valley, the apex of the triangle points downward.

The markers that can be set for Peak Between can also be Tracking markers that are bounded by M1 and M2 or by M3 and M4.

Tracking markers can be especially helpful for specific measurements, such as tuning and testing filters or antennas.

In Figure 3-27, Marker M1 is set for Tracking a Valley. The three images show how the marker remains at the valley as the measurement trace changes.

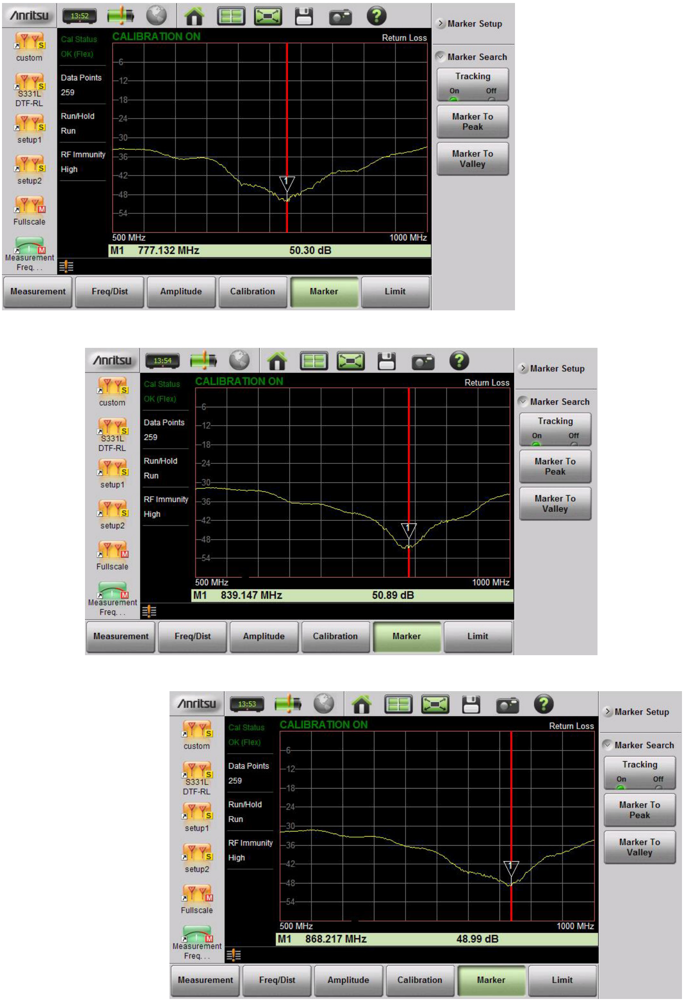


Figure 3-27. Tracking Marker Set to Valley

In Figure 3-28, Marker M5 is set for Tracking a Valley between markers M1 and M2. Marker M6 is Tracking a Valley between markers M3 and M4. The table of markers (below the sweep window in Figure 3-28) shows only 4 markers, but the table can be expanded or reduced by tapping on the table.

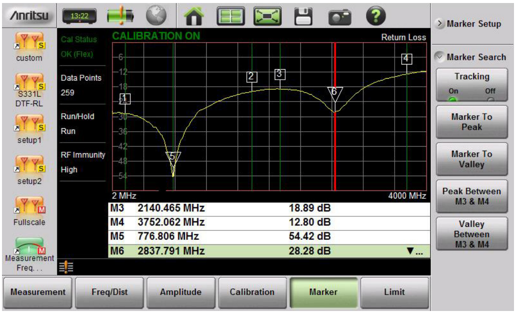


Figure 3-28. Tracking A Valley Between Markers

3-8 Trace

The Site Master S820E allows you to concurrently view the live trace plus a second trace that is stored in trace memory. You can compare the two traces visually or by using trace math functions. Pressing the **Trace** (**5**) main menu key brings up the trace functions.

Overview of Traces

- Recalled measurements (`.dat` files) from internal memory or a USB stick are automatically copied to trace memory and are then available to be displayed. To display the recalled measurement trace along with the live measurement, select Trace & Memory from the Trace Display menu.

Note	Recalled measurements may change the current instrument settings.

- Copy Trace to Memory replaces whatever is in memory with the live (yellow) trace. The memory trace (purple) is displayed behind the live (yellow) trace.
- The default view is live Trace Only. View options (Trace Display) also include viewing only the trace in memory or both traces.
- View only trace memory to have marker values apply to the purple trace.

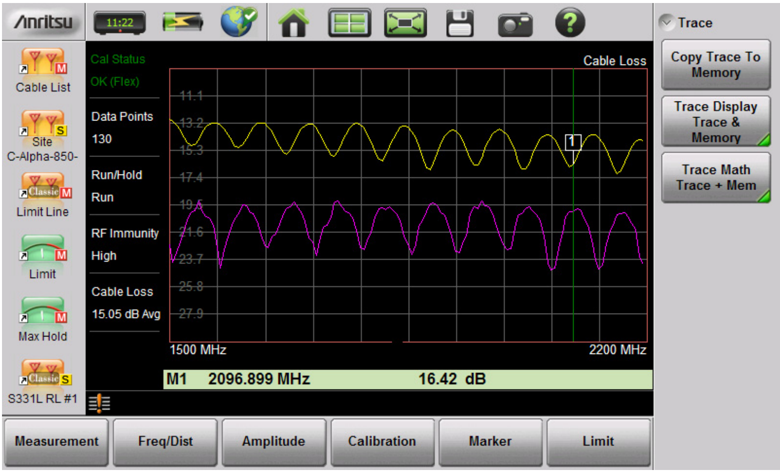


Figure 3-29. Displaying a Live Trace and a Static Trace from Trace Memory

From the **Trace** menu you can Copy Trace to Display Memory. The copied trace can be displayed on the Site Master and used for trace math. Trace Display allows viewing of two traces at the same time to compare the trace stored in memory to the live trace. Trace Math operations include Trace - Memory, Trace + Memory and (Trc + Memory) / 2. Saved traces can also be recalled and compared with the live trace.

Trace Overlay

The examples below illustrate how the trace overlay feature can be used to compare the return loss measurements between two cables.

1. Connect the first cable and setup the measurement. Refer to "Measurement Setup" on page 3-29 for additional information.
1. Press **Trace** (**5**) and then Copy Trace To Memory.
2. Remove the first cable and connect the second cable.
3. Press Trace Display and select Trace & Memory. The purple trace from trace memory is displayed along with the live (yellow) trace.

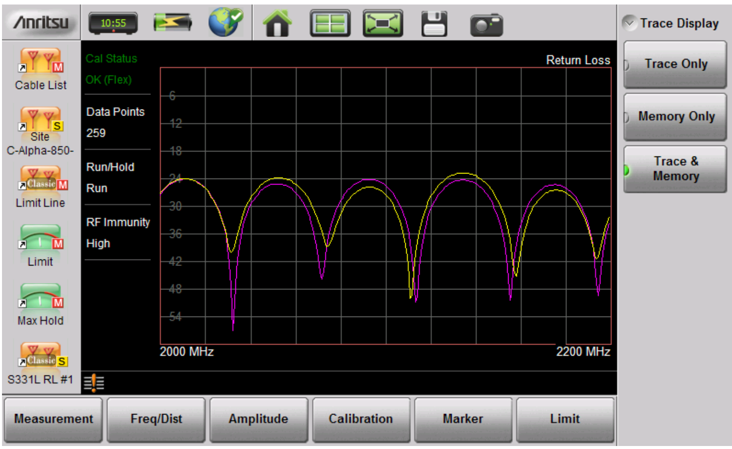


Figure 3-30. Trace Overlay of Two Cables

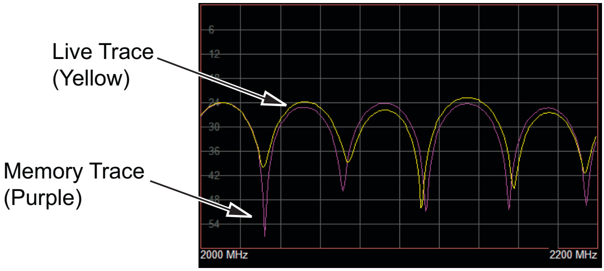
Note	The trace from memory can be displayed only if the measurement settings (except for Amplitude) have not changed since the trace was copied to memory. If one of the traces is cut off, then pressing **Amplitude** > Fullscale adjusts the reference level to display both traces.

Trace Math Example

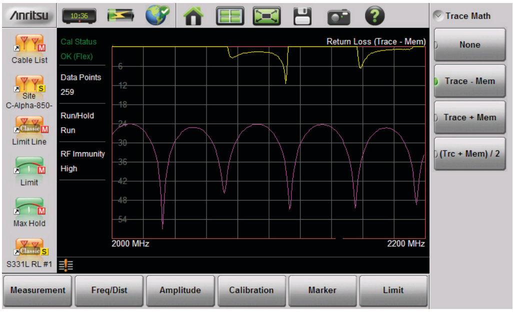
The example below illustrates how the trace math features can be used to compare the measurement of two cables.

1. Complete the steps described in “Trace Overlay” on page 3-48.
2. Press Trace Math and select Trace – Mem, Trace + Mem, or (Trc + Mem) / 2 (Figure 3-31 on page 3-50).

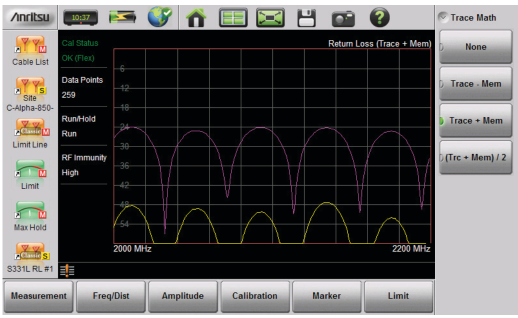
.



Example A. Sample Traces



Example B. Trace - Memory



Example C. Trace + Memory

Figure 3-31. Trace Memory Used to Compare Return Loss of 2 Cables

Notes	The trace math functions often seem backwards to new users. The points to remember with Trace - Memory, Trace + Memory, and (Trc + Mem) / 2 are: • The numbers on the y-axis are negative. • The purple trace is added to or subtracted from the live trace. The sum or difference of the live trace and memory trace is displayed in yellow.

Table 3-1. Trace Math Details (Example from Figure 3-31) (1 of 2)

Example	Example Description
A. Sample Traces	Shows the live yellow trace and purple memory trace.
B. Trace - Memory	In the Trace – Memory graph, the yellow trace is the result of subtracting the purple memory trace from the active trace. (The active trace is displayed in Example B, Trace – Memory as the yellow trace, and appears different because trace math is applied to it.) Note that the yellow Trace – Memory is at 0 or above (and off the graph) whenever the yellow trace (as shown in Example A) is above (has a greater value than) the purple trace. The two down sloping bumps in Example B are when the purple trace (in Example A) moves above the yellow trace. In Trace – Memory, this results in a negative value being displayed.
C. Trace + Memory	In the Trace + Memory graph, the yellow trace is the result of adding the purple trace to the active trace. (The active trace is displayed in Example C, Trace + Memory as the yellow trace, and appears different because trace math is applied to it.) Note that the yellow Trace + Memory is below 60 (and off the graph) whenever adding the yellow trace value to the purple trace value is greater than 60 (refer to Example A).

Table 3-1. Trace Math Details (Example from Figure 3-31) (2 of 2)

Example	Example Description
(Trace + Memory) / 2 *(not shown)*	In the (Trace + Memory) / 2 graph, the yellow trace is the result of adding the purple trace to the active trace and then dividing the result by 2. This math function is most useful when measuring one-port Cable Loss (using the Cable Loss measurement). 1. Connect a Short to the end of the cable and store the trace into memory. 2. Next, connect an Open to the end of the cable and apply (Trc + Mem) / 2 math function. Because the ripple generated by the Short and Open are 180° out of phase, the effect of this math function will be to cancel out the ripple, resulting in a more accurate cable loss measurement.

Refer to "Trace Menu" on page 3-69 for additional information.

3-9 Cable and Antenna Analyzer Menus

Figure 3-32 and Figure 3-33 show maps of the menus. Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

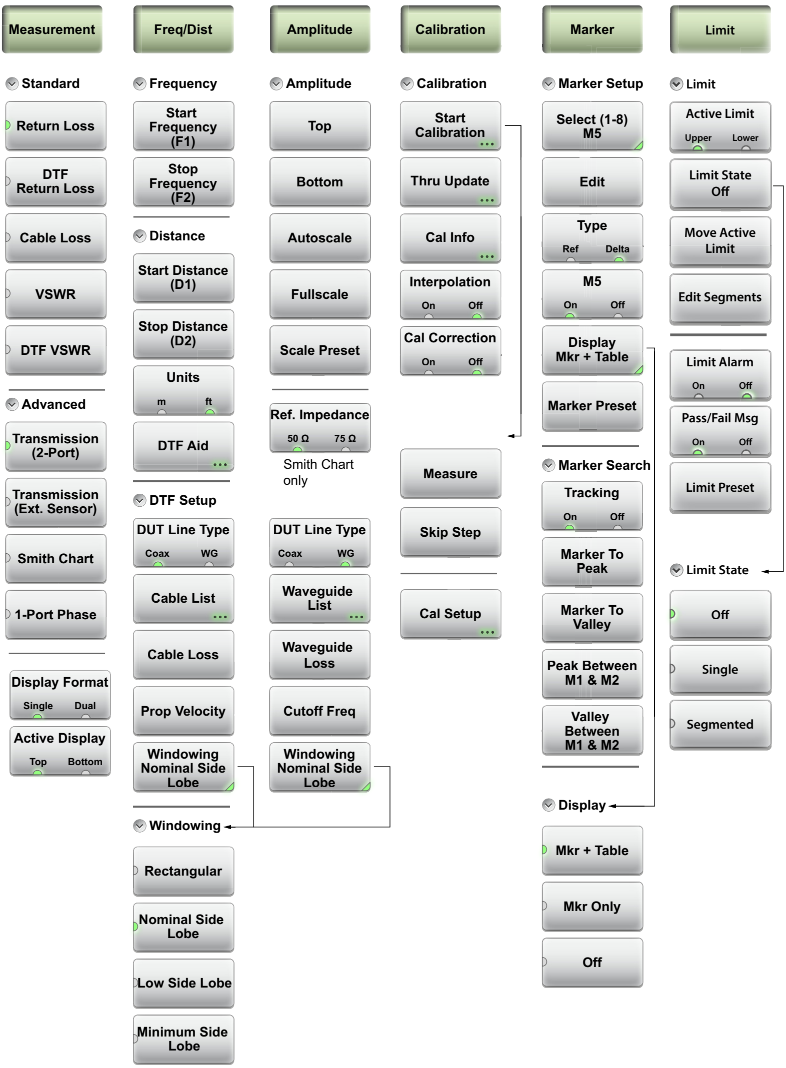


Figure 3-32. Menu Keys (1 of 2)

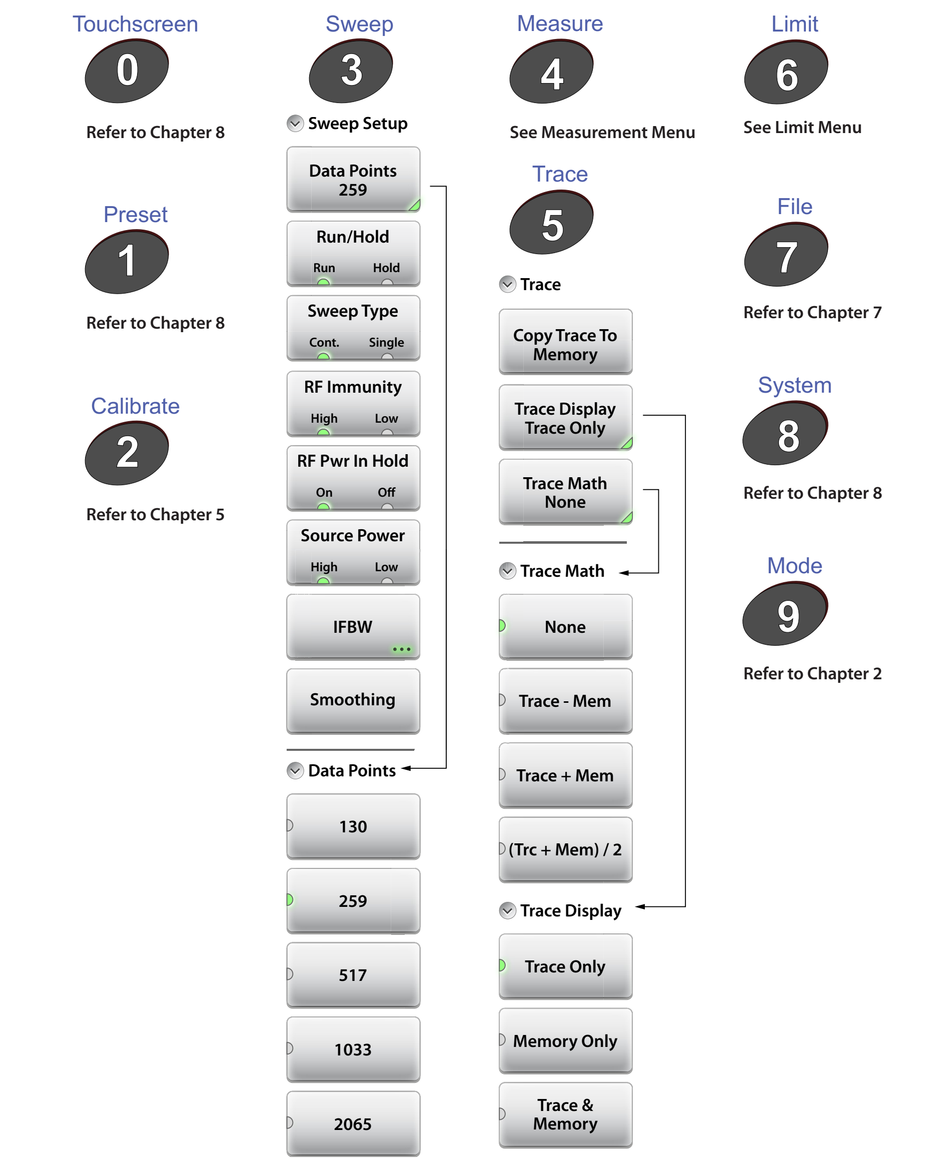


Figure 3-33. Main Menu Keys (2 of 2)

3-10 Measurement Menu

Key Sequence: **Measurement**

Standard

NOTE: All Standard measurements listed below apply only to devices under test that are connected to Port 1 of the Site Master.

Return Loss: Return Loss is used to characterize RF components and systems. The Return Loss indicates how well the system is matched by taking the ratio of the reflected signal to the incident signal, and measuring the reflected power in dB.

DTF Return Loss: The DTF measurement displays return loss values versus distance. If the frequency measurements fail or indicate a problem in the system, then the DTF measurement can be used to identify and pinpoint the exact location of the problem. The DTF measurement shows the return loss value of all the individual components including connector pairs and cable components.

Cable Loss: The cable loss test verifies the signal attenuation level of the cable.

VSWR: Press the VSWR submenu key to view the impedance match in VSWR. VSWR is a ratio of voltage peaks to voltage valleys.

DTF VSWR: Press this submenu key to display VSWR values versus distance. If the frequency measurements fail or indicate a problem in the system, then the DTF measurement can be used to identify and pinpoint the exact location of the problem. The DTF measurement shows the VSWR value of all the individual components including connector pairs and cable components.

Advanced and Common: Shown on next page.

Figure 3-34. Measurement Menu

Measurement Menu (continued)

Standard (Shown on previous page.)

Advanced

Transmission (2-Port): Press this submenu key to measure through the DUT. The Transmission measurement between Port 1 and Port 2 is used to measure the loss (or gain) in dB of a device. This measurement requires that the device be connected directly (or through a test port cable) to both ports of the instrument.

Transmission (Ext. Sensor): Press this submenu key to measure through the DUT. The Transmission measurement between Port 1 and an External USB Sensor is used to measure the loss (or gain) in dB of a device. This measurement requires that one port of the device be connected directly (or through a test port cable) to Port 1 of the Site Master. The second port of the device connects to the External USB Sensor. This measurement is useful when both ends of the device under test (DUT) are far away from each other and cannot both be connected to the Site Master at the same time.

Smith Chart: Press this submenu key to view the measurement results in a Smith Chart. The Smith Chart is a graphical tool that is used to plot the impedance of the device connected to Port 1 of the Site Master. It converts the measured reflection coefficient data into impedance data and displays it in a manner that makes the Smith Chart a useful tool for determining and tuning input match. This complex impedance plot reveals which matching elements are necessary to match a device under test to the reference impedance (which can be set in the Amplitude menu to either 50 Ω or 75 Ω).

Figure 3-35. Measurement Menu

Measurement Menu (continued)

Advanced (continued)

1-Port Phase: Press this submenu key to set the phase of a reflection measurement. 1-Port phase displays the phase of the reflection measurement of the device that is connected to Port 1. The data are displayed from –180° to +180° because the measurement cannot tell the difference between one cycle and the next. This display method removes the discontinuity from the important 0 degrees area that is used as the phase reference.

The 1-port phase measurement is most useful when making relative measurements (comparing the phase of one device to the phase of another) by utilizing the Trace Math function (Trace – Memory).

Common

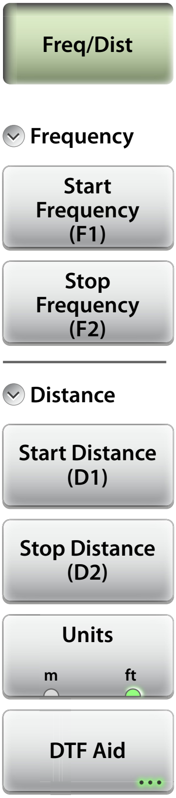
Display Format
Single Dual: Press this submenu key to toggle the sweep window to show one trace (Single) or two traces (Dual).

Active Display
Top Bottom: Press this submenu key to toggle the setting of the active trace. You can also touch either trace to make it the active trace.

Figure 3-36. Measurement Menu

3-11 Freq/Dist Menu

Key Sequence: **Freq/Dist**



Frequency

Start Frequency (F1): Press the Start Frequency (F1) submenu key and enter the desired frequency using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key.

Stop Frequency (F2): Press the Stop Frequency (F2) submenu key and enter the desired frequency using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key.

Distance

Start Distance (D1): Press the Start Distance submenu key and enter the desired distance using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a distance using the keypad, press the appropriate units key.

Stop Distance (D2): Press the Stop Distance submenu key and enter the desired distance using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a distance using the keypad, press the appropriate units key.

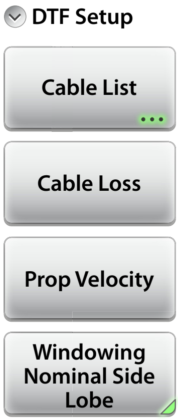
Units: Press the Units key to toggle distance units between meters and feet.

DTF Aid: Opens the DTF Aid dialog box (Figure 3-5). This interactive parameter box allows setting multiple parameters and displays maximum testing distance and resolution.

Figure 3-37. Frequency/Distance Menu (1 of 2)

Freq/Dist Menu (Continued)

Key Sequence: **Freq/Dist**



DTF Setup

Cable List: The Cable List submenu key opens a list of available cable specifications (Figure 3-6). Using **Up/Down Arrow** keys, the rotary knob, or the touchscreen, select the desired cable and press Enter.

Note: When a cable is selected from this list, propagation velocity and cable loss are automatically set by the instrument. If the preselected values for propagation velocity or cable loss are changed, then the analyzer will use “NONE” as the cable type.

Cable Loss: Press the Cable Loss submenu key and enter the loss in dB/ft or dB/m for the selected cable using the keypad, **Up/Down Arrow** keys, or the rotary knob and press **Enter**.

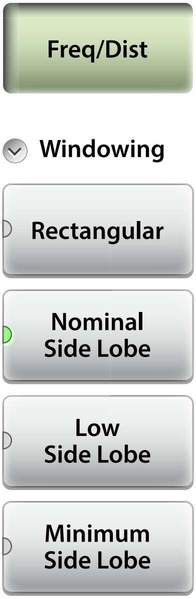
Prop Velocity: Press the Prop Velocity submenu key and enter the applicable propagation velocity for the selected cable using the keypad, **Up/Down Arrow** keys, or the rotary knob and press **Enter**.

Windowing: Opens the “Windowing Menu” on page 3-60.

Figure 3-38. Frequency/Distance Menu (2 of 2)

Windowing Menu

Key Sequence: **Freq/Dist > DTF Setup > Windowing**



Rectangular: Rectangular Windowing shows the highest side lobe levels (worst) and the greatest main lobe resolution (best).

Nominal Side Lobe: Nominal Side Lobe Windowing shows less side lobe levels than Rectangular Windowing (good) but lower main lobe resolution (very good).

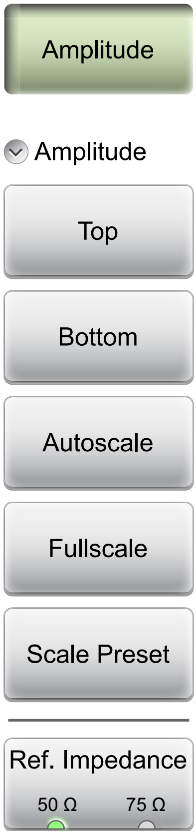
Low Side Lobe: Low Side Lobe Windowing shows less side lobe levels than Nominal Windowing (very good) but lower main lobe resolution (good).

Minimum Side Lobe: Minimum Side Lobe Windowing shows the lowest side lobe levels (best) but the least main lobe resolution (worst).

Figure 3-39. Windowing Menu

3-12 Amplitude Menu

Key Sequence: **Amplitude**



Amplitude

Top: Sets the top amplitude value using the keypad, the **Arrow** keys, or the rotary knob. Press **Enter** to complete the entry.

Bottom: Sets the bottom amplitude value using the keypad, the **Arrow** keys, or the rotary knob. Press **Enter** to complete the entry.

Autoscale: Automatically sets the top and bottom scales to the minimum and maximum values of the measurement with some margin on the y-axis of the display.

Fullscale: Fullscale automatically sets the scale to the maximum allowable setting for each measurement.

Scale Preset: Scale Preset automatically sets the scale to the default setting: 0 dB to 60 dB for Return Loss measurements, 0 dB to 30 dB for Cable Loss, 1 to 3 for VSWR measurements, and +10 dB to –90 dB for Transmission measurements.

The following submenu key appears only for Smith Chart measurements, and is then the only submenu key in the Amplitude Menu:

Ref. Impedance
50 Ω 75 Ω: Sets the reference impedance that is used for Smith Chart calculations to either 50 Ω or 75 Ω. The reference impedance determines the value of impedance at the center of the Smith Chart.

Figure 3-40. Amplitude Menu

3-13 Calibration Menu

Key Sequence: **Calibration**

Calibration

Start Calibration: Opens the Calibration dialog box. Refer to Chapter 4, “Calibration, CAA” for detailed information.

Thru Update: Opens the Calibration dialog box to allow calibrating the Thru component without repeating the entire calibration sequence. This key is displayed only after a calibration with a Thru component.

Cal Info: Displays the Calibration Information table showing the current and active calibration settings. See Figure 4-3 on page 4-3.

Interpolation
On Off: Press this submenu key to toggle Interpolation On or Off. After performing a calibration, you can turn Interpolation On and then change the frequency range (smaller) or change the number of data points (to be higher than 1033).

Cal Correction
On Off: Turn Cal Correction On to apply the correction factor to the current measurement.

Measure: Starts the calibrations process. Follow the on screen instructions.

Skip Step
Previous Step: Press this submenu key to skip the current calibration step. In the dialog box for the next step, the button label becomes Previous Step, which returns to the dialog box of the step just skipped.

Cal Setup: Press this submenu key to choose a calibration type.

Figure 3-41. Calibration Menu

3-14 Marker Menu

Key Sequence: **Marker**

Marker Setup

Select (1–8) M#: Press to turn on a marker (1 to 8) and selects which marker is active (green half circle). Current active marker is displayed on the button (M1).

Edit: Press to change the position of the active marker using the **Up/Down Arrow** keys, rotary knob or the keypad.

Type: Sets the current active marker as a reference (standard) marker or a delta marker to Marker 1. Marker 1 is always a reference marker.

M# (On Off): Toggles the display of the active marker on or off. When off the location of the marker is stored.

Display (Mkr + Table, Mkr Only, Off): Press to open display options.

> **Mkr+Table:** Displays both the markers that are on and marker table.
>
> **Mkr Only:** Displays markers that are on, hides the marker table.
>
> **Off:** Hides all markers and the marker table.

Marker Preset: Turns off all markers except for Marker 1. Sets Marker 1 location to the middle of the sweep.

Figure 3-42. Marker Menu (1 of 2)

Marker Menu (Continued)

Key Sequence: **Marker**

Marker Search

Tracking (On Off): When turned On, the active marker becomes a tracking marker and defaults to tracking the peak. To track Valleys, press the Marker to Valley button after turning on Tracking. The Search settings can all be applied to a Marker with Tracking either On or Off.

Marker to Peak: Places the currently active marker on the highest signal amplitude currently displayed on screen.

Marker to Valley: Places the currently active marker on the lowest signal amplitude currently displayed on screen.

Markers 5, 6, 7, and 8 can perform a special Marker search to find the Peak or Valley between two other markers.

When Marker 5 or Marker 7 is Active:

Peak Between M1 & M2: Places Marker 5 or 7 on the highest signal amplitude between Marker 1 and Marker 2.

Valley Between M1 & M2: Places Marker 5 or 7 on the lowest signal amplitude between Marker 1 and Marker 2.

When Marker 6 or Marker 8 is Active:

Peak Between M3 & M4: Places Marker 6 or 8 on the highest signal amplitude between Marker 3 and Marker 4.

Valley Between M3 & M4: Places Marker 6 or 8 on the lowest signal amplitude between Marker 3 and Marker 4.

Figure 3-43. Marker Menu (2 of 2)

3-15 Limit Menu

Limit lines can be used for visual reference only, or for pass/fail criteria using the limit alarm and Pass/Fail Message keys. Limit alarm failures are reported whenever a signal crosses the limit line.

Key Sequence: **Limit** (**6**) or **Limit**

Limit

Active Limit (Upper Lower): This key toggles the active limit line settings to the Upper or Lower limit.

Limit State: Press this key to display the Limit State menu and select one of three limit states: Off, Single, or Segmented. The current limit state is displayed on the key.

Move Active Limit: Press this key to change the amplitude of the limit line with the **Up/Down Arrow** keys, rotary knob, or the number keypad. If the limit line is divided into segments, then all segments move by the same amount.

Edit Segments: Press this key to display the Segments menu and a table of limit line segments. Tap a segment (Upper or Lower), and then choose a function from Figure 3-46, “Limit Line Segments Menu” on page 3-66.

Limit Alarm (On Off): When turned On, the Limit Alarm sounds a repeating beep when the trace touches the limit line.

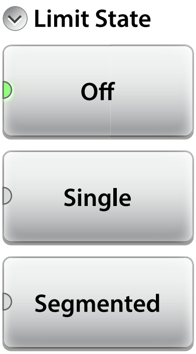
Pass/Fail Msg (On Off): When turned On, a Pass or Fail message is displayed to indicate whether the trace touches or exceeds the limit line (Fail).

Limit Preset: Turns the limit line off and clears amplitude information. The next time that a limit line is turned on, it will be displayed at the default location (center of the display).

Figure 3-44. Limit Menu

3-16 Limit State Menu

Key Sequence: **Limit** (**6**) or **Limit** > Limit State



Limit

Off: Press this key to turn off limit lines.

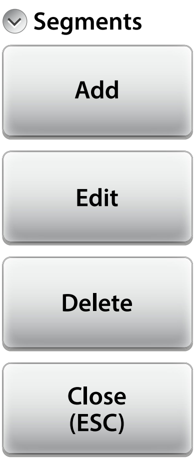
Single: Press this key to create or move a single limit line.

Segmented: Press this key to create or edit segmented limit lines.

Figure 3-45. Limit State Menu

Limit Menu (Continued)

Key Sequence: **Limit** > Edit Segments



Edit Segments

Add: Press this key to add a segment. A dialog box is displayed allowing selection of Upper or Lower limit lines and settings for Start and Stop x-axis values and y-axis values. Press Enter to save changes, or press ESC to close without saving.

Edit: Press this key to edit the highlighted segment. A dialog box is displayed allowing selection of Upper or Lower limit lines and settings for Start and Stop x-axis values and y-axis values. Press Enter to save changes, or press ESC to close without saving.

Delete: Press this key to delete the selected limit segments.

Close (ESC): Press this key (or press the **Esc** key) to close the Segments menu and return to the Limit menu.

Figure 3-46. Limit Line Segments Menu

3-17 Sweep Menu

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

Sweep Setup

Data Points: Sets the number of data points: 130, 259, 517, 1033, or 2065.

Run/Hold
Run Hold: Toggles between Run and Hold. When in Hold mode, pressing this key starts the sweeping and provides a trigger. When in the Run mode, pressing this key pauses the sweep.

Sweep Trigger: This displays the “Sweep Trigger Menu” on page 3-68. The mode is displayed on the submenu key. Continuous is the default.

RF Immunity
High Low: The instrument defaults to RF Immunity Low. Refer to “RF Immunity” on page 3-32 for details.

RF Pwr In Hold
On Off: Sets the RF Output power to be left On or turned Off when Run/Hold is toggled to Hold. Refer to “RF Pwr In Hold” on page 3-32 for details.

Source Power
High Low: This toggles the source power between High and Low.

IFBW: Press this submenu key to display the IFBW selection box. Highlight one of the 4 choices:
100 kHz, the maximum sweep speed
1 kHz, default
100 Hz
10 Hz, the maximum dynamic range

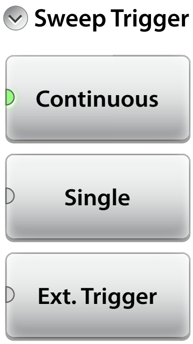
Smoothing: Press this submenu key to set the smoothing in percent (0 % to 20 %). Use the number keypad, the **Up/Down Arrow** keys, or the rotary knob.

Sweep Averaging: Press this submenu key to set the number of sweeps to average at each sweep point (1 to 1000). Use the number keypad, the **Up/Down Arrow** keys, or the rotary knob, then press **Enter**.

Figure 3-47. Sweep Menu

3-18 Sweep Trigger Menu

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



Sweep Trigger

Continuous: Sets the sweep trigger to internal and continuous, and sets the Run/Hold setting to Run. A new sweep is triggered automatically at the end of each sweep. This is the default sweep trigger setting.

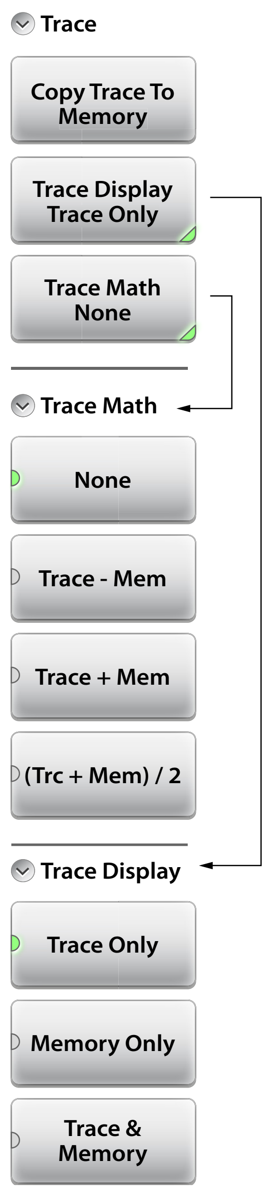
Single: Sets the sweep trigger to internal and single, and sets the Run/Hold setting to Hold. Each sweep is activated by the Run/Hold submenu key.

Ext. Trigger: Sets the sweep trigger to an external source. Each sweep is activated by a TTL signal at the External Trigger In connector. Refer to "Test Panel Connector Overview" on page 2-4.

Figure 3-48. Sweep Trigger Menu

3-19 Trace Menu

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



Trace

Copy Trace to Display Memory: Copies the current trace display to memory for use in Trace Math and Trace Display options.

Trace Display: Press to change the display options.

> **Trace Only:** The active trace is shown (yellow).
>
> **Memory Only:** The trace stored in memory is displayed in purple.
>
> **Trace & Memory:** Displays both the stored trace (purple) if a trace is stored in memory and the current active trace (yellow).

Trace Math: Press to change the trace math options.

> **None:** The active trace is shown as is, with no math functions.
>
> **Trace – Mem:** Displays the difference between the active trace and the trace in memory.
>
> **Trace + Mem:** Displays the results of logarithmic adding of the active trace and the trace in memory.
>
> **(Trc + Mem) / 2:** Displays the results of the average of the active trace and trace in memory.

Figure 3-49. Trace Menu

3-20 Other Menus Keys

Refer to Table 2-1, "Site Master Keypad Functions" on page 2-10.

Chapter 4 — Calibration, CAA

4-1 Introduction

This chapter provides details and procedures for calibrating the Cable-Antenna Analyzer modes of the Site Master S820E.

The Site Master is a high precision instrument. When making 1-port or 2-port measurements, the instrument must be calibrated in order to remove residual errors due to measurement setup conditions. Anritsu recommends performing the calibration under the same conditions as the measurement: temperature, frequency, number of points, source power, and IFBW. The calibration must be conducted using the appropriate standards at the open end of any test port cables and adapters that are connected to Port 1 or Port 2 of the instrument. This ensures that the match, phase length, and loss of these cables and adapters are all accounted for. For optimal performance, high quality phase-stable cables and precision adapters must be used.

Figure 4-1 on page 4-2 and Figure 4-2 on page 4-2 compare a Return Loss measurement before and after the instrument is calibrated.

Note	For accurate results, the instrument must be calibrated before making any measurements.

Chapter Overview

This chapter contains the following sections:

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

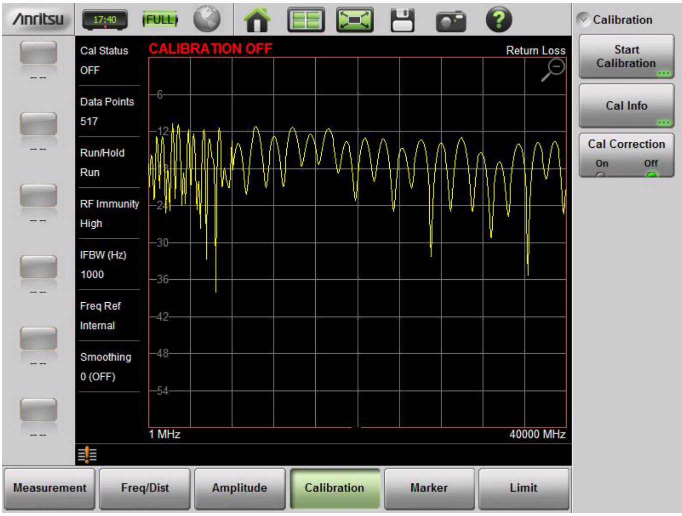


Figure 4-1. Return Loss Measurement before Calibration

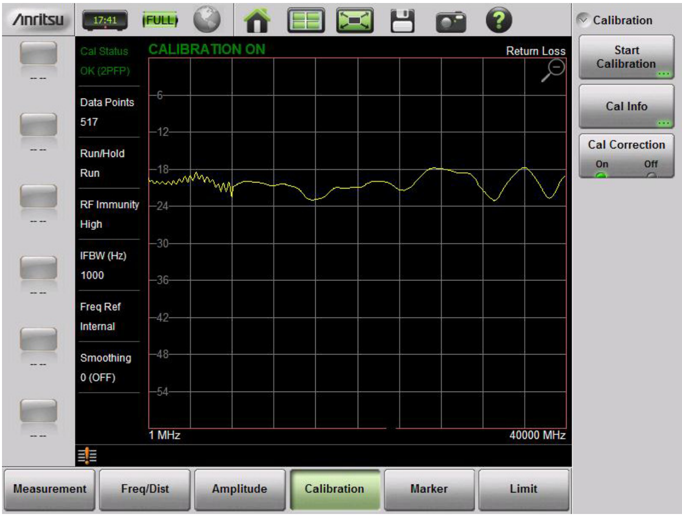


Figure 4-2. Return Loss Measurement after Calibration

4-2 Calibration Setup

In order to perform a proper calibration, several parameters must be set before the calibration procedure is started. These parameters are: Cal Type, Cal Line, Port DUT, and Port Cal Kit.

To view a summary of these settings, begin from the Calibration main menu and press Cal Info. A summary of the Active Cal Settings and the Current Settings of the instrument are displayed (see Figure 4-3). Press **Esc** to close the Cal Info window.


Calibration Information [Cal Status: OK]

Type	Current Settings	Active Cal Settings
Date/Time	27 Sep 2013 / 17:48:09	25 Sep 2013 / 15:48:38
Internal Temp	44 °C / 111 °F	34 °C / 93 °F
Valid Cal Window	--	14 to 54 °C / 57 to 129 °F
Cal Type	1-Path 2-Port - Fwd Path	1-Path 2-Port - Fwd Path
Cal Line Type	Coax	Coax
Cal Kit Port 1	TOSLKF50A-40	TOSLKF50A-40
# of Points	130	1033
Start Frequency	1 MHz	1 MHz
Stop Frequency	40000 MHz	40000 MHz
Source Power	High	High
IFBW	100 kHz	1 kHz

Press ESC to close this dialog.

Figure 4-3. Cal Info Window

The Cal Info window displays all of the key setup parameters for the calibration. The current settings are shown on the left, and the settings of the instrument at the time of the last calibration are shown on the right.

Cal Type

Various calibration types are available for the Site Master S820E. The calibration type must be chosen based on the measurement that is required. Figure 4-4 shows the dialog box with the Cal Type selection table.

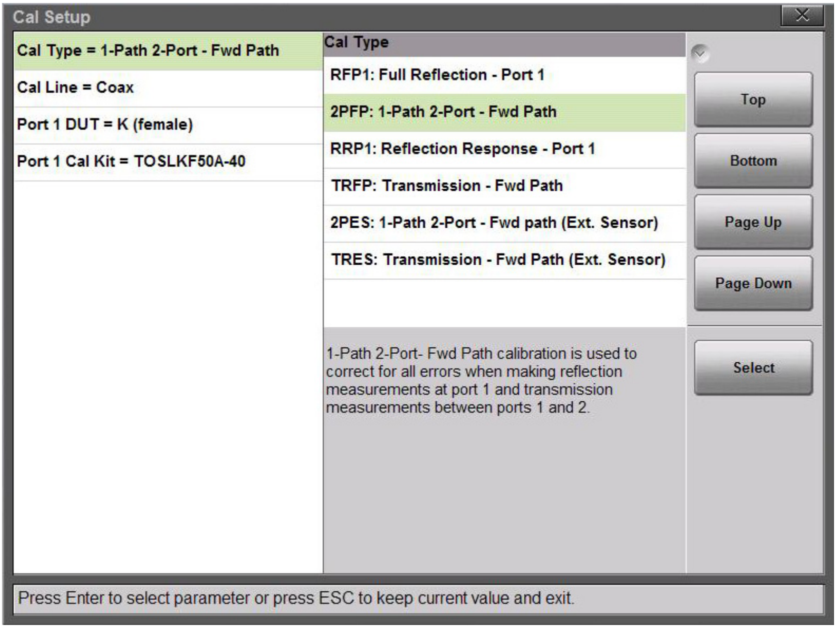


Figure 4-4. Cal Setup Window Showing Cal Type Selection Table

Table 4-1 lists in more detail what types of measurement errors each of these calibration types corrects.

Table 4-1. Measurement Errors Corrected by Calibration (1 of 2)

Calibration Type	Measurement Errors Corrected
RFP1: Full Reflection – Port 1	Full Reflection – Port 1 calibration is used to correct for all errors when making reflection measurements at port 1 (for example, Return Loss, VSWR, Cable Loss, or DTF). This cal type requires three connections to Port 1: Open, Short, Load
2PFP: 1-Path 2-Port – Fwd Path	1-Path 2-Port – Fwd Path calibration is used to correct for all errors when making reflection measurements at port 1 and transmission measurements between ports 1 and 2. This cal type requires four connections to Port 1: Open, Short, Load, Thru (between Port 1 and 2). The Isolation step, using a load connection on each port, is optional. If used, it will improve the dynamic range performance of the Thru measurement.
RRP1: Reflection Response – Port 1	Reflection Response – Port 1calibration is a quick method used to correct for some errors when making reflection measurements at port 1. This cal type requires one connection to Port 1: Open or Short. The load connection is optional, but if used, will improve the effectiveness of this calibration.

Table 4-1. Measurement Errors Corrected by Calibration (2 of 2)

Calibration Type	Measurement Errors Corrected
TRFP: Transmission – Fwd Path	Transmission Response – Fwd Path calibration is a quick method used to correct for some errors when making transmission measurements between ports 1 and 2. This cal type requires one connection: a Thru connection between Port 1 and Port 2.
2PES: 1-Path 2-Port – Fwd path (Ext. Sensor)	1-Path 2-Port – Fwd Path (Ext. Sensor) calibration is used to correct for errors when making reflection measurements at port 1 and transmission measurements between port 1 and an external USB sensor. This cal type requires four connections to Port 1: Open, Short, Load, Thru (between Port 1 and the external USB sensor).
TRES: Transmission – Fwd Path (Ext. Sensor)	Transmission Response – Fwd Path (Ext. Sensor) calibration is used to correct for errors when making transmission measurements between port 1 and an external USB sensor. This cal type requires one connection: a Thru connection between Port 1 and the external USB sensor.

Cal Line

The Site Master S820E supports measurements and calibrations for both coaxial and waveguide media. In the Cal Setup window, set the Cal Line to either Coax or Waveguide before starting the calibration.

Figure 4-5 shows the selection window for the Cal Line, within the Cal Setup dialog box. For coaxial line types, the calibration method that is used is the Open, Short, Load method, or OSL. For waveguide line types, the calibration method that is used is the Offset Short 1 (1/8th wavelength), Offset Short 2 (3/8th wavelength), Load method, or SSL.

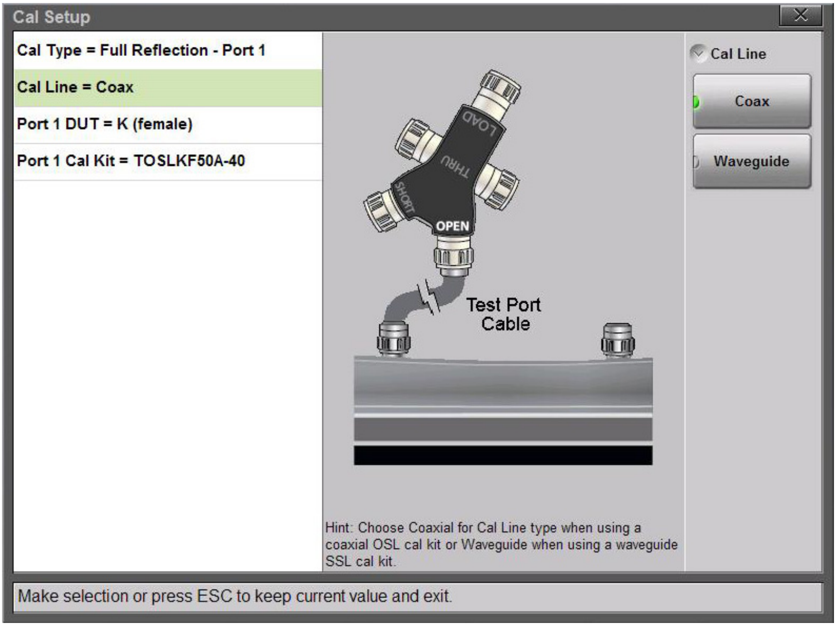


Figure 4-5. Cal Line Selection

Port 1 DUT and Cal Kit

For the most accurate calibrations, you must select the connector of the DUT that will be attached to Port 1 of the instrument. After you select the DUT connector, you must then select the desired calibration kit that will be used for the Port 1 correction. If you do not select a desired calibration kit, then the analyzer defaults to one of the built-in kits.

Figure 4-6 shows the selection window for the Port 1 DUT connector. For easier identification of the DUT connector, a representative picture is shown for each selection. After a connector is chosen, the Port 1 Cal Kit selection is updated in order to list only the available calibration kits that are associated with the selected DUT connector. Figure 4-7 on page 4-9 shows an example of the selection of calibration kits that are available for the K (female) coaxial DUT connector.

For each coaxial kit in the list, the values of the Offset Lengths for the Open, Short, and Thru (if applicable) are listed. The Capacitance and Inductance values for the Open and Short are also listed, as shown in Figure 4-7. For waveguide calibration kits, the Cutoff Frequency and the Offset Short 1 and Short 2 lengths are listed.

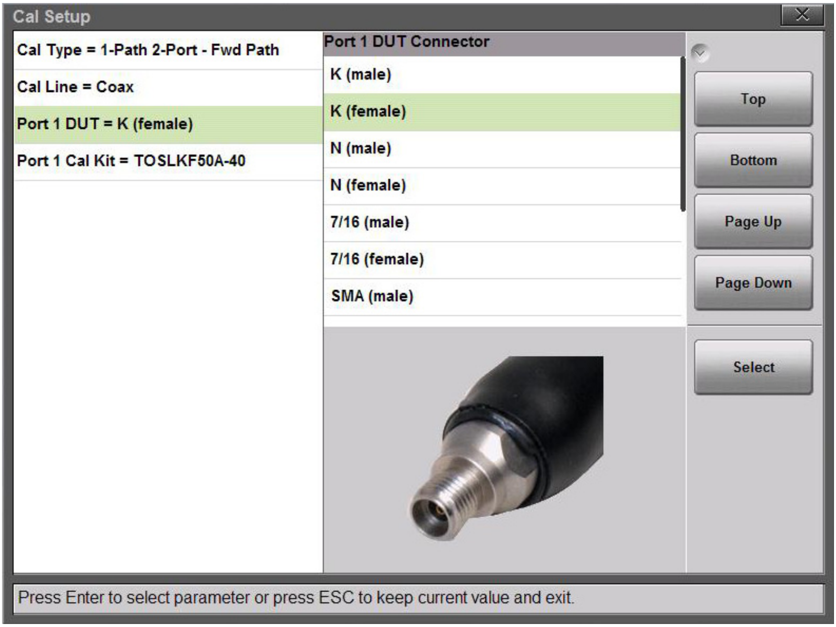


Figure 4-6. Selection Window for Port 1 DUT Connector

Figure 4-7 shows the Selection window for the Port 1 Cal Kit with its list of available calibration kits and the corresponding parameters for each kit.

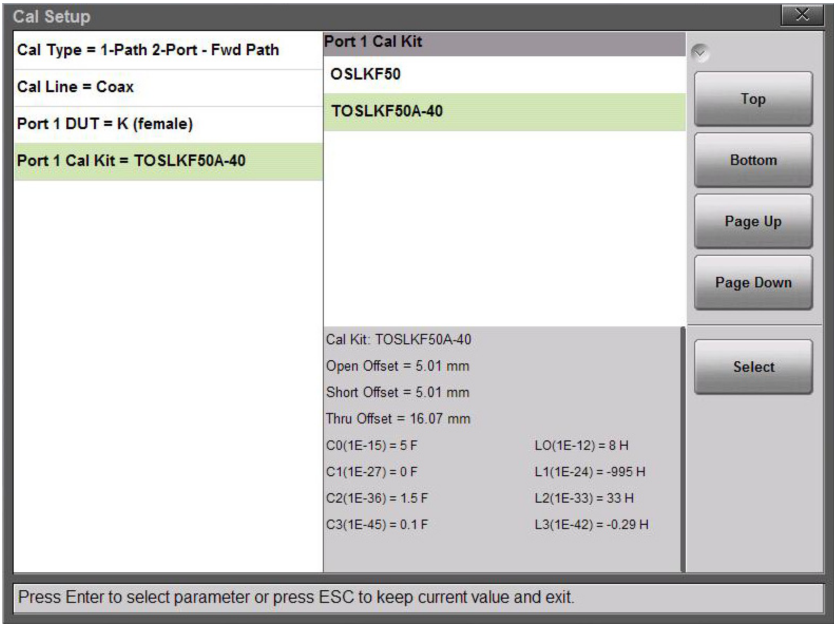


Figure 4-7. Selection Window for Port 1 Cal Kit

The selection list for DUT connectors includes all of the common connectors that you may encounter. Table 4-2, "Coax Dut Connectors and Cal Kits" on page 4-10 and Table 4-3, "Waveguide DUT Connectors" on page 4-11 provide complete lists of Coax and Waveguide connectors and corresponding calibration kits that are selectable through the Cal Setup dialog box.

Table 4-2. Coax Dut Connectors and Cal Kits

Coaxial Connector Name	Available Cal Kits
N-Type (male)	OSLN50, OSLN50-1, OSLN50A-8, OSLN50A-18, TOSLN50A-8, TOSLN50A-18
N-Type (female)	OSLNF50, OSLNF50-1, OSLNF50A-8, OSLNF50A-18, TOSLNF50A-8, TOSLNF50A-18
K (male)	OSLK50, TOSLK50A-20, TOSLK50A-40
K (female)	OSLKF50, TOSLKF50A-20, TOSLKF50A-40
7/16 (male)	2000-1618-R, 2000-767
7/16 (female)	2000-1619-R, 2000-768
SMA (male)	3650 (male components of kit)
SMA (female)	3650 (female components of kit)
TNC (male)	1091-53, Open
TNC (male)	1091-54, Short
TNC (male)	1015-55, Termination
TNC (female)	1091-55, Open
TNC (female)	1091-56, Short
TNC (female)	1015-54, Termination
User 1: Coax	User 1 (Coax)
User 2: Coax	User 2 (Coax)
User 3: Coax	User 3 (Coax)
User 4: Coax	User 4 (Coax)
User 5: Coax	User 5 (Coax)
User 6: Coax	User 6 (Coax)
User 7: Coax	User 7 (Coax)
User 8: Coax	User 8 (Coax)
User 9: Coax	User 9 (Coax)
User 10: Coax	User 10 (Coax)

Table 4-3. Waveguide DUT Connectors

Waveguide Connector Name
WG11A/R40 (3.30 to 4.90 GHz)
WG12/WR187/R48 (3.95 to 5.85 GHz)
WG13 (4.90 to 7.00 GHz)
WG14/WR137/R70 (5.85 to 8.20 GHz)
WG15/WR112/R84 (7.05 to 10.0 GHz)
WG16/WR90/R100 (8.20 to 12.4 GHz)
WG17/R120 (10.0 to 15.0 GHz)
WG18/WR62/R140 (12.4 to 18.0 GHz)
WG20/WR42/R220 (18.0 to 26.5 GHz)
WG22/WR28/R320 (26.5 to 40.0 GHz)
User 1: WG
User 2: WG
User 3: WG
User 4: WG
User 5: WG
User 6: WG
User 7: WG
User 8: WG
User 9: WG
User 10: WG

If you are using custom connectors that are not already listed, then the Site Master S820E allows you to create up to ten User DUT connectors and corresponding User Cal Kits. Choose one of the User connectors from the Port 1 DUT Connector list, as shown in Figure 4-8 on page 4-12. You can edit the name of the DUT connector, as indicated on the Site Master screen.

For each User DUT connector, a corresponding User Cal Kit is selected, as shown in Figure 4-9 on page 4-13. The coefficients for the calibration kit can be edited, as indicated on the Site Master screen. Customizing the connectors and calibration kit coefficients allows you to have the most flexibility in using any calibration kit that may be required for your measurements.

The user-entered coefficients are retained in the instrument's non-volatile memory and will persist even after the Site Master is powered down or after a Factory Reset. Recalling a setup file will not overwrite the user coefficients.

Caution	To ensure utmost measurement accuracy and consistency, please use the Anritsu calibration kits that are listed in the Calibration menu. These can be found in the accessories section of the S820E data sheet. Other Calibration kits that are not listed in the Calibration menu may be used provided you enter the correct required calibration coefficient information under one of the available custom User settings.

Figure 4-8 illustrates the Selection window for the Port 1 DUT connectors, showing the list of custom User connectors available to the user. The name of the connectors can be edited as indicated on the screen.

