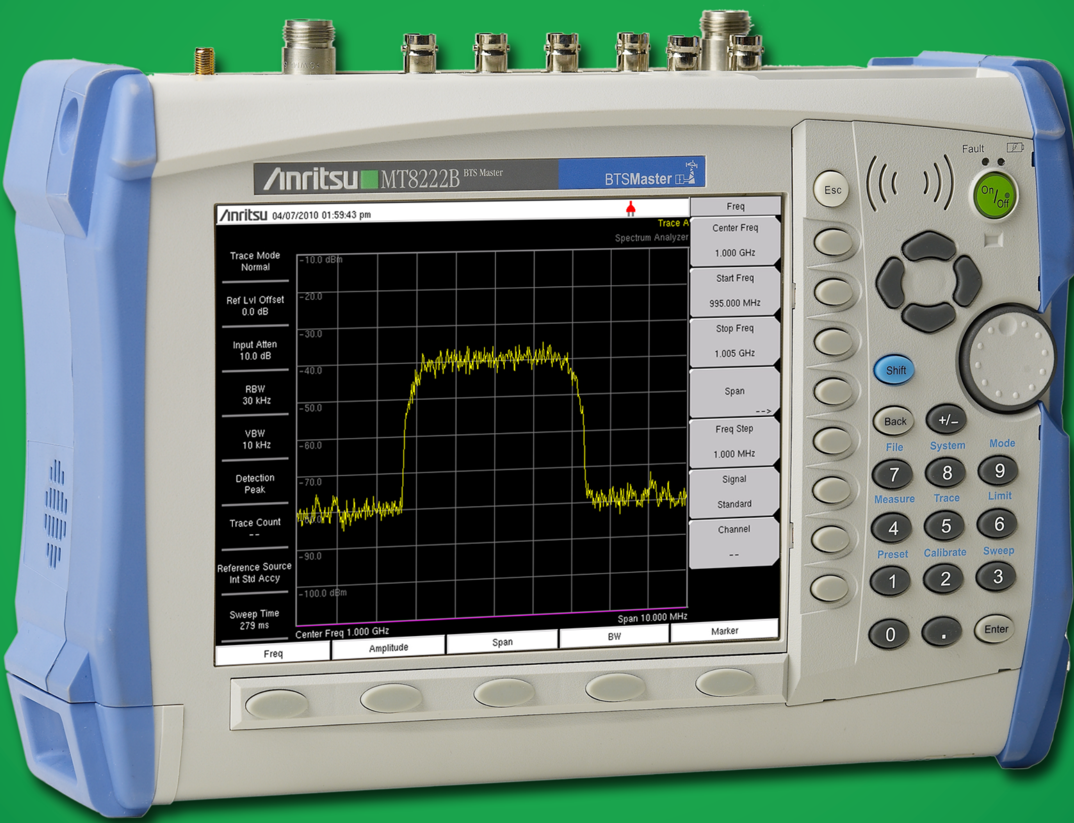
User Guide

BTS Master

MT8221B and MT8222B

The High Performance Handheld Base Station Analyzer



User Guide

BTS Master
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High Performance Handheld Base Station Analyzer

Appendix A provides a list of supplemental documentation for the BTS Master features and options. The documentation set is available as PDF files on the documentation disc and the Anritsu Web site.

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Morgan Hill, CA 95037-2809
USA
http://www.anritsu.com

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Revision: E
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DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: BTS Master

Model Number: MT8221B, MT8222B

conforms to the requirement of:

EMC Directive:	2004/108/EC
Low Voltage Directive:	2006/95/EC

Electromagnetic Compatibility: EN61326:2006

Emissions:	EN55011: 2007 Group 1 Class A	
Immunity:	EN 61000-4-2:1995 +A1:1998 +A2:2001	4kV CD, 8kV AD
	EN 61000-4-3:2006 +A1:2008	3V/m
	EN 61000-4-4:2004	0.5kV SL, 1kV PL
	EN 61000-4-5:2006	0.5kV L-L, 1kV L-E
	EN 61000-4-6: 2007	3V
	EN 61000-4-11: 2004	100% @ 20msec

Electrical Safety Requirement:

Product Safety: EN 61010-1:2001

Eric McLean, Corporate Quality Director

Morgan Hill, CA

17 Jun 2009
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close

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N274

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

Mercury Notification

This product uses an LCD backlight lamp that contains mercury. Disposal may be regulated due to environmental considerations. Please contact your local authorities for disposal or recycling information.

Equipment marked with the Crossed-out Wheelie Bin symbol complies with the European Parliament and Council Directive 2002/96/EC (the "WEEE Directive") in the European Union.

For Products placed on the EU market after August 13, 2005, please contact your local Anritsu representative at the end of the product's useful life to arrange disposal in accordance with your initial contract and the local law.

产品中有毒有害物质或元素的名称及含量

For Chinese Customers Only YLYB

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
LCD	×	×	×	×	○	○
其他（电缆、风扇、连接器等）(Appended goods)	×	○	×	×	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

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注）电池的环保使用期限是 5 年。生产日期标于产品序号的前四码

(如 S/N 0728XXXX 为07 年第 28 周生产)。

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Company uses the following symbols to indicate safety-related information. For your own safety, please read the information carefully *before* operating the equipment.

Symbols Used in Manuals

Danger

This indicates a very dangerous procedure that could result in serious injury or death, or loss related to equipment malfunction, if not performed properly.

Warning

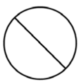
This indicates a hazardous procedure that could result in light-to-severe injury or loss related to equipment malfunction, if proper precautions are not taken.

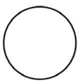
Caution

This indicates a hazardous procedure that could result in loss related to equipment malfunction if proper precautions are not taken.

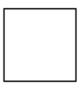
Safety Symbols Used on Equipment and in Manuals

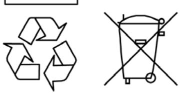
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions *before* operating the equipment. Some or all of the following five symbols may or may not be used on all Anritsu equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.


This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.


This indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.


This indicates a warning or caution. The contents are indicated symbolically in or near the triangle.


This indicates a note. The contents are described in the box.

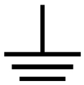

These indicate that the marked part should be recycled.

Warning

Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced. Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.

Warning

or



When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Warning

WARNING ⚠

This equipment can not be repaired by the operator. Do not attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

Caution

Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument’s front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument’s front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.

Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

Warning

This equipment is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product data sheet.

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Chapter 1 — General Information

1-1 Introduction

This chapter provides a description of the BTS Master models MT8221B and MT8222B. It also reviews preventive maintenance, calibration requirements, ESD cautions, and additional documents. general and performance specifications, instrument options, standard accessories, and optional accessories are in the BTS Master MT8221B/22B Technical Data Sheet (PN: 11410-00442). Refer to Appendix A, "Measurement Guides", for additional information. Throughout this manual, this instrument may be referred to as the BTS Master, or MT8221B/22B.

1-2 Additional Documents

This user guide is specific to the BTS Master MT8221B. Additional instrument functions and descriptions of optional measurement capabilities are described in measurement guides. Refer to Appendix A, "Measurement Guides" for a list of these guides and their Anritsu part numbers.

1-3 Contacting Anritsu

To contact Anritsu, please visit:

http://www.anritsu.com/contact.asp

From here, 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 web site:

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 MT8222B:

http://www.anritsu.com/en-US/Products-Solutions/Products/MT8222B.aspx

1-4 Description

The MT8221B BTS Master is an integrated multi-functional base station test tool that eliminates the need to carry and to learn to use multiple test sets. The MT8221B measurement capabilities include: spectrum analyzer smart measurements, precision return loss, VSWR, cable loss, distance-to-fault, two port gain/loss, one-port and two-port magnitude and phase, interference analysis, spectrogram, and power meter.

RF, advanced demodulation, and over-the-air (OTA) measurements can be applied to WCDMA/HSDPA, GSM/GPRS/EDGE, Fixed WiMAX, Mobile WiMAX, CDMA and EVDO, DVB-T/H, TD-SCDMA, LTE, and TD-LTE.

Additional capabilities include a Vector Signal Generator (VSG), GPS location information, enhanced frequency reference oscillator accuracy, T1 measurements (including Vpp), E1 - 2 Mb/s measurements, T3 measurements, and listening to DS0/VF channels.

The BTS Master base model has cable and antenna analysis (MT8221B: 400 MHz to 4.0 GHz, MT8222B: 400 MHz to 6.0 GHz), spectrum analysis (150 kHz to 7.1 GHz), and an internal power meter (10 MHz to 7.1 GHz). The cable and antenna analysis is performed by a Vector Network Analyzer that is designed to make accurate vector-corrected 1-port and 1-path, 2-port magnitude and phase measurements from 400 MHz to 6 GHz.

The MT8221B BTS Master is also a synthesizer-based spectrum analyzer that provides quick and accurate measurement results. Measurements can be easily made by using the main instrument functions: frequency, span, amplitude, and bandwidth. Dedicated keys for one-button measurements of field strength, channel power, occupied bandwidth, Adjacent Channel Power Ratio (ACPR), and Carrier to Interference Ratio (C/I) make the handheld MT8221B the ideal choice for the field. A familiar calculator-type keypad allows for fast data entry.

In transmitter analyzer mode, the MT8221B BTS Master displays 6 markers and the marker table in Code Domain Power and Codogram displays. In Spectrum Analyzer mode, a full range of marker capabilities (such as peak, center, and delta functions) are provided for faster, more comprehensive analysis of displayed signals. Upper and lower multi-segmented limit lines are available to create quick, simple pass/fail measurements. A menu option provides for an audible alert when a limit value is exceeded. A vertical line marker is available with the histogram displays of BERT measurements in the T1/T3 Analyzer. Markers are not available in GSM mode.

Time and date stamping of measurement data is automatic. The internal memory provides for storage and recall of traces and measurement setups. The bright daylight-viewable, high-resolution, color liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions. The BTS Master is capable of approximately 2.5 hours of continuous operation from a fully charged battery and can be operated from a 12 VDC source, which also simultaneously charges the battery.

Anritsu Master Software Tools (MST), a PC-based software program, provides a convenient means for storing measurement data. Master Software Tools can also convert measurements from the BTS Master display into several graphic formats. Master Software Tools supports all of the options that are provided with the BTS Master.

Measurements may be stored in internal memory or in a USB Flash drive. Stored measurements can be downloaded to a PC by using the included USB and Ethernet cables. After being stored, a graphic trace can then be displayed, scaled, or enhanced in Master Software Tools with markers and limit lines. Historical graphs can be overlaid with current data by using the PC mouse in a drag-and-drop fashion. The underlying data can be extracted and used in spreadsheets or for other analytical tasks.

Note	For USB storage, not all after-market USB drives are compatible with the instrument. Many drives come with a second partition that contains proprietary firmware. This partition must be removed. Only one partition is allowed. Refer to the individual manufacturer for instructions on how to remove it. Some drives can be made to work by reformatting them using the FAT32 format.

1-5 Preventive Maintenance

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

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

Clean the RF connectors and center pins with a cotton swab dampened with denatured alcohol. Visually inspect the connectors. The fingers of N(f) connectors and the pins of N(m) connectors should be unbroken and uniform in appearance. If you are unsure whether the connectors are good, gauge the connectors to confirm that their dimensions are correct.

Visually inspect the test port cables. The test port cable should be uniform in appearance, not stretched, kinked, dented, or broken.

1-6 Calibration Requirements

The BTS Master loads factory calibration data during start-up, eliminating the need for daily calibration checks. In WCDMA modes, an additional automatic calibration is performed as the internal temperature of the BTS Master changes (to insure the best possible measurement results).

Although the BTS Master does not require daily field calibration, Anritsu Company recommends annual calibration and performance verification by local Anritsu service centers. The Cable and Antenna Analyzer requires calibration standards for OPEN, SHORT, and LOAD, which are sold separately. The Cable and Antenna Analyzer Measurement Guide is available on the documentation disc and the Anritsu web site. Refer to Appendix A, "Measurement Guides", for a list of measurement guides and their Anritsu part numbers.

Note	Anritsu recommends allowing the instrument to warm up to typical operation temperature (~15 minutes) before calibrating.

1-7 ESD Cautions

The MT8221B, like other high performance instruments, is susceptible to ESD (electrostatic discharge) damage. Coaxial cables and antennas often build up a static charge, which (if allowed to discharge by connecting directly to the MT8221B without discharging the static charge) may damage the MT8221B input circuitry. MT8221B operators **must be aware** of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. Because these apply to the MT8221B, Anritsu Company recommends that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the MT8221B. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the MT8221B. Remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards ensures a safe environment for both personnel and equipment.

1-8 Anritsu Reference Documents

The following URL is an Internet link to the BTS Master product page.

BTS Master product page link: http://www.us.anritsu.com/BTSMaster

A table at the bottom of the web page presents Internet links to related literature and software. Examples include the following types of documents:

- Application Notes
- Brochures
- Data Sheets
- Instruction Sheets
- Technical Notes
- White Papers
- Master Software Tools

1-9 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). Slide the battery door down, towards the bottom of the instrument, to remove it. Remove the battery pack from the instrument by pulling straight out on the battery lanyard. Replacement is the opposite of removal.

Figure 1-1. Battery Compartment Door

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

The battery that is supplied with the BTS Master may need charging before use. The battery can be charged while it is installed in the BTS Master by using either the AC-DC Adapter or the 12-Volt DC adapter, or separately in the optional Dual Battery Charger. Refer to your Technical Data Sheet for Anritsu part numbers. Refer to section “Symbols and Indicators” on page 2-19 for a description of battery symbols.

Caution	When using the Automotive Cigarette Lighter 12 VDC Adapter, always verify that the supply is rated for a minimum of 60 Watts @ 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.

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

1-10 Soft Carrying Case

The instrument 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 BTS Master.
2. Place the soft carrying case face down on a stable surface, with the front panel fully closed and laying flat.
3. Fully 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 BTS Master.

Figure 1-2. Instrument Inserted Into the Soft Carrying Case

5. Close the back panel and secure with the zipper.

The soft carrying case includes a detachable shoulder strap, which can be connected to the D-rings on the upper corners of the case as required for comfort or convenience.

1-11 Tilt Bail Stand

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

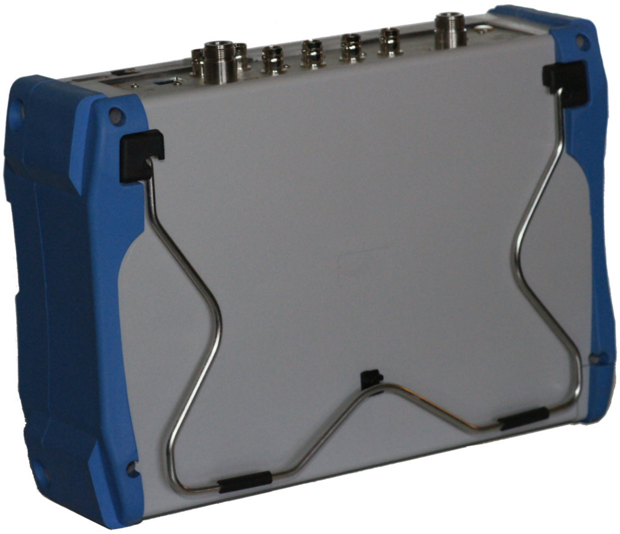


Figure 1-3. Tilt Bail Housed

Figure 1-4. Tilt Bail Extended

1-12 Secure Environment Workplace

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

BTS Master Memory Types

The instrument contains non-volatile disk-on-a-chip memory, EEPROM, and volatile DRAM memory. The instrument is also supplied with an external USB flash drive. The instrument does not have a hard disk drive or any other type of volatile or non-volatile memory.

Disk-On-A-Chip (DOC)

DOC is used for storage of instrument firmware, factory calibration information, user measurements, setups, and .jpg screen images. User information stored on the DOC is erased by the master reset process described below.

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 parameter 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 restarted.

External USB Flash Drive

This memory may be selected as the destination for saved measurements and setups for the instrument. The user can also copy the contents of the internal disk-on-chip memory to the external flash memory for storage or data transfer. The external Flash USB can be reformatted or sanitized using software on a PC.

Refer to the Chapter 4, “File Management” for additional information on saving and copying files to the USB flash drive.

Erase All User Files in Internal Memory

Perform a Master Reset:

1. Turn the instrument on.
2. Press the **Shift** button then the **System** (8) button.
3. Press the System Options submenu key.
4. Press the Reset key, then the Master Reset key.
5. A dialog box will be displayed on the screen warning that all settings will be returned to factory default values and all user files will be deleted. This deletion is a standard file delete and does not involve overwriting exiting information.
6. Press the **Enter** button to complete the master reset.
7. The instrument will reboot and the reset is complete.

Recommended Usage in a Secure Environment

The BTS Master does not currently provide a secure erase feature. In environments where data security is an issue, it is recommended that users store their BTS Master created files on an external USB Flash drive that is then securely retained, sanitized, or destroyed after use.

To set the BTS Master to save files to an external USB Flash drive:

1. Attach the external Flash drive and turn the instrument on.
2. Press the **Shift** button then the **File** (**7**) button.
3. Press the Directory Management submenu key.
4. Confirm that USB is underlined in the Current Location key.

The external USB drive is now the default location for saving files.

Note	For USB storage, not all after-market USB drives are compatible with the instrument. Many drives come with a second partition that contains proprietary firmware. This partition must be removed. Only one partition is allowed. Refer to the individual manufacturer for instructions on how to remove it. Some drives can be made to work by reformatting them using the FAT32 format.

Chapter 2 — Instrument Overview

2-1 Introduction

This chapter provides a brief overview of the Anritsu MT8221B BTS Master. The intent of this chapter is to acquaint you with the instrument. To begin using the instrument immediately, go to Chapter 3, “Basic Measurement Setups”, to find directions for power on, editing, frequency, bandwidth, amplitude, limit line, marker, file management procedures, and firmware update. For more detailed information on measurement setups, refer to the specific measurement guides, which are based on the options that can be purchased for this instrument. The measurement guides and a copy of this user guide are available as PDF files on the documentation disc. Refer to Appendix A, “Measurement Guides”.

2-2 Hardware Overview

Turning On the MT8221B for the First Time

The Anritsu MT8221B BTS Master is capable of approximately 2.5 hours of continuous operation from a fully charged, field-replaceable battery (refer to Section “Battery Replacement” on page 1-5 of Chapter 1). The MT8221B can also be operated from a 12 VDC source (which will also simultaneously charge the battery). This can be achieved with either the Anritsu AC–DC Adapter or 12 VDC Automotive Cigarette Lighter Adapter. Both items are included as standard accessories.

Caution	When using the Automotive Cigarette Lighter 12 VDC 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 MT8221B, press the **On/Off** button on the front panel (Figure 2-1).

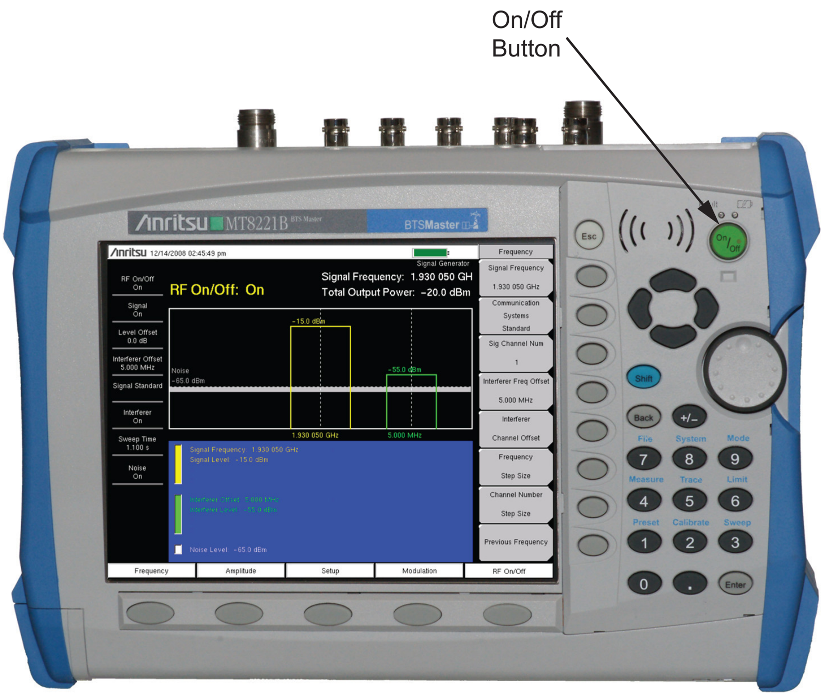


Figure 2-1. MT8221B On/Off Button

The MT8221B BTS Master takes approximately sixty seconds to complete power-up and to load the application software. At the completion of this process, the instrument is ready to be used.

2-3 Front Panel Overview

The BTS Master menu-driven interface is easy to use and requires little training. Hard keys on the front panel are used to initiate function-specific menus. Five main menu keys are located below the display. These keys vary in function depending upon the selected mode of instrument operation.

A rotary knob and 21 hard keys are located to the right of the measurement display. Nine of the hard keys are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself. The alternate function is printed on the panel above each of these nine keys. Use the shift key to access the functions that are printed on the panel. The **Escape** key (which is used for aborting data entry) is the round button located above the submenu keys. The rotary knob, the four arrow keys, and the keypad can be used to change the value of an active parameter. The rotary knob can also be pressed to duplicate the action of the **Enter** key.

Arranged in a vertical column on the instrument case and along the right edge of the measurement display are 8 submenu keys. They change function depending upon the current menu selection. The current submenu key function is indicated in the active function block (submenu key labels) on the right edge and within the measurement display. An example of the keys is shown in Figure 2-2.

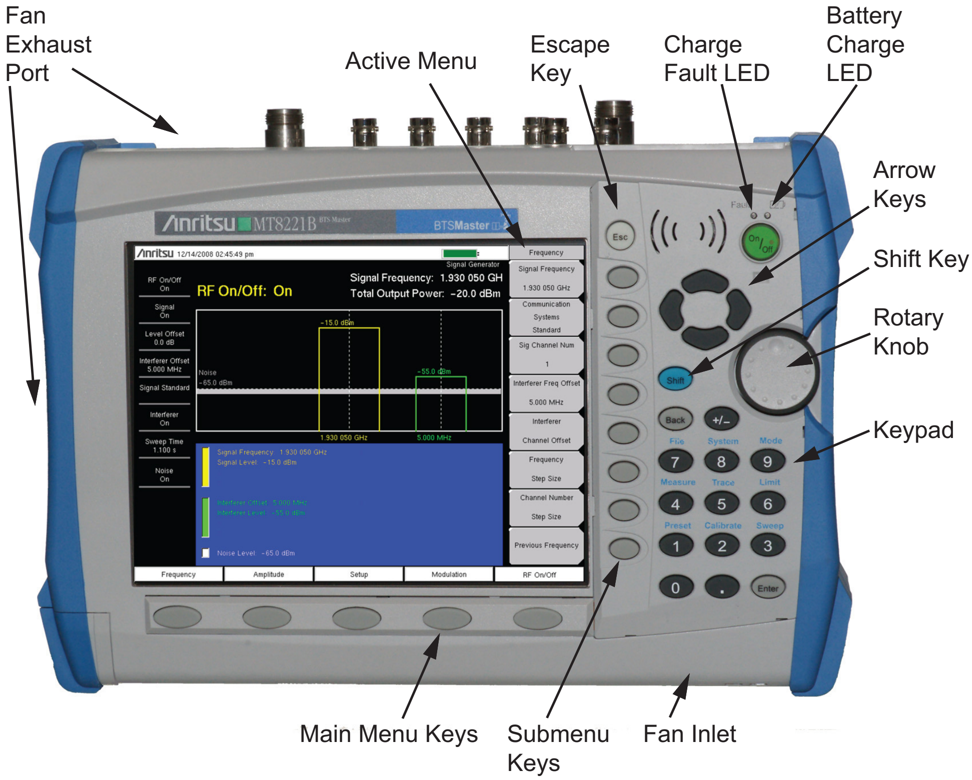


Figure 2-2. Front Panel Overview

Other features on the front panel include:

Battery Charge LED (Green)

The Battery Charge LED flashes if the battery is charging, and remains on steady when the battery is fully charged.

Charge Fault LED (Red)

The Charge Fault LED remains on steady under a battery charger fault condition. Fault conditions include a battery cell voltage that is too low to charge or a battery temperature that is outside the temperature range (–5 °C to +50 °C) for charging.

Fan Inlet and Exhaust Ports

Keeping the fan inlet and exhaust ports clear of obstructions at all times is important for proper ventilation and cooling of the instrument.

2-4 Front Panel Keys

The term hard key refers to all of the buttons on the instrument face except for the vertical row of 8 gray buttons adjacent to the right edge of the measurement display screen (the 8 submenu keys) and the horizontal row of 5 gray buttons below the measurement display screen (the 5 main menu keys).

The hard keys perform as follows:

Esc Key

Press this key to cancel any setting that is currently being made.

Enter Key

Press this key to finalize data input. Pressing the rotary knob performs this same function.

Arrow Keys

The four arrow keys (between the rotary knob and the **Esc** key) are used to scroll up, down, left, or right. The arrow keys can often be used (depending upon measurement selection) to change a value or to change a selection from a list. This function is similar to the function of the rotary knob. In some measurements, the **Left/Right** arrow keys change values by different increments than the **Up/Down** arrow keys or the rotary knob. The arrow keys are also used to move markers.

Shift Key

Press the **Shift** key and then press a number key to open the menu that is indicated in blue text above the number key. When the **Shift** key is active, its icon is displayed at the top-right of the measurement display area between the battery charge indicator and the submenu label.

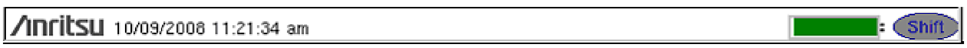


Figure 2-3. Shift Key Icon

The **Shift** key is also used for UPPERCASE letters when entering text (refer to "Text Entry" on page 2-11.

Back Key

Press this key to delete only one character, one number, or the range that is specified by the cursor.

+/– Key

Press this key to change the sign of numbers that are entered with the number keys.

Number Keypad

Press these keys to directly input numbers. Number keys 1 through 9 are also used to open menus. Refer to the functions of the “Shift Key”.

Rotary Knob

Turn the rotary knob to change numerical values, to scroll through selectable items within a list, and to move markers. Values or items may be within a dialog box or an edit window.

Press the rotary knob to finalize the input function in the same manner as pressing the **Enter** key.

Main Menu Keys

The 5 main menu keys are horizontally arranged adjacent to the measurement display screen and along its lower edge. These keys (buttons) have no printed labels. They are positioned to accompany virtual key labels that are displayed in the measurement display area. These main menu key labels change to match specific instrument Mode settings. Each Mode has a specific set of main menu keys. For details about the main menu keys, refer to the section “Firmware Overview” on page 2-20. For details about the Mode settings, refer to section “Mode Selector Menu” on page 2-6.

Submenu Keys

These 8 gray keys (buttons) have no printed labels. They are arranged adjacent to the measurement display screen along the right-hand edge. They are positioned to accompany virtual submenu key labels that are displayed to match instrument modes and measurement functions. The submenu label area is also called the Active Function Block (refer to Figure 2-2 on page 2-3). The virtual key labels change as instrument measurement settings change.

2-5 Mode Selector Menu

To access the functions under the Mode menu, select the **Shift** key, then the **Mode** (**9**) key. Use the directional arrow keys or the rotary knob to highlight the selection, and press the **Enter** key to select. The list of modes that appears in this menu will vary depending upon the options that are installed and activated in your instrument. Figure 2-4 is an example of the Mode menu. Your instrument may not show the same list.

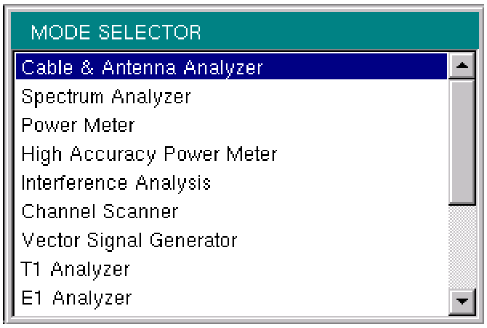


Figure 2-4. Mode Selector Menu

2-6 Secondary Function Menus

Pressing the **Shift** key and then a number key selects the menu function that is printed in blue characters above the number key.

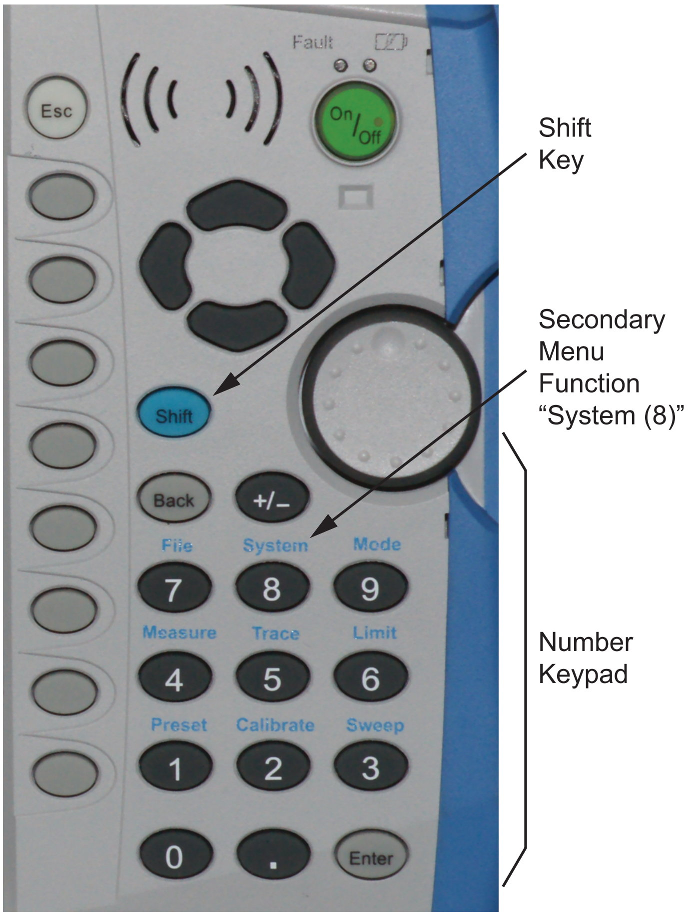


Figure 2-5. Keypad and Secondary Function Menus

Not all Secondary Function Menus are active in various operation Modes. If any one of these 9 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. The Secondary Function Menus are: Preset (1), Calibrate (2), Sweep (3), Measure (4), Trace (5), Limit (6), File (7), System (8), and Mode (9).

2-7 Display Overview

Typical measurement displays are shown for the basic operating modes of the MT8221B, including Cable and Antenna Analyzer mode, Spectrum Analyzer mode, and one of the many measurement options (WCDMA/HSDPA analyzer display shown in Figure 2-8). Note that the images shown in this manual may be different from any images that are displayed on your BTS Master.

Cable and Antenna Analyzer Mode

Figure 2-6 illustrates some of the key information areas of the MT8221B display.
For more detailed key descriptions of the Cable and Antenna Analyzer mode, refer to the Cable and Antenna Analyzer Measurement Guide (Anritsu part number 10580-00230, available on the documentation disc). Also refer to Appendix A, “Measurement Guides”, for a complete list of measurement guides.

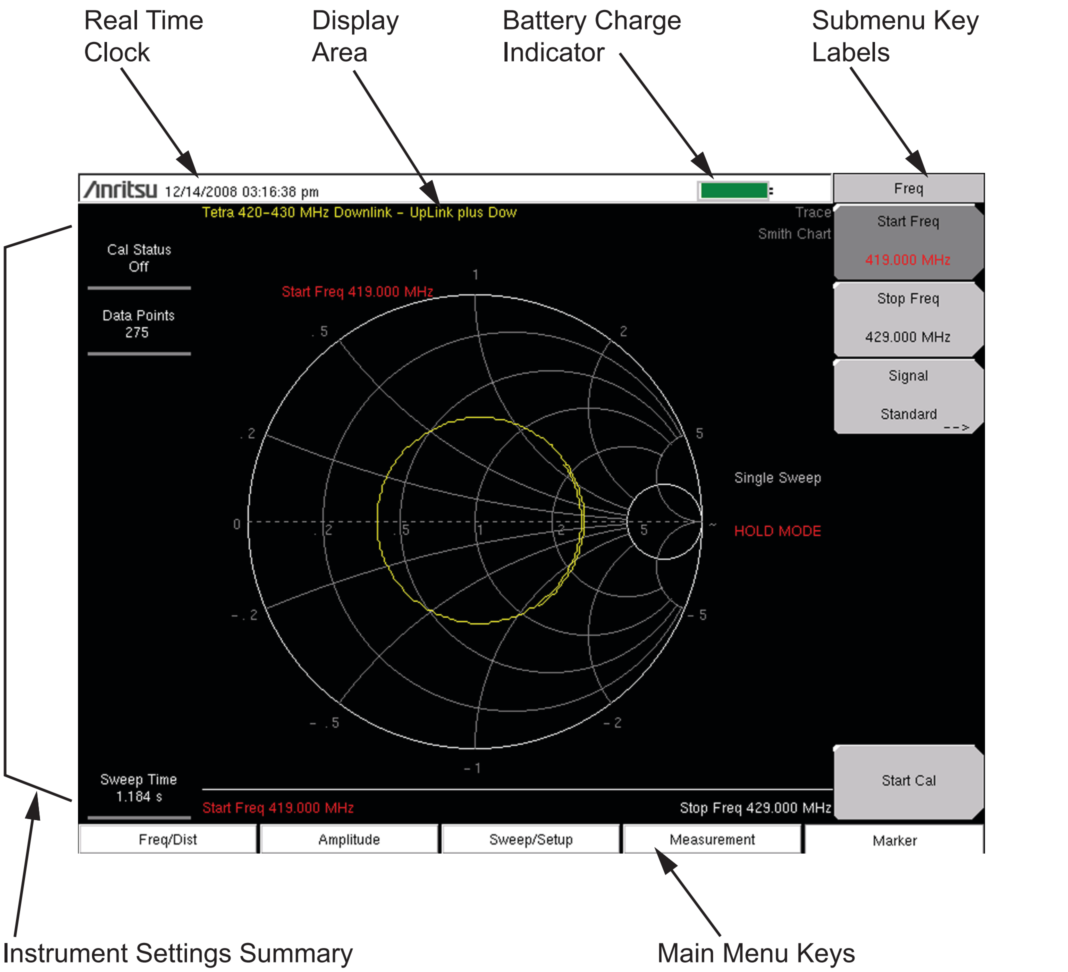


Figure 2-6. Cable and Antenna Analyzer Smith Chart Display

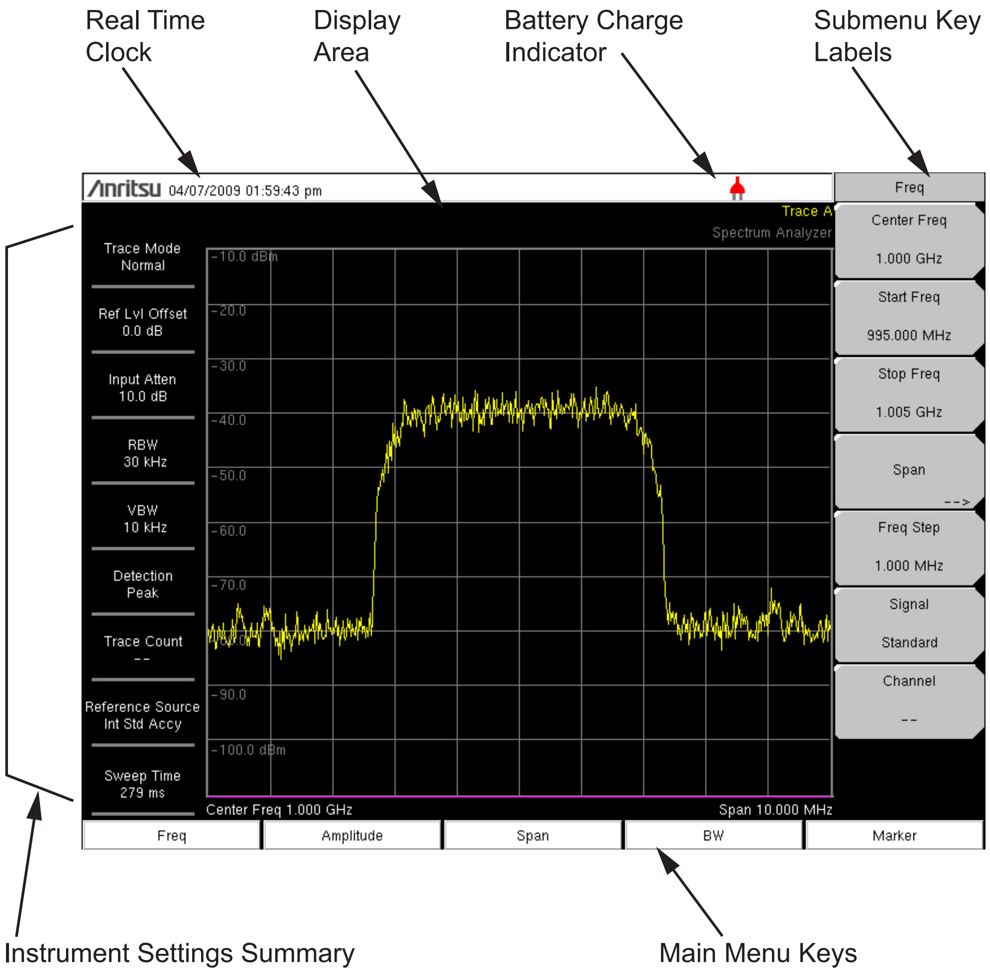


Figure 2-7. Spectrum Analyzer Display

Figure 2-8 illustrates some of the information areas that are unique to the MT8221B WCMDA/HSDPA Signal Analyzer CDP display.

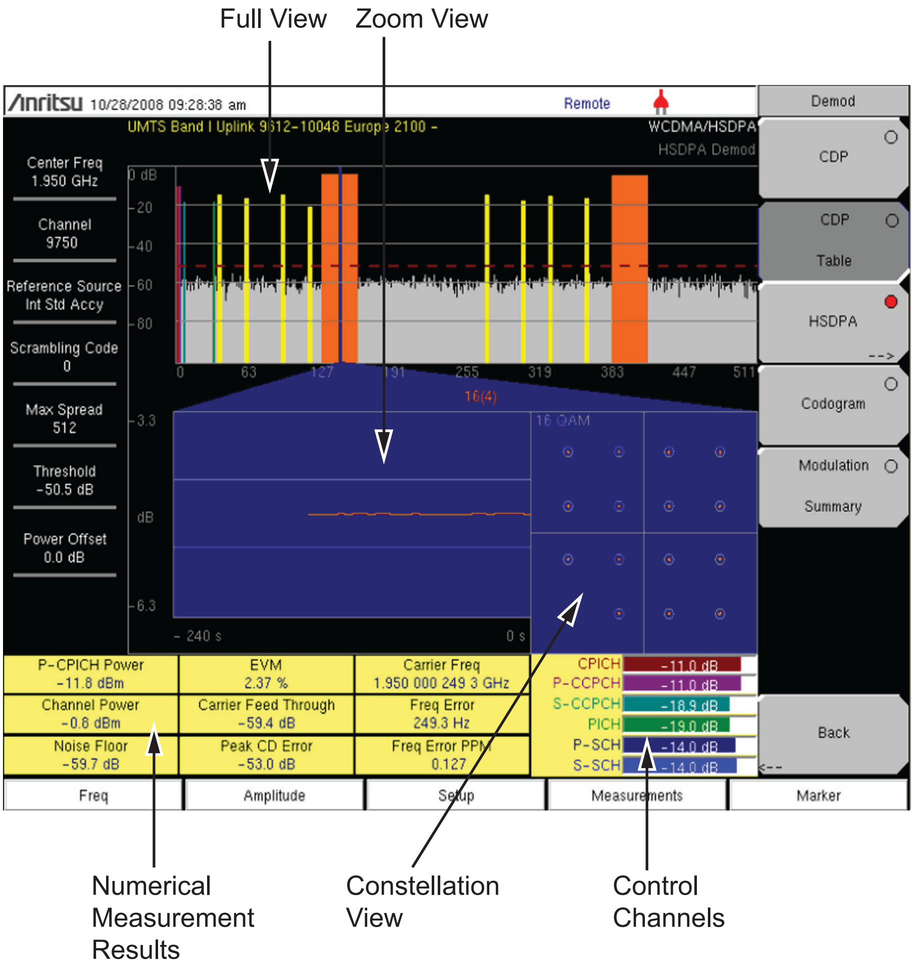


Figure 2-8. WCDMA/HSDPA Signal Analyzer CDP Display Overview

For WCDMA/HSDPA information, refer to the 3GPP Measurement Guide available on the documentation disc and the Anritsu web site.

2-8 Parameter Setting

Pop-up list boxes or edit boxes are used to provide selection lists and selection editors. Scroll through a list of items or parameters with the arrow keys or the rotary knob. Select numerical values by scrolling with the arrow keys or rotary knob or by entering the digits directly from the number keypad. These list boxes and edit boxes frequently display a range of possible values or limits for possible values.

Finalize the input by pressing the rotary knob or the **Enter** key. At any time before finalizing the input, press the escape (**Esc**) key to abort the change and retain the previously existing setting.

Some parameters (such as for antennas or couplers) can be added to list boxes by creating them and importing them through the use of Master Software Tools.

2-9 Text Entry

When entering text (as when saving a measurement) the submenu key for Text Entry displays the characters (alphabet, hyphen, and underscore) in 6 letters per key (Refer to Figure 2-11). Characters can be entered by using the rotary knob or by using the submenu keys. Refer to Figure 2-9, Figure 2-10 and Figure 2-11.

The rotary knob scrolls through the characters in a pop-up window and is pressed to select each character in sequence.

Alternatively, press the a b c / d e f submenu key (for example) to open another submenu with a separate key for each of these letters. The menu returns to the complete character set after each individual letter is entered.

Use the arrow keys to navigate within a name or character string. Use the **Shift** key for capital letters. Press the **Enter** key or the rotary knob to finalize a text entry.

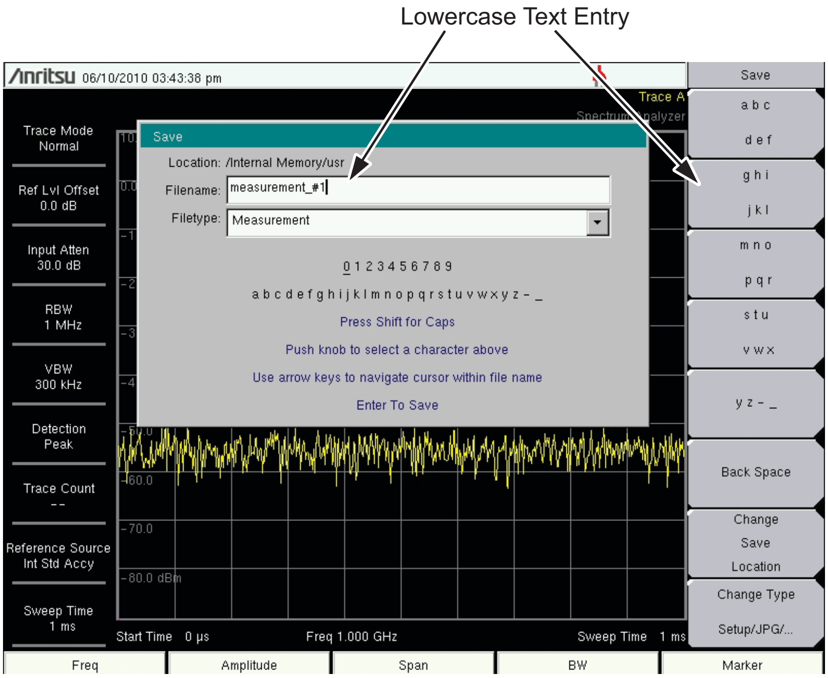


Figure 2-9. Text Entry Menu – Lower Case

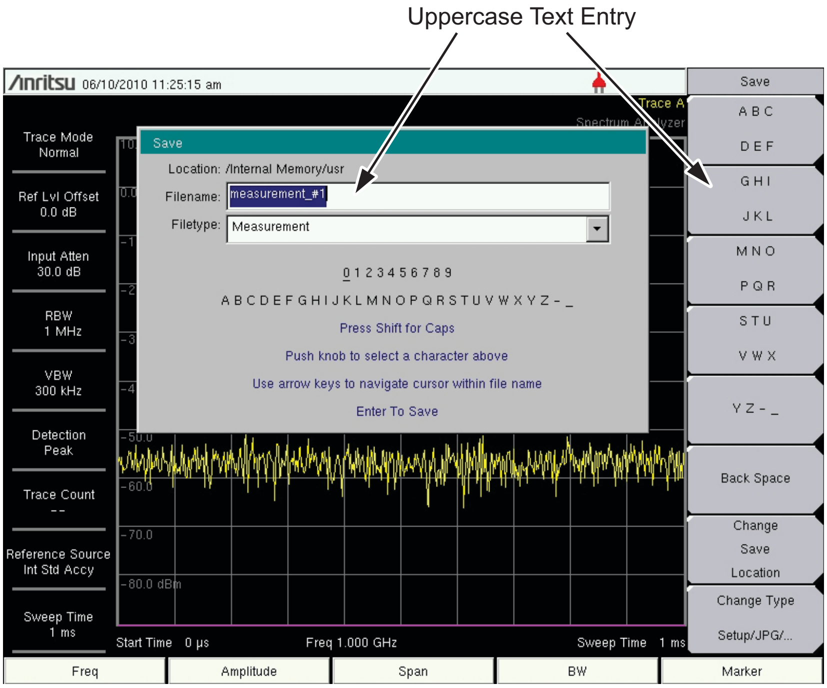


Figure 2-10. Text Entry Menu – Upper Case

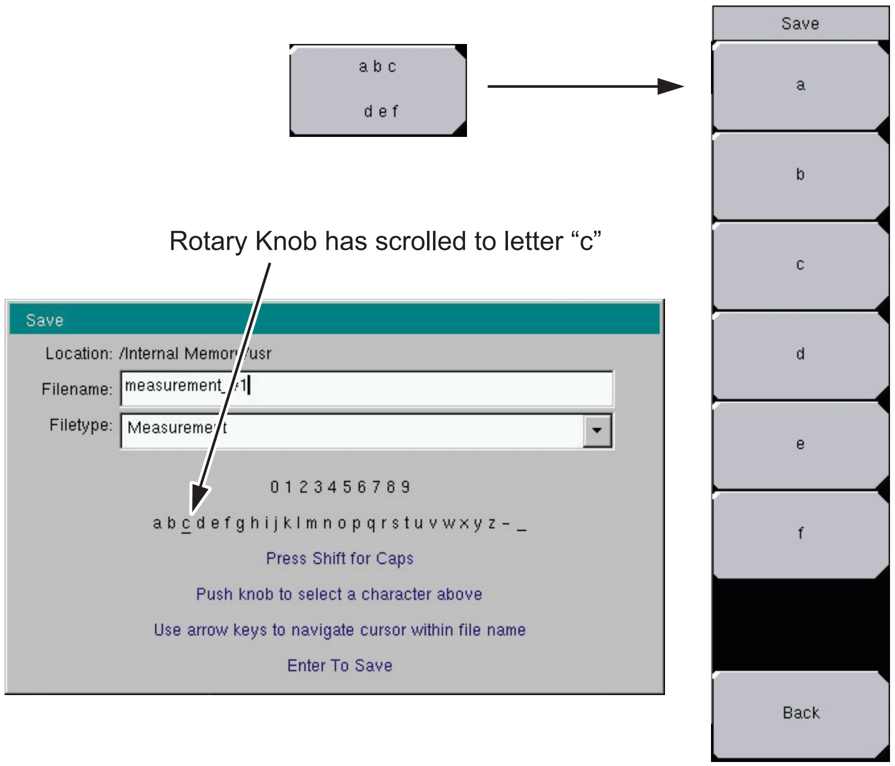


Figure 2-11. Text Entry Menu – Selecting Characters

2-10 Connector Care

Visually inspect connectors for general wear, for cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can damage the instrument. Connection of cables carrying an electrostatic potential, excess power, or excess voltage can damage the connector or the instrument or both. Connection of cables with inadequate torque settings can affect measurement accuracy. Over torquing connectors can damage the cable, the connector, the instrument, or all of these items.

Connecting Procedure

1. Carefully align the connectors.

   The male connector center pin must slip concentrically into the contact fingers of the female connector.

2. Push connectors straight together. Do not twist or screw them together.
3. To tighten, turn the connector nut, not the connector body. Major damage can occur to the center conductor and to the outer conductor if the connector body is twisted.
4. If you use a torque wrench, then initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

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

   Do not over torque the connector.

Disconnecting Procedure

1. If a wrench is needed, then use an open-end wrench to keep the connector body from turning while loosening with a second wrench.
2. Complete the disconnection by hand, turning only the connector nut.
3. Pull the connectors straight apart without twisting or bending.

2-11 Test Panel Connectors

The test panel connectors are shown in Figure 2-12 and Figure 2-13 and are described in the following text.

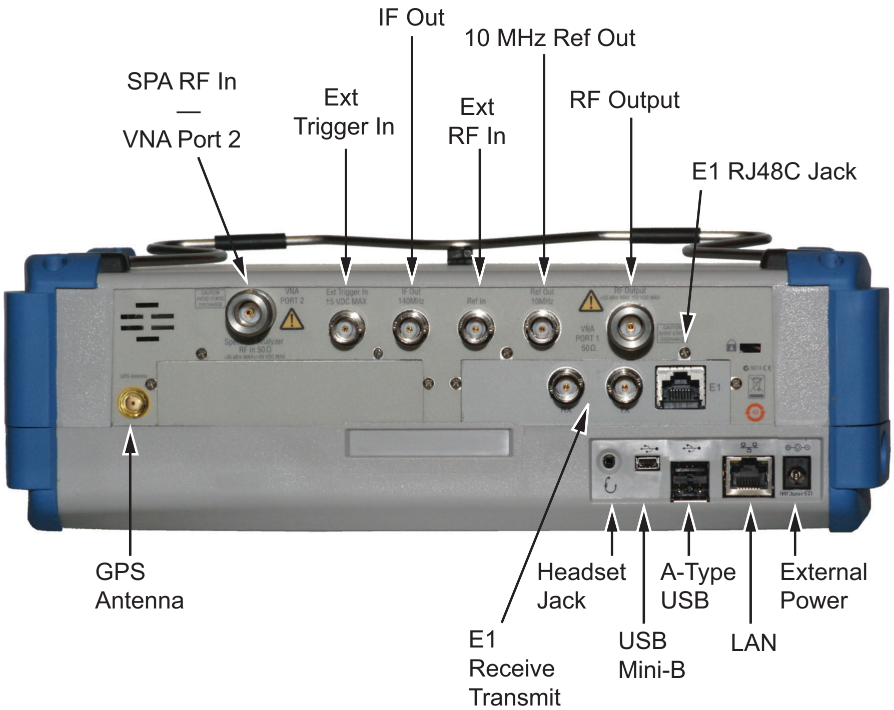


Figure 2-12. Test Panel Connectors, including E1

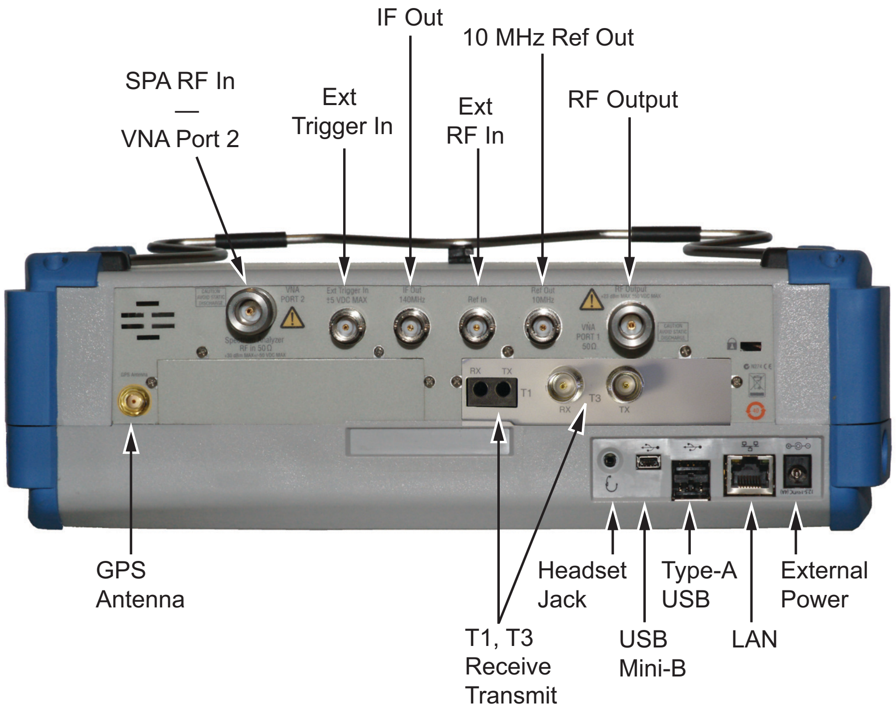


Figure 2-13. Test Panel Connectors, Including T1 and T3

External Power

The external power connector is used to power the unit and for battery charging. Input is 12 VDC to 15 VDC at up to 5.0 A. A green flashing indicator light near the power switch shows that the instrument battery is being charged by the external charging unit. The indicator is steadily illuminated when the battery is fully charged.

Warning	When using the AC-DC Adapter, always use a three-wire power cable that is connected to a three-wire power line outlet. If power is supplied without grounding the equipment in this manner, then the user is at risk of receiving a severe or fatal electric shock.

LAN Connection

The RJ-45 connector is used to connect the BTS Master to a local area network. Integrated into this connector are two LEDs. The amber LED shows the presence of a 10 Mbit/s LAN connection when on, and a 100 Mbit/s LAN connection when off. The green LED flashes to show that LAN traffic is present. For additional information about the LAN connection, Ethernet connection, and DHCP, refer to Appendix C, "Ethernet Configuration".

USB Interface – Type Mini-B

The USB 2.0 interface can be used to connect the MT8221B BTS Master directly to a PC. The first time the MT8221B is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM that shipped with the instrument contains a driver for Windows XP that is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

Note	For proper detection, Master Software Tools should be installed on the PC prior to connecting the BTS Master to the USB port.

USB Interface – Type A

The MT8221B BTS Master can also be a USB Host and allow various USB Flash Memory devices to be connected to the instrument for storing measurements, setups, and files.

Headset Jack

The headset jack provides audio output from the built-in AM/FM/SSB demodulator for testing and troubleshooting wireless communication systems. The jack accepts a 2.5 mm 3-wire miniature phone plug such as those commonly used with cellular telephones.

Ext Trigger In

A TTL signal that is applied to the External Trigger female BNC input connector causes a single sweep to occur. In the Spectrum Analyzer mode, it is used in zero span, and triggering occurs on the rising edge of the signal. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives. This port is also used for External Clock Recovery in T1/T3/E1 operations (described in the Backhaul Measurement Guide). Refer to Appendix A, “Measurement Guides” for reference to the Backhaul Measurement Guide, which also can be found on the documentation disc.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

IF Out 140 MHz

BNC connector for Zero Span IF Output.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

SPA RF In and VNA Port 2

50 Ω Type-N female connector.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

Ref Out 10 MHz

10 MHz Reference Out, BNC, female 50 Ω.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

RF Output and VNA Port 1

RF output, 50 Ω impedance, for reflection measurements. Max input is +23 dBm at ±50 VDC.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

RF In

50 Ω Type-N female connector.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the Type-N connector. Do not overtighten the connector. The recommended torque is 12 lbf ·in to 15 lbf ·in (1.36 N ·m to 1.70 N ·m).

E1, Rx, Tx Connectors

Female BNC connectors for transmit and receive.

To prevent damage to your instrument, do not use pliers or a wrench to tighten the BNC connector. Do not overtighten the connector.

T1, T3, Rx, Tx Connector

BERT tester (Option 51 and Option 53) Bantam jacks for transmit and receive.

GPS Antenna Connector

The GPS antenna connection on the BTS Master is type SMA.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the SMA connector. Do not overtighten the connector. The recommended torque is 8 lbf ·in (0.9 N ·m or 90 N ·cm).

2-12 Symbols and Indicators

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

Cal Status On:

The BTS Master has been calibrated with discrete Open, Short, and Load components.

Cal Status Off:

The BTS Master has not been calibrated.

Battery Symbol:

The battery symbol above the display indicates the charge remaining in the battery. The colored section inside the symbol changes size and color with the charge level.

Figure 2-14. Battery Status

Green with Black Plug body: Battery is fully charged and external power is applied

Green: Battery is 30% to 100% charged

Yellow: Battery is 10% to 30% charged

Red: Battery 0% to 10% charged

Lightning Bolt: Battery is being charged (any color symbol)

When the battery is charging, either from the AC-DC Adapter or the 12 Volt DC adapter, the symbol changes to that shown in Figure 2-15:

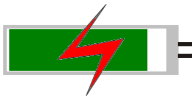


Figure 2-15. Battery Charging Status

The Battery Charge LED (refer to Figure 2-2 on page 2-3) flashes when the battery is charging, and remains on steady when the battery is fully charged.

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

The battery symbol is replaced by a red plug body to indicate that the instrument is running from external power and is not charging the battery (or to indicate that the battery is not present). When the external AC adaptor is connected, the battery automatically receives a charge, and the battery symbol with the lightning bolt is displayed (Figure 2-15). When the battery is not installed, the red plug body is displayed, as shown in Figure 2-16.

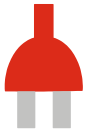


Figure 2-16. Battery Not Installed

Hold

The BTS Master is on hold. To resume sweeping, toggle from Hold to Run in the Sweep menu.

Single Sweep

Single Sweep is selected. Press Continuous sweep to resume sweeping.

2-13 Firmware Overview

Main Menu Keys

The BTS Master menu-driven interface is easy to use and requires little training. The 5 Main Menu keys are located below the measurement display. These 5 keys are used to list function-specific menus in the active menu (submenu labels). These Main Menu keys vary in function based on the selected mode of operation (**Shift, Mode** (9)). Refer to "Mode Selector Menu" on page 2-6 for more information on changing the instrument mode. Table 2-1 lists the Main Menu Key labels for each mode of instrument operation.

Table 2-1. Mode-Dependent Main Menu Keys Located Below Measurement display

Mode	Key 1	Key 2	Key 3	Key 4	Key 5
Cable & Antenna	Freq/Dist	Amplitude	Sweep/Setup	Measurements	Marker
Spectrum Analyzer	Freq	Amplitude	Span	BW	Marker
Interference Analysis	Freq	Amplitude	BW	Measurements	Marker
Channel Scanner	Scanner	Amplitude	Custom Scan	Measurements	
Vector Signal Generator	Freq	Amplitude	Setup	Modulation	RF On/Off
Power Meter	Freq	Amplitude	Average		Limits
High Accuracy Power Meter		Amplitude	Average	Zero/Cal	Limit
GSM/GPRS/EDGE	Freq	Amplitude	Setup	Measurements	Marker
WCDMA/HSDPA	Freq	Amplitude	Setup	Measurements	Marker
TD-SCDMA/HSDPA	Freq	Amplitude	Setup	Measurements	
CDMA	Freq	Amplitude	Setup	Measurements	Marker
EVDO	Freq	Amplitude	Setup	Measurements	Marker

Table 2-1. Mode-Dependent Main Menu Keys Located Below Measurement display

Mode	Key 1	Key 2	Key 3	Key 4	Key 5
Fixed WiMAX	Freq	Amplitude	Setup	Measurements	
Mobile WiMAX	Freq	Amplitude	Setup	Measurements	Marker
T1/FT1, E1, T3/T1/FT1	Configuration	Pattern/Loop	Error/Alarm	Measurements	Start/Stop

Submenu Keys

The 8 submenu keys are located to the right of the measurement display. They change function depending upon the current mode and current menu selection. The current submenu title is shown at the top of the active function block (submenu key labels). Refer to Figure 2-2 on page 2-3.

Chapter 3 — Basic Measurement Setups

3-1 Introduction

This chapter provides a brief overview of the Anritsu MT8221B BTS Master. The intent of this chapter is to provide a starting point for making basic measurement setups. This chapter describes setup, configure frequency, bandwidth, and amplitude before configuring your measurement setups. After measurements are taken, refer to section “Managing Files” on page 4-1 for a description of saving, recalling, and deleting measurement files. For more detailed information about specific measurements, refer to the measurement descriptions in the measurement guides for the specific instrument mode and analyzer technology (such as WiMAX or 3GPP). Refer to Appendix A, “Measurement Guides”, for a list of these guides and their Anritsu part numbers.

3-2 Measurement Setup

Connect the Input Source

Connect the input signal or antenna to the appropriate test connector on the top of the instrument. For connector descriptions, refer to Figure 2-12 on page 2-15.

Editing and Entering Values

- Parameter values that are ready for editing are displayed in red on the submenu key. After changing the value, press **Enter** to set the new value.
- Some submenu keys have toggled parameter values (On / Off, Low / High). On these submenu keys the current value is underlined. Press the submenu key to toggle the value.
- Use the arrow keys, numeric keypad, or rotary knob to change submenu key values, to select list box options, or to enter filenames.

Selecting the Analyzer Mode

1. Press the **Shift** key followed by pressing the **Mode** (9) key on the numeric keypad to open the Mode Selector list box.
2. Use the directional arrow keys or the rotary knob to highlight the desired mode, and press the **Enter** key or the rotary knob to select.

3-3 Set the Measurement Frequency

Using Start and Stop Frequencies

1. Press the **Freq** main menu key. In Cable & Antenna Analyzer mode, press the **Freq/Dist** main menu key.
2. Press the Start Freq submenu key.
3. Enter the desired start frequency. When entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.
4. Press the Stop Freq submenu key.
5. Enter the desired stop frequency.

Entering Center Frequency

1. Press the **Freq** main menu key.
2. Press the Center Freq submenu key.
3. Enter the desired center frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.

The current setting is shown at the top of the instrument settings summary column on the left side of the measurement display.

Selecting Signal Standard

1. Press the **Freq** main menu key.
2. Press the Signal Standard submenu key. The Signal Standards dialog opens.
3. Highlight a signal standard and press **Enter** or the rotary knob to select.
4. Press the Channel submenu key to change the channel value in the Channel Editor.

Note	The signal standards list on your BTS Master can be updated via Master Software Tools.

Setting Measurement Frequency Bandwidth

Spectrum Analyzer and Interference Analysis Mode

1. Press the **BW** main menu key to display the BW menu.
    - Press the RBW or the VBW submenu key (or both) to manually change values.
    - Set RBW and VBW automatically by pressing the Auto RBW submenu key or the Auto VBW submenu key.
2. Press the RBW/VBW submenu key to change the resolution bandwidth and video bandwidth ratio.
3. Press the Span/RBW submenu key to change the span width to resolution bandwidth ratio.

3-4 Set the Amplitude

Press the **Amplitude** main menu key to display the Amplitude menu.

Setting Amplitude Reference Level and Scale

Spectrum Analyzer and Interference Analysis Modes

Note	To change the current measurement units, press the Units submenu key and select the required units from the submenu keys that are presented. Press the Back submenu key to return to the Amplitude menu.

1. Press the Reference Level submenu key and use the **Up/Down** arrow keys or the keypad to change the reference level. Press **Enter** to set the reference level value.
2. Press the Scale submenu key and use the **Up/Down** arrow keys or the keypad to enter the desired scale. Press **Enter** to set the scale value.

Note	The Scale parameter cannot be changed when linear units are selected (Watts or Volts). Press the Amplitude submenu key and select Auto Atten coupling of the attenuator setting and the reference level to help ensure that harmonics and spurs are not introduced into the measurements. Attenuator Functions are described in the Spectrum Analyzer Measurement Guide.

Setting Amplitude Range and Scale

Note	This setting applies to most demodulator modes of instrument operation. The Spectrum Analyzer and Cable and Antenna Analyzer modes have no equivalent to Auto Range. For other analyzer modes, consult the individual measurement guides. Refer to Appendix A, “Measurement Guides”.

1. Press the Adjust Range submenu key to set an optimal reference level based on the measured signal.

Note	To have the instrument continually set the optimal reference level, press the Auto Range submenu key so that On is selected.

2. Press the Scale submenu key.
3. Enter the desired scale units by using the keypad, the arrow keys, or the rotary knob. Press the **Enter** key to set. The y-axis scale is automatically renumbered.

Power Offset Set Up for Compensating External Loss

To obtain accurate results, compensate for any external attenuation by using power offset. In power offset mode, the compensation factor is in dB. (External attenuation can be created by using an external cable or an external high power attenuator.)

Press the **Power Offset** submenu key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. When using the rotary knob, the value changes in increments of 0.1 dB. Using the **Left/Right** arrow keys changes the value in increments of 1.0 dB. When using the **Up/Down** arrow keys, the value changes in increments of 10.0 dB. When using the keypad, enter the new value then press **Enter** or the dB submenu key to set the value. The power offset is displayed in the instrument settings summary column on the left side of the measurement display.

3-5 Set the Span

Spectrum Analyzer, Interference Analysis, and Power Meter Modes

1. Press the **Span** main menu key or the **Freq** main menu key followed by the Span submenu key.
2. To select full span, press the Full Span submenu key. Selecting full span overrides any previously set Start and Stop frequencies.
3. For a single frequency measurement, press the Zero Span submenu key.

Note	To quickly move the span value up or down, press the Span Up 1-2-5 or Span Down 1-2-5 submenu keys These keys facilitate a zoom-in, zoom-out feature in a 1-2-5 sequence.

3-6 Setting Up Limit Lines

Press the **Shift** key then the **Limit** (6) key on the numeric keypad to display the Limit menu.

Single Limit Line

Spectrum Analyzer and Interference Analysis Modes

1. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
2. Activate the selected limit line by pressing the On Off submenu key so that On is underlined.
3. Press the Limit Move submenu key to display the Limit Move menu. Press the Move Limit submenu key to change the dBm level of the limit line.
4. Press the Back submenu key to return to the Limit menu.
5. If necessary, press the Set Default Limit submenu key to redraw the limit line in view.

Cable and Antenna Mode

1. Press the **Shift** key followed by the **Limit** main menu key to list the Limit menu.
2. Activate the limit line by pressing the Limit On Off submenu key so On is underlined. The limit line is displayed on the graph.
3. Press the Single Limit submenu key to change the location of the limit line on the y-axis.
4. If necessary, press the Set Default Limit submenu key to display the limit line.

Segmented Limit Lines

Spectrum Analyzer and Interference Analysis Modes

Initial Setup:

1. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
2. Activate the selected limit line by pressing the On Off submenu key so that On is underlined.
3. Press the Limit Move submenu key to display the Limit Move menu.

Creating a Sample Segmented Limit Line:

4. Press the Move Limit submenu key and use the number keys to enter a limit value of 12 dB. The limit value can also be moved by using the arrow keys or the rotary knob. Press the Back submenu key to return to the Limit menu.
5. Press the Limit Edit submenu key to display the Edit menu.
6. Press the Add Point submenu key.
7. Press the Frequency submenu key and enter 1400 MHz.
8. Press the Add Point submenu key
9. Press the Frequency submenu key and enter 1600 MHz.
10. Press the Amplitude submenu key and enter 15 dB.
11. Press the Add Point submenu key.

12. Press the Frequency submenu key and enter 2000 MHz.
13. Press the Amplitude submenu key and enter 15 dB.

Cable and Antenna Mode

1. Press the **Shift** key followed by the **Limit** main menu key to list the Limit menu.
2. Activate the limit line by pressing the Limit On Off submenu key so that On is underlined. The limit line is displayed on the graph.
3. Press the Multi-Segment Edit submenu key to create a multi-segmented limit line.
4. Highlight the left point on the limit line before adding the first point using the Next Point Left submenu key.
5. Press the Add Point submenu key to place a new point on the limit line. Use the Point Freq and Point Value submenu keys to set the frequency and dB level of the point.
6. Repeat step 5 until the desired number of points have been added.

Limit Line Envelope

Spectrum Analyzer and Interference Analysis Modes

1. Complete step 1 through step 4 in the procedure for Setting Up Non-Segmented Limit Lines.
2. Press the Limit (Upper / Lower) submenu key to select the desired limit line for use in creating an envelope.
3. Press the Limit Envelope submenu key to display the Limit Envelope menu.
4. Press the Create Envelope submenu key to create an envelope around the measurement.
5. Press Upper Points or Lower Points submenu key to change the number of segments in the envelope.

3-7 Setting Up Markers

Press the **Marker** main menu key to display the Marker menu.

Selecting, Activating, and Placing a Marker

1. Press the Marker 1 2 3 4 5 6 submenu key so that the desired marker number is underlined. Each press of the Marker key selects the next higher number (cycling from 6 back to 1 again). Press **Shift**, then the Marker key to backward through the marker list.
2. Press the On Off submenu key so that On is underlined. The selected marker is displayed in red, ready to be moved.
3. Use the rotary knob to place the marker on the desired frequency.
4. Repeat Step 1 and Step 2 to activate and move multiple markers.

Selecting, Activating, and Placing a Delta Marker:

1. Press the Marker 1 2 3 4 5 6 submenu key so that the desired delta marker number is underlined.
2. Press the Delta On Off submenu key so that On is underlined. The selected marker is displayed in red, ready to be moved.
3. Use the rotary knob to place the delta marker on the desired frequency.
4. Repeat Step 1 and Step 2 to activate and move multiple markers.

Viewing Marker Data in a Table Format

1. Press the More submenu key.
2. Press the Marker Table submenu key so that On is underlined. All markers and delta marker data are displayed in a table under the measurement graph.

Chapter 4 — File Management

4-1 Introduction

This chapter will review the file management features of the BTS Master and detail the **File** menu. The submenus under this menu allow the user to save, recall, copy, and delete files in internal memory or an external USB flash drive.

4-2 Managing Files

Press the **Shift** key then the **File** (7) key on the numeric keypad to list the **File** menu. Follow the additional steps below.

Note	When navigating through the **File** menu, pressing the **Esc** key will return to the previous menu.

Save Files

Set the Save Location

Press Save then the Change Save Location submenu keys and select the location to save files. You can save files to the internal memory or to an external USB flash drive. You can also create new folders. If an external USB flash drive is connected or disconnected, press Refresh Directories to update the location tree. Press the Set Location key to store the save location.

Save Measurement As

The Save Measurement As key is used to quickly save measurements with a specific file name. The BTS Master saves the measurement with the latest file name that was used to save a measurement and with a number that is automatically incremented and appended to the end of the file name. For instance, if the last measurement was saved with the name Site 1 Trace, Save Measurement As saves the next measurement as Site 1 Trace_#1, Site 1 Trace_#2, etc. The file name used can be changed using the "Save Menu" on page 4-7.

Save a Measurement

Press the Save Measurement key and enter the name for the measurement file. The file type will default to measurement and the appropriate extension will be added based on the current measurement mode.

Save a Setup

Press the Save submenu key, type a name for the setup file, confirm that the file type is Setup using the Change Type key and press **Enter** to save.

Save a Measurement Screen as JPEG

Press the Save submenu key, type a name for the JPEG file, confirm that the file type is Jpeg using the Change Type key and press **Enter** to save.

Recall Files

The recall menu enables you to view all the Measurement and Setup files in the internal memory and external USB flash drive.

You can sort the recall menu by name, date, or type. You can also select to view only measurement files or setup files by pressing File Type on the Recall dialog box and selecting the file type you want to view.

Recall a Measurement

From the **File** menu, press the Recall Measurement submenu key, select the measurement with the rotary knob or the **Up/Down** arrow keys and press **Enter**.

Recall a Setup

Press the Recall submenu key. Confirm that the file type is Setup or All using the File Type key. Select the setup file (.stp) with the rotary knob or the **Up/Down** arrow keys and press **Enter**.

Recall Dialog Box

The Recall dialog box (Figure 4-1) will open previously saved measurements and setups. See the "Recall Menu" on page 4-10 for additional information.

