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/HSDPA	Option 44	Option 65	Option 35
TD-SCDMA/HSDPA	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/HSDPA	Option 881
TD-SCDMA/HSDPA	Option 882
LTE/LTE-A (FDD and TDD)	Option 883
NB-IOT	Option 887

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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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 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 on http://www.anritsu.com/ and select the Library tab.

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

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

1-4 3GPP Signal Analysis Overview

This section lists the many modes that use 3GPP signal analysis.

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/HSDPA

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

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

TD-SCDMA/HSDPA

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

- Option 882: TD-SCDMA/HSDPA Measurements (requires Option 9)
  - Option 60*: TD-SCDMA/HSDPA RF Measurements
  - Option 61*: TD-SCDMA/HSDPA Demodulation
  - Option 38*: TD-SCDMA/HSDPA 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".

NB-IoT

Narrow-Band IoT signal analysis is described in Chapter 8, "NB-IoT Signal Analyzer (Option 887)".

EMF Measurements (Option 444)

Option 444 adds EMF measurement capability to the W-CDMA Over-the-Air, LTE Over-the-Air, and TD-LTE measurement modes. For the complete description of this option, refer to the EMF Measurement Guide (10580-00455). This option must be used in conjunction with the Anritsu isotropic antenna in the frequency range specified by the instrument and antenna technical data sheets.

1-5 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.

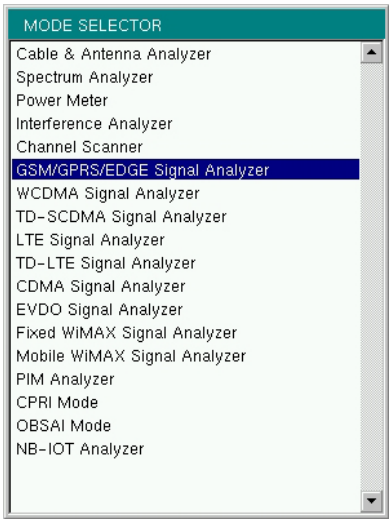


Figure 1-1. Mode Selector List Box

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.

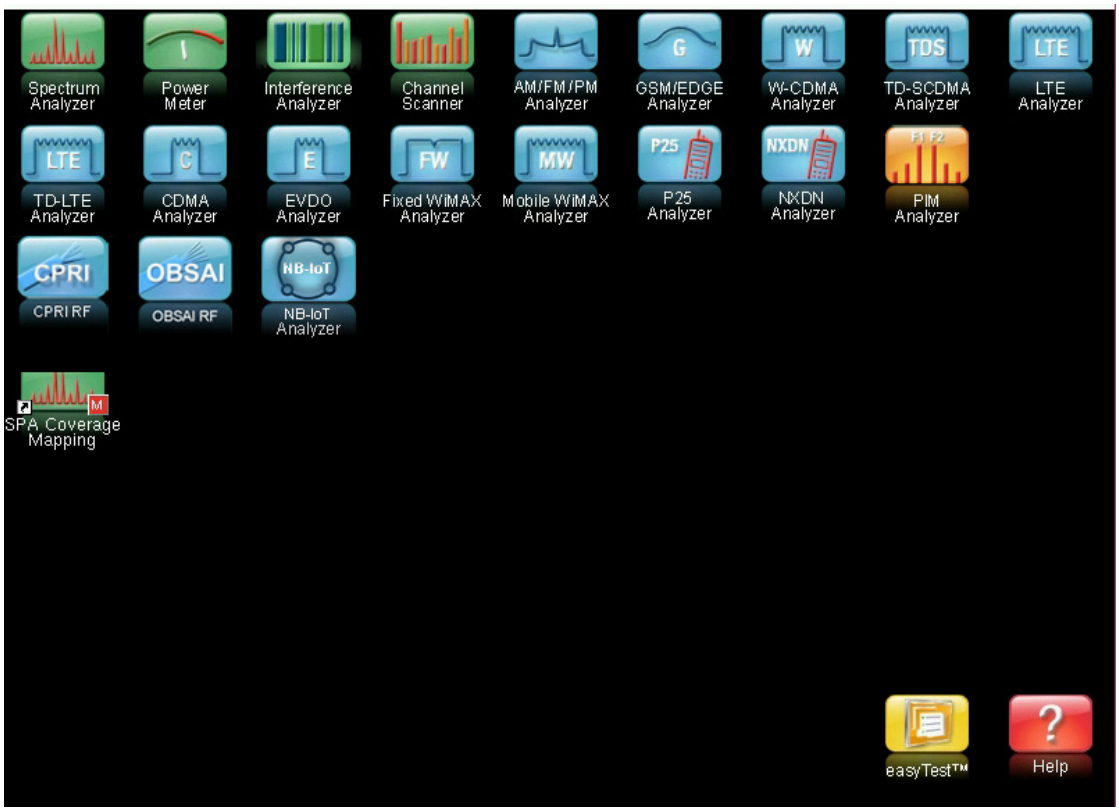


Figure 1-2. Menu Key Screen - Application Icons and User-Defined Shortcuts

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.

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).

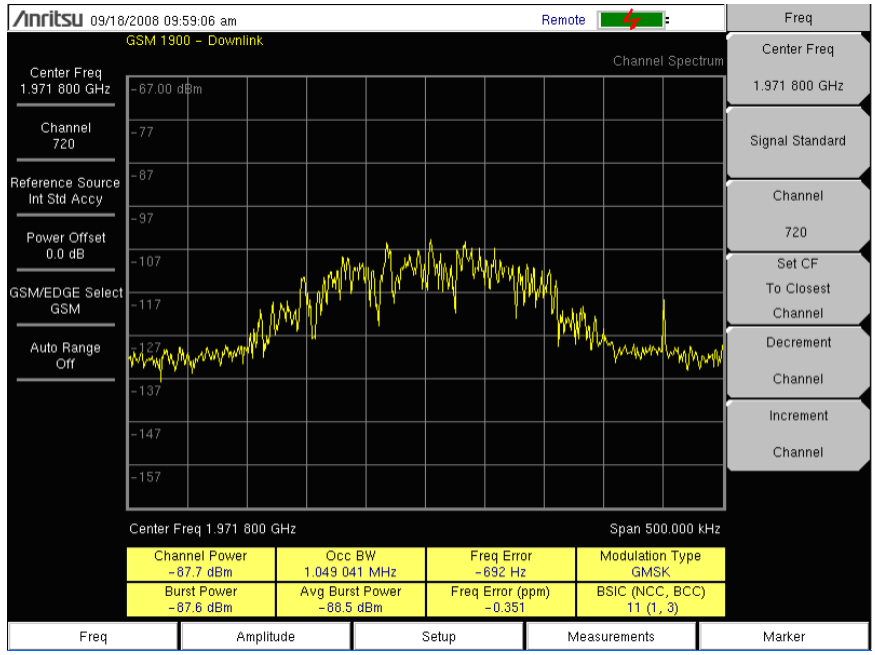


Figure 2-1. GSM Single Channel Measurement

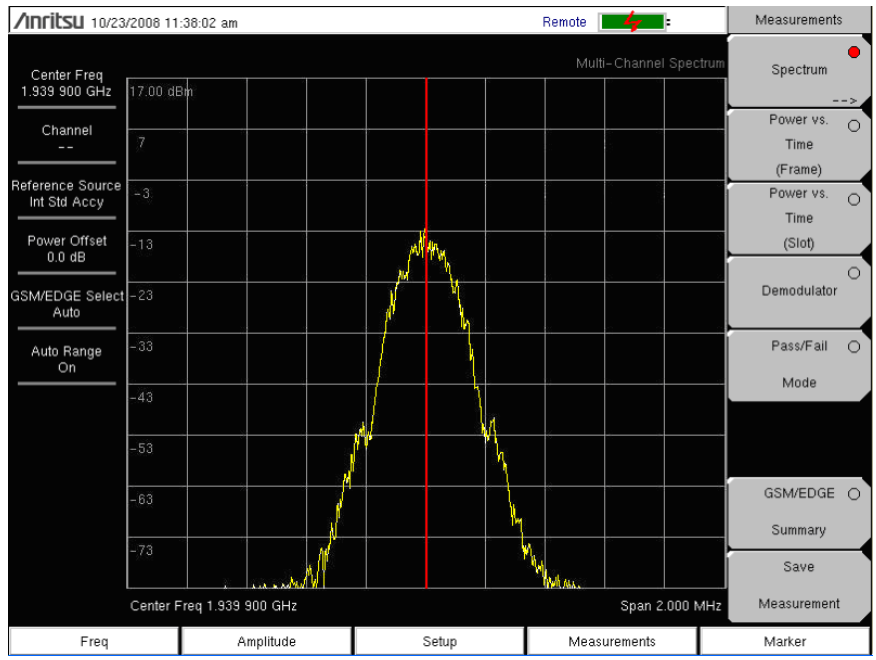


Figure 2-2. GSM Multi-Channel Measurement

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).

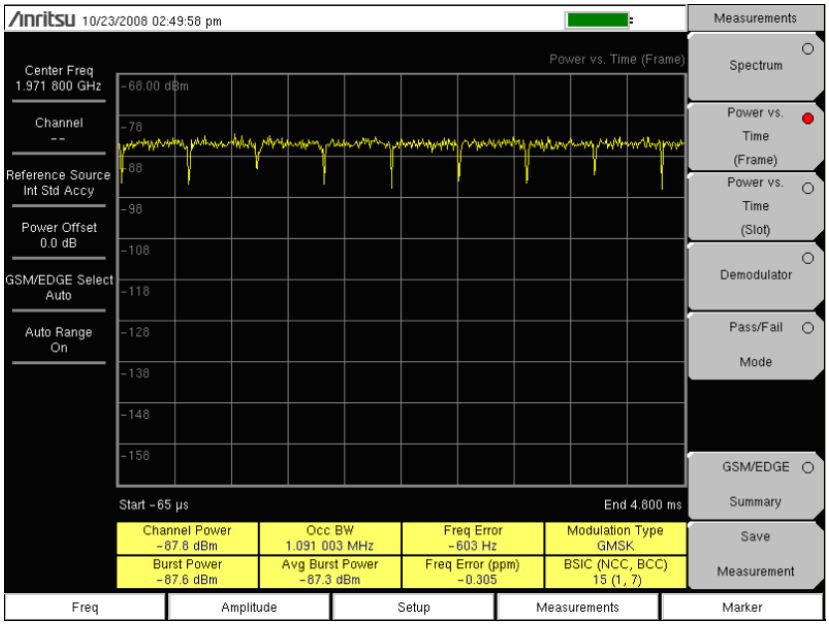


Figure 2-3. GSM Power vs. Time (Frame) Measurement

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.

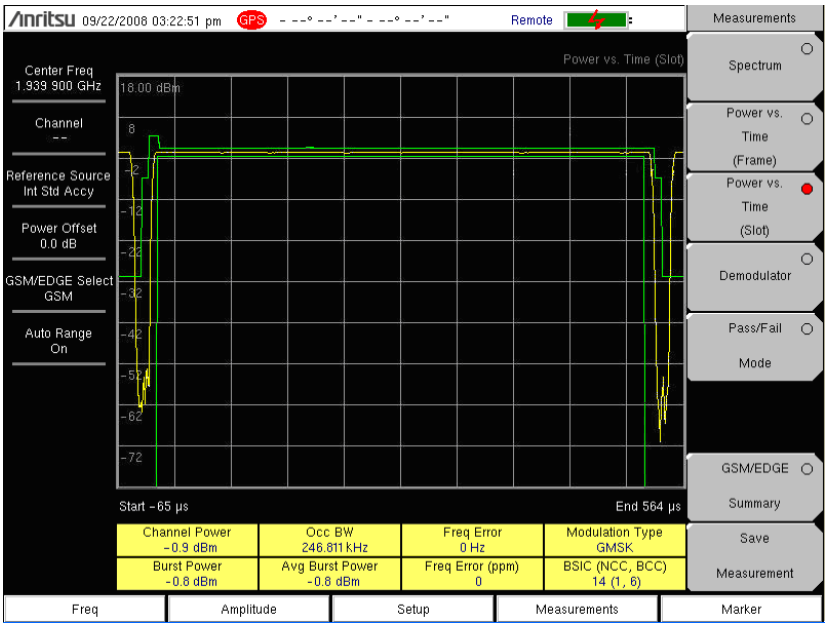


Figure 2-4. GSM Power vs. Time (Slot) Measurement

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.

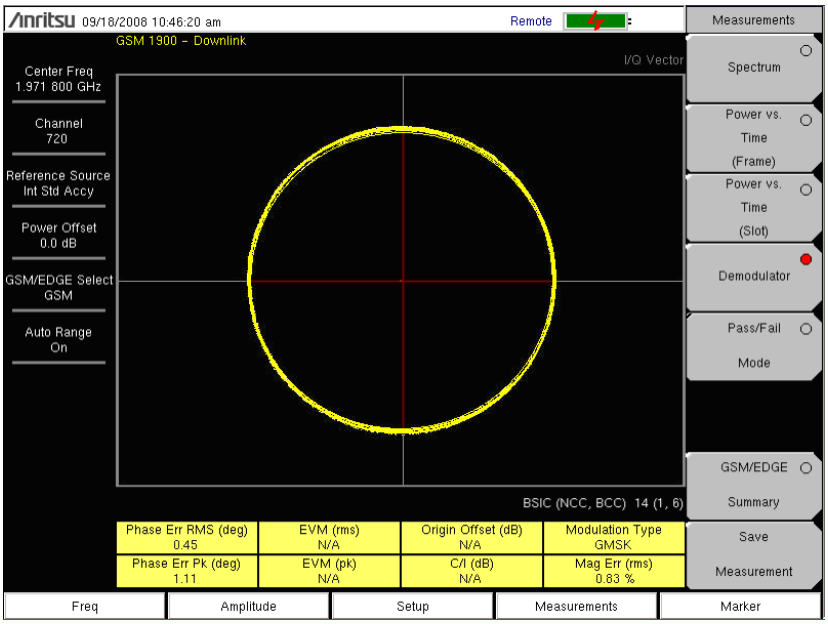


Figure 2-5. GSM Demodulator Measurement

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

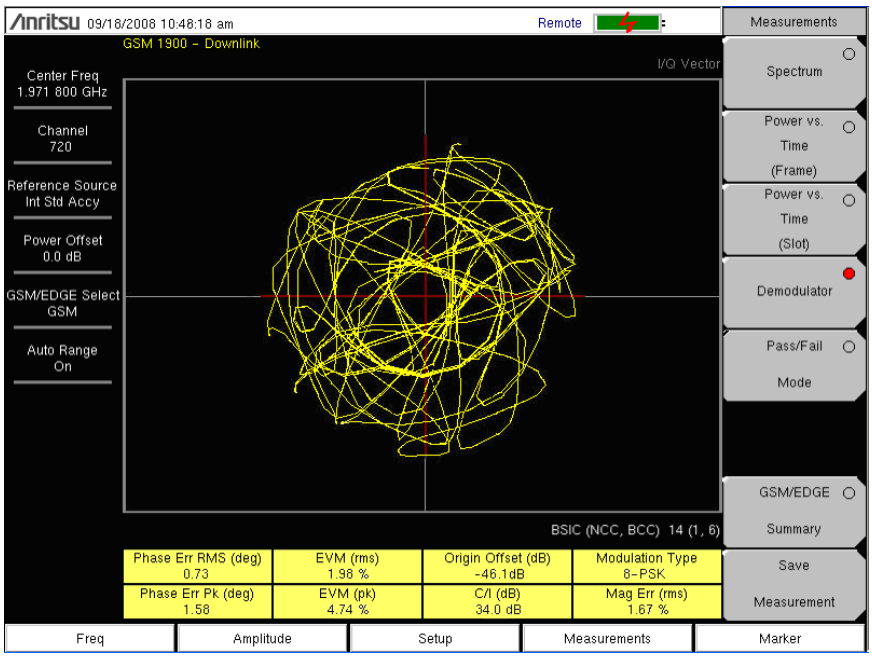


Figure 2-6. EDGE Demodulator Measurement

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

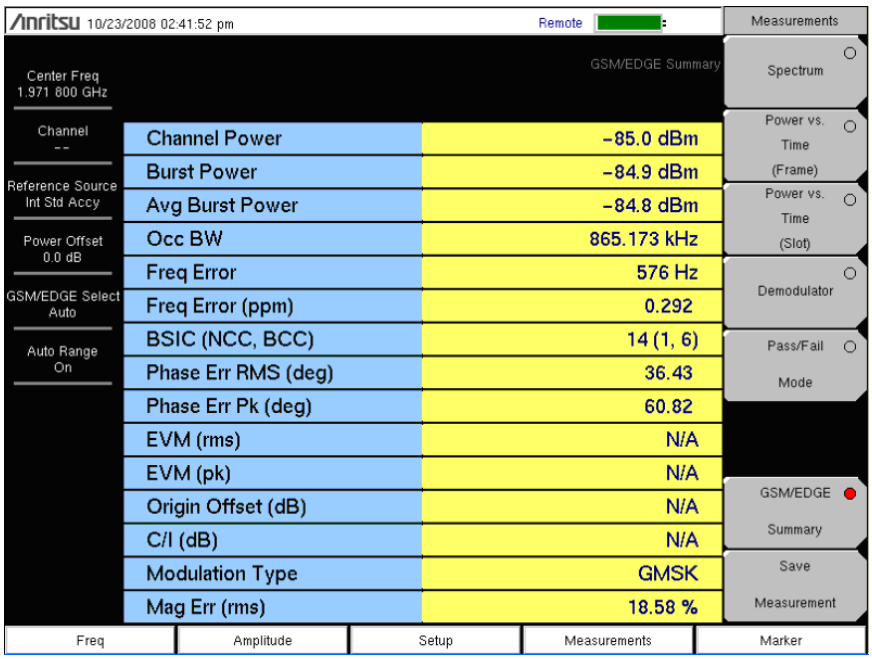


Figure 2-7. GSM/EDGE Summary

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).

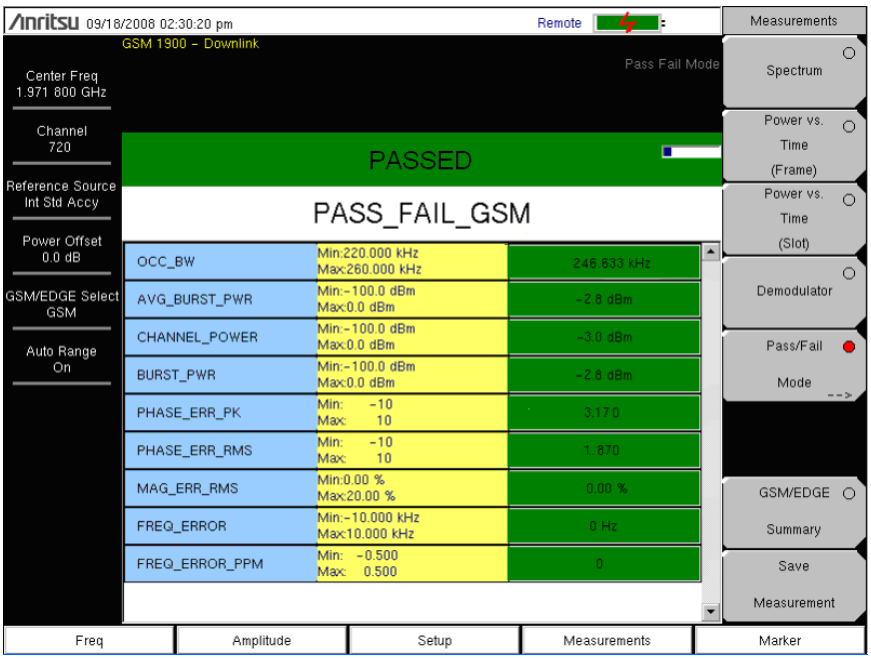


Figure 2-8. Pass/Fail Mode

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.

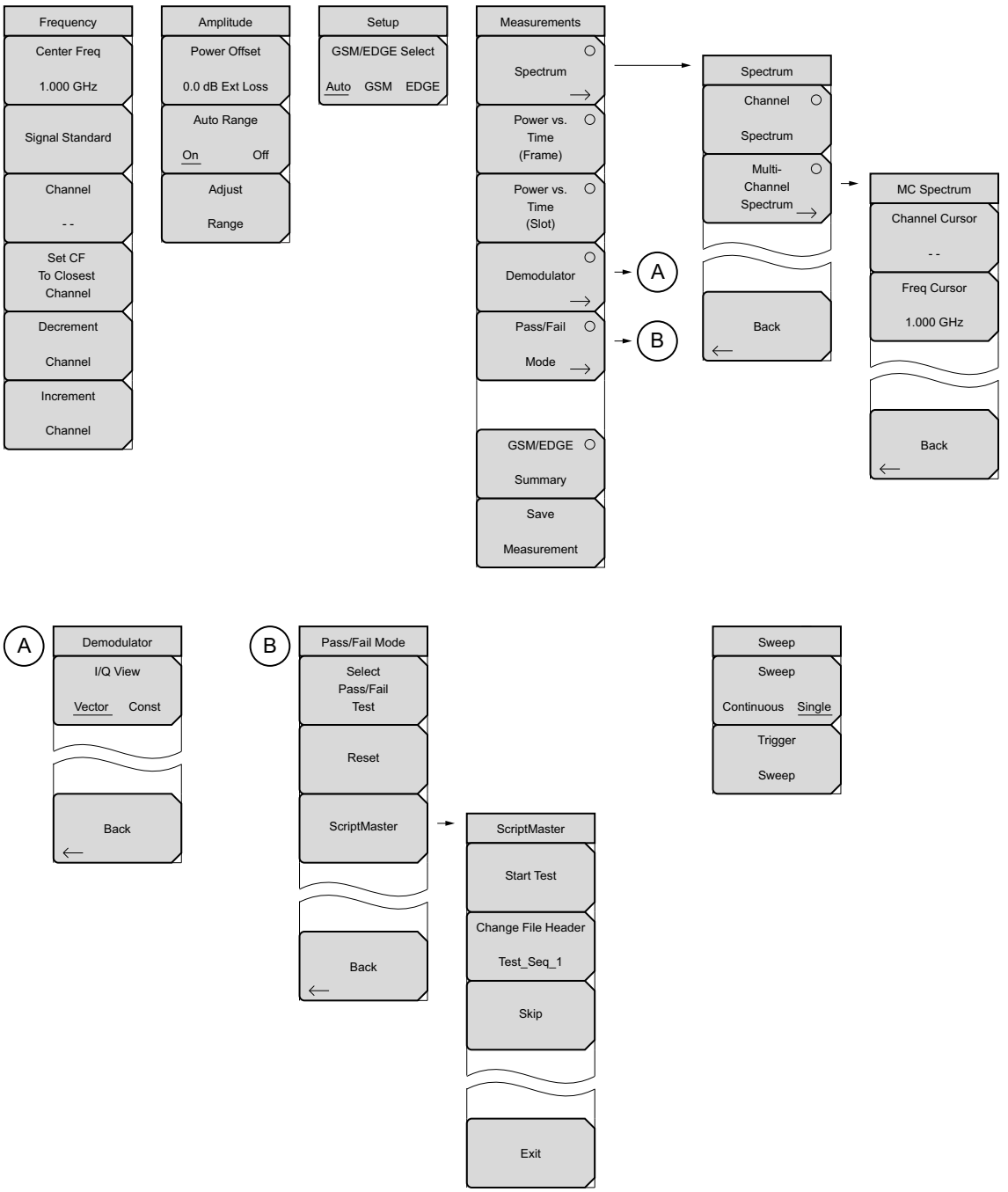
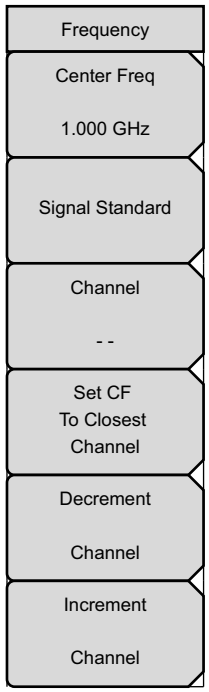


Figure 2-9. GSM/GPRS/EDGE Menu Layout

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.

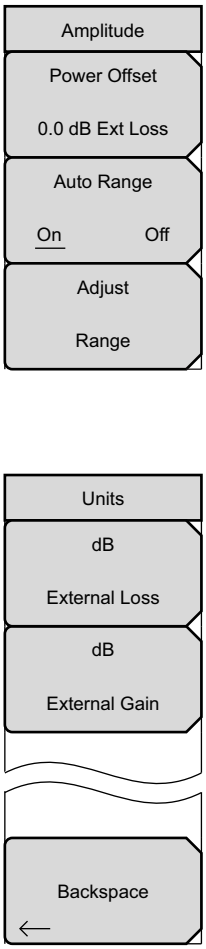
Decrement Channel: Decreases the channel number one channel.

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.

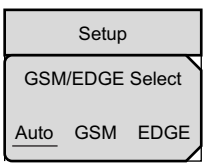
Auto Range: Press this submenu key to toggle the Auto Range function between On and Off. When set to On, the instrument adjusts the reference level automatically for each sweep.

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**

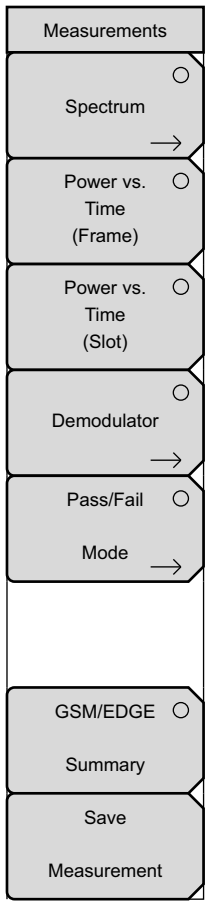


GSM/EDGE Select: Toggles between Auto, GSM and EDGE. Auto allows the instrument to search for a GSM or EDGE signal automatically. Selecting GSM or EDGE sets the instrument to measure only a GSM or EDGE signal.

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.

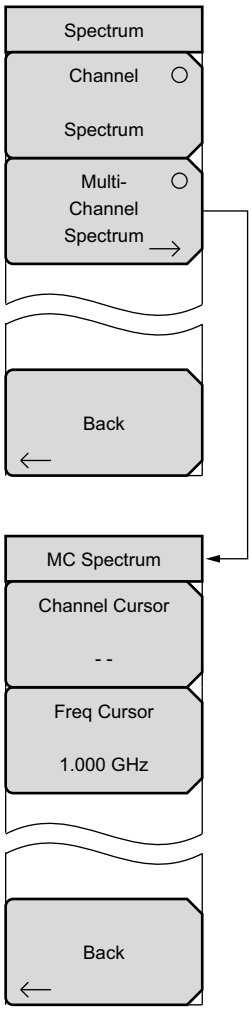
Save Measurement: Opens a dialog window to name and save the current measurement. Refer to the User Guide that came with the instrument for the saving functions.

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:

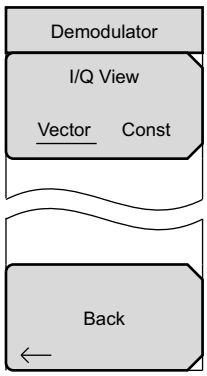
> **Channel Cursor:** Select Channel Cursor to place the cursor at a specific channel location. Use the rotary knob or the **Up/Down** arrow keys to select the channel. Press the **Enter** key to select.
>
> **Freq Cursor:** Select Freq Cursor to place the cursor at a specific frequency. Use the rotary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



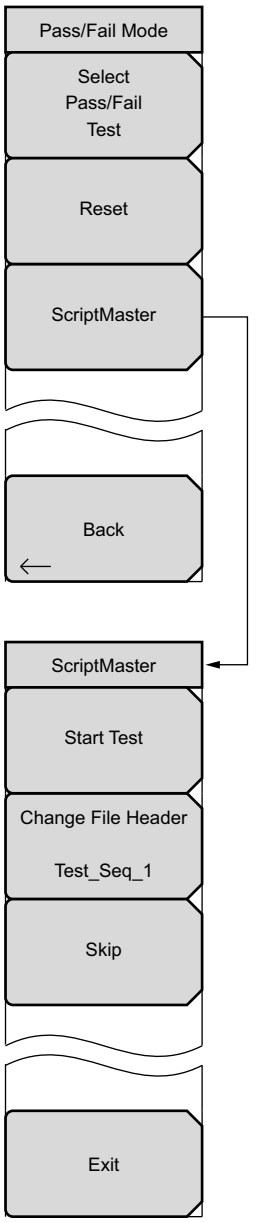
I/Q View: Allows selection between Vector or Const.

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

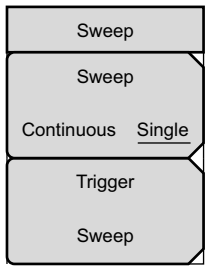
2-13 Marker Menu

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 Continuous/Single: 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/HSDPA Signal Analyzer

3-1 Introduction

The WCDMA/HSDPA 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/HSDPA Demodulator option demodulates both W-CDMA and HSDPA 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/HSDPA 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	Vlewable 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	HSDPA Screen and CDP Screen when the W-CDMA/HSDPA 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.

HSDPA Power versus Time Display

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

Constellation

In the HSDPA 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/HSDPA 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/HSDPA RF Measurements

The W-CDMA/HSDPA 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.

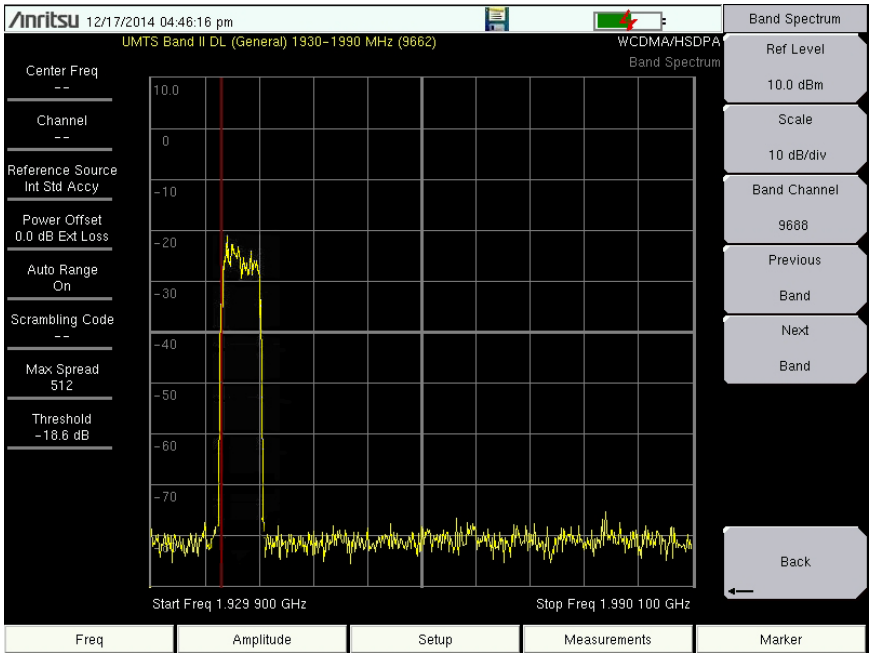


Figure 3-1. Band Spectrum

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.

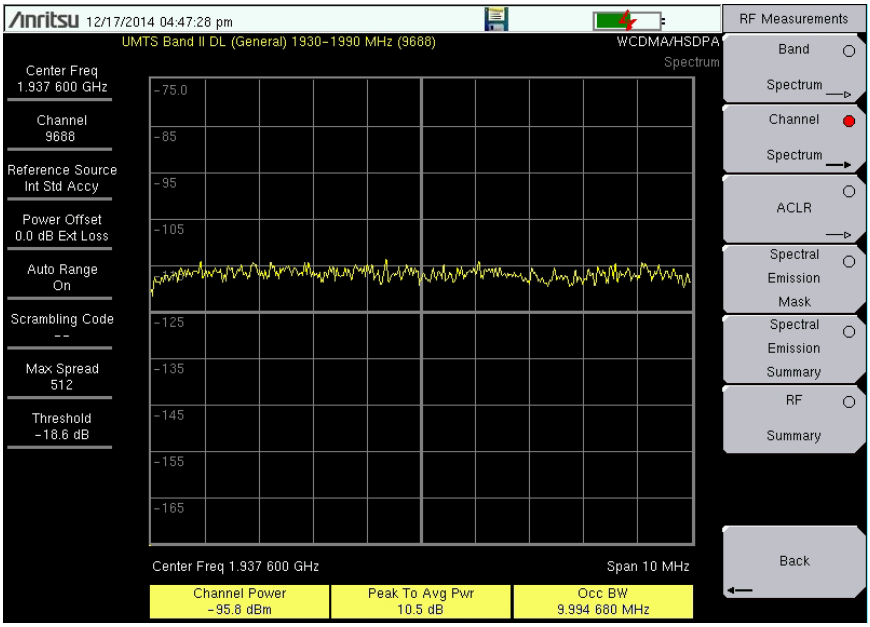


Figure 3-2. Channel Spectrum

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).