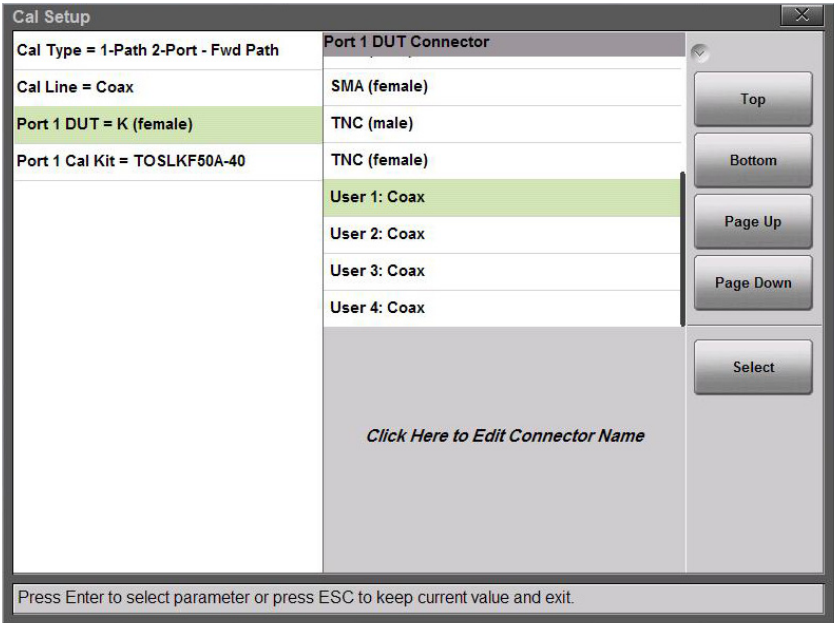


Figure 4-8. Cal Setup, Port 1 DUT Connectors

Figure 4-9 shows the selection window for the custom User cal kits corresponding to the User 6 DUT coaxial connector. The corresponding cal kit parameters are shown and can be edited as indicated on the screen.

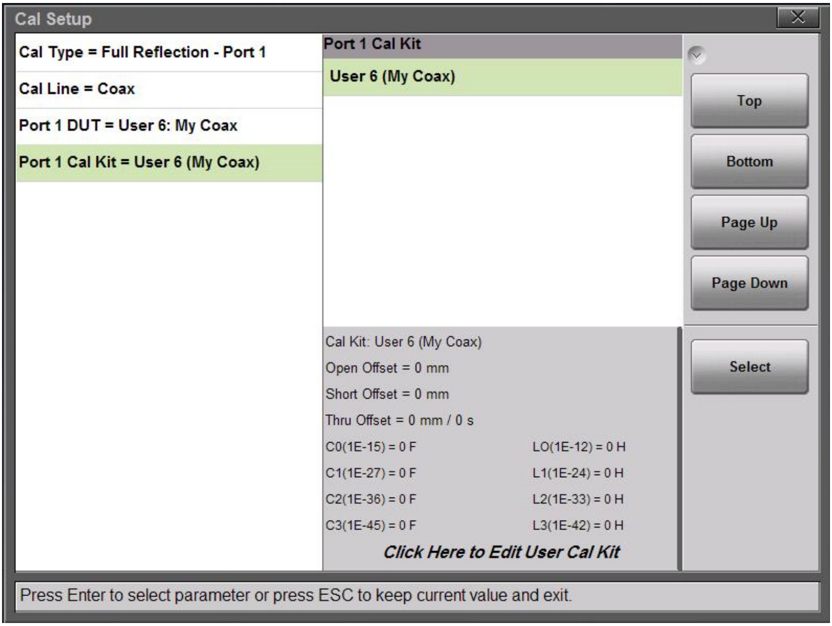


Figure 4-9. Cal Setup, Port 1 DUT Coax Connector

4-3 Calibration Procedures

In Cable and Antenna Analyzer Mode, calibration is required when the "Cal Status Off" or "Cal Status --" message is displayed, or when the test port cable or adapters have been changed. The following sections describe how to perform calibrations.

Note	If a Test Port Extension Cable is to be used (this is recommended), then it must be connected to the Site Master before calibration.

Calibration Procedure

1. Press the **Freq/Dist** main menu key and enter the appropriate frequency range.
2. Press the **Calibration** main menu key, then press Start Calibration.
3. Press Cal Setup to make changes to the setup as needed (refer to Section 4-2 "Calibration Setup" on page 4-3).
4. Press Measure and follow the on screen instructions (see Figure 4-10 on page 4-15).
5. Verify that the calibration has been completed by confirming that the Cal Status message is now displaying "Cal Status OK (xxxx)", where "xxxx" indicates the Cal Type. The calibration correction factor will now be applied to the measurements.
6. The calibration factors can be turned Off with the Cal Correction button. The calibration coefficients are saved and can be reapplied by setting Cal Correction back to On.

Thru Update

When measuring the transmission (or insertion loss) response of a DUT, the calibration requires a Thru measurement to be performed. This requires at least one external cable to be introduced into the calibration. The additional cable component is the most susceptible to changes from environmental conditions, such as temperature changes and mechanical flexing. The Thru Update button (see Figure 4-11 on page 4-18) allows you to quickly eliminate the effects of temperature changes or of changes caused by mechanical flexing of the cable without having to repeat the entire calibration process. The Thru update is particularly useful when viewing DUT transmission responses with small scale resolution (0.5 dB/division or less).

Figure 4-10 shows the Calibration dialog box showing calibration setup and calibration steps. On-screen instructions are given for each step.

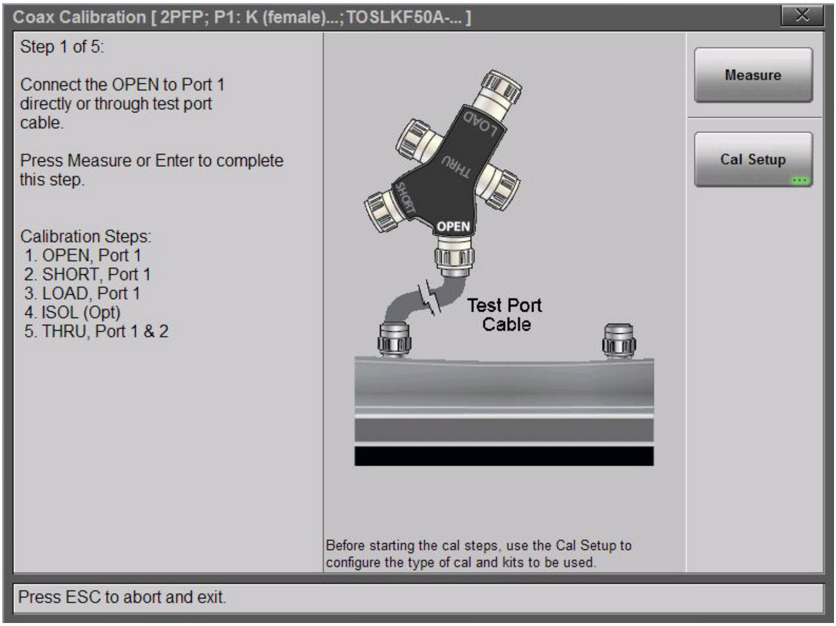


Figure 4-10. Calibration Dialog Box for Coax

Temperature Window

For accurate results, the instrument must be calibrated at the ambient temperature after allowing for warm-up time (approximately 10 minutes) and before making any measurements. The S820E must be re-calibrated whenever the internal instrument temperature exceeds the calibration temperature window (±10 ºC) or when the test port extension cables or adapters are removed or replaced. The instrument must also be re-calibrated every time the frequency range changes.

To ensure that you consistently obtain accurate measurements, the Site Master continuously monitors its internal temperature and compares that to the actual calibration temperature that was recorded when the last calibration was performed. If these 2 values differ by ±10 degrees or more, then the Site Master displays CALIBRATION OFF (↕°C) , indicating that the current temperature has exceeded the calibration temperature window. Anritsu recommends that you perform a new calibration after this occurs in order to continue making accurate measurements. Alternatively, if the instrument temperature comes back into the valid calibration temperature window, then you may reactivate the existing calibration by turning it back on in the Calibration Menu.

If you turn off the correction by using the Cal Correction button, then the Site Master displays CALIBRATION OFF. In this case, you can re-enable the calibration by simply setting the Cal Correction back to On (as long as the valid calibration temperature window has not been exceeded).

Save and Recall Calibration Coefficients

Calibration information is included when a setup (`.stp`) file is saved (even if the Cal Correction is Off). The calibration information is recalled with a setup file and can be applied if the current internal instrument temperature is within the saved calibration window.

Calibration information is not included when a measurement (`.dat`) file is saved.

Interpolation

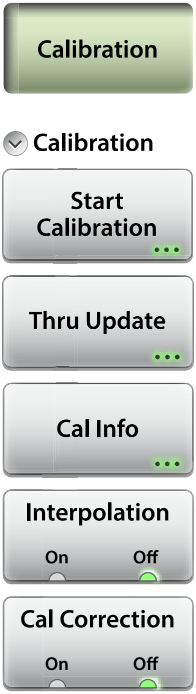
If Interpolation is set to Off and the current Cal Correction is On and valid, you cannot modify the frequency range or the source power level, or increase the number of points above 1033 points (assuming the calibration was performed with 1033 points or less). Any of these changes will require the active calibration to be turned Off and a new calibration to be performed. You can, however, adjust the number of points from 130 to 1033 without forcing the calibration to become invalid. To use 2065 points, the number of points must be set to 2065 before the calibration is started.

If your current Cal Correction is On and you turn Interpolation On, you can then change the frequency range (smaller and anywhere within the calibrated range) or modify the number of points to be higher than 1033 without invalidating the calibration. In that case, the calibration coefficients are regenerated (interpolated) to match the new settings. You cannot increase the frequency range, however, beyond the range that was used during calibration.

For example, you could perform a calibration from 1 MHz to 20 GHz using 2065 points. With Interpolation On, you could then make a measurement by zooming in on a desired frequency range, 410 MHz to 435 MHz, for example. The trace in your measurement would use the full 2065 points within this much narrower frequency range.

4-4 Calibrate Menu

Key Sequence: **Calibration**



Calibration

Start Calibration: Press this submenu key and follow the instructions on screen.

Measure: Press this submenu key to start the calibration process.

Cal Setup: Press this submenu key to open the Setup window to allow adjustments to the Cal Type, Cal Line, Port DUT, and Port Cal Kit. Refer to Figure 4-4 on page 4-4.

Thru Update: Opens the Calibration dialog box to allow calibrating the Thru component without repeating the entire calibration sequence. This key is displayed only after a calibration with a Thru component.

Cal Info ... Press this submenu key to display information about the current settings and active cal settings. Refer to Figure 4-3 on page 4-3.

Interpolation
On Off: Press this submenu key to toggle Interpolation On or Off. After performing a calibration, you can turn Interpolation On and then change the frequency range (smaller) or change the number of data points (to be higher than 1033).

Cal Correction
On Off: Pressing this submenu key determines whether the active cal is applied to the current measurement.

Figure 4-11. Calibrate Menu

Chapter 5 — Classic Mode Operation

5-1 Introduction

The Site Master S820E provides a "Classic" Cable and Antenna Analyzer measurement mode which emulates the user interface from the Anritsu Site Master 'D' series of instruments. This emulation is intended to help users of the S820E follow existing carrier Method of Procedure (MOP) documents that specify an earlier Site Master model.

To provide quick and easy familiarity with the Site Master user interface, many of the advanced features such as Dual Screen display, Smith Chart, Phase, and multi-segmented limits, are purposely removed while in Classic Mode. Please switch to Advanced Mode to access these useful features when desired.

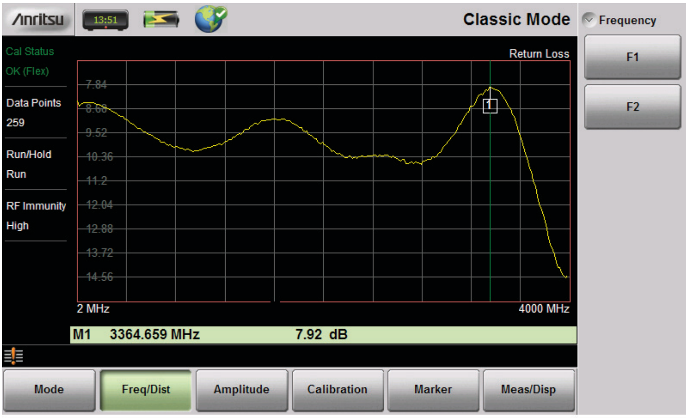
Refer to Figure 5-1 on page 5-2 for a comparison of Site Master S820E "Classic" vs. "Advanced" Cable & Antenna modes.

Note	Use the **Menu** key and confirm that the instrument is in "Classic" Cable-Antenna Analyzer mode before continuing. **Classic Mode** is always displayed above the measurement type when the instrument is in "Classic" mode.

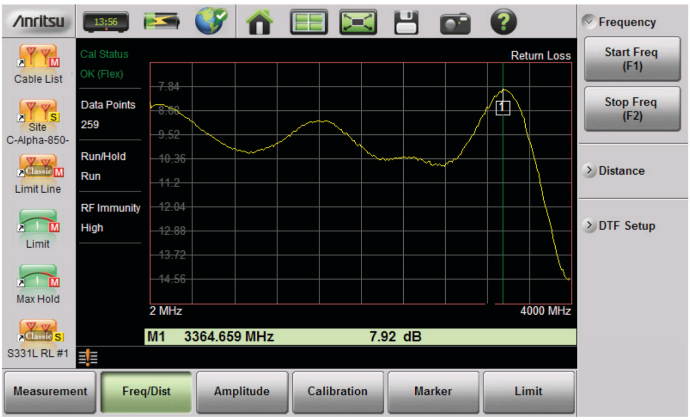
Refer to Chapter 3, "Cable and Antenna Measurements" for a complete overview of the instrument GUI. This chapter summarizes the differences between "Classic" mode and the "Advanced" S820E Cable and Antenna mode.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

5-2 Classic Mode and Advanced Mode



“Classic” Mode (Chapter 4)



“Advanced” Mode (Chapter 3)

Figure 5-1. Comparison of “Classic” Mode vs. “Advanced” Mode

Figure 5-2 on page 5-4 and Figure 5-3 on page 5-5 show an overview of the Classic Cable and Antenna Analyzer menus and keys. Descriptions of the main menus and associated submenus are provided in Chapter 3.

Table 5-1. Menu Differences Between *Classic* Mode and *Advanced* Mode

Classic Mode	Advanced Cable and Antenna Mode
Meas Mode Menu	"Measurement Menu" on page 3-55
Freq – SWR	"VSWR" on page 3-55
Freq – Return Loss	"Return Loss" on page 3-55
Freq – Cable Loss (one port)	"Cable Loss" on page 3-55
Freq – Cable Loss (two port, ext. sensor)	"Transmission (2-Port)" on page 3-56 "Transmission (Ext. Sensor)" on page 3-56
DTF – SWR	"DTF VSWR" on page 3-55
DTF – Return Loss	"DTF Return Loss" on page 3-55
—	"Smith Chart" on page 3-56
—	"1-Port Phase" on page 3-57
Freq/Dist Menu	"Freq/Dist Menu" on page 3-58
F1	"Start Frequency (F1)" on page 3-58
F2	"Stop Frequency (F2)" on page 3-58
D1	"Start Distance (D1)" on page 3-58
D2	"Stop Distance (D2)" on page 3-58
More	*"DTF Setup" on page 3-59*
Marker Menu	Refer to Figure 5-2 on page 5-4 for "Classic" mode marker menu structure. Refer to "Marker Menu" on page 5-6 for menu descriptions.
Meas/Disp Menu	Refer to "Sweep Menu" on page 3-67 and "Trace Menu" on page 3-69

Note	Also refer to Chapter 3 for descriptions of other menus not specifically mentioned in Table 5-1.

In Advanced Mode, two additional submenu keys are available to control the measurement display. In the "Measurement Menu" on page 3-55, the Display Format key toggles Single and Dual trace displays (refer to "Dual Display Format" on page 2-26). The Active Display key toggles the Top or Bottom trace to be active.

5-3 Menu Map – Classic Mode

Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

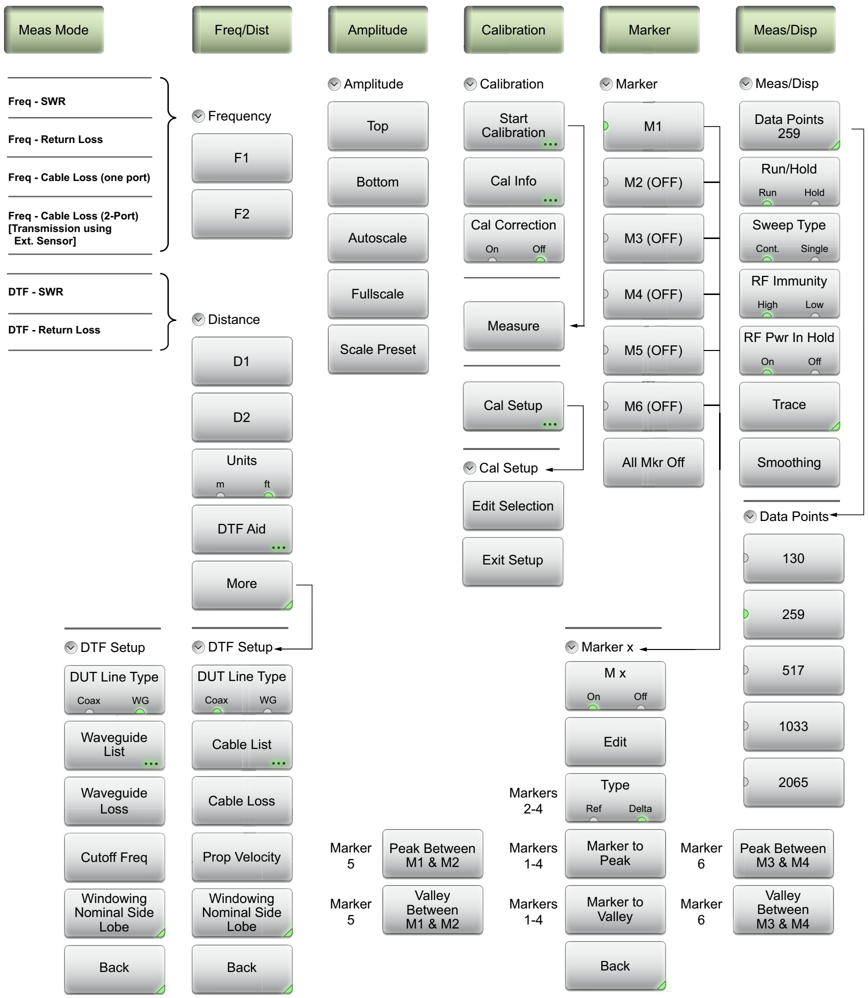


Figure 5-2. "Classic Mode" Menu Keys (1 of 2)

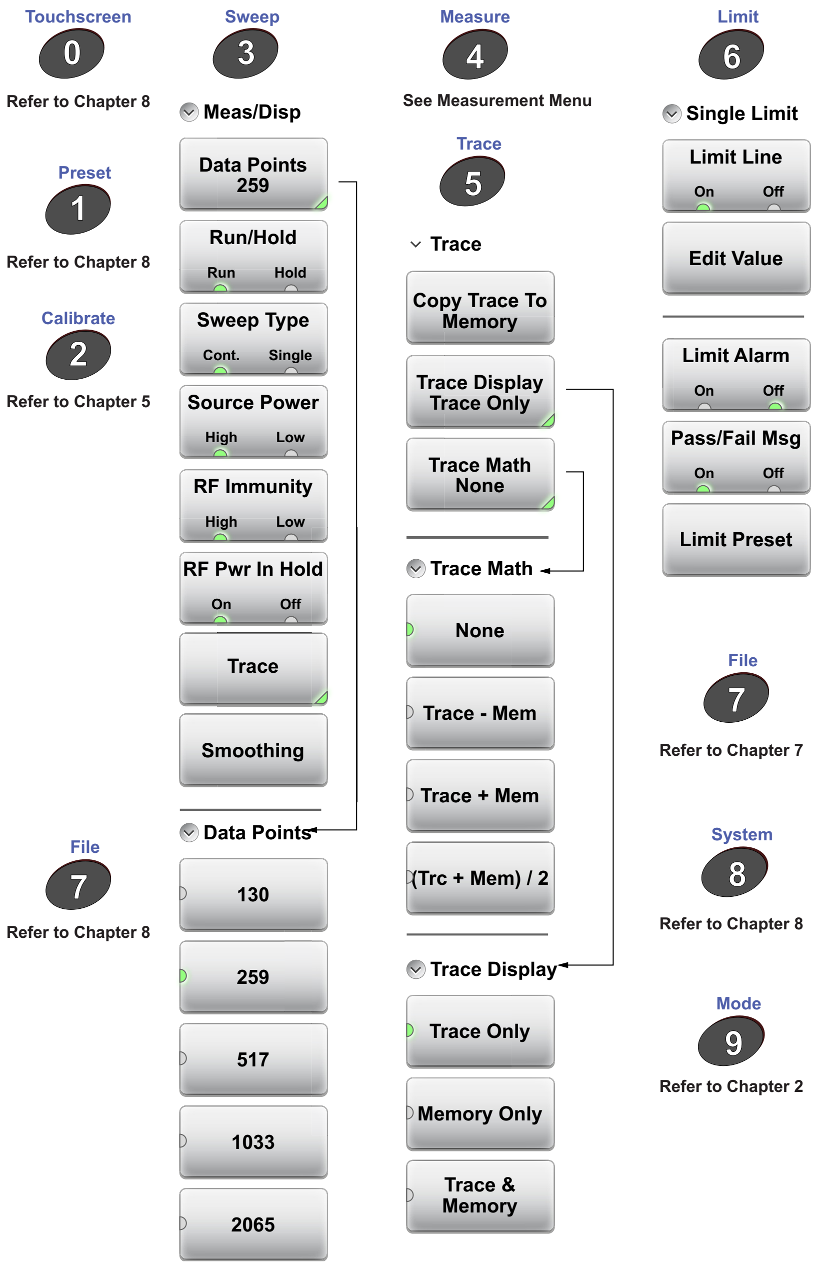


Figure 5-3. “Classic Mode” Menu Keys (2 of 2)

5-4 Marker Menu

Key Sequence: **Marker**

Marker

After pressing the Marker button, Marker 1 (M1) is automatically turned on and appears at the last used location. If no last used location exists (after a preset for example), then Marker 1 appears in the center of the measurement screen.

M1: Press to display the Marker 1 menu (Figure 5-5 on page 5-7), which gives access to marker parameter settings.

The key label displays the marker number only (M1 for example) when the marker is ON, and displays M1 (OFF) when the marker is not in use. The green half circle also indicates that the marker is ON.

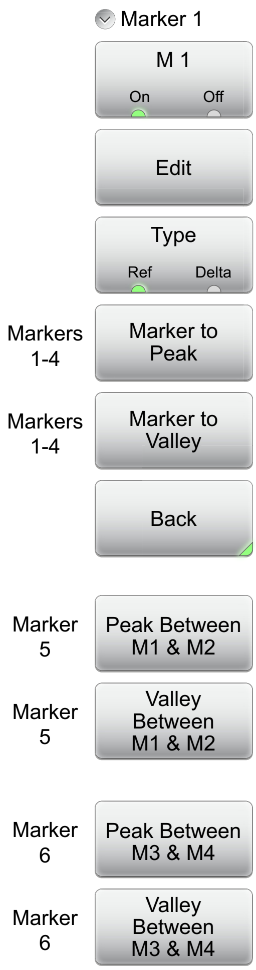
Submenu keys M2 through M6 behave in the same manner as M1.

All Mkr Off: Press this key to turn OFF all markers.

Figure 5-4. Marker Menu (1 of 2)

Marker Menu (Continued)

Key Sequence: **Marker** > M 1



Marker

M 1 (On Off): Press this key to turn OFF the selected marker (M1 to M6).

Edit: Press this key to enter a marker value.

Type (Ref Delta): Press this key to toggle the marker type between Reference and Delta. This key is displayed for markers M2 through M4 only. Marker M1 is a Reference marker only.

Marker to Peak: Press this key to set a Marker (M1 to M4 only) on the highest signal amplitude in the displayed trace.

Marker to Valley: Press this key to set a Marker (M1 to M4 only) on the lowest signal amplitude in the displayed trace.

Back: Press this key to return to the Marker menu.

Markers 5 and 6 can perform a special Marker search to find the Peak or Valley between two other markers. When Marker 5 is Active:

Peak Between M1 & M2: Places Marker 5 on the highest signal amplitude between Marker 1 and Marker 2.

Valley Between M1 & M2: Places Marker 5 on the lowest signal amplitude between Marker 1 and Marker 2.

When Marker 6 is Active:

Peak Between M3 & M4: Places Marker 6 on the highest signal amplitude between Marker 3 and Marker 4.

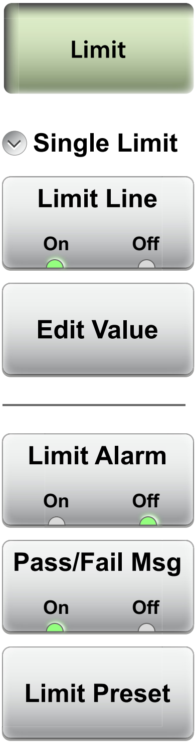
Valley Between M3 & M4: Places Marker 6 on the lowest signal amplitude between Marker 3 and Marker 4.

Figure 5-5. Marker Menu (2 of 2)

5-5 Limit Menu

Limit lines can be used for visual reference only, or for pass/fail criteria using the limit alarm and Pass/Fail Message keys. Limit alarm failures are reported whenever a signal crosses the limit line.

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



Single Limit

Limit Line (On Off): This key toggles the limit line On or Off. Limit line amplitude is stored even when turned off. The type of limit line, upper or lower, is determined by the measurement. For example, VSWR and Return loss utilize an upper limit, and Cable Loss utilizes a lower limit. The limit line changes from green to red when the limit is reached. Any points on a trace that touch or exceed a limit line setting are also displayed in Red.

Edit Value: Press this key to change the amplitude of the limit line with the Up/Down Arrow keys, rotary knob, or the number keypad.

Limit Alarm (On Off): When turned On, the Limit Alarm sounds a repeating beep when the trace touches the limit line.

Pass/Fail Msg (On Off): When turned On, a Pass or Fail message is displayed to indicate whether the trace touches or exceeds the limit line (Fail). See Figure 5-7 on page 5-9.

Limit Preset: Turns the limit line Off and clears amplitude information. The next time that a limit line is turned On, it is displayed at the default location (center of the display).

Figure 5-6. Limit Menu

Pass/Fail Messages

Figure 3-22 on page 3-39 shows the Pass/Fail message. To change the size and location of the Pass/Fail message, (when the Limit menu is displayed) tap the small circled arrow in the lower-right corner of the large format message box. The circled arrow is in the upper-left corner when the message is in small format. Notice that the trace is displayed in red wherever it meets or exceeds the set limit.

Figure 5-7. Pass / Fail Messages

Table 5-2. Classic Mode Limit Lines Messages

Measurement	Typical End Tool	Pass/Fail Criteria
Return Loss	Load	Pass when the trace is below the limit line
DTF Return Loss	Load	Pass when the trace is below the limit line
Cable Loss	Short or Open	Pass when the trace is above the limit line
VSWR	Load	Pass when the trace is below the limit line
DTF VSWR	Load	Pass when the trace is below the limit line

5-6 All Other Menus

The other menus that are shown in Figure 5-2 on page 5-4 and Figure 5-3 on page 5-5 are described in Chapter 3.

Chapter 6 — VNA Mode

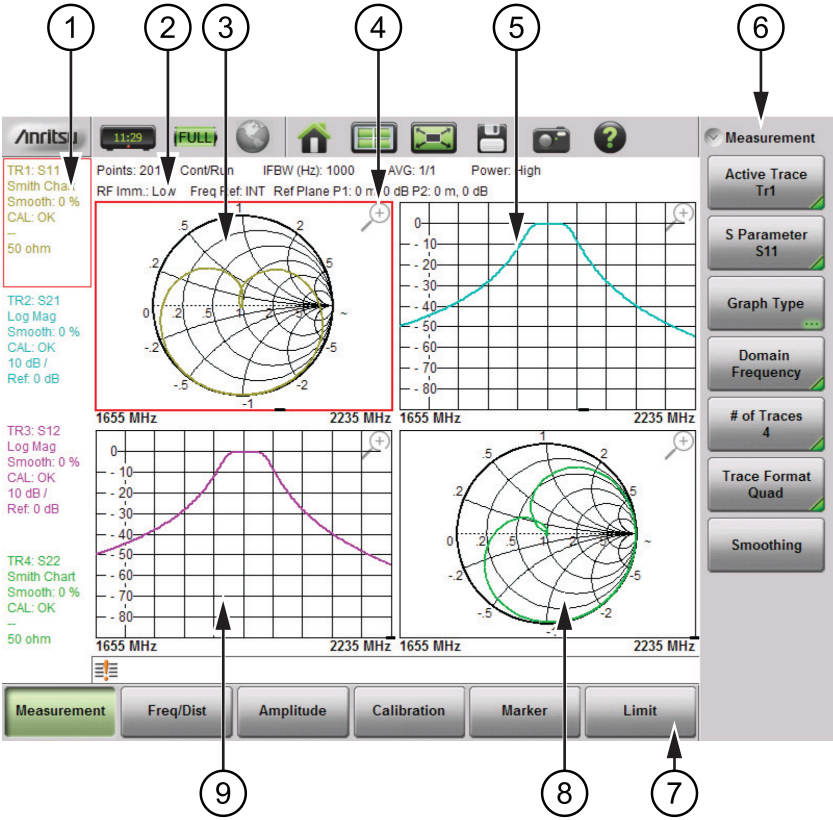
6-1 Introduction

This chapter provides an overview of VNA Mode (Vector Network Analyzer mode, Option 440) measurements.

Note	Use the **Menu** key and confirm that the instrument is in **Vector Network Analyzer** mode.

Figure 6-1 on page 6-2 illustrates a typical VNA Mode display screen.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.



1.	Instrument Settings Summary – unique to each trace
2.	Instrument Settings Summary – applies to all traces
3.	Trace 1 (TR1)
4.	Magnifying Glass, to maximize size of trace
5.	Trace 2 (TR2)
6.	Submenu Button (Key) Labels
7.	Main Menu Button (Key) Labels
8.	Trace 4 (TR4)
9.	Trace 3 (TR3)

Figure 6-1. VNA Mode Display Overview

Chapter Overview

The S820E Site Master is a Vector Network Analyzer that can measure the magnitude and phase characteristics of 1-port or 2-port networks, including cables, antennas, filters, isolators, and attenuators.

VNA mode provides advantages over Cable-Antenna Analyzer Mode via more advanced measurements, more flexibility, and more calibration choices. The main advantages are scattering parameter (S-parameter) choices, graph type choices, and domain choices. In VNA mode, these three measurement choices can be mixed and matched to provide users with more freedom and flexibility. For simplicity in Cable-Antenna Analyzer mode, the choices are more fixed and limited.

Advanced graph types allow you to look at the same device measurements in many different ways. The ability to display four traces provides you with the flexibility of comparing various measurements to obtain the results you need more efficiently.

Advanced graph types such as Group Delay, Real, Imaginary, inverted Smith Chart, Real Impedance, and Imaginary Impedance are available in the S820E in addition to the standard graph types, Log Mag, SWR, Phase, and Smith Chart. The S820E gives you the ability to display four traces overlaid, or they can be displayed in individual graphs.

In Cable-Antenna Analyzer Mode, the S820E is a two-port, 1-path instrument. In VNA Mode, the S820E is a full-reversing VNA that is capable of measuring all S-parameters (S_{11}, S_{21}, S_{22}, and S_{12}) of a 2-port device with a single connection. Being able to measure both forward and reverse S-parameters allows you to use more advanced calibration methods and to make more accurate measurements of a 2-port device.

6-2 S-Parameters

To simplify the description of the types of measurements a VNA can make, the reflection and transmission measurements are defined in terms of scattering parameters, or S-parameters. For a 2-port network, four fundamental S-parameters can be measured, and they are defined as S_{XY}. For a 2-port VNA, measurements of signals leaving Port 1 are called forward measurements, and those leaving Port 2 are called reverse measurements. Signals that leave and return to the same port are designated reflection measurements, and those that leave one port and return to another port are designated transmission measurements. S-parameters are an abbreviated designation for these measurements, and are used as shown in the following list:

- S_{11}: Forward Reflection
- S_{21}: Forward Transmission
- S_{12}: Reverse Transmission
- S_{22}: Reverse Reflection

The first number (X) in S_{XY} is the port number in which the signal is being received, and the second number (Y) is the port number from which the signal is being transmitted. The S-parameter is a ratio of these two signals.

Additional Examples:

S_{11}: Forward Reflection represents the measurement in which the incident signal is transmitted from port 1 and is reflected back to port 1.

S_{21}: Forward Transmission represents the measurement in which the incident signal is transmitted from port 1 and is received at port 2.

S_{12}: Reverse Transmission represents the measurement in which the incident signal is transmitted from port 2 and is received at port 1.

S_{22}: Reverse Reflection represents the measurement in which the incident signal is transmitted from port 2 and is reflected back to port 2.

6-3 Calculating and Displaying S-Parameters

S-parameters are a measure of the ratio of two complex voltage levels, one measured by the port receiver, and one measured by the reference receiver. S-parameters therefore consist of unitless complex numbers.

Depending on the application, S-parameters can be displayed in many ways and can be used to calculate other parameters. S-parameters consist of real and imaginary numbers. More typically, however, they are represented as magnitude and phase. In most cases, the magnitude is displayed in dB (this term is often called log magnitude). We can display phase as "linear phase". With phase, we cannot tell the difference between one cycle and the next. After going through 360 degrees, we are back to where we began. We can display the measurement from – 180 degrees to + 180 degrees, which keeps the phase transition point at the top and bottom edges of the display and away from the important 0 degrees area that is used as the phase reference.

The S820E supports the following display types. Each type is associated with a particular S-parameter:

$$S_{xy} = S_{Real} + jS_{Imaginary}$$

(where `j` is the square root of `-1`).

Log Magnitude

$$\text{LogMagnitude (dB)} = 20\mathrm{Log}_{10}|S_{xy}|$$

Applications

To measure return loss at Port 1 (or Port 2), use the Log Mag display with S_{11} (or S_{22}).

To measure the gain or loss in a DUT that is connected between Port 1 and Port 2, use the Log Mag display with S_{21} or S_{12}.

Log Magnitude / 2

$$\frac{\text{LogMagnitude}}{2}(\mathrm{dB}) = 0.5 \times 20\mathrm{Log}_{10}|S_{xy}|$$

Applications

For measuring 1-port cable loss, use S_{11} or S_{22} with the Log Mag/2 display type to account for the round trip signal path through the cable. When using reflection data to measure cable loss, the end of the cable must be shorted or must be a perfect open.

Phase

$$\mathrm{Phase(degrees)} = \mathrm{Tan}^{-1}\left|\frac{S_{\mathrm{Imaginary}}}{S_{\mathrm{Real}}}\right| \times \left(\frac{180}{\pi}\right)$$

Applications

Use the Phase or Unwrapped Phase measurement to display the phase in degrees of S_{xy}. The Phase measurement is contained within a vertical scale of ±180_degrees, whereas the unwrapped phase displays the linear phase without wrapping it at the 180_degrees transitions. See Figure 6-2 on page 6-8. Unwrapped phase is obtained by counting the number of transitions of the phase measurement (note the vertical scale in the figure). Unwrapped phase will be accurate only if the measurement has enough data points to capture all of these transitions. Also, the first data point must be low enough in frequency so that its phase is less than 180_degrees from DC, otherwise the unwrapped phase measurement will have errors.

Real and Imaginary

$$S_{\mathrm{Real}} = \text{Real part of the complex S-parameter } S_{xy}$$

$$S_{\mathrm{Imaginary}} = \text{Imaginary part of the complex S-parameter } S_{xy}$$

Applications

Use the Real and Imaginary graph types to measure the elements of the complex S-parameter S_{xy}.

SWR

$$\text{SWR} = \frac{(1 + |S_{xx}|)}{(1 - |S_{xx}|)}$$

Applications

SWR, or Standing Wave Ratio, is a measure of the reflection from the DUT input port or output port, and it must be used, therefore, with S_{11} or S_{22}.

Group Delay

Group Delay (sec) = rate of change of phase over a specified frequency aperture

Applications

Group Delay is a measure of the time delay of the signals that are propagating through the DUT versus frequency (using S_{21} or S_{12}). Group delay is a good measure of phase distortion through the DUT.

Smith Chart

Smith Chart = graphical tool for plotting impedance or admittance data versus frequency

Applications

Use Smith Chart with S_{11} or S_{22} to plot the input or output impedance of the DUT.

Use the Inverted Smith Chart to plot admittance data.

Phase versus Unwrapped Phase Graph Types

Two S_{11} measurements are shown in Figure 6-2, one using graph type Unwrapped Phase, and one using graph type Phase. The standard Phase plot displays the phase with its natural wrap-around every 360 degrees (or within a display range of ±180 degrees). The Unwrapped Phase graph removes the wrapping and plots the phase linearly. Unwrapped phase is obtained by counting the number of transitions of the phase measurement. Note the vertical scales of these two measurements in the figure. The Unwrapped Phase display can be useful for measuring the length of a device in degrees of phase.

Unwrapped phase will be accurate only if the measurement has enough data points to capture all of these transitions. Also, the first data point must be low enough in frequency so that its phase is less than 180 degrees from DC, otherwise the unwrapped phase measurement will have errors.

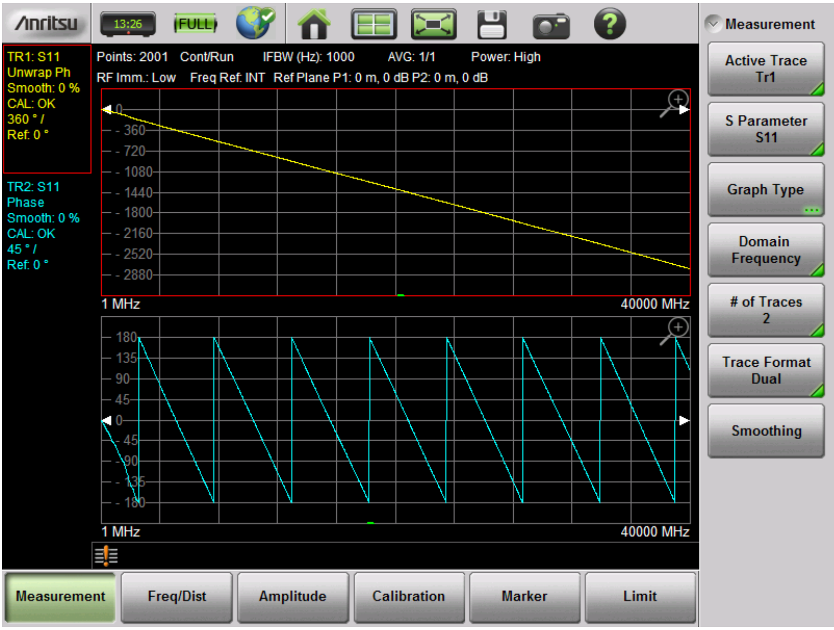


Figure 6-2. Unwrapped Phase Compared with Phase

6-4 Display Capabilities

The vector network analyzer has a flexible display capability that allows single, dual, tri, and quad displays, meaning that you can subdivide the measurement display area into 2, 3, or 4 sections. In addition, the vector network analyzer supports the display of up to four traces in each single, dual, tri, or quad display. Becoming familiar with these flexible display capabilities is important before you begin any calibrations and measurements.

Flexible Features For Displaying Results

If you are not yet familiar with the menus that control trace display, then refer to the “Measurement Menu” on page 6-20 and the “Trace Menu” on page 6-42“. To select the Measurement menu in VNA Mode, press the **Measurement** main menu key (you must be in VNA Mode for this example).

Perform the following steps to observe the trace format features:

1. The default view (after preset) uses Trace Format = Quad with Number of Traces = 4. Refer to Figure 6-3.

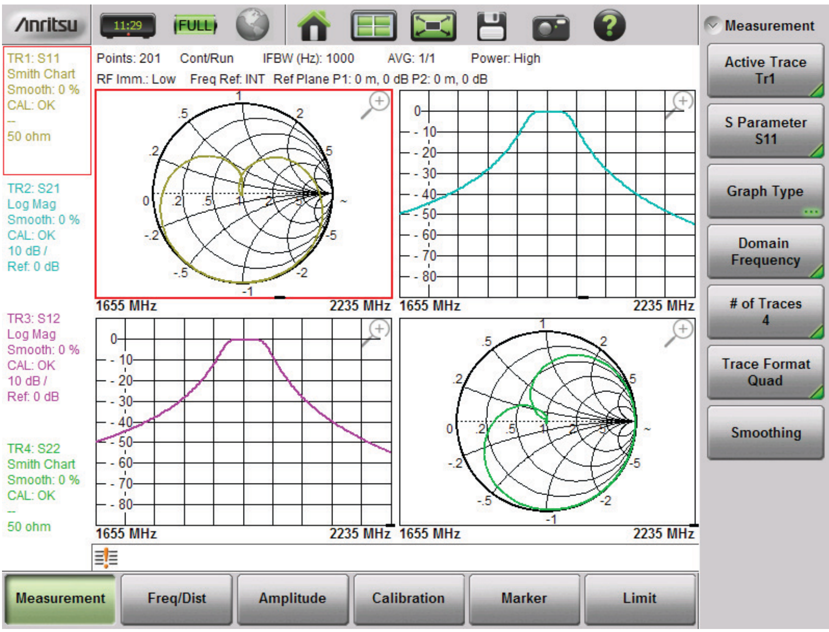


Figure 6-3. Format = Quad, Traces = 4

2. Beginning with the default view, set Trace Format = Single, with Number of Traces = 4. Notice how all 4 traces are overlaid on a single graph. Refer to Figure 6-4.

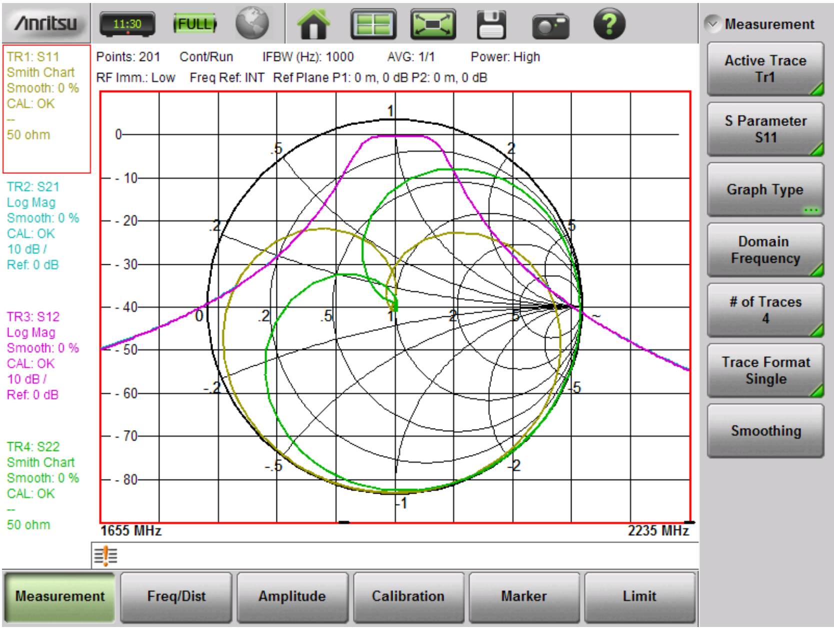


Figure 6-4. Format = Single, Traces = 4

3. Next, set Trace Format = Dual. Note how the 4 traces are assigned to the split display. TR1 (Trace 1) and TR3 are assigned to the top graph. TR2 and TR4 are assigned to the bottom graph. Refer to Figure 6-5.

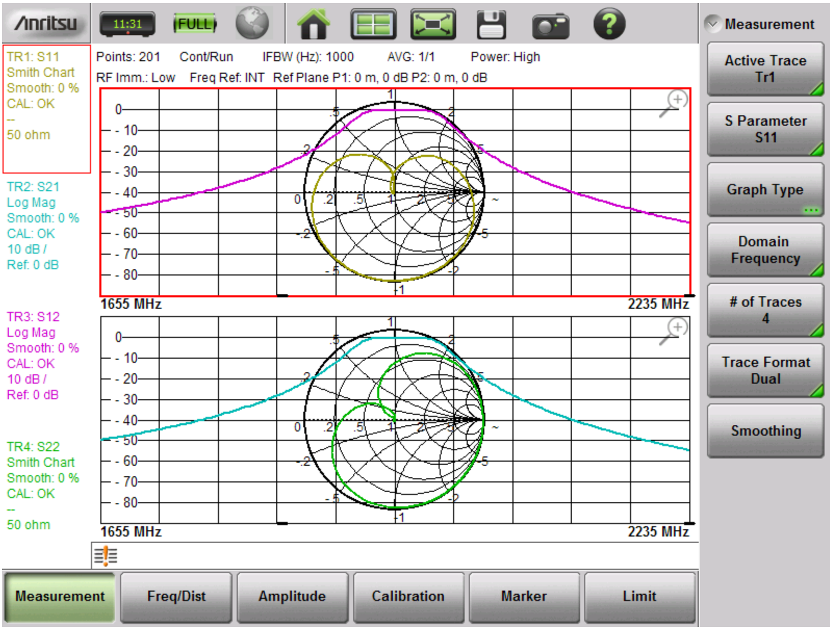


Figure 6-5. Format = Dual, Traces = 4

4. Next change Trace Format to Tri. Note how the 4 traces are assigned on this display. TR3 and TR4 are now overlaid in the bottom half of the display area. Refer to Figure 6-6.

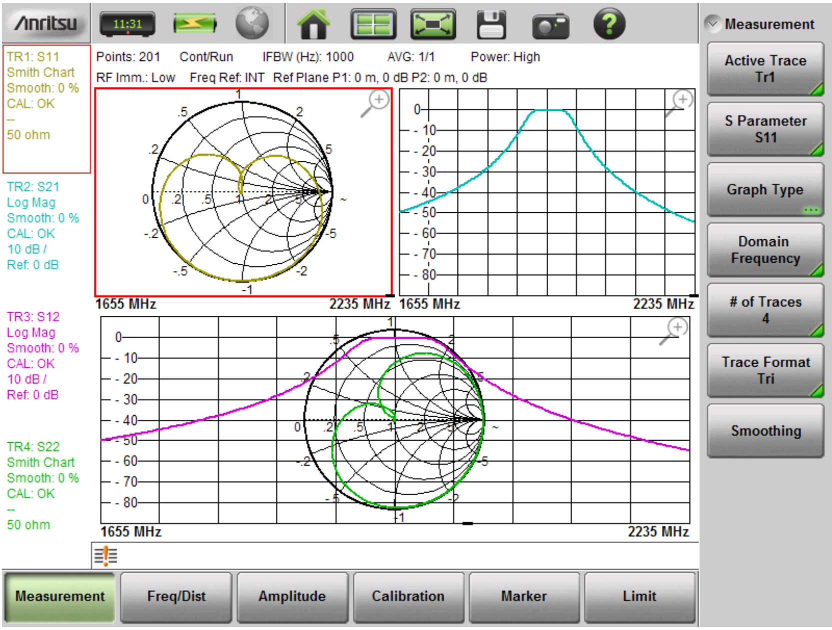


Figure 6-6. Format = Tri, Traces = 4

5. Now return to the default display of Trace Format = Quad. Change the Number of Traces from 4 to 1. Note how the top left quadrant is filled, while the other three quadrants have no data. Refer to Figure 6-7.

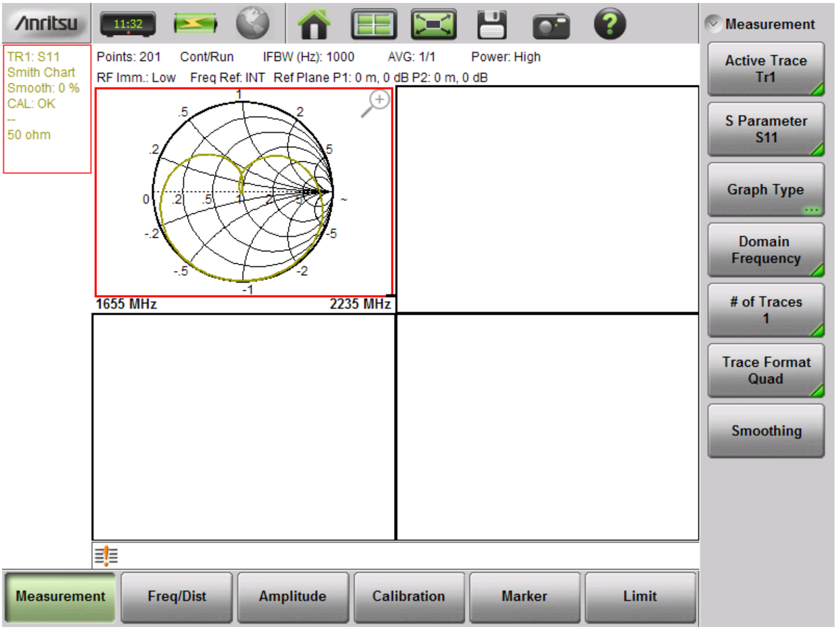


Figure 6-7. Format = Quad, Traces = 1

6. Increment the number of traces from 1 back to 4 and note how the vector network analyzer adds the additional traces to the display. Refer to Figure 6-8. (Note that Figure 6-3 and Figure 6-8 are the same measurement illustration.)

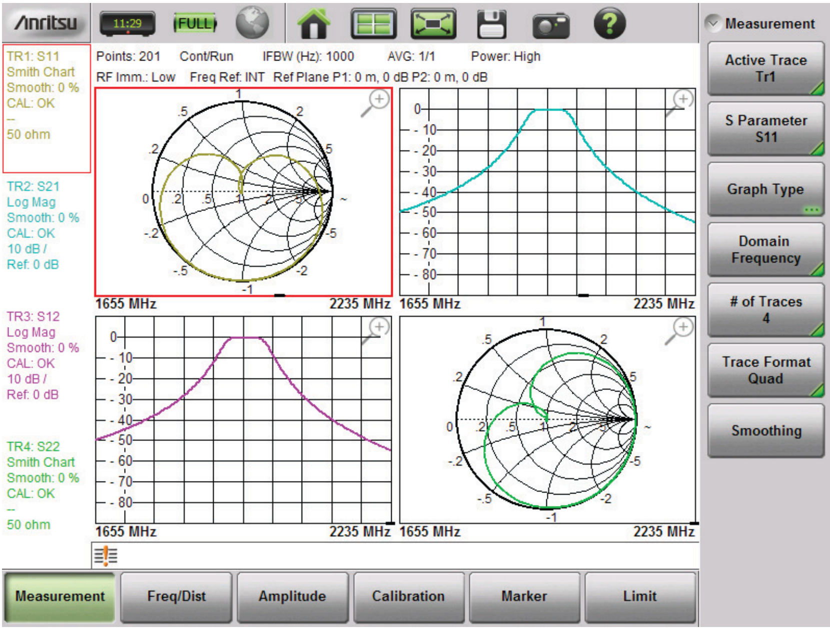


Figure 6-8. Format = Quad, Traces = 4 (same as Figure 6-3)

At this point, the display is back to the default setting of Quad with 4 traces. Regardless of the Trace Format that is selected, the number of traces that are displayed is controlled by the Number of Traces submenu key. For a brief description, refer to the examples in section "Trace Format and Number of Traces" on page 6-21.

6-5 Active Trace and Markers

Notice on the Quad trace format that one trace has a red outline box on the graph, and the trace number in the Instrument Settings Summary (on the left side of the sweep window) is outlined with a red rectangle. This is the active trace, and only one trace is active at a time. Any display or format selection is applied only to the active trace.

You can change the active trace in two ways:

- In the Measure menu, press the Active Trace submenu key to select the trace that you want to be active. After a selection, notice how the active trace indicator on the display has changed. For example, if the active trace changed from TR1 to TR3, then the red highlight box moved from the upper left quadrant to the lower left quadrant.

  Not only does the graph get highlighted in red, but the Instrument Settings Summary legend on the left side of the sweep window also highlights the active trace. This becomes more important when you are trying to distinguish between active traces and other traces when they are all overlaid on one graph.

- Touching a trace area or touching the trace data in the Instrument Settings Summary causes that trace to become active.

Magnifying Glass

When Trace Format is Dual, Tri, or Quad, you can magnify the active trace by touching the magnifying glass symbol in the upper-right corner of the active trace.

Touching the magnifying glass symbol of a magnified trace reduces the trace size to return the display to the selected trace format.

While a trace is magnified, you can still change the active trace selection by touching the trace data in the Instrument Settings Summary.

Moving a Marker

When Trace Format is Single, Dual, Tri, or Quad, touching a trace can affect a marker. After the trace is active, you can touch and hold a marker to make it active. You can then move that marker by dragging with your finger. Your touch point on the vertical red line of the active marker represents a location on the x-axis, and this touch point may be anywhere on the y-axis (along the vertical red line). You can also double-tap (quickly) anywhere within the active trace window to bring the active marker to the x-axis location of your touch point. For greater precision, you can maximize the trace (with the “Magnifying Glass” icon) before moving the marker.

When the Marker Menu is Not Displayed:

You cannot move a marker with the **Arrow Keys** or the rotary knob.

When the Marker Menu is Displayed:

You can then move the active marker by touch, by keypad entry, by **Arrow Key**, or by rotary knob.

6-6 VNA Mode Menus

Figure 6-9, Figure 6-10, and Figure 6-11 show maps of the VNA menus. Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

Figure 6-9. Main Menu Keys

Sweep Menus

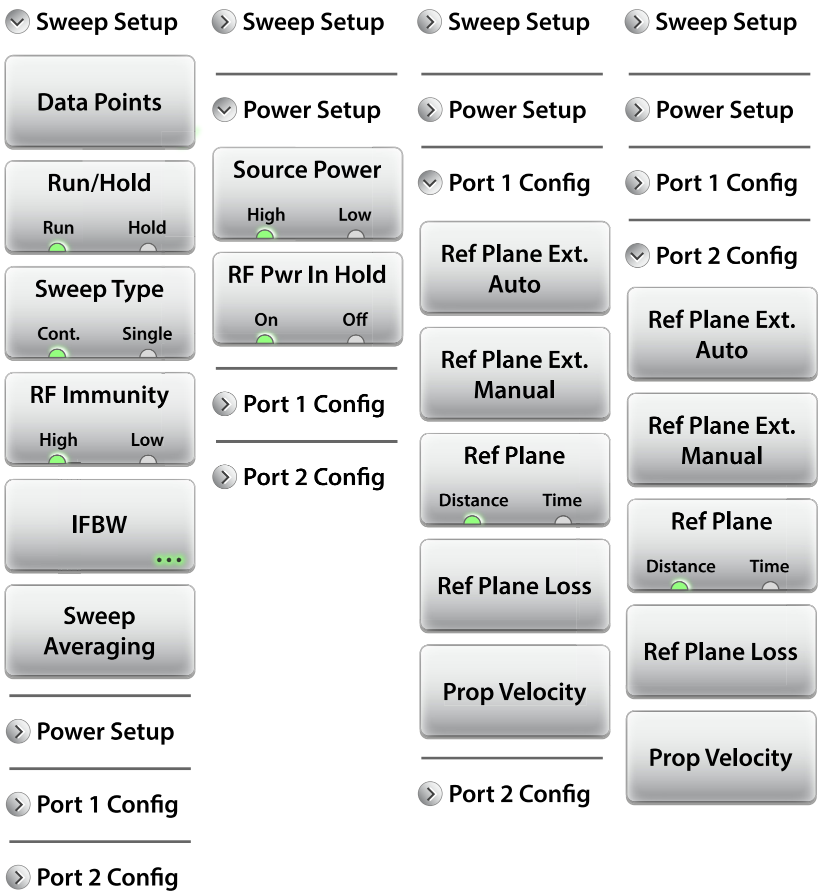


Figure 6-10. Sweep Menu Keys

Trace Menus

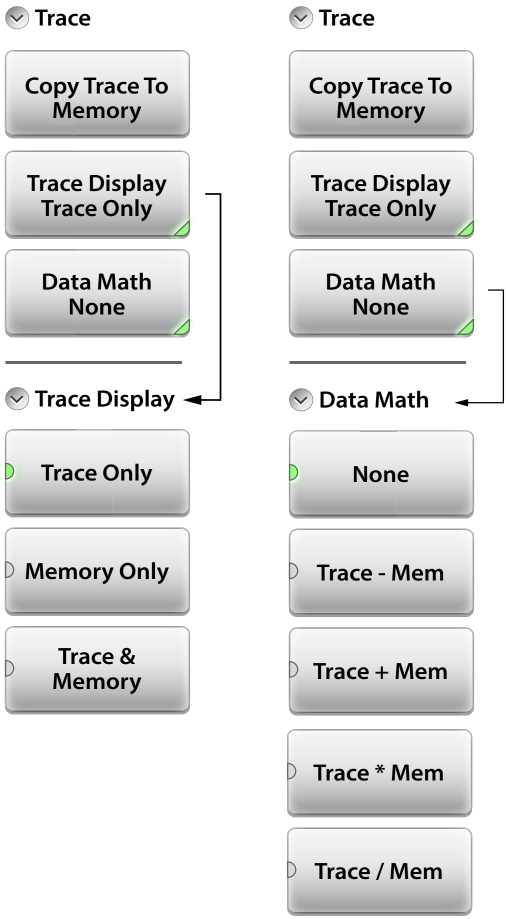
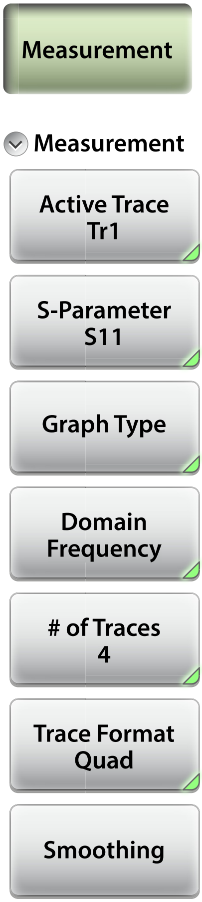


Figure 6-11. Trace Menu Keys

6-7 Measurement Menu

Key Sequence: **Measurement**



Measurement

Active Trace: Press this submenu key to select a trace to become the active trace.