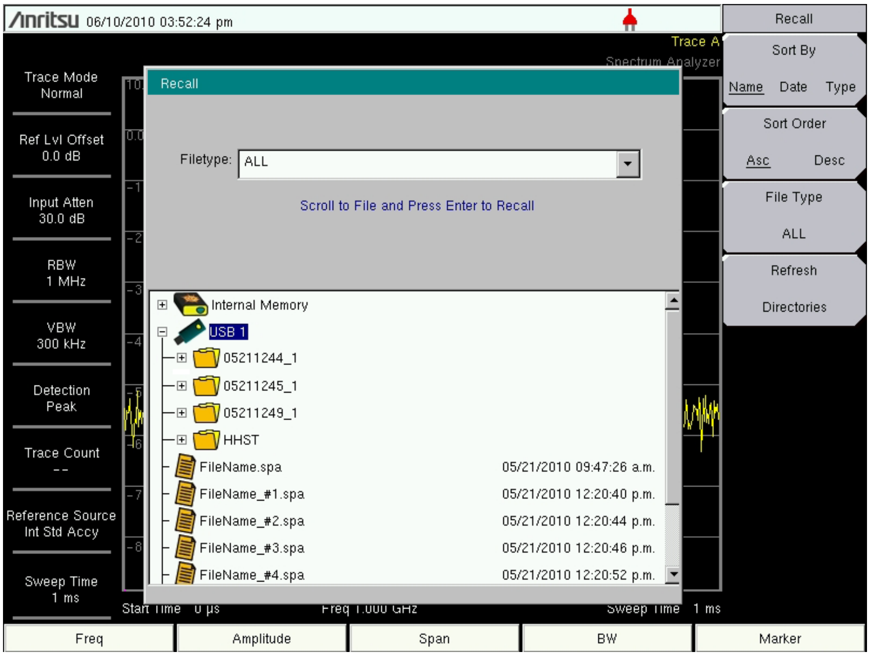


Figure 4-1. Recall Dialog Box

Copying Files

The steps below detail copying a file from internal memory to an external flash drive. Select the files to copy in the top window and the location for the files to be copied to in the bottom window (Figure 4-2). Refer to the "Copy Menu" on page 4-11 for additional information.

1. Insert a USB drive into either USB Type A port of the BTS Master.
2. From the **File** main menu, press the Copy submenu key. The Copy submenu and Copy dialog box are displayed.
3. Select the file(s) to copy. To select multiple files, highlight the first then press the Select or De-Select key to keep the file selected. The file will be outlined in blue. Repeat with all the files to copy. To display files in a folder, select the folder and press the **Enter** key.
4. Press the Scroll key and highlight the USB drive in the lower window using the **Up/Down** arrow keys. The Scroll submenu key toggles between Src (top window) and Dst (bottom window).
5. Press the Copy key to copy the files to the flash drive.

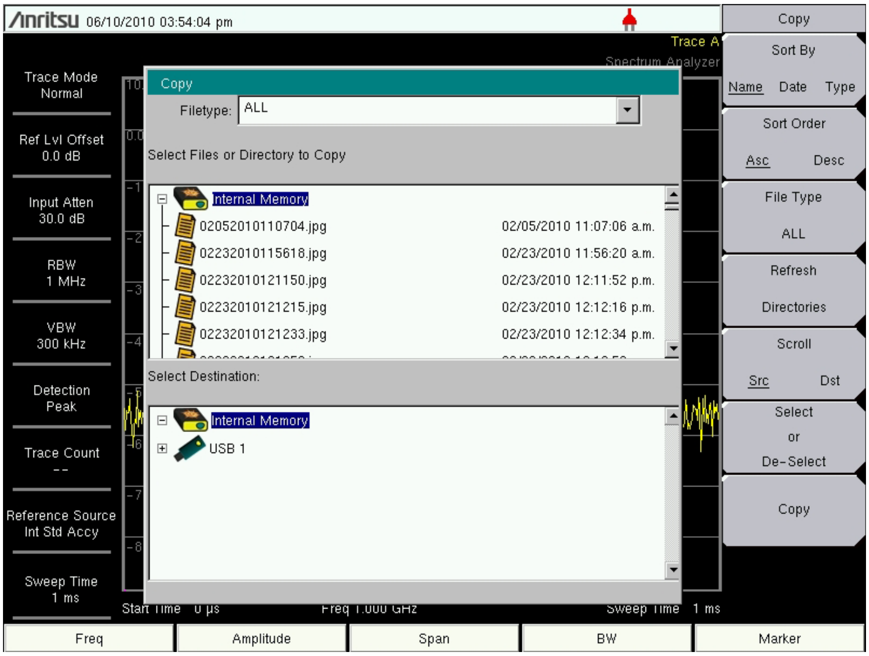


Figure 4-2. Copy Dialog Box

Deleting Files

Delete a Selected File or Files

Press the Delete submenu key. Highlight the file to be deleted with the **Up/Down** arrow keys. Press the Select or De-Select key. The file will be highlighted in blue when selected. Press the Delete key and **Enter** to delete the selected file.

Delete Dialog Box

Press the Delete submenu key to open the Delete dialog box (Figure 4-3). The submenus allow sorting by file type, name and saved date. See the “Delete Menu” on page 4-12 for additional information.

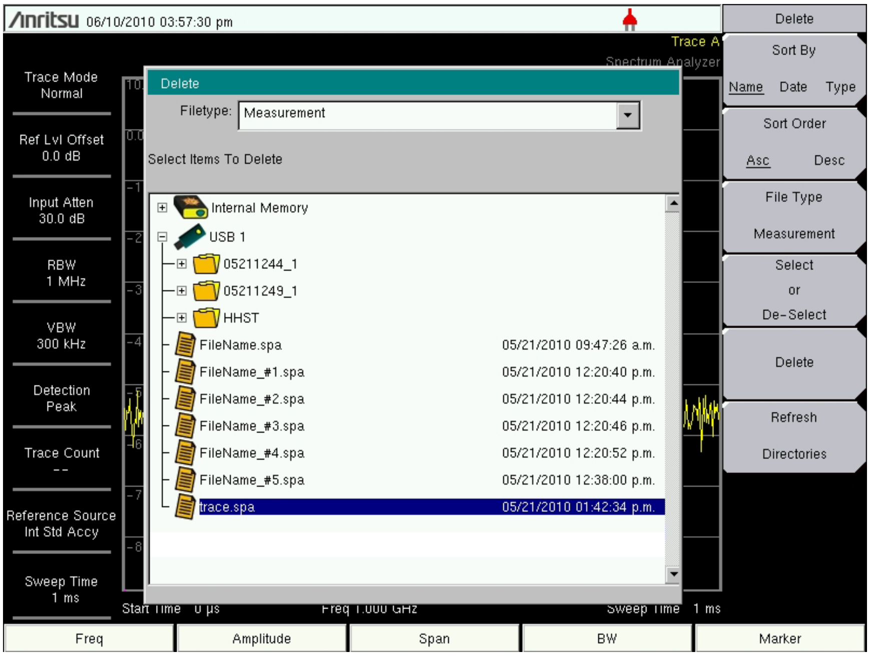


Figure 4-3. Delete Dialog Box

4-3 File Menu Overview

Open this menu by pressing the **Shift** key, then the **File** (7) key.

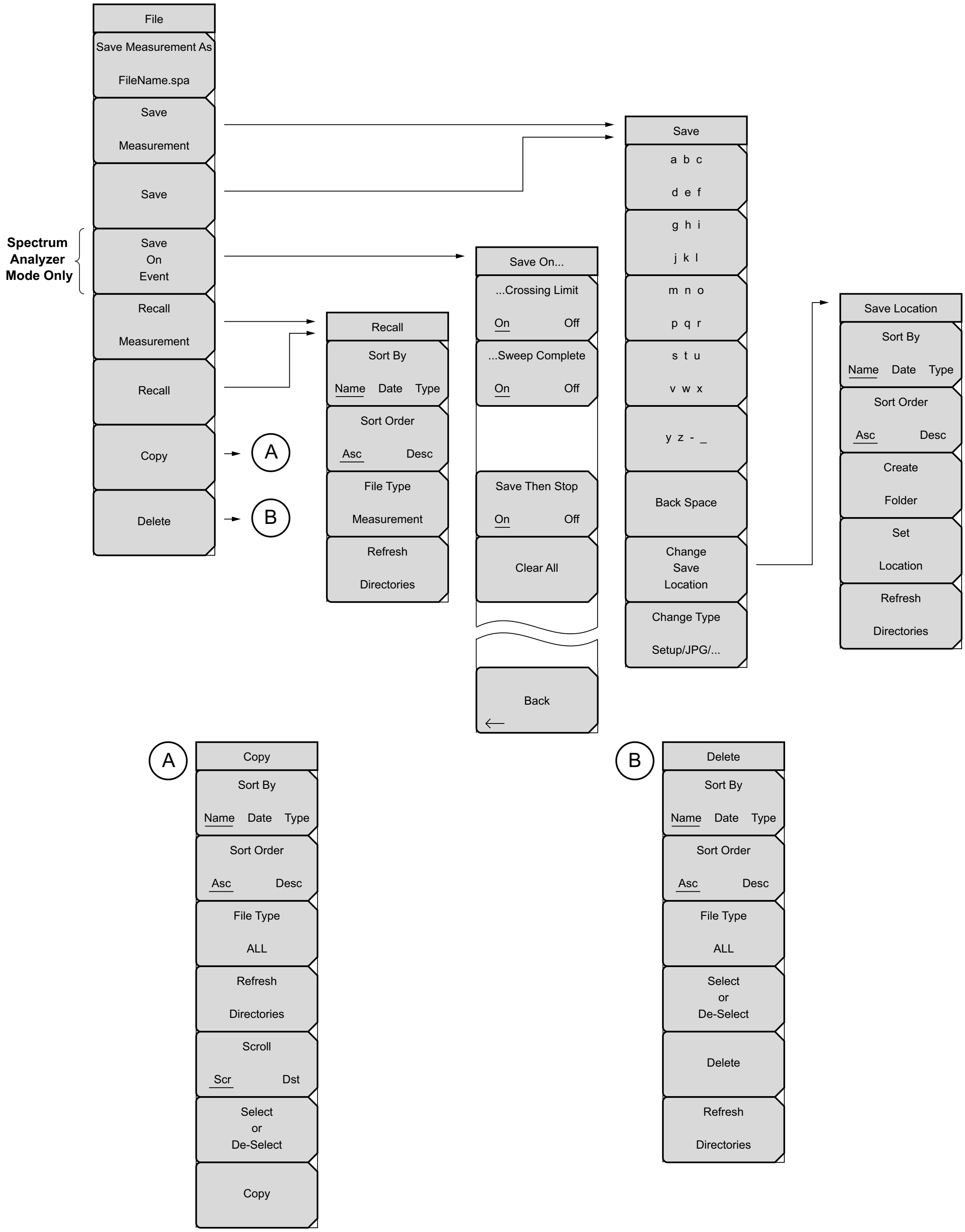
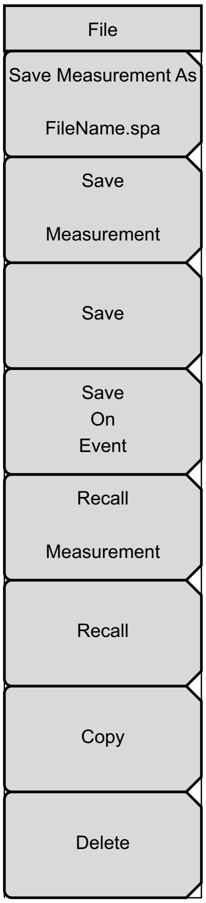


Figure 4-4. File Menu

4-4 File Menu

Key Sequence: **File**



Save Measurement As: This key will save the current setup with a user defined file name. The default file name is changed using the Save submenu. To change the default file name, press the Save Measurement submenu key to open the Save dialog box. Enter the new measurement filename with the letter keys. Refer to “Save Menu” on page 4-7. Press **Enter** to save the name and return to the File menu. The Save Measurement As submenu key displays the new entered name appended with _#1.spa. After a few seconds the screen with return to File menu. Press the Save Measurement As key again and the new file name will be used. Measurement files names have a .spa extension.

Save Measurement: Press this submenu key to display the “Save Menu” on page 4-7 and Save dialog box. Measurements can be saved to internal memory or to a USB flash drive. The saved measurement can be named using the text entry keys. By default, measurements are saved in a directory named /user to internal memory. The save destination is set with the “Save Location Menu” on page 4-8.

Save: Press this submenu key to display the “Save Menu” on page 4-7. Measurements can be saved to internal memory or to a USB flash drive. The BTS Master is shipped with an Anritsu-approved USB flash drive for external data storage. (Refer to the BTS Master Technical Data Sheet listed in Appendix A for the Anritsu Part Number of the USB flash drive).
The saved setup, measurement or JPEG file can be named by using the text entry keys. By default, measurements are saved in a directory named /user to internal memory. The save destination is set with the “Save Location Menu” on page 4-8.

Save on Event (Spectrum Analyzer mode only)**:** Press this submenu key to display the “Save On Event Menu” on page 4-9.

Recall Measurement: Press this submenu key to display the “Recall Menu” on page 4-10. This menu is for recalling measurements from internal memory or a USB flash drive.

Recall: Press this submenu key to display the “Recall Menu” on page 4-10. This menu is for recalling measurement or setup data from internal memory or a USB flash drive.

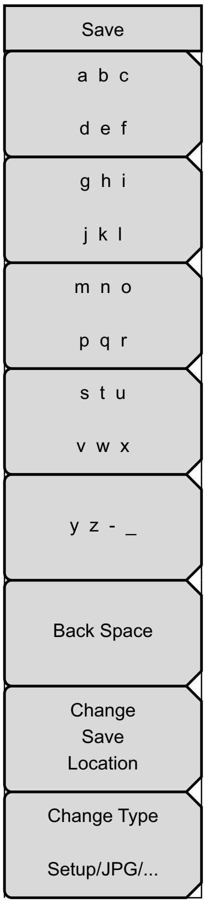
Copy: Press this submenu key to display the “Copy Menu” on page 4-11. This submenu is for copying files or folders from internal memory or a USB flash drive.

Delete: Press this submenu key to display the “Delete Menu” on page 4-12 and a selection box that shows the setup and measurement names, the type and the date and time that the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file that is to be deleted and press the Delete submenu key, then **Enter**. Press the **Esc** key to cancel the operation. Note that deleted files can not be recovered.

Figure 4-5. File Menu

Save Menu

Key Sequence: **File** > Save



Text Entry Keys: The top 5 keys are for text entry. The submenu keys for Text Entry displays the characters (alphabet, hyphen, and underscore). Press the a b c / d e f submenu key (for example) to open another submenu with a separate key for each of these letters. Characters can be entered by using the rotary knob or by using the submenu keys.

The rotary knob scrolls through the characters in a pop-up window and pressing the rotary knob enters a character. The menu returns to the complete character set after each individual letter is entered.

Use the arrow keys to navigate within a name or character string. Use the **Shift** key for capital letters. Press the **Enter** key or the rotary knob to finalize a text entry.

Back Space: Use this key to delete a file name highlighted in blue or delete individual characters.

Change Save Location: Press this submenu key to open the "Save Location Menu".

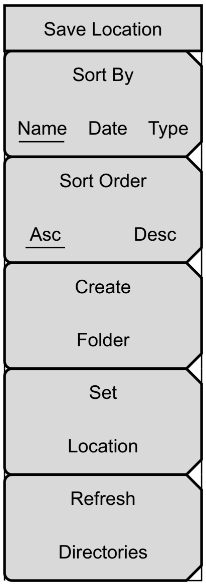
Change Type: Press this submenu key to select what type of file is saved. The options are the Measurement, Setup, or Jpeg. The file type can be changed with the **Up/Down** keys or the rotary knob.

> **Setup (.stp):** Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.
>
> **Measurement (.spa):** Contains the measurement data and opens with Master Software Tools.
>
> **Jpeg (.jpg):** Jpeg files contain a screen capture of the display.
>
> **Limit Lines (.lim):** The Limit line file contains limit line data details.

Figure 4-6. Save Menu

Save Location Menu

Key Sequence: **File** > Save > Change Save Location



This menu and dialog box is used to create folders and select where the BTS Master will save the current file. Select folders or drives with the **Up/Down** keys or the rotary knob.

Note: Only folders (not files) are visible in the Save Location dialog box. To view files, use the "Recall Menu" on page 4-10.

Sort By: Press this submenu key to sort the folders by Name, Type, or Date.

Sort Order: Displays the folder names in ascending or descending order .

Create Folder: This key will create a new folder in the highlighted location or folder. The create directory dialog box will display for naming the folder.

Set Location: This key will set the current location for saving files and return to the "Save Menu" on page 4-7.

Refresh Directories: Press this key to update the display.

Figure 4-7. Save Location Menu

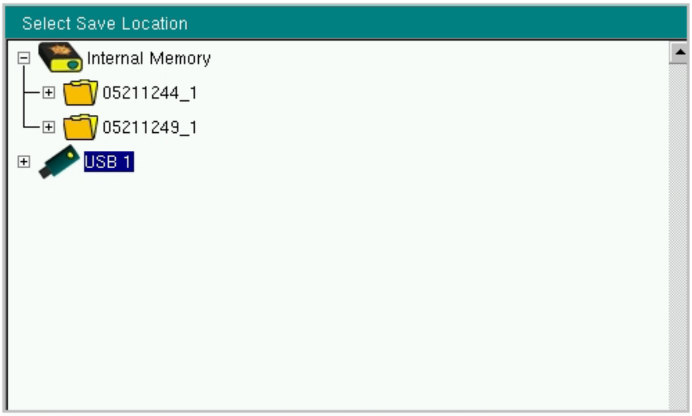
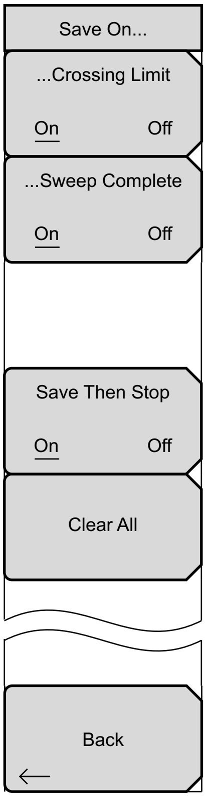


Figure 4-8. Select Save Location Dialog Box

Save On Event Menu

Key Sequence: **File** > Save On Event



This menu is used to auto save measurements to internal memory after:

...Crossing Limit: Toggling this submenu key to On will save the measurement to internal memory when the measurement has crossed a defined limit line created with the **Limit** menu.

...Sweep Complete: Toggling this submenu key to On will save the measurement to internal memory after the current sweep is complete. If Save Then Stop is toggled Off, a measurement will be saved after every sweep.

Save Then Stop: Set this key to On to stop the sweep after a measurement is saved. With this key Off and Sweep Complete On a measurement is saved after every sweep.

Clear All: Pressing this key will turn Off the three save on event keys:

Crossing Limit

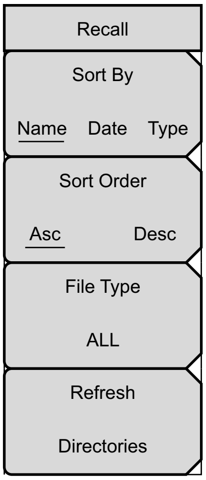
Sweep Complete

Save Then Stop

Figure 4-9. Save On Menu

Recall Menu

Key Sequence: **File** > Recall



This menu and dialog box is used to create folders and select where the BTS Master will save the current file. Select folders or drives with the **Up/Down** keys or the rotary knob.

Sort By: Press this submenu key to sort file and folders by the file name, by the type of file, or by the date that the file or folder was saved.

Sort Order: Displays the folder or file in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select what type of file is viewed. The options are the ALL, Measurement, or Setup. The file type can be changed with the **Up/Down** keys or the rotary knob. Press **Enter** to make the selection.

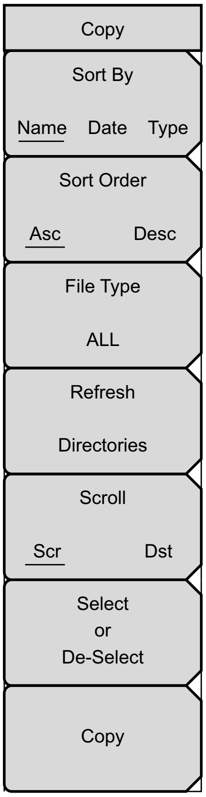
> **Setup:** Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.
>
> **Measurement:** Measurement files contain all of the information in the setup files and the measurement data.
>
> **Limit Lines (.lim):** The Limit line file contains limit line data details.
>
> **ALL:** Displays all file types.

Refresh Directories: Press this key to update the display.

Figure 4-10. Recall Menu

Copy Menu

Key Sequence: **File** > Copy



This menu and dialog box is used to copy folders and files. Select folders or files with the **Up/Down** keys or the rotary knob. Figure 4-2 on page 4-3 shows the Copy dialog box with two Jpeg images and one folder (including the folder's contents) selected and ready to be copied to the USB flash drive. Highlight a folder and press **Enter** to view the contents.

Sort By: Press this submenu key to sort file and folder lists by name, by type of file, or by the date that the file was saved.

Sort Order: Displays the folder or file in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select what type of file to view for copying. The options are: ALL, Measurement, Setup, or Jpeg. The file type can be changed with the **Up/Down** keys or the rotary knob. Press **Enter** to make the selection.

Refresh Directories: Press this key to update the display.

Scroll: Press this submenu key to use the scroll function in the Source Folder (Scr - top panel) or Destination Folder (Dst - bottom panel). See Figure 4-2.

Note: Previously saved files are not visible in this window.

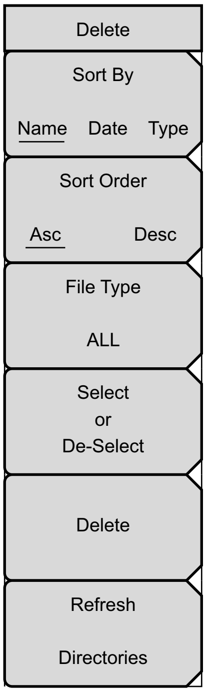
Select or De-Select: Use this key to select or deselect the file(s) or folder(s) to be copied. When selected, a file or folder will be outlined in blue, see Figure 4-2.

Copy: Copies the files or folders selected in the top window to the destination selected in the bottom window. A dialog box will display showing when the copying is complete. If a file with the same name exists in the destination folder a warning box will display to allow file overwrite or to cancel.

Figure 4-11. Copy Menu

Delete Menu

Key Sequence: **File** > Delete



This menu and dialog box is used to delete folders and files. Select folders or files with the **Up/Down** keys or the rotary knob.

Sort By: Press this submenu key to sort files and folders by name, by the type of file, or by the date that the file or folder was saved.

Sort Order: Displays the folder or file in ascending or descending order based on the selection in the Sort By key.

File Type: Press this submenu key to select what type of file view for deleting. The options are the ALL, Measurement, Setup, Limit Lines, or Jpeg. The file type can be changed with the **Up/Down** keys or the rotary knob. Press **Enter** to make the selection.

Select or De-Select: Use this key to select or deselect the file(s) or folder(s) to be deleted. When selected, a file or folder will be outlined in blue.

Delete: Press this key to open the Delete dialog box. Press **Enter** to delete the selected item or **Esc** to Cancel.

Refresh Directories: Press this key to update the display.

Figure 4-12. Delete Menu

Chapter 5 — System Operation

5-1 Introduction

This chapter will review the BTS Master system operations.

- “System Menu Overview” on page 5-2
- “System Menu” on page 5-3
- “Preset Menu” on page 5-7
- “Self Test” on page 5-7
- “Update Firmware” on page 5-8

The other menus (Sweep Measure Trace and Limit) are detailed in the Measurement Guides listed in Appendix A.

5-2 System Menu Overview

To access the functions under the System menu, select the **Shift** key, then the **System** (8) key. Menu maps typically display all possible submenu keys, although some keys are displayed on the instrument only under special circumstances (refer to menu descriptions).

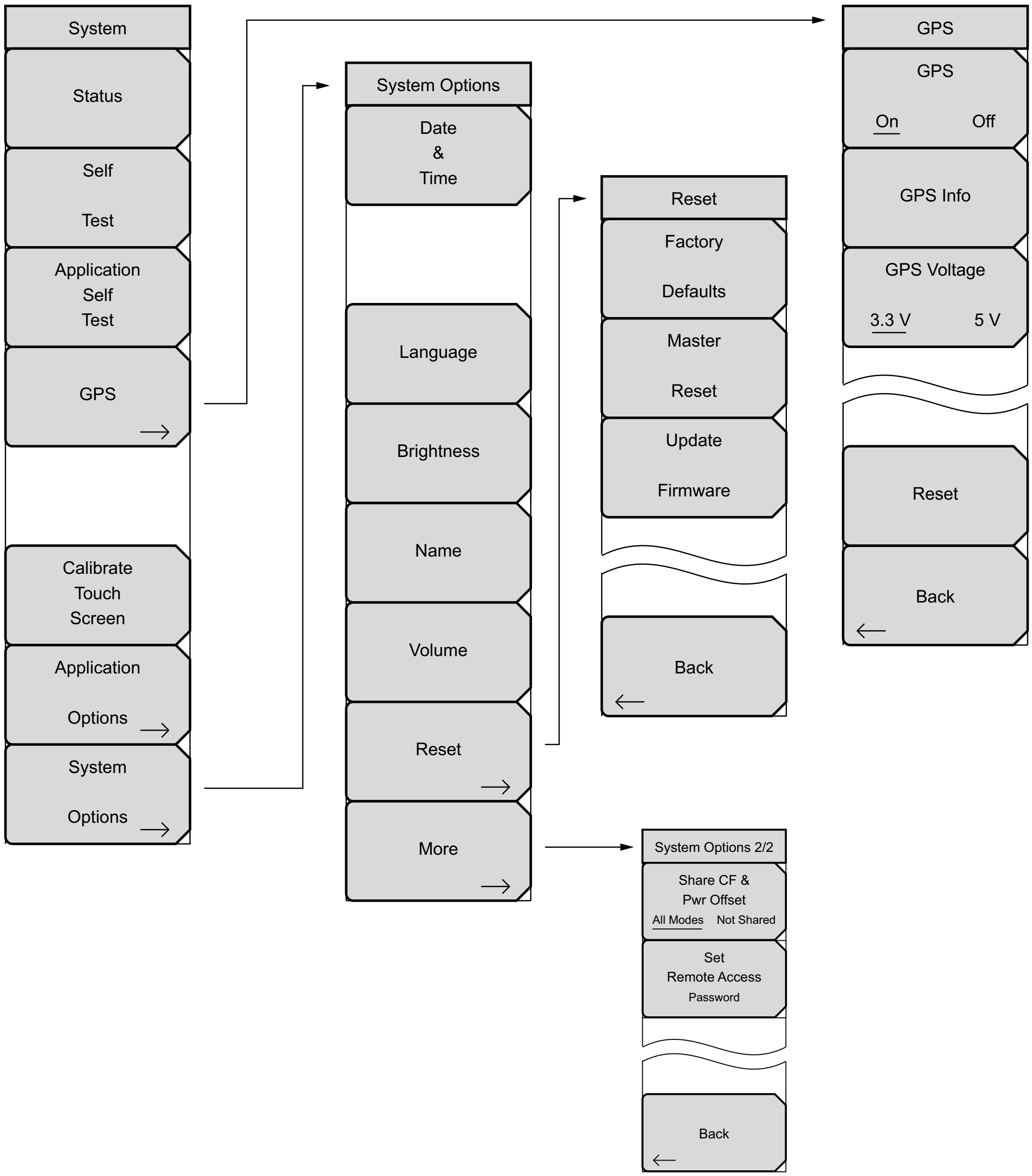
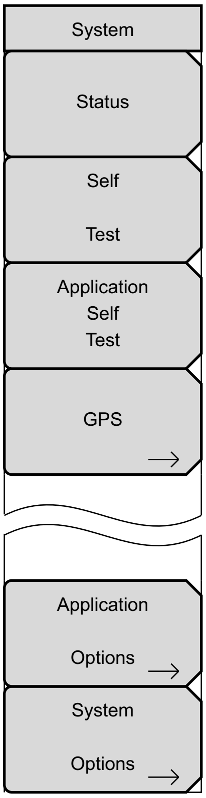


Figure 5-1. System Menus

5-3 System Menu

Key Sequence: **System** (8)



Status: Press this submenu key to display the current system status, including the operating system and firmware versions, temperatures, and other details such as current battery information. Press **Esc** or **Enter** to return to normal operation.

Self Test: Press this submenu key to run a series of tests that are related to the performance of the motherboard hardware. Press the **Esc** key to abort, or press the **Enter** key to continue. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification.

If the Self Test fails when the battery is fully charged and the instrument is within the specified operating temperature, then contact your Anritsu Service Center (refer to "Contacting Anritsu" on page 1-1) and report the test results. Press **Esc** or **Enter** to return to normal operation.

Application Self Test: Press this submenu key to run a series of tests that are related to the performance of the instrument hardware and that are specific to the current instrument application (refer to "Mode Selector Menu" on page 2-6). Press the **Esc** key to abort, or press the **Enter** key to continue. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification. If any test fails, then contact your Anritsu Service Center and report the test results (refer to "Contacting Anritsu" on page 1-1).

Some of the hardware that is tested may also be used in different operating modes. One or more additional submenu keys may be displayed to allow running additional application self tests. For example, in model MS2721B with Option-20 (Tracking Generator), when the test results are displayed, a TG Self Test submenu key is provided for an additional test.

GPS: Press this submenu key to open the "GPS Menu" on page 6-4. Refer to Chapter 6, "GPS (Option 31)" for additional information.

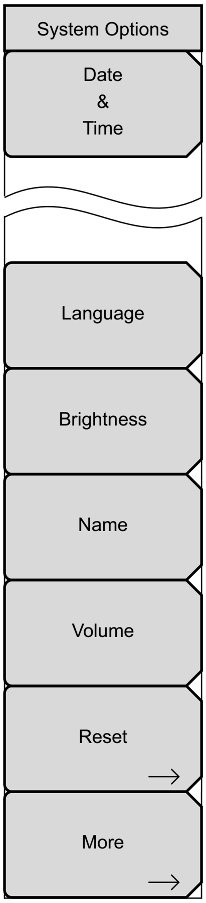
Application Options: Submenu keys are specific to each measurement mode. Please refer to a specific Measurement Guides listed in Appendix A.

System Options: Press this submenu key to open the "System Options Menu" on page 5-4.

Figure 5-2. System Menu

System Options Menu

Key Sequence: **Shift**, **System** (8) > System Options



Date & Time: Press this submenu key to display a dialog box for setting the current date and time. Use the submenu keys or the **Left/Right** arrow keys to select the field to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to select the date and time. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Ethernet Config: Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box to set the IP address of the instrument. For details, refer to section “Ethernet Configuration” on page C-1 in Appendix C, “LAN and DHCP”.

Language: Press this submenu key to open a list box and select a built-in language for the BTS Master displays. The languages that are currently available are: English, French, German, Spanish, Japanese, Chinese, Korean, and Italian. In addition, a custom language may be selected if it has been defined by using Master Software Tools and loaded into the MT8221B. Two custom languages may be loaded into the instrument via Master Software Tools. If a mode does not have language translations available, English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changes.

In addition, any existing language (except English) may be edited for a better local translation.

Note: A **SYSTEM+ON** Factory Default reset will overwrite any custom settings within the BTS Master and will require that you reload the custom language files via Master Software Tools.

Brightness: Press this submenu key to adjust the brightness of the display. This adjustment allows you to optimize viewing under a wide variety of lighting conditions. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to select a brightness level from 1 to 9, where 9 is the brightest. Press **Enter** to accept the change.

Name: Press this submenu key to open a dialog box to name the instrument. The MT8221B can be named by using the text entry controls as described in section “Text Entry” on page 2-11. Press **Enter** to save the name.

Volume: Press this submenu key to set the speaker volume. The current volume setting is displayed on the screen. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to change the volume, and press the **Enter** key to accept the change.

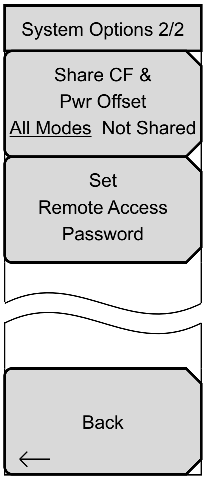
Reset: Press this submenu key to open the “Reset Menu” on page 5-6.

More: Press this submenu key to open the “System Options 2/2 Menu” on page 5-5.

Figure 5-3. System Options Menu

System Options 2/2 Menu

Key Sequence: **Shift**, **System** (8) > System Options > More



Share CF & Pwr Offset
All Modes Not Shared: Press this submenu key to toggle the setting to All Modes or to Not Shared. Select All Modes to have the current center frequency setting and power offset setting carried over when changing measurement modes. This function is not applicable to measurements that do not have a center frequency or power offset setting or to measurements in which the current center frequency or power offset setting is outside the range of the new measurement.

Set Remote Access Password: Press this submenu key to open the Password text box (Figure 5-5) and Text Entry menu. Type in the desired password. Upper case and lower case letters and the symbols - _ + . are the allowed password characters. Press **Enter** to save or **Esc** to cancel.

Back: Press this submenu key to return to the "System Options Menu" on page 5-4.

Figure 5-4. System Options Menu 2/2)

Remote Access Password

Warning	Do not use SCPI commands with this feature.

This function is valid only with Master Software Tools (MST) v2.21.1 or later. After setting the password, reboot the instrument (normal power **OFF** then **ON**) to provide remote access security. Only one user then has access at any one time.

The password is first set into the instrument, then used in MST. When prompted in MST, enter the password into the password text box. The password text box shown in Figure 5-5 may differ from the text box that is displayed on your instrument.

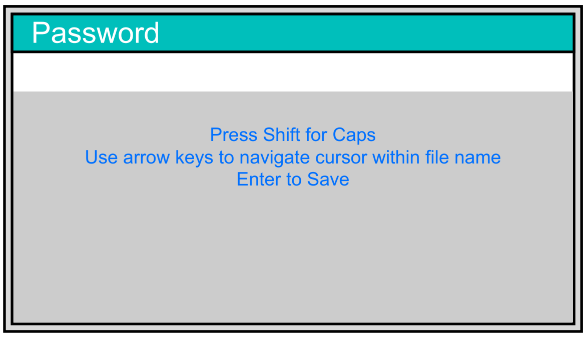
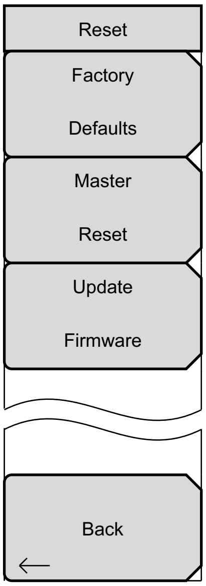


Figure 5-5. Remote Access Password Text Box

The password can be removed or reset by a Master Reset, by a Factory Default reset, or by a firmware update (which includes a restart).

Reset Menu

Key Sequence: **Shift**, **System** (8) > System Options > Reset



Factory Defaults: Press this submenu key to restore the BTS Master to its factory default parameter values and Mode settings, including Ethernet, language, and brightness settings. Press the **Enter** key to initiate the reset. The BTS Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press **Esc** rather than pressing **Enter**.

Note: This same reset sequence can be initiated when turning the BTS Master On by pressing and holding the **Esc**+**On** keys until the Anritsu splash screen is displayed.

Master Reset: Press this submenu key to restore the factory setting to all system parameters, including Ethernet, language, and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored. Press the **Enter** key to initiate the reset. The BTS Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press **Esc** rather than pressing **Enter**.

Note: This same reset sequence can be initiated when turning the BTS Master On by pressing and holding the **System** (8)+**On** keys until the Anritsu splash screen is displayed.

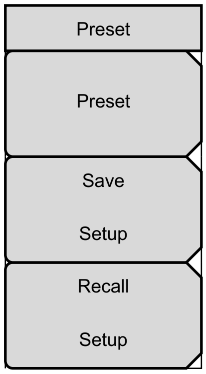
Update Firmware: Press this submenu key to update the instrument operating system using an external USB drive. Press **Enter** to begin the update, or press **Esc** to return to normal operation without updating. Refer to "Update Firmware" on page 5-8 for additional information.

Back: Press this submenu key to return to the "System Options Menu" on page 5-4.

Figure 5-6. Reset Menu

5-4 Preset Menu

Key Sequence: **Preset**



Preset: This key resets the instrument to the default starting conditions.

Save Setup: Opens the Save dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved.

Recall Setup: This key allows the selection and recall of a previously stored instrument setup. All current instrument settings are replaced by the stored setup information.

Figure 5-7. Preset Menu

5-5 Self Test

At power on, the BTS Master runs through a series of quick checks to ensure that the system is functioning properly. The System self test runs a series of tests that are related to the instrument. The Application Self Test runs a series of tests that are related to the current operating mode of the instrument.

If the BTS Master is within the specified operating range with a charged battery, and the self test fails, then contact your Anritsu Service Center.

To initiate a self test when the system is already powered up:

1. Press the **Shift** key and then the **System** (8) key.
2. Press the Self Test submenu key. The Self Test results are displayed.

Press the **Esc** key to continue.

5-6 Update Firmware

Using a USB Memory Device

The BTS Master contains a feature that allows you to update its firmware by using a USB memory device. First, you must load the USB memory device with the firmware using Master Software Tools (MST). Review the section (in MST Help) that discusses this process. After the firmware is loaded onto the USB memory device, follow the instructions below to update the firmware on your BTS Master.

1. Insert the USB Memory Stick into the USB port.
2. Press the follow key sequence: **Shift** > **System** (8) > System Options > Reset > Update Firmware. The Load Firmware main menu key is displayed (Figure 5-8).

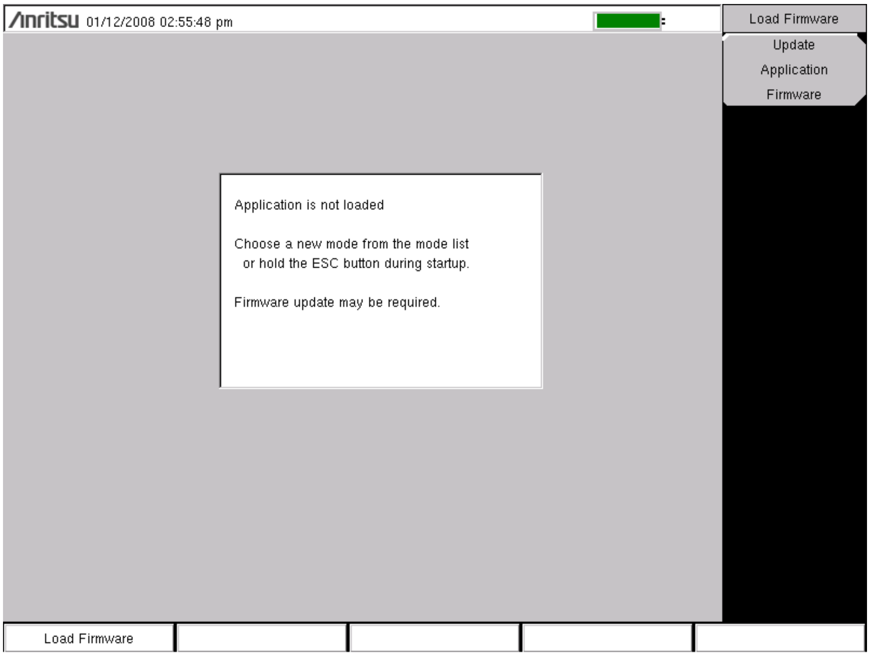


Figure 5-8. Firmware Main Menu

3. Press the **Load Firmware** main menu key to list the Firmware Update menu and Update Application Firmware submenu key.
4. Press the Update Application Firmware submenu key and the Firmware Update dialog opens (Figure 5-9).

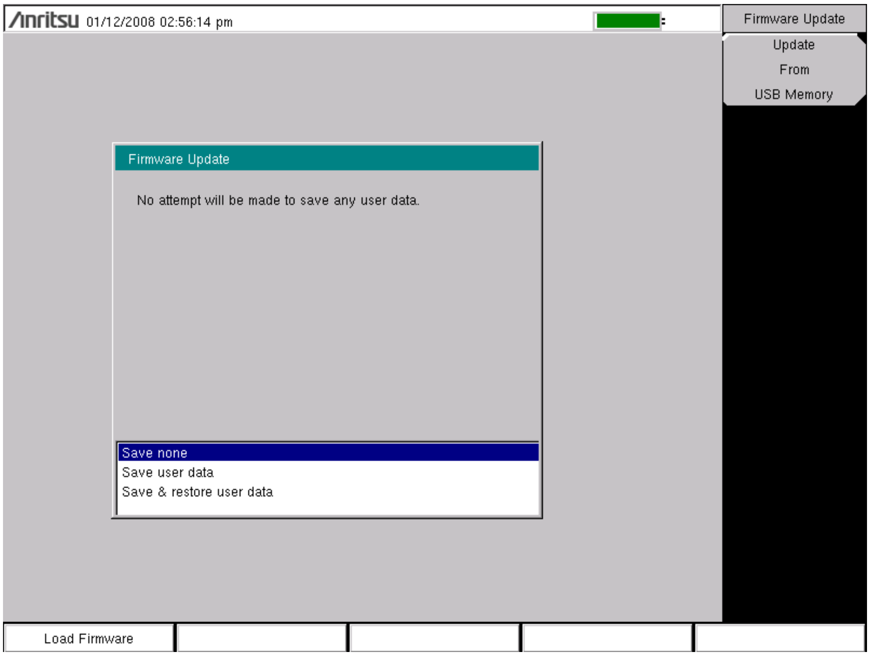


Figure 5-9. Firmware Update Menu

5. Highlight each of the save choices: Save None, Save User Data, and Save & Restore User Data. Read through each choice carefully and then select the desired save mode.
   - **Save None:** No attempt will be made to save any user data.
   - **Save User Data:** User data will be save to the selected external media device.

Warning	If there is not enough available memory space for all user data, then some data may be lost during this process.

   - **Save & Restore:** User data will be saved to the selected external media device. The instrument will also attempt to restore the files to the instrument after the update.

Warning	If there is not enough available memory space for all user data, then some data may be lost during this process.

6. Press **Enter** to begin the firmware update process. To abort the process, press **Esc** then choose another analyzer mode or power down.

7. The Firmware Update dialog will query you to confirm the process by pressing **Enter** to continue or **Esc** to abort (Figure 5-10).

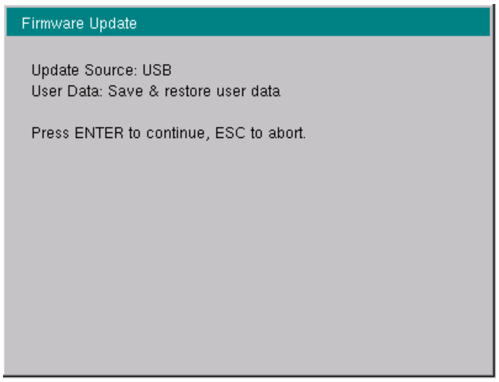


Figure 5-10. Firmware Update Menu

8. Select **Enter** and the firmware update process begins and the Firmware Update dialog displays the following message

   Updating firmware. Please Wait.

9. When complete, the instrument will reboot.

Update Firmware Using Master Software Tools

Refer to “Updating Instrument Firmware” on page 8-2 in Chapter 5, “System Operation”.

Chapter 6 — GPS (Option 31)

6-1 Introduction

This chapter provides a brief overview of the Anritsu MT8221B BTS Master. The intent of this chapter is to acquaint you with the instrument. To begin using the instrument immediately, go to Chapter 3, "Basic Measurement Setups" to find directions for power on, editing, frequency, bandwidth, amplitude, limit line, marker, file management procedures, and firmware update. For more detailed information on measurement setups, refer to the specific measurement guides, which are based on the options that can be purchased for this instrument. The measurement guides and a copy of this user guide are available as PDF files on the documentation disc. Refer to Appendix A, "Measurement Guides".

6-2 Setting Up GPS (Option 31)

The MT8221B BTS Master is available with a built-in GPS receiver (Option 31) that can provide latitude, longitude, altitude, and UTC timing information. This option also enhances frequency reference oscillator accuracy.

Activating the GPS feature:

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

Note	The GPS antenna connection on the BTS Master is fitted with an SMA connector. You can use the GPS menu to select +3.3 VDC or +5 VDC. The default selection is always +3.3 VDC.

Caution	Check the voltage setting before connecting your antenna.

2. Press the **Shift** key then the **System** (8) key on the numeric keypad to display the System menu.
3. Press the GPS submenu key to display the GPS menu (refer to "GPS Menu" on page 6-4).
4. Activate GPS by pressing the GPS, On/Off submenu key so that On is underlined. When GPS is first turned On, the GPS icon is displayed in red.

Figure 6-1. GPS Icon, Red

5. Press the GPS Info submenu key to open the GPS Info window, which displays:
   a. Tracked Satellites
   b. Latitude
   c. Longitude
   d. Altitude
   e. UTC timing information
   f. Fix available
   g. Antenna Status
   h. Receiver Status
   i. Antenna Voltage
   j. Current Draw

When the GPS receiver is tracking at least 3 satellites, the GPS icon changes to green.

Figure 6-2. GPS Icon, Green

Note	As long as 3 minutes may be required for the Ref Freq status to change to GPS High Accuracy in the Status menu, which is displayed on the left side of the measurement display. To reset the GPS, press the Reset submenu key. The green GPS icon with a red cross appears when GPS satellite tracking is lost (refer to Figure 6-3). This occurs after being active (tracking three or more satellites).

Figure 6-3. GPS Icon, Green with Red Cross

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

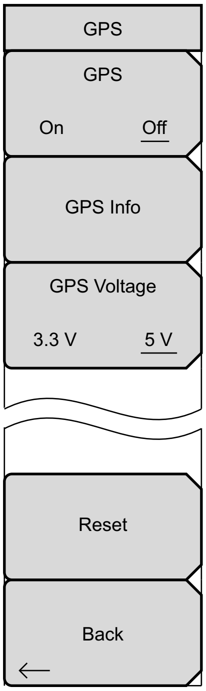
Within three minutes of satellite acquisition, the reference oscillator will have an accuracy of better than 25 ppb (parts per billion). The OCXO internal standard accuracy is ±0.3 PPM. The correction factor applied to the internal OCXO allows the instrument to maintain GPS frequency accuracy for three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

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

The 2000-1528-R GPS Antenna with 5 meter cable is a required accessory (unless you already have a GPS antenna with an SMA connector).

6-3 GPS Menu

Key Sequence: **Shift**, **System** (8) > GPS



GPS: Press this submenu key to turn GPS on or off.

GPS Info: Press this submenu key to display the current GPS information.

GPS Voltage
3.3 V 5 V: Press this submenu key to set the source voltage to be either 3.3 V or 5 V depending on the GPS receiver being used. GPS antenna voltage is set to 3.3 V by default in order to prevent accidental damage to lower-voltage GPS antennas.

Note: Typical base station GPS antennas are 5V, please check your antenna voltage to choose the correct value.

Reset: Press this submenu key to reset the GPS for a new location.

Back: Press this submenu key to return to the “System Menu” on page 5-3.

Figure 6-4. GPS Menu

Chapter 7 — Anritsu Tool Box and Line Sweep Tools

7-1 Introduction

This chapter provides a brief overview of the Anritsu Tool Box and the Line Sweep Tools program. For detailed information about Line Sweep Tools, refer to the program Help.

7-2 Anritsu Tool Box with Line Sweep Tools

The Anritsu Tool Box is a central location to open an Anritsu measurement, visit the Anritsu web site, or launch an Anritsu application. To open the Anritsu Tool Box, either click on the shortcut icon on the desktop or click Start and navigate through the Programs folder to the Anritsu folder. Then click on the Anritsu Tool Box shortcut to open the Anritsu Tool Box. Once the Tool Box is open, move the mouse pointer over any of the application icons to view a short description of the application.

7-3 Install the Software

Place the Installation DVD in your computer and follow the on-screen instructions (Figure 7-1).

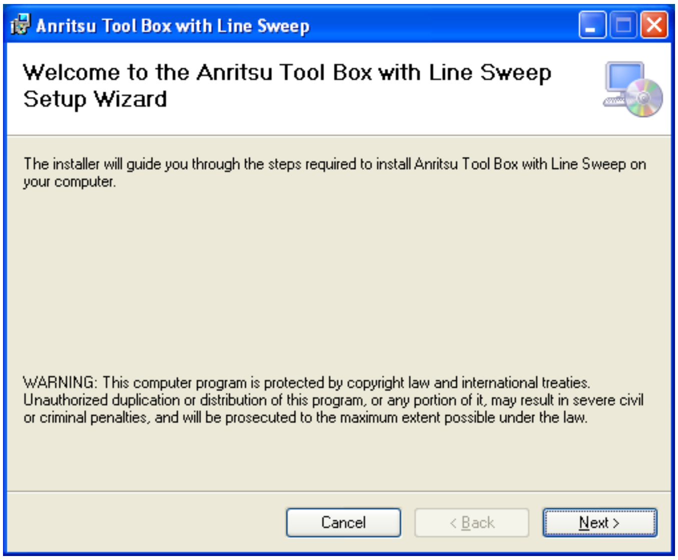


Figure 7-1. Installing Anritsu Tool Box with Line Sweep Tools

If the installer does not autostart, navigate to the DVD and run setup.exe (Figure 7-2).

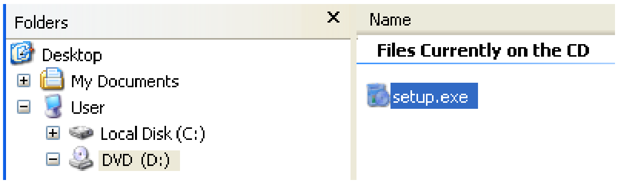


Figure 7-2. setup.exe on the Anritsu Tool Box DVD

The installation will start. Follow the on-screen instructions. The software is also available free of charge from the Anritsu web site (http://www.anritsu.com).

7-4 Other Software

The Anritsu Tool Box may also link to the Anritsu Master Software Tools software and the Anritsu easyMap Tools software. If this software had already been installed on your computer, the Tool Box will link to it. If not, clicking on the icons will bring you to the Anritsu web site, where you will be able to download the software free of charge.

7-5 Why use Line Sweep Tools?

Line Sweep Tools is a program designed to increase productivity for people who work with dozens of Cable traces, Antenna traces, and Passive Intermodulation (PIM) traces every day. Line Sweep Tools will:

- Collect sweeps from Anritsu PIM and Line Sweep gear.
- Help verify that those sweeps are done properly and that the Cable, Antenna and PIM sweeps meet specifications.
- Help create reports of the findings quickly and to a professional standard.

Line Sweep Tools Features

The Line Sweep Tools user interface is familiar to users of Handheld Software Tools, the current industry standard line sweep post-capture trace processing software. This leads to a short learning curve and easy trace collection, validation, and reporting.

Anritsu's Line Sweep Tools program includes:

- Presets for markers and limit lines take hours off the report preparation time for a user with dozens of traces to verify.
- The Report Generator which makes generating PDF reports for multiple traces, with logos, quick and easy.
- Dual Trace viewing mode ensures compatibility with the E series line sweep instruments.
- A naming grid makes renaming files, titles, and subtitles much quicker and error free.

- Line Sweep Tools can open DAT or VNA files from a wide range of current and supported Anritsu hand-held instruments.
- Line Sweep Tools can open the PIM files generated by Passive Inter-Modulation measurements.

7-6 Using Line Sweep Tools

Line Sweep Tools is intuitive for most users. It has the capability to work rapidly with a large number of traces.

Figure 7-3. Line Sweep Tools Window

Line Sweep Tools can open DAT files from HHST; or VNA/DAT files from Anritsu's E-series instruments. It also can open PIM files. Either way, the file once opened, can be inspected and modified in many different ways. Line Sweep Tools saves files as a new type of DAT file, and can export traces as VNA, text, JPG, BMP, or PNG.

Markers and Limit Lines

The easiest way to manage markers is to turn one on and use the mouse to drag it to the desired position. The marker tool bar is shown in Figure 7-4. Marker number 1 is On in the figure below. Markers can be set to an exact value by pressing the "**e**" button, which displays detailed marker controls, numeric value entry, peak find, and valley find.

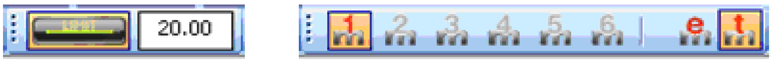


Figure 7-4. Limit Toolbar and Marker Toolbar

The dark button on the left turns on the limit line. Once on, it can be dragged to the desired place, or put on an exact y-axis value by entering a number.

Marker Presets

The fastest way to manage markers on multiple traces is to use the preset function. The marker and limit line preset toolbar allows users to quickly set all markers and the limit line to pre-defined values on similar traces (Figure 7-5).

Figure 7-5. Preset Toolbar

First set the markers and limit lines on a typical trace to the desired values. Then, press the red "**e**" or edit button on the Preset toolbar. This puts the preset buttons into "learn" mode. Now, press a preset button (1 to 7). This programs the preset button where to put the markers and limit lines. Finally, press the red "**e**" button again to exit the learn mode.

The programmed button is now enabled. Line Sweep Tools can program up to 7 buttons with preset markers and limit line.

To use the preset, just press it and the markers and limit line will display at the programmed locations even when switching to a new trace. The two arrow keys make going to the next, or previous, trace simple. Using presets, a dozen similar traces can be reliably validated in seconds.

Renaming Grid

The renaming grid, much like the naming grid in the E series instruments, allows users to quickly and consistently rename filenames, trace titles, and trace subtitles. The grid can be set up with custom phrases to make the renaming process simpler.

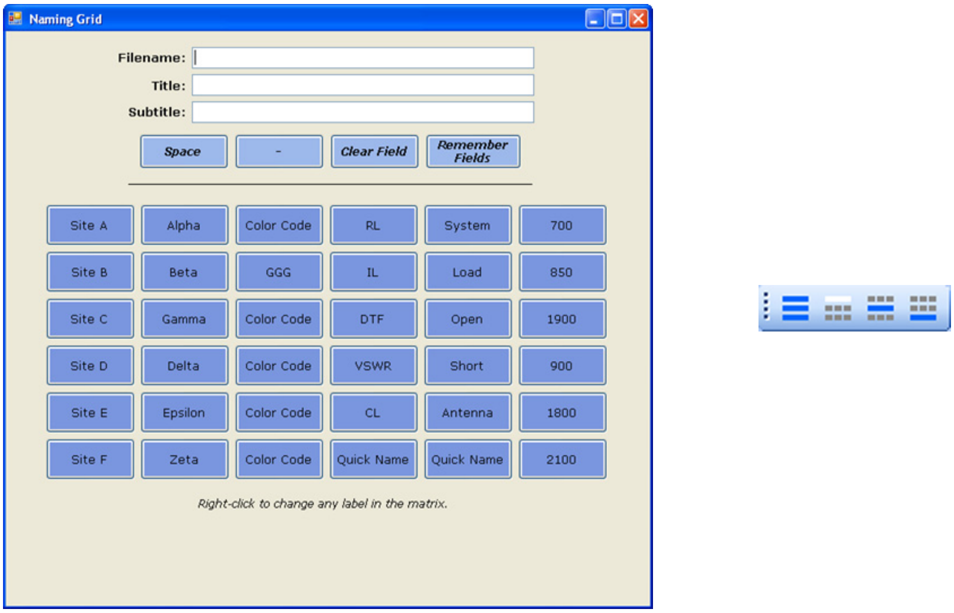


Figure 7-6. Renaming Grid and Renaming Toolbar

To use the renaming grid:

1. Click on the left icon of the Renaming toolbar.
2. Select the filename, title, or subtitle box. Right-clicking on a box will allow you to change the text on the button.
3. Press buttons and type until the desired name is shown.
4. Press Remember Fields to copy the new name for later use.
5. On the toolbar, press the button that corresponds to the field to be renamed.
6. If desired, use the arrow keys on the Marker toolbar to go to the next trace.

Report Generator

To use the report generator in Line Sweep Tools, go to File menu and select Report Setup to tell Line Sweep Tools how you want the report to appear. In this case, the report will have the name of the contractor that did the work (Company field), the contractor logo, and will be generated in PDF format (Figure 7-7).

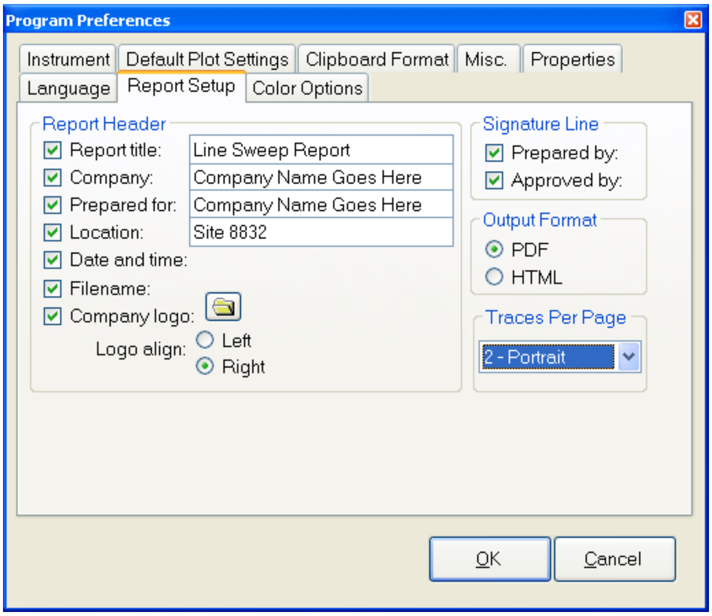


Figure 7-7. Report Setup Tab

Once the report generator is setup, File > Generate Report, will create the PDF. The report will include all traces that were open at the time the report was made (Figure 7-8).

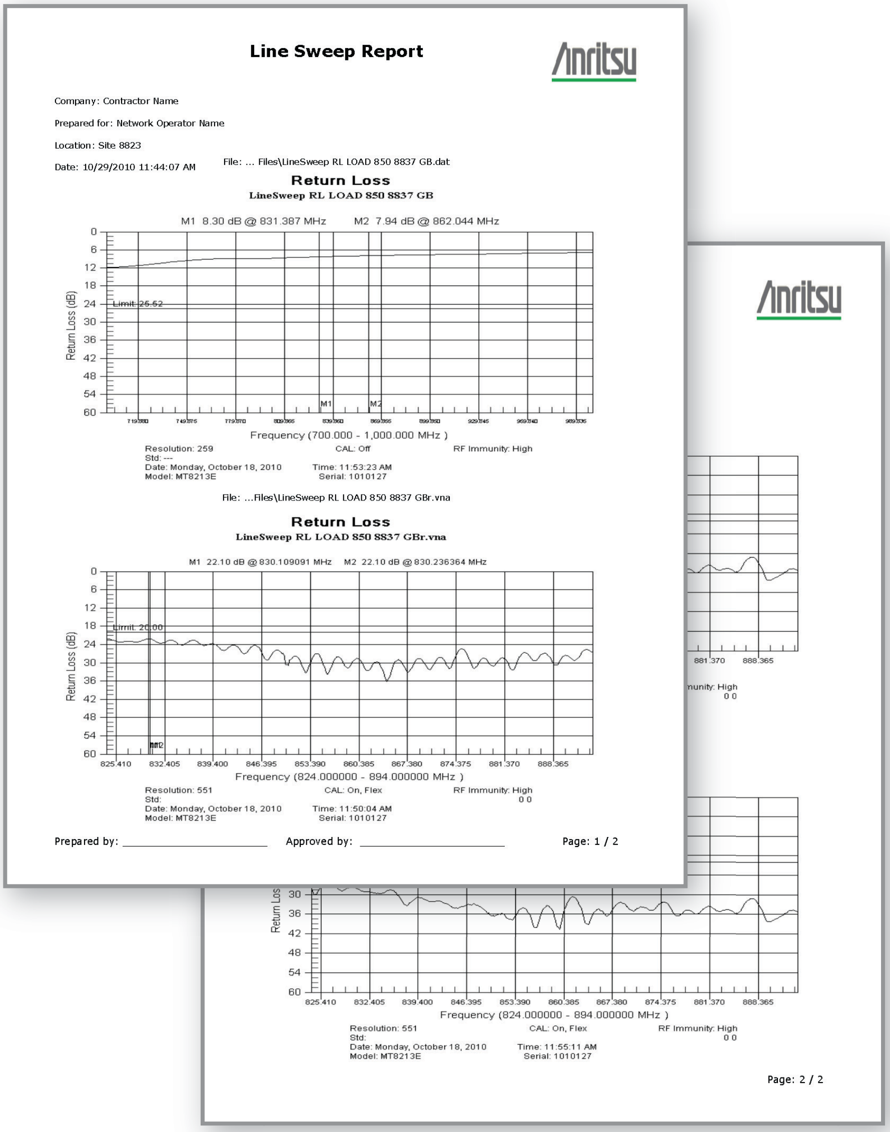


Figure 7-8. Generated Report

Chapter 8 — Master Software Tools

8-1 Introduction

This chapter provides a brief overview of Master Software Tools (MST), firmware update, and emergency repair procedures. For detailed information about Master Software Tools, refer to the MST Manual on the CD-ROM that was included with the BTS Master. The major sections of this chapter include:

- "Master Software Tools Overview" on page 8-1
- "MST Feature Overview" on page 8-1
- "Updating Instrument Firmware" on page 8-2

8-2 Master Software Tools Overview

Anritsu Master Software Tools is a Microsoft Windows 2000 and Windows XP compatible program for transferring and editing saved measurements, markers, and limit lines to a PC. Master Software Tools will not function on earlier versions of the Microsoft Windows operating system.

8-3 MST Feature Overview

Capturing or Retrieving Traces

MST includes a feature to capture the current screen and associated data from the test instrument to the Master Software Tools Graphic Display Editor window. Saved files on the test instrument can also be retrieved and displayed or edited with Master Software Tools.

Editing Graphs

MST can be used to change the scale, limit lines, and markers in a measurement through the Edit Graph button in the workspace toolbar, or through the Context Menus.

Context Menus

Context Menus are accessed by right-clicking the mouse on an active measurement screen in the Graphic Display Editor Window. Context Menu functions may include commands that are also available on the pull down menus and toolbar buttons, or functions, commands, and options specific to the active measurement window.

Overlaying Traces

Trace Math and Overlays allow for comparing multiple traces.

Folder Spectrogram

Folder Spectrogram provides a simulated three dimensional view of a large amount of data in one set of graphs.

Script Master

Script Master is an editor to create files that set up measurement parameters and create automated test procedures that aid field techs or FAEs with measurement testing.

8-4 Installing MST

MST is provided on the CD-ROM included with the instrument. Insert the CD-ROM into a PC to run the installer. Follow the onscreen instruction.

8-5 Updating Instrument Firmware

1. Connect the BTS Master to a PC by using USB or Ethernet. Refer to the Master Software Tools (MST) User Guide (on the CD-ROM) for information regarding connecting your BTS Master to a PC.
2. Run Master Software Tools
3. From the Connection menu:
   - for a USB Connection, Select Connect – USB.
   - for an Ethernet Connection:
     a. Enter the IP Address of your BTS Master by first clicking Enter IP Address…
     b. Then click Connect – Ethernet: xxx.xxx.xxx.xxx
   - In either type of connection, the connection type is displayed in the toolbar.

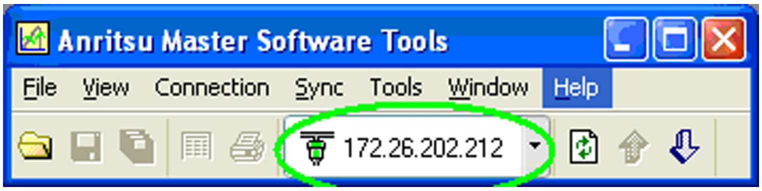


Figure 8-1. IP Address in Connection Button

4. From the Tools menu, click Product Updates.

   The Product Updates window opens.

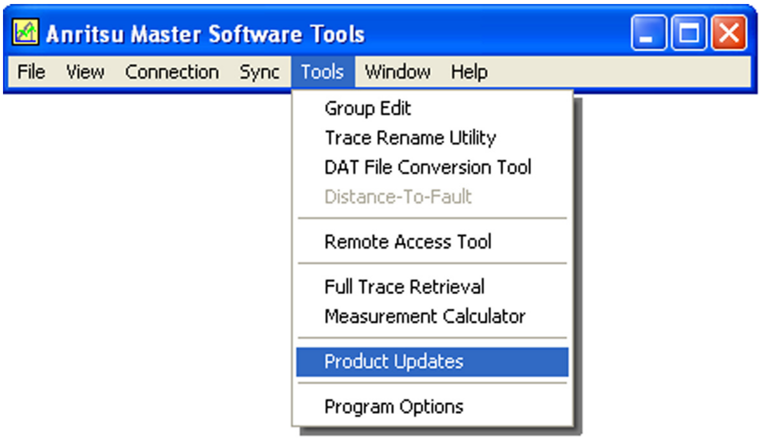


Figure 8-2. Tool Menu: Product Updates Command

5. Notice the differences in the two Product Update windows in Figure 8-3 and Figure 8-4.

- File Status Ready

  In Figure 8-3, the status of the highlighted file is Ready, and the Install to Unit button is active. You can immediately click Install to Unit to update your BTS Master with the new firmware.

- File Status Available

  In Figure 8-4, the status of the highlighted file is Available, and the Install to Unit button is gray and inactive. This means that the updated file is on the Anritsu Product Support Web site and needs to be downloaded to your PC. After the file has been downloaded and placed on your PC, its status changes to Ready, and the Install to Unit button becomes active.

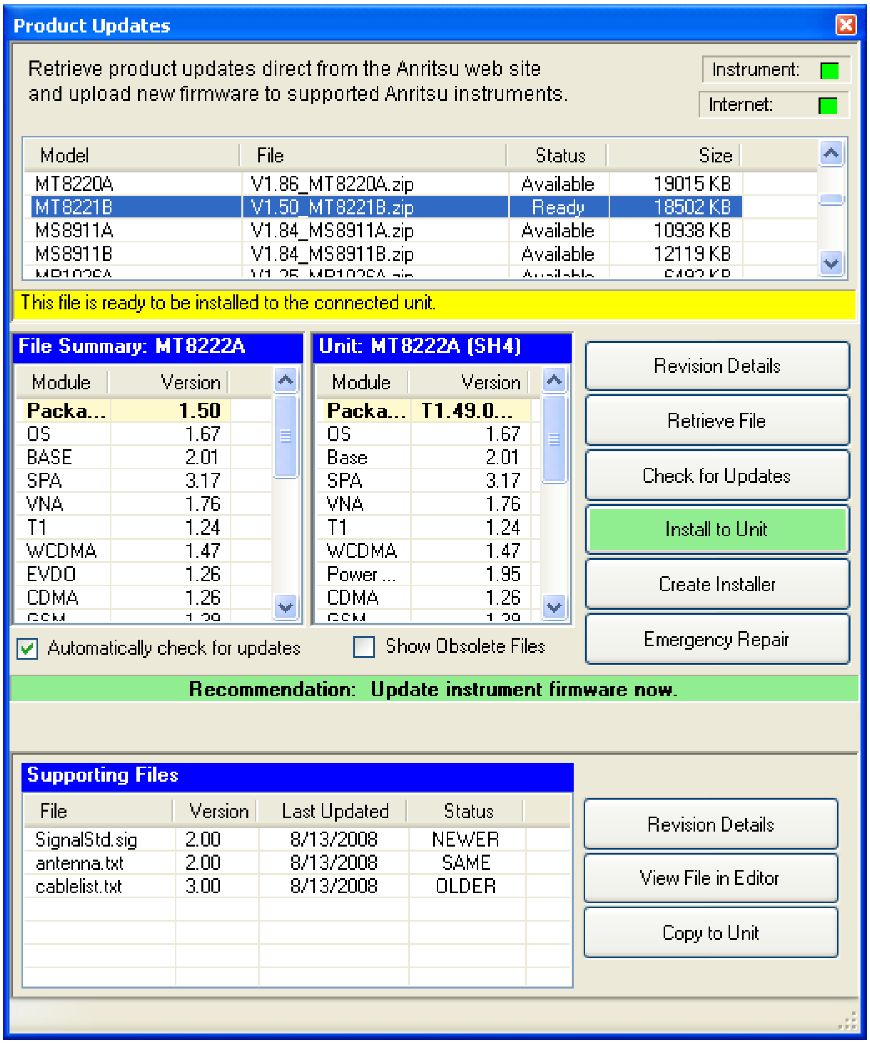


Figure 8-3. Product Updates Window: Status Ready

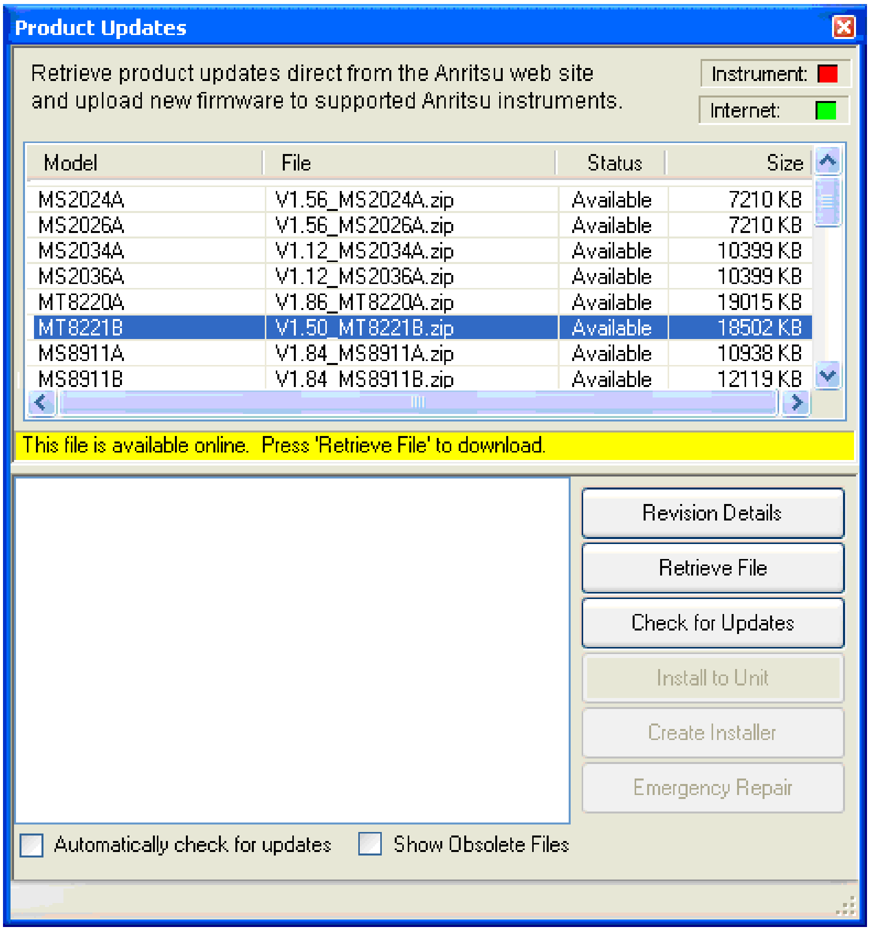


Figure 8-4. Product Updates Window: Status Available

File Status Ready:

1. Check that the file status is Ready and that the Install to Unit button is active.
2. Click the Install to Unit button. Your BTS Master is updated with the new firmware.

File Status Available:

1. Check that the file status is Available.
2. Click Retrieve File to download the file from the Web site to your PC.
3. Check that the file status changes to Ready.
4. Click the Install to Unit button. Your BTS Master is updated with the new firmware.

