Measurement Guide

3GPP2 Signal Analyzer

for Anritsu RF and Microwave Handheld Instruments

BTS Master™, Cell Master™, Spectrum Master™

	RF	Demod	OTA
CDMA	Option 42	Option 43	Option 33
EV-DO	Option 62	Option 63	Option 34

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

CDMA/EV-DO	Option 884

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

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Chapter 3—EVDO Signal Analyzer

Chapter 1 — General Information

1-1 Introduction

This Measurement Guide documents 3GPP2 signal analysis for the following Anritsu instruments:

- BTS Master
- Cell 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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1-4 3GPP2 Signal Overview

CDMA signal analysis is described in Chapter 2, "CDMA Signal Analyzer"

- Option 0042: CDMA RF Measurements
- Option 0043: CDMA Demodulation
- Option 0033: CDMA Over-the-Air (OTA) Measurements
- Option 0884: CDMA/EV-DO Measurements (requires Option 9)

EV-DO signal analysis is described in Chapter 3, "EVDO Signal Analyzer"

- Option 0062: EV-DO RF Measurements
- Option 0063: EV-DO Demodulation
- Option 0034: EV-DO OTA Measurements
- Option 0884: CDMA/EV-DO Measurements (requires Option 9)

1-5 Selecting a Measurement Mode

Select a measurement 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**.

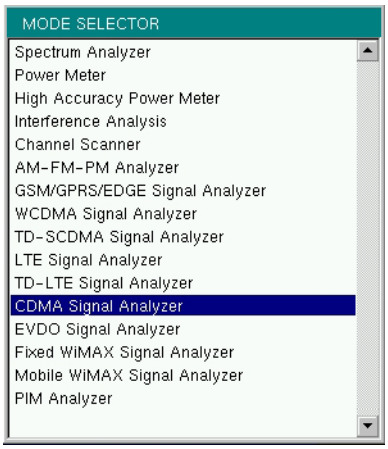


Figure 1-1. Mode Selector Dialog Box

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 — CDMA Signal Analyzer

2-1 Introduction

The instrument offers three CDMA measurement options:

- cdmaOne/CDMA2000 1X RF measurements
- cdmaOne/CDMA2000 1X demodulation
- cdmaOne/CDMA2000 1X Over-the-Air (OTA) measurements, requires Option 31

The instrument can measure CDMA signals over the air (OTA) with an antenna or by directly connecting the instrument to the base station.

2-2 General Measurement Setup

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

2-3 CDMA Measurement Setup

Anritsu instruments can measure CDMA performance over the air with an antenna, or by connecting the base station directly.

To measure a CDMA signal over the air, connect the appropriate frequency band antenna to the instrument's RF Input connector and connect a GPS antenna to the GPS connector.

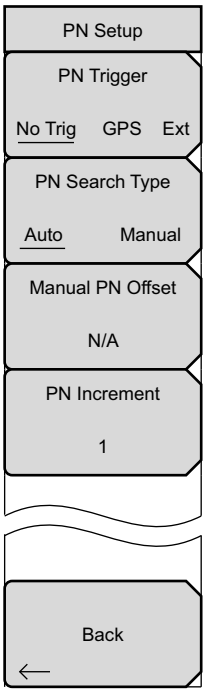
To connect the base station to the instrument, connect the power amplifier of the base station to the RF In port of the instrument using a coupler or attenuator.

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

PN Select Setup

The instrument needs a timing reference in order to determine PN Offset and timing errors. This reference comes from the base station when it is connected, or it can be recovered from GPS when a GPS antenna is connected. The setup for this function is:

1. Press the **Setup** main menu key.
2. Press the PN Setup submenu key to open the PN setup menu (Figure 2-1).
3. Press the PN Trigger submenu key to toggle through No trigger, GPS, or External.



No Trigger: If both GPS and external timing are unavailable, then you may choose No Trigger for the PN search.

GPS: Uses GPS as the timing reference.

External: The instrument uses an external, even-second time mark as the timing reference. The time mark is usually available at the base station on a BNC connector labeled “ESTM” or “PP2S”. ESTM must be connected to the External Trigger In connector on the instrument.

Figure 2-1. PN Setup

4. Press the PN Search Type submenu key to toggle between Auto or Manual. In Auto mode, the instrument automatically detects the strongest pilot, while in Manual mode it searches only for the specified PN.

Note	If Manual Search Type is selected, then press Manual PN Offset and enter the desired PN value.

5. Press Back to return to the previous menu.

Walsh Codes Setup

Walsh Codes setup is used to select whether cdmaOne (Walsh Codes 64) or CDMA2000 1xRTT (Walsh Codes 128) is required for the measurements. When 128 codes is selected, the upper CDP (Code Domain Power) graph displays the CDP in bit-reversed order.

1. Press the **Setup** main menu key.
2. Press the Walsh Codes submenu key, and the key is toggled between 64 codes and 128 codes.

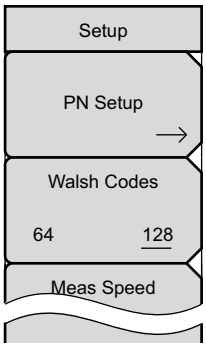


Figure 2-2. Walsh Codes Setup

GPS Setup

GPS provides improved accuracy in the timing circuit, which reduces frequency error. To configure GPS, use the following procedure:

- Install a GPS antenna to the GPS antenna connection on the instrument's connector panel.

Caution	A DC voltage is present on the GPS connector. Never connect anything other than a GPS antenna to this port.

Note	CDMA base stations have GPS available at the cell Site. Connect the instrument to the base station GPS Frequency Reference connector to make accurate frequency error and timing measurements.

See the User Guide for additional information about GPS setup.

2-4 CDMA RF Measurement Setup

To make CDMA RF measurements, connect the instrument to the base station and follow these setup instructions. Press the **Measurements** main menu key then the RF Measurements submenu key to open the measurement menu.

Channel Spectrum Setup

This measurement displays the spectrum of the specified channel and channel power, occupied bandwidth, and peak-to-average power.

From the **Measurements** main menu, use the following procedure for Channel Spectrum:

1. Press the RF Measurements submenu key to open the RF Measurements menu.
2. Press Channel Spectrum to display the active measurement (Figure 2-3).

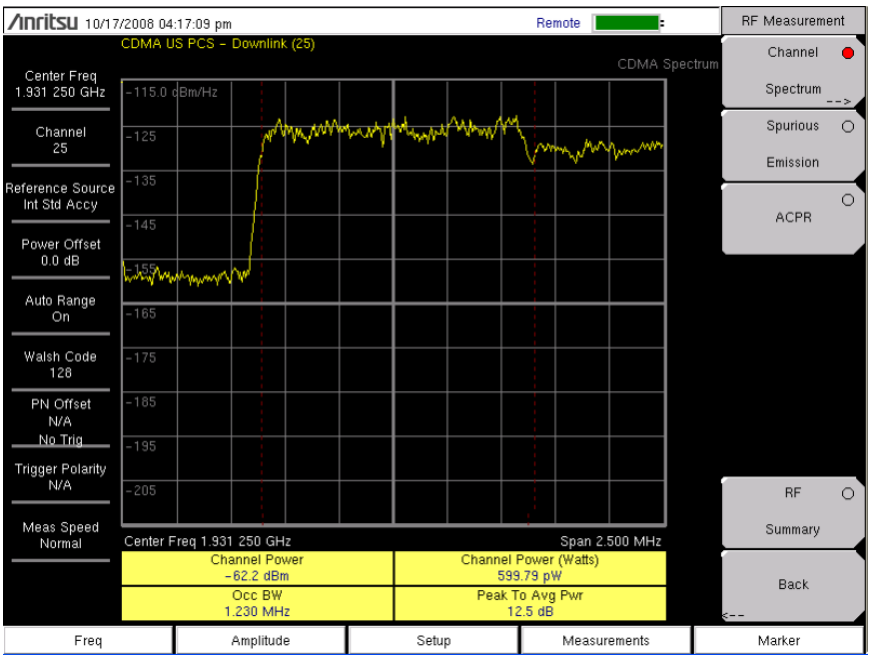


Figure 2-3. RF Measurement, Channel Spectrum

Spurious Emission Setup

This measurement displays the spectrum of the input signal at specific offsets (based upon the Signal Standard, which is selected from the frequency (**Freq**) menu). Markers are automatically tuned to measure the input power at these offsets and to determine a PASS or FAIL according to limits that are set by the signal standard. A blue mask is also calculated and shown on the spectrum to visually check for pass fail conditions.

From the **Measurement** menu, use the following procedure for Spurious Emission:

1. Press the RF Measurement submenu key.
2. Press the Spurious Emission submenu key to activate the measurement (Figure 2-4). The red dot on the submenu key indicates that it is selected.

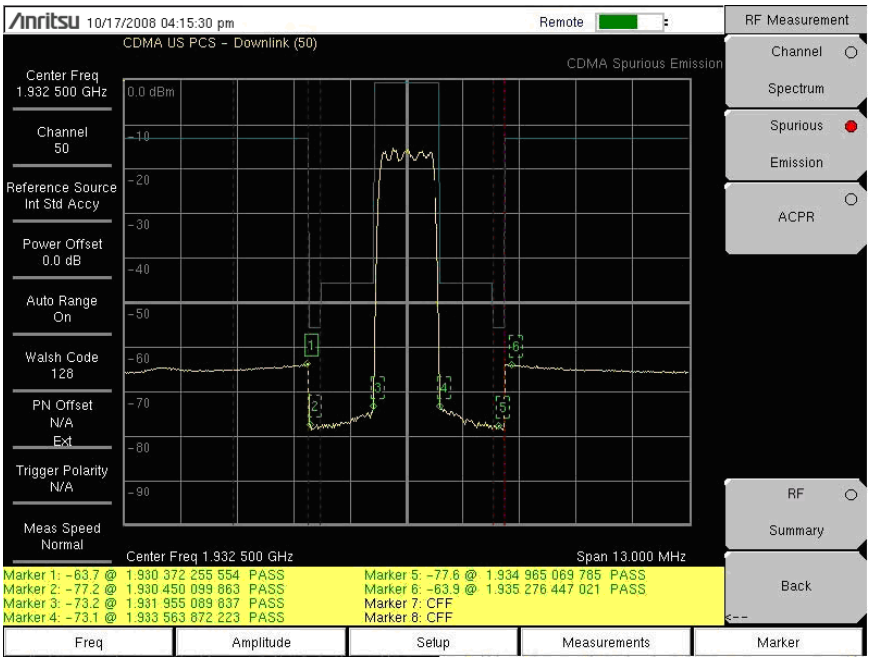


Figure 2-4. RF Measurement, Spurious Emission

ACPR Setup

Adjacent Channel Power Ratio (ACPR) 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.

From the **Measurement** menu, use the following procedure for ACPR:

1. Press the RF Measurement submenu key.
2. Press the ACPR submenu key to activate the ACPR measurement (Figure 2-5). The red dot on the submenu key indicates that it is selected.
3. Press the ACPR submenu key again to specify the Number of Carriers in a multi-carrier configuration and to specify Carrier BW.

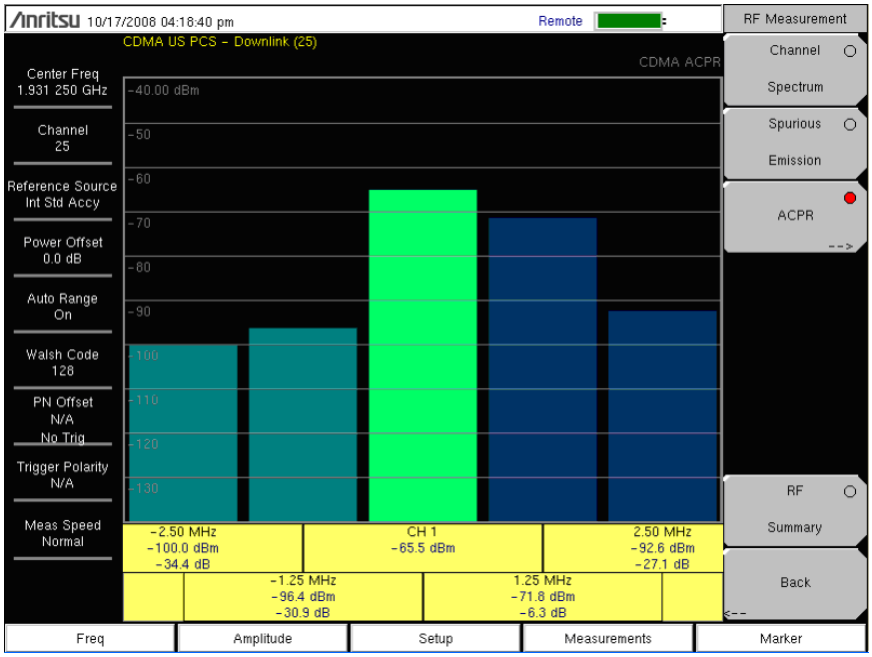


Figure 2-5. RF Measurement, ACPR

2-5 CDMA Demodulator Measurements Setup

CDMA demodulator measurements are selected by pressing the **Measurements** main menu key then the Demodulator submenu key. CDMA demodulator measurements include Code Domain Power (CDP), CDP table, and modulation summary. To demodulate cdmaOne and CDMA2000 1xRTT signals, connect the instrument to the base station following the setup instructions.

To make CDMA Demodulator measurements, connect the instrument to the base station and follow these setup instructions:

1. Press the **Setup** main menu key to open the Setup menu.
2. Press the PN Setup submenu key and choose No Trig, GPS, or External.
3. Press the PN Search Type submenu key and select Auto search or Manual search by toggling the submenu key.

Note	If Manual Search is selected, then press Manual PN Offset submenu key and enter the PN value manually.

4. Press Back to go to the previous (Setup) menu.
5. Press the Walsh Codes submenu key to choose 64 codes or 128 codes based on the transmitting signal.
6. Press the **Measurement** main menu key to open measurements menu.
7. Press the Demodulator submenu key to activate the Demodulator measurements menu.

CDP Setup

The CDP screen displays 64 Walsh Codes or 128 Walsh Codes. Pilot, Sync, Paging, and Quick Paging codes are displayed in a control channel table for easy viewing. Pilot power, channel power, Rho, channel carrier feedthrough, RMS phase error, Frequency Error, and Noise Floor measurements are displayed as numerical values.

From the Demodulator submenu, use the following procedure for CDP:

1. Press the CDP submenu key to display the Code Domain Power menus. This may require pressing the CDP submenu key a second time (Figure 2-6).
2. Press the Zoom submenu key to activate zoom for 16, 32, or 64 codes.
3. Press the Zoom Start Index submenu key and enter the desired location manually.
4. Press CDP Units to select either Relative power (in dB) or Absolute power (in dBm).