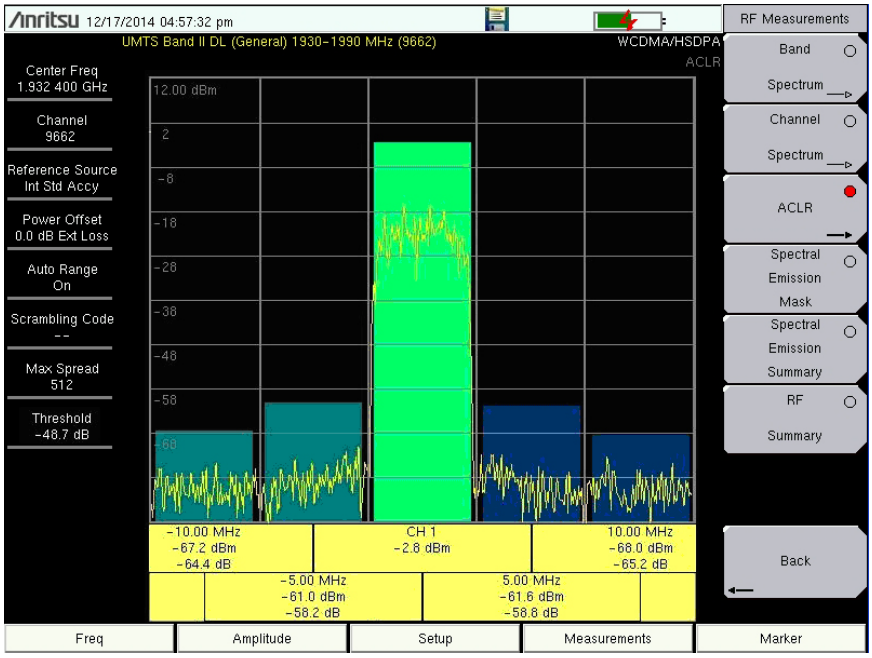


Figure 3-3. ACLR Measurement

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.

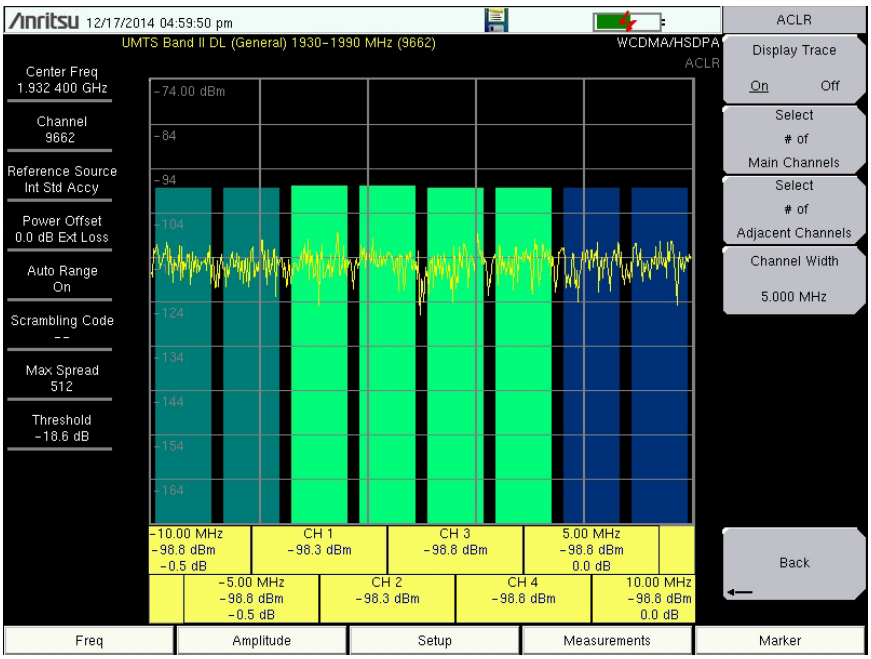


Figure 3-4. ACLR Multi-channel Measurement

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).

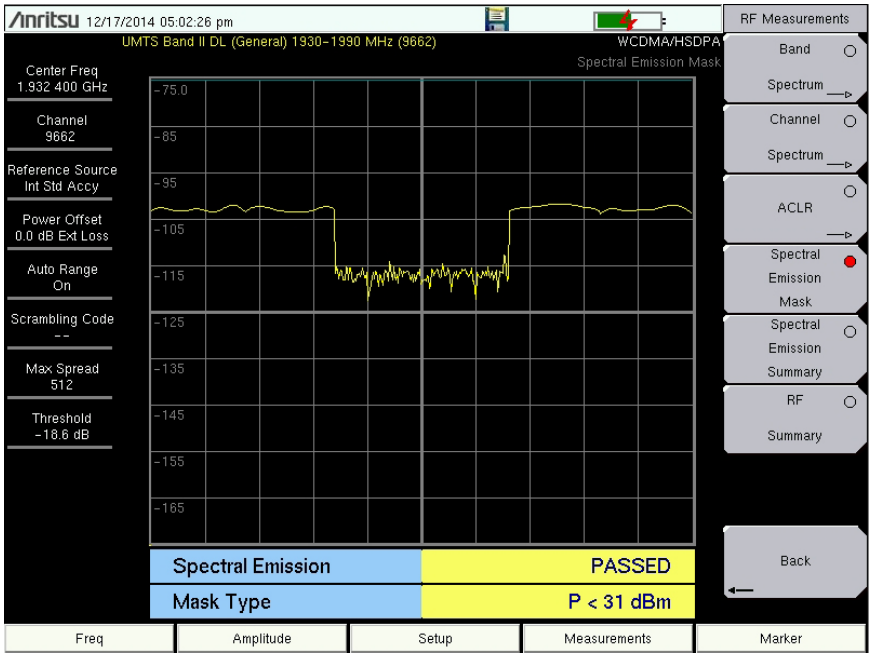


Figure 3-5. Spectral Emission Mask Measurement

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

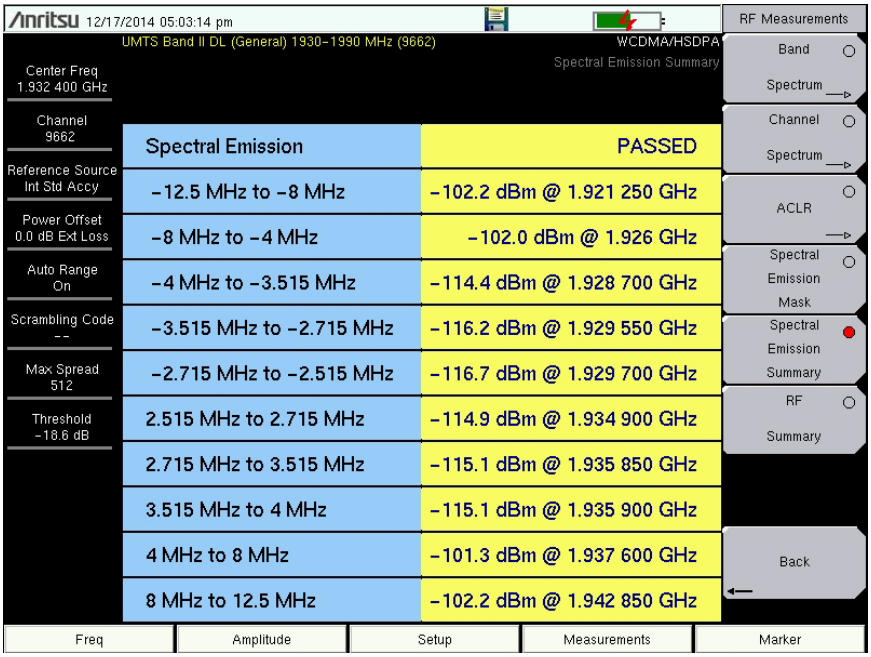


Figure 3-6. Spectral Emission Mask Summary

RF Summary

The RF Summary displays the critical transmitter performance measurements in the table format, without demodulating the W-CDMA/HSDPA signal. The parameters displayed in the RF summary table are Channel Power, 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.

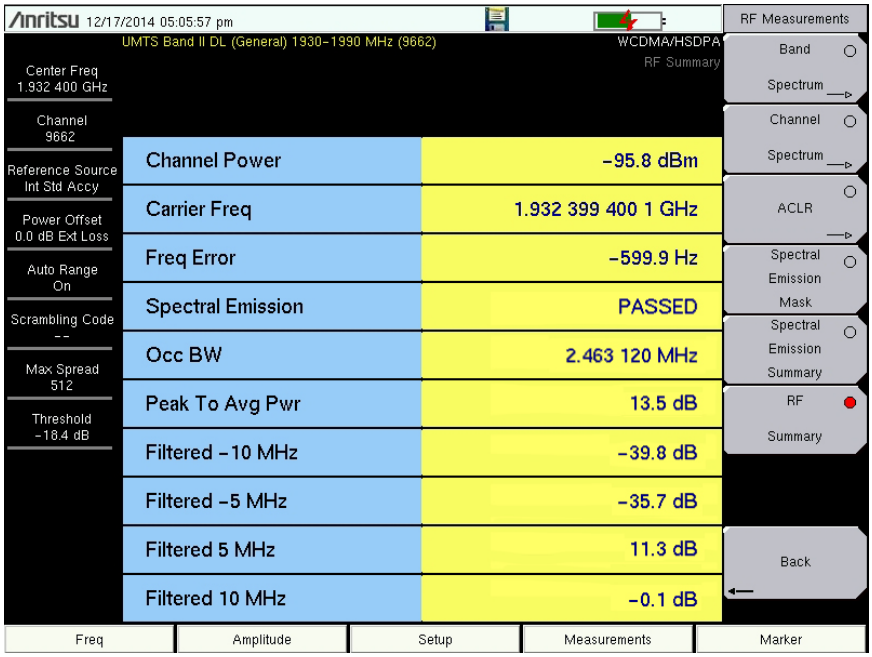


Figure 3-7. RF Summary

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/HSDPA demodulator has Code Domain Power (CDP), HSDPA, Codogram and Modulation Summary screens.

Note	The W-CDMA/HSDPA Demodulator option demodulates both W-CDMA and HSDPA 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/HSDPA Demodulator, the HSDPA 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. If needed, press the CDP 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.

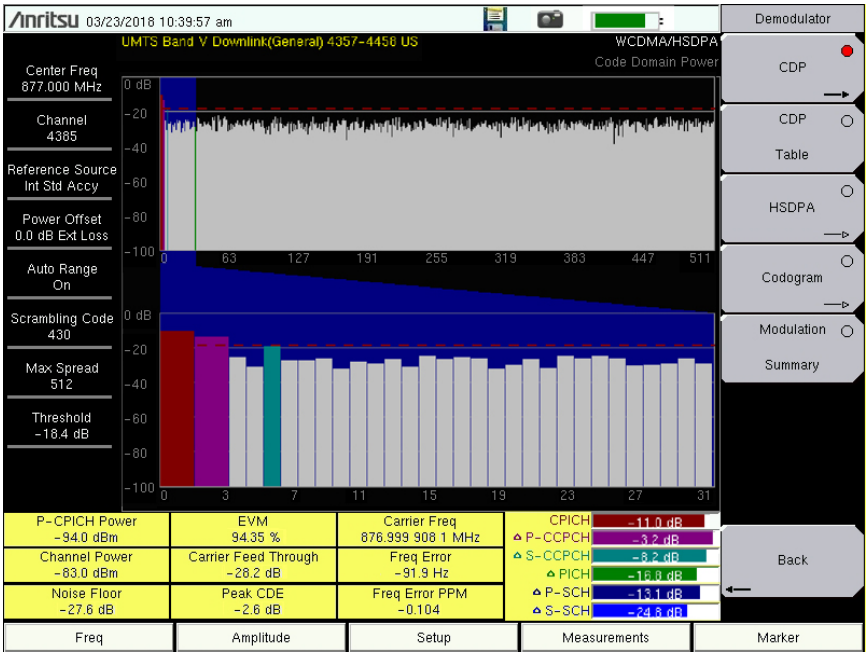


Figure 3-8. CDP Measurement Summary

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/HSDPA measurements.

HSDPA Setup

HSDPA 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 table format.

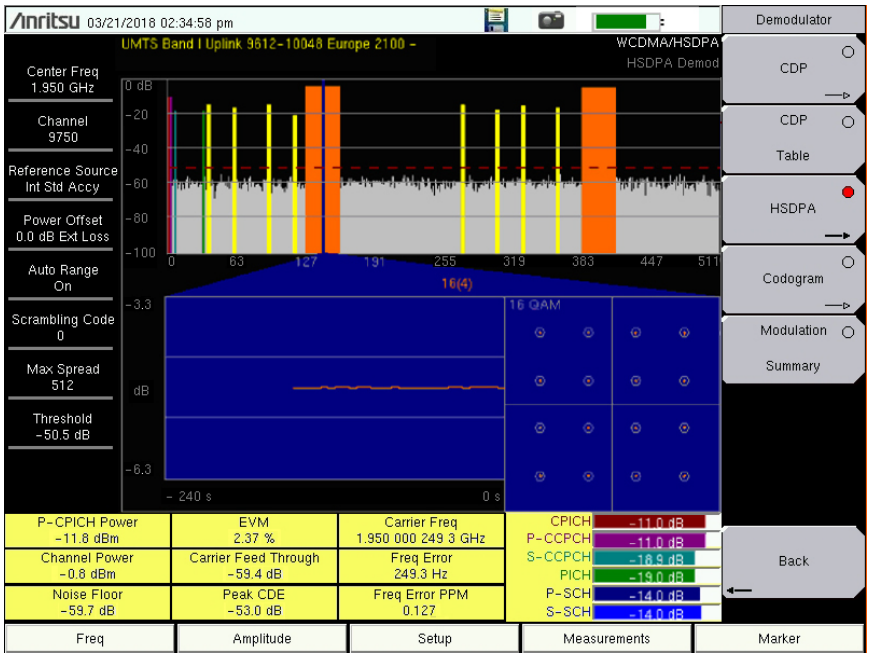


Figure 3-9. HSDPA Measurement Summary

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

HSDPA Procedure

1. Press the Demodulator submenu key to list the Demod menu.
2. Press the HSDPA submenu key to activate the HSDPA measurement. The red dot on the submenu key indicates HSDPA is selected.
3. If needed, press the HSDPA key again to display the HSDPA 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 HSDPA 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/HSDPA 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. If needed, press the Codogram 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.

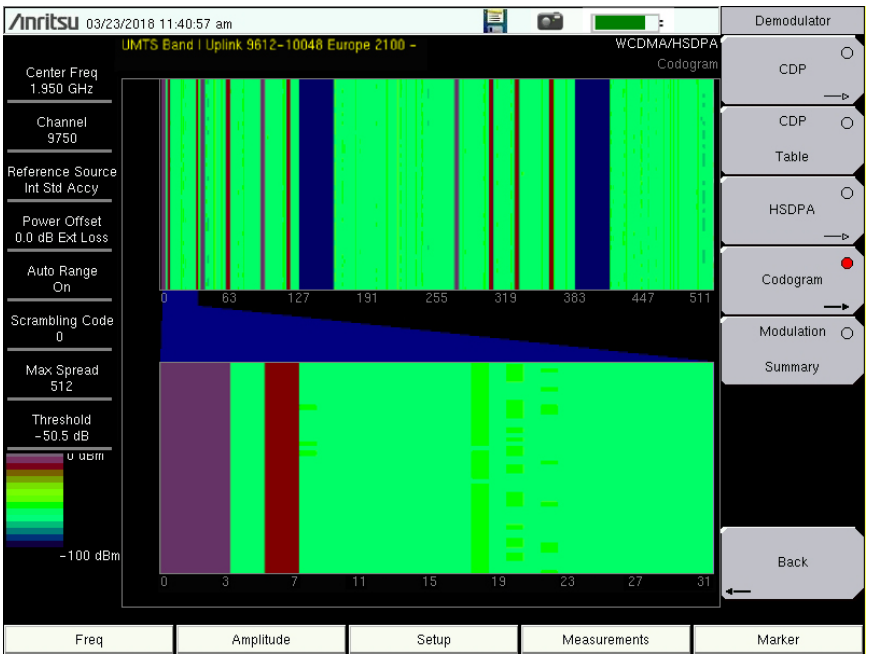


Figure 3-10. Codogram Measurement

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 Code Lock 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 open the Over-The-Air submenu.
5. Press the Scrambling Code submenu key.
6. If needed, press the Scrambling Code key again to open the OTA Setup menu, then select Auto to automatically detect the six scrambling codes (see Figure 3-11).

   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 key locks the code so it will not change with each update.

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

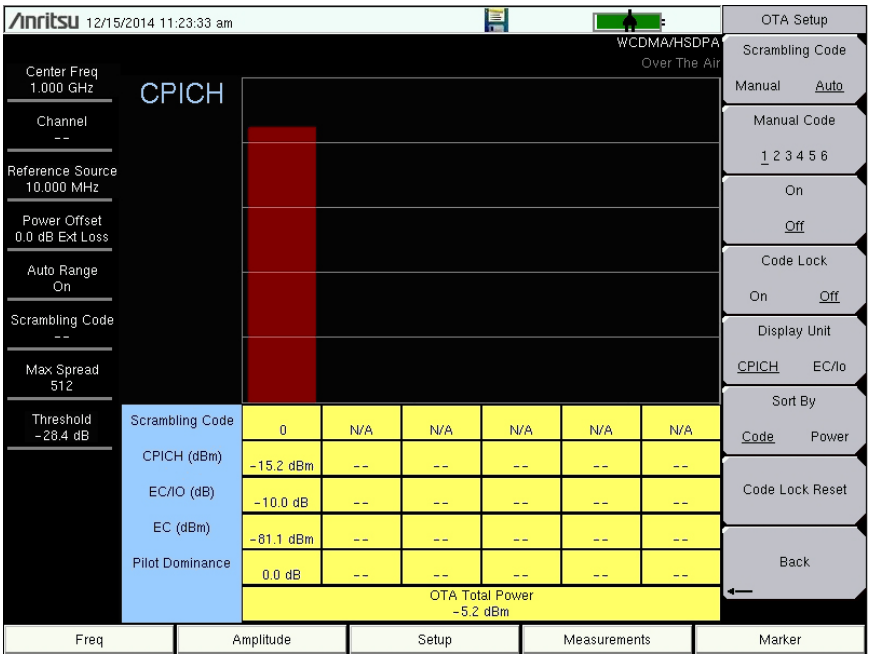


Figure 3-11. OTA Setup

W-CDMA Summary Setup

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

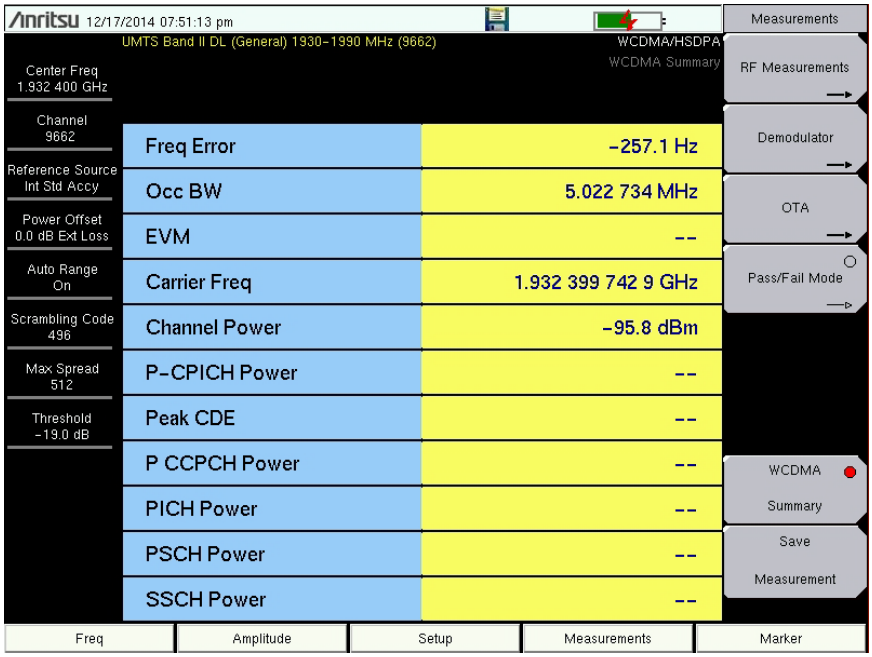


Figure 3-12. W-CDMA Measurement Summary

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).

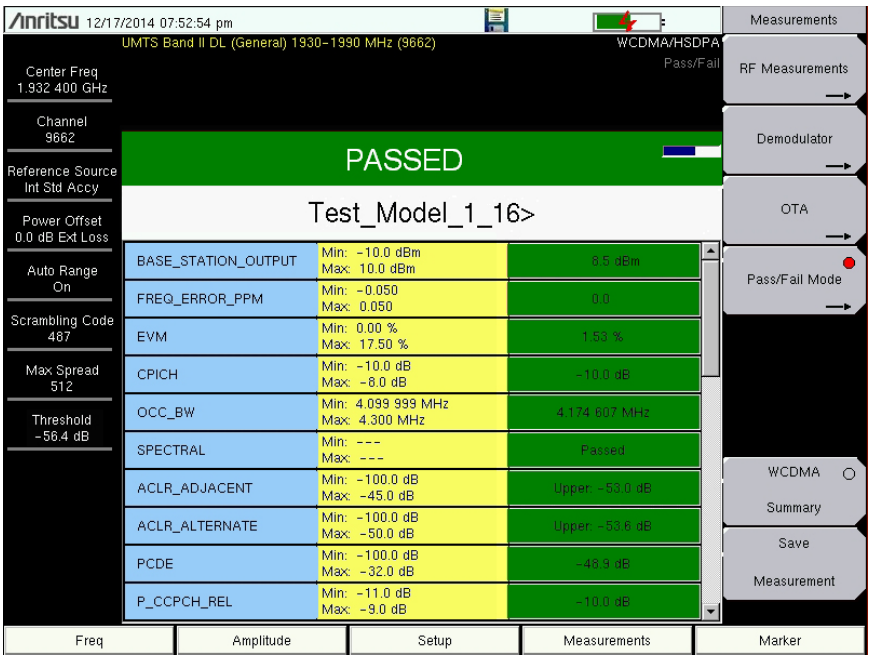


Figure 3-13. Pass/Fail Mode

3-8 W-CDMA/HSDPA Menus

Figure 3-14 show the map of the W-CDMA/HSDPA menus. The following sections describe W-CDMA/HSDPA 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.

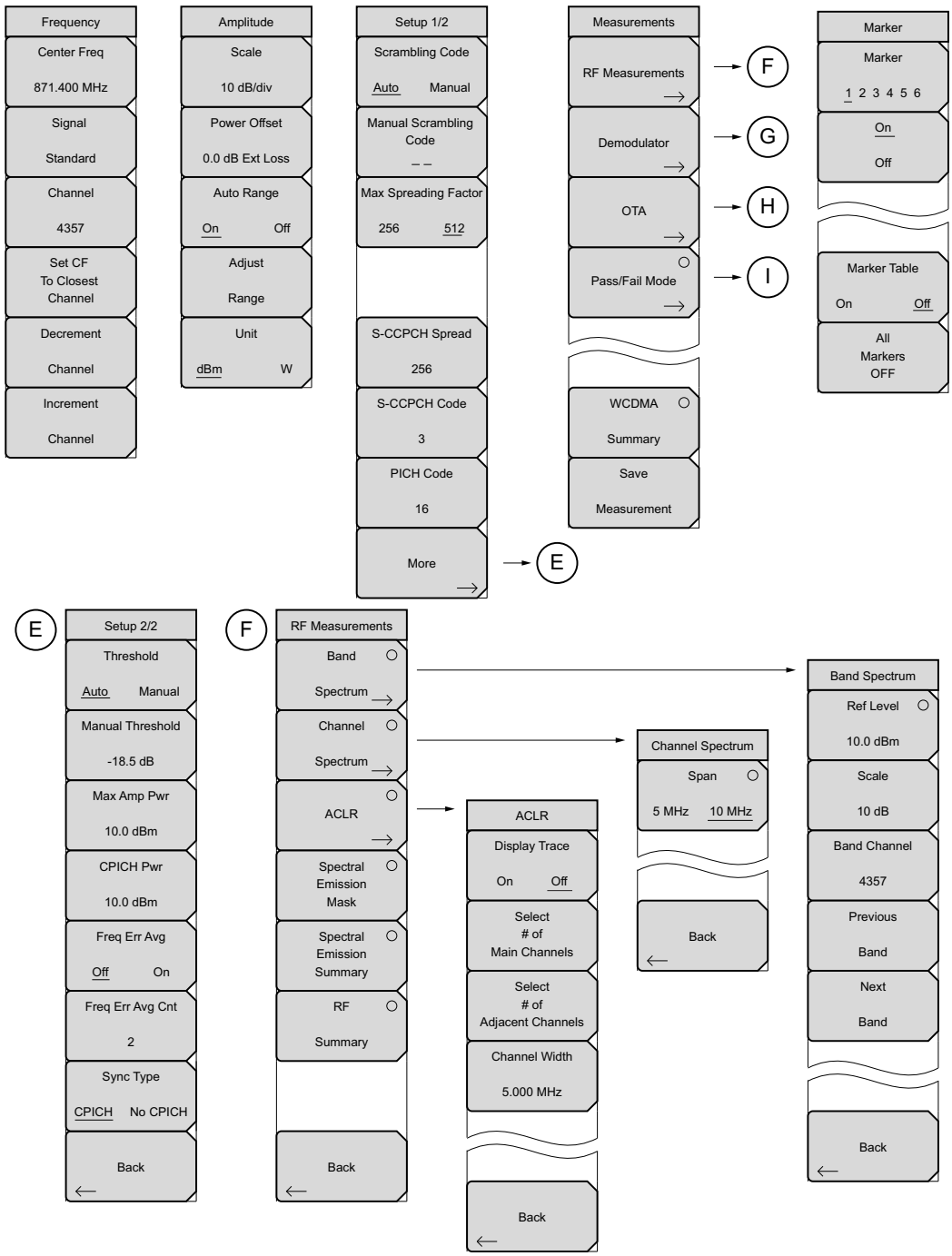


Figure 3-14. W-CDMA/HSDPA Menu Layout (1 of 2)

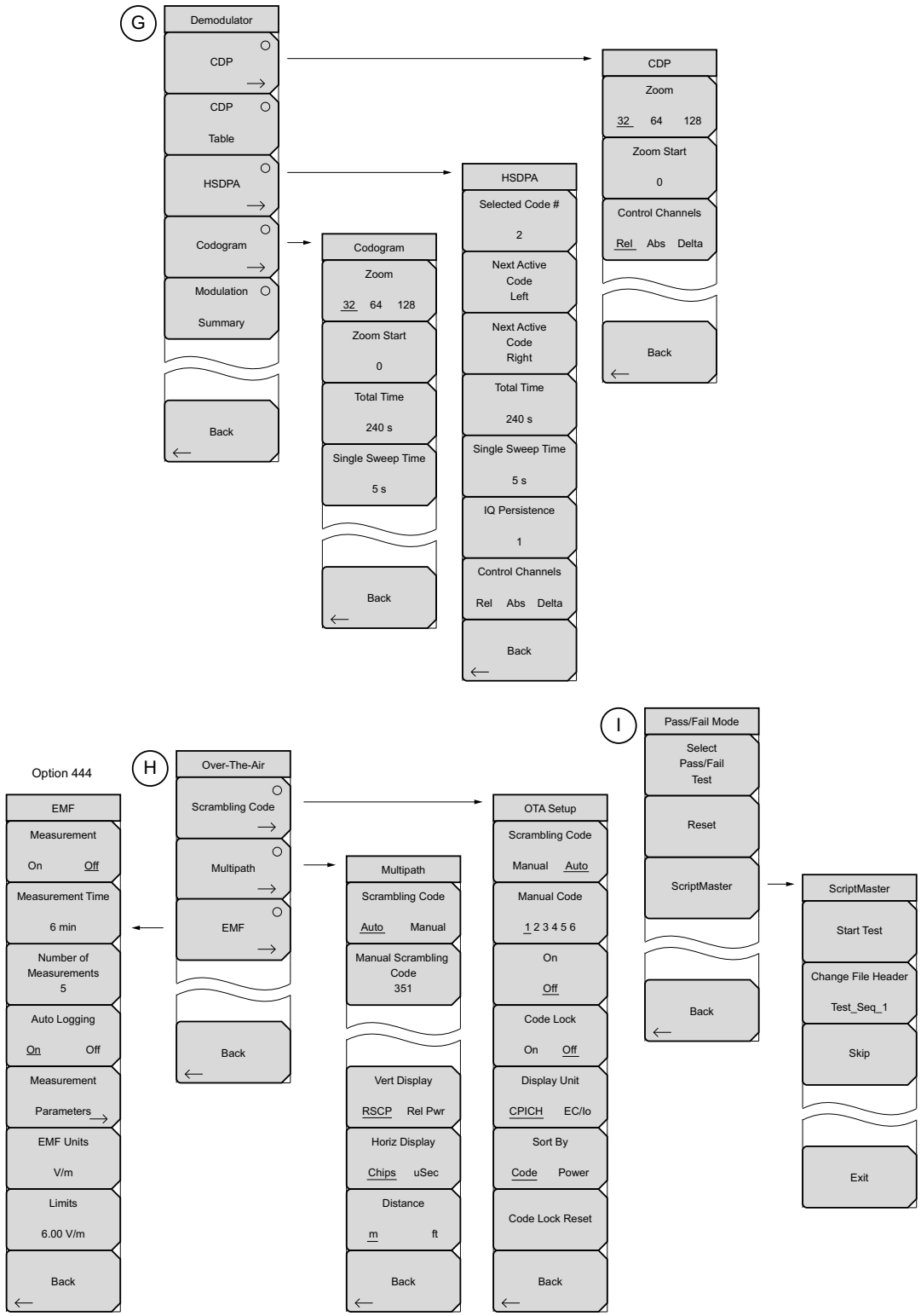
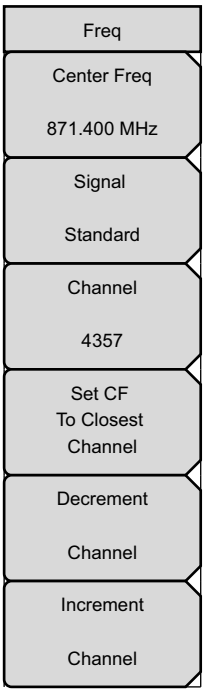


Figure 3-15. W-CDMA/HSDPA Menu Layout (2 of 2)

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.

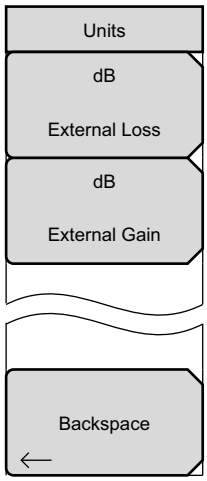
Decrement Channel: Decreases the channel number by one.

Increment Channel: Increases the channel number by one.

Figure 3-16. W-CDMA/HSDPA 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.

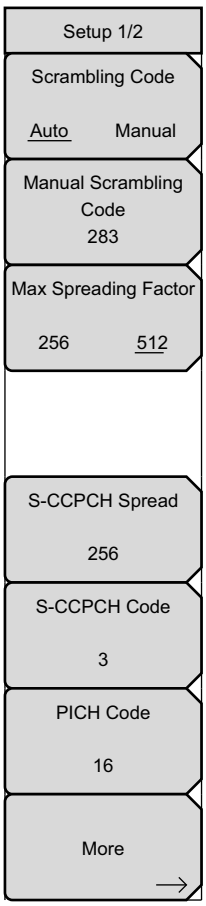
Unit: Changes the unit of measure for the Y-axis between dBm and W.

Figure 3-17. W-CDMA/HSDPA 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.

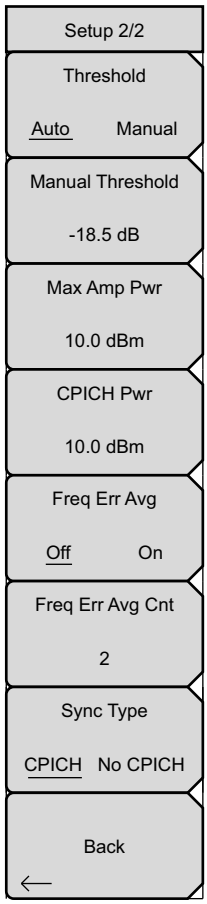
PICH Code: Press the **PICH Code** submenu key to activate Paging Indicator Channel and enter the desired code. The default value is 16.