File Not Listed:

You might open the Products Update window and not find the file that you are looking for. In that case:

1. Click the Check for Updates button. Master Software Tools checks for the latest updates at the Anritsu Product Support Web Site. New updates that are found are listed in the file menu.
2. Click the Retrieve File button. The file is transferred from the Web site to your PC.
3. After the status changes to Ready, click the now-active Install to Unit button. Your BTS Master is updated with the new firmware.

Update Problems

If you do not find the latest update, or if you encounter a problem with updating the firmware, then contact Anritsu. Internet links to worldwide Anritsu locations can be found at the following URL:

http://www.anritsu.com/Contact.asp

Update Firmware Using a USB Device

Refer to "Update Firmware" on page 5-8.

Appendix A — Measurement Guides

A-1 Introduction

This appendix provides a list of supplemental documentation for BTS Master features and options. These measurement guides are available as PDF files on the documentation disc and the Anritsu web site for download.

Table A-1. Analyzer Options (Sheet 1 of 2)

BTS Master Feature (Required Option)	Related Document (Part Number)
Cable and Antenna Analyzer High Voltage Bias Tee (0010)	Cable and Antenna Analyzer Measurement Guide (10580-00230)
Spectrum Analyzer Interference Analyzer (0025) Channel Scanner (0027) Zero-Span IF Output (0089) Gated Sweep (0090)	Spectrum Analyzer Measurement Guide (10580-00231) for *Firmware V1.36 and BEFORE* Spectrum Analyzer Measurement Guide (10580-00244) for *Firmware AFTER V1.36*
High-Accuracy Power Meter (0019)	Power Meter Measurement Guide (10580-00240)
Vector Signal Generator (0023)	Signal Generator Measurement Guide (10580-00232)
GSM/GPRS/EDGE RF Signal Analyzer (0040) GSM/GPRS/EDGE Demodulated Signal Analyzer (0041) W-CDMA/HSDPA RF Signal Analyzer (0044) W-CDMA Demodulated Signal Analyzer (0045) W-CDMA/HSDPA Demodulated Signal Analyzer (0065) W-CDMA/HSDPA Over-the-Air Signal Analyzer (0035) TD-SCDMA/HSDPA RF Signal Analyzer (0060) TD-SCDMA/HSDPA Demodulated Signal Analyzer (0061) TD-SCDMA/HSDPA Over-the-Air Signal Analyzer (0038) LTE RF Measurements (0541) LTE Modulation Measurement (0542) LTE Over-the-Air Measurements (0546) TD-LTE RF Measurements (0551) TD-LTE Modulation Measurement (0552) TD-LTE Over-the-Air Measurements (0556)	3GPP Signal Analyzer Measurement Guide (10580-00234)

Table A-1. Analyzer Options (Sheet 2 of 2)

BTS Master Feature (Required Option)	Related Document (Part Number)
cdmaOne/CDMA2000 1X RF Signal Analyzer (0042) cdmaOne/CDMA2000 1X Demodulated Signal Analyzer (0043) cdmaOne/CDMA2000 1X Over-the-Air Signal Analyzer (0033) CDMA2000 1xEV-DO RF Signal Analyzer (0062) CDMA2000 1xEV-DO Demodulated Signal Analyzer (0063) CDMA2000 1xEV-DO Over-the-Air Signal Analyzer (0034)	3GPP2 Signal Analyzer Measurement Guide (10580-00235)
IEEE 802.16 Fixed WiMAX RF Signal Analyzer (0046) IEEE 802.16 Fixed WiMAX Demodulated Signal Analyzer (0047) IEEE 802.16 Mobile WiMAX RF Signal Analyzer (0066) IEEE 802.16 Mobile WiMAX Demodulated Signal Analyzer (0067) IEEE 802.16 Mobile WiMAX Over-the-Air Signal Analyzer (0037)	WiMAX Signal Analyzer Measurement Guide (10580-00236)
T1 Analyzer (0051) E1 Analyzer (0052) T3/T1 Analyzer (0053) BTS Master MT8221B/22B with Option 450, Comms Board T1 Analyzer (0055) E1 Analyzer (0054) OC-3C Signal Analyzer (0058) T3/T1 Analyzer (0059)	Backhaul Analyzer Measurement Guide (10580-00238)
PIM Analyzer (0419)	PIM Master User Guide (10580-00280)
Performance Specifications	BTS Master MT822xB Technical Data Sheet (11410-00442)
Programming Manual	BTS Master Programming Manual (10580-00208)
Maintenance Manual	BTS Master Maintenance Manual (10580-00209)
Documentation	Handheld Instruments Documentation Disc (10920-00060)

A complete suite of computer software applications are available for download:

http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx

Appendix B — Error Messages

B-1 Introduction

This chapter provides a list of information and error messages that could be displayed on the MT8221B BTS Master. If any error condition persists, contact your local Anritsu Service Center (http://www.anritsu.com/Contact.asp).

B-2 Self Test or Application Self Test Error Messages

Overall Status FAILED

One or more elements of the System or Application Self Test has failed. Refer to the other pass fail tests listed below to determine which specific test failed.

ADC Self Test FAILED

The Analog to Digital converter failed to return an answer. Insure that the battery level is adequate for operation or that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

DDC FAILED

The Digital Down Converter failed to return a value. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Lock Test FAILED

One or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Over Power FAILED

RF Power applied to the input connector is too high. Remove or reduce the input power or add additional attenuation. Sometimes out of band frequencies may be present that can cause an Over Power Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list of available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the Span to maximum in the peak detect mode of operation. Another resolution may be to reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Over Power Start FAILED

RF Power applied to the input connector is too high at turn on. See Over Power FAILED error above.

Mixer Saturation: Increase Attenuation

or

Mixer Overdrive FAILED

Too much power applied with too little Attenuation. Increase attenuation. Sometimes even out of band frequencies may be present that would cause a Mixer Overdrive Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. See the accessories section for a list available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the SPAN to maximum in peak detect mode of operation. Another resolution may be to Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

B-3 Operation Error Messages

ADC Over range: Increase Reference Level

Input signal is too large for the Analog to Digital converter to process. Increase the internal or external attenuation or, if using Auto attenuation, increasing the Reference Level should resolve the error. See also the Mixer Overdrive error above for information on Out of band RF power.

Calibrator Reading Error

Calibration reference source is not providing quality signal. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Fatal Error

Usually caused by a failure to communicate with one section or another. Sometimes resolved by restarting the unit or by Factory Defaults, ESC+ON, resetting of the unit. Under extreme cases the use of MASTER RESET, System+ON, may resolve the issue. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Trace not saved. Please wait for complete sweep and try again.

Attempted to save a measurement trace before the sweep had completed at least once. Wait for at least one complete sweep and try to save again.

Measurement not valid in Zero Span

Attempt was made to make an automated measurement that requires more than ZERO SPAN to accomplish. An example would be Occupied Bandwidth measurement.

The Freq range of the Antenna is invalid for this setup. Please select another Antenna

Choose a start and stop frequency that is within the defined frequency range for the selected antenna compensation table. See also Master Software Tools for creation and Upload of Antenna correction files.

Minimum permitted Sweep time is 50 µs

An attempt was made to set the minimum Sweep time to less than 50 µs.

Invalid Attenuation for Preamp

The only valid attenuation settings while the Preamp is operational are 0 dB and 10 dB. All other settings attempted by the user will result in this message. Select 0 dB or 10 dB or select AUTO Attenuation to let the system determine the correct setting based on the reference level selected.

Valid Attenuations with Preamp on are 0 dB and 10 dB

Same as above

Unable to add additional limit points. %d is the maximum.

Attempted to add an additional limit line point beyond the maximum number of allowed points.

Use Demod type USB or LSB to use Beat Frequency Osc

An attempt to use the Beat Frequency Oscillator while not in Upper or Lower Sideband Demodulation mode.

Trace A/B/C has no data to view

Attempt to turn on or VIEW a trace that has never had data recalled into this trace location. Refer to Recall Trace section for instructions on how to recall stored measurement traces into either Trace A, B or C.

Locking to Internal Ref failed

Switching from an external frequency reference to the internal reference has failed. Some additional warm up time may be needed if the unit has been on external reference for a long time or the unit is not warmed up enough.

Locking to External Ref failed; Lock attempt Failed

Switching from an internal frequency reference to the external reference has failed. Verify that the correct external reference frequency value has been selected from the list of valid external reference frequencies. Verify that the level of the external reference frequency is at least 1vp-p.

Fatal error, EEPROM failed

Hardware communications between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Fatal error, no SPA board connected

Hardware communications between modules has failed. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Operation not Permitted in Recall Mode

Attempted to perform an operation on a recalled trace. Many operations are valid only on a live or active trace.

Cannot change scale in Linear mode

Linear display mode of operation does not support a scaling change in the same manner as the Log display mode.

Cannot turn on delta marker because Ref Marker is invalid

Delta markers cannot be enabled unless the primary marker is within the displayed span.

Cannot turn on delta marker because Ref Marker is a counter Marker

Delta markers cannot be enabled unless the primary marker is NOT a counter Marker. Turn off the Counter Marker mode of marker operation to use Delta Marker.

Current Marker is not ON

Attempted to use a marker mode or feature for a marker that is not enabled. Turn on the appropriate marker to use this function or switch to a marker that is already enabled.

Marker must be ON to Use the feature

Attempted to use a marker mode or feature for a marker that is not enabled. Turn on the appropriate marker to use this function or switch to a marker that is already enabled.

Triggering valid only in Zero Span

External triggering can only be used while the SPAN is set to 0 (zero)

Cannot change Modes for Recalled/Inactive Traces

Detection modes or other elements such as RBW/VBW, averaging, and so forth, cannot be altered on a recalled trace. The trace is displayed with the same parameters in which it was saved.

Cannot change average for Recalled/Inactive Traces

Cannot set Delta Detection modes or other elements such as RBW/VBW, averaging, and so forth, cannot be altered on a recalled trace. The trace is displayed with the same parameters in which it was saved.

Pretune Calibration Table fault

Ensure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Lock failed during initialization

One or more of the Phase Lock Loops failed to achieve lock status during startup. Insure that the battery level is adequate for operation or that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Reference LVL Cal is OFF

Factory Calibration is OFF. Insure that the battery level is adequate for operation or that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

IF Cal is OFF

Factory Calibration is OFF. Insure that the battery level is adequate for operation or that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Cannot set Delta Mkr Freq to Demod Freq

Marker to Demod frequency is only available with a primary marker as the selected marker.

Fan Failure

The system has determined that the fan should be running due to the internal temperature of the unit, but cannot detect that the fan is actually running.

It is important to keep the fan inlet and exhaust ports clear of obstructions. The cooling fan will vary the speed in relation to the internal temperature of the instrument. The fan will turn on at low speed when the internal temperature of the instrument reaches 44°C, and will increase the fan speed to maximum at 54°C. As the internal temperature of the instrument decreases, the fan will reduce speed until the temperature reaches 39°C, at which point the fan will turn off.

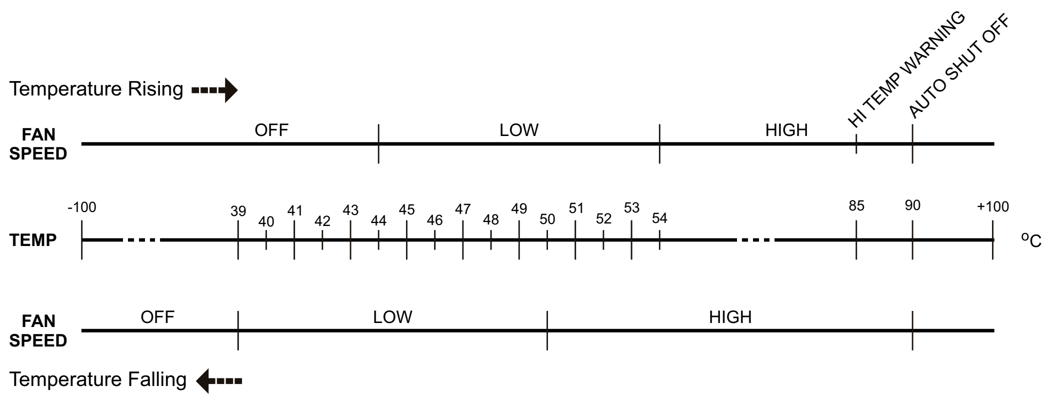


Figure B-1. Fan Speed versus Temperature

High Temp Warning

The internal temperature has reached an excessive level, 85°C. Verify that the ventilation openings are unobstructed and that the fan is running. Internal temperatures may be manually verified by using the SELF TEST function. Turn off the unit and allow the temperature to cool down. If the fault is not resolved and the internal temperature reaches 90°C, a countdown of 10 seconds will begin to give the user a chance to save the current setup before it will turn itself off before internal temperatures can cause any damage. If the error persists after removing any obstructions and allowing the unit to cool, reset to the factory defaults with either Factory Defaults, ESC+ON. Caution: Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition. If the error persists, contact your Anritsu Service Center.

Copy failed. Please check External USB Memory

Attempt to copy user saved data to the external USB Flash drive has failed. Do not attempt to remove or power down the unit before the copy has completed. Be sure that the USB memory device is not already full and that it is fully inserted into the USB connector .

PLL Lock Fail

Phase Lock Loop failed to lock.

Trace not saved. Please wait for complete sweep and try again.

Attempted to save a measurement trace before the sweep had completed at least once. Wait for at least one complete sweep and try to save again.

Appendix C — LAN and DHCP

C-1 Introduction

This appendix describes network connections for the MT8221B BTS Master.

C-2 Ethernet Configuration

LAN Connection

The RJ-45 connector is used to connect the BTS Master to a local area network. Integrated into this connector are two LEDs. The amber LED shows the presence of a 10 Mbit/s LAN connection when on, and a 100 Mbit/s LAN connection when off. The green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the System Options soft key and the Ethernet Config soft key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address, and subnet mask.

Note	An active Ethernet cable must be connected to the instrument before it is turned ON in order to enable the Ethernet port for DHCP or for a static IP address. Depending upon local conditions, the port may remain enabled when changing from DHCP to static IP address, when changing from static IP address to DHCP, or when temporarily disconnecting the Ethernet cable. If the port becomes disabled, ensure that an active Ethernet cable is attached to the instrument before cycling the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the MT8221B to the network and select DHCP protocol in the Ethernet Config menu.

Turn the BTS Master off, and then on. If the network is set up for DHCP, the assigned IP address should be displayed briefly after the power up sequence.

To display the IP address with the instrument on, press the **Shift** key, then the **System** (8) key, then the System Options soft key and the Ethernet Config soft key. The IP address will be displayed as shown in Figure C-1. The image on the display panel of your BTS Master may differ from the image shown here.

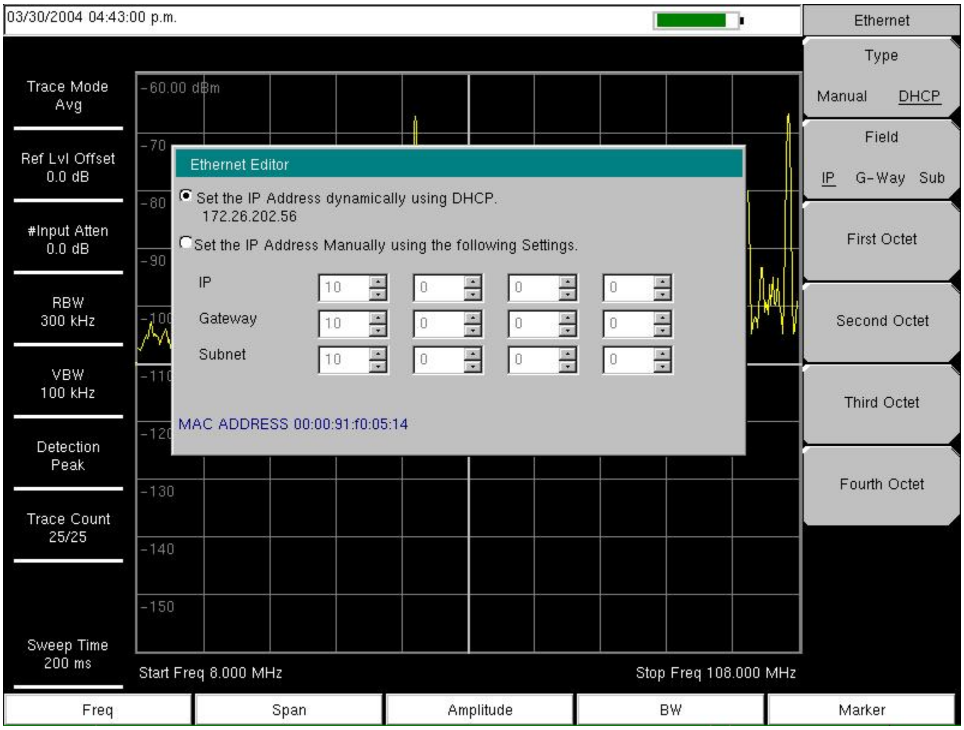


Figure C-1. IP Address Assigned Using DHCP

Ethernet Config

Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box in order to set the IP address of the instrument.

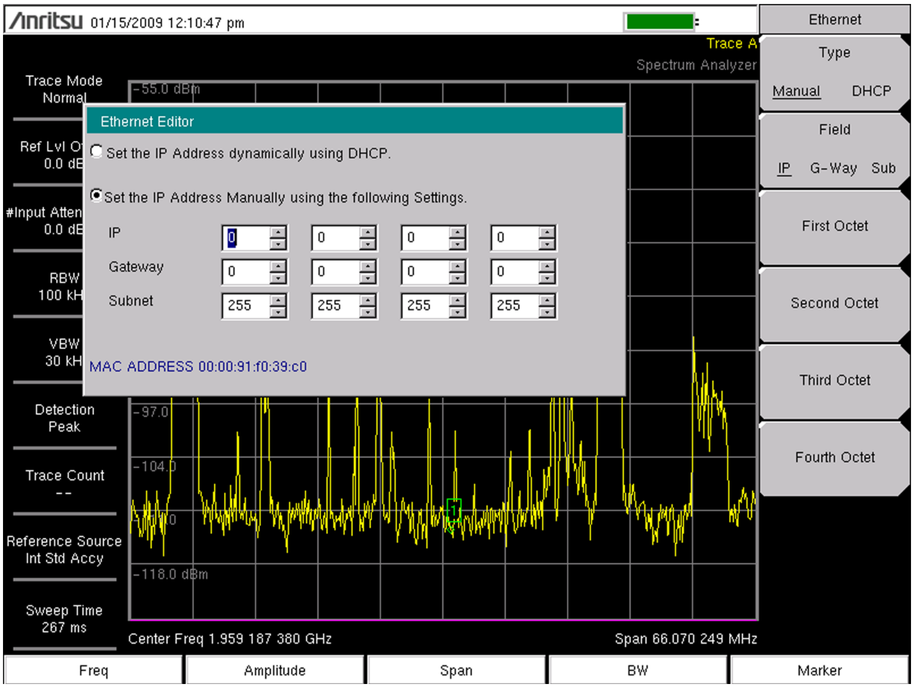
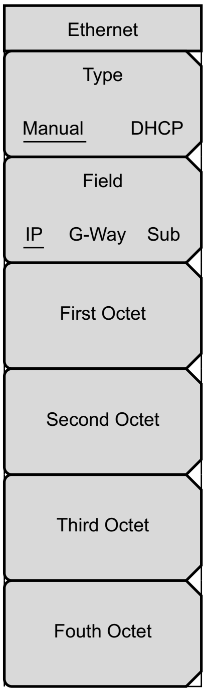


Figure C-2. Setting IP Address Manually

Ethernet Menu

Key Sequence: **Shift**, **System** (8) > System Options > Ethernet Config



Type
Manual DHCP: Press this submenu key to select whether the address will be entered manually, or will be supplied automatically by a network DHCP server. If Manual is selected, then use the submenu keys or the **Left/Right** arrow keys to select the field that is to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to enter the input. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Field
IP G-Way Sub: Press this submenu key to select the desired Internet Protocol Property to be edited.

First Octet: Moves the cursor to the left most column of the selected IP properties field.

Second Octet: Moves the cursor to the second column from the left of the selected IP properties field.

Third Octet: Moves the cursor to the third column from the left of the selected IP properties field.

Fourth Octet: Moves the cursor to the forth column from the left of the selected IP properties field.

Figure C-3. Ethernet Menu

C-3 DHCP

DHCP stands for Dynamic Host Configuration Protocol. It is a protocol that allows a server to dynamically assign IP addresses to devices that are connected to the network. Most networks include a DHCP server to manage IP addresses. When a DHCP server is available on the network, DHCP is the preferred IP address assignment mode.

When using DHCP, no setup is required to lease and use a dynamic IP address. In a dynamic IP operation, the IP address in use may change from use to use. The DHCP server hands out IP addresses on a first come, first served basis. As soon as the device is disconnected from the network, the IP address that it was using becomes available to lease to the next unit that requests an IP address. Normally, some amount of lag time is present on the DHCP server end, so if the device is connected again reasonably soon, then it may end up with the same address.

Note	The MT8221B must be connected to the network before it is turned on in order for DHCP to function. Key elements of the DHCP lease are performed only during the instrument startup operations, or when switching from manual to DHCP

When a DHCP server is not available, a Static IP address can be used. A Static IP address is a fixed address. After being set, it will always remain the same, and care must be taken to not conflict with other equipment on the network.

When using a static IP address on an established network, always request the Static IP address from the network administrator. Randomly choosing a Static IP address on an established network may result in duplicate IP addresses or other conflicts.

Three parameters must be set prior to using a Static IP address:

IP Address

This is the Static IP address on the network.

Default Gateway

Often when a static IP address is assigned, a default gateway is also identified. If the default gateway is unknown, then type in the Static IP address so that the Static IP address and Default Gateway are the same number.

Subnet Mask

This parameter is usually extracted from the Static IP address based on the class of the address and determines the destination of any broadcast messages that might be sent from the instrument. It can be customized if necessary. The subnet mask may also be provided with the Static IP address.

Example 1

In this example, a Static IP address has been chosen because no network DHCP service is available. The instrument is connected to the network port on the PC with a crossover Ethernet cable (not included). This is also referred to as Direct Connect:

```
IP Address: 10.0.0.2

Default Gateway: 10.0.0.2

Subnet Mask: 255.255.0.0
```

Example 2

In this example, the Static IP address has been assigned with an associated gateway and subnet mask:

```
IP Address: 153.56.100.42

Default Gateway: 153.56.100.1

Subnet Mask: 255.255.252.0
```

C-4 ipconfig Tool

A few tools that are built into the Microsoft Windows operating system can assist in making some determinations about the network to which the PC is connected. Typing ipconfig at a command prompt produces a display of information about the in-use parameters of the PC and its network connection. Following is an example of the typical results expected:

Note	The ipconfig display does not report whether the information is from a DHCP server or from a Static IP setup.

```
Y:\>ipconfig

Windows 2000 IP Configuration

Ethernet adapter Local Area Connection:

Connection-specific DNS Suffix. : us.anritsu.com

IP Address. . . . . . . . . . . . : 172.26.202.172

Subnet Mask . . . . . . . . . . . : 255.255.252.0

Default Gateway . . . . . . . . . : 172.26.200.1
```

C-5 Ping Tool

Another tool that can find out if a selected IP address is already on the network is ping. Ping is a harmless way to determine if an address is found on the network, and (if it is found) to receive a reply. Basically, the ping function sends out a request to a specific address to determine if a computing device is connected to the network at that address. If a valid connection is found, then a copy of the signal (that was sent) is returned. If a connection is not found, then the response is "request timed out", which means that no reply was received from that IP address.

```
Y:\>ping 172.26.202.172

Pinging 172.26.202.172 with 32 bytes of data:

Reply from 172.26.202.172: bytes=32 time<10ms TTL=128

Reply from 172.26.202.172: bytes=32 time<10ms TTL=128

Reply from 172.26.202.172: bytes=32 time<10ms TTL=128

Reply from 172.26.202.172: bytes=32 time<10ms TTL=128

Ping statistics for 172.26.202.172:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milliseconds:

Minimum = 0 ms, Maximum = 0 ms, Average = 0 ms
```

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10580-00207 E

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Measurement Guide

3GPP Signal Analyzer for Anritsu RF and Microwave Handheld Instruments

BTS Master™, Cell Master™, Spectrum Master™, LMR Master™

	RF	Demod	OTA
GSM/GPRS/EDGE	Option 40	Option 41	N/A
W-CDMA/HSPA+	Option 44	Option 65	Option 35
TD-SCDMA/HSPA+	Option 60	Option 61	Option 38
LTE/LTE-A	Option 541	Option 542	Option 546
TD-LTE/LTE-A	Option 551	Option 552	Option 556

For some models, RF, Demod, and OTA are combined as a single option.

GSM/GPRS/EDGE	Option 880
W-CDMA/HSPA+	Option 881
TD-SCDMA/HSPA+	Option 882
LTE/LTE-A (FDD and TDD)	Option 883

Note	Not all instrument models offer every option or every measurement within a given option. Please refer to the Technical Data Sheet of your instrument for available options and measurements within the options.

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Notice

Updates

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

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

Product Information, Compliance, and Safety

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

Table of Contents

Chapter 7—LTE and TD-LTE Coverage Mapping

Chapter 1 — General Information

1-1 Introduction

This Measurement Guide documents 3GPP signal analysis for the following Anritsu instruments:

- BTS Master
- Cell Master
- Spectrum Master
- LMR Master

Note	Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options and capabilities supported by your instrument.

1-2 3GPP Signal Analysis Overview

GSM/GPRS/EDGE

GSM/GPRS/EDGE signal analysis is described in Chapter 2, "GSM/GPRS/EDGE Signal Analyzer".

- Option 880: GSM/GPRS/EDGE Measurements (requires Option 9)
  - Option 40*: GSM/EDGE RF Measurements
  - Option 41*: GSM/EDGE Demodulation

W-CDMA/HSPA+

W-CDMA/HSPA+ signal analysis is described in Chapter 3, "W-CDMA/HSPA+ Signal Analyzer".

- Option 881: W-CDMA/HSPA+ Measurements (requires Option 9)
  - Option 44*: W-CDMA/HSPA+ RF Measurements
  - Option 45*: W-CDMA Demodulation
  - Option 65*: W-CDMA/HSPA+ Demodulation
  - Option 35*: W-CDMA/HSPA+ Over-the-Air (OTA) Measurements

TD-SCDMA/HSPA+

TD-SCDMA/HSPA+ signal analysis is described in Chapter 4, "TD-SCDMA/HSPA+ Signal Analyzer".

- Option 882: TD-SCDMA/HSPA+ Measurements (requires Option 9)
  - Option 60*: TD-SCDMA/HSPA+ RF Measurements
  - Option 61*: TD-SCDMA/HSPA+ Demodulation
  - Option 38*: TD-SCDMA/HSPA+ OTA Measurements

LTE

LTE signal analysis is described in Chapter 5, "LTE Signal Analyzer".

- Option 883: LTE/LTE-A FDD/TDD Measurements
  - Option 541*: LTE/LTE-A RF Measurements
  - Option 542*: LTE/LTE-A Modulation Measurements
  - Option 546*: LTE/LTE-A OTA Measurements (requires Options 31, 542, and 543 (15 and 20 MHz bandwidth) for full functionality)

TD-LTE

TD-LTE signal analysis is described in Chapter 6, "TD-LTE Signal Analyzer".

- Option 883: LTE/LTE-A FDD/TDD Measurements
  - Option 551*: TD-LTE/LTE-A RF Measurements
  - Option 552*: TD-LTE/LTE-A Modulation Measurements
  - Option 556*: TD-LTE/LTE-A OTA Measurements (requires Options 31 and 552 for full functionality)

* Indicates the options are obsolete for current products.

Coverage Mapping

LTE and TD-LTE coverage mapping is described in Chapter 7, "LTE and TD-LTE Coverage Mapping".

EMF Measurements

EMF measurements in the LTE and TD-LTE Signal Analyzer modes are described in Chapter 8, "EMF (Option 444)".

1-3 Selecting a Measurement Mode

To change the measurement mode, press **Shift**, then the **Mode** (9) button to open the Mode Selector list box. Highlight the desired measurement mode using the **Up** or **Down** arrow keys or the rotary knob and press **Enter**. The list of available applications depends on the options that are installed and activated on your instrument.

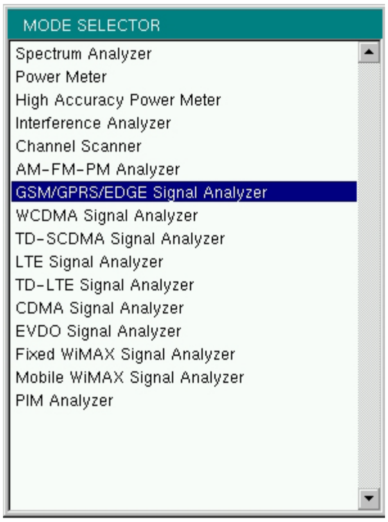


Figure 1-1. Mode Selector List Box

On instruments that have a front panel **Menu** key, an alternate method of switching to another measurement mode is to press **Menu**, then press the appropriate application icon on the touch screen. Press **Esc** to cancel and exit the Menu screen. Refer to the instrument User Guide for additional information.

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

Note	Screen captured images are provided as examples. The touch screen keys and measurement details displayed on your instrument may differ from the examples in this measurement guide, depending on instrument model, firmware version, and installed options.

1-4 Contacting Anritsu

To contact Anritsu, please visit:

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

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

Updated product information can be found on the Anritsu website:

http://www.anritsu.com/

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

Chapter 2 — GSM/GPRS/EDGE Signal Analyzer

2-1 Introduction

The Global Systems for Mobile (GSM) communication is a globally accepted standard for digital cellular communication. GSM uses a combination of Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). Within each band are approximately one hundred available carrier frequencies on 200 kHz spacing (FDMA), and each carrier is broken up into time-slots so as to support eight separate conversations (TDMA). Each channel has an uplink and a downlink. GSM uses the Gaussian Minimum Shift Keying (GMSK) modulation method.

GPRS/EDGE is an extension of GSM technology and is applicable to data services. GSM uses Gaussian Minimum Shift Keying (GMSK) modulation and EGDE uses 8PSK Phase Shift Keying modulation.

The GSM/GPRS/EDGE frequency ranges are: 380–400 MHz, 410–430 MHz, 450–468 MHz, 478–496 MHz, 698–746 MHz, 747–792 MHz, 806–866 MHz, 824–894 MHz, 890–960 MHz, 880–960 MHz, 876–960 MHz, 870–921 MHz, and 1710–1990 MHz.

The instrument features two GSM/GPRS/EDGE measurement modes: RF Measurements and Demodulator. The instrument can be directly connected to any GSM/GPRS/EDGE base station for accurate measurements. When a physical connection is not available or required, the instrument can receive and demodulate GSM/GPRS/EDGE signals over the air.

GSM/GPRS/EDGE RF measurements provide views of spectrum, power versus time (frame), power versus time (slot) with mask and summary screens.

The spectrum view displays channel spectrum and multi-channel spectrum. The channel spectrum screen includes channel power, burst power, average burst power, frequency error, modulation type, and Base Station Identity Code (BSIC). The multi-channel spectrum displays as many as ten channels and, using the cursor to select a channel, can display the measurements for just the selected channel.

GSM/GPRS/EDGE Demodulator demodulates GSM/GPRS/EDGE signals and displays the results of detailed measurements to analyze transmitter modulation performance. Results are shown for phase error (rms), phase error peak, EVM (rms), EVM (peak), origin offset, C/I, modulation type and magnitude error (rms) and a vector diagram of the signal.

This chapter describes the menus in GSM/GPRS/EDGE Signal Analyzer mode.

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

2-2 Measurement Setup

Please refer to the instrument User Guide for detailed information on how to select the GSM/GPRS/EDGE Signal Analyzer mode, set up the frequency range, amplitude, limit lines, markers, and file management.

2-3 GSM/GPRS/EDGE RF Measurements

GSM RF measurements consists of Spectrum, Power versus Time (frame), Power versus Time (slot), Summary and Demodulator. To make GSM/GPRS/EDGE measurements connect the unit to the base station following the instructions.

Caution	The maximum input power without damage is +30 dBm on the RF In port. To prevent damage, always use a coupler or high power attenuator.

1. Press the **Setup** main menu key.
2. Press the GSM/EDGE submenu key and highlight Auto to select the GSM or EDGE signal.

Note	Highlight GSM or EDGE to set the instrument to measure only a GSM or EDGE signal.

3. The instrument has automatic external reference frequency detection or, if equipped, activate GPS to get GPS High Accuracy frequency error measurements. Refer to the User Guide for GPS setup information.

2-4 Measurement Display

Press the **Measurements** main menu key to select measurement display options.

To display Spectrum, press the Spectrum submenu key. Press the Channel Spectrum submenu key for a single channel (Figure 2-1), or the Multi-Channel Spectrum submenu key to display the multi-channel spectrum (Figure 2-2).

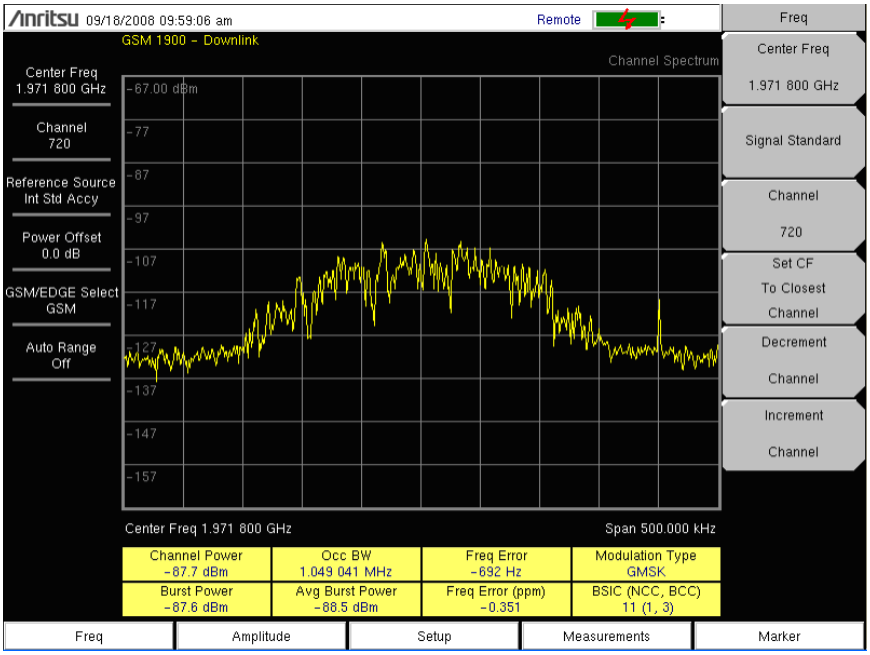


Figure 2-1. GSM Single Channel Measurement

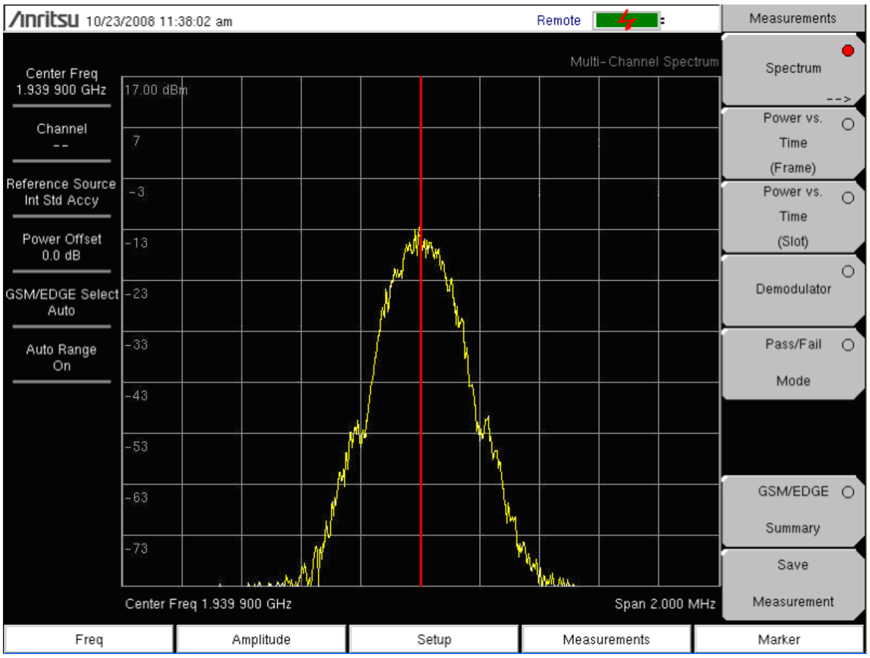


Figure 2-2. GSM Multi-Channel Measurement

To display Power versus Time (Frame) press the Power versus Time (Frame) submenu key to activate the Power versus Time (Frame) measurement (Figure 2-3).

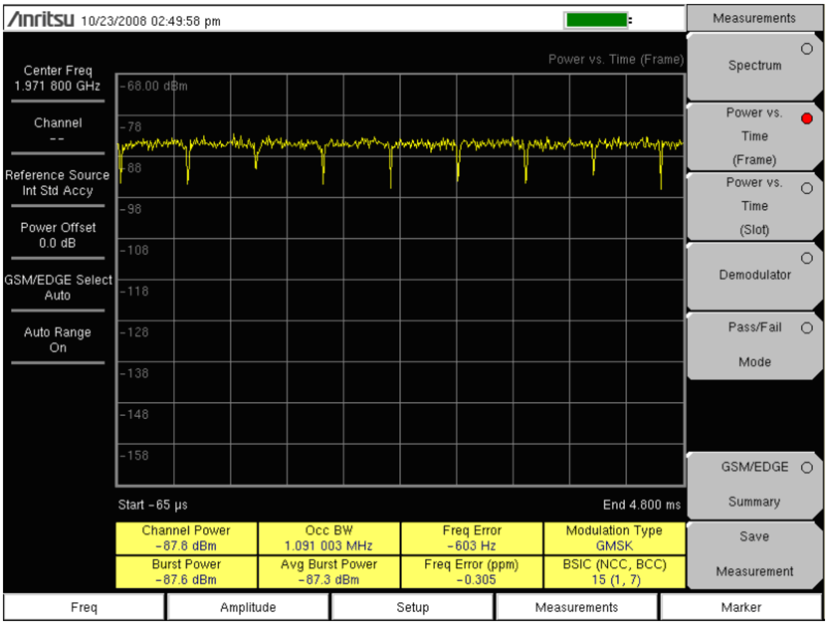


Figure 2-3. GSM Power vs. Time (Frame) Measurement

To display Power versus Time (Slot) press the Power versus Time (Slot) submenu key to activate the Power versus Time (Slot) measurement (Figure 2-4). The mask is according to the 3GPP TS 05.05 specification. The first slot information is displayed.

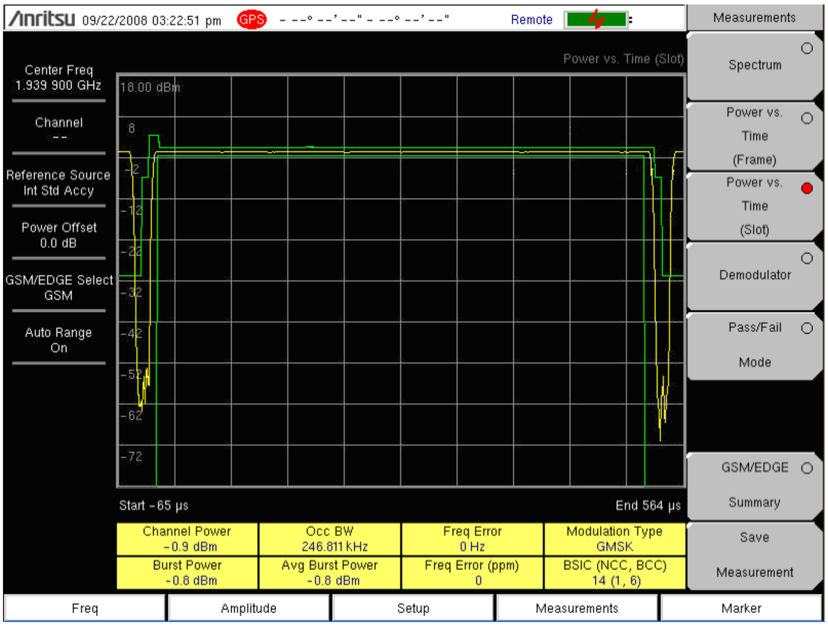


Figure 2-4. GSM Power vs. Time (Slot) Measurement

2-5 Demodulator

This measurement demodulates the GSM/GPRS/EDGE signal and displays the vector with Phase Error, EVM, Origin Offset, C/I, Modulation Type and Magnitude Error (as applicable). See Figure 2-5 and Figure 2-6. To demodulate the GSM/EDGE signal:

1. Set the frequency as described in the User Guide.
2. Press the **Setup** main menu key.
3. Press the GSM/EDGE submenu key and highlight Auto to automatically select the GSM or EDGE signal.

Note	Highlight GSM or EDGE to set the instrument to measure only a GSM or EDGE signal.

4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS to get GPS High Accuracy frequency error measurements. Refer to the User Guide for GPS setup information.
5. Press the **Measurements** main menu key.
6. Press the Demodulator submenu key.

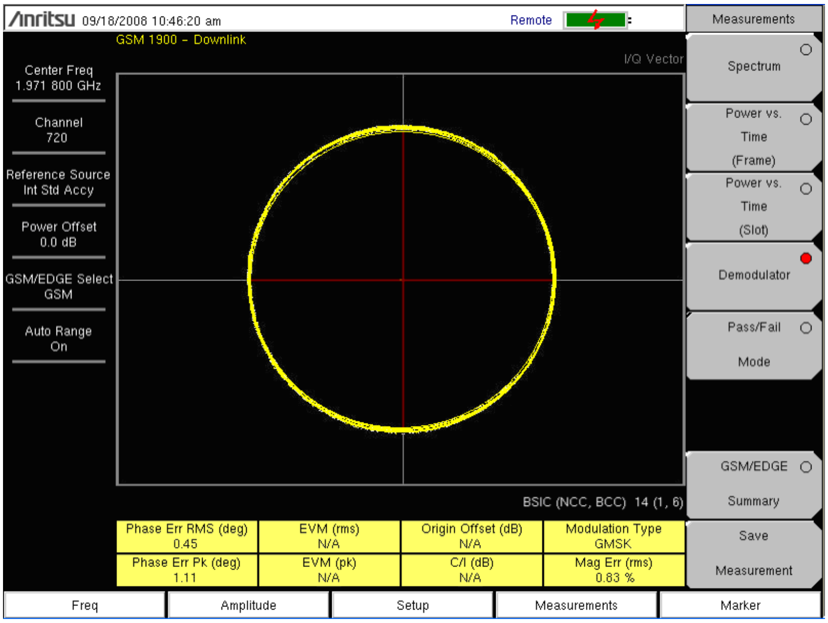


Figure 2-5. GSM Demodulator Measurement

Note	Using multi-channel spectrum, channel cursor, select the channel and press the Demodulator submenu key and the unit will demodulate the selected channel.

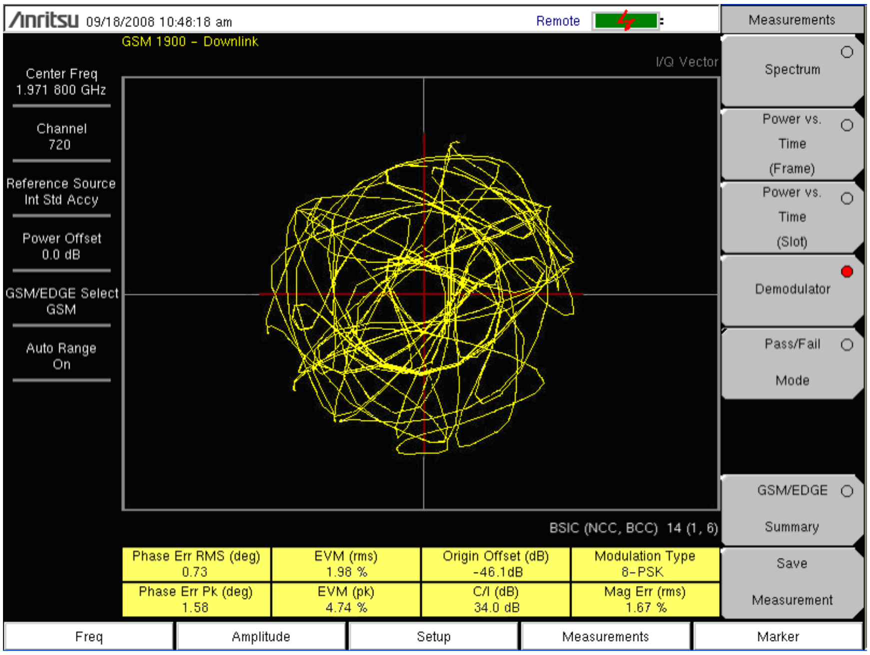


Figure 2-6. EDGE Demodulator Measurement

To display the GSM/EDGE Summary screen (Figure 2-7), press the GSM/EDGE Summary soft key.

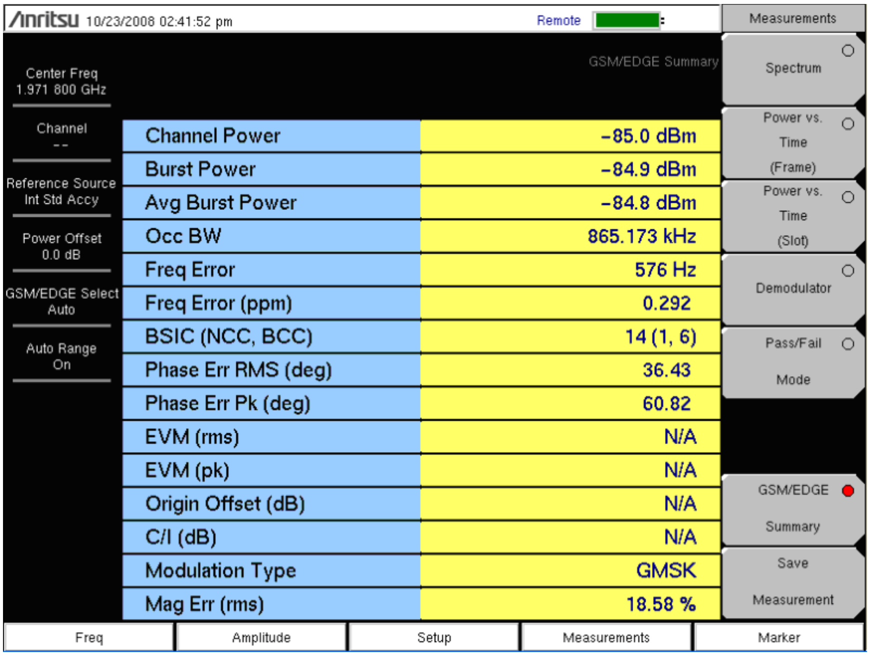


Figure 2-7. GSM/EDGE Summary

2-6 GSM/GPRS/EDGE Mode Pass/Fail

The unit can store test sets for testing base station performance and can recall these test sets for quick, easy measurements. These test sets are for reference only and can be edited using Master Software Tools. When a test set is selected, the unit displays the test results in a tabular format with PASS or FAIL indications that include min/max thresholds (Figure 2-8).

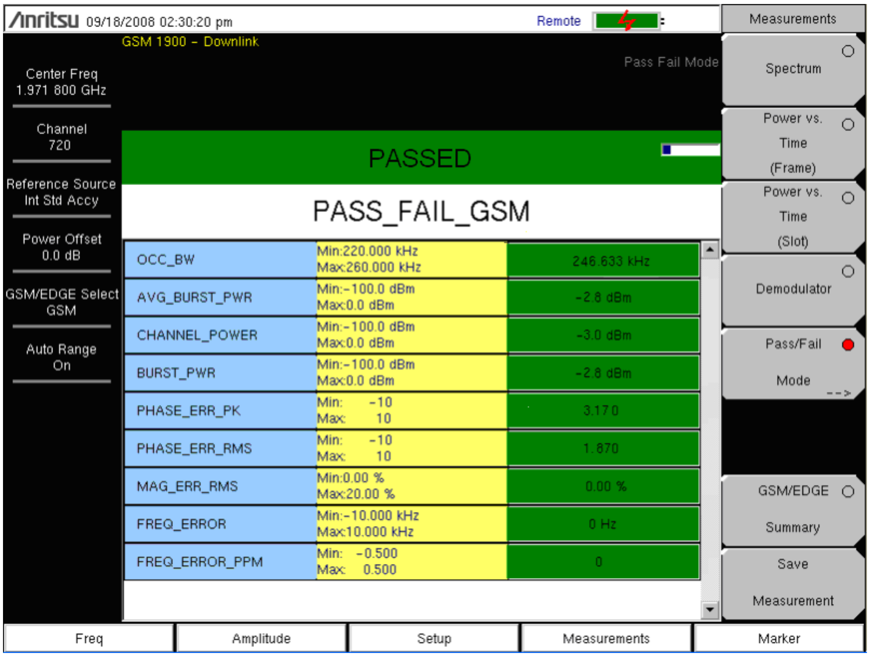


Figure 2-8. Pass/Fail Mode

Using Master Software Tools, a custom test set can also be created and downloaded to the instrument. All measurement parameters can be selected for pass/fail testing.

Pass/Fail Mode Procedure

1. Set the frequency as described in the User Guide.
2. Press the **Measurements** main menu key.
3. Press the Pass/Fail Mode submenu key to activate Pass/Fail Mode.
4. Press the Pass/Fail Mode submenu key to display the Pass/Fail Mode menu and then press the Select Pass/Fail Test submenu key to display the available test sets.
5. Use the rotary knob or **Up/Down** arrow keys to select the applicable test set and to activate the measurement.

Refer to the Master Software Tools documentation for information on creating a custom pass/fail test set.

2-7 Measurement Results

Average Burst Power

The average burst power over 10 measured burst power values. This average is restarted when a new frequency is selected.

Channel Power

Channel power measures the average power in a GSM/EDGE frame in the frequency specified. Out of specification power indicates system faults. Channel power is expressed in dBm.

Freq Error

The difference between the received frequency and the specified frequency is the frequency error. This number is only as accurate as the frequency reference used, and is typically only useful with a good external frequency reference or GPS. Frequency error is displayed in both Hz and ppm.

Occ BW

The occupied bandwidth is calculated as the bandwidth containing 99% of the transmitted power.

Burst Power

Burst power is the average power over the useful part of the first active burst GSM/EDGE slot. A GSM/EDGE signal has eight time slots in a frame.

BSIC (NCC, BCC)

This is the Base Station Identity Code broadcasted on GSM systems. The code consists of a Network Color Code (NCC) and a Base Station Color Code (BCC).

Phase Err RMS (deg)

The RMS phase error measured in degrees between the received signal and an ideal reconstructed reference signal of the first active slot.

Phase Err Pk (deg)

The peak phase error measured in degrees between the received signal and an ideal reconstructed reference signal of the first active slot.

EVM (rms)

The RMS (%) of all the error vectors between the ideal reconstructed reference symbol points and the received symbol points divided by the RMS value of the signal present in the first active slot. This measurement is performed for 8PSK modulated signals (EDGE) only.

EVM (pk)

The peak (%) of all the error vectors between the ideal reconstructed reference symbol points and the received symbol points divided by the RMS value of the signal present in the first active slot. This measurement is performed for 8PSK modulated signals (EDGE) only.

Origin Offset (dB)

Origin Offset is the carrier leakage component of the measured signal in dB and this measurement is applicable to EDGE signal only.

Carrier to Interference Ratio – C/I (dB)

Carrier to Interference Ratio is the ratio of the desired carrier power to the undesired signal power (interferer) in dB. This value is an estimate that is derived from the measured RMS EVM value. This measurement is applicable to an EDGE signal only.

Modulation Type

The modulation type can be GMSK (for GSM signals) or 8PSK (for EDGE signals).

Mag Err (rms)

The RMS of the magnitude error between the received signal and an ideal reconstructed reference signal of the first active slot in %.

2-8 GSM/GPRS/EDGE Menus

Figure 2-9 show the map of GSM/GPRS/EDGE menus. The following sections describe GSM/GPRS/EDGE main menus and associated submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.

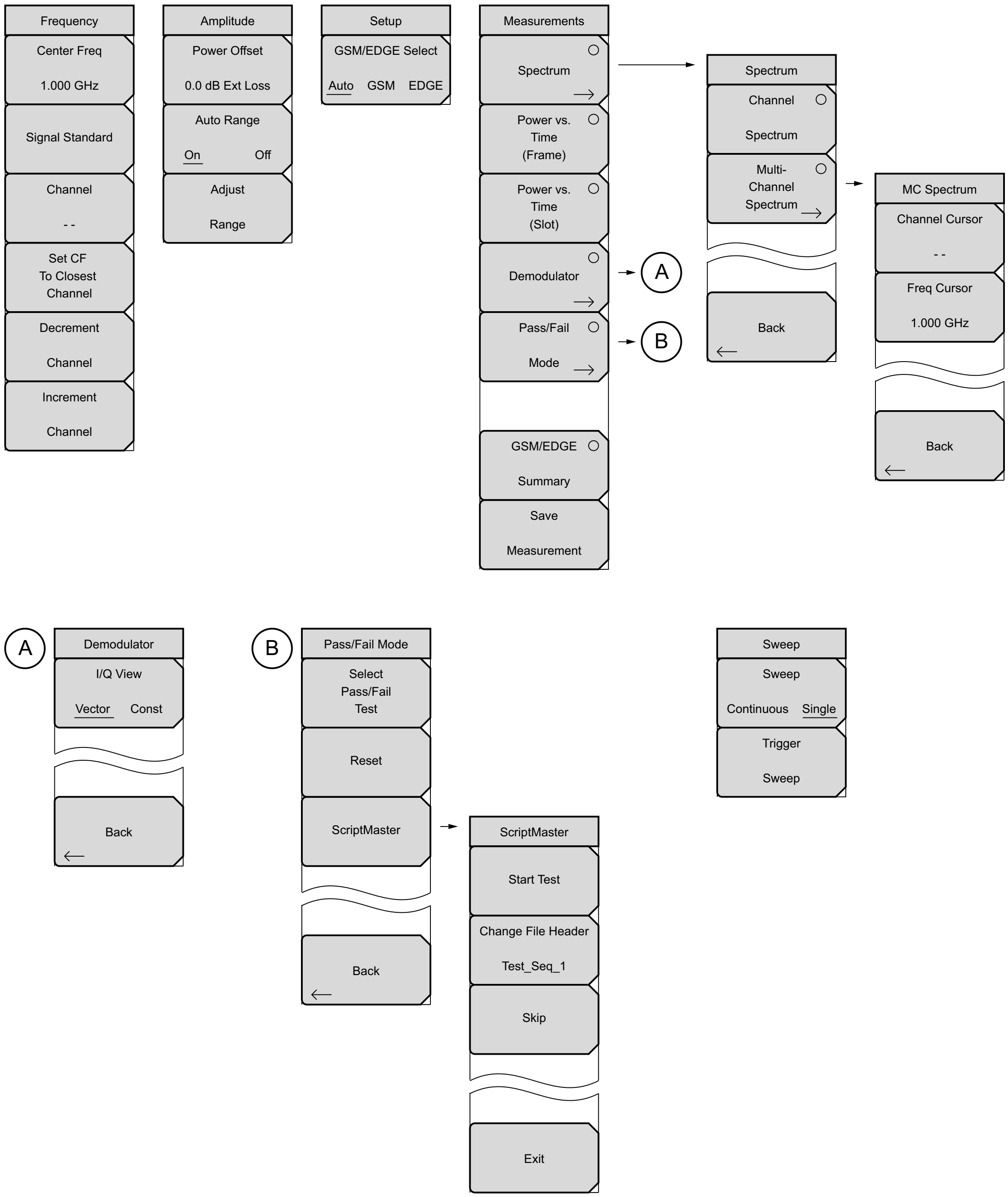
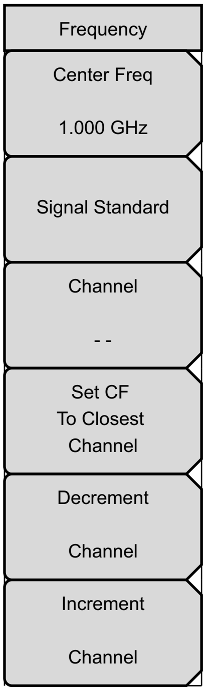


Figure 2-9. GSM/GPRS/EDGE Menu Layout

2-9 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press the **Freq** key followed by the Center Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the Enter key has the same effect as pressing the MHz submenu key.

Signal Standard: Use the **Up/Down** arrow keys or the rotary knob to highlight a signal standard and press **Enter** to select. When a signal standard is selected, the center frequency and span for the first channel of the selected standard is automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered. Appendix A contains a table of the signal standards that are in the instrument firmware.

Channel: Use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard. The center of the channel is automatically tuned to the center frequency of the selected GSM/EDGE channel.

Set CF To Closest Channel: Changes the center frequency to the closest channel.

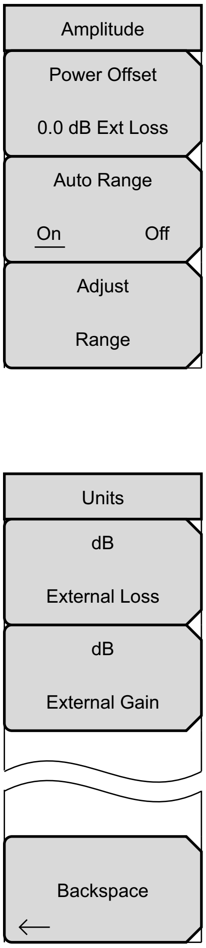
Decrement Channel: Decreases the channel number one channel.

Increment Channel: Increases the channel number one channel.

Figure 2-10. GSM/GPRS/EDGE Freq Menu

2-10 Amplitude Menu

Key Sequence: **Amplitude**



Power Offset: Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

By default, the instrument will automatically change attenuation, preamplifier and digital gain settings to make the best GSM measurements.

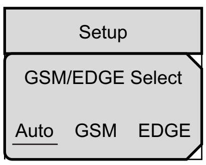
Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

Figure 2-11. GSM/GPRS/EDGE Amplitude Menu

2-11 Setup Menu

Key Sequence: **Setup**

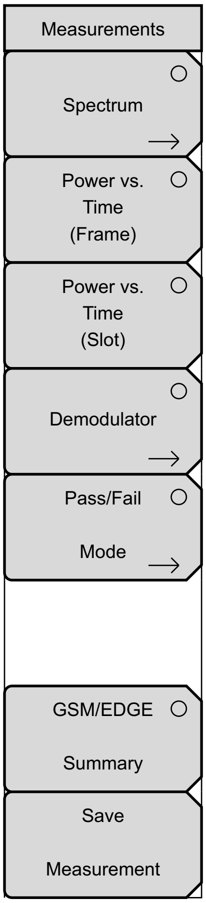


GSM/EDGE Select: Toggles between Auto, GSM and EDGE. Auto allows the instrument to search for a GSM or EDGE signal automatically. Selecting GSM or EDGE sets the instrument to measure only a GSM or EDGE signal.

Figure 2-12. GSM/GPRS/EDGE Setup Menu

2-12 Measurements Menu

Key Sequence: **Measurements**



Spectrum: Opens the "Spectrum Menu" on page 2-14.

Power versus Time (Frame): Displays approximately eight and a half slots of the GSM/EDGE signal frame starting from the first active slot found. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Modulation Type, Burst Power, Avg Burst Power, and BSIC.

Power versus Time (Slot): Displays the first active slot of the GSM/EDGE signal capture. The mask is as specified in 3GPP TS 05.05. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Modulation Type, Burst Power, Avg Burst Power, and BSIC.

Demodulator: Opens the "Demodulator Menu" on page 2-15. Displays the IQ vector of the GSM/EDGE signal. The screen also displays Phase Err RMS, Phase Err Pk, EVM (rms), EVM (pk), Origin Offset (dBc), C/I (dB), Modulation Type and Magnitude Error (rms).

Note: GSM uses GMSK modulation and EDGE uses 8PSK modulation. EVM (rms), EVM(pk), Orgin Offset, C/I are not measured for GSM signals (shows N/A on the display).

Pass/Fail Mode: Opens the "Pass/Fail Mode Menu" on page 2-16. Displays the Pass/Fail measurements in a table format with clear pass or fail indicators that include min/max thresholds and actual measured results.

GSM/EDGE Summary: Displays the measurement results in a table format.

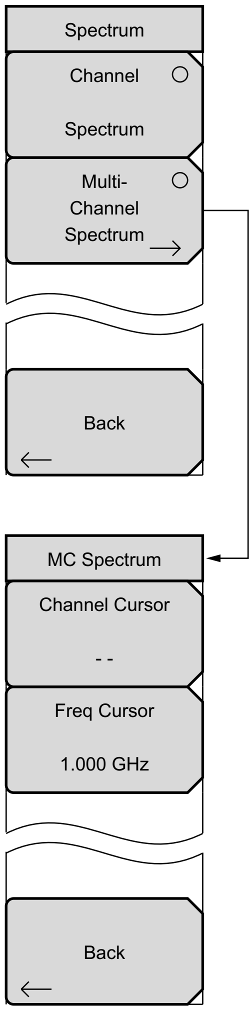
Save Measurement: Opens a dialog window to name and save the current measurement. Refer to the User Guide that came with the instrument for the saving functions.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Trace-1, Trace-2, and so forth) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or press the submenu key for each letter. GSM measurements are saved with a .gsm file extension, and GSM/EDGE measurements are saved with an .edg extension.

Figure 2-13. GSM/GPRS/EDGE Measurements Menu

Spectrum Menu

Key Sequence: **Measurements** > Spectrum



Channel Spectrum: Displays the spectrum of the selected channel. The screen also displays Channel Power, Occupied Bandwidth, Frequency Error in PPM and Hz, Burst and Average Burst Power, and the Base Station Identity Code (BSIC).

Multi-Channel Spectrum: Displays the spectrum of ten GSM/EDGE channels. Opens the MC Spectrum Menu shown below:

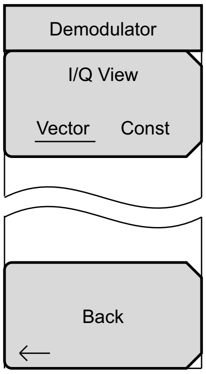
> **Channel Cursor:** Select Channel Cursor to place the cursor at a specific channel location. Use the rotary knob or the **Up/Down** arrow keys to select the channel. Press the **Enter** key to select.
>
> **Freq Cursor:** Select Freq Cursor to place the cursor at a specific frequency. Use the rotary knob or the **Up/Down** arrow keys to select the frequency. Press the **Enter** key to select.
>
> **Back:** Returns to the Spectrum Menu.

Back: Returns to the "Measurements Menu".

Figure 2-14. Spectrum Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



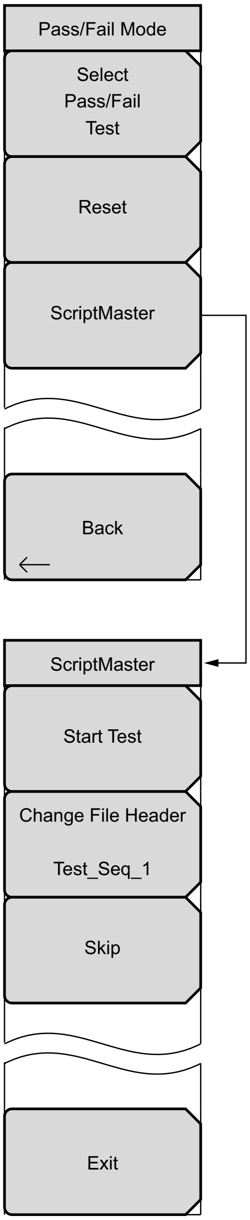
I/Q View: Allows selection between Vector or Const.

Back: Returns to the “Measurements Menu”.

Figure 2-15. GSM/GPRS/EDGE Freq Menu

Pass/Fail Mode Menu

Key Sequence: **Measurements** > Pass/Fail Mode



Select Pass/Fail Test: Display the available test sets in the Select Pass/Fail Test window.

Reset: Resets the Pass/Fail Mode test.

ScriptMaster: Opens the Select File by Scrolling window and also lists Recall and Back submenu keys. Recall a Script file, created in Master Software Tools, from the window. The ScripMaster instructions are loaded into the instrument and the ScriptMaster menu is listed.

> **Start Test:** Begins running the instructions listed in ScriptMaster.
>
> **Change File Header:** Opens the Pass Fail Test File Header entry window and lists the Text Entry menu to name the saved file after the ScriptMaster measurement process is complete.
>
> **Skip:** Skips over a ScripMaster instruction.
>
> **Exit:** Ends the ScriptMaster measurement process. Returns the instrument to the previous measurement setup.

Back: Returns to the "Measurements Menu".

Figure 2-16. GSM/GPRS/EDGE Pass/Fail Menu

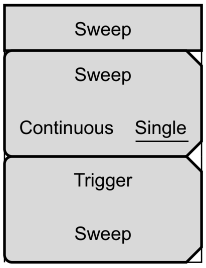
2-13 Marker Menu

Key Sequence: **Marker**

This menu is available only in Multi-Channel Spectrum view and opens the MC Spectrum submenu. See the “Spectrum Menu” on page 2-14 for details.

2-14 Sweep Menu

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



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

Trigger Sweep: Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

Figure 2-17. GSM/GPRS/EDGE Sweep Menu

2-15 Measure Menu

This menu opens the “Measurements Menu” on page 2-13.

2-16 Trace Menu

This menu is not available in GMS/GPRS/EDGE measurement mode.

2-17 Limit Menu

This menu is not available in GMS/GPRS/EDGE measurement mode.

2-18 Other Menus

Preset, **File**, **Mode** and **System** are described in the instrument User Guide.

Chapter 3 — W-CDMA/HSPA+ Signal Analyzer

3-1 Introduction

The WCDMA/HSPA+ signal analyzer supports the following measurement modes:

- RF Measurements
- Demodulator
- Over-The-Air (OTA) Measurements

Connect the instrument to any Node B/BTS for accurate RF and demodulator measurements.

Note	The W-CDMA/HSPA+ Demodulator option demodulates both W-CDMA and HSPA+ signals. Refer to the instrument Technical Data Sheet for option availability.

The instrument can measure node B transmitter performance over the air or directly. To measure a W-CDMA signal over the air, connect the appropriate frequency band antenna to the RF In connector. To connect the node B equipment directly, connect the power amplifier of the node B equipment to the RF In connector of the unit using a coupler or attenuator.

Note	The maximum input damage level of the RF In port is +30 dBm. To prevent damage, always use a coupler or high power attenuator.

3-2 W-CDMA/HSPA+ Measurements

Note	Use an applicable band pass filter to eliminate out of band signals that can cause mixer saturation.

Carrier Frequency

Carrier Frequency is the selected transmitter operating center frequency entered by the user or calculated from the signal standard and channel number entered by the user.

Carrier Feedthrough

Carrier Feedthrough measures the amount of unmodulated signal that is leaking through the transmitter and is displayed in the Code Domain Power display. The W-CDMA 3GPP specification does not specify carrier feedthrough measurement.

CDP

Code Domain Power displays how much of the channel power is in each Orthogonal Variable Spreading Factor (OVSF code). Power is normalized to the channel power, so if a code reads –10 dB, it means that the code is 1/10th of the channel power. Colors are applied according to Table 3-1.

Table 3-1. Channel Power Colors

Parameter	Description	Color	VIewable on Display
CPICH	Common Pilot Channel	Red	All CDP views
P-CCPCH	Primary Common Control Physical Channel	Magenta	All CDP views
S-CCPCH	Secondary Common Control Physical Channel	Cyan	All CDP views
PICH	Paging Indicator Channel	Green	All CDP views
P-SCH	Primary Sync Channel	Navy Blue	Control Channels
S-SCH	Secondary Sync Channel	Blue	Control Channels
Traffic	W-CDMA Traffic	Yellow	All CDP views
Noise	Noise	Grey	All CDP views
HS-PDSCH	High Speed Physical Downlink Shared Channel	Orange	HSPA+ Screen and CDP Screen when the W-CDMA/HSPA+ option is installed

Note	In W-CDMA specification, the P-SCH and S-SCH are not assigned spreading codes and therefore do not appear in the code domain power display. They have special non-orthogonal scrambling codes and are on 10% of the time.

Channel Power

Channel power is the total power transmitted in the 5 MHz W-CDMA channel specified. Channel Power measures the node B/base station transmitting power across the entire 5 MHz W-CDMA (BTS) channel. Channel power is displayed in dBm and Watts.

For Over the Air (OTA) measurements, the channel power will vary as the signal path from the node B transmitter to the instrument varies.

Scrambling Code

In the W-CDMA specification, the scrambling code can be from 0 to 511. If the scrambling code is known, its value can be entered and the test set can decode and display the code domain power of the signal. If the scrambling code is unknown, the instrument can be set to auto scrambling so that the test set can lock onto the strongest code to decode and display the code domain power of the signal.

Spreading Factor (OVSF)

According to the 3GPP standard the spreading factor can be from 4 to 512, and the instrument can be set to a maximum spreading factor of 256 or 512.

Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This is tied to the external frequency reference accuracy and is typically useful only with a good external frequency reference.

Codogram

When Codogram is selected the screen displays the changes in code power levels over time.

Noise Floor

The average power of inactive codes in the code domain, as displayed in the CDP measurement display.

Threshold

The Active Channel Threshold Level can be set to indicate which code channels are considered active. Any code channels exceeding this power level are considered active traffic channels and any code channels below this power level are considered inactive (or noise). A horizontal red line on the screen represents the threshold level. This level can be set automatically based on the received signal, or the user can manually enter a value in the Threshold setup menu.

Occupied Bandwidth

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the transmitted spectrum around the selected center frequency.

EVM (Error Vector Magnitude)

The Error Vector Magnitude is the ratio in percent of the difference between the measured waveform and the reference waveform. EVM metrics are used to measure the modulation quality of a transmitter. The 3GPP standard requires that the EVM not exceed 17.5%.

```
EVM = (reference-measured) / reference x 100
```

Symbol EVM (EVM)

Symbol EVM is defined as the EVM for a single code channel.

Peak to Average Power

Peak to Average power is the ratio of the peak power and the RMS power of the signal calculated over one frame interval and is displayed in dB.

Peak CD Error (Peak Code Domain Error)

PCDE takes the noise and projects the maximum impact it will have on all OVSF codes. PCDE is the maximum value for the code domain error for all codes (both active and inactive).

In the 3GPP standard, in order to address the possibility of uneven error power distribution in W-CDMA, the EVM measurement has been supplemented with PCDE. The 3GPP standard requires that the PCDE not exceed –33 dB at a spreading factor of 256.

Ec

Ec is a measurement of energy. Ec is determined by multiplying CPICH by the chip time.

Ec/Io

The pilot power compared to the total channel power. Ec/Io is displayed in text-only displays and in OTA measurement displays.

Pilot Dominance

The strength of the strongest pilot compared to the next strongest pilot in the same channel. This should be >10 dB in order to make good measurements.

OTA Total Power

The total channel power is also called (Io) and displayed in dBm.

CPICH Power

CPICH power is the power of the Common Pilot Channel power displayed in dBm.

P-CCPCH Power

P-CCPCH power is the Primary Common Control Physical Channel power displayed in dBm.

S-CCPCH Power

S-CCPCH power is the Secondary Common Control Physical Channel power displayed in dBm.

P-SCH Power

P-SCH power is the Primary Sync Channel power displayed in dBm.

S-SCH Power

S-SCH power is the Secondary Sync Channel Power displayed in dBm.

PICH

PICH is the Paging Indicator Channel Power.

HSPA+ Power versus Time Display

Select the code and set the time to display how the code is varying over time. In CDP view, HSPA+ signals are displayed in orange.

Constellation

In the HSPA+ view, the symbol constellation for the selected code is displayed (16QAM or QPSK).

3-3 General Measurement Setups

Please refer to the User Guide for information on selecting the W-CDMA/HSPA+ Signal Analyzer mode, setting up frequency, amplitude, power offset for compensating external loss, limit lines, markers, and file management.

