Measurement Guide

WiMAX Signal Analyzer for Anritsu RF and Microwave Handheld Instruments

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

	RF	Demod	OTA
Fixed	Option 46	Option 47	N/A
Mobile	Option 66	Option 67	Option 37

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

WiMAX Fixed/Mobile	Option 885

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Chapter 3—Mobile WiMAX Signal Analyzer

Chapter 1 — General Information

1-1 Introduction

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

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

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

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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Updated product information can be found on the Anritsu web site:

http://www.anritsu.com/

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

1-4 Overview

Fixed WiMAX

Fixed WiMAX signal analysis is described in Chapter 2, “Fixed WiMAX Signal Analyzer”.

- Option 0046: Fixed WiMAX RF Measurements
- Option 0047: Fixed WiMAX Demodulator
- Option 0885: WiMAX Fixed/Mobile Measurements (requires Option 9)

Instruments with these options can measure both FDD and TDD Fixed WiMAX networks. They can measure Fixed WiMAX BTS transmitter performance over the air by connecting an antenna to the instrument or by connecting the BTS equipment directly to the instrument.

Mobile WiMAX

Mobile WiMAX signal analysis is described in Chapter 3, “Mobile WiMAX Signal Analyzer”.

- Option 37: Mobile WiMAX Over-the-Air (OTA) Measurements
- Option 66: Mobile WiMAX RF Measurements
- Option 67: Mobile WiMAX Demodulator
- Option 0885: WiMAX Fixed/Mobile Measurements (requires Option 9)

Instruments with these options can measure TDD Mobile WiMAX networks. OTA, RF, and demodulator measurements require that an antenna be attached to the RF In (50 Ohm) connector on the instrument.

Attach a coupler or attenuator to the same connector to make measurements directly from the WiMAX BTS transmitter.

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

1-5 Selecting a Measurement Mode

Select either Fixed WiMAX Analyzer or Mobile WiMAX Analyzer mode by pressing **Shift** and then the **Mode** (9) button to open the Mode Selector dialog box. Highlight the desired measurement mode using the **Up** or **Down** arrow keys and press **Enter**.

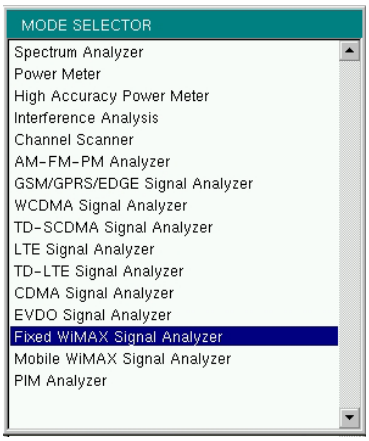


Figure 1-1. Mode Selector Dialog Box

Some Anritsu handheld instruments also have a **Menu** button which displays icons of installed measurement modes and allows measurement mode selection using the touch screen.

Figure 1-2. Mode Selector Dialog Box

Refer to the instrument User Guide for additional information.

Chapter 2 — Fixed WiMAX Signal Analyzer

2-1 Introduction

Anritsu handheld instruments offer Fixed WiMAX RF measurements and Demodulator measurements. Connect your instrument to any Fixed WiMAX base transceiver station (BTS) for accurate RF and demodulator measurements. These instruments can measure both FDD (Frequency Division Duplexing) and TDD (Time Division Duplexing) networks.

The instruments can measure WiMAX BTS transmitter performance over the air by connecting an antenna or by connecting the BTS equipment directly to the instrument. To connect the BTS equipment directly to the instrument, connect the power amplifier of the BTS equipment to the RF In connector of the instrument by using a coupler or attenuator. To measure a WiMAX signal over the air, connect the appropriate frequency band antenna to the instrument RF In connector.

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

2-2 Fixed WiMAX Measurements

The following measurements can be made when the instrument is set to Fixed WiMAX mode.

Channel Power (RSSI)

Channel power measures the average time domain power within the selected bandwidth and is expressed in dBm. Received Signal Strength Indicator (RSSI) is vendor-defined in the standard and is typically the same as Channel Power.

Occupied BW

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

Data Burst Power

Data Burst power is the RMS power over the data burst part of the WiMAX downlink subframe.

Preamble Power

Preamble power is the RMS power over the preamble part of the WiMAX downlink subframe.

Crest Factor

Crest Factor is the ratio of the peak to average power over the entire downlink subframe.

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. Frequency error is displayed in both Hz and ppm. Option 31 (GPS Receiver) can be used for improved frequency accuracy when an external reference is not available at a BTS.

EVM (Error Vector Magnitude)

The Error Vector Magnitude (in percent) displays the difference between the reference waveform and the measured waveform, and then EVM is normalized.

Relative Constellation Error (RCE)

Relative Constellation Error is similar to EVM but is expressed in dB (RCE = 20 log(EVM) where EVM is expressed in %/100) Both rms and peak values over an entire downlink subframe are displayed.

Carrier Frequency

Carrier Frequency is the measured frequency of the input signal after demodulation, and is the same as the tuned Center Frequency of the instrument plus the measured Frequency Error from demodulation.

Base Station ID

Each transmitter has a unique ID of 48 bits. These instruments display the ID as Base Station ID by decoding the FCH (Frame Control Header), the lower significant bits (LSB) of 4 bits of the downlink frame.

Adjacent Subcarrier Flatness (Peak)

Adjacent Subcarrier Flatness is the absolute difference between the adjacent sub carriers.

2-3 General Measurement Setups

CP Ratio (G) Setup

The 802.16-2004 standard specifies Cyclic Prefix (CP) ratios 1⁄4, 1⁄8, 1⁄16, or 1⁄32.
A specific CP ratio can be set manually. The instrument offers support for the following ratios: 1⁄4, 1⁄8, 1⁄16, 1⁄32.

To set the CP ratio:

1. Press the **Setup** main menu key.
2. Press the CP Ratio (G) submenu key to display the available ratios: 1⁄4, 1⁄8, 1⁄16, 1⁄32.
3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable ratio, and press the **Enter** key to set the ratio. The selected ratio is displayed in the user settable parameters to the left of the display.

Span Setup

To set the span for Spectrum View:

1. Press the **Setup** main menu key.
2. Press the Span submenu key to display the available spans: 5 MHz, 10 MHz, 20 MHZ, 30 MHz.
3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable span on the list, and press the **Enter** key to set the span.

Frame Length Setup

To set the frame length:

1. Press the **Setup** main menu key.
2. Press the Frame Length submenu key to toggle through the available frame length selections: 2.5 ms, 5 ms, 10 ms.

2-4 Fixed WiMAX RF Measurements

Fixed WiMAX RF Measurements include these three measurement types: Spectrum, Power versus Time, and Adjacent Channel Leakage Ratio (ACPR). The following sections describe how to make Fixed WiMAX RF measurements.

Setup for Fixed WiMAX RF Measurements

1. Press the **Setup** main menu key.
2. Set the bandwidth, frame length, and CP Ratio as described in the "General Measurement Setups" on page 2-3.

Spectrum

The Spectrum screen displays the spectrum of the input signal and of channel power in dBm and displays the occupied bandwidth in Hz.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX RF Measurements" on page 2-4.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements key.
4. Press the Spectrum submenu key to activate the spectrum measurement. The sample image in Figure 2-1 may differ from any image on your instrument.

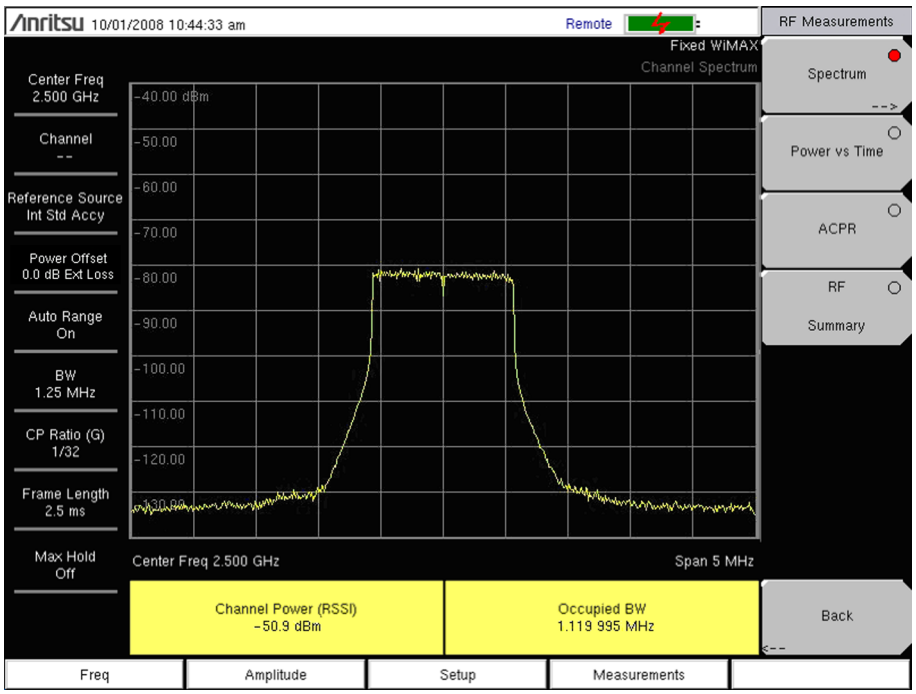


Figure 2-1. Spectrum

Power versus Time

The Power versus Time view shows the time domain view of a WiMAX 802.16-2004 OFDM signal over approximately one frame. The preamble is always 3 dB higher than the data. The screen also displays Channel Power (RSSI), Data Burst Power, Preamble Power, and Crest Factor.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX RF Measurements" on page 2-4.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements key.
4. Press the Power vs Time submenu key to activate the measurement. The sample image in Figure 2-2 may differ from any image on your instrument.

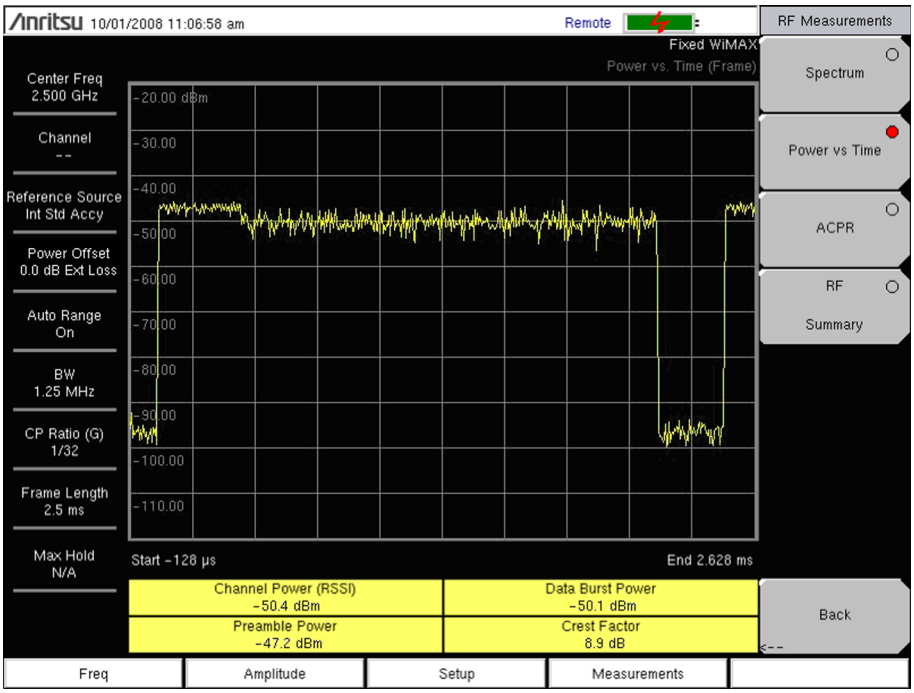


Figure 2-2. Power Versus Time

Adjacent Channel Power Ratio (ACPR)

The ACPR view shows one main channel and two adjacent channels, and it displays the power levels for each channel (both absolute and relative). The channel spacing matches the selected bandwidth, and the channels are color coded.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX RF Measurements" on page 2-4.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements key.
4. Press the ACPR submenu key to activate the measurement. The sample image in Figure 2-3 may differ from any image on your instrument.

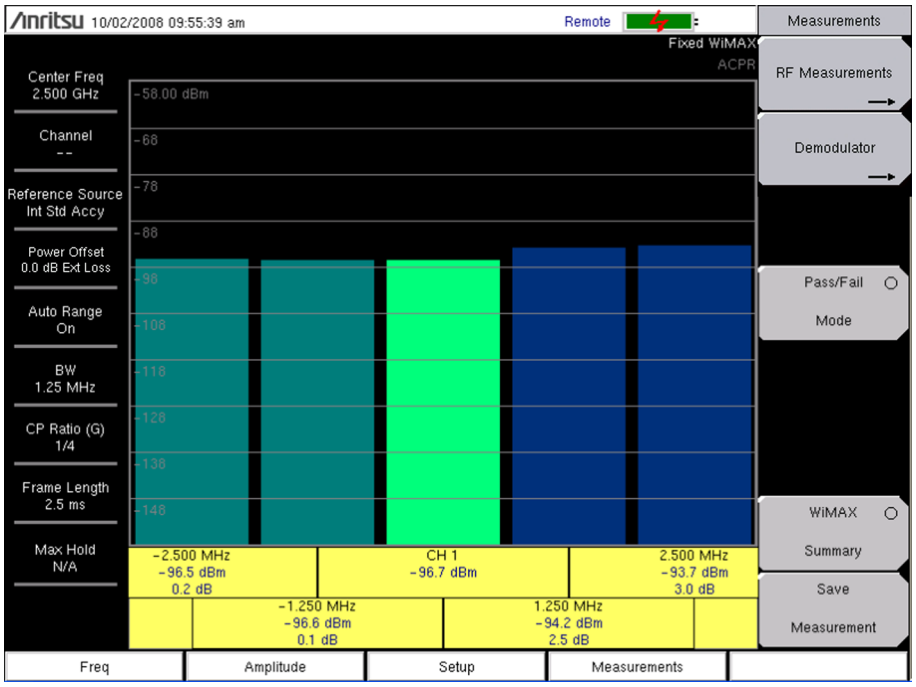


Figure 2-3. ACPR

RF Summary

The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the WiMAX signal. The parameters that are displayed in the RF summary table are Channel Power in dBm, Data Burst power in dBm, Preamble power in dBm, Occupied Bandwidth, and Crest Factor.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX RF Measurements" on page 2-4.
2. Press the **Measurements** main menu key.
3. Press the RF Measurements key.
4. Press the RF Summary submenu key to activate the measurement. The sample image in Figure 2-4 may differ from any image on your instrument.

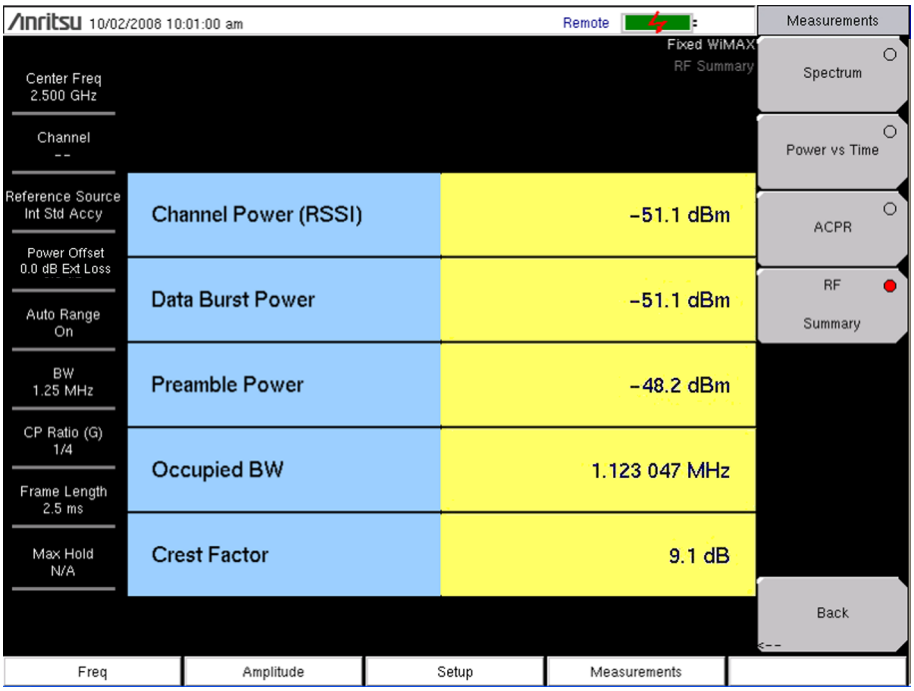


Figure 2-4. RF Summary

2-5 Fixed WiMAX Demodulator

This instrument can demodulate a Fixed WiMAX Signal from a Base Station and can display the results in Constellation, Spectral Flatness, EVM versus Sub Carrier, EVM versus Symbol, and Modulation Summary views.