S-Parameter: Press this submenu key to select an S-Parameter for the current (active) trace, choosing from: S_{11}, S_{21}, S_{12}, S_{22}

Graph Type: Press this submenu key to display the Graph type list box and choose a type for the current (active) trace. See Figure 6-13 on page 6-22.

Domain Frequency: Press this submenu key to choose a domain for the current (active) trace: Frequency or Distance. Each trace can use a different domain.

# of Traces: Press this submenu key to open the Number of Traces submenu and select the number of traces (1, 2, 3, or 4) to be simultaneously displayed in the sweep window. Refer also to “Trace Format and Number of Traces” on page 6-21.

Trace Format: Press this submenu key to open the Trace Format submenu and choose the screen format for trace display: Single, Dual, Tri, Quad. The selected Trace Format is shown on the soft key face.

Smoothing: Press this submenu key to add a smoothing percentage from 0 (zero) to 20 %. Use the arrow keys, the rotary knob, or the number keypad to input the value, and then press the % submenu key or the **Enter** key.

To turn smoothing Off, set its value to 0 %.

Figure 6-12. Measurement Menu

Trace Format and Number of Traces

Use Single trace format to display the active trace (or traces) at full size in the sweep window. If more than one trace is selected by the # of Traces submenu key, then the traces are displayed overlapping in the sweep window.

Use Dual trace format to display 2 traces in the sweep window, with the sweep window divided horizontally into 2 equal rectangles.

Use Tri trace format to display 3 traces in the sweep window, with the sweep window divided horizontally and vertically so that 2 equal rectangles share the upper half of the window, and one wide rectangle occupies the lower half of the window.

Use Quad trace format to display 4 traces in the sweep window, with the sweep window divided horizontally and vertically into 4 equal rectangles.

Regardless of the Trace Format that is selected, the number of traces that are displayed is controlled by the # of Traces submenu key.

Examples:

If 4 traces are displayed in Single Trace Format mode, then all 4 traces are displayed overlapping in the sweep window.

If 4 traces are displayed in Dual Trace Format mode, then Trace 1 and Trace 3 are displayed overlapping in the upper sweep window, and Trace 2 and Trace 4 are displayed overlapping in the lower sweep window.

If 4 traces are displayed in Tri Trace Format mode, then Trace 1 and Trace 2 are displayed individually in the upper half of the sweep window, and Trace 3 and Trace 4 are displayed overlapping in the lower sweep window.

If 4 traces are displayed in Quad Trace Format mode, then all 4 traces are displayed individually in the sweep window, each trace occupying one quarter of the sweep window.

If 1 trace is displayed in Dual, Tri, or Quad format, then that trace is displayed in the first quarter section of the sweep window, and any other sections are blank.

Graph Type List Box

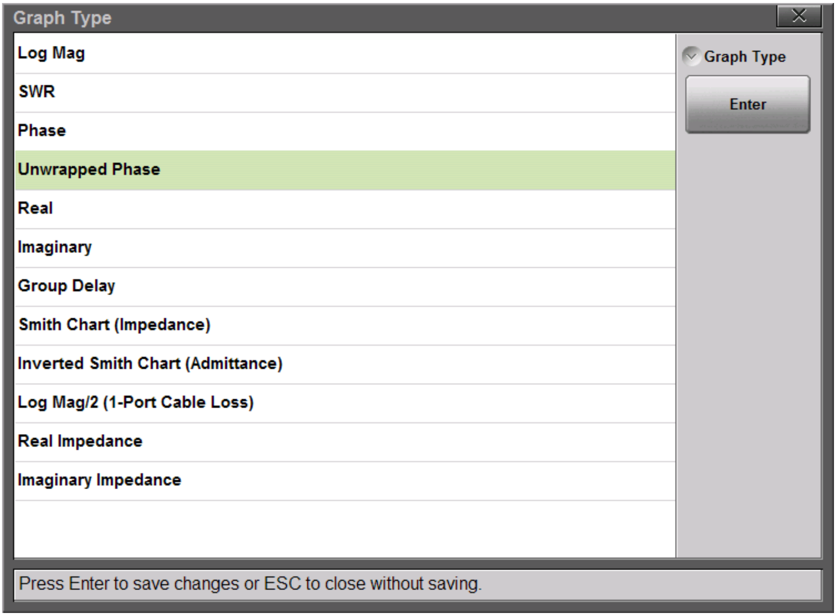
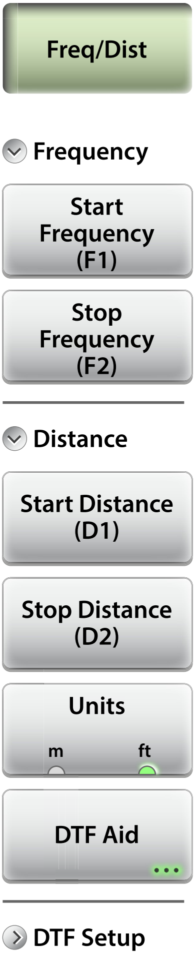


Figure 6-13. Graph Type List Box

6-8 Freq/Dist Menu

Key Sequence: **Freq/Dist** > Frequency or Distance



Frequency

Start Frequency (F1): Press the Start Frequency (F1) submenu key and enter the desired frequency using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key.

Stop Frequency (F2): Press the Stop Frequency (F2) submenu key and enter the desired frequency using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key.

Distance

Start Distance (D1): Press the Start Distance submenu key and enter the desired distance using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a distance using the keypad, press the appropriate units key.

Stop Distance (D2): Press the Stop Distance submenu key and enter the desired distance using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a distance using the keypad, press the appropriate units key.

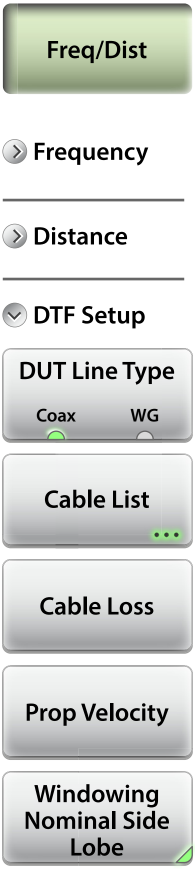
Units: Press the Units key to toggle distance units between meters and feet.

DTF Aid: Opens the DTF Aid dialog box (see Figure 3-5 on page 3-10). This interactive parameter box allows setting multiple parameters and displays maximum testing distance and resolution.

Figure 6-14. Frequency/Distance Menu (1 of 2)

Freq/Dist Menu (Continued)

Key Sequence: **Freq/Dist**



DTF Setup

DUT Line Type (Coax WG): Press this submenu key to toggle the line type between Coaxial cable and Waveguide. See Figure 6-16 on page 6-25 for the waveguide submenu keys.

Cable List: The Cable List submenu key opens a list of available cable specifications. Using **Up/Down Arrow** keys, the rotary knob, or the touchscreen, select the desired cable and press **Enter**. See Figure 6-17 on page 6-26 for an example of the cable and waveguide lists.

Note: When a cable is selected from this list, propagation velocity and cable loss are automatically set by the instrument. If the preselected values for propagation velocity or cable loss are changed, then the analyzer will use “NONE” as the cable type.

Cable Loss: Press the Cable Loss (or Waveguide Loss) submenu key and enter the loss in dB/ft or dB/m for the selected cable (or Waveguide) by using the keypad, **Up/Down Arrow** keys, or the rotary knob, and then press **Enter**.

Prop Velocity: Press the Prop Velocity submenu key and enter the applicable propagation velocity for the selected cable by using the keypad, **Up/Down Arrow** keys, or the rotary knob, and then press **Enter**.

Cutoff Freq: Press this waveguide submenu key and enter the applicable cutoff frequency in Hz for the selected waveguide by using the keypad, **Up/Down Arrow** keys, or the rotary knob, and then press **Enter**. See Figure 6-16 on page 6-25 for the waveguide submenu keys.

Windowing: Opens the “Windowing Menu” on page 6-27.

Figure 6-15. Frequency/Distance Menu (2 of 2)

DTF Setup for Waveguide

When the DUT line type is WG (waveguide), the coaxial cable submenu keys are changed to waveguide submenu keys.

Figure 6-16. Waveguide Submenu Keys

Cable and Waveguide List Boxes

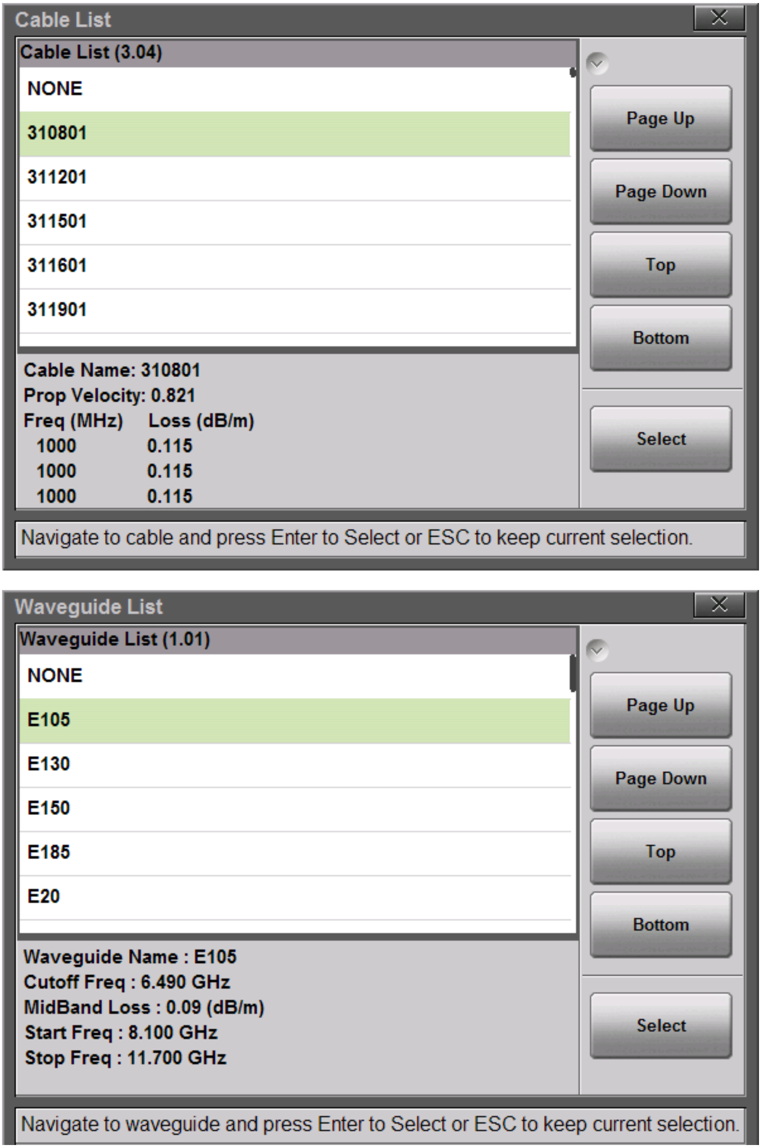


Figure 6-17. Cable and Waveguide List Boxes

Windowing Menu

Key Sequence: **Freq/Dist >** DTF Setup > Windowing

Windowing

Rectangular: Rectangular Windowing shows the highest side lobe levels (worst) and the greatest main lobe resolution (best).

Nominal Side Lobe: Nominal Side Lobe Windowing shows less side lobe levels than Rectangular Windowing (good) but lower main lobe resolution (very good).

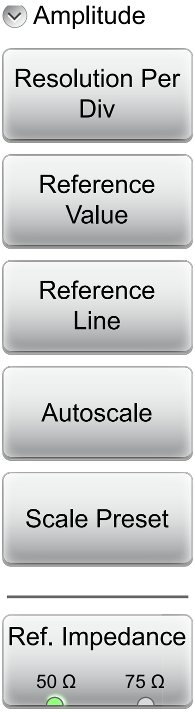
Low Side Lobe: Low Side Lobe Windowing shows less side lobe levels than Nominal Windowing (very good) but lower main lobe resolution (good).

Minimum Side Lobe: Minimum Side Lobe Windowing shows the lowest side lobe levels (best) but the least main lobe resolution (worst).

Figure 6-18. Windowing Menu

6-9 Amplitude Menu

Key Sequence: **Amplitude**



Amplitude

Resolution Per Div: Press this submenu key to set the number of units that are displayed between horizontal vertical graph lines. Units depend upon frequency, time, and distance settings. Use the **Up/Down Arrow** keys, the keypad, or the rotary knob to set this parameter, then press the **Enter** key to complete the entry.

Reference Value: Press this submenu key to set the value of the Reference Line. Use the **Up/Down Arrow** keys, the keypad, or the rotary knob to set this parameter, then press the **Enter** key.

Reference Line: Press this submenu key to set which horizontal graph is at the reference value. The reference line is indicated by a small colored triangle along the right edge of the graph. Use the **Up/Down Arrow** keys, the keypad, or the rotary knob to set this parameter, then press the **Enter** key.

Autoscale: Press the Autoscale submenu key to automatically adjust the Resolution Per Div and Reference Value so that the trace for the current measurement is shown in the middle of the display.

Scale Preset: Scale Preset automatically sets the scale to the default setting:

Log Mag: Res/Div = 10 dB, Ref Val = 0 dB
SWR: Res/Div = 1, Ref Val = 1
Phase: Res/Div = 45 deg, Ref Val = 0
Real/Imag: Res/Div = 0.2, Ref Val = 0
Impedance: Res/Div = 10 ohm, Ref Val = 50 ohm
Group Delay: Res/Div = 1 ns, Ref Val = 0 ns;

Ref. Impedance
50 Ω 75 Ω: Sets the reference impedance that is used for Smith Chart calculations to either 50 Ω or 75 Ω. The reference impedance determines the value of impedance at the center of the Smith Chart. This submenu key is displayed only when a Smith Chart trace is active.

Figure 6-19. Amplitude Menu

6-10 Calibration Menu

Refer to Chapter 7, “Calibration, VNA”.

6-11 Marker Menu

Key Sequence: **Marker**

Marker Setup

Select (1–8) M#: Press to turn on a marker (1 to 8) and selects which marker is active (green half circle). Current active marker is displayed on the button (M1).

Edit: Press to change the position of the active marker using the **Up/Down Arrow** keys, rotary knob or the keypad.

Type: Sets the current active marker as a reference (standard) marker or a delta marker relative to Marker 1. Marker 1 is always a reference marker.

M1 (On Off): Toggles the display of the active marker (M1 through M8) On or OFF. When off, the location of the marker is stored.

Display (Mkr + Table, Mkr Only, Off): Press to see display options.

> **Mkr+Table:** Displays both the markers that are on and the marker table.
>
> **Mkr Only:** Displays markers that are on, but hides the marker table.
>
> **Off:** Hides all markers and the marker table.

Marker Preset: Turns off all markers except for Marker 1. Sets Marker 1 location to the middle of the sweep.

Figure 6-20. Marker Menu (1 of 2)

Marker Menu (Continued)

Key Sequence: **Marker** > Marker Search

Marker Search

Tracking (On Off): When turned On, the active marker becomes a tracking marker and defaults to tracking the peak. To track Valleys, press the Marker to Valley button after turning on Tracking. The Search settings can all be applied to a Marker with Tracking either On or Off.

Marker to Peak: Places the currently active marker on the highest signal amplitude currently displayed on screen.

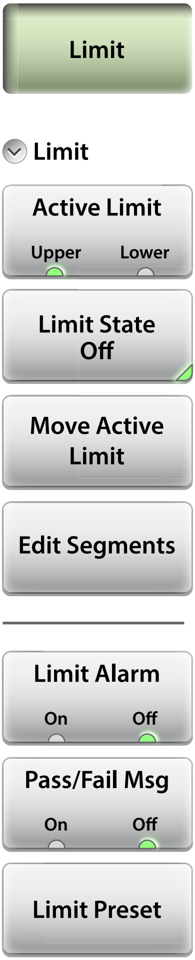
Marker to Valley: Places the currently active marker on the lowest signal amplitude currently displayed on screen.

Figure 6-21. Marker Menu (2 of 2)

6-12 Limit Menu

Limit lines can be used for visual reference only, or for pass/fail criteria using the limit alarm and Pass/Fail Message keys. Limit alarm failures are reported whenever a signal crosses the limit line.

Key Sequence: **Limit** (**6**) or **Limit**



Limit

Active Limit (Upper Lower): This key toggles the active limit line settings to the Upper or Lower limit.

Limit State: Press this key to display the Limit State menu and select one of three limit states: Off, single, or Segmented. The current limit state is displayed on the key.

Move Active Limit: Press this key to change the amplitude of the limit line with the **Up/Down Arrow** keys, rotary knob, or the number keypad. If the limit line is divided into segments, then all segments move by the same amount.

Edit Segments: Press this key to display the Segments menu and a table of limit line segments (see Figure 6-24 on page 6-33). Tap a segment (Upper or Lower), and then choose a function from the Edit Segments menu (Figure 6-25 on page 6-33). Refer also to "Edit Limit Values Dialog Box" on page 6-34.

Limit Alarm (On Off): When turned On, the Limit Alarm sounds a repeating beep when the trace touches the limit line.

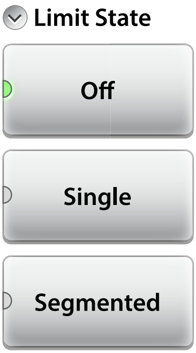
Pass/Fail Msg (On Off): When turned On, a Pass or Fail message is displayed to indicate whether the trace touches or exceeds the limit line (Fail).

Limit Preset: Turns the limit line off and clears amplitude information. The next time that a limit line is turned on, it will be displayed at the default location (center of the display).

Figure 6-22. Limit Menu

6-13 Limit State Menu

Key Sequence: **Limit** (**6**) or **Limit** > Limit State



Limit

Off: Press this key to turn off limit lines.

Single: Press this key to create or move a single limit line.

Segmented: Press this key to create or edit segmented limit lines.

Figure 6-23. Limit State Menu

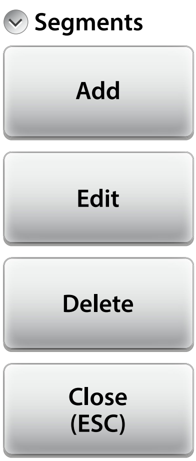
Edit Segments List Box

	#	Type	Start(x1,y1)	Stop(x2,y2)
	1	U	1 MHz, 26 dB	40000 MHz, 26 dB
	1	L	1 MHz, -14 dB	10000 MHz, -9 dB
	2	L	10100 MHz, -9 dB	20000 MHz, -9 dB
	3	L	20100 MHz, -9 dB	40000 MHz, -14 dB

Figure 6-24. Edit Segments List Box

Edit Segments (Limit) Menu

Key Sequence: **Limit** > Edit Segments



Edit Segments

Add: Press this key to add a segment. A dialog box is displayed allowing selection of Upper or Lower limit lines and settings for Start and Stop x-axis values and y-axis values. Press **Enter** to save changes, or press **ESC** to close without saving. Refer to "Edit Limit Values Dialog Box" on page 6-34.

Edit: Press this key to edit the highlighted segment. A dialog box is displayed allowing selection of Upper or Lower limit lines and settings for Start and Stop x-axis values and y-axis values. Press **Enter** to save changes, or press **ESC** to close without saving.

Delete: Press this key to delete the selected limit segments.

Close (ESC): Press this key (or press the **Esc** key) to close the Segments menu and return to the Limit menu.

Figure 6-25. Limit Line Segments Menu

Edit Limit Values Dialog Box

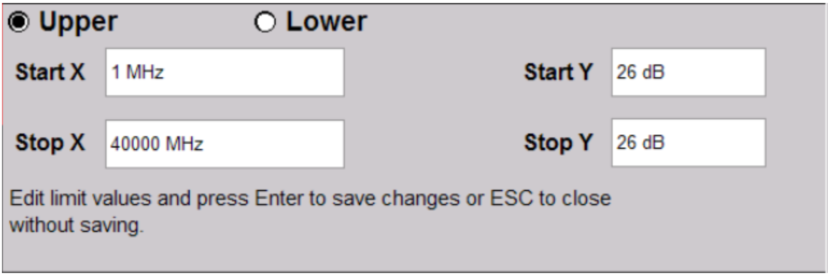
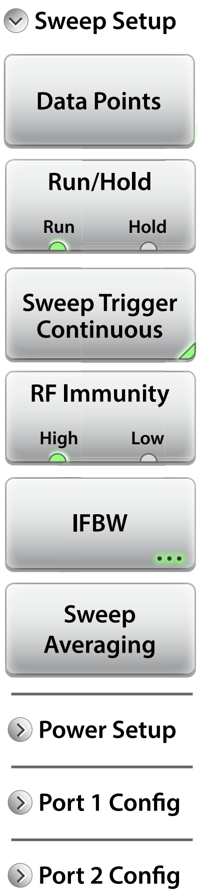


Figure 6-26. Edit Limit Values Dialog Box

6-14 Sweep Menu 1

Sweep Setup

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



Sweep Setup

Data Points: Sets the number of data points in the sweep. This value can be set to any integer value between 2 and 4001.

Run/Hold
Run Hold: Toggles between Run and Hold. When in Hold mode, pressing this key provides a trigger to initiate a sweep. When in the Run mode, pressing this key pauses the sweep.

Sweep Trigger: This displays the “Sweep Trigger Menu” on page 6-36. The mode is displayed on the submenu key. Continuous is the default.

RF Immunity
High Low: The instrument defaults to RF Immunity Low.

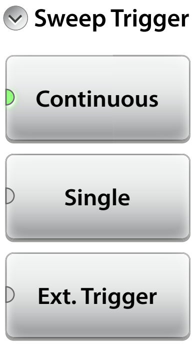
IFBW: Press this submenu key to display the IFBW selection box. Highlight one of the 13 choices. Refer to “IFBW” on page 6-37.

Sweep Averaging: Press this submenu key to set the number of sweeps to average at each sweep point (1 to 1000). Use the number keypad, the **Up/Down Arrow** keys, or the rotary knob, then press **Enter**.

Figure 6-27. Sweep Menu – Sweep Setup

6-15 Sweep Trigger Menu

Key Sequence: **Sweep** (**3**) > Sweep Setup > Sweep Trigger



Sweep Trigger

Continuous: Sets the sweep trigger to internal and continuous, and sets the Run/Hold setting to Run. A new sweep is triggered automatically at the end of each sweep. This is the default sweep trigger setting.

Single: Sets the sweep trigger to internal and single, and sets the Run/Hold setting to Hold. Each sweep is activated by the Run/Hold submenu key.

Ext. Trigger: Sets the sweep trigger to an external source. Each sweep is activated by a TTL signal at the External Trigger In connector. Refer to “Test Panel Connector Overview” on page 2-4.

Figure 6-28. Sweep Trigger Menu

IFBW

The following choices are available for the intermediate frequency bandwidth setting:

100 kHz	the maximum sweep speed
50 kHz	
20 kHz	
10 kHz	
5 kHz	
2 kHz	
1 kHz	default
500 Hz	
200 Hz	
100 Hz	
50 Hz	
20 Hz	
10 Hz	the maximum dynamic range

RF Immunity

The instrument defaults to RF Immunity Low. When set to High, RF Immunity protects the instrument from stray signals generated by nearby or co-located transmitters that can affect frequency and distance domain DTF measurements. The algorithm that is used to improve instrument ability to reject unwanted signals may slow down the sweep speed if interferers are detected. If the instrument is used in an environment where immunity is not an issue, then the RF Immunity key can be set to Low to optimize sweep speed. Use this feature with caution, because the introduction of an interfering signal might be mistaken for a problem with the antenna or cable run. If Immunity is set to Low during a normal measurement, then the instrument will be more susceptible to interfering signals. Interfering signals can make the measurement look better or worse than it really is.

6-16 Sweep Menu 2

Power Setup

Key Sequence: **Sweep** (**3**) > Power Setup

Power Setup

Source Power

High Low: This toggles the source power between High and Low. Refer to “Calibration Data and Indications” on page 7-2.

RF Pwr In Hold

On Off: Sets the RF Output power to be left On or to be turned Off when Run/Hold is toggled to Hold. Refer to “RF Pwr In Hold” for details.

Figure 6-29. Sweep Menu – Power Setup

RF Pwr In Hold

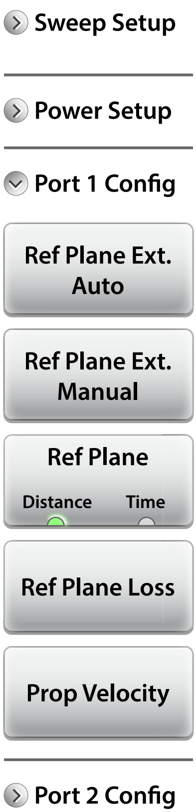
This setting determines if the RF output power at the RF Out/Reflect In port stays On or is turned Off when the instrument Run/Hold setting is toggled to Hold. To turn off RF power at the port when the instrument is placed in Hold mode and is not sweeping, set RF Pwr In Hold to Off. Power at the port is resumed when the Run/Hold setting is toggled back to Run. This is useful when you may not want a signal radiating out of the port at all times.

6-17 Sweep Menu 3

Port 1 Config and Port 2 Config

Port 2 configuration is identical except for the port number.

Key Sequence: **Sweep (3)** > Port 1 Config



Port 1 Config or *Port 2 Config*

Ref Plane Ext. Auto: Press this submenu key to automatically determine the best distance or time to mathematically extend the reference plane (Plane of Calibration) in order to remove an appropriate amount of linear phase rotation from the measurement data. Refer to "Reference Plane Extension Auto" on page 6-40.

Ref Plane Ext. Manual: Press this submenu key to manually enter a distance or time to which the Reference Plane (Plane of Calibration) is extended. Refer to "Reference Plane Extension Manual" on page 6-41.

Ref Plane Distance Time: Press this submenu key to toggle the units setting between Distance and Time for the Reference Plane Extension. This setting affects both the Auto and Manual units setting of the Reference Plane Extension.

Ref Plane Loss: Press this submenu key to set the reference plane loss in dB. The entered loss value for each port is displayed in the Instrument Settings Summary above the graph area.

Prop Velocity: This value is used by the Reference Plane Extension functions (distance units). Press this submenu key to enter the propagation velocity of electrical signals in the length of cable that is being removed by the Reference Plane Extension calculations. Values are expressed as a decimal ratio compared to the speed of light in a vacuum.

Examples:

1 = speed of light, and 0.5 = 1/2 the speed of light.

Figure 6-30. Sweep Menu – Port 1 Config or Port 2 Config

Reference Plane Extension Auto

This submenu key is used to automatically determine the best distance or time to mathematically extend the reference plane (Plane of Calibration) in order to remove an appropriate amount of linear phase rotation from the measurement data. The resultant display will unwrap phase (refer to "Phase versus Unwrapped Phase Graph Types" on page 6-8) to allow a better view of the phase properties of the Device Under Test. This function can be applied to a reflection measurement (S_{11} for port 1 or S_{22} for port 2) or to a transmission measurement (S_{21} for port 1 or S_{12} for port 2), depending on the user setup. To determine the appropriate phase rotation, and depending on your display settings, you may be presented with a message box (see Figure 6-31) asking you to specify to which S-parameter the reference plane extension should be applied. The calculated distance value or time value for each port is displayed in the Instrument Settings Summary above the graph area.

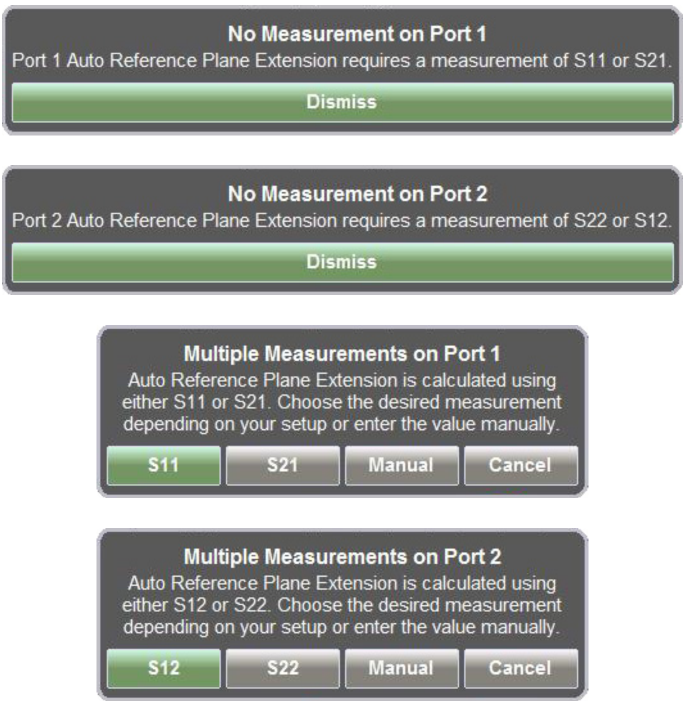


Figure 6-31. Message Boxes for Reference Plane Extension

Reference Plane Extension Manual

This submenu key is used to manually enter a distance or time to which the Reference Plane (Plane of Calibration) is extended. This action calculates and removes an appropriate amount of linear phase rotation (from the measurement data) based on the time or distance entered by using this submenu key. The entered distance or time value for each port is displayed in the Instrument Settings Summary above the graph area. When you enter a time or distance value, a Units menu is provided (as shown in Figure 6-32).

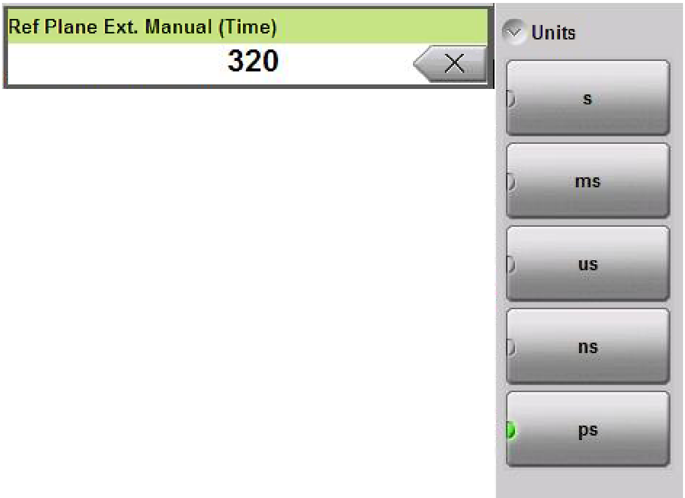


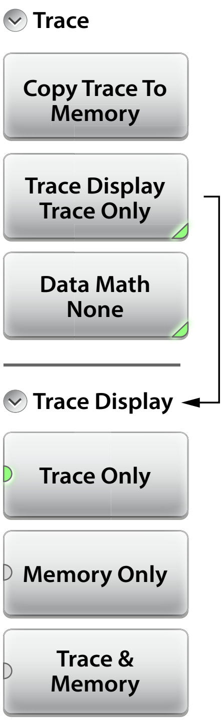
Figure 6-32. Manual Reference Plane Extension Entry with Time Units

6-18 Trace Menu

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

and

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



Trace

Copy Trace to Display Memory: Copies the current trace display to memory for use in Trace Math and Trace Display options.

Trace Display: Press to change the display options.

Data Math: Press to change the trace math options. Refer to "Trace Menu (continued)" on page 6-43.

Trace Display

Trace Only: The active trace is displayed (yellow).

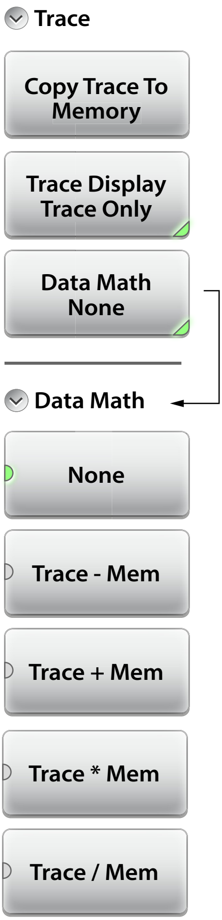
Memory Only: The trace that is stored in memory is displayed (purple).

Trace & Memory: If a trace is stored in memory, then the stored trace (purple) and the current active trace (yellow) are both displayed.

Figure 6-33. Trace Menu (1 of 2)

Trace Menu (continued)

Key Sequence: **Trace** (**5**) > Data Math



Trace > *Data Math*

Data Math: Press to change the trace math options. Note that all data math operations are applied to the complex S-parameter data of the trace or memory.

None: Press this submenu key to display the active trace as it is, with no math functions.

Trace – Mem: Press this submenu key to display the difference between the active trace and the trace in memory by subtracting the trace in memory from the current trace.

Trace + Mem: Press this submenu key to display the results of logarithmic adding of the active trace and the trace in memory.

Trace * Mem: Press this submenu key to set the trace math function to multiply the current trace by the trace that is in memory.

Trace / Mem: Press this submenu key to set the trace math function to divide the current trace by the trace that is in memory.

Figure 6-34. Trace Menu (2 of 2)

6-19 Other Menus Keys

Refer to Table 2-1, “Site Master Keypad Functions” on page 2-10.

Chapter 7 — Calibration, VNA

7-1 Introduction

This chapter provides details and procedures for calibrating the Vector Network Analyzer modes of the Site Master S820E.

Note	For accurate results, the instrument must be calibrated before making any measurements.

The Site Master is a high-precision instrument. When making 1-port or 2-port measurements, the instrument must be calibrated in order to remove residual errors due to measurement setup conditions. Anritsu recommends performing the calibration under the same conditions as the measurement: temperature, frequency, number of points, source power, and IFBW. The calibration must be conducted using the appropriate standards at the open end of any test port cables and adapters that are connected to Port 1 or Port 2 of the instrument. This will ensure that the match, phase length, and loss of these cables and adapters are all accounted for. For optimal performance, high quality phase-stable cables and precision adapters must be used.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

7-2 Calibration Considerations

Various 2-port calibrations are available in the S820E in VNA Mode. Transmission response is the simplest and requires only one connection during calibration, but it does not correct for test port match errors. 1-Path 2-Port calibration requires four calibration connections and corrects for the transmit port match, but does not correct for the receive port. Full 2-port calibration requires seven calibration connections and corrects for both test port match errors. The full 2-port calibration technique offers the most accuracy. Figure 7-5 on page 7-8 shows how calibration connections are displayed by the S820E.

Note	The previously described calibration considerations omit isolation steps in which loads are connected to each test port. During the isolation step of the calibration procedure, the S820E (in VNA Mode) measures the isolation between test ports in order to achieve best dynamic range performance.

For accurate results, the S820E must be calibrated at the ambient temperature after allowing for warm up time (approximately 15 minutes) and before making any measurements. The instrument must be recalibrated whenever the setup frequency changes, whenever the ambient temperature changes by an amount that has more than likely rendered the calibration invalid, or whenever a test port extension cable is added, removed, or replaced. For an example of measurement improvement after calibration, refer to “Example of Calibration Benefits” on page 7-4.

The calibration menu has a Thru Update submenu key (see Figure 7-12 on page 7-18) that allows you to recalibrate the Thru component without repeating the entire calibration sequence. Refer to “Thru Update” on page 4-15.

Calibration data are saved when you save a Setup file. When you recall a setup, the calibration remains valid if instrument conditions (such as temperature) remain within the calibration tolerance.

Calibration Data and Indications

When you perform a calibration, the correction coefficients are calculated for specific S-parameters (depending on the type of calibration chosen) and for instrument settings (frequency range, number of points, and power level). The term “calibration correction” refers to the measurement correction coefficients that are applied to measurements as a result of your calibration.

When calibration correction is On, the correction is applied to all applicable S-parameters. For example, if a Full S_{11} (1-port) calibration is performed, then only traces that measure S_{11} have a valid calibration. For those traces, the calibration information data in the Instrument Settings Summary shows "**CAL: OK**". All other traces that do not measure S_{11} display "**CAL: --**" to indicate that no valid calibration is available for those traces. The calibration correction can also be turned off manually under the Calibration menu by toggling the Cal Correction soft key from On to Off. In that case, the display shows "**CAL: OFF**" for all traces that have valid correction data available.

Note that "**CAL: OFF**" means that a calibration correction has been created, but it is not currently being used. This is different from "**CAL: --**", which means that no valid calibration correction is available for the current setting.

When you have Cal Correction on and Interpolation set to off, you cannot modify the frequency range or the source power level, or increase the number of points. You can, however, decrease the number of points without forcing the calibration to become invalid.

If you reduce only the number of points, then the frequency range is not changed. The S820E finds a subset of the original points in the sweep that can be used. You can therefore notice that the instrument may not use the exact number of points that you have entered. It picks a specific number of points that allow the calibration correction to continue to be valid. If you use the rotary knob, then you will more easily find the available number of points that can be set. For example, if you calibrated with 201 points, then you can observe that you can reduce the number of points to 101, 68, 51, 41, and so forth.

If Interpolation is set to on, then you can reduce the frequency range and modify the number of points without invalidating the calibration. In that case, the calibration coefficients are regenerated (interpolated) to match the new settings.

Another status information display that you may see is "**CAL: ON (X)**", which indicates that the instrument temperature has deviated (since the time the calibration was conducted) by an amount that has more than likely rendered the calibration invalid. When this occurs, a new calibration is highly recommended before further measurements are conducted.

Only one calibration is available at one time. Performing a new calibration overwrites any existing calibration. You can, however, store a measurement setup, which also stores the calibration. You can therefore have multiple calibrations available (as long as the calibration settings and conditions continue to apply).

Example of Calibration Benefits

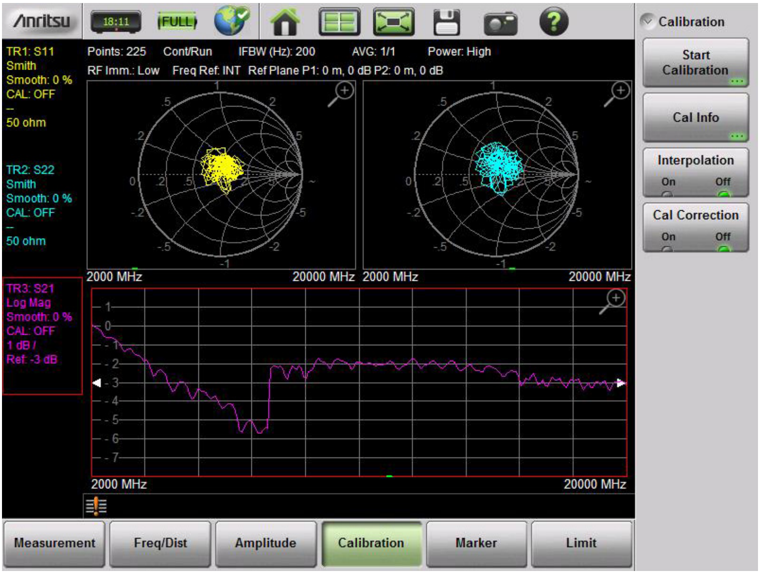


Figure 7-1. S_{11}, S_{22}, and S_{21} Measurements before Calibration

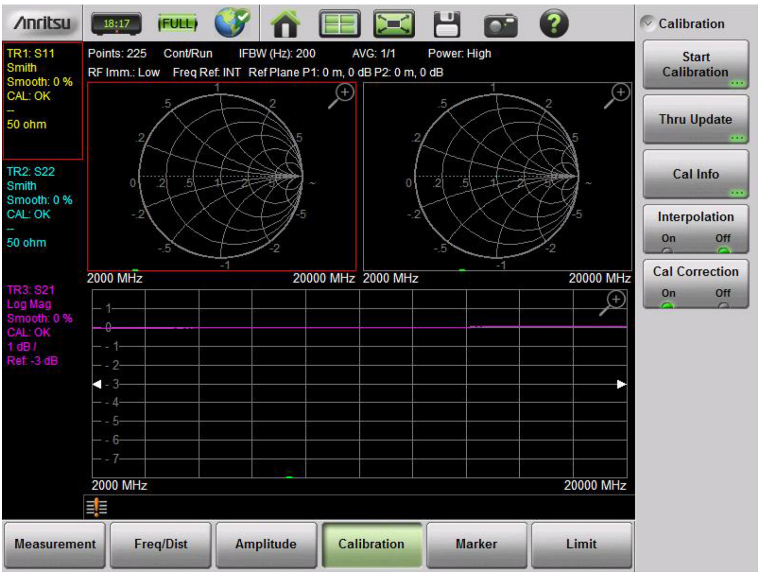
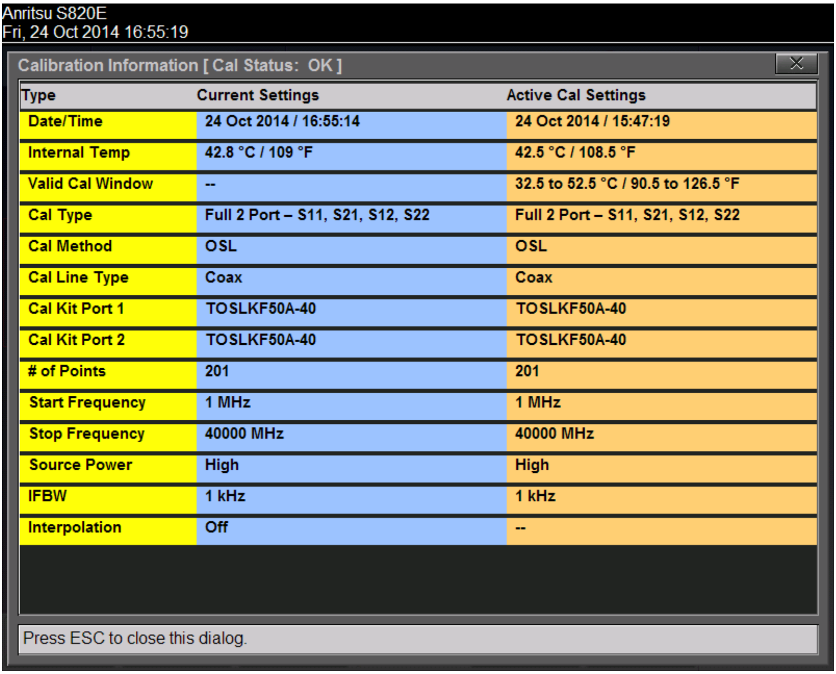


Figure 7-2. S_{11}, S_{22}, and S_{21} Measurements after Calibration

7-3 Calibration Setup

In order to perform a proper calibration, several parameters must be set before the calibration procedure is started. These parameters are: Cal Type, Cal Line, Cal Method, Port DUT, Port Cal Kit, and Thru Device.

To view a summary of these settings, begin from the Calibration main menu and press Cal Info. A summary of the Active Cal Settings and the Current Settings of the instrument are displayed (see Figure 7-3). Press **Esc** to close the Cal Info window.



Anritsu S820E
Fri, 24 Oct 2014 16:55:19

Calibration Information [Cal Status: OK]

Type	Current Settings	Active Cal Settings
Date/Time	24 Oct 2014 / 16:55:14	24 Oct 2014 / 15:47:19
Internal Temp	42.8 °C / 109 °F	42.5 °C / 108.5 °F
Valid Cal Window	--	32.5 to 52.5 °C / 90.5 to 126.5 °F
Cal Type	Full 2 Port – S11, S21, S12, S22	Full 2 Port – S11, S21, S12, S22
Cal Method	OSL	OSL
Cal Line Type	Coax	Coax
Cal Kit Port 1	TOSLKF50A-40	TOSLKF50A-40
Cal Kit Port 2	TOSLKF50A-40	TOSLKF50A-40
# of Points	201	201
Start Frequency	1 MHz	1 MHz
Stop Frequency	40000 MHz	40000 MHz
Source Power	High	High
IFBW	1 kHz	1 kHz
Interpolation	Off	--

Press ESC to close this dialog.

Figure 7-3. Cal Info Window

The Cal Info window displays all of the key setup parameters for the calibration. The current settings are shown on the left, and the settings of the instrument at the time of the last calibration are shown on the right.

Cal Type

Press the Cal Setup submenu button to choose a setup. In the Cal Setup menu, press the Edit Selection submenu button to choose a Cal Type.

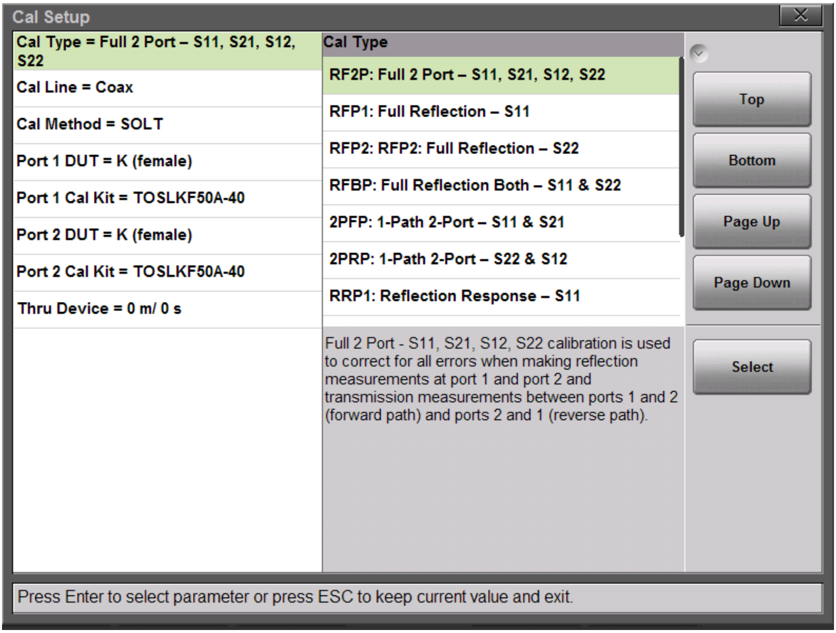


Figure 7-4. Cal Setup and Cal Type Dialog Box

Notice the Cal Type description below the Cal Type selection list.

Cal Line and Cal Method

The Site Master S820E supports measurements and calibrations for both coaxial and waveguide media. In the Cal Setup window, set the Cal Line to either Coax or Waveguide before starting the calibration.

Figure 7-5 shows the selection window for the Cal Line, within the Cal Setup dialog box. For coaxial line types, the calibration method that is most commonly used is the Open, Short, Load, Thru method, or SOLT. For waveguide line types, the calibration method that is most commonly used is the Offset Short 1 (1/8th wavelength), Offset Short 2 (3/8th wavelength), Load, Thru method, or SSLT. Use the Cal Method selection to set the appropriate method for the type of media being used during the calibration and measurements.

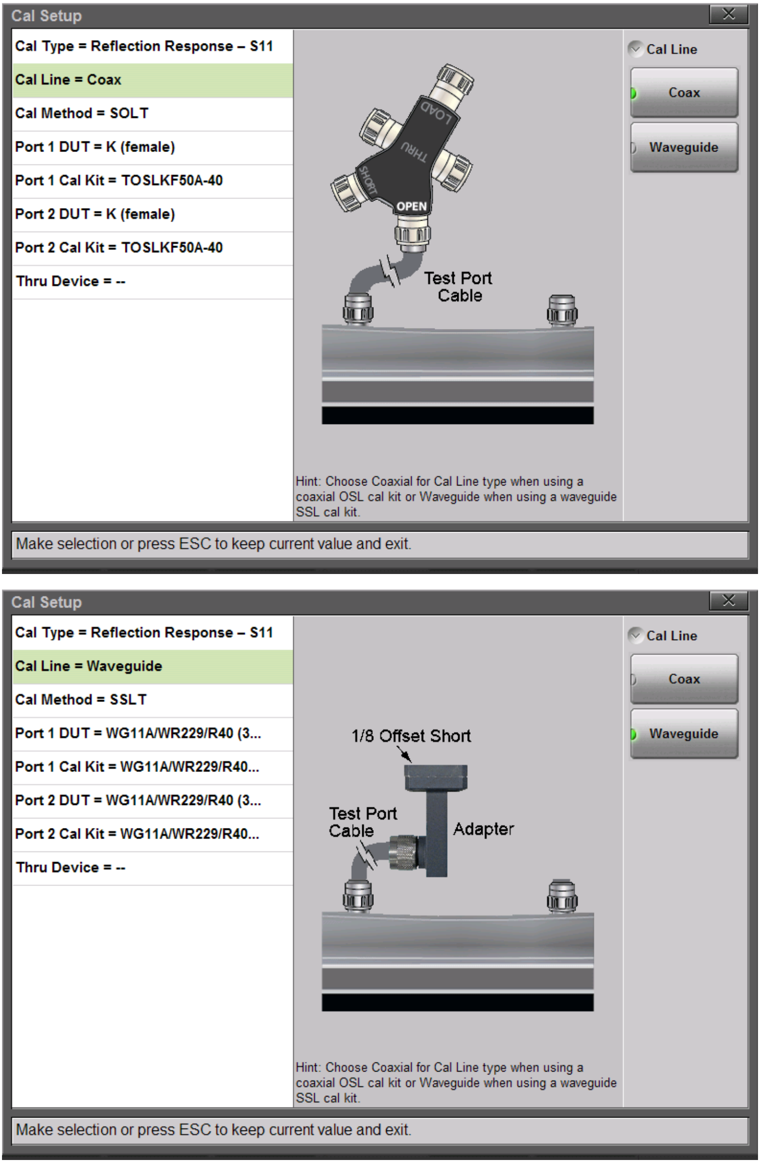


Figure 7-5. Cal Line Setup

Port 1 or Port 2 DUT and Cal Kit

For the most accurate calibrations, you must select the connector of the DUT that will be attached to Port 1 or Port 2 of the instrument. After you select the DUT connector, you must then select the desired calibration kit that will be used for the Port 1 or 2 correction. If you do not select a desired calibration kit, then the analyzer defaults to one of the built-in kits.

Figure 7-6 shows the selection window for the Port 1 DUT connector. For easier identification of the DUT connector, a representative picture is shown for each selection. After a connector is chosen, the Port 1 Cal Kit selection is updated in order to list only the available calibration kits that are associated with the selected DUT connector. Figure 7-7 on page 7-10 shows an example of the selection of calibration kits that are available for the K (female) coaxial DUT connector.

For each coaxial kit in the list, the values of the Offset Lengths for the Open, Short, and Thru (if applicable) are listed. The Capacitance and Inductance values for the Open and Short are also listed, as shown in Figure 7-7. For waveguide calibration kits, the Cutoff Frequency and the Offset Short 1 and Short 2 lengths are listed.

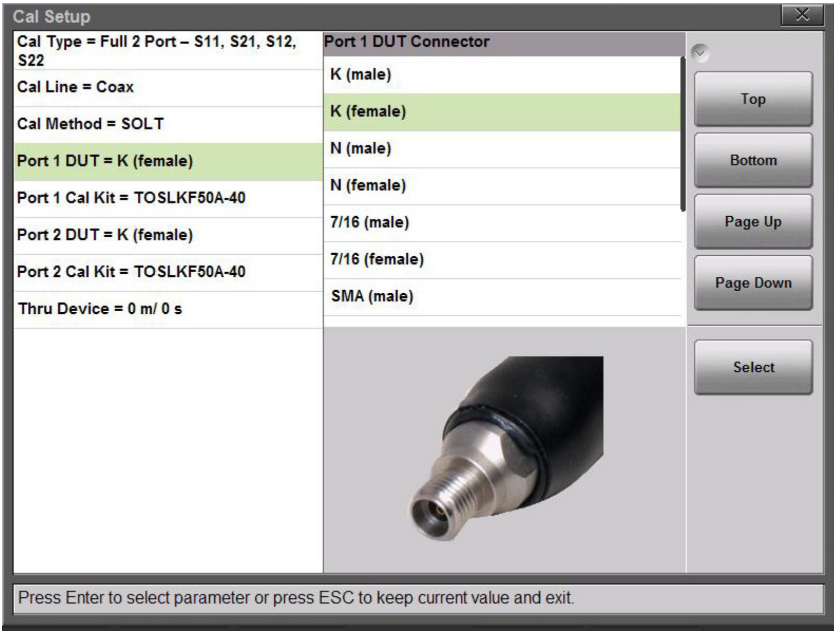


Figure 7-6. Selection Window for Port 1 DUT Connector

Figure 7-7 shows the Selection window for the Port 1 Cal Kit with its list of available calibration kits and the corresponding parameters for each kit.

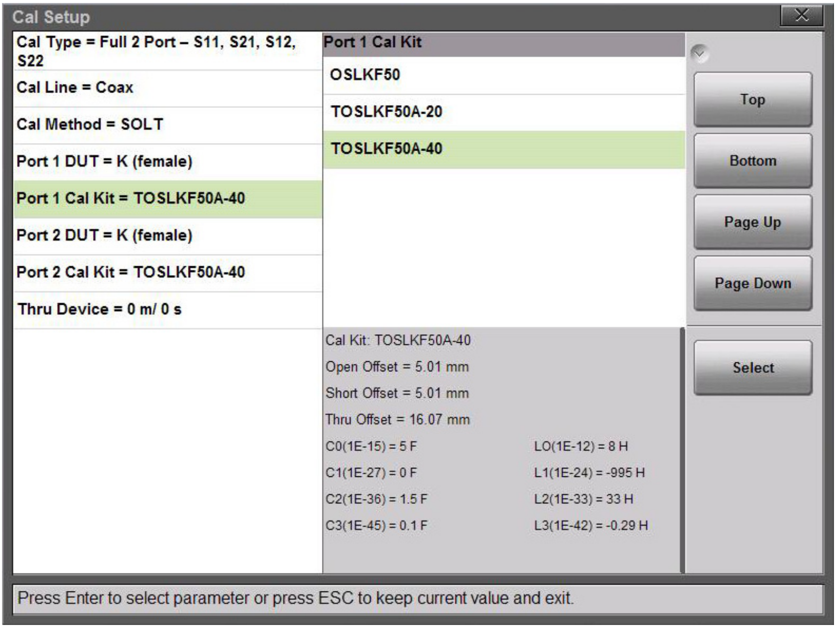


Figure 7-7. Selection Window for Port 1 Cal Kit

The selection list for DUT connectors includes all of the common connectors that you may encounter. Table 7-1, "Coax Dut Connectors and Cal Kits" on page 7-11 and Table 7-2, "Waveguide DUT Connectors" on page 7-12 provide complete lists of Coax and Waveguide connectors and corresponding calibration kits that are selectable through the Cal Setup dialog box.

Table 7-1. Coax Dut Connectors and Cal Kits

Coaxial Connector Name	Available Cal Kits
N-Type (male)	OSLN50, OSLN50-1, OSLN50A-8, OSLN50A-18, TOSLN50A-8, TOSLN50A-18
N-Type (female)	OSLNF50, OSLNF50-1, OSLNF50A-8, OSLNF50A-18, TOSLNF50A-8, TOSLNF50A-18
K (male)	OSLK50, TOSLK50A-20, TOSLK50A-40
K (female)	OSLKF50, TOSLKF50A-20, TOSLKF50A-40
7/16 (male)	2000-1618-R, 2000-767
7/16 (female)	2000-1619-R, 2000-768
4.3-10 (male)	2000-1915-R
4.3-10 (female)	2000-1914-R
SMA (male)	3650 (male components of kit)
SMA (female)	3650 (female components of kit)
TNC (male)	1091-53, Open
TNC (male)	1091-54, Short
TNC (male)	1015-55, Termination
TNC (female)	1091-55, Open
TNC (female)	1091-56, Short
TNC (female)	1015-54, Termination
User 1: Coax	User 1 (Coax)
User 2: Coax	User 2 (Coax)
User 3: Coax	User 3 (Coax)
User 4: Coax	User 4 (Coax)
User 5: Coax	User 5 (Coax)
User 6: Coax	User 6 (Coax)
User 7: Coax	User 7 (Coax)
User 8: Coax	User 8 (Coax)
User 9: Coax	User 9 (Coax)
User 10: Coax	User 10 (Coax)

Table 7-2. Waveguide DUT Connectors

Waveguide Connector Name
WG11A/R40 (3.30 to 4.90 GHz)
WG12/WR187/R48 (3.95 to 5.85 GHz)
WG13 (4.90 to 7.00 GHz)
WG14/WR137/R70 (5.85 to 8.20 GHz)
WG15/WR112/R84 (7.05 to 10.0 GHz)
WG16/WR90/R100 (8.20 to 12.4 GHz)
WG17/R120 (10.0 to 15.0 GHz)
WG18/WR62/R140 (12.4 to 18.0 GHz)
WG20/WR42/R220 (18.0 to 26.5 GHz)
WG22/WR28/R320 (26.5 to 40.0 GHz)
User 1: WG
User 2: WG
User 3: WG
User 4: WG
User 5: WG
User 6: WG
User 7: WG
User 8: WG
User 9: WG
User 10: WG

If you are using custom connectors that are not already listed, then the Site Master S820E allows you to create up to ten User DUT connectors and corresponding User Cal Kits. Choose one of the User connectors from the Port 1 DUT Connector list, as shown in Figure 7-8 on page 7-13. You can edit the name of the DUT connector, as indicated on the Site Master screen.

