User Guide

Economy Microwave Spectrum Analyzer
Model MS2717B, MS2718B, MS2719B

MS2717B Frequency Range 9 kHz to 7.1 GHz

MS2718B Frequency Range 9 kHz to 13 GHz

MS2719B Frequency Range 9 kHz to 20 GHz

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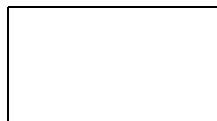
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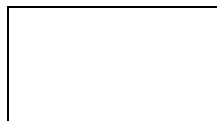
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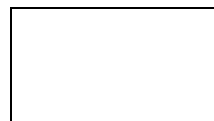VxWorks Runtime License 2000-1189   WindML Target License 2000-1372

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Manufacturer's Name: ANRITSU COMPANY

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

declares that the product specified below:

Product Name: Economy Spectrum Analyzer

Model Number: MS2717B, MS2718B, MS2719B

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 2006/95/EC as amended by Council directive 93/68/EEC

Electromagnetic Compatibility: EN61326-1:1997 +A1:1998 +A2:2002 +A3:2003

Emissions: EN55011: 1998 +A1:1999 +A2:2002 Group 1 Class A

Immunity:		
EN 61000-4-2:1995+ A1:1998+ A2:2001	- 4kV CD, 8kV AD
EN 61000-4-3:2002+ A1:2002	- 3V/m
EN 61000-4-4:2004	- 0.5kV SL, 1kV PL
EN 61000-4-5:1995+ A1:2001	- 0.5kV L-L, 1kV L-E
EN 61000-4-6:1996+ A1:2001	- 3V
EN 61000-4-11:1994+ A1:2001	- 100% @ 20msec

Electrical Safety Requirement:

Product Safety: EN61010-1: 2001

Eric McLean, Corporate Quality Director

Morgan Hill, CA

21 MAR 2007
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close, Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

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部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(Ⅵ)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
LCD	×	×	×	×	○	○
其他（电缆、风扇、 连接器等） (Appended goods)	×	○	×	×	○	○
○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规 定的限量要求以下。 ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。						

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Parliament and Council Directive 2002/96/EC (the
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For Products placed on the EU market after
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representative at the end of the product's useful
life to arrange disposal in accordance with your
initial contract and the local law.

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

Symbols Used in Manuals

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

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

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

Safety Symbols Used on Equipment and in Manuals

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

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

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

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

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

These indicate that the marked part should be recycled.

For Safety

Warning	Always refer to the operation manual when working near locations at which the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.
	Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.
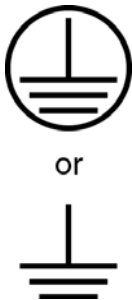
Warning or	When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

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

Warning ⚠ CAUTION >18 kg HEAVY WEIGHT	Use two or more people to lift and move this equipment, or use an equipment cart. There is a risk of back injury if this equipment is lifted by one person.

Caution	Electrostatic Discharge (ESD) can damage the highly sensitive circuits in the instrument. ESD is most likely to occur as test devices are being connected to, or disconnected from, the instrument's front and rear panel ports and connectors. You can protect the instrument and test devices by wearing a static-discharge wristband. Alternatively, you can ground yourself to discharge any static charge by touching the outer chassis of the grounded instrument before touching the instrument's front and rear panel ports and connectors. Avoid touching the test port center conductors unless you are properly grounded and have eliminated the possibility of static discharge.
	Repair of damage that is found to be caused by electrostatic discharge is not covered under warranty.

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Chapter 1 — General Information

1-1   Introduction

This chapter provides a description, performance specifications, optional accessories, preventive maintenance, and calibration requirements for the Anritsu Economy Microwave Spectrum Analyzer models listed below. Throughout this manual, any of these instruments may be referred to as a Spectrum Analyzer.

Table 1-1.   Model Numbers and Frequency Ranges

Model	Frequency Range
MS2717B	9 kHz to 7.1 GHz
MS2718B	9 kHz to 13 GHz
MS2719B	9 kHz to 20 GHz

If the reference is to all model numbers, then the reference used will be MS271xB.

1-2   Description

The Anritsu Economy Microwave Spectrum Analyzer is a synthesizer-based economy spectrum analyzer that provides quick and accurate measurement results. Measurements can be easily made using the main instrument functions: frequency, span, amplitude, and bandwidth. Dedicated keys for common functions and a familiar calculator-type keypad accommodate fast data entry.

Time and date stamping of measurement data is automatic. The internal memory provides for the storage and recall of more than 1000 measurement setups and more than 1000 traces. The bright, high-resolution color liquid crystal display (LCD) provides easy viewing in a variety of lighting conditions.

The Anritsu Economy Microwave Spectrum Analyzer is designed for monitoring, measuring, and analyzing signal environments. A full range of marker capabilities such as peak, center, and delta functions are provided for faster, more comprehensive analysis of displayed signals. Upper and lower multi-segmented limit lines are available to create quick, simple pass/fail measurements. A menu option provides for an audible alert when a limit value is exceeded.

Anritsu Master Software Tools, a PC-based software program, provides for storing measurement data. Master Software Tools can also convert the Spectrum Analyzer display into several graphic formats.

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

1-3   MS271xB Options and Accessories

MS2717B Options

The following options are available for the MS2717B Spectrum Analyzer.

Table 1-2.   MS2717B Spectrum Analyzer Options

Option	Description
MS2717B-007	Secure Data Operation Option
MS2717B-009	RF and Demodulation Hardware
MS2717B-017	GPIB Option
MS2717B-019	High Accuracy Power Meter
MS2717B-020	Tracking Generator
MS2717B-040	GSM/GPRS/EDGE RF Measurements (requires Option 009)
MS2717B-041	GSM/GPRS/EDGE Demodulator (requires Option 009)
MS2717B-042	CDMA RF Measurements (requires Option 009)
MS2717B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Option 009)
MS2717B-044	WCDMA/HSDPA RF Measurements (requires Option 009)
MS2717B-045	WCDMA Demodulator (requires Option 009)
MS2717B-046	Fixed WiMAX RF Measurements (requires Option 009)
MS2717B-047	Fixed WiMAX Demodulation (requires Option 009)
MS2717B-060	TD-SCDMA RF Measurements (requires Option 009)
MS2717B-061	TD-SCDMA Demodulator (requires Option 009)
MS2717B-062	EVDO RF Measurements (requires Option 009)
MS2717B-063	EVDO Demodulator (requires Option 009)
MS2717B-065	WCDMA/HSDPA Demodulator (requires Option 009)
MS2717B-066	Mobile WiMAX RF Measurements (requires Option 009)
MS2717B-067	Mobile WiMAX Demodulator (requires Option 009)

MS2718B Options

The following options are available only for the MS2718B Economy Microwave Spectrum Analyzer:

Table 1-3.   MS2718B Spectrum Analyzer Options

Option	Description
MS2718B-007	Secure Data Operation Option
MS2718B-009	RF and Demodulation Hardware
MS2718B-017	GPIB Option
MS2718B-019	High Accuracy Power Meter
MS2718B-040	GSM/GPRS/EDGE RF Measurements (requires Option 009)
MS2718B-041	GSM/GPRS/EDGE Demodulator (requires Option 009)
MS2718B-042	CDMA RF Measurements (requires Option 009)
MS2718B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Option 009)
MS2718B-044	WCDMA/HSDPA RF Measurements (requires Option 009)

Table 1-3.   MS2718B Spectrum Analyzer Options *(Continued)*

Option	Description
MS2718B-045	WCDMA Demodulator (requires Option 009)
MS2718B-046	Fixed WiMAX RF Measurements (requires Option 009)
MS2718B-047	Fixed WiMAX Demodulation (requires Option 009)
MS2718B-060	TD-SCDMA RF Measurements (requires Option 009)
MS2718B-061	TD-SCDMA Demodulator (requires Option 009)
MS2718B-062	EVDO RF Measurements (requires Option 009)
MS2718B-063	EVDO Demodulator (requires Option 009)
MS2718B-065	WCDMA/HSDPA Demodulator (requires Option 009)
MS2718B-066	Mobile WiMAX RF Measurements (requires Option 009)
MS2718B-067	Mobile WiMAX Demodulator (requires Option 009)
MS2718B-089	IF Output Option

MS2719B Options

The following options are available only for the MS2719B Economy Microwave Spectrum Analyzer:

Table 1-4.   MS2719B Spectrum Analyzer Options

Option	Description
MS2719B-007	Secure Data Operation Option
MS2719B-009	RF and Demodulation Hardware
MS2719B-017	GPIB Option
MS2719B-019	High Accuracy Power Meter
MS2719B-040	GSM/GPRS/EDGE RF Measurements (requires Option 009)
MS2719B-041	GSM/GPRS/EDGE Demodulator (requires Option 009)
MS2719B-042	CDMA RF Measurements (requires Option 009)
MS2719B-043	cdmaOne and CDMA2000 1xRTT Demodulator (requires Option 009)
MS2719B-044	WCDMA/HSDPA RF Measurements (required Option 009)
MS2719B-045	WCDMA Demodulator (requires Option 009)
MS2719B-046	Fixed WiMAX RF Measurements (requires Option 009)
MS2719B-047	Fixed WiMAX Demodulation (requires Option 009)
MS2719B-060	TD-SCDMA RF Measurements (requires Option 009)
MS2719B-061	TD-SCDMA Demodulator (requires Option 009)
MS2719B-062	EVDO RF Measurements (requires Option 009)
MS2719B-063	EVDO Demodulator (requires Option 009)
MS2719B-065	WCDMA/HSDPA Demodulator (requires Option 009)
MS2719B-066	Mobile WiMAX RF Measurements (requires Option 009)
MS2719B-067	Mobile WiMAX Demodulator (requires Option 009)
MS2719B-089	IF Output Option

MS271xB Supplied Accessories

The following standard accessories are supplied with the MS271xB:

Table 1-5.   MS271xB Supplied Standard Accessories

Part Number	Description
10580-00181	MS271xB User Guide (this document)
2300-498	Master Software Tools Program CD ROM
3-2000-1498	USB A/5-pin Mini-B Cable, 3 m (10 feet)
2000-1371	Ethernet Cable, 213 cm (7 feet)
3-2000-1567	512 MB Compact Flash Memory Module
2000-1520-R	2 GB USB Flash Drive
1091-27	Type-N male to SMA female Adapter
1091-172	Type-N male to BNC female Adapter
—	One year Warranty (includes firmware and software)

MS271xB Optional Accessories

The following optional accessories are available for the MS271xB:

Table 1-6.   MS271xB Optional Accessories

Part Number	Description
3-2000-1567	512 MB Compact Flash Memory Module
2000-1520-R	2 GB USB Flash Drive
42N50A-30	30 dB, 50 W, Bi-directional, DC to 18 GHz, N(m) to N(f) Attenuator
34NN50A	Precision Adapter, DC to 18 GHz, 50 W, N(m) to N(m)
34NFNF50	Precision Adapter, DC to 18 GHz, 50 W, N(f) to N(f)
15NNF50-1.5B	Test port cable armored, 1.5 meter, N(m) to N(f), 18.0 GHz
15NN50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(m), 6 GHz
15NN50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(m), 6 GHz
15NN50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(m), 6 GHz
15NNF50-1.5C	Test port cable armored, 1.5 meter, N(m) to N(f), 6 GHz
15NNF50-3.0C	Test port cable armored, 3.0 meter, N(m) to N(f), 6 GHz
15NNF50-5.0C	Test port cable armored, 5.0 meter, N(m) to N(f), 6 GHz
15ND50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(m), 6.0 GHz
15NDF50-1.5C	Test port cable armored, 1.5 meter, N(m) to 7/16 DIN(f), 6.0 GHz
3-806-152	Ethernet Cable, Crossover
2300-498	Master Software Tools Program CD ROM
1091-27	Adapter, Type-N male to SMA female
510-90	Adapter, 7/16 DIN (f) to N(m), DC to 7.5 GHz, 50 ohm
510-91	Adapter, 7/16 DIN (f) to N(f), DC to 7.5 GHz, 50 ohm
510-92	Adapter, 7/16 DIN(m) to N(m), DC to 7.5 GHz, 50 ohm
510-93	Adapter, 7/16 DIN(m) to N(f), DC to 7.5 GHz, 50 ohm
510-96	Adapter 7/16 DIN (m) to 7/16 DIN(m), DC to 7.5 GHz, 50 ohm
510-97	Adapter 7/16 DIN(f) to 7/16 DIN(f), 7.5 GHz, 50 ohm

Table 1-6.　　MS271xB Optional Accessories　*(Continued)*

Part Number	Description
760-244-R	MS271xB Transit Case
MS271xB-001	Rack Mount Kit (no slides)
10580-00181	Anritsu User Guide, Model MS271xB
10580-00182	Anritsu Programming Manual, Model MS271xB
10580-00183	Anritsu Maintenance Manual, Model MS271xB
2300-517	Phase Noise Measurement Software

For a complete list of accessories available for the MS271xB, refer to the ***MS271xB Spectrum Analyzer Technical Datasheet***, Anritsu part number 11410-00417, available online at www.us.anritsu.com.

1-4   MS271xB Operation and Maintenance

Performance Specifications

For a complete list of MS271xB specifications, refer to the ***MS271xB Spectrum Analyzer Technical Datasheet,*** Anritsu part number 11410-00417, available online at www.us.anritsu.com.

Preventive Maintenance

MS271xB preventive maintenance consists of cleaning the unit and inspecting and cleaning the RF connector on the instrument and all accessories. Clean the MS271xB with a soft, lint-free cloth dampened with water or water and a mild cleaning solution.

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

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

Calibration Requirements

The MS271xB loads factory calibration data during start-up, eliminating the need for daily calibration checks. Although the MS271xB does not require daily calibration, Anritsu recommends annual calibration and performance verification by local Anritsu service centers. Anritsu service centers are listed in this chapter.

ESD Cautions

The MS271xB, like other high performance instruments, is susceptible to ESD damage. Very often, coaxial cables and antennas build up a static charge, which, if allowed to discharge by connecting directly to the MS271xB without discharging the static charge, may damage the MS271xB input circuitry. MS271xB operators should be aware of the potential for ESD damage and take all necessary precautions.

Operators should exercise practices outlined within industry standards such as JEDEC-625 (EIA-625), MIL-HDBK-263, and MIL-STD-1686, which pertain to ESD and ESDS devices, equipment, and practices. As these apply to the MS271xB, it is recommended that any static charges that may be present be dissipated before connecting coaxial cables or antennas to the MS271xB. This may be as simple as temporarily attaching a short or load device to the cable or antenna prior to attaching to the MS271xB. It is important to remember that the operator may also carry a static charge that can cause damage. Following the practices outlined in the above standards will ensure a safe environment for both personnel and equipment.