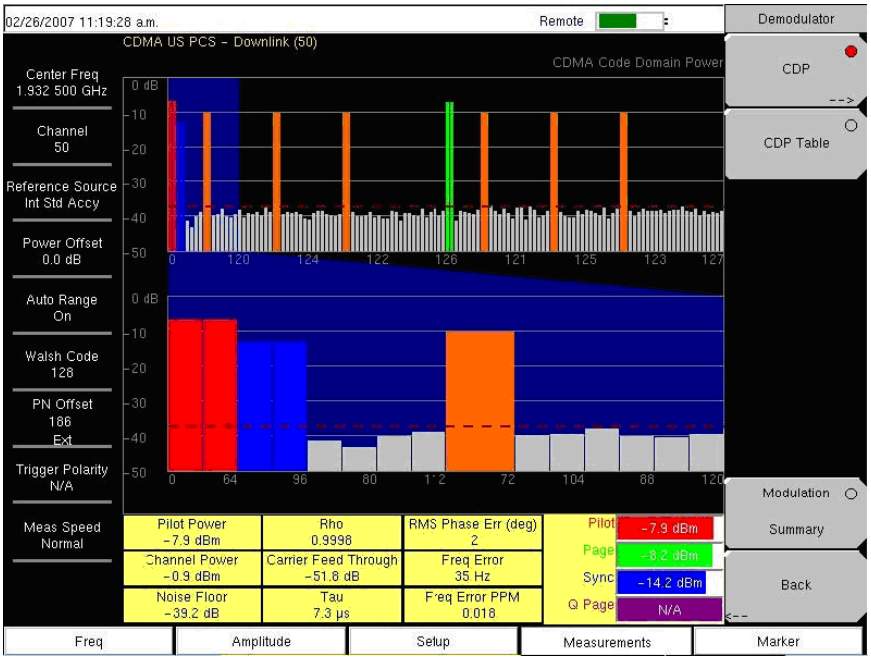


Figure 2-6. Demodulator, CDP Setup

CDP Table View Setup

The CDP table view displays all of the active codes in a tabular format.

From the Demodulator measurement menu, use the following procedure for CDP Table view:

1. Press the CDP submenu key to display the Code Domain Power menus.
2. Press the Zoom submenu key to activate zoom for 16, 32, or 64 codes.
3. Press the Zoom Start Index submenu key and enter the desired location manually.
4. Press CDP Units to select either Relative power (in dB) or Absolute power (in dBm).
5. Press Back to go back to the previous menu.
6. Press the CDP Table submenu key to display the measurements (Figure 2-7).

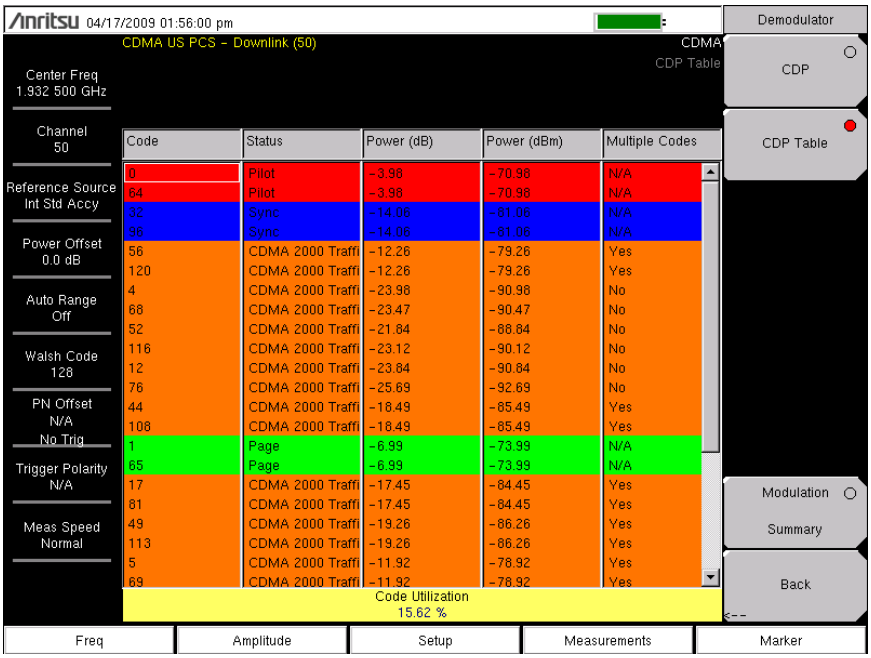


Figure 2-7. Demodulator, CDP Table

2-6 CDMA Over-The-Air Measurement Setup

OTA (Over-The-Air) testing provides field technicians with the ability to monitor hard-to-reach pole-top base stations. Traditionally, the repair process for pole-top base stations entailed pulling down the failed base station, then installing a new one. The failed base station was then returned to the manufacturer or repair depot for service. If a base station was determined to be healthy (no trouble found, or NTF), then the cost of the process was incurred unnecessarily. OTA testing provides information about the health of the base station, thereby improving the likelihood that a correct decision will be made with regard to the base station condition. The result is fewer NTFs and elimination of associated costs.

If you choose to measure CDMA performance over the air with an antenna, then additional setup is required, as explained in the following sections. The instrument needs a timing reference to determine PN Offset and timing errors. This reference comes from the base station GPS when it is connected to the instrument or it can be recovered from GPS when a GPS antenna is connected.

The Over-The-Air (OTA) Measurement option consists of Pilot Scan, Multipath, and Limit Test.

1. Follow the setup instructions for "GPS Setup" on page 2-3.
2. Press the **Setup** main menu key then the Walsh Codes submenu key to choose 64 codes or 128 codes depending upon the transmitting signal.
3. Press the **Measurement** main menu key to open the Measurements menu.
4. Press the OTA submenu key to activate Over-The-Air measurements.

Pilot Scan Setup

From the Over-The-Air menu, press the Pilot Scan submenu key to display the nine strongest pilots, the PN codes, Ec/Io, Tau, Pilot Power, Channel Power, and Pilot Dominance (Figure 2-8).

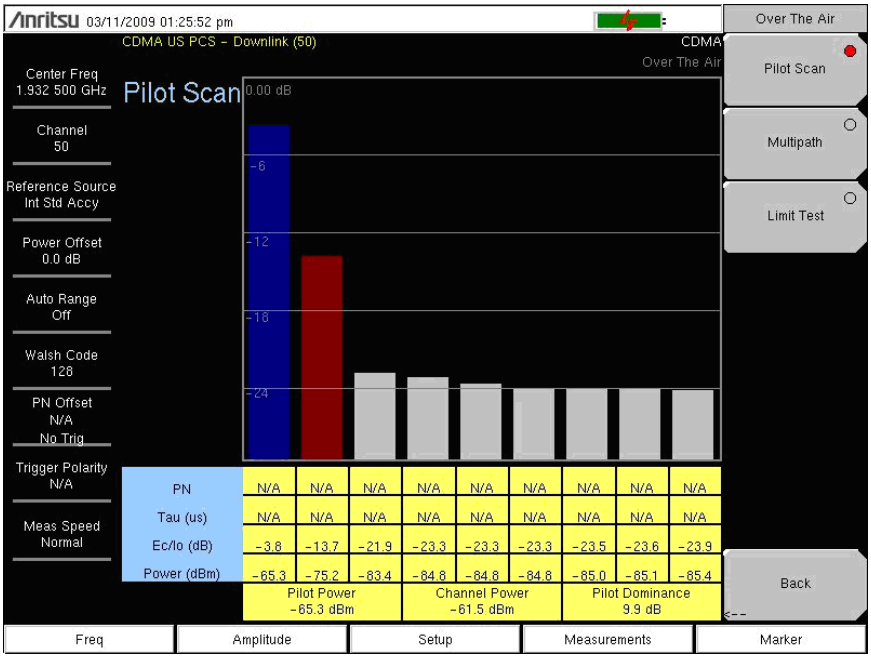


Figure 2-8. Over-The-Air Pilot Scan Measurement

Multipath Setup

From the Over-The-Air menu, press the Multipath submenu key to measure and display multipath parameters.

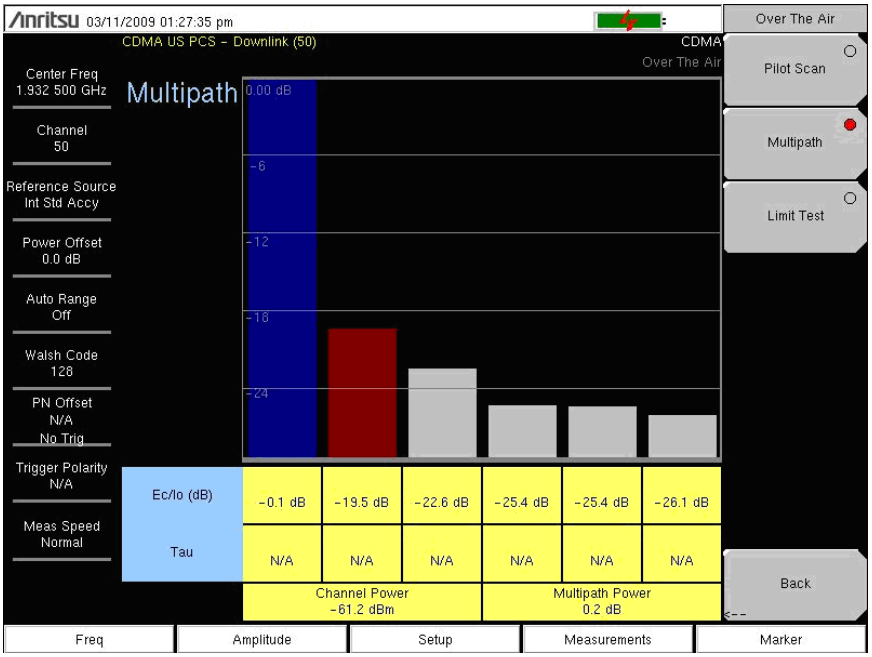
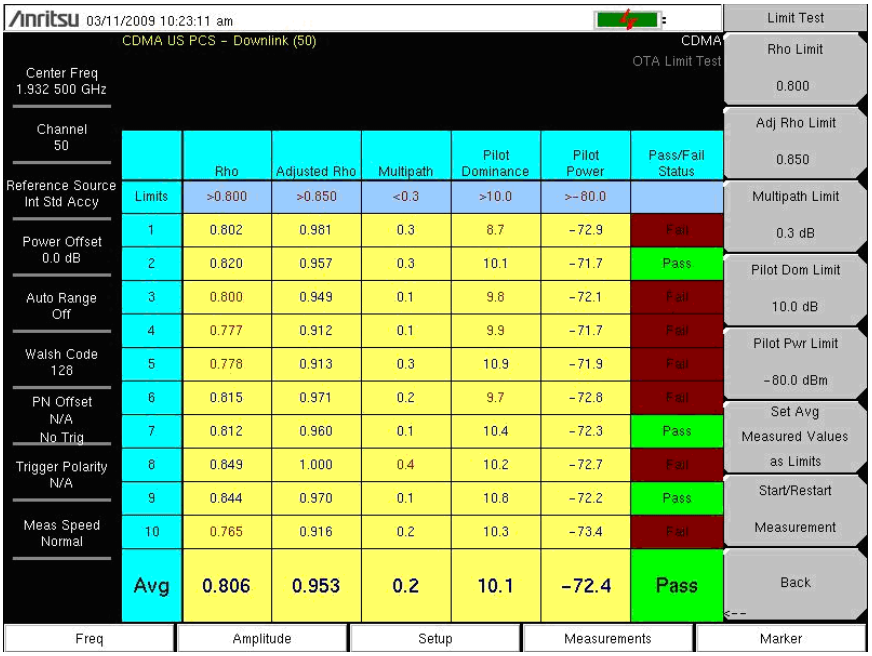


Figure 2-9. Over-The-Air Pilot Multipath Measurement

Limit Test Setup

1. Press the Limit Test submenu key to display the Limit Test measurement and list the Limit Test window. Set the Rho Limit, Adj Rho Limit, Multipath Limit, Pilot Dom Limit, and Pilot Pwr Limit by pressing their respective submenu key.
2. Start or restart the measurement by pressing the Start/Restart Measurement submenu key. The test takes ten measurements and displays pass or fail status for each measurement. After the ten measurements are taken, the average for the five parameters is calculated and a pass or fail status is displayed.
3. To set new limits from the current limit average values, press the Set Avg Measured Values as Limits submenu key.



	Rho	Adjusted Rho	Multipath	Pilot Dominance	Pilot Power	Pass/Fail Status
Limits	>0.800	>0.850	<0.3	>10.0	>–80.0	
1	0.802	0.981	0.3	8.7	–72.9	Fail
2	0.820	0.957	0.3	10.1	–71.7	Pass
3	0.800	0.949	0.1	9.8	–72.1	Fail
4	0.777	0.912	0.1	9.9	–71.7	Fail
5	0.778	0.913	0.3	10.9	–71.9	Fail
6	0.815	0.971	0.2	9.7	–72.8	Fail
7	0.812	0.960	0.1	10.4	–72.3	Pass
8	0.849	1.000	0.4	10.2	–72.7	Fail
9	0.844	0.970	0.1	10.8	–72.2	Pass
10	0.765	0.916	0.2	10.3	–73.4	Fail
Avg	0.806	0.953	0.2	10.1	–72.4	Pass

Figure 2-10. Over-The-Air Limit Test

2-7 Pass Fail Setup

The instrument stores user-defined Pass/Fail criteria for testing base station performance and recalls these models for quick, easy measurements. After selection of a test file, the instrument displays test results in tabular format with clear PASS or FAIL indications that include minimum/maximum threshold.

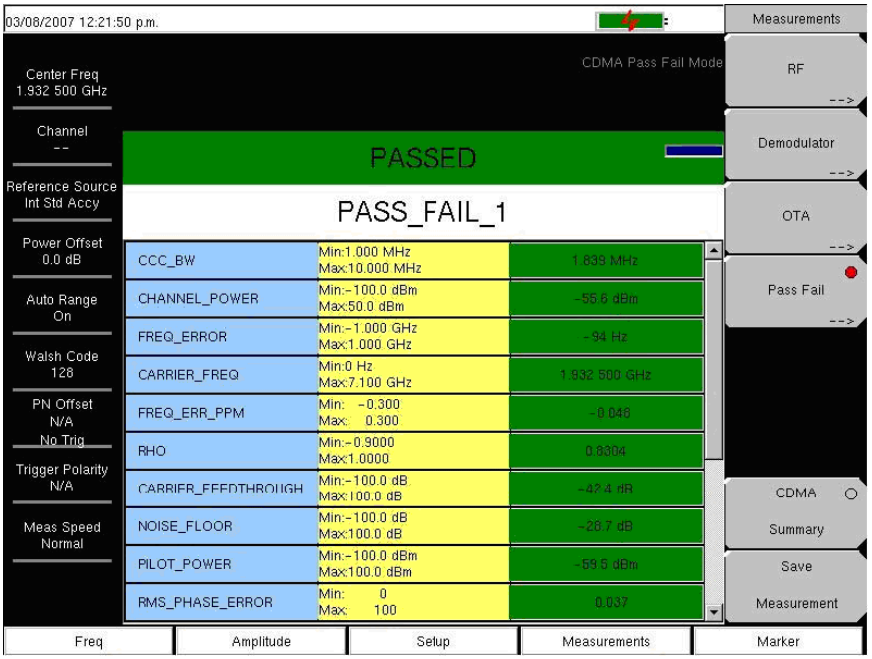


Figure 2-11. Pass Fail Measurement

A custom test list can be created and downloaded into the instrument using Master Software Tools. All critical parameters can be selected for pass/fail testing.

From the **Measurements** main menu, use the following procedure for Pass/Fail setup:

1. Press the Pass/Fail Mode submenu key to display the pass/fail measurements.
2. Press the Pass/Fail Mode submenu key again to display the Pass/Fail Mode menu.
3. Press the Select Pass/Fail Test submenu key and select the applicable Test Model to activate the measurement.
4. Press Reset to reset the pass fail function and begin a new pass/fail test.

2-8 CDMA Measurement Descriptions

Code Division Multiple Access (CDMA) is used in spread spectrum systems to achieve multiple access. The frequency spectrum of a signal is spread by using a code that is not correlated with the data signal. This code is unique to each recipient. A distinction can be made among signals because the codes are chosen to have low cross-correlation values. By matching the send and receive codes, the receiver is able to properly translate the message or data.