For each User DUT connector, a corresponding User Cal Kit is selected, as shown in Figure 7-9 on page 7-14. The coefficients for the calibration kit can be edited, as indicated on the Site Master screen. Customizing the connectors and calibration kit coefficients allows you to have the most flexibility in using any calibration kit that may be required for your measurements.

The user-entered coefficients are retained in the instrument's non-volatile memory and will persist even after the Site Master is powered down or after a Factory Reset. Recalling a setup file will not overwrite the user coefficients.

Caution	To ensure utmost measurement accuracy and consistency, please use the Anritsu calibration kits that are listed in the Calibration menu. These can be found in the accessories section of the S820E technical data sheet. Other Calibration kits that are not listed in the Calibration menu may be used provided you enter the correct required calibration coefficient information under one of the available custom User settings.

Figure 7-8 illustrates the Selection window for the Port 1 DUT connectors, showing the list of custom User connectors available to the user. The name of the connectors can be edited as indicated on the screen.

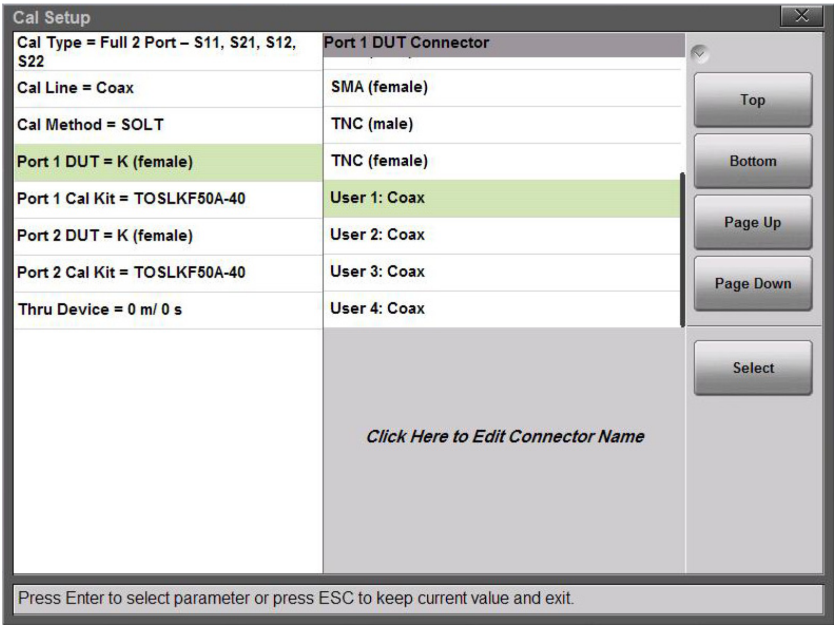


Figure 7-8. Cal Setup, Port 1 DUT Connectors

[Figure 7-9](#) shows the selection window for the custom User cal kits corresponding to the User 6 DUT coaxial connector. The corresponding cal kit parameters are shown and can be edited as indicated on the screen.

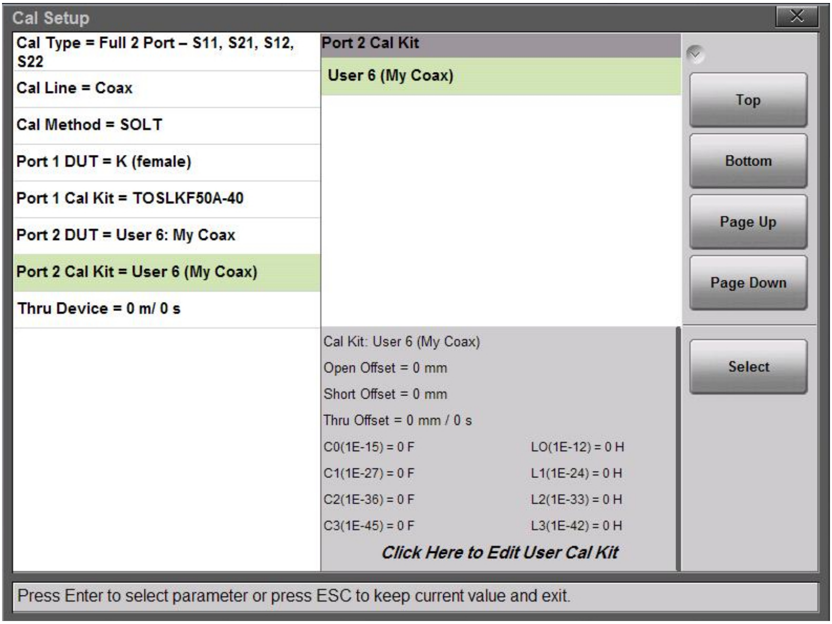


Figure 7-9. Cal Setup, Port 1 DUT Coax Connector

Thru Device

After you have set up Port 1 and Port 2 DUT and cal kits, you must also set the Thru Device that is used in the Thru step of the calibration that is being conducted, if applicable. The Thru device accounts for any extra length that is used during the calibration steps (such as an adapter) but is removed for the actual measurement of the DUT. In these cases, if the Thru device length is not accounted for, then the resulting measurements will have an offset error.

The Thru device length can be set in units of distance or time, or it can be set to equal the Thru length offset of the cal kits that are used for Port 1 or Port 2, if applicable. Figure 7-10 shows the selection window for the Thru device setting.

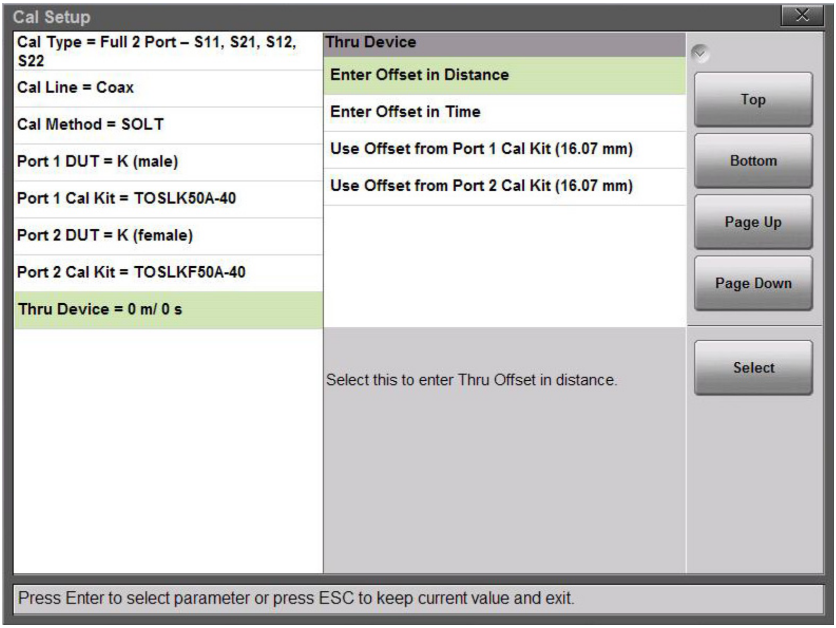


Figure 7-10. Thru Device Setting

7-4 Calibration Procedures

In Vector Network Analyzer Mode, calibration is required when the test port cable or adapters have been changed or when no valid calibration is available (**Cal Status --**). The following sections describe how to perform calibrations.

Note	If a Test Port Extension Cable is to be used (this is recommended), then it must be connected to the Site Master before calibration.

Calibration Procedure

1. Press the **Freq/Dist** main menu key and enter the appropriate frequency range.
2. In the Sweep menu, set the source power level.
3. Press the **Calibration** main menu key, then press Start Calibration.
4. Press Cal Setup to make changes to the setup as needed (refer to Section 7-3 “Calibration Setup” on page 7-5).
5. Press Measure and follow the on screen instructions (see Figure 7-11 on page 7-17).
6. Verify that the calibration has been completed by confirming that the Cal Status message is now displaying “**Cal: OK**”. The calibration correction factor will then be applied to the measurements.
7. The calibration factors can be turned Off with the Cal Correction button. The calibration coefficients are saved and can be reapplied by setting Cal Correction back to On.

Figure 7-11 shows the Calibration dialog box illustrating calibration setup and calibration steps. On-screen instructions are given for each step.

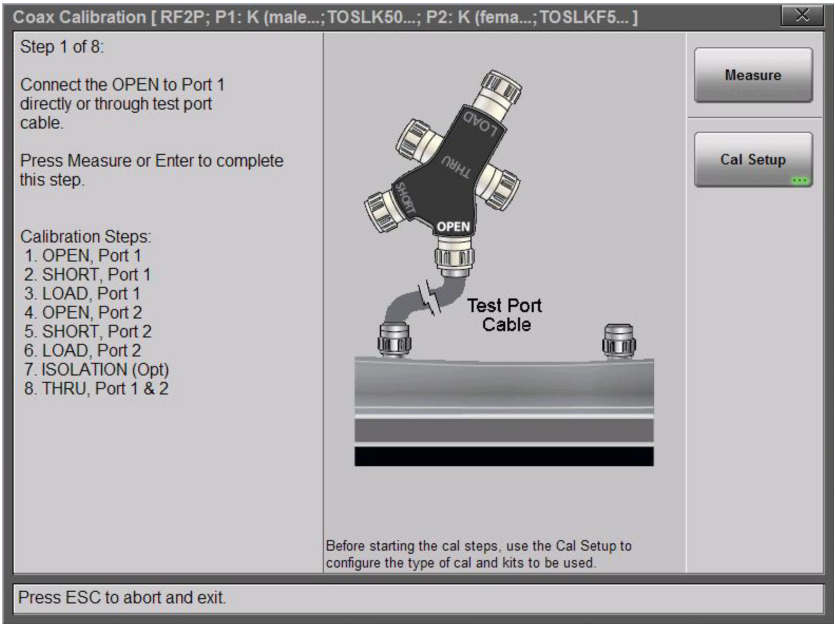


Figure 7-11. Calibration Dialog Box for Coax

Save and Recall Calibration Coefficients

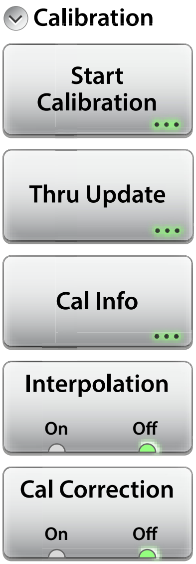
Calibration information is included when a setup (`.stp`) file is saved (even if the Cal Correction is Off). The calibration information is recalled with a setup file and can be applied if the current internal instrument temperature is within the saved calibration window.

Calibration information is not included when a measurement (`.svna`) file is saved.

7-5 Calibration Menu

Key Sequence: **Calibration**

Calibration



Start Calibration: Opens the Calibration dialog box (Figure 7-13 on page 7-20). Two menu buttons are displayed in the Calibration dialog box.

Thru Update: Opens the Calibration dialog box to allow calibrating the Thru component without repeating the entire calibration sequence. This key is displayed only after a calibration with a Thru component.

Cal Info: Displays the Calibration Information table showing the current and active calibration settings. See Figure 7-3 on page 7-5.

Interpolation (On Off): Press this submenu key to toggle Interpolation On or Off. After performing a Standard calibration, you can turn Interpolation On and then change the frequency range (smaller) or change the number of data points. For more details, refer to "Interpolation" on page 7-19.

Cal Correction (On Off): Press this submenu key to toggle Cal Correction On or Off. Turn Cal Correction On to apply the correction factor to the current measurement. For more details, refer to "Cal Correction" on page 7-19.

Figure 7-12. Calibration Menu

Interpolation

You can set your instrument to interpolate the calibration coefficients of a Standard mode calibration. After performing a Standard calibration, you can turn Interpolation On and then change the frequency range (smaller and anywhere within the calibrated range) or change the number of data points. You cannot increase the frequency range beyond the range that was used during calibration. The submenu key is “Interpolation (On Off)” on page 7-18.

For example, you could perform a calibration from 1 MHz to 40 GHz using 4001 points. With Interpolation On, you could then make a measurement by zooming in on a desired frequency range, 410 MHz to 435 MHz for example. The trace in your measurement would use of the full 4001 points within this much narrower frequency range. With Interpolation Off, the instrument would use only the number of points that were calibrated within this narrower frequency band, which would be a much smaller number of points.

Cal Correction

Cal Correction is turned on automatically after the calibration process has been completed successfully. When Cal Correction is On, the calibration coefficients are applied to the measured data, resulting in corrected S-parameter data. You can turn Cal Correction Off, which results in trace data using uncorrected (or raw) S-parameter data.

Calibration Dialog Box

Key Sequence: **Calibration** > Start Calibration

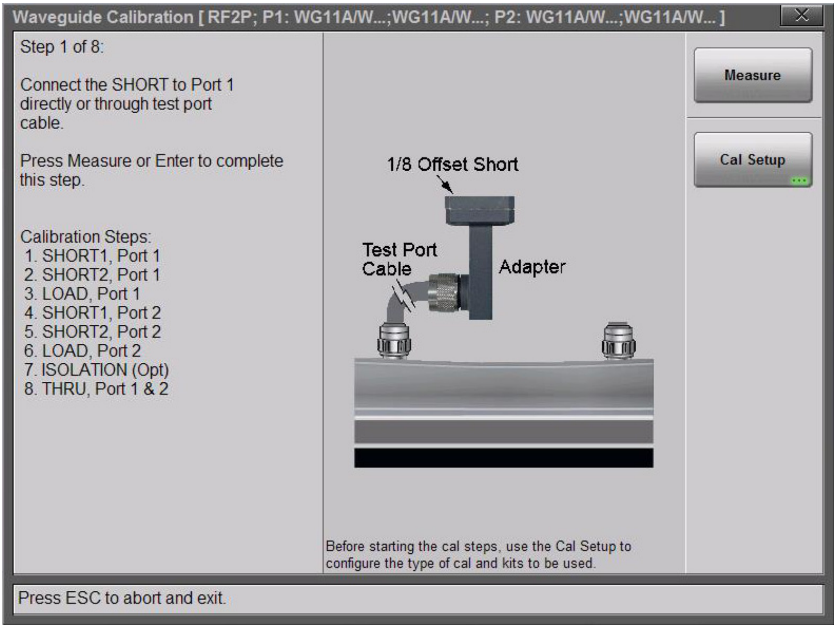


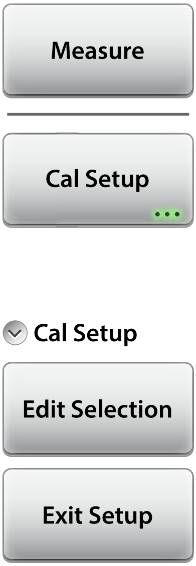
Figure 7-13. Calibration Dialog Box

Measure: Starts the calibrations process. Follow the on screen instructions.

Cal Setup: Press this submenu key to choose a calibration type.

Start Calibration Menu

Key Sequence: **Calibration** > Start Calibration



Calibration

Measure: Starts the calibrations process. Follow the on screen instructions.

Cal Setup: Press this submenu key to choose a calibration type.

Edit Selection: Press this submenu key to further refine a calibration setup type. For an example, refer to "Calibration Edit Selection Dialog Box" on page 7-22.

Exit Setup: Press this submenu key to exit the setup screen and begin the calibration (by pressing Measure).

Figure 7-14. Start Calibration Menu

Calibration Edit Selection Dialog Box

Key Sequence: **Calibration** > Start Calibration > Cal Setup > Edit Selection

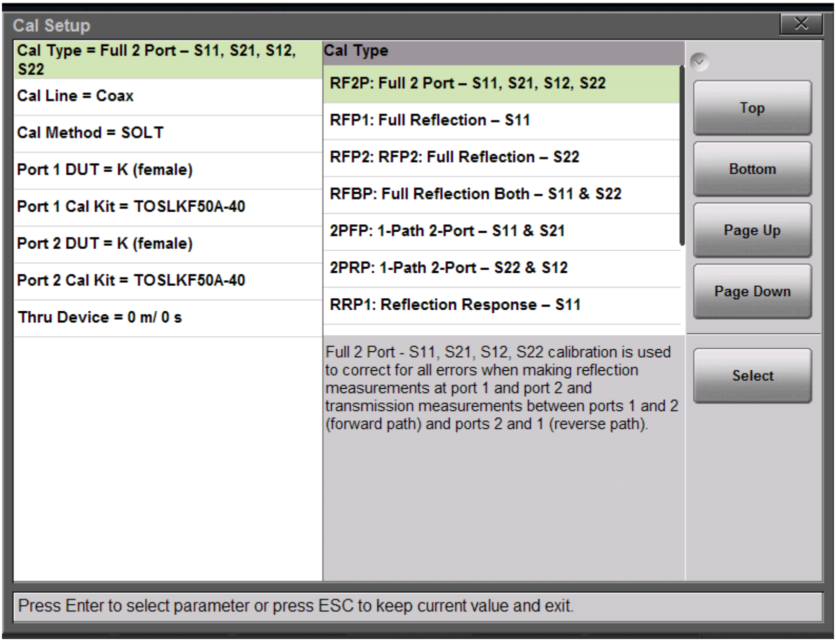


Figure 7-15. Calibration Edit Selection Dialog Box

Chapter 8 — Vector Voltmeter

8-1 Introduction

This chapter provides an overview of Vector Voltmeter or VVM Mode (Option 441). Vector Voltmeter Mode in the S820E provides a modern equivalent functionality to the classic analog Vector Voltmeter (VVM) instrument, which has been discontinued for many years. The classic analog VVM had 2 input channels (typically A and B), and both were capable of measuring voltage directly. The classic VVM, however, did not have any internal signal source or bridges or couplers needed to perform reflection or transmission measurements. Those items needed to be supplied externally.

With the proper addition and usage of those external items, the classic analog VVM could be configured to perform complex measurements (reflection or transmission) between the 2 inputs (A/B or B/A). Typically one of the input channels would be dedicated as the reference channel, and the remaining channel would be used to perform the desired measurements. The A/B and B/A ratio measurements were the predominant usage of the classic analog VVM.

The S820E VVM option provides equivalent A/B and B/A ratio capability, which means that it can be used as a drop-in replacement for a classic analog VVM. Since it already has a source and couplers built-in, it can also measure reflection or transmission of a DUT directly without needing any additional external items.

The S820E VVM option also offers additional capabilities that the classic VVM did not offer, such as the table display, which allows you to measure up to 12 devices. All 12 DUT measurements can be simultaneously compared to a single reference DUT response. This is especially useful in complex phase array antenna systems where cable lengths that are feeding multiple antennas need to have a precise phase relationship to each other.

The function hard keys in Vector Voltmeter mode are:

Measurement, Frequency, Amplitude, Calibration, Sweep, [BLANK]

The sixth key is not used in this mode.

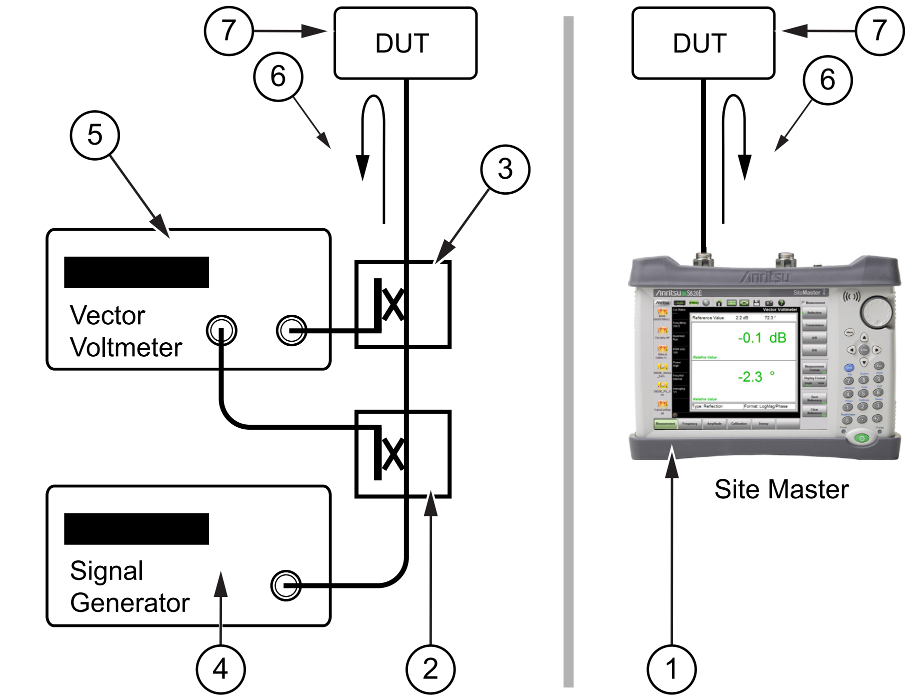
8-2 How the VVM Function Works

Four basic vector voltmeter measurement types are available: Reflection, Transmission, A/B (Port 1/Port 2), and B/A (Port 2/Port 1).

With Option 441 in the S820E, you can measure relative magnitude and phase of a DUT either directly (using the built-in source and couplers) or as a ratio function (A/B or B/A) using appropriate external accessories such as a CW signal source and either a power splitter or a coupler. Direct measurements can be 1-port (reflection) or 2-port (transmission) and may also be vector error corrected, thereby providing absolute measured values versus relative measured values. Option 441 is a stand-alone option in the S820E and does not require the VNA Mode (Option 440) to provide full A/B and B/A ratio capability. All measurements made with Option 441 are based on CW signals. They are not swept frequency measurements.

Reflection measurement (1-port): This technique is most often used for cable trimming, but it can also be used to validate the proper electrical length of any low loss DUT. It is most often used with a reference measurement (golden DUT) which is stored into memory, then subsequent DUTs may be measured and compared against the stored reference. As an option, the measurement port may be vector error corrected (via the calibration process, refer to Chapter 4) to provide optimal results. This is the simplest and most convenient VVM measurement. Best results are obtained when the DUT loss is < 20 dB. For a very lossy DUT, use the Transmission Measurement type.

Figure 8-1 shows a block diagram comparison of the test configuration for the traditional Vector Voltmeter instrument method (left) and the equivalent measurement capability integrated within the Site Master in VVM mode (right) when the S820E is used for a reflection measurement.

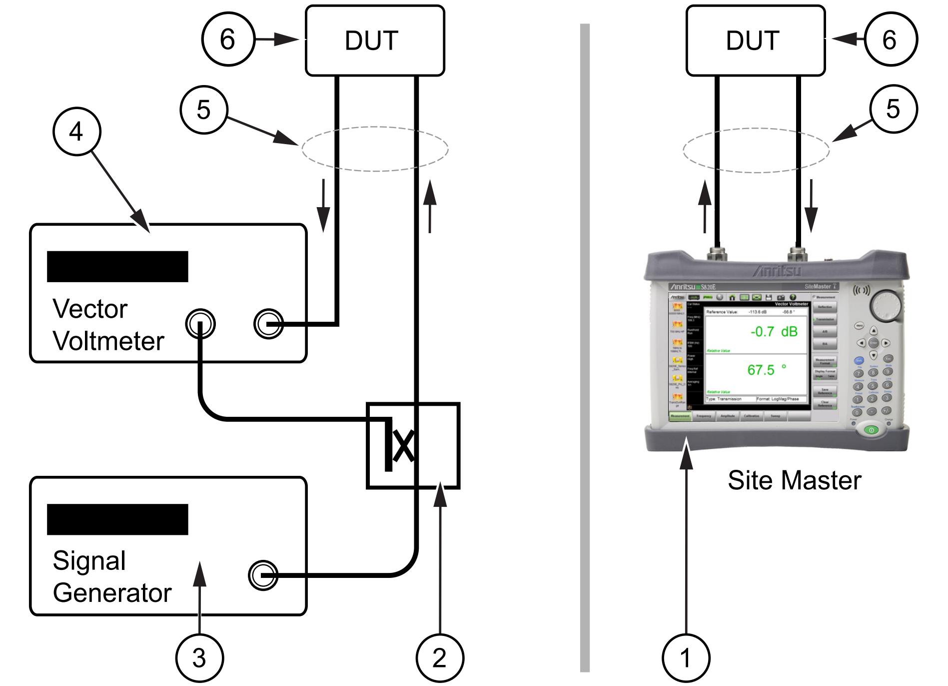


(Left) Vector Voltmeter and (Right) S820E Site Master Equivalent Measurement	
1	S820E Site Master
2	Coupler or Splitter
3	Coupler or Bridge
4	Signal Generator
5	Vector Voltmeter
6	Reflection Measurement
7	DUT (Device Under Test)

Figure 8-1. Vector Voltmeter Reflection Measurement

Transmission measurement (2-port): This technique uses the VVM function in a straightforward manner with its 2-port setup. The transmission response of the DUT is measured from port 1 to port 2. The DUT amplitude and phase shift are measured by the highly sensitive port 2 receiver. The high dynamic range of this measurement is ideal when the DUT loss is high.

Figure 8-2 shows a block diagram comparison of the test configuration for the Vector Voltmeter instrument method (left) and the equivalent measurement capability integrated within the Site Master in VVM mode (right) when the S820E is used for a transmission measurement.

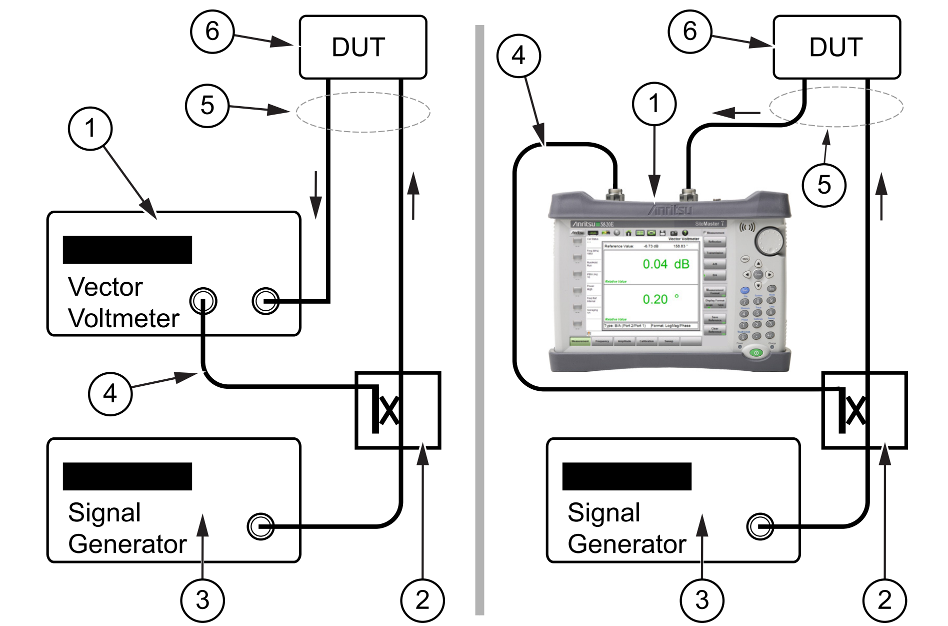


(Left) Vector Voltmeter and (Right) S820E Site Master Equivalent Measurement	
1	S820E Site Master
2	Coupler or Splitter
3	Signal Generator
4	Vector Voltmeter
5	Transmission Measurement
6	DUT (Device Under Test)

Figure 8-2. Vector Voltmeter Transmission Measurement

A/B or B/A Measurements: For Reflection or Transmission measurements, the S820E VVM function can replace the entire setup of source, VVM, and couplers, as shown in Figure 8-1 and Figure 8-2. If the measurement setup still requires the use of an external source and couplers, however, then the S820E VVM function can replace only the original Vector Voltmeter by using the A/B or B/A measurement selection. The B/A setup is shown in Figure 8-3 with the traditional Vector Voltmeter instrument method (left) and the equivalent measurement using the Site Master in VVM mode (right). For these measurements, the reference signal is received on one port of the S820E (Port 1 for B/A and Port 2 for A/B) while the signal transmitted through or reflected from the DUT is received on the other port.

B/A Measurement



(Left) Vector Voltmeter and (Right) S820E Site Master Equivalent Measurement

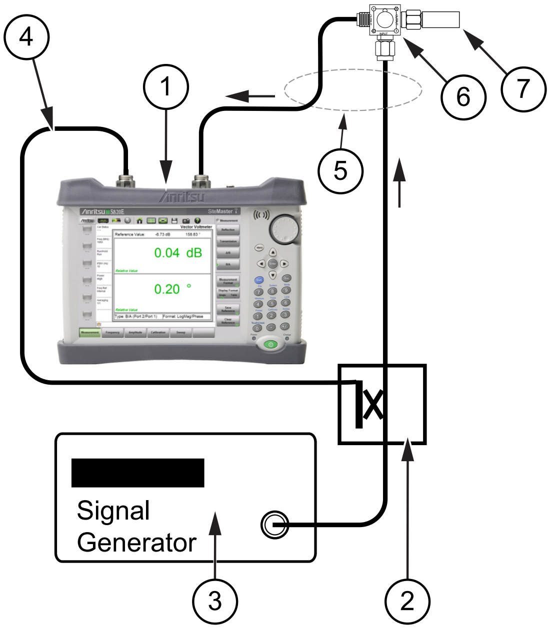
1	Vector Voltmeter or S820E Site Master
2	Coupler or Splitter
3	Signal Generator
4	Reference Signal
5	B/A Measurement
6	DUT (Device Under Test)

Figure 8-3. Vector Voltmeter B/A Measurement

8-3 Example B/A Measurement

The S820E in VVM mode can be used to measure the two ports of a splitter and compare them.

1. Connect a reference frequency to Port 1 of the S820E and to the input of the splitter (see Figure 8-4). This is the A input for the B/A measurement.



1	S820E Site Master in VVM mode
2	Coupler or Splitter
3	Signal Generator
4	Reference Signal
5	B/A Measurement
6	Splitter as DUT
7	50 ohm Load

Figure 8-4. VVM B/A Measurement of a Splitter

2. Connect one output side of the splitter to Port 2, and connect a 50 ohm load to the opposite output side. Press Save Reference to use this measurement as reference when you measure the other output side of the splitter. See Figure 8-5.

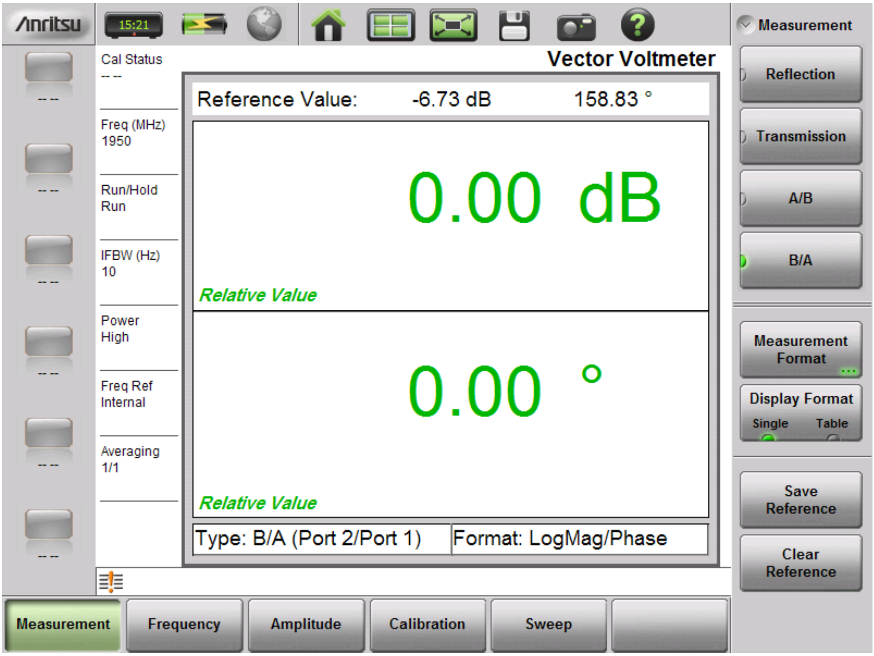


Figure 8-5. First Side of Splitter Measured and Saved as Reference

3. After the reference value has been stored (in Step 2), reverse the splitter output connections and remeasure. The difference between both outputs of the splitter is displayed as the *Relative Value* that is shown in green on the S820E screen. This is the error between the two outputs of the splitter. A properly working splitter should have very closely matched values, as seen in Figure 8-6. When in doubt, consult the splitter data sheet to determine if it is still functioning within specifications.

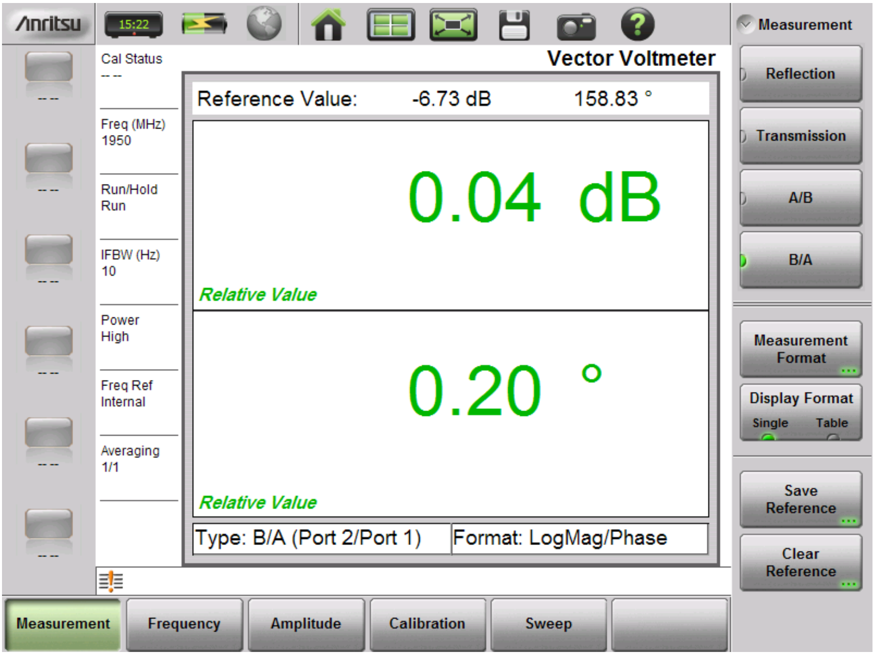


Figure 8-6. Second Side of Splitter Relative to Saved Reference

8-4 Relative Measurements

Often, absolute phase measurement of a DUT (cable in the following example) is not as important as the phase relationships among multiple DUTs. For the following example application, the Vector Voltmeter is used to make relative phase measurements.

The operations for relative measurements are described in the following steps.

1. Preset the S820E, then set up for this measurement by setting the frequency and the measurement type and format.

   Measurement format may be LogMag/Phase, LinMag/Phase, SWR, or Impedance. LogMag/Phase measurement format is used in this example. You may change the measurement format at any time. If a reference value has already been recorded in a particular measurement format, and if you change the measurement format, then the reference value is automatically converted to the new selected measurement format.

2. Since many VVM measurements are made relative to a stored reference, vector error correction is not absolutely required. Absolute Reflection or Transmission measurements require calibration to remove residual errors, including port match errors. Refer to Section 8-6 “VVM Calibration” on page 8-19 for more details.

   For A/B or B/A measurements, vector error correction of the instrument is not possible. In some cases where the measured results are unstable or not as expected, the overall measurement results may be improved simply by adding 3 dB or 6 dB attenuators on each measurement port (A and B). The process of storing the reference value will need to be repeated if attenuators are added after the initial reference value was stored.

3. Connect the first DUT (device under test).

4. If you want to use the measurement result of this first DUT as your reference (the golden DUT), then press the Save Reference submenu key.

5. As shown in Figure 8-7, the current measurement is saved and displayed as the Reference Value (at the top of the VVM display). The displayed values are now relative to the saved values, which are the difference between the current measurement and the saved reference. In other words, saving a reference will normalize the results to the current measurement.

   The amplitude and phase windows now display *Relative Value*, and their text and data are displayed in green. If you clear the reference values, then the data are again displayed in black.

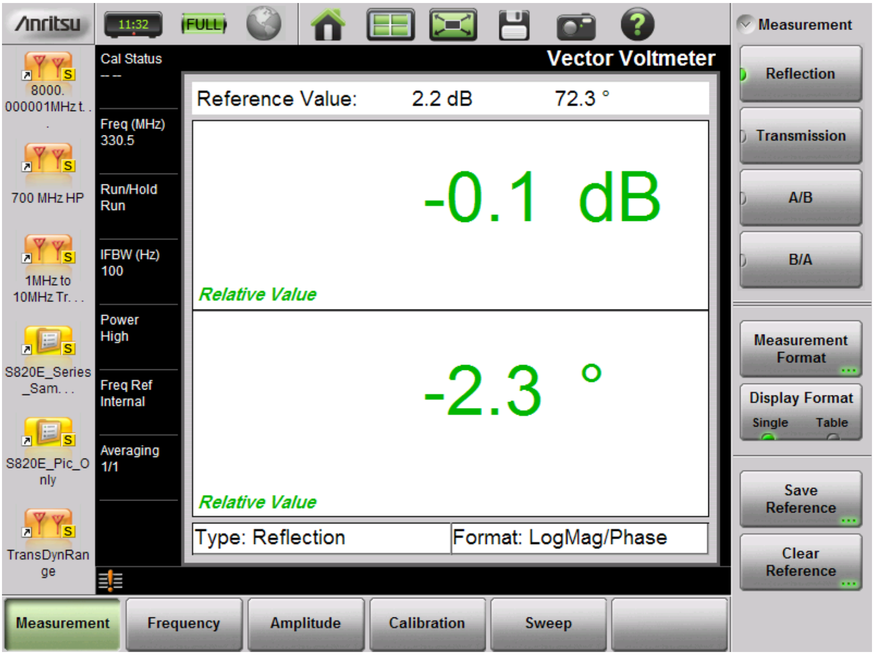


Figure 8-7. Relative Reflection Measurement

6. Additional DUTs may be connected consecutively (as required), and their relative results will be based on the stored reference.

7. To create a new reference, press the Clear Reference submenu key, then press the Save Reference submenu key while measuring the DUT for which you want to capture the new reference values.

If you are making many measurements, the display format can be set to Table. Refer to "Table Display Format" on page 8-12.

Note	Clearing the reference while using the Table Display Format will immediately clear all of the relative measurement values that have been stored within the table. Saving a new reference value while using the Table Display Format will immediately recalculate and display all of the relative measurement values with respect to the new saved reference. You can change the current reference without pressing the Clear Reference submenu key. When the current measurement is desired as the new reference, press the Save Reference submenu key.

This completes the procedure for relative measurements.

8-5 Table Display Format

Begin the measurements and save a reference (if needed). The measurement results are displayed in the top row of the table. Press the **Enter** key to save a measurement and move to the next row of the table.

In the example shown in Figure 8-8, multiple tuning stubs are being measured and compared to a reference stub. Tolerance was specified as < ± 0.1 dB and < ± 2° compared to the reference. From the results you can see that stub numbers 4, 5, 6, and 8 fail the tolerance, but numbers 1,2,3 and 7 pass.

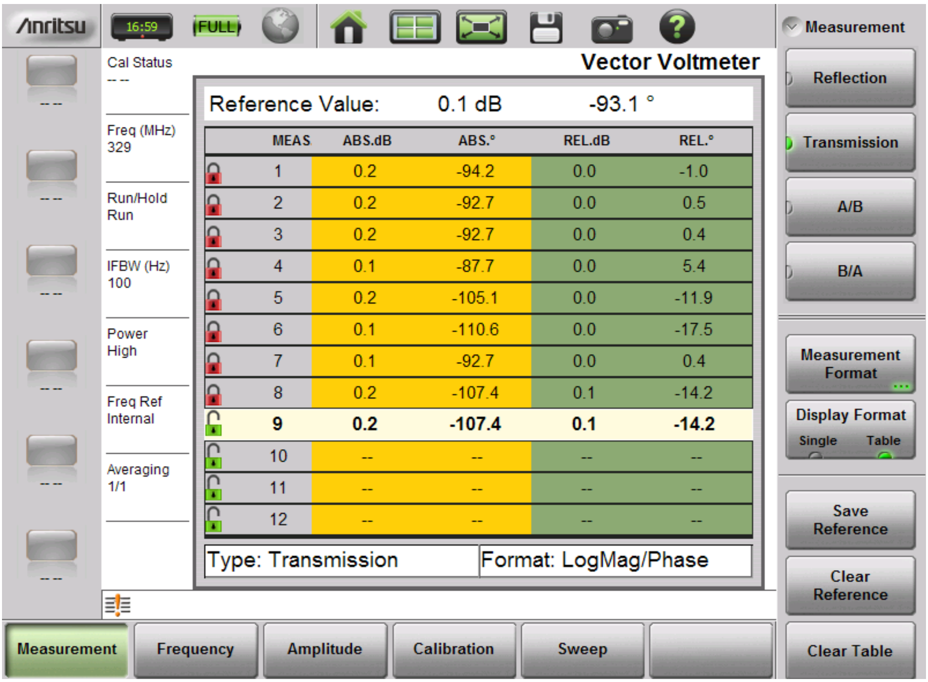


Figure 8-8. Table Display Format

You can make a new row become the active row. Use the touchscreen to tap a lock icon, or use the arrow keys or the rotary knob to highlight a row, then press **Enter**.

When you press **Enter** on a saved row, a message is displayed (see Figure 8-9). In order to make the measurement row active, the stored data must be cleared. Press the Continue button or the Cancel button.

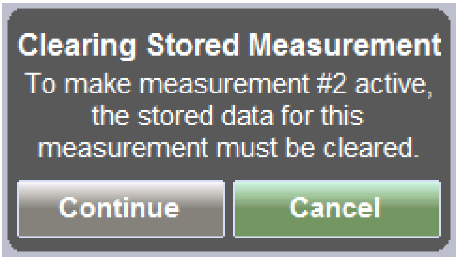


Figure 8-9. Message – Clearing Stored Measurement

When you have saved 12 measurements (the table rows are all used), if you press **Enter** again, you are asked if you want to clear the active measurement and remeasure. If you highlight any saved row and press **Enter**, you are asked if you want to clear the measurement and make that row active.

When the Display Format is set to Table, an additional submenu key (Clear Table) is displayed at the bottom of the list to allow you to clear the entire table. A message is displayed asking you to confirm your choice. When the table is cleared, the active measurement returns to row 1. The saved reference remains as the reference value.

You can continue to make measurements with the same saved reference until you press the Clear Reference key.

Note

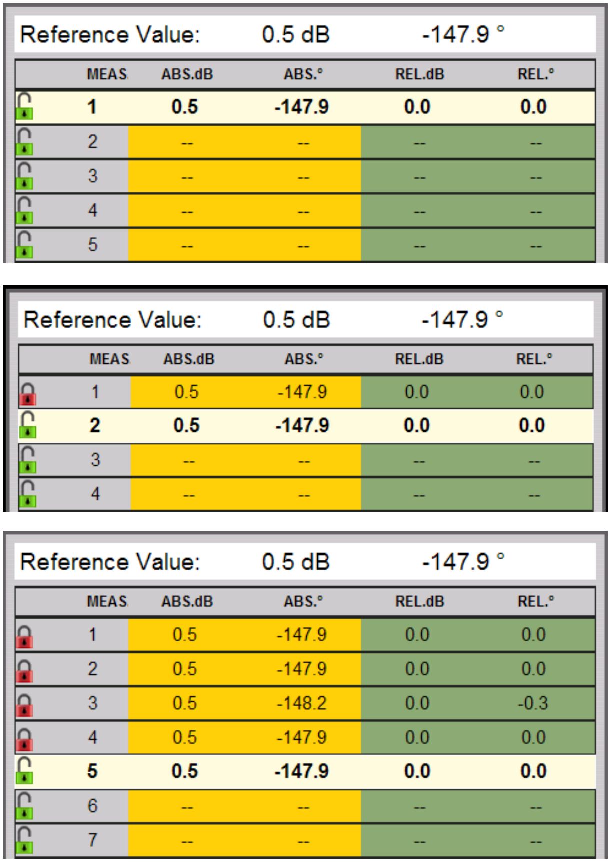
Clearing the reference while using the Table Display Format will immediately clear all of the **relative** measurement values that have been stored within the table. The stored measurements are not affected.

As soon as you save another reference value, all of the relative measurement values are recalculated for stored measurements.

Pressing Save Reference when a reference value is already saved, overwrites the saved reference with the new (current) value.

In the example shown in Figure 8-10 on page 8-15, measurement starts from the default active Row 1. When you press **Enter** to lock in the measurement data for that row, the Green unlock icon changes to a Red lock icon to indicate that the data in that row have been locked. The next available row (Row 2) then becomes active with live data. Pressing **Enter** on Row 2 locks the data, and the next available row (Row 3) then becomes active. This repeats until the table has been completely filled. If you skip back to a previously filled row and press **Enter**, then the pop-up message that is shown in Step 5 appears. Pressing Continue clears the data for that row, and the row becomes active with live data. After the live data are locked into that row, the next unused row in the table (if any remain) will become live, and the standard sequence returns.

The following procedure describes working with the features of Table Display Format.



1

Reference Value:	0.5 dB	-147.9 °		
MEAS	ABS.dB	ABS.°	REL.dB	REL.°
1	0.5	-147.9	0.0	0.0
2	--	--	--	--
3	--	--	--	--
4	--	--	--	--
5	--	--	--	--

2

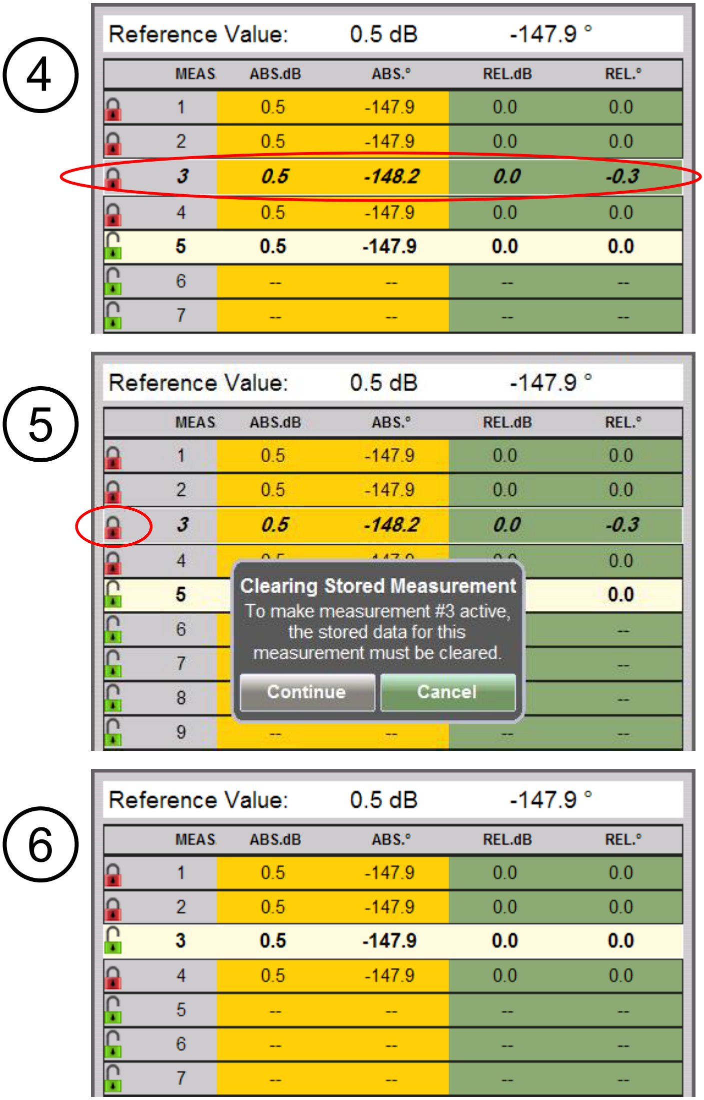
Reference Value:	0.5 dB	-147.9 °		
MEAS	ABS.dB	ABS.°	REL.dB	REL.°
1	0.5	-147.9	0.0	0.0
2	0.5	-147.9	0.0	0.0
3	--	--	--	--
4	--	--	--	--

3

Reference Value:	0.5 dB	-147.9 °		
MEAS	ABS.dB	ABS.°	REL.dB	REL.°
1	0.5	-147.9	0.0	0.0
2	0.5	-147.9	0.0	0.0
3	0.5	-148.2	0.0	-0.3
4	0.5	-147.9	0.0	0.0
5	0.5	-147.9	0.0	0.0
6	--	--	--	--
7	--	--	--	--

1.	Row 1 is active and highlighted.
2.	Press **Enter**. Row 1 is saved (lock icon becomes red). Row 2 becomes active and highlighted.
3.	Press **Enter** for Row 2, then for Row 3, then for Row 4. Rows 1 through 4 have stored measurements (icons show locked). Row 5 is active and highlighted. Note that the measured values are identical except for Row 3.

Figure 8-10. Working with Table Display Format – 1 of 3



4.	Use arrow keys or rotary knob to highlight Row 3 (until the numerals are bold and slanted). Row 5 remains active.
5.	Press **Enter** or tap the lock icon for Row 3. Then tap Continue to make Row 3 active. Note that previously saved data are overwritten with the current live data, as shown in Step 6.

Figure 8-11. Working with Table Display Format – 2 of 3

6.	Row 3 is active and highlighted. The data that were in Row 5 prior to making Row 3 active are not saved because it was not locked in. After new data are locked in Row 3 by pressing the **Enter** button, the active measurement drops down to the next available row in the table. In this case Row 5 becomes active again. See Step 7.

Figure 8-11. Working with Table Display Format – 2 of 3

7

Reference Value: 0.5 dB -147.9 °

MEAS	ABS.dB	ABS.°	REL.dB	REL.°
1	0.5	-147.9	0.0	0.0
2	0.5	-147.9	0.0	0.0
3	**0.5**	**-147.9**	**0.0**	**0.0**
4	0.5	-147.9	0.0	0.0
5	--	--	--	--
6	--	--	--	--
7	--	--	--	--

8

Reference Value: 0.5 dB -147.9 °

MEAS	ABS.dB	ABS.°	REL.dB	REL.°
1	0.5	-147.9	0.0	0.0
2	0.5	-147.9	0.0	0.0
3	0.5	-147.9	0.0	0.0
4	0.5	-147.9	0.0	0.0
5	**0.5**	**-147.9**	**0.0**	**0.0**
6	--	--	--	--
7	--	--	--	--

7.	In the example of Step 6, the **Enter** key was pressed to save the data in Row 3. This is a view of the table just before pressing **Enter**.
8.	Press **Enter** to save the measurement in Row 3 and to make Row 5 active. Note that measurement data in Row 3 were stored, and all measurements are now identical.

Figure 8-12. Working with Table Display Format – 3 of 3

When you press **Enter**, a lower unused row (if available) becomes active. When you press **Enter**, and the lower unused rows are saved, a higher unused row becomes active.

The lock icon is red if measurement data are saved for that row.

Tapping the green lock icon of the active measurement stores that measurement, which is the same result as pressing **Enter**.

Tapping the green or red lock icon of any inactive row produces the same result as highlighting that row and pressing **Enter**. If the lock icon was green, then the row becomes active immediately. If the lock icon was red, then the confirmation dialog box is displayed, and you must press Continue to unlock the row and overwrite its data.

8-6 VVM Calibration

VVM Calibration versus Save Reference

Which one should be used?

The Save Reference function stores the current measurement and normalizes the main measurement display to the stored value. All subsequent measurements are now displayed as relative to the stored reference value. This function is independent of VVM Calibration and should not be confused with VVM Calibration. The Save Reference function will be used for ALL relative measurements made with the VVM. In comparison, VVM Calibration may not be required for all VVM relative measurements, although it is recommended because it allows for absolute measurement values of the DUTs, including the reference DUT, and it removes any inherent system errors of the instrument itself. VVM Calibration also compensates (via vector error correction) for any test cables, adapters, or fixtures that may have been added between the DUT and the instrument and the appropriate calibration kit.

Absolute VVM Measurements

Absolute, error corrected reflection or transmission measurements may be made on a DUT in VVM mode. For absolute measurements, a VVM calibration is required. The absolute measurement may then be stored as a reference, if required. Vector error corrected measurements on additional DUTs relative to the stored reference can then be made. This provides the best possible accuracy for relative VVM reflection and transmission measurements. VVM calibration removes system errors and defines a known measurement reference plane, which is mandatory for making accurate absolute measurements.

Relative VVM Measurements

Many VVM measurements are made relative to a stored reference, and in these cases, vector error correction may not be required. VVM calibration removes system errors and may improve relative measurement results. For these reasons, when you are making relative measurements, VVM calibration is recommended, but it is not mandatory.

A/B or B/A Ratio Measurements

VVM calibration is not available when making A/B or B/A ratio measurements. In some cases, adding a 3 dB or 6 dB attenuator to each measurement port (A and B) may be helpful to reduce mismatch errors, which cannot be vector error corrected. If attenuators are going to be added, they must be installed BEFORE performing the Save Reference function. Test port cables, adapters, fixtures, or any other items that are needed to connect to the DUT must also be in place before performing the Save Reference function, and must remain in place for the duration of the measurements.

Performing Calibrations

The calibration menu choices are a subset of those found in Chapter 4, "Calibration, CAA" with fewer choices due to the fewer types of measurements that are available with the vector voltmeter.

To view a summary of these settings, begin from the **Calibration** main menu and press Cal Info. A summary of the Active Cal Settings and the Current Settings of the instrument are displayed (for an example, see Figure 4-3 on page 4-3). Press **Esc** to close the Cal Info window.

The calibration menu has a Thru Update submenu key (see Figure 8-20 on page 8-27) that allows you to recalibrate the Thru component without repeating the entire calibration sequence. Refer to "Thru Update" on page 4-15.

For more specific calibration information, refer to Chapter 4, "Calibration, CAA".

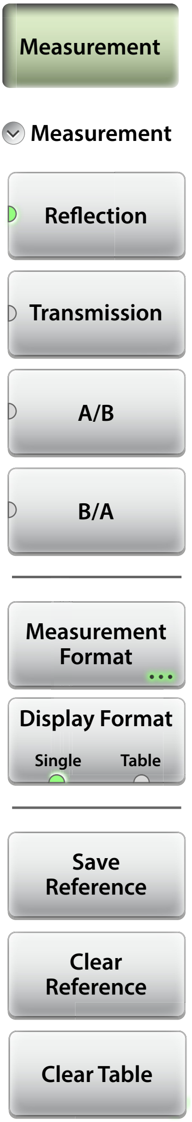
8-7 Vector Voltmeter Menus

Figure 8-13 shows a menu map of the VVM menus. Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

Figure 8-13. Main Menu Keys

8-8 Measurement Menu (1 of 2)

Key Sequence: **Measurement**



Measurement

Reflection: Press this submenu key to select a reflection (Port 1) measurement.

Transmission: Press this submenu key to select a transmission (Port 1 to Port 2) measurement.

A/B: Press this submenu key to display the result of Port 1/Port 2.

B/A: Press this submenu key to display the result of Port 2/Port 1.

Measurement Format: Press this submenu key to open the Measurement format dialog box and select one of the available formats. Figure 8-17 on page 8-25 Choose from:

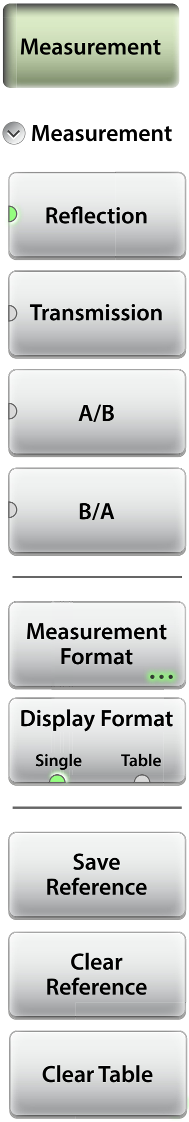
LogMag/Phase
LinMag/Phase
SWR
Impedance

Display Format
Single Table: Press this submenu key to toggle the display format to Single or Table. Single is the default setting. With Single format, the selected measurement type is displayed as shown in Figure 8-17 on page 8-25. With Table selected, 12 rows are available to display up to 12 measurements. Refer to section "Table Display Format" on page 8-12.

Figure 8-14. Measurement Menu – 1 of 2

8-9 Measurement Menu (2 of 2)

Key Sequence: **Measurement**



Measurement

Save Reference: Press this submenu key to save the current measurement as a reference. Note that this is equivalent to the **Zero** function found on some other VVM products. Saving a reference sets the VVM to relative measurement mode. Text and data in the display are changed from black font to green, and “Relative Value” is displayed. The reference values are displayed in black font.