Scrambling Code Setup

The scrambling code can be set up automatically or manually.

In Auto mode, the unit automatically locks on to the strongest scrambling code in the signal. In Manual mode, the desired code is manually entered and the unit looks only for that specific scrambling code.

To set up auto scrambling:

1. Press the **Setup** main menu key.
2. Press the Scrambling Code submenu key to select Auto.

To manually set up a Scrambling Code:

1. Press the **Setup** main menu key.
2. Press the Scrambling Code submenu key to select Manual and use the keypad, the arrow keys, or the rotary knob to enter the desired Scrambling Code, as shown on the left side of the screen. Press the **Enter** key to set the scrambling code.

Maximum Spreading Factor Setup

In a W-CDMA system, the number of chips per data symbol is called the Spreading Factor. The lower the spreading factor the higher the data rate. According to the 3GPP standard, the spreading factor can vary from 4 to 512 and the maximum spreading factor is either 256 or 512. The instrument can be set to 256 or 512 maximum spreading factors. To set up the maximum spreading factor:

1. Press the **Setup** main menu key.
2. Press the Max Spreading Factor submenu key to select either 256 or 512.

S-CCPCH Spreading Factor, S-CCPCH Code and PICH Code Setup

In the 3GPP specification, two optional control channels are provided for S-CCPCH and PICH. These codes can have different spreading codes and spreading factors. The S-CCPCH spreading factor and S-CCPCH and PICH codes can be manually entered.

Note	For the most accurate results, manually enter the S-CCPCH spreading factor and the S-CCPCH and PICH codes before taking the measurement.

1. Press the **Setup** main menu key.
2. Press the S-CCPCH Spread submenu key and manually enter the desired spreading factor. The default value is 256.
3. Press the S-CCPCH Code submenu key and manually enter the desired spreading code. The default value is 3.
4. Press the PICH Code submenu key and manually enter the desired spreading code. The default PICH code is 16.

Threshold Setup

The threshold level is an advanced setting that can be set to indicate which codes are considered active. In the Code Domain Power screen, the threshold level is indicated by a horizontal dotted red line. Any code channels exceeding this power level are considered active traffic channels and any code channels below this power level are considered inactive or noise. To set the threshold level:

1. Press the **Setup** main menu key, then press More.
2. Press the Threshold submenu key and select Auto or Manual.
3. To set the threshold level manually, press the Manual Threshold submenu key and use the rotary knob, arrow keys, or the numeric keypad to change the value. When entering a threshold using the keypad, the screen menu will show the Units key. Press the dB submenu key or the **Enter** key to set the entered threshold.

Filtered versus Unfiltered Power

The ACLR measurement uses the filtered channel power to determine the ACLR values and it is listed as filtered on the display. In all other screens the unfiltered channel power is displayed as channel power.

3-4 W-CDMA/HSPA+ RF Measurements

The W-CDMA/HSPA+ RF Measurements consist of three measurements:

- Spectrum
- Adjacent Channel Leakage Ratio (ACLR)
- Spectral Emission Mask

To make W-CDMA RF measurements, connect the RF in connector to the node B equipment.

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.

Band Spectrum Setup

Displays the selected band spectrum. The cursor can be moved to select the desired channel using the directional arrow keys or the rotary knob. The Channel Number can also be directly entered using the numerical keypad.

Note	Selecting Channel Spectrum after selecting a channel using the cursor will display the measurements for the selected signal.

Band Spectrum Procedure

1. Set the measurement frequency by using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key and the RF Measurements submenu key.
3. Press the Band Spectrum submenu key to display the band spectrum (Figure 3-1).

4. Move the cursor, using the directional arrow keys or the rotary knob, to select the desired channel. The Channel Number can also be directly entered using the numerical keypad.

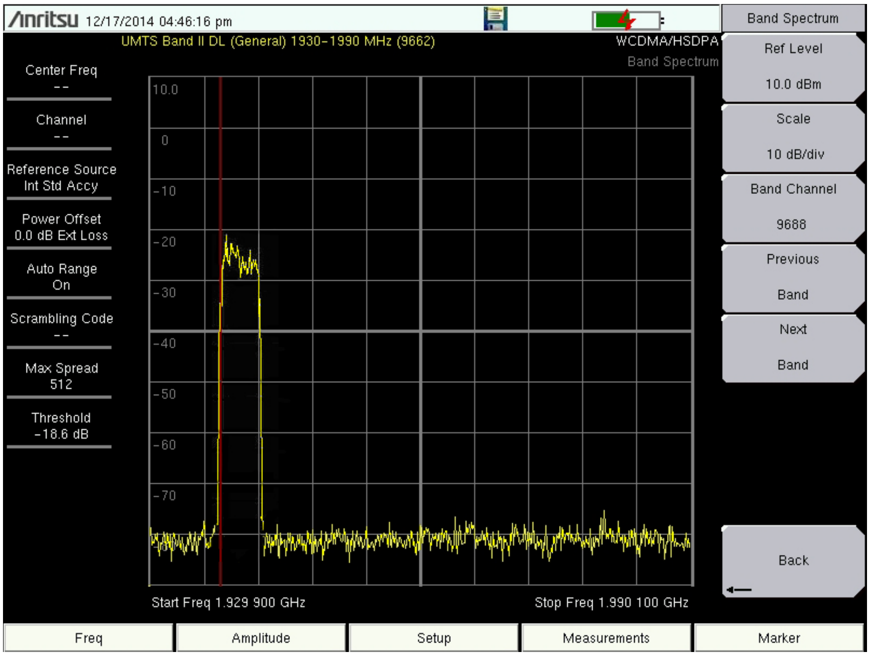


Figure 3-1. Band Spectrum

Channel Spectrum Setup

The channel spectrum screen displays the selected channel signal and the following measurements: channel power in dBm and Watts, occupied bandwidth, and peak to average power. When Channel Spectrum is selected, the unit automatically displays the measurements for the selected signal.

Channel Spectrum Procedure

1. Press the **Setup** main menu key.
2. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
3. Press the **Measurements** main menu key.
4. Press the RF Measurements submenu key.
5. Press the Channel Spectrum submenu key to activate the spectrum measurement (Figure 3-2).

Note	Using the Band Spectrum cursor, select the desired channel and the unit will automatically display the measurements for the selected channel when the Channel Spectrum key is selected.

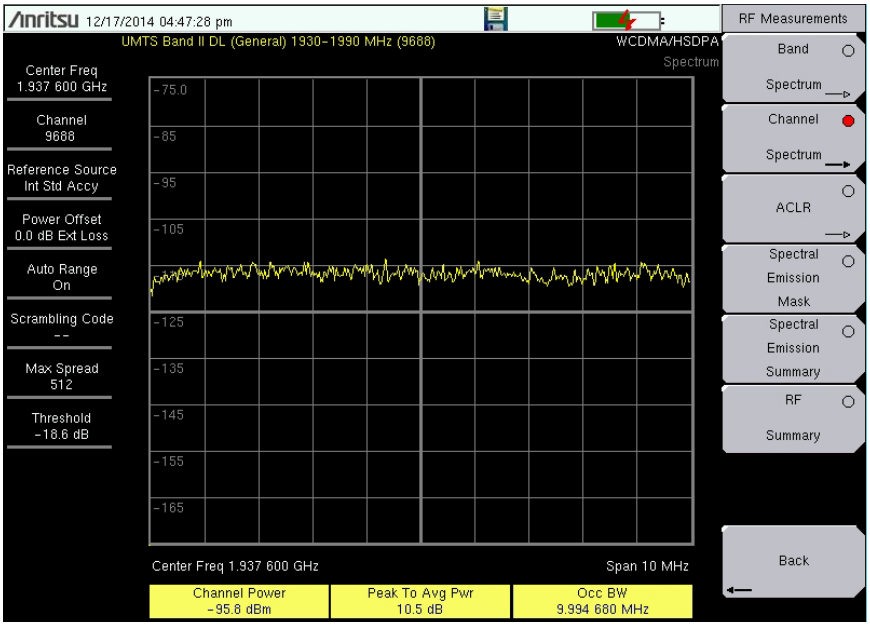


Figure 3-2. Channel Spectrum

ACLR Measurement Setup

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The 3GPP standard specifies one main channel and two adjacent channels. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph.

The channel spacing is –10 MHz, –5 MHz, +5 MHz and +10 MHz and the channels are color coded. The 3GPP standard requires the adjacent channel power leakage ratio to be better than 45 dB at 5 MHz offset and 50 dB at 10 MHz offset.

ACLR measurements can be made for multi-channel systems by measuring the main channels and the adjacent channels, from one to four channels. The ACLR screen can display up to 12 channels total.

In the ACLR measurement mode the filtered channel power is used to determine ACLR values and is listed as filtered on the display.

The following procedure is for one main channel two adjacent channels.

ACLR Measurement Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key.

3. Press the RF Measurements submenu key.

Note	The ACLR measurement uses the filtered channel power to determine the ACLR values and it is listed as filtered on the display. In all other screens the unfiltered channel power is displayed as channel power.

4. Press the ACLR submenu key to activate the ACLR measurement.

Note	Using the Band Spectrum cursor, select the required channel and press the ACLR submenu key. The measurement will be displayed.

5. Press the ACLR submenu key again and select one main channel and two adjacent channels (Figure 3-3).

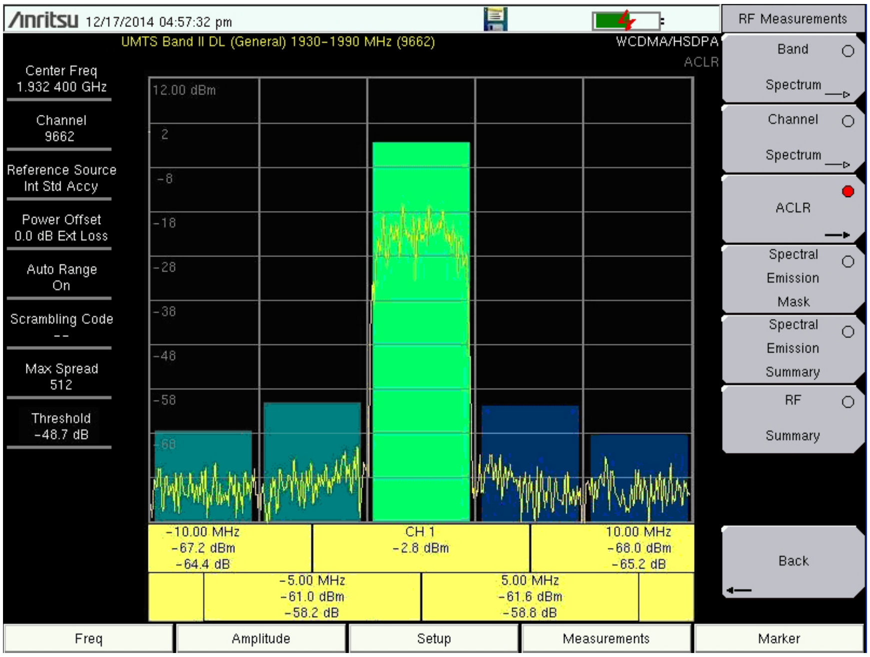


Figure 3-3. ACLR Measurement

ACLR Multi-channel ACLR Procedure

1. Press the **Measurements** main menu key.
2. Press the RF Measurements submenu key.
3. Press the ACLR submenu key to activate the ACLR measurement.
4. Press the ACLR submenu key again to open the ACLR menu.
5. Press Select # of Main Channels to open the Num of Main Channels list box. Highlight the desired number of channels and press **Enter**. In Figure 3-4, four channels were selected.

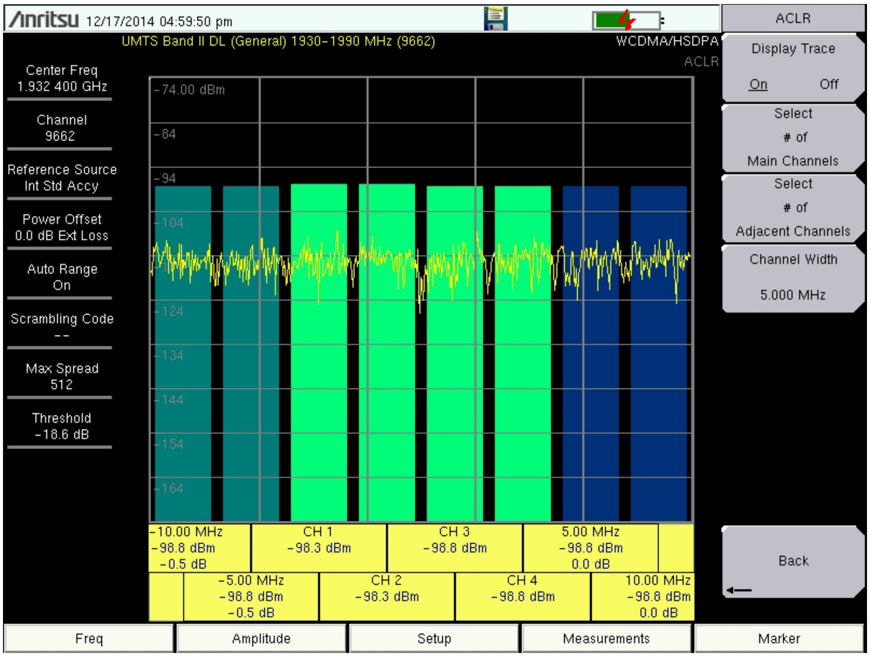


Figure 3-4. ACLR Multi-channel Measurement

Spectral Emission Mask Setup

The Spectral Emission Mask displays the selected signal and the mask as defined in the 3GPP specification. The mask varies depending upon the input signal. The instrument also indicates if the signal is within the specified limits by displaying PASSED or FAILED. The emission mask is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

The 3GPP specification specifies four masks depending upon the base station output power:

- $P \geq 43$ dBm
- $39 \leq P < 43$ dBm
- $31 \leq P < 39$ dBm
- $P < 31$ dBm

Spectral Emission Mask Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. Press the Spectral Emission Mask submenu key to activate the Spectral Emission Mask measurement (Figure 3-5).

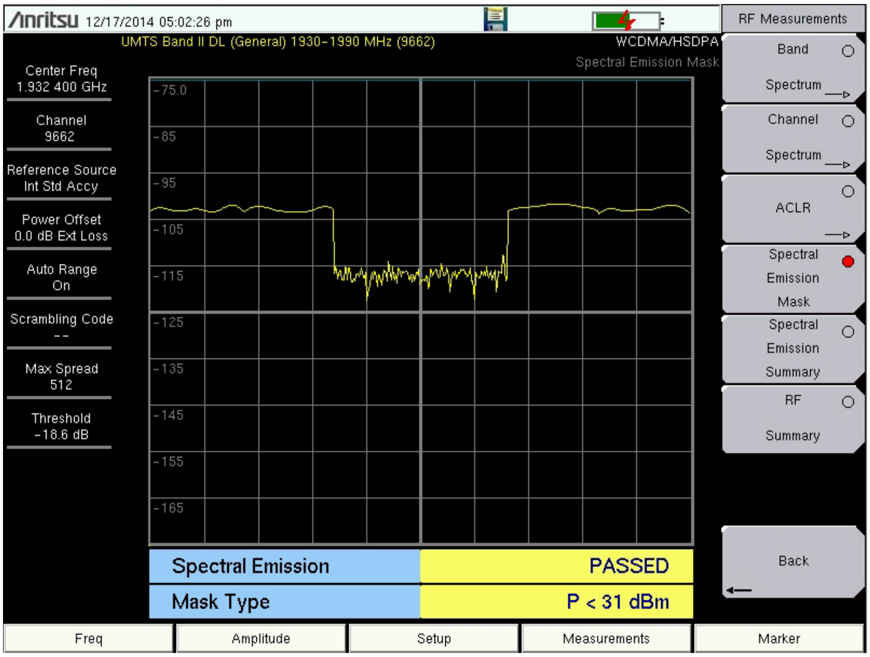


Figure 3-5. Spectral Emission Mask Measurement

5. Press the Spectral Emission Summary submenu key to display the Spectral Emission Summary table (Figure 3-6).

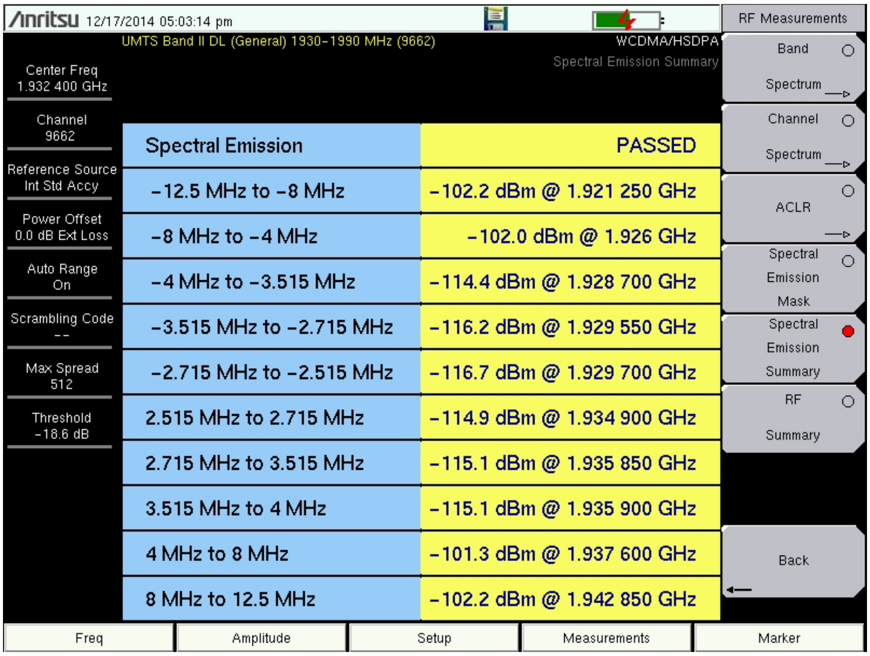


Figure 3-6. Spectral Emission Mask Summary

RF Summary

The RF Summary displays the critical transmitter performance measurements in the table format, without demodulating the W-CDMA/HSPA+ signal. The parameters displayed in the RF summary table are Channel Power in dBm and Watts, Carrier Frequency, Frequency Error, Spectral emission Pass/Fail criteria, Occupied Bandwidth, Peak to Average Power, ACLR at –10 MHz, –5 MHz, 5 MHz and 10 MHz channels.

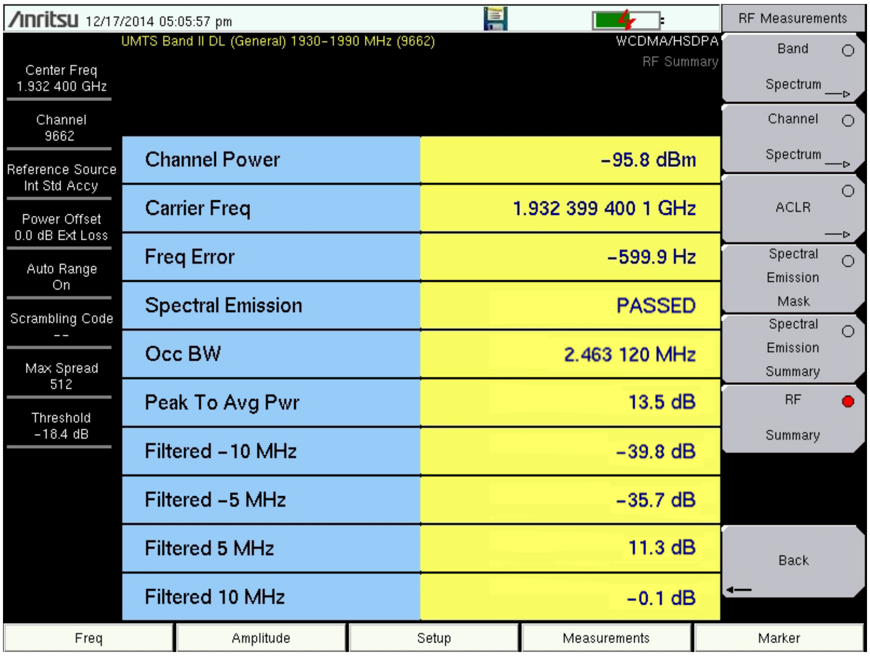


Figure 3-7. RF Summary

3-5 Demodulator

In the demodulator mode, the RF In is connected to the node B equipment and the unit will demodulate the W-CDMA signal. The W-CDMA/HSPA+ demodulator has Code Domain Power (CDP), HSPDA, Codogram and Modulation Summary screens.

Note	The W-CDMA/HSPA+ Demodulator option demodulates both W-CDMA and HSPA+ signals. The W-CDMA Demodulator only demodulates W-CDMA signals.

Zoom Function

In CDP and Codogram measurements, the Zoom function can be activated to zoom in on selected OVSF codes. The Zoom function can be set to start from a particular OVSF code.

Note	Press CDP or Codogram twice to activate the zoom function. The arrow in the lower right corner of the submenu key indicates a sub menu is available.

Code Domain Power (CDP) Setup

The Code Domain Power (CDP) display includes spreading factor (OVSF codes) 256 or 512 with zoom in on codes. The instrument can zoom to 32, 64 and 128 codes and the user can input the zoom code to start the zoom in from the entered OVSF codes. The demodulator also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH power in the table format. For W-CDMA/HSPA+ Demodulator, the HSPA+ codes are also displayed.

Code Domain Power (CDP) Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
5. Connect the external reference to the RF In BNC connector and wait for the unit to recognize the external reference and lock up to it. Refer to the User Guide for additional information.
6. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
7. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
8. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
9. Press the Threshold submenu key to manually set the Threshold level which determines which codes are active. The default value is –30 dB.
10. Press the **Measurements** main menu key.
11. Press the **Demodulator** submenu key to activate the demodulator menu.
12. Press the CDP submenu key to activate the CDP measurement.
13. Press the CDP submenu key again to activate the zoom function.
14. Press the Zoom submenu key to select the appropriate zoom level. The Zoom key toggles between 32, 64, and 128.
15. Press the Zoom Start submenu key to manually enter the zoom start code.
16. Press the Back submenu key to go back to the CDP measurement.

Note	The blue color block on the CDP screen represents the selected zoom codes and the same codes are displayed in the zoom screen.

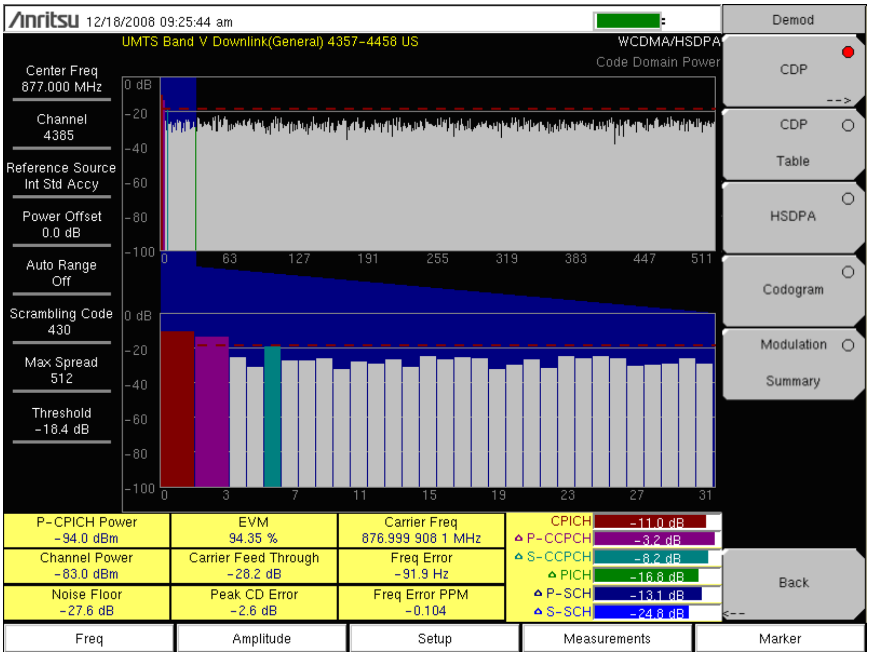


Figure 3-8. CDP Measurement Summary

Activating Markers

1. Press the **Marker** main menu key to display the Marker menu.
2. Press the Marker submenu key to select the appropriate marker (1 through 6). The underlined marker number is the currently selected marker.
3. Press the On/Off submenu key to activate the selected marker.
4. Press the Marker Table submenu key to display the Marker table. The marker table is displayed on the screen below the CDP measurements table.

Note	Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the W-CDMA/HSPA+ measurements.

HSPA+ Setup

HSPA+ displays the spreading factor (OVSF codes) 256 or 512 codes and high speed downlink physical shared channel codes HS-PDSCH. The right or left active codes can be selected using the cursor. The selected code power versus time and constellation are displayed. The demodulator also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH power in the table format.

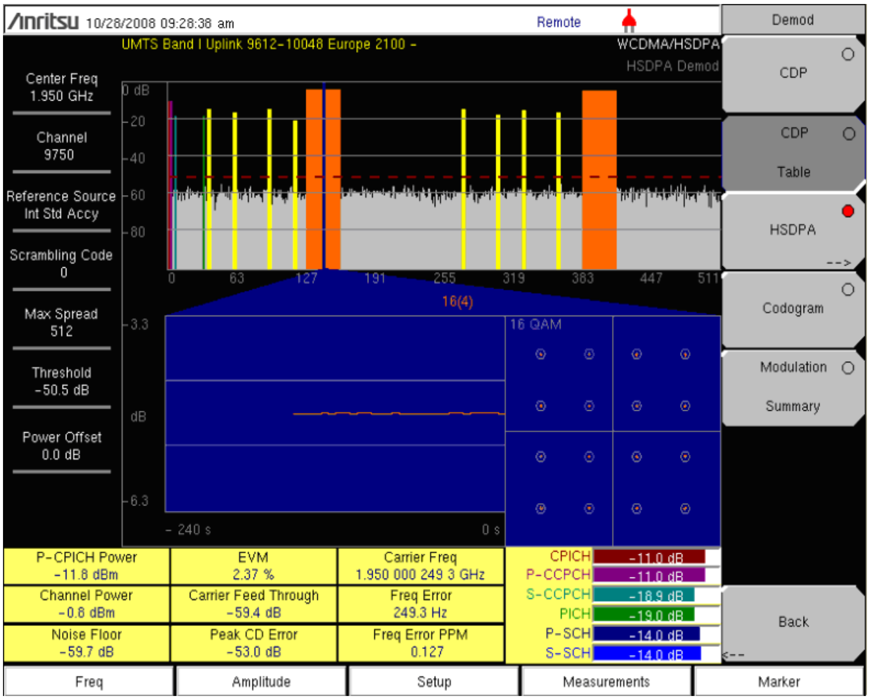


Figure 3-9. HSPA+ Measurement Summary

Note	This screen is available with the W-CDMA/HSPA+ demod option only.

HSPA+ Procedure

1. Press the Demodulator submenu key to list the Demod menu.
2. Press the HSPA+ submenu key to activate the HSPA+ measurement. The red dot on the submenu key indicates HSPA+ is selected.
3. Press the HSPA+ submenu key again to display the HSPA+ measurement signal parameters.
4. Press the Total Time submenu key to set the time or the Single Sweep Time submenu key to set the time for the power versus time display. The maximum time is 72 hours.
5. Use the cursor to select the desired code. The code parameters are displayed on the screen.

6. Press the IQ Persistence submenu key and use the keypad or rotary knob to set the IQ Persistence to 2. The instrument will display the constellation diagram after the first sample, and then update the constellation diagram after the second sample. IQ Persistence can be set as high as 48. When the maximum is reached, the first sample is replaced.

Note	The W-CDMA modulation type is QPSK, and the HSPA+ modulation is 16QAM or QPSK.

Activating Markers

1. Press the **Marker** main menu key to display the Marker menu.
2. Press the Marker submenu key to select the appropriate marker (1 through 6). The underlined marker number is the currently selected marker.
3. Press the On/Off submenu key to activate the selected marker.
4. Press the Marker Table submenu key to display the Marker table. The marker table is displayed on the screen below the measurements table.

Note	Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the W-CDMA/HSPA+ measurements.

Codogram Setup

Codogram displays the code power levels over time. Two graphs are displayed on the screen, the top one displays all the selected OVSF codes and the bottom one displays the selected OVSF zoom codes.

Codogram Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
5. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
6. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
7. Press the Threshold submenu key to manually set the Threshold level which determines which codes are active. The default value is –30dB.
8. Press the **Measurements** main menu key.
9. Press the Demodulator submenu key to list the Demod menu.

10. Press the Codogram submenu key to activate the Codogram measurement.
11. Press the Codogram submenu key again to list the Codogram menu and set the zoom and test time parameters for the measurement.
12. Press the Zoom submenu key to select the appropriate zoom level. The Zoom key toggles between 32, 64, and 128.
13. Press the Zoom Start submenu key to manually enter the zoom start code.
14. Press the Total Time or Single Sweep Time submenu key to set the required time.
15. Press the Back submenu key to go back to the Codogram measurement.

Note	The blue color block on the Codogram screen represents the selected zoom codes and the same codes are displayed in the zoom screen. Save the data before making any measurements, otherwise the data will be lost.

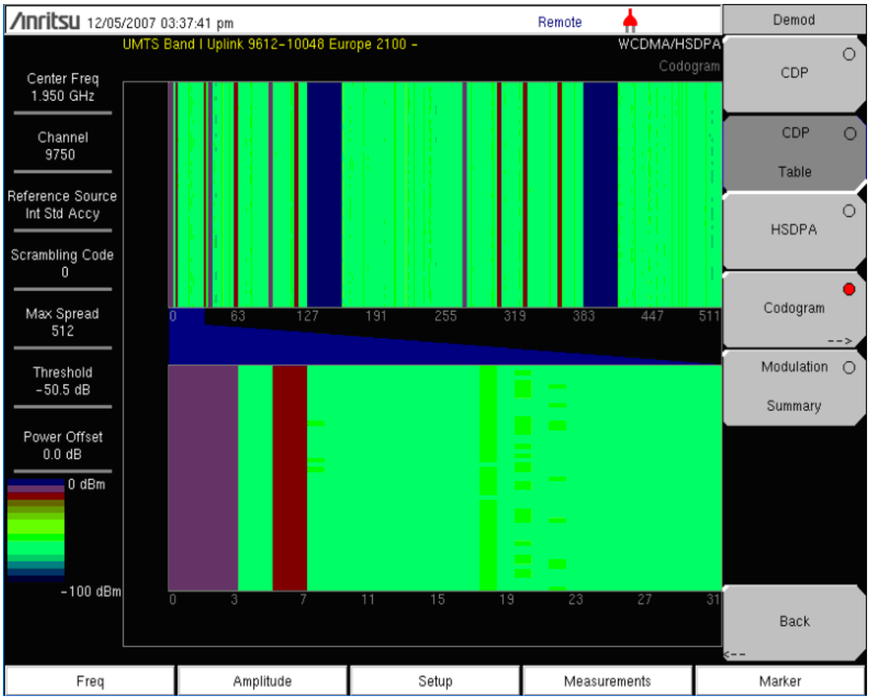


Figure 3-10. Codogram Measurement

3-6 Over-the-Air Measurements

OTA Setup

In Over-the-Air (OTA) mode, the instrument is not connected to the node B equipment. The OTA screen displays the six strongest scrambling codes as bar graphs. Displayed underneath the bar graphs are the related scrambling code number, CPICH, Ec/Io, Ec, and pilot dominance in the table format.

In Over-the-Air measurement, the Scrambling Code can be set to Auto to automatically measure and display the six strongest scrambling codes, or Manual, to look for the set scrambling codes.

The OTA measurement screen can be locked by pressing the Code Lock On/Off submenu key. The Display Unit submenu key can be used to display the OTA bar graph by selecting CPICH or Ec/Io. The default display is CPICH. The Sort By submenu key can display the scrambling codes sorted by Power or Code.

Note	Press Reset to activate the OTA measurement in a different location for accurate results.

OTA Procedure

1. Connect the appropriate antenna to the RF In connector to make OTA measurements.
2. Set the measurement frequency using one of the methods listed in the User Guide
3. Press the **Measurements** main menu key.
4. Press the OTA submenu key to display the Over-The-Air submenu.
5. Press the Scrambling Code submenu key and select Auto to automatically detect the six scrambling codes (Figure 3-11).
6. To only look for specific scrambling codes, press the Scrambling Code submenu key to highlight Manual, then use the Manual Code submenu key to select the specific code and the On/Off submenu key to turn the selected code on or off. The Code Lock submenu key locks the code, so that the code will not change with each update.

Refer to “Over-The-Air Menu” on page 3-38 for a description of OTA measurement submenus.

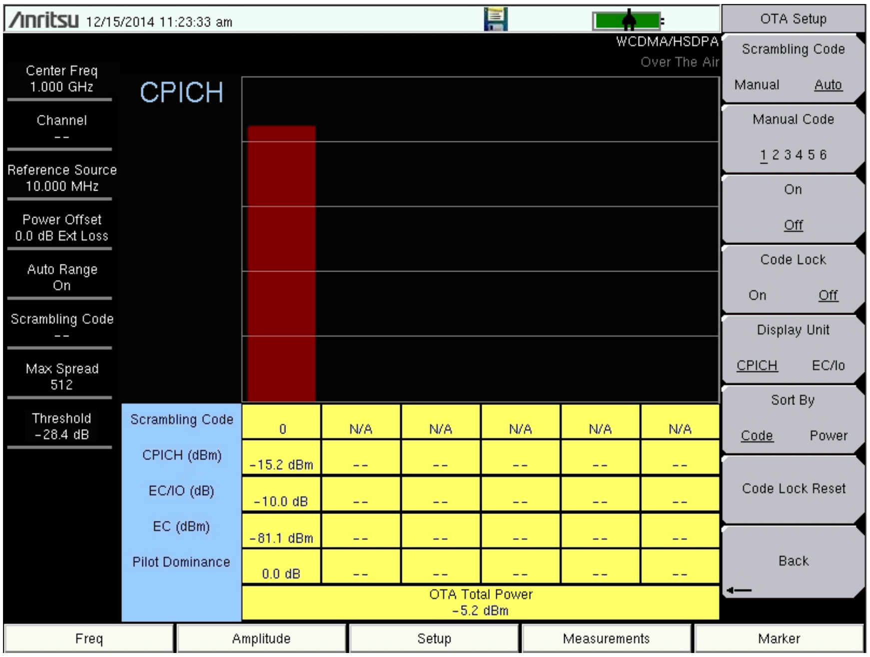


Figure 3-11. OTA Measurement Summary

W-CDMA Summary Setup

W-CDMA summary (Figure 3-12) displays the critical W-CDMA measurements from RF and demodulation measurements.

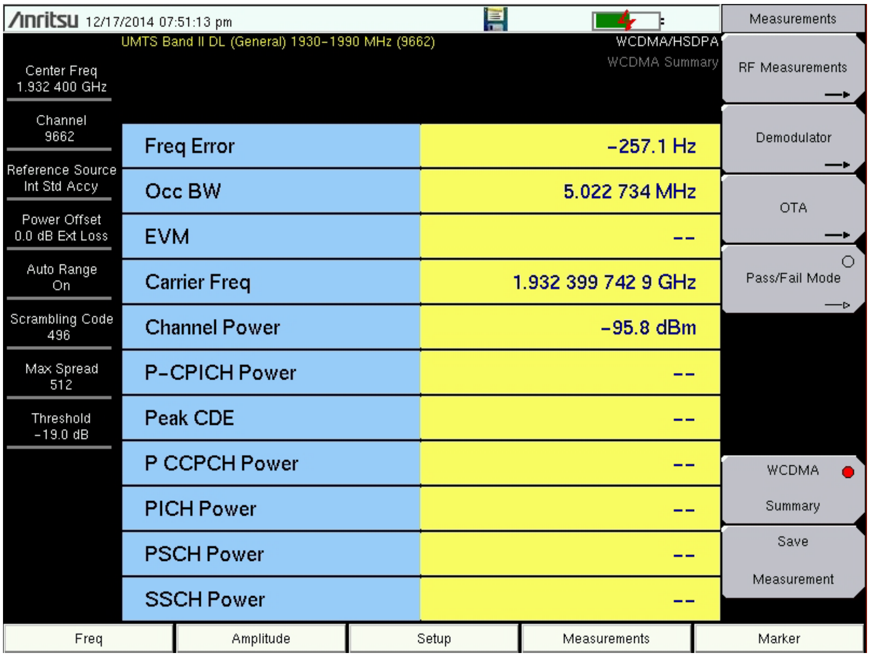


Figure 3-12. W-CDMA Measurement Summary

W-CDMA Summary Procedure

1. Set the measurement frequency using one of the methods listed in the User Guide.
2. Press the **Setup** main menu key.
3. Press the Scrambling Code submenu key to select Auto so that the scrambling code is automatically detected.
4. The instrument has automatic external reference frequency detection or, if equipped, activate GPS and synchronize the instrument to High Internal accuracy.
5. Connect the external reference to the RF In BNC connector and wait for the unit to recognize the external reference and lock to it.
6. Press the S-CCPCH Spread submenu key to manually set the S-CCPCH spreading. The default S-CCPCH spreading factor of 256 will be displayed in all the views. Set the S-CCPCH spreading factor to show accurate results.
7. Press the S-CCPCH Code submenu key to enter the correct S-CCPCH code. The default S-CCPCH code of 3 will be displayed in all the views. Set the S-CCPCH code to show accurate results.
8. Press the PICH Code submenu key to enter the correct PICH code. The default PICH code of 16 will be displayed in all the views. Set the PICH code to show accurate results.
9. Press the **Threshold** submenu key to manually set the Threshold level to determine which codes are active. The default value is –30dB.

10. Press the **Measurements** main menu key.
11. Press the W-CDMA Summary submenu key.

3-7 Pass/Fail Mode Setup

The instrument stores the five test models specified in the 3GPP specification (TS 125.141) for testing base station performance and recalls these models for quick easy measurements. After selection of a test model, the instrument displays test results in tabular format with clear PASS or FAIL indications that include min/max threshold.

Using Master Software Tools, a custom test list can be created and downloaded into the instrument. All critical parameters can be selected for pass/fail testing, including each individual code power level, the spreading factor and symbol EVM.

Pass/Fail Mode Procedure

1. Connect the appropriate antenna to the RF In connector to make OTA measurements.
2. Press the **Measurements** main menu key.
3. Press the Pass/Fail Mode submenu key to display the pass/fail mode menu.
4. Press the Select Pass/Fail Test submenu key and select the applicable Test Model to activate the measurement (Figure 3-13).

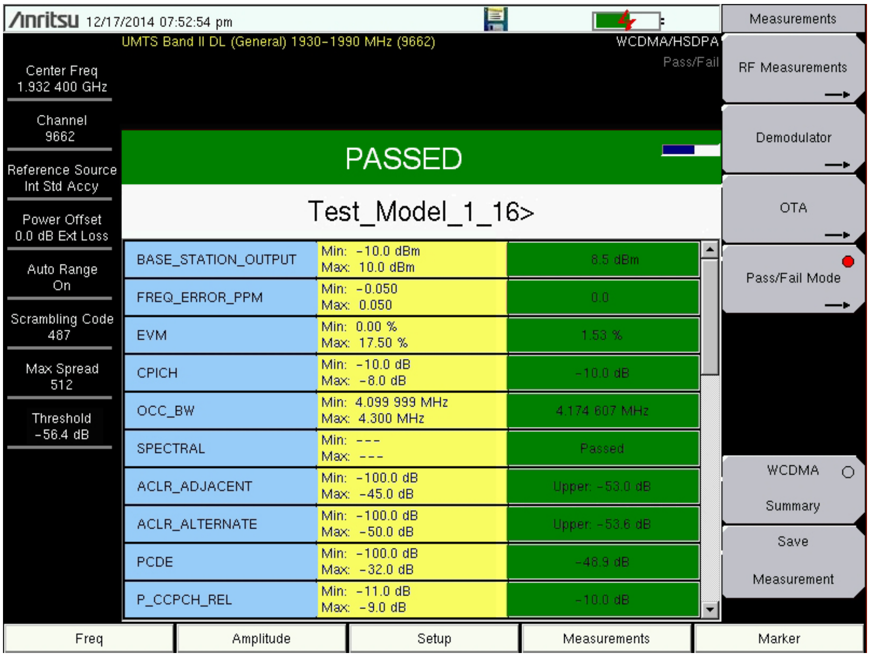


Figure 3-13. Pass/Fail Mode

3-8 W-CDMA/HSPA+ Menus

Figure 3-14 show the map of the W-CDMA/HSPA+ menus. The following sections describe W-CDMA/HSPA+ main menus and associated submenus. The submenus are listed in the order they appear on the display from top to bottom under each main menu.

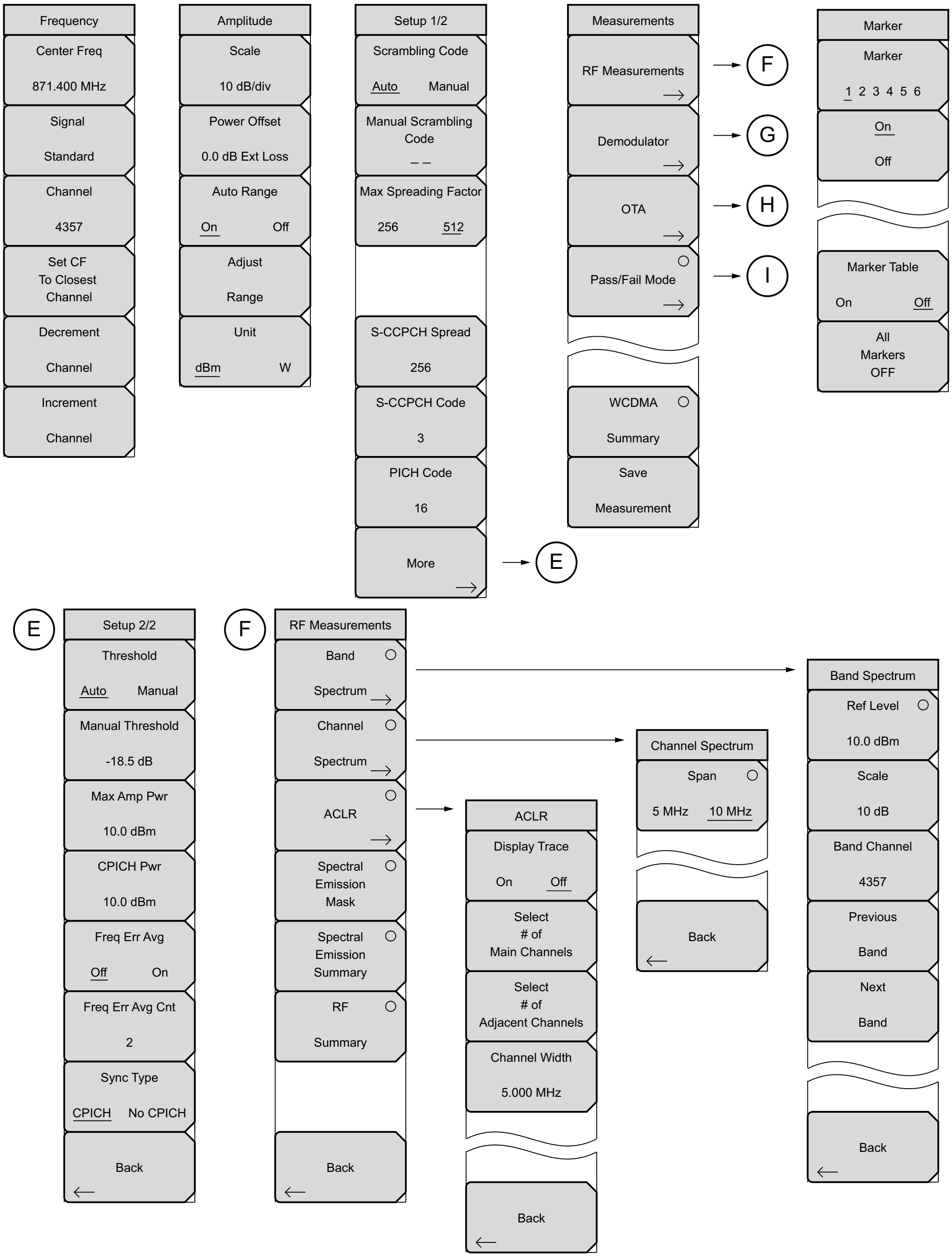


Figure 3-14. W-CDMA/HSPA+ Menu Layout (1 of 2)

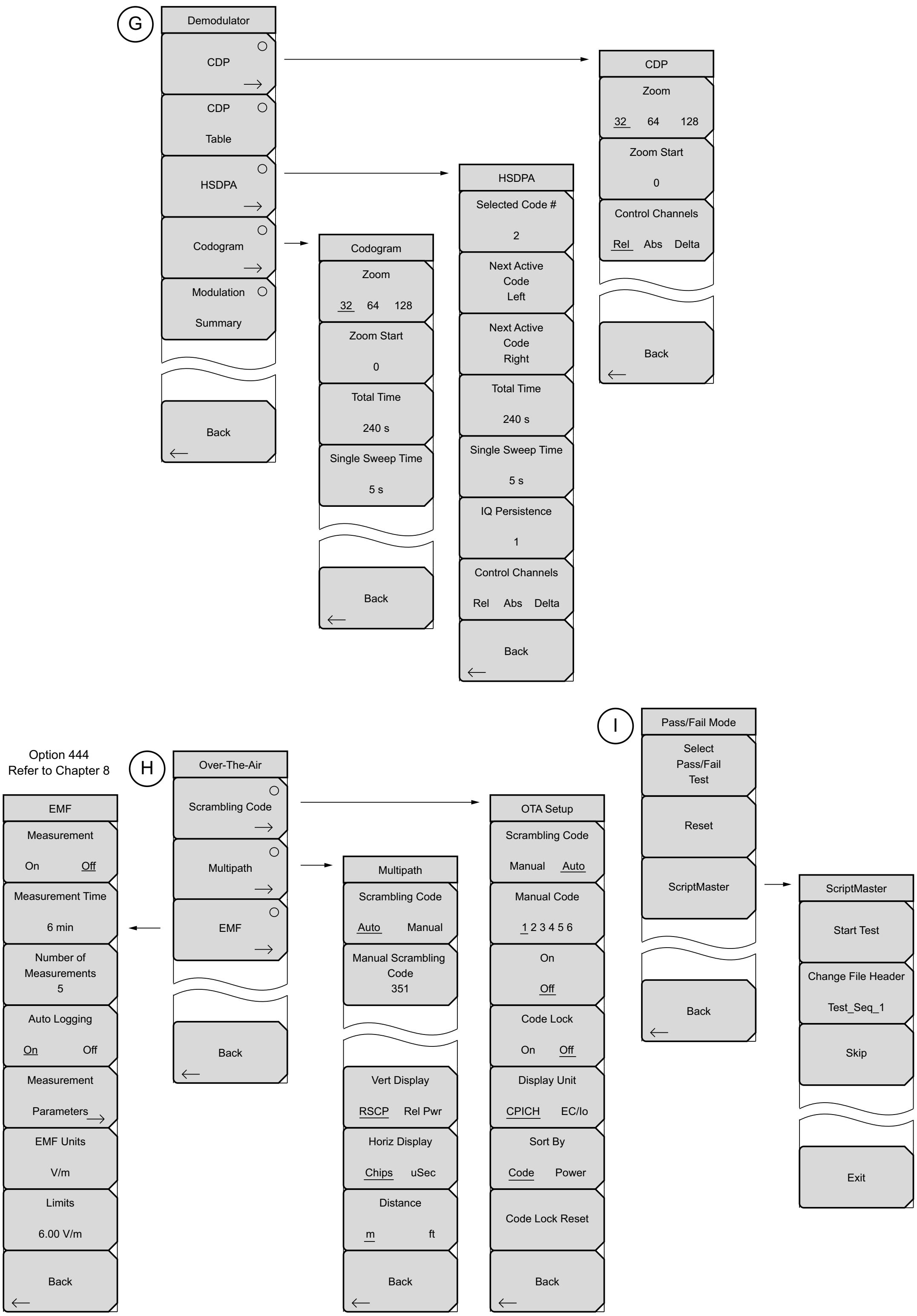
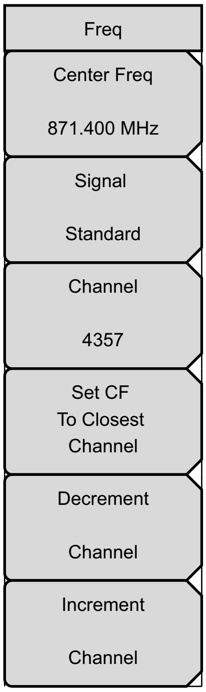


Figure 3-15. W-CDMA/HSPA+ Menu Layout (2 of 2)

3-9 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press the **Freq** key followed by the Center Freq submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the Enter key has the same effect as pressing the MHz submenu key.

Signal Standard: Use the **Up/Down** arrow keys or the rotary knob to highlight a signal standard and press Enter to select. When a signal standard is selected, the center frequency and span for the first channel of the selected standard is automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered. Appendix A contains a table of the signal standards that are in the instrument firmware.

Channel: Use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard. The center of the channel is automatically tuned to the center frequency of the selected W-CDMA channel.

Set CF To Closest Channel: Changes the center frequency to the closest channel.

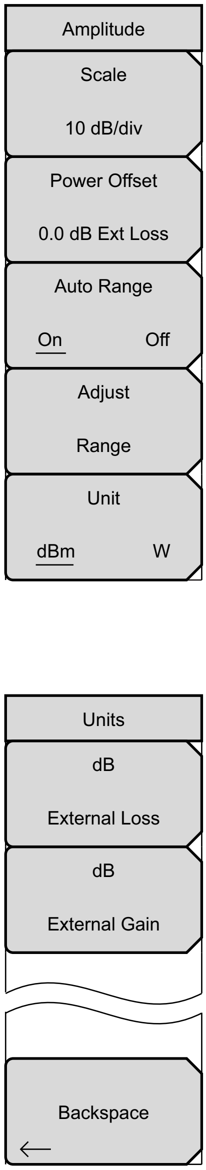
Decrement Channel: Decreases the channel number by one.

Increment Channel: Increases the channel number by one.

Figure 3-16. W-CDMA/HSPA+ Freq Menu

3-10 Amplitude Menu

Key Sequence: **Amplitude**



Scale: The scale can be set in 1 dB steps from 1 dB per division to 15 dB per division. The value can be changed using the numeric keypad, rotary knob, or the arrow keys. When using the keypad, the submenu changes to Units, in which case, press the dB/div key to accept the entered scale value.

Power Offset: Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

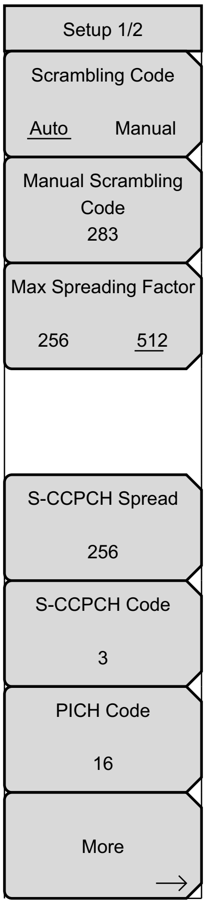
Unit: Changes the unit of measure for the Y-axis between dBm and W.

Figure 3-17. W-CDMA/HSPA+ Amplitude Menu

3-11 Setup Menu

Setup 1/2 Menu

Key Sequence: **Setup**



Scrambling Code: Press the **Scrambling Code** submenu key to toggle between Auto and Manual Scrambling Code.

Manual Scrambling Code: Press the **Manual Scrambling Code** submenu key to manually enter the scrambling code using the arrow keys, rotary knob, or numeric keypad.

Max Spreading Factor: Press the **Max Spreading Factor** submenu key to toggle between 256 codes and 512 codes.

S-CCPCH Spread: Press the **S-CCPCH Spread** submenu key to enable the S-CCPCH spreading factor and enter the desired code. The default value is 256.

S-CCPCH Code: Press the **S-CCPCH Code** submenu key to enable and enter the S-CCPCH code. The default value is 3.

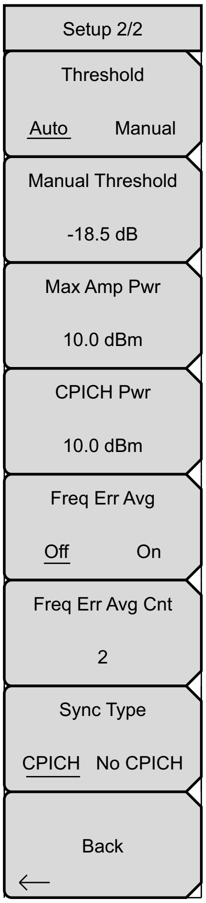
PICH Code: Press the **PICH Code** submenu key to activate Paging Indicator Channel and enter the desired code. The default value is 16.

More: Lists the “Setup 2/2 Menu” on page 3-29 to continue measurement setup.

Figure 3-18. W-CDMA/HSPA+ Setup Menu (1/2)

Setup 2/2 Menu

Key Sequence: **Setup** > More



Threshold: Sets the measurement threshold to be set either automatically by the instrument or manually by the user.

Manual Threshold: Change the measurement threshold manually by entering a desired value and pressing **Enter**.

Max Amp Pwr: Sets the maximum transmit power of the base station.

CPICH Pwr: Sets the power of the CPICH.

Freq Err Avg: Turns on averaging for the frequency error measurement.

Freq Err Avg Cnt: Sets the number of measurements to use in the frequency error averaging calculations. The number can be set from 2 to 15.

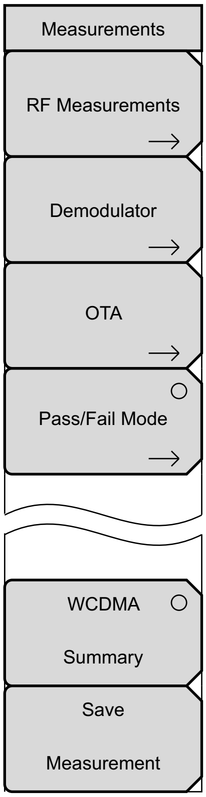
Sync Type: Selects between CPICH or No CPICH for synchronization.

Back: Returns to the “Setup 1/2 Menu” on page 3-28.

Figure 3-19. W-CDMA/HSPA+ Setup Menu (2/2)

3-12 Measurements Menu

Key Sequence: **Measurements**



RF Measurement: Opens the “RF Measurement Menu” on page 3-31.

Demodulator: Opens the “Demodulator Menu” on page 3-34. In this mode, the received W-CDMA signal is demodulated. The demodulator has five displays, CDP, CDP Table, HSPA+, Codogram and Modulation Summary.

OTA: Opens the “Over-The-Air Menu” on page 3-38. Press it once to display the W-CDMA/HSPA+ Over-the-Air Measurements and list the Over-the-Air menu.

Pass/Fail Mode: Opens the “Pass/Fail Mode Menu” on page 3-41. The instrument saves the five test model conditions specified in the 3GPP specification to test the base station. After the selected test model, the unit displays whether the base station passed or failed the test. Using Master Software Tools, a custom test list can be created and downloaded into the unit. All critical measurements can be selected for pass fail testing including each individual code power, spreading factor and symbol EVM. The results are displayed in table format with clear identification of pass/fail results including min/max thresholds and measured results.

W-CDMA Summary: Displays the critical W-CDMA measurements in a table format.

Save Measurement: Opens a dialog window to name and save the current measurement. Refer to the User Guide for additional information on saving a measurement.

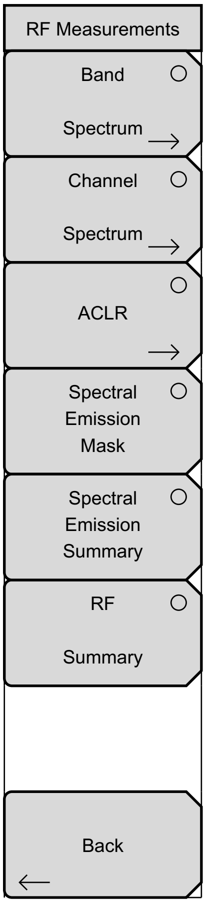
W-CDMA/HSPA+ measurements are saved with a WCD extension. GSM/EDGE measurements are saved with an EDG extension.

Note: If a measurement has been previously saved, the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Trace-1, Trace-2, and so forth) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob, or press the submenu key for each letter.

Figure 3-20. W-CDMA/HSPA+ Measurements Menu

RF Measurement Menu

Key Sequence: **Measurements** > RF Measurements



Band Spectrum: Opens the “Band Spectrum Menu” on page 3-32.

Channel Spectrum: Opens the “Channel Spectrum Menu” on page 3-32. Press once to select the Channel Spectrum display. The screen also displays Channel Power in dBm and watts, Peak to Average power and Occupied Bandwidth. Press it again to open the Channel Spectrum menu.

ACLR: Opens the “ACLR Menu” on page 3-33. Press once to select the Adjacent Channel Leakage Ratio (ACLR) display. The user can set the main channels and adjacent channels from 1 channel to 4 channels. This screen can display up to 12 channels total.

Spectral Emission Mask: Displays the received signal and the mask based on received signal strength.

Spectral Emission Summary: Displays the spectral emission mask in table format and whether the received signal passed in each frequency range.

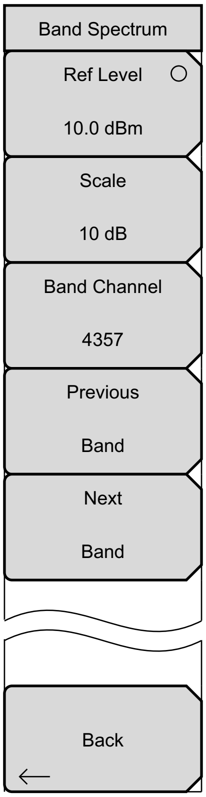
RF Summary: Displays the RF measurements in table form.

Back: Returns to the “Measurements Menu” on page 3-30.

Figure 3-21. W-CDMA/HSPA+ RF Measurement Menu

Band Spectrum Menu

Key Sequence: **Measurements** > RF Measurements > Band Spectrum



Ref Level: Sets the required reference level.

Scale: Changes the scale.

Band Channel: Use the cursor to select the required channel to analyze the selected channel signal.

Previous Band: Selects the previous band.

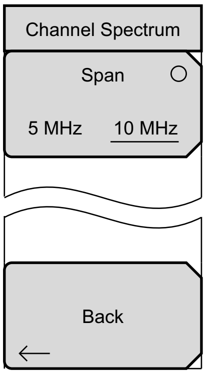
Next Band: Selects the next band.

Back: Returns to the "RF Measurement Menu" on page 3-31.

Figure 3-22. W-CDMA/HSPA+ Band Spectrum Menu

Channel Spectrum Menu

Key Sequence: **Measurements** > RF Measurements > Channel Spectrum



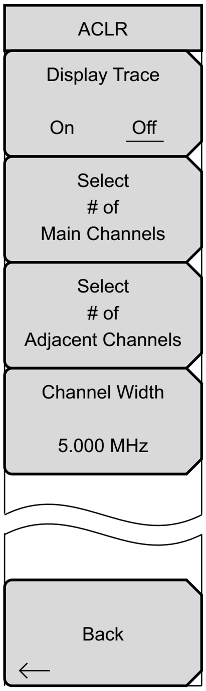
Span: Select either a 5 MHz or 10 MHz span.

Back: Returns to the "RF Measurement Menu" on page 3-31.

Figure 3-23. W-CDMA/HSPA+ Channel Spectrum Menu

ACLR Menu

Key Sequence: **Measurements** > RF Measurements > ACLR



Display Trace: Select On to display the trace.

Select # of Main Channels: Set the main channels from 1 channel to 4 channels.

Select # of Adjacent Channels: Set the adjacent channels from 1 channel to 4 channels.

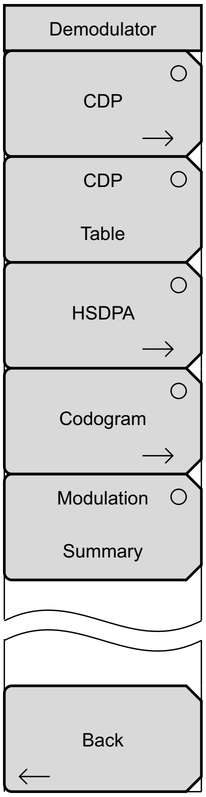
Channel Width: Set the bandwidth for the channels for the number of adjacent channels selected.

Back: Returns to the “RF Measurement Menu” on page 3-31.

Figure 3-24. W-CDMA/HSPA+ ACLR Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



CDP: Open the “CDP Menu” on page 3-35. When Code Domain Power (CDP) is selected the screen displays all the selected OVSF codes and selected OVSF zoom codes in the graphical format. The display also displays P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error. The screen also displays control channel view with CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in the table format. If the marker is set on the code, the marker will display the code number, power and Symbol EVM.

Note: For the W-CDMA/HSPA+ demodulator option, the CDP screen displays HSPA+ and W-CDMA signals. P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error are also displayed. The screen displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in the table format. If the marker is set on the code, the marker will display the code number, power and Symbol EVM.

CDP Table: Displays the following Code Domain Power (CDP) parameters in table format: Code, Status, EVM, Mod Type, Power (dB), and Power (dBm).

HSPA+: Open the “HSDPA Menu” on page 3-36. When HSPA+ is selected, the screen displays all the selected OVSF including high speed data channel codes and selected OVSF with high speed codes in the graphical format. The selected code Power versus time and Constellation diagram will be displayed. The screen also displays control channel view with P-CPICH Abs power, EVM, Carrier Frequency, Channel Power, Carrier Feedthrough, Frequency Error in Hz and PPM, Noise Floor and Peak CD Error. The screen also displays CPICH, P-CCPCH, S-CCPCH, PICH, P-SCH and S-SCH powers in table format.

Note: This screen is available with the W-CDMA/HSPA+ demod option only.

Codogram: Open the “Codogram Menu” on page 3-37. When Codogram is selected the screen displays the changes in code power levels over time. Two graphs are displayed on the screen, the top one displays all the selected OVSF codes and the bottom one displays the selected OVSF zoom codes.

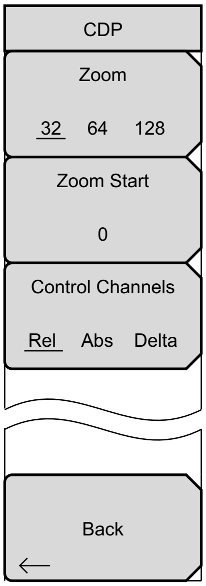
Modulation Summary: Displays the demodulation parameters in the table format.

Back: Returns to the “Measurements Menu” on page 3-30.

Figure 3-25. W-CDMA/HSPA+ Demodulator Menu

CDP Menu

Key Sequence: **Measurements** > Demodulator > CDP



Zoom: Select a zoom function of 32, 64, or 128 codes.

Zoom Start: Enter the required zoom start code. For example, to start at code 2, enter 2.

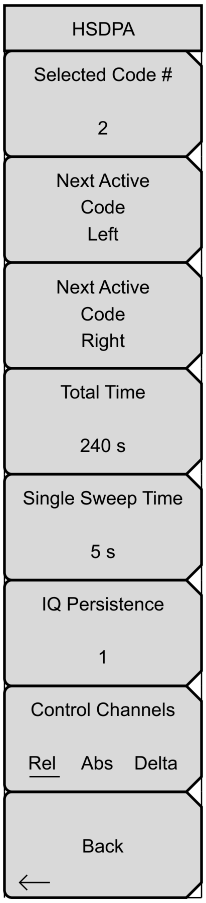
Control Channels: Select a control channel mode between Rel, Abs, and Delta.

Back: Returns to the “Demodulator Menu” on page 3-34.

Figure 3-26. W-CDMA/HSPA+ CDP Menu

HSDPA Menu

Key Sequence: **Measurements** > Demodulator > HSDPA



Selected Code: Press this submenu key to select the active code, using the arrow keys, rotary knob, or numeric keypad. The range is 0 to 255 or 0 to 511 depending on the Max Spreading Factor set under the Setup main menu. Refer to “Setup 1/2 Menu” on page 3-28.

Next Active Code Left: Select the next active code to the left of the selected code.

Next Active Code Right: Select the next active code to the right of the selected code.

Total Time: Set the time for the power versus time screen. The maximum total time is 72 hours.

Single Sweep Time: Set the single sweep time. The instrument automatically calculates the total time.

IQ Persistence: Set the number of samples before displaying the screen (maximum 48).

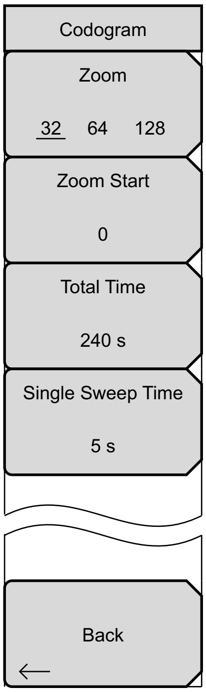
Control Channels: Select a control channel mode between Rel, Abs, and Delta.

Back: Returns to the “Demodulator Menu” on page 3-34.

Figure 3-27. HSPA+ Menu

Codogram Menu

Key Sequence: **Measurements** > Demodulator > Codogram



Zoom: Select a zoom function of 32, 64, or 128 codes.

Zoom Start: Enter the required zoom start code. For example, to start at code 2, enter 2.

Total Time: Use the keypad, arrow keys, or the rotary knob to enter the total time to display the changes in code power levels. The maximum total time for Codogram is 72 hours.

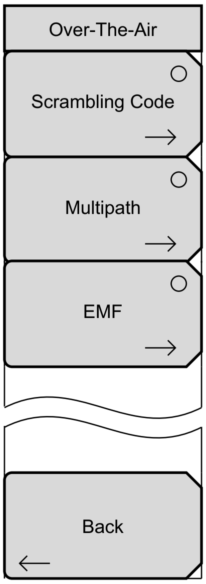
Single Sweep Time: Single sweep time is related to total time. Use the keypad, arrow keys, or the rotary knob to set the single sweep time.

Back: Returns to the “Demodulator Menu” on page 3-34.

Figure 3-28. W-CDMA/HSPA+ Codogram Menu

Over-The-Air Menu

Key Sequence: **Measurements** > OTA



Scrambling Code: Opens the "OTA Setup Menu" on page 3-39.

Multipath: Opens the "Multipath Menu" on page 3-40.

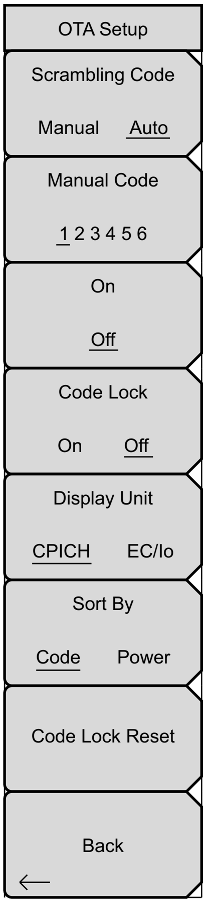
EMF (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this key opens the "W-CDMA EMF Menu" on page 8-10.

Back: Returns to the "Measurements Menu" on page 3-30.

Figure 3-29. W-CDMA/HSPA+ Over-The-Air Menu

OTA Setup Menu

Key Sequence: **Measurements** > OTA > Scrambling Code



Scrambling Code: Set the scrambling codes to manual or auto.

Manual Code: Select the scrambling code manually.

On/Off: Switch On/Off the manually selected scrambling code.

Code Lock: Lock the measured codes.

Display Unit: Display the codes by CPICH or Ec/Io.

Sort By: Sort the measured codes by code numbers or power.

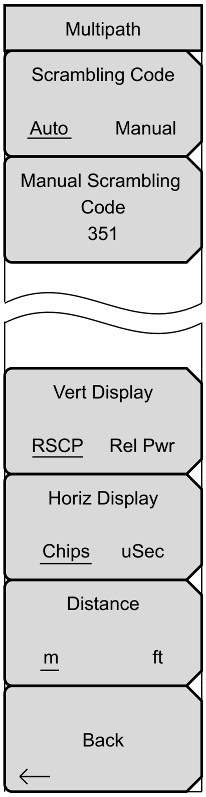
Code Lock Reset: Reset the measurement screen.

Back: Returns to the “Over-The-Air Menu” on page 3-38.

Figure 3-30. W-CDMA/HSPA+ Over-The-Air (OTA) Setup Menu

Multipath Menu

Key Sequence: **Measurements** > OTA > Multipath



Scrambling Code: Set the scrambling codes to manual or auto.

Manual Scrambling Code: Sets the manual scrambling code.

Vert Display: Switch vertical display between RSCP and Rel Pwr.

Horiz Display: Switch between Chips and uSec for the horizontal display.

Distance: Switch between meters and feet.

Back: Returns to the "Over-The-Air Menu" on page 3-38.

Figure 3-31. W-CDMA/HSPA+ Multipath Menu

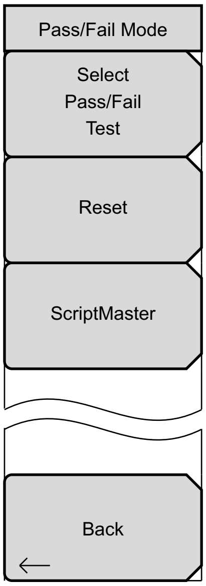
EMF Menu

Key Sequence: **Measurements** > OTA > EMF

Refer to "W-CDMA EMF Menu" on page 8-10.

Pass/Fail Mode Menu

Key Sequence: **Measurements** > Pass/Fail Mode



Select Pass/Fail Test: Select the parameters file from the list.

Reset: Restart the measurement.

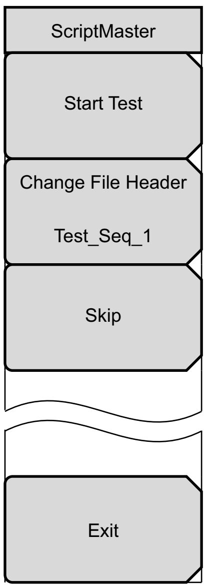
ScriptMaster: Opens the "ScriptMaster Menu" on page 3-41.

Back: Returns to the "Measurements Menu" on page 3-30.

Figure 3-32. W-CDMA/HSPA+ Pass/Fail Mode Menu

ScriptMaster Menu

Key Sequence: **Measurements** > Pass/Fail Menu > ScriptMaster



Opens the Select File by Scrolling window and also lists Recall and Back submenu keys. Recall a Script file, created in Master Software Tools, from the window. The ScripMaster instructions are loaded into the instrument and the ScriptMaster menu is listed.

Start Test: Begins the running the instructions listed in ScriptMaster.

Change File Header: Opens the Pass Fail Test File Header entry window and lists the Text Entry menu to name the saved file after the ScriptMaster measurement process is complete.

Skip: Skips over a ScripMaster instruction.

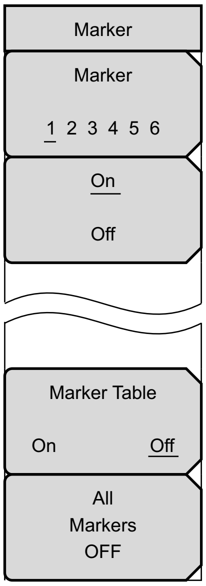
Exit: Ends the ScriptMaster measurement process. Returns the instrument to the previous measurement setup.

Figure 3-33. W-CDMA/HSPA+ ScriptMaster Menu

3-13 Marker Menu

Key Sequence: **Marker**

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



Marker: Selects the active marker (1 to 6). The underlined marker number is the active marker. Each press of the submenu key moves the underline to the next marker number. Pressing **Shift** causes reverses the direction of marker selection. Press the **Shift** button again to change back to the original direction.

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

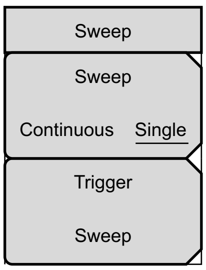
Marker Table On/Off: Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered for them.