Replacing the Line Fuse

The MS271xB line fuse value is printed on the rear panel next to the power connector.

Caution	Before changing the fuse, always remove the power cord from the power outlet. A risk exists of receiving a fatal electric shock if the fuse is replaced with the power cord connected. Always use a new fuse of the type and rating specified by the fuse markings on the rear panel of the instrument

To replace the line fuse:

1. Turn off the rear panel power switch and disconnect the MS271xB from the power source.

2. Using a small flat-blade screwdriver, carefully pry under the tab above the rear panel power switch to open the cover and gain access to the fuse holders (refer to the figure below).
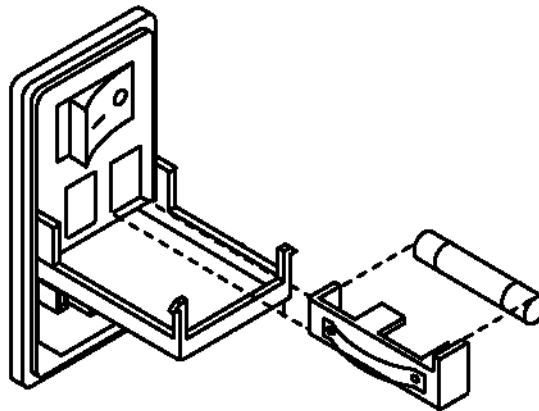
Figure 1-1.   Replacing the Line Fuse

3. Slide the fuse out of the fuse holder.

4. If the fuse is defective, then replace the fuse with a new fuse of the type and rating specified by the fuse markings on the rear panel of the instrument.

5. Reinstall the fuse holder in the rear panel power connector.

6. Close the cover to secure the fuse holder in place. The cover will close with an audible snap.

7. Reconnect the MS271xB to the power source and turn on the rear panel power switch.

Rack Mount Kit

The MS271xB Rack Mount Kit (part number MS271xB-001) allows the unit to be mounted to a standard 19-inch equipment rack. Follow the instructions below to install the kit.

1. Turn off the rear panel power switch and disconnect the MS271xB from the power source.

2. Using a small flat blade screwdriver, carefully pry the four hole plugs from the front sides of the unit to expose the rack mount bracket mounting holes.

Figure 1-2.   Rack Mount Bracket Mounting Holes

3. Align the rack mount brackets (part number 65642) with the screw holes and insert the mounting screws (905-2620) as shown. Tighten using a #1 Phillips screw driver.

Figure 1-3.   Insert the Mounting Screws

4. Repeat the process on the other side. The unit is ready to be mounted into an instrument rack.

Chapter 2 — Quick Start Guide

2-1   Introduction

This chapter provides a brief overview of the Anritsu MS271xB Spectrum Analyzer. The intent of this chapter is to provide a starting point for making basic measurements. For more detailed information, refer to Chapter 3, "Key Functions" and Chapter 4, "Measurement Fundamentals".

Turning the MS271xB On for the First Time

No initial setup is required. After unpacking, the MS271xB is ready for use. The MS271xB is equipped with automatic line-power sensing and will operate with line voltages from 90 VAC to 250 VAC, at 50-60 Hz, 400 VA maximum. The MS271xB is intended for Installation Category (Over Voltage Category) II.

1. Connect the AC line cord to the AC Input on the rear panel of the instrument and to an adequate power supply.

Caution	When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, then use a conversion adapter and ground the green (grounding) wire. If power is supplied without grounding the equipment, then a risk exists for receiving a severe or fatal electric shock.

2. Switch the AC Power rocker switch on the rear panel to "|" in order to apply the line voltage to the power supply.
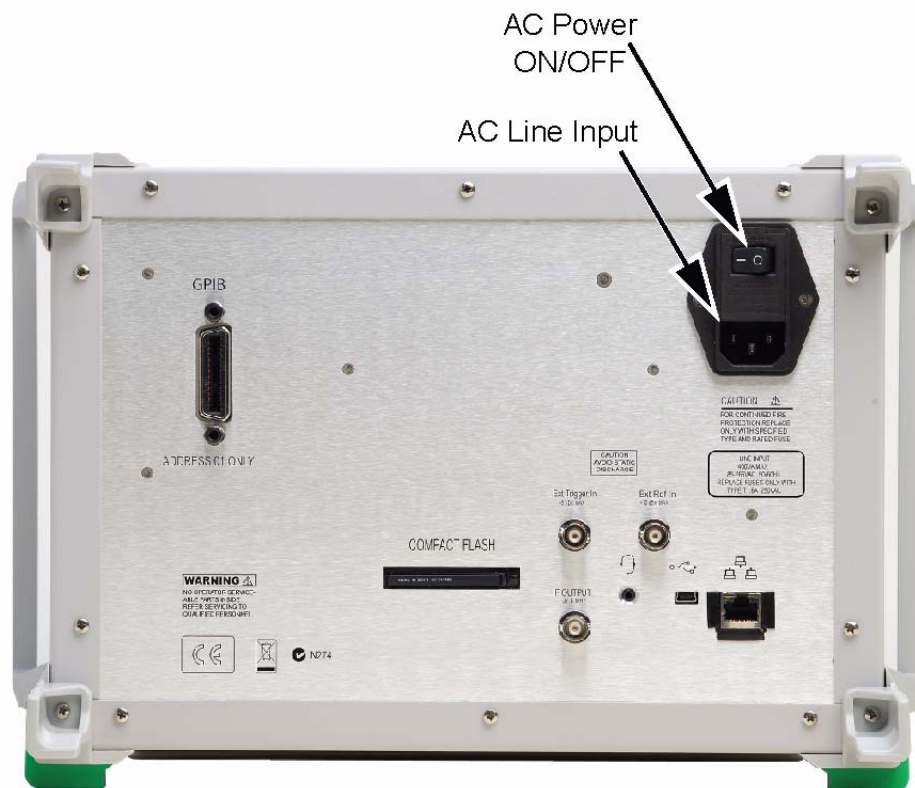
Figure 2-1.   MS271xB AC Input

3. Set the instrument to operate by pressing the illuminated **On/Off** front panel button.
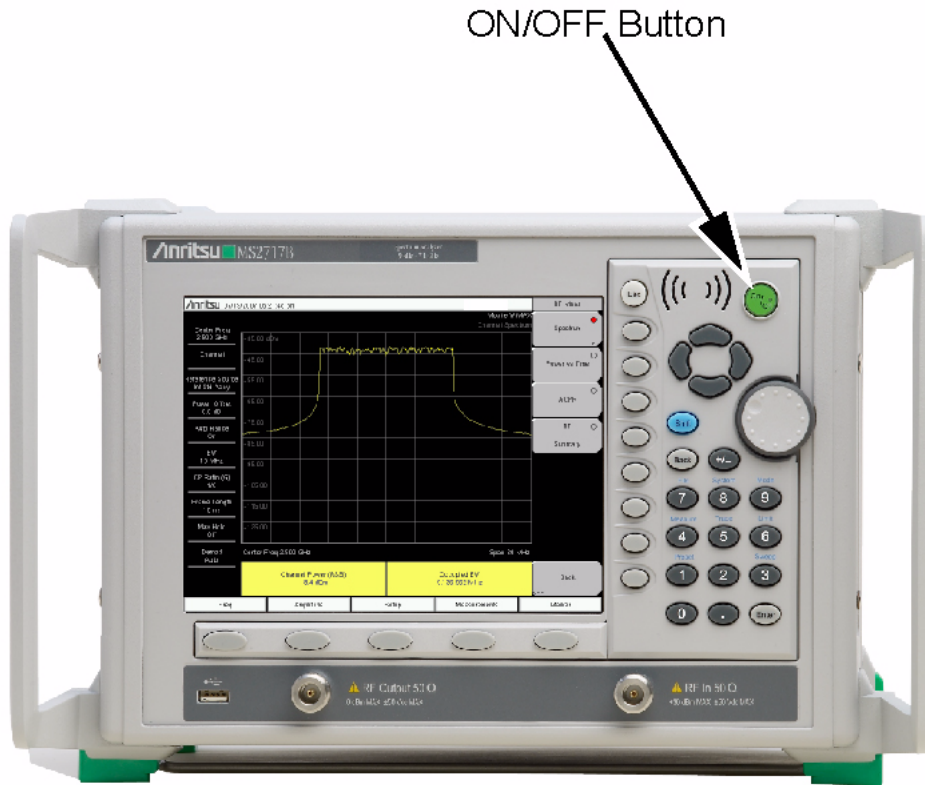
Figure 2-2. MS271xB On/Off Button

The MS271xB takes about forty-five seconds to complete power up and load the application software. At the completion of this process, the instrument is ready to use.

For information on making measurements with the MS271xB, refer to Section 2-7, "Making Spectrum Analyzer Measurements" on page 2-14.

For advanced applications, refer to Chapter 4, "Measurement Fundamentals" and Chapter 5, "Transmitter Measurements".

2-2 Instrument Features

Ventilation Ports

Important: Keep the ventilation ports on the top and sides of the instrument clear of obstructions at all times for proper ventilation and cooling of the instrument.

Front Panel Overview

The menu-driven interface is easy to use and requires little training. Hard keys on the front panel are used to initiate function-specific menus. Five function hard keys are located below the display. In Spectrum Analyzer mode, the function hard keys are: **Freq** (Frequency), **Amplitude**, **Span**, **BW** (Bandwidth), and **Marker**. In WCDMA Signal Analyzer mode, the function hard keys are: **Freq** (Frequency), **Amplitude**, **Setup**, **Measurements**, and **Marker**.

A rotary knob and 21 hard keys are located to the right of the display. Eight of the hard keys are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself, and with the alternate function printed on the panel above the key. Use the **Shift** key to access the functions that are printed on the panel. The **Esc** (Escape) key (used for aborting data entry) is the round button located above the soft keys. The rotary knob and the keypad can both be used to change the value of an active parameter.

Located just to the right of the display are eight soft keys, which change function depending upon the current menu selection. The current soft key function is indicated in the active function block within the right edge of the display. The locations of the different keys are shown in Figure 2-3.
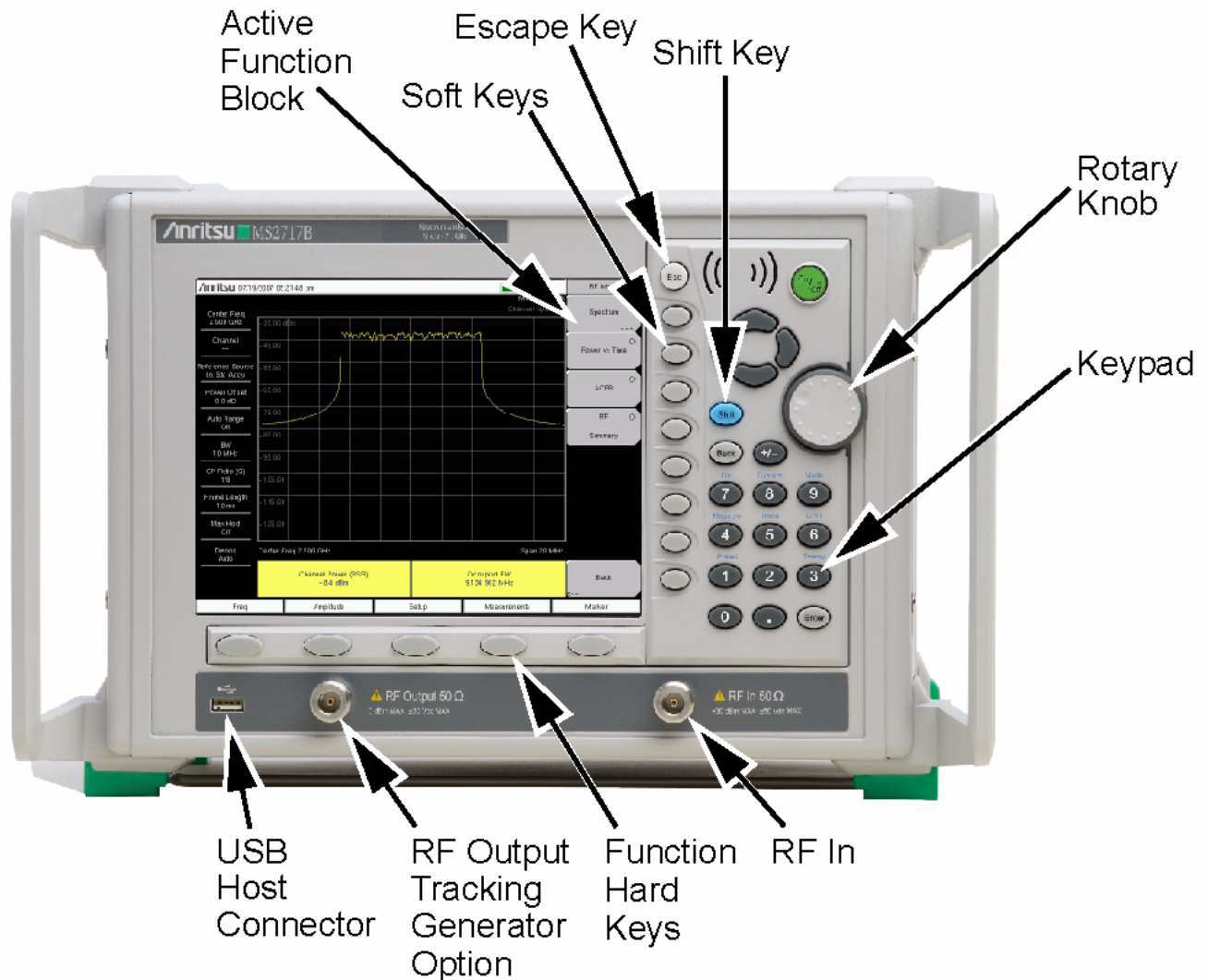
Figure 2-3.   MS271xB Overview

Figure 2-3 shows model MS2717B with the Tracking Generator option, which includes a type N(f) RF Output connector. In all models without the Tracking Generator option, the type N(f) RF input connector is located on the left side of the instrument (in the same location as shown for the Tracking Generator RF Output type N(f) connector), and the right side of the lower panel is blank.

Front Panel Keys and Connectors

The term hard key refers to all of the buttons on the instrument face except for the vertical row of gray buttons adjacent to the measurement display. The eight vertically arranged gray buttons are called soft keys, and they are used to activate virtual soft key buttons within the measurement display screen (as shown in Figure 2-3 as the active function block).

Esc Key

Pressing this key cancels any setting that is currently being made.

Enter Key

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

Arrow Keys

The four arrow keys (between the rotary knob and the **Esc** key) are used to scroll up, down, left, or right. The arrow keys can often be used to change a value or to change a selection from a list. This function is similar to the function of the rotary knob. In some measurement modes, the **Left/Right** arrow keys change values in increments that differ from the increment changes that are produced by the **Up/Down** arrow keys (refer to "Reference Level" on page 3-2). The arrow keys are also used to move markers.