Clear Reference: Press this submenu key to remove the reference measurement from memory. This resets the VVM to display absolute measurement values.

Clear Table: Press this submenu key to clear all of the saved measurements in Table display format. The saved reference value remains saved to allow additional relative measurements. This submenu key appears only when Display Format is set to Table.

Figure 8-15. Measurement Menu – 2 of 2

Measurement Format

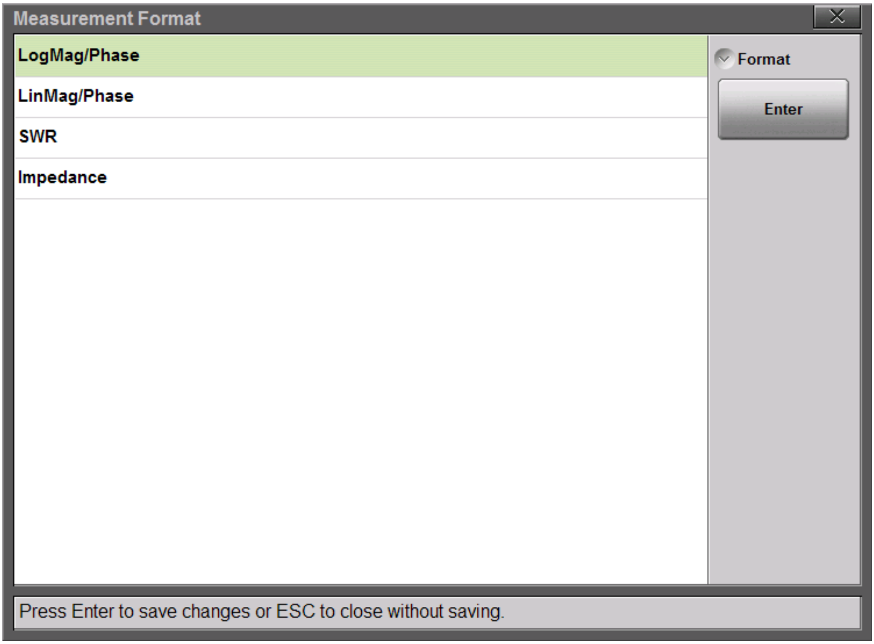


Figure 8-16. Measurement Format Dialog Box

LogMag/Phase measurement results are displayed as logarithmic amplitude in dB in the upper window and as phase in degrees in the lower window.

LinMag/Phase measurement results are displayed as linear amplitude in the upper window and as phase in degrees in the lower window.

SWR displays the ratio (with no units) in the upper window only.

Impedance measurement results are displayed as real impedance in the upper window, and as imaginary impedance in the lower window.

Single Display Format

This Vector Voltmeter display shows single measurement results in 2 rectangular windows, as shown in Figure 8-17. Single is the default Display Format setting. For Reflection and Transmission measurements in magnitude and phase formats, the measurement results are displayed as amplitude in the upper window and phase in the lower window.

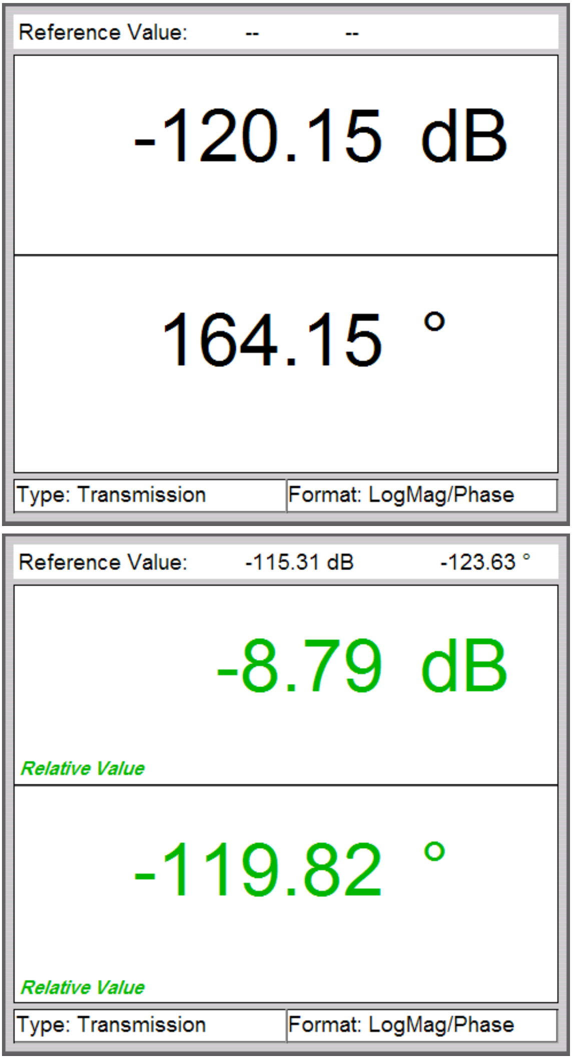
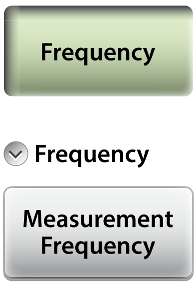


Figure 8-17. Single Display Format

8-10 Frequency Menu

Key Sequence: **Measurement**



Frequency

Measurement Frequency: Press this submenu key to set a frequency for the measurement. Use the number keypad to enter a value, then press a Units submenu key (Hz, kHz, MHz, or GHz). Pressing the **Enter** key is the same as pressing MHz. The frequency can also be changed using the **Up/Down** arrow keys and the rotary knob.

Figure 8-18. Frequency Menu

8-11 Amplitude Menu

Key Sequence: **Amplitude**

Amplitude

Resolution
1 2: Press this submenu key to toggle the decimal display to 1 or 2 digits after the decimal point. The default setting is 1.

Ref. Impedance
50 Ω 75 Ω: Press this submenu key to toggle the reference impedance setting. The default setting is 50 Ω.

Figure 8-19. Amplitude Menu

8-12 Calibration Menu

Key Sequence: Calibration

Calibration

Start Calibration: Press this submenu key to display the Step 1 calibration dialog box (see Figure 8-21 on page 8-28).

Thru Update: Press this submenu key to Open the Calibration dialog box to allow calibrating the Thru component without repeating the entire calibration sequence. This key is displayed only after a calibration with a Thru component.

Cal Info: Press this submenu key to display the Calibration Information table (for an example, see Figure 4-3 on page 4-3).

Cal Correction
On Off: Press this submenu key to toggle the current calibration On or Off. A valid calibration must be available in order to turn on this setting.

Figure 8-20. Calibration Menu

Step 1 Calibration Dialog Box

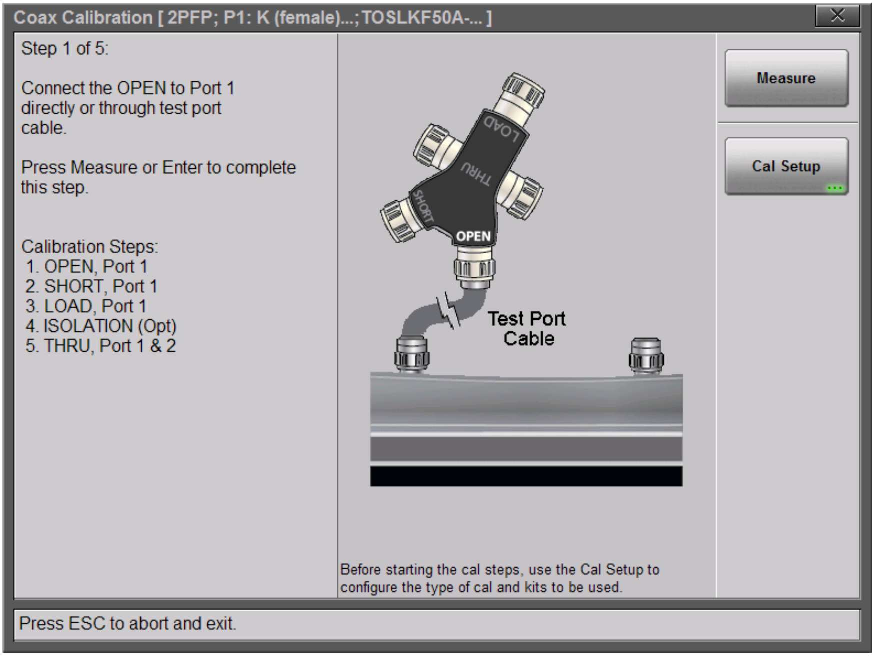


Figure 8-21. Calibration Step 1 of 5

8-13 Sweep Menu

Key Sequence: **Sweep**

Sweep

Run/Hold
Run Hold: Default is Run. Press this submenu key to toggle the sweep setting between Run and Hold. Hold stops the active measurement and holds the current measurement results. Run restores the active measurement and continuously updates the active measurement results.

RF Pwr In Hold
On Off: Press this submenu key to toggle RF power On or Off while the sweep is set to Hold.

Source Power
High Low: Press this submenu key to toggle the internal source power setting to High power or Low power.

IFBW: Press this submenu key to display the IFBW dialog box (see Figure 8-23 on page 8-30) and select a bandwidth. Choose from:

100 kHz (maximum sweep speed)
1 kHz
100 Hz (default)
10 Hz (maximum dynamic range)

Sweep Averaging: Press this submenu key to enter the number of sweeps to use for averaging. Use the **Up/Down** arrow keys, the rotary knob, or the number keypad. The setting range is 1 to 1000.

Figure 8-22. Sweep Menu

Source Power

The default setting is High, which is more accurate because you are measuring further above the noise floor. Use Low power for devices that are sensitive to higher power levels, such as amplifiers. Source Power is not applicable for A/B and B/A measurement types.

IFBW Dialog Box

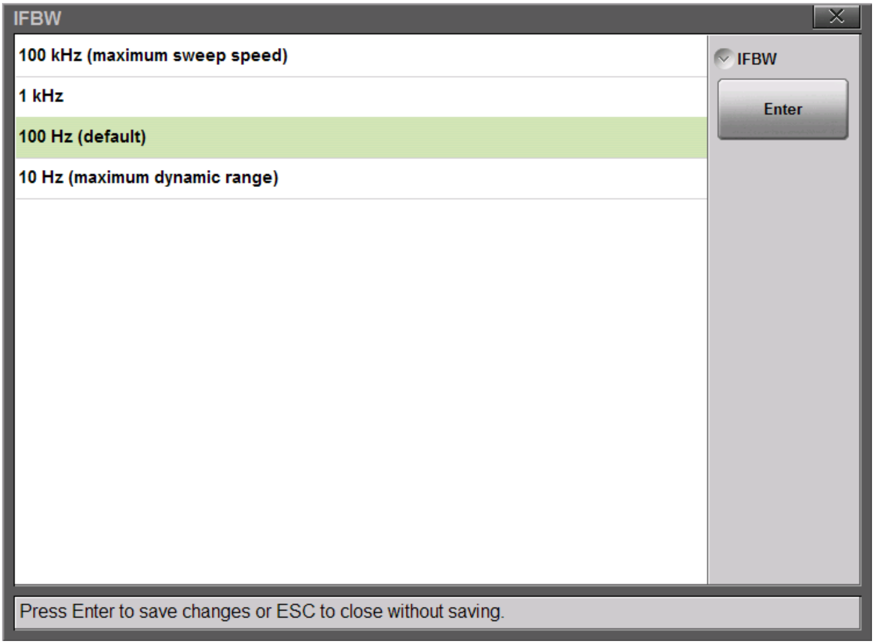


Figure 8-23. IFBW Dialog Box

8-14 Preset Menu

Key Sequence: **Preset** (**1**)

Refer to Section 11-9 "Preset Menu" on page 11-26.

8-15 Trace Menu

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

Not used in VVM mode.

8-16 Limit Menu

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

Not used in VVM mode.

8-17 File Menu

Key Sequence: **File** (**7**)

Refer to Section 10-11 "File Menu" on page 10-24.

8-18 System Menu

Key Sequence: **System** (**8**)

Refer to Section 11-8 "System Menu" on page 11-15.

8-19 Mode Menu

Key Sequence: Mode (**9**)

Refer to Table 2-1, "Site Master Keypad Functions" on page 2-10.

Chapter 9 — High Accuracy Power Meter

9-1 Introduction

This chapter provides an overview of power meter measurements and how to setup the instrument to use an external USB Sensor in the High Accuracy Power Meter mode. Actual power is measured at the USB sensor connector in dBm and Watts or relative power in dB and percentage. The frequency span and dynamic range for measurements is determined by the USB external sensor.

Note	Check the graph title in the top right of the display to confirm that the instrument is in High Accuracy Power Meter mode. If necessary, press the **Menu** key to change modes.

In this mode and with an appropriate sensor, the instrument can be used to make high accuracy power measurements including true RMS measurements for both CW and complex digitally modulated signals.

A general overview of USB sensors, including connection and measurements setup, begins in Section 9-3 “General Measurement Setup Connection” on page 9-4.

With the MA24105A in-line sensor, additional functions are available including: forward and reverse measurements.

- Forward Measurements: Average Power, Crest Factor, Burst Average Power, Peak Envelope Power (PEP), and CCDF.
- Reverse Measurements: Average Power, Reflection Coefficient, Return Loss, and VSWR.

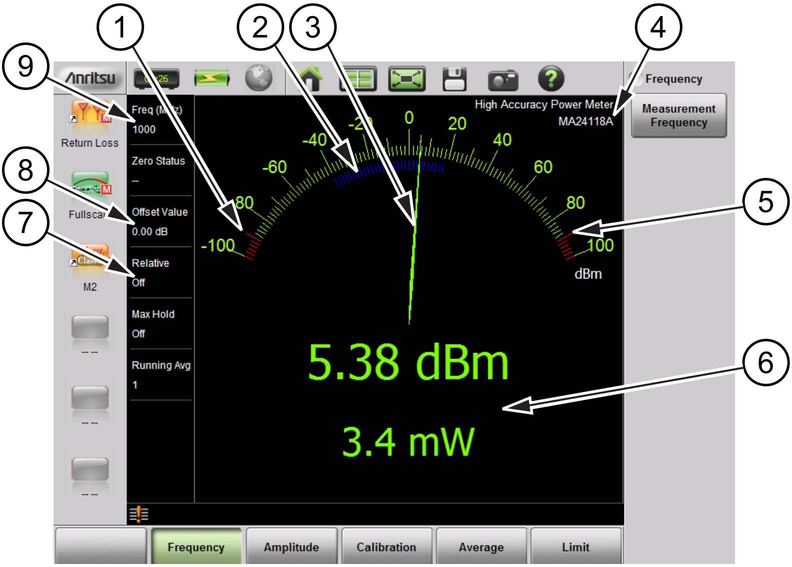
Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

Refer to “MA24105A Inline Power Sensor” on page 9-12 for information specific to this in-line sensor.

Note	Sensors are not included with the Site Master and must be purchased separately. The S820E Site Master data sheet lists compatible sensors. The SC8268 is not a compatible power sensor. It is not valid for use with High Accuracy Power Meter mode.

9-2 Power Meter Display

Figure 9-1 illustrates the preset Power Meter display with limits turned on.



1.	Preset –90 dBm Lower Limit
2.	Power Range of Attached Sensor
3.	Power Meter Needle
4.	High Accuracy Power Meter Mode and Connected USB Sensor
5.	Preset +90 dBm Upper Limit
6.	Current Power in dBm and Watts (including any Offset Value) or “No USB sensor detected” if an external USB sensor is not connected or recognized by the Site Master.
7.	Relative Power (dB and %) or Absolute Power (dBm and Watts)
8.	Offset Value to Account for External Attenuation or Gain
9.	Source Frequency Used for Correction Factor

Figure 9-1. Power Meter Display Overview

9-3 General Measurement Setup Connection

Note	Refer to the label on the USB sensor for information on frequency range and dynamic range.

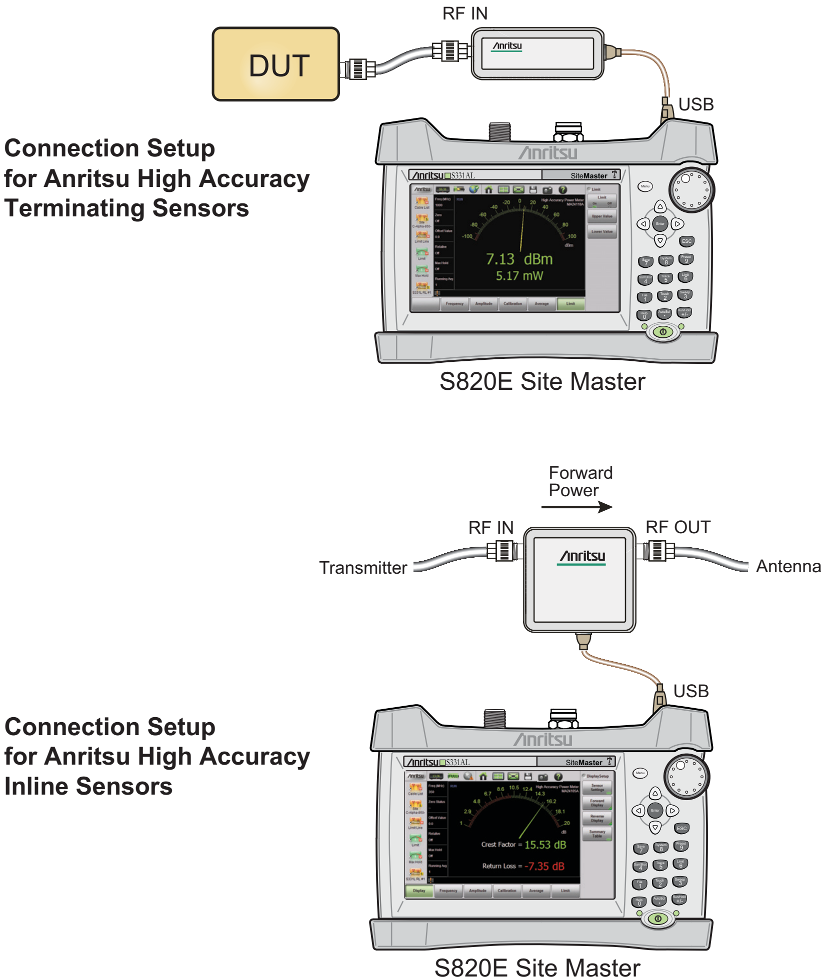


Figure 9-2. External USB Sensor Connection Setups

Connection and Offset

1. Connect the source to be measured to the USB sensor. Use any required external attenuation or gain so the expected power level is within specification for the sensor.
2. Press **Amplitude** then Offset Value. Enter an offset value for any external attenuation (negative value) or external gain (positive value). The displayed power is adjusted by the offset value.

   As an example, a power source around 1 Watt (30 dBm) may cause damage to some sensors. 10 dB of in-line external attenuation will bring the power level down to approximately 100 mW, within the sensor range. Adding an Offset Value of –10 dB will remove the external attenuation from the displayed power level resulting in the correct power value being displayed on the analyzer.

Setting the Measurement Frequency

Press the **Frequency** main menu key then press Measurement Frequency. Set the measurement frequency to match the actual signal frequency being measured by using the number keypad. Then press the unit of measure button. The USB sensors contain EEPROM correction data for their own inherent frequency response. Failing to set the measurement frequency properly degrades measurement accuracy.

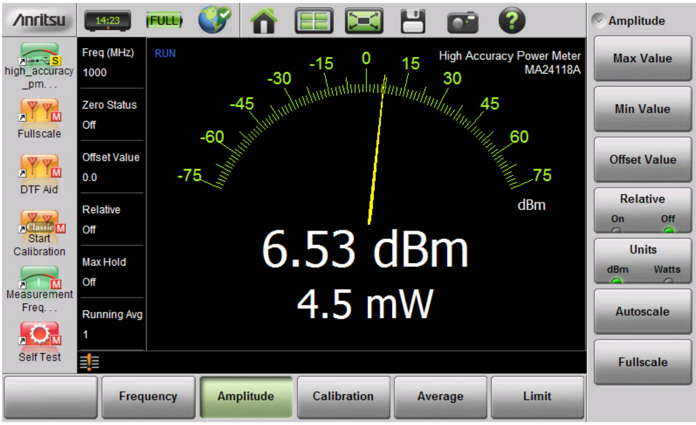
Setting the Amplitude

The maximum and minimum values of the analog display can be set in the **Amplitude** menu. Relative Power is a useful feature to obtain the power reading with respect to a previous power level.

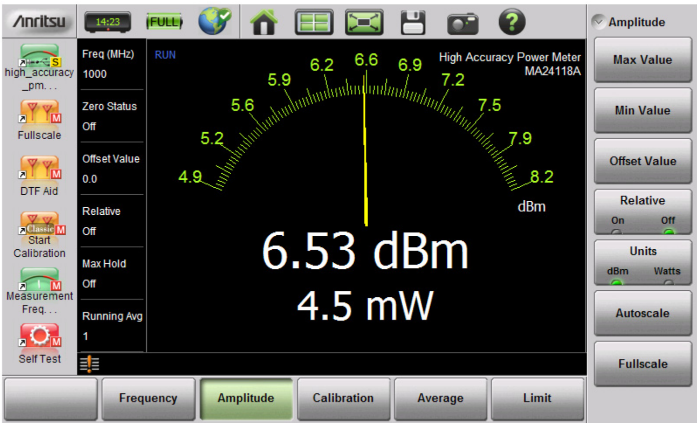
1. Press the **Amplitude** main menu key.
2. Press the Max Value submenu key and set the upper scale value. Press the Min Value submenu key and set the lower scale value.

   or

   Press the Autoscale submenu key to adjust the range automatically. The current power level is centered with Min Value automatically set at 90 % of the current power and Max Value automatically set at 110 % of the current power. Refer to Figure 9-3 on page 9-6.



Before Autoscale



After Autoscale

Figure 9-3. Autoscale to Zoom In on a Measurement

Changing the Display Units

The power meter scale can be displayed in dBm or Watts. Use the following procedure to change the displayed units:

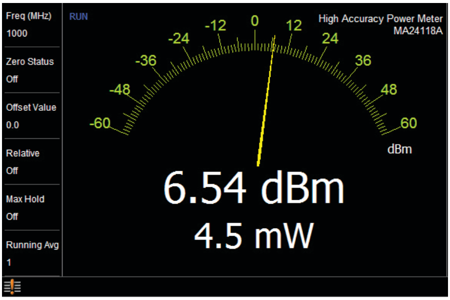
1. Press the **Amplitude** main menu key.
2. Press the Units submenu key and select the display units.

Displaying Relative Power

Use the following procedure to select Relative Power through the Amplitude menu.

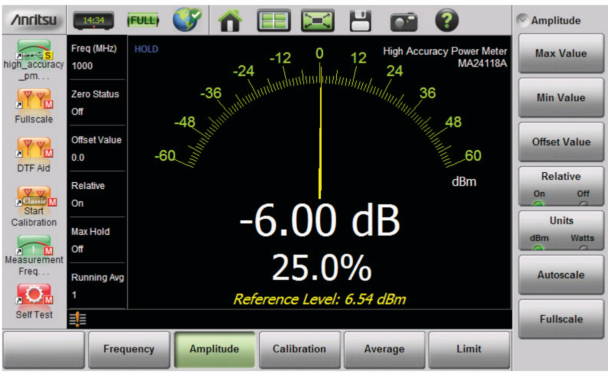
1. With the desired base power (reference) level connected to the USB sensor, press the **Amplitude** main menu key.
2. Press the Relative submenu key. Note that the absolute value of the measurement at the time the Relative key is pressed is shown in yellow below the numerical display (see Figure 9-4 on page 9-8).
3. Any change in power will now be displayed relative to the set reference level. Refer to the bottom image in Figure 9-4 on page 9-8.

Relative
Off



First Power Level in dBm and mW

First Power Level, Relative On



Reduced Second Power Level, -6 dB (25%) of First

Figure 9-4. Relative Power Example

Note	Relative power is displayed numerically in dB and percentage, scale is absolute.

Setting Upper and Lower Limits

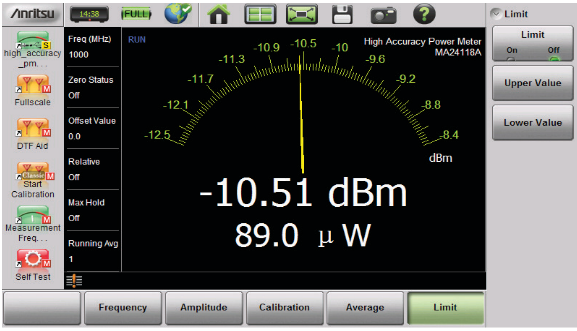
Maximum and minimum limits can be set as follows:

1. Press the **Limit** main menu key and set Limit to On.
2. Press the Upper Value submenu key and use the keypad, **Up/Down Arrow** keys, or the rotary knob to set the desired upper limit. Then press **Enter**.
3. Press the Lower Value submenu key and use the keypad, **Up/Down Arrow** keys, or the rotary knob to set the desired upper limit. Then press **Enter**.

The needle color and color of the numeric power level displayed below the graph change based on the current limit settings:

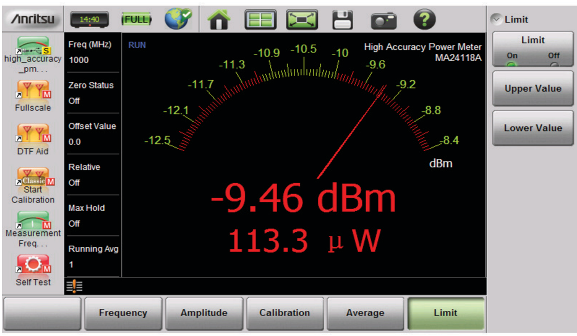
- Yellow needle, White text: Limits are turned off.
- Green need and text: Limits are on and the current power level is within limits.
- Red needle and text: Limits are on and the current power level is not within limits.

Refer to Figure 9-5 on page 9-10 for examples of each condition.



Limits Turned Off (Yellow Needle, White Text)

Power Level Within Limits (Green Text and Needle)



Power Level Beyond Limits (Red Text and Needle)

Figure 9-5. Limit Setting Display Changes

Average Menu Options

If the displayed values are unstable, then increase the Running Average from the default value of 1. Maximum value is 60. Increasing the running average is useful when measuring unstable sources or when measuring near the zero calibration level described below.

To monitor and record the maximum power level over time, set Max Hold to On. The needle and numeric values display the maximum recorded value until Max Hold is turned Off.

In Cont + Run mode (Figure 9-5), the power meter is continuously measuring and updating the power reading. In Cont + Hold mode, the readings are halted.

In Single + Run mode, the power meter performs the number of readings set in Running Average (default is 1) and then places the instrument in Hold mode. Changing the mode from Hold to Run initiates another series of readings and then returns the instrument mode to Hold once again.

Calibration

Zero the sensor to remove any residual noise before making power measurements. If frequent low-level measurements are being made, then check the sensor zeroing often, and repeat as necessary. Before zeroing the sensor, remove any RF input signal to the external sensor.

Zero Failure

This message appears if the zero operation is unsuccessful. The most common reason could be the presence of RF power at the input of the sensor.

Double check to ensure that no RF signal is present at the input of the sensor, and then try the zero operation again.

1. Press the **Calibration** main menu key and then press the Zero Sensor key.
2. When the process is complete, “Zero Status Ok” is displayed in the Measurement Settings Summary area.
3. Connect the sensor to the Device Under Test. The High Accuracy Power Meter will now display the power level of the desired RF signal, with the residual noise removed.

9-4 MA24105A Inline Power Sensor

Note	Refer to the previous sections in this chapter for a general overview of using USB sensors with the Site Master. This section is specific to the additional options and settings available when the MA24105A in-line sensor is attached (Figure 9-2 on page 9-4). There are numerous menu changes with this meter. Refer to Figure 9-21 on page 9-26.

Introduction

Attaching the MA24105A inline peak power sensor adds additional menus and submenus required for making the following in-line measurements:

- Forward Measurements: Average Power, Crest Factor, Peak Envelope Power (PEP), Burst Average Power, and CCDF.
- Reverse Measurements: Average Power, Reflection Coefficient, Return Loss, and VSWR.

In the default view the analog meter displays the forward measurements. The reverse measurements are displayed below the numerical display of the forward measurements (Figure 9-6). To view all of the forward and reverse measurements in table format, use the Summary Table display (Figure 9-7).

Figure 9-6. Power Meter View

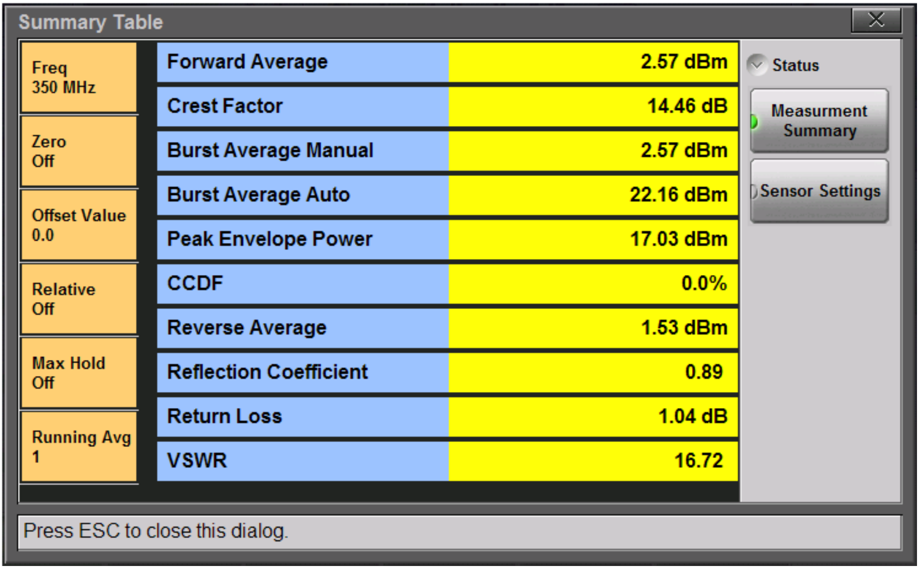


Figure 9-7. Summary Table View

Inline Sensor Setup

The Sensor Settings submenu under the **Display** main menu adjusts the inline sensor parameters (Figure 9-8). The on screen instructions provide information for each parameter. To change a parameter, select it with the **Up/Down Arrow** keys or the touchscreen and press Edit.

Note	Several sensor settings are only appropriate for specific measurements. Refer to the on screen information in the Sensor Settings dialog for additional information.

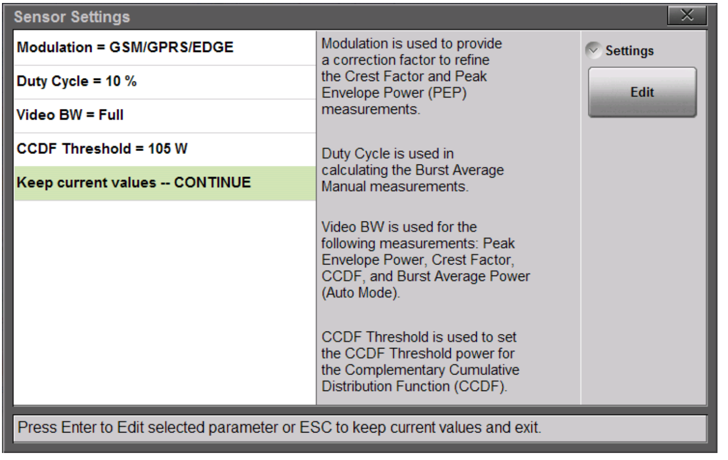


Figure 9-8. Sensor Settings

Modulation

In the Sensor Settings dialog, highlight the Modulation = ... row and press Edit. Use the **Up/Down** keys, rotary knob or touchscreen to highlight the desired modulation type, and then press Select.

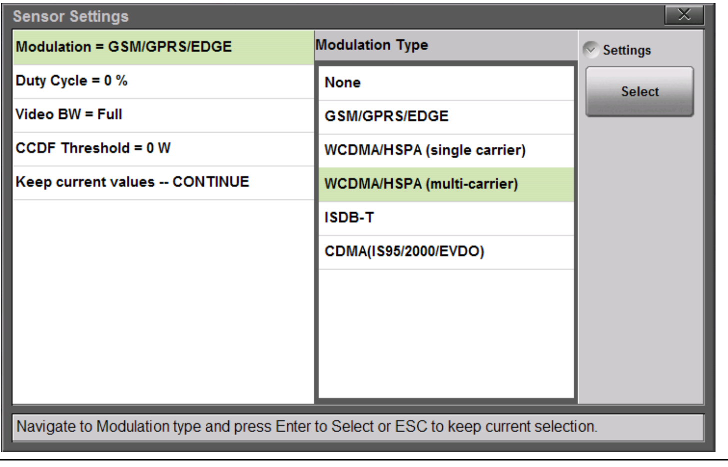


Figure 9-9. Sensor Settings

The selection of a specific modulation type provides a correction factor to refine the PEP calculation.

Duty Cycle

Sets the duty cycle used for averaging when the forward measurement is set to Burst Average Manual. Select a value from 0 % to 100 %. In the Sensor Settings dialog, highlight the Duty Cycle = ... row and press Edit. Use the **Up/Down** keys, rotary knob or key pad to set the duty cycle and then press **Enter**.

Video Bandwidth

Sets the Video Bandwidth span used in several forward measurements. In the Sensor Settings dialog, highlight the Video BW = ... row and press Edit. Use the **Up/Down** keys, rotary knob or touchscreen to highlight the desired View BW and then press Select.

CCDF Threshold

Sets the power threshold value used in the Complementary Cumulative Distribution Function (CCDF) forward measurement. CCDF describes the probability that the signal power is greater than the user-defined threshold value. In the Sensor Settings dialog, highlight the CCDF Threshold ... row and press Edit. Set the desired value and press one of the units of measure buttons to complete.

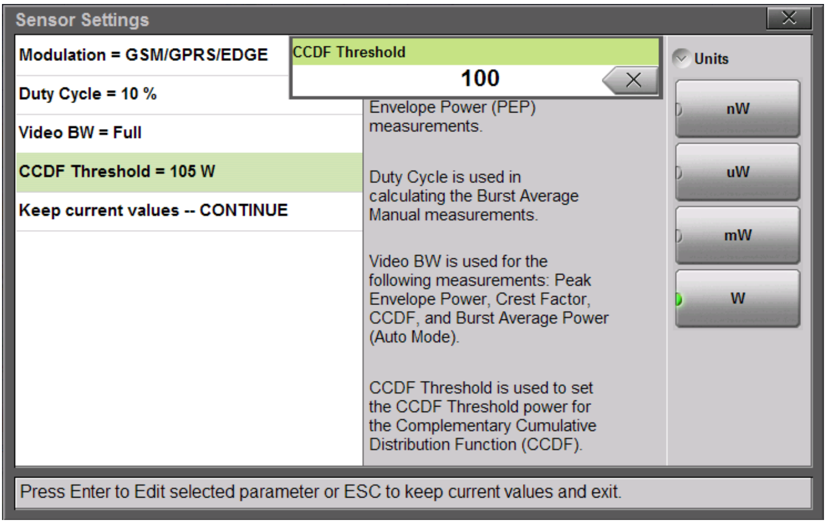


Figure 9-10. CCDF Threshold

Displayed Measurements

Select the forward and reverse measurements to display in the graph area (the analog graph always shows the forward measurement). Select Forward Display and/or Reverse Display under the Display main menu and choose a measurement. See Figure 9-8 for examples of measurement combinations. Refer to “Forward Menu” on page 9-28 and “Reverse Menu” on page 9-29 for additional information.

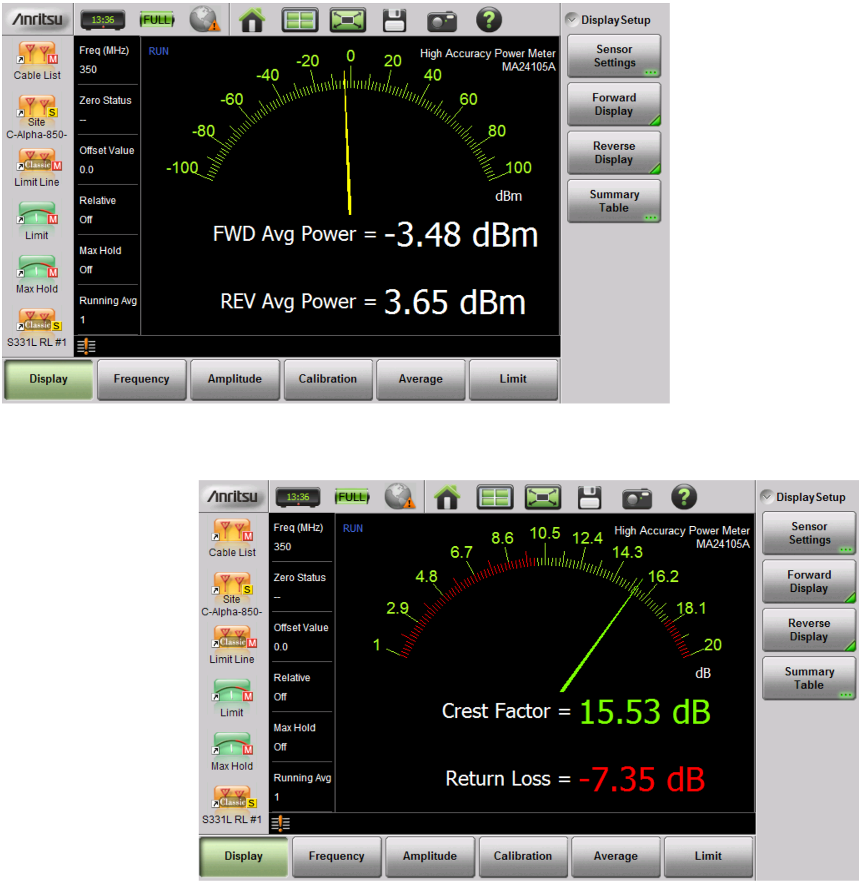


Figure 9-11. Forward and Reverse Measurement Combinations

Summary View

The Summary Table button under the **Display** main menu provides a summary of Site Master instrument settings, DUT forward and reverse measurements, and sensor settings (Figure 9-12).

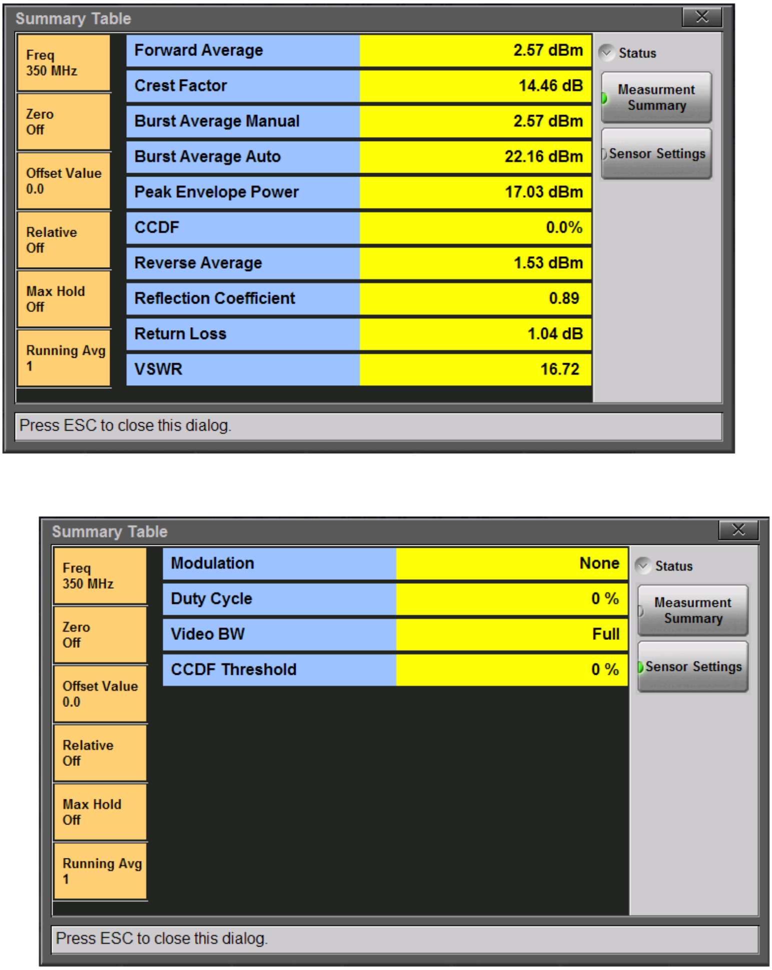


Figure 9-12. Summary Table

Note	Modifying sensor settings is described in “Inline Sensor Setup” on page 9-13.

Displaying Relative Power

Use the following procedure to select Relative Power through the Amplitude menu.

1. With the desired base power (reference) levels connected to the USB in-line sensor, press the **Amplitude** main menu key.
2. Press the Fwd Relative and/or Rev Relative submenu keys.
3. Any change in either forward or reverse power is now displayed relative to the set reference level power. Refer to Figure 9-13.

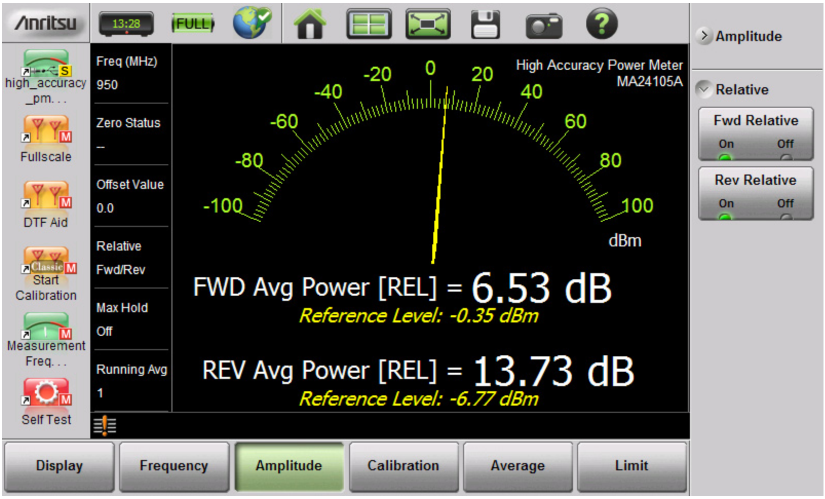


Figure 9-13. Forward and Reverse Relative Power

Limits for Forward and Reverse Measurements

Connecting the MA24105 sensors enhances the limit menu by providing upper and lower limits for both forward and reverse measurements.

1. Press the **Limit** main menu key and set Limit to On.
2. Press the Fwd Upper Value submenu key and use the keypad, **Up/Down Arrow** keys, or the rotary knob to set the limit. Then press **Enter**.
3. Repeat Step 2 for Fwd Lower Value, Rev Upper Value, and Rev Lower Value.

The text color of the numeric power level displayed below the graph changes based on the current limit settings:

- **White text:** Limits are turned off.
- **Green text:** Limits are on and the current measured value is within limits.
- **Red text:** Limits are on and the current measured value is not within limits.

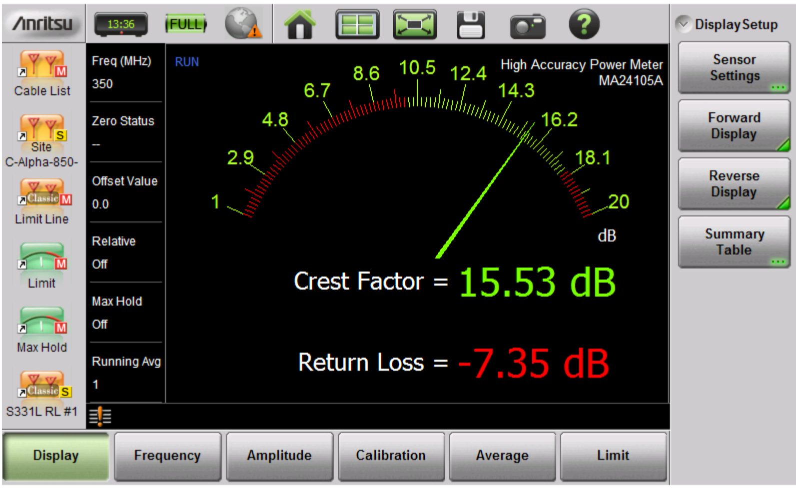


Figure 9-14. Measurement Value Beyond Reverse Limits Indicated by Red Text

9-5 High Accuracy Power Meter Menus

Figure 9-15 shows the map of the High Accuracy Power Meter menus. Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

Note	MA24105A sensor menus in Section 9-11 on page 9-26

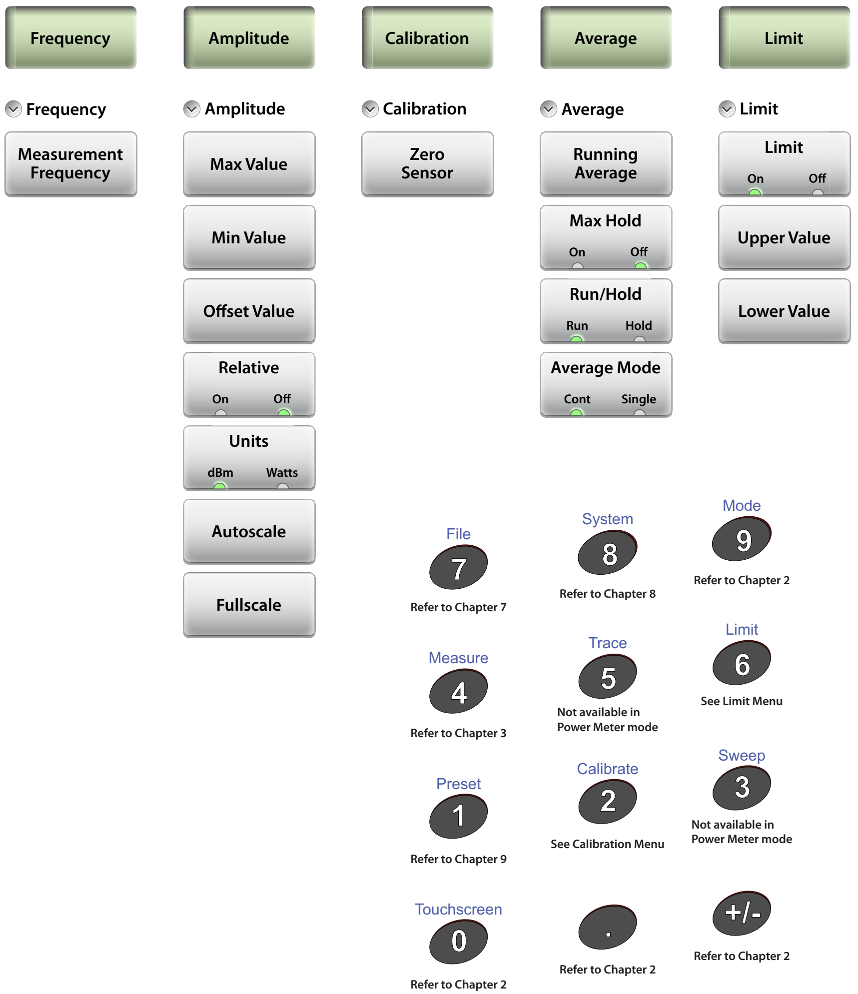
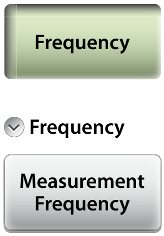


Figure 9-15. High Accuracy Power Meter Menus

9-6 Frequency Menu

Key Sequence: **Frequency**



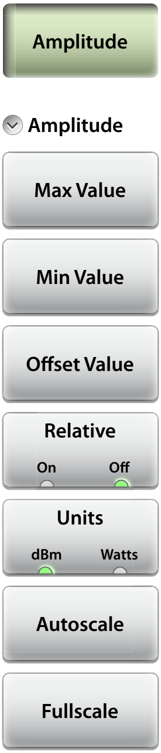
Frequency

Measurement Frequency: Sets the frequency at the center of the measurement. Press the Measurement Frequency submenu key and enter the desired frequency using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key. Pressing **ESC** while editing the frequency restores the previous setting.

Figure 9-16. High Accuracy Power Meter Frequency Menu

9-7 Amplitude Menu

Key Sequence: **Amplitude**



Amplitude

Max Value: Sets the maximum value on the display in dBm or Watts.

Min Value: Sets the minimum value on the display in dBm or Watts.

Offset Value: Used to set external power attenuation or gain. The displayed power level is offset by the dB value entered.

Relative On Off: Press this submenu key to toggle relative power On or Off. This measurement shows the relative level of the current power level to the level when relative was turned on. When ON, the message **Relative On** shows in the message area.

Units dBm Watts: Sets the unit of measure for the power meter.

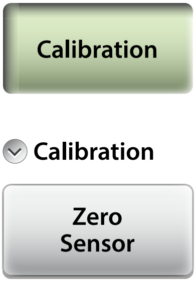
Autoscale: Adjusts the Top and Bottom values so that the power meter needle will be shown in the middle of the analog display.

Fullscale: Adjusts the Top and Bottom values to their maximum allowed values (default settings).

Figure 9-17. High Accuracy Power Meter Amplitude Menu

9-8 Calibration Menu

Key Sequence: **Calibration**



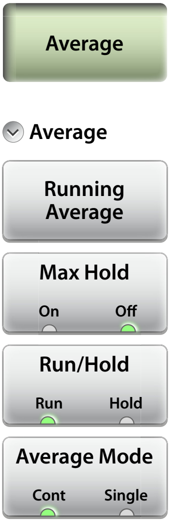
Calibration

Zero Sensor: Initiates the zero calibration of the sensor. A message box is displayed with further instructions. Refer to "Calibration" on page 9-11 for additional information.

Figure 9-18. High Accuracy Power Meter Calibration Menu

9-9 Average Menu

Key Sequence: **Average**



Average

Running Average: Sets the number of measurements used in calculating the average. Also sets the number of measurements made when Average Mode is set to Single, and when Run/Hold is toggled from Hold to Run. The default setting is1 measurement, and the maximum setting is 60 measurements. Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. Press **Enter** to set, or press **Esc** to restore the previous setting.

Max Hold: Setting Max Hold to On will display only the maximum power level. Turning Max Hold Off will display the current power level.

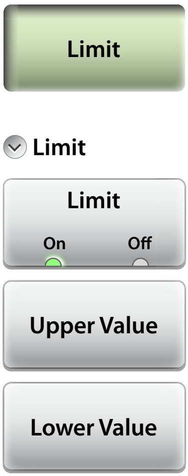
Run/Hold: Toggles between Run and Hold. When in Hold mode, pressing this key starts the measurements and provides a trigger. When in the Run mode, pressing this key pauses the sweep.

Average Mode: Toggles between single measurement and continuous measurements. In Single, each measurement (or series of measurements if Running Average is greater than 1) must be activated by the Run/Hold key.

Figure 9-19. High Accuracy Power Meter Average Menu

9-10 Limit Menu

Key Sequence: **Limit** or **Limit** (**6**)



Limit

Limit: Turns the limits On or Off.

Upper Value: Sets the upper limit (displayed as red hash marks). Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new values, or press the **Esc** button to restore the previous setting.

Lower Value: Sets the lower limit (displayed as red hash marks). Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new values, or press the **Esc** button to restore the previous setting.

Figure 9-20. High Accuracy Power Meter Limit Menu

9-11 MA24105A Menus

Figure 9-21 shows the map of the High Accuracy Power Meter menus when the MA24105A sensor is attached to the Site Master. Menu maps typically display all possible submenu keys, although some keys may be displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

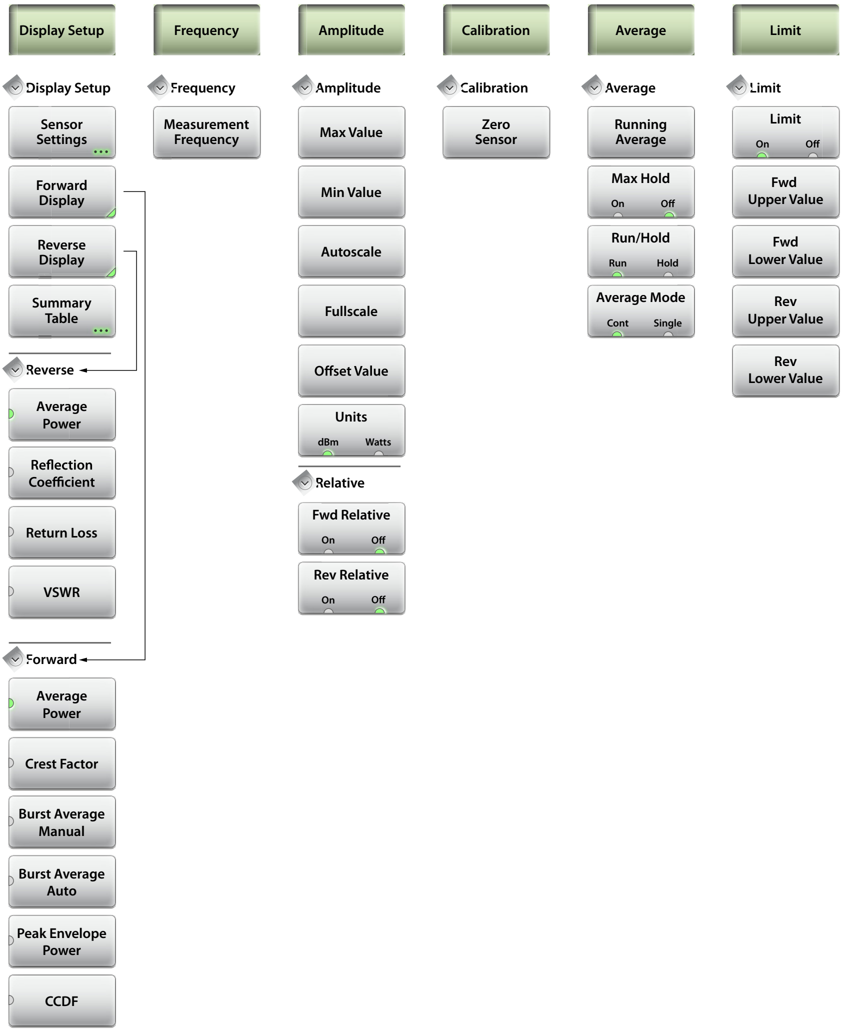
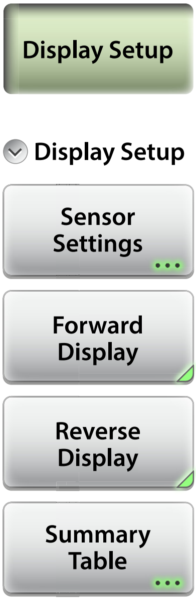


Figure 9-21. High Accuracy PM (MA24105A) Menus

9-12 Display Setup Menu

Key Sequence: **Display Setup**



Display Setup

Sensor Settings: Displays the Forward Settings table (Figure 9-8) for the MA24105A sensor. Select a sensor parameter using the **Up/Down Arrow** keys or the touchscreen. Press Edit to change the value of the selected parameter.

Forward Display: Displays the forward measurement options shown in "Forward Menu" on page 9-28.

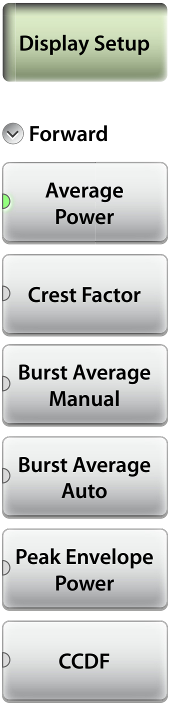
Reverse Display: Displays the reverse measurement options shown in "Reverse Menu" on page 9-29.

Summary Table: Displays a summary of Site Master instrument settings, USB sensor settings, and DUT forward and reverse measurements (Figure 9-12).

Figure 9-22. High Accuracy PM (MA24105A) Display Setup Menu

Forward Menu

Key Sequence: **Display Setup** > Forward



Forward

Average Power: Press this submenu key to have the sensor measure the average power in the forward direction.

Crest Factor: Press this submenu key to have the sensor measure the Crest Factor in the forward direction. Crest Factor is a ratio of peak power to RMS power.

Burst Average Manual: Press this submenu key to have the sensor measure the average power within the signal bursts (in the forward direction). You define the duty cycle of the bursts in order to complete the averaging calculation.

Burst Average Auto: Press this submenu key to have the sensor measure the average power within the signal bursts (in the forward direction). In auto, the sensor determines the duty cycle of the bursts in order to complete the averaging calculation.

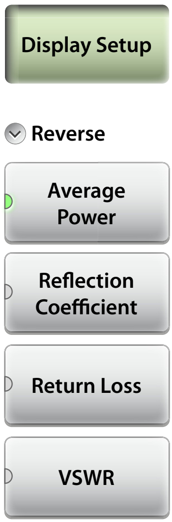
Peak Envelope Power: Press this submenu key to have the sensor measure the peak power in the forward direction.