RF Measurements

Channel Spectrum

This function includes (below the measurement display) a table view of Channel Power (in dBm and Watts), Occ BW, and Peak To Avg Pwr.

Occupied BW

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

Peak to Average Power

This is a ratio of the peak envelope power to the average power, in dB.

Spurious Emission

This function includes a measurement display with eight fixed markers. The marker values are displayed below the measurement and include the power and frequency at each marker along with a pass fail indication.

ACPR

This function displays from 1 to 5 channels (carriers) and two adjacent channels on each side. The power of each channel is displayed below the measurement graph and includes the frequency and power in each of the 4 adjacent channels.

RF Summary

This function displays a table view of Channel Power (in dBm and Watts), Spurious Emission, Occ BW, and Peak To Avg Pwr.

Demodulator Measurements

Code Domain Power

Code Domain Power (CDP) displays how much of the channel power is in each Walsh Code. Power is normalized to the channel power and, therefore, a code reading of –10 dB means that the power in that code is 1/10th of the channel power. The upper half of the measurement display shows all of the channels, and the lower half shows a zoom view of selected channels. The number of zoom channels and the starting position (relative to the upper display) are set with CDP submenu keys for Zoom and Zoom Start Index. A colored background in the upper display indicates the channels that are in the lower, zoom display. Colors are applied according to Table 2-1:

Table 2-1. Code Domain Power

Code Channel	Color
Pilot	Red
Sync	Blue
Page	Green
Quick Page	Purple
IS95 Traffic	Yellow
CDMA2000 Traffic	Orange
Noise	Grey

Carrier Feedthrough

Carrier Feedthrough measures the amount of unmodulated signal that is leaking through the transmitter.

Frequency Error

Frequency error is the difference between the received center frequency and the specified center frequency. This is only as accurate as the frequency reference that is used and is typically only useful with a good quality external frequency reference.

Noise Floor

Noise floor is the average power in the unused Walsh Codes.

Paging Code Power

Paging Code Power is a measure of Page Walsh Code power, displayed in dBm.

Q Paging Power

Q Paging Power is Quick Page Walsh Code 80 power, displayed in dBm.

Rho

Rho is a measure of modulation quality and measures the amount of power that is correctly transmitted. An rho of 1.0 indicates a perfect signal. The standard requires > 0.912, and common measurements are > 0.94. Due to environmental factors, rho values are typically poor (< 0.9) when measured over the air, and are usually useful only when connected to a base station.

Sync Power

Sync Power is a measure of Sync Walsh Code power, displayed in dBm.

Tau

Tau is the timing error. It is the timing offset, or the difference in time between when the PN sequence (or short code) restarts, and when the PN sequence should restart. A base station needs to be aligned in time to an absolute reference such as GPS. This cannot be measured if the PN search is set to No Trigger.

Note that during OTA measurement, Tau increases with distance from the transmitter. If the instrument is connected to the base station, then a Tau of 10 µs or less is specified, and 5 µs is typical. If the timing error becomes too large, mobiles may have trouble when being handed off to this particular base station.

CDP Table

This function displays a table view of the channels with channel code number, status, power (dB and dBm), and whether multiple codes are used. Overall code utilization is displayed as a percent at the bottom of the measurement screen.

Modulation Summary

This function displays a table view of the values of Pilot Power, Channel Power, Freq error, Freq error PPM, Carrier Freq, Rho, Noise floor, RMA Phase Err (deg), and Tau.

OTA Measurements

Pilot Scan

The strongest nine received PNs are displayed as bar graphs, and the PN numbers are displayed at the bottom of the bar graphs.

For each PN, a table displays PN number, Ec/Io, and Tau. Also shown are Pilot Power, Channel Power, and Pilot Dominance.

Pilot Power: Pilot power is the total power in the pilot channel. This is normally a constant for a base station. When the instrument is connected to the base station, if the measured power is unexpected, then check that the entered power offset is correct and that the connections are tight. Unexpected readings may indicate an incorrect power setting at the base station. For Over-The-Air (OTA) measurements, the pilot power will vary as the signal path from the transmitter to receiver varies.

Channel Power: Channel power is the total power that is broadcast in the specified CDMA channel.

Pilot Dominance: Pilot Dominance is a measure of the strength of the strongest pilot compared to the next strongest pilot in the same channel. This should be >10 dB to make good demodulator measurements.

Multipath

The length of the bar represents the relative strength in the path. Six paths are displayed.

For each path, a table below the bar graph displays Ec/Io and Tau. Also shown are Channel Power and Multipath Power.

Multipath Power: Multipath Power is a measure of the total power in the dominant signal (spread in time due to multipath echoes) relative to its power in the main transmission path. This value should be < 0.4 dB to make good measurements.

Ec/Io

Ec/Io is the pilot power compared to the total channel power.

2-9 CDMA Menus

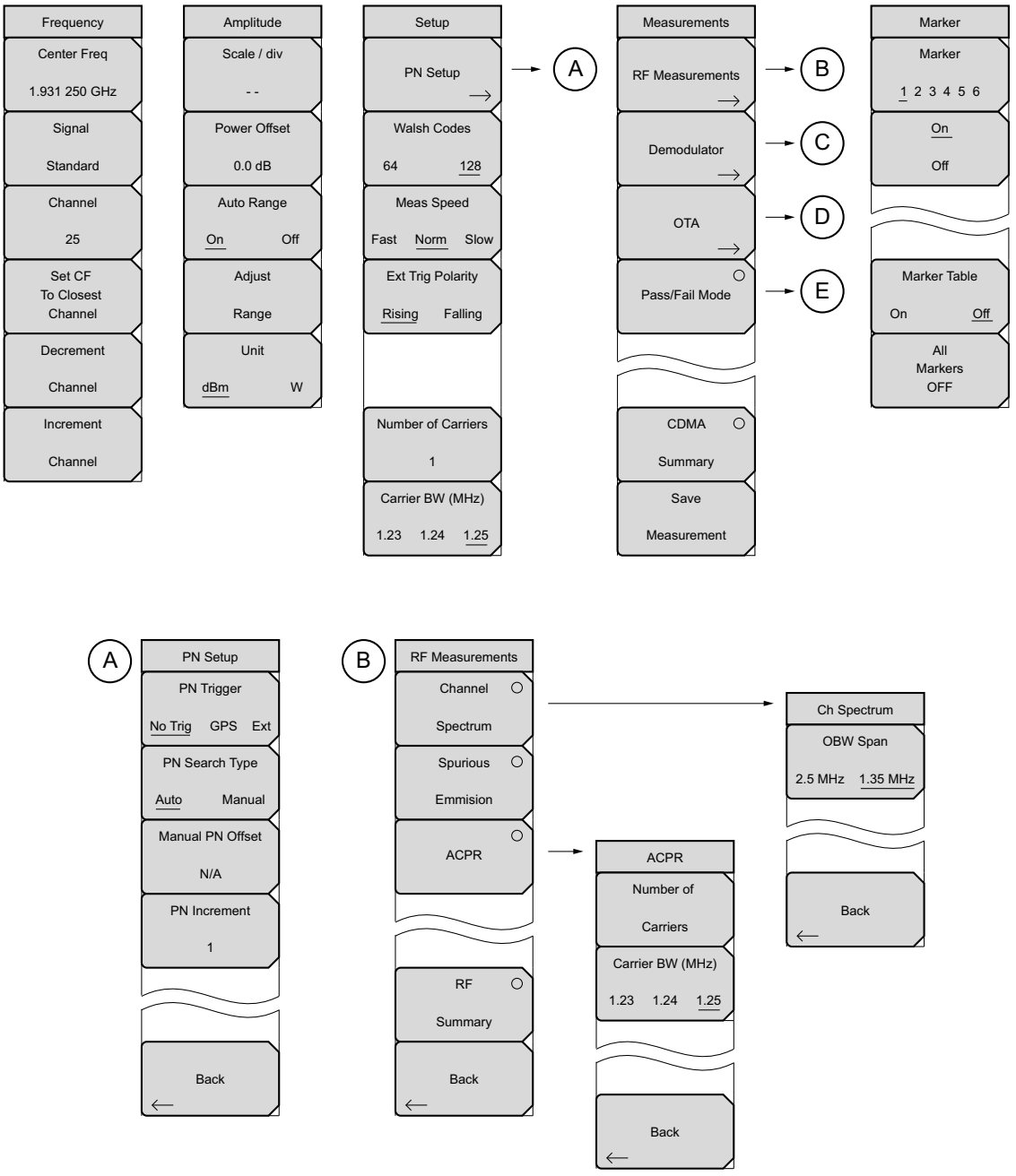


Figure 2-12. CDMA Menu Layout (1 of 2)

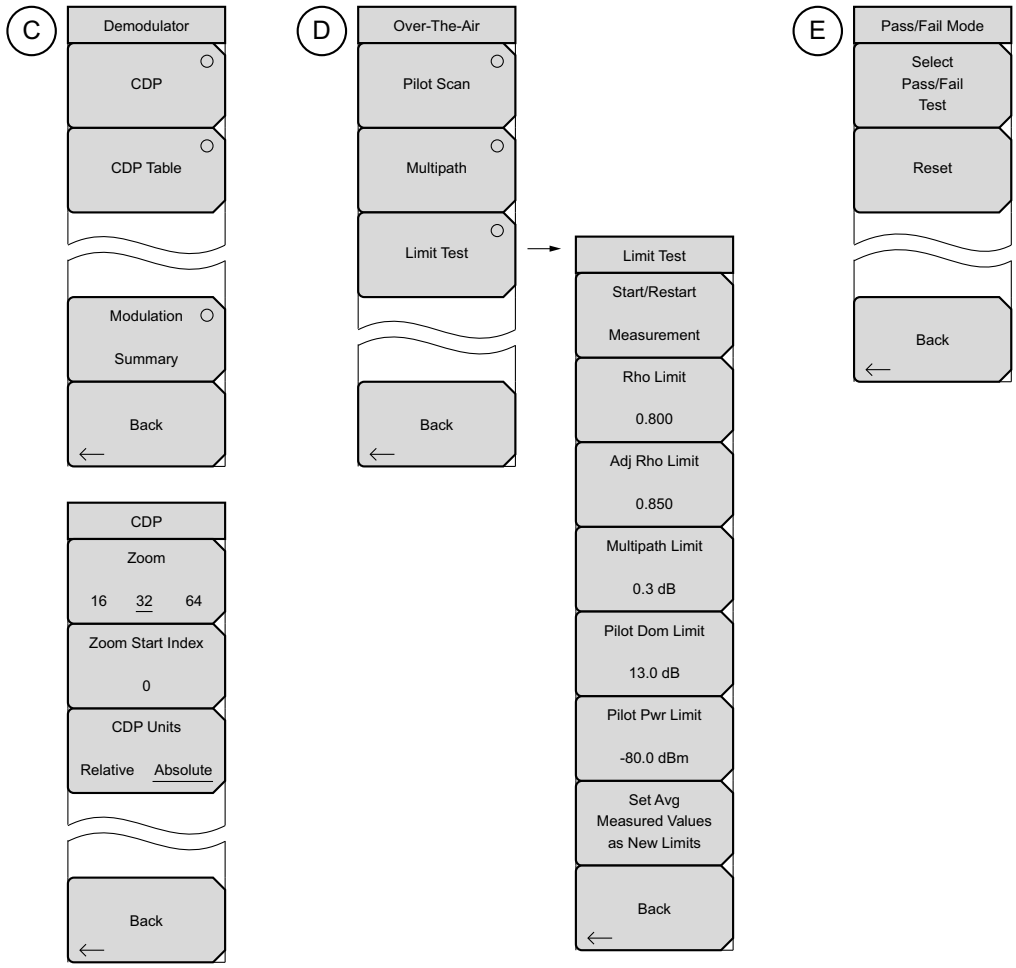
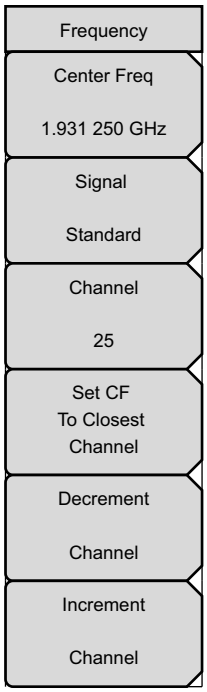


Figure 2-13. CDMA Menu Layout (2 of 2)

2-10 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press the **Freq** main menu 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 by 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 affect 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 are automatically tuned. Other settings (such as channel spacing and integration bandwidth) are also automatically entered. The Signal Standards dialog box includes all of the CDMA standards.

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 CDMA channel. The Channel Editor dialog box indicates the selected signal standard. The range of channels and the channel step size depend upon the selected standard.

Set CF To Closest Channel: Press this submenu key to change the center frequency to the closest channel.

Decrement Channel: Depending upon the signal standard and upon the selected channel, pressing this submenu key decrements the channel number by a standard step size.

Increment Channel: Depending upon the signal standard and upon the selected channel, pressing this submenu key increments the channel number by a standard step size.

Figure 2-14. CDMA Freq Menu

2-11 Amplitude Menu

Key Sequence: **Amplitude**

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

Scale changes the y-axis scale. This applies to the Spectrum view only. When in any other view, the display is "**--**".

Power Offset: Choose power offset to automatically adjust for the loss that occurs through any external cables, attenuators, and couplers. The power can be offset from 0 dB to 100 dB. Press the Power Offset key, enter the values, and press the dB submenu key.

Auto Range: Pressing this submenu key toggles between On and Off. This function adjusts the reference level automatically when Auto Range is activated.

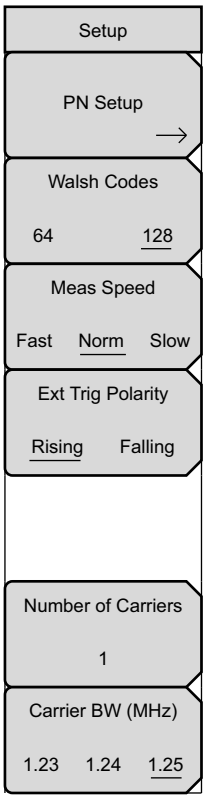
Adjust Range: When Auto Range is OFF, pressing Adjust Range sets the Reference Level automatically for that one particular measurement. Pressing this button when Auto Range is ON, will turn Auto Range to OFF

Units: select either dBm or Watts as the power unit.

Figure 2-15. CDMA Amplitude Menu

2-12 Setup Menu

Key Sequence: **Setup**



PN Setup: Opens the “PN Setup Menu” on page 2-23.

Walsh Codes: Toggles between 64 codes and 128 codes.

Meas Speed: Toggles through “Fast”, “Norm” (normal), and “Slow” measuring speed.

Ext Trig Polarity: Toggles between Rising edge and Falling edge trigger polarity.

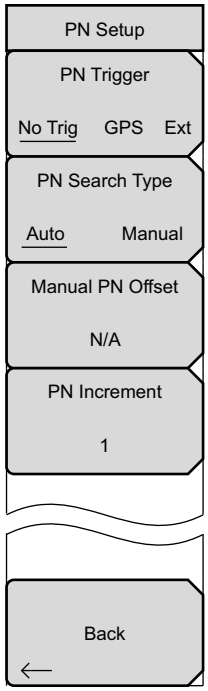
Number of Carriers: This submenu key sets the number of required channels. This affects the ACPR and Spurious Emissions measurements.

Carrier BW: This submenu key sets the carrier bandwidth. It rotates between 1.23, 1.24 and 1.25.