Shift Key

Pressing the **Shift** key and then one of eight number keys executes the function that is indicated in blue text above the number key. When the **Shift** key is active, its icon is displayed in the upper right of the measurement display area.

11/10/2005 01:46:42 p.m.   Shift
                    Continuous   Measuring
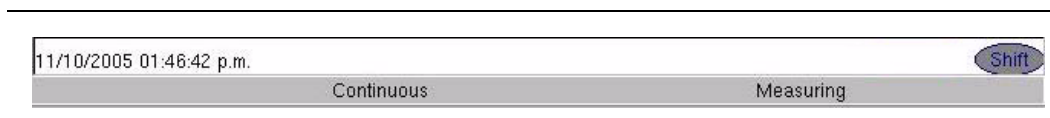
Figure 2-4.   Shift Key Icon at Top of Display

Back Key

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

Code (+/-) Key

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

Number Keypad

These keys are used to directly input numbers. The eight dual-purpose keys provide additional functions when used with the **Shift** key (refer to "Shift Key").

Rotary Knob

Turning the rotary knob changes numerical values, scrolls through selectable items from a list, and moves markers. Values or items may be within a dialog box or an edit window.

Pressing this knob finalizes the input function in the same manner as pressing the **Enter** key.

Function Hard Keys

The five function hard keys are horizontally arranged adjacent to the measurement display screen along the lower edge. These buttons have no labels. As with the soft keys, they are positioned to accompany virtual key labels that are displayed to match specific instrument Mode settings. Each Mode has a specific set of Function Hard Keys. For details about the Mode settings, refer to Section 3-9, "Mode" on page 3-26 in Chapter 3, "Key Functions".

RF In Connector

The front-mounted RF In connector is a 50 Ω Type-N female connector.

USB Interface - Type A

The MS271xB ships with a 2 GB USB Flash device (Anritsu Part Number 2000-1520-R) for trace and setup storage via the USB Type A interface. Data can be stored directly to the USB device by pressing **Shift - File** (7), then the Directory Management soft key, and pressing the Current Location soft key until USB is underlined.

Soft Keys

These eight gray keys have no labels. They are arranged adjacent to the measurement display screen along the right-hand edge. They are positioned to accompany virtual soft key labels that are displayed to match instrument modes and measurement functions. These soft key labels (also called the Active Function Block) change as instrument measurement settings change. The following soft key descriptions describe how these keys are used.

2-3   Soft Key Types

Select Soft Key

A **Select** soft key has a small circle in the upper-right corner of the virtual key face and is used to select the function or item that is displayed on the virtual soft key label. When not selected, the circle is gray. When selected, the circle is red to indicate that the function is active.

Press the key to make the selection. Press a different key to make a different selection.

A **Select** soft key may also be a **Switching** soft key. These keys show both a gray circle and an arrow mark (-->).

A **Select** soft key may change to a **Switching** soft key when active. These keys show only the gray circle when not active, but show the arrow mark as well as the red circle when active. For more information on switching functions, refer to "Switching Soft Key".

Input Soft Key

An **Input** soft key is used to select an item or a value. This type of soft key displays the setting parameter and the setting value on the virtual key face. When the key is pressed, a select box or edit box may open on the display screen, or the key face may turn a darker gray color to show that the setting is being made. At any time before finalizing the input, press the **Esc** key to abort the change and retain the previously existing setting.

To set or select an item or a value, use the number keys, the arrow keys, or the rotary knob. Press the rotary knob or the **Enter** key to finalize data input. If a value is being selected or entered, then the soft key Active Function Block may change to provide one or more soft keys for units, such a Hz or dB. Pressing a unit soft key sometimes finalizes the data input in the same manner as pressing the **Enter** key. If more than one unit key is displayed, then pressing the **Enter** key without first pressing a unit key selects a specific unit by default. For an example, refer to "Center Frequency" on page 3-11.

With some functions, only a specific set of values are valid. When scrolling with the **Up/Down** or **Left/Right** arrow keys or the rotary knob, only valid values are offered. If different values are set with the number keypad, then those values might not be accepted. Even if different values are accepted on the soft key face, the values may not be valid for the selected measurement.

Toggle Soft Key

A **Toggle** soft key displays the setup item and the toggle states. Toggle states may be On and Off or may be a selection of types or values, such as: 50 ohms, 75 ohms, Other.

Each press of the **Toggle** soft key moves the selection to the next value or item in sequence. The selected item or value is underlined on the virtual key face.

Switching Soft Key

A **Switching** soft key is used to open an additional soft key menu, and it has an arrow mark (-->) in the lower-right corner of the virtual key face.

Some **Select** soft keys become **Switching** soft keys after being pressed (after becoming active). These keys do not display the arrow mark until their circle is red. An additional press, after the circle is red and the arrow mark is displayed, opens the additional soft key menu. Refer to "Select Soft Key".

The **Switching** soft key that is labeled More opens a similar menu with additional soft key functions. The **Switching** soft key that is labeled Back returns to a previous soft key menu. The Back key has the arrow mark (<--) in the lower-left corner of the virtual key face.

2-4   Common Operations

Parameter Setting

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

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

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

Text Entry

When entering text (as when saving a measurement), the soft key menu for Text Entry displays the characters (alphabet, hyphen, and underscore) in six letters per soft key. Characters can be entered by using the rotary knob or by using the soft keys.

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

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

Use the arrow keys to navigate within a name or character string. Use the **Shift** key for capital letters. Press the **Enter** key or the rotary knob to finalize a text entry. For examples of entering text, refer to Figure 2-5, Figure 2-6, and Figure 2-7.
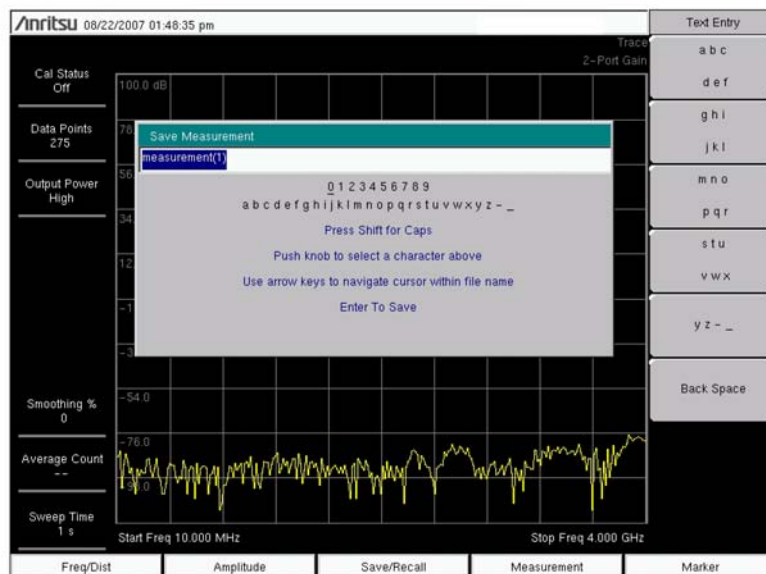
Figure 2-5.   Text Entry Menu – Lower Case
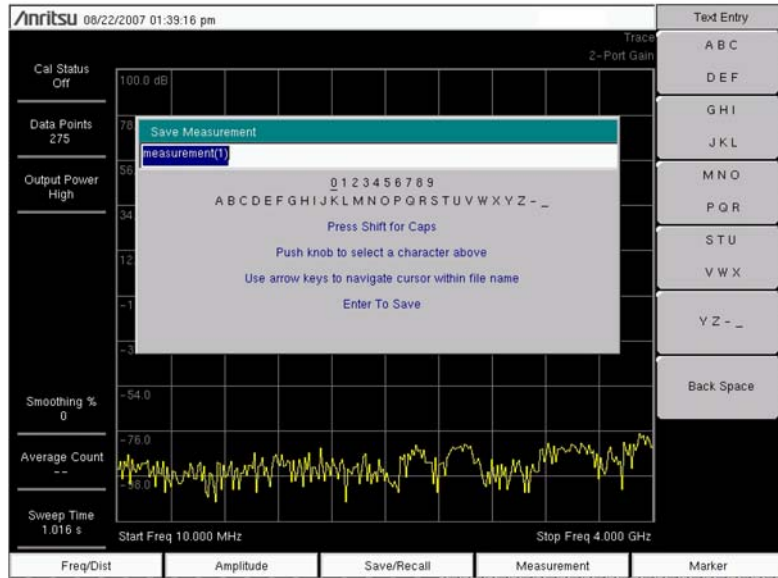
Figure 2-6. Text Entry Menu – Upper Case

Rotary Knob has scrolled to letter "h"
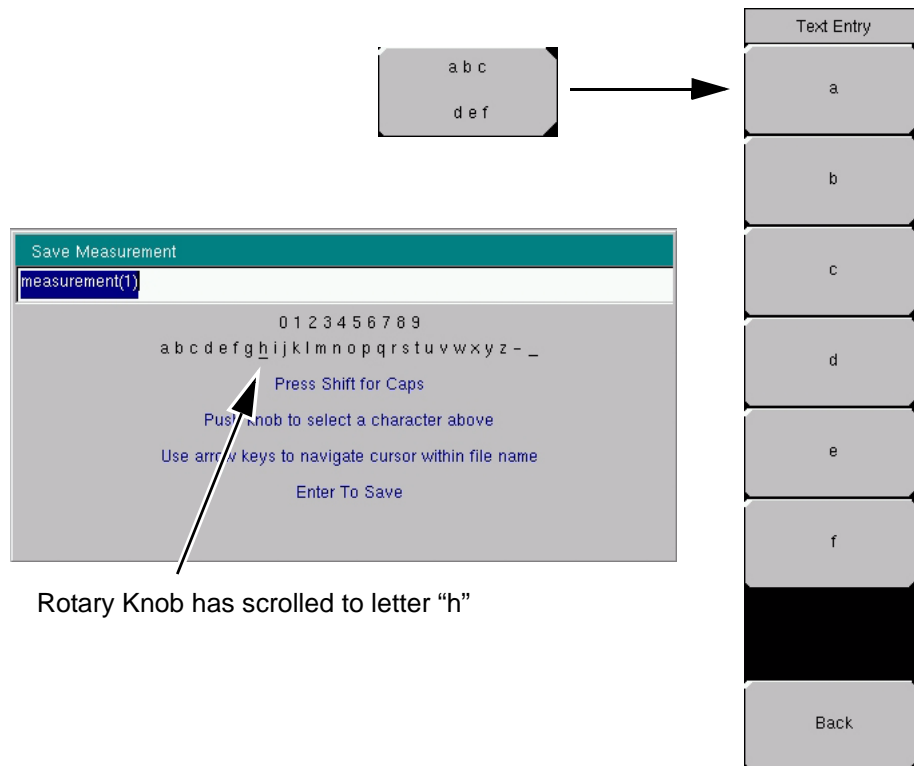
Figure 2-7. Text Entry Menu – Selecting Characters

2-5   Display Overview

Figure 2-8 illustrates some of the main information areas of the MS271xB Spectrum Analyzer display. For detailed key descriptions, refer to Chapter 3, "Key Functions".
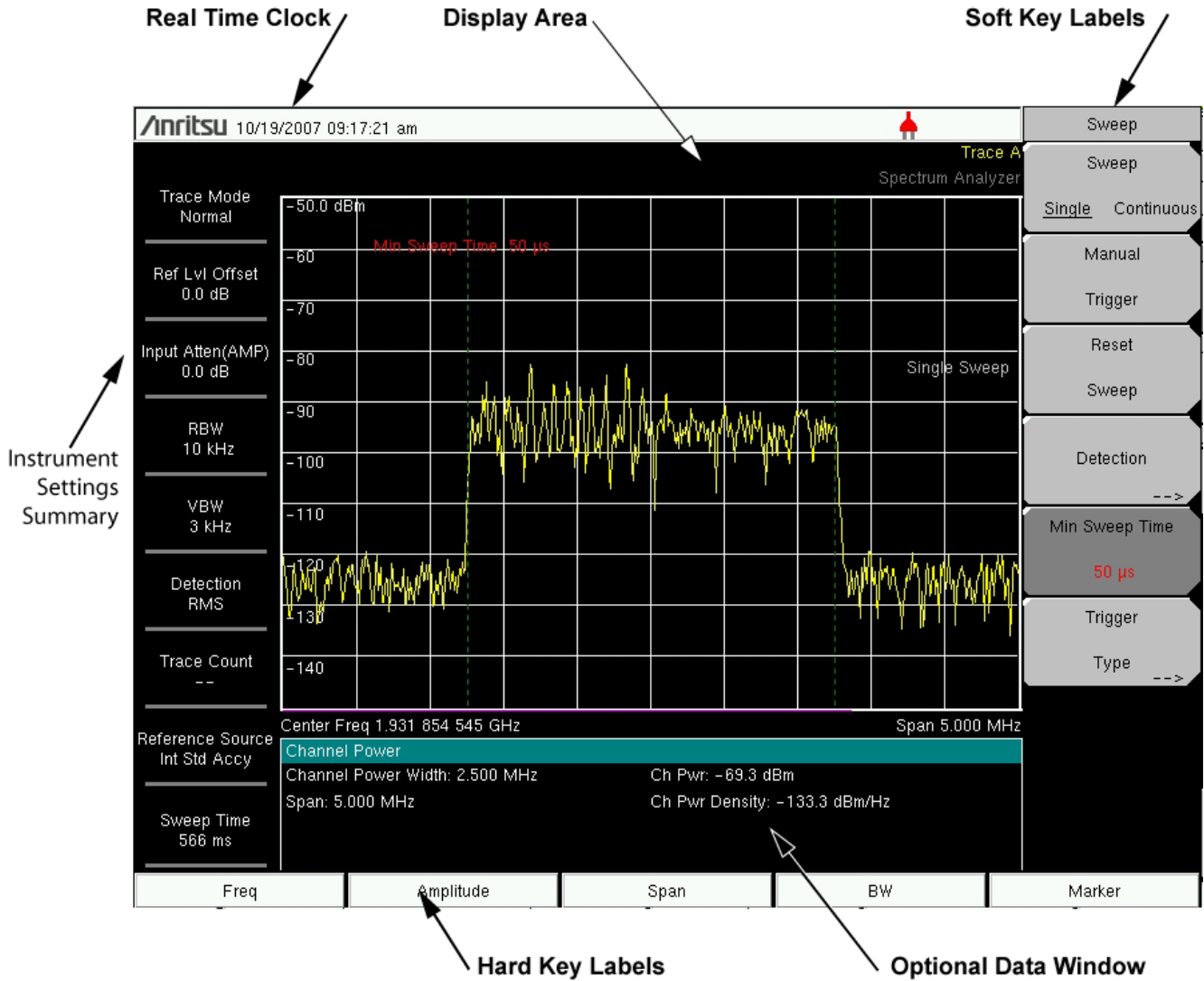
Figure 2-8.   Display Overview