CCDF: Press this submenu key to have the sensor measure the value of the Complementary Cumulative Distribution Function (CCDF). The CCDF describes the probability that the signal power is greater than a threshold value.

Figure 9-23. High Accuracy PM (MA24105A) Forward Menu

Reverse Menu

Key Sequence: **Display Setup** > Reverse



Reverse

Average Power: Press this submenu key to have the sensor measure the average power in the reverse direction.

Reflection Coefficient: Press this submenu key to measure the reflection coefficient:

Reflected Power / Forward Power

Return Loss: Press this submenu key to measure return loss, which is the measurement in dB of reflected energy caused by impedance mismatch. May also be referred to as S11.

VSWR: Press this submenu key to measure Voltage Standing Wave Ratio (VSWR), which is another measurement of reflected energy caused by impedance mismatch. Expressed as a ratio of X:1. VSWR measures the voltage peaks and valleys.

Figure 9-24. High Accuracy PM (MA24105A) Reverse Menu

9-13 Frequency Menu

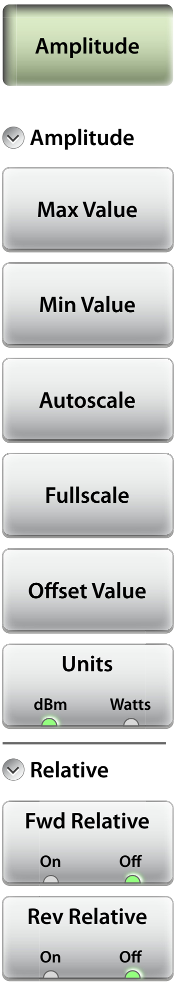
Key Sequence: **Frequency**

Frequency	*Frequency*
Frequency Measurement Frequency	**Measurement Frequency:** Sets the frequency at the center of the measurement. Press the Measurement Frequency submenu key and enter the desired frequency by using the **Up/Down Arrow** keys, the rotary knob, or the keypad. Press **Enter** to complete the entry or, if entering a frequency using the keypad, press the appropriate units key. Pressing **ESC** while editing the frequency restores the previous setting.

Figure 9-25. High Accuracy PM (MA24105A) Frequency Menu

9-14 Amplitude Menu

Key Sequence: **Amplitude**



Amplitude

Max Value: Sets the maximum value on the display in dBm or Watts.

Min Value: Sets the minimum value on the display in dBm or Watts.

Autoscale: Adjusts the Top and Bottom values so that the power meter needle will be shown in the middle of the analog display.

Fullscale: Adjusts the Top and Bottom values to their maximum allowed values (default settings).

Offset Value: Used to set external power attenuation or gain. The displayed power level is offset by the dB value entered.

Units dBm Watts: Sets the unit of measure for the power meter.

Relative

Fwd Relative On Off: Press this submenu key to toggle On or Off. This measurement shows the relative level of the current forward power level to the forward power level when Fwd Relative was turned on.

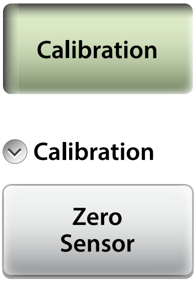
Rev Relative On Off: Press this submenu key to toggle On or Off. This measurement shows the relative level of the current reverse power level to the reverse power level when Rev Relative was turned on.

Note: The message **Relative On** shows in the message area when either Fwd or Rev Relative is on.

Figure 9-26. High Accuracy PM (MA24105A) Amplitude Menu

9-15 Calibration Menu

Key Sequence: **Average**



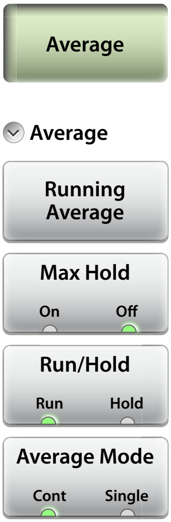
Calibration

Zero Sensor: Initiates the zero calibration of the sensor. A message box is displayed with further instructions. Refer to "Calibration" on page 9-11 for additional information.

Figure 9-27. High Accuracy PM (MA24105A) Calibration Menu

9-16 Average Menu

Key Sequence: **Average**



Average

Running Average: Sets the number of measurements used in calculating the average. Also sets the number of measurements made when Average Mode is set to Single, and when Run/Hold is toggled from Hold to Run. The default setting is1 measurement, and the maximum setting is 60 measurements. Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. Press **Enter** to set, or press **Esc** to restore the previous setting.

Max Hold: Setting Max Hold to On will display only the maximum power level. Turning Max Hold Off will display the current power level.

Run/Hold: Toggles between Run and Hold. When in Hold mode, pressing this key starts the measurements and provides a trigger. When in the Run mode, pressing this key pauses the sweep.

Average Mode: Toggles between single measurement and continuous measurements. In Single, each measurement (or series of measurements if Running Average is greater than 1) must be activated by the Run/Hold key.

Figure 9-28. High Accuracy PM (MA24105A) Average Menu

9-17 Limit Menu

Key Sequence: **Limit** or **Limit** (**6**)

Limit

Limit: Turns the limits On or Off.

Fwd Upper Value: Sets the forward measurement upper limit (displayed as red hash marks). Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new setting or press the **Esc** button to restore the previous setting.

Fwd Lower Value: Sets the forward measurement lower limit (displayed as red hash marks). Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new setting or press the **Esc** button to restore the previous setting.

Rev Upper Value: Sets the reverse measurement upper limit. Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new setting or press the **Esc** button to restore the previous setting.

Rev Lower Value: Sets the reverse measurement lower limit. Enter the desired number by using the keypad, the rotary knob, or the **Up/Down Arrow** keys. If the keypad was used to enter new values, then press **Enter** to set the new setting or press the **Esc** button to restore the previous setting.

Figure 9-29. High Accuracy PM (MA24105A) Limit Menu

9-18 Sweep Menu

This menu is not available in High Accuracy Power Meter measurement mode.

9-19 Trace Menu

This menu is not available in High Accuracy Power Meter measurement mode.

9-20 Other Menus Keys

Refer to Table 2-1, “Site Master Keypad Functions” on page 2-10.

Chapter 10 — File Management

10-1 Introduction

This chapter reviews the file management features of the Site Master S820E. The File menu and associated submenus allow you to save, recall, rename, copy, and delete files in internal memory or on an external USB drive.

The File menu is accessed by pressing the **File** (1) keypad menu key. In Video Inspection Probe (VIP) mode, you can alternatively press the Save/Recall main menu key on the touchscreen.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may depict instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

10-2 Overview

Remember the following tips when reviewing this chapter:

- File management functions apply to files stored in internal memory or on a removable disk.
- Select the destination for saved files using the Location button and the Set Location key in the Save dialog box.
- Rename saved files under the File Management menu (**File** > File Mgmnt).
- Sort files by tapping a column heading.
- Move up and down file lists using buttons under the Navigation menu.
- Press **Esc** to return to the previous screen.
- Saved measurements also contain setup information.
- Recalled measurements display in purple and may change the current instrument settings (*which will not be saved*) in order to display the recalled measurement.
- Calibration information is recalled with setup files but not recalled with measurement files.
- Use the Left arrow key to move out of a folder.
- Use the Right arrow key to move inside of a highlighted folder.

10-3 File Types

Filename extensions used in the Site Master S820E include:

- `*.dat` for Cable and Antenna measurement files
- `*.hipm` for High Accuracy Power Meter measurement files
- `*.svna` for VNA mode measurement files
- `*.s2p (SnP)` for VNA mode measurement files:

  Real/Imag

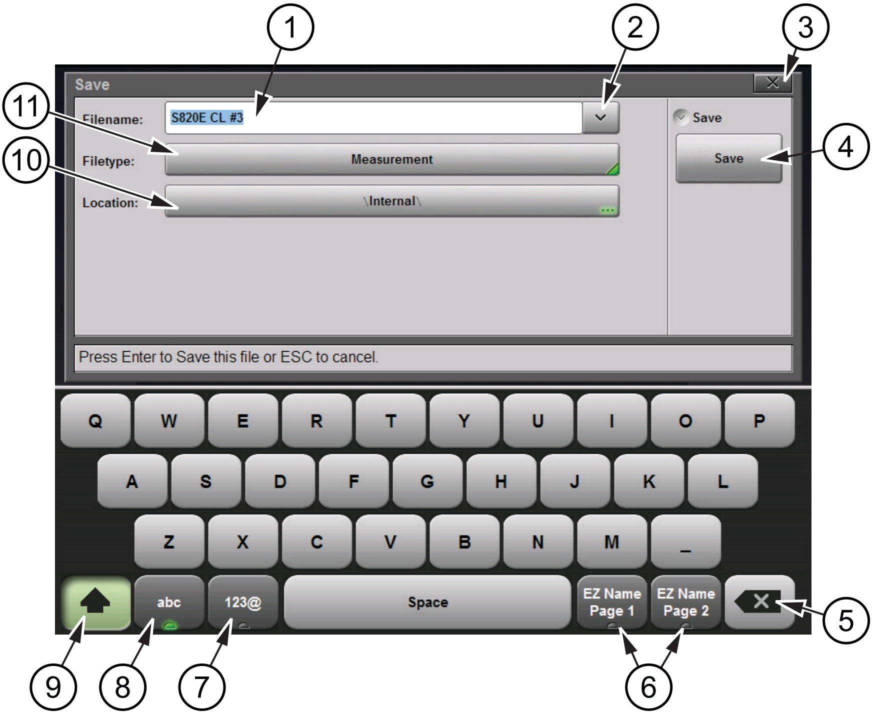
  Lin Mag/Phase

  Log Mag/Phase
- `*.ett` for easyTest files
- `*.stp` for Setup files
- `*.png` for Screen Shot files
- `*.csv` text file with Comma Separated Values (CSV), for saving formatted data
- `*.txt` for saving Status information and Self Test results
- `*.vipi` for Video Inspection Probe measurement files

Note	S2P is a standard ASCII text file format that is used for scattering parameters from a 2-Port measurement. This is a subset of SnP (where n equals the number of ports). An S2P file can be used as input for signal analysis. The CSV and Text files contain setup information and final formatted data that are shown on the instrument display screen. This file information includes any post-processing that was done on the data (smoothing, trace math, and so forth). These files contain the data for any traces that are displayed, including the memory traces. They also contain the markers that are turned on when the file is saved.

10-4 Save Files

Press **File** (**7**) to display the File main menu, then press Save to open the Save dialog. Alternatively, you can press the  icon in the System Function Tool Bar at the top of the display. In Video Inspection Probe mode, the Save icon automatically applies the current auto filename settings, if enabled, to the saved file (see Figure 14-4 on page 14-5).



1.	Current Filename (ready for editing). Refer to “File Name” on page 10-4.
2.	Recent Filenames (tap to view)
3.	Close Dialog Box Without Saving File
4.	Save File and Close
5.	Delete Filename Character Key
6.	EZ Name Keys. Refer to “EZ Name Keys” on page 10-6.
7.	Symbols and Numbers Keyboard
8.	Letters Keyboard

Figure 10-1. Save Dialog Box (1 of 2)

9.	Shift Key
10.	Current Save Location. Tap to Change. Refer to “Save Location” on page 10-8.
11.	Current Filetype. Tap to Change. Refer to “File Type” on page 10-7.

Figure 10-1. Save Dialog Box (2 of 2)

File Name

In the Filename edit box, you can either use the default name or enter a custom name. The default name is based on the instrument model, current display format and measurement type, and a sequence number. For example:

`S820E 1x [DTF-RL] #3.dat`, where:

`1x` = Single display
`2x` = Dual display

`RL` = Return Loss
`DTF-RL` = Distance to Fault Return Loss
`CL` = Cable Loss
`VSWR` = Voltage Standing Wave Ratio
`DTF-VSWR` = Distance to Fault Voltage Standing Wave Ratio
`TR2P` = Transmission (2-Port)
`TRES` = Transmission (Ext. Sensor)
`SC` = Smith Chart
`PH` = 1-Port Phase
`HiPM` = High Accuracy Power Meter

The file sequence number (#n) is automatically incremented each time a file of the same type is saved. The file extension is determined by the type of file being saved, such as measurement (.dat), setup (.stp), or screen shot (.png).

To enter a custom file name, simply type over the default name. Optionally, you can use the EZ Name keyboards to quickly enter character strings that make up a custom file name.

EZ Name Keyboards

Some carriers may require files to be named according to specific conventions, including site ID, color coding, measurement type, termination device, and frequency information.

Press one of the two EZ Name Page Selection keys to display the EZ Name keyboard, then touch an EZ Name key to enter the corresponding preset character string in the Filename edit box.

Figure 10-2. EZ Name Keyboards

The Separator keys determine whether to automatically insert a separating character (hyphen or underscore) after each name string entered by pressing an EZ Name key.

EZ Name Keys

Pressing an EZ Name key inserts the associated character string into the name of the file being saved. To define your own EZ Name keys or rename an existing key:

1. Press Rename Keys on the appropriate EZ Name keyboard (Page 1 or Page 2). See.
2. Press the EZ Name key you want to define or rename.
3. Enter a new name, e.g., GREEN, for the selected key.

Figure 10-3. Renaming an EZ Name Key

4. Press Done to apply the character string to the EZ Name key. The EZ Name keyboard now shows the key with its new name. In the example, one of the Color Code keys was renamed.

Figure 10-4. Renamed EZ Name Key

Note	User-defined EZ Name keys are saved in internal memory until the custom file is deleted, or a Master Reset is performed. Refer to the “Preset Menu” on page 11-26 for additional information.

File Type

The default file type in the Save dialog box is Measurement. To select a different type of data to save, press the Filetype button, then touch the appropriate key under the File Type menu. The selected file type determines the file name extension, as shown in Figure 10-5.

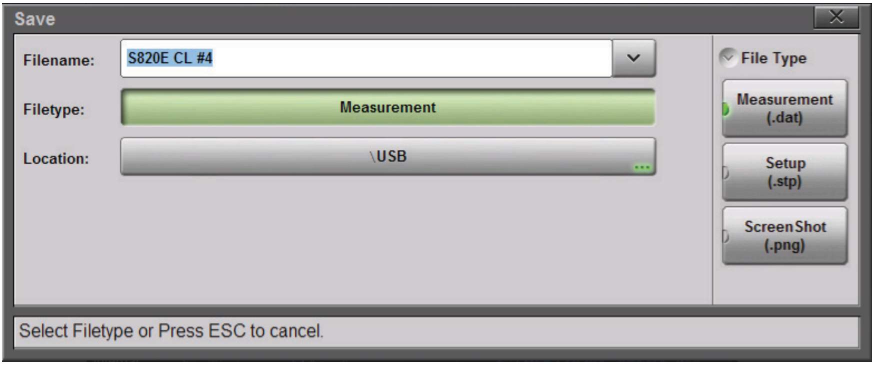


Figure 10-5. Save File Type

Measurement files are typically saved for reporting and monitoring. They contain both the measurement data and setup data.

Note	In Video Inspection Probe mode, the Measurement file type (.vipi extension) saves the captured VIP image and analysis results. See Chapter 14, "Video Inspection Probe (VIP)".

Setup files help ensure consistent instrument setup when making future measurements. They contain basic setup details including: measurement type, frequency span, distance span, DTF setup, amplitude settings, markers, limit lines, calibration coefficients, and additional instrument settings (data points, run/hold status and RF immunity status).

Screen shot files contain a screen capture of the current display. The image appearance is set using the ScrnShot Settings.

Save Location

The current save destination is shown on the Location button in the Save dialog box. To change to another location, press the Location button and select where to save the file. Double-tap a folder to open it.

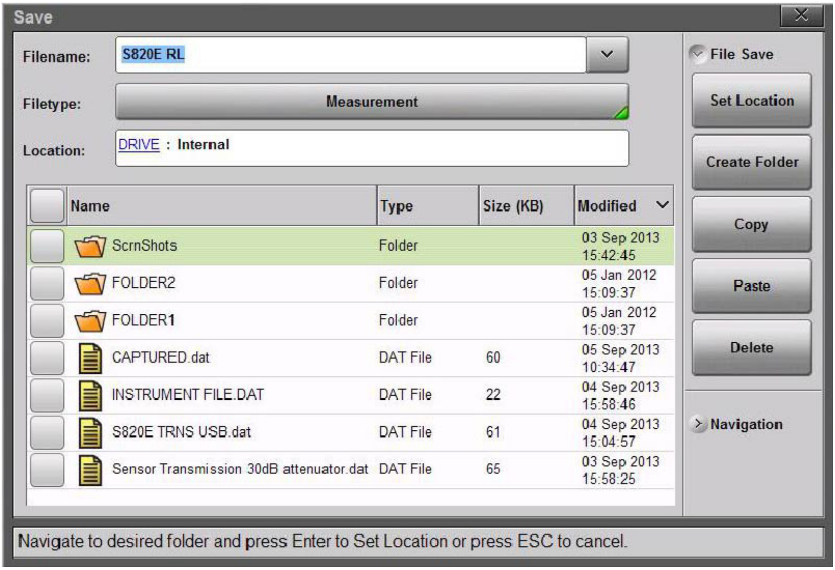


Figure 10-6. File Save Location

Files can also be saved to an external storage drive like a USB removable disk. Double-tap Drive: in the Location directory path to open the dialog below, then select the removable disk and press **Enter**. Select or create any subfolders as needed.

Once the destination folder is selected, press the Set Location button.

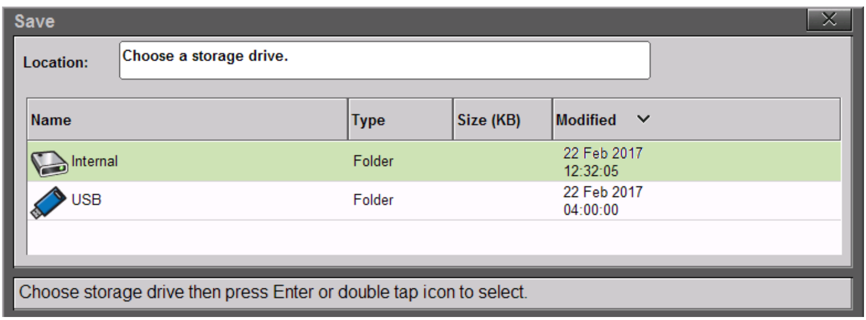


Figure 10-7. Choose a Storage Drive

10-5 Recall File

You can recall a previously saved measurement or setup or a screen shot file either from the instrument internal memory or from a removable USB drive. Only one file of any type can be recalled at a time.

Note	Recalling a measurement or setup may change the current instrument settings and turn off any calibration correction. Consider saving the current setup before recalling a file.

Recall a Measurement

1. Press the **File** (**7**) key to display the File menu.
2. Press Recall to open the Recall dialog box.
3. Press the Filetype button, then touch Measurement or All to list only measurement files or all file types, respectively.
4. Press the Location button and navigate to the desired measurement file (.dat). Select it, then press **Enter** (or Recall in the Recall dialog).

   In the example below, the selected file is a Cable Loss measurement file located on a removable USB drive.

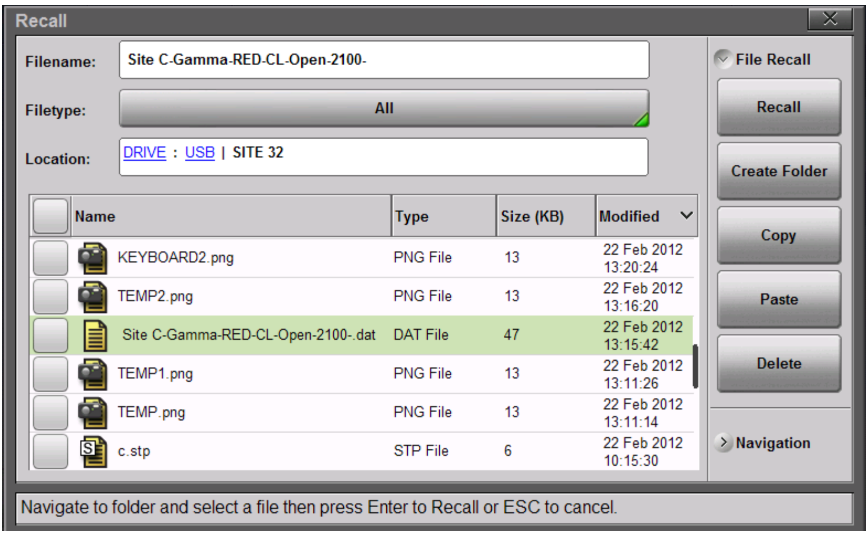


Figure 10-8. Recall Dialog Box

5. In the preview screen that opens, press Enter to complete recalling the measurement. To cancel the recall and return to the File Recall menu, press **ESC**.

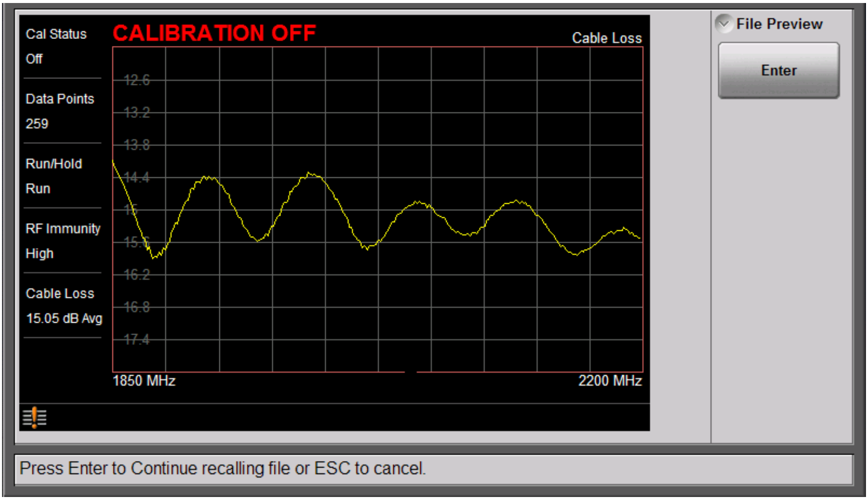


Figure 10-9. Preview of a Recalled Measurement

6. Figure 10-10 illustrates a recalled measurement and active trace.

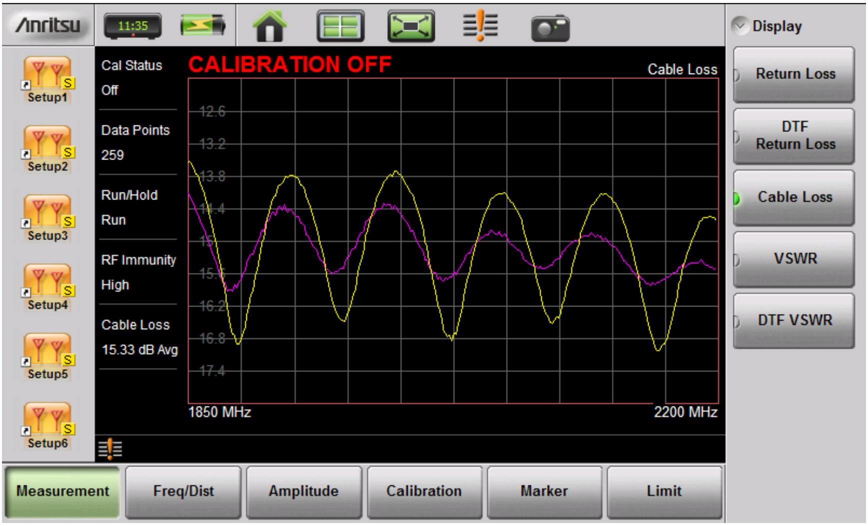


Figure 10-10. Recalled Measurement and Active Trace

The recalled measurement is the purple trace and is overlaid on the current active (yellow) trace. In Figure 10-10, the recalled measurement is used to compare the cable loss of two different RF cables. Recalled measurements are automatically saved to trace memory for use in trace match functions. To see the recalled measurement and the current measurement simultaneously, select Trace & Memory in the Trace Display submenu. Refer to "Trace" on page 3-47.

Recall a Setup

Setup files contain basic instrument setup details including: measurement type, frequency span, distance span, DTF setup, amplitude setting, markers, limit line, calibration coefficients, and additional instrument settings (data points, run/hold status). Recalling a setup may change the current settings.

1. Press the **File** (**7**) key to display the File menu.
2. Press Recall to open the Recall dialog box.
3. Press the Filetype button, then touch Setup or All to list only setup files or all file types, respectively.
4. Press the Location button and navigate to the desired setup file (.stp extension).
5. Double-tap the file to recall the setup. Alternatively, you can press the file name to select, then press **Enter** (or Recall in the Recall dialog).

Recall/Preview a Screen Shot

1. Press the **File** (**7**) key to display the File menu.
2. Press Recall to open the Recall dialog box.
3. Press the Filetype button, then touch ScreenShot or All to list only screen shot files or all file types, respectively.
4. Press the Location button and navigate to the desired screen shot file (.png extension).
5. Select the file, then press **Enter** (or Recall in the Recall dialog). Alternatively, you can simply double-tap a file in the list to recall the screen shot.

6. A preview screen displaying the selected screen shot is illustrated in Figure 10-11. Press **ESC** to return to the File Recall menu.

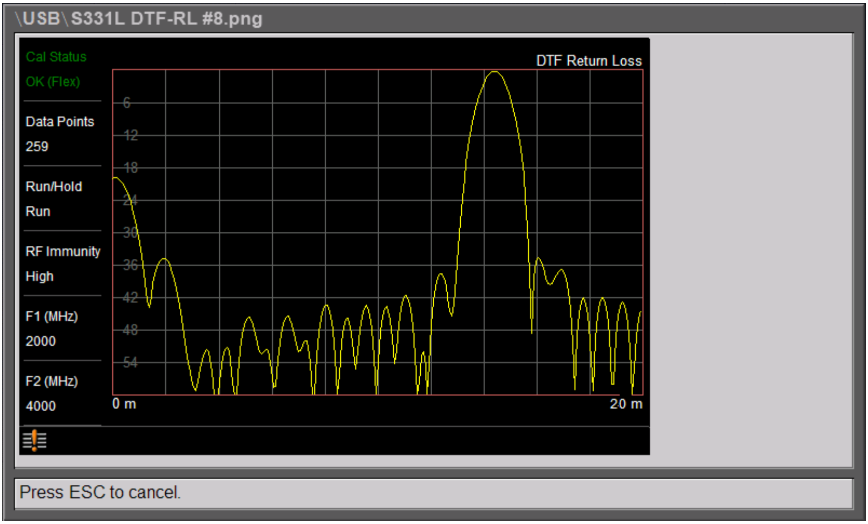


Figure 10-11. Preview of a Recalled Screen Shot

Recall a VIP Measurement (VIP Mode Only)

In Video Inspection Probe mode, press the Save/Recall main menu key, then press Recall. Confirm that the Filetype is Measurement or All.

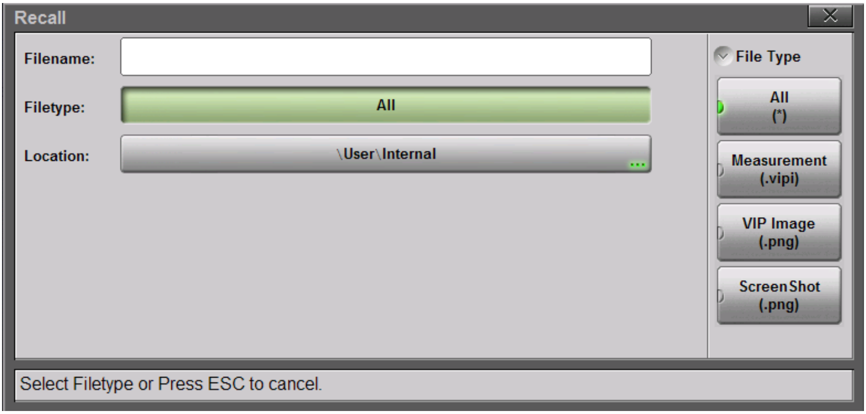


Figure 10-12. Recall File Type (VIP Mode)

Select the file (`.vipi` extension) with the touchscreen, rotary knob, or the **Up/Down** arrow keys, then press **Enter** (or the Recall submenu key).

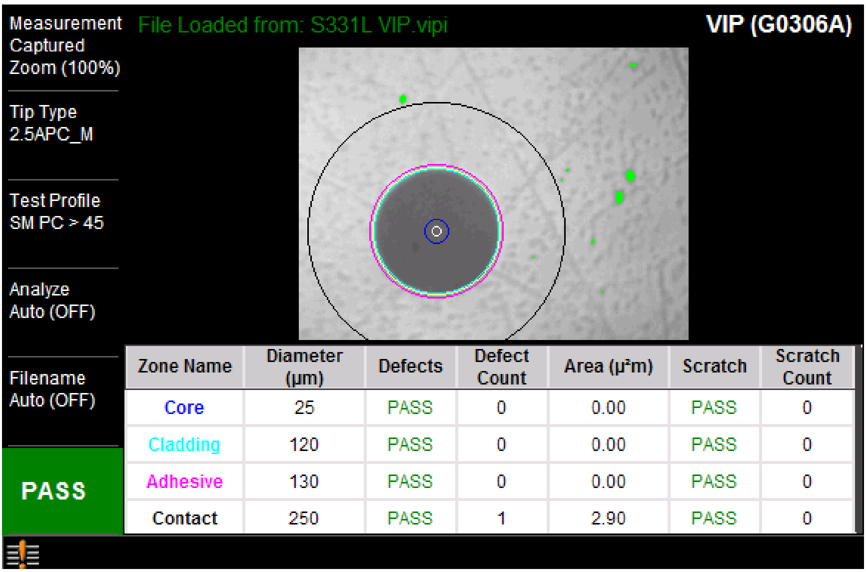


Figure 10-13. Recalled VIP Measurement File

Recall a VIP Image (VIP Mode Only)

In VIP mode, press the Save/Recall main menu key, then press Recall. Confirm that the Filetype is VIP Image or All. Select the file (`.png` extension) with the touchscreen, rotary knob, or the **Up/Down** arrow keys, then press **Enter** (or the Recall submenu key).

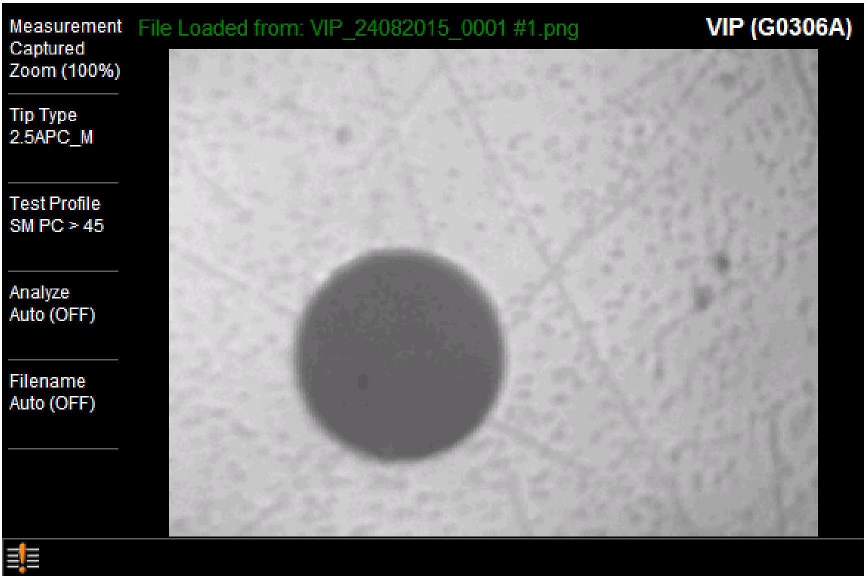


Figure 10-14. Recalled VIP Image File

A recalled VIP image can be analyzed and the results included in a VIP report. Refer to “Measurement Menu” on page 14-13.

10-6 Rename File

1. Press the **File** (**7**) key to display the File menu.
2. Press File Mgmnt to open the File Mgmnt dialog box.
3. Navigate to the file you wish to rename and press to select.

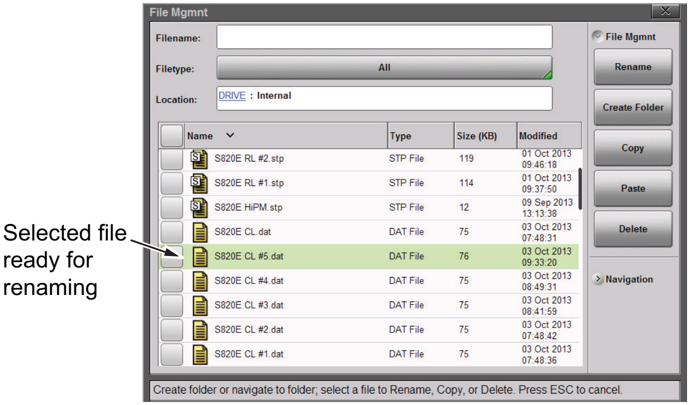


Figure 10-15. Select a File to Rename

4. Press the Rename submenu key to open the New Name edit box and on-screen keyboard.
5. Enter the new file name. Optionally, you can use the EZ Name keyboards to enter preset character strings. Refer to "EZ Name Keyboards" on page 10-5.

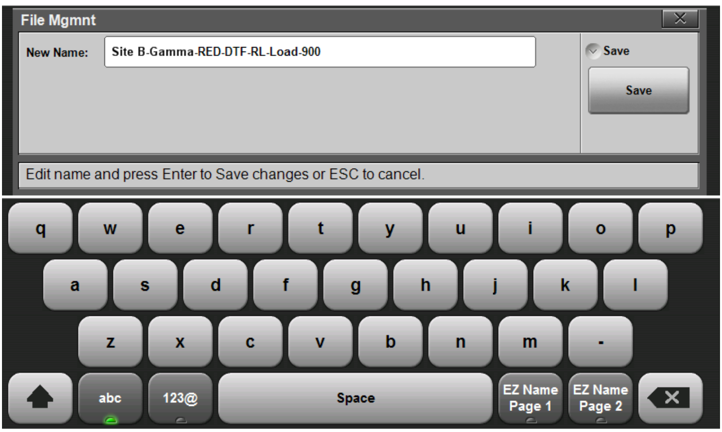


Figure 10-16. Enter a New File Name

6. Press Save to apply the new file name and return to the File Mgmnt dialog box.

   Figure 10-17 illustrates the file directory with the renamed file.

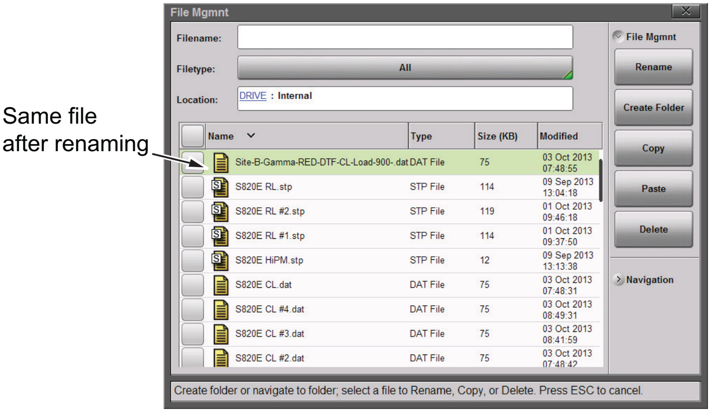


Figure 10-17. Renamed File

10-7 Copy and Paste File

The Site Master S820E allows multiple files and folders to be copied or moved at the same time. The example below describes how to copy or move files and folders from internal memory to a removable USB drive.

Note	For user convenience, the Create Folder, Copy, Paste, and Delete buttons are available under each of the File Mgmnt, Recall, and Save submenus.

1. Press the **File** (**7**) key to display the File menu.
2. Press File Mgmnt to open the File Mgmnt dialog box.
3. Navigate to the file you wish to copy or move and press the checkbox next to it to select. Use the Navigation submenu keys as needed to move through a long list of files.

   You can select a single or multiple files and folders, as illustrated in Figure 10-18. Press the top checkbox to select all files and folders in the current directory.

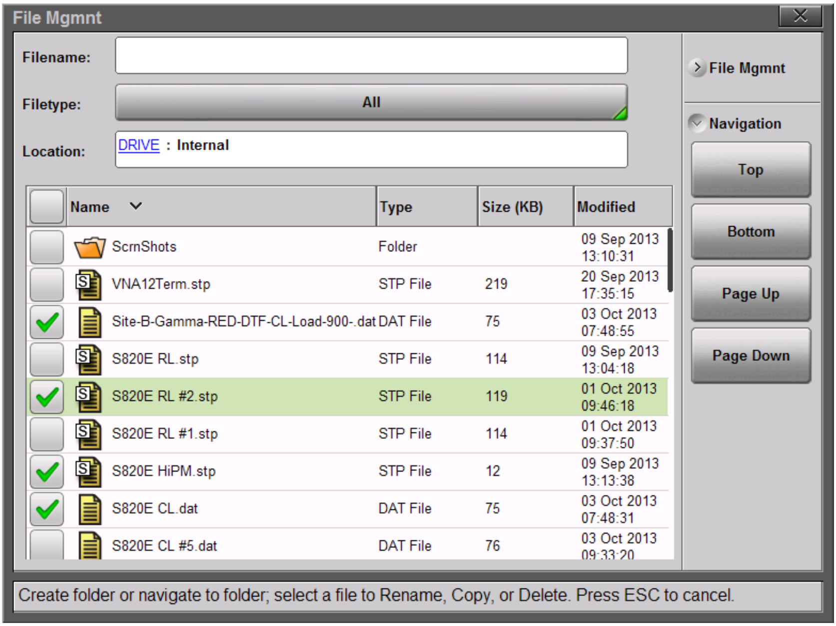


Figure 10-18. Multiple Item Selection

4. Under File Mgmnt, select Copy.
5. Insert a USB flash drive into one of the Site Master's USB ports.
6. Double-tap on Drive in the Location field, then double-tap on the USB drive icon.
7. Navigate to the destination folder as needed, then press Paste to either copy or move the selected files and folders from internal memory to the USB drive.
8. In the Paste Selection message box, press Paste or Move, as appropriate. Paste will create copies of the selected files in the destination folder. Move will place copies in the destination folder and remove the selected files from the source location.

Figure 10-19. Paste Selection Dialog Box

9. If files with the same name already exist in the destination folder, a confirmation dialog will display, prompting you to select whether to overwrite some or all of the files.

Figure 10-20. Paste Warning

10. After pasting is completed, the USB drive can be removed. No Eject command is required to remove the drive.

Note	Files are removed from Site Master clipboard memory after pasting. The Site Master does not allow concurrent pasting.

10-8 Delete Files

The Site Master S820E allows multiple files and folders to be deleted at the same time from either internal memory or an external USB drive.

The example below describes deleting all the files from a folder in internal memory.

1. Press the **File** (**7**) key to display the File menu.
2. Press File Mgmnt to open the File Mgmnt dialog box.
3. Navigate to the file you wish to delete and press the checkbox next to it to select. Use the Navigation submenu keys as needed to move through a long list of files.

   You can select a single or multiple files and folders, as illustrated in Figure 10-21. Press the top checkbox to select all files and folders in the current directory.

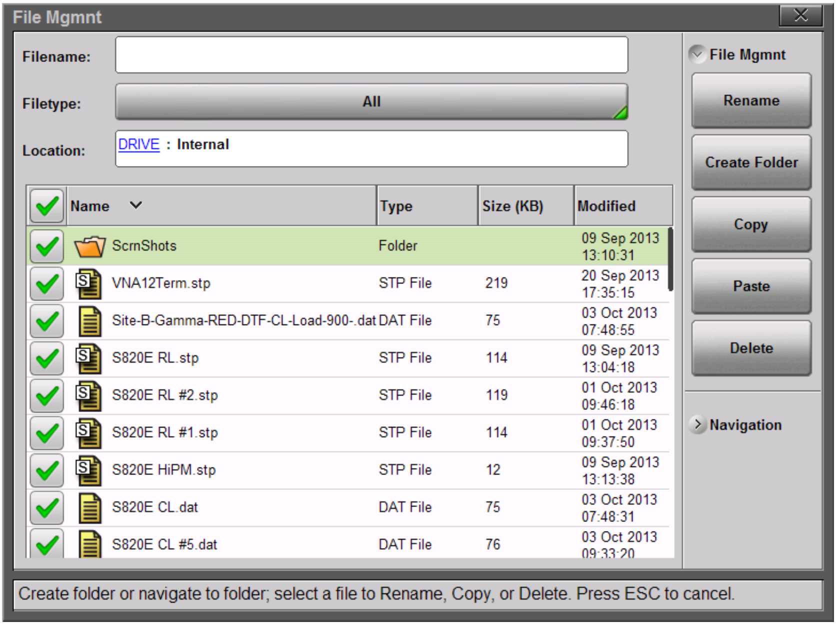


Figure 10-21. Selecting Multiple Items to Delete

4. Under File Mgmnt, press Delete. Touch Yes in the confirmation message box if appropriate.

The Delete function deletes all selected files, including files not created by the S820E. Use caution when deleting files.

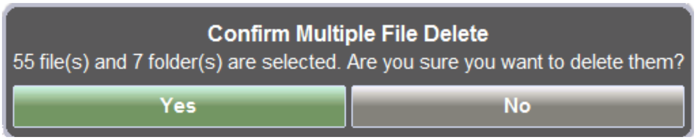


Figure 10-22. Confirm File Deletion

10-9 Create a Folder

The Site Master S820E allows folders to be created in either internal memory or an external USB drive. This functionality is helpful in organizing traces by date, technician, carrier, and/or site location.

1. Press the **File** (**7**) key to display the File menu.
2. Press File Mgmnt to open the File Mgmnt dialog box.
3. Navigate to the location where you want to create the new folder.

Note	Double-tap a folder to open it. You can also use the Right and Left keys on the keypad pane to open and close folders.

4. Under File Mgmnt, press Create Folder to open the Foldername edit box and on-screen keyboard.
5. Enter the new folder name. Optionally, you can use the EZ Name keyboards to enter preset character strings. Refer to "EZ Name Keyboards" on page 10-5.

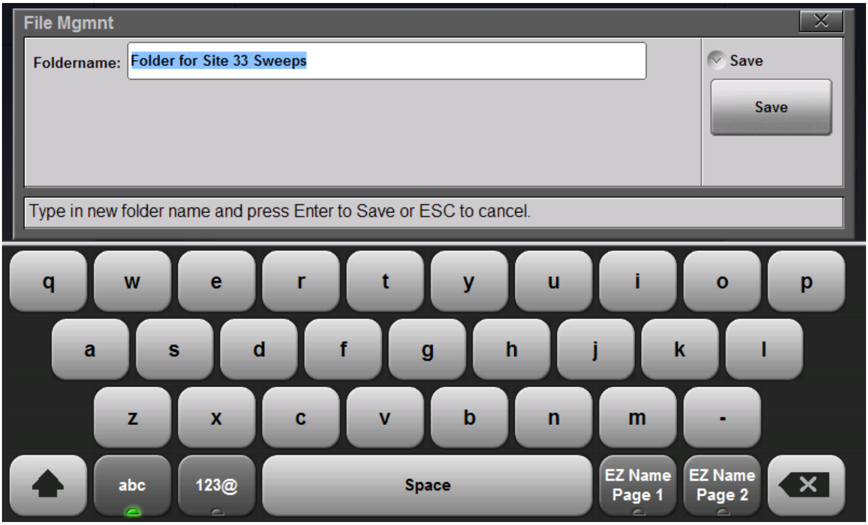


Figure 10-23. Enter a New Folder Name

6. Press Save to apply the new folder name and return to the File Mgmnt dialog box.

Figure 10-24 illustrates the newly created folder in internal memory.

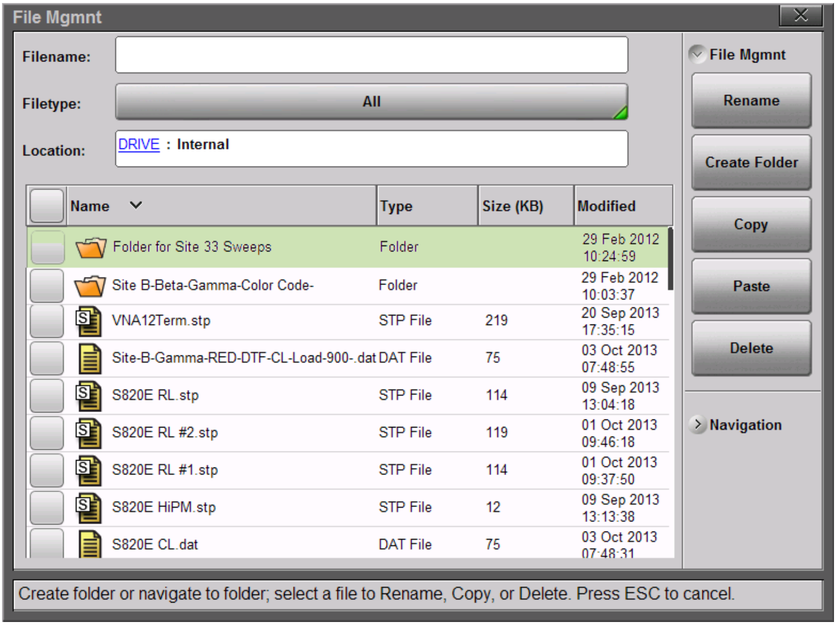


Figure 10-24. New Folder Created

10-10 File Menu Overview

Figure 10-25 shows the map of the File menus and submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu. The selectable file types are different in VIP Mode (see Figure 14-7 on page 14-8).

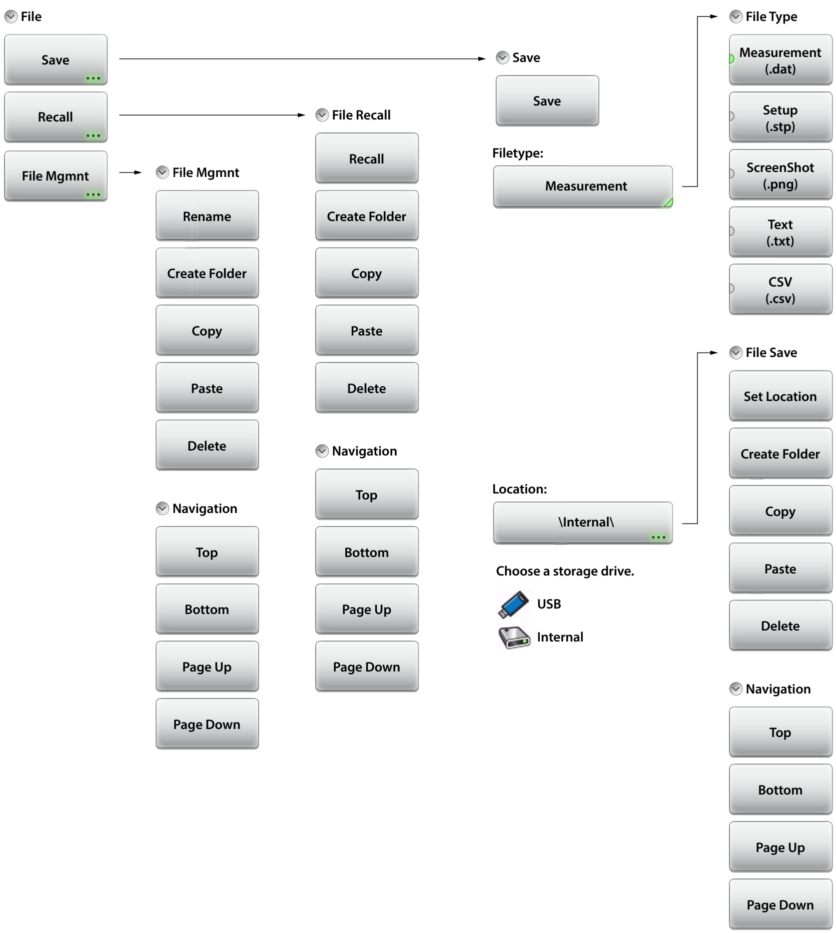
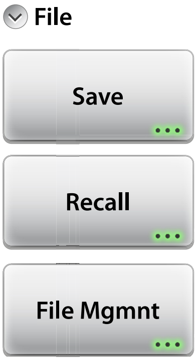


Figure 10-25. File Menu Map

10-11 File Menu

Key Sequence: **File (7)**



File

Save: Press this submenu key to display the “Save Menu” on page 10-25 and the touch screen keyboard. Site Master files can be saved to internal memory or to a USB flash drive. The saved Measurement, Setup, or Screen shot file can be named by using the touch screen keyboard. By default, measurements are saved to internal memory. The save destination is set using “Set Location” on page 10-26.

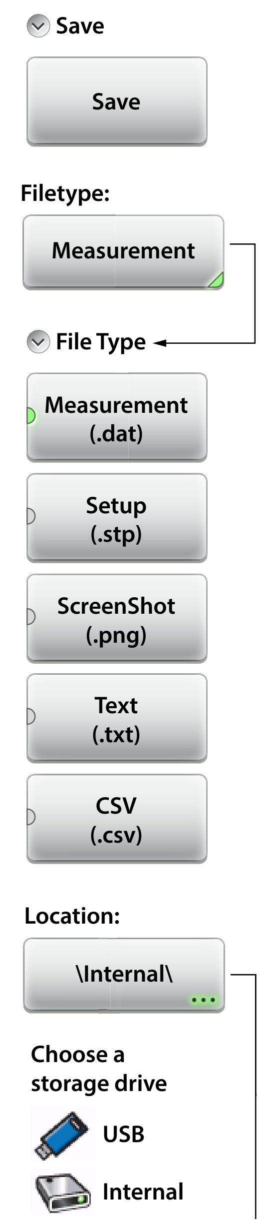
Recall: Press this submenu key to display the “Recall Menu” on page 10-27. This menu is for recalling a measurement or setup data from internal memory or from a USB flash drive. The Recall function can also be used to preview saved Screen Shot Files.

File Mgmnt: Press this submenu key to display the “File Mgmnt Menu” on page 10-29. This menu contains basic file management functions including renaming files or folders, creating folders, copying, pasting, and deleting files or folders. Many of the file management functions are duplicated in the Save and Recall menus for user convenience.

Figure 10-26. File Menu

Save Menu

Key Sequence: **File (7)** > Save



File > Save

Save: Press this key to save to file the current measurement data, setup data, or screen.

Save > Filetype

Filetype: Press this key to select the type of data to save. Refer to "File Type" on page 10-7.

Measurement (.dat): Measurement files contain the measurement data and setup data. They can be recalled and viewed on the instrument or viewed on a PC with Line Sweep Tools.

Setup (.stp): Setup files contain basic instrument information, measurement setup details, measurement marker data, and limit data.

ScreenShot (.png): Screen shot files contain an image capture of the current display. Capture settings are set in the "Display/Audio Menu" on page 11-21.

Text (.txt): Saved instrument status and self-test results are stored in text files.

CSV (.csv): CSV files contain saved data in text format with Comma Separated Values (CSV).

The selectable file types are different in Video Inspection Probe (VIP) mode. See Figure 14-7 on page 14-8.

Save > Location

Location: Displays the current save location. Press this key to change the location where the Site Master saves files. Select folders or drives with the arrow keys, the rotary knob, or the touchscreen. Refer to "Save Location" on page 10-8.

Figure 10-27. Save Menu (1 of 2)

Save Menu (continued)

Set Location: Press this submenu key to set the current location for saving files and then return to the "Save Menu" on page 10-25.

Create Folder: Press this submenu key to create a new folder in the highlighted location or folder. Name the new folder with the onscreen keyboard and press **Save**.

Copy: Press this submenu key to mark the selected files and/or folders for copying or moving, using the Paste command. Use the checkbox column to select multiple items to copy or move.

Paste: Press this submenu key to paste the selected files and/or folders to the destination location. In the message box that appears (see Figure 10-19 on page 10-18), press Paste to create duplicate copies in the destination folder; press Move to place copies in the destination folder and remove the selected files from the source location. If files or folders with the same name already exist in the destination location, the Site Master will ask you to confirm that the existing files should be overwritten.

Delete: Press this submenu key to delete the files and/or folders that are selected. Only files or folders from one location can be deleted at a time. Use the checkbox column to select multiple items to delete.

Once an item is deleted, it cannot be recovered.

Navigation:

Top: Press this key to navigate to the top item of the current location.

Bottom: Press this key to navigate to the bottom item of the current location.

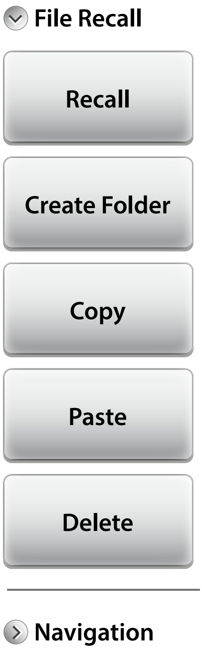
Page Up: Moves up one screen of items (7 rows) in the current location.

Page Down: Moves down one screen of items (7 rows) in the current location.

Figure 10-28. Save Menu (2 of 2)

Recall Menu

Key Sequence: **File (7)** > Recall



File Recall

Recall: Press this submenu key to recall the selected file. Measurements, setups, or screen shots can be recalled.

Recalled measurements are first displayed on the Site Master as a preview. Press **Enter** to complete recalling the measurement or press **ESC** to cancel the recall and return to the File Recall menu. Refer to “Recall File” on page 10-9 for additional information.

Recalled setups change the current setup including measurement type, frequency/distance, amplitude, marker, and limit data.

Recalled screen shots are previewed on the Site Master. Press **ESC** to return to the File Recall menu.

Create Folder: Press this submenu key to create a new folder in the highlighted location or folder. Name the new folder with the onscreen keyboard and press **Save**.

Copy: Press this submenu key to mark the selected files and/or folders for copying or moving, using the Paste command. Use the checkbox column to select multiple items to copy or move.

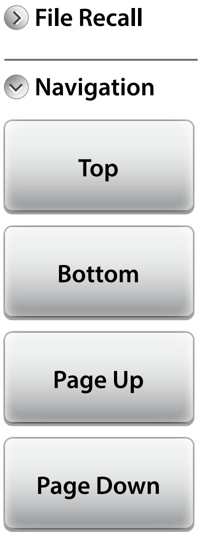
Paste: Press this submenu key to paste the selected files and/or folders to the destination location. In the message box that appears (see Figure 10-19 on page 10-18), press Paste to create duplicate copies in the destination folder; press Move to place copies in the destination folder and remove the selected files from the source location. If files or folders with the same name already exist in the destination location, the Site Master will ask you to confirm that the existing files should be overwritten.

Delete: Press this submenu key to delete the files and/or folders that are selected. Only files or folders from one location can be deleted at a time. Use the checkbox column to select multiple items to delete.

Once an item is deleted, it cannot be recovered.

Figure 10-29. Recall Menu (1 of 2)

Recall Menu (continued)



File Recall

Navigation

Top: Press this key to navigate to the top item of the current location.

Bottom: Press this key to navigate to the bottom item of the current location.

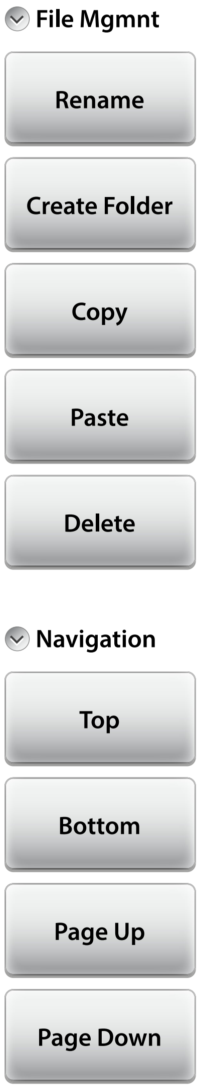
Page Up: Moves up one screen of items (7 rows) in the current location.

Page Down: Moves down one screen of items (7 rows) in the current location.

Figure 10-30. Recall Menu (2 of 2)

File Mgmnt Menu

Key Sequence: **File (7)** > File Mgmnt



File Mgmnt

Rename: Press this submenu key to rename a selected file or folder. The current name is displayed for editing or appending. Press Save or **Enter** to complete.

Create Folder: Press this submenu key to create a new folder in the highlighted location or folder. Name the new folder with the onscreen keyboard and press **Save**.

Copy: Press this submenu key to mark the selected files and/or folders for copying or moving, using the Paste command. Use the checkbox column to select multiple items to copy or move.

Paste: Press this submenu key to paste the selected files and/or folders to the destination location. In the message box that appears (see Figure 10-19 on page 10-18), press Paste to create duplicate copies in the destination folder; press Move to place copies in the destination folder and remove the selected files from the source location. If files or folders with the same name already exist in the destination location, the Site Master asks you to confirm that the existing files should be overwritten.

Delete: Press this submenu key to delete the files and/or folders that are selected. Only files or folders from one location can be deleted at a time. Use the checkbox column to select multiple items to delete.

Once an item is deleted, it cannot be recovered.

Navigation

Top: Press this key to navigate to the top item of the current location.