Figure 2-16. CDMA Setup Menu

PN Setup Menu

Key Sequence: **Setup** > PN Setup



PN Trigger: This submenu key toggles through “No Trig” (no trigger), “GPS”, and “Ext” (external trigger).

PN Search Type: This submenu key toggles between “Auto” and “Manual” PN search. In the Auto mode, the instrument automatically searches for the strongest PN. When using manual setup, enter the required PN offset to limit the search. Auto search is available only when the trigger selection is GPS or External. If “No Trig” is selected, then pressing this submenu key causes an error message to be displayed, stating “Applicable only when PN Type is GPS or External”.

Manual PN Offset: Press to manually set the PN offset. Use the arrow keys, rotary knob, or numeric keypad to choose an offset, then press the rotary knob or the **Enter** key to select the value. Editing this value automatically changes the PN Search Type to Manual.

The Manual PN Offset function is available only when the trigger selection is GPS or External. If “No Trig” is selected, then pressing this submenu key causes an error message to be displayed, stating “Applicable only when PN Type is GPS or External”.

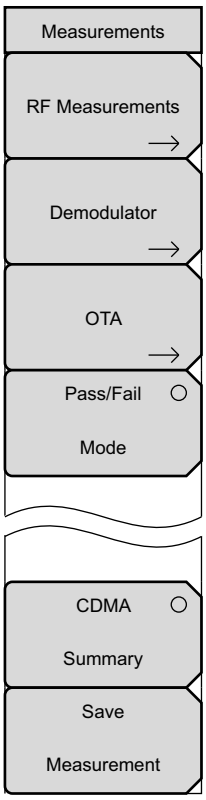
PN Increment: Use the arrow keys, rotary knob, or numeric keypad to set the PN increment value.

Back: Returns to the “Setup Menu” on page 2-22.

Figure 2-17. CDMA PN Setup Menu

2-13 Measurements Menu

Key Sequence: **Measurements**



RF Measurement: Opens the “RF Measurements Menu” on page 2-25.

Demodulator: Opens the “Demodulator Menu” on page 2-26. In demodulator mode, the received CDMA signal is demodulated. The demodulator has three measurement displays: CDP, CDP Table, and Modulation Summary.

OTA: Opens the “Over-The-Air Menu” on page 2-27. OTA displays the CDMA Over-The-Air measurements, which include: Pilot Codes, Ec/Io (dB), Tau, Pilot Power, Channel Power, Pilot Dominance, and Multipath.

Pass Fail Mode: The first press of this submenu key puts the instrument into Pass Fail Mode. The next press of the submenu key opens the “Pass Fail Mode Menu” on page 2-29.

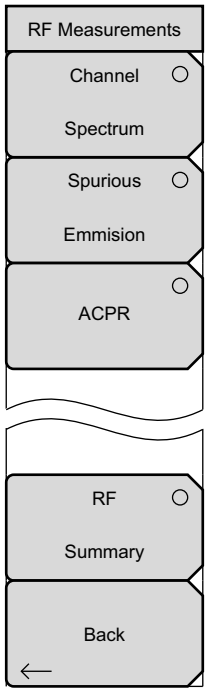
CDMA Summary: Displays a summary of all of the CDMA-related numerical measurements in a table format.

Save Measurement: Opens a dialog box to name and save the current measurement. Press Enter to save the CDMA measurement, which is saved with a .cdma extension.

Figure 2-18. CDMA Measurements Menu

RF Measurements Menu

Key Sequence: **Measurements** > RF Measurements



Channel Spectrum: Pressing this submenu key displays the channel spectrum of the input signal (2.5 MHz span). The screen also displays numeric values of Channel Power in dBm and watts, Peak to Average power in dB, and Occupied Bandwidth (Occ BW). The Ch Spectrum submenu allows OBW Span to toggle between 2.5 MHz and 1.35 MHz.

Spurious Emission: Pressing this submenu key displays the received signal and the mask, based upon received signal strength.

ACPR: Pressing this submenu key displays the Adjacent Channel Power Ratio (ACPR). The instrument displays one or more main channels and two adjacent channels on each side of the main channel. A data window below the channel measurement display indicates the power in each channel. When this submenu key is active (an arrow on the key symbol indicates that a sub menu is available), another key press opens the "ACPR Menu" on page 2-25.

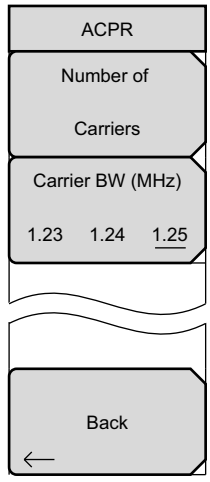
RF Summary: Displays a summary table of all the RF numerical measurement results.

Back: Returns to the "Measurements Menu" on page 2-24.

Figure 2-19. CDMA RF Measurement Menu

ACPR Menu

Key Sequence: **Measurements** > RF Measurement > ACPR



Number of Carriers: Press this submenu key to set the number of main channels from 1 to 5. Change the number of main channels with the arrow keys or the rotary knob, then press the rotary knob or the **Enter** key. Or change the number of channels by pressing a number on the numeric keypad, press the Enter submenu key, and then press the **Enter** key. The adjacent channels remain displayed.

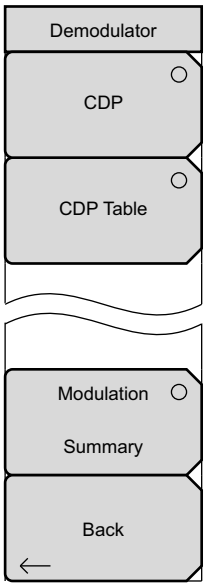
Carrier BW: Press this submenu key and use the numeric keypad to enter a frequency. The submenu key menu displays units of GHz, MHz, kHz, and Hz. After choosing the units, press the **Enter** key. If the **Enter** key is used without first selecting units, then the default units are MHz, and the **Enter** key must be pressed a second time to set the frequency. You can also use the arrow keys or rotary knob to change the carrier bandwidth in 1 Hz increments, then press the rotary knob or the **Enter** key to set the frequency.

Back: Returns to the "RF Measurements Menu" on page 2-25.

Figure 2-20. CDMA ACPR Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



CDP: The first press of this submenu key displays the Code Domain Power and also displays an arrow on the submenu key symbol (to indicate that a sub menu is available).

When Code Domain Power (CDP) is selected, the screen displays all of the selected Walsh Codes and the selected Walsh Codes zoom codes in a graphical format. Depending upon the Walsh Code set parameter, this display includes either 64 Walsh Codes or 128 Walsh Codes. When 128 Walsh Codes is selected, the top CDP graph displays the CDP in bit-reversed order. The screen also displays the following Control channels in table format: Pilot, Page, Sync, and Quick Page. If the marker is set on the code, then the marker displays the code number, power, and code type.

The codes are color coded as follows:

Pilot in Red
Page in Green
Sync in Blue
cdmaOne (IS95) Traffic in Yellow
CDMA2000 1xRTT Traffic in Orange

An additional press of the CDP submenu key opens the “CDP Menu” on page 2-27.

CDP Table: This screen shows the power of the codes in a tabular format. The table displays the following five columns:

Code: Code number
Status: Pilot, Page, Sync, All Traffic (Color Coded rows)
Relative Power (in dB)
Absolute Power (in dBm)
Multiple codes: A number indicating how many codes are used up by a particular user (traffic)

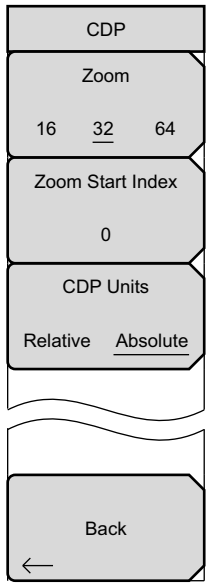
Modulation Summary: Pressing this submenu key displays a summary of all the modulation-related numerical measurements in a table format, with rows for: Pilot Power, Channel Power, Freq Error, Freq Error PPM, Carrier Freq, Rho, Noise Floor, RMS Phase Err (deg), and Tau.

Back: Returns to the “Measurements Menu” on page 2-24.

Figure 2-21. CDMA Demodulator Menu

CDP Menu

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



Zoom: Toggles through a zoom function of 16, 32, or 64 codes.

Zoom Start Index: Press this submenu key, then enter the required zoom start index. For example, to start at code 120, which is the 15th code power that is displayed, press the 1 key and the 5 key on the numeric keypad, then press either the Enter submenu key (which appears when the numeric keypad is used) or the **Enter** key.

Also, press this submenu key, then use the arrow keys or rotary knob to change the zoom start index. The CDP submenu key menu remains after pressing the rotary knob or the **Enter** key.

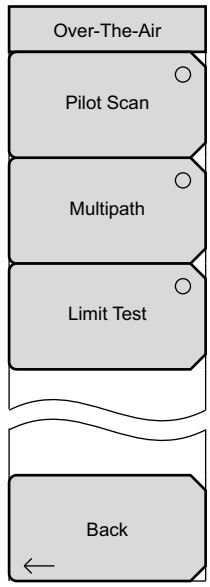
CDP Units: Use this submenu key to toggle between Relative units (in dB) or Absolute units in (dBm). When units are Relative, the code power is measured relative to Channel Power.

Back: Returns to the "Demodulator Menu" on page 2-26.

Figure 2-22. CDMA CDP Menu

Over-The-Air Menu

Key Sequence: **Measurements** > OTA



Pilot Scan: Displays the power of the 9 strongest PNs in histogram graphical format. The strongest PN or the user-selected PN is color coded blue, those colored red are probably real pilots, and the remaining, which are color coded gray, are probably noise.

Multipath: Displays 6 multipaths in histogram graphical format. The strongest is color coded blue. The remaining are color coded red, or are color coded gray if noise. The unit also displays Ec/Io (dB), Tau, Channel Power, and Multipath Power.

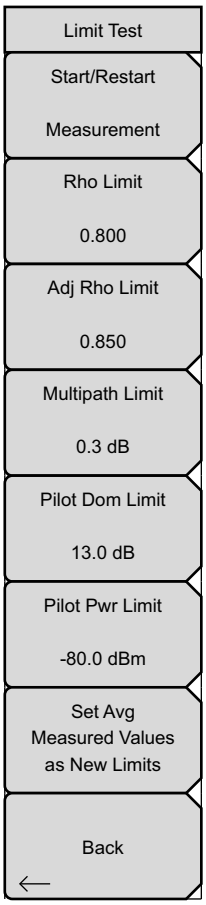
Limit Test: Press once to select the Limit Test. Press again to open the "Limit Test Menu" on page 2-28 for Limit Test configuration.

Back: Returns to the "Measurements Menu" on page 2-24.

Figure 2-23. CDMA Over-The-Air Menu

Limit Test Menu

Key Sequence: **Measurements** > OTA > Limit Test



Start/Restart Measurement: Starts or restarts the measurement.

Press the submenu keys to set the desired limit:

Rho Limit

Adj Rho

Multipath Limit

Pilot Dom Limit

Pilot Pwr Limit

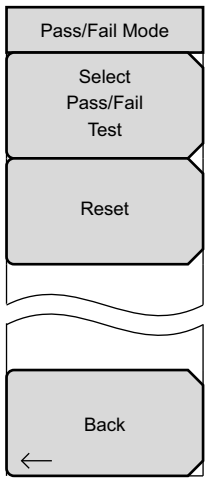
Set Avg Measured Values as Limits: Takes the calculated average values for Rho, Adjusted Rho, Multipath, Pilot Dominance, and Pilot Power in the Avg row and places them in the Limits row.

Back: Returns to the "Over-The-Air Menu" on page 2-27.

Figure 2-24. CDMA Limit Test Menu

Pass Fail Mode Menu

Key Sequence: **Measurements** > Pass Fail



Select Pass/Fail Test: This submenu key function allows the selection of a user-defined file that specifies a list of measurements with pass fail criteria. Select a test model by using the arrow keys or rotary knob. This mode will sequentially assess the appropriate measurements and indicate a pass or fail state based upon the test model criteria. Custom pass fail tests can be created by using Master Software Tools.

Reset: Press this submenu key to restart the measurement.

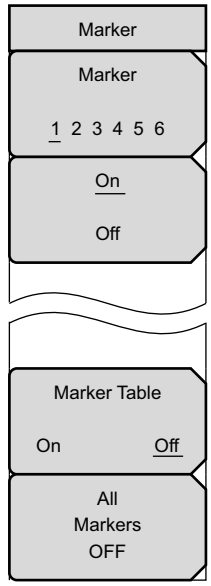
Back: Returns to the "Measurements Menu" on page 2-24.

Figure 2-25. CDMA Pass Fail Mode Menu

2-14 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.



Markers are available only in CDP and Spectrum measurements.

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.

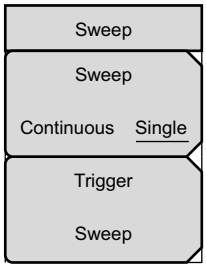
Marker Table On/Off: Causes a table to be displayed below the sweep window. The table is automatically sized to display all markers that are turned on. In addition to the marker frequency and amplitude, the table also shows delta frequencies and amplitude deltas for all markers that have deltas entered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

All Markers Off: Turns off all markers.

Figure 2-26. CDMA Marker Menu

2-15 Sweep Menu

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



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

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

Figure 2-27. WCDMA/HSDPA Sweep Menu

2-16 Measure Menu

This menu is not available in CDMA measurement mode.

2-17 Trace Menu

This menu is not available in CDMA measurement mode.

2-18 Limit Menu

This menu is not available in CDMA measurement mode.

2-19 Other Menus

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

Chapter 3 — EVDO Signal Analyzer

3-1 Introduction

The instrument offers three EVDO measurement options:

- CDMA2000 1xEV-DO RF measurements
- CDMA2000 1xEV-DO Demodulator, Rev. A compatible
- CDMA2000 1xEV-DO OTA measurements, requires Option 31

CDMA2000 1xEVDO has a chip rate of 1.2288 MHz, the same as cdmaOne and CDMA2000 1xRTT. Each chip lasts for a duration of 0.8138 microseconds. In downlink, an EVDO signal can be time-divided into “half slots.” Each half slot has 1024 chips.

The 1024 chips in a half slot can be further time-divided into three different channels: Pilot, MAC, and Data. The Pilot Channel provides synchronization for the EVDO Access Terminals (for example, cell phones, laptops, and so forth.). The MAC (Medium Access Control) Channel controls the overall EVDO traffic. The Data Channel transmits data to various users.

The Pilot and MAC Channels are always active in an EVDO signal, but the Data Channel may sometimes transmit no data. When no data is transmitted, the half slot is considered idle. Otherwise, it is called an active slot.

The instrument can measure EVDO signals over the air (OTA) by connecting the antenna to the unit or by directly connecting to the base station.

3-2 General Measurement Setup

Please refer to the User Guide for information on selecting the EVDO Signal Analyzer mode, setting up frequency, amplitude, power loss for compensating external loss, limit lines, markers, and file management.

3-3 EVDO Measurement Setup

The instrument can measure EVDO performance over the air (OTA) with an antenna, or by connecting the base station directly to the instrument.

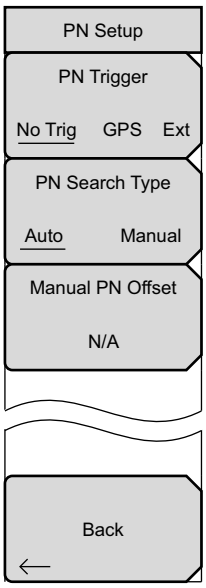
To measure an EVDO signal over the air, connect the appropriate frequency band antenna to the RF Input, and connect a GPS antenna to the GPS connector.