2-6   Rear Panel Connectors

Rear Panel Connectors

The connectors and indicators located on the rear panel are labeled and shown in Figure 2-9.
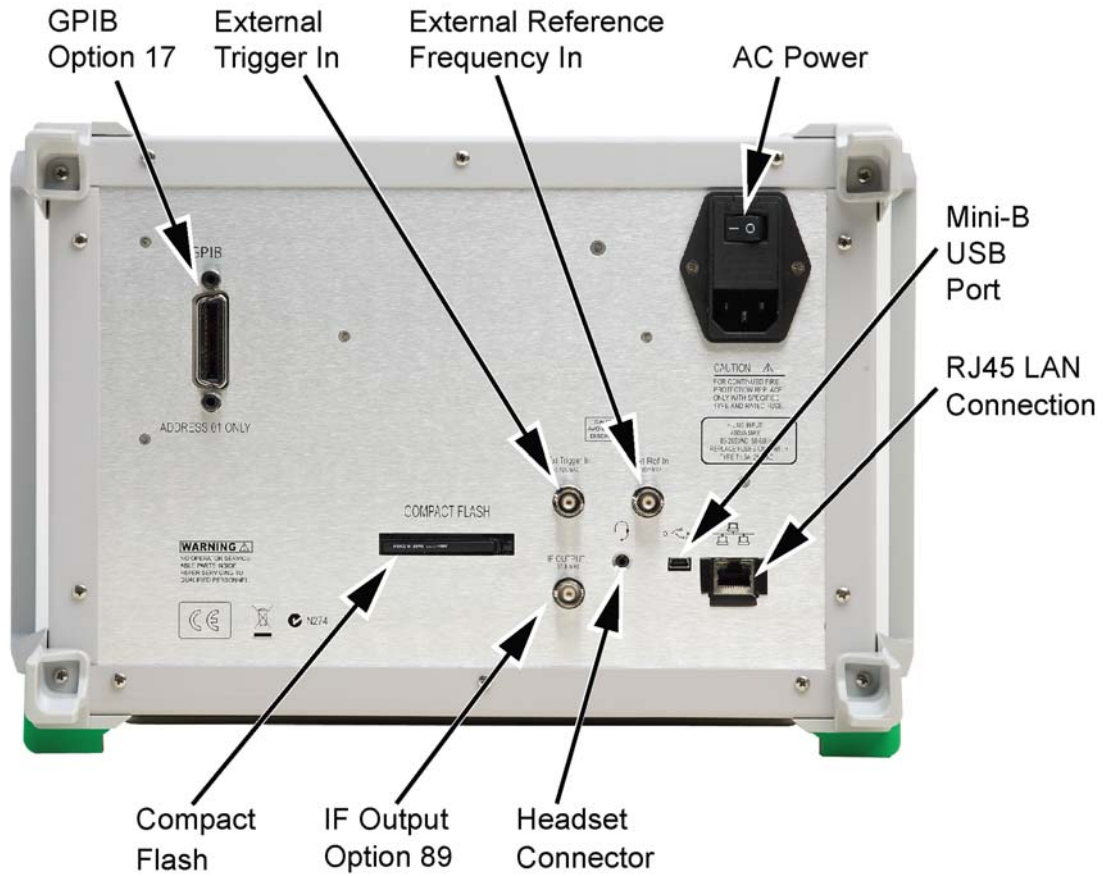
Figure 2-9.   Rear Panel Connectors

Caution	When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, then use a conversion adapter and ground the green (grounding) wire. If power is supplied without grounding the equipment, then a risk exists for receiving a severe or fatal electric shock. The MS271xB is equipped with automatic line-power sensing and will operate with line voltages from 90 V to 250 VAC, at 50-60 Hz, 400 VA maximum.

LAN Connection

The RJ-45 connector is used to connect the MS271xB to a local area network. Integrated into this connector are two LEDs. The amber LED indicates the presence of LAN voltages and a live LAN connection. The green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key, followed by the System Options soft key and the Ethernet Config soft key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired static IP address, gateway address, and subnet mask.

Note	An active Ethernet cable must be connected to the MS271xB before it is turned ON in order to enable the Ethernet port for DHCP or for a static IP address. Depending upon local conditions, the port may remain enabled when changing from DHCP to static IP address, when changing from static IP address to DHCP, or when temporarily disconnecting the Ethernet cable. If the port becomes disabled, then ensure that an active Ethernet cable is attached to the MS271xB before cycling the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the MS271xB to the network and select DHCP protocol in the Ethernet Config menu. Turn the MS271xB OFF and then ON. If the network is set up for DHCP, then the assigned IP address is displayed briefly after the power up sequence.

To display the IP address with the instrument on, press the **Shift** key, then the **System** (8) key, then the System Options soft key and the Ethernet Config soft key. The IP address is displayed as shown in Figure 2-10.
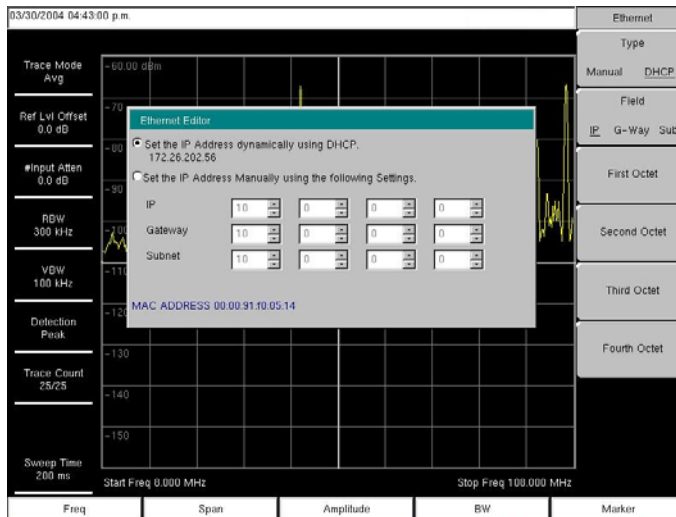
Figure 2-10.   IP Address Assigned Using DHCP

More About DHCP

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

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

Note	The MS271xB must be connected to the network *before* it is turned on in order for DHCP to work. Key elements of the DHCP lease are performed only during the instrument startup operations, or when switching from manual to DHCP.

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

When using a Static IP address on an established network, always request a Static IP address from the network administrator. Randomly choosing a Static IP address on an established network may result in duplicate IP addresses or other conflicts. Three parameters must be set prior to using a Static IP address:

IP Address

This is the Static IP address on the network.

Default Gateway

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

Subnet Mask

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

Example 1

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

```
IP Address: 10.0.0.2
Default Gateway: 10.0.0.2
Subnet Mask: 255.255.0.0
```

Example 2

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

```
IP Address: 153.56.100.42
Default Gateway: 153.56.100.1
Subnet Mask: 255.255.252.0
```

Ipconfig Tool

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

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

```
Y:\>ipconfig
Windows 2000 IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix. : us.anritsu.com
IP Address. . . . . . . . . . . : 172.26.202.172
Subnet Mask . . . . . . . . . . : 255.255.252.0
Default Gateway . . . . . . . . : 172.26.200.1
```