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

Figure 3-18. W-CDMA/HSDPA 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.

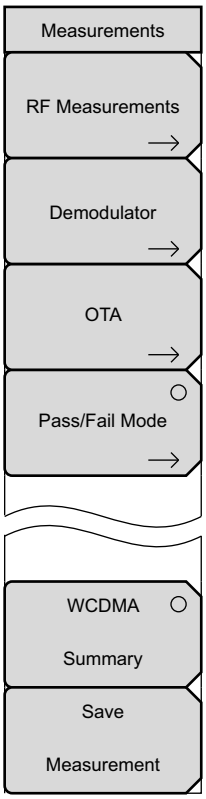
Sync Type: Selects between CPICH or No CPICH for synchronization.

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

Figure 3-19. W-CDMA/HSDPA 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, HSDPA, Codogram and Modulation Summary.

OTA: Opens the “Over-The-Air Menu” on page 3-38.

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.

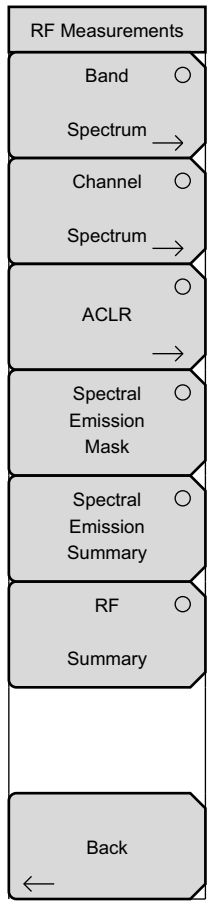
> W-CDMA/HSDPA measurements are saved with a WCD extension. GSM/EDGE measurements are saved with an EDG extension.

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/HSDPA 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.

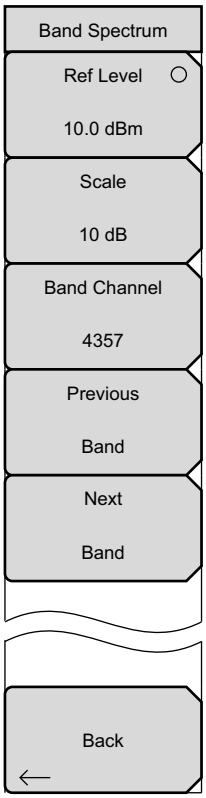
RF Summary: Displays the RF measurements in table form.

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

Figure 3-21. W-CDMA/HSDPA 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.

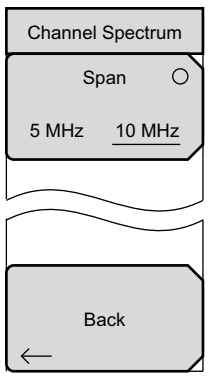
Next Band: Selects the next band.

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

Figure 3-22. W-CDMA/HSDPA Band Spectrum Menu

Channel Spectrum Menu

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



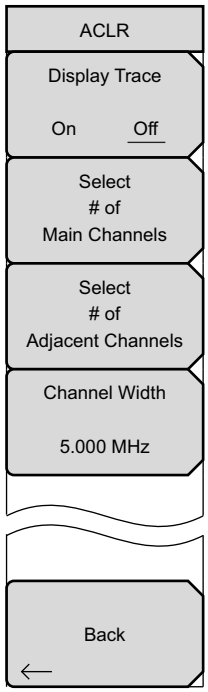
Span: Select either a 5 MHz or 10 MHz span.

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

Figure 3-23. W-CDMA/HSDPA 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.

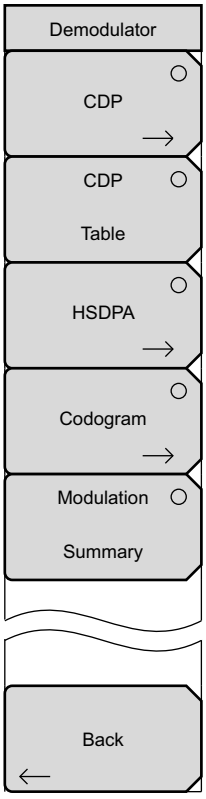
Channel Width: Set the bandwidth for the channels for the number of adjacent channels selected.

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

Figure 3-24. W-CDMA/HSDPA 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/HSDPA demodulator option, the CDP screen displays HSDPA 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).

HSDPA: Open the "HSDPA Menu" on page 3-36. When HSDPA 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/HSDPA 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.

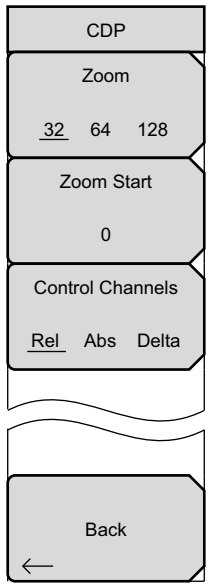
Modulation Summary: Displays the demodulation parameters in the table format.

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

Figure 3-25. W-CDMA/HSDPA 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/HSDPA 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. HSDPA 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.

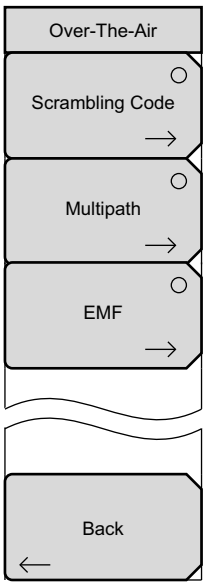
Single Sweep Time: Single sweep time is related to total time. Use the keypad, arrow keys, or the rotary knob to set the single sweep time.

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

Figure 3-28. W-CDMA/HSDPA 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.

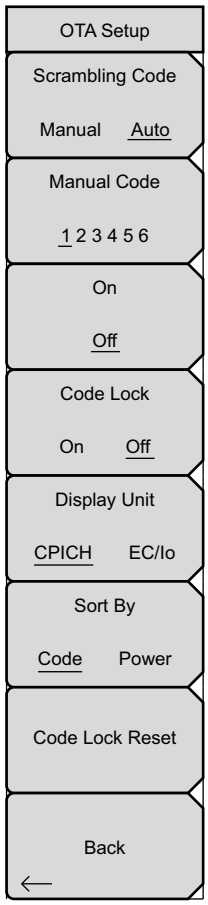
EMF (Option 444 only)**:** When first selected, this submenu key enables the EMF Measurement mode. See “EMF Measurements (Option 444)” on page 1-3 for more information.

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

Figure 3-29. W-CDMA/HSDPA 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.

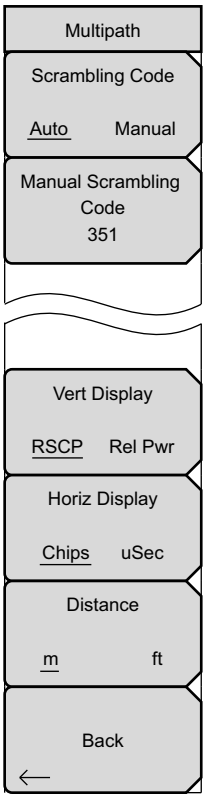
Code Lock Reset: Reset the measurement screen.

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

Figure 3-30. W-CDMA/HSDPA 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.

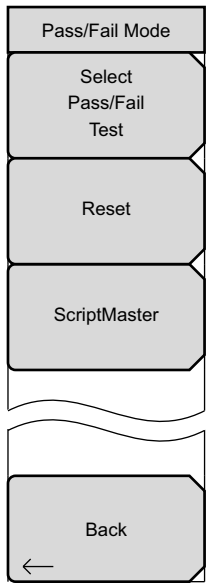
Distance: Switch between meters and feet.

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

Figure 3-31. W-CDMA/HSDPA Multipath Menu

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.

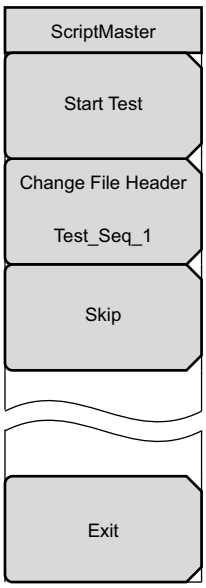
ScriptMaster: Opens the "ScriptMaster Menu".

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

Figure 3-32. W-CDMA/HSDPA 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: Runs the test 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.

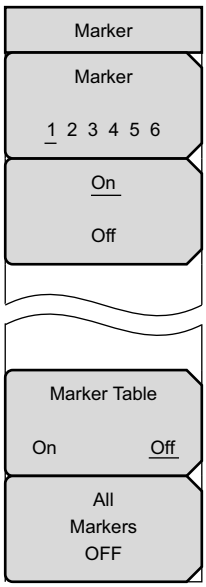
Exit: Ends the ScriptMaster measurement process. Returns the instrument to the previous measurement setup.

Figure 3-33. W-CDMA/HSDPA 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.

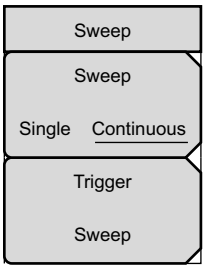
Marker Table On/Off: Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered for them.

All Markers Off: Turns off all markers.

Figure 3-34. W-CDMA/HSDPA 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/HSDPA Sweep Menu

3-15 Trace Menu

This menu is not available in W-CDMA/HSDPA measurement mode.

3-16 Limit Menu

This menu is not available in W-CDMA/HSDPA measurement mode.

3-17 Other Menus

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

Chapter 4 — TD-SCDMA/HSDPA Signal Analyzer

4-1 Introduction

The TD-SCDMA/HSDPA 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/HSDPA Signal Analyzer mode, set up frequency and amplitude, and perform file management.

4-3 TD-SCDMA/HSDPA 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

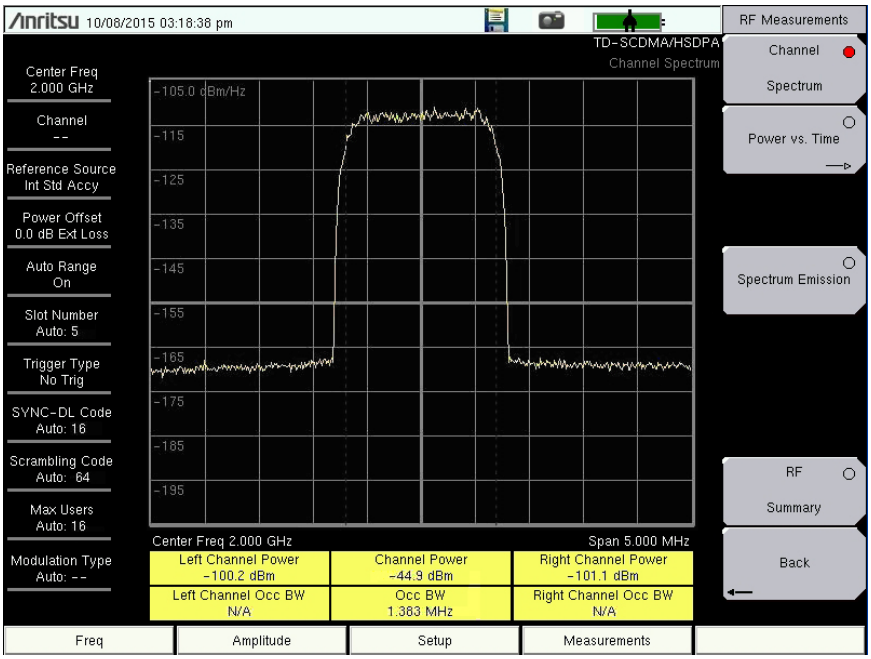


Figure 4-1. TD-SCDMA/HSDPA Channel Spectrum

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.

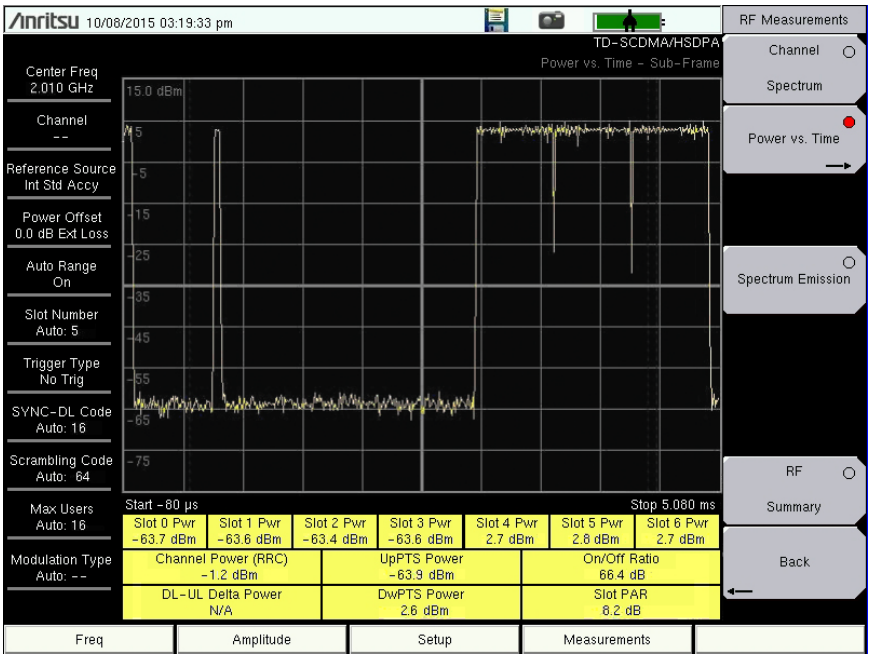


Figure 4-2. TD-SCDMA/HSDPA Power vs. Time: Sub-Frame Measurement

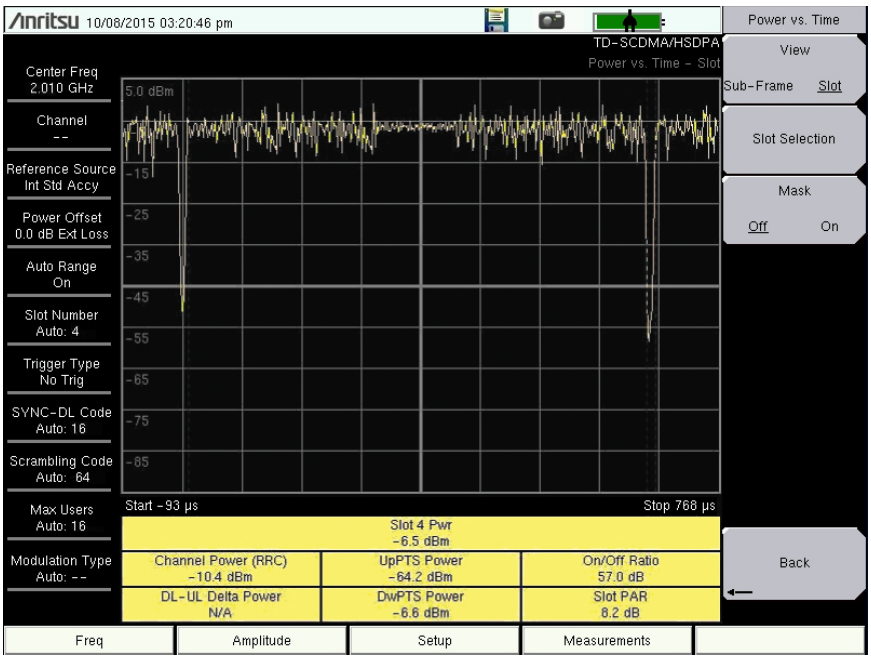


Figure 4-3. TD-SCDMA/HSDPA Power vs. Time: Slot Measurement

RF Summary

The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the TD-SCDMA/HSDPA 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 to select the number of carriers present in the signal (1 or 3).
    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/HSDPA Demodulator

Figure 4-4. TD-SCDMA/HSDPA 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/HSDPA 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/HSDPA 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/HSDPA Over-the-Air Measurements

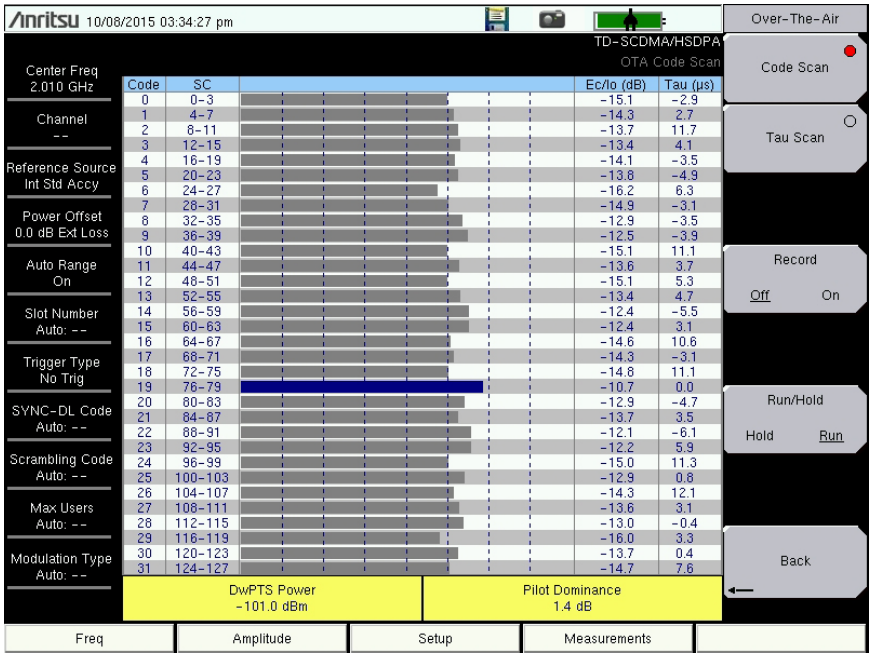


Figure 4-5. TD-SCDMA/HSDPA OTA Code Scan

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.

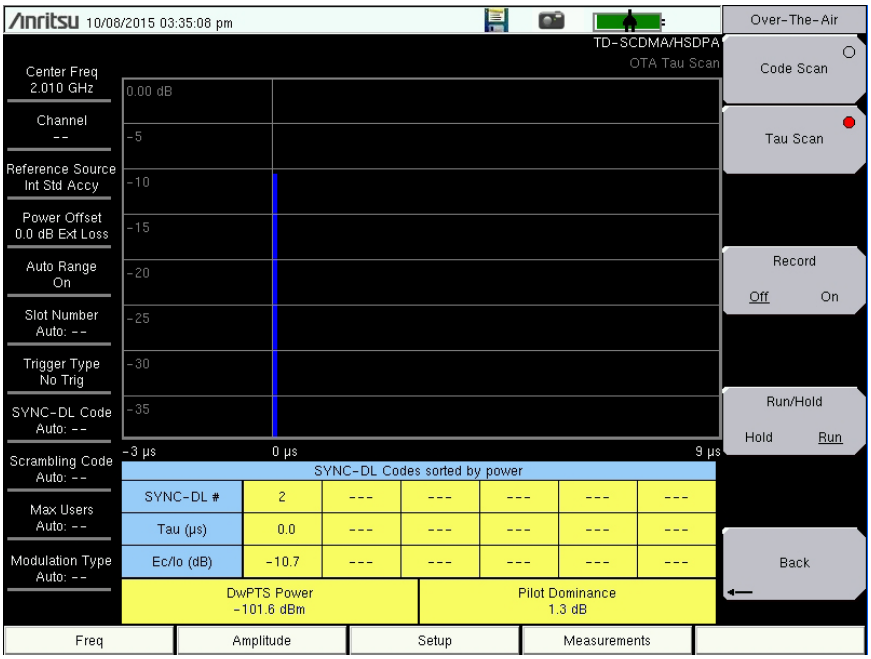


Figure 4-6. TD-SCDMA/HSDPA OTA Tau Scan

Measurement Setup

Refer to the User Guide for selecting the TD-SCDMA/HSDPA 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/HSDPA 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/HSDPA 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.

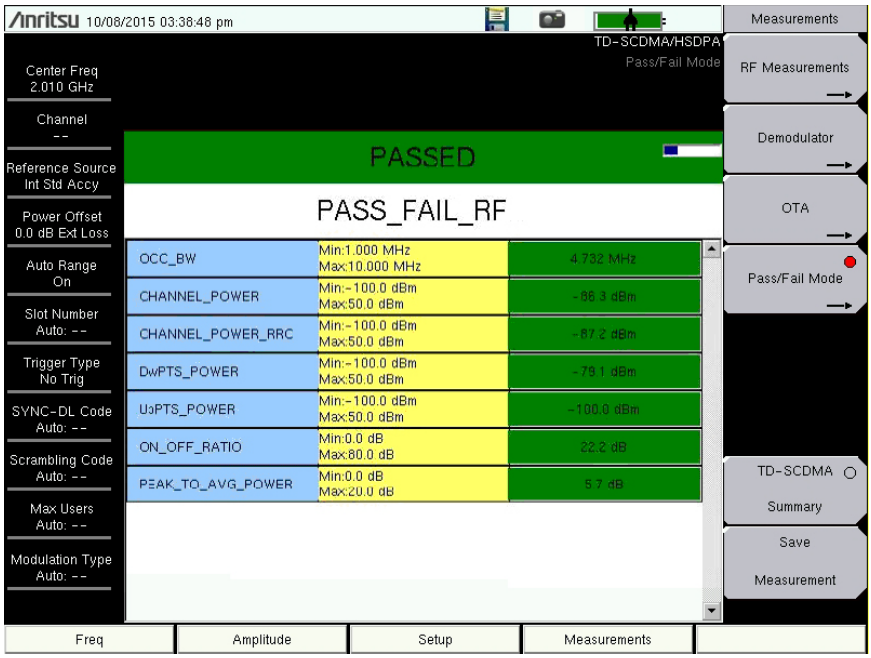


Figure 4-7. TD-SCDMA/HSDPA Pass/Fail Measurements

4-7 TD-SCDMA/HSDPA Menus

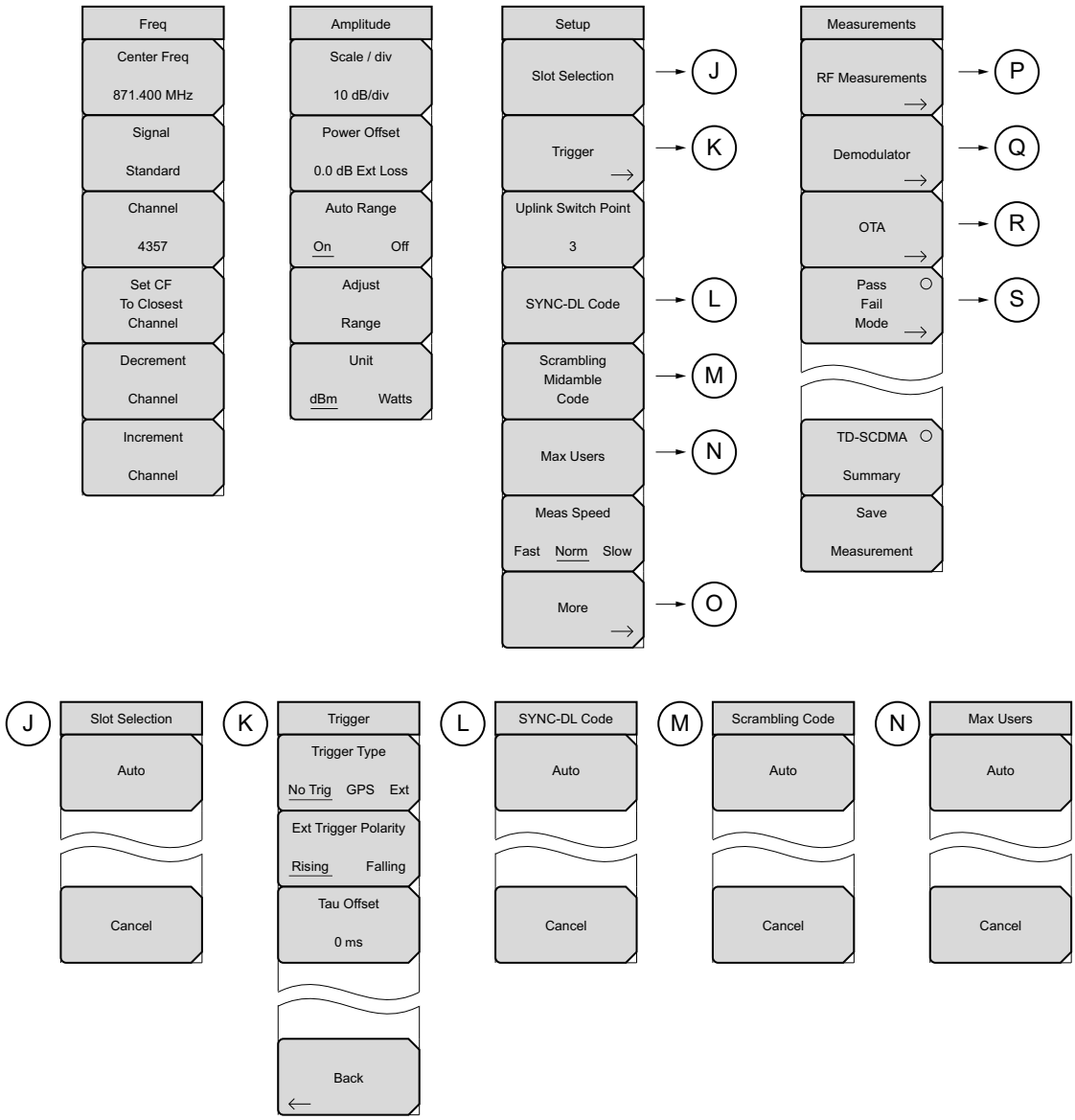


Figure 4-8. TD-SCDMA/HSDPA Menu Layout (1 of 2)

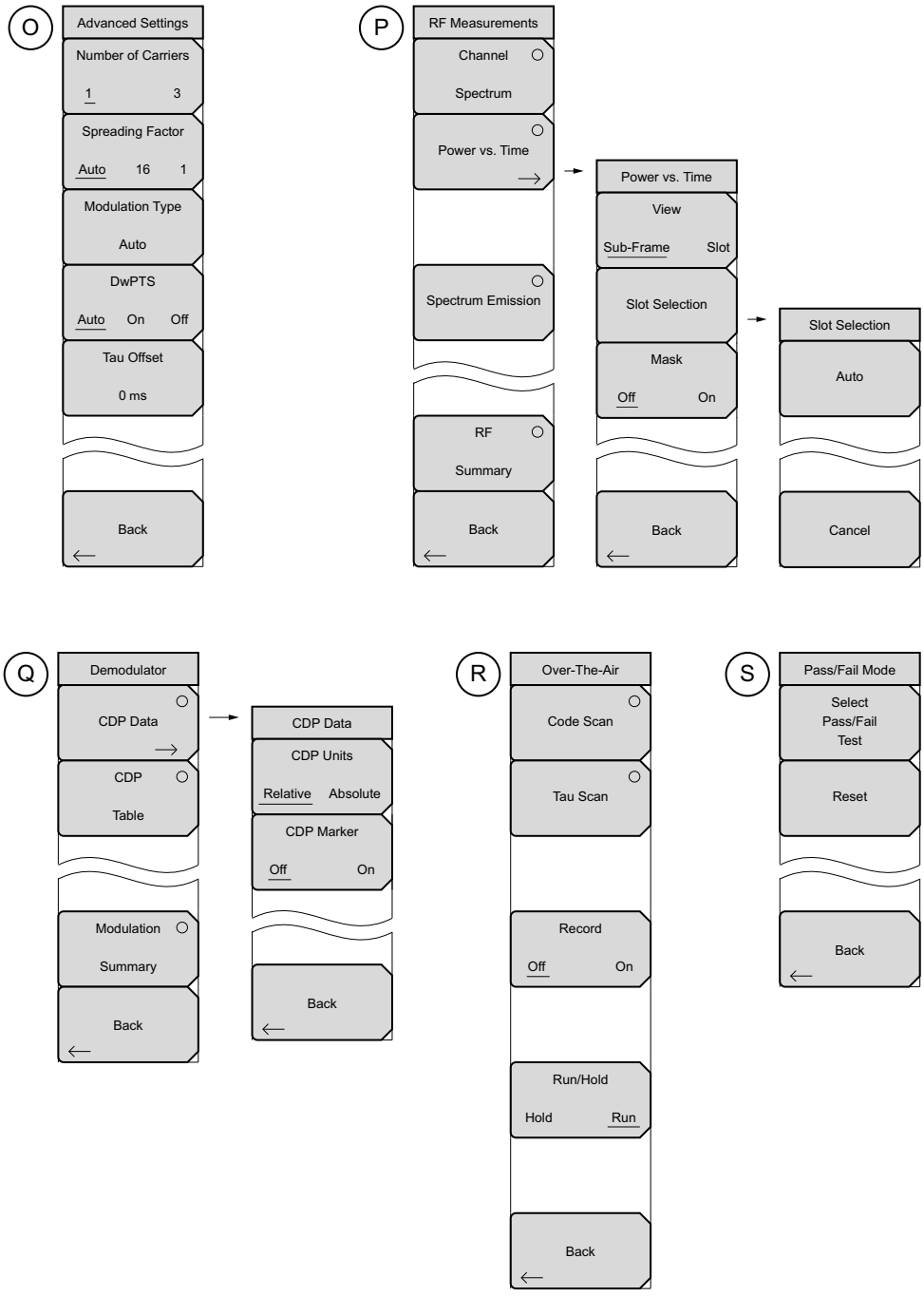
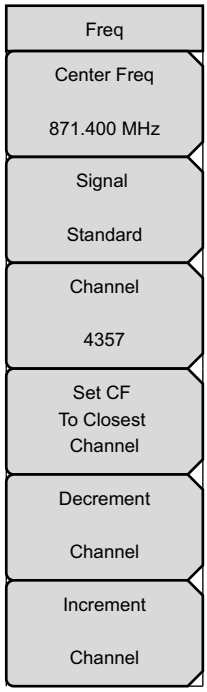


Figure 4-9. TD-SCDMA/HSDPA Menu Layout (2 of 2)

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.

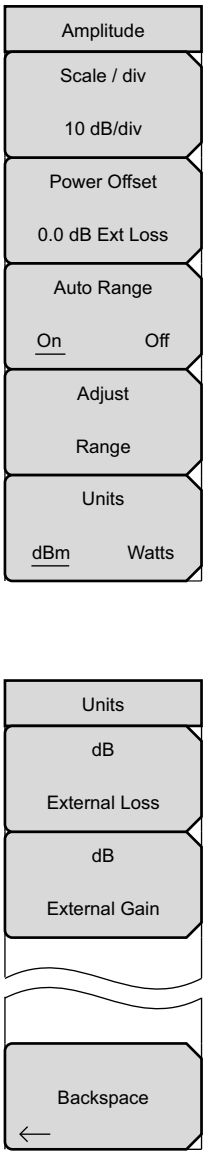
Decrement Channel: Decrements the channel by one channel.

Increment Channel: Increments the channel by one channel.

Figure 4-10. TD-SCDMA/HSDPA 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.

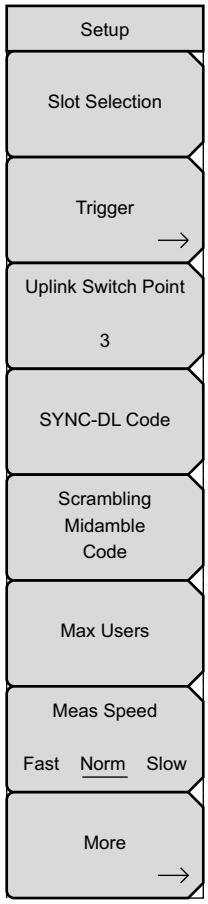
Adjust Range: Press this submenu key to perform a single reference level adjustment. Auto Range is automatically turned Off.

Units: Press this submenu key to view the power measurements in dBm or watts.

Figure 4-11. TD-SCDMA/HSDPA 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.

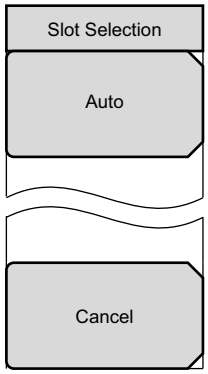
Meas Speed: Press this submenu key to select the desired scan speed: Fast, Normal, or Slow. The active state is underlined on the face of the submenu key.

More: Opens the "Advanced Settings Menu" on page 4-20.

Figure 4-12. TD-SCDMA/HSDPA Setup Menu

Slot Selection Menu

Key Sequence: **Setup** > Slot Selection



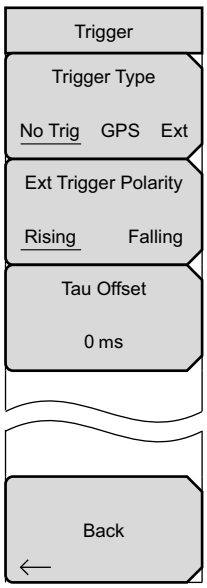
Auto: Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to "Setup Menu" on page 4-17.