PN Select Setup

The instrument needs a timing reference in order to determine PN Offset and timing errors. This reference comes from the base station when it is connected to the instrument, or it can be recovered from GPS when a GPS antenna is connected.

The setup menu for this function is:

1. Press the **Setup** main menu key.
2. Press the PN Setup submenu key to open up the PN Setup menu.
3. Press the PN Trigger submenu key to toggle through No trigger, GPS, or External.



No Trigger: If both GPS and external timing are unavailable, then you may choose No Trigger for the PN search.

GPS: Uses GPS as the timing reference.

External: The instrument uses an external, even-second time mark as the timing reference. The time mark is usually available at the base station on a BNC connector labeled “ESTM” or “PP2S”. ESTM must be connected to the External Trigger In connector on the instrument.

Figure 3-1. PN Setup

4. Press the PN Search Type submenu key to toggle between Auto or Manual. In Auto mode, the instrument automatically detects the strongest pilot, while in Manual mode it searches only for the specified PN.

Note	If Manual Search Type is selected, then press Manual PN Offset and enter the desired PN value.

5. Press Back to return to the previous menu.

MAC Codes Setup

MAC Walsh Codes setup is used to select 64 codes or 128 codes.

1. Press the **Setup** main menu key.
2. Press the Walsh Codes submenu key to toggle between 64 codes and 128 codes.

3-4 EVDO RF Measurements Setup

To make EVDO RF measurements, connect the instrument to the base station following the setup instructions. Press the **Measurement** and RF Measurement submenu keys to open the measurement menu.

Channel Spectrum Setup

This measurement displays the spectrum of the specified channel and channel power, occupied bandwidth, and peak-to-average power.

1. Press the RF Measurement submenu key to open the RF Measurement menu.
2. Press Channel Spectrum to display the active measurement (Figure 3-2).

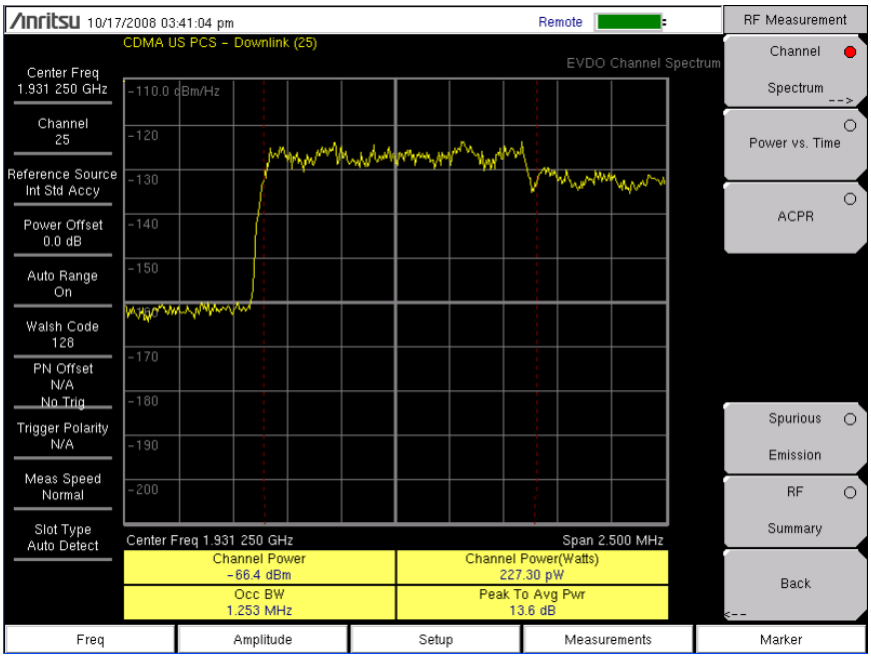


Figure 3-2. EVDO Channel Spectrum

Power vs Time Setup

From the RF Measurement menu, press Power vs Time to display the active measurement. (Figure 3-3).

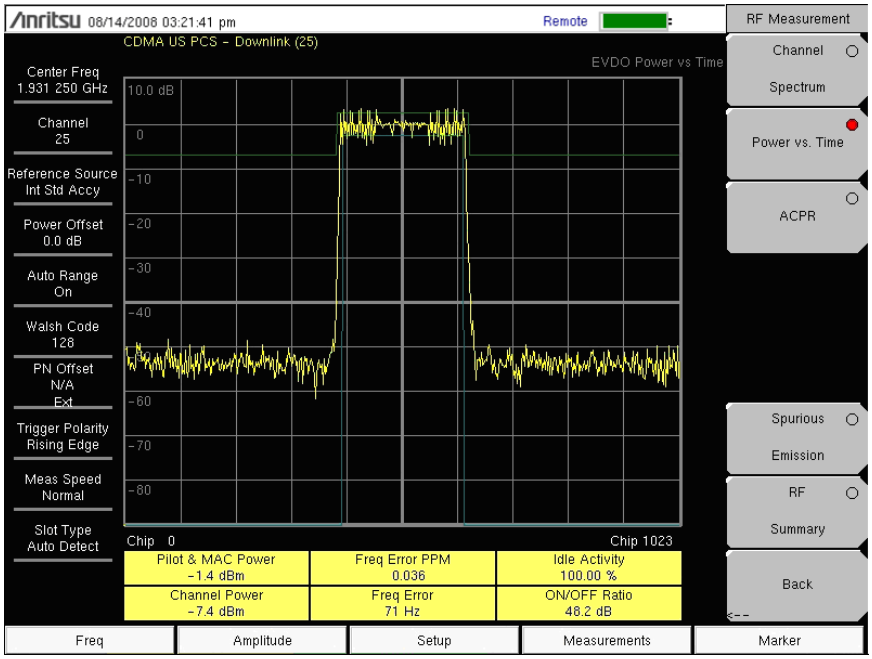


Figure 3-3. EVDO Power vs. Time

ACPR Setup

ACPR (Adjacent Channel Power 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.

From the RF Measurement menu, use the following procedure for ACPR:

1. Press the ACPR submenu key to activate the ACPR measurement (Figure 3-4). The red dot on the submenu key indicates that it is selected.
2. Press the ACPR submenu key again to specify the Number of Carriers in a multi-carrier configuration and to specify Carrier BW.

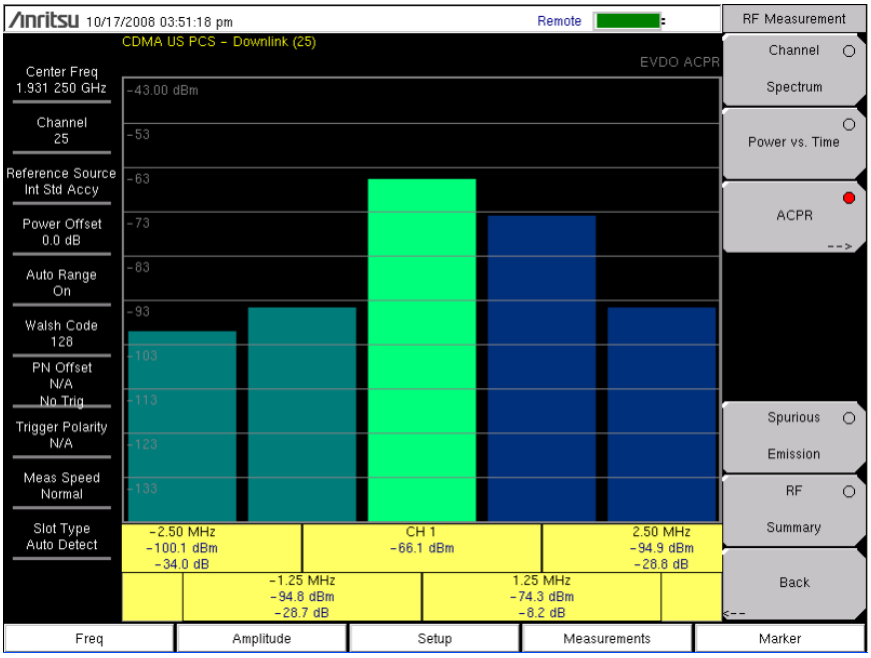


Figure 3-4. EVDO ACPR Measurement

Spurious Emission Setup

The Spurious Emission test examines emissions at frequencies that are outside of the assigned EVDO channel. Spurious emission should be measured at the base station RF output port by using a direct cable connection.

To perform the test, select the correct band class and channel number. A band-class-specific mask will be shown on the screen. Maximum emission power in each frequency offset region will be highlighted by markers. Typical resolution bandwidths (RBW) that are used in the emission test are 30 KHz and 1 MHz. Due to the variable RBW in some band classes, the spectrum can appear to have “steps”.

For accurate EVDO emission measurements, users are required to input an all-idle or all-active signal, and to set the instrument slot setting accordingly. The emission mask is drawn according to the following document: Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Network. (See 3GPP2 C.S0032-A or TIA-864-A for details.)

Note	In the case of a multi-carrier EVDO signal, the “Number of Carriers” setting can be changed (setting it to a maximum of 5 carriers). When the center frequency of a signal is entered directly (instead of giving Band Class and Channel Number info), the instrument automatically determines the most likely band class and its emission mask, according to the specified frequency.

From the RF Measurement menu, press the Spurious Emission submenu key to activate the measurement (Figure 3-5). The red dot on the submenu key indicates that it is selected.

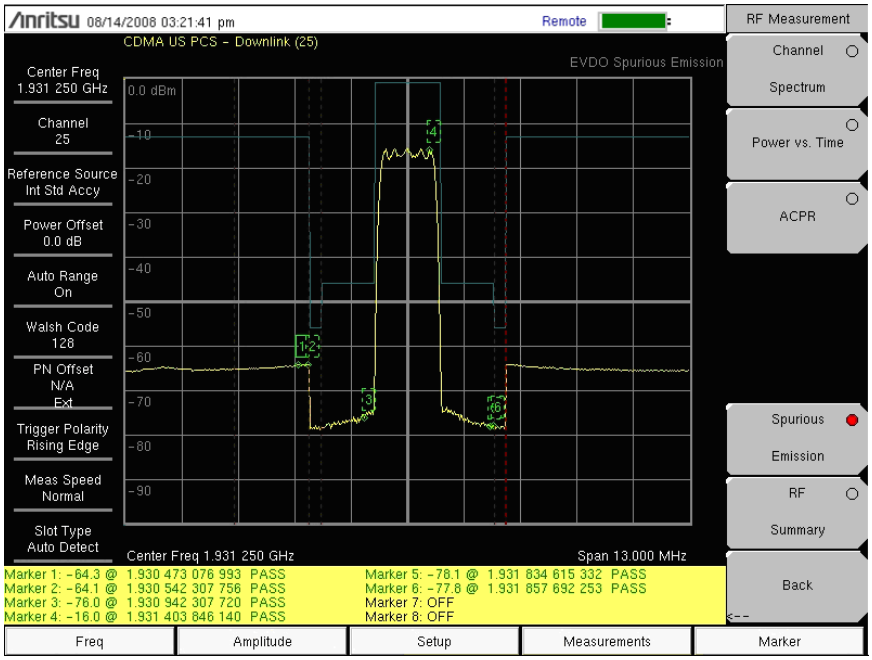


Figure 3-5. EVDO Spurious Emission

3-5 EVDO Demodulator Measurements Setup

EVDO demodulator measurements include, CDP MAC, CDP Data, MAC CDP table, and Modulation Summary. To demodulate EVDO signals, connect the instrument to the base station by using the following setup instructions:

1. Press the **Setup** key to open Setup menu.
2. Press the PN Setup submenu key and choose the trigger type: No Trigger (No Trig), GPS, or External (Ext).
3. Press PN Search Type submenu key to toggle between Auto and Manual search.

Note	If Manual Search is selected, then press Manual PN Offset submenu key and enter the PN value manually.

4. Press Back to go to the previous menu.
5. Press the Walsh Codes submenu key to choose 64 codes or 128 codes.
6. Press the **Measurement** main menu key to open the measurements menu.
7. Press the Demodulator submenu key to activate the Demodulator measurements menu.

CDP MAC Setup

8. Pressing this submenu key displays the CDP MAC codes (Figure 3-6). The lower part of the screen displays the zoom codes.

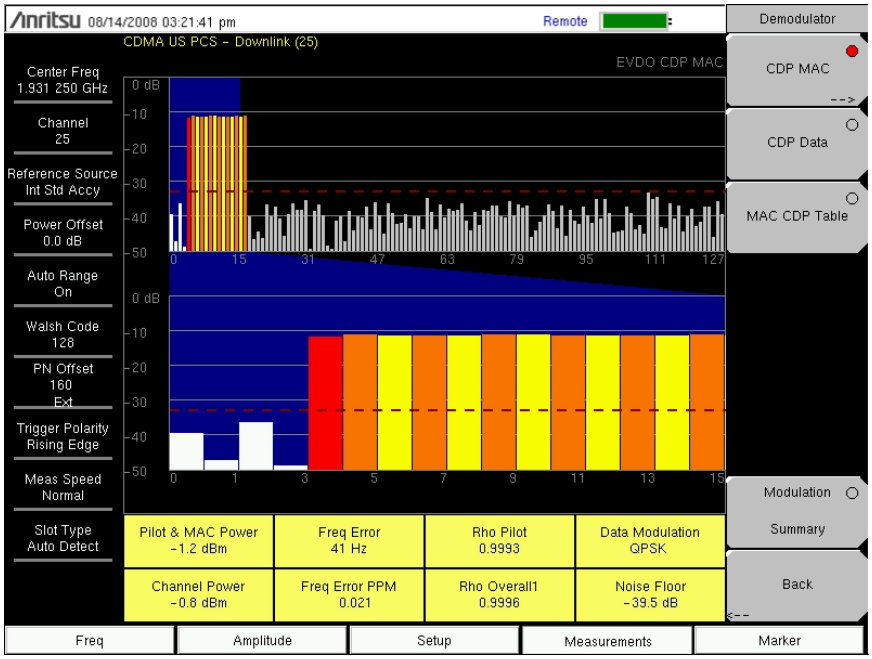


Figure 3-6. EVDO CDP MAC

From the Demodulator menu, use the following procedure for CDP MAC measurements:

1. Press the CDP MAC submenu key to display MAC codes.
2. Press the CDP MAC submenu key again to display the CDP MAC submenu key menu.
3. Press the Zoom submenu key and select 16 codes, 32 codes, or 64 codes.
4. Press the Zoom Start submenu key and enter the desired zoom starting code.
5. Press CDP Units submenu key to select Relative power (in dB) or Absolute Power (in dBm) for the y-axis in the graphic display.

Marker Setup (Activating Markers)

Note	Markers are only available in Channel Spectrum measurements.

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 toggle the selected marker On or Off.
4. Press the Marker Table submenu key to display the Marker table. The marker table is displayed on the measurement screen below the CDP measurements table.

CDP Data Setup

CDP Data displays the data I (In phase) and Q (Quadrature phase) codes (Figure 3-7).