Ping Tool

Another tool that can find out if a selected IP address is already on the network is ping. Ping is a quick way to determine if an address is found on the network and, if it is found, for it to reply. Greatly simplified, ping sends out a request to a specific address to determine if a connection exists. If a device is found, then it will respond by sending back what was sent to it. If it is not found, then the response will be "request timed out" meaning that no reply was received from that IP address.

```
Y:\>ping 172.26.202.172
Pinging 172.26.202.172 with 32 bytes of data:
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Reply from 172.26.202.172: bytes=32 time<10ms TTL=128
Ping statistics for 172.26.202.172:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

USB Interface – Type Mini-B

The USB 2.0 interface can be used to connect the MS271xB directly to a PC via the smaller Type Mini-B connector. The first time that the MS271xB is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM that is shipped with the instrument contains a driver for Windows 2000 and for Windows XP that is installed when Master Software Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

Cellular Headset Jack

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

Ext Trigger

A TTL signal applied to the External Trigger female BNC input connector causes a single sweep to occur. This mode is used in zero span, and triggering occurs on the rising edge of the signal. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives.

Ext Freq Ref

This is a BNC female connector for connection of an external frequency reference or external trigger. Press the Ext Ref Freq soft key under the System menu in order to select the frequency of the external reference from the list that is presented. Valid frequencies are in the following list at an amplitude from −10 dBm to +10 dBm:

- 1 MHz
- 1.2288 MHz
- 1.544 MHz
- 2.4576 MHz
- 4.8 MHz
- 4.9152 MHz
- 5 MHz
- 9.8304 MHz
- 10 MHz
- 13 MHz
- 19.6608 MHz

Compact Flash

The MS271xB is shipped with a 512 MB Compact Flash Memory Module, Anritsu Part Number 3-2000-15670. The removable compact flash card can be up to 512 MB, although it must be a minimum of 256 MB in order to be able to hold the entire contents of the internal flash memory.

GPIB Connector (Option 017)

Option 17 adds a GPIB interface to the MS2717B, MS2718B, or MS2719B. The Anritsu implementation for GPIB uses a third-party adapter into an internal USB "B" port. The available SCPI commands are unchanged from what has been available over Ethernet. The GPIB address is fixed at 01, and cannot be changed.

IF Output Connector (Option 089, MS2718B and MS2719B only)

Option 89 provides an IF signal at a center frequency of 37.8 MHz out of a BNC female connector when the instrument span is set to zero span. The user can select the three extra-wide IF bandwidths of 16 MHz, 10 MHz, and 7 MHz. The output level of the IF signal ranges from −20 dBm to −45 dBm for a full-scale signal on the Spectrum Analyzer display. This option applies only to the MS2718B and MS2719B Economy Microwave Spectrum Analyzers.

2-7   Making Spectrum Analyzer Measurements

Required Equipment

- MS271xB Economy Microwave Spectrum Analyzer
- Optionally, an appropriate RF signal generator

Making a Measurement

To make a measurement, locate and display the signals of interest by selecting the desired frequency, span, and amplitude value, as explained below.

Note	In most cases, information and parameters can be entered into the MS271xB through the keypad, the directional arrows, or the rotary knob. The numerical keypad enters the information directly. The **Up** and **Down** arrow keys change a frequency parameter by the value that is entered through the Freq Step soft key (default value is 1 MHz). The **Left** and **Right** arrow keys change the frequency parameter by one graticule (that is, by one-tenth of the total span). The rotary knob changes the frequency parameter by one pixel per step. In normal mode, the screen size is 551 pixels across. Choose whichever method is most convenient to enter the required information.

1. Connect the input signal or antenna to the RF In test port.
2. Press the **Freq** key to display the Frequency menu.
3. To enter a center frequency, press the Center Freq soft key and enter the desired center frequency.
4. To set a specific frequency band, press the Start Freq soft key and enter the desired start frequency. Then press the Stop Freq soft key and enter the desired stop frequency.
5. Press the **Span** key to display the Span menu and to enter the span. For a full span, press the Full Span soft key. Selecting a full span will override any previously set Start and Stop frequencies. For a single frequency measurement, press the Zero Span soft key.

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

Setting the Amplitude

1. Press the **Amplitude** key.

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

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

Note	Press the Amplitude soft key and select Auto Atten coupling of the attenuator setting and the reference level to help ensure that harmonics and spurs are not introduced into the measurements. For more information, refer to Section 4-5, "Attenuator Functions" on page 4-2 in Chapter 4, "Measurement Fundamentals".

Selecting a Signal Standard

Selecting a signal standard sets the center frequency, channel spacing, integration bandwidth, and span for the first channel of the selected standard. For a table listing of the signal standards that are available in the instrument, refer to Appendix A, "Signal Standards".

To select a signal standard:

1. Press the **Freq** key to display the Frequency menu.

2. Press the Signal Standard soft key and use the **Up/Down** arrow keys or the rotary knob to highlight the desired signal standard. Press **Enter** to select the highlighted signal standard.

3. Press the Channel# soft key to choose the required channel. By default, if a channel number has not yet been entered, then the lowest channel number for that standard is automatically selected. The channel numbers that can be selected correspond to the channel numbering schemes of the various signal standards.

Setting Bandwidth Parameters

Both resolution bandwidth (RBW) and video bandwidth (VBW) can be automatically or manually coupled to the frequency span. That is, the wider the span, the wider the RBW. The ratio of the span width to the resolution bandwidth is 300:1 by default and, if necessary, can be changed as follows:

1. Press the BW key.

2. Press the Span/RBW soft key. The current Span/RBW ratio is shown as part of the soft key label. Change the value using the keypad, the directional arrows, or the rotary knob.

When auto coupling between the span and the RBW is selected, it is indicated on the left side of the display as RBW XXX, where XXX is the bandwidth value. If manual RBW coupling is selected, then a "#" is shown in front of RBW on the left side of the display, and the resolution bandwidth can be adjusted independently of the span. If a non-existent resolution bandwidth is entered, then the instrument will select the next higher resolution bandwidth. If a value greater than the widest RBW is entered, then the widest RBW will be selected.

Auto coupling of the VBW links the video bandwidth to the resolution bandwidth, so that the wider the RBW, the wider the VBW. Auto coupling is indicated on the left side of the display as VBW XXX. If manual VBW coupling is selected, then a "#" (keypad number symbol) is shown in front of VBW on the left side of the display, and the video bandwidth can be adjusted independently of the RBW. If a non-existent video bandwidth is entered, then the instrument will select the next higher video bandwidth. If a value greater than the widest VBW is entered, then the widest VBW will be selected.

The ratio of the resolution bandwidth to the video bandwidth can be changed by pressing the **BW** key, the RBW/VBW soft key, and then using the keypad, the directional arrows, or the rotary knob to set the ratio. The current value of the ratio is shown as part of the soft key label.

Setting Sweep Parameters

To set the sweep parameters, press the **Shift** key and then the **Sweep** (3) key.

Single/Continuous

When this soft key is pressed, the instrument toggles between Single sweep and Continuous sweep. In single sweep mode, after the sweep the instrument waits in Hold mode until the Manual Trigger soft key is pressed or until another triggering mode is selected.

Trigger Type

To select a specific type of triggering, press the Trigger Type soft key. Selections are:

Free Run

Free Run is the default trigger type, in which the instrument begins another sweep as soon as one is finished.

External

A TTL signal applied to the External Trigger BNC input connector causes a single sweep to occur. This mode is used in zero span, and triggering occurs on the rising edge of the signal. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives.

Video

This mode is used in zero span to set the power level at which a sweep is initiated. The power level can be set from −130 dBm to +20 dBm. Trigger is based upon the measured signal level. If no signal reaches or exceeds the trigger level, then no trace appears on the screen.

Change Trigger Position

This soft key is used in conjunction with video triggering in order to set the horizontal position on the display where a signal that meets the video triggering criterion will be placed. The value can be from 0% to 100%. Zero percent places the triggering event at the left edge of the screen, and 100% places the triggering at the right edge of the screen. When the trigger position is any value other than 0%, the portion of the trace before the trigger event is displayed very quickly because the trace data is stored in memory. The portion of the trace that occurs after the trigger point is painted on the screen at the normal rate as the signal is swept.

Chapter 3 — Key Functions

3-1 Introduction

This chapter describes the Spectrum Analyzer keys and how to use them. The major key sections are arranged in alphabetical order with soft key menus (that are under those key selections) listed in the order in which they appear on the instrument, from top to bottom.

Five hard keys are located below the display and are used to initiate function-specific menus of:

- Amplitude
- Bandwidth
- Frequency
- Marker
- Span

A rotary knob and 21 hard keys are located to the right of the display. Eight of the hard keys are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself. The alternate function is printed on the panel above the key. Use the **Shift** key to access the functions printed on the panel. The **Esc** key (used for aborting data entry) is the round button located above the soft keys. The rotary knob and the keypad can both be used to change the value of an active parameter.

Eight soft keys are located to the right of the display. Their functions change depending upon the current menu selection. The current soft key function is indicated in the active function block on the right edge of the display.

3-2   Amplitude Menu

The Amplitude hard key is located below the display. The Amplitude menu soft keys are shown in Figure 3-1:
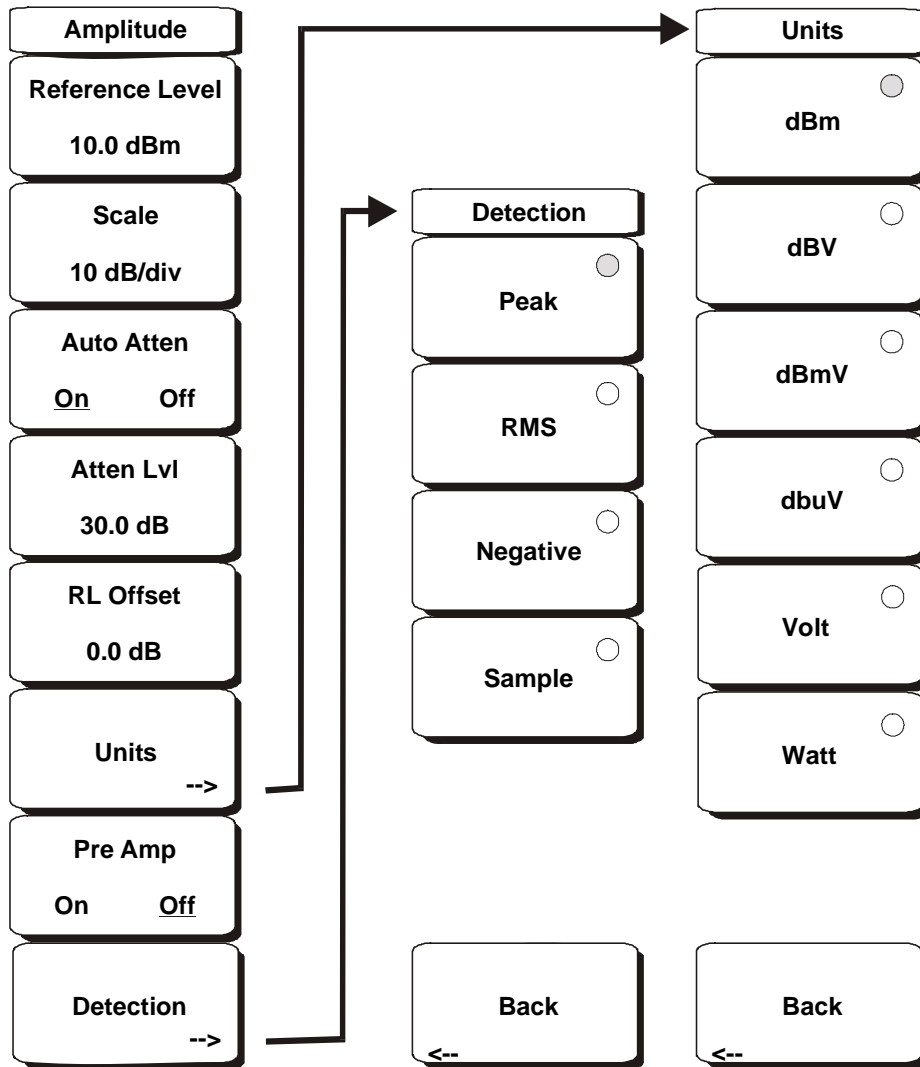
Figure 3-1.   Amplitude Menu Soft Keys

Reference Level

The reference level is the top graticule line on the display, and can be set from +30 dBm to –130 dBm. A signed value may be entered from the key pad by using the ± key as the minus sign. After entering the value, press the dBm soft key or the **Enter** key. The **Up/Down** arrow keys change the reference level in 10 dB steps, and the **Left/Right** arrow keys change the value by 1 dB. The rotary knob changes the value by 0.1 dB per detent.

The reference level value may be modified by the reference level offset value, which is discussed later in this chapter.

Scale

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

Auto Atten On/Off

Input attenuation can be either tied to the reference level (On) or manually selected (Off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected in order to make sure that the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required.

Atten Lvl

Input attenuation can be set from 0 dB to 65 dB, in 5 dB steps. Press this soft key and use the keypad, the rotary knob, or the **Up/Down** arrow keys to change the attenuation value. When the Preamplifier is turned on, the allowed attenuation settings are 0 dB and 10 dB.

RL Offset

Reference Level Offset compensates for the presence of input attenuation or gain that is external to the instrument. Enter a positive value to compensate for an external amplifier, or enter a negative value to compensate for an external attenuator. Use the ± key to enter the negative sign when a negative attenuation value is being entered.

Units

Press the appropriate soft key to select the display units from the soft key menu. Press the Back soft key to return to the **Amplitude** menu.

Pre Amp On/Off

This soft key turns the low-noise front-end preamplifier on or off. The preamplifier lowers the noise floor by approximately 25 dB. To assure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than -50 dBm.

Detection

Several detection methods tailor the performance of the instrument to meet specific measurement requirements. In general, more points are measured across the screen than are displayed. The various detection methods are different ways of dealing with selecting which measurement point will be shown at each display point. Display methods (such as Max Hold and Min Hold) are described in the "Trace Menu" on page 3-36.

Peak

This method causes the largest measurement point to be shown for each display point, and assures that a narrow peak is not missed.

RMS

This method performs a root-mean-square calculation of all the measurement points in each display point, and is particularly useful in displaying the average value of noise.

Negative

This method causes the smallest measurement point to be shown for each display point. Typically, this mode is used to help detect small discrete signals in the presence of nearly equal values of noise. The display points that contain only noise tend to show lower amplitudes than those that contain discrete signals.

Sample

This is frequently the fastest detection method because, for each display point, only one frequency point is measured. Use this method when speed is of paramount importance, and the possibility of missing a narrow peak is not important.

Quasi-peak

When this selection is made, resolution bandwidths and video bandwidths of 220 Hz, 9 kHz, and 120 kHz are available. This detection method is designed to meet CISPR requirements.

Quasi-peak is not available when the analyzer is set to Zero Span.

Back

Returns to the previous menu.

3-3   BW (Bandwidth) Menu

The **BW** hard key is located below the display. The BW menu soft keys are:

```
┌──────────────┐
│      BW      │
├──────────────┤
│     RBW      │
│    3 MHz     │
├──────────────┤
│   Auto RBW   │
│  On     Off  │
├──────────────┤
│     VBW      │
│    1 MHz     │
├──────────────┤
│   Auto VBW   │
│  On     Off  │
├──────────────┤
│   RBW/VBW    │
│      3       │
├──────────────┤
│   Span/RBW   │
│     300      │
└──────────────┘
```
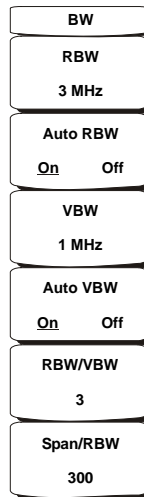
Figure 3-2.   BW Menu Soft Keys

RBW

The current resolution bandwidth value is displayed by pressing this soft key. The RBW can be changed using the keypad, the **Up/Down** arrow keys, or the rotary knob. The range is 1 Hz to 3 MHz in a 1-3-10 sequence, from 10 Hz to 30 Hz to 100 Hz, and so on.

Auto RBW

When Auto RBW is On, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified by pressing the Span/RBW soft key. When the quasi-peak detector is selected, the RBW/VBW ratio is set to Auto, and the ratio is changed to 1.

VBW

The current video bandwidth value is displayed by pressing this soft key. The VBW can be changed by using the keypad, the **Up/Down** arrow keys, or the rotary knob. The range is 1 Hz to 3 MHz in a 1-3-10 sequence.

Auto VBW

When Auto VBW is On, the instrument selects the video bandwidth based upon the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set by pressing the RBW/VBW soft key.

RBW/VBW

Pressing this soft key displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, press this soft key and use the keypad, the **Up/Down** arrow keys, or the rotary knob to select a new ratio. The default ratio is 3. When the quasi-peak detector is selected, the RBW/VBW ratio is changed to 1.

Span/RBW

Pressing this soft key displays the ratio between the span width and the resolution bandwidth. The default value is 300, meaning that the span width is approximately 300 times the resolution bandwidth. The value is approximate because resolution bandwidth filters come in discrete steps while span width can be set to any value up to the upper frequency limit. To change the ratio, press this soft key and use the keypad, the **Up/Down** arrow keys, or the rotary knob to select a new ratio.

3-4   File Menu

To access the functions under the File menu, press the **Shift** key, then the **File** (7) key. The File menu soft keys are shown in Figure 3-3:
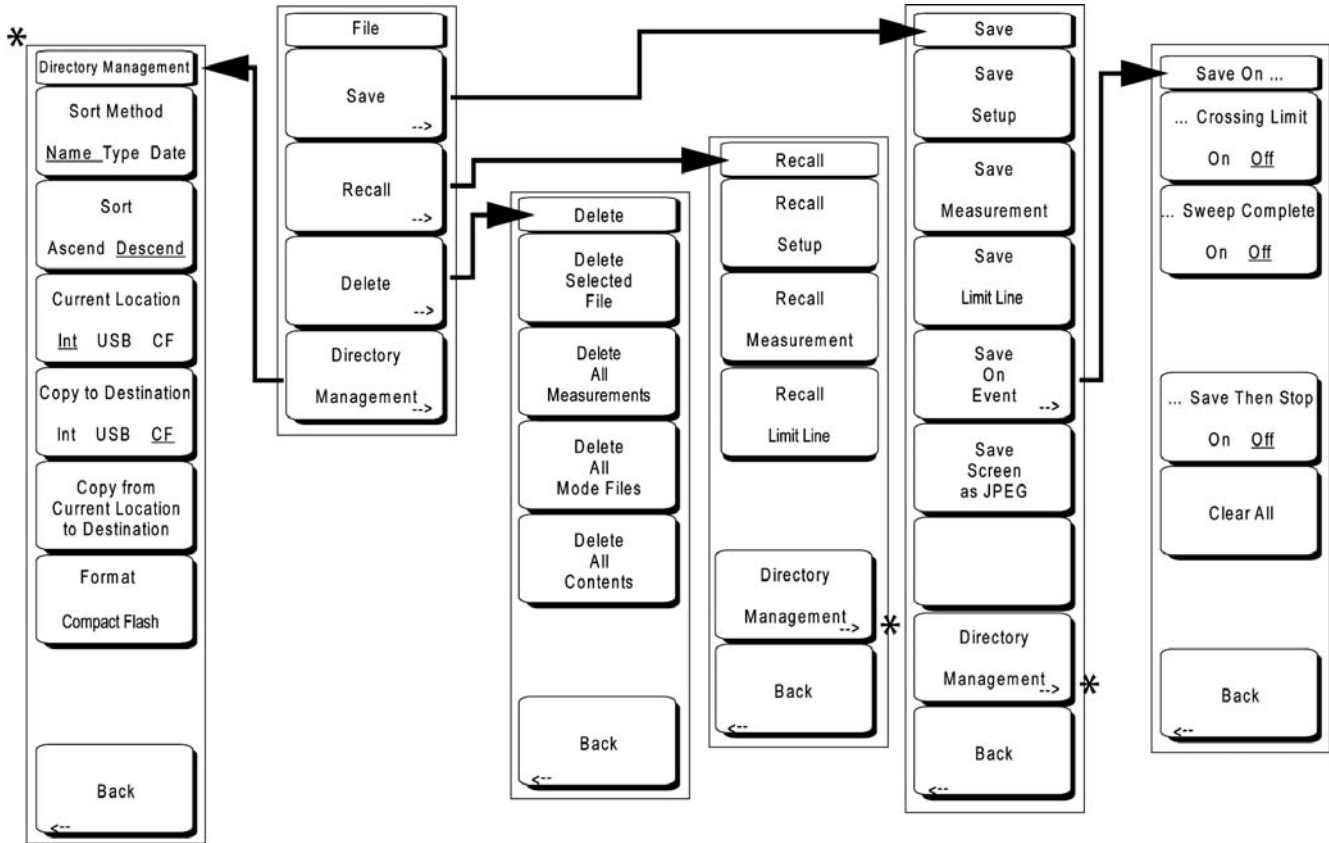
Figure 3-3.   File Menu Soft Keys

Save

Measurements may be saved to the internal memory, to an external Type-1 Compact Flash module, or to a USB Flash Drive. Anritsu recommends saving to external storage if a large number of measurements are to be saved. The Spectrum Analyzer is shipped with a Compact Flash module and a USB Flash Drive. In order to hold the entire contents of the internal memory, external memory devices must be at least 256 MB. Compact Flash modules greater than 512 MB storage capacity may not function properly.

For information on external memory part numbers, refer to Section 1-3, "MS271xB Options and Accessories" on page 1-2 in Chapter 1, "General Information".

Save Setup

Pressing this soft key opens a dialog box that is used to name and to save the current operating settings, allowing them to be recalled later to return the instrument to the state that it was in at the time that the setup was saved. The saved setup can be named by using the keypad to select numbers, by using the rotary knob to highlight a number or character, and by pressing the rotary knob to select each letter (or by selecting the soft key for each letter). Use the **Shift** key to select an upper case letter. Use the **Left/ Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement

Pressing this soft key initiates a dialog box to name and save measurement data for all three current trace locations: A, B, and C. The saved measurement can be named by using the keypad to select numbers, by using the rotary knob to highlight a number or character, and by pressing the knob to select each letter (or by selecting the soft key for each letter). Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement trace. Measurements are saved in a directory called `/usr` on the Compact Flash memory module or on the USB Flash Drive.

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

Table 3-1. SPA File Storage on Compact Flash Modules

Memory Size	Approximate # of SPA Files Stored
256 MB	8900
512 MB	17800

Save On Event…

The instrument can be configured to automatically save a measurement if a selected condition is satisfied. As measurements are saved, an on-screen message indicates approximately how many more files can be saved. Over 3000 Spectrum Analyzer measurements can be saved before the internal memory is full. The number of measurements that can be stored in the Compact Flash memory depends on the size of the memory module. When measurements are saved, they are saved into subdirectories that are automatically created in the `/usr` subdirectory. The names are based upon the date and time. Each subdirectory can contain a maximum of 1000 measurements.

… Crossing Limit On/Off

When Crossing Limit is On, and an upper or lower limit line is set, if any point in a measurement exceeds either the upper or lower limit line, then the measurement is automatically saved at the end of the sweep. The saved measurement is named "LIM" followed by the date and time in the format: `LIMyyyymmddhhmmss`. The time value in the file name will generally be slightly earlier than the measurement time stamp shown in the file list, because the file name is created at the time that the limit violation is noted, and the time stamp is the time at which the measurement file is actually saved.

If a limit line has not been set, then selecting this soft key results in the on-screen message: "You must have a limit ON first."

… Sweep Complete On/Off

When Sweep Complete is On, the measurement is automatically saved at the end of a sweep. This is particularly useful for very slow sweeps. The saved measurement is named "EOS" with a file name in the format: `EOSyyyymmddhhmmss`.

Save Then Stop On/Off

When the Save Then Stop soft key is set to On, the instrument saves just one measurement when the Crossing Limit or Sweep Complete soft keys are set to On, and when the qualifying event occurs. Sweeping stops after a measurement is saved. If it is set to Off, then sweeping continues after a measurement is saved, and more measurements may be saved. The default for this selection is Off.

Note	This feature should be used with care. With Save Then Stop set to Off (the default), a large number of measurements can be saved when the Crossing Limit or Sweep Complete soft keys are set to On, making it time-consuming to retrieve saved measurements or to delete unwanted measurements. When many saved measurements exist, the time required to display a file list can be several minutes. When it is necessary to save many measurements, it is best to save them to the memory module, and then read them directly into a computer.

Clear All

Pressing this soft key turns off both save-on-event conditions and sets Save then Stop to Off, which is the default state.

Back

The Back key returns to the previous menu.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named by using the keypad to select numbers, the rotary knob to highlight a number or character, and by pressing the rotary knob to select (or by pressing the soft key for each letter). Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with `.jpg` appended.

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

Directory Management

For information on the Directory Management soft key, refer to .

Back

The Back key returns to the previous menu.

Recall

This soft key opens the Recall options menu.

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter** key, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

Recall Measurement

This soft key opens a selection box that allows recall of a previously stored measurement from the currently selected storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved measurement trace, and press **Enter**, the rotary knob, or the Recall soft key to select.

The recalled traces A, B, and C will be shown as information-only traces, along with the live traces currently on the display. The name of the recalled measurement, along with the setup information for each of its traces, is displayed in the area below the graph.

Press the **Shift** key and the **Trace** (5) key to access operations concerning the recalled traces. The recalled traces can be viewed or blanked, cleared completely from memory, or moved into live trace locations to be used for trace math and marker operations.

Directory Management

For information on the Directory Management soft key, refer to .

Delete

Opens a selection box that shows the first 1000 stored setups and traces that are in the currently selected location (refer to). The list shows the setup and measurement names, the type (`stp` for a saved setup, spa for a saved trace, `jpg` for a JPEG file), and the date and time that the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file to be deleted, and press **Enter**, or press the Delete soft key to delete. Press the **Esc** key to cancel the operation. Note that no mechanism exists to retrieve deleted files.

Delete Selected File

Use the **Up/Down** arrow keys or the rotary knob to select the file that is to be deleted. Press **Enter** to confirm that you want to delete the file, or press **Esc** to exit without deleting.

Delete ALL Measurements

Deletes all measurements of the current mode in the currently selected storage location. The memory from which measurements will be deleted is set in the Directory Management menu and is the Current Location.

Delete ALL Mode Files

Deletes all measurements of the type saved in the current operating mode of the instrument. In addition, all jpg and setup files (regardless of the mode) are deleted.

Delete ALL Contents

Deletes all measurements, jpg files, and setup files of all measurement types. All contents of external devices are deleted (CF and USB memory). For internal memory, all user files are deleted. Use with caution.

Back

The Back key returns to the previous menu.

Directory Management

This soft key opens the Directory Management menu. Note that the Directory Management menu is available from both the Recall and Save menus.

Sort Method Name Type Date

File lists can be sorted by the name of the file, the type of file (SPA file, STP file, and so forth) or by the date that the file was saved.

Sort Ascending Descending

Selects whether the selected sort is from lowest to highest (ascending) or from highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort).

Current Location Int USB CF

This choice lets you select where measurements and setups will be saved. Pressing the soft key toggles between storing files on the internal memory, USB flash drive, or a Compact Flash memory module. The "current location" and the "copy to destination" may not be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location. Units with Option 7, Secure Data Operation, will not allow the Int selection for Current Location.

Copy to Destination Int USB CF

This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, then the current location is automatically changed if the current location is the same as the selected copy to destination. Units with Option 7, Secure Data Operation, will not allow the Int selection for Copy to Destination.

Copy From Current Location To Destination

Pressing this soft key causes all measurements, setups, and jpg files that are stored in the user selected "current location" to be copied to the "copy to destination". If no storage module is installed in the instrument, then an error message is displayed.

Format Compact Flash

This selection erases all files that are stored on an installed Compact Flash module. A message is displayed warning that all files will be erased. Press **Enter** to confirm that you want to erase, or press **Esc** to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups, and jpg files.

Back

The Back key returns to the previous menu.

3-5   Freq (Frequency) Menu

The tuning frequency range for the MS271xB Spectrum Analyzer can be entered in several different ways depending upon what makes the most sense for the user or for the application. The center frequency and span can be specified, the start and stop frequencies can be entered, or a signal standard and channel number can be selected from the built-in list. The **Freq** hard key is located below the display. The Freq menu soft keys are shown in Figure 3-4:
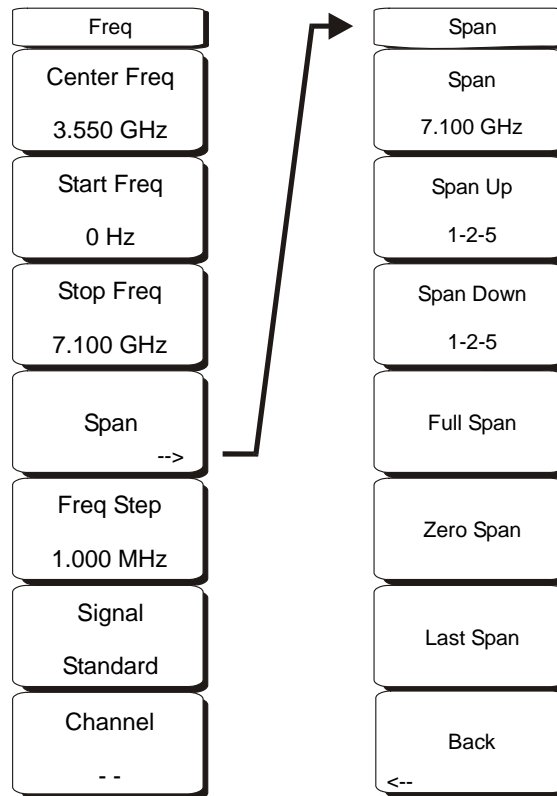
Figure 3-4.   Freq Menu Soft Keys

Center Frequency

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

Note	When using the **Up** and **Down** arrow keys, the frequency moves in steps defined by the value that was entered using the Freq Step soft key.
	When using the **Left** or **Right** arrow keys, the frequency of the active parameter moves by 10% of the current frequency span. If the instrument is in zero span, then the **Left** and **Right** arrow keys do nothing.