Figure 4-13. TD-SCDMA/HSDPA 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.

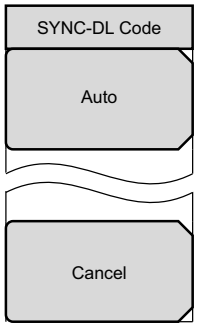
Tau Offset: Press this submenu key to add an offset (5 sec is the maximum offset that can be entered) to the current Tau value.

Back: Press this submenu key to return to "Setup Menu" on page 4-17.

Figure 4-14. TD-SCDMA/HSDPA Trigger Menu

SYNC-DL Code Menu

Key Sequence: **Setup** > SYNC-DL Code



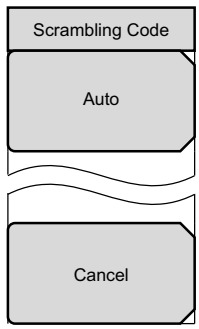
Auto: Automatically seeks the active SYNC-DL code. Auto in the SYNC-DL Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to "Setup Menu" on page 4-17.

Figure 4-15. TD-SCDMA/HSDPA Trigger Menu

Scrambling Code Menu

Key Sequence: **Setup** > Scrambling Midamble Code



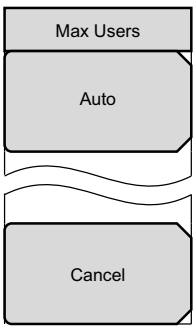
Auto: Automatically looks for the Scrambling/Midamble code. Auto in the Scrambling/Midamble Code selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to "Setup Menu" on page 4-17.

Figure 4-16. TD-SCDMA/HSDPA Scrambling Midamble Code Menu

Max Users Menu

Key Sequence: **Setup** > Max Users



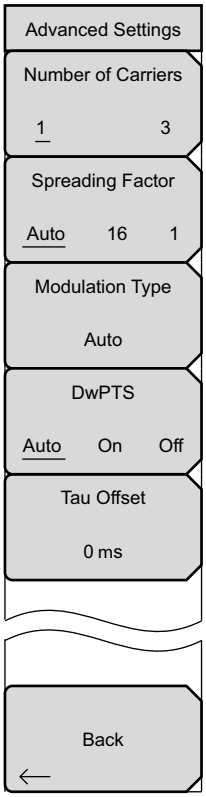
Auto: Automatically looks for the maximum number of users. Auto in the Maximum Users selection window and the Auto submenu key have the same function. The Auto submenu key provides a one-touch method of selecting the Auto setting.

Cancel: Disregards any entry and returns to "Setup Menu" on page 4-17.

Figure 4-17. TD-SCDMA/HSDPA 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/HSDPA Advanced Settings Menu

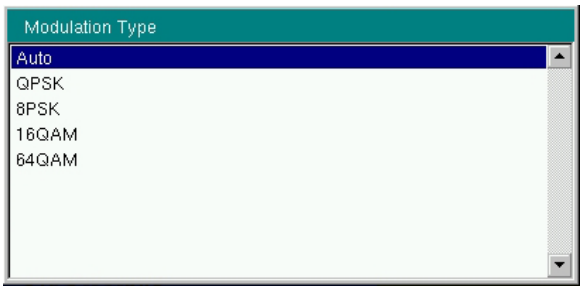
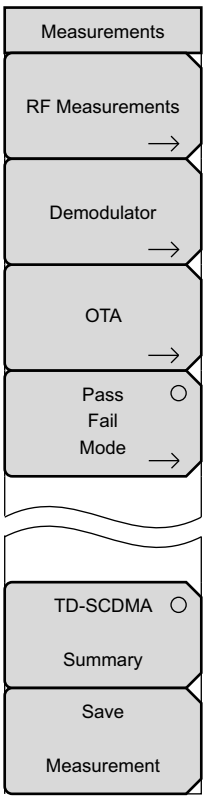


Figure 4-19. Modulation Type Window

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:

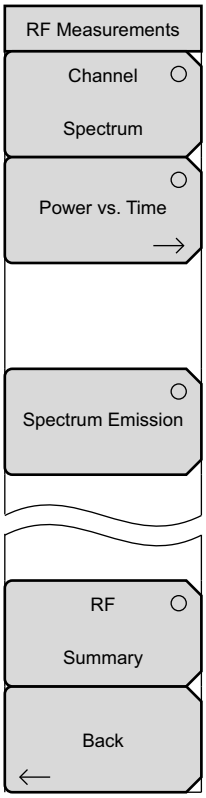
- Channel Power
- Occ BW
- Slot Power
- DwPTS Power
- UpPTS Power
- On/Off Ratio
- Freq Error
- Freq Error PPM
- EVM
- Peak CDE
- Tau

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/HSDPA 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:

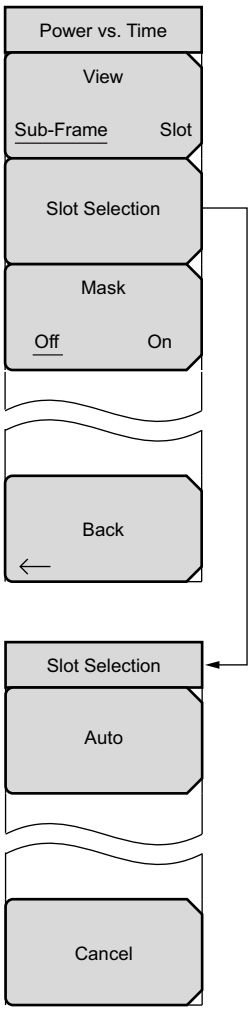
- Channel Power
- Channel Power (RRC)
- Occ BW
- DwPTS Pwr
- UpPTS Pwr
- On/Off Ratio
- Slot PAR
- Left Channel Power
- Right Channel Power
- Left Channel Occ BW
- Right Channel Occ BW

Back: Press this submenu key to return to "Measurements Menu" on page 4-21.

Figure 4-21. TD-SCDMA/HSDPA 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.

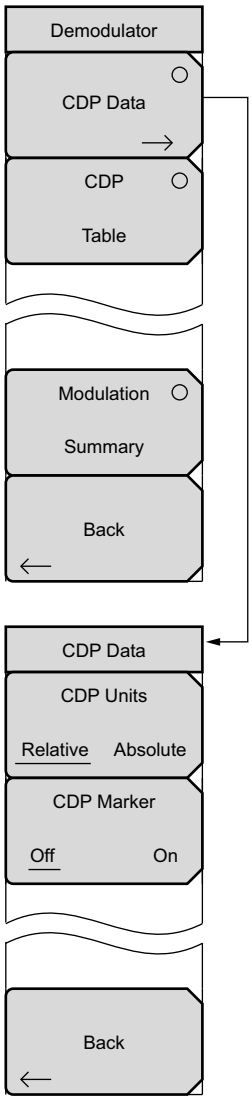
Mask: Press this submenu key to turn the mask On and Off.

Back: Press this submenu key to return to the "Measurements Menu" on page 4-21.

Figure 4-22. TD-SCDMA/HSDPA 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/HSDPA signal in table format. The following parameters are displayed in the table:

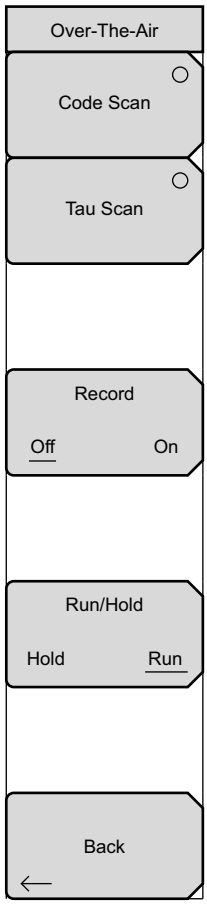
Slot Power (dBm)
EVM
Peak EVM
Freq Error
Freq Error PPM
Tau
Noise Floor
Carrier Feed Through
Peak CDE

Back: Press this submenu key to return to the "Measurements Menu" on page 4-21.

Figure 4-23. TD-SCDMA/HSDPA 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.

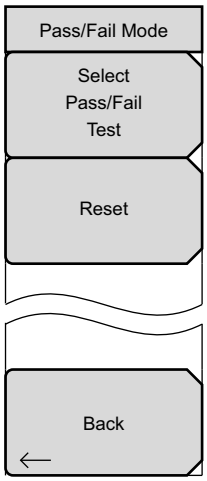
When Record is already toggled On, pressing the Run/Hold submenu key toggles the taking of measurements on and off to continue appending new measurements within the same log file, rather than creating a new log file.

Back: Press this submenu key to return to the “Measurements Menu” on page 4-21.

Figure 4-24. TD-SCDMA/HSDPA 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.

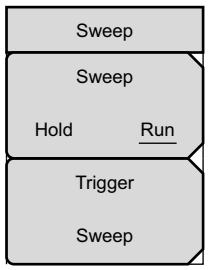
Reset: Press this submenu key to restart the measurement or to begin a new pass/fail test measurement.

Back: Press this submenu key to return to the “Measurements Menu” on page 4-21.

Figure 4-25. TD-SCDMA/HSDPA 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/HSDPA 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/HSDPA measurement mode.

4-15 Limit Menu

This menu is not available in TD-SCDMA/HSDPA 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).

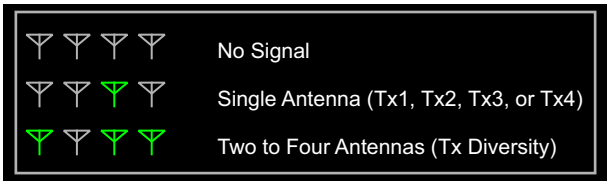


Figure 5-1. Antenna Status

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.

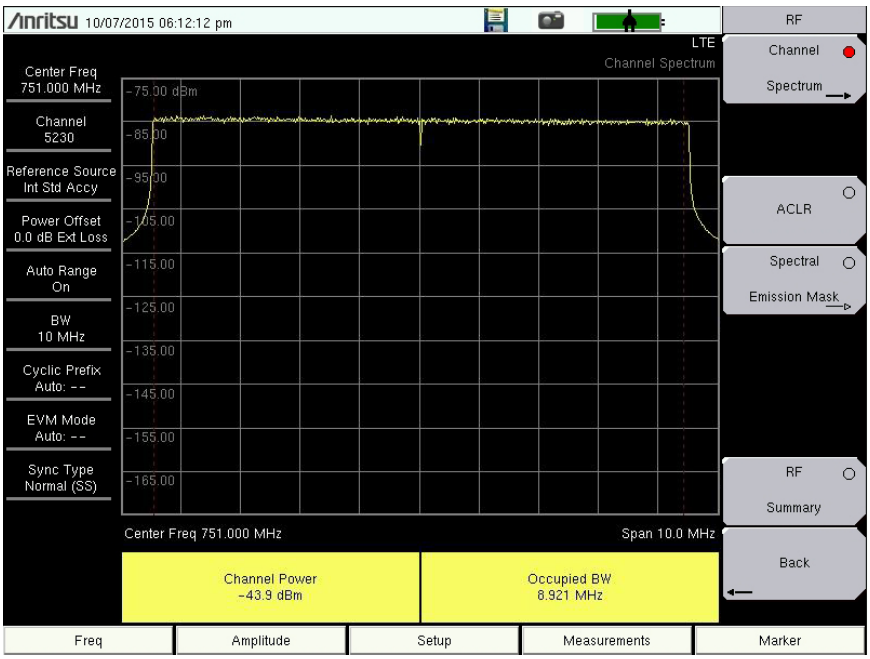


Figure 5-2. Channel Spectrum

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).

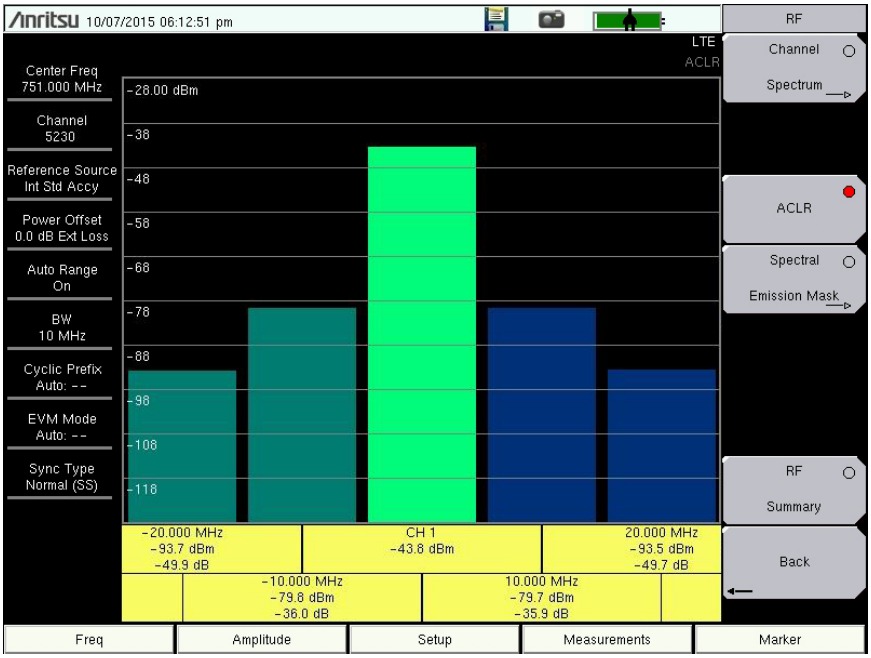


Figure 5-3. Adjacent Channel Leakage Ratio

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.

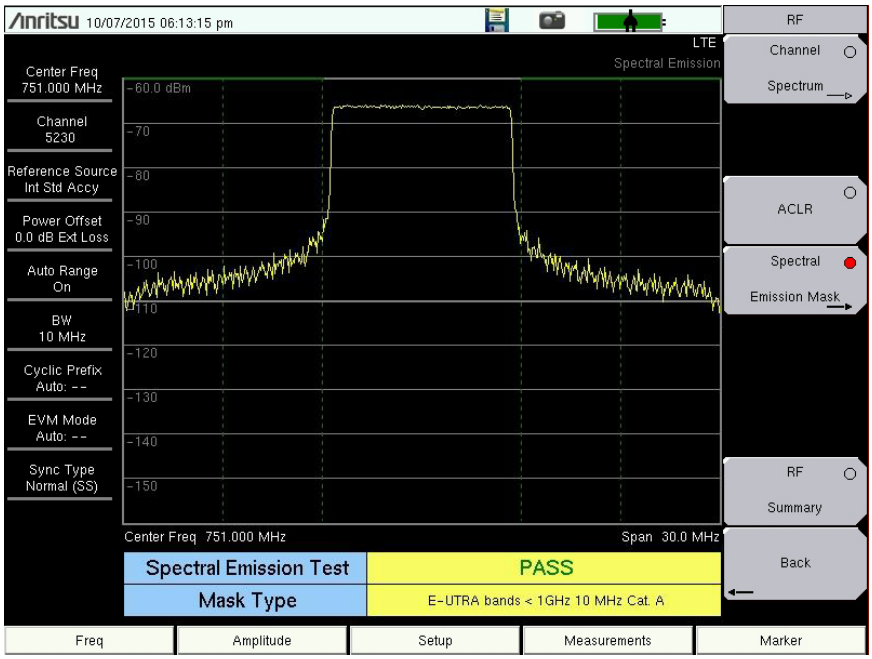


Figure 5-4. Spectral Emission Mask

4. Press the Spectral Emission Mask submenu key again to list the Spectral Emission menu and set up its parameters. Refer to "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.
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).

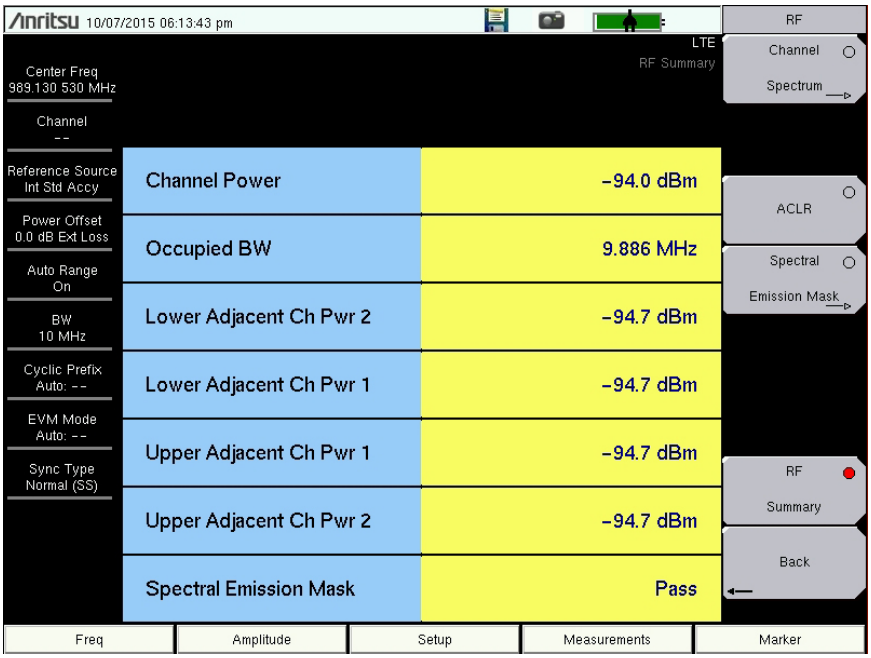


Figure 5-5. RF Summary

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. If the LTE carrier uses 256-QAM modulation scheme, the corresponding EVM measurement result is displayed, provided Option 886 is installed and activated on your instrument (see Figure 5-6 on page 5-11).

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.

   In the figure below, note that EVM measurement result for 256-QAM modulation type is displayed only when Option 886 is installed on your instrument.

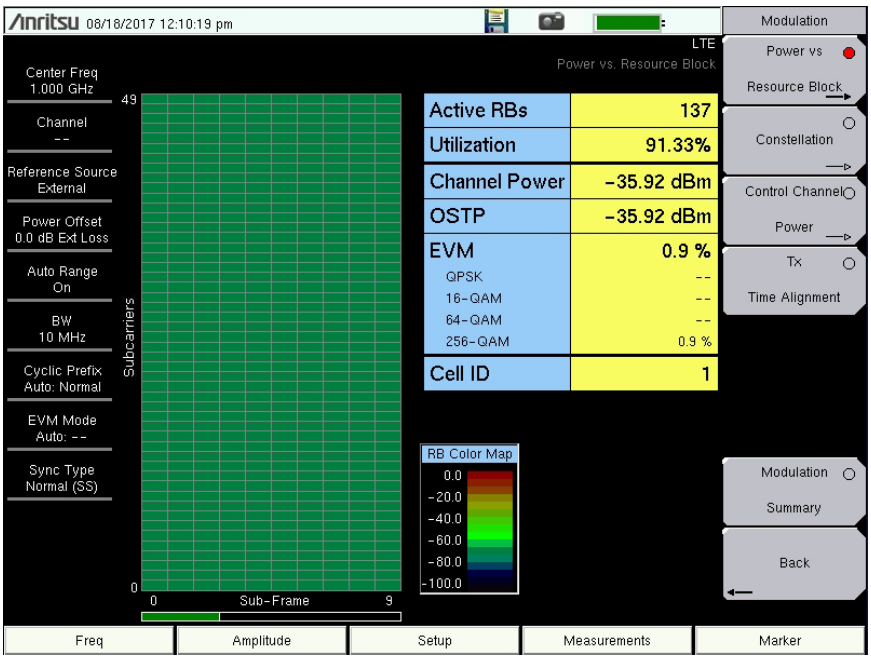


Figure 5-6. Power versus Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to display 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 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 key.
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 select a sub-frame, press Marker Sub-frame and move it to the desired sub-frame using the arrow buttons, rotary 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.
4. Press the Constellation key again to display the Constellation menu and enable or disable the reference constellation points and the data legend (see Figure 5-7).
   a. Press the Reference Points submenu key to turn the reference points on or off.
   b. Press the Data Legend submenu key to turn the data legend on or off.

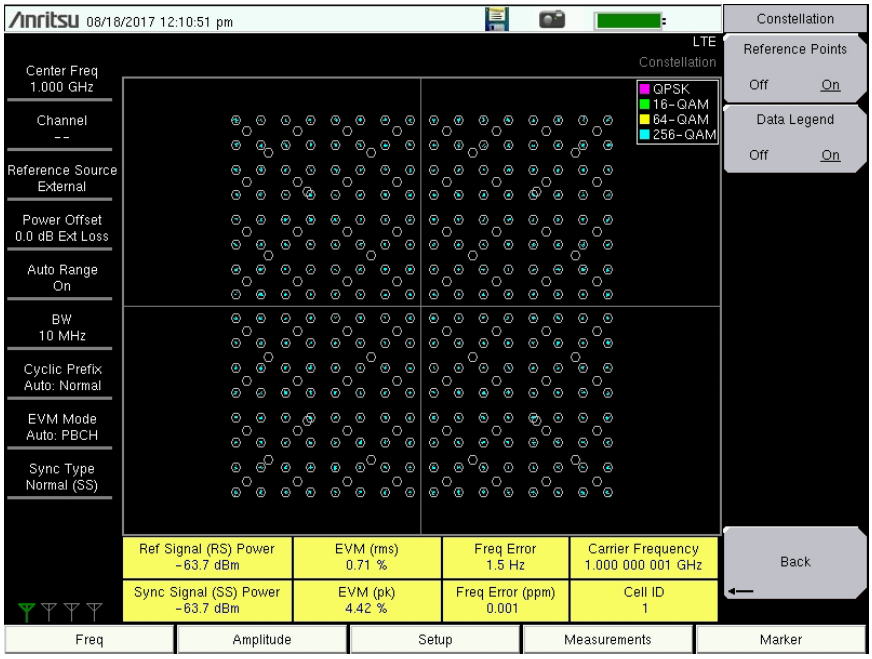


Figure 5-7. Constellation Measurement View

Note	Support for 256-QAM modulation as shown in the data legend above is available only with Option 886.

5. 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 (Figure 5-8). Press the key again to view or change the Display Mode and Control Channel EVM settings.

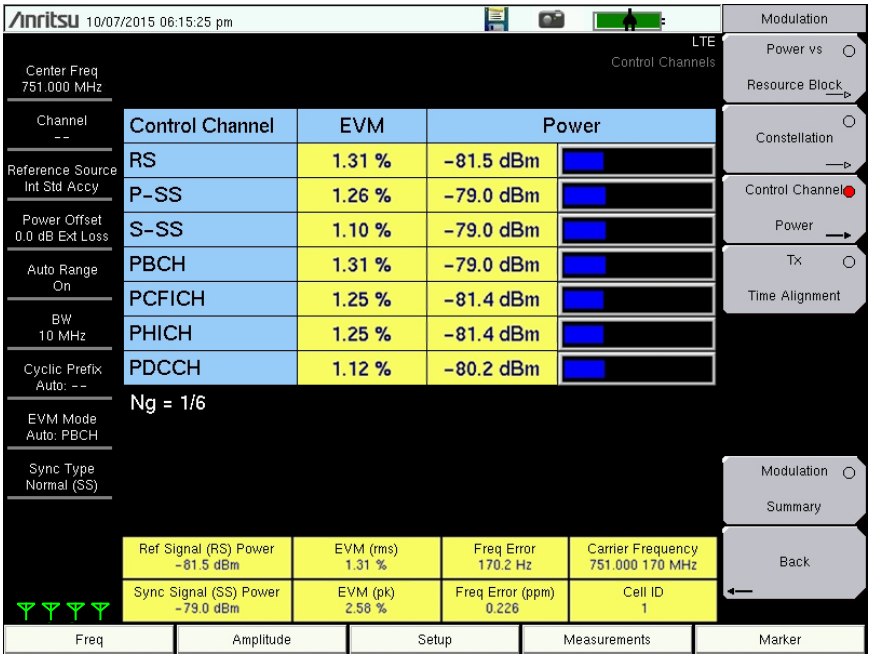


Figure 5-8. Control Channel Power

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.

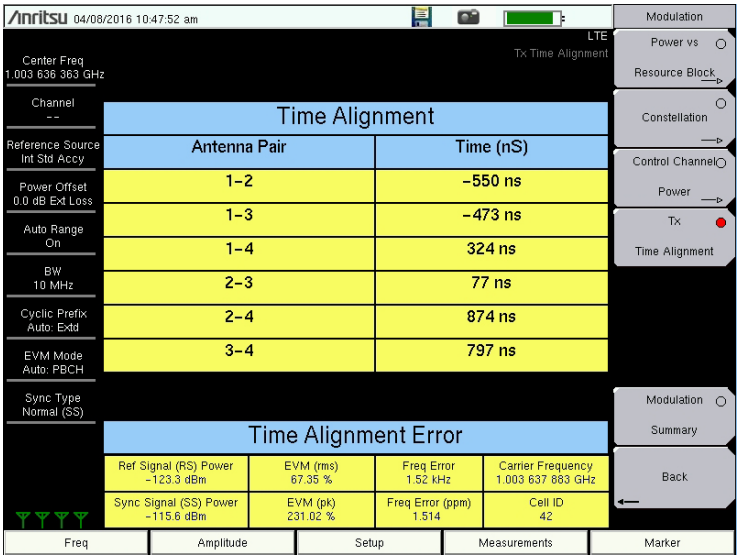


Figure 5-9. Tx Time Alignment (4x4 MIMO Configuration)

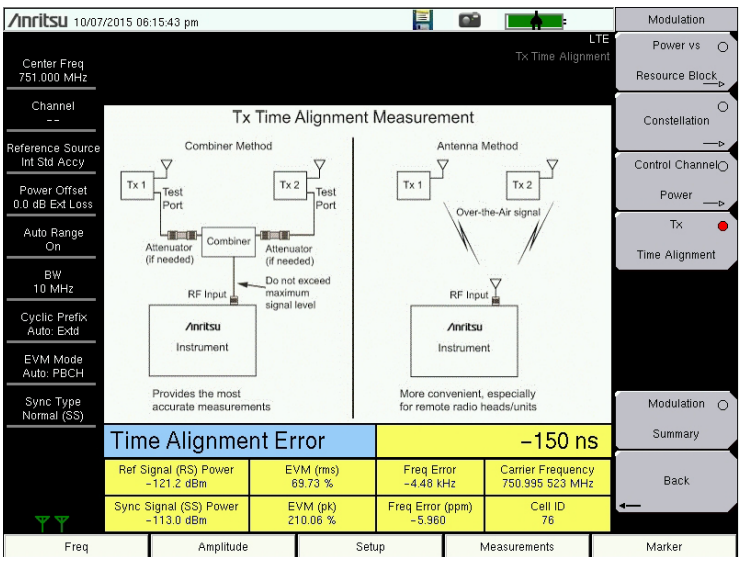


Figure 5-10. Tx Time Alignment

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).

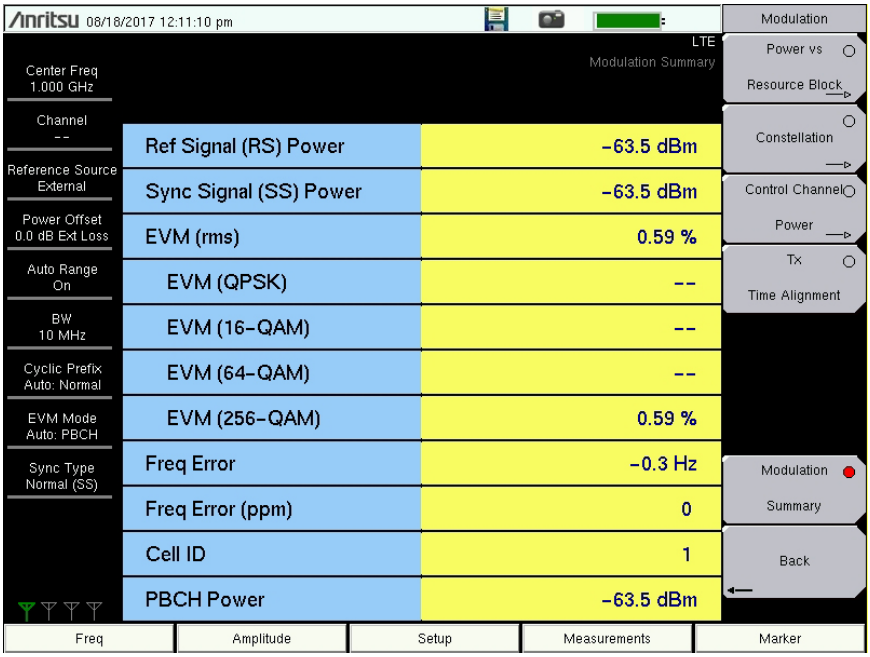


Figure 5-11. Modulation Summary

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 is the average power of Resource Elements (RE) that carry cell-specific Reference Signals (RS) over the entire bandwidth.

RSRQ

Reference Signal Received Quality provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRQ 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.

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.

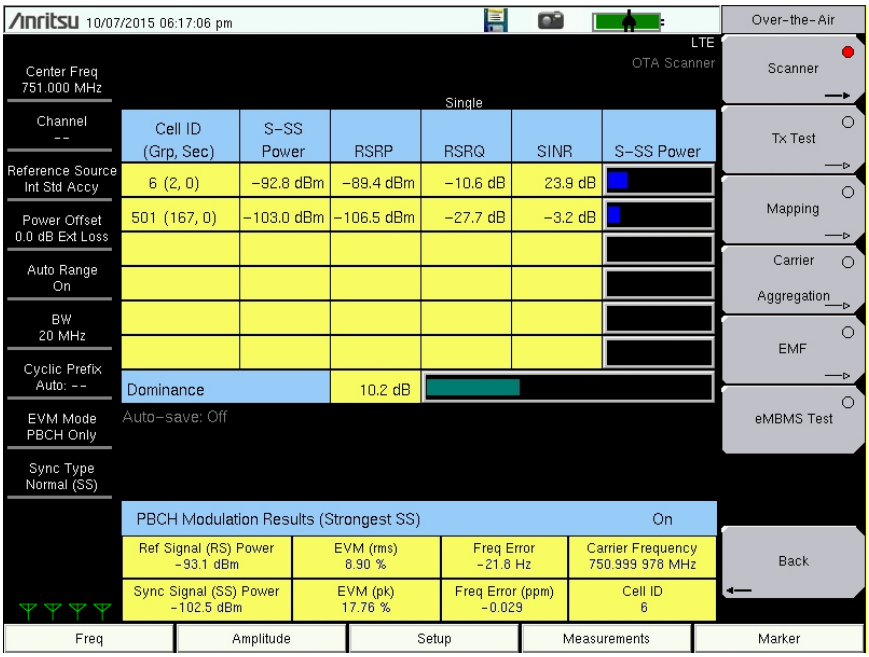


Figure 5-12. Over-the-Air Scanner Measurements

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.