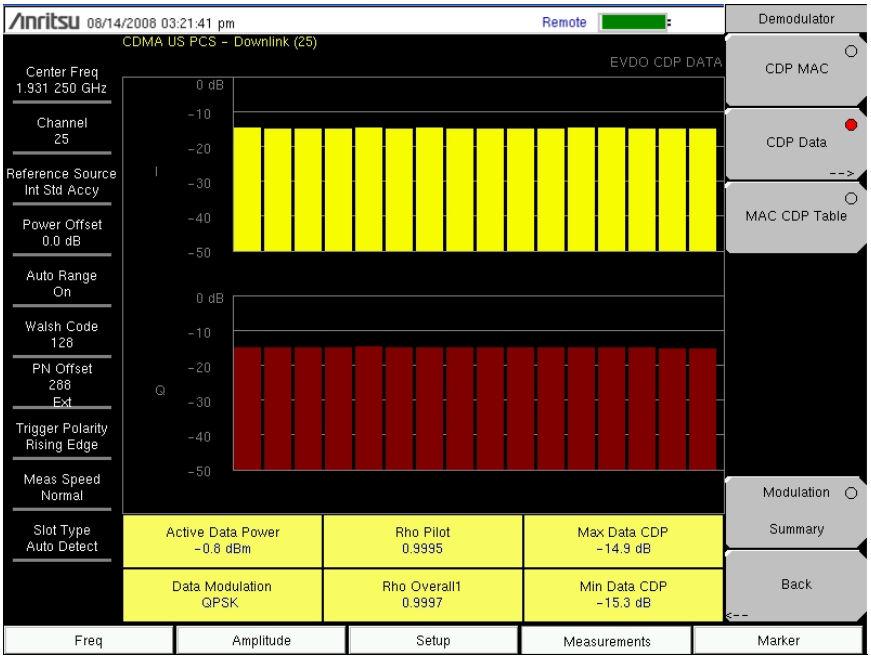


Figure 3-7. EVDO CDP Data

From the Demodulator menu, use the following procedure for CDP Data measurements:

1. Press the CDP Data submenu key to display the codes.
2. Press the CDP Data submenu key again to display the CDP Data submenu.
3. Press the CDP Units submenu key to select Relative power (in dB) or Absolute power (in dBm).

MAC CDP Table Setup

The MAC CDP Table View displays all of the active codes in a tabular format. From the Demodulator menu, press the MAC CDP Table submenu key to display the Code Domain Power table view (Figure 3-8).

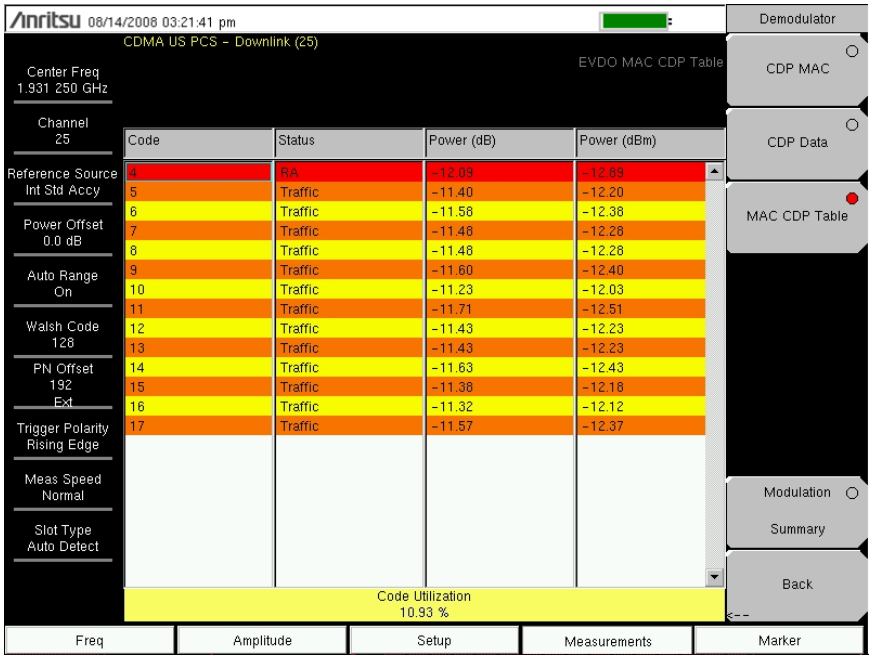


Figure 3-8. EVDO MAC CDP Table

EVDO Modulation Summary Setup

The EVDO modulation summary view displays EVDO critical RF and demodulator measurements in tabular format. From the Demodulator menu, press the Modulation Summary submenu key to display the summary of measurements (Figure 3-9).

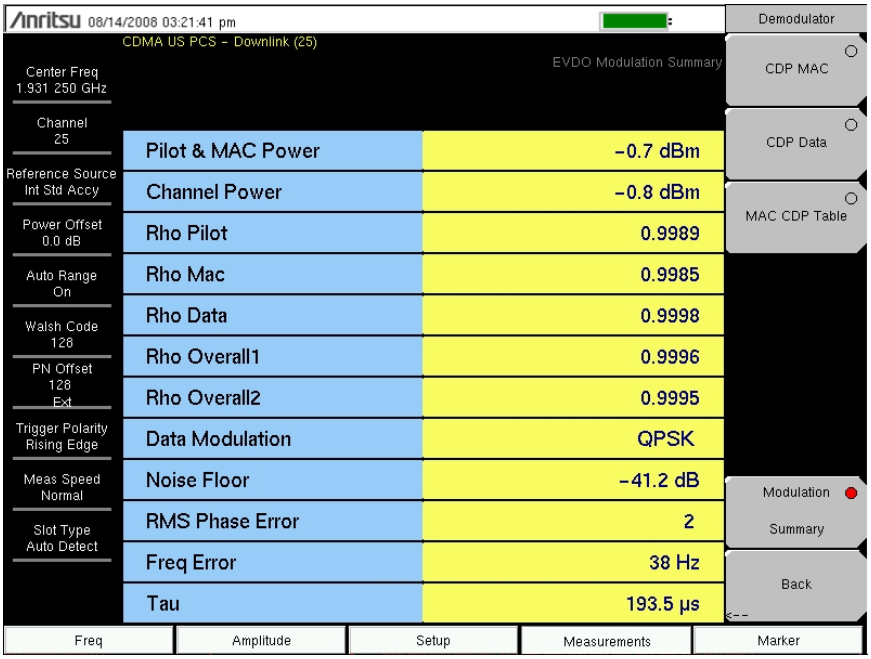


Figure 3-9. EVDO Modulation Summary

3-6 EVDO Over-The-Air Measurement Setup

OTA (over-the-air) testing provides field technicians with the ability to monitor hard-to-reach pole-top base stations. Traditionally, the repair process for pole-top base stations entailed pulling down the failed base station, then installing a new one. The failed base station was then returned to the manufacturer or repair depot for service. If a base station was determined to be healthy (a no trouble found (NTF) event), then the cost of the process was incurred unnecessarily. OTA testing provides information about the health of the base station, thereby improving the likelihood that a correct decision will be made with regard to the base station. The result is fewer NTFs and elimination of their associated costs.

If you choose to measure EVDO performance over the air with an antenna, then additional setup is required, as explained in the setup section. The instrument needs a timing reference in order to determine PN Offset and timing errors. This reference comes from the base station GPS when it is connected to the instrument, or it can be recovered from GPS when a GPS antenna is connected.

To make EVDO OTA measurements, connect the instrument to the base station and perform the following setup procedure:

1. Press **Freq** main menu key then press the Channel 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 center of the channel is tuned to the center of the display.
2. Press the **Setup** main menu key to open the Setup menu.
3. Press the PN Setup submenu key and choose GPS. Follow the setup instructions "GPS Setup" on page 2-3.
4. Press the PN Search Type submenu key and select Auto.
5. Press the **Setup** main menu key then press the Walsh Codes submenu key to toggle between 64 codes and 128 codes depending upon the transmitting signal.

Note	64 Walsh Codes can be displayed when the unit is in 128 code mode. The Walsh Codes will be repeated on the measurement screen.

6. Press the **Measurements** key to open the measurements menu.
7. Press the OTA submenu key to activate Over-The-Air measurements.

The following procedures are used to display the OTA Pilot Scan and Multipath views:

From the OTA menu, press the Pilot Scan submenu key to display the nine strongest pilots, the PN codes, Ec/Io, Tau, Pilot Power, Channel Power, and Pilot dominance (Figure 3-10).

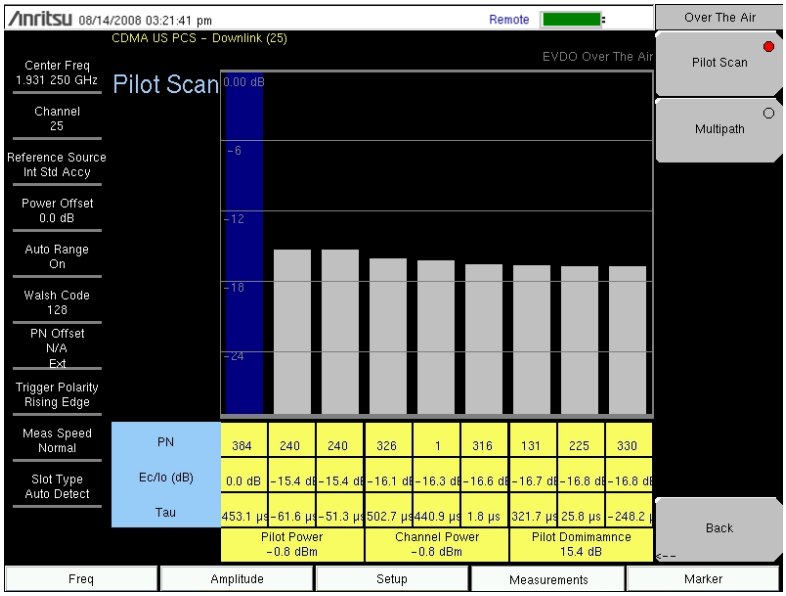


Figure 3-10. EVDO OTA Pilot Scan

From the OTA menu, press the Multipath submenu key to display six channels of multipath parameters, including Ec/Io, Tau, Channel Power, and Multipath Power (Figure 3-11).

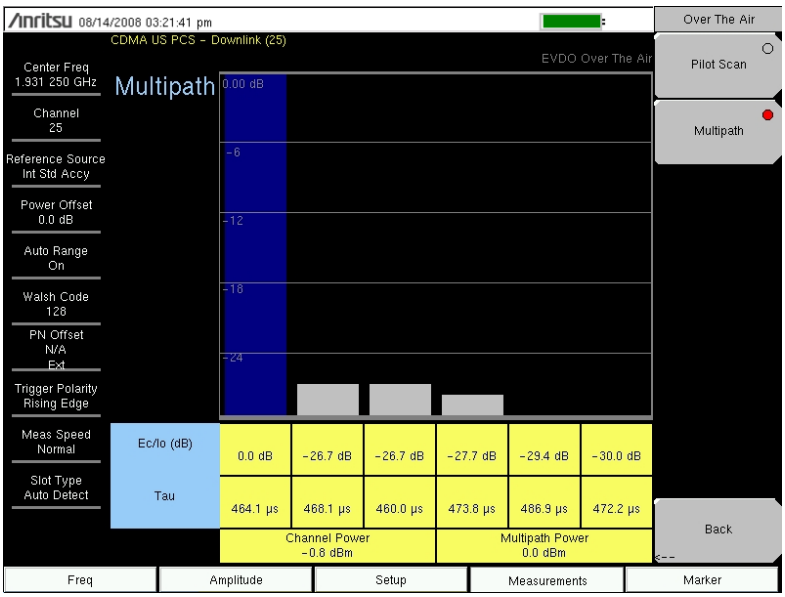


Figure 3-11. EVDO OTA Multipath

3-7 Pass Fail Setup

The instrument stores user-defined pass fail criteria test models 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 (Figure 3-12).

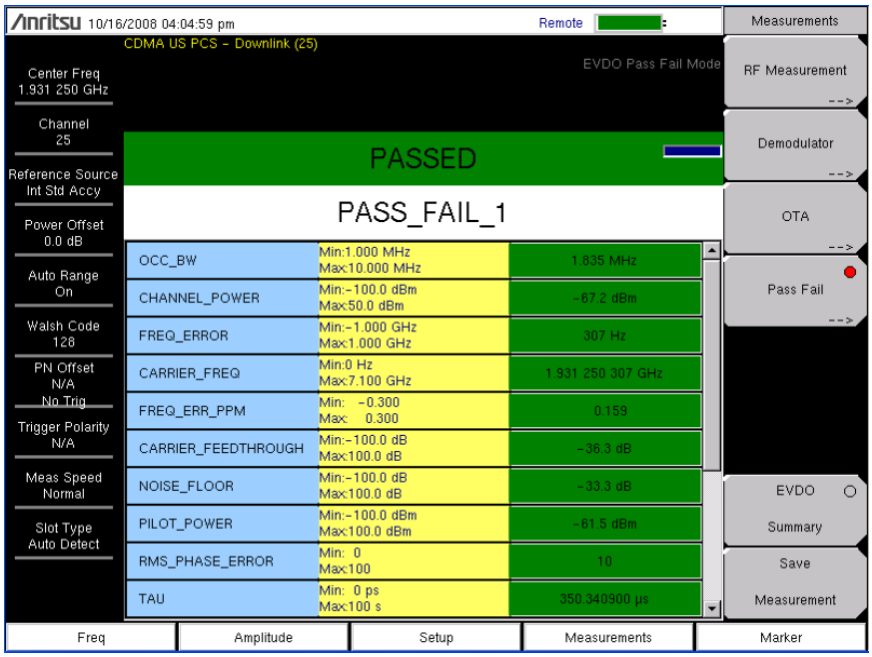


Figure 3-12. Pass Fail Measurement

Using Master Software Tools, a custom test list can be created and downloaded into the BTS Master. All critical parameters can be selected for pass fail testing.

From the **Measurements** main menu, use the following procedure to enter the Pass Fail Mode:

1. Press the Pass Fail submenu key to display pass fail criteria.
2. Press the Pass Fail submenu key again to open the Pass Fail Mode key menu.
3. Press the Select Pass/Fail Test submenu key and select the applicable Test Model to activate the measurement.
4. Press the Reset submenu key to reset the pass fail function and begin a new pass fail test.

3-8 EVDO Summary Setup

EVDO summary displays EVDO critical RF and demodulator measurements in tabular format.

From the **Measurements** main menu, press the EVDO Summary submenu key to display the measurements in tabular format (Figure 3-13).

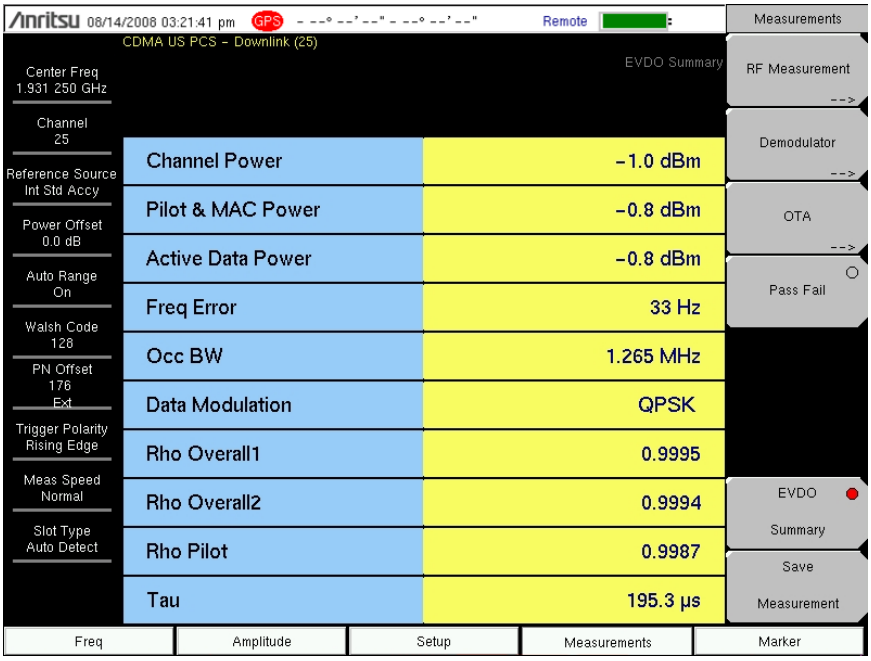


Figure 3-13. Pass Fail Measurement

From the **Measurements** menu, press the Save Measurement submenu key to open a dialog box in order to name and save the current measurement.