Setup for Fixed WiMAX Demodulator Measurements

1. Press the **Setup** main menu key.
2. Set the bandwidth, frame length, and CP Ratio as described in the "General Measurement Setups" on page 2-3.

Constellation

The instrument displays the constellation of the demodulated data symbols over one frame. The various constellations are color coded for modulation as follows:

- BPSK is shown in orange.
- QPSK is shown in purple.
- 16QAM is shown in green.
- 64QAM is shown in yellow.

The numerical results that are displayed in this view are: RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Carrier Frequency in Hz, and Base Station ID.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Demodulator submenu key.
4. Press the Constellation submenu key to activate the measurement.
5. Press the Constellation submenu key again to activate the reference points menu.
6. Press the Reference Points submenu key to switch the reference points On or Off (refer to "Demodulator Menu" on page 2-22.

The sample image in Figure 2-5 may differ from any image on your instrument.

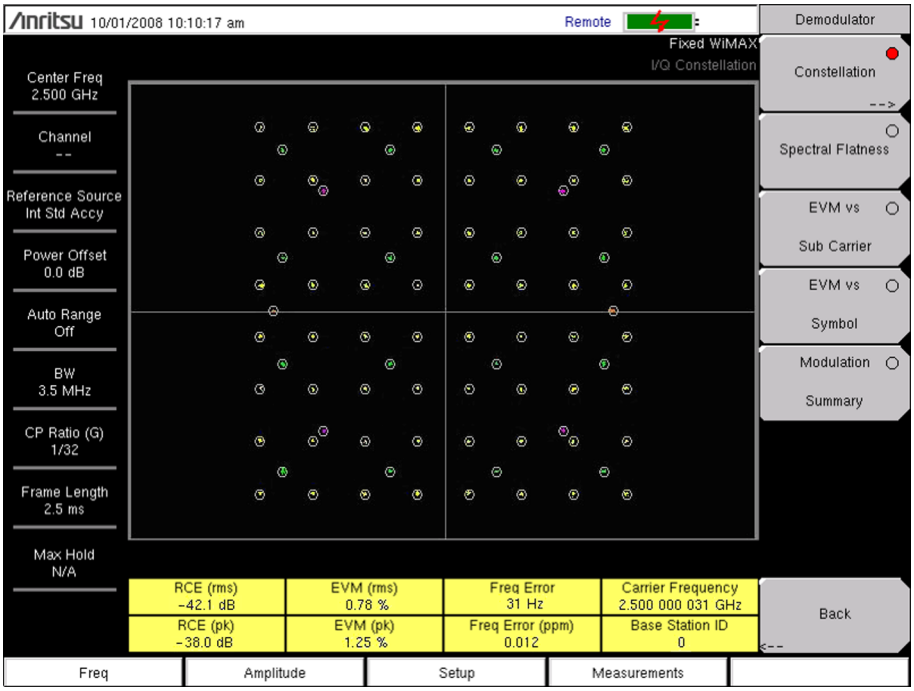


Figure 2-5. Constellation View, Demodulator Menu

Spectral Flatness

The Spectral Flatness view shows the data that is collected from the preamble at the channel estimation step. The deviation of the Spectral Flatness from the average (over all of the carriers) is shown in dB. A mask that conforms to the specification is overlaid on the trace. Green color on the mask indicates pass, and red color indicates regions of the mask that fail. The specification for the mask is:

0 to ±50 subcarriers < ±2 dB,

±50 to ±100 subcarriers < +2 dB and –4 dB

This mask is referenced from the average of all 200 subcarrier amplitude values. The numerical result that is displayed in this view is the adjacent sub-carrier flatness (in dB).

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Demodulator submenu key.
4. Press the Spectral Flatness submenu key to activate the measurement.

The sample image in Figure 2-6 may differ from any image on your instrument.

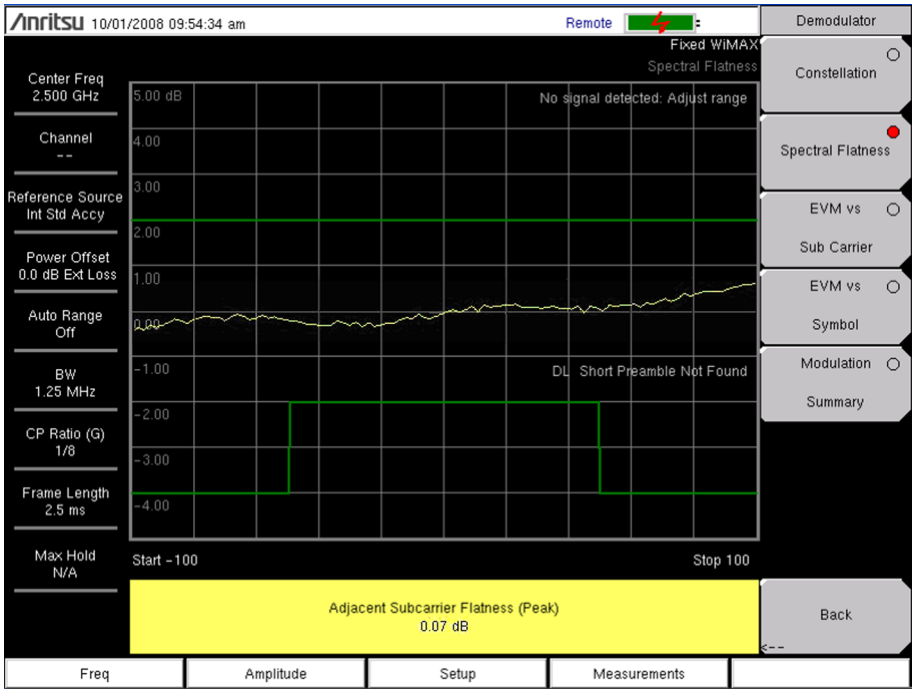


Figure 2-6. Spectral Flatness

EVM versus SubCarrier

This view shows the EVM (rms) values versus OFDM sub-carriers. Eight pilot sub-carriers are shown in orange, and 192 data sub carriers are shown in yellow. The numerical results that are displayed in this view are: RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Carrier Frequency in Hz, Base Station ID.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Demodulator submenu key.
4. Press the EVM vs SubCarrier submenu key to activate the measurement. The sample image in Figure 2-7 may differ from any image on your instrument.

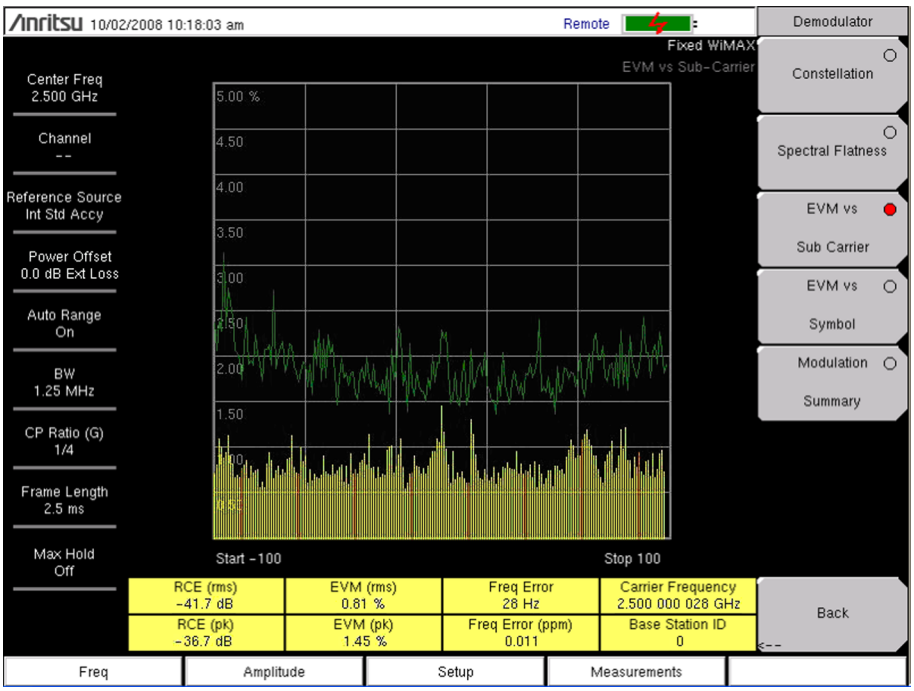


Figure 2-7. EVM Versus SubCarrier

EVM versus Symbol

This view shows the EVM (rms) values versus OFDM symbols. The numerical results that are displayed in this view are: RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Carrier Frequency in Hz, Base Station ID.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Demodulator submenu key.
4. Press the EVM vs Symbol submenu key to activate the measurement. The sample image in Figure 2-8 may differ from any image on your instrument.

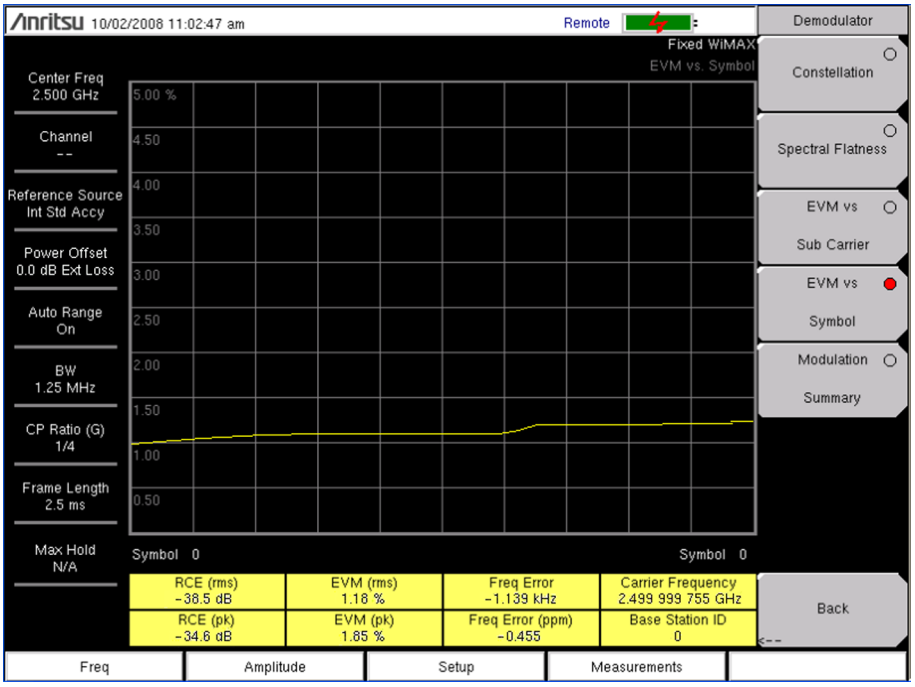


Figure 2-8. EVM Versus Symbol

Modulation Summary

The Modulation Summary displays the critical Modulation transmitter performance measurements in a table format by demodulating the WiMAX signal. The numerical results that are displayed in the Modulation summary table are: RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Freq Error in Hz, Freq Error in ppm, Carrier Frequency in Hz, Base Station ID.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Demodulator submenu key.
4. Press the Modulation Summary submenu key to activate the measurement. The sample image in Figure 2-9 may differ from any image on your instrument.

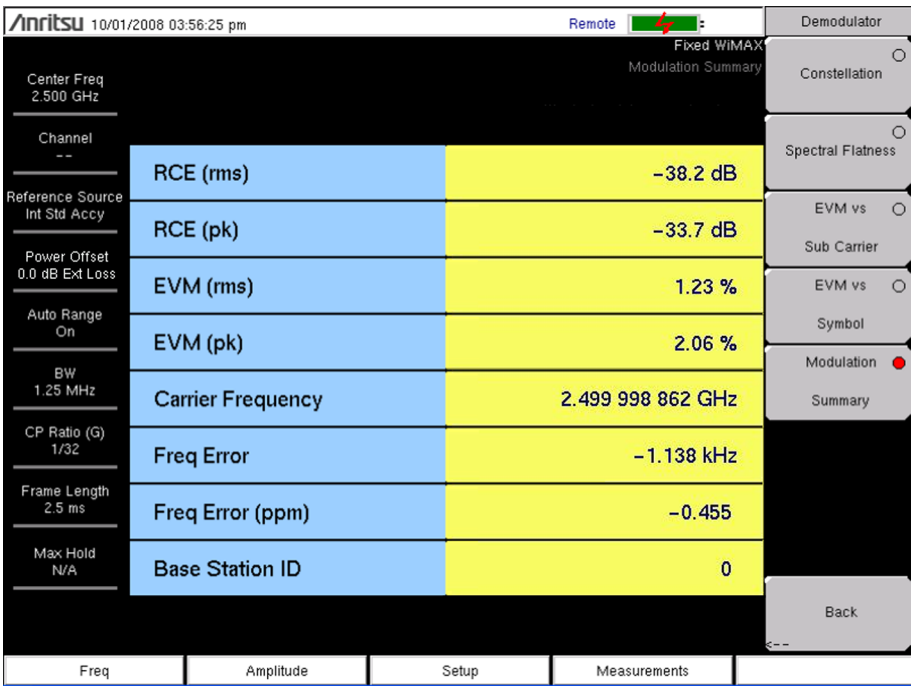


Figure 2-9. Fixed WiMAX Modulation Summary

Pass/Fail Mode

The Pass/Fail mode allows selection of a user-defined file that specifies a list of measurements with Pass/Fail criteria. This mode sequences through the appropriate measurements and indicates a pass or fail state based on the criteria. By using Master Software Tools, a custom test list can be created and uploaded into the instrument. All critical measurements can be selected for pass fail testing. The results are displayed in a table format with clear identification of Pass/Fail results, including minimum and maximum thresholds and measured results.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the Pass/Fail Mode submenu key.
4. Press the Pass/Fail Mode submenu key again to activate the submenu.
5. Press the Select Pass/Fail Test submenu key to view a list of Pass/Fail test definition files.
6. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable Pass/Fail test on the list, and press the **Enter** key to select.

The sample image in Figure 2-10 may differ from any image on your instrument.

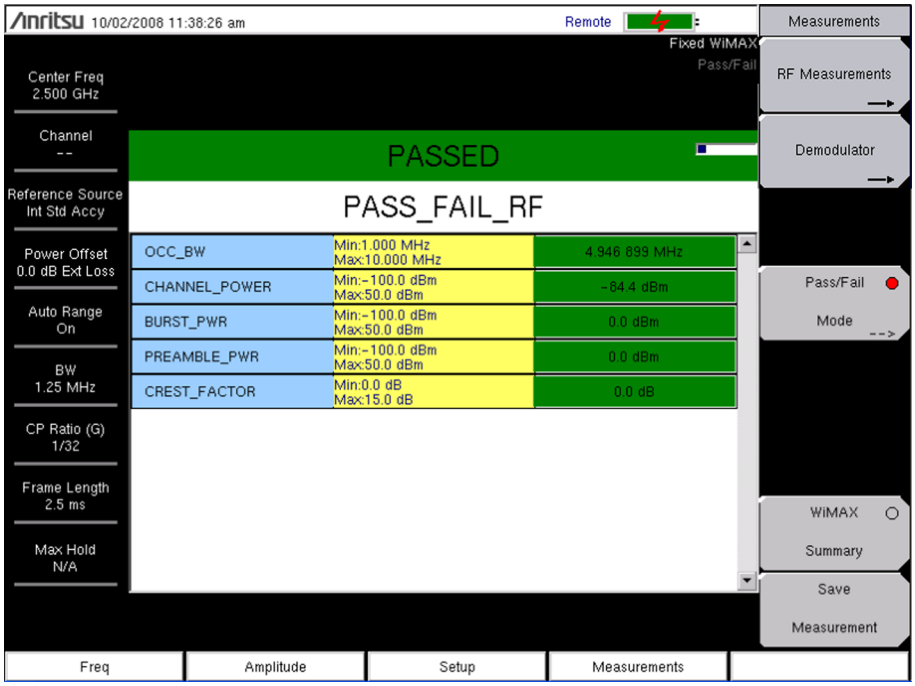


Figure 2-10. Pass Fail Mode

WiMAX Summary

The WiMAX Summary is a summary list of critical Fixed WiMAX measurements from the RF and Demodulation measurements.