Bottom: Press this key to navigate to the bottom item of the current location.

Page Up: Moves up one screen of items (7 rows) in the current location.

Page Down: Moves down one screen of items (7 rows) in the current location.

Figure 10-31. File Management Menu

Chapter 11 — System Operations

11-1 Introduction

This chapter describes various instrument management features of the Site Master.

Note	The **Save** menu and **File** menu are discussed in Chapter 10. The other keyboard menu keys are measurement mode specific and discussed in Chapter 3, "Cable and Antenna Measurements" or Chapter 9, "High Accuracy Power Meter".

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

11-2 Self Test

At power on, the Site Master runs through a series of checks to ensure that the system is functioning properly.

If the Site Master is within the operating temperature range with a charged battery and fails the self test, contact your Anritsu Service Center at http://www.anritsu.com/contact-us

To start a self test when the system is already powered up:

1. Press the **System** (**8**) key.
2. Press the Diagnostics submenu, then Self Test. The test starts, and the results are displayed in the dialog box (Figure 11-1).
3. Use the **Up/Down Arrow** keys, rotary knob, or on screen navigation keys to move through the test results.
4. Pressing Save to File automatically creates a text file of the test results. The file is saved to internal memory and labeled `S820ESelfTest#X.txt`. The `.txt` file can be copied to a USB memory device (using the copy/paste function in File Mgmnt) and viewed on a PC with a text reader or word processor.

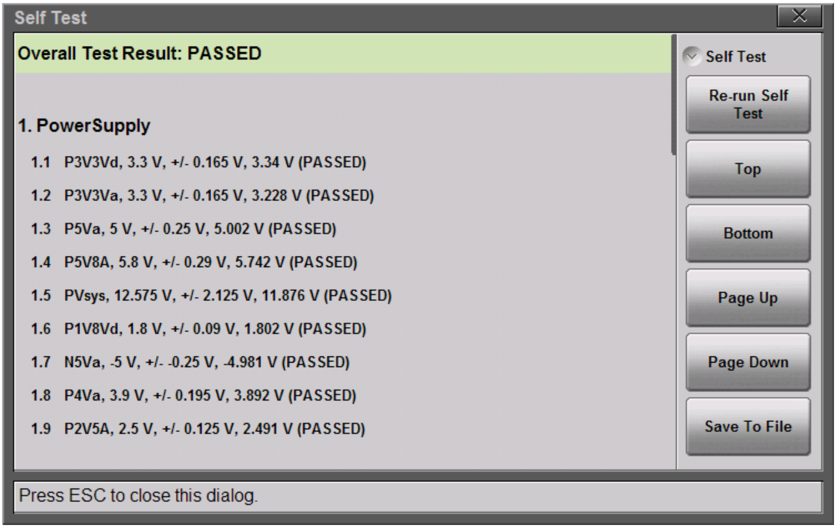


Figure 11-1. Site Master Self Test

11-3 Touchscreen Menu

Key Sequence: **Touchscreen** (**0**)

The touchscreen menu includes touchscreen calibration, an on screen cursor option moved by the **Arrow** keys, and the ability to lock out the touchscreen. Refer to the instructions shown in Figure 11-2 and the additional details provided in Figure 11-3 on page 11-4.

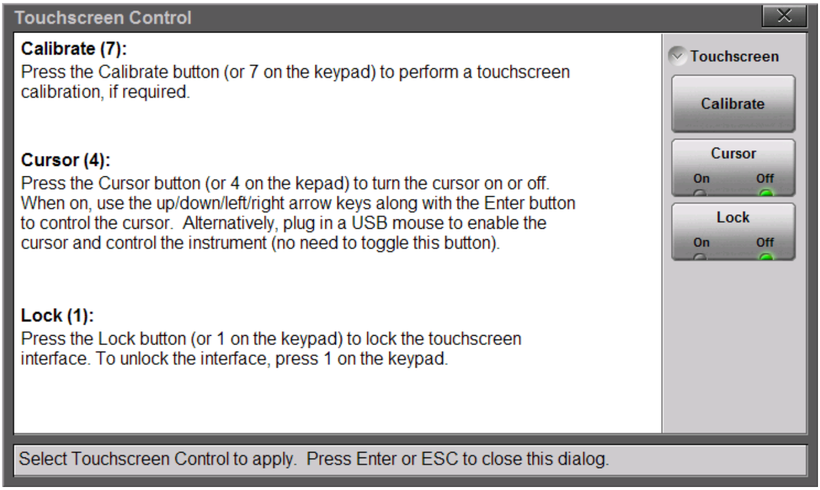
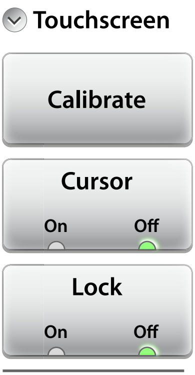


Figure 11-2. Touchscreen Control



Touchscreen

Calibrate: Calibrate the touchscreen if it does not seem to correctly respond to screen presses. Press Calibrate (or the **7** key on the number keypad) and follow the on-screen instructions to recalibrate the touchscreen. Use an appropriate touchscreen stylus for the most accurate results. After the calibration procedure, press **Enter** to accept, or press **Esc** to cancel the recalibration.

Cursor: The Site Master includes a screen cursor that can be controlled with the four directional **Arrow** keys (#7 in Figure 2-5 on page 2-13) above the keypad. Toggle the Touchscreen menu Cursor button to On and press one of the four directional **Arrow** keys to display the screen cursor. Control the cursor movement with the 4 **Arrow** keys, and use the **Enter** key for selection. You can also toggle the Cursor key On and Off by pressing the **4** key on the number keypad. When a message box is displayed, the **Left** and **Right Arrow** keys are used to make a selection.

Note that when the cursor is enabled, the **Enter** key is used exclusively for activating the cursor mouse-up/mouse-down key functions. All other **Enter** key functions are disabled.

Lock: When Lock is toggled to On, the touchscreen does not register user input. The touchscreen would normally be locked only if it was registering unintended input that was not resolved with a touchscreen calibration. This scenario may happen after touchscreen damage. A lock icon is displayed at the top of the screen in the Status Tool Bar when Lock is set to On.

To unlock the touchscreen, press **Touchscreen** (**0**) to display the Touchscreen menu, and then press the **1** key on the number keypad.

The Site Master can continue to be used to make measurements and save files (even with touchscreen locked or damaged) by using a USB mouse or by turning on the Arrow Cursor control.

Figure 11-3. Touch Menu

11-4 Help Menu

Key Sequence: **Help** 

Pressing this System Function Tool Bar **Help** icon displays options to view information about the instrument status, Site Master Frequently Asked Questions (FAQ), or the Instrument User Guide (Figure 11-4).

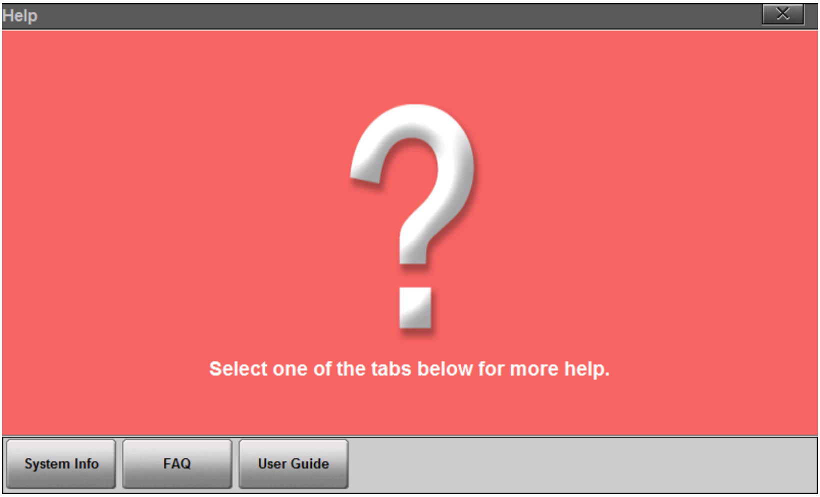


Figure 11-4. Main Help Menu Screen

Press the System Info button to display information about the current status (Figure 11-5).

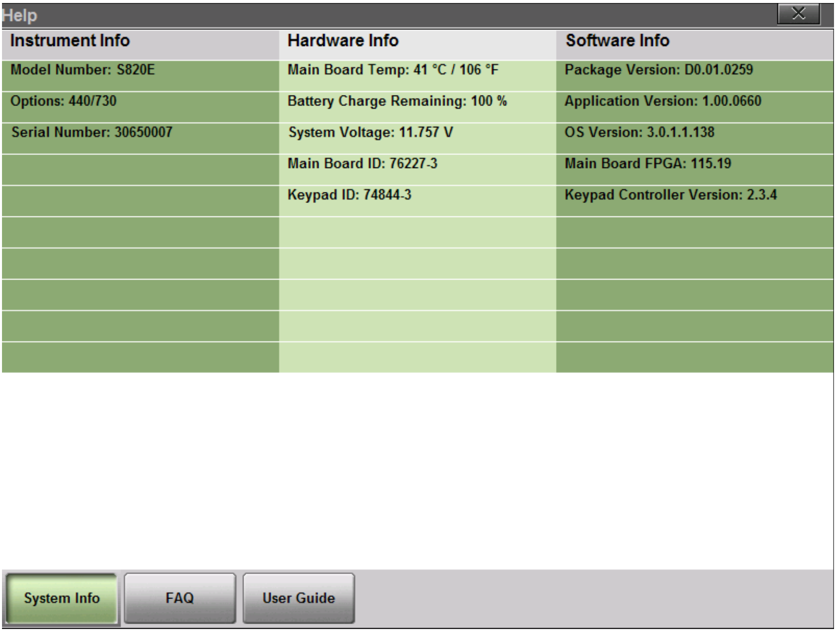


Figure 11-5. System Info

Note that Main Board Temp is displayed in the Hardware Info column.

Package Version (in the Software Info column) is the current firmware version.

Press **Esc** or  to close and return to the main help menu screen. Press **Esc** or  a second time to exit the help menu.

From the main help screen, press the FAQ button to display answers to frequently asked questions including the difference between Classic and Advanced Cable-Antenna Analyzer modes (Figure 11-6).

Scroll through the .html files using the touchscreen navigation aids on the top and bottom of each screen.

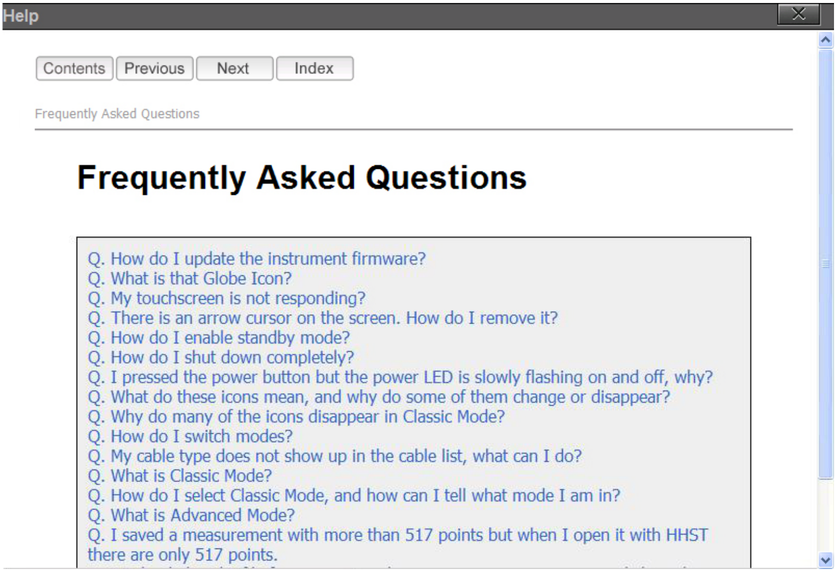


Figure 11-6. FAQ File

Press **Esc** or to close and return to the main help menu screen. Press **Esc** or a second time to exit the help menu.

Note

The S820E Site Master **Arrow** keys can be used to navigate through previously viewed screens.

The **Left Arrow** key () functions as the browser back button and displays the screen viewed immediately before the current screen. Pressing the **Left Arrow** key more than once continues to move back to display previously viewed screens.

The **Right Arrow** key () functions as the browser forward button. Pressing it (after having pressed the left arrow key,) returns the display towards the current screen.

From the main help screen, press the User Guide button to display the instrument User Guide onscreen. (See Figure 11-7).

Figure 11-7. User Guide

Each page in the User Guide displays navigation buttons and bread crumbs. Links to the TOC and a compiled index are also available.

Press **Esc** or [X] to close and to return to the main help menu screen. Press **Esc** or [X] a second time to exit the help menu.

11-5 Updating the Site Master Firmware

The Site Master firmware is updated using a customer supplied USB memory stick. The firmware update is downloaded from the Anritsu website.

Note	Press the Anritsu logo in the upper-left corner of the screen to display instrument status. Press **SW Info** button to view the current software revision. Instrument status can also be found in the System menu.

Updated product information can be found on the Anritsu website:

http://www.anritsu.com/

Search for the product model number. The firmware updates are on the product page under the Library tab in the “Drivers, Software Downloads” section.

Note	The “Release History” link provides a summary of the firmware changes.

1. Click on the “Firmware Update for the Site Master S820E” link.
2. Click the “Download” button and then “Run”. After the download is complete, press “Run” again and follow the onscreen instructions.

   Press “Help (?)” for additional information.
3. After the firmware update is saved on the USB memory stick, remove the memory stick from the computer.
4. Turn off the Site Master and insert the USB memory stick into the USB port.
5. Connect the AC adapter and turn the Site Master on.
6. Press the **Preset** (**1**) key.

7. Under the Reset submenu press Update Firmware. The Update Firmware dialog (Figure 11-8) appears.

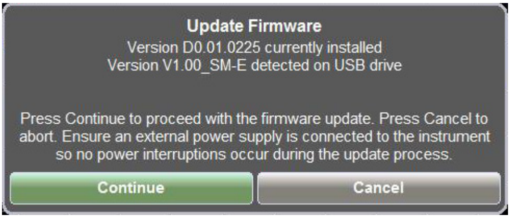


Figure 11-8. Update Firmware Message

8. Select CONTINUE to begin the firmware update or CANCEL to cancel.
9. After the update is complete, the instrument will power down and restart to complete the firmware update.
10. Software version information is displayed in the System Status dialog box. See Figure 11-5 on page 11-6.

Warning	Do not remove power or turn off the instrument during the firmware update to avoid potential serious damage to the instrument.

11-6 Screen Shot Capture

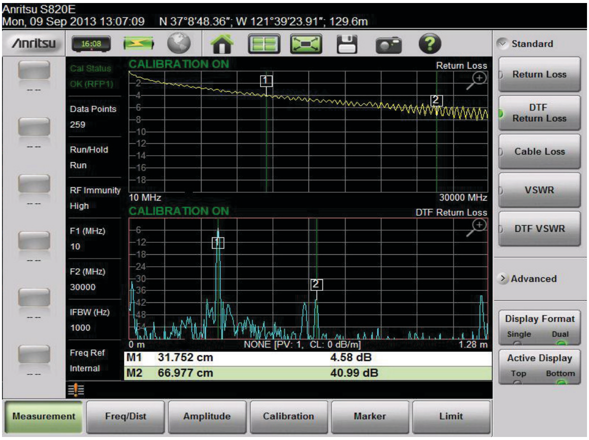
The Site Master can capture a bit mapped image of the display in Portable Network Graphics (.png) format using the Camera icon, .

The file is automatically named based on the instrument model and measurement type. Screen shot files are saved to the instrument's internal memory in the ScrnShots folder (Drive : Internal | ScrnShots).

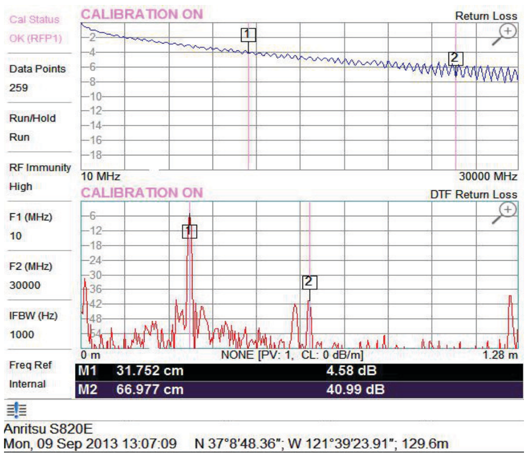
The number keypad can be used to save a screen shot by pressing and holding the **Shift** key while pressing the period (**.**) key, then the **+/–** key.

The look of the saved screen shot is set in this location: **System** (**8**) > System Setups > Display/Audio > ScrnShot Settings. Refer to the "Display/Audio Menu" on page 11-21 for details. Figure 11-9 on page 11-13 is an example of the same measurement saved with different screen shot settings.

Note	Measurements can also be saved as screen shots using the **File** (**7**) menu then Save and setting the Filetype to ScreenShot. Screen shots saved through the File Save Menu will be saved in the current save directory. Refer to Chapter 10 for additional information.



Settings:
Image Capture Size: Full Screen
Background Color: Standard
Image header/footer: Header



Settings:
Image Capture Size: Graph Only
Background Color: Inverted
Image header/footer: Footer

Figure 11-9. Screen Shot Settings

11-7 System Menu Overview

Figure 11-10 show the map of the System menus and submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.

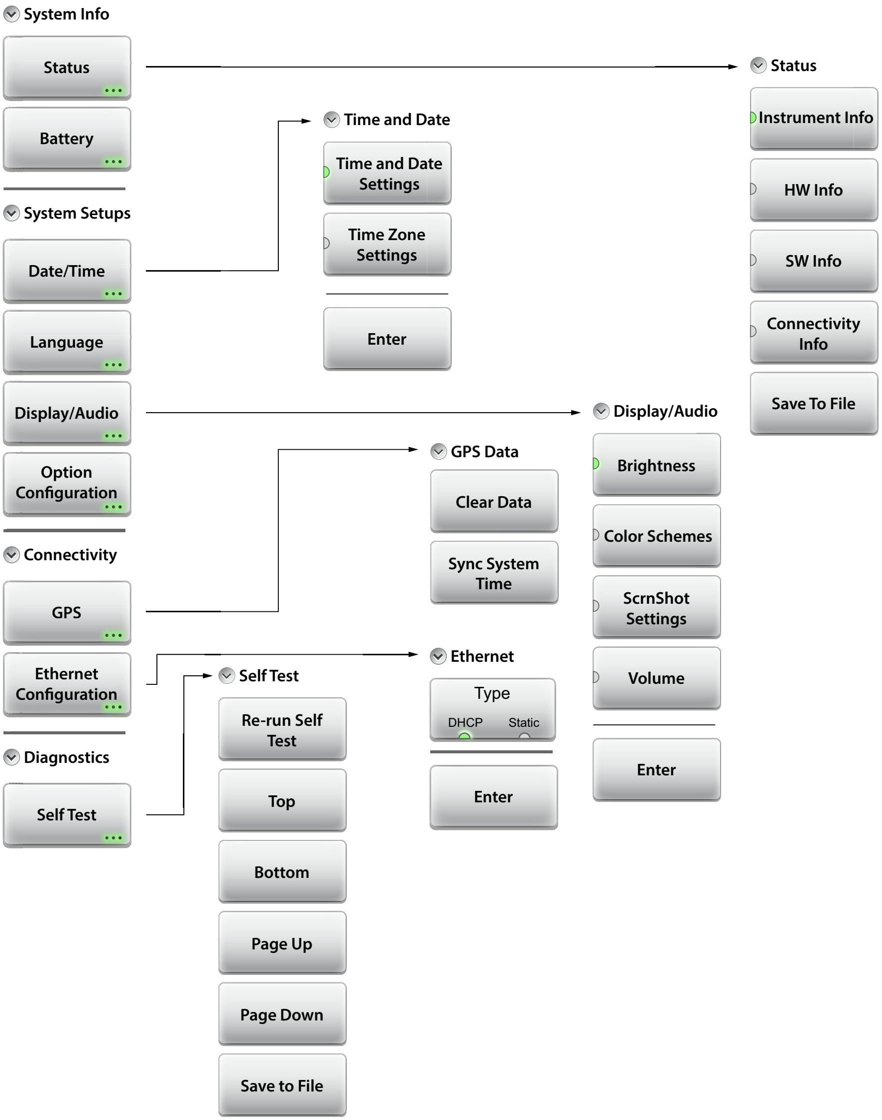
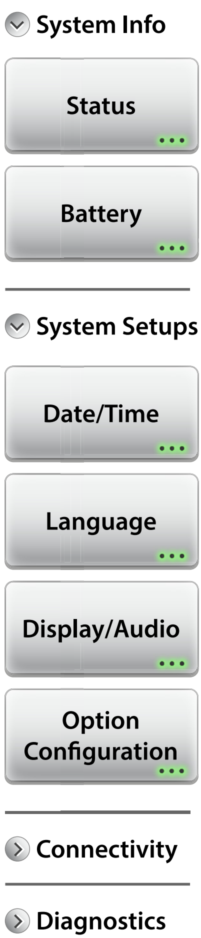


Figure 11-10. System Menu Keys

11-8 System Menu

Key Sequence: **System** (**8**)



System Info

Status: Press this submenu key to display the "Status Menu" on page 11-18 including detailed instrument, hardware, software and connectivity information.

Battery: Press this key to display the battery charge remaining and charge status.

System Setups

Date/Time: Press to display the "Time and Date Menu" on page 11-20.

Language: Press to set the default language. Options include: English, French, German, Italian, Spanish, Russian, Portuguese, Japanese, Korean, or Chinese.

Display/Audio: Press this submenu key to display the "Display/Audio Menu" on page 11-21, which includes display, screen shot, and volume settings.

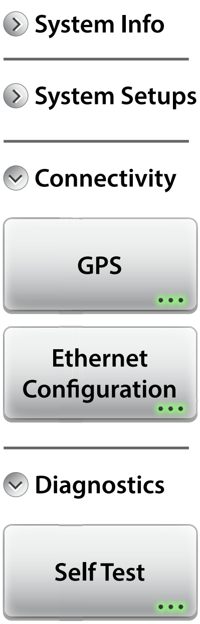
Option Configuration: Press this submenu key to see a list of installed options and also any available software options.

To enable new options, enter the Option Key or the file that is provided by Anritsu Customer Service. Refer to "Option Configuration Dialog Box" on page 11-17.

Figure 11-11. System Menu (1 of 2)

System Menu (continued)

Key Sequence: **System** (**8**)



Connectivity

GPS: Press to display the “GPS Menu” on page 11-23.

Ethernet Configuration: Press this submenu key to display the “Ethernet Configuration Menu” on page 11-25, which displays the IP Address and MAC Address of the instrument and allows you to choose the setting for obtaining the IP Address (DHCP or Static).

Diagnostics

Self Test: Press this submenu key to initiate a series of diagnostic tests that check the components of the instrument. A display lists the individual tests with a pass or fail indication (Figure 11-1 on page 11-2). Press **Esc** to close the dialog box.

Press Save to File to create a text file of the test results. The file is saved to internal memory and labeled `S820ESelfTest#X.txt`. The `.txt` file can be copied to a USB memory device and viewed on a PC with a text reader or word processor.

Figure 11-12. System Menu (2 of 2)

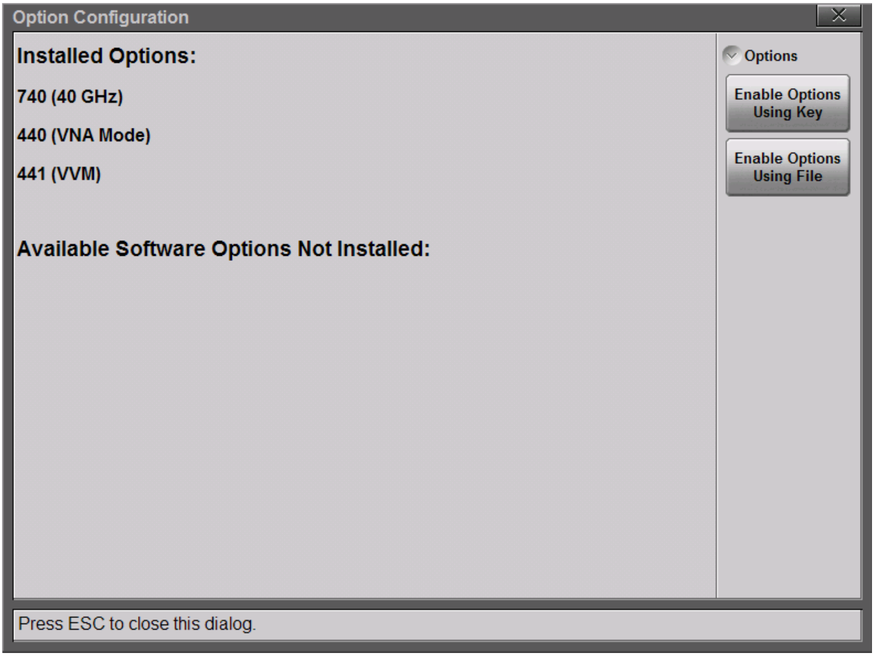


Figure 11-13. Option Configuration Dialog Box

Status Menu

Key Sequence: **System** (**8**) > System Info > Status

Status

Instrument Info: Displays the instrument model, installed options, serial number, UUID.

HW Info: Displays information on main board temperature (internal temperature), remaining battery charge, system voltage, and ID information for various components.

SW Info: Press this submenu key to display the version of various software components.

Connectivity Info: Press this submenu key to display the Ethernet IP Address and MAC address of the instrument.

Save to File: Press Save to File to create a text file of the instrument status. The file is saved to internal memory and labeled `S820EStatus#X.txt`. The `.txt` file can be copied to a USB memory device and viewed on a PC with a text reader or word processor.

Figure 11-14. Status Menu

Pressing the Anritsu logo on the touchscreen also displays this Status menu. (Refer to item 1 in Figure 2-6 on page 2-15.)

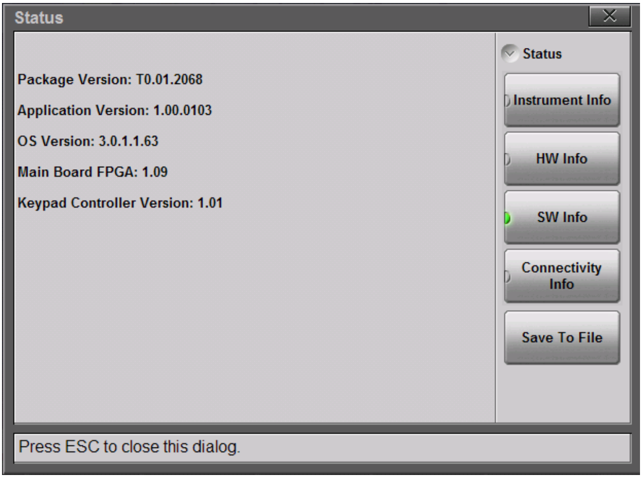


Figure 11-15. System Status Dialog Box

Time and Date Menu

Key Sequence: **System** (**8**) > System Setups > Date/Time

Time and Date

Time and Date Settings: Press to change the current time and/or date using the touchscreen or the number keypad. Press **Enter** to save the changes. (Figure 11-17).

With a good fix, the system date and time can be updated from the GPS signal. Refer to “GPS Menu” on page 11-23.

Time Zone Settings: Press to change the time zone and to select whether the system clock is automatically adjusted for daylight saving time. Press **Enter** to save the changes.

Figure 11-16. Time and Date Menu

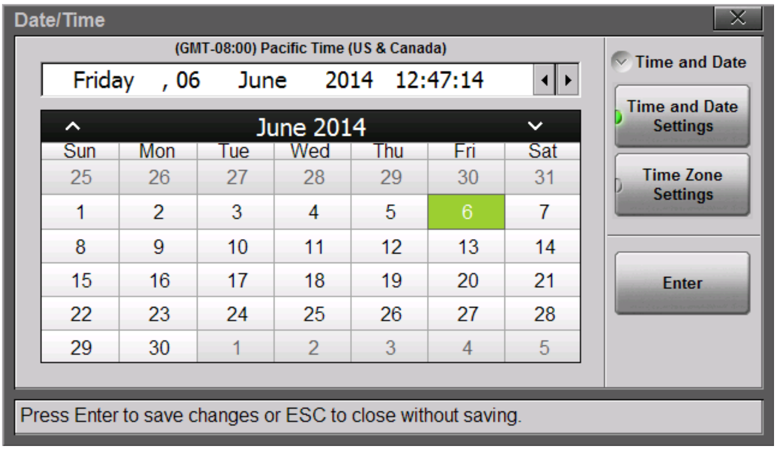


Figure 11-17. Date/Time Dialog Box

Display/Audio Menu

Key Sequence: **System** (**8**) > System Setups > Display/Audio

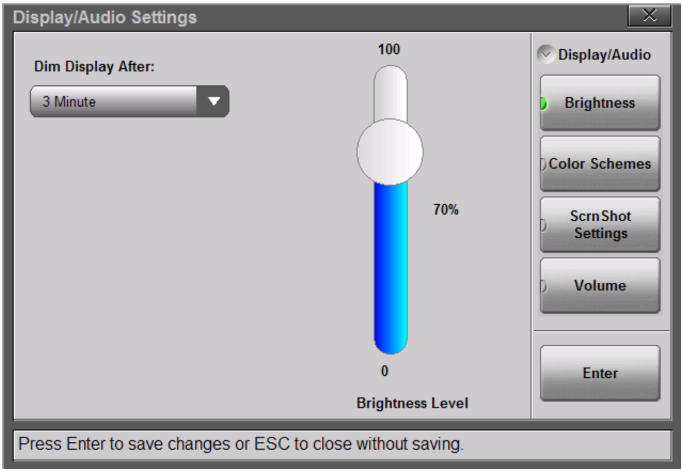
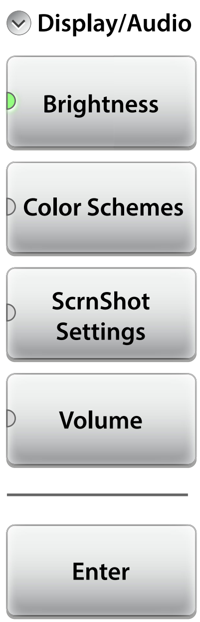


Figure 11-18. Display Brightness Dialog



Brightness: Press this key to access the display brightness settings. See Figure 11-18. You can adjust the level for a wide variety of lighting conditions.

Use the touchscreen, the **Up/Down** arrow keys, or the rotary knob to adjust the currently active setting. Press **Enter** to save the change or **Esc** to cancel.

Display Auto-dimming is enabled by default (1 minute) to extend battery life. Tap the Dim Display After bar to display the available drop-down selections for Auto-dimming. You can choose to dim after a number of minutes (from 1, 2, 3, 5, 10, or 15) or choose Never. The default dim level is fixed at 3 minutes.

Figure 11-19. Display/Audio Menu (1 of 2)

Color Schemes: Press this key and use the touchscreen to select Standard, Daytime, or Nighttime color scheme.

Daytime increases the contrast of the display and is useful outdoors in bright light or other challenging viewing conditions.

Nighttime sets the display to a darker red-tinted color scheme, useful in night-time viewing conditions.

ScrnShot Settings: Press to change the settings used when capturing a screen shot with the  icon, or when saving a screen shot (`.png`) file. See Figure 11-9 on page 11-13.

Under Image Capture Size, select Graph Only, or select Full Screen to capture the entire display screen including menu buttons.

Under Background Color, select Inverted to remove the graph background color (useful for paper printing) or Standard for the typical black background.

Use Image Header/Footer to select the location where the instrument model, name, and date stamp are displayed.

Volume: Press this submenu key to adjust the volume. The current volume setting is displayed. Use the touchscreen, the **Up/Down** arrow keys, or the rotary knob to change the volume and press the **Enter** key to accept the change.

Enter: Press this key or the **Enter** key on the number keypad to apply changes that have been set in the other Display/Audio submenus.

Figure 11-19. Display/Audio Menu (2 of 2)

GPS Menu

To use GPS, you must have an external USB-based GPS module connected.

Key Sequence: **System** (**8**) > Connectivity > GPS

GPS Data

Clear Data: Press this key to clear the Site Master's current GPS location data or last known GPS location data. If a compatible GPS module is attached, then the instrument will attempt to re-acquire a GPS fix.

Note: The last Good Fix location information will be retained until the instrument is powered off, the Clear Data button is pressed, or a new Good Fix is acquired. The Good Fix or the Last Fix location information is store d in the measurement file and is included in the screen capture header/footer.

Sync System Time: Press this key to sync the instrument's time setting with the current GPS information. Sync only works with a good GPS fix.

After a valid sync the instrument time is reset based on the UTC time plus/minus the time zone offset. Refer to "Time Zone Settings" on page 11-20.

Figure 11-20. GPS Menu

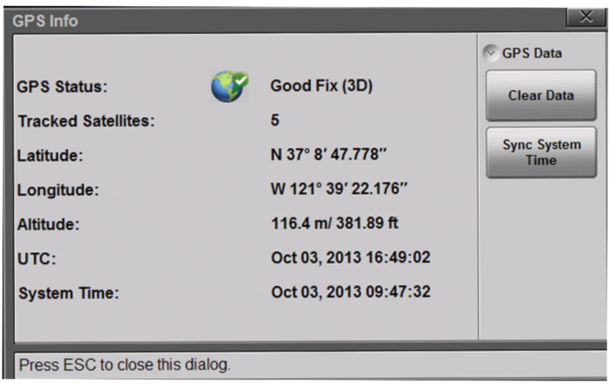


Figure 11-21. GPS Info

Note	An exclamation mark (!) is appended to the GPS location data in screen captures when the instrument is using Last Fix instead of current GPS information.

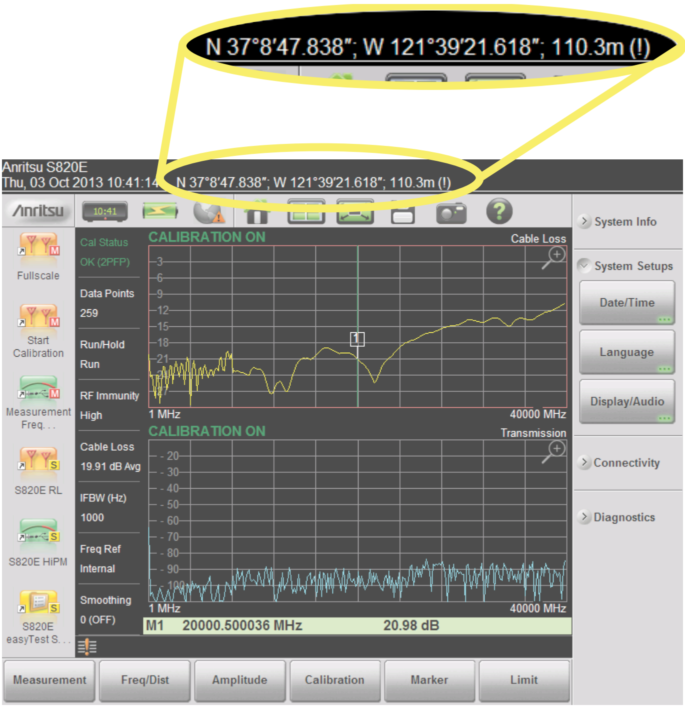
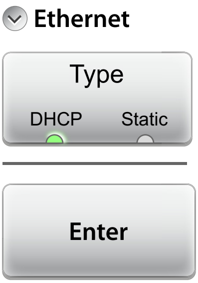


Figure 11-22. “(!)” Indicates Last Fix GPS Data

Ethernet Configuration Menu

Key Sequence: **System** (**8**) > Connectivity > Ethernet Configuration



Ethernet

Type: Press this key to select the type of IP Address setting: DHCP or Static. When set to DHCP, the instrument dynamically sets the IP Address and displays it, as shown in Figure 11-24. When set to Static, the user must manually enter the IP, Gateway, and Subnet addresses, as shown in Figure 11-25. The settings are saved once the Enter button is pressed.

Figure 11-23. Ethernet Configuration Menu

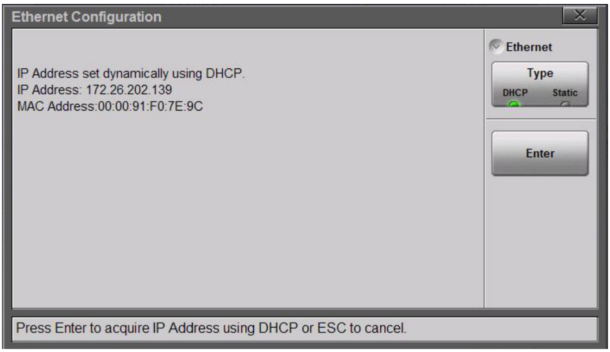


Figure 11-24. Ethernet Configuration Dialog - DHCP

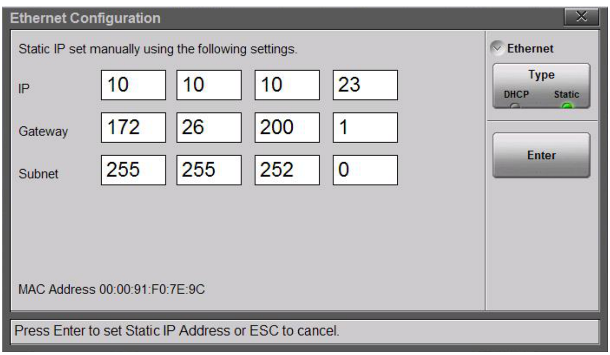
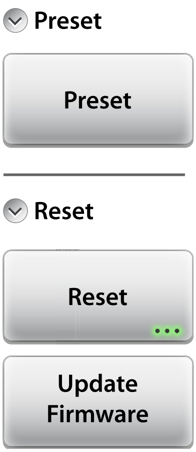


Figure 11-25. Ethernet Configuration Dialog - Static

11-9 Preset Menu

Key Sequence: **Preset** (**1**)

Caution	Carefully read the information on screen before performing any of the functions under the Preset menu. User files that are deleted cannot be recovered.



Preset

Preset: Press this key to reset the instrument to the default conditions.

Preset condition in Cable-Antenna mode: Return Loss measurement, full frequency range, full amplitude scale, no calibration, all markers off, and limit line off.

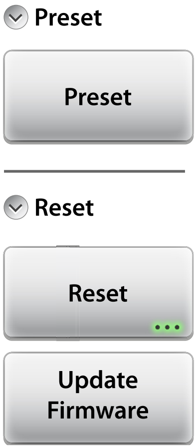
Reset

Reset: Press this key to display the reset options shown below. Select the Reset option to apply using the touchscreen, **Up/Down Arrow** keys or rotary knob. Carefully read the on screen information before confirming the reset.

> **Factory Reset:** Press this key to restore the instrument to the factory default values, including language, volume, display/audio settings. User saved files and user created shortcut icons on the Menu screen are not deleted.
>
> Press the Factor Reset button to initiate the reset, and power cycle the instrument. Press **Esc** to cancel and close.
>
> **Delete All User Files:** Deletes all user files in Site Master internal memory including measurements, setup files, and screen shots. Menu shortcuts, customized EZ key names, and custom cable types are not deleted.
>
> To delete all user files, press the Delete All User Files button and then press Yes to confirm.

Continued on next page

Figure 11-26. Preset Menu (1 of 2)



Delete Custom Files: Select the custom files to delete including keyboard EZ names, menu shortcuts, and custom cable types (see Figure 11-27).

Use the touchscreen to select the custom file types to delete and press the Delete Custom Files button and then press Yes to confirm.

Master Reset: In addition to the functions described in Factory Reset above, all user files in the internal memory and all custom files are deleted (see Figure 11-28 on page 11-28).

Press the Master Reset button to initiate the Master Reset and reboot the instrument, then press Yes to confirm.

Update Firmware: Press this submenu key to update the instrument operating system with a USB flash drive. Follow the on screen instructions to update the firmware. Refer to "Updating the Site Master Firmware" on page 11-10 for additional information.

Figure 11-26. Preset Menu (2 of 2)

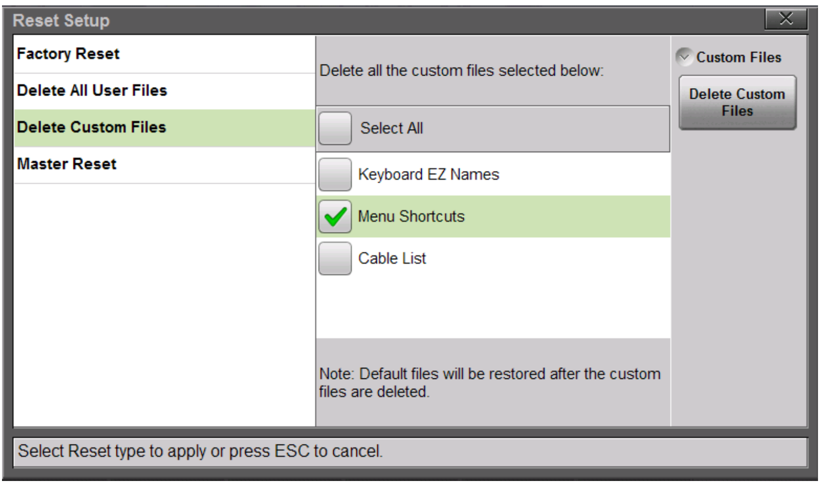


Figure 11-27. Delete Custom Files

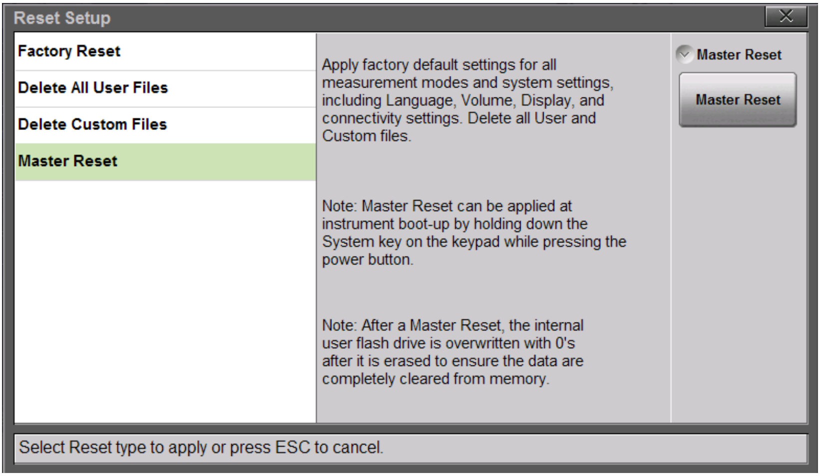


Figure 11-28. Master Reset

Note	If the Site Master is not functioning as expected, then perform a preset. All the current settings and applied calibration factors will be cleared. The next step (if a preset does not resolve the issue) is a Factory Reset. This can be performed at power On by holding down the **Esc** key and then pressing the power button, or through the **Preset** (**1**) menu.

Chapter 12 — Battery Replacement

12-1 Introduction

This chapter provides details and procedures about the Site Master batteries including replacing the existing battery.

Note	Screen images in this User Guide are illustrations of typical instrument features. Some images may include instruments other than the Site Master S820E. Traces and other display features may differ from the screen displays of your instrument.

12-2 Site Master Battery

The battery that is supplied with the Site Master may need charging before use. The battery can be charged using either the AC-DC Adapter or the DC adapter. Refer to Figure 2-8 on page 2-20 for a description of battery symbols.

Note	Use only Anritsu Company approved batteries, adapters, and chargers with this instrument.

Pressing the battery icon displays the current battery information (Figure 12-1). Press **Esc** to clear the message.

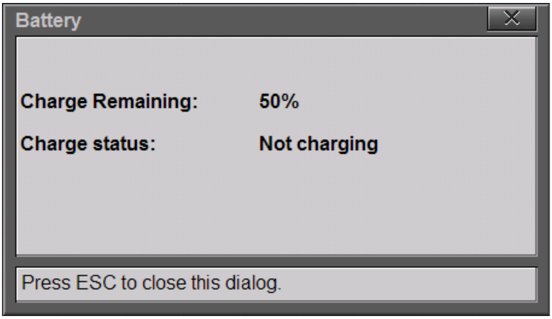


Figure 12-1. Battery Information

12-3 Battery Replacement

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

Remove the battery as follows:

1. Slide the catch toward the bottom of the instrument
2. Pull the top of the door away from the instrument
3. Lift out the battery door.
4. Remove the battery pack from the instrument by grabbing the battery lanyard and pulling it out.

Replacement is the opposite of removal. The battery key side (slot below the contacts) must be facing the front on the instrument and must slide in first.

Note	When inserting the battery, the battery label must face the back of the instrument, and the guide slot on the battery must be below the contacts. If the battery door does not latch closed, then the battery may be inserted incorrectly.

Figure 12-2. Battery Compartment

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

Caution	When using the Automotive power outlet adapter, always verify that the supply is rated for a minimum of 5 amps (60 Watts) at 12 VDC, and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

The batteries will charge at a faster rate when the instrument is turned off or is set to standby mode. Charging the batteries while the instrument is running will require a longer time to reach a full charge.

To prolong the useful battery life, the internal charging circuit monitors the battery temperature. Normal charging occurs when the battery temperature is between 0 °C and 45 °C. Charging is paused when the battery temperature is beyond this range.

Chapter 13 — Anritsu Tool Box

13-1 Introduction

The Anritsu Tool Box is a suite of applications designed to improve productivity for people who work with large numbers of cable and antenna traces every day.

Tool Box applications may be downloaded from the Anritsu website at anritsu.com/en-US/test-measurement/support/technical-support/handheld-tools-tool-box

This chapter gives an overview of the top features and functions of the Line Sweep Tools and easyTest Tools. For a detailed description of these features and how to perform specific tasks, refer to each application's Help system.

13-2 Line Sweep Tools (LST)

Line Sweep Tools is post-capture trace processing software intended for users who need to analyze and generate reports on large numbers of cable and antenna traces. Software features include the following:

- Presets for markers and limit lines take hours off the report preparation time for a user with dozens of traces to verify.
- Easily convert Return Loss or VSWR traces to Distance-to-Fault (DTF) traces.
- A Measurement Calculator provides quick conversion between commonly used measurement units such as VSWR or RL.
- A Cable Editor lets you retrieve the cable list from instrument and modify as required.
- Signal standard list can also be retrieved from instrument and modified as needed.
- A naming grid function makes changing file names and trace titles and subtitles much quicker and error free.
- The Report Generator makes generating PDF or HTML-based reports for multiple traces quick and easy.

13-3 easyTest Tools

easyTest Tools is used to create work instruction files that consist of a command sequence and intructions to help less experienced personnel with operating the instrument in the field.

- A drag-and-drop tool facilitates the creation of test scripts from a library of commands.
- Instructions can be a mix of text prompts and custom user images that may include connection diagrams or procedure steps.
- Recall Setup command lets you specify a particular setup, placing the instrument in a known state by retrieving saved parameters such as measurement type, frequency and amplitude settings, markers and limit lines.
- Measurements or screen shots can be saved automatically or manually.

To recall an easyTest file:

1. Press **Menu** on the S820E interface screen.
2. Press the easyTest  icon on the Menu Shortcut window.
3. In the easyTest Recall dialog, select the .ett file and press Recall.

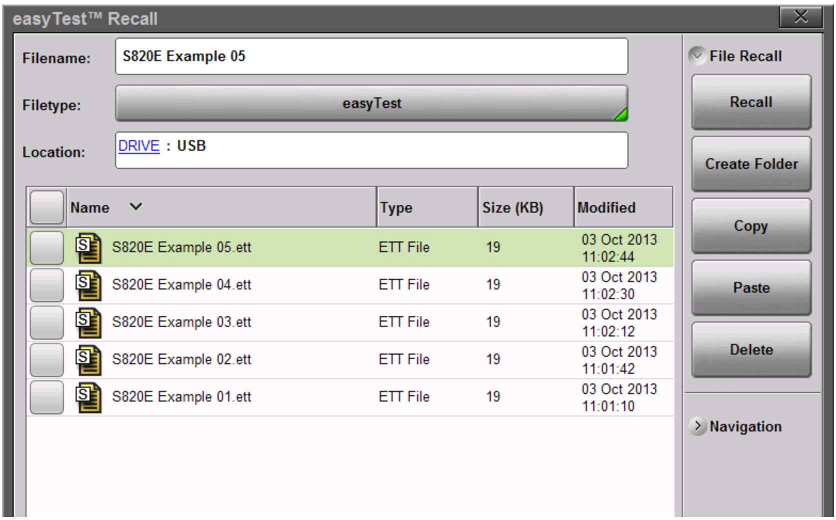


Figure 13-1. easyTest Recall Dialog

4. Press Next to move to the next instruction screen. To abort the easyTest sequence, press **Esc**.

Chapter 14 — Video Inspection Probe (VIP)

14-1 Introduction

Signal degradation may occur as a result of a dirty or damaged optic fiber ferrule endface. The Site Master S820E supports an application that lets you inspect fiber optic terminations, using a Video Inspection Probe (VIP) such as Anritsu Model G0306A. See Figure 14-1. The captured image and analysis results help determine if a connector should be cleaned or replaced. Pass/Fail evaluations are made in accordance with the IEC61300-3-35 standard. You can also save the data to file and generate test reports.

Figure 14-1. Anritsu G0306A Video Inspection Probe

14-2 Setup and Operation Summary

1. Attach to the VIP a probe tip, or ferrule adapter, that is compatible with the type of fiber optic connector you wish to test. Refer to "Connect the VIP" on page 14-3.
2. Connect the probe to the fiber optic endface and to the USB port on the Site Master S820E.
3. On the Site Master, select VIP Mode. Refer to "Launch the VIP Application" on page 14-4. The instrument screen will display a live image of the fiber edge surface.
4. Press the **Setup** main menu key and verify or change the VIP test settings, which include the probe model, tip type, and test profile. Refer to "VIP Test Settings" on page 14-4.
5. If needed, use the Focus Control knob on the probe to adjust the image focus.
6. Press the **Measurement** key on the Site Master screen, then press the Captured key to capture the displayed image.
7. Turn the rotary knob to zoom the captured image. Use the arrow keys to pan.
8. Press the Analyze key to execute analysis of the current VIP image. Detailed analysis results are displayed in tabular form if Auto is selected with the Results Table key.
9. To quickly save the captured image and test results using the current auto filename settings, press the Save icon on the "System Function Tool Bar" on page 2-24. You can also press the **Save/Recall** main menu key, then press Save to manually enter a file name and select its location.
10. Press **Report** if you wish to generate a report, in PDF format, on either the current or previously saved analysis results, or both.

14-3 VIP Setup

Follow the instructions in this section to connect the Video Inspection Probe, set the Site Master to VIP Mode, and select the VIP test settings. You can change these settings anytime via the Setup menu.

Connect the VIP

The Anritsu G0306A Video Inspection Probe comes with seven changeable probe tips: four standard tips (SC, LC, and FC) and three universal tips (1.25 mm and 2.5 mm). See Table 14-1. The standard tips are compatible with common types of bulkhead adapters. The universal tips are typically used for inspecting patch cords.

Table 14-1. Probe Tip Types

Tip Type	Description
SC_APC_F	SC Angled Physical Contact, Female
SC_PC_F	SC Physical Contact, Female
LC_PC_F	LC Physical Contact, Female
FC_PC_F	FC Physical Contact, Female
2.5APC_M	Universal 2.5 mm Angled Physical Contact, Male
2.5PC_M	Universal 2.5 mm Physical Contact, Male
1.25PC_M	Universal 1.25 mm Physical Contact, Male

1. Depending on the connector type you wish to test, attach the appropriate probe tip to the Video Inspection Probe.
2. Connect the probe to the bulkhead or patch cord to be tested.
3. Insert the USB connector at the end of the coiled cord into the S820E USB port.

Launch the VIP Application

If the S820E is currently running a different application, or measurement mode, press the **Menu** key, then press the VIP Mode application icon. See Figure 14-2.

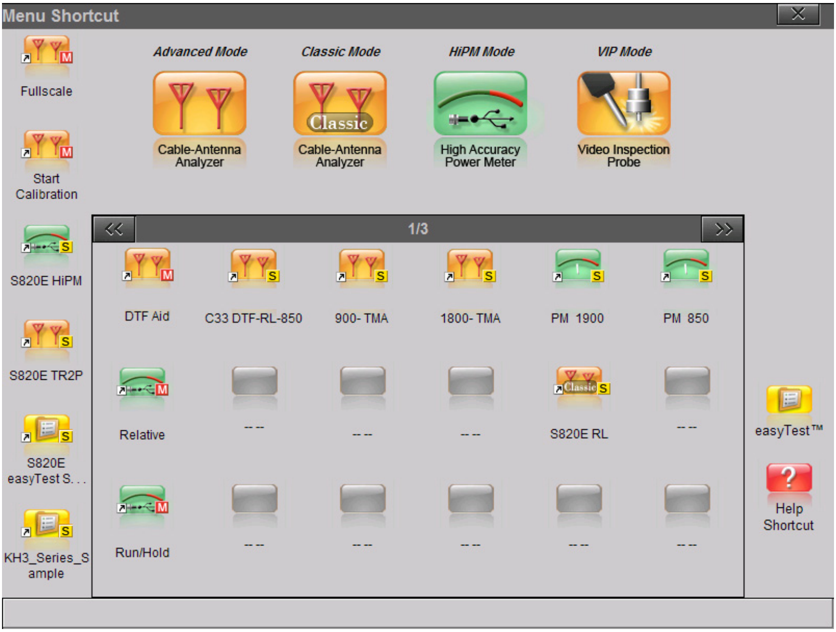


Figure 14-2. Menu Screen

VIP Test Settings

To access the VIP test settings, press the Setup main menu key. Refer to “Setup Menu” on page 14-12 for a description of the submenu keys.

1. The Probe Model submenu key shows the currently selected VIP model. The Site Master currently supports only the Anritsu Model G0306A probe.

2. Press the Tip Type submenu key to display the selection box. Use the rotary knob or the **Up/Down** arrow keys to highlight the appropriate probe tip, then press Enter to save the setting. Table 14-1 on page 14-3 lists the available tip types.

   To close the Tip Type dialog without making a change, press the **Esc** key.

3. Press the Test Profile key to open the selection box. Use the rotary knob or the **Up/Down** arrow keys to highlight the desired profile, then press Enter to save the setting.

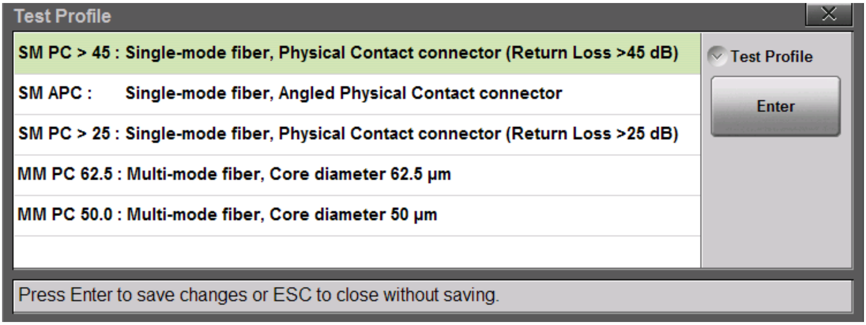


Figure 14-3. VIP Test Profile Selection Box

4. If needed, press the Auto Analyze key to set it On or Off. When On, the VIP image is immediately analyzed when captured. Auto analysis is not performed if the setting is Off.
5. The Auto Filename key determines if a file name is automatically generated when saving a measurement or image to file. When this setting is On, the saved file name and location are taken from the auto filename settings.
6. Press the Auto Filename Settings submenu key to open the dialog box shown in Figure 14-4. Press the Location bar to change the save location. To edit the file prefix or the starting number, press the appropriate text box. You may also include the current date.

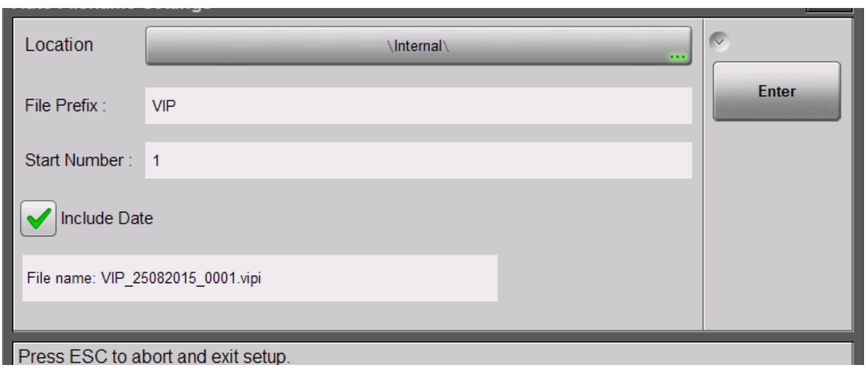


Figure 14-4. Auto Filename Settings Dialog

14-4 Operation

Once the Video Inspection Probe is properly connected and you have started the VIP application on the Site Master, a live view of the optical fiber endface should display on the instrument screen. See Figure 14-5.