3-9 EVDO Measurement Descriptions

Pilot & MAC Power

The Pilot & MAC power shows the average power of the Pilot and MAC Channels. It is an absolute number that is expressed in dBm or Watts.

Active Data Power

Active Data Power is the average power of the Data Channel. When the slot is active, the data power should be very similar to the MAC & Pilot power (less than 2.5 dB difference). When the slot is idle, the Active Data Power should be at least 7 dB below the MAC & Pilot power if the instrument is connected directly to a base station.

Channel Power

During an active slot, Channel Power should be similar to Pilot & MAC power and should also be similar to Active Data Power. During an idle slot, channel power should be somewhere between the Pilot & MAC power and Data Power, because it is a weighted average of the two. When measuring an EVDO station with live traffic, channel power will vary according to how busy the downlink is, because channel power also depends upon the percentage of idle slots and active slots in the captured sample.

Noise Floor

Noise floor is the average power of the inactive MAC channels, relative to the total MAC channel power. It is expressed in dB. When connected to a good EVDO source, the noise floor should be -31.5 dB or below. When noise or distortion is present (for example, in an over-the-air measurement), the noise floor can be considerably higher.

Freq Error

Frequency error is the difference between the received center frequency and the specified center frequency. This is only as accurate as the frequency reference that is being used and is typically more useful with a good external frequency reference or GPS.

Data Modulation

The instrument can determine the data channel modulation type automatically. EVDO data channel has three modulation types: QPSK, 8PSK, and 16QAM. “Idle” is displayed when the slot is idle.

PN Offset

Each EVDO base station is identified by a unique PN Offset in its pilot signal. This is similar to CDMA.

Tau

Tau measures the time delay from the input trigger to the “start of a slot.” This means that Tau can be much larger than what is commonly seen in CDMA if the signal is not synchronized to the trigger.

Note	The EVDO PN must be aligned with the start of an EVDO slot, in addition to referencing the external trigger or GPS signal. Therefore, when the user connects an external trigger that is poorly aligned with the EVDO signal slots, the instrument may report a Tau value that is very large in magnitude, in order to give the best possible PN Offset estimation.

Rho

Rho is a number between 0 and 1. A good signal should have a Rho that is close to 1. When connected to a good EVDO source, all Rhos should be 0.97 or above, and should decrease when the channel power is too weak. When noise or distortion is present, for example in an over-the-air measurement, Rhos can drop dramatically.

Rho Pilot

Rho Pilot is an indicator of the quality of the Pilot Channel.

Rho Data

Rho Data is an indicator of the quality of the Data Channel.

Rho MAC

Rho MAC is an indicator of the quality of the MAC Channel.

Rho Overall 1 and 2

Rho Overall 1 and 2 are both indicators of the overall quality of the EVDO signal during an active slot. They differ from each other in the sense that Rho Overall 1 measures from the beginning to the end of a half slot, while Rho Overall 2 measures from the middle of one half slot to the middle of another half slot. In general, they should have similar values.

Carrier Feedthrough

Carrier Feedthrough measures the amount of unmodulated signal that is leaking through the transmitter.

CDP Data

The Data Channel in EVDO consists of 16 “I” sub channels and 16 “Q” sub channels. Each of these channels should have a power of approximately -15.05 dB relative to the total Data Channel power. When connected to a good signal source, the Data Code Min is usually larger than -15.5 dB, and the Data Code Max is usually less than -14.6 dB. The smaller the difference between these two values, the better the signal quality.

CDP MAC

MAC channels are Walsh despread into 64 sub-channels (physical layer Subtype 0 or 1) or 128 sub-channels (physical layer Subtype 2). See the menu description for CDP MAC for color code details.

Pilot Scan

The strongest 9 PNs that are received are displayed. The length of the bar represents the absolute or relative power of the signal in dBm or dB. The strongest PN or the user-selected PN is color coded blue, those colored red are probably real pilots, and the remaining, which are color coded gray, are probably noise.

Note	This graph is not meaningful if the PN search is set to No Trigger.

Multipath

The length of the bar represents the relative power in the signal path in dB. Ec/Io and Tau are displayed below each bar. The strongest signal is color coded blue. The remaining signals are color coded red, or they are color coded gray if they are due to system noise.

Pilot Dominance

Pilot Dominance is a measure of 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 demodulator measurements.

Multipath Power

Multipath Power is a measure of the total amount of power in the dominant signal (that is being spread in time due to multipath echoes) relative to its power in the main transmission path. This should be < 0.4 dB in order to make good measurements.

Ec/Io

The pilot power compared to the total channel power during the pilot time slot.

Occupied BW

The occupied bandwidth is calculated as the bandwidth containing 99% of the transmitted power in a 2.5 MHz span.

Power vs. Time Graph

This view shows the time domain view of an EVDO half-slot. The Slot Type selection in the Setup menu determines the priorities regarding which slot is displayed.

Idle or Active Activity %

This shows the estimated percentage of idle or active slots in the total number of slots captured. Expect the idle percent (%) to be low and the active percent to be high when many EVDO users are connected to a base station.

3-10 EVDO Menus

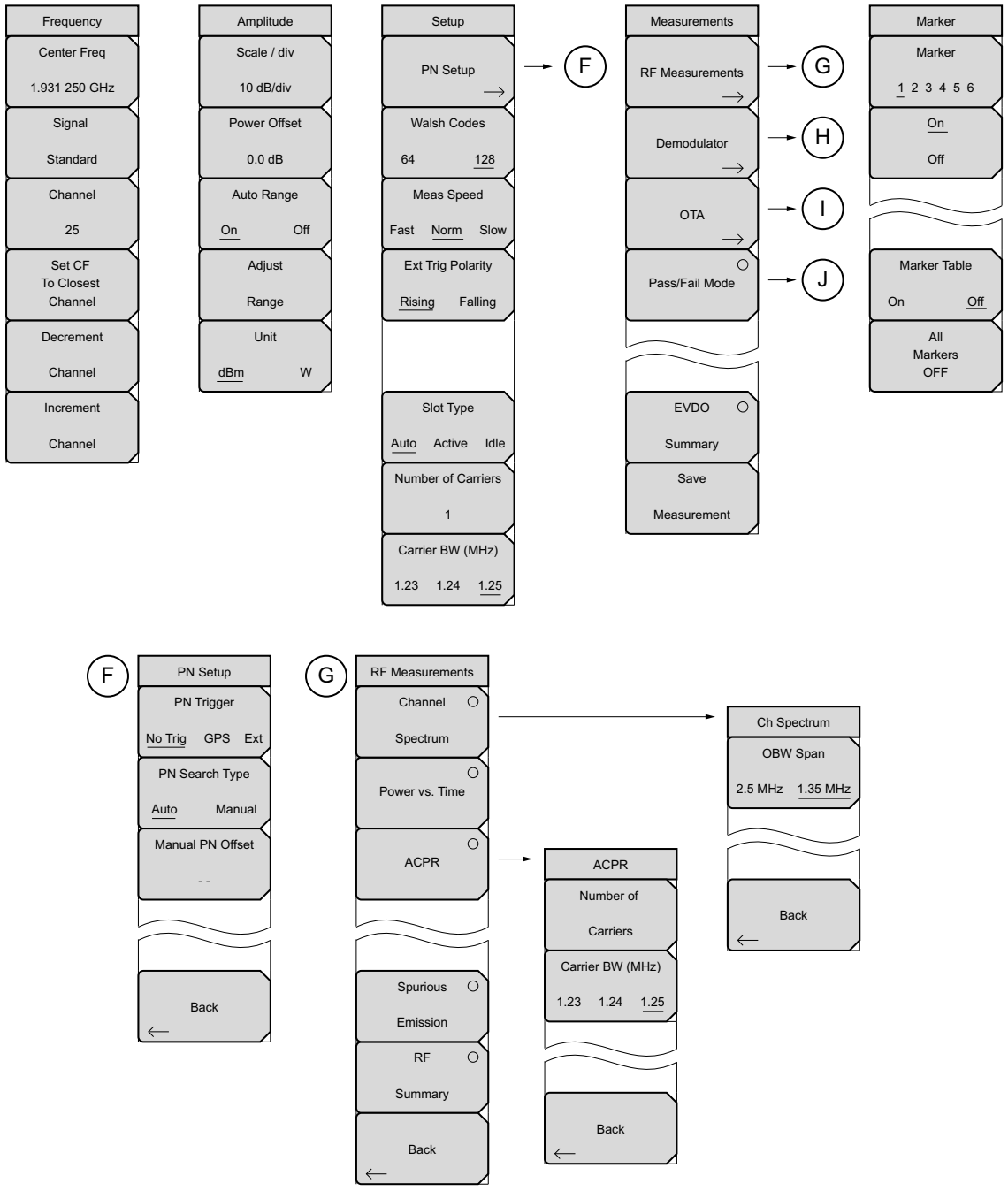


Figure 3-14. EVDO Menu Layout (1 of 2)

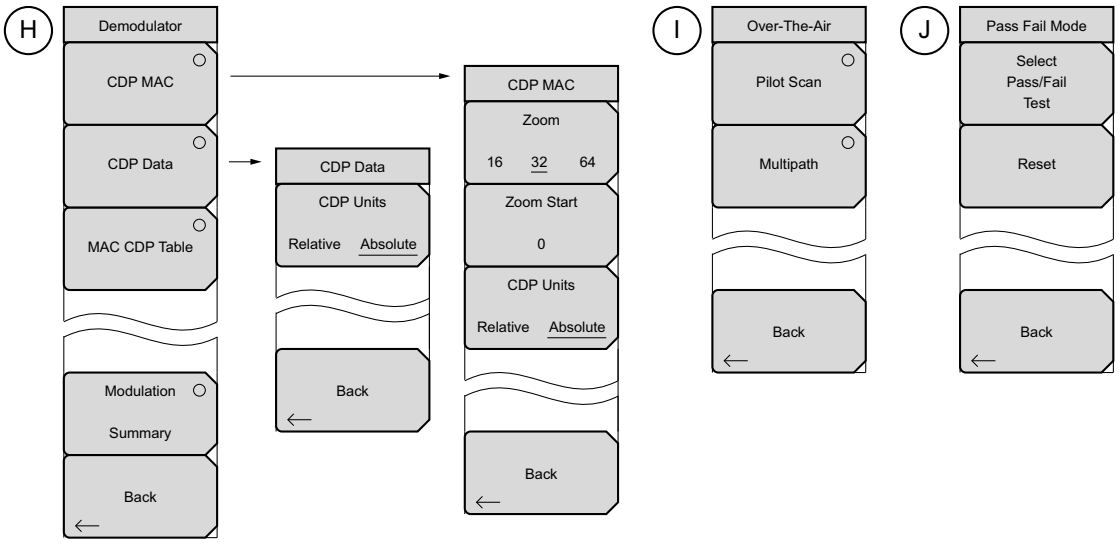
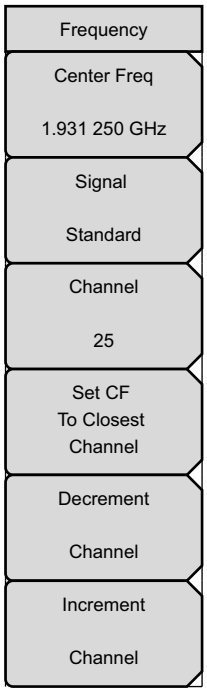


Figure 3-15. EVDO Menu Layout (1 of 2)

3-11 Freq (Frequency) Menu

Key Sequence: **Freq**



Center Freq: Press the **Freq** main menu 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 by 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 affect 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 are automatically tuned. Other settings (such as channel spacing and integration bandwidth) are also automatically entered. The Signal Standards dialog box includes all of the EVDO standards.

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 EVDO channel. The Channel Editor dialog box indicates the selected signal standard. The range of channels and the channel step size depend upon the selected standard.

Set CF To Closest Channel: Press this submenu key to change the center frequency to the closest channel.

Decrement Channel: Depending upon the signal standard and upon the selected channel, pressing this submenu key decrements the channel number by a standard step size.

Increment Channel: Depending upon the signal standard and upon the selected channel, pressing this submenu key increments the channel number by a standard step size.

Figure 3-16. EVDO Freq Menu

3-12 Amplitude Menu

Key Sequence: **Amplitude**

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

Scale changes the y-axis scale. This applies to the Spectrum view only. When in any other view, the display is "--".

Power Offset: Choose power offset to automatically adjust for the loss that occurs through any external cables, attenuators, and couplers. The power can be offset from 0 dB to 100 dB. Press the Power Offset key, enter the values, and press the dB submenu key.

Auto Range: Pressing this submenu key toggles between On and Off. This function adjusts the reference level automatically when Auto Range is activated.

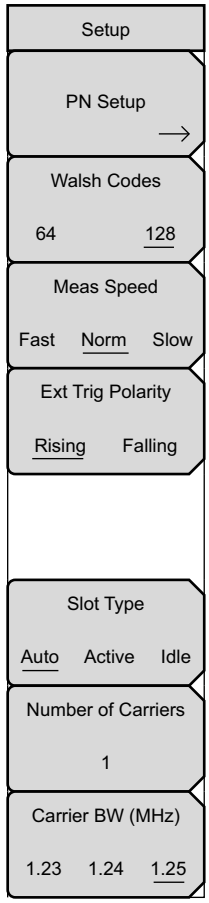
Adjust Range: Pressing Adjust Range will trigger reference level detection once and also set Auto Range to Off. The instrument will no longer automatically trigger reference level detection. The user must press Adjust Range to do this when necessary until Auto Range is turned back on.

Units: Select either dBm or Watts as the power unit.

Figure 3-17. EVDO Amplitude Menu

3-13 Setup Menu

Key Sequence: **Setup**



PN Setup: Opens the "PN Setup Menu" on page 3-24.

Walsh Codes: This allows you to toggle between 64 and 128 MAC indices. Note that MAC 128 is applicable only to Rev. A physical layer subtype 2.

Meas Speed: Toggles through "Fast", "Norm" (normal), and "Slow" measuring speed.

Ext Trig Polarity: Toggles between Rising edge and Falling edge trigger polarity.

Slot Type: Press this soft key to toggle through Auto, Active, and Idle slot types. Selecting Active makes the Power vs Time display an active slot if one is available. Selecting Idle makes the Power vs Time display an idle slot if one is available. Selecting Auto makes the Power vs Time show an Idle slot, or an Active slot if no idle slot is available. This setting also affects the type of power trigger that is used in a Spurious Emission Test.

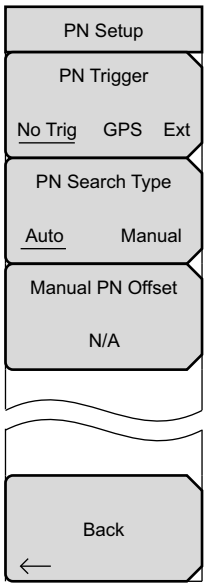
Number of Carriers: This submenu key sets the number of required channels. This affects the ACPR and Spurious Emissions measurements.