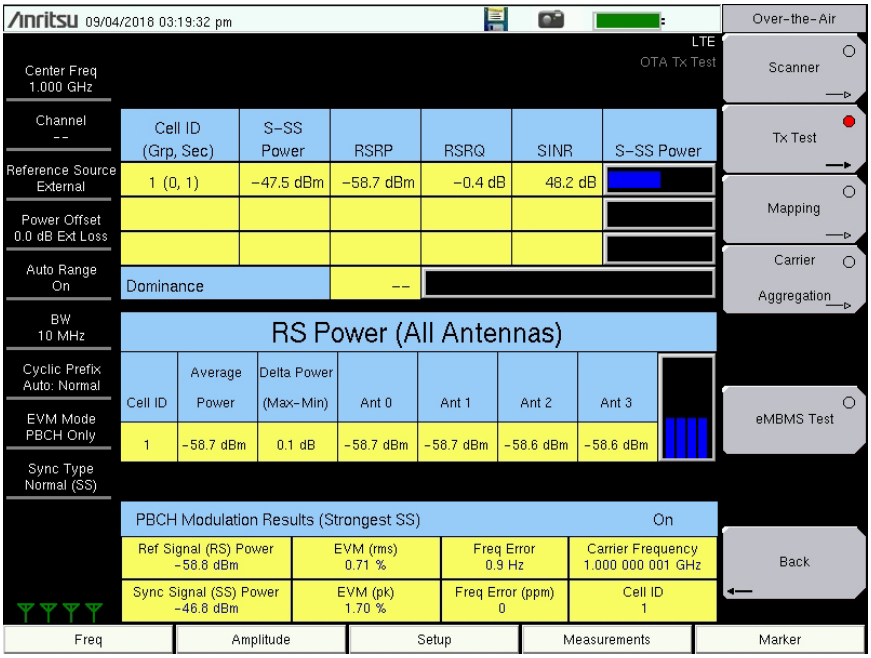


Figure 5-13. Over-the-Air Tx Test Measurement

Mapping

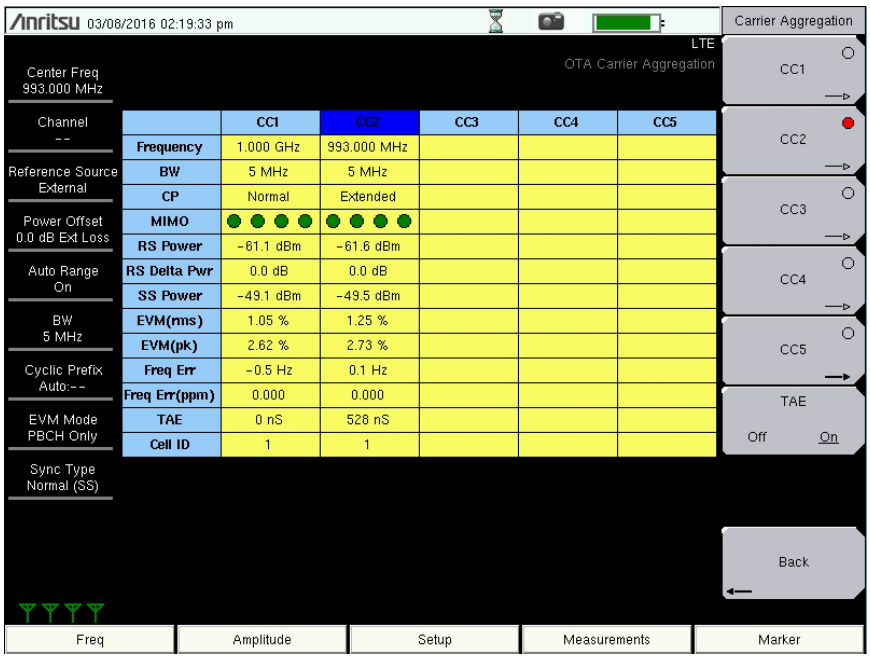
Refer to Chapter 7, "LTE and TD-LTE Coverage Mapping".

Carrier Aggregation

Your Anritsu test instrument supports single-input single-output (SISO) as well as 2x2 and 4x4 multiple-input multiple-output (MIMO) systems. If a single antenna is active, the Component Carrier measurements illustrated in Figure 5-14 are aggregated from the entire modulated contents of the LTE signal. When two or more antennas are active, the measurement results displayed represent the QPSK modulated signal on the Physical Broadcast Channel (PBCH).

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 data.



	CC1	CC2	CC3	CC4	CC5
Frequency	1.000 GHz	993.000 MHz			
BW	5 MHz	5 MHz			
CP	Normal	Extended			
MIMO					
RS Power	-61.1 dBm	-61.6 dBm			
RS Delta Pwr	0.0 dB	0.0 dB			
SS Power	-49.1 dBm	-49.5 dBm			
EVM(rms)	1.05 %	1.25 %			
EVM(pk)	2.62 %	2.73 %			
Freq Err	-0.5 Hz	0.1 Hz			
Freq Err(ppm)	0.000	0.000			
TAE	0 nS	528 nS			
Cell ID	1	1			

Figure 5-14. Over-the-Air Carrier Aggregation Measurement

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.

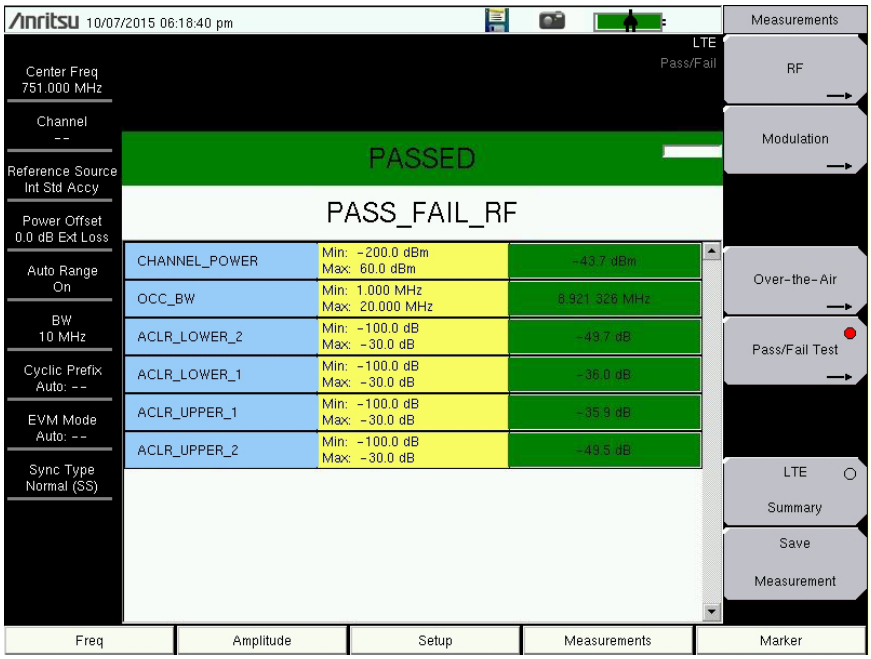


Figure 5-15. Past/Fail Test

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.

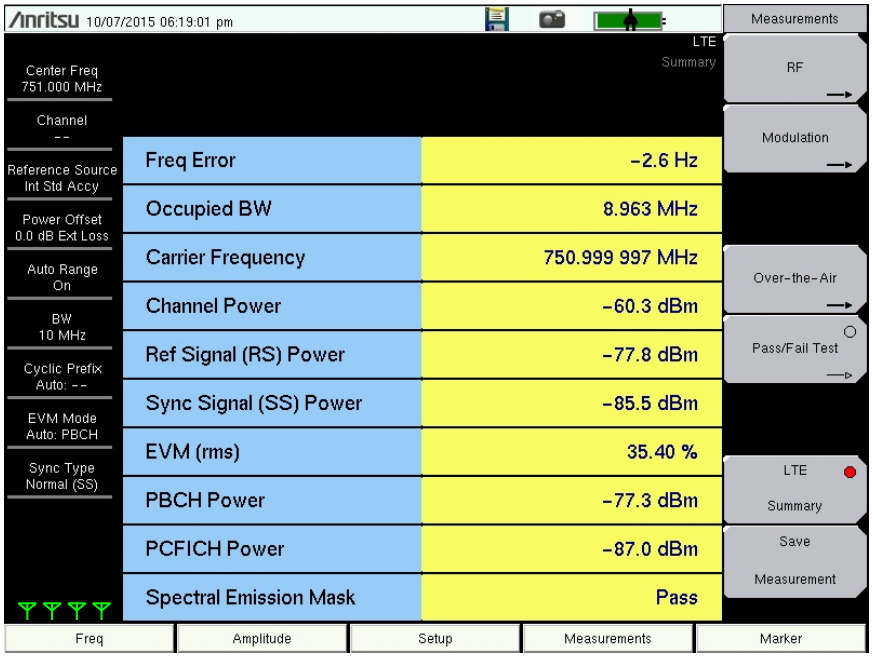


Figure 5-16. LTE Summary

5-8 LTE Menus

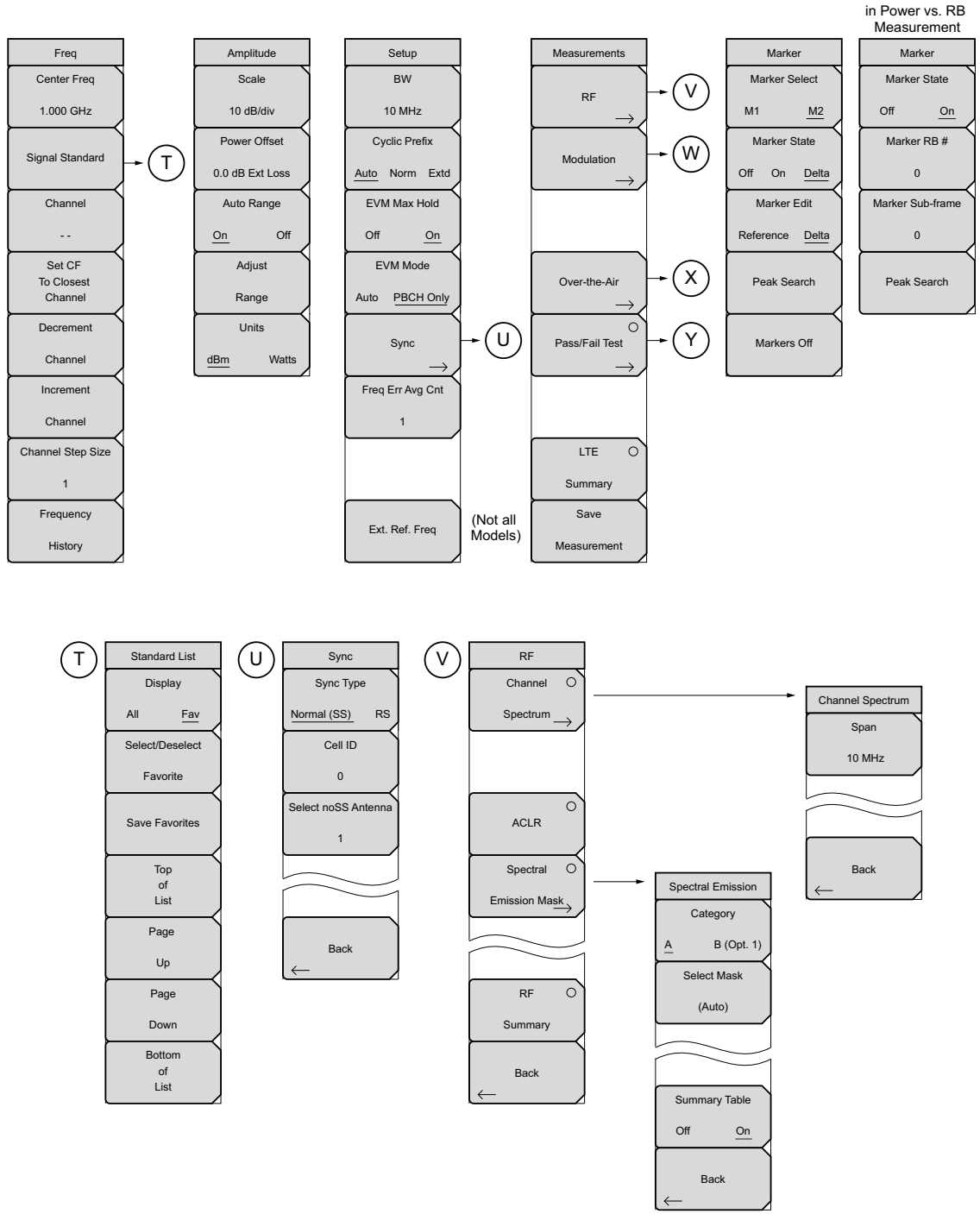


Figure 5-17. LTE Menu Layout (1 of 3)

LTE Menus (continued)

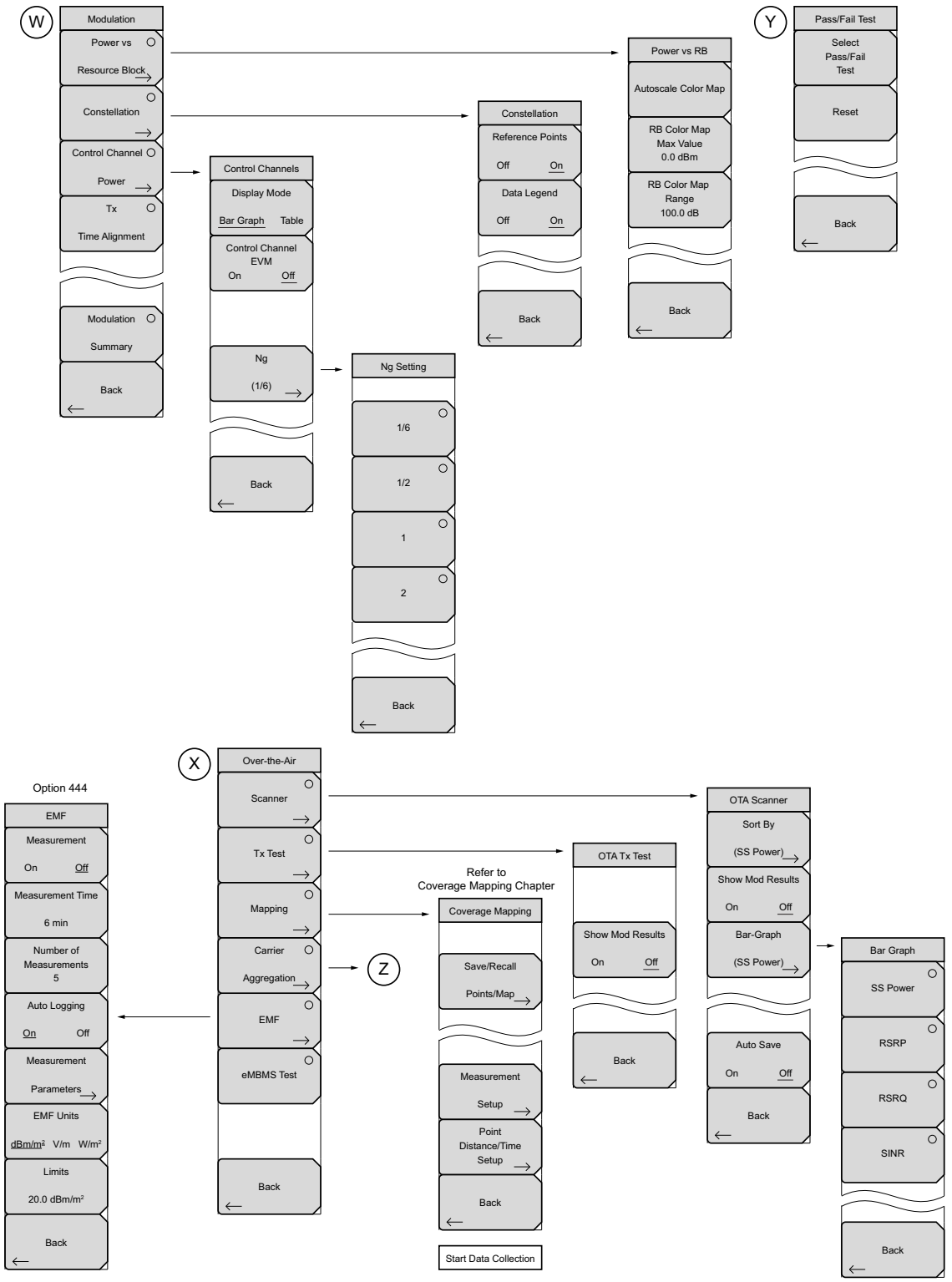


Figure 5-18. LTE Menu Layout (2 of 3)

LTE Menus (continued)

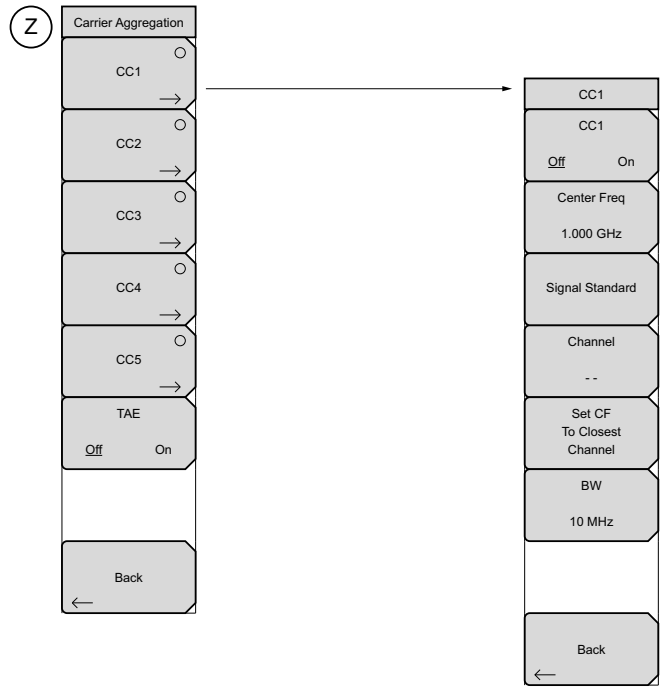
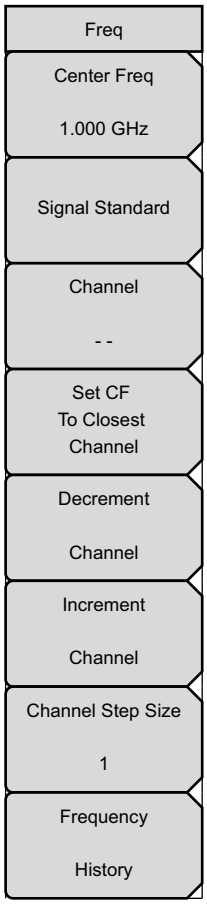


Figure 5-19. LTE Menu Layout (3 of 3)

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.

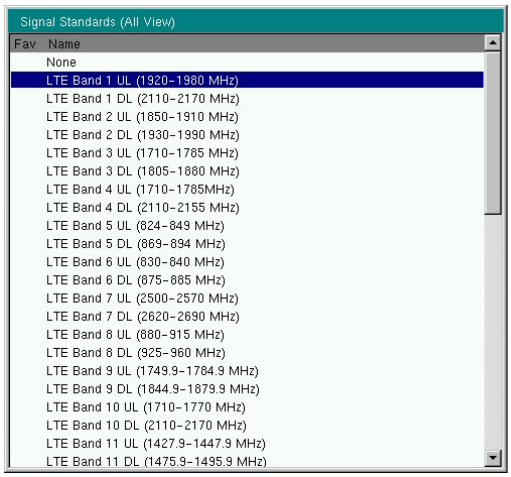
Page Up: Press this submenu key to scroll up one page in the signal standard list.

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



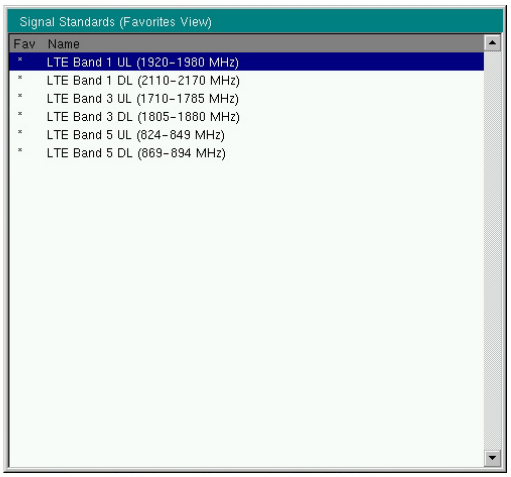


Figure 5-22. LTE Signal Standard List, All and Favorites

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.

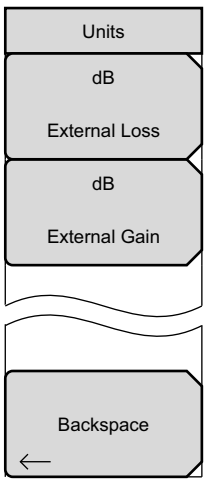
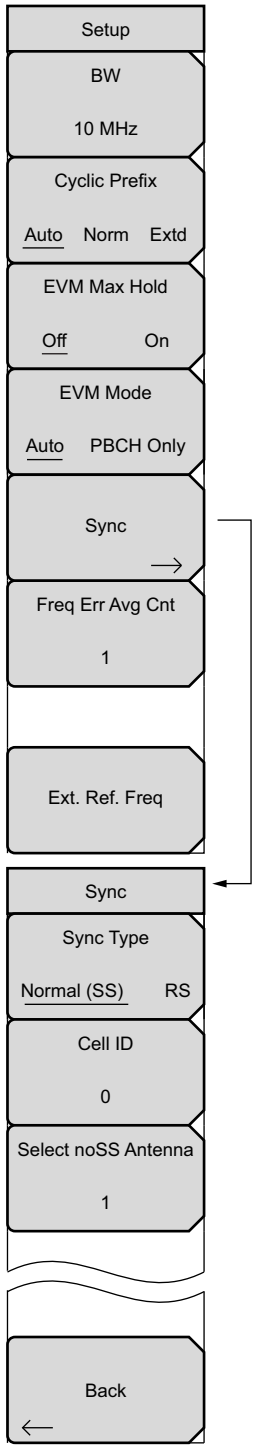


Figure 5-23. LTE Amplitude Menu

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: Select the antenna (1 through 3) in a 4x4 MIMO system that does not receive a sync signal. Antenna 0 must receive a sync signal. This selection is applicable only in RS Sync Type.

Back: Returns to the Setup menu.

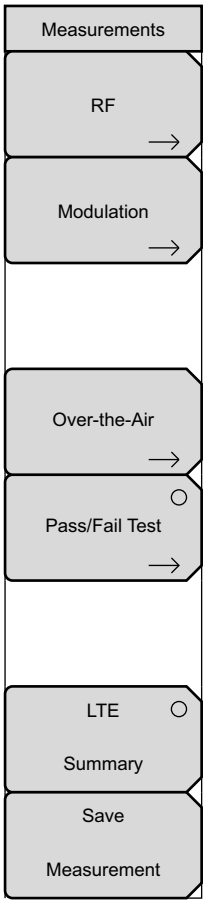
Freq Err Avg Cnt: When the count is greater than one, the frequency error value is averaged over past measurements. If the count is one, then no averaging occurs.

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:

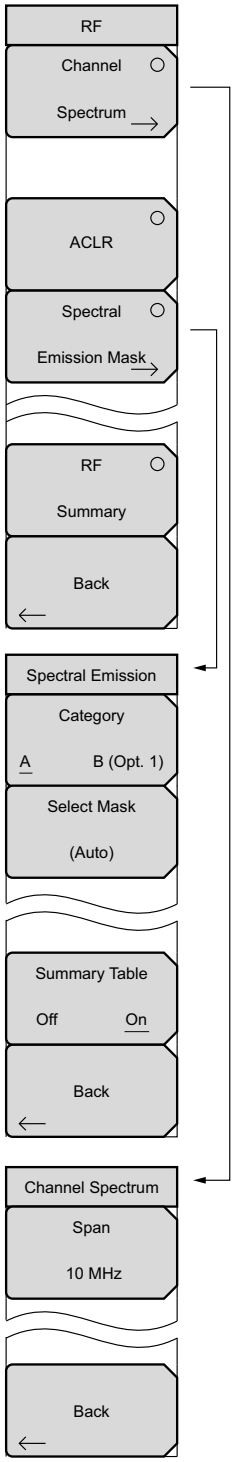
Freq Error
Occupied BW
Carrier Frequency
Channel Power
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
PBCH Power
PCFICH Power
Spectral Emission Mask

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:

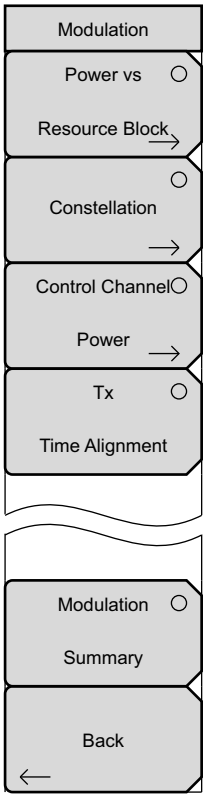
Channel Power
Occupied BW
Lower Adjacent CH Pwr 2
Lower Adjacent CH Pwr 1
Upper Adjacent CH Pwr 1
Upper Adjacent CH Pwr 2
Spectral Emission Mask

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 the modulation-related measurement results:

Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
EVM(256-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

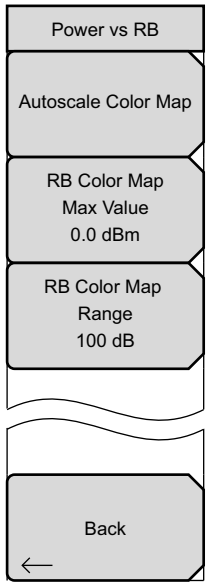
Note: 256-QAM modulation scheme is supported only when Option 886 is installed.

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



Depending on the current measurement view, you may need to press the Power vs Resource Block key one more time to display this menu.

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.

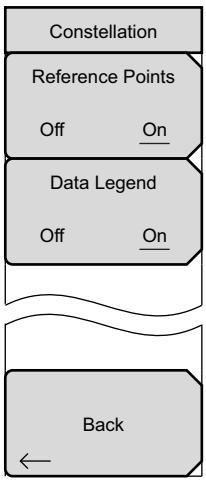
RB Color Map Range: Press to adjust the RB Color Range manually.

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



Depending on the current measurement view, you may need to press the Constellation key one more time to display this menu.

Reference Points: Press this key to turn on and off the reference points (small white circles) for the various constellations. On is the default state.

Data Legend: Turns on and off the legend box in the top right corner of the constellation graph. 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
256-QAM is shown in blue

Note: 256-QAM modulation is supported only when Option 886 is installed.

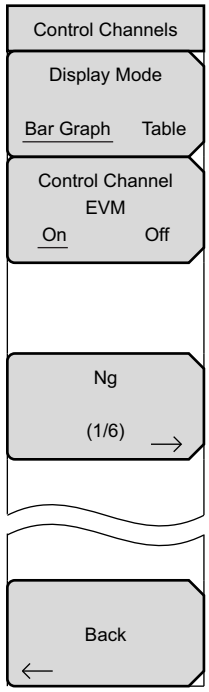
Values for the following measurements are displayed in a table beneath the graph:

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.

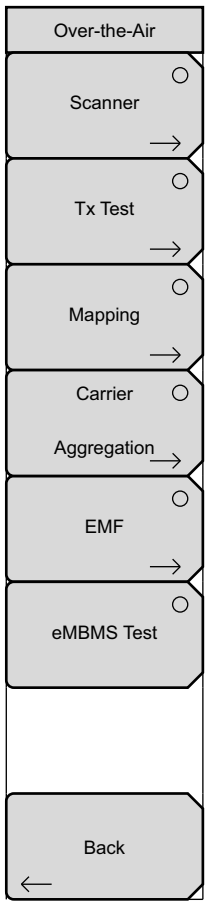
Ng (1/6): Determines the number of PHICH groups in a LTE sub-frame.

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. See "EMF Measurements (Option 444)" on page 1-3 for more information.

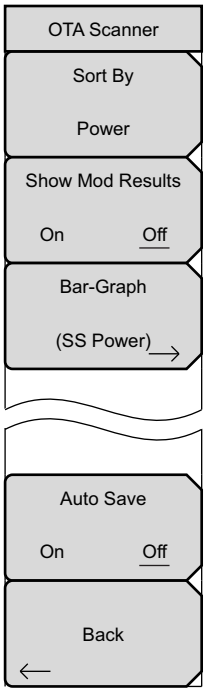
eMBMS: When selected, this submenu key enables the OTA eMBMS Test Measurement mode. Once this mode is active, the display area indicates the Cell ID and the RSRP (Reference Signal Received Power). Note that eMBMS information may require several frame captures and each capture can take several seconds 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

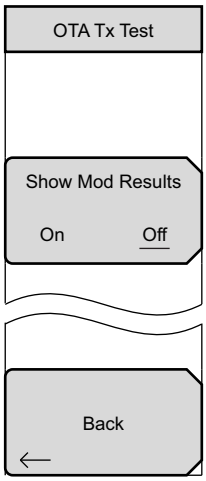
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

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



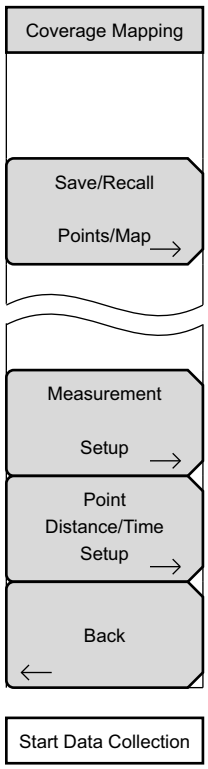
Show Mod Results: When set to On, the PBCH Modulation Results table is displayed. See Figure 5-13 on page 5-20.

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.

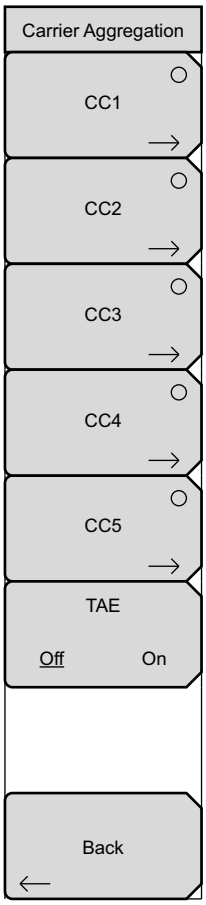
Back: Returns to the "Over-the-Air Menu" on page 5-38.

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.

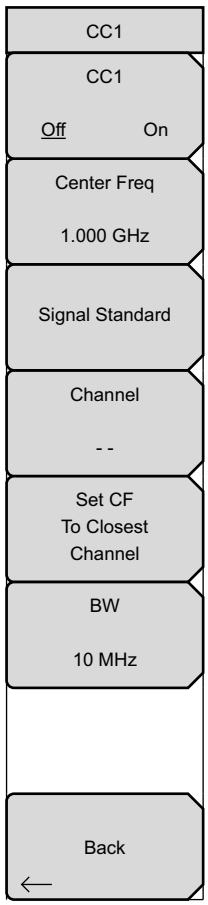
TAE: Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

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.

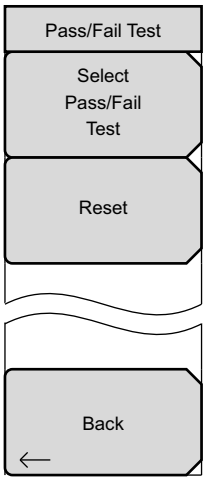
BW: Displays the list of available bandwidths.

Back: Returns to the previous menu.

Figure 5-36. Component Carrier Menu

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.

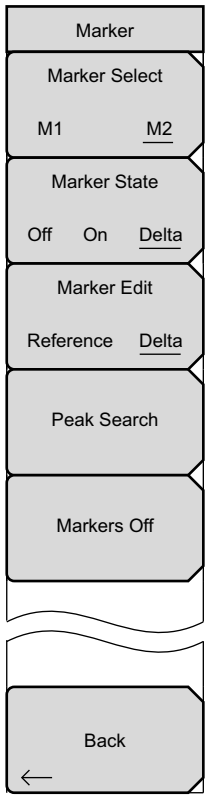
Back: Press this submenu key to return to “Measurements Menu” on page 5-32.

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.

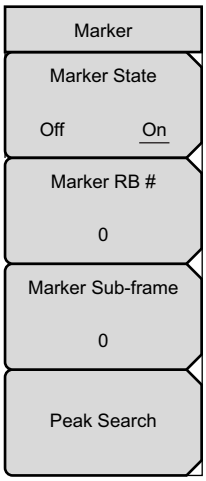
Markers Off: Turns off all markers.

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.

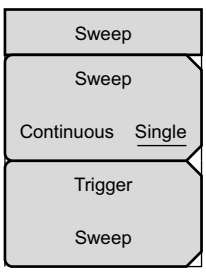
Figure 5-39. LTE Resource Block Marker Menu

5-14 Calibrate Menu

This menu is not available in LTE measurement mode.

5-15 Sweep Menu

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



Sweep Continuous/Single: 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).

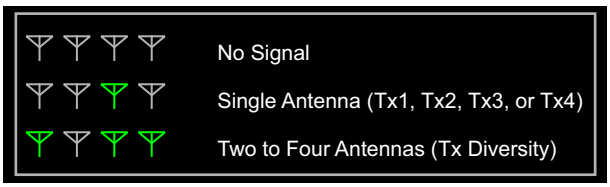


Figure 6-1. Antenna Status

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.

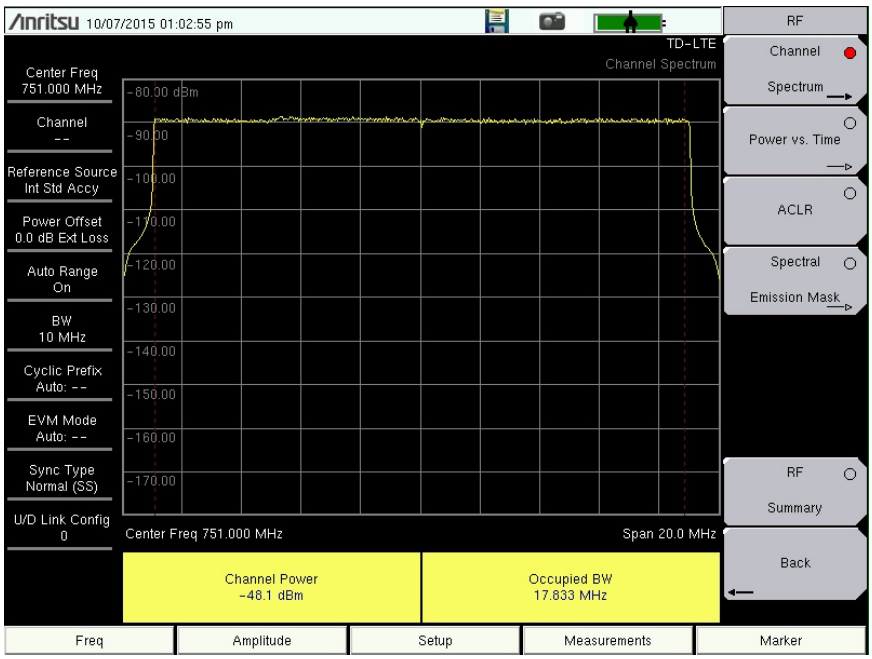


Figure 6-2. Channel Spectrum

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.