Procedure:

1. Setup the measurement as described in "Setup for Fixed WiMAX Demodulator Measurements" on page 2-8.
2. Press the **Measurements** main menu key.
3. Press the WiMAX Summary submenu key. The sample image in Figure 2-11 may differ from any image on your instrument.

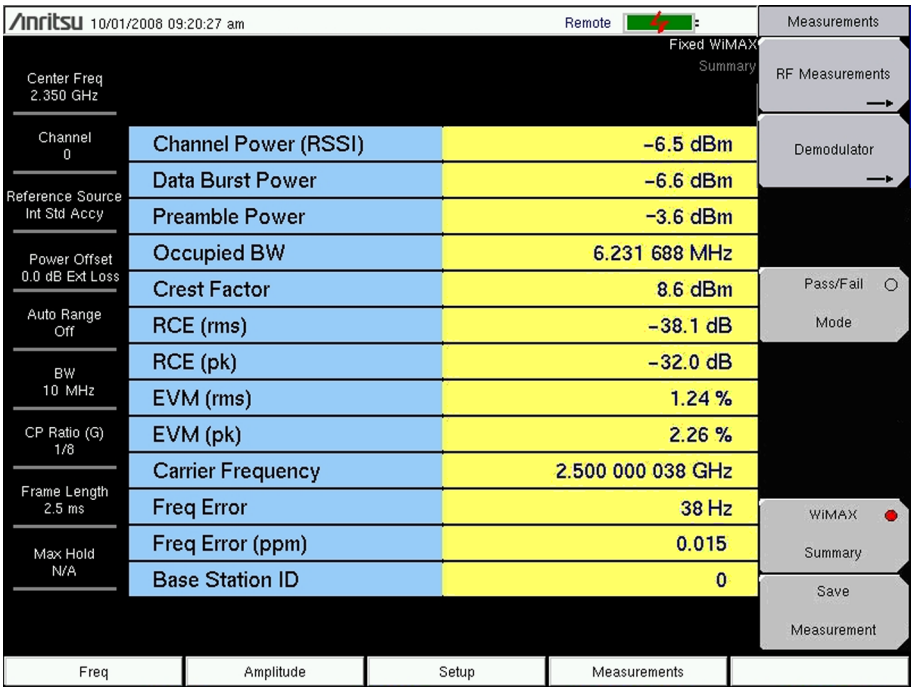


Figure 2-11. WiMAX Summary

2-6 Fixed WiMAX Menus

Figure 2-12 shows the map of the Fixed WiMAX menus. The following sections describe WiMAX 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.

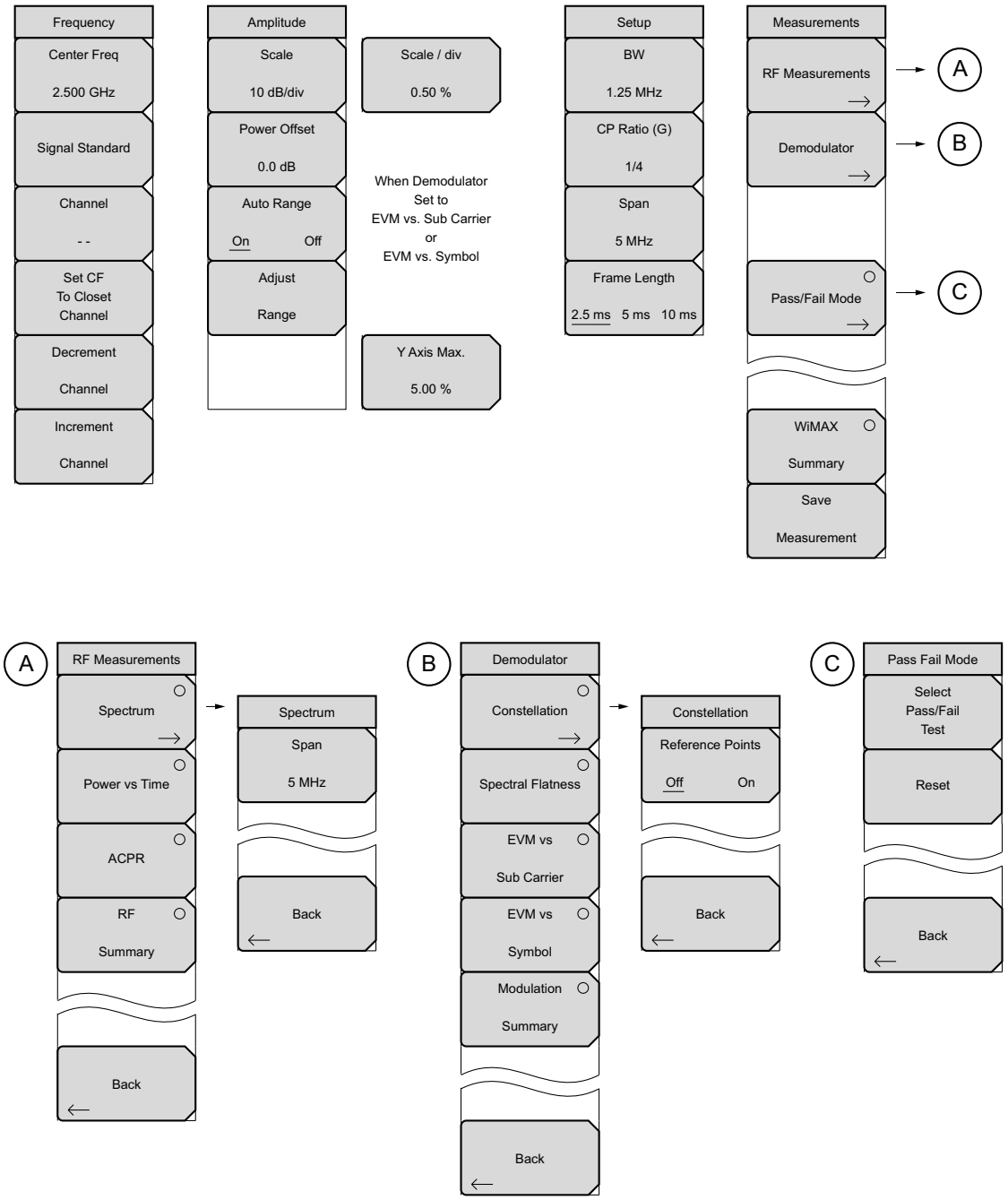
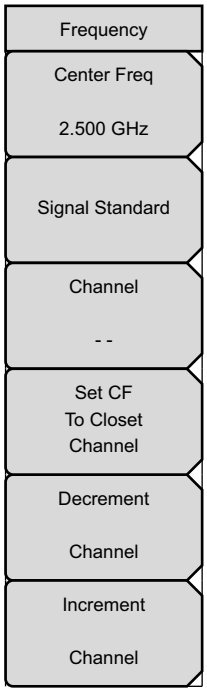


Figure 2-12. Fixed WiMAX Menus

2-7 Freq (Frequency) Menu

Key Sequence: **Frequency**



Center Freq: The Center Freq submenu key is used 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 by using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units submenu key to finalize the data input. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.

Signal Standard: Press this submenu key to open the Signal Standards list box. 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 are automatically tuned for the first channel of the selected standard. Other settings, such as channel spacing and integration bandwidth, are also automatically entered.

Channel: Press this submenu key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected Signal Standard. The instrument measurement display is automatically tuned to the center frequency of the selected channel. The listed channels are from 0 to 199.

Set CF to Closest Channel: Press this submenu key to move the current Center Frequency to the closest frequency that matches a channel number in the current Signal Standard.

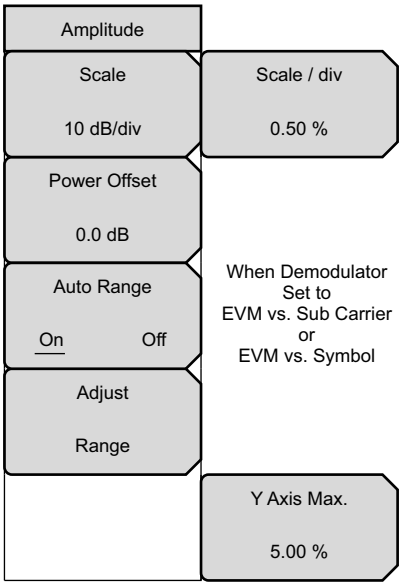
Decrement Channel: Press this submenu key to decrease the selected channel number by one channel step size for the selected standard.

Increment Channel: Press this submenu key to increase the selected channel number by one channel step size for the selected standard.

Figure 2-13. Fixed WiMAX Freq Menu

2-8 Amplitude Menu

Key Sequence: **Amplitude**



Scale: Press this submenu key to set the scale of the Y axis on the measurement display. The units are in dB/div. Scale can be set from 1 dB/div to 15 dB/div. The default value is 10 dB/div. When the **Spectral Flatness** view is selected from the Measurements | Demodulator menu, the default scale value changes to 1 dB/div (the range remains from 1 dB/div to 15 dB/div).

Scale / div: The Scale/div submenu key is displayed instead of the Scale submenu key only when making **EVM vs Subcarrier** and **EVM vs Symbol** measurements, set from the Measurements | Demodulator menu. The units are in percent (%).

Power Offset: Press this submenu key to have the instrument automatically adjust for the loss through any external cables, attenuators, or couplers. The power can be offset from –100 dB to +100 dB. To set a power offset, press the Power Offset submenu key, use the rotary knob, the arrow keys, or the numeric keypad to enter the offset value, and press the dB submenu key or the **Enter** key.

Auto Range: When Auto Range is activated, the reference level is automatically adjusted. Press the Auto Range submenu key to switch between On and Off.

Adjust Range: When Auto Range is set to the Off state, press this submenu key to adjust the internal reference level to be optimal, based on the measured signal. The Range adjustment is performed once each time the submenu key is pressed. When Auto Range is set to On, pressing this submenu key causes Auto Range to be set to Off.

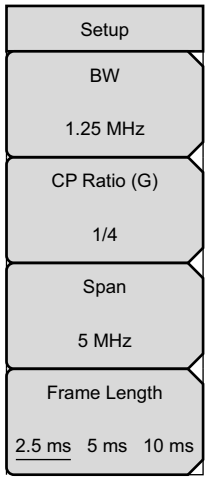
Note that when the Adjust Range submenu key had been pressed, the instrument no longer adjusts the internal gain automatically because Auto Range has been set to Off by pressing this Adjust Range submenu key. Press the Auto Range submenu key to toggle the setting to On in order to resume automatic gain ranging.

Y Axis Max: Press this submenu key to set the maximum value of the Y axis. In combination with the Scale control, this allows you to zoom in and zoom out on the Y axis. This control is available only in the Spectral Flatness, EVM versus Symbol, and EVM versus Sub-carrier views.

Figure 2-14. Fixed WiMAX Amplitude Menu

2-9 Setup Menu

Key Sequence: **Setup**



BW: Press this submenu key to select the Bandwidth by using the **Up/Down** arrow keys or the rotary knob, and press **Enter**. The following bandwidths are available: 1.25 MHz, 1.5 MHz, 1.75 MHz, 2.50 MHz, 3.0 MHz, 3.5 MHz, 5 MHz, 5.5 MHz, 6.0 MHz, 7 MHz, or 10 MHz. The default bandwidth is 1.25 MHz.

CP Ratio (G): Press this submenu key to select the desired Cyclic Prefix Ratio using the **Up/Down** arrow keys or the rotary knob, and press **Enter**. Available CP Ratios are: 1⁄4, 1⁄8, 1⁄16, and 1⁄32. The default CP Ratio is 1⁄4.

Span: Press this submenu key to select the desired Span for the Spectrum view by using the **Up/Down** arrow keys or the rotary knob, and then press **Enter**. The available Span selections are: 5 MHz, 10 MHz, 20 MHz, or 30 MHz.

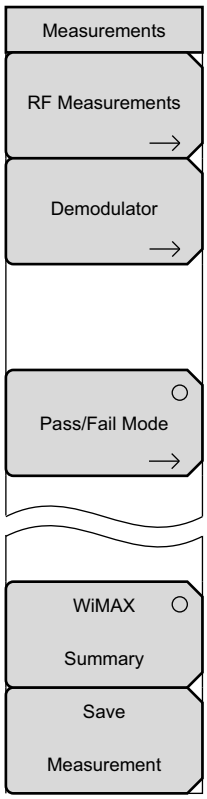
Note: The span value is automatically adjusted to the next largest available span when the BW setting is changed. The span can be changed to any of the listed values to override the automatic selection.

Frame Length: Press this submenu key to select the frame length by toggling through the available selections: 2.5 ms, 5 ms, or 10 ms. The selected value is underlined on the virtual submenu key face.

Figure 2-15. Fixed WiMAX Setup Menu

2-10 Measurements Menu

Key Sequence: **Measurements**



RF Measurements: Press this submenu key to open the "RF Measurements Menu" on page 2-21.

Demodulator: Press this submenu key to open the "Demodulator Menu" on page 2-22.

Pass/Fail Mode: Pass/Fail mode allows the selection of a user-defined file that specifies a list of measurements with pass/fail criteria. This mode moves in sequence through the appropriate measurements and indicates a pass or fail state based upon the criteria. A custom test list can be created with Master Software Tools and can be uploaded into the instrument. All critical measurements can be selected for pass fail testing. The results are displayed in table format with clear identification of pass/fail results including minimum and maximum thresholds and measured results. Press the key again to open the "Pass Fail Mode Menu" on page 2-24

WiMAX Summary: Displays a summary of all the WiMAX-related numerical measurement results:

- Channel Power (RSSI) in dBm
- Data Burst Power in dBm
- Preamble Power in dBm
- Occupied BW in Hz
- Crest Factor in dBm
- RCE (rms) in dB
- RCE (pk) in dB
- EVM (rms) in %
- EVM (pk) in %
- Carrier Frequency in Hz
- Freq Error in Hz
- Freq Error (ppm)
- Base Station ID

Save Measurement: Initiates a dialog box to name and save the current measurement. WiMAX measurements are saved with a .wmxd extension.

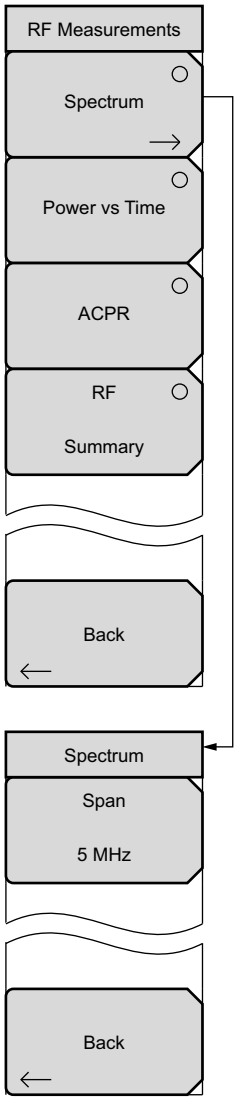
The saved measurement can be named by using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by pressing the submenu key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrow keys to move the cursor position. Press **Enter** to save. WiMAX measurements are saved with a .wmxd extension.

Text entry is described in greater detail in the instrument User Guide.

Figure 2-16. Fixed WiMAX Measurements Menu

RF Measurements Menu

Key Sequence: **Measurements** > RF Measurements



Spectrum: This view displays the spectrum of the input signal. The span is automatically adjusted to the next largest available span based on the bandwidth setting. Channel Power (RSSI) in dBm and Occupied bandwidth measurements are displayed as numerical values.

Span: Press this submenu key to open the Span selection dialog box. Select the desired Span for the Spectrum view using the **Up/Down** arrow keys or rotary knob, and press Enter. The list shows the following choices: 5 MHz, 10 MHz, 20 MHz, 30 MHz.

Note: The span value is automatically adjusted to the next largest available span when the BW setting is changed. You can change the span to any of the 4 values to override the automatic selection.

Back: Returns to the RF Measurements menu.

Power vs Time: The Power versus Time view shows the time domain view of a WiMAX 802.16-2004 OFDM signal over approximately one frame.

The Channel Power in dBm, Preamble power in dBm, burst power of data bursts in dBm, and the Crest Factor are displayed as numerical values.

ACPR: The ACPR (Adjacent Channel Power Ratio) view shows one main channel and two adjacent channels. It displays the power levels for each channel (both absolute and relative).