	Turning the rotary knob changes the active frequency parameter in increments of one display point for each click of the knob. The measurement display shows 551 display points across the screen.

Start Frequency

Press the **Freq** key followed by the Start Freq soft key, and enter the desired frequency by using the keypad, the arrow keys, or the rotary knob. If a start frequency that is higher than the current stop frequency is entered, then the stop frequency is changed to yield a 10 Hz span.

Stop Frequency

Press the **Freq** key followed by the Stop Freq soft key, and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If a stop frequency that is lower than the current start frequency is entered, then the start frequency is changed to yield a 10 Hz span.

Span

Press the **Freq** key followed by the Span soft key to access the Span menu. The Span menu is used to set the frequency range over which the instrument will sweep. For the MS2717B, the span can be set from 10 Hz to 7.1 GHz. For the MS2718B, the span can be set from 10 Hz to 13 GHz. For the MS2719B, the span can be set from 10 Hz to 20 GHz. Span can also be set to zero span for all models.

This soft key shows the current value for span in units of GHz, MHz, kHz, or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys, or the rotary knob to increase or decrease the span frequency. If the span is changed by using the **Up/Down** arrow keys, then the span changes in a 1-2-5 sequence for each key press.

For more information on the Span menu, refer to Figure 3-11, "Span Menu Soft Keys" in section "Span Menu" on page 3-28.

Freq Step

Press the **Freq** key followed by the Freq Step soft key in order to enter the desired frequency step size. The frequency step size specifies the amount by which a frequency will change when the **Up/Down** arrow keys are pressed during a frequency change.

The Center Freq, Start Freq, and Stop Freq soft keys use the frequency step size value that is set by using Freq Step. The active parameter (Center, Start, or Stop) is changed by the frequency step size when the **Up/Down** arrow keys are pressed. The frequency step size can be any value from 1 Hz to 7.1 GHz, 13 GHz, or 20 GHz with a resolution of 1 Hz.

If Freq Step is the active parameter, then nothing happens when the arrow keys are pressed. Use the keypad or the rotary knob to change the frequency step size.

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 particular standard are automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered. For a listing of a table of signal standards that are in the instrument firmware, refer to Appendix A, "Signal 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 tuned to the center of the Spectrum Analyzer display.

3-6 Limit Menu

To access the functions under the Limit menu, press the **Shift** key, then the **Limit** (6) key. The Limit menu soft keys are shown in Figure 3-5.
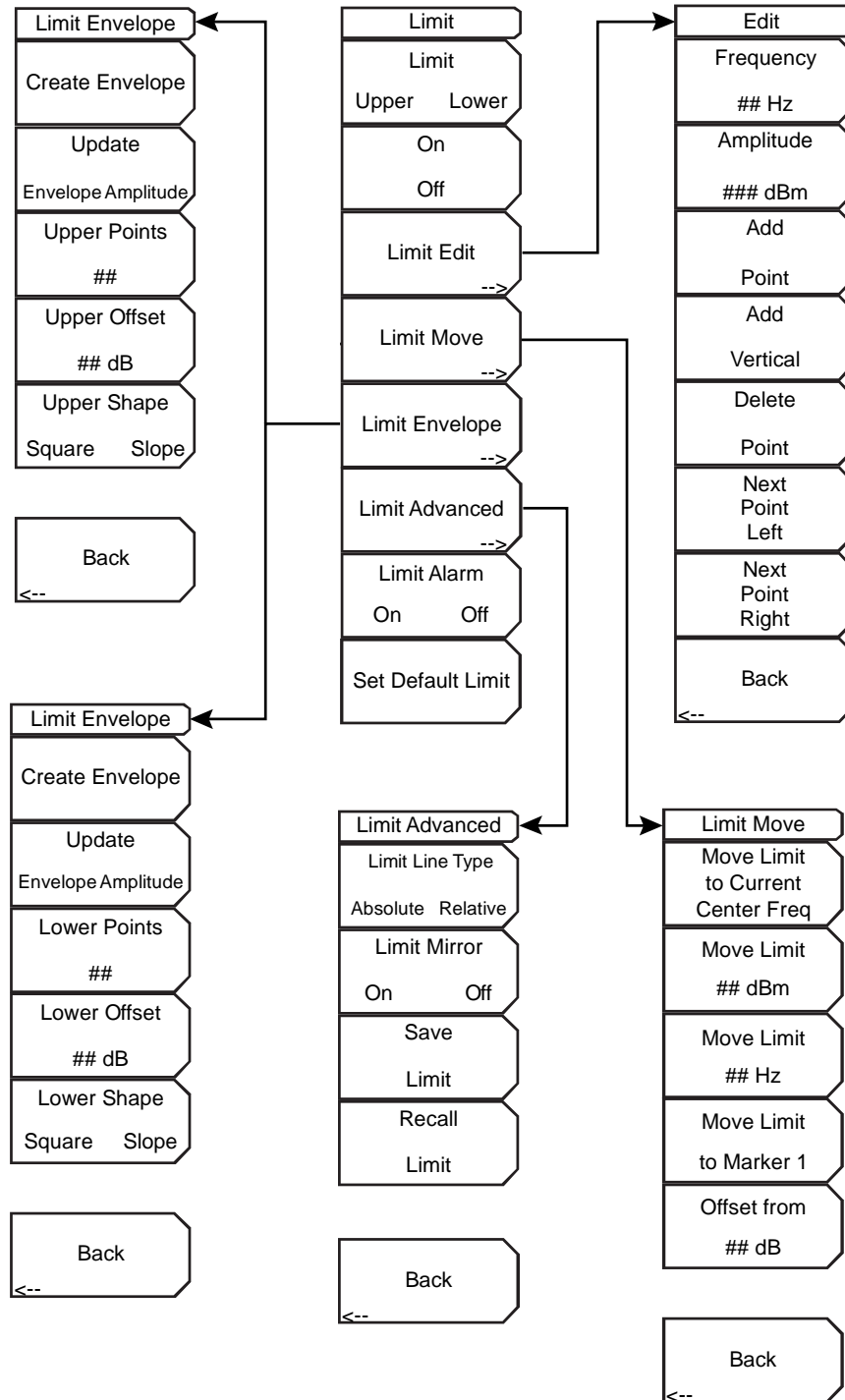
Figure 3-5. Limit Menu Soft Keys

Two types of limit lines can be specified: lower limit lines and upper limit lines. Limit lines can be used for visual reference only, or for pass/fail criteria by using the limit alarm (refer to "Limit Alarm On Off" on page 3-18). Limit alarm failures are reported whenever a signal is above the upper limit line or below the lower limit line.

Each limit line can consist of a single segment, or as many as 40 segments across the entire frequency span of the instrument. These limit segments are retained regardless of the current frequency span of the instrument, which allows the configuring of specific limit envelopes at various frequencies of interest without having to re-configure them each time the frequency is changed.

Limit Menu

Limit
Upper Lower

This soft key selects which limit line will be active for editing. The limit line that is currently selected for editing is <u>underlined</u> on the virtual soft key face.

On / Off

This soft key turns the active limit line (upper or lower) On or Off.

Limit Edit

This soft key displays a submenu that allows creating or editing of single or multi-segment limit lines. The currently active limit point is marked by a red circle on the display.

Frequency, ## Hz

Press this soft key to set the frequency of a limit line inflection point. The frequency of each inflection point in a limit line can be individually set. When a new point is added, it takes on a value halfway between two existing points, or it takes on the stop frequency of the current sweep if no point is higher in frequency than the one being added. Refer to the Add Point soft key description for more details. Use the keypad, the **Left/Right** arrow keys, or the rotary knob to change the frequency.

Amplitude, ### dBm

Press this soft key to set the amplitude of a limit line inflection point. The amplitude of each inflection point can also be individually set. By default, when a new point is added, it takes on the amplitude that is on the limit line at the frequency where the point was added. Use the keypad (using the ± key to set a negative value), the **Up/Down** arrow keys, or the rotary knob to move the point to the desired value. The unit of the amplitude limit is the same as the current vertical amplitude unit. Refer to the Add Point soft key description for more details.

Add Point

Press this soft key to a limit line inflection point. The precise behavior of this soft key depends upon which inflection point is active at the time that the key is pressed. If the active limit point is somewhere in the middle of a multi-segment limit line, then a new limit point is added that is halfway between the currently active point and the point immediately to its right. The amplitude of the inflection point will be such that it falls on the limit line. For example, if a limit point exists at 2.0 GHz with an amplitude of -30 dBm, and if the next point is 3.0 GHz with an amplitude of -50 dBm, then the added point will be at 2.5 GHz with an amplitude of -40 dBm. The frequency and amplitude values of the new point can be adjusted as needed with the Frequency and Amplitude soft keys.

If the last limit point is active (assuming it is not at the right edge of the display), then the new limit point is placed at the right edge of the display at the same amplitude as the point immediately to its left. Points may not be added beyond the current sweep limits of the instrument.

Add Vertical

In many measurement masks, step changes occur in the value of the limit line. Press this soft key to add two inflection points. The two inflection points share the same frequency and are centered midpoint between adjacent measured points. The magnitudes of the points are set by using a visually intuitive algorithm that is based upon the adjacent inflection points.

You can adjust the magnitudes independently, but the frequencies of the two points remain linked and are adjusted as a vertical pair. Setting a discrete frequency, a limit inflection point keeps that exact frequency and places the limit point appropriately regardless of the frequency span. This is especially useful for emission mask verification.

Delete Point

Press this soft key to delete the currently active point. The new active point becomes the point that is immediately to the left of the point that is being deleted.

Next Point Left

Press this soft key to select the inflection point that is immediately to the left of the active point, making this newly selected point active for editing or deletion. With each key press, the active point becomes that point to the left of the previously active point, until the newly selected active point becomes the leftmost point on the screen.

Next Point Right

Press this soft key to select the limit point immediately to the right of the active point, making this newly selected point active for editing or deletion. With each key press, the active point becomes that point to the right of the previously active point, until the newly selected active point becomes the rightmost point on the screen.

Back

Press this soft key to return to the **Limit** soft key menu.

Limit Move

Press this soft key to display the Limit Move soft key menu.

Move Limit to Current Center Freq

Pressing this soft key moves the center of the existing limit line to the center frequency of the measurement. The span of the existing limit line is not changed by doing this. Use this soft key as an easy way to get an existing limit line on screen. If no limit line is turned on, then a new, flat default limit line is turned on and is located 2.5 divisions (2.5 graticule lines) from the top of the screen for the upper limit line or 2.5 divisions from the bottom of the screen for the lower limit line.

Move Limit, ## dB or Move Limit, ## dBm

If the limit line is flat, then use this soft key to move the limit line to an absolute power point in dBm. If the limit line is not flat, then use this soft key to move the limit line up or down by the selected number of dB. Use the keyboard to enter the desired value. The entire line moves by the amount that is entered. The limit line can also be moved by using the rotary knob. Turn the rotary knob clockwise to move the line to higher power levels.

Move Limit, ## Hz

Pressing this soft key allows you to adjust the frequencies of the limit line. All inflection points are moved by the value entered. The rotary knob can also be used to make this adjustment. Turn the rotary knob clockwise to move the limit line to higher frequencies.

Move Limit to Marker 1

Press this soft key to move the frequency and amplitude of the center frequency of the limit line to at the frequency and amplitude of Marker 1 (assuming that the Offset from soft key is set to 0 dB).

Offset from ## dB

Press this soft key to set a limit line offset value from Marker 1 amplitude. This feature moves the limit line amplitude and frequency as needed to place the center of the limit line the user-specified number of dB from the position of Marker 1. Positive values place the limit line above Marker 1, and negative values place the limit line below Marker 1.

Back

Press this soft key to return to the **Limit** soft key menu.

Limit Envelope

Press this soft key to open the Limit Envelope soft key menu. A limit envelope is very useful when you want to easily detect new signals in the presence of other preexisting signals. Use the limit envelope function to automatically create upper or lower limit lines that are based upon the on-screen measured spectrum analysis values. Refer to Figure 3-6 for an example limit envelope.

Create Envelope

Press this soft key to generate the envelope using the Limit Envelope characteristics. If the default results are not satisfactory, then you can make adjustments to the amplitude and frequency of each inflection point, and you can add or delete inflection points.

Update Envelope Amplitude

While working on your envelope (or if your signal amplitude changes), you may want to adjust the amplitude of the current limit without changing the frequencies of the inflection points. Pressing this soft key makes those amplitude adjustments without frequency adjustments.

Upper Points, ## (if Upper Limit is selected)
Lower Points, ## (if Lower Limit is selected)

Press this soft key to define how many inflection points you want for the selected upper or lower limit envelopes. The value can be between 2 and 41. Note that the upper and lower limit lines do not need to have the same number of points.

Upper Offset, ## dB (if Limit is toggled to Upper)
Lower Offset, ## dB (if Limit is toggled to Lower)

Press this soft key to define how far away from the measured signal the upper or lower envelope will be placed. The limits are ±100 dB. For an upper envelope, usually the value will be positive in order to place the envelope above the signal. For a lower envelope, the value will usually be negative in order to place the envelope below the signal.

Upper Shape, Square/Slope (if Limit is toggled to Upper)
Lower Shape, Square/Slope (if Limit is toggled to Lower)

Press this soft key to choose whether the default for the upper or lower envelope will be with flat tops and reasonably vertical lines to change level, or whether the envelope will have sloped lines between adjacent inflection points. When the square envelope type is selected, two inflection points are used for each horizontal segment. You can alternate between a square envelope and a sloped envelope by pressing this soft key.

Back

Press this soft key to return to the **Limit** soft key menu
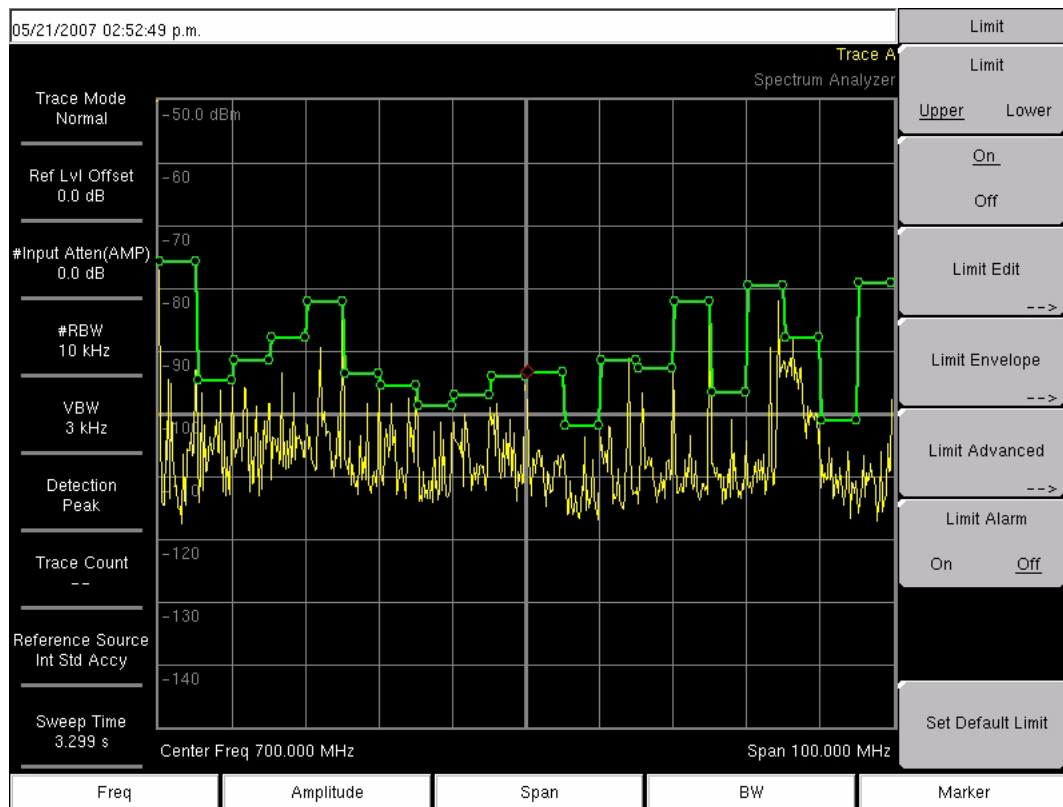
Figure 3-6.   Example Limit Envelope, Square

Limit Advanced

Press this soft key to open the Limit Advanced soft key menu. The advanced limit line section offers several useful functions. In this section, you can create either an **absolute** limit line (which is based upon the frequencies that are entered for each inflection point) or a **relative** limit line (which is based upon the delta frequencies between the center frequency and the inflection points). Both types of limit lines can be saved and recalled.

Limit Advanced soft key menu:

Limit Line Type