All Markers Off: Turns off all markers.

Figure 3-34. W-CDMA/HSPA+ Marker Menu

3-14 Sweep Menu

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



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

Trigger Sweep: Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

Figure 3-35. W-CDMA/HSPA+ Sweep Menu

3-15 Measure Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

3-16 Trace Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

3-17 Limit Menu

This menu is not available in W-CDMA/HSPA+ measurement mode.

3-18 Other Menus

Preset, **File**, **Mode** and **System** are described in the instrument User Guide.

Chapter 4 — TD-SCDMA/HSPA+ Signal Analyzer

4-1 Introduction

The TD-SCDMA/HSPA+ Signal Analyzer offers three options:

- RF Measurements
- Demodulator
- Over-The-Air (OTA) Measurements

Three display types are provided for RF Measurements: Channel Spectrum display, Power versus Time display, or the RF Summary table.

Demodulator measurements can be viewed in either the CDP Data display or the Modulation Summary table.

The Over-the-Air Code Scan measurement displays the power of all 32 sync codes in sequential order. The Tau Scan measurement displays the codes based on Tau values.

4-2 General Measurement Setups

Refer to the instrument User Guide for information on how to select the TD-SCDMA/HSPA+ Signal Analyzer mode, set up frequency and amplitude, and perform file management.

4-3 TD-SCDMA/HSPA+ RF Measurements

The following parameters are measured in the RF Measurement mode.

Channel Power

Channel power measures the average time domain power within the 1.6 MHz channel bandwidth and is expressed in dBm.

Channel Power (RRC)

Channel Power (RRC) is similar to Channel Power but is measured after being filtered by using the Root Raised Cosine (RRC) filter. It is usually smaller than channel power.

Slot x Pwr

X denotes slots 0 through 6. This is the power in each of the 7 slots, excluding the gap.

Occ BW

Occupied bandwidth is the calculated bandwidth containing 99% of the total integrated power occupied in the span. Span is 5 MHz when Number of Carrier is set to 1. For all other values, span is set to 1.6 MHz.

DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

UpPTS Pwr

The power in the Uplink Pilot Slot, excluding the gap.

DL-UL Delta Power

The average difference between the active DL slots and the active UL slots, including pilot slots. UL and DL slots are selected according to the Uplink Switch Point setting. Without UL data slot and without UpPTS, the DL-UL Delta Power value is not applicable.

On/Off Ratio

The ratio of the power between the on and off portions of the Downlink slots.

Slot PAR

The peak to average power in the selected (or auto detected) slot. The highest 0.1% power of the slot is used as the peak.

Left Channel Power

The channel power of the 1.6 MHz channel left of the main channel. This is useful in the multi-carrier environments.

Right Channel Power

The channel power of the 1.6 MHz channel right of the main channel. This is useful in the multi-carrier environments.

Left Channel Occ BW

This is the occupied bandwidth of the channel left of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

Right Channel Occ BW

This is the occupied bandwidth of the channel right of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

Measurement Setup

Refer to the User Guide for general instrument setup instructions, and continue with the following setups for the specific RF measurements.

Channel Spectrum

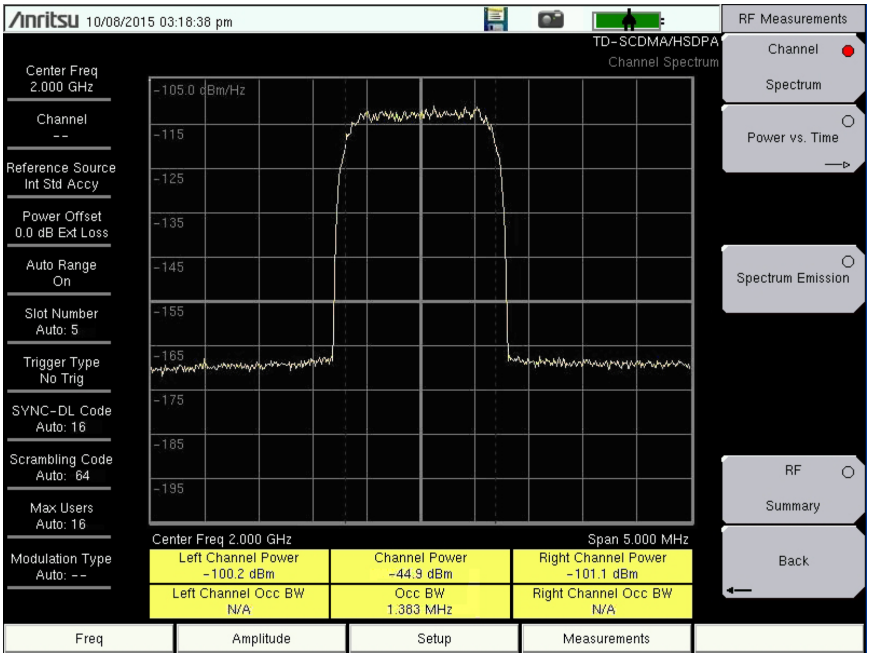


Figure 4-1. TD-SCDMA/HSPA+ Channel Spectrum

1. Press the **Setup** main menu key.
2. Press the More submenu key.
   a. Press the Number of Carriers submenu key so that the desired number is underlined.
   b. Press the Spreading Factor submenu key so that the desired Spreading Factor is underlined: Auto, 16, or 1.
   c. To set the Modulation Type, press the Modulation Type submenu key. The Modulation Type selection window opens. Select the desired setting: Auto, QPSK, 8PSK, 16QAM, or 64QAM.
   d. If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, select Off. If the presence of the DwPTS is unknown, select Auto.
   e. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum value is 5 sec.
   f. Press the Back submenu key to return to the Setup menu
3. Press the **Measurements** main menu key.
4. Press the RF Measurements submenu key.
5. Press the Channel Spectrum submenu key to activate this RF measurement view (see Figure 4-1).
6. Press the Back submenu key again to return to the Measurements menu.

Power versus Time

The Power versus Time view shows the time domain view.

1. Press the **Setup** main menu key.
   a. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   b. Press the Trigger submenu key. The Trigger menu opens.
   1. Press the Trigger Type submenu key to select No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
   2. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
   3. Press the Back submenu key to return to the Setup menu.
   c. Press the More submenu key to continue with setups under the Advanced Settings menu.
   d. Press the Number of Carriers submenu key so that the desired number is underlined.
   e. Press the Spreading Factor submenu key to so that the desired Spreading Factor is underlined: Auto, 16, or 1.
   f. To set the Modulation Type, press the Modulation Type submenu key. The Modulation Type selection window opens. Select the desired setting: Auto, QPSK, 8PSK, 16QAM, or 64QAM.
   g. If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, select Off. If the presence of the DwPTS is unknown, select Auto.
   h. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum value is 5 sec.
   i. Press the Back submenu key to return to the Setup menu.
   j. Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. Press the Power vs. Time submenu key to activate this RF measurement view. Press this key again to set up the Power vs. Time measurement.
   a. Press the View submenu key to toggle the measurement view to Sub-Frame (see Figure 4-2) or Slot (see Figure 4-3).
   b. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   c. Press the Back submenu key to return to the RF Measurements menu.
   d. Press the Back submenu key again to return to the Measurements menu.

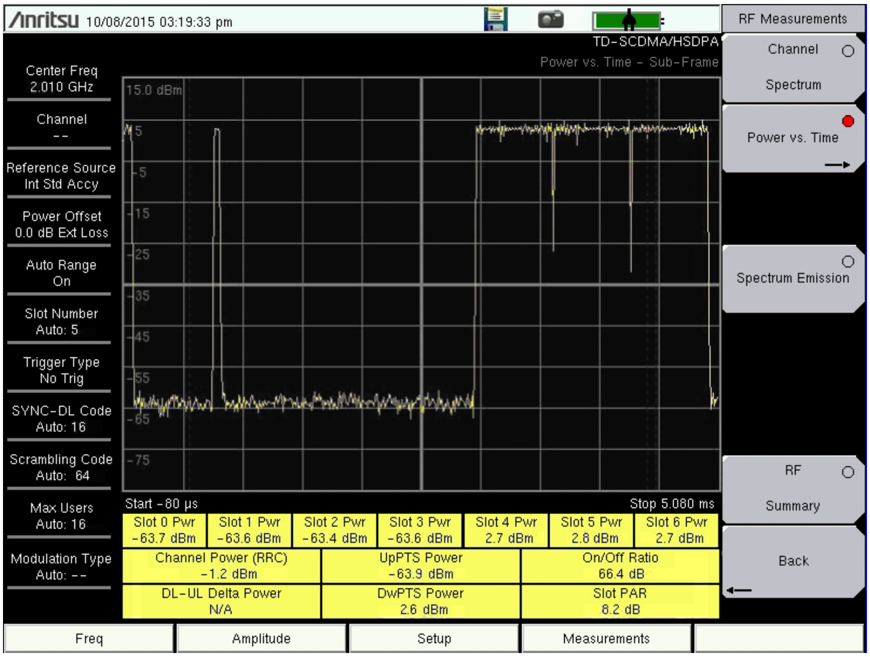


Figure 4-2. TD-SCDMA/HSPA+ Power vs. Time: Sub-Frame Measurement

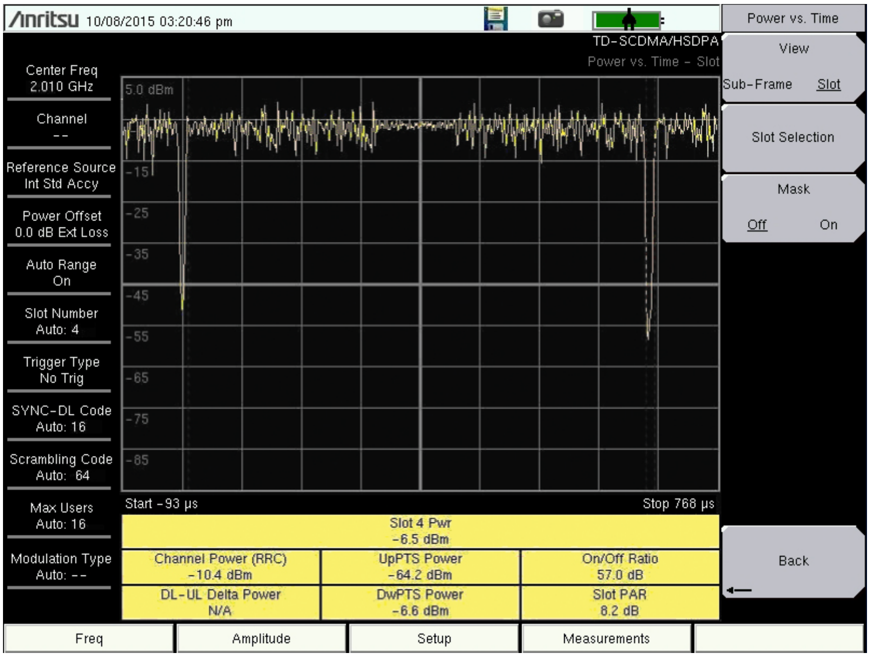


Figure 4-3. TD-SCDMA/HSPA+ Power vs. Time: Slot Measurement

RF Summary

The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the TD-SCDMA/HSPA+ signal. The parameters that are displayed in the RF summary table are Channel Power (dBm), Channel Power (RRC) (dBm), Occupied Bandwidth (Hz), DwPTS Power (dBm), UpPTS Power (dBm), On/Off Ratio (dB), Slot PAR (dB), Left Channel Power (dBm), Right Channel Power (dBm), Left Channel Occupied Bandwidth, and Right Channel Occupied Bandwidth.

1. Press the **Setup** main menu key.
   a. Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   b. Press the Trigger submenu key. The Trigger menu opens.
      1. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
      2. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
      3. Press the Back submenu key to return to the Setup menu.
   c. Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
   d. Press the More submenu key to continue with setups under the Advanced Settings menu.
   e. Press the Number of Carriers submenu key so that the desired number is underlined.
   f. Press the Back submenu key to return to the Setup menu.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements submenu key.
4. In the RF Measurements menu, press the RF Summary submenu key to view the primary RF measurements in a table.

4-4 TD-SCDMA/HSPA+ Demodulator

Figure 4-4. TD-SCDMA/HSPA+ Demodulator, CDP Data

The following parameters are measured in the Demodulator option.

Slot Power

The power measured in the selected slot, excluding the gap. If Slot Selection is set to Auto, then the instrument searches for an active downlink slot and uses the detected slot number for measuring slot power.

DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

Noise Floor

Noise floor is the average of inactive codes powers (dB) from the code domain power (CDP).

Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

Tau

Tau is the timing delay of the frame starting point in reference to the occurrence of a trigger. When no trigger is used, Tau values are relative to the most dominant SYNC-DL code.

Scrambling Codes

The display format is Scrambling Code # (relative power in dB). A measure of the relative powers of the four scrambling codes (relative to Slot Power) that correspond to the detected SYNC-DL code. Only those scrambling codes with high relative power are displayed. Typically, only one scrambling code is displayed unless significant interference occurs from neighboring codes.

EVM

The Error Vector Magnitude (EVM) is the ratio (in percent) of the difference between the reference waveform and the measured waveform. EVM metrics are used to measure the modulation quality of a transmitter. The EVM value displayed by the instrument is the root mean square EVM of the measured downlink slot data.

Peak EVM

The peak of the measured EVM.

Peak CDE

The peak of the Code Domain Error (CDE) is the remnant power in the code domain after the useful signal is extracted.

Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode and continue with the following setups for the specific Demodulator measurements.

1. Press the **Setup** main menu key.
   - **a.** Press the Slot Selection submenu key. The Slot Selection window and menu open. In the list window, use the rotary knob or press the touch screen to highlight Auto or the desired slot (0 to 6), then press the **Enter** key.
   - **b.** Press the Trigger submenu key. The Trigger menu opens.
     1. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
     2. Press the Ext Trigger Polarity submenu key to toggle either Rising or Falling trigger edge.
     3. Press the Back submenu key to return to the Setup menu.
   - **c.** Press the Uplink Switch Point submenu key. The numerical value on the face of the submenu key turns red and is ready to be edited. Use the arrow keys or the rotary knob to change the value. You can also use the numeric keypad, then press **Enter**.
   - **d.** Press the SYNC-DL Code submenu key. The SYNC-DL Code menu and selection window open. Use the rotary knob or press the touch screen to highlight Auto or the desired code (0 to 31), then press **Enter**.
   - **e.** Press the Scrambling Midamble Code submenu key to open the Scrambling Code selection window and menu. Use the rotary knob or press the touch screen to highlight Auto or the desired code (0 to 127), then press the **Enter** key.
   - **f.** Press the Max Users submenu key to open the Maximum Users selection window and menu. Use the rotary knob or press the touch screen to highlight Auto or the desired value (2 to 16), then press **Enter**.

g. Press the Meas Speed submenu key to toggle through the measuring speeds: Fast, Norm, and Slow.

h. Press More to continue with setups in the Advanced Settings menu. Refer to "Advanced Settings Menu" on page 4-20 for a description of available parameters.

i. Press the Back submenu key to return to the Setup menu.

CDP Data

1. Press the **Measurements** main menu key.
2. Press the Demodulator submenu key.
3. Press the CDP Data submenu key once to select the CDP Data measurement and press again to open the CDP Data menu.
4. In the CDP Data menu, press the CDP Units submenu key to toggle Relative or Absolute.
5. Press the Back submenu key to return to Demodulator menu.
6. Press the Back submenu key again to return to the Measurements menu.

Modulation Summary

The Modulation Summary displays the critical Modulation transmitter performance measurements in a table format by demodulating the TD-SCDMA/HSPA+ signal that is displayed in the Modulation Summary table: Slot Power, EVM, Peak EVM, Freq Error, Freq Error PPM, Tau, Noise Floor, Carrier Feed Through, and Peak CDE.

1. Press the **Measurements** main menu key.
2. Press the Demodulator submenu key.
3. Press the Modulation Summary submenu key to display the modulation summary table.
4. Press the Back submenu key to return to the Measurements menu.

CDP and CDE

Code Domain Power (CDP) and Code Domain Error (CDE) are displayed with color coding as described in Table 4-1:

Table 4-1. Color Legend for CDP and CDE

Display Color	Code Type
Orange	Active Codes
Gray	Idle Codes
Light Blue	Code Domain Errors

4-5 TD-SCDMA/HSPA+ Over-the-Air Measurements

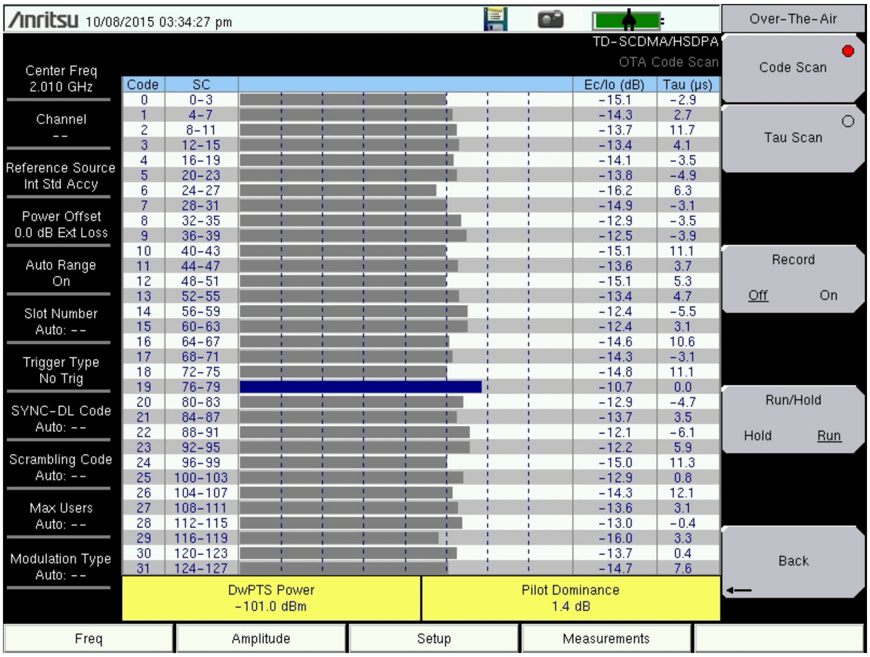


Figure 4-5. TD-SCDMA/HSPA+ OTA Code Scan

Code Scan

Scans and displays the power of all 32 SYNC-DL codes in sequential order, including Ec/Io (dB) and Tau (µs). DwPTS Power and Pilot Dominance values are displayed below the table of codes (see Figure 4-5). The Scrambling Codes (SC) corresponding to each SYNC-DL code are also displayed next to each code for easy reference.

Tau Scan

Displays the code power versus Tau in a bar graph format. The horizontal axis (Tau) has dynamic scale. The six strongest SYNC-DL codes are displayed below the bar graph with their Tau (us) and Ec/Io (dB) values. DwPTS Power and Pilot Dominance values are displayed below the table of the six strongest codes (see Figure 4-6).

DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

Pilot Dominance

Pilot dominance is a measure of the strength of the strongest code compared to the next strongest code in the same channel.

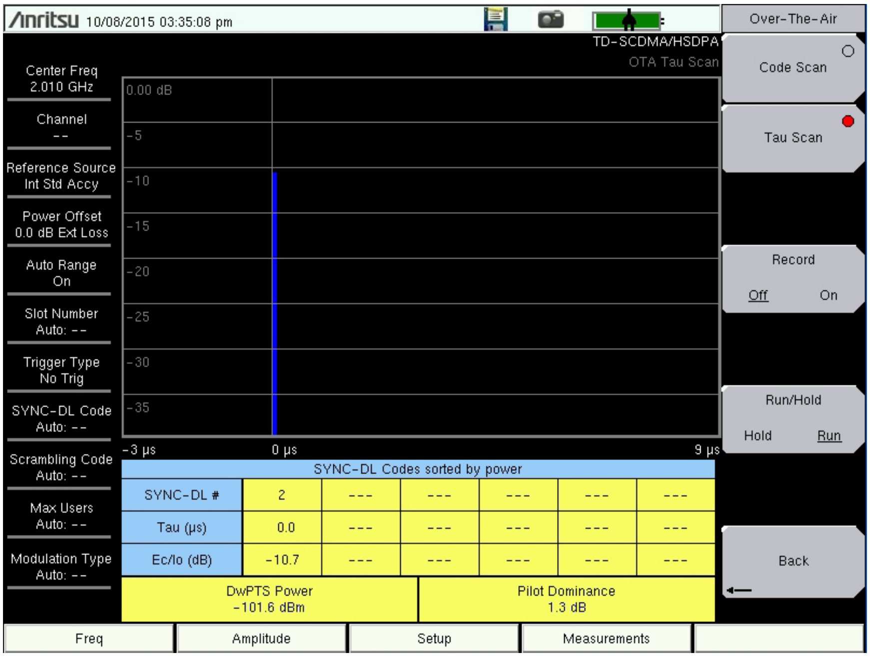


Figure 4-6. TD-SCDMA/HSPA+ OTA Tau Scan

Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode.

1. Press the **Setup** main menu key. Press the Trigger submenu key. The Trigger menu opens.
   a. Press the Trigger Type submenu key to toggle through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the submenu key.
   b. Press the Ext Trigger Polarity submenu key to select either Rising or Falling trigger edge.
   c. If necessary, press the Tau Offset submenu key to specify a Tau Offset value. The maximum offset value is 5 sec.
   d. Press the Back submenu key to return to the Setup menu.
2. Continue with the following setups for the specific OTA measurements.

Code Scan

1. Press the **Measurements** main menu key.
2. Press the OTA submenu key. The Over-the-Air menu is displayed.
3. Press the Code Scan submenu key to activate this measurement view.

Tau Scan

1. Press the **Measurements** main menu key.
2. Press the OTA submenu key.
3. Press the Tau Scan submenu key to activate this measurement view.

4-6 TD-SCDMA/HSPA+ Pass/Fail Measurements

The following is an example of a Pass/Fail measurement.

Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSPA+ Signal Analyzer mode.

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail submenu key to activate the test.
3. Press the Pass/Fail submenu key again to display the Pass/Fail menu.
4. Press the Select Pass/Fail Test submenu key. Use the arrow keys or the rotary knob to highlight the desired test mode, then press the Select Test submenu key or the **Enter** key.
5. Press the Reset submenu key to begin a new pass/fail test measurement (see Figure 4-7).
6. Press the Back submenu key to return to the Measurements menu.

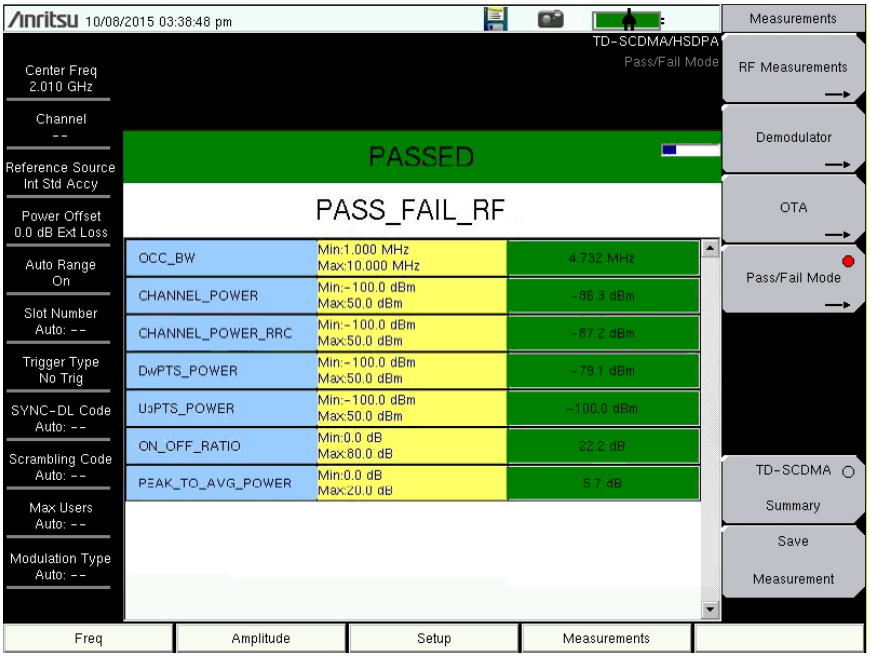


Figure 4-7. TD-SCDMA/HSPA+ Pass/Fail Measurements

4-7 TD-SCDMA/HSPA+ Menus

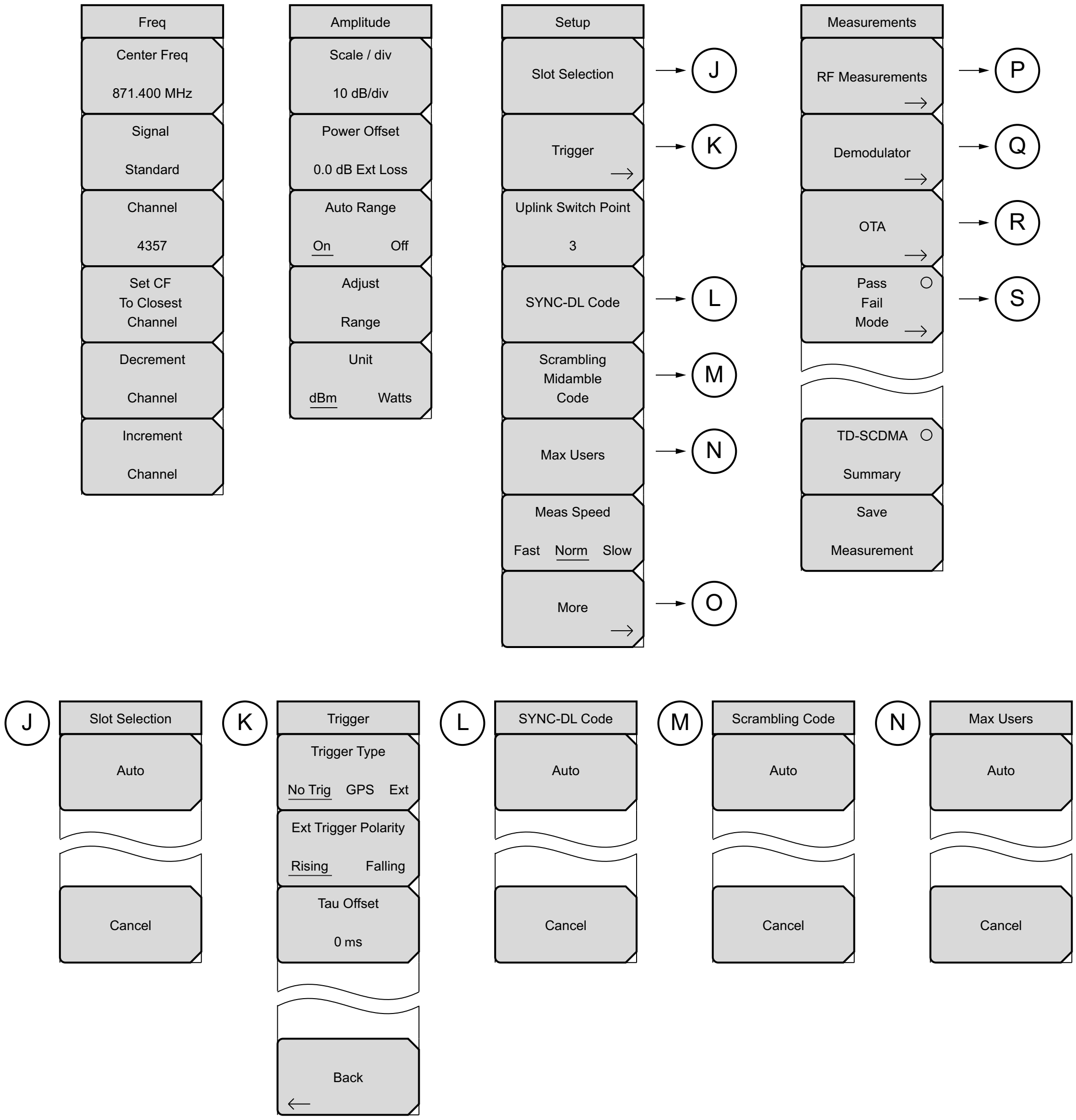


Figure 4-8. TD-SCDMA/HSPA+ Menu Layout (1 of 2)

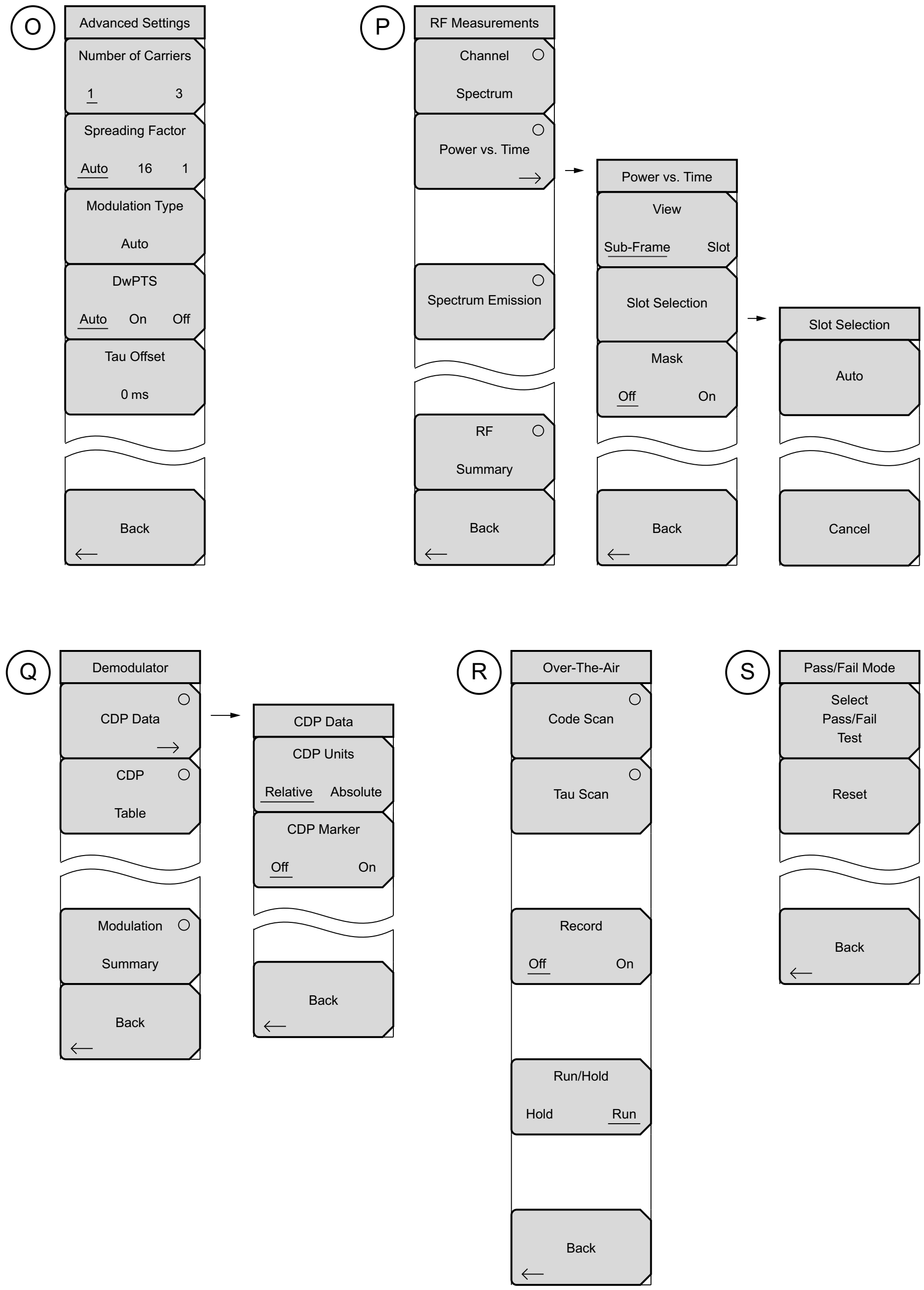
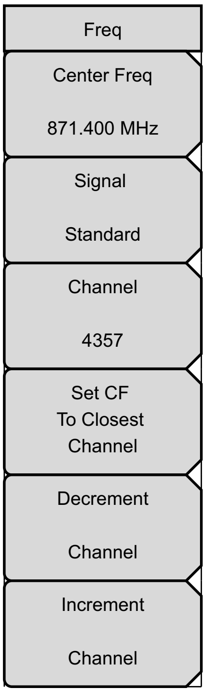


Figure 4-9. TD-SCDMA/HSPA+ Menu Layout (2 of 2)

4-8 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency (2.7 GHz is the maximum value that can be entered) by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

Signal Standard: Opens the Signal Standards list box in order to select signal standard.

Channel: Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

Set CF to Closet Channel: Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

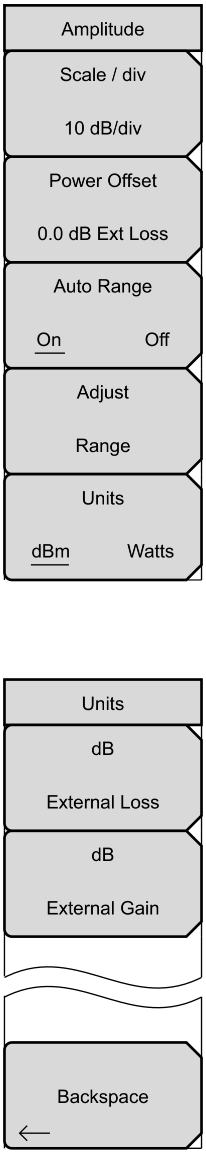
Decrement Channel: Decrements the channel by one channel.

Increment Channel: Increments the channel by one channel.

Figure 4-10. TD-SCDMA/HSPA+ Freq Menu

4-9 Amplitude Menu

Key Sequence: **Amplitude**



Scale/div: Press this submenu key to change the scale of the y-axis in the measurement display. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div. The value can be changed using the numeric keypad, rotary knob, or the arrow keys. This setting applies to the Channel Spectrum, Power vs. Time, and Spectrum Emission views only.

Power Offset: Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

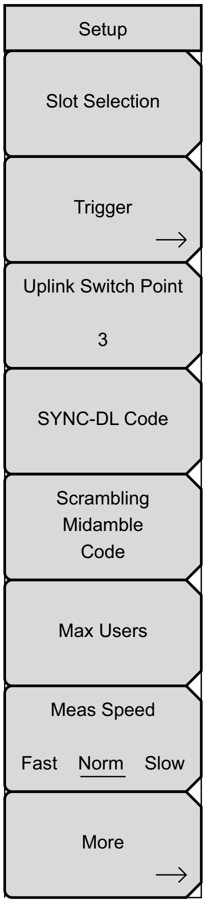
Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

Units: Press this submenu key to view the power measurements in dBm or watts.

Figure 4-11. TD-SCDMA/HSPA+ Amplitude Menu

4-10 Setup Menu

Key Sequence: **Setup**



Slot Selection: Press this submenu key to display the "Slot Selection Menu" on page 4-18 and open the Slot Selection window. Use the rotary knob or press the touch screen to highlight the desired slot (0 to 6), then press **Enter**. If Auto is selected, the active slot is automatically detected.

Trigger: Opens the "Trigger Menu" on page 4-18. Press this submenu key to list the Trigger menu, to set up the trigger parameters, and to set up the Tau Offset.

Uplink Switch Point: Press this submenu key to set an uplink switch point. This is the slot number of the last uplink timeslot. Slots from the next timeslot to the end of the sub-frame are considered downlink. Use the rotary knob or the arrow keys to change the value, which ranges from 0 through 6, where 0 is no uplink. The default value is 3.

SYNC-DL Code: Press this submenu key to display the "SYNC-DL Code Menu" on page 4-19 and open the SYNC-DL Code selection window. Use the rotary knob or press the touch screen to highlight the desired code (0 through 31), then press **Enter**. If Auto is selected, the active SYNC-DL code is applied.

Scrambling Midamble Code: Press this submenu key to display the "Scrambling Code Menu" on page 4-19 and open the Scrambling/Midamble Code selection window. Use the rotary knob or press the touch screen to highlight the desired code (0 through 127), then press **Enter**. If Auto is selected, the active Scrambling/Midamble code is applied.

Max Users: Press this submenu key to display the "Max Users Menu" on page 4-19 and open the Maximum Users selection window. Use the rotary knob or press the touch screen to highlight the desired number of users (2 through 16), then press **Enter**. If Auto is selected, the maximum number of users is listed.

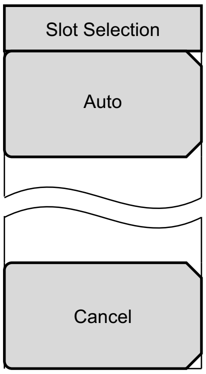
Meas Speed: Press this submenu key to select the desired scan speed: Fast, Normal, or Slow. The active state is underlined on the face of the submenu key.

More: Opens the "Advanced Settings Menu" on page 4-20.

Figure 4-12. TD-SCDMA/HSPA+ Setup Menu

Slot Selection Menu

Key Sequence: **Setup** > Slot Selection



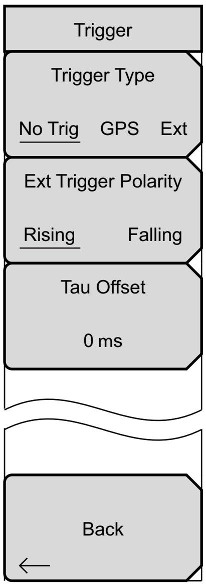
Auto: Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to "Setup Menu" on page 4-17.

Figure 4-13. TD-SCDMA/HSPA+ Slot Selection Menu

Trigger Menu

Key Sequence: **Setup** > Trigger



Trigger Type: Select a trigger type by pressing this submenu key to toggle among No Trig, GPS, or Ext. The active state is underlined on the face of the submenu key.

Ext Trigger Polarity: Press this submenu key to toggle either Rising or Falling polarity of external trigger.

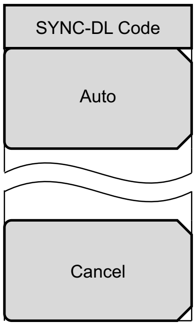
Tau Offset: Press this submenu key to add an offset (5 sec is the maximum offset that can be entered) to the current Tau value.

Back: Press this submenu key to return to "Setup Menu" on page 4-17.

Figure 4-14. TD-SCDMA/HSPA+ Trigger Menu

SYNC-DL Code Menu

Key Sequence: **Setup** > SYNC-DL Code



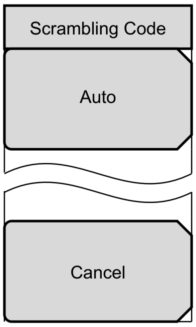
Auto: Automatically seeks the active SYNC-DL code. Auto in the SYNC-DL Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to “Setup Menu” on page 4-17.

Figure 4-15. TD-SCDMA/HSPA+ Trigger Menu

Scrambling Code Menu

Key Sequence: **Setup** > Scrambling Midamble Code



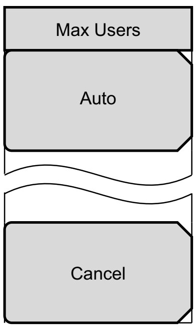
Auto: Automatically looks for the Scrambling/Midamble code. Auto in the Scrambling/Midamble Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to “Setup Menu” on page 4-17.

Figure 4-16. TD-SCDMA/HSPA+ Scrambling Midamble Code Menu

Max Users Menu

Key Sequence: **Setup** > Max Users



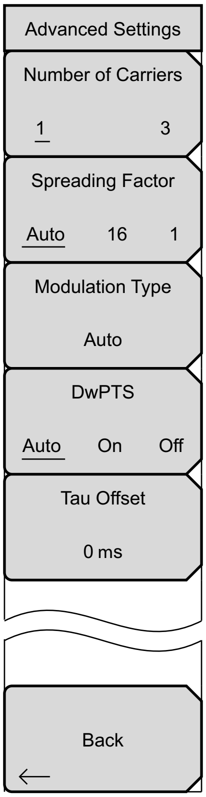
Auto: Automatically looks for the maximum number of users. Auto in the Maximum Users selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to “Setup Menu” on page 4-17.

Figure 4-17. TD-SCDMA/HSPA+ Max Users Menu

Advanced Settings Menu

Key Sequence: **Setup** > More



Number of Carriers: Press this submenu key to select the number of carriers present in the signal. The setting toggles between 1 and 3.

Spreading Factor: Select the desired spreading factor, Auto, 16 or 1.

Modulation Type: Press this submenu key to display the Demodulation Types menu and open the Modulation Type selection window (see Figure 4-19). Use the rotary knob or press the touch screen to highlight the desired type, then press **Enter**. Select Auto if you are unsure.

DwPTS: If the channel in use has a known DwPTS signal, select On. If the channel in use does not have a DwPTS signal, then select Off. If the presence of the DwPTS is unknown, select Auto.

Tau Offset: Press this submenu key to add an offset to the current Tau value. Use the rotary knob or the arrow keys to change the value. You can also enter a value using the numeric keypad, in which case you need to press the appropriate Units key (μs, ms, or s). 5 sec is the maximum offset that may be entered.

Back: Press this submenu key to return to "Setup Menu" on page 4-17.

Figure 4-18. TD-SCDMA/HSPA+ Advanced Settings Menu

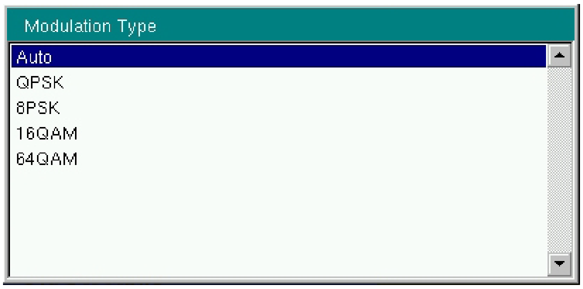
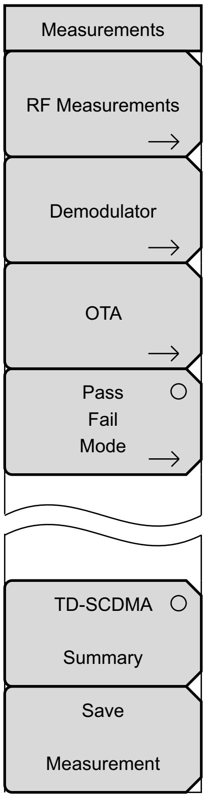


Figure 4-19. Modulation Type Window

4-11 Measurements Menu

Key Sequence: **Measurements**



RF Measurements: Press this submenu key to display the "RF Measurements Menu" on page 4-22.

Demodulator: Press this submenu key to display the "Demodulator Menu" on page 4-24 and to set up demodulator testing.

OTA: Press this submenu key to display the "Over-The-Air Menu" on page 4-25.

Pass Fail Mode: Press this submenu key to activate the Pass/Fail test. Press this submenu key again to display the "Pass Fail Mode Menu" on page 4-26 and set up pass/fail testing.

TD-SCDMA Summary: Press this submenu key to display a table of the TD-SCDMA measurements. The following measurement values are displayed in the table:

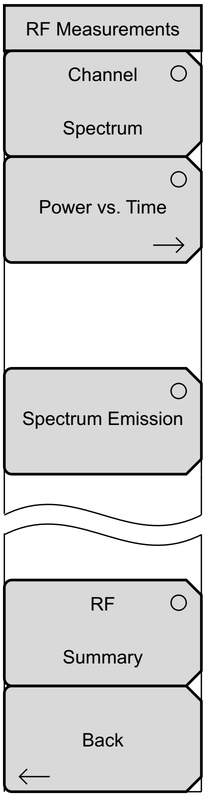
Channel Power
Occ BW
Slot Power
DwPTS Power
UpPTS Power
On/Off Ratio
Freq Error
Freq Error PPM
EVM
Peak CDE
Tau

Save Measurement: Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument's User Guide for information on file management functions.

Figure 4-20. TD-SCDMA/HSPA+ Measurements Menu

RF Measurements Menu

Key Sequence: **Measurements** > RF Measurements



Channel Spectrum: Displays the spectrum of the input signal. The span is automatically set to 5 MHz. Beneath the graph, values for the following measurements are displayed: Left Channel Power, Channel Power, Right Channel Power, Left Channel Occ BW, Occ BW, and Right Channel Occ BW. Channel Power is displayed in dBm or watts depending on unit selection.

Power vs. Time: Opens the "Power vs. Time Menu" on page 4-23.

Spectrum Emission: Changes the display for Spectrum Emission measurement.

RF Summary: Press this submenu key to display the following RF measurements in table format:

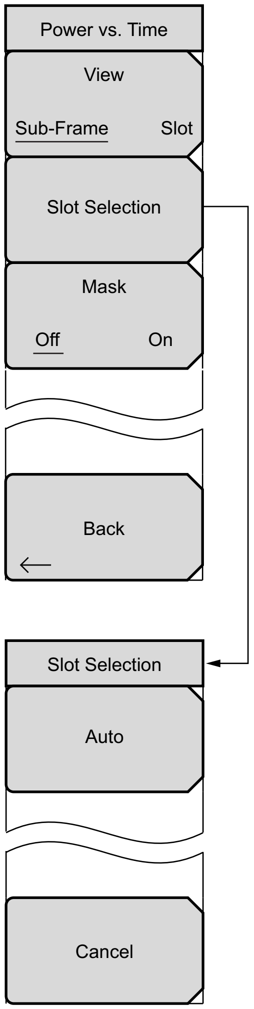
Channel Power
Channel Power (RRC)
Occ BW
DwPTS Pwr
UpPTS Pwr
On/Off Ratio
Slot PAR
Left Channel Power
Right Channel Power
Left Channel Occ BW
Right Channel Occ BW

Back: Press this submenu key to return to "Measurements Menu" on page 4-21.

Figure 4-21. TD-SCDMA/HSPA+ RF Measurement Menu

Power vs. Time Menu

Key Sequence: **Measurements** > RF Measurements > Power vs. Time



View: Press this submenu key to display the Power vs. Time graph in either the Sub-Frame view or the Slot view.

Slot Selection: Press this submenu key to display the Slot Selection menu and open the Slot Selection window. Use the rotary knob or press the touch screen to highlight the desired slot (0 to 6), then press **Enter**. If Auto is selected, the active slot will be detected automatically.

> **Auto:** Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto submenu key have the same function.
>
> **Cancel:** Cancels any new setting you have highlighted without pressing **Enter**. If the Slot Selection currently in effect is highlighted, returns to the Power vs. Time menu.

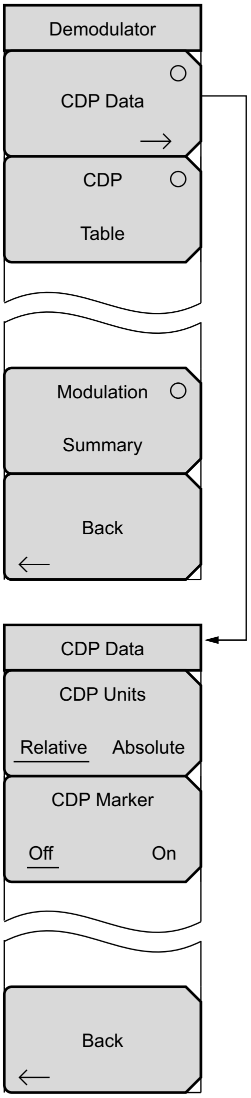
Mask: Press this submenu key to turn the mask On and Off.

Back: Press this submenu key to return to the "Measurements Menu" on page 4-21.

Figure 4-22. TD-SCDMA/HSPA+ Power vs. Time Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



CDP Data: Press this submenu key once to activate this test. Press this submenu key again to display the CDP Data menu and further set up the measurement.

> **CDP Units:** Select either Relative units (dB) or Absolute units (dBm).
>
> **CDP Marker:** Press this submenu key to toggle the CDP markers On or Off.
>
> **Back:** Returns to the Demodulator menu.

CDP Table: Press this submenu key to display a table of the CDP Code, Mod Type, Power (dB), and Power (dBm).

Modulation Summary: Press this submenu key to view the performance of the transmitter demodulated TD-SCDMA/HSPA+ signal in table format. The following parameters are displayed in the table:

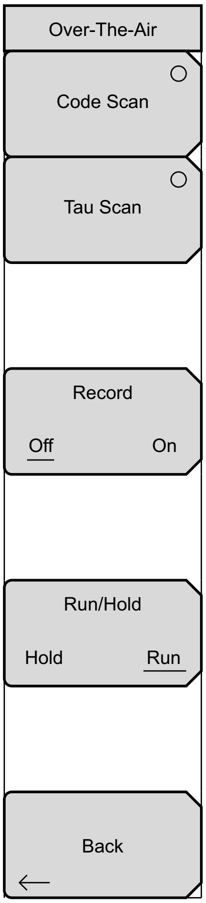
Slot Power (dBm)
EVM
Peak EVM
Freq Error
Freq Error PPM
Tau
Noise Floor
Carrier Feed Through
Peak CDE

Back: Press this submenu key to return to the “Measurements Menu” on page 4-21.

Figure 4-23. TD-SCDMA/HSPA+ Demodulator Menu

Over-The-Air Menu

Key Sequence: **Measurements** > OTA



Code Scan: Press this submenu key to display the 32 sync codes in table format. Displayed below the table are DwPTS Power (in dBm) and Pilot Dominance (in dB).

Tau Scan: Press this submenu key to display the code power versus Tau in bar graph format. Code numbers are displayed at the top of each bar. A table below the bar graph shows the 6 strongest codes (identified by number) and the Tau (in µs) and the Ec/Io (in dB).

Record Off/On: Pressing this submenu key so that On is underlined (selected) sets the instrument to automatically record all OTA measurements that are taken while in the Run mode. Before recording occurs, the name of a log file is flashed on the screen. This is the file in which all recorded data is stored. Selecting Off stops all recording and closes the log file. When pressed again, recording begins in a new file. If Record is turned On when the measurement is a non-OTA measurement (such as Spectrum), then no action is performed.

Run/Hold: Press this submenu key to set either Run mode or Hold mode. Hold mode prevents the instrument from taking any new measurements and freezes the current measurement. Run mode allows the instrument to continually take measurements.

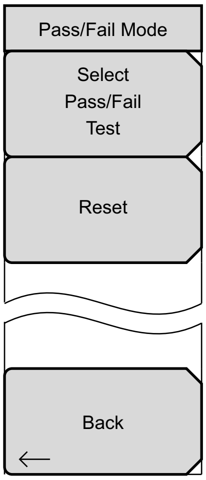
When Record is already toggled On, pressing the Run/Hold submenu key toggles the taking of measurements on and off to continue appending new measurements within the same log file, rather than creating a new log file.

Back: Press this submenu key to return to the “Measurements Menu” on page 4-21.

Figure 4-24. TD-SCDMA/HSPA+ Over the Air Menu

Pass Fail Mode Menu

Key Sequence: **Measurements** > Pass Fail Mode



Select Pass/Fail Test: Press this submenu key to open the Select Pass/Fail Test selection window. Use the rotary knob or the arrow keys, or press the touch screen to highlight the desired test (PASS_FAIL_RF, PASS_FAIL_DEMOD, or PASS_FAIL_ALL), then press the Select Test submenu key. Press **Esc** to return to the Pass/Fail Mode menu without initiating a test.

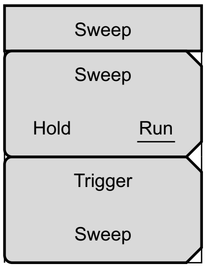
Reset: Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

Back: Press this submenu key to return to the "Measurements Menu" on page 4-21.

Figure 4-25. TD-SCDMA/HSPA+ Pass Fail Mode Menu

4-12 Sweep Menu

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



Sweep Hold/Run: Press this submenu key to toggle between Run mode and Hold mode. Hold mode prevents the instrument from taking any new measurements and freezes the current measurement. Run mode allows the instrument to continually take measurements.

Trigger Sweep: Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

Figure 4-26. TD-SCDMA/HSPA+ Sweep Menu

4-13 Measure Menu

Displays the “Measurements Menu” on page 4-21.

4-14 Trace Menu

This menu is not available in TD-SCDMA/HSPA+ measurement mode.

4-15 Limit Menu

This menu is not available in TD-SCDMA/HSPA+ measurement mode.

4-16 Other Menus

Preset, **File**, **Mode** and **System** are described in the User Guide.

Chapter 5 — LTE Signal Analyzer

5-1 Introduction

The Long Term Evolution (LTE) Signal Analyzer offers three measurement options:

- RF Measurements

  The following display types are provided for RF measurements: Channel Spectrum display, ACLR display, Spectral Emission Mask display, and the RF Summary table.

- Modulation Measurements

  Modulation measurements can be viewed in Power vs Resource Block, Constellation display, Control Channel Power display, or the Modulation Summary table.

- Over-The-Air (OTA) Measurements

  Over-the-Air measurements include Scanner, Tx Test, eMBMS Test, Coverage Mapping, and Carrier Aggregation. EMF measurements are available with Option 444.

5-2 General Measurement Setups

Please refer to the User Guide for selecting the LTE Signal Analyzer mode, setting up frequency, amplitude, and file management. In addition, perform the following LTE specific setup procedures.

1. Press the **Setup** main menu key.
2. Press the BW submenu key to open the Select Bandwidth list. Select the desired Bandwidth with the arrow keys or rotary knob and press **Enter**.
3. Press the EVM Mode submenu key to select either Auto or PBCH Only. Selecting Auto measures Physical Downlink Shared Channel (PDSCH) if data is available, otherwise it measures Physical Broadcast Channel (PBCH), a control channel that carries a broadcast message. Selecting PBCH Only forces a PBCH measurement.

Note	The Modulation Constellation will show a QPSK constellation when PBCH is being measured. PBCH Only mode is useful when making measurements over the air under conditions where the transmitted data uses MIMO. The instrument also automatically selects PBCH only when OTA measurements are selected. PBCH only is also necessary when connecting directly to the transmitter and MIMO is used, when measuring live traffic and assuming that precoding is used in that eNodeB.

4. Press Sync then the Sync Type submenu key to select between the Normal (SS) or RS for synchronization. RS should be selected *ONLY* when there is no sync signal. This happens only when directly connected to a base station that is configured such that one of the antenna ports does not have a sync signal. When RS is selected, the Cell ID submenu key becomes active. Enter the Cell ID of the base station. The Cell ID field is automatically populated with the last measured Cell ID for user convenience.

Note	Sync Type RS is only supported when BW is set to 10 MHz.

5. Press Back to return to the **Setup** main menu.

Antenna Status

The Antenna Status indicator can show when antennas are detected and which one is currently being measured. Antenna Status is displayed for any EVM measurement shown: Constellation, Control Channel Power, Modulation Summary and LTE Summary. The antennas icons are displayed at the lower-left corner of the display screen (Figure 5-1).

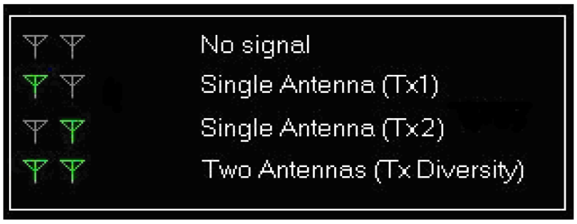


Figure 5-1. Antenna Status

5-3 LTE RF Measurements

The following parameters are measured in the RF Measurement mode.

Channel Spectrum

Channel Spectrum displays the spectrum of the input signal across one channel. The Channel Power and Occupied BW are computed and displayed below the graph.

Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

ACLR

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph. For example, when BW is set to 10 MHz, the channel spacing is –20 MHz, –10 MHz, +10 MHz and +20 MHz and the channels are color coded.

Spectral Emission Mask

The Spectral Emission Mask (SEM) measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

RF Summary

The RF Summary is a display of the occupied bandwidth, power of the main channel, upper adjacent channels, and lower adjacent channels in a table format. The RF Summary also shows the SEM status: PASS or FAIL. Refer to individual RF measurement descriptions for additional details on each measurement.

RF Measurement Setups

Channel Spectrum

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Channel Spectrum submenu key to activate this RF measurement view (Figure 5-2).
4. Press the Channel Spectrum submenu key again to select the Channel Spectrum menu, where you can adjust the span.

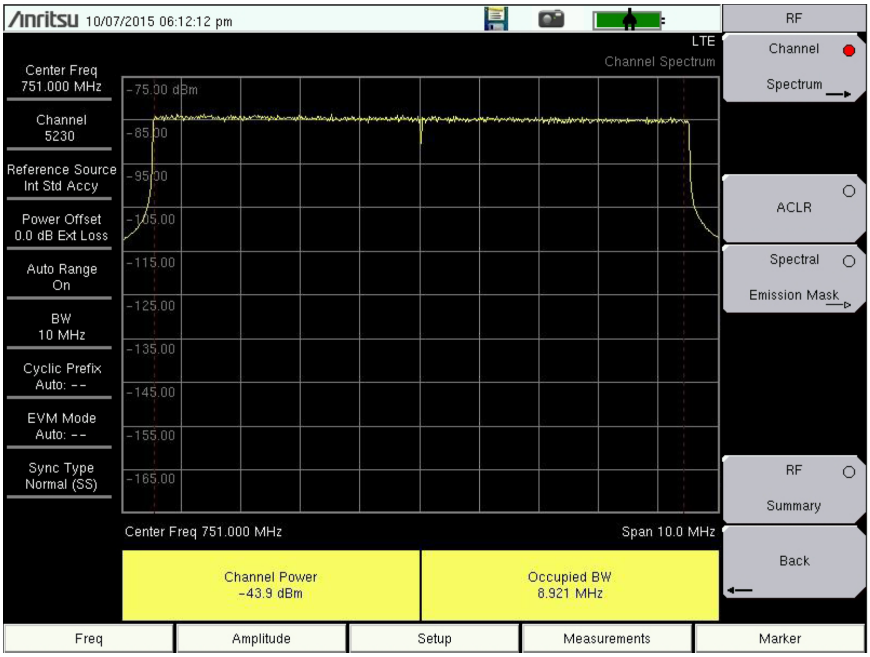


Figure 5-2. Channel Spectrum

5. Press the Back submenu key to return to the RF menu.

ACLR

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the ACLR submenu key to activate ACLR display and measurement (Figure 5-3).

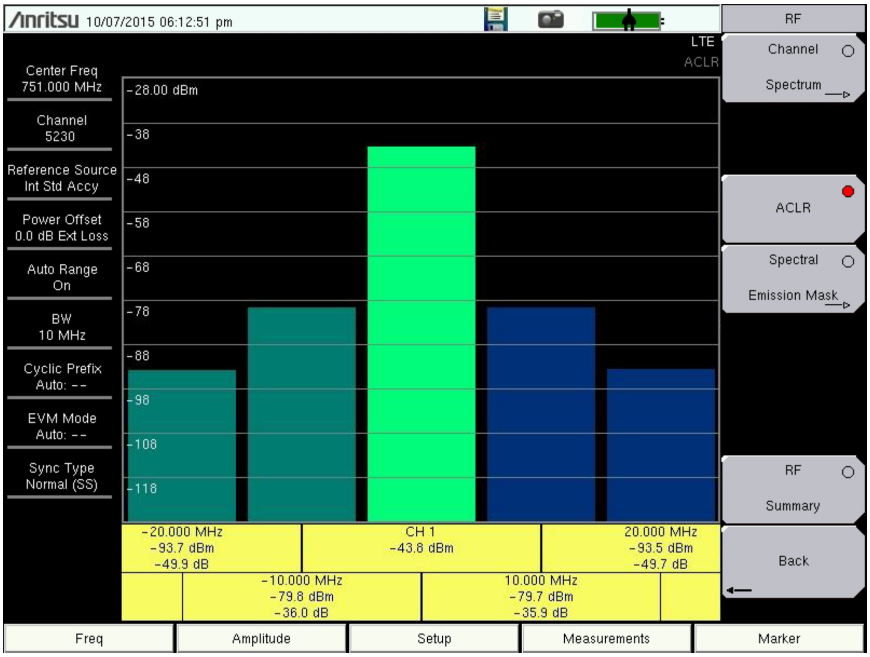


Figure 5-3. Adjacent Channel Leakage Ratio

4. Press the Back submenu key to return to the Measurements menu.

Spectral Emission Mask

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Spectral Emission Mask submenu key to activate the Spectral Emission measurement and display (Figure 5-4).
4. Press the Spectral Emission Mask submenu key again to list the Spectral Emission menu and set up its parameters. Refer to Figure 5-26, "LTE RF Menu" on page 5-33 for additional information.
5. To view the measurement data in a table format, press the Summary Table submenu key so On is underlined.

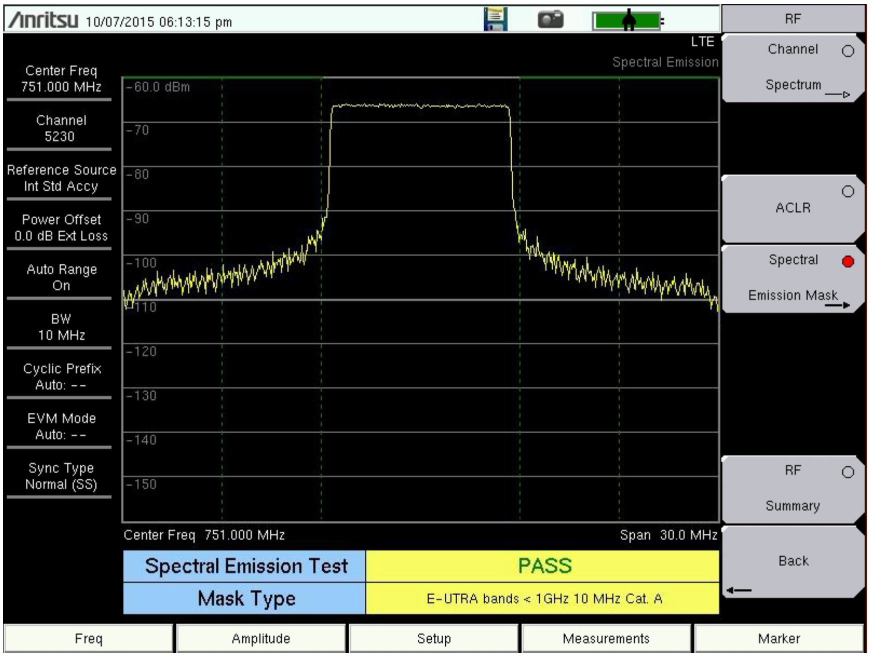


Figure 5-4. Spectral Emission Mask

6. Press the Back submenu key to return to the RF menu.

RF Summary

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the RF Summary submenu key to activate and display the RF measurements in table format (Figure 5-5).

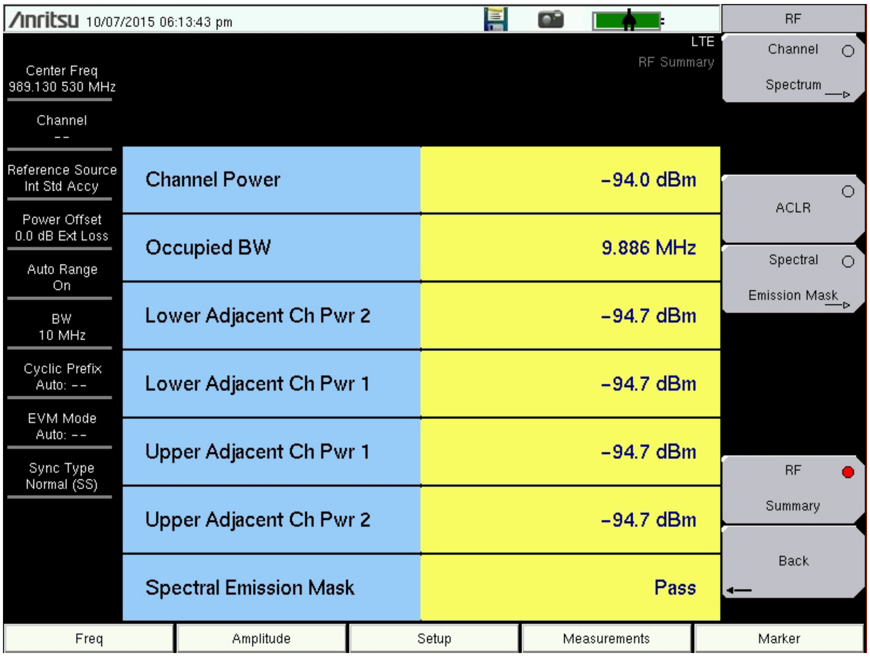


Figure 5-5. RF Summary

4. Press the Back submenu key to return to the Measurements menu.

5-4 LTE Modulation Measurements

The following parameters are measured in the Modulation Measurement mode.

Power vs Resource Block (RB)

This measurement displays the Power vs RB grid, an RB Color Map, the measurements table, and measurement progress bar. See Figure 5-6 on page 5-11.

Two Dimensional Power vs RB Grid

Shows the PDSCH power of each RB using color. The y-axis is frequency (sub-carriers) and the x-axis is time (sub-frame). There are ten columns for the ten sub-frames. The number of subcarriers varies depending on the bandwidth chosen and hence the number of RBs on the y-axis. Each cell in the grid corresponds to a particular RB in a particular sub-frame. As the measurement progresses, each sub-frame is measured and the cells in the grid are colored according to the PDSCH power in the RB.

Resource Block Color Map

The color mapping of the RB power level is determined by the RB Color Map Max Value and RB Color Map Range submenus. Setting these values can be done by entering them manually or by pressing Autoscale Color Map.

Note	The Power Offset is applied to the measured value before matching to a color map.

Measurements Table

Active RBs
The number of active Resource Blocks. A RB is determined to be active if the measured PDSCH power is above a certain threshold that indicates that the RB is being used for carrying data.

Utilization
The percentage of RBs that carry data. It is the number of Active RBs divided by the total number of RBs, expressed as a %.

Channel Power
Channel power is the average total power within the bandwidth and is expressed in dBm.

OSTP
OSTP is the measurement of the OFDM symbol transmit power.

EVM
The RMS (%) of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. Individual frame EVM(RMS) is displayed for the modulation types QPSK, 16-QAM, and 64-QAM.

Cell ID
Cell identifying information sent by the transmitter in the sync signal.

Measurement Progress Bar

This progress bar indicates the sub-frame that is currently being measured.

Markers

Markers are available for use in the Power vs Resource Block measurement. The markers will outline the selected RB. Above the two dimensional grid, the specific RB subcarrier/sub-frame coordinates will be displayed along with its power level.

Constellation

This measurement displays the constellation of the demodulated symbols over the first sub-frame and a results table of the measurements described below. See Figure 5-7 on page 5-12.

Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value. Reset occurs when setup parameters are changed or by toggling the EVM Max Hold button.

Freq Error

The difference between the measured carrier frequency and the specified carrier frequency is the frequency error. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM value since Reset and the second number is the current measured value.

Freq Error (ppm)

Freq Error displayed in parts per million (ppm).

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

Control Channel Power

This measurement shows the power levels of key physical layer Control Channels and also includes the numerical results table described in the "Constellation" section above. EVM per control channel is also available (see Figure 5-8 on page 5-13), as well as a table view showing the power in both per-resource-element and total power formats. Refer to "Control Channel Power Menu" on page 5-37.

Ref Signal (RS) Power

Reference Signal power displayed in dBm. The reference signal is used for downlink channel estimation.

P-SS Power

Primary Sync Signal power displayed in dBm or Watts. The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.

S-SS Power

Secondary Sync Signal power displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.

PBCH Power

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

PCFICH Power

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDCCH and PDSCH channels.

PHICH Power

Physical Hybrid Automatic Repeat Request Indicator Channel. Transmits the channel coded HARQ indicator codeword used for error correction.

PDCCH Power

Physical Downlink Control Channel.

Ng

Ng is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in a LTE sub-frame (this number is constant for all sub-frames).

Tx Time Alignment

Measures the delay between the signals from two antennas at the antenna ports.

Modulation Summary

Modulation Summary displays the Ref Signal (RS) Power, Sync Signal (SS) Power, EVM (rms), Freq Error (Hz and ppm), Cell ID and PBCH Power in a table format. Refer to individual modulation measurement descriptions for additional detail on each measurement.

Modulation Measurement Setups

Power vs Resource Block

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Power vs Resource Block submenu key to activate the Power vs Resource Block measurement view.

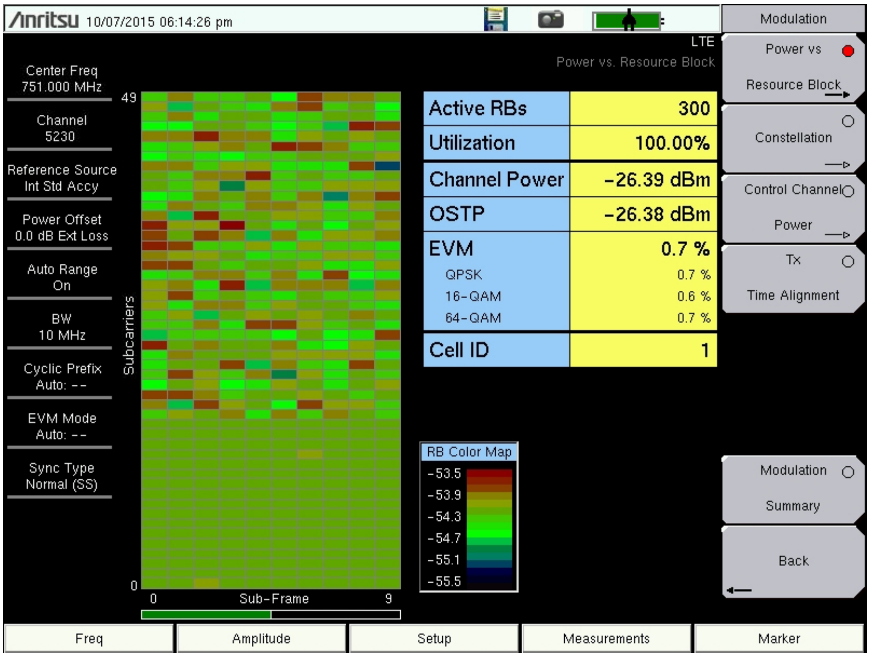


Figure 5-6. Power versus Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to list the Power versus RB menu for setting up the RB Color Map maximum value and range. Press a submenu key to change the desired parameter. Or, press the Autoscale Color Map submenu key to automatically set the Max and Range values.
5. Press the Back submenu key to return to the Modulation menu.

Note	Values shown in the Power vs Resource Block measurement display pertain to the data subcarriers. This is useful in the monitoring of changes in traffic loading on the base station. To measure the power levels of the physical layer Control Channels, use the "Control Channel Power" measurement.

Markers

1. While in the Power vs Resource Block measurement, press the **Marker** main menu key. The RB Marker submenu opens. The Marker State button default value is On, so the markers highlight a row of sub-frames and a column of sub-carriers.
2. To immediately find the strongest resource block press the Peak Search button.
3. To choose a specific resource block, press the Marker RB # submenu key and move it to the desired RB # using the arrow buttons, knob or enter a RB number and press **Enter**.
4. To choose a specific sub-frame, press the Marker Sub-frame submenu key and move it to the desired Sub-frame using the arrow buttons, knob, or enter the sub-frame number and press **Enter**.

Constellation

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Constellation submenu key to activate the Constellation measurement view (Figure 5-7). Press the Constellation submenu key again to list the Constellation menu and set up the reference points and data legend.
   a. Press the Reference Points submenu key to turn the reference points (small white circles) On or Off.
   b. Press the Data Legend submenu key to turn the data legend On or Off.
4. Press the Back submenu key to return to the Modulation menu.