RF Summary: Press this submenu key to display a summary of all of the RF numerical measurement results:

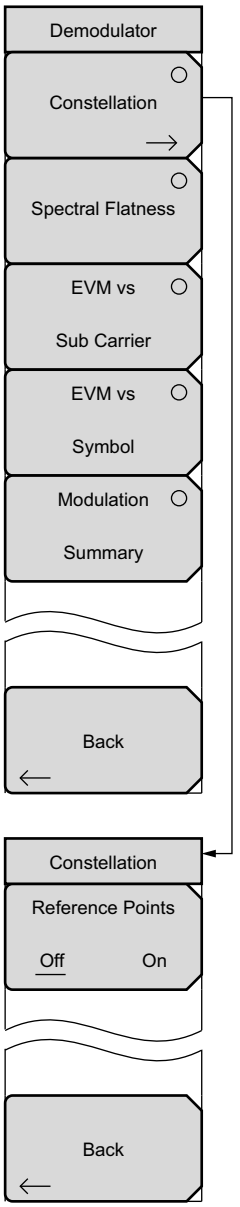
- Channel Power (RSSI) in dBm
- Data Burst Power in dBm
- Preamble Power in dBm
- Occupied BW in Hz
- Crest Factor in dB

Back: Press this submenu key to return to the "Measurements Menu" on page 2-20.

Figure 2-17. Fixed WiMAX RF Meas Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



Constellation: Press the Constellation submenu key to set the demodulation to Constellation view. The constellation view shows the constellation of the demodulated data symbols over one frame. When demodulation is set to Constellation view, press this submenu key again to open the Constellation menu.

The constellations are color coded as follows:

- BPSK is shown in orange
- QPSK is shown in purple
- 16-QAM is shown in green
- 64-QAM is shown in yellow

Reference Points: Press this submenu key to display reference points for the various constellations. On is the default state.

Back: Press this submenu key to return to the Demodulator menu.

Spectral Flatness: Press this submenu key to show the spectral flatness data that is measured from the preamble at the channel estimation step. The deviation of the spectral flatness from the average of all the carriers is shown in dB.

A mask that conforms to the specification is overlaid on the trace. Green color on the mask indicates pass, and red color on the mask indicates regions of the mask where the signal fails.

The specification for the mask is:

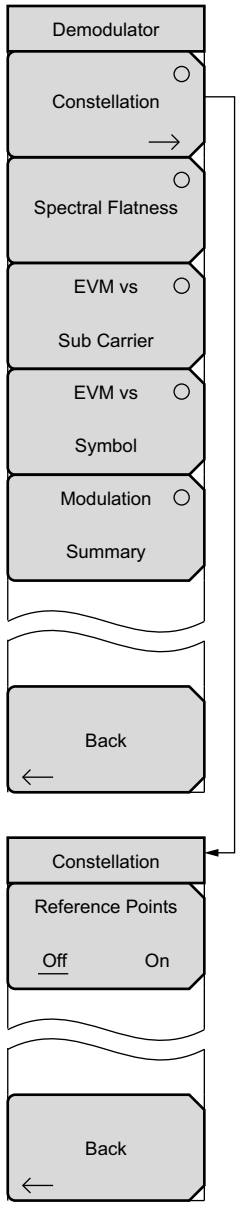
0 to ±50 subcarriers < ±2 dB

±50 to ±100 subcarriers < +2 dB, and –4 dB

This mask is referenced from the average of all 200 subcarrier amplitude values. Absolute delta of the power between adjacent subcarriers is displayed as a numerical value in dB.

Figure 2-18. Fixed WiMAX Demodulator Menu (1 of 2)

Demodulator Menu (Continued)



EVM vs Sub Carrier: Press this submenu key to display the EVM (rms) values versus OFDM subcarriers. The pilot subcarriers are shown in orange.

EVM vs Symbol: Press this submenu key to display the EVM (rms) values versus OFDM symbols.

Modulation Summary: Press this submenu key to display a summary table of all of the modulation-related numerical measurement results:

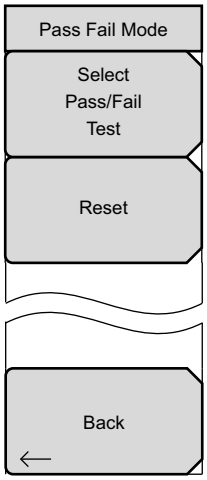
- RCE (rms) in dB
- RCE (pk) in dB
- EVM (rms) in %
- EVM (pk) in %
- Freq Error in Hz
- Freq Error (ppm)
- Carrier Frequency in Hz
- Base Station ID

Back: Press this submenu key to return to the "Measurements Menu" on page 2-20.

Figure 2-19. Fixed WiMAX Demodulator Menu (2 of 2)

Pass Fail Mode Menu

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



Select Pass/Fail Test: Press this submenu key to display the list of available Pass/Fail tests.

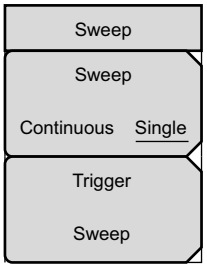
Reset: Press this submenu key to reset the Pass/Fail test.

Back: Press this submenu key to the "Measurements Menu" on page 2-20.

Figure 2-20. Fixed WiMAX Pass Fail Mode Menu

2-11 Sweep Menu

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



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

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

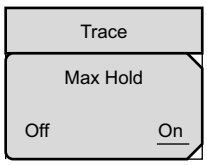
Figure 2-21. Fixed WiMAX Sweep Menu

2-12 Measure Menu

This menu opens the "Measurements Menu" on page 2-20.

2-13 Trace Menu

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



Max Hold: Press this submenu key to toggle Max Hold On or Off. It applies to Spectrum view and EVM vs Sub Carrier view. This function allows the spectrum trace to hold its peak value from trace to trace. This helps in capturing a representative spectrum of a burst RF signal, such as WiMAX. All Max Hold operations show two traces. One trace is a max hold value, and the other is a live trace with the current measurement results.

Figure 2-22. Fixed WiMAX Sweep Menu

2-14 Limit Menu

This menu is not available in Fixed WiMAX measurement mode.

2-15 Other Menus

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

Chapter 3 — Mobile WiMAX Signal Analyzer

3-1 Introduction

Anritsu handheld instruments offer Mobile WiMAX Over-the-Air (OTA) measurements, RF measurements, and Demodulator measurements. OTA Measurements require that an antenna be attached to the Spectrum Analyzer RF In (50 Ohm) connector on the instrument. Attach a coupler or attenuator to the same connector to make measurements directly from the WiMAX BTS transmitter.

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

3-2 Mobile WiMAX Measurements

The following measurements are made in this mode:

Channel Power (RSSI)

Channel power measures the average time domain power within the selected bandwidth and is expressed in dBm. Received Signal Strength Indicator (RSSI) is vendor-defined and is often the same as Channel Power.

Occupied BW

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

Downlink Burst Power

Downlink Burst power is the RMS power over the downlink subframe of the WiMAX frame.

Uplink Burst Power

Uplink Burst power is the RMS power over the uplink subframe of the WiMAX frame.

Preamble Power

Preamble power is the RMS power over the preamble part of the downlink subframe.

Freq Error

The difference between the received frequency and the specified frequency is the frequency error. Frequency error is displayed in both Hertz (Hz) and parts per million (ppm).

Error Vector Magnitude (EVM)

The Error Vector Magnitude 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. Both rms and peak values over the downlink portion are displayed (the preamble portion is excluded for this measurement).

Relative Constellation Error (RCE)

Relative Constellation Error is similar to EVM but is expressed in dB (RCE = 20 log (EVM in %/100)). Both rms and peak values over an entire downlink subframe are displayed. (The preamble portion is excluded for this measurement).

Carrier Frequency

Carrier frequency is the measured frequency of the input signal after demodulation, and is the same as the tuned center frequency of the instrument plus the measured frequency error from demodulation.

Base Station ID

The unique code contained in messages on the broadcast channels of a cell or base station that identifies the base station.

Sector ID

Three cell sectors may produce signals with different preambles. The Sector ID may be 0, 1, or 2. The Sector ID is displayed in several of the Demodulator measurement screen.

CINR

Carrier to Interference-plus-Noise Ratio (CINR), expressed in decibels (dBs), is a measurement of signal effectiveness. The carrier is the desired signal, and the interference can either be noise or co-channel interference or both. In order for the signal receiver to be able to decode the signal, the signal must fall into an acceptable CINR range.

PCINR

Physical CINR is an estimate of C / (N+I) ratio on non-boosted data sub-carriers. It is calculated by measuring the power of the sub-carriers in the preamble (where the sub-carrier allocations are known for the primary BS and interfering BS). The power of the primary preamble detected is used as the carrier power (C). The power of all the other interfering preambles is used as the interference power (I) and the noise (N) is measured using the power in the guard interval.

Adjacent Subcarrier Flatness (Peak)

Adjacent Subcarrier Flatness is the absolute difference between adjacent subcarriers in the Spectral Flatness measurement.

Preamble Scanner

This measurement displays the six strongest preamble signals in bar graph form. The Preamble Index, Relative Pwr, Cell ID, and Sector ID are listed for each preamble signal. The PCINR, calculated from all six preambles, and the Base Station ID, of the strongest preamble signal, are listed below the table.

3-3 General Measurement Setups

Bandwidth Setup

The instrument bandwidth can be manually set to 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, or 10 MHz. Set the correct bandwidth for Demodulator, Preamble Scanner, and Power versus Time measurements.

1. Press the **Setup** main menu key.
2. Press the BW (bandwidth) submenu key to display a set of available bandwidths: 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, or 10 MHz.
3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable bandwidth on the list, and press the **Enter** key to set the bandwidth. The selected bandwidth is displayed in the instrument settings summary column.

Frame Length Setup

The frame length can be set to 5 ms or 10 ms. For Demodulation, Preamble Scanner, and Power versus Time measurements, frame length needs to be set correctly for successful preamble synchronization.

1. Press the **Setup** main menu key.
2. Press the Frame Length submenu key to toggle between 5 ms and 10 ms.

Demod Type Setup

The instrument can demodulate the signal in three ways:

- It can demodulate the signal by decoding the downlink map (DL-MAP Parameter Tree).
- It can demodulate the signal based upon manually-entered parameters for the DL-MAP Parameter Tree (by using an .xml file). DL-MAP Parameter Tree parameters can be defined by using the Anritsu IQProducer software and then uploading into the instrument with Master Software Tools.
- It can demodulate only the frame control header (FCH) portion of the signal.

1. Press the **Setup** main menu key.
2. Press the Demod key to select Auto, Man, or FCH.
3. If Man (manual) is selected, press the Load Parameter File submenu key to load an XML file with the DL-MAP parameters that are defined by using the Anritsu IQProducer software.

Span Setup

1. Press the **Setup** main menu key.
2. Press the Span submenu key to display the available spans: 5 MHz, 10 MHz, 20 MHZ, 30 MHz.
3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable span on the list, and press the **Enter** key to set the span.

3-4 Mobile WiMAX RF Measurements

Mobile WiMAX RF Measurements consist of three measurement types: Spectrum, Power versus Time, and Adjacent Channel Power Ratio (ACPR).

Setup for RF Measurements

1. Press the **Measurements** main menu key.
2. Press the RF Measurements key to select one of the following RF measurements.

Spectrum

The Spectrum screen displays the spectrum of the input signal, the channel power in dBm, and occupied bandwidth.

1. Press the Spectrum submenu key to select the spectrum measurement.
2. Press the Spectrum submenu key again to open the Spectrum menu and change the Span, if desired. Span choices are: 5 MHz, 10 MHz, 20 MHz, and 30 MHz. The sample image in Figure 3-1 may differ from any image on your instrument.

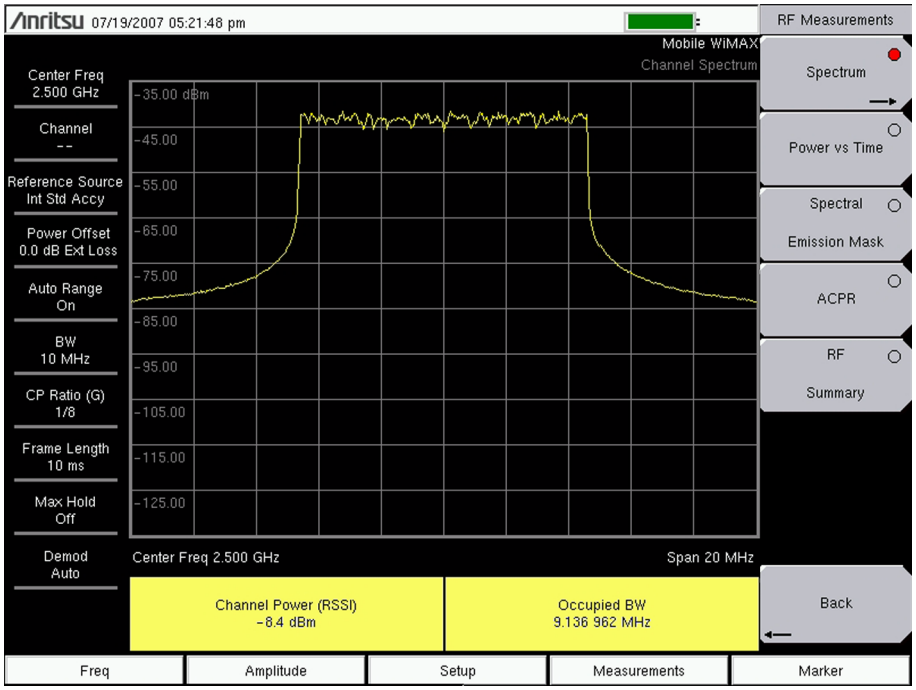


Figure 3-1. Mobile WiMAX Spectrum Measurement

Power versus Time

The Power versus Time view shows the time domain view of a Mobile WiMAX signal over approximately one frame. The screen also displays Channel Power (RSSI), Downlink Burst Power, Uplink Burst Power, and Preamble Power. The sample image in Figure 3-2 may differ from any image on your instrument.

Press the Power vs Time submenu key to select the measurement.

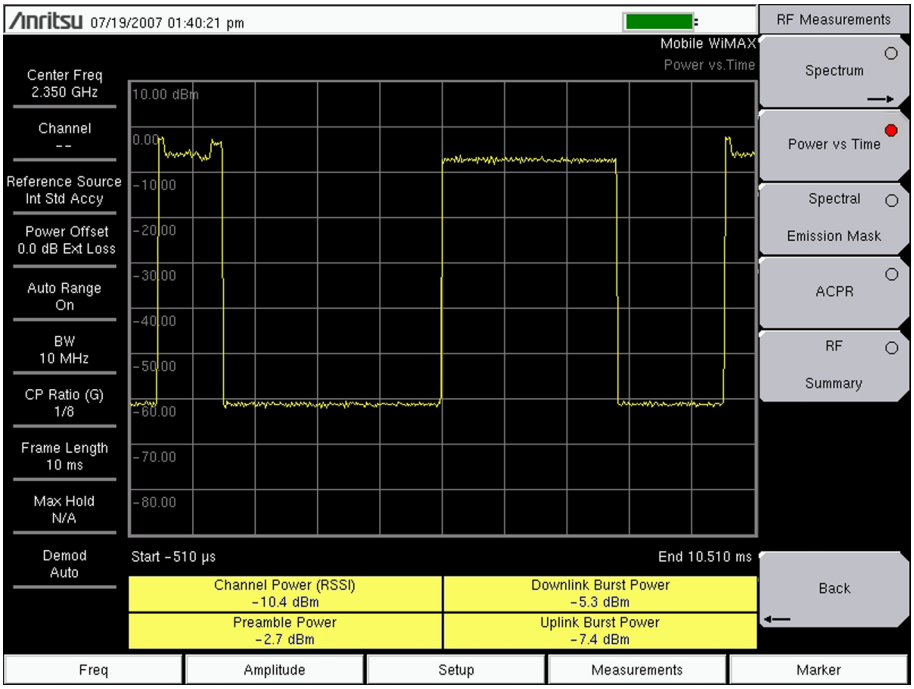


Figure 3-2. Mobile WiMAX Power versus Time Measurement

Spectral Emission Mask

The Spectral Emission Mask (SEM) measurement supports the testing for Operating Band Unwanted Emissions described in the 802.16 testing document. The instrument displays the frequency masks on the spectrum display, and it indicates the reference power and whether 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, power levels, and measured bandwidth and whether the signal PASSED or FAILED in that region.