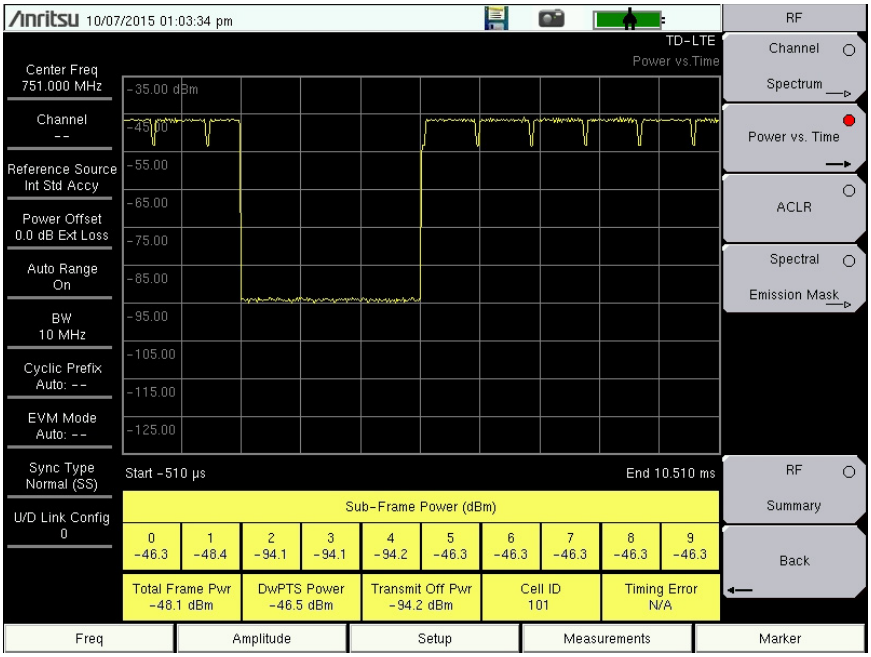


Figure 6-3. Power vs. Time

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).

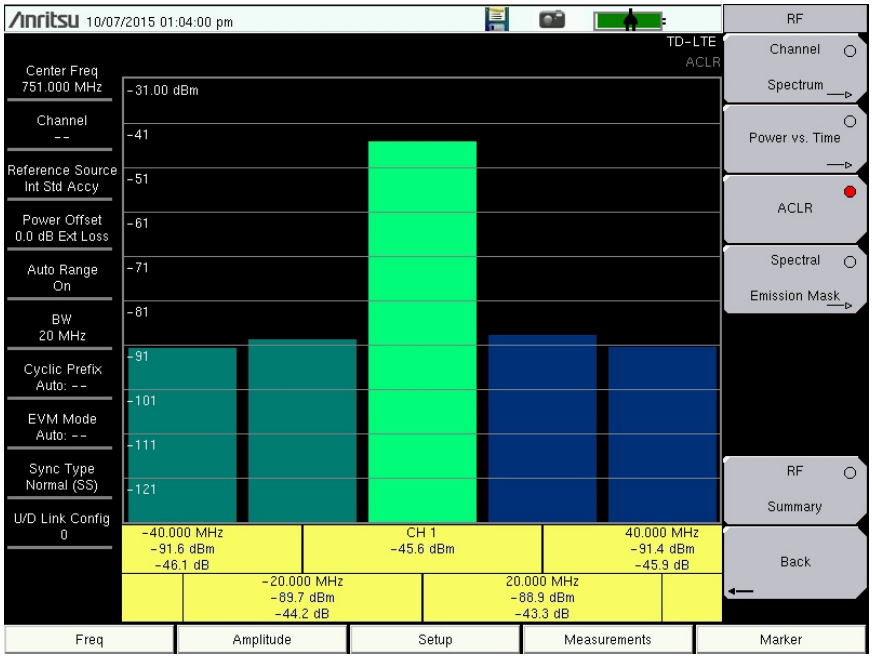


Figure 6-4. Adjacent Channel Leakage Ratio

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.
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 to select On.

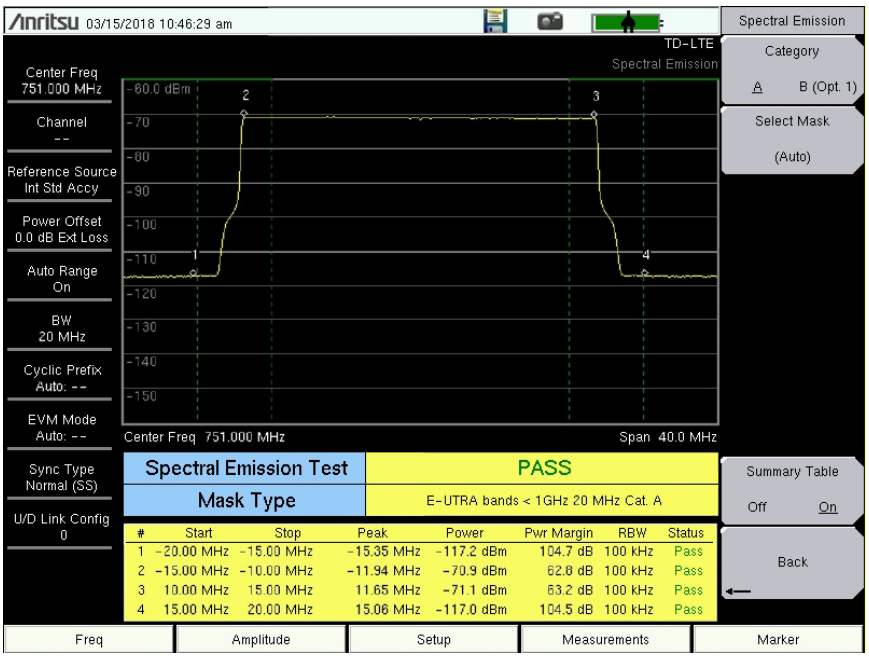


Figure 6-5. Spectral Emission Mask

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).

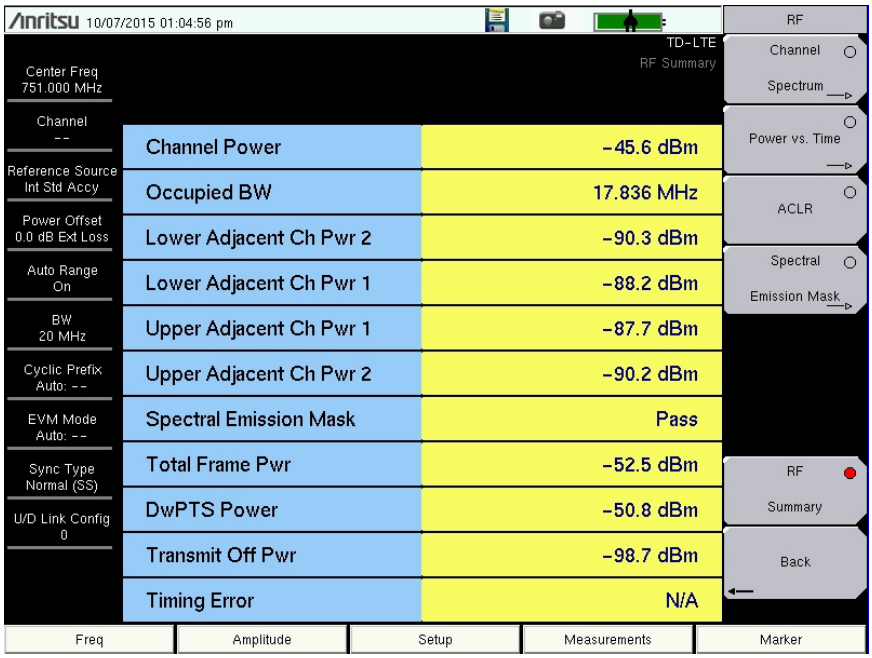


Figure 6-6. RF Summary

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. If the LTE carrier uses 256-QAM modulation scheme, the corresponding EVM measurement result is displayed, provided Option 886 is installed and activated on your instrument (see Figure 6-7 on page 6-12).

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 different 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.

   In the figure below, note that EVM measurement result for 256-QAM modulation type is displayed only when Option 886 is installed on your instrument.

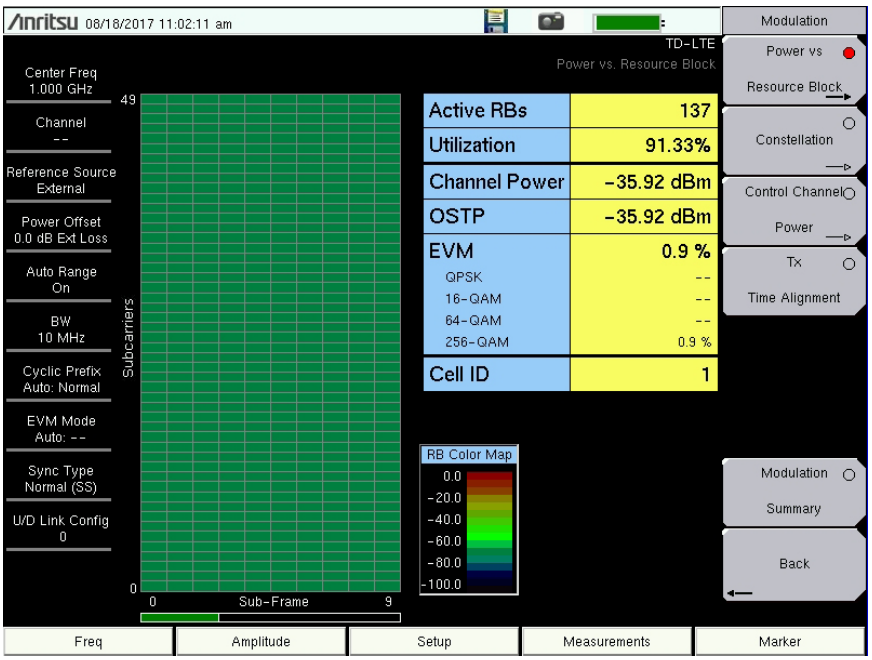


Figure 6-7. Power vs Resource Block Measurement View

4. Press the Power vs Resource Block submenu key again to display the Power vs RB menu and set up the RB Color Map max value and range. Press a submenu key to change the desired parameter, or press the Autoscale Color Map 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 key.
3. To choose a specific RB, press the Marker RB # submenu key and move it to the desired RB# using the arrow buttons or rotary knob, or enter the RB number and press **Enter**.
4. To select a sub-frame, press Marker Sub-frame and move it to the desired sub-frame using the arrow buttons, rotary 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.
4. Press the Constellation key again to display the Constellation menu and enable or disable the reference constellation points and the data legend (see Figure 6-8).
   a. Press the Reference Points submenu key to turn the reference points on or off.
   b. Press the Data Legend submenu key to turn the data legend on or off.

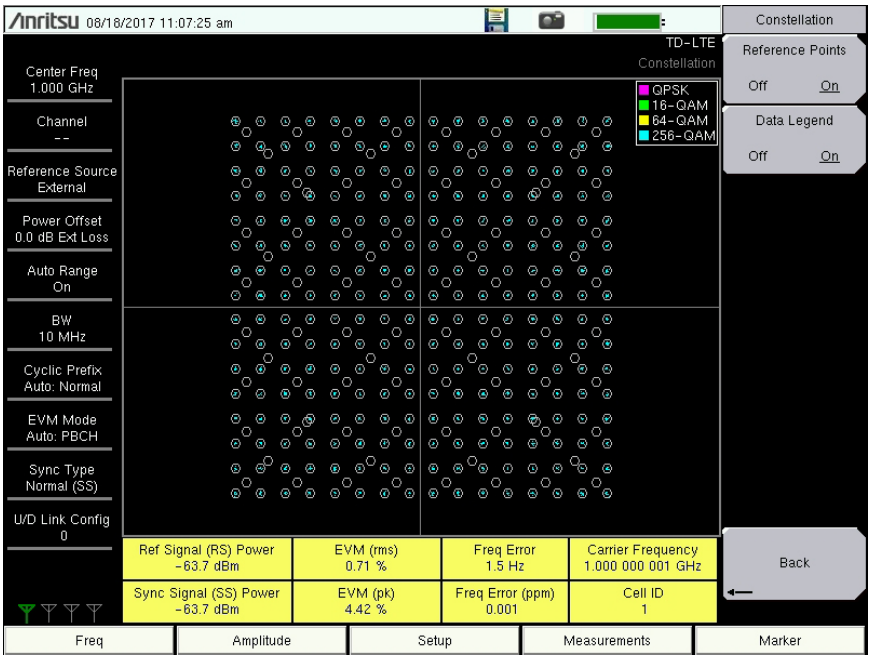


Figure 6-8. Constellation Measurement View

Note	Support for 256-QAM modulation as shown in the data legend above is available only with Option 886.

5. 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.

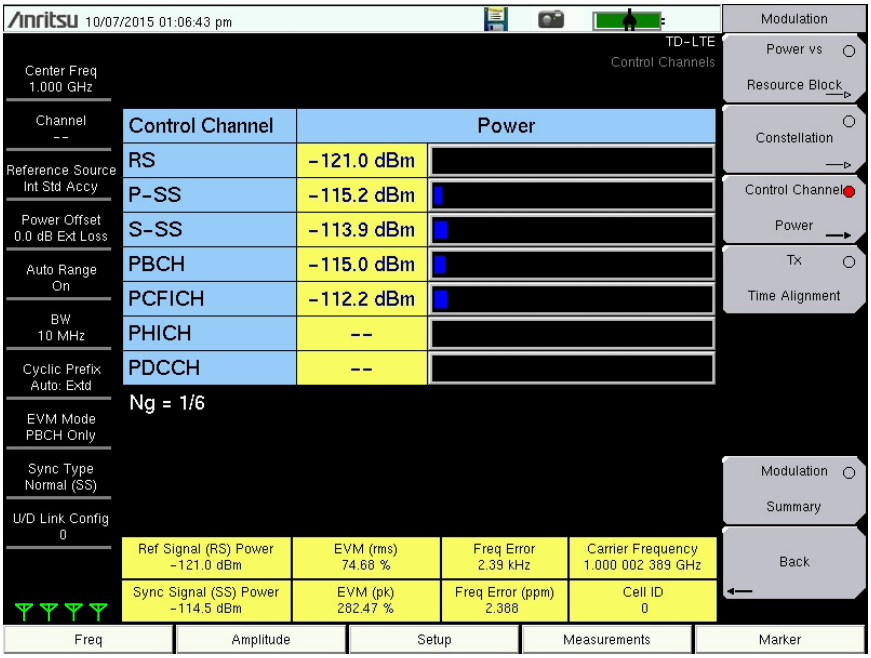


Figure 6-9. Control Channel Power

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). If your instrument is loaded with older firmware that does not support 4x4 MIMO, the display may look similar to Figure 6-11.
4. Press the Back submenu key to return to the Measurements menu.

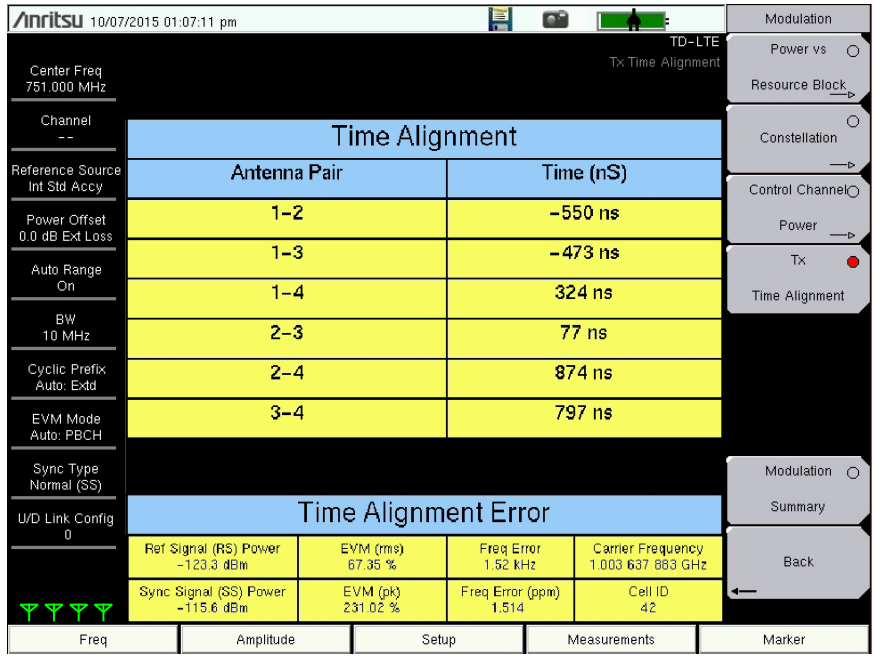


Figure 6-10. Tx Time Alignment

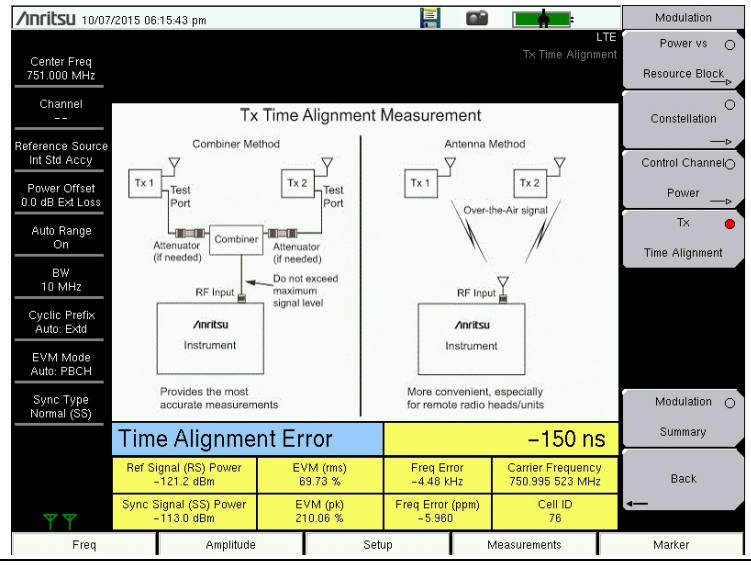


Figure 6-11. Tx Time Alignment

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 6-12).

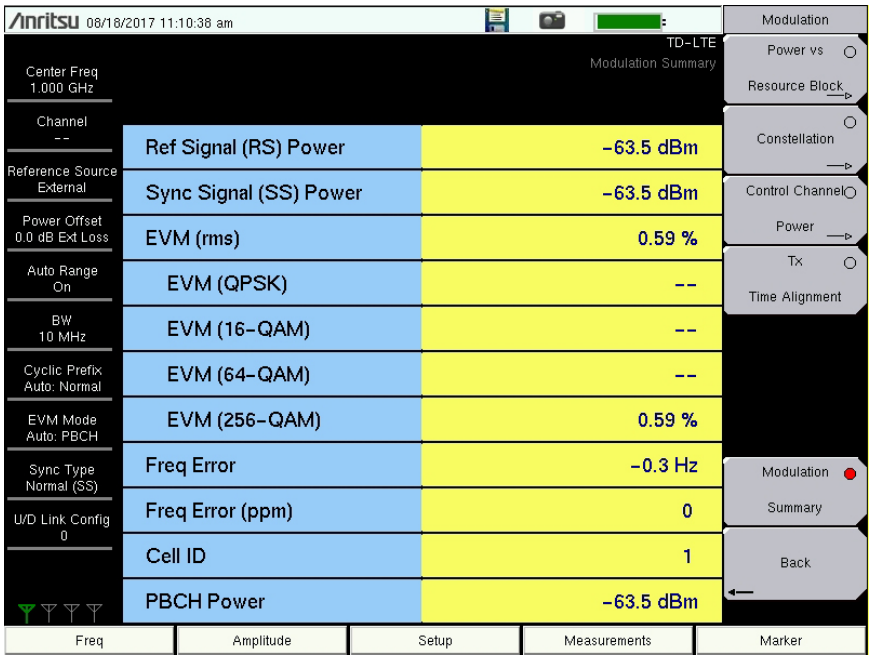


Figure 6-12. Modulation Summary

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 is the average power of Resource Elements (RE) that carry cell-specific Reference Signals (RS) over the entire bandwidth.

RSRQ

Reference Signal Received Quality. Provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRQ 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

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 show which transmitters are active in a MIMO configuration. Active transmitters display as a green dot, inactive as gray. 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.

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 6-13 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.

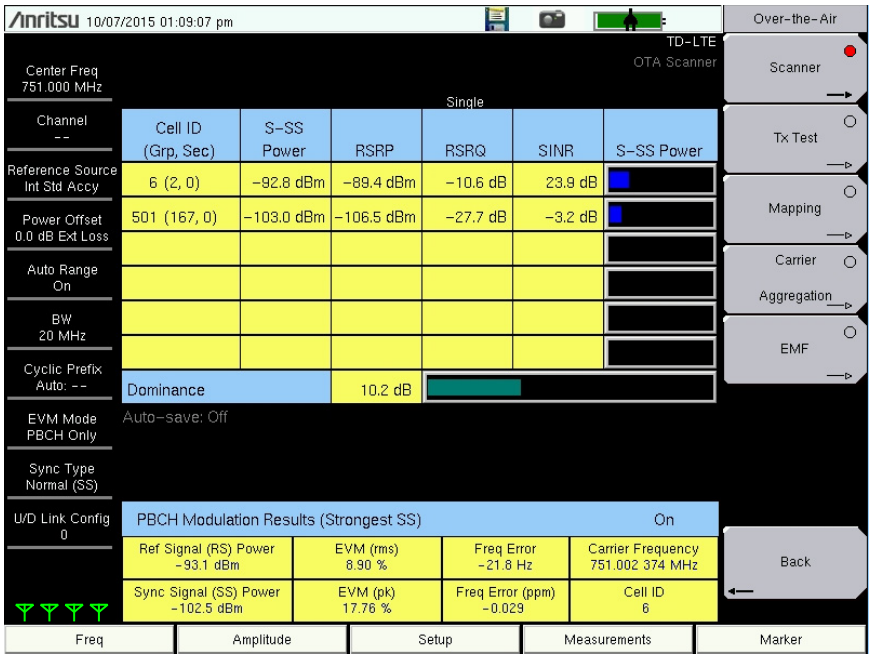


Figure 6-13. Over-the-Air Measurements

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 6-14 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.

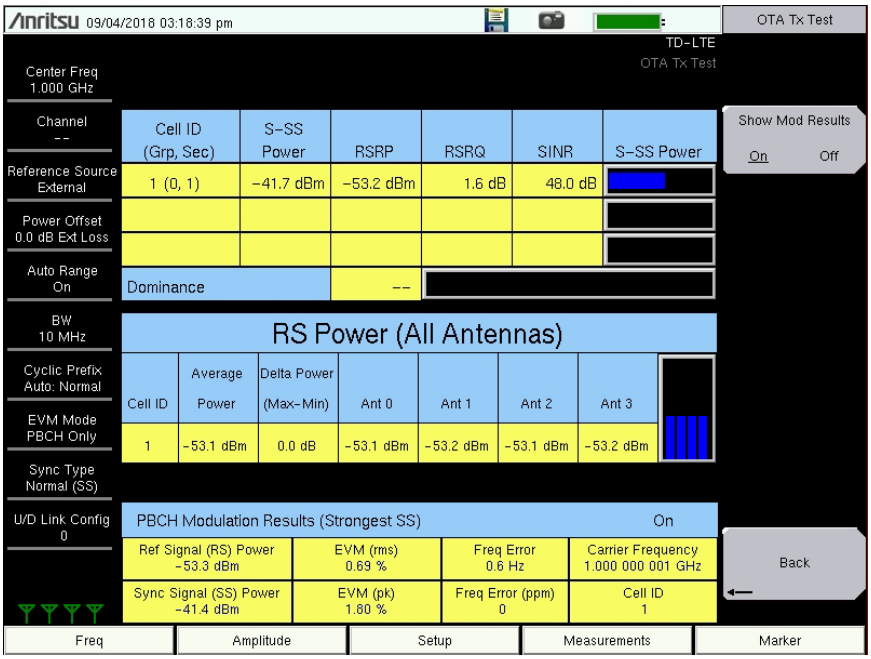


Figure 6-14. Over-the-Air Tx Test Measurement

Mapping

Refer to Chapter 7, “LTE and TD-LTE Coverage Mapping”.

Carrier Aggregation

Your Anritsu test instrument supports single-input single-output (SISO) as well as 2x2 and 4x4 multiple-input multiple-output (MIMO) systems. If a single antenna is active, the Component Carrier measurements illustrated in Figure 6-15 are aggregated from the entire modulated contents of the LTE signal. When two or more antennas are active, the measurement results displayed represent the QPSK modulated signal on the Physical Broadcast Channel (PBCH).

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 6-15.
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 6-47.
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 6-15 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 6-18 for a description of the measurement data.

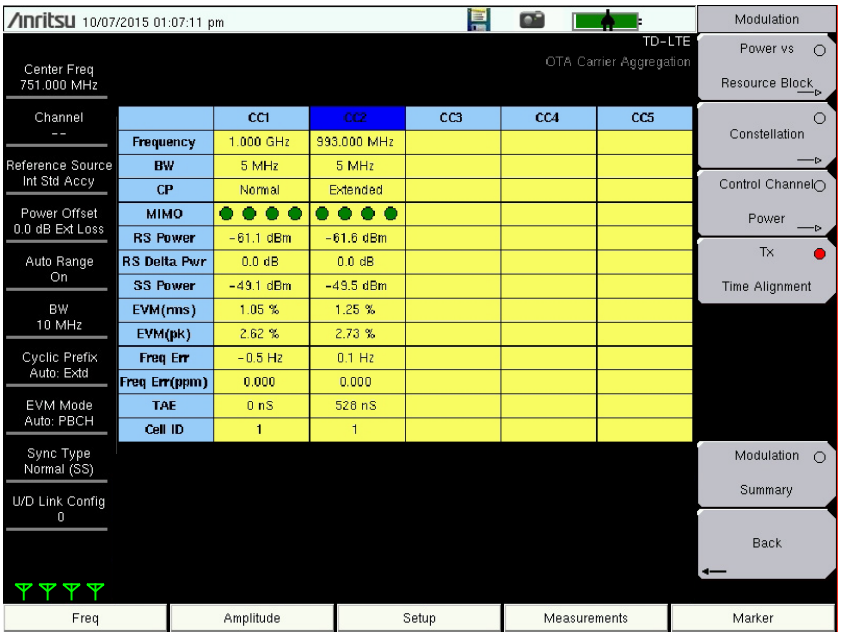


Figure 6-15. Over-the-Air Carrier Aggregation Measurement

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 6-16). 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.

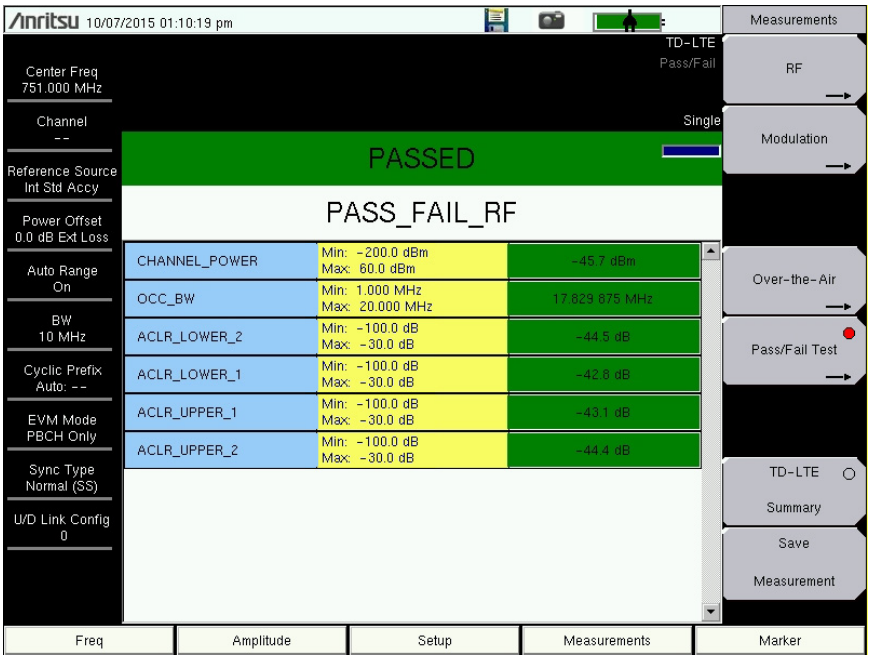


Figure 6-16. Past/Fail Test

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.