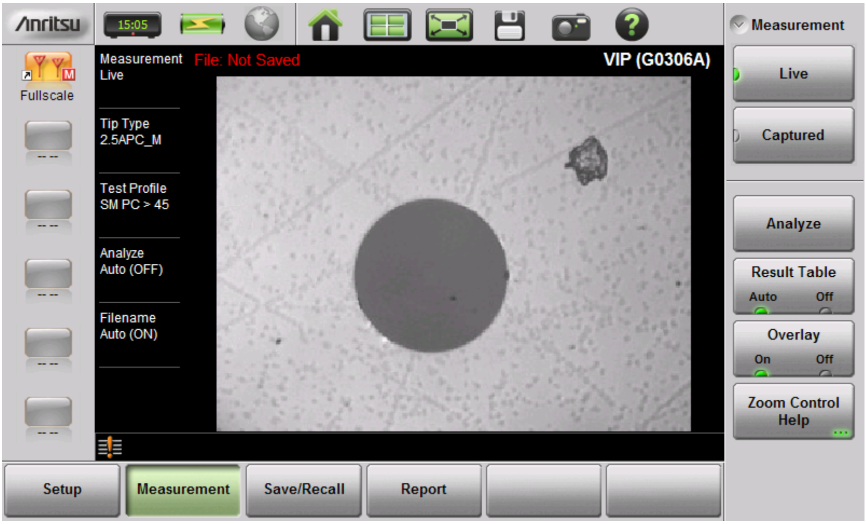


Figure 14-5. VIP Image Live View

Note	Instead of capturing and analyzing a live VIP image, you can recall a previously saved image and perform VIP analysis on it. Refer to "Recall a VIP Image (VIP Mode Only)" on page 10-14.

VIP Image Analysis

Skip the first three steps below if the displayed VIP image is a recalled image.

1. While the display is in Live view, adjust the image focus if needed.
2. Press the **Measurement** main menu key to display the Measurement menu, shown in Figure 14-5.
3. Press the Captured key to capture the VIP image.

4. Optionally, use the rotary knob and arrow keys to zoom and pan the image, respectively. The Zoom Control Help key displays the related Help message.

5. To execute the VIP image analysis, press the Analyze submenu key. Skip this step if the Auto Analyze setting is On, in which case the image is automatically analyzed when captured (refer to the "Setup Menu" on page 14-12).

   After the analysis completes, the overall Pass/Fail indicator is displayed in the lower left corner of the screen.

6. Press the Results Table submenu key to show or hide the detailed analysis results. See Figure 14-6. For each of the analysis areas, or zones (core, cladding, adhesive, contact), the table shows the count of scratches and contaminations or defects, and their Pass/Fail evaluation results. The table will not appear if there are no analysis results to display.

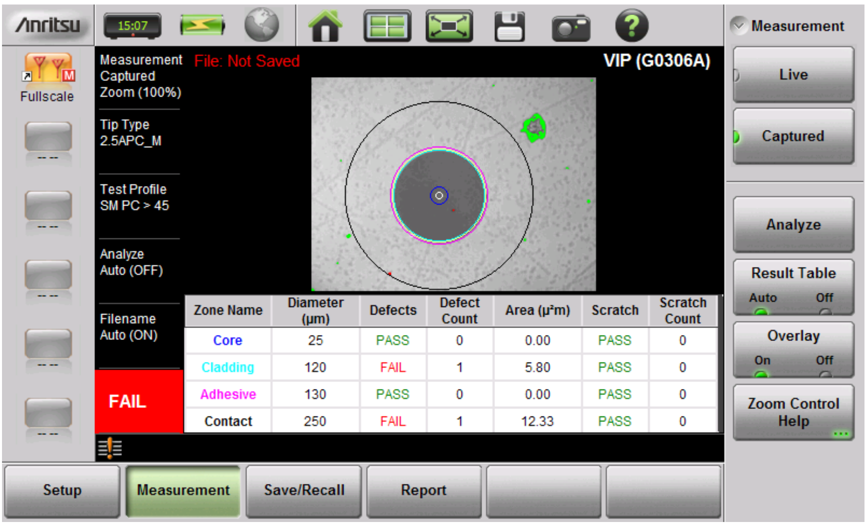


Figure 14-6. VIP Image Captured and Analyzed

7. Press the Overlay submenu key to turn on and off the colored circles around the analysis areas, and the red and green highlights showing the defects and scratches found on the connector endface. Defects of an acceptable size are green (Pass). Defects that are large enough to potentially cause a problem are highlighted in red (Fail).

8. To save the VIP data to file with one press of the touchscreen, press the Save icon in the "System Function Tool Bar". The current auto filename settings are applied to the saved file, provided the Auto Filename submenu key is set to On. Refer to "VIP Test Settings" on page 14-4.

   If Auto Filename is Off, or if you press the **Save/Recall** main menu key followed by Save, or press **Save** (7) on the numeric keypad, the Save dialog is displayed. See Figure 10-1 on page 10-3.

9. Enter the file name. Refer to "File Name" on page 10-4.

10. To select the type of file to save, press the Filetype button, then press the desired submenu key. See Figure 14-7.

    Measurement (.vipi) – Saves the VIP image and analysis results

    VIP Image (.png) – Saves the VIP image only

    ScreenShot (.png) – Saves a screen capture of the current display

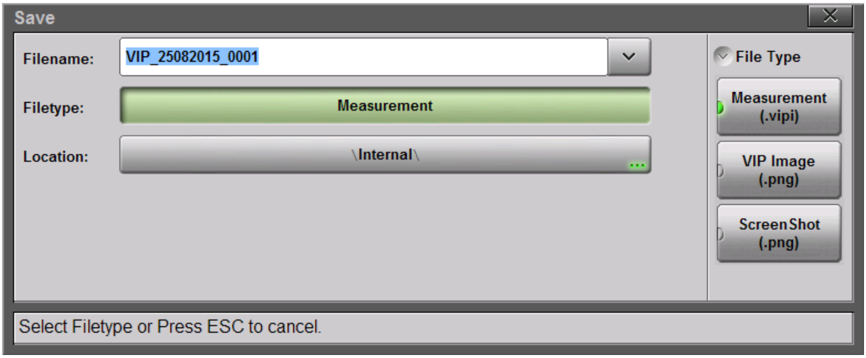


Figure 14-7. VIP File Type

11. Optionally, press the Location button and select the destination folder as described in "Save Location" on page 10-8.

12. Press the Save button in the Save dialog.

If the overall analysis result is a Fail, follow standard practices to clean or replace the fiber optic connector.

VIP Reporting

You can output the captured VIP image and analysis results to a PDF-formatted file, using the **Report** main menu key. The report may include current or previously saved data, or both.

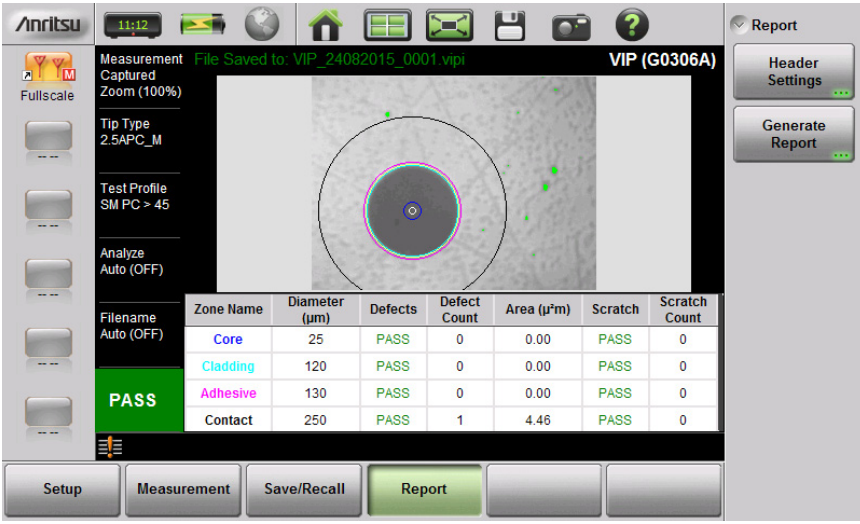


Figure 14-8. VIP Report Menu

1. Press Header Settings to enter or change the report header data.

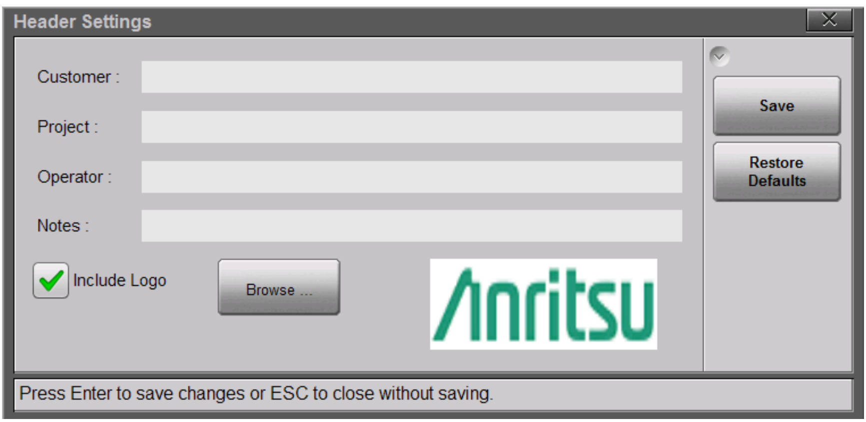


Figure 14-9. VIP Report Header Settings Dialog

2. In the Header Settings dialog box, press the text field to be edited and use the touchscreen keyboard to enter the information.

3. If you want the report to show your company logo, select the Include Logo checkbox and browse to the location of the desired logo image. This image must be in PNG format, and will be resized automatically.

4. Press Save to save the header information, which is retained until modified.

5. Press the Generate Report submenu key to open the dialog box in Figure 14-10.

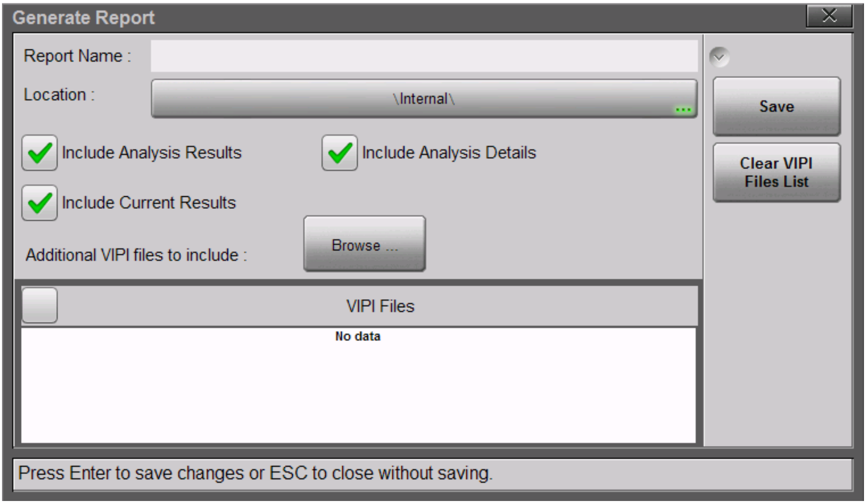


Figure 14-10. Generate Report Dialog

6. Enter the report name and select the destination folder as needed.

7. Optionally, press the Clear VIPI Files List button to remove saved files from the list included in the report.

8. Select or deselect the checkboxes as appropriate:

   Analysis Results – Overall Pass/Fail result
   Analysis Details – Detailed results by analysis area
   Current Results – Image and analysis results of currently displayed VIP measurement
   Additional VIPI Files – Previously saved measurement data

9. Press Save to generate the report.

14-5 VIP Menus

Figure 14-11 illustrates the menus available in VIP Mode. The main menu keys appear at the bottom of the display screen. The **Save/Recall** key brings up the same File menu as does the keypad menu key **File (1)**.

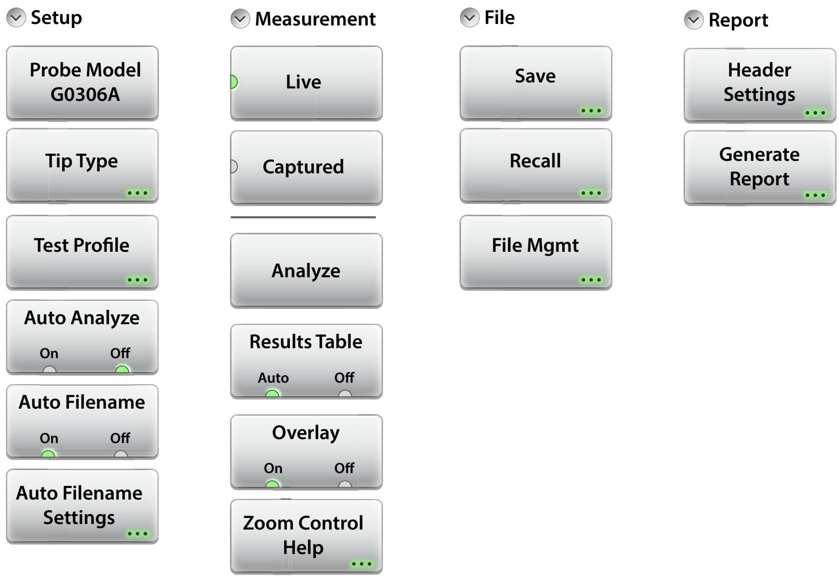


Figure 14-11. VIP Menu Map

Setup Menu

Key Sequence: **Setup**

Probe Model: This submenu key shows the currently selected probe model. Press the key to display the list of supported VIP models from which you can select.

Tip Type: Press this submenu key to display the Tip Type selection box. Use the rotary knob or the **Up/Down** arrow keys to highlight the appropriate probe tip, then press Enter to save the setting. See Table 14-1 on page 14-3 for a list and description of possible selections.

To close the Tip Type dialog without making a change, press the **Esc** key.

Test Profile: Press this submenu key to select a profile that matches the type of fiber being tested. Use the rotary knob or the **Up/Down** arrow keys to highlight the appropriate probe tip, then press Enter to save the setting. See Figure 14-3 on page 14-5.

Auto Analyze On/Off: When set to On, the fiber endface image is automatically analyzed following capture. Select Auto Analyze Off if you want to view the image before manually executing the analysis.

Auto Filename On/Off: If Auto Filename is On, the file naming scheme currently defined in the Auto Filename Settings dialog is applied when you press the Save icon. With Auto Filename Off, pressing the Save icon opens the Save dialog the same way as pressing Save under the File menu would.

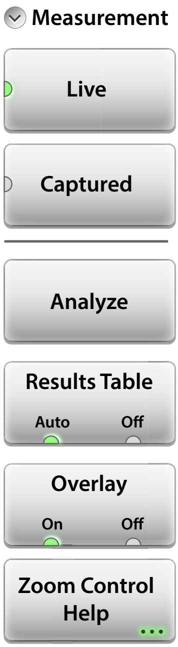
Auto Filename Settings: Press this submenu key to open a dialog box where you can preset the location and name of files to be saved. See Figure 14-4 on page 14-5. You can define a prefix (VIP is the factory default) and set the starting number from which file numbering will increment. You may also choose to include the current date in the file name, in the format DDMMYYY. For example:

VIP_0001.vipi
VIP_21082015_0001.vipi

Figure 14-12. VIP Setup Menu

Measurement Menu

Key Sequence: **Measurement**



Live: In Live mode, the instrument displays a live view of the connector endface. Use the control on the probe to adjust the focus. The image cannot be panned or zoomed until it is captured.

Captured: Press this submenu key to capture the currently displayed image, which you may then zoom and pan, using the rotary knob and arrow keys. The message “File Not Saved” is displayed at the top of the screen until you save the image and/or the measurement results.

Analyze: Press this submenu key to start analysis of the VIP image. The overall Pass/Fail result is displayed in the lower left corner of the screen. If the Results Table setting is Auto, a table showing detailed results of the VIP test is also displayed.

Results Table Auto/Off: This submenu key toggles on and off the table of detailed VIP test results. When set to Auto, the table will appear only when there are analysis results to display.

Overlay On/Off: Press this submenu key to turn on and off the colored circles showing the analysis areas and to highlight any scratches and defects on the connector endface:

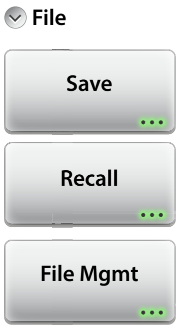
Green – Unimportant scratches and contaminations
Red – Serious scratches and contaminations that may impact signal quality

Zoom Control Help: Press this submenu key to display a Help message with instructions on how to zoom and pan the image. Press Dismiss to close the message box.

Figure 14-13. VIP Measurement Menu

File Menu

Key Sequence: **Save/Recall**



Save: Press this key to open the Save dialog (Figure 10-1 on page 10-3). This function is the same as pressing the keypad menu key **Save** (7).

You can choose to save the VIP image and analysis results, the VIP image alone, or the current display screen. See Figure 14-7 on page 14-8.

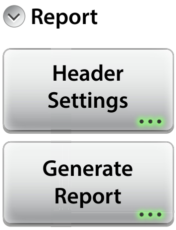
Recall: Press this submenu key to open a previously saved VIP measurement file (.vipi extension) or VIP image (.png extension). Refer to "Recall a VIP Measurement (VIP Mode Only)" on page 10-13. Note that a captured screen shot of the display cannot be recalled and analyzed.

File Mgmt: Press this submenu key to display the "File Mgmnt Menu" on page 10-29. This menu contains basic file management functions including renaming files or folders, creating folders, copying, pasting, and deleting files or folders. Many of the file management functions are duplicated in the Save and Recall menus for user convenience.

Figure 14-14. File Menu

Report Menu

Key Sequence: **Report**



Header Settings: Press this submenu key to enter or change report header information. Refer to "VIP Reporting" on page 14-9.

Generate Report: This submenu key opens the Generate Report dialog, where you can enter the report name, select the destination location, and select what data to include:

Analysis Results – Overall Pass/Fail result
Analysis Details – Detailed results by analysis area
Current Results – Image and analysis results of currently displayed VIP measurement
Additional VIPI Files – Previously saved measurement data

Figure 14-15. VIP Report Menu

Appendix A — Instrument Messages

A-1 Introduction

This appendix provides additional details regarding messages displayed on the S820E Site Master. The text of the dialog boxes is shown below, listed in alphabetical order.

Example Message:

Message Shown in Instrument: Additional details or suggestions regarding the message.

1. **Command to USB device returns error or invalid data:** Check the connection to the USB device and try again.
2. **Device not ready:** Device being accessed is not ready or responding. Try to access again.
3. **EEPROM corrupted:** EEPROM device being accessed has been corrupted. Perform a Factory Reset under the "Preset Menu" on page 11-26 and then cycle the instrument power. If the error message persists, call your Anritsu Service Center.
4. **Encountered error in loading cable list. Default file restored:** The cable list file has been corrupted and will not be loaded. The default file has been used.
5. **Encountered error in loading keyboard settings. Default file restored:** The onscreen keyboard file has been corrupted and will not be loaded. The default file has been used.
6. **Encountered error in loading shortcut icon settings. Default file restored:** The menu shortcut file has been corrupted and will not be loaded. The default file has been used.
7. **Encountered error in restoring last setup. Default file restored:** The last setup file has been corrupted and will not be loaded. The default file has been used.
8. **Error executing remote command:** The remote command sent to the instrument has generated an unexpected error. Perform a Factory

Reset and then cycle the power to the instrument. If error message persists, call your Anritsu Service Center.

9. **Error executing remote query command:** The remote query command sent to the instrument has generated an unexpected error. Perform a Factory Reset and then cycle the power to the instrument. If error message persists, call your Anritsu Service Center.
10. **Error occurred while zeroing. Please zero sensor without RF input:** When zeroing a USB power sensor, the RF input connector of the sensor must not be connected to any source of RF power. If RF power is detected during the zeroing, then the calibration will fail and the zeroing will not be applied.
11. **File cannot be recalled:** File being recalled failed because the instrument model used when the file was saved does not match the current instrument model.
12. **File missing:** File being accessed cannot be found. The file has either been deleted or moved to a different location.
13. **Forward relative not applicable:** For the USB In-line power sensor, relative readings do not apply when making forward measurements of CCDF.
14. **Hardware driver failed to load:** One of the hardware drivers required has not loaded correctly. Perform a Factory Reset and then cycle the power to the instrument. If error message persists, call your Anritsu Service Center.
15. **Loading USB Sensor ... :** The USB power sensor has been detected and a connection is being established to this sensor.
16. **Model Mismatch:** When recalling a setup file or measurement file, this message is displayed if the file being recalled was generated by an instrument that is not the same model as the one being used to recall the file.
17. **PLL Lock failed:** Phase Lock Loop hardware has failed to lock. Perform a Factory Reset and then cycle the power to the instrument. If error message persists, call your Anritsu Service Center.
18. **Recalling File...Failed:** An error was encountered while recalling the file. The recall process was aborted. Try again. If the error persists, then the file may be corrupted.
19. **Reverse relative not applicable:** For the USB In-line power sensor, relative readings do not apply when making reverse measurements of Reflection Coefficient, Return Loss, or VSWR.

20. **Saving File…Failed:** An error was encountered while saving the file. The save process was aborted. Check that the destination location is accessible and try again. If the problem persists, then the current setup may have corrupted parameters or data. Preset the instrument and try saving the file again.

21. **USB drive missing. Please connect one to either USB port:** No USB flash drive was found while copying log files. Check that the USB drive is installed correctly and try again.

22. **Verifying easyTest File ... :** When an easyTest file is first opened, a check is performed to ensure that the file is compatible with the instrument and that the file is not corrupted. After the verification passes the file is recalled. If it fails, then a message box is displayed with more specific information about the failure.

23. **Zero Sensor completed:** The zeroing function performed on the attached USB power sensor has been completed.

Appendix B — Measurement Review

B-1 Introduction

This appendix provides additional data about typical cable and antenna measurements.

B-2 Measurement Overview

What is Measured?

Line sweeping is a quality measure of the transmission lines or antenna system or both. Systems may include cables, connectors, lightning protectors, tower mounted amplifiers, and antennas (Figure B-1). Line sweeping can measure the power losses in the system at the functional frequencies. Line sweeping measures system impedance and confirms whether the system meets carrier specifications.

If the system does not meet specification, then line sweeping can also locate components that are reflecting power above specified levels.

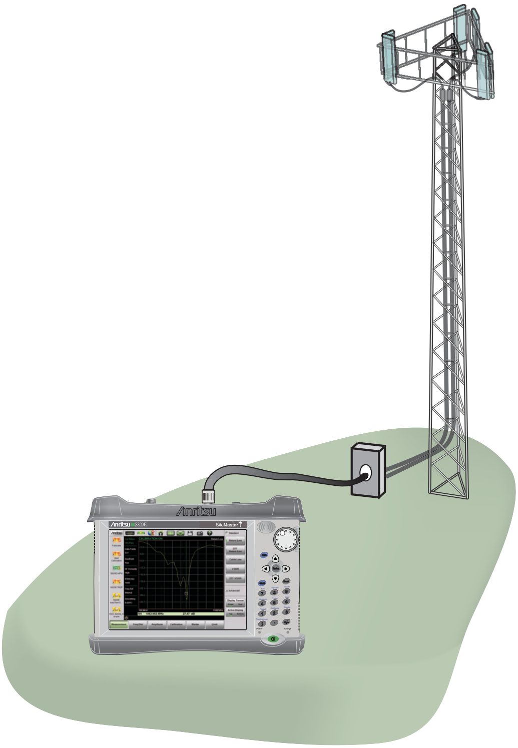


Figure B-1. Cable and Antenna Line Sweeping

Note	The Site Master does not measure system linearity (PIM Testing). Anritsu also sells the PIM Master, which is available in several carrier bands. The PIM Master tests for passive inter-modulation.

Why Measure?

The basic goal of a wireless communication system is to transfer the maximum amount of RF energy to achieve coverage (Figure B-2). Wireless communication systems require good integration of all components from the ground to the antenna. Problems such as dented shielding, bad connectors, water ingress, or over-torque will cause a mismatch and reflect power in a manner that reduces RF energy transfer.

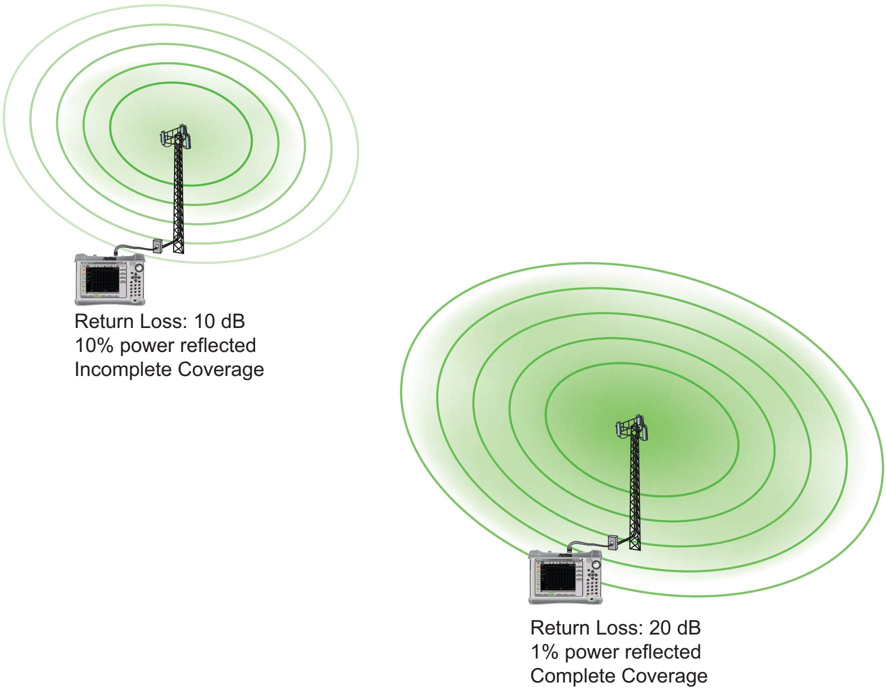


Figure B-2. Coverage Area

Line Sweeping

System performance issues are seen in two ways: excessive reflections (more common) caused by impedance mismatches, or excessive insertion losses (less common) caused by energy dissipated in the connectors or cables.

The two measurements that are used to determine communication system performance are:

- Return Loss or Standing Wave Ratio (SWR) for reflections.
- Cable Loss (Insertion Loss) for insertion losses.

Remember that Return Loss and VSWR are typically Pass/Fail tests. They both measure reflection, but they display the results in different ways. For either measurement, set a limit line to the specification determined by the carrier and make the measurement. If the *ENTIRE* swept frequency range is below the limit line, then the test passes. If *ANY* part of the sweep is at or above the limit line, then the test fails.

With a failed test, one or more components is at fault. Distance to Fault mode is used to find the problem. Figure B-3 shows a failed Return Loss measurement (part of the trace is above the limit line). Figure B-4 on page B-5 is a Distance to Fault measurement of the same system.

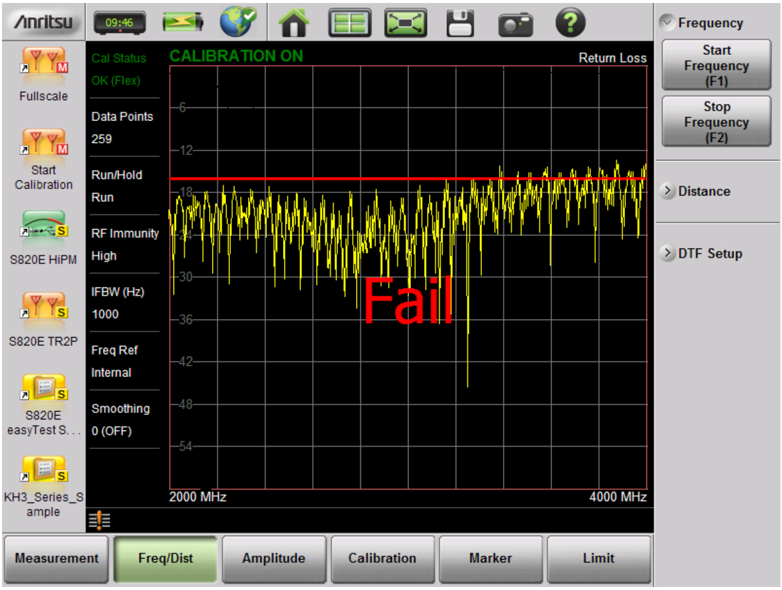
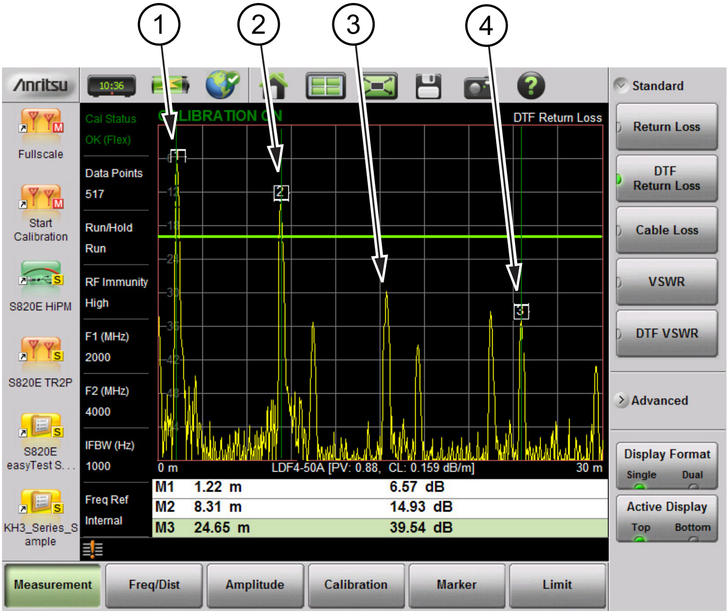


Figure B-3. Failed Return Loss Measurement



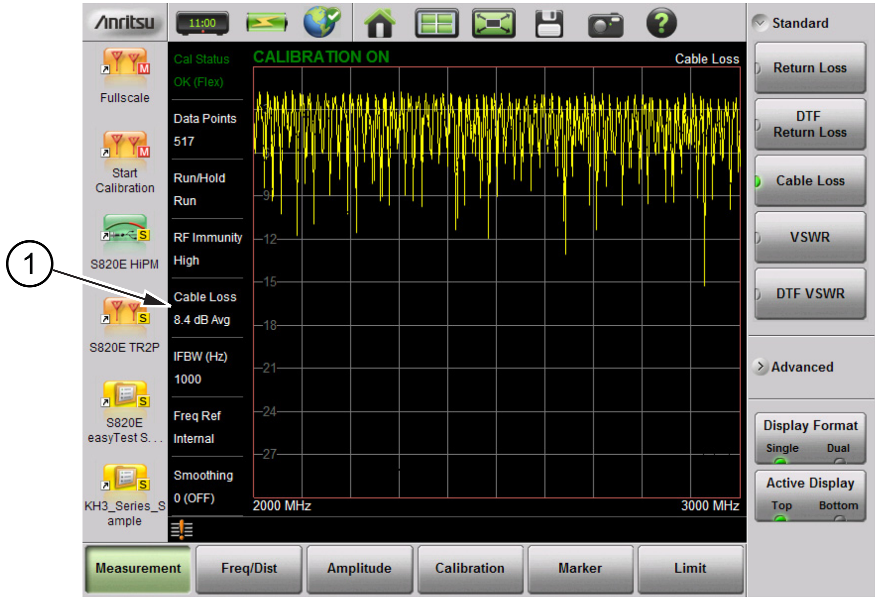
1.	Failure at Jumper (1.22 m)
2.	Possible Failure at 8.31 m
3.	Example of Good Connector (~30 dB)
4.	Precision Load Connected at End of Cable (24.65 m)

Figure B-4. Distance to Fault Measurement Shows Failing Components

The second common Line Sweeping measurement is Cable Loss (Figure B-5 on page B-6). This is a measure of signal output power compared to input power. If output power is smaller than input power, then the loss comes from heat and leakage. Cable manufacturers will specify the loss per foot or meter at different frequencies and may call it attenuation. The Site Master has loss specifications preinstalled for many cable types.

The Cable Loss measurement is typically a Pass/Fail measurement. It requires a short or open at the cable end. This is a typical measurement specified on new installations or main transmission line replacement, but it is not typically tested on existing systems.

Note	Cable Loss cannot be measured with an antenna connected.



1	Average Cable Loss

Figure B-5. Cable Loss Measurement

Calibration

For accurate results, the instrument must be calibrated before making any measurements.

The Cable and Antenna Analyzer mode requires calibration standards or external sensors, which are sold separately.

The instrument must be re-calibrated whenever the temperature exceeds the calibration temperature range window or whenever the test port extension cable is removed or replaced. The instrument must also be re-calibrated every time the setup frequency changes. Refer to Chapter 4 for details on how to perform a calibration and the various calibration options available for coaxial cable and waveguide measurements.

Note	Anritsu recommends allowing the S820E to warm up for at least 10 minutes to typical operation temperature before calibrating. The instrument will require a new calibration if the internal instrument temperature changes more than ±10 ºC after calibration. The external InstaCal Calibration Module is *NOT* compatible with the Microwave Site Master S820E.

B-3 Measurement Review

Table B-1 provides a summary of the typical measurements and required cable end tool. The typical values are for general information purposes. The carriers will provide final values in the acceptance testing specification.

Table B-1. Cable and Antenna Measurement Overview

Measurement	Mode	End Tool	Marker
TYPICAL PASS/FAIL MEASUREMENTS			
Pass/Fail Test of Cable & Connectors	Freq Return Loss or (Freq, SWR)	Load	Peak
Pass/Fail Test of System Including Antenna	Freq Return Loss or (Freq, SWR)	Antenna	Peak
Frequency Range of Antenna	Freq Return Loss or (Freq, SWR)	Antenna	Valley
Cable Loss	Freq Cable Loss	Short or Open	Peak & Valley
Cable Loss (High Accuracy)	Freq Cable Loss (Open and Short) / 2 using trace memory function	Short and Open	Peak
Return Loss	Freq Return Loss	Load	Peak
TROUBLESHOOTING MEASUREMENTS			
Cable Length	DTF Return Loss or (DTF SWR)	Short or Open	Peak
Good Cable & Connectors	DTF Return Loss or (DTF SWR)	Load	Peak
Good System Including Antenna	DTF Return Loss or (DTF SWR)	Antenna	Peak

B-4 Common RF Terms

Refer to Appendix C, "Glossary" for additional definitions of common RF terms that may be associated with the use of an S820E Site Master.

3 dB rule: A 3 dB gain means twice (x2) the power. A 3 dB loss means half the power. A system with 40 watts of input power and a 6 dB insertion loss will have only 10 watts of output power.

dB: Decibel, a logarithm ratio of the difference between two values (a logarithm ratio is equal to 10 times). The Site Master uses dB to measure the ratio of sent signal energy to reflected signal energy.

Common values of dB to ratios: 0 dB = 1:1, 10 dB = 10:1, 20 dB = 100:1, 30 dB = 1,000:1, –30 dB = 0.001:1, or (1/1000):1.

dBm: An absolute measurement of power relative to 1 milliwatt.

0 dBm = 1.0 milliwatt,
10 dBm = 10 milliwatt,
30 dBm = (1 mW x 1,000) = 1 watt.

DTF (Distance to Fault): Measures the location and reflection size of impedance mismatches. This is typically a diagnostic measurement, not a pass/fail judgment measurement. DTF is used to identify and locate faults within an antenna system when the system is failing to meet the specified return loss or VSWR limits. DTF is also useful to verify the total length of a coaxial cable assembly.

Impedance: A measure of RF component electrical resistance, measured in ohms (Ω). In most cable and antenna systems, the standard impedance is 50 Ω.

Insertion Loss (Cable Loss): Measures the total amount of signal energy absorbed (lost) by the cable assembly. Measured in dB. S_{21} is another name for this measurement. This is often a pass/fail measurement.

Return Loss: Measurement in dB of reflected energy caused by impedance mismatch. May also be referred to as S_{11}. Although S_{11} values are expressed as negative numbers, Return Loss values are expressed as positive numbers because by definition the "Loss" expression implies a negative sign. The higher the value, the better the impedance match *(think of a large negative number being less than a smaller negative number)*. 40 dB is nearly ideal. Only 0.01 % of the total transmitted power is reflected if the Return Loss measurement value is 40 dB. A measured value of 0 dB would be a complete reflection, or stated another way, 100 % of the transmitted power is reflected back. Return Loss is typically a pass/fail measurement.

RF (Radio Frequency): Frequency of radio sine waves. The RF range is 3 kHz to 300 GHz.

VSWR (Voltage Standing Wave Ratio): Another method to measure reflected energy caused by impedance mismatch. Expressed as a ratio of X:1. VSWR measures the voltage peaks and valleys. A ratio of 1:1 would be a perfect match. A typical cable and antenna system would be around 1.43:1 (VSWR) or 15 dB Return Loss. The Site Master can measure either Return Loss or VSWR. Some carriers require that Return Loss is measured in VSWR. This is typically a pass/fail measurement.

Watt: Unit of measure for power.

B-5 Standard Line Sweep Measurements

To verify the performance of the transmission feed line system and to analyze typical problems, three types of line sweeps are required:

- Return Loss
- Cable Loss
- Distance-To-Fault

The measurements for these sweeps are defined as

- Return Loss — System Sweep
- Cable Loss — Cable Loss Sweep
- DTF — Load Sweep

Return Loss / VSWR Measurement

Return Loss measures the reflected power of the system in decibels (dB). This measurement can also be taken in the Standing Wave Ratio (SWR) mode, which is the ratio of voltage peaks to voltage valleys, as caused by reflections.

Cable Loss Measurement

Cable Loss measures the energy absorbed, or lost, by the transmission line in dB/meter or dB/ft. Different transmission lines have different losses, and the loss is both frequency-specific and distance-specific. The higher the frequency or longer the distance, the greater the loss.

Distance-To-Fault (DTF) Measurement

A DTF measurement reveals the precise fault location of components in the transmission line system. This test helps to identify specific problems in the system, such as connector transitions, jumpers, kinks in the cable, moisture intrusion, or mechanical damage.

Line Sweep Measurement Types

Return Loss – System Sweep

Return Loss is the measurement made when the antenna is connected at the end of the transmission line. This measurement provides an analysis of how the various components of the system are interacting. It provides an aggregate return loss of the entire system.

Distance To Fault – Load Sweep

A measurement is made with the antenna disconnected. The antenna is replaced with a 50 Ω precision load at the end of the transmission line. This measurement allows analysis of the various components of the transmission feed line system in the DTF mode.

Cable Loss – Cable Loss Sweep

A Cable Loss Sweep is a measurement made when a short is connected at the end of the transmission line. This condition allows analysis of the signal loss through the transmission line. This measurement identifies problems in the system. High insertion loss in the feed line or jumpers can contribute to poor system performance and loss of coverage.

This whole process of measurements and of testing the transmission line system is called Line Sweeping.

Advanced measurements are described in Section 3-6 “Advanced Measurements” on page 3-23. They including Transmission (2-Port), Transmission (External Sensor), Smith Chart, and 1-Port Phase.

Appendix C — Glossary

C-1 Introduction

This glossary provides definitions for common RF terms that may be associated with the use of an S820E Site Master.

C-2 Glossary Terms

3 dB rule : The 3 dB rule provides a means to estimate relative power values. A 3 dB gain indicates that power increases to twice the power (a multiple of 2). A 3 dB loss indicates that power decreases to half the power (a multiple of 1/2). A system with 40 watts of input power and a 6 dB insertion loss will have only 10†watts of output power (a multiple of 1/2 for each 3 dB loss, or 1/4 of 40 watts).

Adapter : A fitting that supplies a passage between two sets of equipment when they cannot be directly interconnected.

Adaptive Array Antenna : Adaptive array antenna is a type of advanced 'smart' antenna technology that continually monitors a received signal and dynamically adapts signal patterns to optimize wireless system performance. The arrays use signal processing algorithms to adapt to user movement, to changes in the radio-frequency environment, and to multi-path and co-channel interference.

ADC : Analog-to-Digital Converter (ADC, A/D or A to D) is an electronic device that converts continuous signals to discrete digital numbers. The reverse operation is performed by a digital-to-analog converter (DAC). ADC can uniquely represent all analog input values within a specified total input range by a limited number of digital output codes. Refer also to DAC.

Analog System : An Analog system uses an analog transmission method to send voice, video and data-using analog signals, such as electricity or sound waves, that are continuously variable rather than discreet units as in digital transmissions. Mobile analog systems include AMPS, NMT and ETACS.

Analog Transmission : Analog Transmission refers to signals propagated through the medium as continuously varying electromagnetic waves.

Antenna : Antenna is a device which radiates and/or receives radio signals, including RF, microwave, and RADAR.

Antenna beamwidth : Antenna beamwidth, also known as the half-power beamwidth, is the angle of an antenna pattern or beam over which the relative power is at or above 50% of the peak power.

Antenna Directivity : Antenna directivity, also known as antenna gain, is the relative gain of the main beam of an antenna pattern to a reference antenna, usually an isotropic or standard dipole. Antenna Directivity is the percentage of radiated signal transmitted or received in a given direction related to beamwidth.

Antenna Efficiency : Antenna Efficiency is the percentage of theoretical gain actually realized from an antenna.

Antenna Gain : Antenna gain, also known as antenna directivity, is the relative gain of the main beam of an antenna pattern to a reference antenna, usually an isotropic or standard dipole. Antenna Gain is the effectiveness of a directional antenna expressed as the ratio of input power of the directional antenna to input power of an isotropic radiator to provide the same field strength in the desired direction. Sometimes related to a dipole antenna.

Antenna, Isotropic : An isotropic antenna is a theoretical point source radiating a spherical power envelope.

Antenna, Parabolic : A parabolic antenna is an antenna utilizing a reflector that is shaped as a paraboloid in order to both concentrate the radiated signal into a beam and to provide considerable gain. Beamwidth varies inversely and gain varies directly with the size of the antenna and with frequency.

Attenuation : Attenuation refers to decreasing in signal magnitude between two points. These points may be along a radio path, transmission line or other devices.

Attenuator : Attenuator is a device specifically designed to decrease the magnitude of a signal transmitted through it.

Average power : Average power is the peak power averaged over time and is usually applied to pulsed systems where the carrier power is switched on and off.

Backhaul : In wireless technology, backhaul refers to transporting voice and data traffic from a cell site to the switch.

Band Pass Filter : A Band Pass Filter is a radio wave filter with a specific range of frequencies in which it is designed to pass. It rejects frequencies outside the pass-band range. A resistor-inductor-capacitor circuit is an example of a Band Pass Filter.

Bandwidth : Bandwidth usually identifies the capacity of a circuit or amount of data that can be sent through a given circuit. It may be user-specified in a PVC. It is an indication of the amount of data that is passing over a medium. Also, bandwidth is the portion of the frequency spectrum required to transmit desired information. Each radio channel has a center frequency and additional frequencies above and below this carrier frequency which is used to carry the transmitted information. The range of frequencies from the lowest to the highest used is called the bandwidth.

Bandwidth Ratio : Bandwidth Ratio is the ratio of two devices having differing bandwidths, not necessarily in the same frequency spectrum.

BER : Bit Error Rate or Bit Error Ratio (link quality specification/testing) (BER) is a measure of transmission quality. The ratio of error bits to the total number of bits transmitted. A bit error rate of 10-6 refers to an average of one error per million bits. It is generally shown as a negative exponent, (for example, 10-7 which means 1 out of 107 bits are in error or 1 out of 10,000,000 bits are in error). Bit Error Rate is the fraction of a sequence of message bits that are in error.

BERT : Bit Error Rate Test/Tester (BERT) is a test that gauges the quality of the T1 or digital line. By sending a known pattern to another device across the span, the far end device can compare incoming pattern to its own, thereby indicating bit errors on the line.

Broadband : Broadband refers to telecommunication that provides multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing. It is a service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

Calibration : When making measurements, the instrument must be calibrated in order to remove residual errors due to measurement setup conditions. Anritsu recommends performing the calibration under the same conditions as the measurement: temperature, frequency, number of points, source power, and IFBW. Calibrations standards with known reflection coefficients are used to calculate the correction factors. The calibration must be conducted using the appropriate standards at the open end of any test port cables and adapters that are connected to the instrument. This ensures that the match, phase length, and loss of these cables and adapters are all accounted for. For optimal performance, high quality phase-stable cables and precision adapters must be used.

CCDF : Complementary Cumulative Distribution Function (CCDF) is a method used to characterize the peak power statistics of a digitally modulated signal. The CCDF curve can be used to determine design parameters for CDMA systems (such as the amount of back-off to run in a power amplifier).

Cell : In wireless communication, a Cell is the geographic area encompassing the signal range from one base station (a site containing a radio transmitter/receiver and network communication equipment). Wireless transmission networks are composed of many hexagonal, overlapping cell sites to efficiently use radio spectrum for wireless transmissions. Also, cell is the basis for the term ’cellular phone.’

Cell Delineation : Cell Delineation is the process for recognizing the beginning and end of ATM cells within the raw serial bit stream.

Cell Site : Cell Site, also called Base Station, is the local cellular tower and radio antenna (including the radios, controller, switch interconnect, etc.) that handles communication with subscribers in a particular area or cell. A cellular network is made up of many cell sites, all connected back to the switch via landline or microwave.

Cellular : In wireless communications, cellular refers most basically to the structure of the wireless transmission networks which are comprised of cells or transmission sites. Cellular is also the name of the wireless telephone system originally developed by Bell Laboratories that used low-powered analog radio equipment to transmit within cells. The terms ’cellular phone’ or ’cell phone’ are used interchangeably to refer to wireless phones. Within the wireless industry, cellular is also used to refer to non-PCS products and services.

Coaxial Cable : Coaxial Cable (Coax) is a type of electrical communications medium used in the LAN environment. This cable consists of an outer conductor concentric to an inner conductor, separated from each other by insulating material, and covered by some protective outer material. This medium offers large bandwidth, supporting high data rates with high immunity to electrical interference and a low incidence of errors. Coax is subject to distance limitations and is relatively expensive and difficult to install.

Configuration Commands : Configuration Commands are commands that are issued to an instrument and that change a specific instrument configuration.

COW : Cell site On Wheels (COW) is a mobile site placed at a location to fill in or increase coverage.

CPLT : Cell Site on Light Truck (CPLT) is a mobile site on a vehicle placed at a location to fill in or increase coverage.

CPM : Continuous Phase Modulation (CPM) is a phase modulation technique employing smooth transitions between signal states. This reduces sidelobe spectral energy and improves co-channel performance.

CW : Continuous Wave (CW)

DANL : Displayed Average Noise Level (DANL): Displayed average noise level is sometimes confused with the term Sensitivity. While related, these terms have different meanings. Sensitivity is a measure of the minimum signal level that yields a defined signal-to-noise ratio (SNR) or bit error rate (BER). It is a common metric of radio receiver performance. Spectrum analyzer specifications are always given in terms of the DANL. One of the primary uses of a spectrum analyzer is to search out and measure low-level signals. The limitation in these measurements is the noise generated within the spectrum analyzer itself. This noise, generated by the random electron motion in various circuit elements, is amplified by multiple gain stages in the analyzer and appears on the display as a noise signal. On a spectrum analyzer, this noise is commonly referred to as the Displayed Average Noise Level, or DANL 1. While there are techniques to measure signals slightly below the DANL, this noise power ultimately limits our ability to make measurements of low-level signals.

dB : Decibel or deciBel (dB) is a logarithmic ratio of the difference between two values (a logarithm ratio is equal to 10 times). dB is a unit for measuring relative power ratios in terms of gain or loss. The units of dB are expressed in terms of the logarithm to base 10 of a ratio and typically are expressed in watts. For example, a -3 dB loss indicates a 50% loss in power; a +3 dB reading is a doubling of power; 10 dB indicates an increase (or a loss) by a factor of 10; 20 dB indicates an increase (or a loss) of a factor of 100; 30 dB indicates an increase (or a loss) by a factor of 1000. Common values of dB expressed in ratios: 0 dB = 1:1, 10 dB = 10:1, 20 dB = 100:1, 30 dB = 1000:1, -30 dB = 0.001:1 [or (1/1000):1].

dBc : Decibels referenced to the carrier (dBc) is a technique for expressing a power measurement in logarithmic form using the carrier power as a reference. The units are used to describe how far down signals and noise are relative to a known signal. Typical use of this term is to describe spurious signals and noise compared to a desired transmit signal.

dBd : Decibels referenced to a dipole antenna (dBd) is a technique for expressing a power gain measurement in logarithmic form using a standard dipole antenna as a reference. dBd is a measurement of signal gain used in radio antenna design. Pecifically, dBd referrs to signal gain in a dipole radiator.

dBm : dBm is an absolute measurement of power relative to 1 milliwatt. In other words, dBm is a decibel value referenced to a milliWatt (dBm). This is a technique for expressing a power measurement in logarithmic form using 1 mW as a reference. dBm is a decibel ratio (log 10) of Watts (W) to one milliwatt (1mW). dBm, therefore, represents absolute power. Examples are: 0 dBm = 1.0 milliwatt, 10 dBm = 10 milliwatt, 30 dBm = 1000 milliwatt = 1 watt.

DHCP : Dynamic Host Configuration Protocol (DHCP)

DSP : Digital Signal Processing (DSP)

DSRC : Dedicated Short Range Communications (DSRC): DSRC is a system that is intended for communications between two vehicles, or from one vehicle to a roadside network. Refer to IEEE 802.11p.

DTF : Distance-To-Fault (DTF) is the distance from the instrument output connector (or the end of a test lead) to a problem area, as indicated by a peak in the displayed signal. DTF measures the location and reflection size of impedance mismatches. This is typically a diagnostic measurement, not a pass/fail judgement measurement. DTF is used to identify and locate faults within an antenna system when the system is failing to meet the specified return loss or VSWR limits. DTF is also useful to verify the total length of a coaxial cable assembly.

FFT : Fast Fourier Transform (FFT) is an efficient algorithm to compute the Discrete Fourier transform (DFT) and its inverse. FFTs are of great importance to a wide variety of applications, from digital signal processing to solving partial differential equations to algorithms for quickly multiplying large integers.

Flash Memory : Flash memory is a non-volatile solid state storage device that is packaged as a chip. It can be electrically erased and reprogrammed. It is primarily used in memory cards, USB flash drives, MP3 players, and solid-state drives for general storage and transfer of data between computers and other digital products. It is a specific type of EEPROM (electrically erasable programmable read-only memory) that is erased and programmed in large blocks.

GPS : The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times when and where an unobstructed line of sight is available to four or more GPS satellites. The system is maintained by the United States government and is freely accessible by anyone with a GPS receiver. The Global Positioning System is making it possible for people using ground receivers to determine their geographic location within 10 meters to 100 meters. The satellites use simple mathematical calculations to broadcast information that is translated as longitude, latitude, and altitude by Earth-based receivers.

Impedance : Impedance is a measure of RF component electrical resistance, measured in ohms. In most cable and antenna systems, the standard impedance is 50 ohms.

Insertion Loss : Insertion Loss (or Cable Loss) is a measure of the total amount of signal energy absorbed (lost) by the cable assembly. It is measured in dB. S21 (an S-Parameter) is another name for this measurement.

IP Address : An Internet Protocol address (IP address) is usually a numerical label that is assigned to each device (computer or printer for example) that is participating in a computer network that uses the Internet Protocol for communication. An IP address serves two main functions: location addressing and host (or network) interface identification. The Internet Protocol originally defined an IP address as a 32-bit number. This was known as Internet Protocol Version 4 (IPv4), which is still in use. Growth of the Internet requires a new addressing system. An Internet Protocol Version 6 (IPv6) that uses 128 bits for the address was developed in 1995, and it is standardized as RFC 2460. IPv6 began being deployed worldwide in the year 2000. IP adresses are binary numbers, but they are usually stored in text files and displayed in human-readable notations, such as decimal nnn.nnn.nnn.nnn or 172.16.255.1 (for IPv4), and hexadecimal nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn or 2C01:AB18:0:1234:FF03:567C:8:1 (for IPv6). In IPv4, each decimal group (nnn) represents values from 000 to 255, or binary values of 8 bits. In IPv6, each hexadecimal group (nnnn) represents values from 0000 to FFFF, or binary values of 16 bits (0000 0000 0000 0000 to 1111 1111 1111 1111).

IPv6 : Internet Protocol Version 6 (IPv6) is a numerical label that is used to identify a network interface of a computer or other network node participating in an IPV6-enabled computer network. IPv6 uses 128 bits for the address (as compared to an IPv4 address, which is defined as a 32-bit number). Pv6 was developed in 1995, and it is standardized as RFC 2460. V6 began being deployed worldwide in the year 2000. I addresses are binary numbers, but they are usually stored in text files and displayed in human-readable notations, such as hexadecimal nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn.nnnn or 2C01:AB18:0:1234:FF03:567C:8:1 (where FFFF [Hex] = 65535 [Dec]). Ea hexadecimal group (nnnn) represents values from 0000 to†FFFF, or binary values of 16 bits (0000 0000 0000 0000 to 1111 1111 1111 1111).

LST : Line Sweep tools (LST) is PC-based post-processing software that efficiently manipulates line sweep and PIM traces for reporting purposes.

NF : Noise Figure (NF) is a measure of degradation of the signal-to-noise ratio (SNR) that is caused by components in a radio frequency (RF) device. The noise factor (F) of a system is defined as the signal-to-noise ratio of the input power of the system divided by the signal-to-noise ratio of the output power of that system. F (the noise figure) is defined as the decibel value of the noise factor. NF = 10log (F) where log uses the base 10, or common log. This formula is valid only then the input termination is at standard noise temperature.

OBW : Occupied Bandwidth (OBW) is a measure of the bandwidth containing 99% of the total integrated power of the transmitted spectrum, centered on the assigned channel frequency. Interference to other channels or to other systems can occur if OBW is too large.

OSL : OSL or Open Short Load calibration method for coaxial line types. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSL or Offset Short 1, Offset Short 2, Load calibration method for waveguide line types.

OSLT : OSLT or Open Short Load Thru calibration method for coaxial line types. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSLT or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types.

OTA : Over The Air (OTA): OTA refers generally to any transfer of information or signal that takes place in a wireless environment, rather than using a wired connection. OTA is usually used in connection with a standard defining the provisioning of mobile devices and applications, such as downloading or uploading content or software, and commonly used in conjunction with the Short Messaging Service (SMS). SMS OTA Messages contain information that is used to configure the settings of a WAP browser in a mobile phone (refer to SMS and WAP).

Return Loss : Return Loss is a measurement (in dB) of reflected energy caused by impedance mismatch. May also be referred to as S11. Although S11 values are expressed as negative numbers, Return Loss values are expressed as positive numbers because by definition the ìLossî expression implies a negative sign. The higher the value, the better the impedance match (think of a large negative number being less than a smaller negative number). 40 dB is nearly ideal. Only 0.01 % of the total transmitted power is reflected if the Return Loss measurement value is 40 dB. A measured value of 0 dB would be a complete reflection, or stated another way, 100 % of the transmitted power is reflected back. Return Loss is typically a pass/fail measurement.

RF : Radio Frequency (RF) is the frequency of radio sine waves. RF generally refers to wireless communications within a frequency range of 3 kHz to 300 GHz. Formally, according to the Article 2 of the Radio Law, radio frequency is below 3,000 GHz. Radio frequencies can be used for communications between a mobile telephone and an antenna mast.

SCPI : Standard Commands for Programmable Instruments (SCPI)

SOLT : SOLT or Short Open Load Thru calibration method for coaxial line types with simple and redundant standards. It is not band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with SSLT or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types.

SSL : SSL or Short Short Load or Offset Short 1, Offset Short 2, Load calibration method for waveguide line types uses Shorts with different offset lengths. It is a calibration (common in waveguide) with simple and redundant standards, but it is band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Offset Short 1 is 1/8 wavelength, and Offset Short 2 is 3/8 wavelength. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with OSL or Open Short Load calibration method for coaxial line types.

SSLT : SSLT or Short Short Line Thru or Offset Short 1, Offset Short 2, Load, Thru calibration method for waveguide line types uses Shorts with different offset lengths. It is a calibration (common in waveguide) with simple and redundant standards, but it is band-limited. It requires well-defined standards. It has lower accuracy at higher frequencies. Offset Short 1 is 1/8 wavelength, and Offset Short 2 is 3/8 wavelength. Calibrations standards with known reflection coefficients are used to calculate the correction factors. Refer to Calibration. Compare this with OSLT or Open Short Load Thru calibration method for coaxial line types.

VSWR : Voltage Standing Wave Ratio (VSWR). VSWR is another method to measure reflected energy caused by impedance mismatch. It is expressed as a ratio of X:1. VSWR measures the voltage peaks and valleys. A ratio of 1:1 would be a perfect match. A typical cable and antenna system would be around 1.43:1 (VSWR) or 15 dB Return Loss.

Watt : Watt (W) is a unit of measure for power.

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