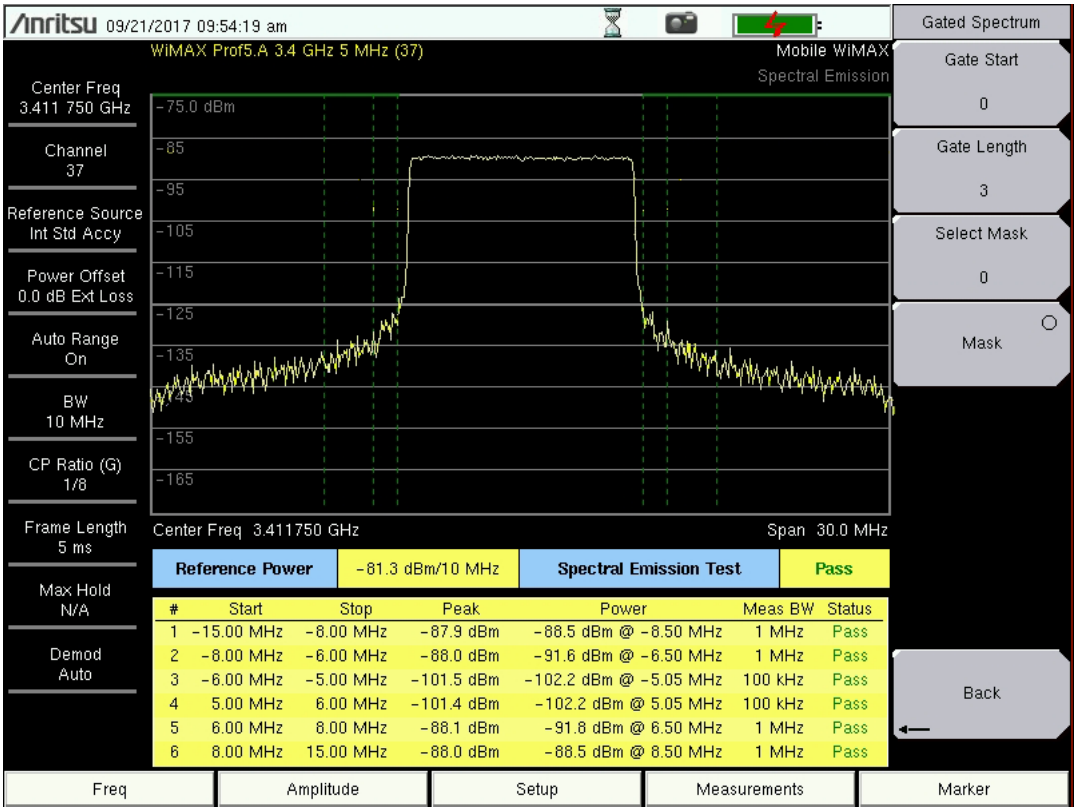


Figure 3-3. Mobile WiMAX Spectral Emission Mask

Adjacent Channel Power Ratio (ACPR)

The ACPR view shows one main channel and two adjacent channels on each side (5 channels total). This view also displays the power levels for each channel (both absolute and relative). The channel spacing matches the selected bandwidth, and the channels are color coded. The sample image in Figure 3-4 may differ from any image on your instrument.

Press the ACPR submenu key to select the measurement.

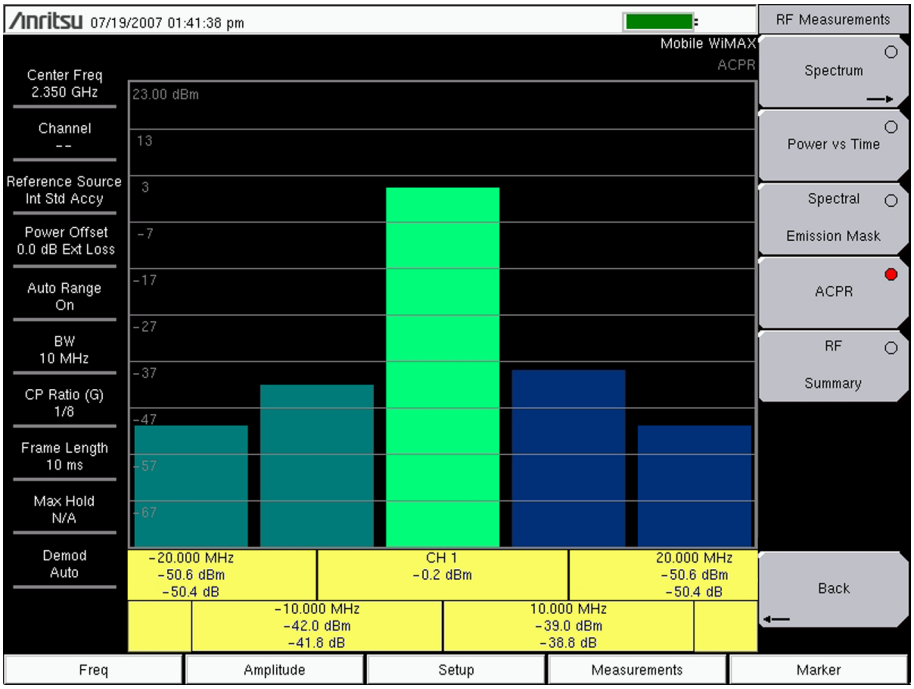


Figure 3-4. Mobile WiMAX ACPR Measurement

RF Summary

The RF Summary measurement displays the critical RF transmitter performance measurements in a table format, without demodulating the WiMAX signal. The parameters that are displayed in the RF Summary table are Channel Power (dBm), Downlink Burst Power (dBm), Uplink Burst Power (dBm), Preamble Power (dBm), and Occupied Bandwidth (Hz). The sample image in Figure 3-5 may differ from any image on your instrument.

Press the RF Summary submenu key to activate the measurement.

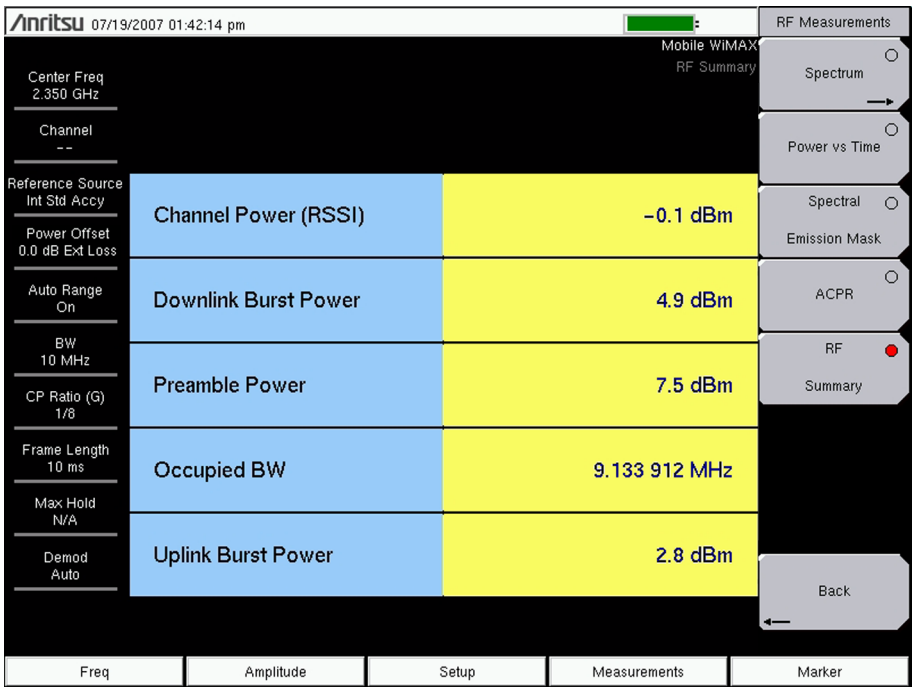


Figure 3-5. Mobile WiMAX RF Summary

3-5 Mobile WiMAX Demod Measurements

These instruments can demodulate a Mobile WiMAX Signal from a Base Station, and it can display the results in Constellation, Spectral Flatness, EVM versus Sub Carrier, EVM versus Symbol, Modulation Summary, and DL-MAP Parameter Tree views.

Setup for Demodulator Measurements

1. Press the **Measurements** main menu key.
2. Press the Demodulator submenu key to open the Demodulator menu, and select one of the following demodulator measurements.

Constellation

The instrument displays the constellation of the demodulated data symbols over one frame. The various constellations are color coded as follows:

QPSK is shown in purple.

16QAM is shown in green.

64QAM is shown in yellow.

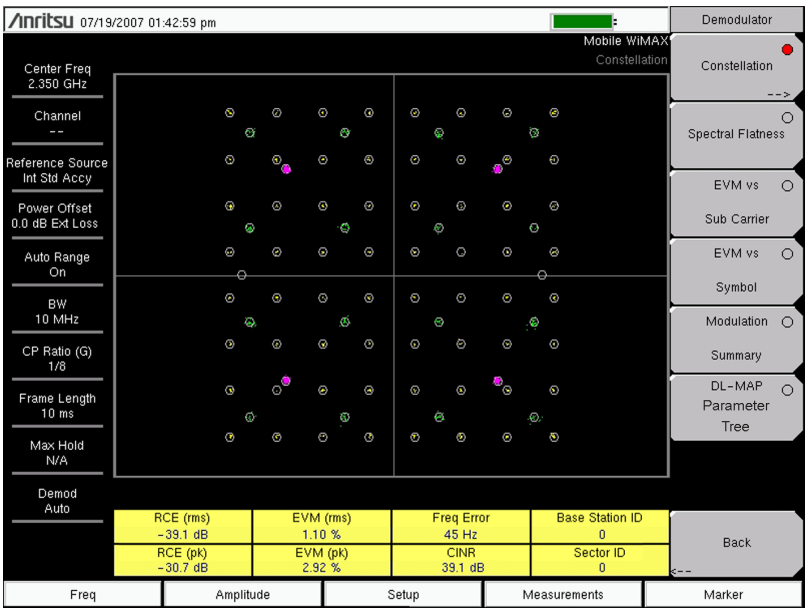


Figure 3-6. Mobile WiMAX Demodulator Constellation Measurement

The numerical results that are displayed in this view are: RCE (rms) in (dB), RCE (pk) in (dB), EVM (rms) in (%), EVM (pk) in (%), Freq Error in (Hz), CINR, Base Station ID, and Sector ID. The sample image in Figure 3-6 may differ from any image on your instrument.

1. Press the Constellation submenu key to activate the measurement.
2. Press the Constellation submenu key again to activate the Constellation menu.
3. Press the Reference Points submenu key to toggle the reference points On or Off.

Spectral Flatness

The Spectral Flatness view shows the data that is collected from the preamble at the channel estimation step. The deviation of the Spectral Flatness from the average (over all of the carriers) is shown in dB. A mask that conforms to the specification is overlaid on the trace. Green color on the mask indicates pass, and red color on the mask indicates regions of the mask where the signal fails.

This mask is referenced from the average of all subcarrier amplitude values. The numerical result that is displayed in this view is the adjacent subcarrier flatness (in dB).

Press the Spectral Flatness submenu key to select the measurement. The sample image in Figure 3-7 may differ from any image on your instrument.

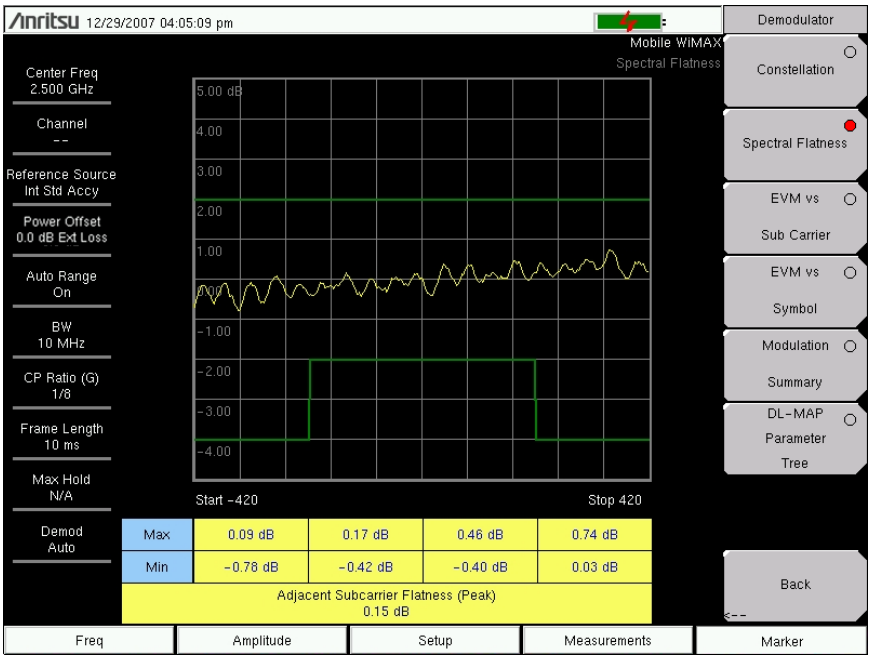


Figure 3-7. Mobile WiMAX Demodulator Spectral Flatness Measurement

EVM versus Sub Carrier

This view shows the EVM(rms) values versus OFDMA subcarriers. The numerical results that are displayed in this view are: RCE (rms) in (dB), RCE (pk) in (dB), EVM (rms) in (%), EVM (pk) in (%), Freq Error in (Hz), CINR, Base Station ID, and Sector ID. The sample image in Figure 3-8 may differ from any image on your instrument.

Press the EVM vs Sub Carrier submenu key to select the measurement.

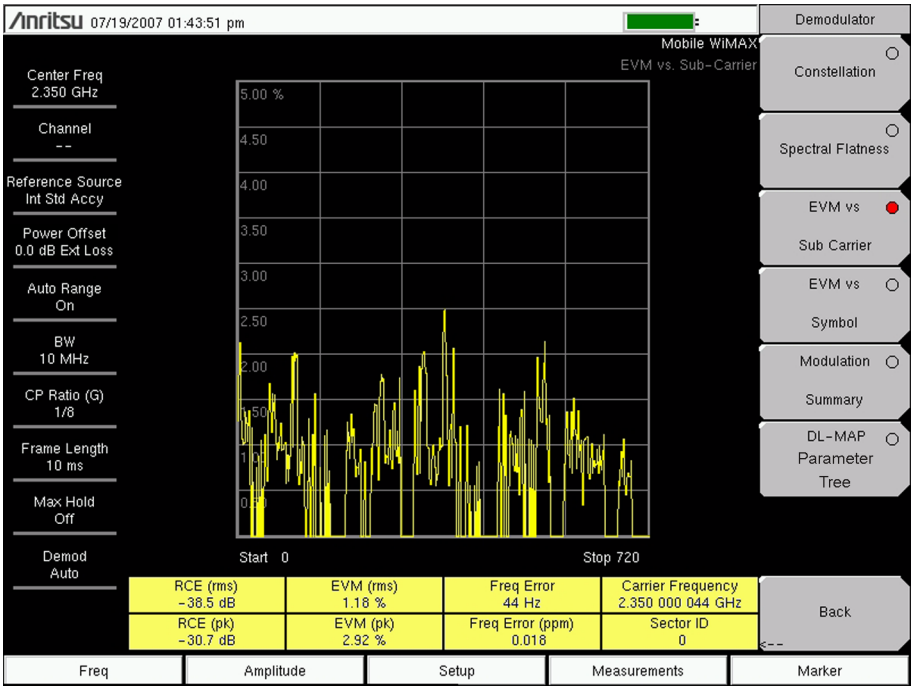


Figure 3-8. Mobile WiMAX Demodulator EVM versus Sub Carrier Measurement

EVM versus Symbol

This view shows the EVMRMS values versus OFDM symbols. The numerical results that are displayed in this view are: RCE (rms) in (dB), RCE (pk) in (dB), EVM (rms) in (%), EVM (pk) in (%), Freq Error in (Hz), Freq Error (ppm), Carrier Frequency (Hz), and Sector ID. The sample image in Figure 3-9 may differ from any image on your instrument.

Press the EVM vs Symbol submenu key to select the measurement.