Carrier BW: This submenu key sets the carrier bandwidth. It rotates between 1.23, 1.24 and 1.25.

Figure 3-18. EVDO Setup Menu

PN Setup Menu

Key Sequence: **Setup** > PN Setup



PN Trigger: This submenu key toggles through “No Trig” (no trigger), “GPS”, and “Ext” (external trigger).

PN Search Type: This submenu key toggles between “Auto” and “Manual” PN search. In the Auto mode, the instrument automatically searches for the strongest PN. When using manual setup, enter the required PN offset to limit the search. Auto search is available only when the trigger selection is GPS or External. If “No Trig” is selected, then pressing this submenu key causes an error message to be displayed, stating “Applicable only when PN Type is GPS or External”.

Manual PN Offset: Press this submenu key to manually set the PN offset. Use the arrow keys, rotary knob, or numeric keypad to choose an offset, then press the rotary knob or the **Enter** key to select the value. Editing this value automatically changes the PN Search Type to Manual.

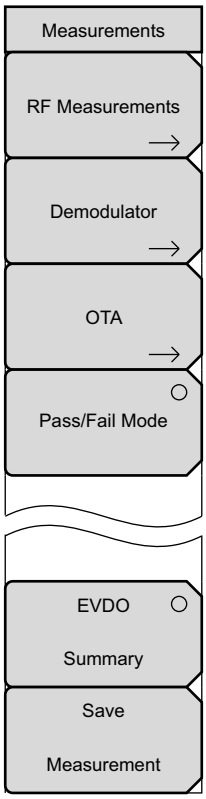
The Manual PN Offset function is available only when the trigger selection is GPS or External. If “No Trig” is selected, then pressing this submenu key causes an error message to be displayed, stating “Applicable only when PN Type is GPS or External”.

Back: Returns to the “Setup Menu” on page 3-23.

Figure 3-19. EVDO PN Setup Menu

3-14 Measurements Menu

Key Sequence: **Measurements**



RF Measurement: Opens the “RF Measurement Menus” on page 3-26.

Demodulator: Opens the “Demodulator Menu” on page 3-28. The received EVDO signal is demodulated in this measurement. The demodulator has four measurement displays: CDP MAC, CDP Data, MAC CDP Table, and Modulation Summary.

OTA: Opens the “Over-The-Air Menu” on page 3-31. OTA displays the EVDO Over-The-Air measurements, which include: Pilot Codes, Ec/Io (dB), Tau, Pilot Power, Channel Power, Pilot Dominance, and Multipath.

Pass/Fail Mode: The first press of this submenu key puts the instrument into Pass Fail Mode. The next press of the submenu key opens the “Pass Fail Mode Menu” on page 3-31.

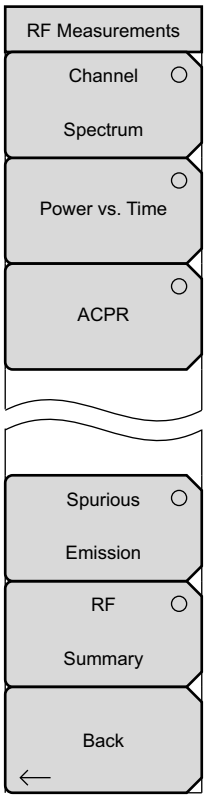
EVDO Summary: Displays a summary of all of the EVDO-related numerical measurements in a table format.

Save Measurement: Opens a dialog box to name and save the current measurement. Press **Enter** to save the EVDO measurement, which is saved with an .evdo extension.

Figure 3-20. EVDO Measurements Menu

RF Measurement Menus

Key Sequence: **Measurements** > RF Measurements



Channel Spectrum: Pressing this submenu key displays the channel spectrum of the input signal (2.5 MHz span). The screen also displays numeric values of Channel Power in dBm and watts, Peak to Average power in dB, and Occupied Bandwidth (Occ BW). The Ch Spectrum submenu allows OBW Span to toggle between 2.5 MHz and 1.35 MHz.

Power vs. Time: Pressing this submenu key displays a power versus time measurement. This view shows the time domain view of an EVDO half-slot. The Slot Type selection in the Setup menu determines the priority of which slot is displayed. Below the measurement display, numerical values are included for:

Pilot and Mac Power in dBm
Freq Error in Hz and PPM
Channel Power in dBm
ON/OFF Ratio: Power ratio (in dB) of Pilot and MAC power to the data power in an idle slot
Idle Activity: Percentage of idle slots relative to total slots in the captured signal

ACPR: Pressing this submenu key displays the Adjacent Channel Power Ratio (ACPR). The instrument displays one or more main channels and two adjacent channels on each side of the main channel. A data window below the channel measurement display indicates the power in each channel. When this submenu key is active (an arrow on the key symbol indicates that a sub menu is available), another key press opens the “ACPR Menu” on page 3-27.

Spurious Emission: Pressing this submenu key displays the received signal and the mask, based upon received signal strength.

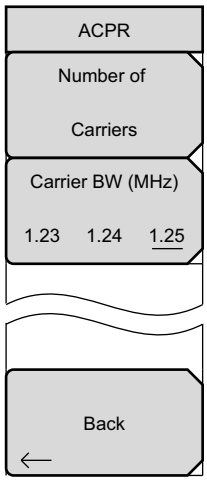
RF Summary: Displays a summary table of all the RF numerical measurement results.

Back: Returns to the “Measurements Menu” on page 3-25.

Figure 3-21. EVDO RF Measurement Menu

ACPR Menu

Key Sequence: **Measurements** > RF Measurement > ACPR



Number of Carriers: Press this submenu key to set the number of main channels from 1 to 5. Change the number of main channels with the arrow keys or the rotary knob, then press the rotary knob or the **Enter** key. Or change the number of channels by pressing a number on the numeric keypad, press the Enter submenu key, and then press the **Enter** key. The adjacent channels remain displayed.

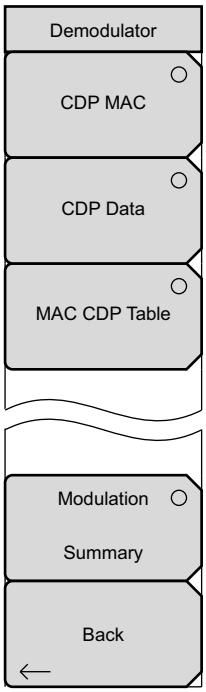
Carrier BW (MHz): Press this submenu key to select a bandwidth of 1.23, 1.24, or 1.25 MHz.

Back: Returns to the "RF Measurement Menus" on page 3-26.

Figure 3-22. EVDO ACPR Menu

Demodulator Menu

Key Sequence: **Measurements** > Demodulator



CDP MAC: The first press of this submenu key begins a CDP MAC measurement and also displays an arrow on the soft key (to indicate that a sub menu is available). The Code Domain Power (CDP) MAC view displays all of the Pilot and MAC codes in a color coded graphical format. MAC channels are Walsh despread into 64 sub-channels (physical layer Subtype 0 or Subtype 1) or 128 sub-channels (physical layer Subtype 2).

The bottom half of the CDP graph area shows a zoomed-in view of the code powers. A blue mask behind the zoomed-in area is duplicated in the upper graph to indicate which signals are in the zoom view.

The numerical results displayed in this view are:

Pilot and MAC Power (dBm)
Freq Error (Hz)
Rho Pilot
Data Modulation
Channel Power (dBm)
Freq Error PPM
Rho Overall1
Noise Floor (dB)

The codes are color coded according to the following list:

Reserved Channels in White
Inactive channels in Gray
Reverse Activity (RA) in Red
Active channels alternate between Orange and Yellow

An additional press of the CDP submenu key opens the “CDP MAC Menu” on page 3-30.

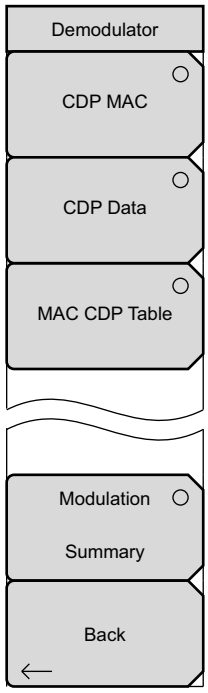
CDP Data: Lists the CDP Data menu. The Code Domain Power (CDP) Data view displays only the data code powers. The display is split into the I (In phase) data and Q (Quadrature phase) data components. Each contains 16 sub-channels.

The numerical results that are displayed in this view are:

Active Data Power (dBm)
Rho Pilot
Max Data CDP
Data Modulation Type
Rho Overall1
Min Data CDP

Figure 3-23. EVDO Demodulator Menu (1 of 2)

Demodulator Menu (Continued)



MAC CDP Table: This screen shows the power of the codes in a tabular format. The table displays the following 4 columns:

Code number
Status: RA, Active, Pilot, Page, Sync, All Traffic (Color Coded rows)
Power (in dB, relative)
Power (in dBm, absolute)
Code Utilization is displayed in percent (%) at the bottom of the table. It is a number indicating how many codes are used by a particular user (traffic).

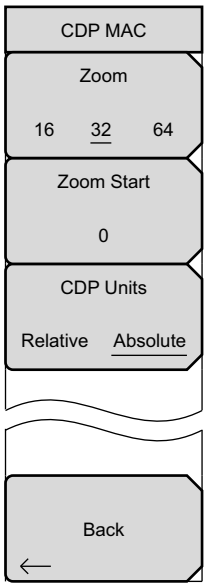
Modulation Summary: Pressing this submenu key displays a summary of all the modulation-related numerical measurement results in a table format, with rows for: Pilot & MAC Power, Channel Power, Rho Pilot, Rho MAC, Rho Data, Rho Overall1, Rho Overall2, Data Modulation, Noise Floor, RMS Phase Err, Freq Error, and Tau.

Back: Returns to the "Measurements Menu" on page 3-25.

Figure 3-24. EVDO Demodulator Menu (2 of 2)

CDP MAC Menu

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



Zoom: Press this submenu key to select one of these three settings to view 16, 32, or 64 carriers in the measurement display.

Zoom Start: Press this submenu key, then enter the required zoom start index. For example, to start at code 2, which is the second code power that is displayed, press the 2 key on the numeric keypad, then press either the submenu Enter key (which appears when the numeric keypad is used) or the **Enter** key.

In addition, press this key, then use the **Arrow Keys** or rotary knob to change the zoom start index. The CDP submenu key remains after pressing the rotary knob or the **Enter** key.

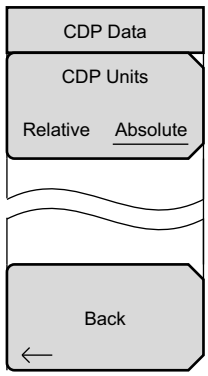
CDP Units: Press this submenu key to toggle between Relative units (in dB) or Absolute units in (dBm). Select Relative to show CDP power values in dB relative to Pilot and MAC Power, or Absolute to show power values in dBm.

Back: Returns to the “Demodulator Menu” on page 3-28.

Figure 3-25. EVDO CDP Menu

CDP Data Menu

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



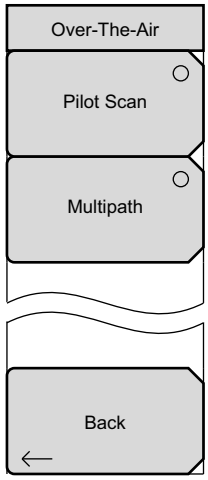
CDP Units: Press this submenu key to toggle between Relative units (in dB) or Absolute units in (dBm). Select Relative to show CDP power values in dB relative to Pilot and MAC Power, or Absolute to show power values in dBm.

Back: Returns to the “Demodulator Menu” on page 3-28.

Figure 3-26. EVDO CDP Data Menu

Over-The-Air Menu

Key Sequence: **Measurements** > OTA



Pilot Scan: Displays the power of the 9 strongest PNs in histogram graphical format. The strongest PN or the user-selected PN is color coded blue, those colored red are probably real pilots, and the remaining, which are color coded gray, are probably noise. PN, Ec/Io, and Tau are displayed below each PN bar graph signal. Pilot Power (dBm), Channel Power (dBm), and Pilot Dominance (dB) are displayed below the graph.

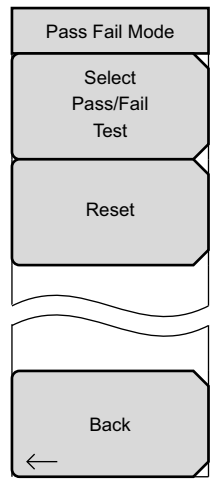
Multipath: Displays six multipaths in histogram graphical format. The strongest is color coded blue. The remaining signals are color coded red, or they are color coded gray if they are due to system noise. The numerical results that are displayed in this view are Ec/Io (dB) and Tau for each path. Channel Power, and Multipath Power are displayed below the graph.

Back: Returns to the "Measurements Menu" on page 3-25.

Figure 3-27. EVDO Over-The-Air Menu

Pass Fail Mode Menu

Key Sequence: **Measurements** > Pass Fail



Select Pass/Fail Test: This submenu key function allows the selection of a user-defined file that specifies a list of measurements with pass fail criteria. Select a test model by using the arrow keys or rotary knob. This mode will sequentially assess the appropriate measurements and indicate a pass or fail state based upon the test model criteria. Custom pass fail tests can be created by using Master Software Tools.

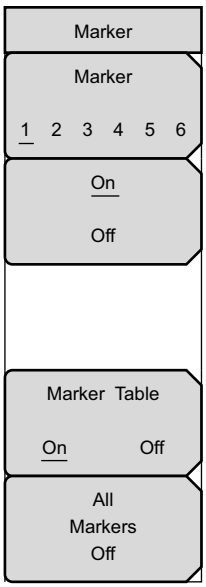
Reset: Press this submenu key to restart the measurement.

Back: Returns to the "Measurements Menu" on page 3-25.

Figure 3-28. EVDO Pass Fail Mode Menu

3-15 Marker Menu

Key Sequence: **Marker**



Markers are available only in CDP MAC and Spectrum measurements.

Marker: Press this submenu key to select marker 1 to marker 6. The selected marker is underlined on the key. Each press of the key moves the selection to the next marker number. Use the On Off submenu key to turn the marker On or Off.

On, Off: Press this submenu key to turn On or Off the marker that is currently selected (shown underlined) on the Marker, 1 2 3 4 5 6 key.

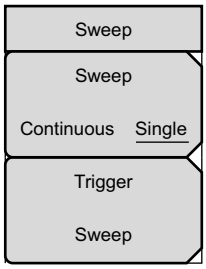
Marker Table: This functions turns On and Off a marker table in the CDP MAC view only. The marker table indicates the values of all active markers.

All Markers Off: Pressing this soft key turns OFF all markers.

Figure 3-29. EVDO Measurements Menu

3-16 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. EVDO Sweep Menu

3-17 Measure Menu

This menu is not available in EVDO measurement mode.

3-18 Trace Menu

This menu is not available in EVDO measurement mode.

3-19 Limit Menu

This menu is not available in EVDO measurement mode.

3-20 Other Menus

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

Appendix A — Error Messages

A-1 Introduction

This Appendix provides a list of 3GPP2 error messages. Self Test and General Operation error messages are in the User Guide.

A-2 CDMA and EVDO Messages

Warning Messages

"No trigger found"

This message is displayed if the PN trigger is setup for External or GPS, and the software does not detect a trigger. Most measurement results that depend on a trigger are then cleared ('--' is seen in the result area).

"Short Code not found"

This message is displayed if no dominant PN short code is found in the input signal.

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