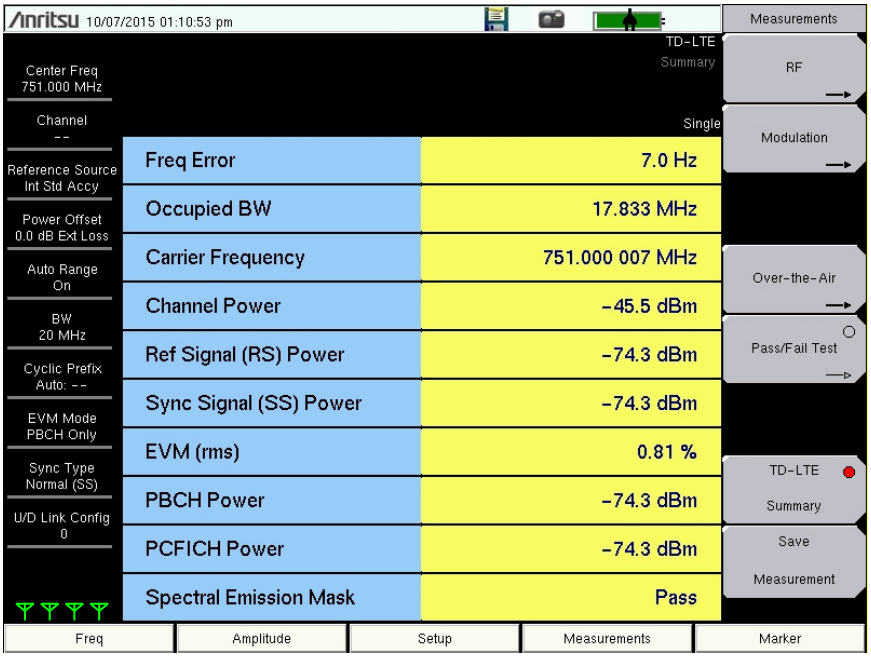


Figure 6-17. TD-LTE Summary

6-8 TD-LTE Menus

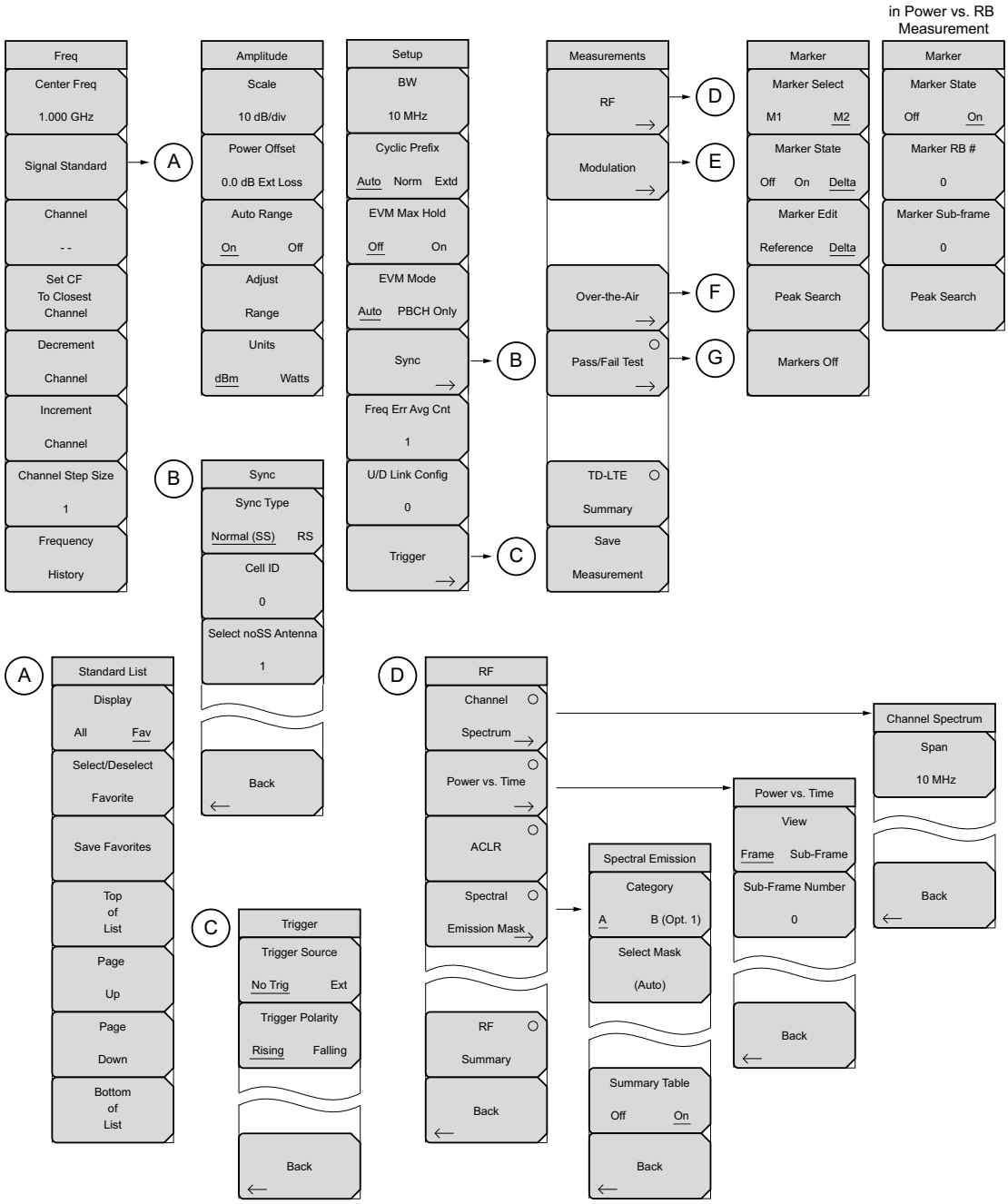


Figure 6-18. TD-LTE Menu Layout (1 of 3)

TD-LTE Menus (continued)

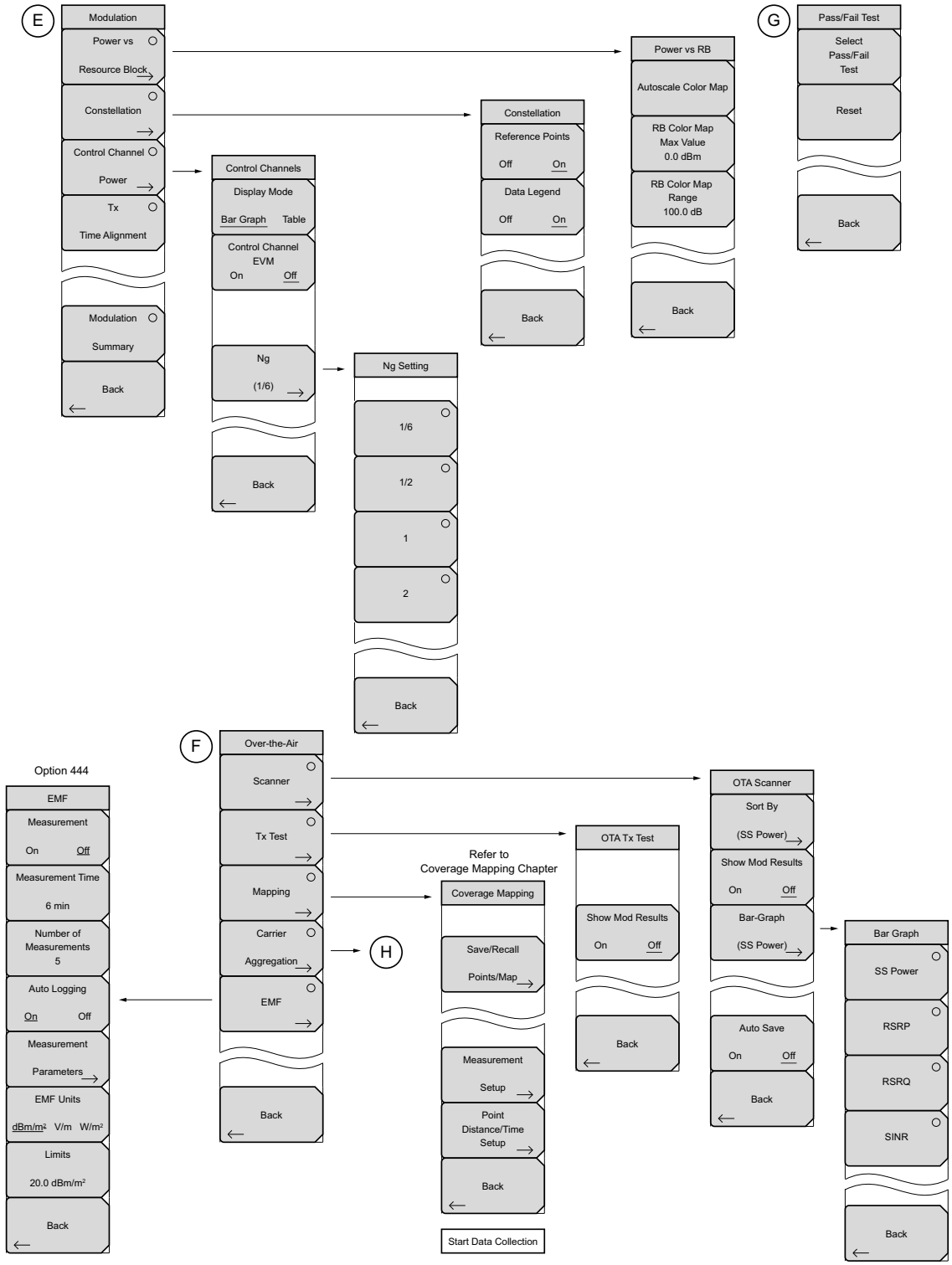


Figure 6-19. TD-LTE Menu Layout (2 of 3)

TD-LTE Menus (continued)

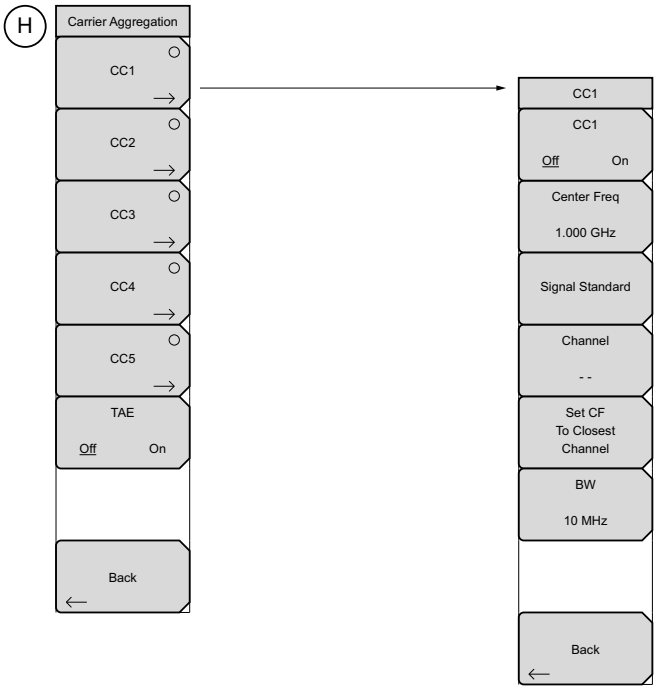
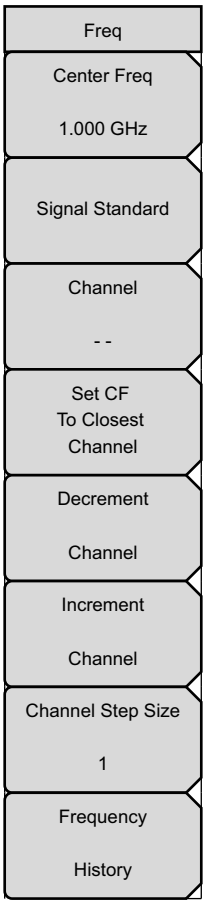


Figure 6-20. TD-LTE Menu Layout (3 of 3)

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 6-21. 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.

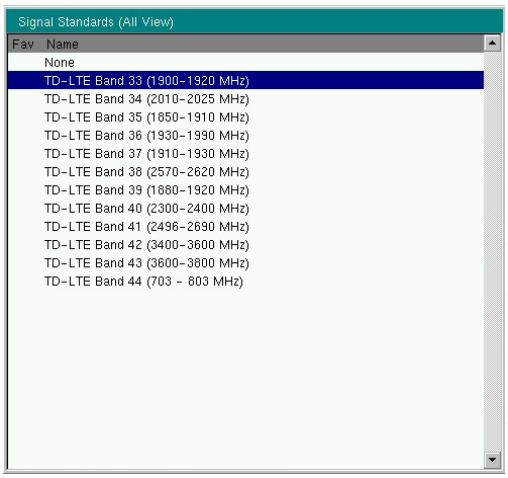
Page Up: Press this submenu key to scroll up one page in the signal standard list.

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 6-22. TD-LTE Signal Standards



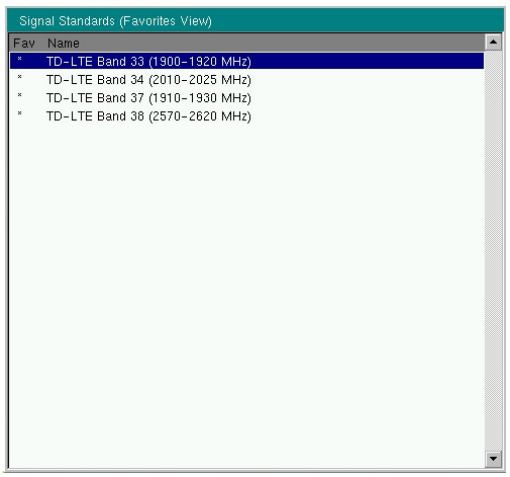


Figure 6-23. TD-LTE Signal Standard List, All and Favorites

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.

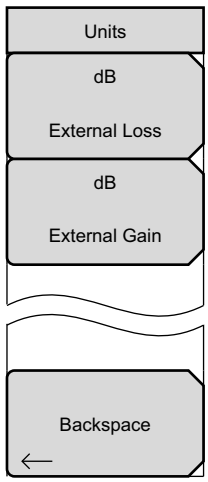
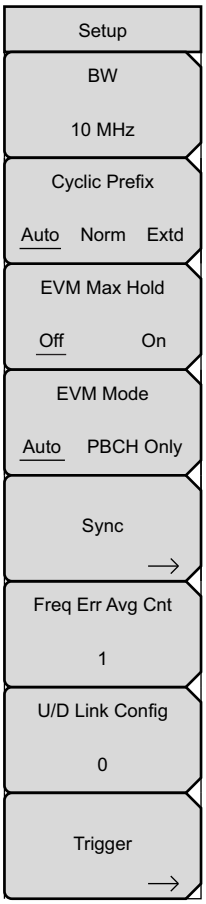


Figure 6-24. TD-LTE Amplitude Menu

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 6-33.

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.

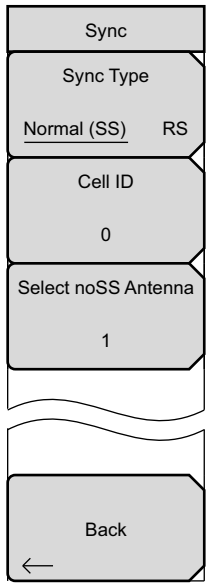
U/D Link Config: Press this key to set the Uplink/Downlink configuration, also known as the Frame Format. Use the keypad, arrow keys, or the rotary knob to set the value between 0 and 6 inclusive. This selection determines which subframes are uplink subframes and which are downlink subframes, and where the transitions between uplink and downlink subframes occur.

Trigger: Press this key to open the “Trigger Menu” on page 6-33.

Figure 6-25. TD-LTE Setup Menu

Sync Menu

Key Sequence: **Setup** > Sync



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.

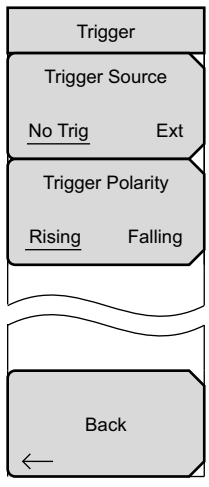
Select noSS Antenna: Select the antenna (1 through 3) in a 4x4 MIMO system that does not receive a sync signal. Antenna 0 must receive a sync signal. This selection is applicable only in RS Sync Type.

Back: Press this submenu key to return to the "Setup Menu" on page 6-32.

Figure 6-26. 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.

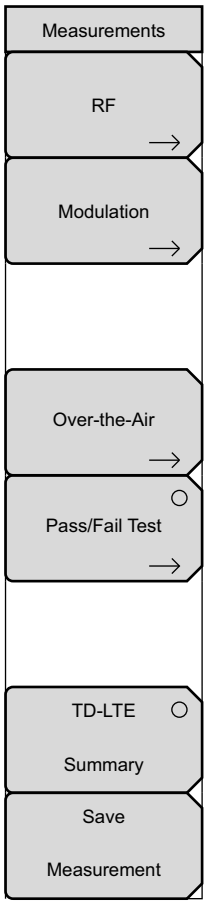
Trigger Polarity: Select the desired edge of the external trigger source to use for reference.

Back: Press this submenu key to return to the "Setup Menu" on page 6-32.

Figure 6-27. TD-LTE Sync Menu

6-12 Measurements Menu

Key Sequence: **Measurements**



RF: Press this submenu key to display the "RF Menu" on page 6-35.

Modulation: Press this submenu key to display the "Modulation Menu" on page 6-38.

Over-the-Air: Press this submenu key to display the "Over-the-Air Menu" on page 6-42.

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 6-48 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:

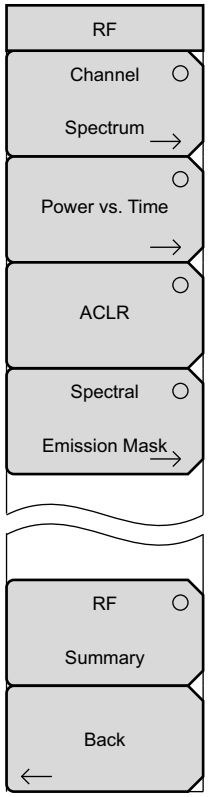
Freq Error
Occupied BW
Carrier Frequency
Channel Power
Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
PBCH Power
PCFICH Power
Spectral Emission Mask

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 6-28. TD-LTE Measurements Menu

RF Menu

Key Sequence: **Measurements** > RF



Channel Spectrum: Opens the "Channel Spectrum Menu" on page 6-36. 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 6-36. 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 6-37. 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:

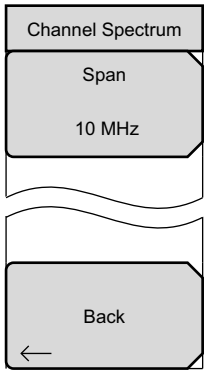
Channel Power
Occupied BW
Lower Adjacent CH Pwr 2
Lower Adjacent CH Pwr 1
Upper Adjacent CH Pwr 1
Upper Adjacent CH Pwr 2
Spectral Emission Mask
Total Frame Pwr
DwPTS Power
Transmit Off Pwr
Timing Error

Back: Press this submenu key to return to the "Measurements Menu" on page 6-34.

Figure 6-29. TD-LTE RF Menu

Channel Spectrum Menu

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



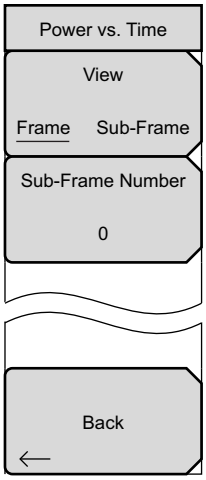
Span: Opens the Span list to select a frequency span or Auto.

Back: Returns to the "RF Menu" on page 6-35.

Figure 6-30. 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

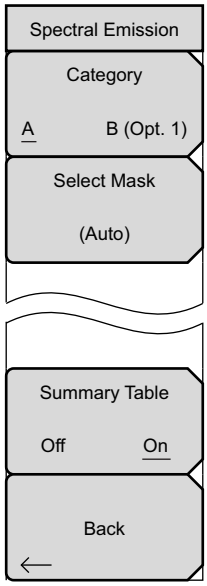
Sub-Frame Number: If Sub-Frame is selected, press to enter the desired sub-frame to view.

Back: Returns to the "RF Menu" on page 6-35.

Figure 6-31. TD-LTE Power vs. Time Menu

Spectral Emission Menu

Key Sequence: **Measurements** > RF > Spectral Emission Mask



Category A B (Opt. 1): Select the desired category based on the information on page 6-35.

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.

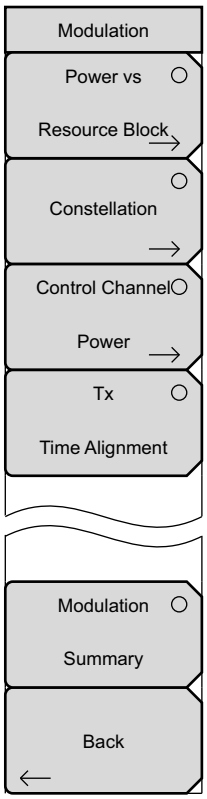
Summary Table: Displays the Spectral Emission measurement data in table form.

Back: Returns to the “RF Menu” on page 6-35.

Figure 6-32. 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 6-39 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 6-40.

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 6-41.

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 the modulation-related measurement results:

Ref Signal (RS) Power
Sync Signal (SS) Power
EVM (rms)
EVM(QPSK)
EVM(16-QAM)
EVM(64-QAM)
EVM(256-QAM)
Freq Error
Freq Error (ppm)
Cell ID
PBCH Power

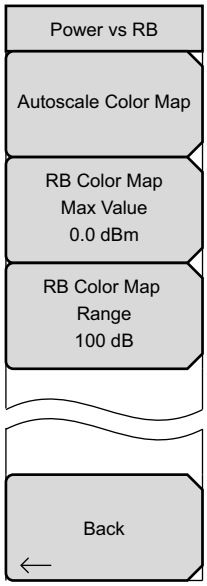
Note: 256-QAM modulation scheme is supported only when Option 886 is installed.

Back: Press this submenu key to return to "Measurements Menu" on page 6-34.

Figure 6-33. TD-LTE Modulation Menu

Power vs. Resource Block Menu

Key Sequence: **Measurements** > Modulation > Power vs Resource Block



Depending on the current measurement view, you may need to press the Power vs Resource Block key one more time to display this menu.

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.

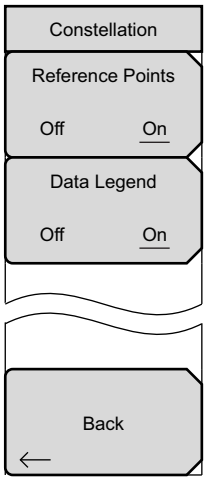
RB Color Map Range: Press to adjust the RB Color Range manually.

Back: Press this submenu key to return to the “Modulation Menu” on page 6-38.

Figure 6-34. TD-LTE Power vs. Resource Block Menu

Constellation Menu

Key Sequence: **Measurements** > Modulation > Constellation



Depending on the current measurement view, you may need to press the Constellation key one more time to display this menu.

Reference Points: Press this key to turn on and off the reference points (small white circles) for the various constellations. On is the default state.

Data Legend: Turns on and off the legend box in the top right corner of the constellation graph. On is the default state.

Back: Press this submenu key to return to the "Modulation Menu" on page 6-38.

The constellations are color coded as follows:

QPSK is shown in purple
16-QAM is shown in green
64-QAM is shown in yellow
256-QAM is shown in blue

Note: 256-QAM modulation is supported only when Option 886 is installed.

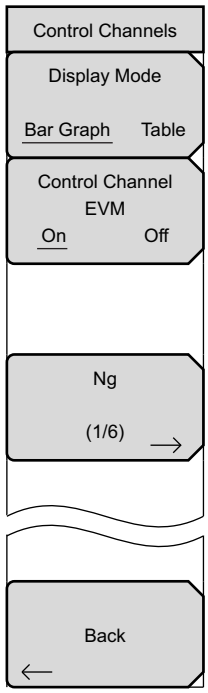
Values for the following measurements are displayed in a table beneath the graph:

Ref. Signal (RS) Power
EVM (rms)
Freq Error
Carrier Frequency
Sync Signal (SS) Power
EVM (pk)
Freq Error (ppm)
Cell ID

Figure 6-35. 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.

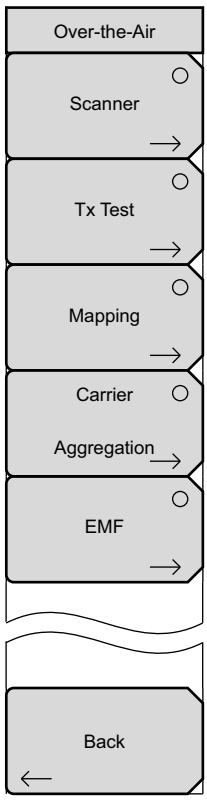
Ng (1/6): Determines the number of PHICH groups in a LTE sub-frame.

Back: Press this submenu key to return to the "Modulation Menu" on page 6-38.

Figure 6-36. 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 6-43 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 6-44 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 6-46.

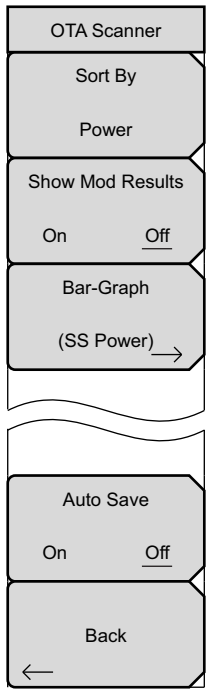
EMF (Option 444 only)**:** When first selected, this key enables the EMF Measurement mode only if an isotropic antenna is connected. See "EMF Measurements (Option 444)" on page 1-3 for more information.

Back: Press this submenu key to return to the "Measurements Menu" on page 6-34.

Figure 6-37. 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: 2009081122332244.tdlte

y - year, 2009, m - month, 08, d - day, 11, h - hour, 22, n - minutes, 33 s - seconds, 44

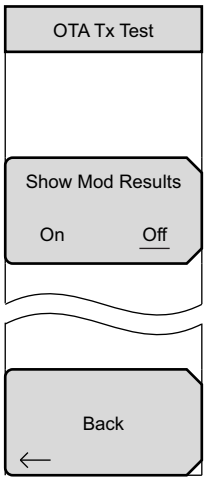
Note: GPS coordinates are saved in addition to the measurement results, if GPS is on and a fix is established.

Back: Press this submenu key to return to the "Over-the-Air Menu" on page 6-42.

Figure 6-38. TD-LTE OTA Scanner Menu

Over-the-Air Tx Test Menu

Key Sequence: **Measurements** > Over-the-Air > Tx Test



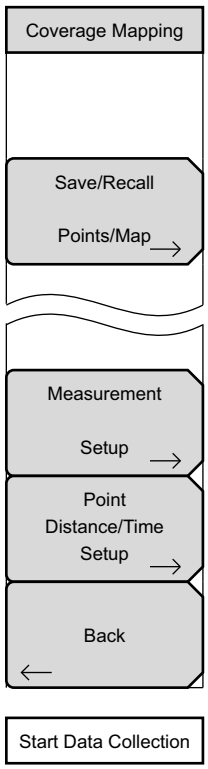
Show Mod Results: When set to On, the PBCH Modulation Results table is displayed. See Figure 6-14 on page 6-21.

Back: Press this submenu key to return to the “Over-the-Air Menu” on page 6-42.

Figure 6-39. 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.

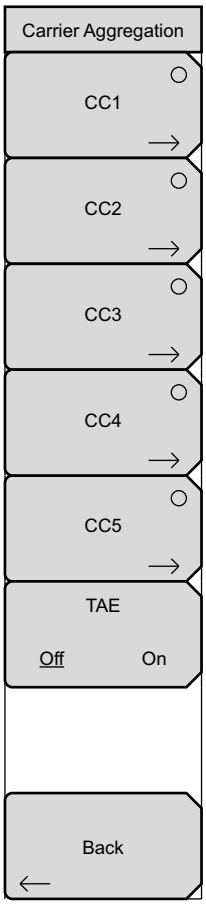
Back: Returns to the "Over-the-Air Menu" on page 6-42.

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 6-40. 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 6-42.

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.

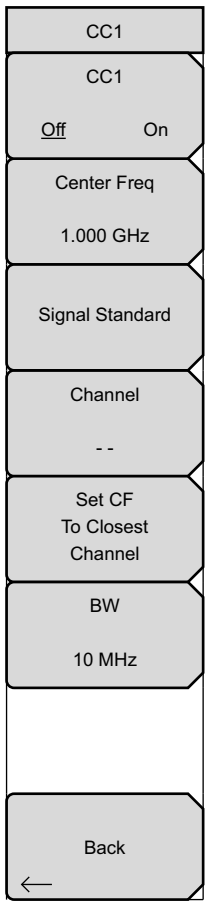
TAE: Time Alignment Error (TAE) is a measurement of the differential transmission delay between the Component Carriers. The 3GPP specification identifies the limits of the delays for the system to operate properly.

Back: Returns to the "Over-the-Air Menu" on page 6-42.

Figure 6-41. 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 6-30.

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.

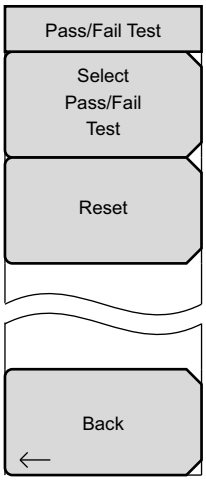
BW: Displays the selectable bandwidth list.

Back: Returns to the previous menu.

Figure 6-42. Component Carrier Menu

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.

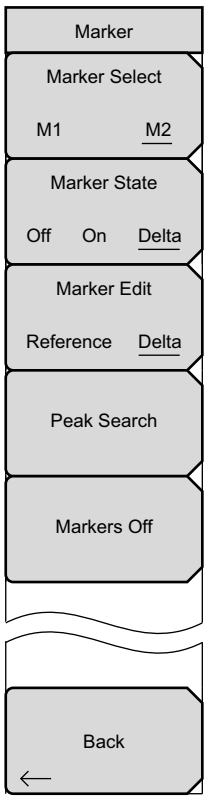
Back: Press this submenu key to return to the “Measurements Menu” on page 6-34.

Figure 6-43. 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.

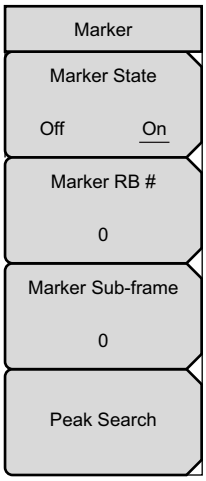
Markers Off: Turns off all markers.

Back: Press this submenu key to return to the “Measurements Menu” on page 6-34.

Figure 6-44. 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 6-34.

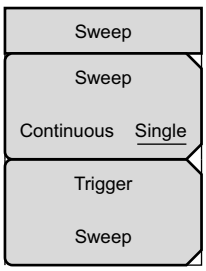
Figure 6-45. TD-LTE Resource Block Marker Menu

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 Continuous/Single: 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 6-46. TD-LTE Sweep Menu

6-16 Measure Menu

Displays the "Measurements Menu" on page 6-34.

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

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.

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

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.

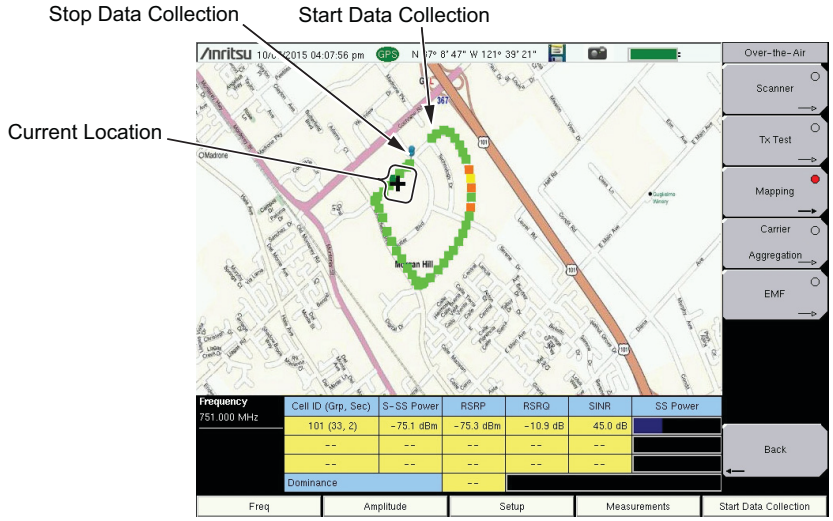


Figure 7-1. Outdoor Coverage Mapping (GPS On)

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.

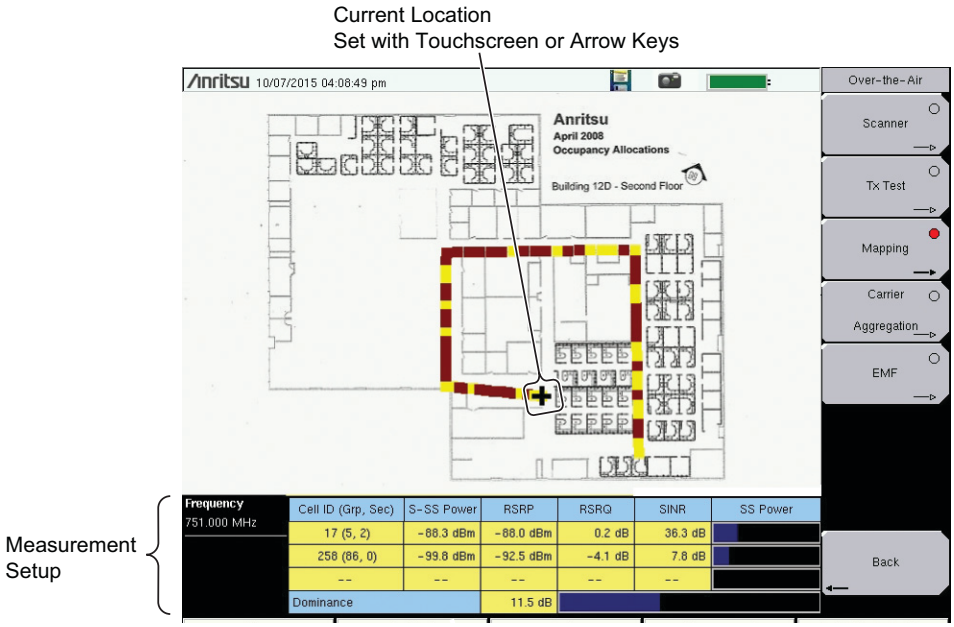


Figure 7-2. Indoor Coverage Mapping (GPS Off)

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.

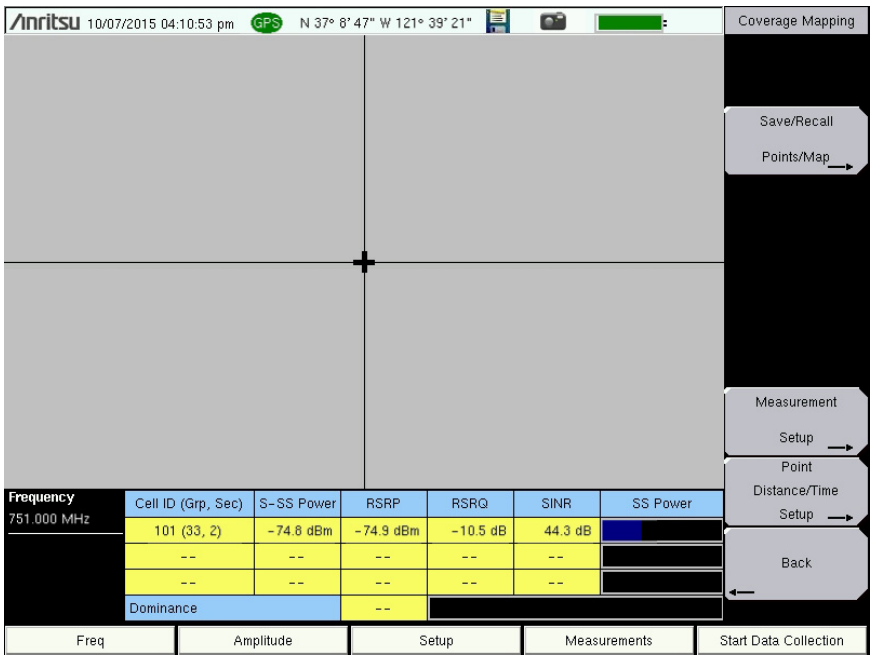


Figure 7-3. LTE Coverage Mapping with the Default Grid

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.