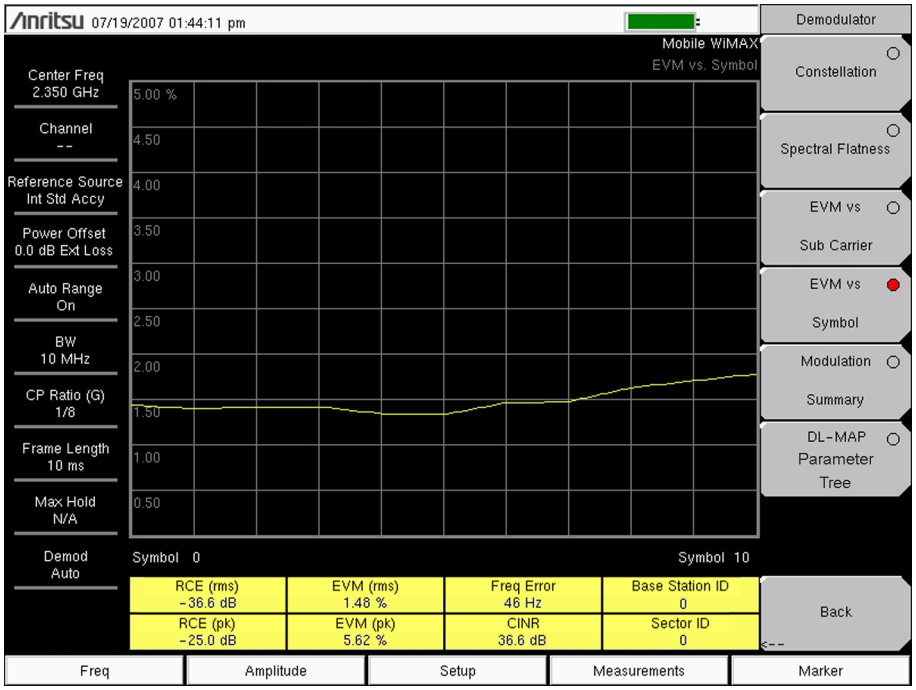


Figure 3-9. Mobile WiMAX Demodulator EVM versus Symbol Measurement

Modulation Summary

The Modulation Summary measurement displays the critical Modulation transmitter performance measurements in a table format by demodulating the WiMAX signal. The parameters that are displayed in the Modulation summary table are: RCE (rms) in (dB), RCE (pk) in (dB), EVM (rms) in (%), EVM (pk) in (%), Freq Error in (Hz), CINR, Carrier Frequency (Hz), and Sector ID. The sample image in Figure 3-10 may differ from any image on your instrument.

Press the Modulation Summary submenu key to select the measurement.

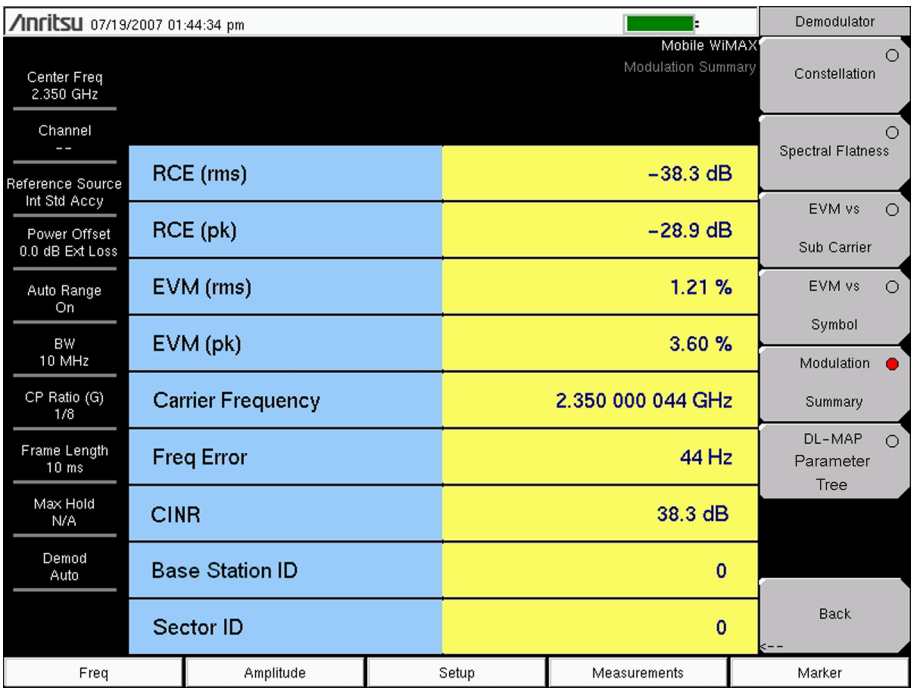


Figure 3-10. Mobile WiMAX Demodulator Modulation Summary Measurement

DL-MAP Parameter Tree

The DL-MAP Parameter Tree measurement displays the DL-MAP Parameter Tree information from the decoded results (Auto mode) or from the parsed information, which is from the .xml parameter file (Manual mode). The .xml parameter file is uploaded to the instrument with Master Software Tools.

1. Press the DL-MAP Parameter Tree submenu key to open the DL-MAP Parameter Tree, which displays a list of WiMAX parameters.
2. Use the **Up/Down** and **Left/Right** arrow keys to close or to open subordinate lists within the map. The sample image in Figure 3-11 may differ from any image on your instrument.

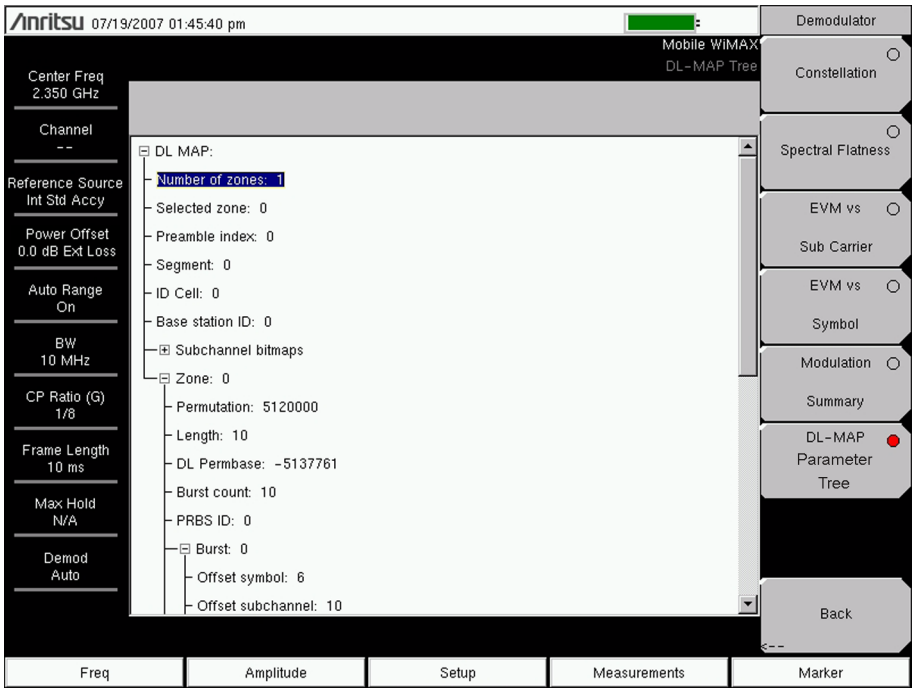


Figure 3-11. Mobile WiMAX Demodulator DL-MAP Parameter Tree Measurement

3-6 Mobile WiMAX OTA Measurements

The Over the Air (OTA) Measurement option displays a Channel Power Monitor and Preamble Scanner.

Setup for Measurements Setup

1. Press the **Measurements** main menu key.
2. Press the OTA submenu key to open the Over-The-Air submenu.

Channel Power Monitor

This measurement displays the Channel Power (RSSI) value over a period of time that you specify. You can also specify the time interval between channel power measurements. Time stamps are recorded along with the power information. If GPS is activated on the instrument, then UTC time is stored, and GPS coordinates are also stored. If GPS is not activated on the instrument, then the internal clock is used.

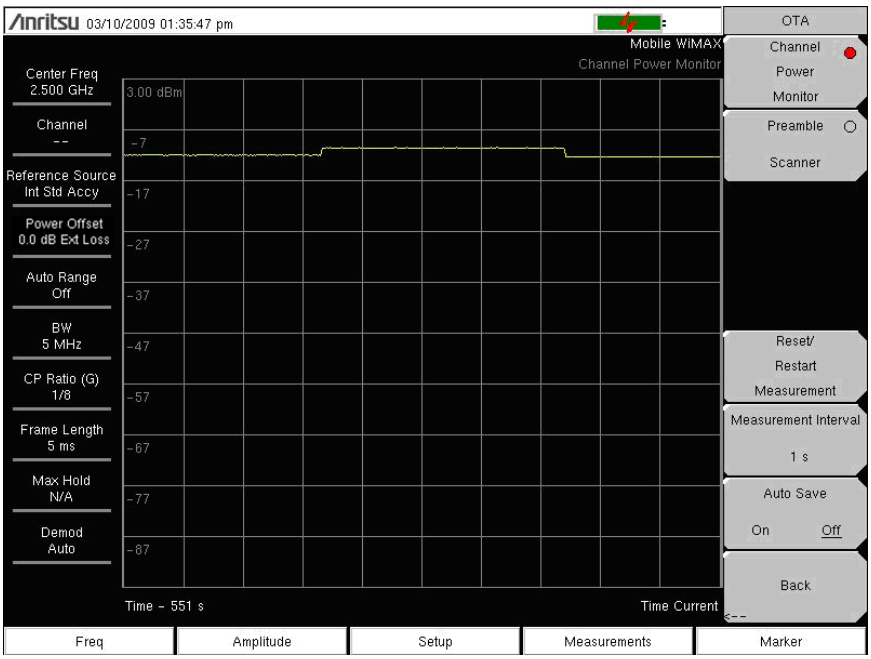


Figure 3-12. Mobile WiMAX OTA Channel Power Monitor Measurement

1. Press the Channel Power Monitor submenu key to select the Channel Power Monitor.
2. Set the Measurement Interval and Auto Save features as desired.
3. Press the Reset/Restart Measurement key to discard logged Channel Power data and restart logging of the data.

Preamble Scanner

This measurement displays the six strongest preamble signals in bar graph form. The Preamble Index, Relative Pwr, Cell ID, and Sector ID are listed for each preamble signal. The PCINR, calculated from all six preambles, and the Base Station ID, of the strongest preamble signal, are listed below the table.

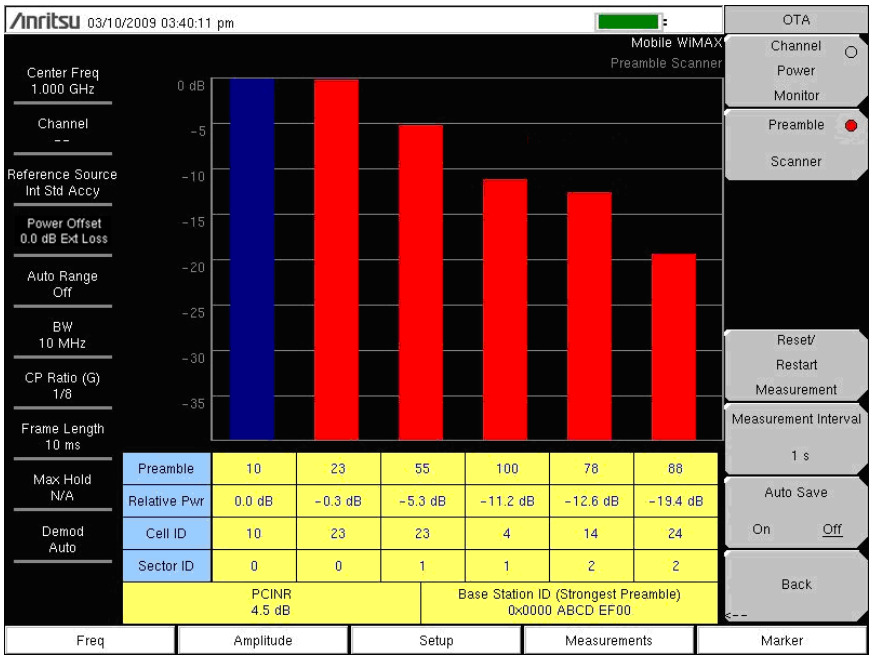


Figure 3-13. Mobile WiMAX OTA Preamble Scanner Measurement

1. Press the Preamble Scanner submenu key.
2. Set the Auto Save submenu key turn as desired.
3. Press the Reset/Restart Measurement submenu key to discard logged Preamble data and restart logging of the data.

Pass/Fail Mode

The Pass/Fail mode allows selection of a user-defined file that specifies a list of measurements with Pass/Fail criteria. In this mode, the instrument steps in sequence through the appropriate measurements and indicates a pass or fail state based upon the criteria. Using Master Software Tools (MST), a custom test list can be created and uploaded into the instrument. All of the critical measurements are available and can be selected for Pass/Fail testing. The results are displayed in a table format with clear identification of Pass/Fail results, including minimum and maximum thresholds and measured results. The sample image in Figure 3-14 may differ from any image on your instrument.

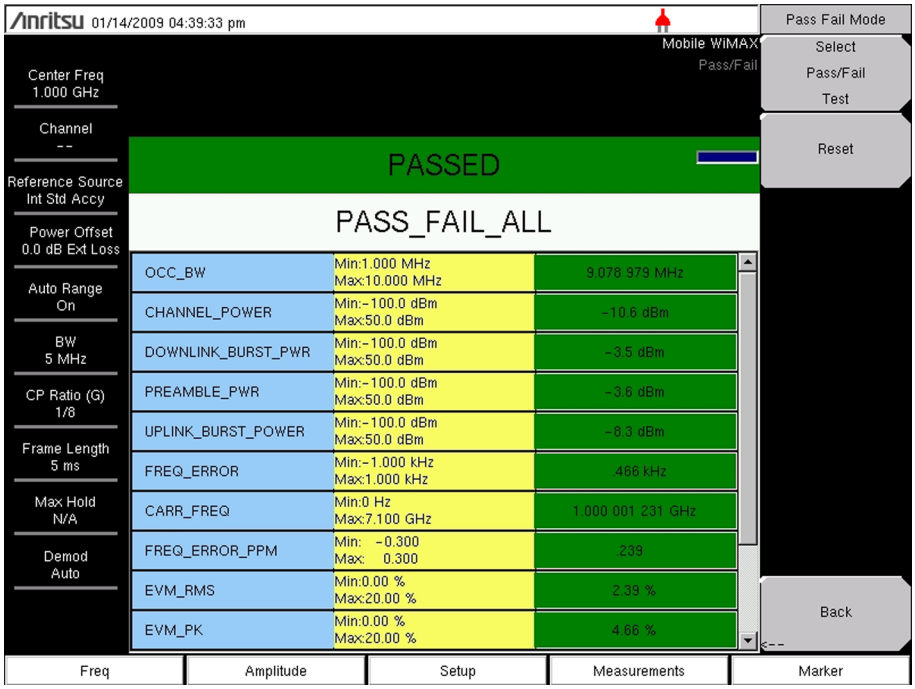


Figure 3-14. Mobile WiMAX Pass/Fail Measurement Display

1. Press the **Measurements** main menu key.
2. Press the Pass/Fail Mode submenu key.
3. Press the Pass/Fail Mode submenu key again to activate the Pass Fail Mode menu.
4. Press the Select Pass/Fail Test submenu key to view a list of Pass/Fail test definition files.
5. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable Pass/Fail test on the list, and press the **Enter** key to select.
6. Press the Reset submenu key to begin a new Pass/Fail test measurement.

WiMAX Summary

The WiMAX Summary is a summary of critical Mobile WiMAX measurements from the RF and Demodulator measurements: Channel Power (RSSI) in dBm, Downlink Burst Power in dBm, Preamble Power in dBm, Occupied BW in Hz, Uplink Burst Power in dBm, RCE (rms) in dB, RCE (pk) in dB, EVM (rms) in %, EVM (pk) in %, Carrier Frequency in Hz, Freq Error in Hz, CINR, Base Station ID, and Sector ID.

1. Press the **Measurements** main menu key.
2. Press the WiMAX Summary submenu key. The sample image in Figure 3-15 may differ from any image on your instrument.

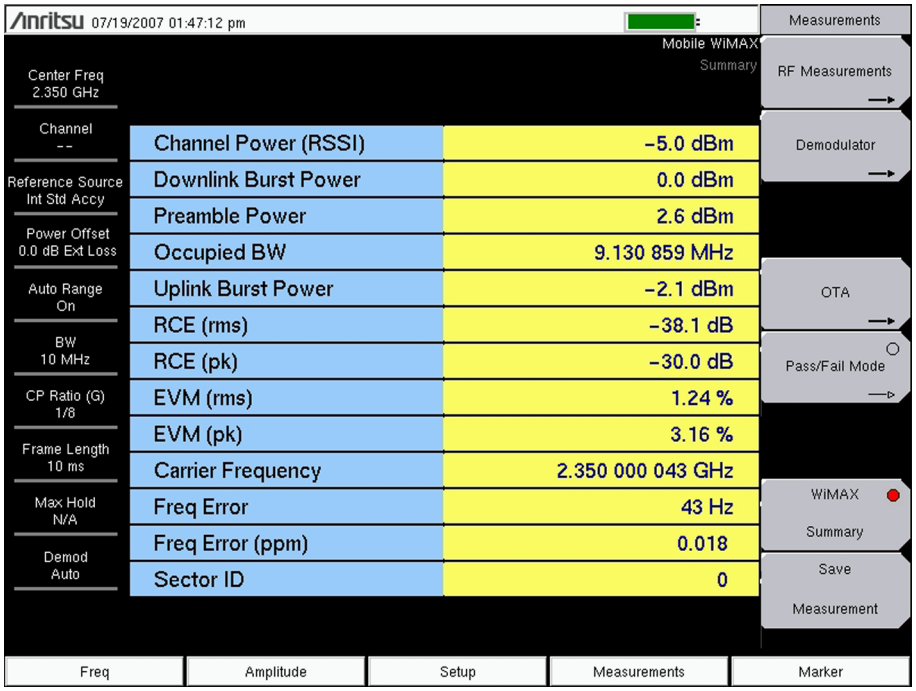


Figure 3-15. Mobile WiMAX OTA WiMAX Summary Measurement

3-7 Mobile WiMAX Menus

Figure 3-16 and Figure 3-16 shows the map of the Mobile WiMAX menus. The following sections describe WiMAX 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.