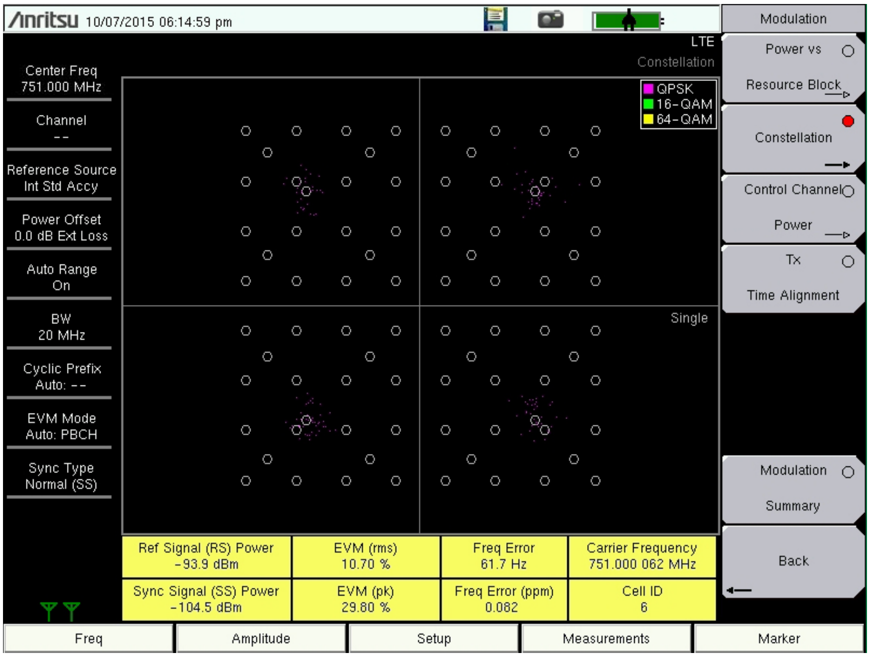


Figure 5-7. Constellation Measurement View

Control Channel Power

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Control Channel Power submenu key to activate the Control Channel Power display (Figure 5-8). Press the key again to view or change the Display Mode and Control Channel EVM settings.

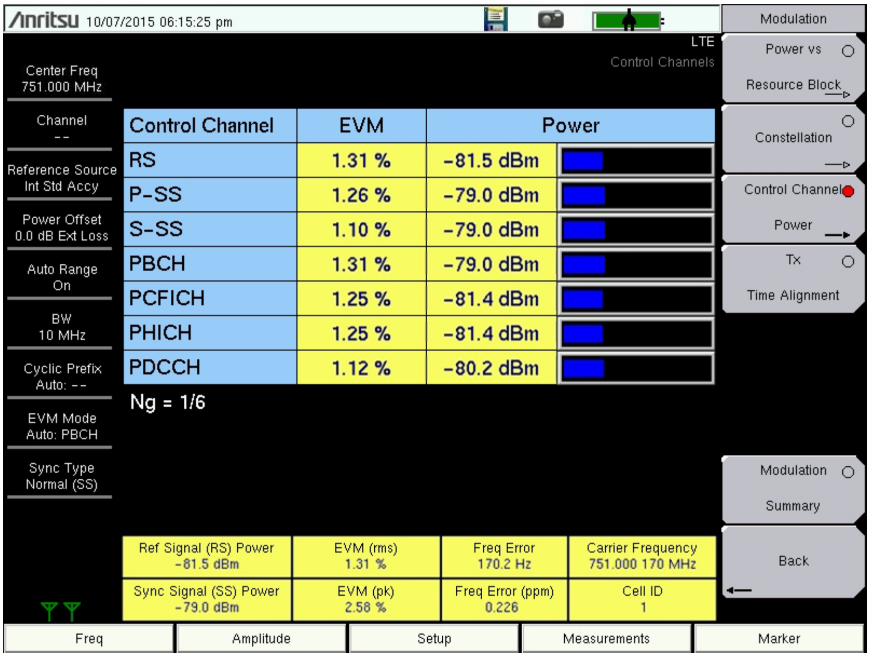


Figure 5-8. Control Channel Power

4. Press the Back submenu key to return to the Modulation menu.

Tx Time Alignment

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Tx Time Alignment submenu key to set the modulation measurement to Tx Time Alignment view. The instrument display lists the Time Alignment measurement results and the TAE values for each antenna pair. See Figure 5-9. If your instrument is loaded with older firmware that does not support 4x4 MIMO, the display may look similar to Figure 5-10.
4. Press the Back submenu key to return to the Measurements menu.

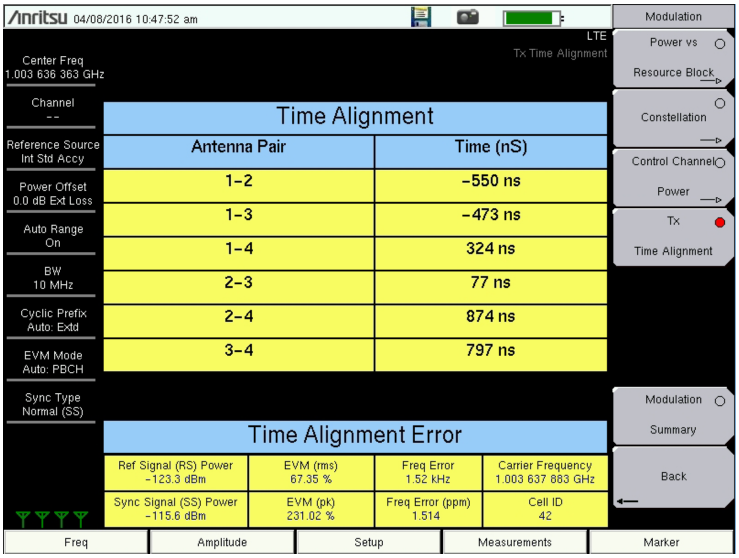


Figure 5-9. Tx Time Alignment (4x4 MIMO Configuration)

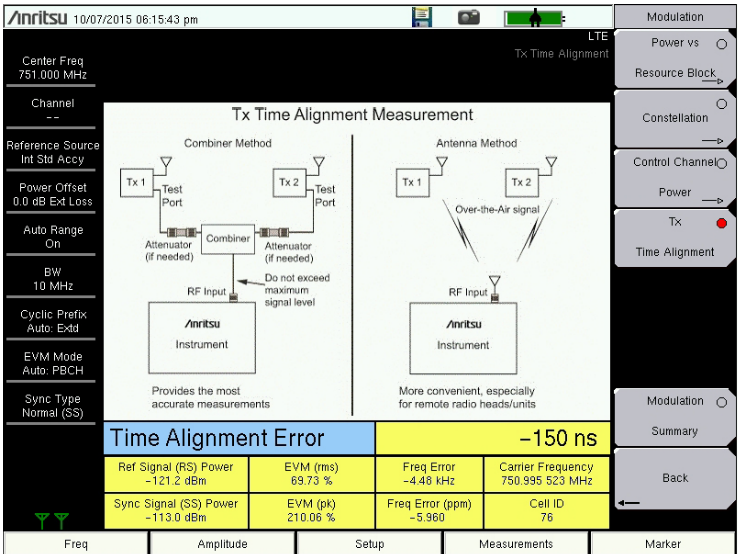


Figure 5-10. Tx Time Alignment

Modulation Summary

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Modulation Summary submenu key to activate and display the modulation measurements in table format (Figure 5-11).

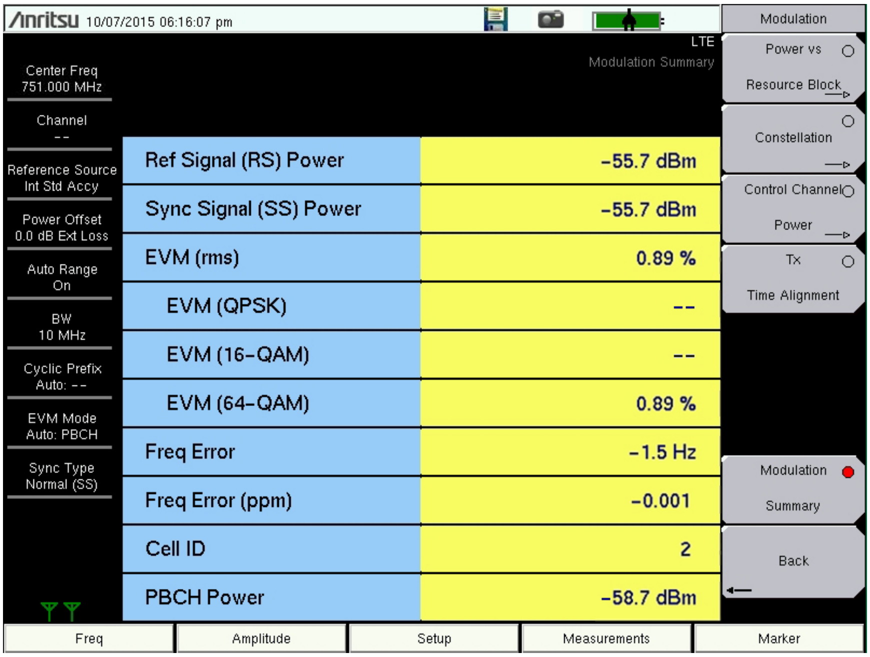


Figure 5-11. Modulation Summary

4. Press the Back submenu key to return to the Measurements menu.

5-5 LTE Over-the-Air (OTA) Measurements

Scanner, Tx Test, Mapping, and Carrier Aggregation are measurements taken over the air. EMF measurements are available only with Option 444.

Antenna Status

The Antenna Status indicators, if any, are located in the bottom left corner of the instrument display. They show the number of antennas detected and which one is currently being measured. In OTA measurements, the Antenna Status is displayed when Show Mod Results is On for Scanner and Tx Test.

Scanner

The Scanner measurement scans for the presence of up to 6 cell IDs and the following measurement values.

Cell ID, Sector ID, Group ID

Identifying information sent by the transmitter in the sync signal.

S-SS Power

Secondary Sync Signal power is displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. S-SS Power contains information needed for cell search.

RSRP

Reference Signal Received Power provides the UE with essential information about the strength of cells from which path loss can be calculated and used for determining optimum power settings for operating networks. RSRP is used in both idle and connected states. RSRP is used as a parameter in multi-cell scenarios.

RSRQ

Reference Signal Receive Quality provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRP is the ratio between RSRP and RSSI measured in dB.

SINR

Signal-to-Interference-plus-Noise Ratio is measured in dB.

Dominance

Dominance is the ratio of the power for the largest signal to the sum of all other signals found, measured in dB.

PBCH Modulation Results

The PBCH Modulation Results table is displayed when the Show Mod Results setting is set to On. Refer to “OTA Scanner Menu” on page 5-39. The displayed values are the same as described under “Constellation” on page 5-9.

Tx Test

Tx Test measurements are optimized for remote radio heads and MIMO (systems. The first table in Tx Test replicates the Scanner table measurements, except the measurement scans the presence of up to 3 cell IDs. The second table shows the RS power across all detected antennas (transmitters) for the strongest Cell ID. This is displayed as average power and delta power for the detected transmitters, along with a small bar graph that shows the relative RS powers for each Tx. The PBCH Modulation Results table can also be turned on.

Mapping (Coverage Mapping)

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ) and SINR. It is the same measurement as in Scanner which scans for the presence of up to 6 cell IDs but only displays the presence of up to 3 cell IDs. For full details regarding Coverage Mapping setup and testing, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

Carrier Aggregation

This measurement displays a table of up to five Component Carriers (CC) used in Carrier Aggregation and their measured signal components.

Frequency

This is the set center frequency.

Bandwidth (BW)

This is the set bandwidth of the Component Carrier.

Cyclic Prefix (CP)

The length of Cyclic Prefix can be specified as either Normal or Extended.

MIMO

Multiple input, multiple output technology, or spatial multiplexing, uses two or more simultaneous RF transmission paths to improve signal performance. In 2x2 MIMO, for example, the overall bitrate increases through transmission of different data streams from two TX antennas to two RX antennas on the same frequency and time, but different reference signals. Your Anritsu test instrument supports 2x2 and 4x4 MIMO configurations. Note that 4x4 MIMO may not be available if your instrument is loaded with older firmware. Refer to your instrument User Guide for instructions on updating firmware.

The MIMO status indicators on the instrument screen show which transmitters are active. See Figure 5-14 on page 5-21. There are two icons in a 2x2 MIMO configuration, four icons if 4x4 MIMO signals are detected. Active transmitters display as green dots. Inactive transmitters are gray. They correspond to the antenna icons displayed at the bottom left of the screen for each Component Carrier scanned.

Reference Signal (RS) Power

Reference Signal power is displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

RS Delta Power

RS Delta Power shows the maximum relative power difference in dB between the RS powers of the MIMO signals and can be used to check correct MIMO configuration.

Sync Signal (SS) Power

Sync signal power is displayed in dBm or Watts.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

Freq Error

This is the difference between the measured carrier frequency and the specified carrier frequency. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

Freq Error (ppm)

This is the frequency error displayed in parts per million.

TAE

Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

EMF (Option 444 only)

EMF measurements are available in Over-the-Air LTE Signal Analyzer mode only when Option 444 is installed. The option requires an isotropic antenna, at a frequency range that is within specification of the instrument used. Refer to the isotropic antenna and spectrum analyzer Technical Data Sheets.

Chapter 8, "EMF (Option 444)" provides connection instructions for the antenna and detailed descriptions of the EMF Measurement menu and submenus.

Measurement Setup

Scanner

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Scanner submenu key to activate the OTA Scanner display. See Figure 5-12 on page 5-19. Press the Scanner key again to display the OTA Scanner menu.
   a. Press the Sort By... submenu key to list the Sort By menu and select the parameter the OTA Scanner will use for sorting (Cell ID, Group ID, Sector ID, S-SS Power, RSRP, RSRQ or SINR) and press **Enter**.

b. Press the Show Mod Results submenu key to display or hide the Modulation Results of the strongest signal.

Note	When Show Mod Results is on, the scanner measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the LTE demod option to toggle this submenu to On.

c. Use the Auto Save submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file.

4. Press Back to return to the Over-the-Air menu.

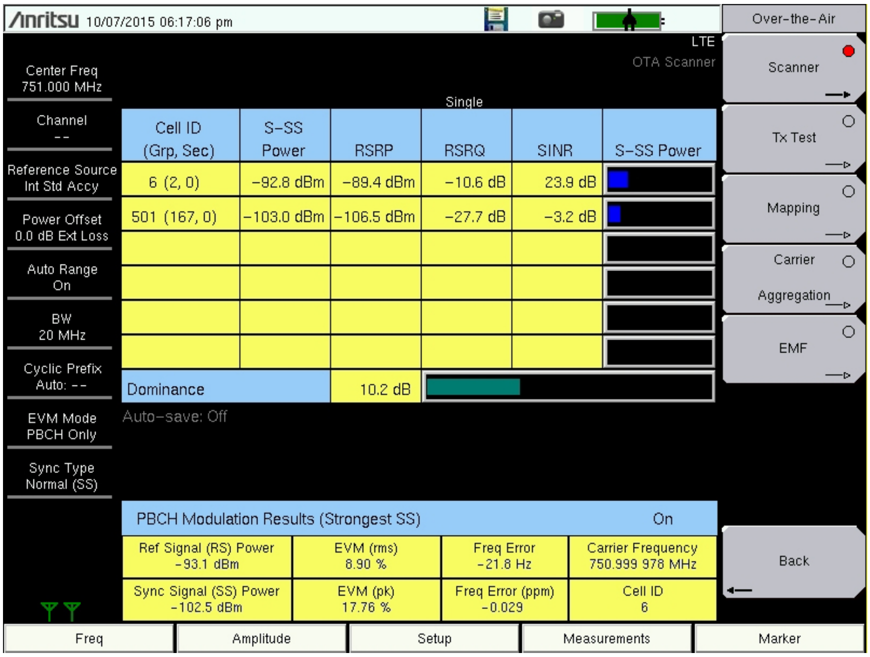


Figure 5-12. Over-the-Air Scanner Measurements

Tx Test

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Tx Test submenu key to activate the OTA Tx Test display. See Figure 5-13 on page 5-20. Press the Tx Test key again to display the OTA Tx Test menu.
4. Press the Show Mod Results key to display or hide the PBCH Modulation Results (Strongest SS) table.

5. Press Back to return to the Over-the-Air menu.

Note	When Show Mod Results is on, the Tx Test measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the LTE demod option to toggle this submenu to On.

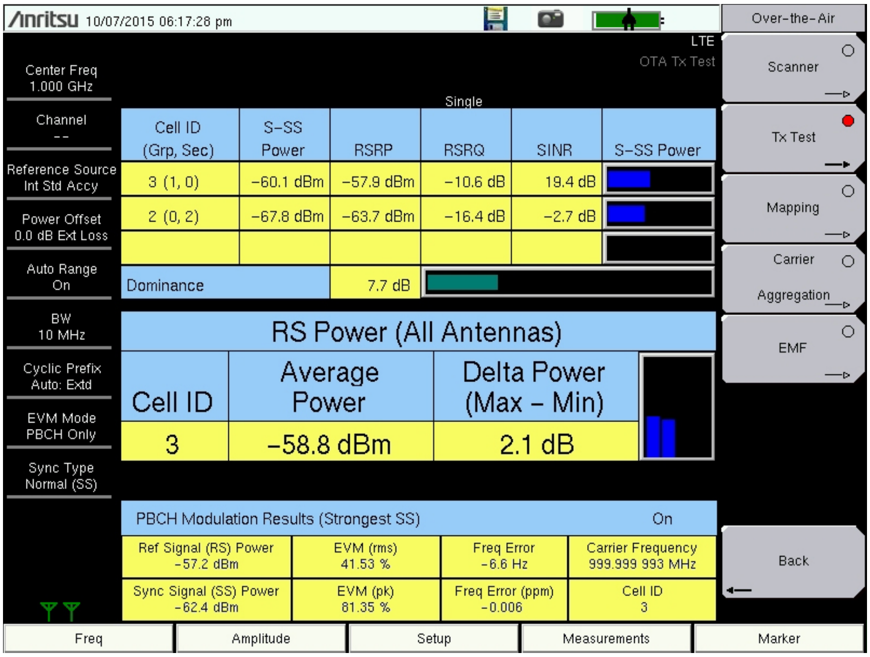


Figure 5-13. Over-the-Air Tx Test Measurement

Mapping

Refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

Carrier Aggregation

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Carrier Aggregation submenu key to display the OTA Carrier Aggregation table. Press the key again to display the Carrier Aggregation menu. See Figure 5-14.
4. Press one of the five Component Carrier (CC) submenu keys to set it up for measurement.
5. Configure each Component Carrier as needed. Refer to "Component Carrier Menu" on page 5-43.
6. Press the TAE submenu key to turn on or off the Time Alignment Error measurement.
7. Press Back to return to the Over-the-Air menu.

Note	Figure 5-14 illustrates a 4x4 MIMO configuration. In 2x2 MIMO, there are two transmitter status indicator dots for each active Component Carrier. Refer to "Carrier Aggregation" on page 5-17 for a description of the measurement result values.

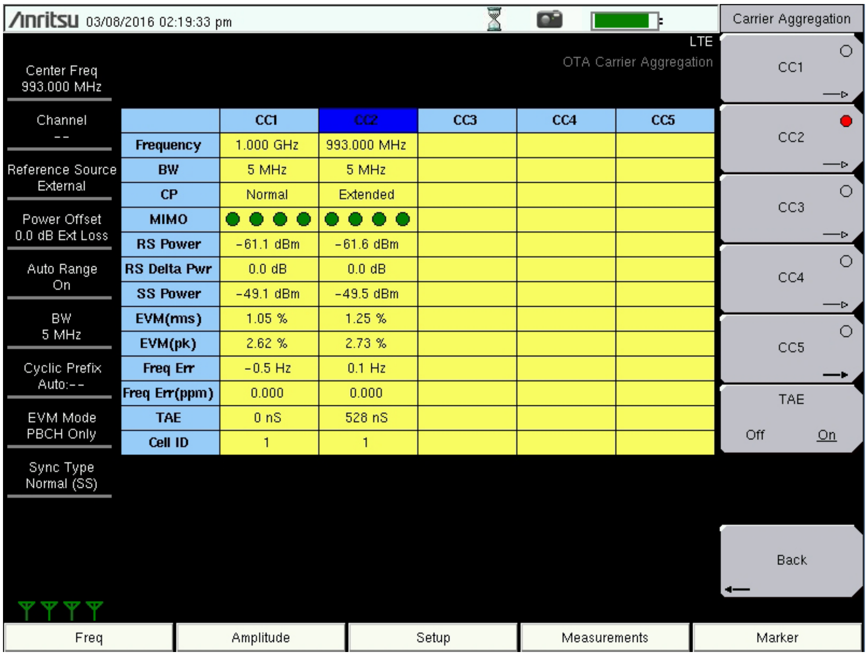


Figure 5-14. Over-the-Air Carrier Aggregation Measurement

EMF

Refer to "LTE/TD-LTE EMF Menu" on page 8-2.

5-6 Pass/Fail Tests

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail Test submenu key to activate the Pass/Fail display in table format (Figure 5-15). Press the Pass/Fail Test submenu key again to select a Pass/Fail test.
   a. Press the Select Pass/Fail Test submenu key to open the Select Pass Fail Test window. Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test. Refer to the instrument User Guide and the Master Software Tools (MST) User Guide for creating new Pass/Fail tests.
   b. Press the Reset submenu key to erase a previous measurement/s and restart the Pass/Fail test.

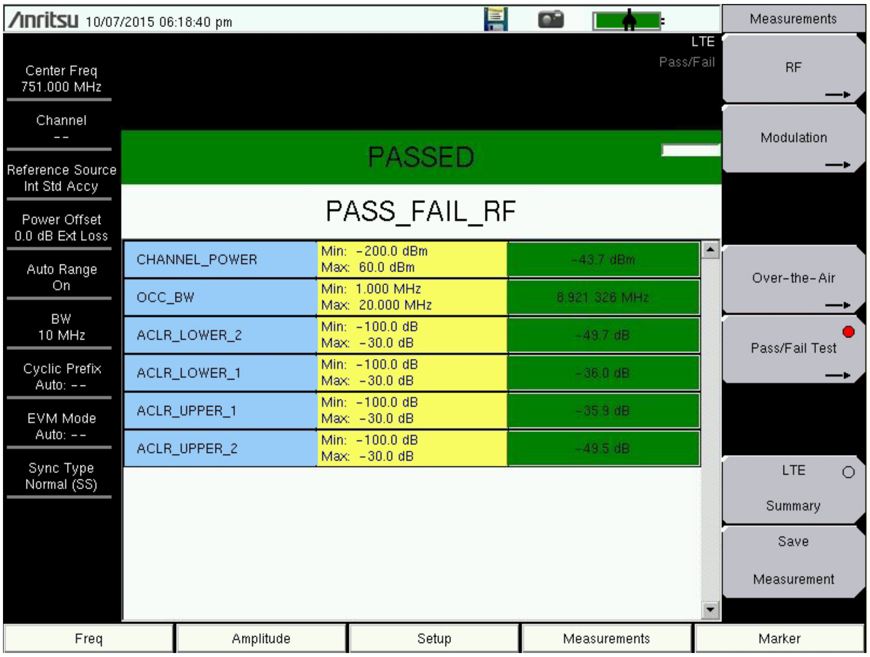


Figure 5-15. Past/Fail Test

3. Press the Back submenu key to return to the Measurements menu.

5-7 LTE Summary

The following parameters are displayed in the LTE Summary measurement.

Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

PBCH Power

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

PCFICH Power

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDSCH (Physical Downlink Shared Channel).

Spectral Emission Mask

Displays a Pass/Fail status for the signal measured against the selected mask.

Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the LTE Summary submenu key to activate and display the LTE measurements in table format.

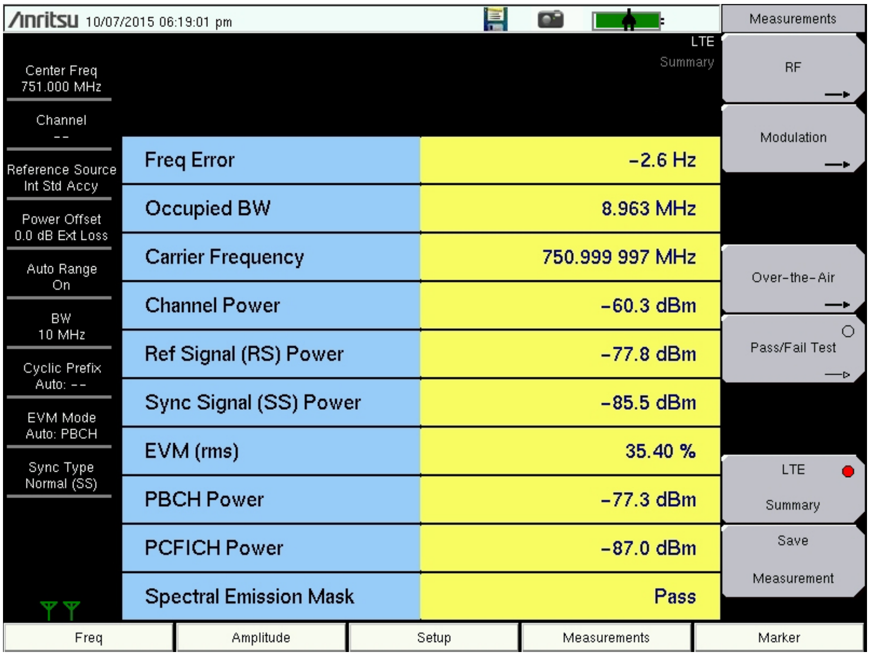


Figure 5-16. LTE Summary

5-8 LTE Menus

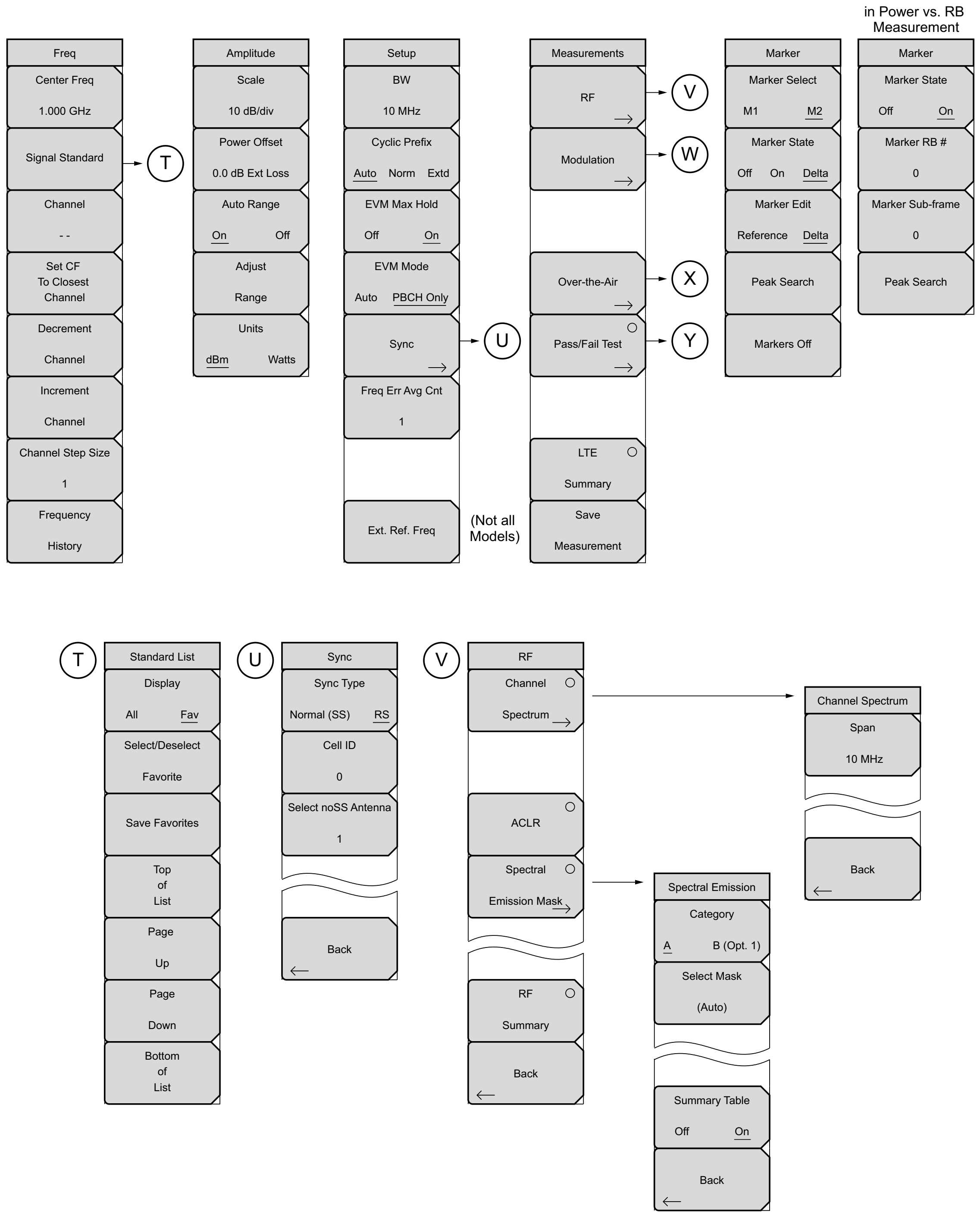


Figure 5-17. LTE Menu Layout (1 of 3)

LTE Menus (continued)

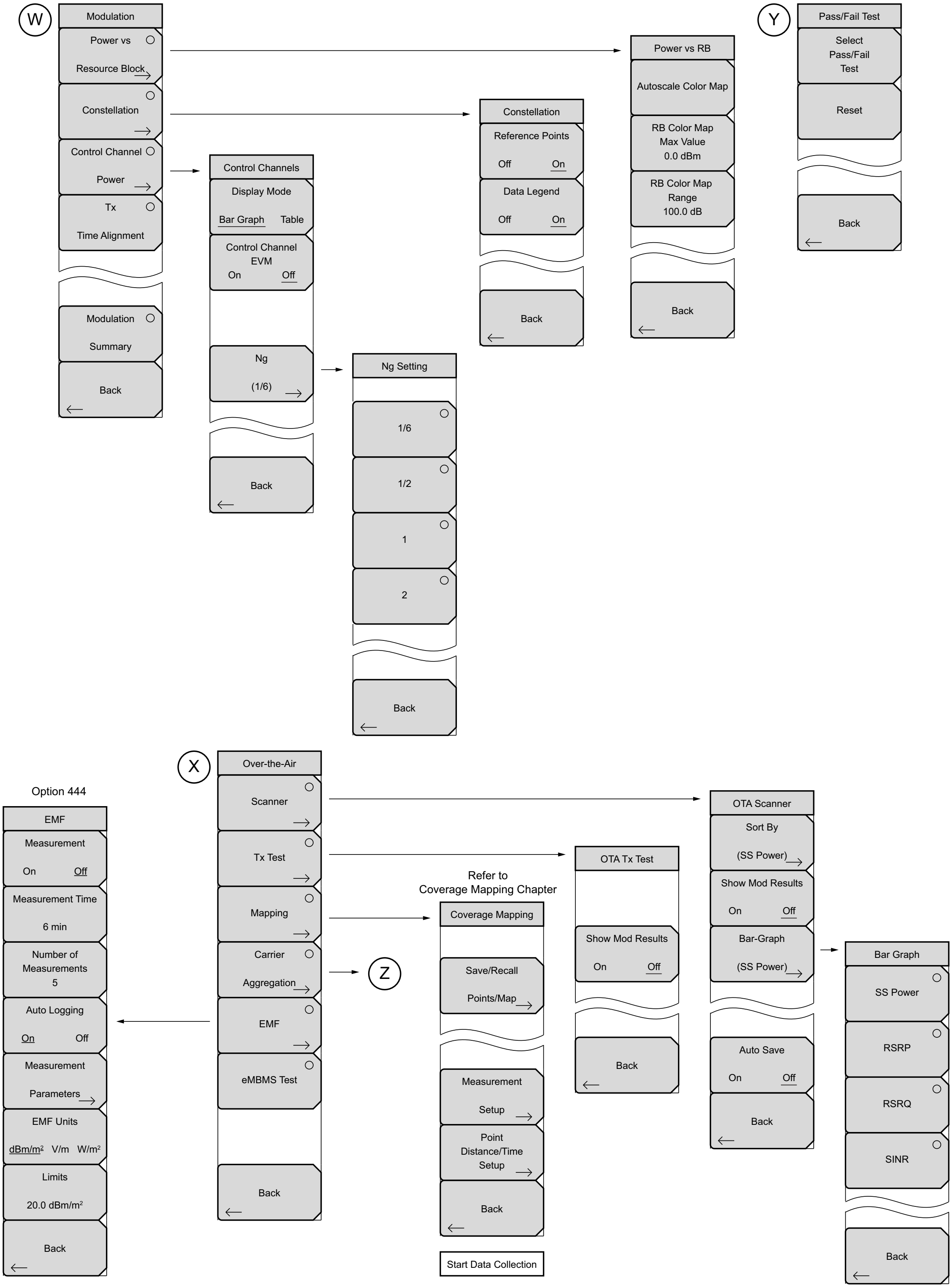


Figure 5-18. LTE Menu Layout (2 of 3)

LTE Menus (continued)

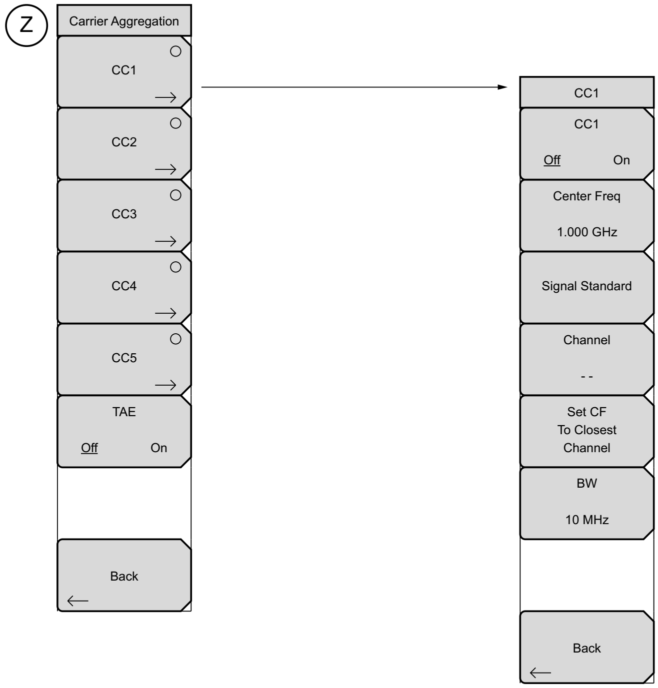
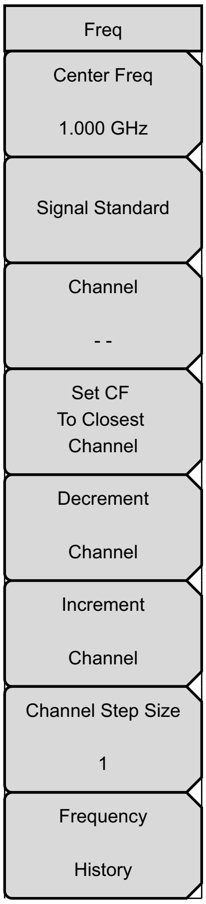


Figure 5-19. LTE Menu Layout (3 of 3)

5-9 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

Signal Standard: Opens the "Standard List Menu" on page 5-29.

Channel: Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

Set CF to Closest Channel: Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

Decrement Channel: Decrements the channel by one channel.

Increment Channel: Increments the channel by one channel.

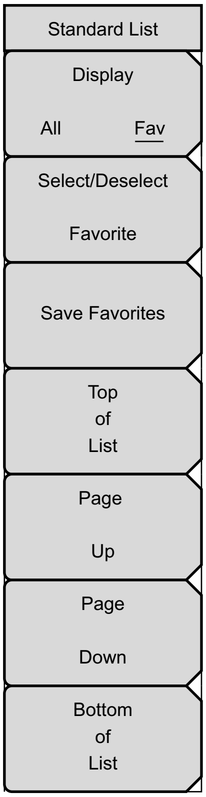
Channel Step Size: Use this submenu key to specify the step size used for incrementing or decrementing the channel number. Change the step value by using the arrow keys or rotary knob. Press the **Enter** key to set the value.

Frequency History: Opens a list box that displays the last five selected frequencies. When a frequency is entered using the Center Frequency submenu key or the Signal Standard/Channel submenu keys, the list will be updated.

Figure 5-20. LTE Freq Menu

Standard List Menu

Key Sequence: **Freq** > Signal Standard



Display: Toggles between displaying all available signal standards and the signal standards marked as favorites (* in the Fav column).

Select/Deselect Favorite: Press this submenu key to select or deselect a signal standards as a favorite.

Save Favorites: Press this submenu key to have the instrument save to memory the signal standards were selected as favorites. Next time the signal standard list is displayed, these signal standard will be marked as favorites (* in the Fav column).

Top of List: Press this submenu key to display the first signal standard in the list.

Page Up: Press this submenu key to scroll up one page in the signal standard list.

Page Down: Press this submenu key to scroll down one page in the signal standard list.

Bottom of List: Press this submenu key to display the last signal standard in the list.

Press **Esc** to close the Signal Standards list and return to the Frequency menu.

Figure 5-21. LTE Signal Standards

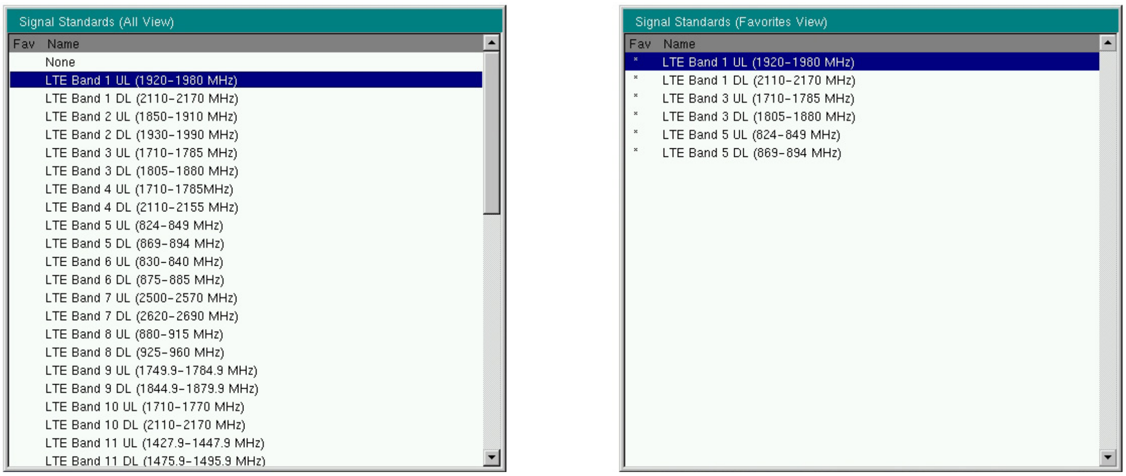
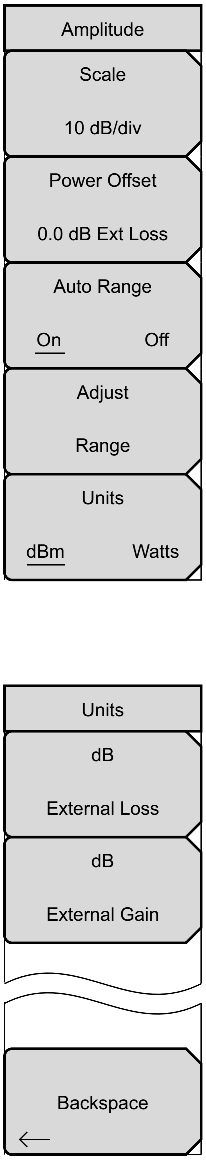


Figure 5-22. LTE Signal Standard List, All and Favorites

5-10 Amplitude Menu

Key Sequence: **Amplitude**



Scale: Press this submenu key to change the scale of the y-axis in the RF measurement displays. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div.

Power Offset: Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

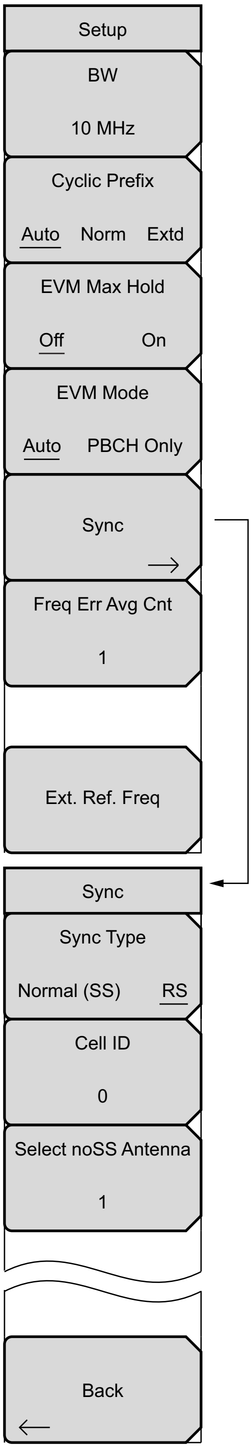
Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

Units: Press this submenu key to set the units for all measurements and summary tables in either dBm or Watts.

Figure 5-23. LTE Amplitude Menu

5-11 Setup Menu

Key Sequence: **Setup**



BW: Opens the Select Bandwidth list. Choose from the available bandwidths.

Cyclic Prefix: Press this key to set the instrument to measure signal with a Normal or Extended Cyclic Prefix, or to allow the instrument to detect the Cyclic Prefix automatically.

EVM Max Hold: Turn the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.

EVM Mode: Press to select either Auto or PBCH Only. Selecting Auto measures PDSCH if data is available, otherwise, it measures PBCH. Selecting PBCH Only forces a PBCH measurement and the constellation measurement will only show QPSK. The instrument will automatically choose PBCH Only mode when the OTA Scanner is used.

Sync: Opens the Sync submenu.

> **Sync Type:** Press to choose between the Normal (SS) or RS (Reference Signal) Sync Type. Only choose RS when there is no sync signal present in the transmitter under test. If RS is chosen and a sync signal is present, no modulation measurements will be available.
>
> **Cell ID:** Identifying information sent by the transmitter in the sync signal. If Normal (SS) is selected as the Sync Type, the Cell ID is extracted automatically from the Sync Signal. The Cell ID must be entered manually when RS Sync Type is selected. For user convenience, the Cell ID is automatically populated from the last measured signal with an SS.
>
> **Select noSS Antenna:** Selects which antenna in a 4x4 MIMO system that does not receive a sync signal. Antenna 0 must receive a sync signal.
>
> **Back:** Returns to the Setup menu.

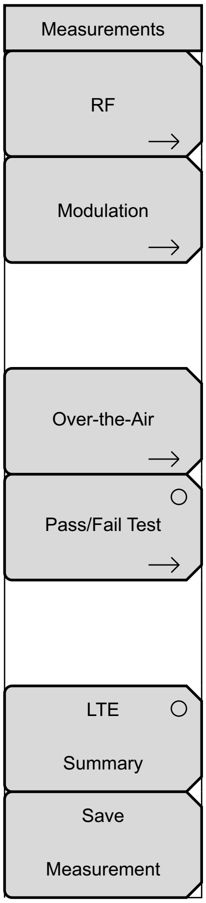
Freq Err Avg Cnt: When the count is greater than one, the frequency error value is averaged over past measurements. If the count is one, then no averaging occurs.

Ext. Ref. Freq (Only Some Models): Press to set the external reference frequency. The External Reference Frequency list opens. Highlight the desired frequency and press **Enter**.

Figure 5-24. LTE Setup Menu

5-12 Measurements Menu

Key Sequence: **Measurements**



RF: Press this submenu key to display the “RF Menu” on page 5-33.

Modulation: Press this submenu key to display the “Modulation Menu” on page 5-34.

Over-the-Air: Press this submenu key to display the “Over-the-Air Menu” on page 5-38.

Pass/Fail Test: Press this submenu key to activate the Pass/Fail test. Press key again to display the “Pass/Fail Test Menu” on page 5-44 and set up pass/fail testing.

LTE Summary: Press this submenu key to display a table of the LTE measurements. The following measurement values are displayed in the table:

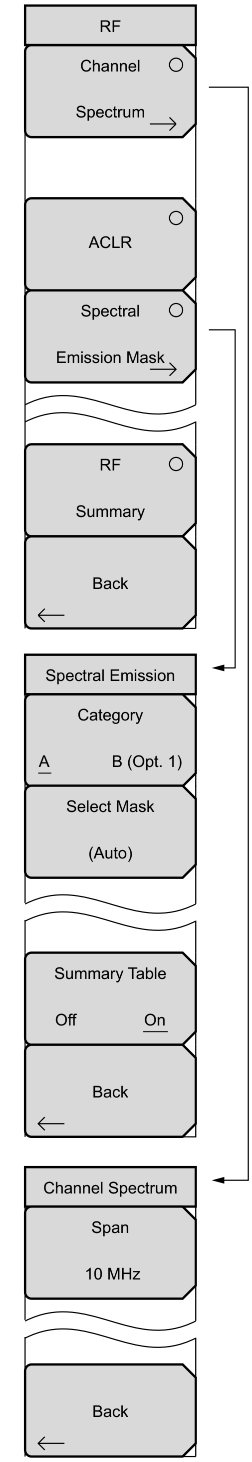
Freq Error
Occupied BW
Carrier Frequency
Channel Power
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
PBCH Power
PCFICH Power
Spectral Emission Mask

Save Measurement: Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument’s User Guide for information on file management functions.

Figure 5-25. LTE Measurements Menu

RF Menu

Key Sequence: **Measurements** > RF



Channel Spectrum: Displays the spectrum of the input signal. Beneath the graph, values for the following measurements are displayed: Channel Power and Occupied BW. Channel Power is displayed in dBm or Watts (based on the Units submenu setting in the **Amplitude** menu) and Occupied BW is displayed in MHz. Press this button again to list the Channel Spectrum menu to set the Span.

> **Span:** Opens the Span list file to select a frequency span or Auto.
>
> **Back:** Returns to the RF Menu.

ACLR: Displays a bar graph of the main channel power and two adjacent channels on either side. The table underneath the chart lists the frequency, power, and power relative to the main channel (in dB).

Spectral Emission Mask: The Spectral Emission Mask measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region. Press this button again to list the Spectral Emission submenu.

> **Category A B (Opt. 1):** Select the desired category based on the information above.
>
> **Select Mask (Auto):** Displays a list of standard and custom masks for use in SEM measurements. Select “Auto Select” if the desired mask is unknown.
>
> **Summary Table:** Displays the Spectral Emission measurement data in table form.
>
> **Back:** Returns to the RF Menu.

RF Summary: Press this submenu key to display the following RF measurements in table format:

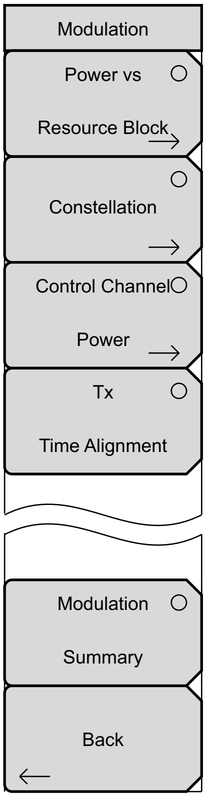
> Channel Power
> Occupied BW
> Lower Adjacent CH Pwr 2
> Lower Adjacent CH Pwr 1
> Upper Adjacent CH Pwr 1
> Upper Adjacent CH Pwr 2
> Spectral Emission Mask

Back: Press this submenu key to return to “Measurements Menu” on page 5-32.

Figure 5-26. LTE RF Menu

Modulation Menu

Key Sequence: **Measurements** > Modulation



Power vs Resource Block: Press once to display the Power vs. Resource Block measurement window. Press again to open the "Power vs. Resource Block Menu" on page 5-35 for setting up the Resource Block Color Map parameters.

Constellation: Press this submenu key to set the modulation measurement to Constellation view. This view displays the constellation of the modulated data symbols over subframe 0. Press the key again to open the "Constellation Menu" on page 5-36.

Control Channel Power: Press the Control Channel Power submenu key to set the display as bar graph or table.

Tx Time Alignment: Press to set the modulation measurement to Tx Time Alignment view. Refer to "Tx Time Alignment" on page 5-14.

Modulation Summary: Press this submenu key to display a summary table of all of the modulation-related numerical measurement results:

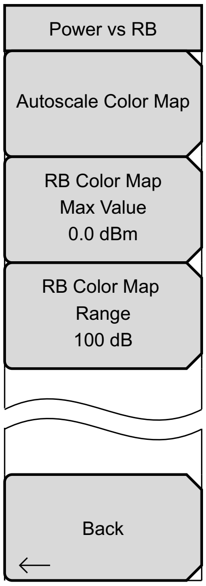
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

Back: Press this submenu key to return to the "Measurements Menu" on page 5-32.

Figure 5-27. LTE Modulation Menu

Power vs. Resource Block Menu

Key Sequence: **Measurements** > Modulation > Power vs. Resource Block



Autoscale Color Map: Adjusts the RB Max Value and Range automatically on the color map.

RB Color Map Max Value: Press to adjust the RB Color Map Max Value manually.

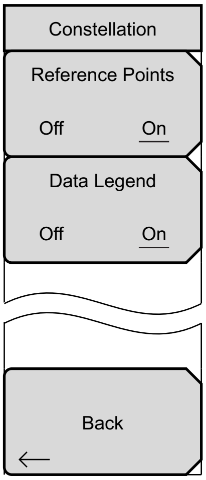
RB Color Map Range: Press to adjust the RB Color Range manually.

Back: Press this submenu key to return to the "Modulation Menu" on page 5-34.

Figure 5-28. LTE Power vs. Resource Block Menu

Constellation Menu

Key Sequence: **Measurements** > Modulation > Constellation



Reference Points: Press this submenu key to display reference points (small white circles) for the various constellations. On is the default state.

Data Legend: Turns the legend box in the top right corner of the constellation graph On and Off. On is the default state.

Back: Press this submenu key to return to the "Modulation Menu" on page 5-34.

The constellations are color coded as follows:

QPSK is shown in purple
16-QAM is shown in green
64-QAM is shown in yellow

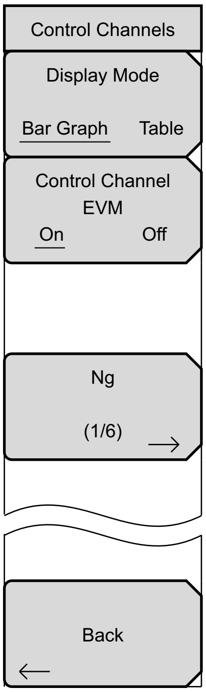
Values for the following measurements are shown beneath the graph:

Ref. Signal (RS) Power
EVM (rms)
Freq Error
Carrier Frequency
Sync Signal (SS) Power
EVM (pk)
Freq Error (ppm)
Cell ID

Figure 5-29. LTE Constellation Menu

Control Channel Power Menu

Key Sequence: **Measurements** > Modulation > Control Channel Power



Display Mode: Select Bar Graph or Table as the desired view.

Control Channel EVM On Off: When On, the EVM column is included to display the EVM of each control channel. The EVM column is included for either Bar Graph or Table displays.

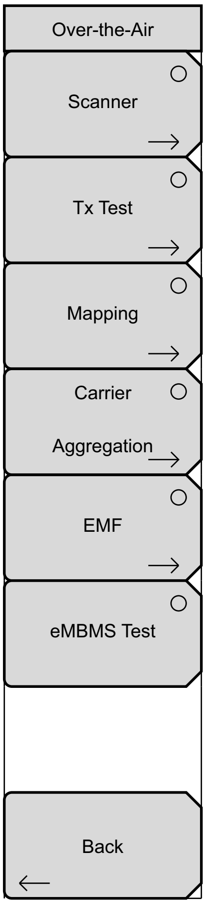
Ng (1/6): Determines the number of PHICH groups in a LTE sub-frame.

Back: Press this submenu key to return to the “Modulation Menu” on page 5-34.

Figure 5-30. LTE Control Channel Menu

Over-the-Air Menu

Key Sequence: **Measurements** > Over-the-Air



Scanner: Press this submenu key to display the Scanner table, which shows several power measurements for multiple base stations at the same frequency. Measurements include Sync Signal (S-SS) Power, RSRP, RSRQ, and SINR. Press the key again to display the “OTA Scanner Menu” on page 5-39 to set up Sort By and Show Mod Results.

Tx Test: Opens the OTA Tx Test mode. Press it again to open the “Over-the-Air Tx Test Menu” on page 5-40 and the Show Mod Results submenu key.

Mapping: Sets the display for coverage mapping. Press it again to set the coverage mapping parameters – Save/Recall Points/Map, Measurement Setup and Point Distance/Time Setup.

For full details, refer to Chapter 7, “LTE and TD-LTE Coverage Mapping”.

Carrier Aggregation: Press this submenu key to display the Carrier Aggregation Component Carrier frequencies and measured parameters. In the Carrier Aggregation Menu, select the desired Component Carrier to set up for measurement. Refer to “Carrier Aggregation Menu” on page 5-42.

EMF (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this button opens the “LTE/TD-LTE EMF Menu” on page 8-2.

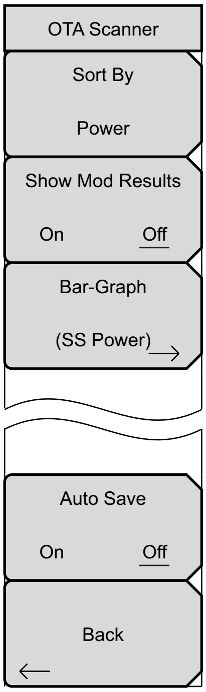
eMBMS: When selected, this submenu key enables the OTA eMBMS Test Measurement mode. Once this mode is active, the display area indicates the Cell ID and the RSRP (Reference Signal, Received Power). Note that eMBMS information may require several frame captures and each capture can take several seconds to analyze. NA will be displayed until a valid measurement is achieved.

Back: Press this submenu key to return to the “Measurements Menu” on page 5-32.

Figure 5-31. LTE Over-the-Air Menu

OTA Scanner Menu

Key Sequence: **Measurements** > Over-the-Air > Scanner > Scanner



Sort By: Opens the Sort By list dialog. Choose one of the following parameters to sort the Scanner table rows.

Cell ID
Group ID
Sector ID
S-SS Power
RSRP
RSRQ
SINR

Show Mod Results (Demod option required on some instruments): Displays in table format the following measurements and information.

Ref. Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM (pk)
Freq Error
Freq Error (ppm)
Carrier Frequency
Cell ID

Bar-Graph: Opens the Bar Graph menu to select the parameter to be displayed in the last Bar-Graph column: SS Power, RSRP, RSRQ or SINR. Press **Back** to return to the OTA Scanner menu.

Auto Save: Use this submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file. When a file is full, a new file is automatically created.

Files are automatically saved to the instrument's Current Location selection in the subdirectory /Internal Memory/user. Refer to the File Management chapter in your instrument User Guide for instructions on setting the Current Location for saving files.

File names are automatically created:

Yyyymmddhhnnss.lte

example: 2009081122332244.lte

y - year, 2009, m - month, 08, d - day, 11, h - hour, 22, n - minutes, 33
s - seconds, 44

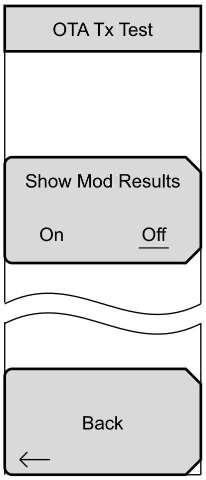
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

Back: Press this submenu key to return to "Over-the-Air Menu" on page 5-38.

Figure 5-32. LTE OTA Scanner Menu

Over-the-Air Tx Test Menu

Key Sequence: **Measurements** > Over-the-Air > Tx Test



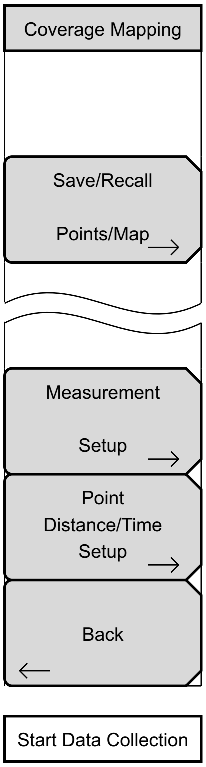
Show Mod Results: When set to Off, the PBCH Results table and Antenna Status indicators are not displayed. When set to On, the Antenna Status and PBCH Modulation Results table are displayed.

Back: Press this submenu key to return to "Over-the-Air Menu" on page 5-38.

Figure 5-33. LTE Over-the-Air Tx Test Menu

Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping



Save/Recall Map Points: Opens the "Mapping Save/Recall Menu" on page 7-13.

Measurement Setups: Opens the "Measurement Setup Menu" on page 7-14.

Point Distance/Time Setup: Opens the "Point Distance/Time Setup Menu" on page 7-15.

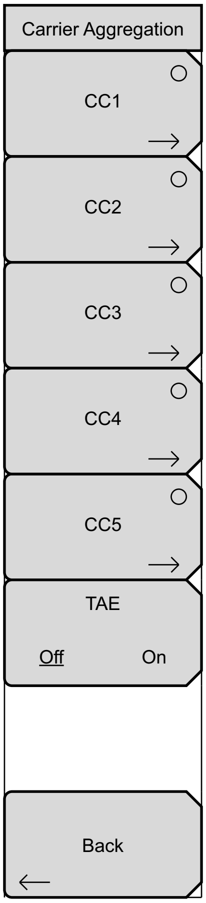
Back: Returns to the "Over-the-Air Menu" on page 5-38.

Start/Stop Data Collection: Press this main menu key to start coverage mapping data collection based on Measurement Setup settings and Point Distance/Time Setup settings. A running count of collected data points is displayed at the bottom of the screen. Press again to stop data collection.

Figure 5-34. Coverage Mapping Menu

Carrier Aggregation Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation



CC1 through CC5: Select the desired Component Carrier to set up for measurement. See Figure 5-36.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

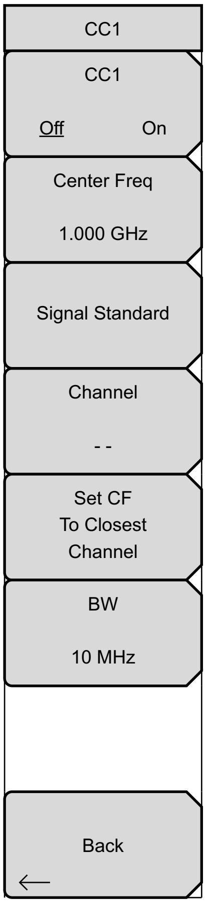
TAE: Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

Back: Returns to the "Over-the-Air Menu" on page 5-38.

Figure 5-35. Carrier Aggregation Menu

Component Carrier Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation > CC1



CC1 Off On: Turns On the Component Carrier.

Center Freq: Press this submenu key to set the receiver center frequency. Enter the frequency using the keypad, arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels change to Units: GHz, MHz, kHz, and Hz. In this case, enter the desired value, then press the desired unit submenu key or press **Enter** to select MHz as the frequency unit.

Signal Standard: Opens the “Standard List Menu” on page 5-29.

Channel: Opens the Channel Editor dialog where you can select a channel number within the range of the selected signal standard.

Set CF to Closest Channel: Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

BW: Displays the list of available bandwidths.

Back: Returns to the previous menu.

Figure 5-36. Component Carrier Menu

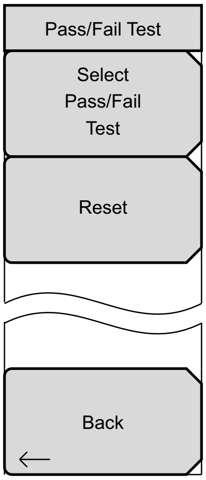
EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF

Refer to “LTE/TD-LTE EMF Menu” on page 8-2.

Pass/Fail Test Menu

Key Sequence: **Measurements** > Pass/Fail Test > Select Pass/Fail Test



Select Pass/Fail Test: Press this submenu key to open the Select Pass/Fail Test list box and select a test type. Choose from:

PASS_FAIL_RF
PASS_FAIL_MOD
PASS_FAIL_CONTROL
PASS_FAIL_ALL

Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test or press **Esc** to cancel your choice.

Note: The current list of pass/fail tests is a default list. Master Software Tools (MST) includes features to create additional pass/fail tests.

Reset: Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

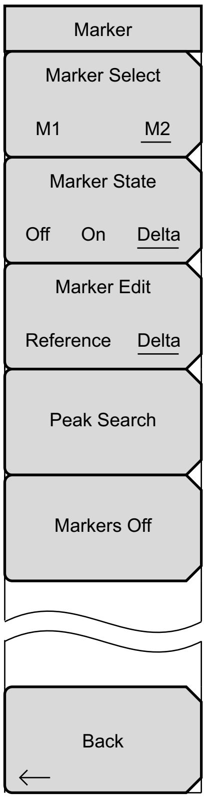
Back: Press this submenu key to return to “Measurements Menu” on page 5-32.

Figure 5-37. LTE Pass Fail Mode Menu

5-13 Marker Menu

Key Sequence: **Marker**

Available for Channel Spectrum measurements. When making Power vs Resource Block measurements, refer to "Power vs Resource Block Marker Menu" on page 5-46.



Marker Select: Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

Marker State: Sets the state of the selected marker underlined in the Marker Select submenu.

Marker Edit: Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

Peak Search: Moves the selected marker to the trace peak.

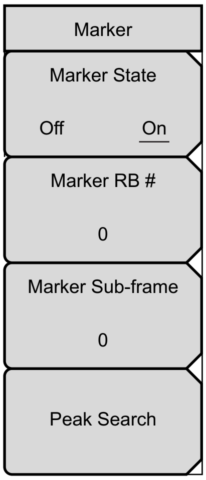
Markers Off: Turns off all markers.

Back: Press this submenu key to return to "Measurements Menu" on page 5-32.

Figure 5-38. LTE Marker Menu

Power vs Resource Block Marker Menu

Key Sequence: **Marker** (When Power vs. Resource Block measurement is selected).



Marker Select: Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

Marker State: Sets the state of the selected marker underlined in the Marker Select submenu.

Marker Edit: Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

Peak Search: Moves the selected marker to the trace peak.

Markers Off: Turns off all markers.

Back: Press this submenu key to return to "Measurements Menu" on page 5-32.

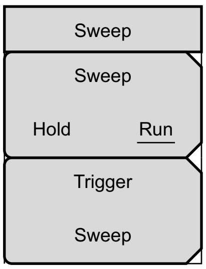
Figure 5-39. LTE Resource Block Marker Menu

5-14 Calibrate Menu

This menu is not available in LTE measurement mode.

5-15 Sweep Menu

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



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

Trigger Sweep: Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

Figure 5-40. LTE Sweep Menu

5-16 Measure Menu

Displays the "Measurements Menu" on page 5-32.

5-17 Trace Menu

This menu is not available in LTE measurement mode.

5-18 Limit Menu

This menu is not available in LTE measurement mode.

5-19 Other Menus

Preset, **File**, **Mode** and **System** are described in the instrument User Guide.

Chapter 6 — TD-LTE Signal Analyzer

6-1 Introduction

The Time-Division Long Term Evolution (TD-LTE) Signal Analyzer offers three measurement options:

- RF Measurements

  The following display types are provided for RF measurements: Channel Spectrum display, Power vs. Time, ACLR display, Spectral Emission Mask display, and the RF Summary table.

- Modulation Measurements

  Modulation measurements can be viewed in Power vs Resource Block, Constellation display, Control Channel Power display, or the Modulation Summary table.

- Over-The-Air (OTA) Measurements

  Over-the-Air measurements include Scanner, Tx Test, Coverage Mapping, and Carrier Aggregation. EMF measurements are available with Option 444.

6-2 General Measurement Setups

Please refer to the User Guide for selecting the TD-LTE Signal Analyzer mode, setting up frequency, amplitude, and file management. In addition, perform the following TD-LTE specific setup procedures.

1. Press the **Setup** main menu key.
2. Press the BW submenu key to open the Select Bandwidth list. Select the desired Bandwidth with the arrow keys or rotary knob and press **Enter**.
3. Press the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.
4. Press the EVM Mode submenu key to select either Auto or PBCH Only. Selecting Auto measures Physical Downlink Shared Channel (PDSCH) if data is available, otherwise it measures Physical Broadcast Channel (PBCH), a control channel that carries a broadcast message. Selecting PBCH Only forces a PBCH measurement.

Note	The Constellation will show a QPSK constellation when PBCH is being measured. PBCH Only mode is especially useful when making measurements over the air under conditions where the transmitted data uses MIMO.

5. Press the Trigger submenu key. The Trigger menu opens to set Trigger Source and Trigger Polarity. For Trigger Source, select No Trig or Ext. Then select the trigger edge by setting Trigger Polarity to Rising or Falling. Press the Back submenu key to return to the Setup menu.
6. *(Not applicable for all models)* Press the Ext. Ref. Freq submenu key to configure the instrument using an external reference frequency. The External Reference Frequency list opens. Highlight the desired frequency and press **Enter**.

Antenna Status

The Antenna Status indicator can show when antennas are detected and which one is currently being measured. Antenna Status is displayed for any EVM measurement shown: Constellation, Control Channel Power, Modulation Summary and LTE Summary. The antennas icons are displayed at the lower-left corner of the display screen (Figure 6-1).

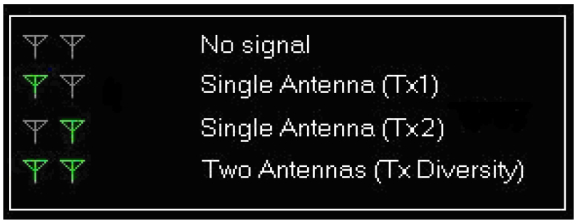


Figure 6-1. Antenna Status

6-3 TD-LTE RF Measurements

The following parameters are measured in the RF Measurement mode.

Channel Spectrum

Channel Spectrum displays the spectrum of the input signal across one channel. The Channel Power and Occupied BW are computed and displayed below the graph.

Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm or Watts.

Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

Power vs. Time

Power vs Time displays the power of the received signal in the time domain. A submenu allows the user to toggle between viewing 1 full Frame and 1 Sub-Frame and specify a Sub-Frame number when viewing just the Sub-Frame.

Sub-Frame Power

Power of each sub-frame in dBm or Watts.

Total Frame Power

Average power of the 10 sub-frames in dBm or Watts.

DwPTS Power

The power of the Downlink Pilot Time Slot in Sub-Frame 1 in dBm or Watts.

Transmit Off Power

The mean power measured over a 70 µs window in the transmitter OFF period.

Cell ID

Identifying information sent by the transmitter in the sync signal.

Timing Error

The error in time between the external trigger input signal and the start of the frame. The Timing Error is only displayed if Triggering is set up to use an external trigger signal to act as a timing reference.

ACLR

ACLR (Adjacent Channel Leakage Ratio) is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel and is displayed in table format under the bar graph. The ACLR screen displays the main channel power and the power of two adjacent channels on each side as a bar graph. For example, when BW is set to 10 MHz, the channel spacing is –20 MHz, –10 MHz, +10 MHz and +20 MHz and the channels are color coded.

Spectral Emission Mask

The Spectral Emission Mask (SEM) measurement supports the testing for "Operating Band Unwanted Emissions" described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region.

RF Summary

The RF Summary is a display of the occupied bandwidth, power of the main channel, upper adjacent channels, and lower adjacent channels in a table format. The RF Summary also shows the SEM status: PASS or FAIL. Refer to individual RF measurement descriptions for additional details on each measurement.

RF Measurement Setups

Channel Spectrum

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Channel Spectrum submenu key to activate this RF measurement view (Figure 6-2).
4. Press the Channel Spectrum submenu key again to select the Channel Spectrum menu, where you can adjust the span.

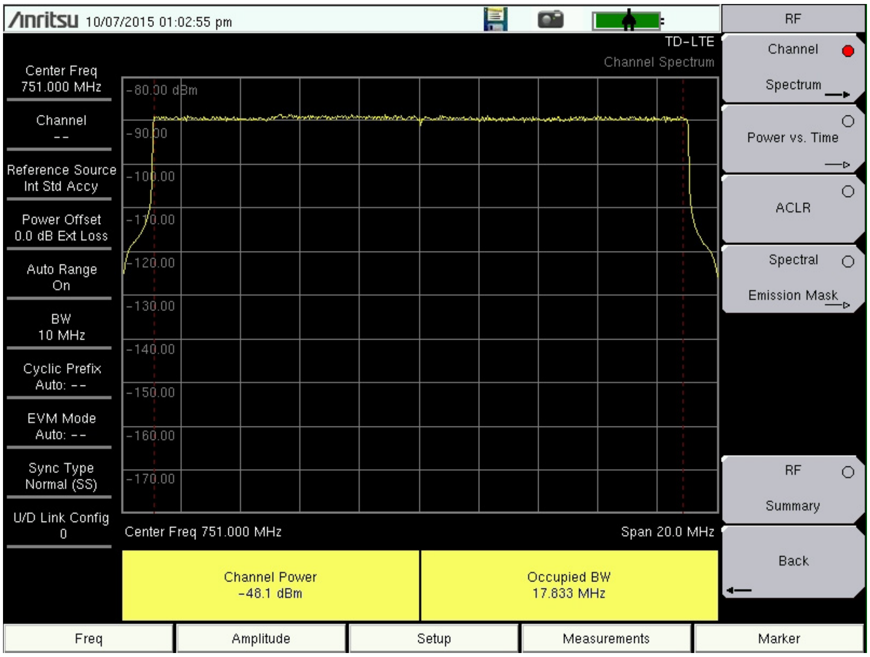


Figure 6-2. Channel Spectrum

5. Press the Back submenu key to return to the RF menu.

Power vs. Time

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Power vs. Time submenu key to select measurement.
4. Press the Power vs. Time submenu key again to set the View and Sub-Frame Number parameters.

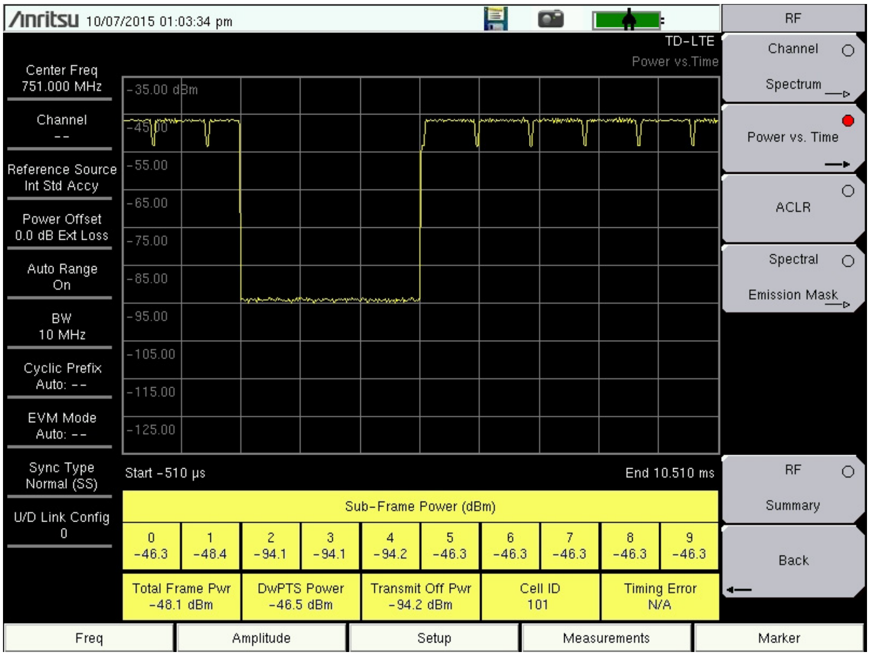


Figure 6-3. Power vs. Time

5. Press the Back submenu key to return to the RF menu.

ACLR

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the ACLR submenu key to activate ACLR display and measurement (Figure 6-4).