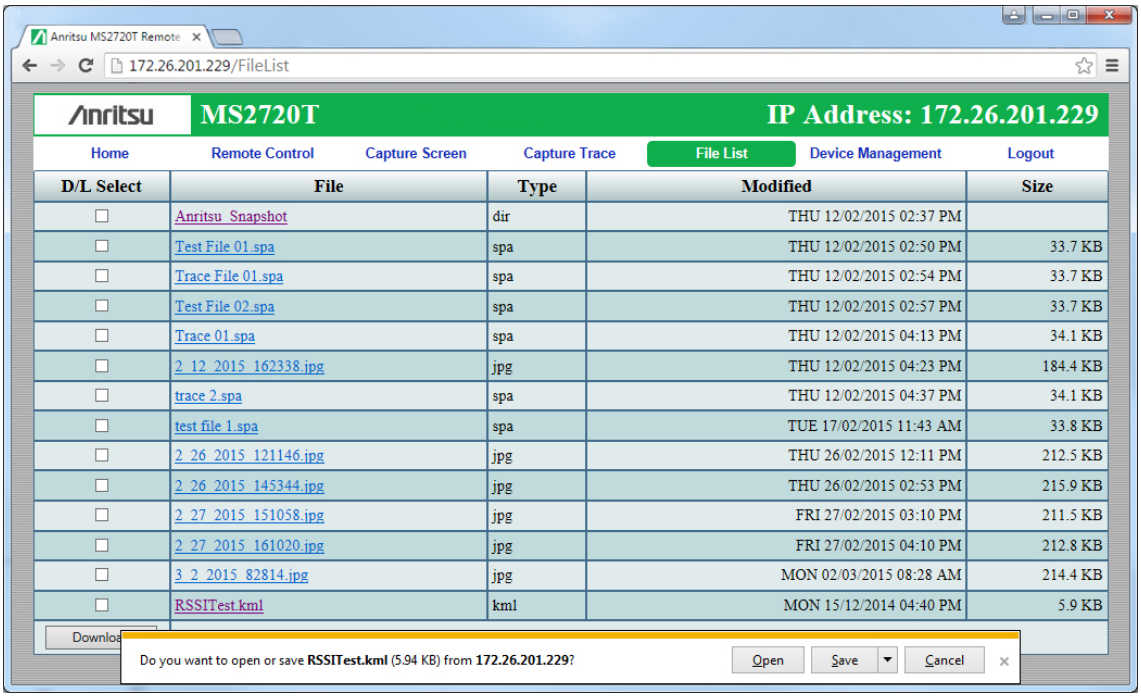


Figure 7-4. Web Remote Control Window - File List Tab

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.

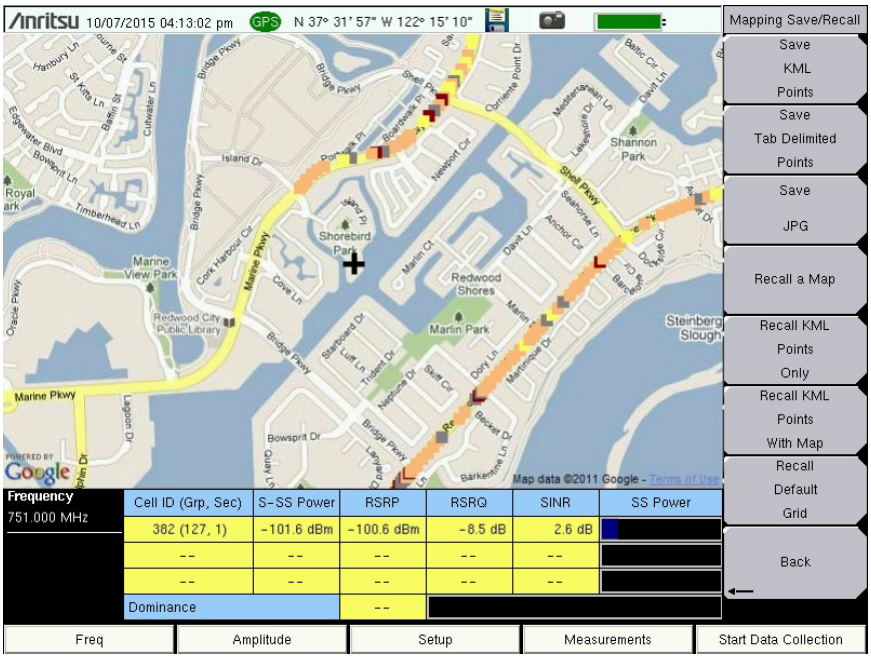


Figure 7-6. Coverage Mapping Measurement Saved as a .jpg File

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.

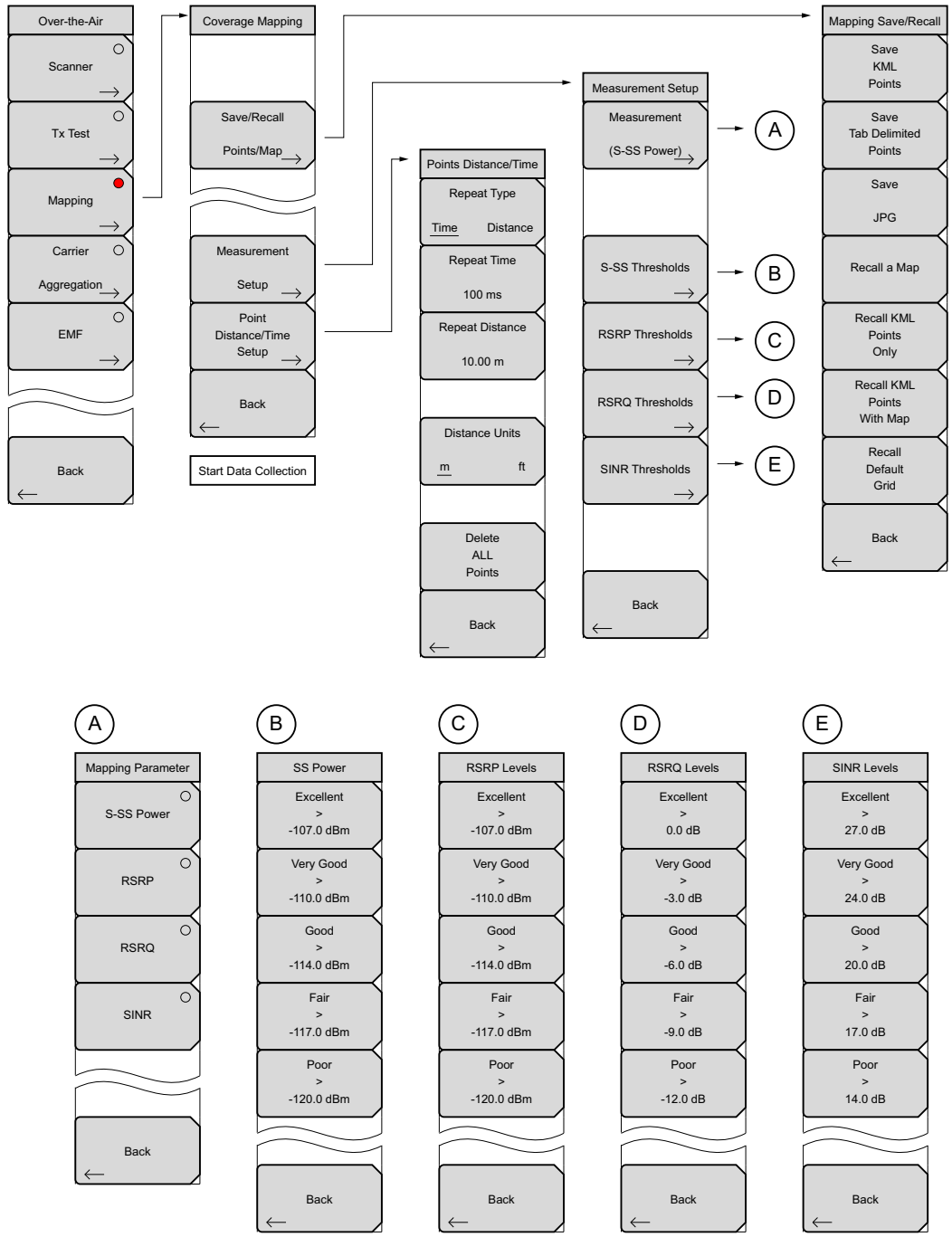
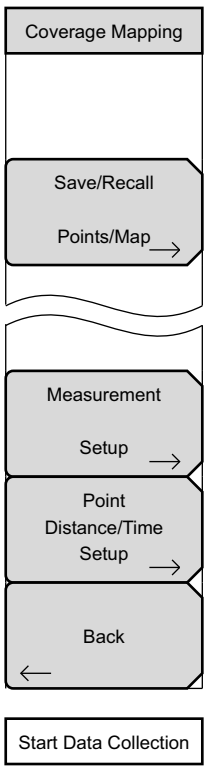


Figure 7-7. Coverage Mapping Menu

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.

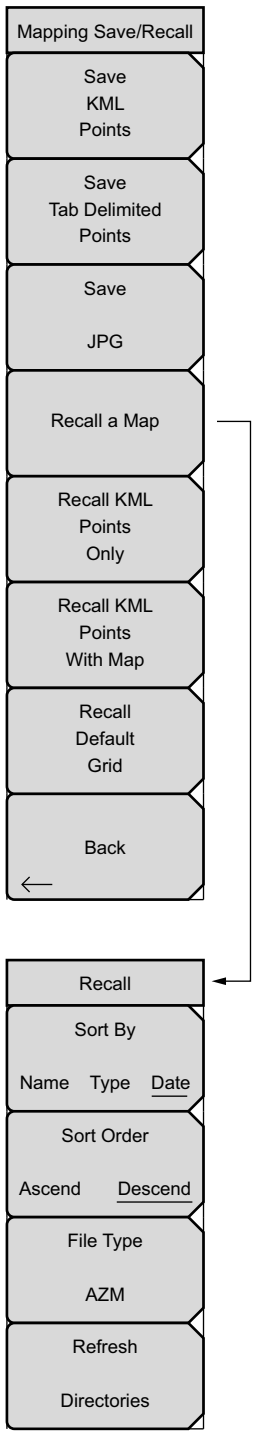
Back: Returns to the "Over-the-Air Menu" on page 5-38 (LTE) or "Over-the-Air Menu" on page 6-42 (TD-LTE).

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.

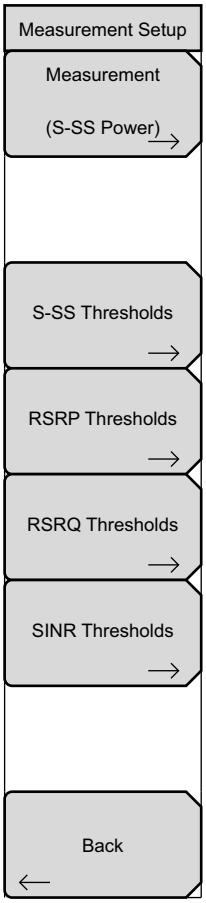
Recall Default Grid: If you do not have a GPS embedded map but are out in the field making measurements, the Recall Default Grid submenu allows you to save points and the corresponding GPS coordinates (or screen coordinates for indoor maps) to view at a later time. You can also load the map after acquiring 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.

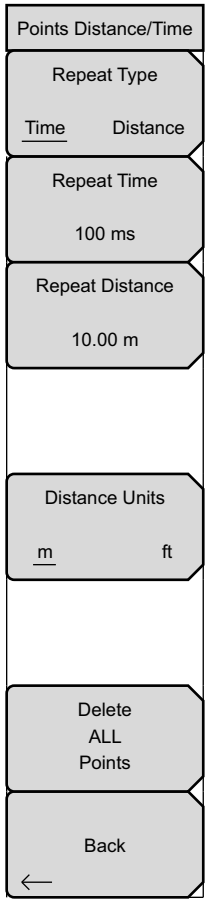
SINR Levels: Set the SINR threshold levels as desired. Press the desired threshold level. Use the arrows, knob, or numeric keypad to change its value. Press **Enter**. Press Back to return to the Measurement Setup Menu.

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 — NB-IoT Signal Analyzer (Option 887)

Note	Not all instrument models offer every option. Refer to the Technical Data Sheet of your instrument for available options.

8-1 Introduction

Narrow-Band Internet of Things (NB-IoT) is a Low Power Wide Area Network (LPWAN) protocol optimized for a large number of low-cost devices to connect to cellular networks in the 200 kHz channel bandwidth, at low data rates. The NB-IoT standard is integrated in Release 13 of the 3GPP specification.

Option 887 enables your Anritsu test instrument to analyze Standalone and Guard Band NB-IoT downlink signals. The Standalone deployment mode uses the 200 kHz bandwidth, typically by reframing 850/900 MHz GSM carriers. Guard Band NB-IoT utilizes the empty, or unused, resource blocks within the LTE carrier's guard band.

8-2 NB-IoT Measurement Setups

The following measurements are available in NB-IoT Mode:

- NB-IoT Summary
- Channel Spectrum
- Spectral Emission Mask

NB-IoT Summary

1. Press the **Measurements** main menu key.
2. Press the Summary key to display the NB-IoT measurement results in table format. See Figure 8-1.

The Summary table displays these values:

Carrier Frequency

Carrier Frequency is the measured transmitter operating center frequency.

Channel Power

Channel Power measures the average power within the selected bandwidth. It is expressed in dBm or Watts, based on the currently selected Amplitude units.

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.

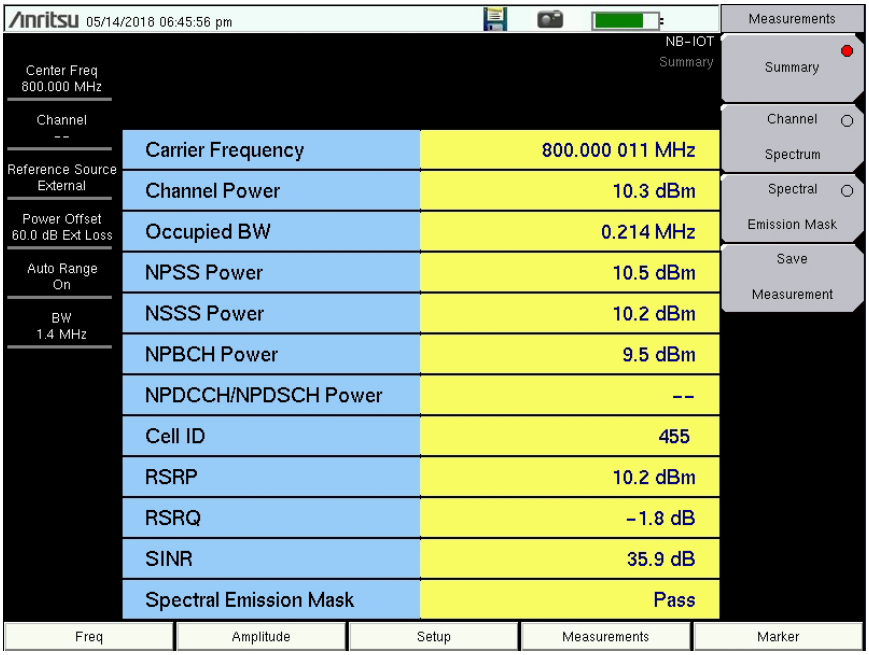


Figure 8-1. NB-IoT Summary

NPSS Power

This is the average power measurement of the Narrowband Primary Synchronization Signal.

NSSS Power

This is the average power measurement of the Narrowband Secondary Synchronization Signal.

NPBCH Power

This is the average power measurement on the Narrowband Physical Broadcast Channel.

NPDCCH/NPDSCH Power

This is the average power measurement on the Narrowband Physical Downlink Control Channel or the Narrowband Physical Downlink Shared Channel.

Cell ID

Cell identifying information sent by the transmitter in the sync signal.

RSRP

Reference Signal Received Power is the average power of Resource Elements (RE) that carry cell-specific Reference Signals (RS) over the entire bandwidth.

RSRQ

Reference Signal Received Quality provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRQ is the ratio between RSRP and RSSI, measured in dB.

SINR

Signal-to-Interference-plus-Noise Ratio is measured in dB.

Spectral Emission Mask

This is the overall Pass/Fail status of all spectral emission mask segments.

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.

1. Press the **Measurements** main menu key.
2. Press the Channel Spectrum key to display the spectrum of the input signal.
3. To select the frequency span, press the Span menu key and choose the desired bandwidth from the displayed list box, then press **Enter**. In NB-IoT, the optimal span for spectrum view is usually 1.4 MHz.

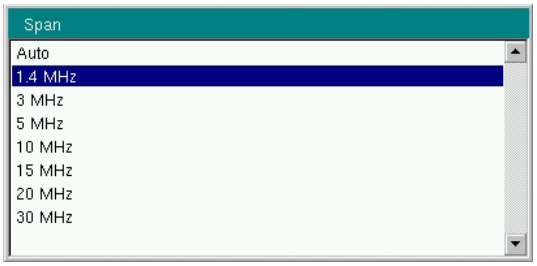


Figure 8-2. Span List Box

4. To return to the Measurements menu, press Back.

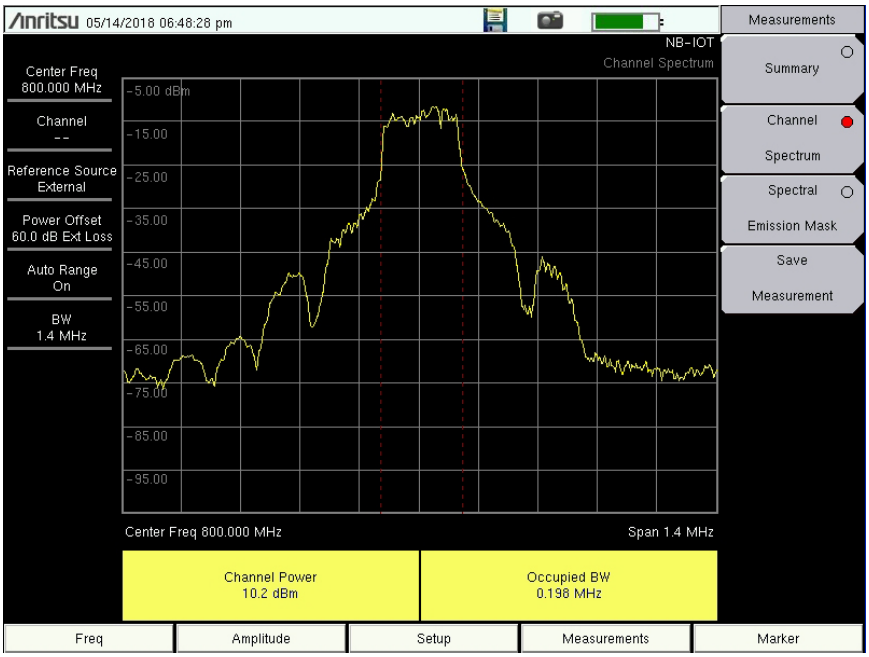


Figure 8-3. NB-IoT Channel Spectrum Display

The RF Channel Spectrum summary table is displayed at the bottom of the trace window.

Channel Power

Channel Power measures the average power within the selected bandwidth. It is expressed in dBm or Watts, based on the currently selected Amplitude units.

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.

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.

The measurement results indicate if the signal is within the limits set in the 3GPP specification. The spectral emission information for each mask segment is displayed in a table, which you can show or hide.

1. Press the **Measurements** main menu key.
2. Press the Spectral Emission Mask menu key to activate the Spectral Emission measurement and open the menu.
3. Select Spectral Emission Mask Category A.
4. Press Select Mask and choose NB-IoT Fixed from the displayed list.

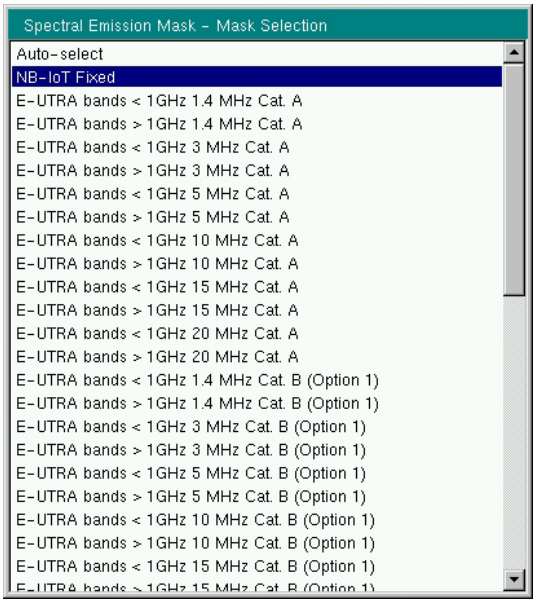


Figure 8-4. Spectral Emission Mask List Box

5. To show or hide the Summary table of Spectral Emission measurement results, press the Summary Table submenu key to toggle the setting on or off.

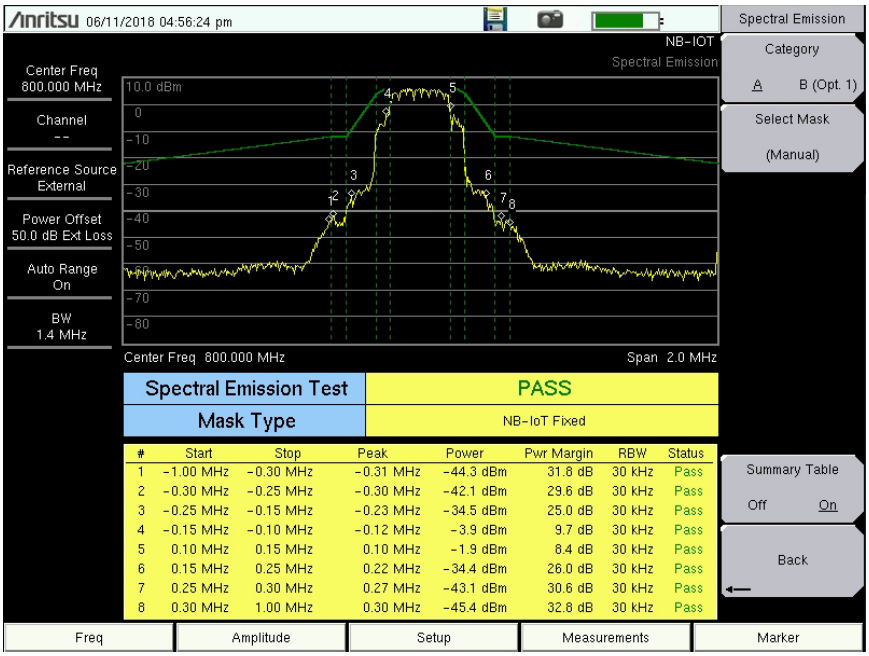


Figure 8-5. NB-IoT Spectral Emission Mask Display

6. Press the Back key to return to the Measurements menu.

Markers in the spectrum display are placed at the peak amplitude locations within the mask segments, as defined by the 3GPP specification. See Figure 8-5. The measurement status is returned as a Fail when the marker value is above the mask line in any of the mask segments.

The Summary table displays the following measurement results for each numbered mask segment:

Start, Stop, Peak – These are the start, stop, and peak frequencies in the mask segment.

Power – This is the peak amplitude in the segment.

Pwr Margin – Power Margin is the difference between the mask line, as specified in the 3GPP standard, and the marker value.

RBW – Is the Resolution Bandwidth.

Status – The measurement status is Pass if the peak power is within the 3GPP-specified limit, that is, the marker does not exceed the displayed mask line.

8-3 NB-IoT Menus

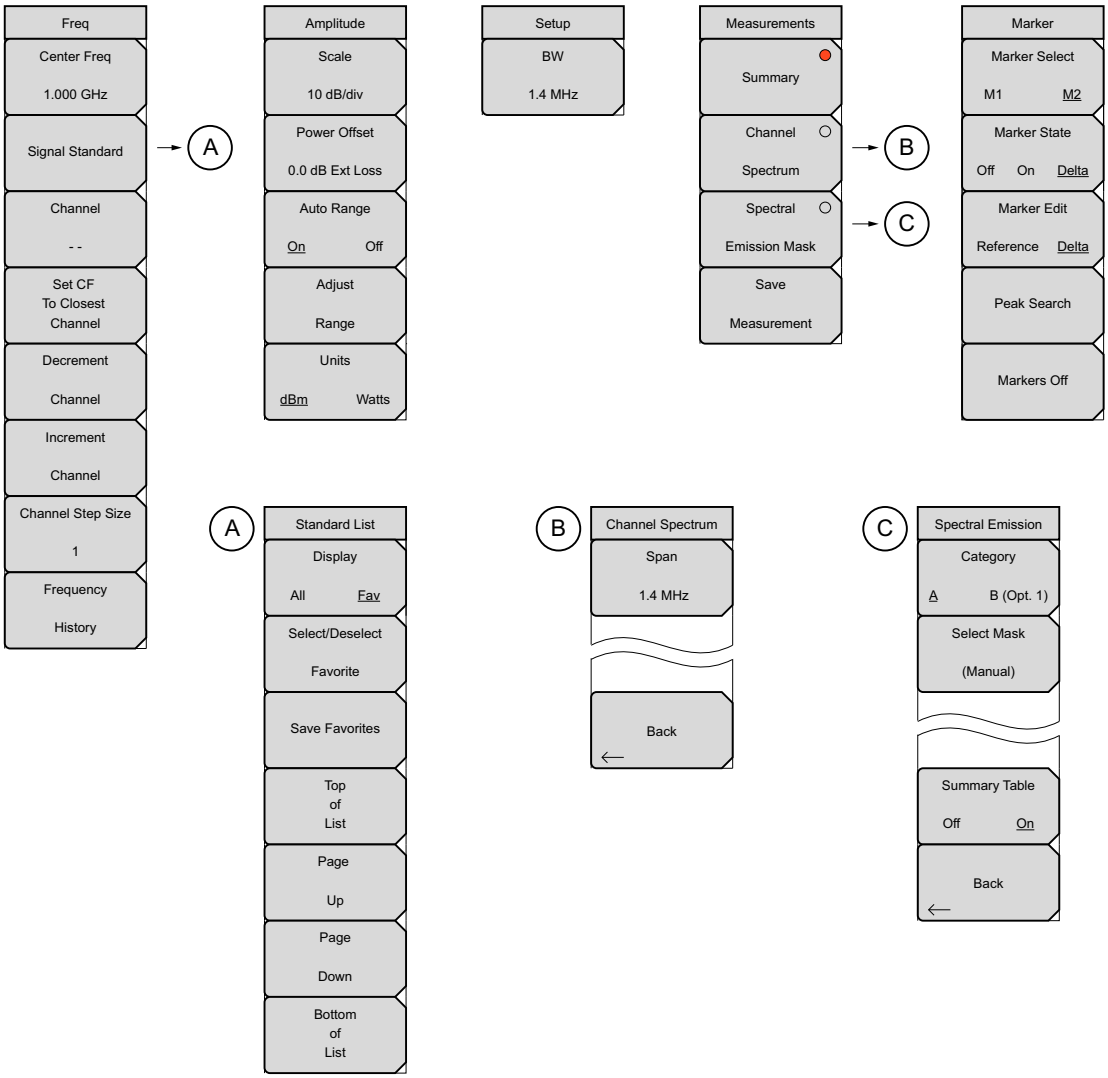


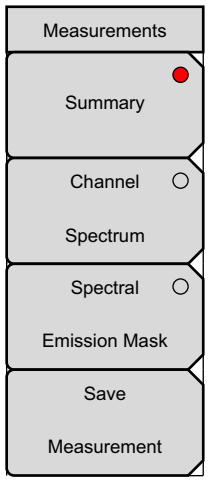
Figure 8-6. NB-IoT Menu Layout

For a description of the Frequency, Amplitude, and Marker menus, refer to the corresponding section in Chapter 5, "LTE Signal Analyzer".

Under the Setup menu, set the bandwidth at 1.4 MHz for NB-IoT measurements.

8-4 Measurements Menu

Key Sequence: **Measurements**



Summary: Displays the table of NB-IoT measurement results. See Figure 8-1 on page 8-2.

Channel Spectrum: Displays the spectrum of the input signal and opens the "Channel Spectrum Menu". The RF Channel Spectrum summary table is displayed at the bottom of the trace window. Refer to "Channel Spectrum" on page 8-3 for a description of Channel Power and Occupied BW.

Spectral Emission Mask: Opens the "Spectral Emission Menu" and spectrum display. 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.

Save Measurement: Press this menu key to save a measurement file (.iot), setup (.stp), or screen capture (.jpg). You may accept the default file name or enter another file name. See Figure 8-8. Refer to your instrument's User Guide for information on file management functions.

Figure 8-7. NB-IoT Measurements Menu

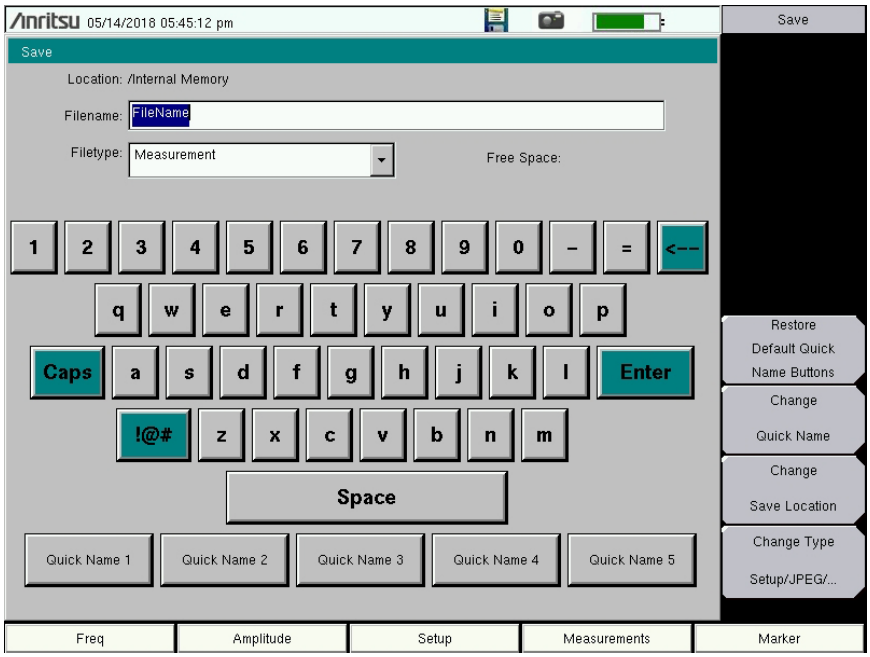
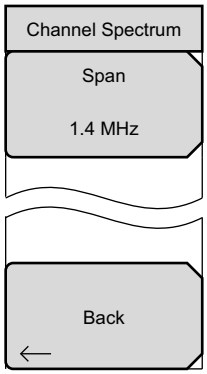


Figure 8-8. Save Screen

8-5 Channel Spectrum Menu

Key Sequence: **Measurements** > Channel Spectrum



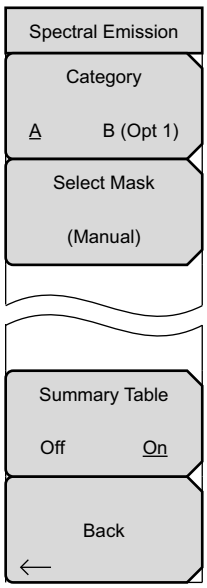
Span: Opens the Span list box. For NB-IoT measurements, select 1.4 MHz. See Figure 8-2 on page 8-3.

Back: Returns to the "Measurements Menu". Figure 8-3 on page 8-3 illustrates an NB-IoT spectrum display.

Figure 8-9. Channel Spectrum Menu

8-6 Spectral Emission Menu

Key Sequence: **Measurements** > Spectral Emission Mask



Category A / B (Opt. 1): Select spectral emission mask Category A.

Select Mask: Press this key to display a list of standard and custom spectral emission masks. For NB-IoT, choose the "NB-IoT Fixed" mask type. See Figure 8-4 on page 8-4.

Summary Table Off/On: Turns on and off the table of spectral emission measurement results at the bottom of the instrument screen.

Back: Returns to the "Measurements Menu" on page 8-7.

Figure 8-10. Spectral Emission Menu

Appendix A — Error Messages

This Appendix provides a list of 3GPP error messages. Self Test and General Operation error messages are in the User Guide.

A-1 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-2 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-3 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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