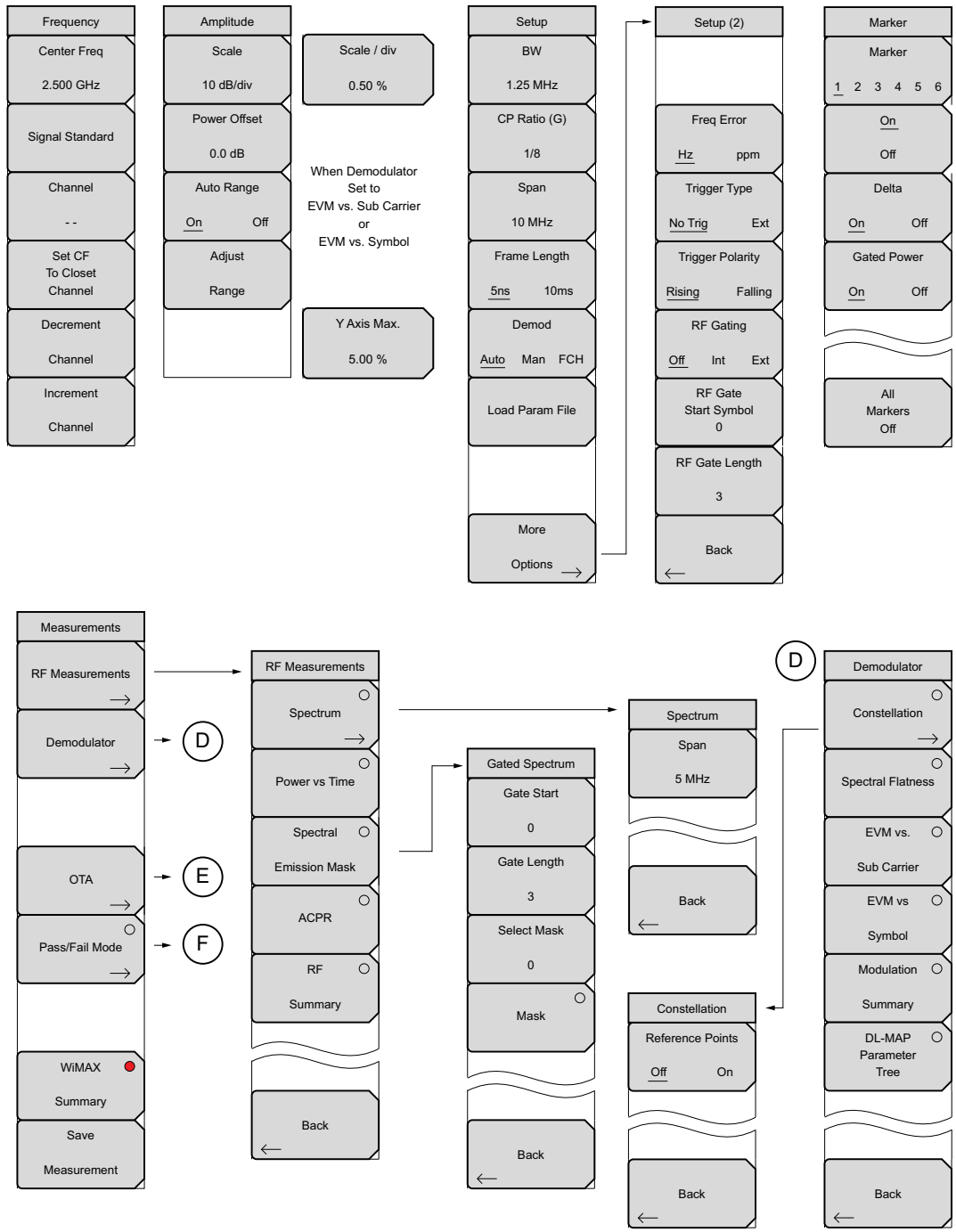


Figure 3-16. Mobile WiMAX Menus (1 of 2)

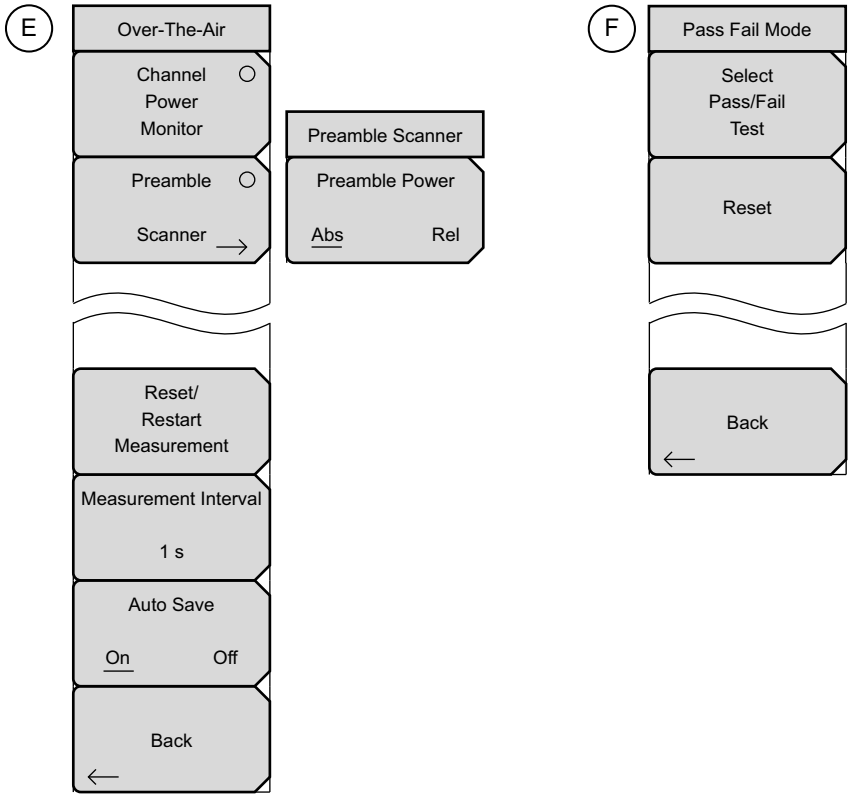
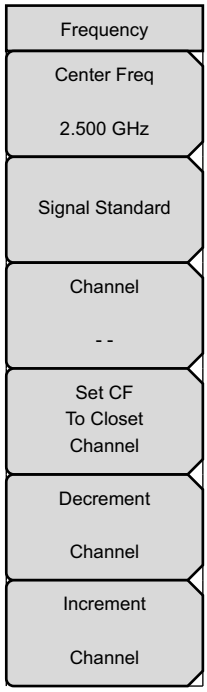


Figure 3-17. Mobile WiMAX Menus (2 of 2)

3-8 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: The Center Freq submenu key is used 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 by using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units submenu key to finalize the data input. Pressing the **Enter** key has the same affect as pressing the MHz submenu key.

Signal Standard: Press this submenu key to open the Signal Standards list box. 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 are automatically tuned for the first channel of the selected standard. Other settings, such as channel spacing and integration bandwidth, are also automatically entered.

The applicable signal standards (for 10 MHz BW only) are U-NII middle, U-NII upper, CEPT band B, and CEPT band C.

Channel: Press this submenu key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected Signal Standard. The instrument measurement display is automatically tuned to the center frequency of the selected channel. The listed channels are from 0 to 199.

Set CF to Closest Channel: This submenu key moves the current Center Frequency to the closest frequency that matches a channel number in the current Signal Standard.

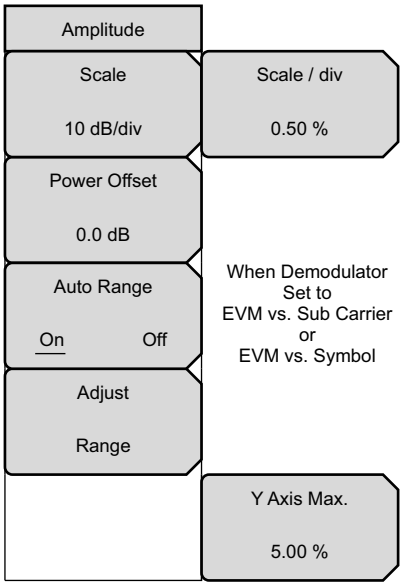
Decrement Channel: Press this submenu key to decrease the selected channel number by one channel step size for the selected standard.

Increment Channel: Press this submenu key to increase the selected channel number by one channel step size for the selected standard.

Figure 3-18. Mobile WiMAX Freq Menu

3-9 Amplitude Menu

Key Sequence: **Amplitude**



Scale: Press this submenu key to set the scale of the Y axis on the measurement display. Scale can be set from 1 dB/div to 15 dB/div. The default value changes from 10 dB/div to 1 dB/div when the Spectral Flatness view is selected from the Measurements | Demodulator menu.

The Scale/div submenu key only appears when making EVM vs. Subcarrier and EVM vs. Symbol measurements, set from the Measurements | Demodulator menu. All other measurements use the dB/div Scale menu.

Power Offset: Press this submenu key to have the instrument automatically adjust for the loss through any external cables, attenuators, or couplers. The power can be offset from –100 dB to +100 dB. To set a power offset, press the Power Offset submenu key, use the rotary knob, the arrow keys, or the numeric keypad to enter the offset values, and press the dB submenu key or the **Enter** key.

Auto Range: Press this submenu key to toggle the auto range function On and Off. The active state is underlined on the submenu key face. When Auto Range is activated (the default state), the reference level is automatically adjusted (automatic gain ranging).

Adjust Range: When Auto Range is set to the OFF state, press this submenu key to adjust the internal reference level to be optimal, based on the measured signal. The Range adjustment is performed once each time the submenu key is pressed. When Auto Range is set to On, pressing this submenu key causes Auto Range to be set to Off.

Note: When the Adjust Range submenu key is pressed, the instrument no longer adjusts the internal gain automatically because Auto Range is set to Off. Press the Auto Range submenu key to resume automatic gain ranging.

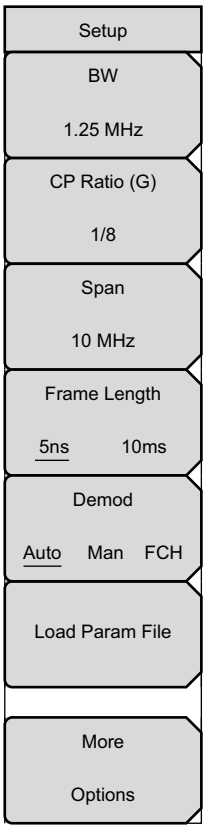
Y-Axis Max: Press this submenu key to set the maximum value of the Y-axis. In combination with the Scale control, this setting allows you to zoom in and zoom out on the Y-axis.

This control is available in only 4 measurements: OTA Channel Power Monitor and Demodulator Spectral flatness, EVM versus Sub Carrier, and EVM versus Symbol. When the instrument is set up for other measurements, this submenu key is not displayed.

Figure 3-19. Mobile WiMAX Amplitude Menu

3-10 Setup Menu

Key Sequence: **Setup**



BW: Opens the Select Bandwidth list box. Use the **Up/Down** arrow keys or the rotary knob, and then press the **Enter** key. The following three bandwidths are available: 3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, and 10 MHz. The default bandwidth is 5 MHz.

CP Ratio (G): The CP Ratio is fixed at 1/8 for Mobile WiMAX. You cannot change this parameter.

Span: Press this submenu key to open the Span list box and select the desired span for the Spectrum view. Use the **Up/Down** arrow keys or the rotary knob, and then press the **Enter** key. The available span selections are: 5 MHz, 10 MHz, 20 MHz, and 30 MHz.

Note: The span value is automatically adjusted to the next largest available span when the bandwidth setting is changed. The span can be changed to any of the available values in order to override the automatic selection.

Frame Length: Toggles between 5 ms and 10 ms for the desired frame length.

Demod: Toggles through the available selections for Automatic, Manual, and Frame Control Header (Auto, Man, FCH).

When Auto is chosen, the instrument attempts to demodulate the signal, decode the DL-MAP Parameter Tree, and use that information to demodulate the data portion of the frame.

When Manual is chosen, a parameter file must be available (you must have already loaded this parameter file). The parameters from this file are used by the instrument to demodulate the data bursts.

Note: The Manual mode setting is not saved in setup files, nor is it saved when power is turned off. If Demod is set to Manual mode before the instrument is turned off, then the Demod setting becomes Auto mode when the instrument is turned on.

When FCH is chosen, only the FCH portion of the signal is demodulated.

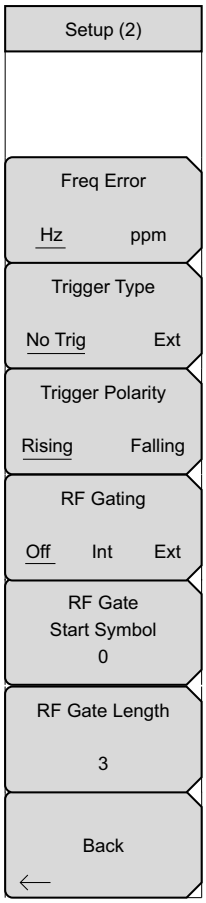
Load Param File: Press this submenu key to open the Parameter Files (XML) list box and to select the parameters that are stored in an XML file. This file needs to be generated by using the Anritsu IQProducer software.

More Options: Press this submenu key to open the “Setup (2) Menu” on page 3-24, to view the menu description.

Figure 3-20. Mobile WiMAX Setup Menu

Setup (2) Menu

Key Sequence: **Setup** > More Options



Freq Error: Press this submenu key to toggle between units of Hz and ppm. The current setting is underlined on the submenu key face.

Trigger Type
No Trig Ext: Press this submenu key to toggle between no trigger and an external trigger. The current setting is underlined on the submenu key face.

Trigger Polarity
Rising Falling: Press this submenu key to toggle between a Rising or Falling trigger polarity. The current setting is underlined on the submenu key face.

RF Gating
Off Int Ext: Press this submenu key to select the gating trigger source. The current setting is underlined on the submenu key face.

RF Gate Start Symbol: Press this submenu key to enter the start gate symbol. The current setting is shown on the submenu key face.

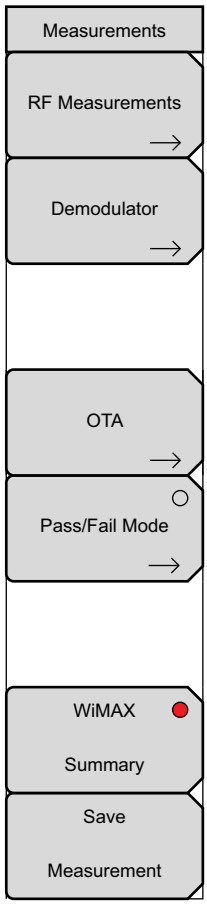
RF Gate Length: Press this submenu key to enter the RF gate length (number of symbols). The current setting is shown on the submenu key face.

Back: Press this submenu key to return to the “Setup Menu” on page 3-23.

Figure 3-21. Mobile WiMAX Setup (2) Menu

3-11 Measurements Menu

Key Sequence: **Measurements**



RF: Press this submenu key to open the "RF Measurements Menu" on page 3-26.

Demodulator: Press this submenu key to open the "Demodulator Menu" on page 3-28.

OTA: Press this submenu key to open the "Over-The Air Menu" on page 3-30.

Pass/Fail Mode: Press this submenu key once to display the PASS_FAIL table. Press the key again to open the Pass/Fail submenu key menu (refer to "Pass Fail Mode Menu" on page 3-31).