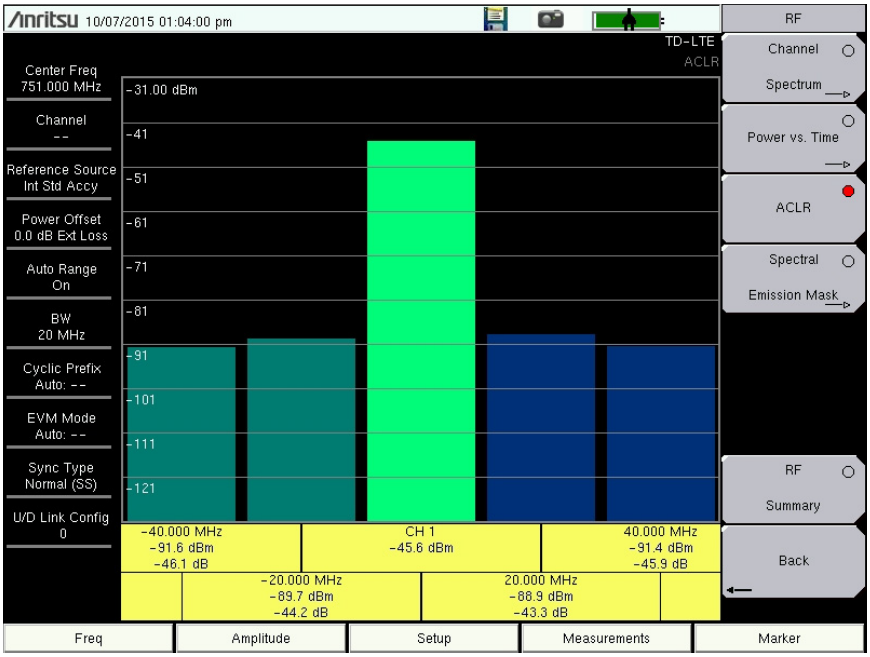


Figure 6-4. Adjacent Channel Leakage Ratio

4. Press the Back submenu key to return to the Measurements menu.

Spectral Emission Mask

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the Spectral Emission Mask submenu key to activate the Spectral Emission measurement and display (Figure 6-5).
4. Press the Spectral Emission Mask submenu key again to list the Spectral Emission menu and set up its parameters.
5. To view the measurement data in a table format, press the Summary Table submenu key so On is underlined.

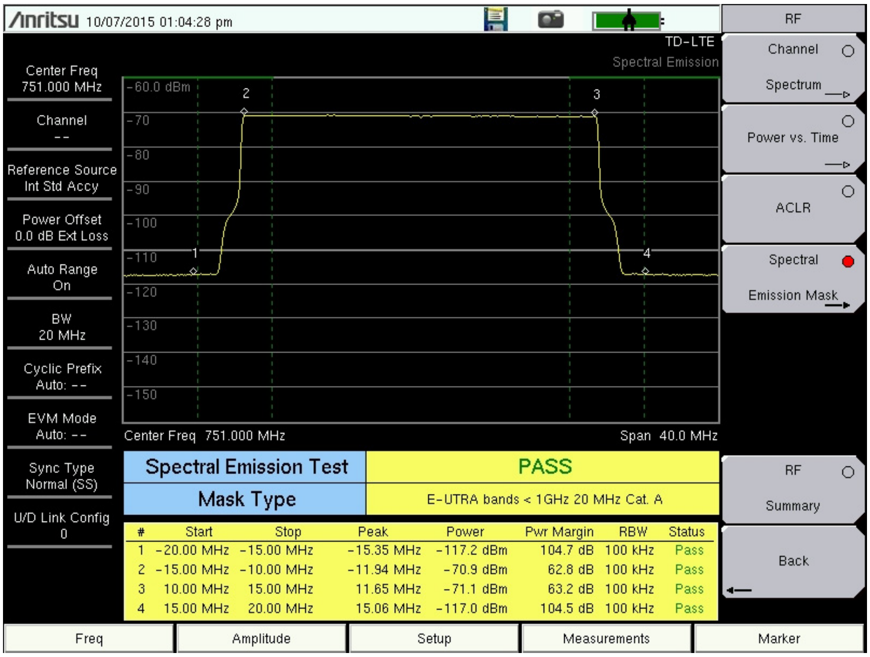


Figure 6-5. Spectral Emission Mask

6. Press the Back submenu key to return to the RF menu.

RF Summary

1. Press the **Measurements** main menu key.
2. Press the RF submenu key.
3. Press the RF Summary submenu key to activate and display the RF measurements in table format (Figure 6-6).

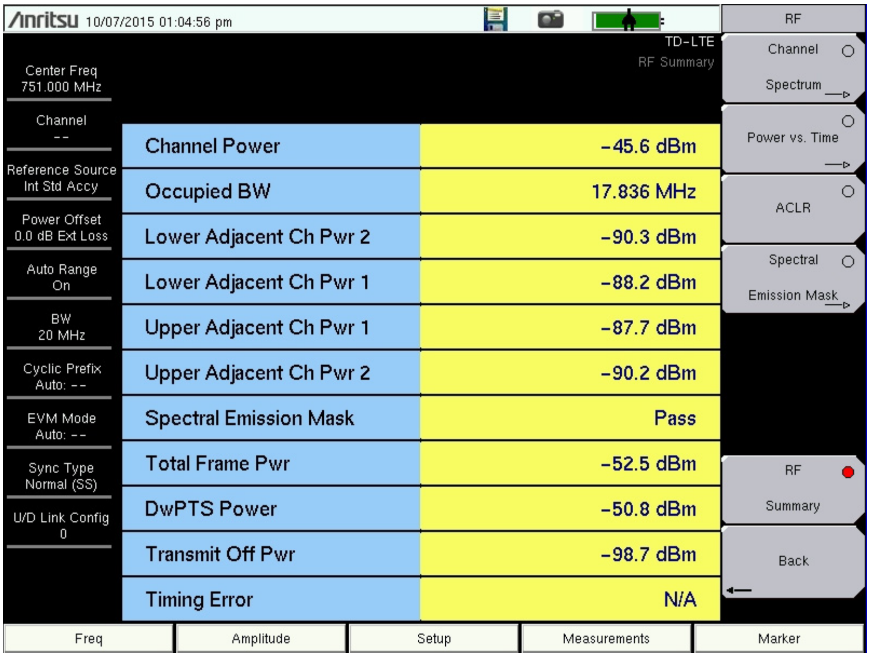


Figure 6-6. RF Summary

4. Press the Back submenu key to return to the Measurements menu.

6-4 TD-LTE Modulation Measurements

The following parameters are measured in the Modulation Measurement mode.

Power vs Resource Block (RB)

This measurement displays the Power vs RB grid, an RB Color Map, the measurements table, and measurement progress bar. See Figure 6-7 on page 6-12.

Two Dimensional Power vs RB Grid

This view shows the PDSCH power of each RB using color. The y-axis is frequency (sub-carriers) and the x-axis is time (sub-frames). The number of subcarriers varies depending on the bandwidth chosen and hence the number of RBs on the y-axis. Each cell bin the grid corresponds to a particular RB in a particular sub-frame. For TD-LTE, the number of Active Resource Blocks and Utilization is only displayed for sub-frame 0.

Resource Block Color Map

The color mapping of the RB power level is determined by the RB Color Map Max Value and RB Color Map Range submenus. Setting these values can be done by entering them manually or by pressing Autoscale Color Map.

Note	The Power Offset is applied to the measured value before matching to a color map.

Measurements Table

Active RBs

The number of active Resource Blocks in sub-frame 0. An RB is determined to be active if the measured PDSCH power is above a certain threshold that indicates that the RB is being used for carrying data.

Utilization

The percentage of Resource Blocks that carry data. It is the number of Active Resource Blocks in sub-frame 0 divided by the total number of Resource Blocks in sub-frame 0, expressed as a %.

Channel Power

Channel power is the average total power within the bandwidth and is expressed in dBm.

OSTP

OSTP is the measurement of the OFDM symbol transmit power.

EVM

The RMS (%) of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. Individual frame EVM(RMS) is displayed for the modulation types QPSK, 16-QAM, and 64-QAM.

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

Measurement Progress Bar

This progress bar indicates the sub-frame that is currently being measured.

Markers

Markers are available for use in the Power vs Resource Block measurement. The markers will outline the selected RB. Above the two dimensional grid, the specific RB subcarrier/sub-frame coordinates will be displayed along with its power level.

Constellation

This measurement displays the constellation of the demodulated symbols over the first sub-frame and a results table of the following measurements. See Figure 6-8 on page 6-13.

Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value. Reset occurs when setup parameters are changed or by toggling the EVM Max Hold button.

Freq Error

The difference between the measured carrier frequency and the specified carrier frequency is the frequency error. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. When EVM Max Hold is On (**Setup** menu) two values are displayed. The first number is the maximum EVM (rms) value since Reset and the second number is the current measured value.

Freq Error (ppm)

Freq Error displayed in parts per million (ppm).

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

Control Channel Power

This measurement shows the power levels of key physical layer Control Channels and also includes the numerical results table described in the "Constellation" section above. EVM per control channel is also available, as well as a table view showing the power in both per-resource-element and total power formats. See Figure 6-9 on page 6-14.

Ref Signal (RS) Power

Reference Signal power displayed in dBm. The reference signal is used for downlink channel estimation.

P-SS Power

Primary Sync Signal power displayed in dBm or Watts. The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.

S-SS Power

Secondary Sync Signal power displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.

PBCH Power

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

PCFICH Power

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDCCH and PDSCH channels.

PHICH Power

Physical Hybrid Automatic Repeat Request Indicator Channel. Transmits the channel coded HARQ indicator codeword used for error correction.

PDCCH Power

Physical Downlink Control Channel.

Ng

Ng is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in a TD-LTE sub-frame (this number is constant for all sub-frames).

Tx Time Alignment

Measures the delay between the signals from two antennas at the antenna ports.

Modulation Summary

Modulation Summary displays the Ref Signal (RS) Power, Sync Signal (SS) Power, EVM (rms), Freq Error (Hz and ppm), Cell ID and PBCH Power in a table format. Refer to individual Modulation measurement descriptions for additional detail on each measurement.

Modulation Measurement Setups

Power vs Resource Block

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Power vs Resource Block submenu key to activate the Power vs Resource Block measurement view.

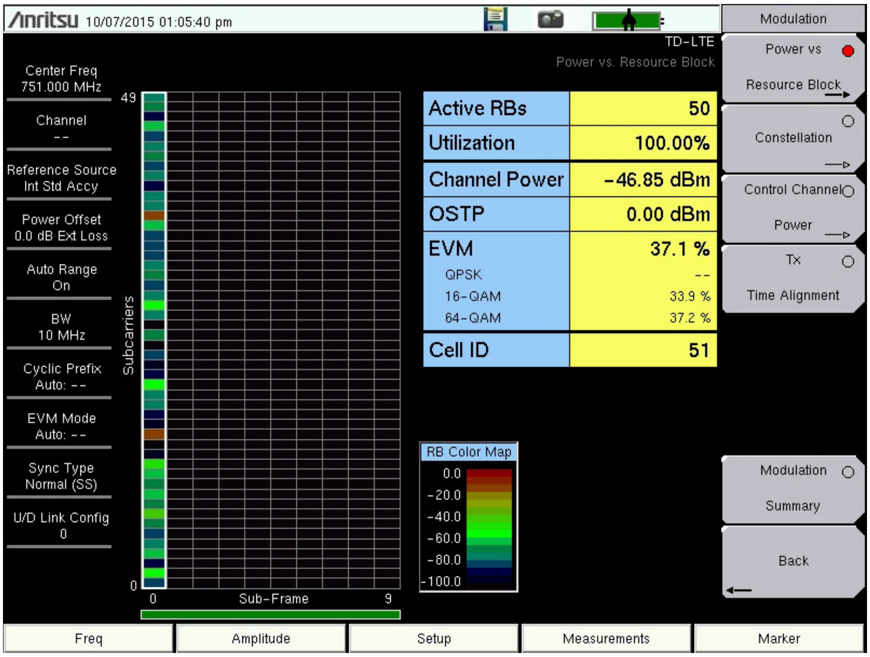


Figure 6-7. Power vs Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to list the Power vs RB Menu and set up the RB Color Map max value and range. Press the submenu key to change the desired parameter, or, press the Autoscale Color Map submenu key to automatically set the Max and Range values.
5. Press the Back submenu key to return to the Modulation menu.

Note	Values shown in the Power vs Resource Block measurement display pertain to the data subcarriers. This is useful in the monitoring of changes in traffic loading on the base station. To measure the power levels of the physical layer Control Channels, use the “Control Channel Power” measurement.

Markers

1. While in the Power vs Resource Block measurement, press the **Marker** main menu key. The RB Marker submenu opens. The Marker State button default value is On, so the markers highlight a row of sub-frames and a column of sub-carriers.
2. To immediately find the strongest subcarrier within the sub-frame, press the Peak Search button.
3. To choose a specific RB #, press the Marker RB # submenu key and move it to the desired RB# using the arrow buttons, knob or enter the RB number and press **Enter**.
4. To choose a specific sub-frame, press the Marker Sub-frame submenu key and move it to the desired Sub-frame using the arrow buttons, knob or enter the sub-frame number and press **Enter**.

Constellation

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Constellation submenu key to activate the Constellation measurement view (Figure 6-8). Press the Constellation submenu key again to list the Constellation menu and set up the reference points and data legend.
   a. Press the Reference Points submenu key to turn the reference points (small white circles) On or Off.
   b. Press the Data Legend submenu key to turn the data legend On or Off.

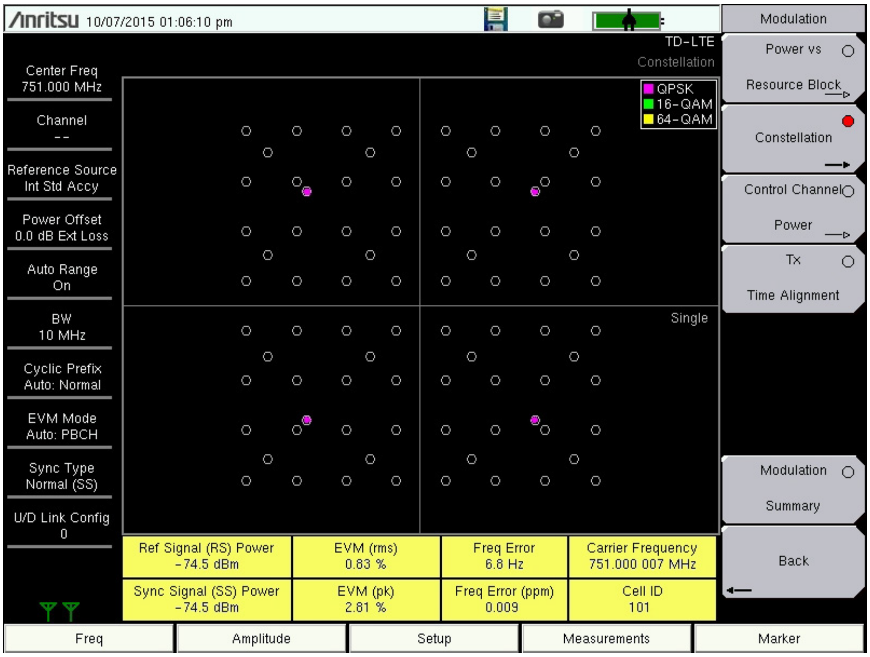


Figure 6-8. Constellation Measurement View

4. Press the Back submenu key to return to the Modulation menu.

Control Channel Power

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Control Channel Power submenu key to activate the Control Channel Power display in table format (Figure 6-9). Press the key again to view or change the Display Mode and Control Channel EVM settings.

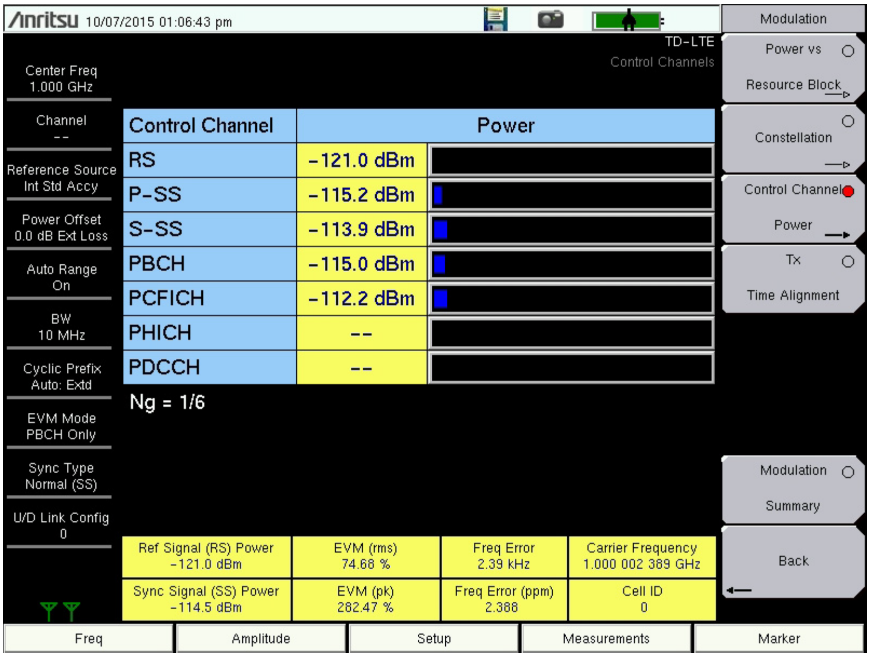


Figure 6-9. Control Channel Power

4. Press the Back submenu key to return to the Modulation menu.

Tx Time Alignment

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Tx Time Alignment submenu key to set the modulation measurement to Tx Time Alignment view (Figure 6-10).

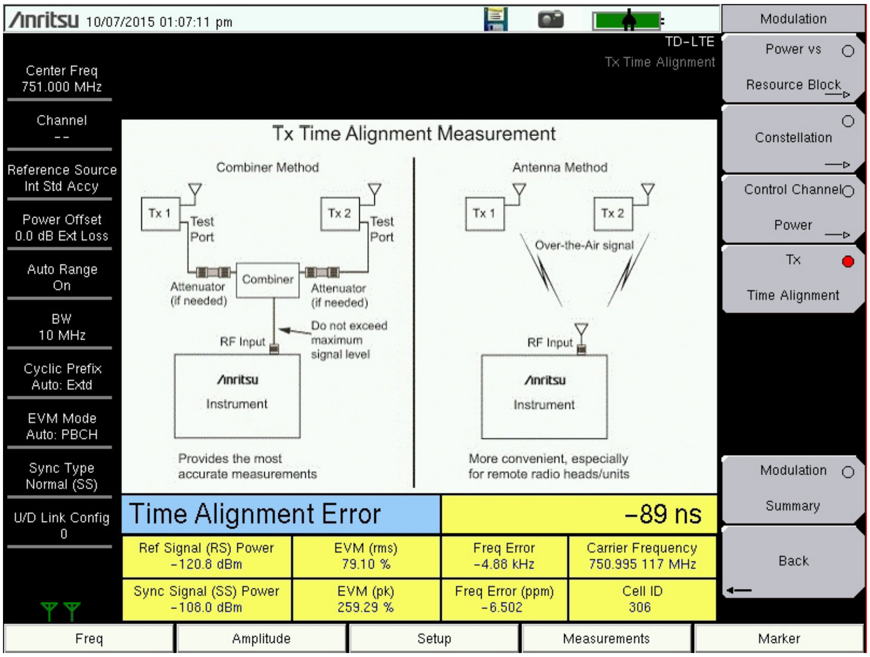


Figure 6-10. Tx Time Alignment

4. Press the Back submenu key to return to the Measurements menu.

Modulation Summary

1. Press the **Measurements** main menu key.
2. Press the Modulation submenu key.
3. Press the Modulation Summary submenu key to activate and display the modulation measurements in table format (Figure 6-11).

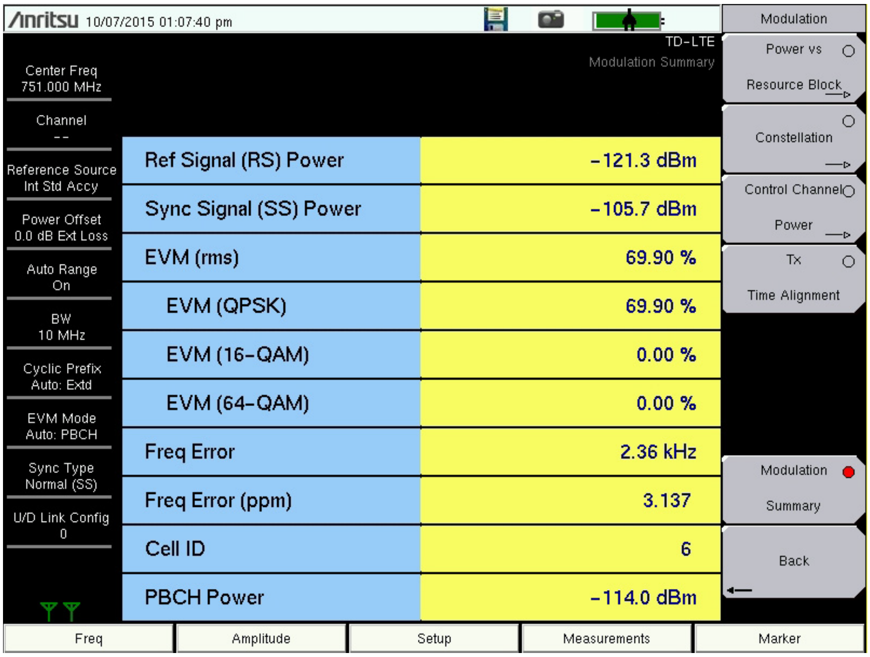


Figure 6-11. Modulation Summary

4. Press the Back submenu key to return to the Measurements menu.

6-5 TD-LTE Over-the-Air (OTA) Measurements

Scanner, Tx Test, Antenna Status and Mapping are measurements taken over the air. EMF measurements are available only with Option 444.

Antenna Status and the PBCH Modulation Results table are displayed when the Show Mod Results are set On for Scanner and Tx Test measurements. The PBCH Modulation Results table is the same numeric results table displayed in LTE Modulation Constellation and Control Channel Power measurements.

Antenna Status

The Antenna Status indicator shows the number of antennas detected and which one is currently being measured. In OTA Measurements, the Antenna Status is displayed when Show Mod Results is On for Scanner and Tx Test.

Scanner

The Scanner measurement scans for the presence of up to 6 cell IDs and the following measurements.

Cell ID, Sector ID, Group ID

Identifying information sent by the transmitter in the sync signal.

S-SS Power

Secondary Sync Signal power is displayed in dBm or Watts. The secondary sync signal is used to obtain frame synchronization and cell identity. S-SS Power contains information needed for cell search.

RSRP

Reference Signal Received Power. Provides the UE with essential information about the strength of cells from which path loss can be calculated and used for determining optimum power settings for operating networks. RSRP is used in both idle and connected states. RSRP is used as a parameter in multi-cell scenarios.

RSRQ

Reference Signal Receive Quality. Provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRP is the ratio between RSRP and RSSI measured in dB.

SINR

Signal-to-Inference Noise Ratio in dB.

Dominance

Dominance is the ratio of the power for the largest signal to the sum of all other signals found, in dB.

Tx Test

Tx Test measurements are optimized for remote radio heads and MIMO systems. The first table in Tx Test replicates the Scanner table measurements, except the measurement scans the presence of up to 3 cell IDs. The second table shows the RS power across all detected antennas (transmitters) for the strongest Cell ID. This is displayed as average power and delta power for the detected transmitters, along with a small bar graph that shows the relative RS powers for each Tx. The PBCH Modulation Results table can also be turned on.

Mapping (Coverage Mapping)

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ) and SINR. It is the same measurement as in Scanner which scans for the presence of up to 6 cell IDs but only displays the presence of up to 3 cell IDs. For full details regarding Coverage Mapping setup and testing, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

Carrier Aggregation

This measurement displays a table of up to five Component Carriers (CC) used in Carrier Aggregation and their measured signal components.

Frequency

This is the set center frequency.

Bandwidth (BW)

This is the set bandwidth of the Component Carrier.

Cyclic Prefix (CP)

The length of Cyclic Prefix can be specified as either Normal or Extended.

MIMO

The MIMO status indicators show which transmitters are active in a MIMO configuration. Active transmitters display as a green dot, inactive as grey. They correspond to the antenna icons shown at the bottom left of the screen for each Component Carrier scanned.

Reference Signal (RS) Power

Reference Signal power is displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

RS Delta Power

RS Delta Power shows the maximum relative power difference in dB between the RS powers of the MIMO signals and can be used to check correct MIMO configuration.

Sync Signal (SS) Power

Sync signal power is displayed in dBm or Watts.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

EVM (pk)

The peak (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

Freq Error

This is the difference between the measured carrier frequency and the specified carrier frequency. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GPS.

Freq Error (ppm)

This is the frequency error displayed in parts per million.

TAE

Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

EMF (Option 444 only)

EMF measurements are available in Over-the-Air TD-LTE Signal Analyzer mode only when Option 444 is installed. The option requires an isotropic antenna, at a frequency range that is within specification of the instrument used. Refer to the isotropic antenna and spectrum analyzer Technical Data Sheets.

Chapter 8, "EMF (Option 444)" provides connection instructions for the antenna and detailed descriptions of the EMF Measurement menu and submenus.

Measurement Setup

Scanner

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Scanner submenu key to activate the OTA Scanner display (Figure 6-12 on page 6-20). Press the Scanner key again to display the OTA Scanner menu.
    a. Press the Sort By... submenu key to list the Sort By menu and select the parameter the OTA Scanner will use for sorting (Power, Cell ID, or Sector ID). Press Back to return to the OTA Scanner menu.
    b. Press the Show Mod Results submenu key to display or hide the Modulation Results of the strongest signal.

Note	When Show Mod Results is on, the overall scanner measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the TD-LTE demod option to toggle this submenu to On.

c. Use the Auto Save submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file.

4. Press the Back submenu key to return to the Over-the-Air menu.

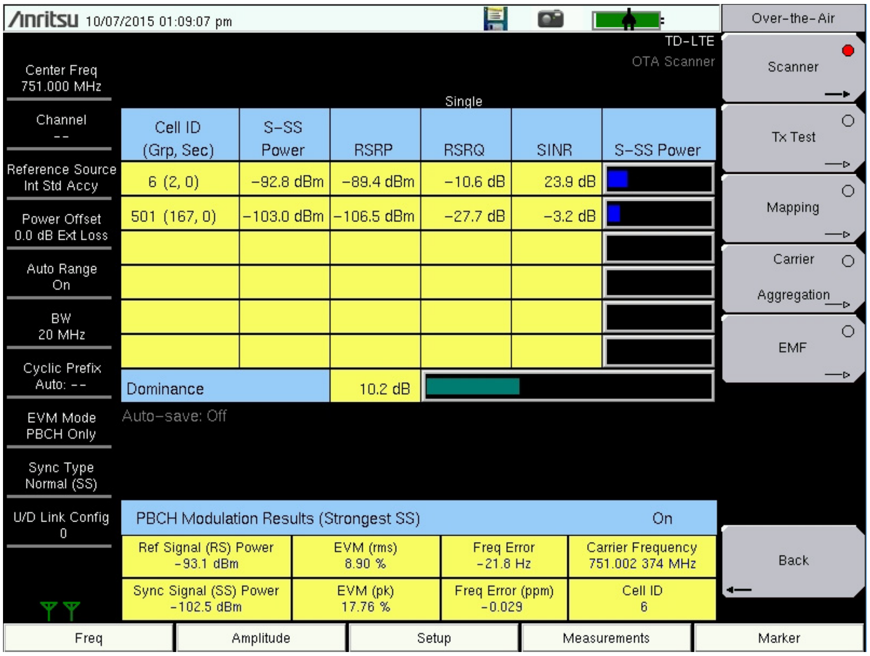


Figure 6-12. Over-the-Air Measurements

Tx Test

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Tx Test submenu key to activate the OTA Tx Test display (Figure 6-13 on page 6-21). Press the Tx Test key again to display the OTA Tx Test menu.
4. Press the Show Mod Results key to display or hide the PBCH Modulation Results (Strongest SS) table.
5. Press **Back** to return to the Over-the-Air menu.

Note	When Show Mod Results is on, the Tx Test measurement speed is slower due to the additional time required to demodulate the strongest signal. Some instruments require the TD-LTE demod option to toggle this submenu to On.

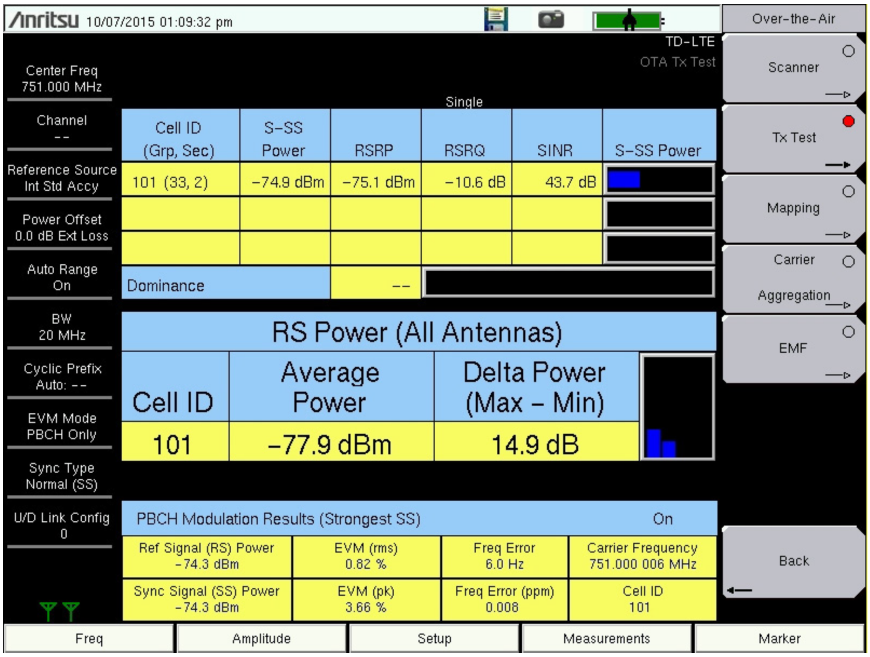


Figure 6-13. Over-the-Air Tx Test Measurement

Mapping

Refer to Chapter 7, “LTE and TD-LTE Coverage Mapping”.

Carrier Aggregation

Refer to “Carrier Aggregation Menu” on page 6-45.

EMF

Refer to “LTE/TD-LTE EMF Menu” on page 8-2.

6-6 Pass/Fail Tests

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail Test submenu key to activate the Pass/Fail display in table format (Figure 6-14). Press the Pass/Fail Test submenu key again to select a Pass/Fail test.
   a. Press the Select Pass/Fail Test submenu key to open the Select Pass Fail Test window. Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test. Refer to the instrument User Guide and the Master Software Tools (MST) User Guide for creating new Pass/Fail tests.
   b. Press the Reset submenu key to erase a previous measurement/s and restart the Pass/Fail test.

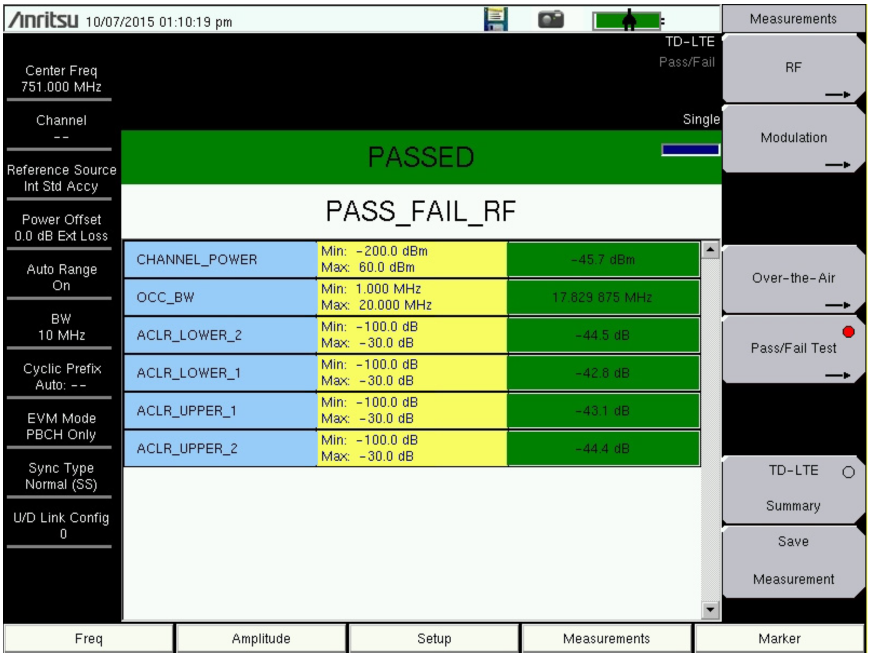


Figure 6-14. Past/Fail Test

3. Press the Back submenu key to return to the Measurements menu.

6-7 TD-LTE Summary

The following parameters are displayed in the TD-LTE summary measurement.

Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This value is linked to the external frequency reference accuracy and is typically useful only with a good external frequency reference or GPS reference.

Occupied BW

The measured occupied bandwidth is calculated as the bandwidth containing 99% of the total integrated power within the selected span around the selected center frequency.

Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

Channel Power

Channel power measures the average power within the selected bandwidth and is expressed in dBm.

Ref Signal (RS) Power

Reference Signal power displayed in dBm or Watts. The reference signal is used for downlink channel estimation.

Sync Signal (SS) Power

Sync signal power displayed in dBm or Watts.

EVM (rms)

The RMS (%) of all the error vectors, between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.

PBCH Power

Physical Broadcast Channel Power. This physical channel carries system information for user equipment (UE) requiring access to the network.

PCFICH Power

Physical Control Format Indicator Channel Power. This channel provides information to enable the UE to decode the PDSCH (Physical Downlink Shared Channel).

Spectral Emission Mask

Displays a Pass/Fail status for the signal measured against the selected mask.

Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the TD-LTE Summary submenu key to activate and display the TD-LTE measurements in table format.

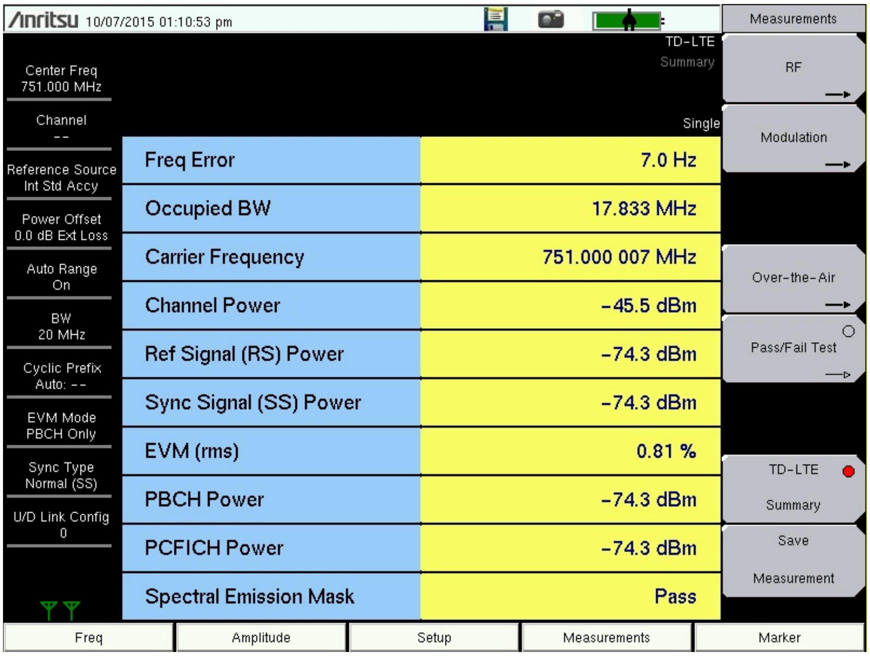


Figure 6-15. TD-LTE Summary

6-8 TD-LTE Menus

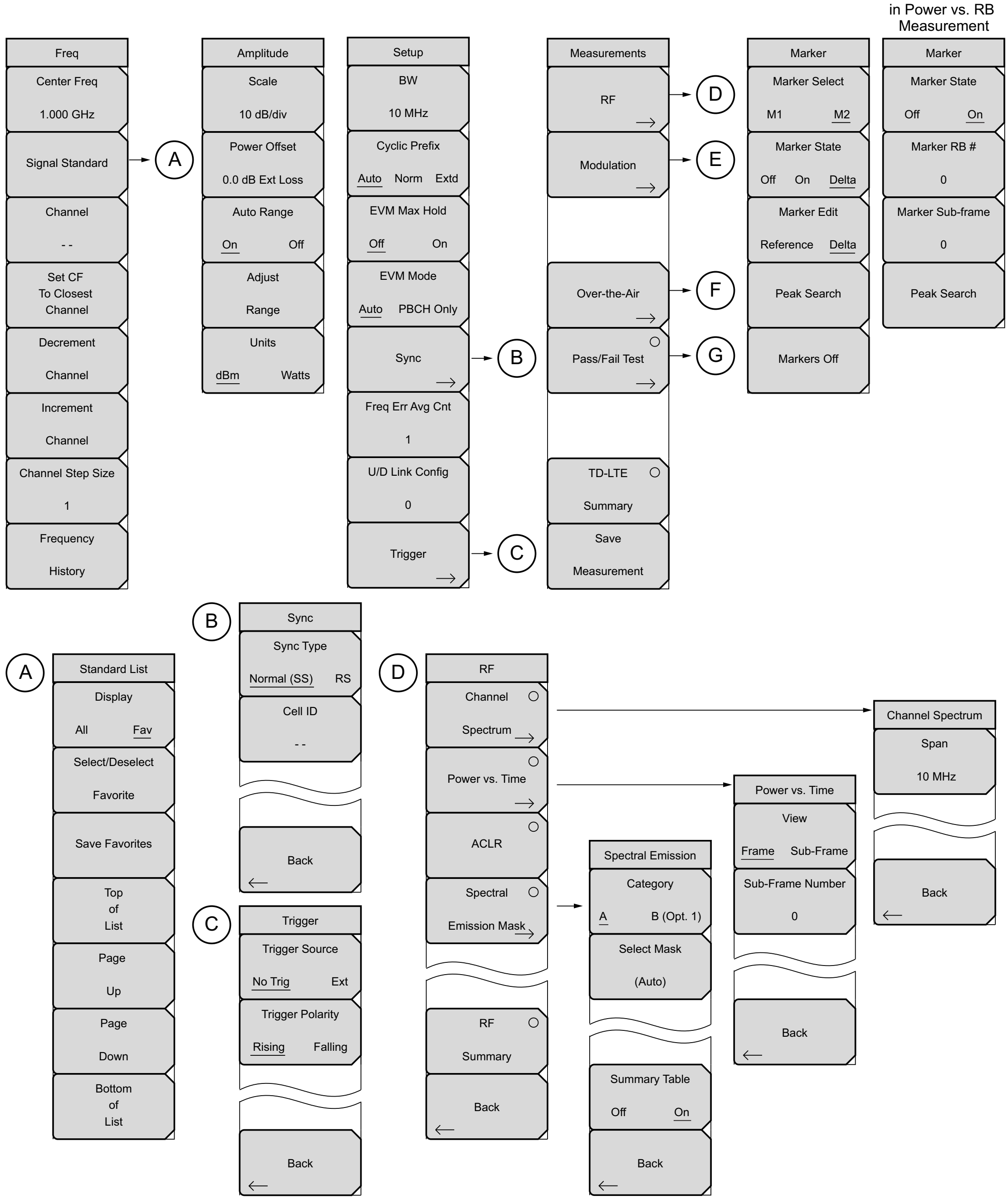


Figure 6-16. TD-LTE Menu Layout (1 of 3)

TD-LTE Menus (continued)

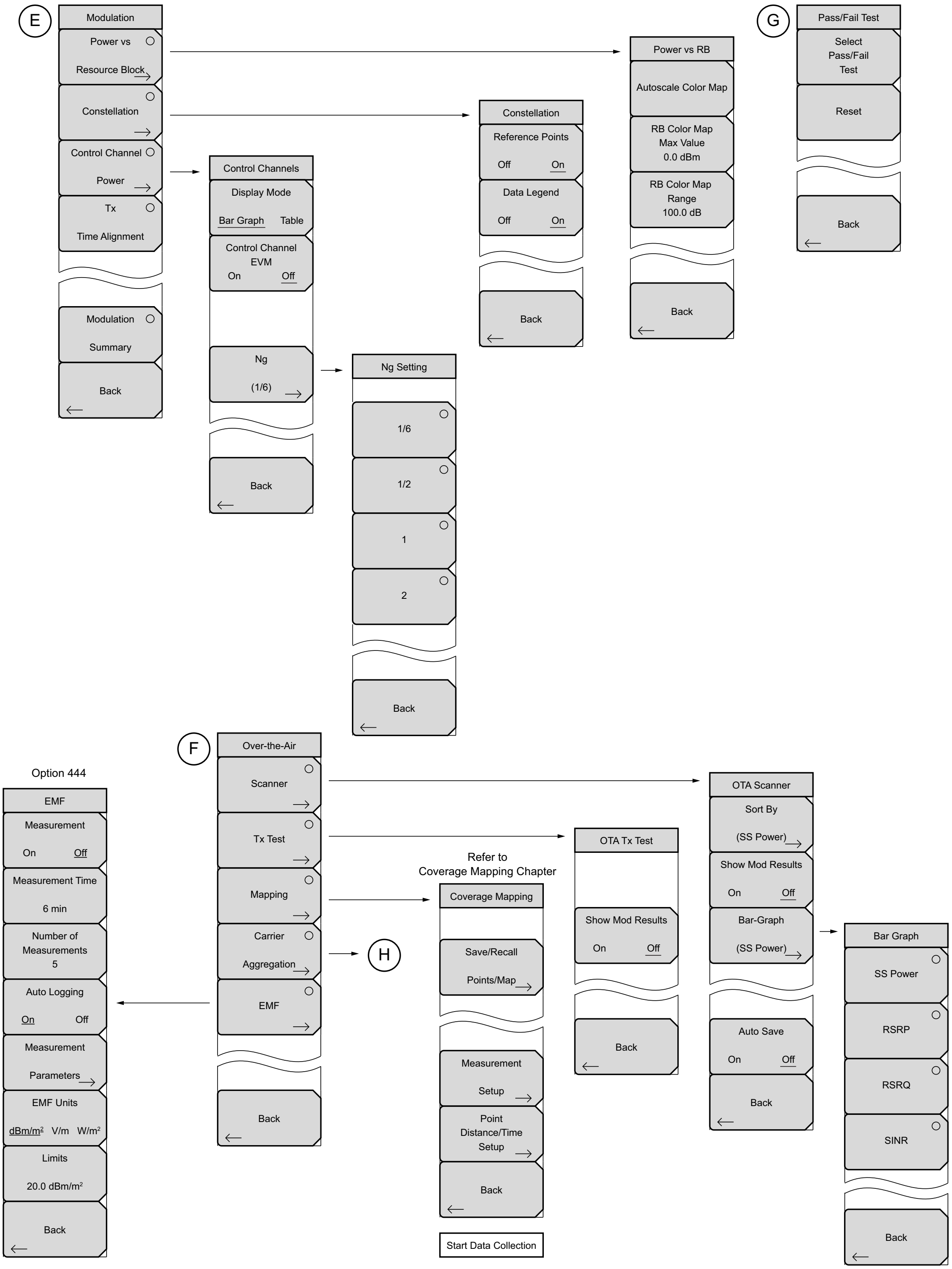


Figure 6-17. TD-LTE Menu Layout (2 of 3)

TD-LTE Menus (continued)

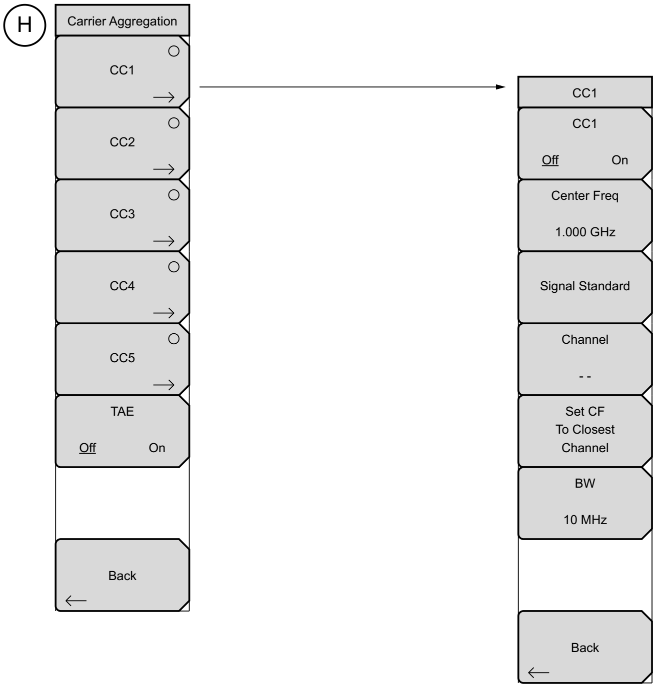
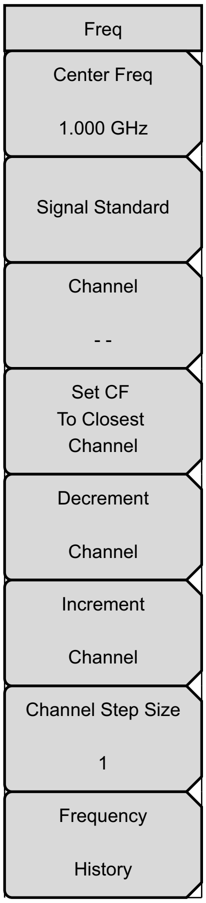


Figure 6-18. TD-LTE Menu Layout (3 of 3)

6-9 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press this submenu key to set the receiver center frequency to the desired value. Enter the frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels will change to Units: GHz, MHz, kHz, and Hz. Press the appropriate units submenu key. Pressing the **Enter** key has the same effect as pressing the MHz submenu key.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

Signal Standard: Opens the Signal Standards list box in order to select signal standard.

Channel: Opens the Channel Editor list box in order to select a channel number within the range of the selected signal standard.

Set CF to Closest Channel: Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

Decrement Channel: Decrements the channel by one channel.

Increment Channel: Increments the channel by one channel.

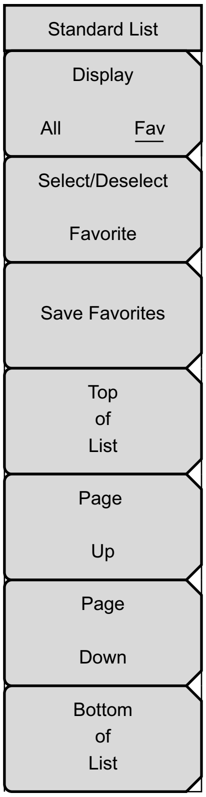
Channel Step Size: Use this submenu key to specify the step size used for incrementing or decrementing the channel number. Change the step value by using the arrow keys or rotary knob. Press the **Enter** key to set the value.

Frequency History: Opens a list box that displays the last five selected frequencies. When a frequency is entered using the Center Frequency submenu key or the Signal Standard/Channel submenu keys, the list will be updated.

Figure 6-19. TD-LTE Freq Menu

Standard List Menu

Key Sequence: **Freq** > Signal Standard



Display: Toggles between displaying all available signal standards and the signal standards marked as favorites (* in the Fav column).

Select/Deselect Favorite: Press this submenu key to select or deselect a signal standards as a favorite.

Save Favorites: Press this submenu key to have the instrument save to memory the signal standards were selected as favorites. Next time the signal standard list is displayed, these signal standard will be marked as favorites (* in the Fav column).

Top of List: Press this submenu key to display the first signal standard in the list.

Page Up: Press this submenu key to scroll up one page in the signal standard list.

Page Down: Press this submenu key to scroll down one page in the signal standard list.

Bottom of List: Press this submenu key to display the last signal standard in the list.

Press **Esc** to close the Signal Standards list and return to the Frequency menu.

Figure 6-20. TD-LTE Signal Standards

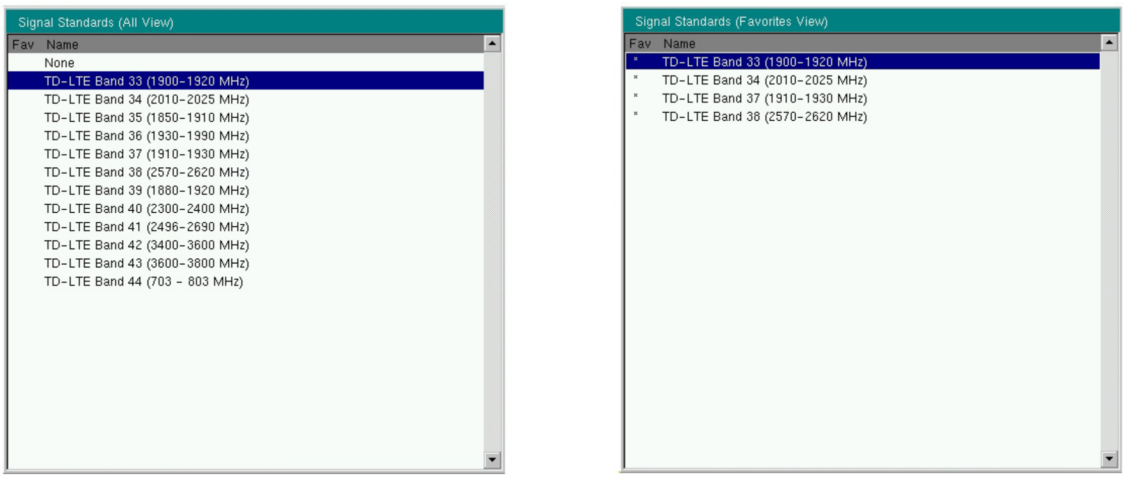
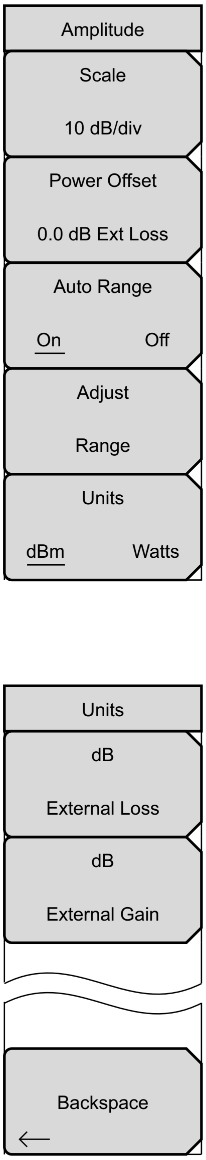


Figure 6-21. TD-LTE Signal Standard List, All and Favorites

6-10 Amplitude Menu

Key Sequence: **Amplitude**



Scale: Press this submenu key to change the scale of the y-axis in the RF measurement displays. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div.

Power Offset: Enter the power offset to automatically adjust for the loss or gain through any external cables, attenuators and couplers. The power can be offset from 0 dB to 100 dB in either direction. Press the Power Offset key, then enter a value using the arrow keys, rotary knob, or numeric keypad.

Note: When using the keypad, the submenu keys will change to Units keys (dB) of External Loss and External Gain, as illustrated on the left, below the Amplitude menu. Enter a value, then press the appropriate Units key to make your selection. A negative offset value in external gain equates to the same amount of external loss. For example, entering –1.0 dB in Ext Gain is the same as 1.0 db of Ext Loss.

Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

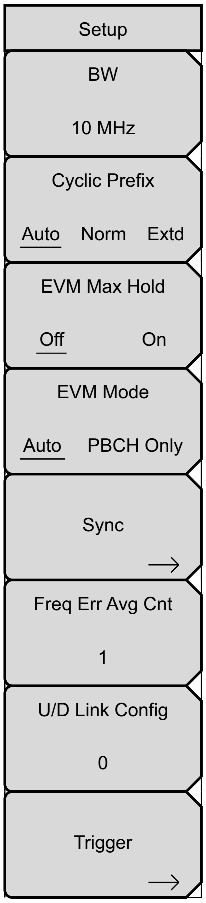
Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

Units: Press this submenu key to set the units for all measurements and summary tables in either dBm or Watts.

Figure 6-22. TD-LTE Amplitude Menu

6-11 Setup Menu

Key Sequence: **Setup**



BW: Opens the selectable bandwidth list.

Cyclic Prefix: Press this submenu key to set the instrument to measure signal with a Normal or Extended Cyclic Prefix, or to allow the instrument to detect the Cyclic Prefix automatically.

EVM Max Hold: Turn the EVM Max Hold submenu key On to display both the Maximum EVM value since Reset and the current measured value. This applies to EVM RMS and Peak values. Selecting Off displays only the current measured value.

EVM Mode: Press this key to select either Auto or PBCH Only. Selecting Auto measures PDSCH if data is available, otherwise, it measures PBCH. Selecting PBCH Only forces a PBCH measurement and the constellation measurement will only show QPSK. The instrument will automatically choose PBCH Only mode when the OTA Scanner is used.

Sync: Press this key to open the "Sync Menu" on page 6-32.

Freq Err Avg Cnt: When the count is greater than one, the frequency error value is averaged over past measurements. If the count is one, then no averaging occurs.

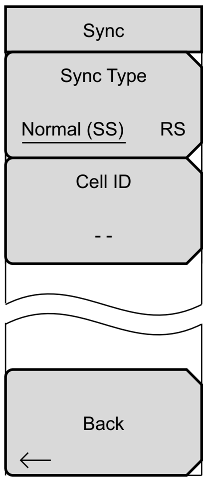
U/D Link Config: Press this key to set the Uplink/Downlink configuration, also known as the Frame Format. Use the keypad, arrow keys, or the rotary knob to set the value between 0 and 6 inclusive. This selection determines which subframes are uplink subframes and which are downlink subframes, and where the transitions between uplink and downlink subframes occur.

Trigger: Press this key to open the "Trigger Menu" on page 6-32.

Figure 6-23. TD-LTE Setup Menu

Sync Menu

Key Sequence: **Setup** > Sync



Sync Type: Press to choose between the Normal (SS) or RS Sync Type. Only choose RS when there is no sync signal present in the transmitter under test. If RS is chosen and a sync signal is present, no modulation measurements will be available.

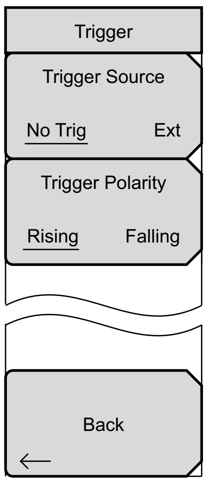
Cell ID: Identifying information sent by the transmitter in the sync signal. If Normal (SS) is selected as the Sync Type, the Cell ID is extracted automatically from the Sync Signal. The Cell ID must be entered manually when RS Sync Type is selected. For user convenience, the Cell ID is automatically populated from the last measured signal with an SS.

Back: Press this submenu key to return to the "Setup Menu" on page 6-31.

Figure 6-24. TD-LTE Sync Menu

Trigger Menu

Key Sequence: **Setup** > Trigger



Trigger Source: Press this key to choose between No Trig or External (Ext). When Ext is chosen, the instrument uses an external trigger input to determine frame start timing for data acquisition. The internal algorithms will search for a frame sync and use the delta between the external timing reference and internal sync to compute a 'Timing Error' measurement.

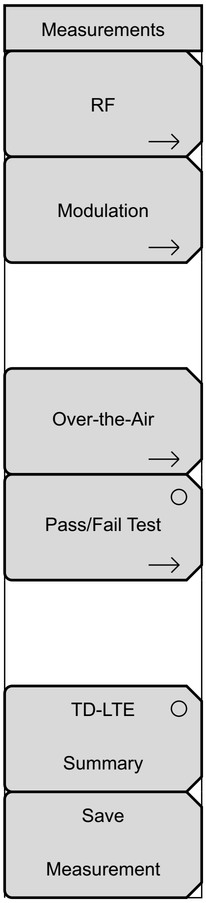
Trigger Polarity: Select the desired edge of the external trigger source to use for reference.

Back: Press this submenu key to return to the "Setup Menu" on page 6-31.

Figure 6-25. TD-LTE Sync Menu

6-12 Measurements Menu

Key Sequence: **Measurements**



RF: Press this submenu key to display the “RF Menu” on page 6-34.

Modulation: Press this submenu key to display the “Modulation Menu” on page 6-37.

Over-the-Air: Press this submenu key to display the “Over-the-Air Menu” on page 6-41.

Pass/Fail Test: Press this submenu key to activate the Pass/Fail test. Press the key again to display the “Pass/Fail Test Menu” on page 6-47 and set up pass/fail testing.

TD-LTE Summary: Press this submenu key to display a table of the TD-LTE measurements. The following measurement values are displayed in the table:

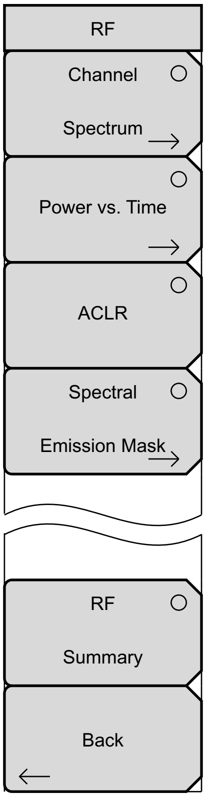
Freq Error
Occupied BW
Carrier Frequency
Channel Power
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
PBCH Power
PCFICH Power
Spectral Emission Mask

Save Measurement: Press this submenu key to save a measurement. You may accept the default filename or enter your own filename. Refer to your instrument’s User Guide for information on file management functions.

Figure 6-26. TD-LTE Measurements Menu

RF Menu

Key Sequence: **Measurements** > RF



Channel Spectrum: Opens the "Channel Spectrum Menu" on page 6-35. Displays the spectrum of the input signal. Beneath the graph, values for the following measurements are displayed: Channel Power and Occupied BW. Channel Power is displayed in dBm or Watts (based on the Units submenu setting in the **Amplitude** menu) and Occupied BW is displayed in MHz. Press this button again to list the Channel Spectrum menu to set the Span.

Power vs. Time: Opens the "Power vs. Time Menu" on page 6-35. Displays the Power vs. Time graph showing the signal in the time domain.

ACLR: Displays a bar graph of the main channel power and two adjacent channels on either side. The table underneath the chart lists the frequency, power, and power relative to the main channel (in dB).

Spectral Emission Mask: Opens the "Spectral Emission Menu" on page 6-36. The Spectral Emission Mask measurement supports the testing for "Operating Band Unwanted Emissions" described in the 3GPP TS 36.141 Base Station Conformance testing document. There is support for Category A and Category B (Option 1 only) masks which are automatically selected based on the current carrier frequency/channel and BW values.

The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region. Press this button again to list the Spectral Emission submenu.

RF Summary: Press this submenu key to display the following RF measurements in table format:

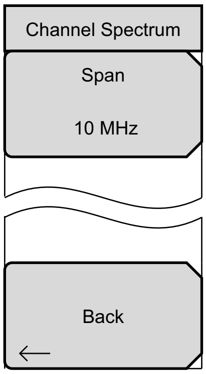
Channel Power
Occupied BW
Lower Adjacent CH Pwr 2
Lower Adjacent CH Pwr 1
Upper Adjacent CH Pwr 1
Upper Adjacent CH Pwr 2
Spectral Emission Mask
Total Frame Pwr
DwPTS Power
Transmit Off Pwr
Timing Error

Back: Press this submenu key to return to the "Measurements Menu" on page 6-33.

Figure 6-27. TD-LTE RF Menu

Channel Spectrum Menu

Key Sequence: **Measurements** > RF > Channel Spectrum



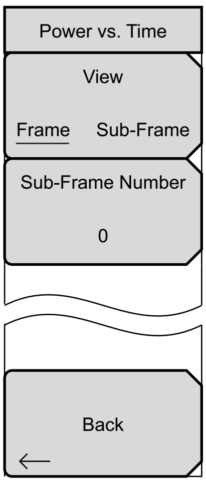
Span: Opens the Span list to select a frequency span or Auto.

Back: Returns to the “RF Menu” on page 6-34.

Figure 6-28. TD-LTE Channel Spectrum Menu

Power vs. Time Menu

Key Sequence: **Measurements** > RF > Power vs. Time



View: Press to select either Frame or Sub-Frame

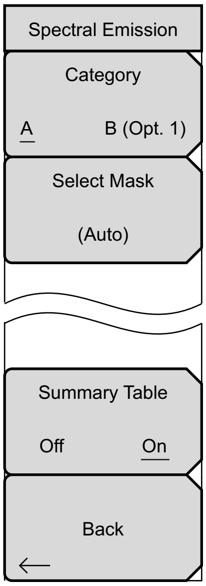
Sub-Frame Number: If Sub-Frame is selected, press to enter the desired sub-frame to view.

Back: Returns to the “RF Menu” on page 6-34.

Figure 6-29. TD-LTE Power vs. Time Menu

Spectral Emission Menu

Key Sequence: **Measurements** > RF > Spectral Emission



Category A B (Opt. 1): Select the desired category based on the information on page 6-34.

Select Mask (Auto): Displays a list of standard and custom masks for use in SEM measurements. Select “Auto Select” if the desired mask is unknown.

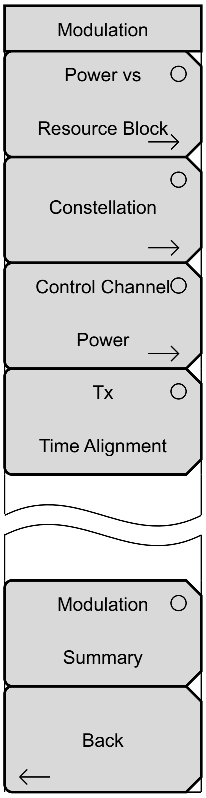
Summary Table: Displays the Spectral Emission measurement data in table form.

Back: Returns to the “RF Menu” on page 6-34.

Figure 6-30. TD-LTE Spectral Emission Menu

Modulation Menu

Key Sequence: **Measurements** > Modulation



Power vs Resource Block: Press once to display the Power vs. Resource Block measurement window. Press again to open the "Power vs. Resource Block Menu" on page 6-38 for setting up the Resource Block Color Map parameters.

Constellation: Press this submenu key to set the modulation measurement to Constellation view. This view displays the constellation of the modulated data symbols over subframe 0. Press the key again to open the "Constellation Menu" on page 6-39.

Control Channel Power: Press the Control Channel Power submenu key to set the display as bar graph or table. Refer to the "Control Channel Power Menu" on page 6-40.

Tx Time Alignment: Press to set the modulation measurement to Tx Time Alignment view. Refer to "Tx Time Alignment" on page 6-15.

Modulation Summary: Press this submenu key to display a summary table of all of the modulation-related numerical measurement results:

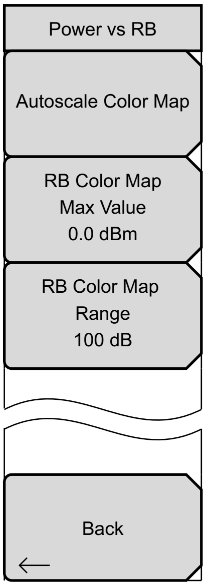
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

Back: Press this submenu key to return to "Measurements Menu" on page 6-33.

Figure 6-31. TD-LTE Modulation Menu

Power vs. Resource Block Menu

Key Sequence: **Measurements** > Modulation > Power vs. Resource Block



Autoscale Color Map: Adjusts the RB Max Value and Range automatically on the color map.

RB Color Map Max Value: Press to adjust the RB Color Map Max Value manually.

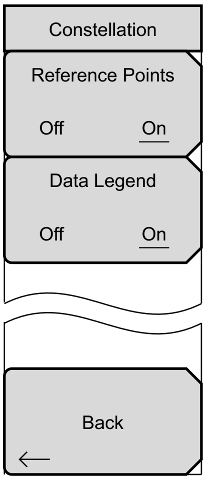
RB Color Map Range: Press to adjust the RB Color Range manually.

Back: Press this submenu key to return to the "Modulation Menu" on page 6-37.

Figure 6-32. TD-LTE Power vs. Resource Block Menu

Constellation Menu

Key Sequence: **Measurements** > Modulation > Constellation



Reference Points: Press this submenu key to display reference points (small white circles) for the various constellations. On is the default state.

Data Legend: Turns the legend box in the top right corner of the constellation graph On and Off. On is the default state.

Back: Press this submenu key to return to the "Modulation Menu" on page 6-37.

The constellations are color coded as follows:

QPSK is shown in purple
16-QAM is shown in green
64-QAM is shown in yellow

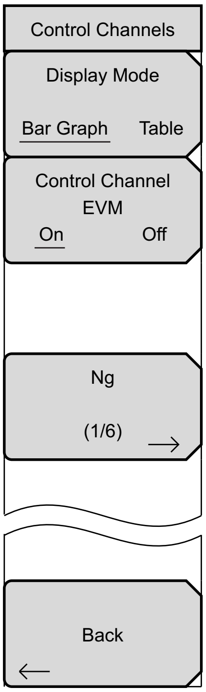
Values for the following measurements are shown beneath the graph:

Ref. Signal (RS) Power
EVM (rms)
Freq Error
Carrier Frequency
Sync Signal (SS) Power
EVM (pk)
Freq Error (ppm)
Cell ID

Figure 6-33. TD-LTE Constellation Menu

Control Channel Power Menu

Key Sequence: **Measurements** > Modulation > Control Channel Power



Display Mode: Select Bar Graph or Table as the desired view.

Control Channel EVM On Off: When On, the EVM column is included to display the EVM of each control channel. The EVM column is included for either Bar Graph or Table displays.

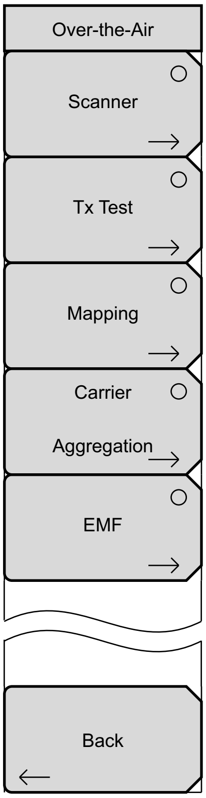
Ng (1/6): Determines the number of PHICH groups in a LTE sub-frame.

Back: Press this submenu key to return to the “Modulation Menu” on page 6-37.

Figure 6-34. TD-LTE Control Channel Menu

Over-the-Air Menu

Key Sequence: **Measurements** > Over-the-Air



Scanner: Press this submenu key to display the Scanner table, which shows several power measurements for multiple base stations at the same frequency. Measurements include Sync Signal (S-SS) Power, RSRP, RSRQ, and SINR. Press the key again to display the "OTA Scanner Menu" on page 6-42 to set up Sort By and Show Mod Results.

Tx Test: Opens the OTA Tx Test mode. Press it again to open the "Over-the-Air Tx Test Menu" on page 6-43 and the Show Mod Results submenu key.

Mapping: Sets the display for coverage mapping. Press it again to set the coverage mapping parameters – Save/Recall Points/Map, Measurement Setup and Point Distance/Time Setup.

For full details, refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

Carrier Aggregation: Press this submenu key to display the Carrier Aggregation Component Carrier frequencies and measured parameters. In the Carrier Aggregation Menu, select the desired Component Carrier to set up for measurement. Refer to "Carrier Aggregation Menu" on page 6-45.

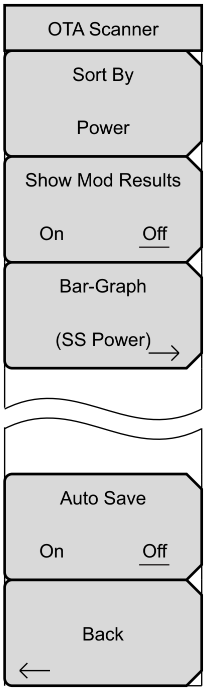
EMF (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. Once the EMF Measurement mode is active, this button opens the "LTE/TD-LTE EMF Menu" on page 8-2.

Back: Press this submenu key to return to the "Measurements Menu" on page 6-33.

Figure 6-35. TD-LTE Over-the-Air Menu

OTA Scanner Menu

Key Sequence: **Measurements** > Over-the-Air > Scanner > Scanner



Sort By: Opens the Sort By list dialog. Choose one of the following parameters to sort the Scanner table rows.

Cell ID
Group ID
Sector ID
S-SS Power
RSRP
RSRQ
SINR

Show Mod Results (Demod option required on some instruments): Displays in table format the following measurements and information.

Ref. Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM (pk)
Freq Error
Freq Error (ppm)
Carrier Frequency
Cell ID

Bar-Graph: Opens the Bar Graph menu to select the parameter to be displayed in the last (rightmost) column of the bar graph: SS Power, RSRP, RSRQ or SINR. Press **Back** to return to the OTA Scanner menu.

Auto Save: Use this submenu key to automatically save measurement records. The instrument logs a data record at the end of each measurement cycle. A maximum of 10,000 records can be stored in a file. When a file is full, a new file is automatically created.

Files are automatically saved to the instrument's Current Location selection in the subdirectory /Internal Memory/user. Refer to the File Management chapter in your instrument User Guide for instructions on setting the Current Location for saving files.

File names are automatically created:

Yyyymmddhhnnss.tdlte

example: 20090811223322 44.tdlte

y - year, 2009, m - month, 08, d - day, 11, h - hour, 22, n - minutes, 33
s - seconds, 44

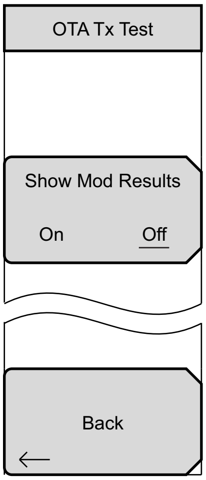
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

Back: Press this submenu key to return to the "Over-the-Air Menu" on page 6-41.

Figure 6-36. TD-LTE OTA Scanner Menu

Over-the-Air Tx Test Menu

Key Sequence: **Measurements** > Over-the-Air > Tx Test



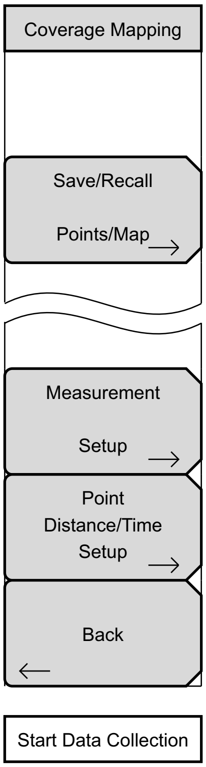
Show Mod Results: When set to Off, the PBCH Results table and Antenna Status indicators are not displayed. When set to On, the Antenna Status and PBCH Modulation Results table are displayed.

Back: Press this submenu key to return to the "Over-the-Air Menu" on page 6-41.

Figure 6-37. TD-LTE Over-the-Air Tx Test Menu

Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping



Save/Recall Map Points: Opens the “Mapping Save/Recall Menu” on page 7-13.

Measurement Setups: Opens the “Measurement Setup Menu” on page 7-14.

Point Distance/Time Setup: Opens the “Point Distance/Time Setup Menu” on page 7-15.

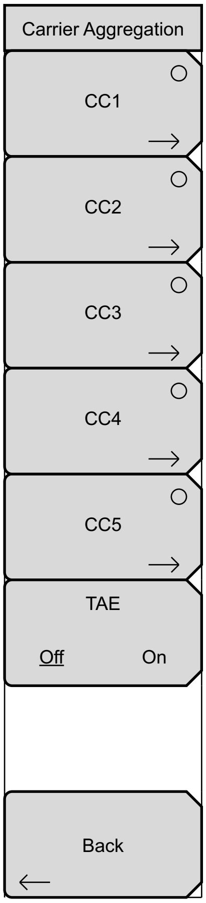
Back: Returns to the “Over-the-Air Menu” on page 6-41.

Start/Stop Data Collection: Press this main menu key to start coverage mapping data collection based on Measurement Setup settings and Point Distance/Time Setup settings. A running count of collected data points is displayed at the bottom of the screen. Press again to stop data collection.