Pass/Fail mode allows the selection of a user-defined file that specifies a list of measurements with pass/fail criteria. This mode moves in sequence through the appropriate measurements and indicates a pass or fail state based for each of the criteria. A custom test list can be created with Master Software Tools and can be uploaded into your instrument. All critical measurements can be selected for pass fail testing. The results are displayed in table format with clear identification of pass/fail results, including minimum and maximum thresholds and measured results.

WiMAX Summary: Press this submenu key to display a summary of all of the WiMAX-related numerical measurement results.

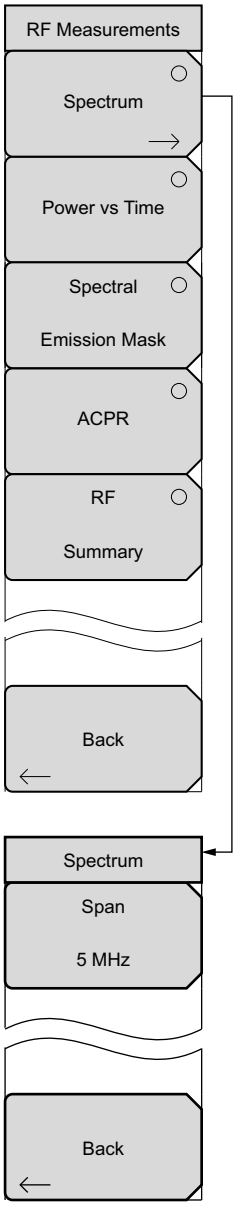
- Channel power (dBm)
- Downlink Burst Power
- Preamble Power
- Occupied Bandwidth
- Uplink Burst Power
- RCE (rms)
- RCE (pk)
- EVM (rms)
- EVM (pk)
- Carrier Frequency
- Freq Error
- CINR
- Base Station ID
- Sector ID

Save Measurement: Initiates a dialog box to name and save the current measurement. The saved measurement can be named by using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by pressing the submenu key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrow keys to move the cursor position. Press **Enter** to save. WiMAX measurements are saved with a .wmxe extension.

Figure 3-22. Mobile WiMAX Measurements Menu

RF Measurements Menu

Key Sequence: **Measurements** > RF Measurements



Spectrum: Press this submenu key to display the spectrum of the input signal. The span is automatically adjusted to the next largest available span based on the bandwidth setting. Channel Power (RSSI) in dBm and Occupied bandwidth measurements are displayed as numerical values.

Span: Press this submenu key to open the Span selection dialog. Select the desired Span for the Spectrum view using the **Up/Down** arrow keys or rotary knob and press Enter. The list shows the following choices: 5 MHz, 10 MHz, 20 MHz, 30 MHz.

Back: Press this submenu key to return to the RF Measurements menu.

Power vs Time: Press this submenu key to show the time domain view of a WiMAX 802.16-2004 OFDM signal over approximately one frame.

The Channel Power (RSSI) in dBm, Preamble Power in dBm, Downlink Burst Power in dBm, and Uplink Burst Power are displayed as numerical values.

Spectral Emission Mask: Press this submenu key to show the main channel out-of-channel emissions and the in-channel power. It displays the reference power level and pass/fail results of the emission test. Press the menu again to open the "RF Measurements Menu" on page 3-26

ACPR: Press this submenu key to show one main channel and two adjacent channels. It displays the power levels for each channel (both absolute and relative).

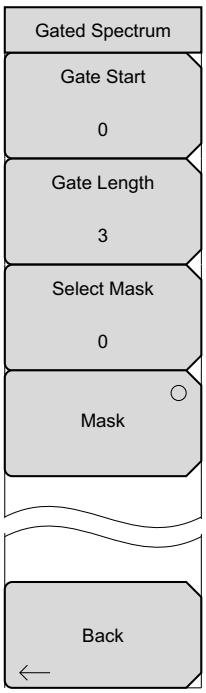
RF Summary: Press this submenu key to display a summary of all of the RF numerical measurement results.

Back: Press this submenu key to return to the "Measurements Menu" on page 3-25.

Figure 3-23. Mobile WiMAX RF Measurements Menu

Gated Spectrum Menu

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



Gate Start: Press this submenu key to set the gate start time.

Gate Length: Press this submenu key to set the gate length.

Select Mask: Press this submenu key to select the desired mask.

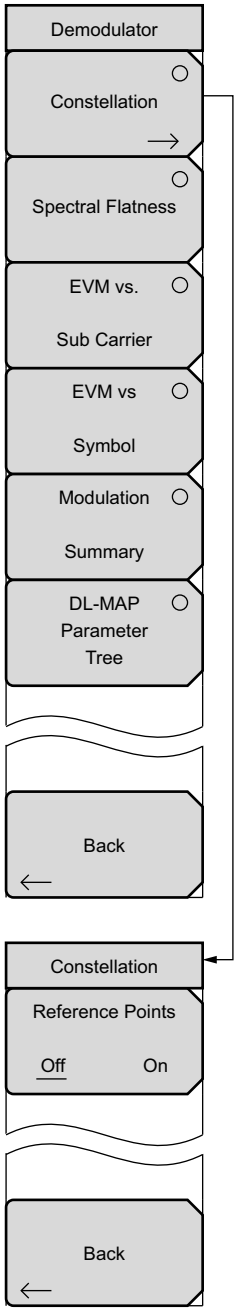
Mask: Press this submenu key to turn the mask display on or off.

Back: Press this submenu key to return to the "Measurements Menu" on page 3-25.

Figure 3-24. Mobile WiMAX RF Gated Spectrum Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



Constellation: Press the Constellation submenu key to set the demodulation to Constellation view. The constellation view shows the constellation of the demodulated data symbols over one frame. The constellations are color coded.

Constellation View Color Codes:

- QPSK is shown in purple.
- 16-QAM is shown in green.
- 64-QAM is shown in yellow.

Constellation View Numerical Results

- RCE (rms) in dB
- RCE (pk) in dB
- EVM (rms) in %
- EVM (pk) in %
- Freq Error in Hz
- CINR
- Base Station ID
- Sector ID

Reference Points: Press this submenu key to display reference points for the various constellations. On is the default state.

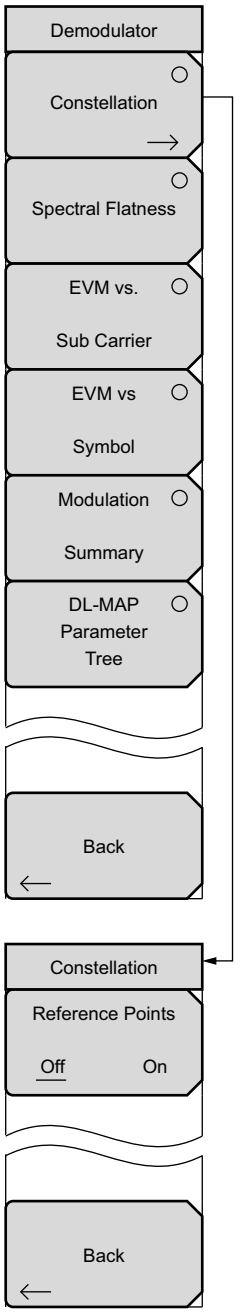
Back: Press this submenu key to return to the Demodulator menu.

Spectral Flatness: Press this submenu key to show the spectral flatness data that is measured from the preamble at the channel estimation step. The deviation of the spectral flatness from the average of all the carriers is shown in dB.

A mask that conforms to the specification is overlaid on the trace. Green color on the mask indicates pass, and red color on the mask indicates fail. This mask is referenced from the average of all subcarrier amplitude values. Absolute delta of the power between adjacent subcarriers is displayed as a numerical value in dB.

Figure 3-25. Mobile WiMAX Demodulator Menu (1 of 2)

Demodulator Menu (Continued)



EVM vs Sub Carrier: Press this submenu key to display the EVM (rms) values versus subcarriers. Because some subcarriers are not used in OFDMA, their values are set to 0 (zero).

EVM vs Symbol: Press this submenu key to display the EVM (rms) values versus OFDM symbols.

Modulation Summary: Press this submenu key to display a summary table of all of the modulation-related numerical measurement results. The following measurements are displayed:

- RCE (rms)
- RCE (pk)
- EVM (rms)
- EVM (pk)
- Carrier Frequency
- Freq Error
- CINR
- Base Station ID
- Sector ID

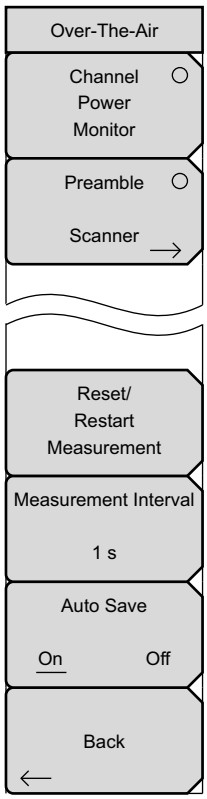
DL-MAP Parameter Tree Parameter Tree: Press this submenu key to display the DL-MAP Parameter Tree information in Auto mode (from the decoded results) or in Manual mode (from the parsed information, which is from the .xml parameter file).

Back: Press this submenu key to return to the "Measurements Menu" on page 3-25.

Figure 3-26. Mobile WiMAX Demodulator Menu (2 of 2)

Over-The Air Menu

Key Sequence: **Measurements** > OTA



Channel Power Monitor: Displays the Channel Power (RSSI) value over a variable time period that is specified with the Measurement Interval submenu keys.

Preamble Scanner: Displays a bar graph and data table of the six strongest preambles. Signal data includes Preamble Index, Relative Pwr, Cell ID, and Sector ID. The PCINR, calculated from all six preambles, and the Base Station ID of the strongest preamble signal are listed below the table.

Reset/Restart Measurement: Press this key to reset or to restart the measurement. Pressing this key discards logged Channel Power data and restarts logging of the data.

Measurement Interval (Channel Power Monitor Only)**:** Used to specify the time interval between channel power measurements. Time stamps are recorded along with the power information.

Auto Save: Press this key to toggle between On and Off. When the Auto Save function is On, measurements are automatically saved to file.

When the Auto Save function is active, each 551 data points are saved as a measurement. The amount of available memory in the instrument determines how many measurements can be saved. If the Measurement Interval is set to values that will require more memory than is available, then pressing the Auto Save soft key causes the instrument to reset the Measure Duration to a value that allows saving all of the measurements that are taken. The instrument can continue monitoring the signal, but additional measurements are not saved.

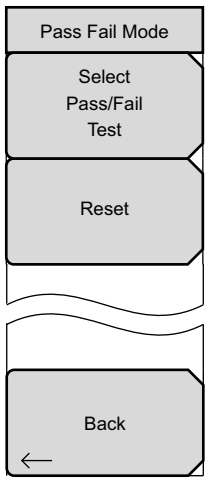
If GPS is activated on the instrument, then UTC time is stored, and GPS coordinates are also stored. If GPS is not activated on the instrument, then the internal clock is used.

Back: Press this submenu key to return to the “Measurements Menu” on page 3-25.

Figure 3-27. Mobile WiMAX OTA Menu

Pass Fail Mode Menu

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



Select Pass/Fail Test: Press this submenu key to select a pass/fail test from the list of available Pass/Fail tests. The default list is:

- PASS_FAIL_RF
- PASS_FAIL_DEMOD
- PASS_FAIL_ALL

You can create a user-defined file by using Master Software Tools. Refer to "Pass/Fail Mode" on page 3-17.

Reset: Press this submenu key to restart a Pass/Fail test.

Back: Press this submenu key to return to the "Measurements Menu" on page 3-25.

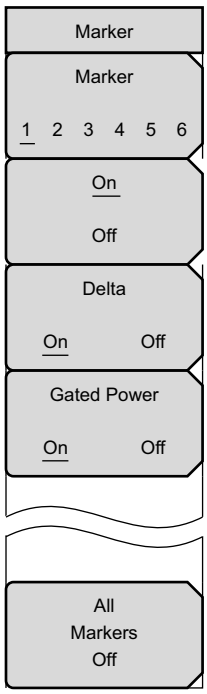
Figure 3-28. Mobile WiMAX Pass/Fail Menu

3-12 Marker Menu

This feature is available only when the Power vs Time measurement is activated from the RF Meas menu (**Measurements** > RF > Power vs. Time).

These instruments have 6 regular line markers and 6 delta markers. Marker information includes time and power level in dBm. Delta marker information includes delta time and delta power.

Key Sequence: **Marker**



Marker
1 2 3 4 5 6: Press this submenu key to select and set up a marker for display

On Off: Press this submenu key to turn On and Off the selected (underlined) marker in the Marker submenu key face

Delta
On Off: Press this submenu key to turn a delta marker On or Off. You can move the delta marker to read offsets in time and power by using the rotary knob or by entering a time offset using the number keypad.

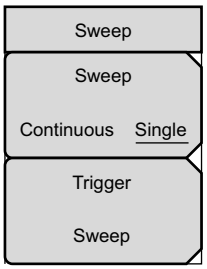
Gated Power
On Off: Press this submenu key to turn Gated Power On and Off.

All Markers Off: Press this submenu key to turn Off all markers and remove them from the display

Figure 3-29. Mobile WiMAX Marker Menu

3-13 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.

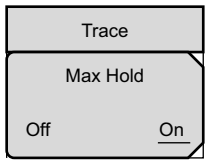
Figure 3-30. Mobile WiMAX Sweep Menu

3-14 Measure Menu

This menu open the "Measurements Menu" on page 3-25.

3-15 Trace Menu

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



Max Hold: Press this submenu key to toggle Max Hold On or Off. It applies to Spectrum view and EVM vs Sub Carrier view. This function allows the spectrum trace to hold its peak value from trace to trace. This helps in capturing a representative spectrum of a burst RF signal, such as WiMAX. All Max Hold operations show two traces. One trace is a max hold value, and the other is a live trace with the current measurement results.

Figure 3-31. Mobile WiMAX Sweep Menu

3-16 Limit Menu

This menu is not available in Mobile WiMAX measurement mode.

3-17 Other Menus

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

Appendix A — Error Messages

A-1 Introduction

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

A-2 Common WiMAX Messages

Attempting to lock to External Reference

When the instrument detects an external reference frequency has been connected, this message is displayed briefly.

External Reference Locked Successfully

When the instrument has detected an external reference and has successfully locked to the reference, this message is displayed briefly.

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.

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.

ADC over range

When the software detects that the internal ADC is being overloaded, this message is displayed. depending upon the gain settings, either a "decrease input power" or "adjust range" message is also displayed with this message.

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.

Weak Signal: Increase input power

When the software does not measure enough signal power at the input, this message is displayed. Measurement results are cleared ('--' is seen in the result area). The instrument will continue to check the signal power and start showing results when the power is increased or internal attenuation is reduced.

A-3 Fixed WiMAX Messages

DL Short Preamble not found

When the software does not detect a Downlink short preamble in the burst, this message is displayed on the screen. All Demodulation measurement results are cleared ('--' is seen in the result area). The short preamble is required for all Demodulation measurements.

The short preamble is also required for the Power versus Time trace to be synchronized but if the preamble is not present, an unsynchronized time domain trace is displayed and all but the Channel Power result is cleared.

The instrument will continue to check for the presence of the short preamble.

DL Long Preamble not found

When the software does not detect a Downlink long preamble in the burst, this message is displayed on the screen. All Demodulation measurement results are cleared ('--' is seen in the result area). The long preamble is required for all Demodulation measurements.

The instrument will continue to check for the presence of the long preamble

FCH decoder failed

This message is displayed when there is an error detected in the FCH decoder that is used to determine the base station ID.

A-4 Mobile WiMAX Messages

DL Short Preamble not found

When the software does not detect a Downlink short preamble in the burst, this message is displayed on the screen. All demodulation measurement results are cleared ("--" is seen in the result area). The short preamble is required for all demodulation measurements.

The short preamble is also required for the Power versus Time trace to be synchronized, but if the preamble is not present, then an unsynchronized time domain trace is displayed, and all data results are cleared except the Channel Power result. The instrument continues to check for the presence of the short preamble.

Demodulation Error

This message is typically displayed if the input signal is a proprietary implementation of Mobile WiMAX.

The Demodulation Error is displayed when the following conditions are **not met:**

- FFT size is 1024 or 512
- preamble index is within the range of 0 to 113
- modulation type is QPSK, 16QAM, or 64 QAM
- reserved bit is not zero in DL-MAP
- first zone is not PUSC

DL-MAP not CC encoded

When Demod Type is set to Auto, and the decoded information from the DL-MAP indicates that the encoding type is not Convolutional Coding (CC), then this message is displayed because the instrument supports only Convolutional Coding at this time.

Too many symbols in DL-MAP

When the number of symbols exceeds the maximum number that is supported by the instrument, then this message is displayed.

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