Figure 6-38. Coverage Mapping Menu

Carrier Aggregation Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation



CC1 through CC5: Select the desired Component Carrier to set up for measurement. See Figure 6-40.

Note: When switching from the Carrier Aggregation to other measurements, the frequency is automatically set to the currently selected Component Carrier, if it is on.

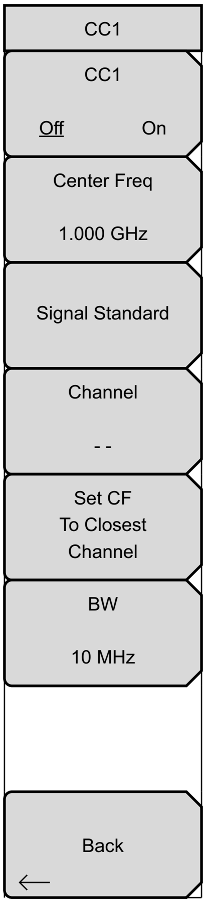
TAE: Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

Back: Returns to the “Over-the-Air Menu” on page 6-41.

Figure 6-39. Carrier Aggregation Menu

Component Carrier Menu

Key Sequence: **Measurements** > Over-the-Air > Carrier Aggregation > CC1



CC1 Off On: Turns On the Component Carrier.

Center Freq: Press this submenu key to set the receiver center frequency. Enter the frequency using the keypad, arrow keys, or the rotary knob. When entering a frequency using the keypad, the submenu key labels change to Units: GHz, MHz, kHz, and Hz. In this case, enter the desired value, then press the desired unit submenu key or press **Enter** to select MHz as the frequency unit.

Signal Standard: Opens the “Standard List Menu” on page 6-29.

Channel: Opens the Channel Editor dialog where you can select a channel number within the range of the selected signal standard.

Set CF to Closest Channel: Moves the center frequency to the closest frequency that matches a channel number in the current signal standard.

BW: Displays the selectable bandwidth list.

Back: Returns to the previous menu.

Figure 6-40. Component Carrier Menu

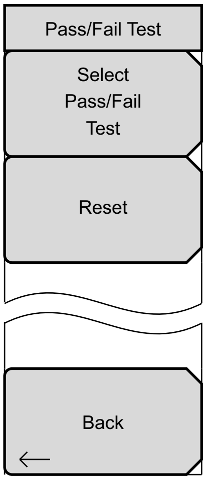
EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF

Refer to “LTE/TD-LTE EMF Menu” on page 8-2.

Pass/Fail Test Menu

Key Sequence: **Measurements** > Pass/Fail Test > Select Pass/Fail Test



Select Pass/Fail Test: Press this submenu key to open the Select Pass/Fail Test list box and select a test type. Choose from:

PASS_FAIL_RF
PASS_FAIL_MOD
PASS_FAIL_CONTROL
PASS_FAIL_ALL

Highlight the desired test with the arrow keys or rotary knob and press **Enter** to start the test or press **Esc** to cancel your choice.

Note: The current list of pass/fail tests is a default list. Master Software Tools (MST) includes features to create additional pass/fail tests.

Reset: Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

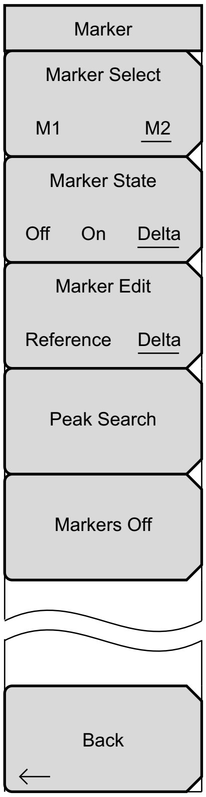
Back: Press this submenu key to return to the “Measurements Menu” on page 6-33.

Figure 6-41. TD-LTE Pass Fail Mode Menu

6-13 Marker Menu

Key Sequence: **Marker**

Available for Channel Spectrum and Power vs. Time measurements.



Marker Select: Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

Marker State: Sets the state of the selected marker underlined in the Marker Select submenu.

Marker Edit: Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

Peak Search: Moves the selected marker to the trace peak.

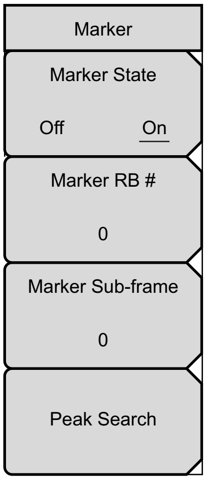
Markers Off: Turns off all markers.

Back: Press this submenu key to return to the "Measurements Menu" on page 6-33.

Figure 6-42. TD-LTE Marker Menu

Power vs Resource Block Marker Menu

Key Sequence: **Marker** (When Power vs. Resource Block measurement is selected).



Marker Select: Selects the active marker M1 or M2. The underlined marker is active marker. Each press of the submenu key moves the underline to the other marker.

Marker State: Sets the state of the selected marker underlined in the Marker Select submenu.

Marker Edit: Displays when the Market State submenu is set to Delta. Toggles between activating the Reference or Delta marker.

Peak Search: Moves the selected marker to the trace peak.

Markers Off: Turns off all markers.

Back: Press this submenu key to return to "Measurements Menu" on page 6-33.

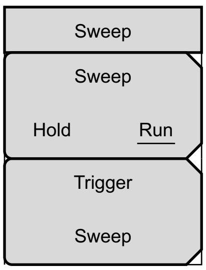
Figure 6-43. TD-LTE Resource Block Marker Menu

6-14 Calibrate Menu

This menu is not available in TD-LTE measurement mode.

6-15 Sweep Menu

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



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

Trigger Sweep: Pressing this submenu key causes the instrument to make a single sweep when the instrument is in single sweep mode. This key has no function when the instrument is in continuous sweep mode.

Figure 6-44. TD-LTE Sweep Menu

6-16 Measure Menu

Displays the “Measurements Menu” on page 6-33.

6-17 Trace Menu

This menu is not available in TD-LTE measurement mode.

6-18 Limit Menu

This menu is not available in TD-LTE measurement mode.

6-19 Other Menus

Preset, **File**, **Mode** and **System** are described in the User Guide.

Chapter 7 — LTE and TD-LTE Coverage Mapping

Note	Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options.

7-1 Introduction

Coverage Mapping allows users to measure and map Sync Signal Power, Reference Signal Received Power (RSRP), Reference Signal Receive Quality (RSRQ), and SINR. The Anritsu easyMap Tools program creates special maps compatible with Anritsu handheld spectrum analyzers. The software creates files with or without GPS information. The files compatible with coverage mapping will have a .map extension. easyMap Tools is available from the Anritsu website (www.anritsu.com).

This chapter presents brief examples and menu overview of Coverage Mapping, Coverage Mapping setup, measurement parameters setup, and points distance/time setup.

7-2 General Measurement Setups

Refer to the Measurement Setups section in this Measurement Guide for the specific measurement mode used in setting up frequency, amplitude, and GPS.

7-3 Coverage Mapping

The instrument logs data automatically based on either time or distance interval. If there is no map available when making the measurements, it is still possible to save all the data to a KML file and then later combine the data file with a map.

Coverage Mapping is possible both outdoors (GPS signal required) and indoors (no GPS signal). For more accurate position data for indoor measurements, use a stylus such as the Anritsu 2000-1691-R.

- **Outdoor Mapping:** The instrument logs data automatically based on either time or distance interval. If there is no map available when making the measurements, it is still possible to save all the data to a KML file and then combine the data with a map. You may also recall a map after taking the data without having to save and recall it.

Note	Outdoor coverage mapping requires Option 31 or an Anritsu analyzer having the GPS receiver as a standard accessory component.

- **Indoor Mapping:** Using a start-walk-stop approach, the instrument provides in-building coverage mapping by overlaying data directly onto the downloaded map (which may be a drawing of a building). Data is captured when you tap the touchscreen. The instrument places points linearly between taps if Time interval is used for capturing data and there is more than one measurement. When the Repeat Type is Distance, new measurements are placed at the next tap point.

Outdoor Coverage

With a valid GPS signal, the instrument identifies the current location on the displayed GeoEmbedded map with a plus sign. Previously saved locations display as colored squares. Using GPS, latitude, longitude, and altitude data is automatically saved for each location.

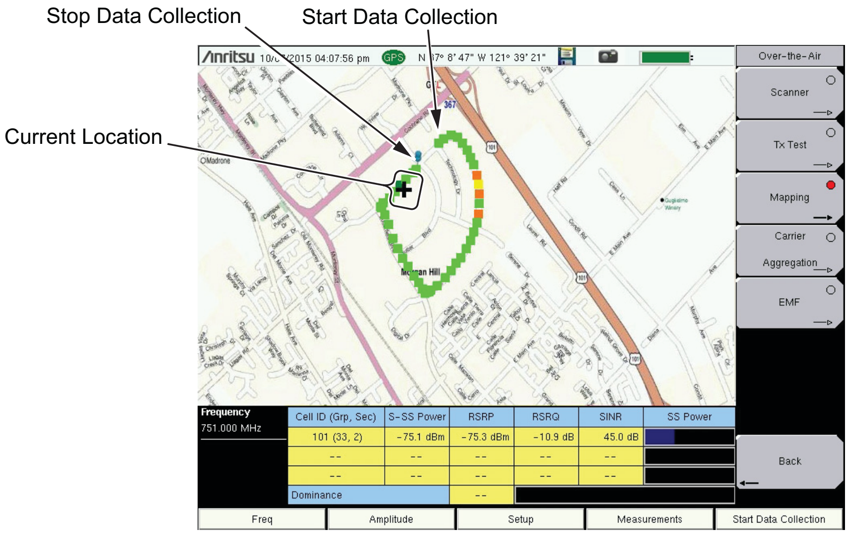


Figure 7-1. Outdoor Coverage Mapping (GPS On)

Indoor Coverage

With GPS turned off and a non-GeoEmbedded map file, the user indicates the current position (+) with the touchscreen. On instruments that do not have a touchscreen, use the arrow keys. Previously saved locations are displayed as colored squares.

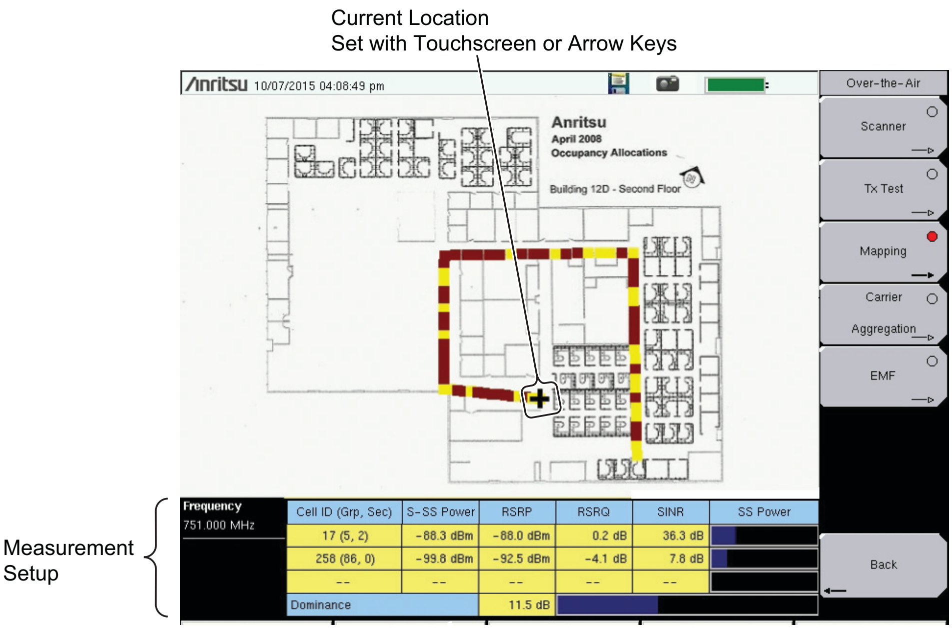


Figure 7-2. Indoor Coverage Mapping (GPS Off)

Coverage Mapping is a four-step process:

- Create an indoor or outdoor map using “Anritsu easyMap Tools”.
- Load the map and configure the “Instrument Settings” on page 7-4.
- Connect an antenna to the instrument and go to “Measurement Setup” on page 7-6.
- “Save the Coverage Mapping Information” on page 7-7.

Anritsu easyMap Tools

Anritsu easyMap Tools allows you to capture maps of any location and create Anritsu Map Files. These maps are viewed on the Anritsu instrument during coverage mapping. There are two Anritsu Map File formats:

- legacy .map map files
- .azm map files, which are displayed in full zoom-out view (pan-and-zoom is currently not supported in Coverage Mapping)

Download easyMap Tools from the Anritsu website (www.anritsu.com). Additional information about easyMap Tools is available in the software Help.

Outdoor Map

Type an address in easyMap Tools and capture the map with GPS data.

Indoor Map

In easyMap Tools, open a bitmapped image (JPEG, GIF, TIFF, or PNG) of the floor plan for indoor mapping. You can also use a downloaded map and make it an indoor map. This method works well if you can get a good aerial view of a building.

The image size should be close to 666 pixels x 420 pixels (~1.6:1 ratio).

Note	A USB flash drive is required to transfer maps to the instrument.

Instrument Settings

Setup

1. Create the appropriate map with Anritsu easyMap Tools. Refer to "Anritsu easyMap Tools" on page 7-3 and the software Help. Outdoor mapping requires a GeoEmbedded map or the default grid.
2. Open up Coverage Mapping by pressing the **Measurements** main menu button followed by the Over-the-Air submenu key and then pressing the Mapping submenu key.

   Continue with Step 3 for outdoor coverage mapping only. GPS must be off for indoor mapping.
3. Turn on GPS.
   a. Press **Shift** then **System** (8).
   b. Press the GPS submenu key.
   c. Connect a GPS antenna to the SMA connector.
   d. Turn on GPS. On should be underlined in the GPS submenu key.
   e. Press the GPS Voltage submenu key to select the appropriate voltage for the antenna being used. Refer to the instrument Technical Data Sheet for voltage specifications of supported GPS antennas.
   f. Press GPS info and verify that the information from four or more satellites is captured. Press **Esc** to close the info box.

   It may take several minutes for the GPS receiver to track at least four satellites. When it does, the GPS icon at the top of the screen turns green. Refer to your instrument User Guide for additional information on GPS.

Recall a Map

The instrument allows you to recall a .map file or .azm file created with easyMap Tools. With a valid GPS signal, the current location will be displayed on an outdoor map or an arrow will show the direction of the current location if it is outside the map coverage area. With an indoor map, position the plus sign at the current location by using the touchscreen or by using the arrow keys and then pressing **Enter**.

Connect the USB flash drive that has the map file or files created in "Anritsu easyMap Tools" on page 7-3 to the instrument.

1. Press the Mapping submenu key in the Over-the-Air submenu.
2. Press the Save/Recall Points/Map submenu key.
3. Press Recall a Map and select the appropriate map from the USB flash drive.
4. Use the arrow keys to scroll down to the desired map and press **Enter** to select.

   Step 5 and Step 6 apply to outdoor coverage mapping only.
5. The new map file will be displayed and the current location (if within the GPS boundaries of the displayed map) is shown as a plus sign with outdoor mapping.
6. If the current location is outside the map boundaries, an arrow indicates the direction of the current location in relation to the displayed map.

If you do not see the USB drive in the Recall menu:

1. Press the Refresh Directories submenu key.
2. If the drive is still not visible, exit the menu, then remove and reconnect the USB drive.
3. Press Recall a Map again.
4. If the drive is still not visible, reformat the USB flash drive in FAT32 format, then copy the map files to the reformatted drive.

Recall the Default Grid

The instrument can make coverage mapping measurements even when an Anritsu easyMap Tools file of the current indoor or outdoor location is not available. In such cases, use the default grid map, save the KML points, and recall them at a later time with a map. You may also recall a map after taking the data without having to save and recall it. Alternatively, you can save the KML points and view them in Google Earth or Google Maps, or you can save the points in mtd (mapping tab delimited) format, and use another tool for analysis, such as Microsoft Excel. Refer to "Mapping Save/Recall Menu" on page 7-13 for additional information on recalling saved maps and .kml data.

Note	When using the default grid, the coverage area for outdoor mapping is fixed at 10 x 10 miles. For indoor coverage mapping, the grid size is the indoor map file dimensions (666 pixels by 420 pixels). If GPS is on and locked, the center point of the default grid is the current location.

1. Select the Mapping submenu key.
2. Press the Save/Recall Points/Map submenu key.
3. Press the Recall Default Grid submenu key.

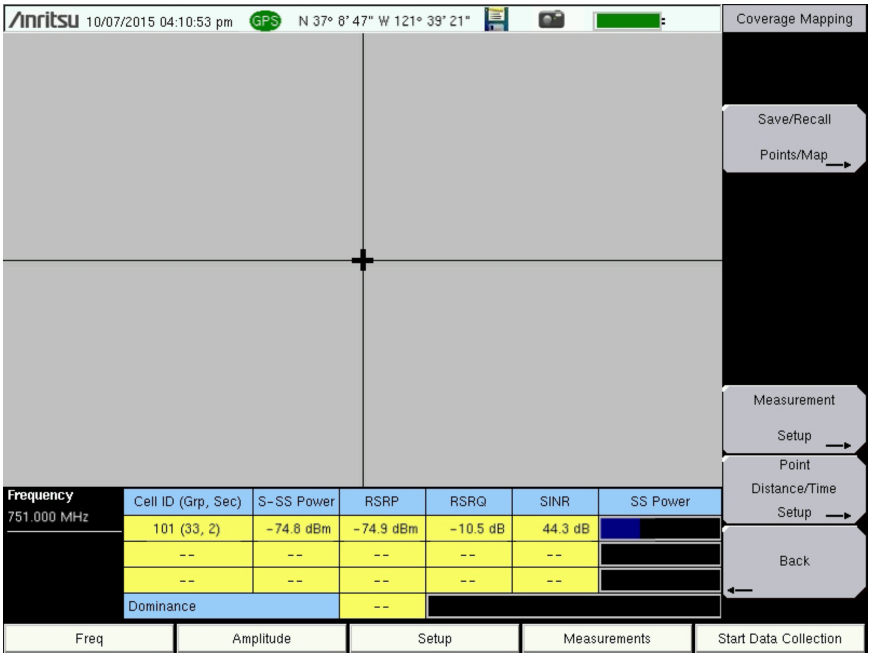


Figure 7-3. LTE Coverage Mapping with the Default Grid

Measurement Setup

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key.
3. Press the Mapping submenu key to activate the Coverage Mapping display. Press the Mapping key again to display the Coverage Mapping menu.
4. Press the Measurement Setup submenu key to open the Measurement Setup menu to select which measurement is mapped and to set the threshold values for S-SS, RSRP, RSRQ and SINR.
5. Press the Measurement submenu key to open the Mapping Parameter menu.
   a. Select the signal parameter to be mapped and displayed in bar graph form by selecting one of the parameter buttons and then pressing Back. All four measurements are saved for each data point, independent of which one is chosen for mapping on the instrument screen. For example, if RSRP is selected for mapping, the resulting .kml file will also include S-SS, RSRQ and SINR values.
   b. Set the thresholds for S-SS, RSRP, RSRQ or SINR by pressing the respective Thresholds button. After pressing a threshold button, set the threshold levels for Excellent, Very Good, Good, Fair and Poor. Then press the Back button.
6. Set up the interval type and interval parameters. Press the Point Distance/Time Setup submenu button to open the Points Distance/Time menu. If Time is selected for Repeat Type, then set the time period by pressing the Repeat Time submenu key. If Distance is selected for Repeat Type, then set the Repeat Distance and Distance Units. If necessary, delete any previously stored points by pressing the Delete ALL Points button.

Note	All files will be stored in the default save location. To change the default location, Press **Shift** then **File** (7) to enter File menu. Press Save then Change Save Location. Create a new folder or change the current location on the USB flash drive or in the instrument's storage memory. Press Set Location to make this the new default location for saving files.

7. Press Back to return to the Over-the-Air menu.

Measurement Mapping

After completing the setups for Coverage Mapping and measurements, you are ready to make measurements.

1. Press the **Start Data Collection** main menu key. Data will be collected at the time or distance interval based on the setting in "Point Distance/Time Setup Menu" on page 7-15. The color of the squares indicates the power level based on the chosen measurement and its threshold level setup.
2. Press the **Stop Data Collection** main menu key to end the measurement process. Save the collected data as a .kml file, a tab-delimited text file (.mtd) or a .jpg file. Refer to "Save the Coverage Mapping Information" on page 7-7.

Save the Coverage Mapping Information

1. Press the **Measurements** main menu key.
2. Press the Over-the-Air submenu key, then Mapping.
3. Coverage Mapping has three save options. Refer to “Save KML Points”, “Save Tab Delimited Points” or “Save JPG”.

All files will be stored in the default save location. To change the default location:

1. Press **Shift**, then **File (7)** to access the File menu.
2. Press Save.
3. Press Change Save Location.
4. Select an existing folder or press the Create Folder submenu key to create a new folder in the instrument’s internal memory or on a USB drive.
5. Press Set Location to make the selected folder the new default location for saving files.

Save KML Points

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save KML Points. In the Save dialog, change the file name as appropriate, then press **Enter**. The following information is saved for the points currently displayed on the screen:

- Location and time based on GPS information
- Cell, Group and Sector ID
- Center Frequency
- Measured signals: S-SS, RSRP, RSRQ and SINR

The `.kml` file can be recalled and viewed on the instrument. Refer to “Mapping Save/Recall Menu” on page 7-13 for information on recalling a map.

The `.kml` file can also be opened and viewed using Google Earth and a network connection.

Note	**Installing Google Earth** If you don’t have Google Earth installed on your computer: 1. Go to www.google.com/earth. 2. Click Download Google Earth and follow the on-screen instructions. 3. After installation and Google Earth is opened, user instructions and several types of help are available from the Help pull-down menu.

1. Connect your computer or mobile device to the instrument via the Web Remote Control server. To do this, enter the instrument IP address in the address bar of your HTML-5 compatible Web browser. Anritsu strongly recommends using Google Chrome, as other browsers do not fully support HTML-5.

   You can look up your instrument IP address by pressing **Shift**, then **System (8)**, followed by Status. If your instrument has not been set up with an IP address, press System Options, then Ethernet Config to access the Ethernet Editor dialog.

2. Click the File List tab and look for the `.kml` file you want to view in Google Earth. See Figure 7-4.
3. Click the map file name in the File column. Alternatively, you can select the checkbox next to the .kml file name, then click the Download button.
4. Click Open or Save in the pop-up dialog.

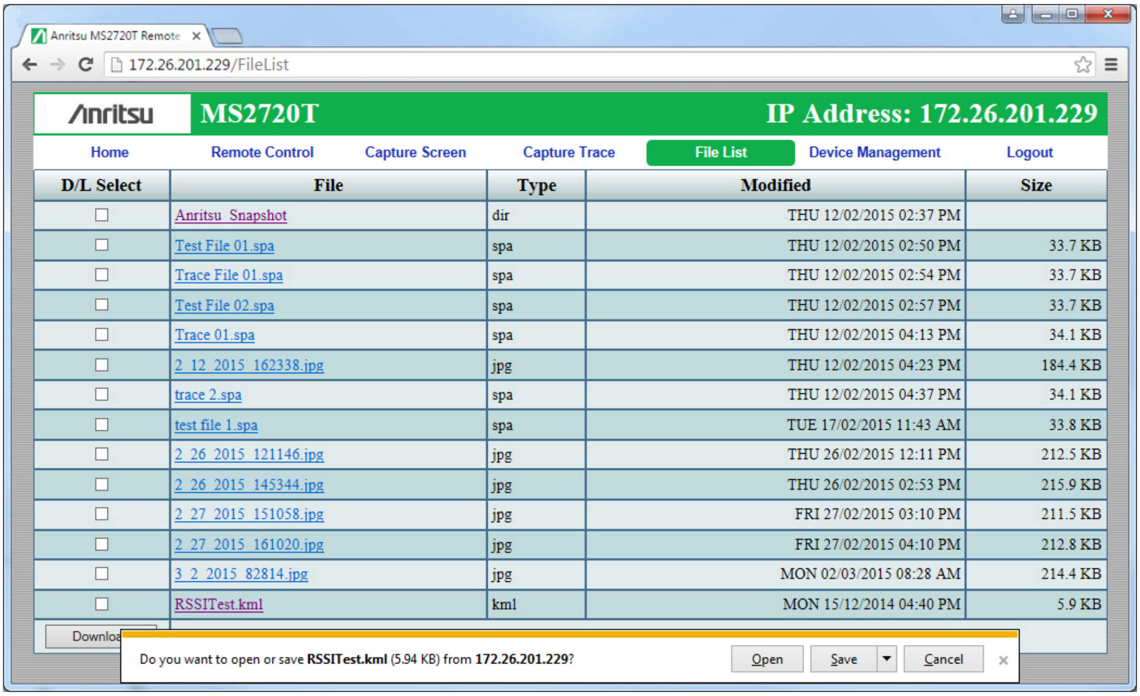


Figure 7-4. Web Remote Control Window - File List Tab

Opening the `.kml` file automatically launches Google Earth if the application is not currently open. Figure 7-5 illustrates a sample coverage mapping `.kml` file viewed in Google Earth. You can also view the file with Google Maps, provided you have the appropriate plug-in for your browser.

Figure 7-5. Sample Coverage Mapping KML File in Google Earth

Save Tab Delimited Points

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save Tab Delimited Points. In the Save dialog, change the file name as appropriate, then press **Enter**. A tab delimited text file (.mtd) of the coverage mapping data currently displayed on the screen will be saved to the default location.

Save JPG

In the Coverage Mapping submenu, press Save/Recall Points/Map, then Save JPG. In the Save dialog, change the file name as appropriate, then press **Enter**. A .jpg file of the current screen is saved to the default location.

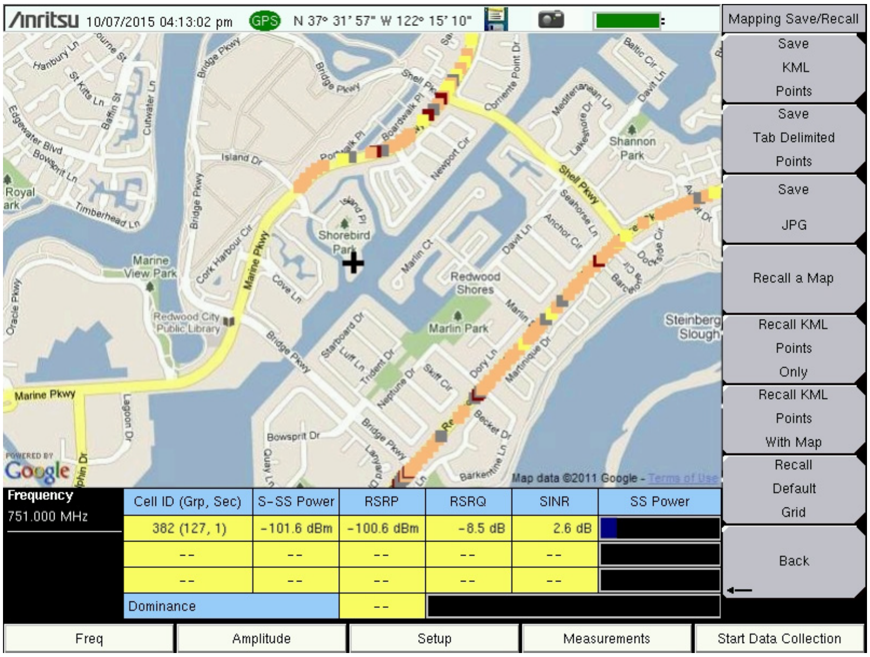


Figure 7-6. Coverage Mapping Measurement Saved as a .jpg File

7-4 Coverage Mapping Menus

Figure 7-7 shows the map of the LTE and TD-LTE Over-the-Air Coverage Mapping and associated submenus. Section 7-5 describes the details of Coverage Mapping menus and associated submenus.

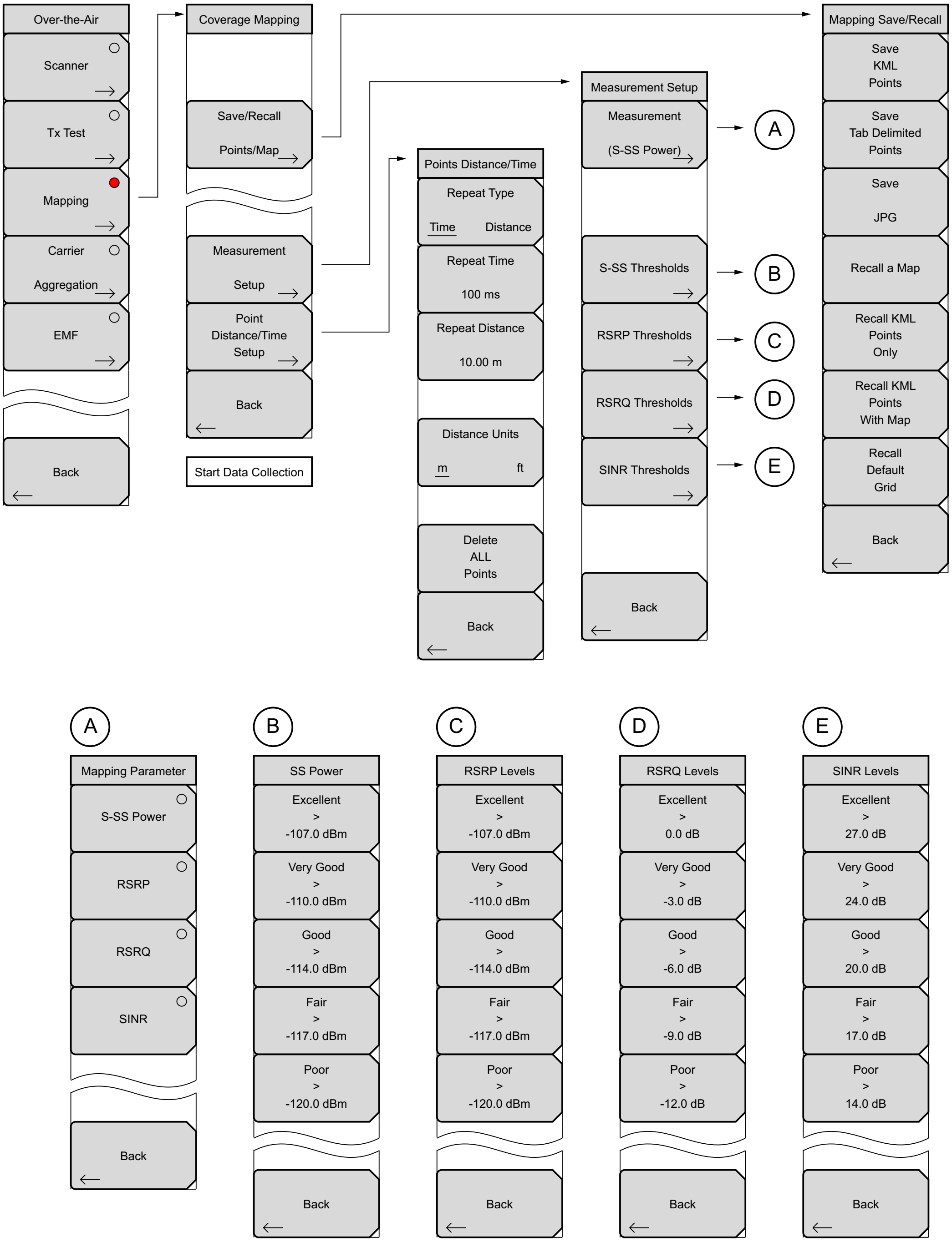
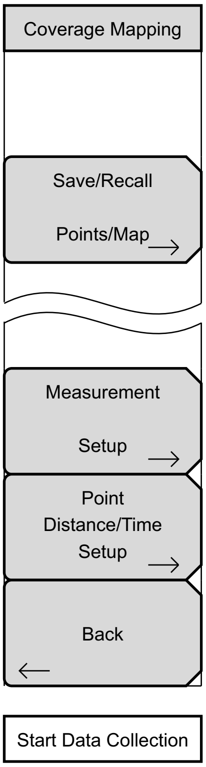


Figure 7-7. Coverage Mapping Menu

7-5 Coverage Mapping Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping



Save/Recall Map Points: Opens the “Mapping Save/Recall Menu” on page 7-13.

Measurement Setups: Opens the “Measurement Setup Menu” on page 7-14.

Point Distance/Time Setup: Opens the “Point Distance/Time Setup Menu” on page 7-15.

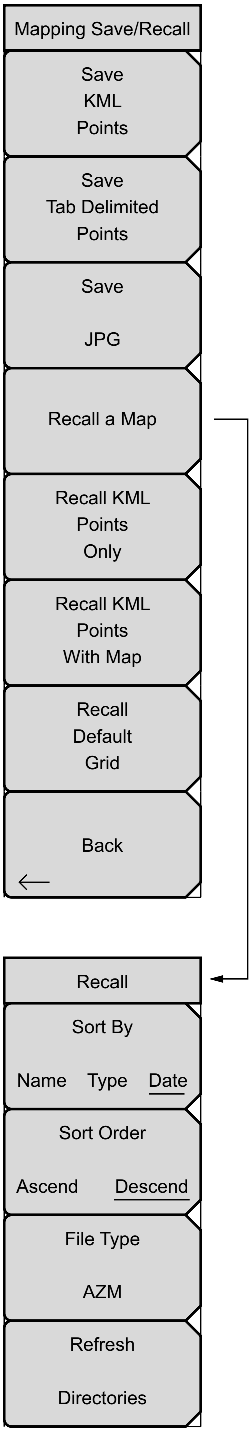
Back: Returns to the “Over-the-Air Menu” on page 5-38 (LTE) or “Over-the-Air Menu” on page 6-41 (TD-LTE).

Start/Stop Data Collection: Press this main menu key to start collection of coverage mapping data based on the settings of Measurement Setup and Point Distance/Time Setup. A running count of collected data points is displayed at the bottom of the map. Press this key again to stop data collection.

Figure 7-8. Coverage Mapping Menu

Mapping Save/Recall Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Save/Recall Points/Map



Save KML Points: Press this button to save the KML points. FileName.kml will be stored in the default save location. From the File menu, press Save, then Change Save Location to change default location. Refer to "Save the Coverage Mapping Information" on page 7-7.

Save Tab Delimited Points: Press this button to save the points in a tab delimited text file. FileName.mtd will be stored in the default location.

Save JPG: Press the Save JPG key to save a .jpg file of the current screen.

Recall a Map: Opens the Recall submenu (shown at the bottom left of this page) for selecting a map to display on the screen. The default map type is .azm. Press the File Type submenu key to select a different map type to recall.

Recall KML Points Only: Opens the Recall submenu for selecting a .kml file. Displays the saved locations overlaid on the current map or the default grid.

Recall KML Points With Map: Opens the Recall submenu for selecting a .kml file. The map that was used when the points were saved will be recalled if it is available.

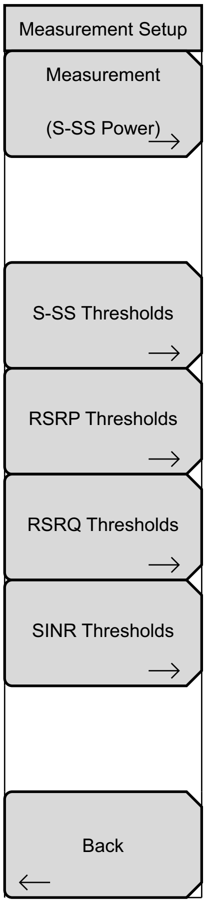
Recall Default Grid: If you do not have a GPS embedded map but are out in the field making measurements, the Recall Default Grid submenu allows you to save points and the corresponding GPS coordinates (or screen coordinates for indoor maps) to view at a later time. You can also load the map after acquiring points, or switch maps at any time without losing data.

Back: Returns to the "Coverage Mapping Menu" on page 7-12.

Figure 7-9. Mapping Save/Recall Menu

Measurement Setup Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Measurement Setup



Measurement: Press and select which measurement to map on the screen: S-SS Power, RSRP, RSRQ or SINR. All measurements are stored as part of the saved file:

S-SS Thresholds: Opens the SS Power menu for setting threshold levels.

> **SS-Power:** Set the SS Power threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

RSRP Thresholds: Opens the RSRP Levels menu for setting threshold levels.

> **RSRP Levels:** Set the RSRP threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

RSRQ Thresholds: Opens the RSRQ Levels menu for setting threshold levels.

> **RSRQ Levels:** Set the RSRQ threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

SINR Thresholds: Opens the SINR Levels menu for setting threshold levels.

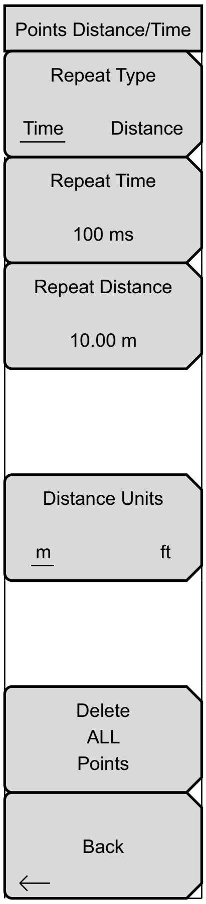
> **SINR Levels:** Set the SINR threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

Back: Returns to the “Coverage Mapping Menu” on page 7-12.

Figure 7-10. Measurement Setup Menu

Point Distance/Time Setup Menu

Key Sequence: **Measurements** > Over-the-Air > Mapping > Point Distance/Time Setup



Repeat Type: Toggles between using a Time or Distance interval for capturing data. Refer to "Measurement Setup" on page 7-6. You may have to move the instrument around for data collection, and you may need to tap the touchscreen if indoors.

Repeat Time: When the Repeat Type is Time and GPS is turned On for outdoor coverage mapping, use this submenu key to set the time interval between measurements. For indoor mapping (GPS is Off), the instrument interpolates position measurements in a straight line between each pair of screen-tap locations.

Repeat Distance: When the Repeat Type is Distance and GPS is turned On for outdoor mapping, use this submenu key to set the distance interval between measurements. For indoor mapping (GPS is Off), the instrument places all new measurements at the next screen-tap location.

Distance Units: Toggles the unit of measure between meters and feet.

Delete ALL Points: Deletes any and all map points.

Back: Returns to the "Coverage Mapping Menu" on page 7-12.

Figure 7-11. Point Distance/Time Setup Menu

Chapter 8 — EMF (Option 444)

Note	Not all instrument models offer every option. Please refer to the Technical Data Sheet of your instrument for available options.

8-1 Introduction

Option 444 adds the EMF Measurement menu to the Over-the-Air LTE and TD-LTE measurement modes. It must be used in conjunction with the Anritsu isotropic antenna, at a frequency range that is within specification of the instrument and antenna used. Refer to the isotropic antenna and signal analyzer technical data sheets.

8-2 Connecting the Antenna

1. Connect the antenna RF connector to the **Analyzer/RF In** port on the instrument. See Figure 8-1. The antenna connector must be *finger* tight.
2. Connect the antenna USB connector to one of the USB Type A ports on the instrument.

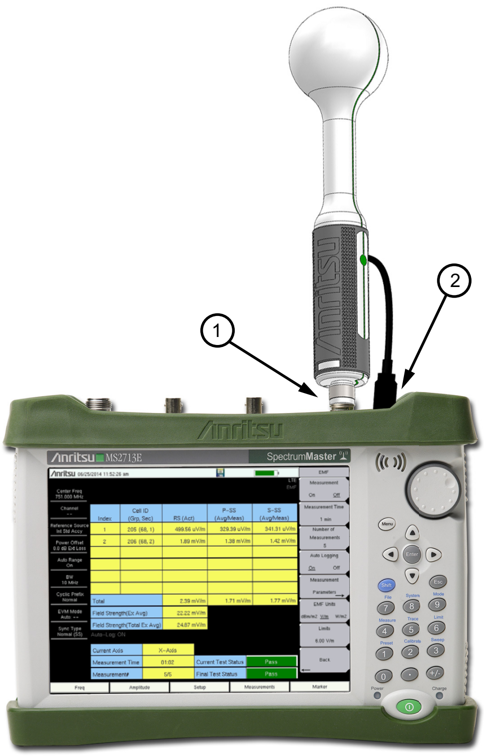
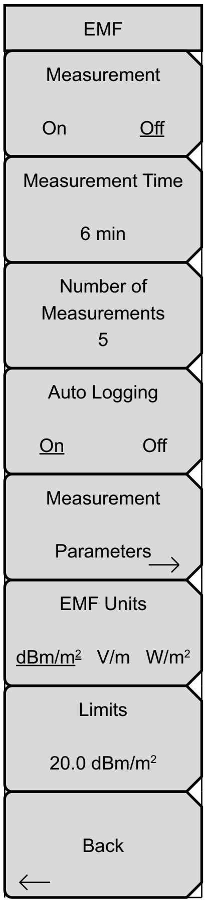


Figure 8-1. Connecting the Anritsu Isotropic Antenna

8-3 LTE/TD-LTE EMF Menu

Key Sequence: **Measurements** > Over-the-Air > EMF



Measurement On/Off: Starts the EMF Measurement and removes access to all other menu buttons. The measurement turns On only if the Center Frequency is set within the valid range and the Anritsu Isotropic Antenna is connected.

Note that the Measurement Time and other related parameters must be set before starting the measurement. This button is useful for stopping or restarting measurements when settings need to be changed. When the measurement is in progress, access to other menus and key presses are blocked.

Measurement Time: Sets the duration of each EMF measurement from one minute up to 30 minutes. The default is 6 min. The instrument captures over-the-air data for the X axis when a valid sync signal is found and a valid Cell ID exists, then moves to the Y and Z axes. There is no axis dwell time parameter. You will get as many isotropic results for the set of three axes as can be obtained within the specified Measurement Time.

When no valid sync signal is found for the current axis, data captured for this axis will be excluded from the measurement results and the instrument moves to the next axis. Refer to "Measurement Results (LTE/TD-LTE)" on page 8-7.

Number of Measurements: Sets the number of EMF measurements to complete from 1 up to 10,000. The EMF test is fully executed when the specified number of measurements have completed.

Auto Logging On/Off: Auto Logging is On by default. This must be selected prior to starting the measurements for the results to be logged. The average, max, and min values of each isotropic set of three axes, the isotropic trace data, and the computed total average, max, and min values are saved in a tab delimited text file in internal memory.

The location of this log file is a new folder named with the current time stamp followed by _1, and created in "/Internal Memory/EMF/". The folder can hold 100 files. Each file holds five measurements. The 101st file and the files created thereafter are stored in a new folder with the same time stamp as the first, followed by _2 (then _3, and so on). Each file has its own time stamp.

Measurement Parameters: Opens the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

EMF Units: dBm/m^2, V/m, and W/m^2 are the currently supported units. V/m is the default unit.

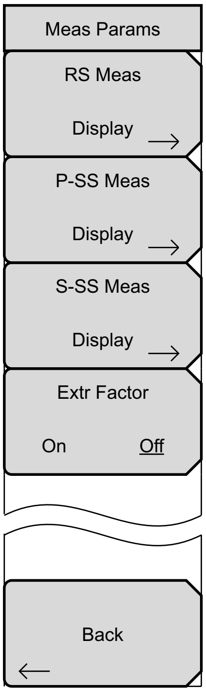
Limits: A single number can be entered. The Field Strength (Avg) value is the running average for the current Measurement Time and should stay below this limit (default 6 V/m) for the test to pass. When the Extrapolation Factor is On (refer to "Meas Params Menu (LTE/TD-LTE)" on page 8-3), the Field Strength (Avg) is extrapolated and the computed value should stay below the limit for the test to pass.

Back: Returns to the previous menu.

Figure 8-2. LTE/TD-LTE EMF Menu

Meas Params Menu (LTE/TD-LTE)

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters



RS Meas Display: Opens the “RS Display Menu” on page 8-4.

P-SS Meas Display: Opens the “P-SS Display Menu” on page 8-5.

S-SS Meas Display: Opens the “S-SS Display Menu” on page 8-6.

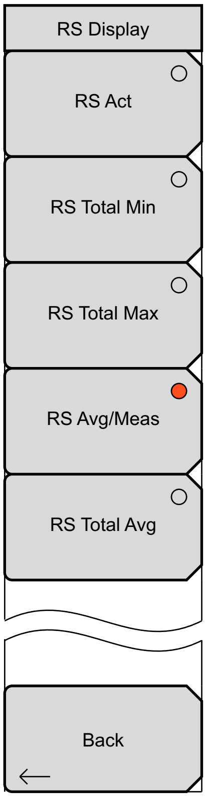
Extr Factor On/Off: Toggles On/Off the Extrapolation Factor. The extrapolation factor, if turned On, displays the extrapolated field strength number for the selected capture bandwidth.

Back: Returns to the “LTE/TD-LTE EMF Menu” on page 8-2.

Figure 8-3. LTE/TD-LTE Meas Params Menu

RS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > RS Meas Display



The displayed **Reference Signal** parameters below can be changed at the start or at the end of the measurement cycle. All of the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

RS Act: Selects the display of Actual Value (current isotropic number).

RS Total Min: Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

RS Total Max: Selects the display of Total Max, which is the maximum value for the entire measurement period.

RS Avg/Meas: Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

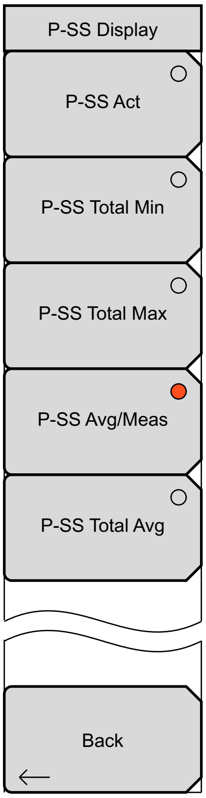
RS Total Avg: Selects the display of Total Avg, which is the running average for the entire measurement period.

Back: Returns to the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

Figure 8-4. RS Display Menu

P-SS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > P-SS Meas Display



The displayed **Primary Synchronization Signal** parameters below can be changed at the start or at the end of the measurement cycle. All of the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

P-SS Act: Selects the display of Actual Value (current isotropic number).

P-SS Total Min: Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

P-SS Total Max: Selects the display of Total Max, which is the maximum value for the entire measurement period.

P-SS Avg/Meas: Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

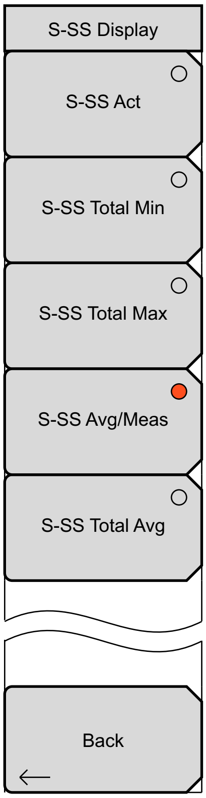
P-SS Total Avg: Selects the display of Total Avg, which is the running average for the entire measurement period.

Back: Returns to the "Meas Params Menu (LTE/TD-LTE)" on page 8-3.

Figure 8-5. P-SS Display Menu

S-SS Display Menu

Key Sequence: **Measurements** > Over-the-Air > EMF > Measurement Parameters > S-SS Meas Display



The displayed **Secondary Synchronization Signal** parameters below can be changed at the start or at the end of the measurement cycle. All the parameters are always computed and stored. Once the measurement is complete, any combination of parameters can be viewed (three at a time and in any one of the desired units).

S-SS Act: Selects the display of Actual Value (current isotropic number).

S-SS Total Min: Selects the display of Total Min, which is the minimum value for the entire measurement period (Measurement Time × Number of Measurements).

S-SS Total Max: Selects the display of Total Max, which is the maximum value for the entire measurement period.

S-SS Avg/Meas: Selects the display of Avg/Meas, which is the running average for the current Measurement Time. This is the default selection.

S-SS Total Avg: Selects the display of Total Avg, which is the running average for the entire measurement period.

Back: Returns to the “Meas Params Menu (LTE/TD-LTE)” on page 8-3.

Figure 8-6. S-SS Display Menu

Measurement Results (LTE/TD-LTE)

The measurement starts by setting the antenna's X axis and capturing over-the-air data. If a sync signal is found and a valid Cell ID exists, then the following parameters are detected and stored: the channel power in 1.4 MHz bandwidth, the Cell ID, RS, P-SS, and S-SS (all per Resource Element). This is repeated for Y and Z axes. If any one of the axes has a valid Cell ID, the isotropic result (for example, $(RS^2{}_X + RS^2{}_Y + RS^2{}_Z)^{0.5}$) for each of the above parameters is displayed as the Actual result.

The Measurement Parameters submenu (refer to page 8-3) lets you choose which computed result is displayed in the measurements table, in each of the RS, P-SS, and S-SS columns. See Figure 8-7. The choices of display parameters are: Actual, Total Min, Total Max, Avg/Meas (the default), and Total Avg.

Total Min, Total Max, and Total Avg are the min, max, and average values computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements). Avg/Meas is the running average of the isotropic results computed from all measurements completed thus far within the specified Measurement Time.

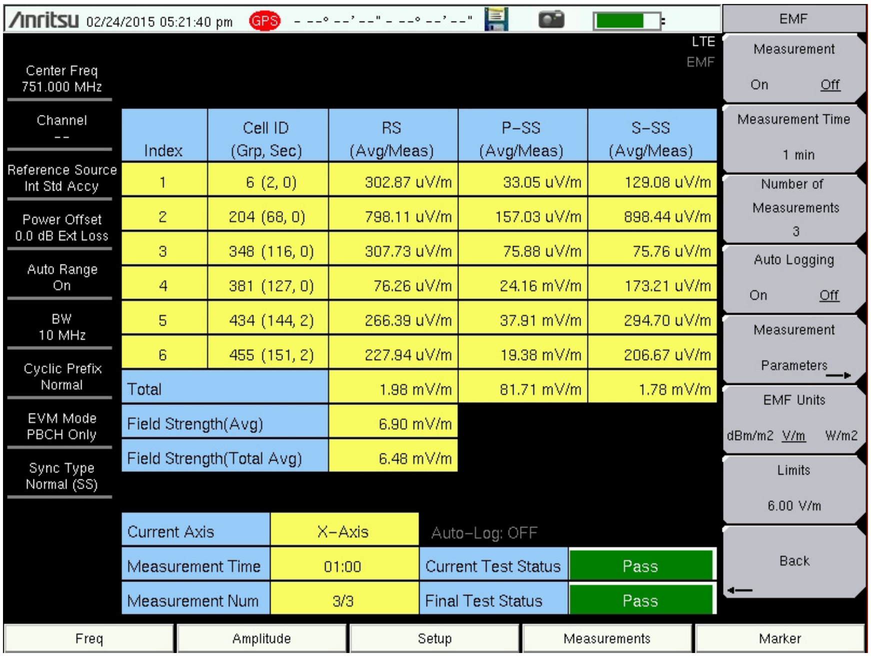


Figure 8-7. LTE EMF Measurement Results

There is no axis dwell time parameter. If a sync signal is not found within a specific time, data for the current axis is excluded and the instrument switches to the next axis. The Field Strength number is still computed and compared with the specified limit to determine the Pass or Fail status at the end of the measurement period (Measurement Time × Number of Measurements).

Field Strength (Avg) is the running average for the current Measurement Time. Field Strength (Total Avg) is the running average for all measurements completed thus far within the measurement period.

When the extrapolation factor is turned Off, the Field Strength number is the measured Channel Power in a 1.4 MHz bandwidth. Changing the bandwidth (BW) setting in the Setup menu does not change this number.

If the extrapolation factor is On, the Field Strength (E_{max}) is computed as follows:

$$E_{max} = E_{cp} \times N_{cp}$$

where E_{cp} is the RMS value of the channel power recorded in each axis and N_{cp} is the number of subcarriers divided by 72. The number of subcarriers can be provided by the network operator or can be calculated from Table 8-1. The selected channel bandwidth (BW key in the instrument Setup main menu) determines the number of subcarriers. The default BW is 1.4 MHz.

Table 8-1. Field Strength Numbers

Channel Bandwidth (MHz)	Subcarriers
1.4	72
3	180
5	300
10	600
15	900
20	1200

Assuming that all subcarriers in the BW setup are at the same power level, the Field Strength value for other BW setups can be extrapolated based on the Channel Power in 1.4 MHz BW. The Field Strength cell labels in the table are updated with an *Ex*, such as Field Strength (Ex Avg), to indicate the extrapolation factor has been applied. See Figure 8-8 on page 8-9.

The displayed values are measurement results from the BW setup made prior to starting the measurement. Changing the BW setup, hence the extrapolation factor, after the measurement is complete has no effect on the currently displayed values.

If a valid Cell ID is obtained even once during the entire measurement period, an entry will be made in the table. “--” indicates an invalid result. A maximum of six cell IDs can be detected. The Total row sums the isotropic numbers for the selected display parameter across Cell IDs.

Pass/Fail

The limit check is done at the end of each Measurement Time. If the Field Strength (Avg), with or without extrapolation, exceeds the set limit, the Current and the Final Test Status are marked as Fail in red. If the Field Strength (Avg) does not exceed the limit, the Current Test Status is marked as Pass in green. In the example in Figure 8-8, the extrapolated Field Strength (Ex Avg) is 22.22 mV/m.

If all of the measurements pass, the Final Test Status is updated to Pass in green.

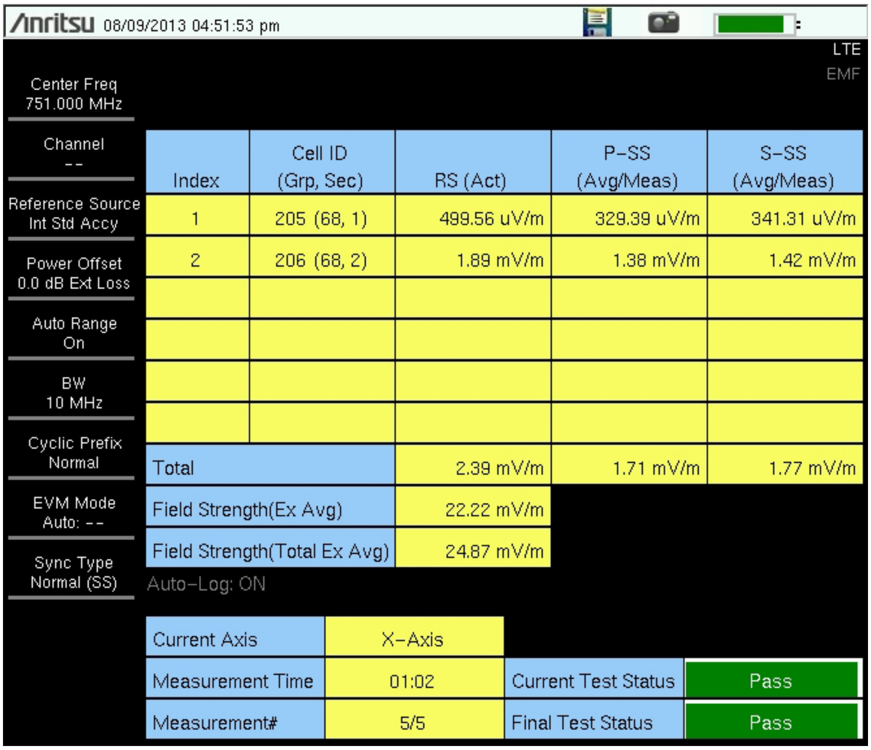
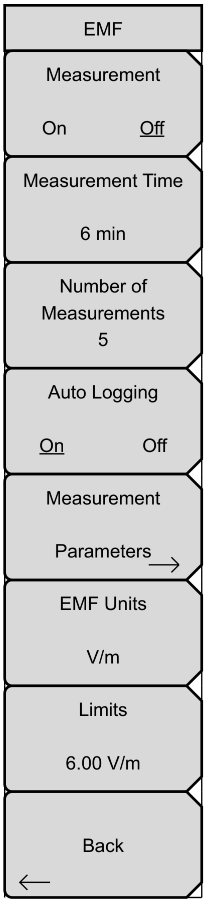


Figure 8-8. LTE/TD-LTE EMF Measurement Display

8-4 W-CDMA EMF Menu

Key Sequence: **Measurements** > OTA > EMF



Measurement On/Off: Starts the EMF Measurement and removes access to all other menu buttons. The measurement turns On only if the Center Frequency is set within the valid range and the Anritsu Isotropic Antenna is connected.

Note that the Measurement Time and other related parameters must be set before starting the measurement. This button is useful for stopping or restarting measurements when settings need to be changed. When the measurement is in progress, access to other menus and key presses are blocked.

Measurement Time: Sets the duration of each EMF measurement from one minute up to 30 minutes. The default is 6 min. The instrument captures over-the-air data for the X axis when a sync signal is found and there is a valid scrambling code, then moves to the Y and Z axes. There is no axis dwell time parameter. You will get as many isotropic results for the set of three axes as can be obtained within the specified Measurement Time.

When no valid sync signal is found for the current axis, data captured for this axis will be excluded from the measurement results and the instrument moves to the next axis. Refer to "Measurement Results (W-CDMA)" on page 8-14.

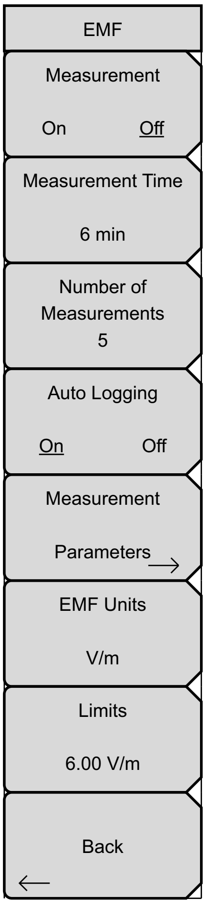
Number of Measurements: Sets the number of EMF measurements to complete from 1 up to 10,000. The EMF test is fully executed when the specified number of measurements have completed.

Auto Logging On/Off: Auto Logging is On by default. This must be selected prior to starting the measurements for the results to be logged. The PCPICH (Primary Common Pilot Channel) and Field Strength actual and average values of the current measurement are stored. The maximum, minimum, and total average values stored are not per measurement, but for all the values captured until that point.

The location of the saved log file is a new folder named with the current time stamp followed by _1, and created in "/Internal Memory/EMF/". The folder can hold 100 files. Each file holds five measurements. The 101st file and the files created thereafter are stored in a new folder with the same time stamp as the first, followed by _2 (then _3, and so on). Each file has its own time stamp.

Measurement Parameters: Opens the "Meas Params Menu (W-CDMA)" on page 8-12.

Figure 8-9. W-CDMA EMF Menu (1 of 2)



EMF Units: The unit choices are dBm/m^2, V/m, W/m^2, % of Limit (V/m), and % of Limit (W/m^2). V/m is the default unit.

% of Limit (V/m) and % of Limit (W/m^2) display the measured numbers as a percentage of the selected limit. The submenu key shows the currently selected EMF unit. If the selected base unit is in V/m or % of Limit (V/m), the averaging over the selected period is done in Volt units; if any of the other units are selected, the measurements are performed in power (Watt) units. If you change the EMF units at the end of the measurement, the values displayed are converted from the base units used during the measurement.

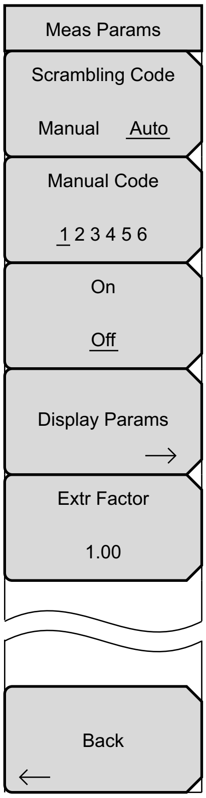
Limits: A single number can be entered. The Field Strength (Avg) value should stay below this limit (default 6 V/m) for the test to pass.

Back: Returns to the previous menu.

Figure 8-10. W-CDMA EMF Menu (2 of 2)

Meas Params Menu (W-CDMA)

Key Sequence: **Measurements** > OTA > EMF > Measurement Parameters



Scrambling Code: Press this key to toggle between Auto or Manual scrambling code. Auto scrambling code determines the scrambling code automatically.

The choice of Auto or Manual scrambling codes and the code lock/reset options function in the same manner as Scrambling Code in W-CDMA OTA measurement mode. Refer to "OTA Setup Menu" on page 3-39.

Manual Code: Press this submenu key to select a scrambling code index, 1 through 6. The key is active only in Manual mode, which is selected using the Scrambling Code submenu key.

Refer to "General Measurement Setups" on page 3-5 for details on manually setting up the scrambling code and related parameters.

On Off: Switches On/Off the manual codes.

Display Params: Opens the "Display Menu" on page 8-13. Enter this submenu to select the parameter you want displayed in the rightmost column of the measurement results table.

Extr Factor: The extrapolation factor, when turned On (> 1), displays the extrapolated P-CPICH numbers. The field strength values are not extrapolated.

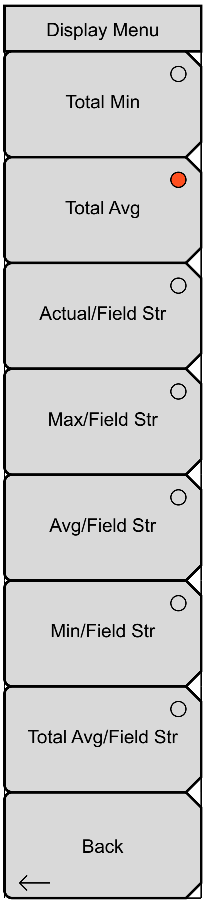
This parameter can be set between 1 and 100 (the network operator can provide this number). It can be used to provide a safety margin in case of an increase in transmit power from an LTE station. The fine tuning may be based on operator input (system setup/power ratio) and/or per regulatory requirements (margins). Refer to "Measurement Results (W-CDMA)" on page 8-14.

Back: Returns to the "W-CDMA EMF Menu" on page 8-10.

Figure 8-11. W-CDMA Meas Params Menu

Display Menu

Key Sequence: **Measurements** > OTA > EMF > Measurement Parameters > Display Params



Press one of the keys in this submenu to select which parameter is displayed in the rightmost column of the measurement results table. The default selection is Total Avg. See Figure 8-13 on page 8-14.

The parameter to be displayed can be changed at the start or at the end of the measurement cycle. All the parameters are always computed and stored. Once the measurement is complete, any parameter can be viewed in the desired units and with the desired extrapolation factor.

Total Min is the minimum value computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements).

Total Avg is the average value computed from all measurements completed thus far within the measurement period.

The remaining choices are coverage measurements computed as a ratio of common pilot signal to the channel power (5 MHz bandwidth):

Actual/Field Str

Max/Field Str

Avg/Field Str

Min/Field Str

Total Avg/Field Str

Back: Returns to the “Meas Params Menu (W-CDMA)” on page 8-12.

Figure 8-12. W-CDMA Display Menu

Measurement Results (W-CDMA)

The measurement starts by setting the antenna's X axis and capturing over-the-air data. If a sync signal is found and there is a valid scrambling code, the PCPICH and Channel Power in 5 MHz bandwidth are stored. This is repeated for Y and Z axes. If any one of the axes has a valid scrambling code, the isotropic result (for example, $(PCPICH^2{}_X + PCPICH^2{}_Y + PCPICH^2{}_Z)^{0.5}$) for each of the above parameters is displayed as the Actual result.

The PCPICH Actual, Total Max, and Avg/Meas parameters are displayed as fixed columns in the measurement results table. See Figure 8-13. Total Max is the max value computed from all measurements completed thus far within the measurement period (Measurement Time × Number of Measurements). Avg/Meas is the running average of the isotropic results computed from all measurements completed thus far within the specified Measurement Time.

Using the Display Params submenu, you can select the computed result to display in the rightmost table column. Refer to "Display Menu" on page 8-13.

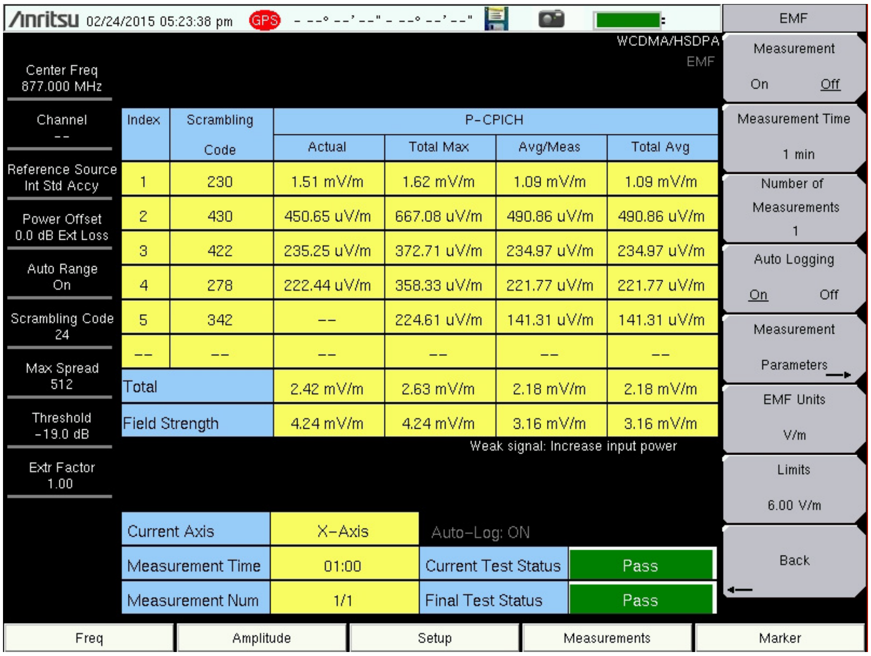


Figure 8-13. W-CDMA EMF Measurement Results

There is no axis dwell time parameter. If a sync signal is not found within a specific time, data for the current axis is excluded and the instrument switches to the next axis.

The Field Strength number is the measured Channel Power in a 5 MHz bandwidth.

If the extrapolation factor is turned On, the E_{max} value is the extrapolated PCPICH for Total Max, Total Min, Total Avg, or Avg/Meas, and is computed as follows:

$$E_{max} = E_{pcpich} \times \sqrt{k}$$

where E_{pcpich} is the root sum square (rss) value of the common pilot signal recorded in each axis and k is the extrapolation factor provided by the network operator. For example:

$$E_{max\ (pcpich\ total\ max)} = E_{pcpich\ total\ max} \times \sqrt{k}$$

Note	The extrapolation factor k is the ratio of the maximum total output power at the base station to the power of PCPICH at the base station. If there is a power boosting factor (BF), k = (max total output power ÷ P(PCPICH)) ÷ BF. Changing the extrapolation factor immediately updates the displayed values, except for Field Strength. Refer to “Meas Params Menu (W-CDMA)” on page 8-12.

If a valid scrambling code is obtained even once during the entire measurement period, an entry is made in the table. A maximum of 6 scrambling codes can be detected. The Total row sums the isotropic numbers for the selected display parameter across scrambling codes.

If no valid scrambling code is detected for any of the three axes, the isotropic numbers are excluded from all measurement results (Total Max, Total Min, Total Avg, Avg/Meas). In this case, the display will show “--” .

Pass/Fail

The limit check is performed at the end of each Measurement Time. If the Field Strength (Avg/Meas) exceeds the set limit, the Current and Final Test Status are marked as Fail in red. If the Field Strength (Avg/Meas) does not exceed the limit, the Current Test Status is marked as Pass in green. In the example in Figure 8-14, the Field Strength (Avg Meas) is 5.05 mV/m.

If all of the measurements pass, the Final Test Status is updated to Pass in green.

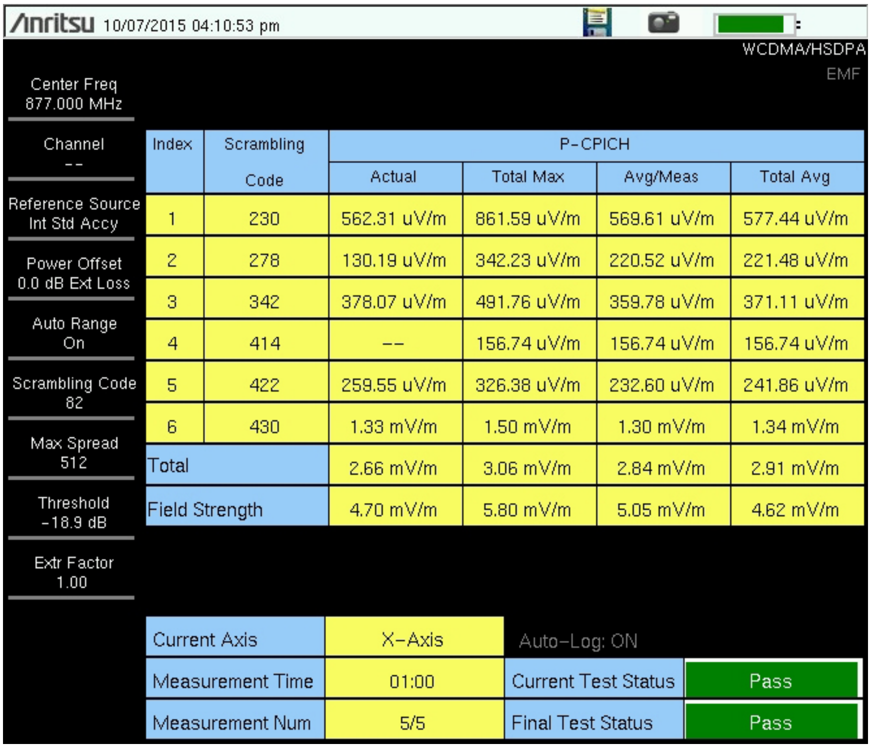


Figure 8-14. W-CDMA EMF Measurement Display

Appendix A — Error Messages

A-1 Introduction

This Appendix provides a list of 3GPP error messages. Self Test and General Operation error messages are in the User Guide.

A-2 3GPP Messages

Warning Messages

1. External Reference not found. Internal reference Locked successfully

   This message is displayed when the instrument has detected an external reference but couldn't lock to the reference. It automatically switches to the Internal Reference. This could happen if the external reference frequency does not match the specified external reference frequency in the Setup menu.

2. External Reference Locked Successfully

Notifications

1. RF Over Power
2. ADC over range
   a. If Auto Range is On - ADC over range: Decrease input power.
   b. If Auto Range is Off - ADC over range: Adjust range or decrease input power.
3. Level Under
   a. If Auto Range is On - No signal detected: Increase input power.
   b. If Auto Range is Off: Adjust range or increase input power.
4. Out of band saturation

   When the software detects that there is too much power outside the current frequency range, this message is displayed. This usually means that the instrument is currently tuned to a frequency with a very low amplitude signal or no signal and there is a strong signal at another frequency outside the current IF bandwidth.

5. Poor Range
   a. If Auto Range is On - Weak signal: Increase input power.
   b. If Auto Range is Off: Adjust range or increase input power.
6. Lock Failure xx

   When there is a lock failure detected from any of the internal LOs, this message is displayed. The xx is usually an error code in hex that can be interpreted by a service center to obtain more information on which LO had the failure.

7. Attempting to lock to Internal ref.
8. Attempting to lock to External ref.

A-3 LTE Messages

1. Sync signal not found

   When the firmware does not find a synchronization signal (P-SS and S-SS), this message is displayed. Measurement results are cleared (‘--’ is seen in the result area for all modulation and Scanner results. Channel Power will continue to be displayed).

2. Demodulation Error

   When a wrong cell ID is entered after setting Sync Type to RS, this message is displayed. All Measurement results are cleared.

A-4 TD-LTE Messages

1. Sync signal not found

   When the firmware does not find a synchronization signal (P-SS and S-SS), this message is displayed. Measurement results are cleared (‘--’ is seen in the result area for all modulation and Scanner results. Channel Power will continue to be displayed).

2. No Trigger found

   When Trigger is set to ‘External’ and no external trigger is found, this message is displayed. Results that depend on the trigger are cleared (‘--’ is seen in the result area)

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