Absolute   Relative

Press this soft key to choose to have either limit line be absolute or be relative. The upper and lower limit lines may be different. This soft key may be used at any time while working with limit lines.

Absolute limit lines set the limit inflection points based upon the entered frequencies for each point.

Relative limit lines set the limit inflection points relative to the current center frequency.

Regardless of how a limit line is set up, saved, or recalled, it can be changed between absolute and relative by toggling with this soft key.

Limit Mirror
On   Off

Press this soft key to turn the Limit Mirror feature On and Off.

Many emission masks are symmetrical. The low frequency side is identical to the upper side. The Limit Mirror feature allows you to create half of the limit line and get the other half built automatically. This feature can work in either of two ways:

Turn Limit Mirror On before beginning to build a limit line. As you add a point on either side of the center frequency, another point is automatically added on the opposite side of the center frequency.

Leave Limit Mirror Off until half of the limit line is built, then turn On Limit Mirror. The other half of the limit line is built automatically.

Save Limit

Pressing this soft key opens a dialog to save the current upper and lower limit lines. You can name the saved limit line yourself or accept the name that is suggested by the instrument (which is based upon a previously saved name). If you did not intend to save the limit line, then press **Esc** to close the dialog and avoid saving the limit line.

Recall Limit

Pressing this soft key opens a dialog box to recall a saved limit line. The dialog box presents a list of saved limit lines. Highlight the desired limit line and press **Enter**. If you decide not to recall a limit line, then press **Esc** to close the dialog.

If the saved limit is a relative limit, then it is recalled centered about the current center frequency. If the saved limit is an absolute limit, then it is recalled to the frequency at which it was created.

If you recall an absolute limit, and if it is off screen, then you will see the left or right limit off-screen indicator on the edge of the screen.

Back

Press this soft key to return to the **Limit** soft key menu.

Limit Alarm
On   Off

Pressing this (toggle) soft key to alternate the alarm function On and Off for the currently active limit line. When On, an alarm beep occurs when a data point exceeds the limit.

Set Default Limit

Pressing this soft key deletes all limit points for the currently active limit line and sets the default limit line value. The default limit line value is a single limit whose position is 2.5 graticule lines from the top of the screen (for the upper limit line) or 2.5 graticule lines from the bottom of the screen (for the lower limit line), depending upon which limit is active. The inactive limit line is not altered.

3-7   Marker Menu

Press the **Marker** function hard key to open the Marker menu. The Spectrum Analyzer is equipped with six markers. Any or all markers can be employed simultaneously. The **Marker** hard key is located below the display. The Marker menu soft keys are shown in Figure 3-7:
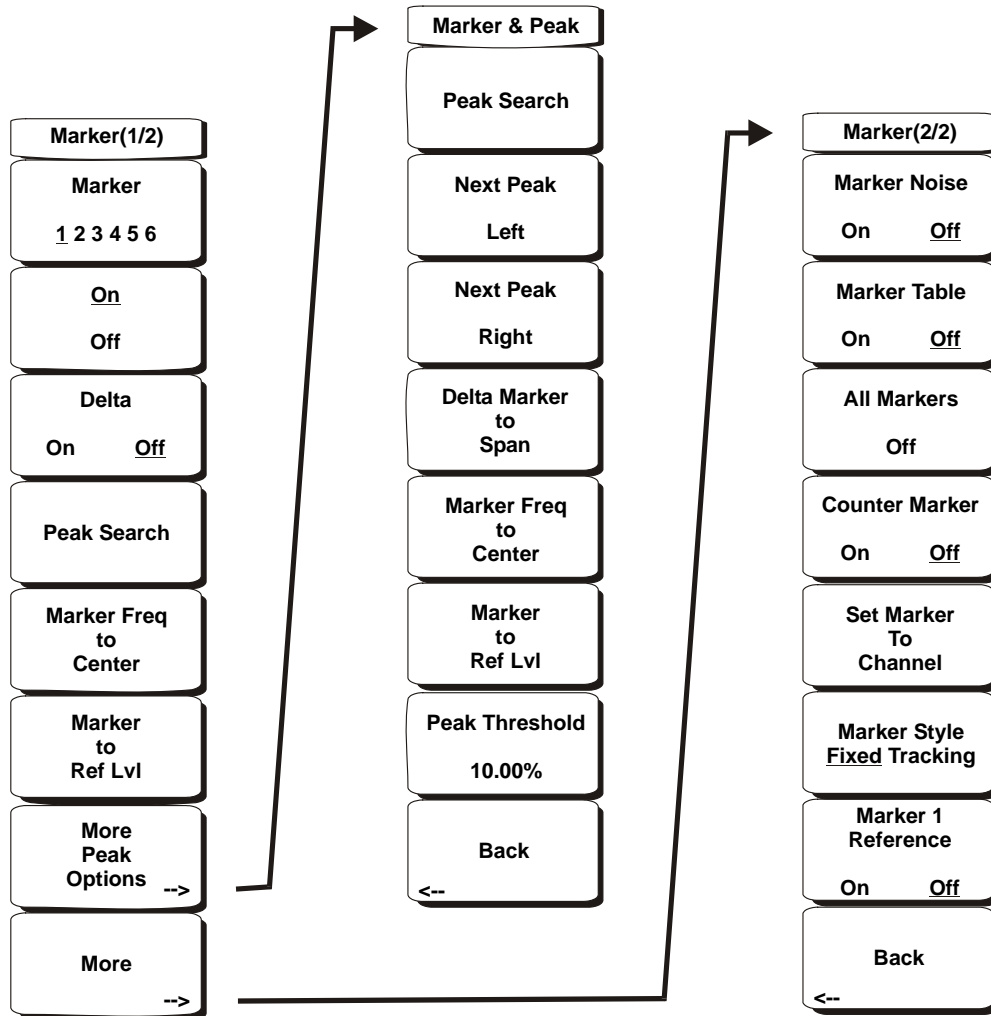
Figure 3-7.   Marker Menu Soft Keys

Marker
1 2 3 4 5 6

Use this soft key to select the active marker. The underlined marker number is the active marker. Each press of the soft key moves the underline to the next marker number. Pressing the **Shift** button causes subsequent button presses to move from higher marker numbers to lower numbers. Press the **Shift** button again to change back to the original direction.

On/Off (Marker)

This soft key makes the marker selected by the Marker (number) soft key active for editing. If the marker is currently active for editing, then pressing the On/Off key causes the marker, and any associated Delta marker, to be turned off.

Delta
On Off

If the Delta marker is on, but not active for editing, then pressing this soft key makes the Delta marker active for editing. If the marker is currently active for editing, then pressing the On/Off key causes the Delta marker to be turned off and sets the corresponding reference marker active for editing.

Peak Search

This soft key places the currently active marker on the highest signal amplitude currently displayed on screen.

Marker Freq to Center

This soft key changes the center frequency to place the currently active marker at the center of the display.

Marker to Ref Level

This soft key causes the amplitude of the currently active marker to become the reference level, which is the top horizontal line of the display.

More Peak Options

This soft key opens a Marker & Peak secondary menu of soft keys for additional peak searching options.

Peak Search

This soft key places the currently active marker on the highest amplitude signal currently on screen.

Next Peak Left

From the current position of the active marker, the instrument searches to the left (toward lower frequencies) for a peak signal that rises at least a certain amount above the previous valley. If no such peak is found, then the marker is placed at the left end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Next Peak Right

From the current position of the active marker, the instrument searches to the right (toward higher frequencies) for a peak signal that rises at least a certain above the previous valley. If no such peak is found, then the marker is placed at the right end of the trace. The Peak Threshold soft key allows the user to specify the performance of peak searching.

Delta Marker to Span

Sets the total span width to the value of the delta marker. If the delta marker is zero, then the span is set to 10 Hz. If no delta marker is in use, or if the delta marker value is set to less than 10 Hz, then the span will be set to 10 Hz. Delta Marker to Span is not available when the analyzer is set to Zero Span.

Marker Freq to Center

Sets the center frequency to the frequency of the currently active marker.

Marker to Ref Lvl

Sets the amplitude of the currently active marker to the top graticule line as the reference level.

Peak Threshold

This soft key allows the user to specify how far above the average noise floor a signal must rise before it is considered a peak.

Back

Returns to the higher-level menu.

More

Opens the Marker (2/2) submenu that contains additional Marker options.

Marker (2/2)

Marker Noise

This marker option turns the markers into noise markers with units of dBm/Hz. When this option is selected, the detection method is automatically changed to RMS and the displayed value is compensated for the noise bandwidth of resolution bandwidth filter. Marker Noise is not available when the analyzer is set to Zero Span.

Marker Table

Pressing this soft key 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

This soft key turns off all markers and the marker table.

Counter Marker
On Off

Sets the frequency counter mode for all markers. Marker frequency values are normally limited in resolution to individual display pixels. Each pixel may represent multiple frequencies. Using Counter Marker in association with Marker to Peak will result in the exact frequency of the peak within the pixel to a resolution of 1 Hz.

Set Marker To Channel

If a signal standard has been selected, then pressing this soft key opens a dialog box to select a channel. Select a channel number for the current signal standard, and the active marker will be set to the center frequency of the channel.

If no signal standard has been selected, then the following message is displayed: "No standard selected. Press **Enter** or **Esc** to Continue." Press either button to leave the settings as they were before the soft key was pressed.

Marker Style
Fixed Tracking

This soft key changes the behavior of the reference markers. If Fixed is selected, then reference markers stay at the amplitude they were at when the associated delta marker was turned on. If Tracking is selected, then the amplitude of the reference marker changes as the signal amplitude is changed. Note that the reference marker tracks the amplitude, not the frequency of a signal.

Marker 1 Reference On/Off

This soft key selects whether Marker 1 is the reference for all six delta markers, or whether each of the six reference markers has an associated delta marker.

Back

Returns to the previous menu.
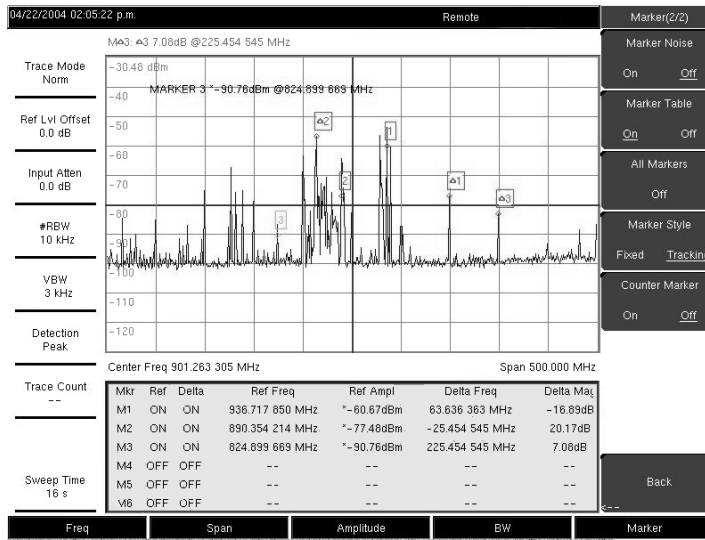
Figure 3-8.   Markers

Note	When using the **Up/Down** arrows, the active marker moves in steps that are defined by the value that was entered by using the Freq Step soft key.
	When using the **Left/Right** arrow keys, the active marker moves by one division.

3-8   Measure Menu

To access the functions under the Measure menu, press the **Shift** key, then the **Measure** (4) key. The Measure menu soft keys are shown in Figure 3-9:
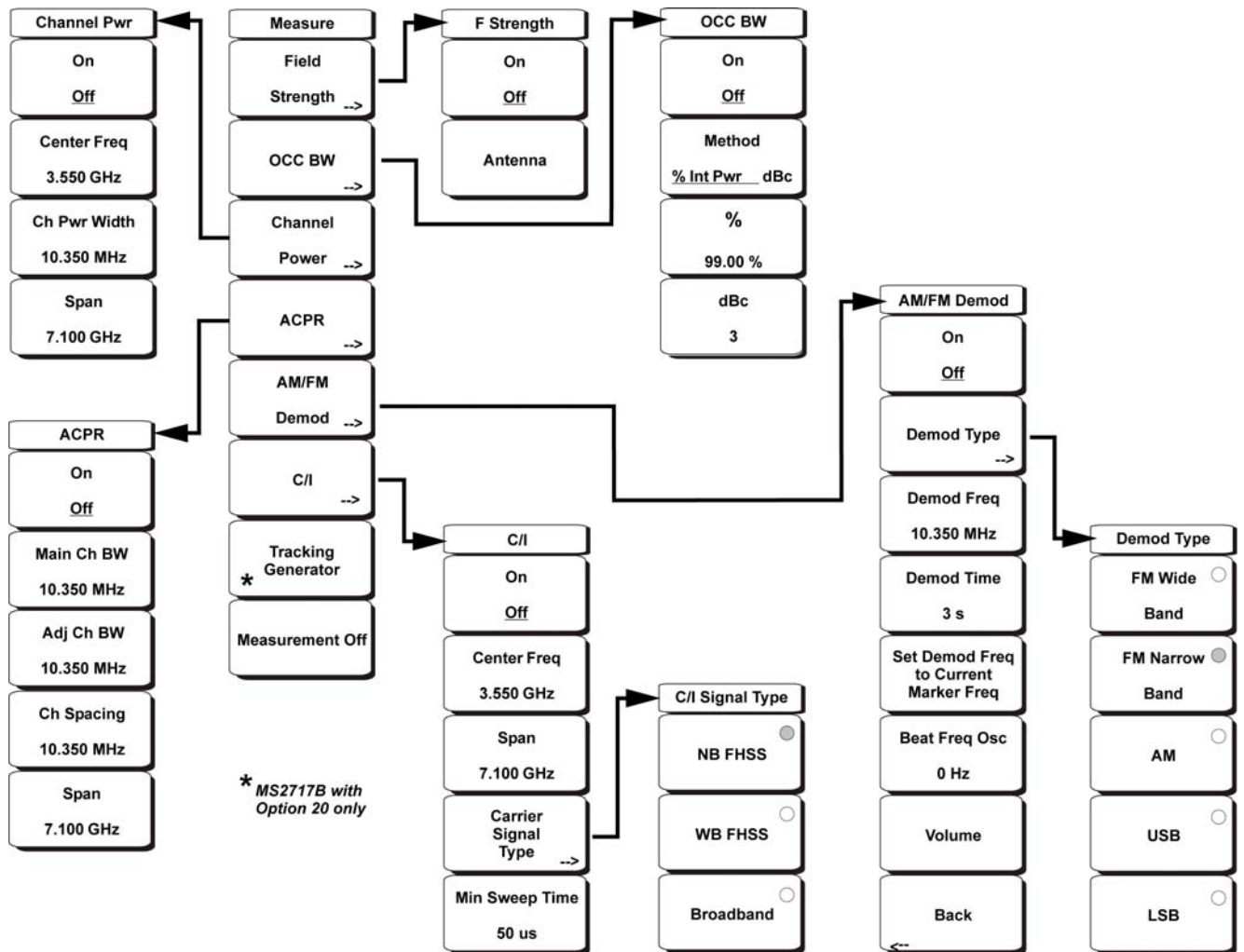
Figure 3-9.   Measure Menu Soft Keys

Measure Menu

Field Strength

This measurement allows the use of an antenna with known gain characteristics and measures the field strength over the frequency range of the antenna in units of dBm/meter, dbV/meter, dBmV/meter, dBμV/meter, volts/meter, or watts/meter.

F Strength Menu

On/Off (Field Strength)

Turns field strength measurements On or Off.

Antenna

This soft key opens a dialog box that lists all the antennas for which the instrument has data, including both standard antennas and custom antennas that have been added using Master Software Tools. Use the **Up/Down** arrow keys or the rotary knob to select the desired antenna and press **Enter**.

Back

Returns to the previous (Measure) menu.

OCC BW

Activates the occupied bandwidth menu. Select either % or dBc method of occupied bandwidth measurement.

OCC BW Menu

Method % Down/dBc Down

Select either the % of Power (default) or dB Down measurement method as displayed in the message area.

%

Use the keypad, the directional arrow keys, or the rotary knob to enter the percent of power, from 0 to 100%.

dBc

Use the keypad, the directional arrow keys, or the rotary knob to enter the dBc value (0 dB to 100 dB).

Back

Returns to the previous menu.

Channel Power

Activates the Channel Power measurement function. Channel Power and Channel Power Density are measured based on the selection in the Units menu.

On/Off (Channel Power)

Begins or ends the channel power measurement. When the measurement is on, Ch Pwr will appear below the display. The detection method will automatically be changed to RMS Average when the measurement is started. The detection method can be modified by pressing the **Shift** key and the **Sweep** key and then pressing the Detection soft key.

Center Freq

Activates the center frequency function and sets the center frequency of the Spectrum Analyzer for the channel power measurement. Use the keypad, the directional arrow keys, or the rotary knob to enter the center frequency.

Ch Pwr Width

Sets the integration bandwidth for channel power measurement. Modifying this value automatically adjusts the channel span to maintain the same ratio. Use the keypad, the directional arrow keys, or the rotary knob to enter the integration bandwidth.

Span

Sets the channel span for channel power measurement. Use the keypad, the directional arrow keys, or the rotary knob to enter the channel span.

Back

Returns to the previous menu.

ACPR

Accesses a menu of Adjacent Channel Power Ratio measurement options:

On/Off (ACPR)

Begins or ends the ACPR measurement.

Main Ch BW

Sets the bandwidth of the main channel for ACPR measurement. Use the keypad, the directional arrow keys, or the rotary knob to enter the a specific frequency. When using the keypad, press the GHz, MHz, kHz, or Hz soft key to accept the frequency input. Changing this value automatically changes the adjacent channel bandwidth and the channel spacing.

Adj Ch BW

Sets the bandwidth of the adjacent channels for ACPR measurement. Use the keypad, the directional arrow keys, or the rotary knob to enter the a specific frequency. When using the keypad, press the GHz, MHz, kHz, or Hz soft key to accept the frequency input.

Ch Spacing

Sets the channel spacing between the main and adjacent channels. Use the keypad, the directional arrow keys, or the rotary knob to enter a specific frequency. When using the keypad, press the GHz, MHz, kHz, or Hz soft key to accept the frequency input. This value must be greater than, or equal to, half of the main channel bandwidth plus half of the adjacent channel bandwidth.

Span

Sets the channel span for channel power measurement. Use the keypad, the directional arrow keys, or the rotary knob to enter the channel span.

Back

Returns to the previous menu.

AM/FM Demod

The user can select AM, Narrow Band FM (300 µs de-emphasis), Wide Band FM (50 µs de-emphasis), Upper Sideband, or Lower Sideband.

On/Off (AM/FM Demod)

Turns AM/FM Demodulation on or off.

Demod Type

Provides soft keys to select the type of signal to be demodulated. Options are FM Wide Band, FM Narrow Band, AM, USB, and LSB.

Demod Freq

Use the keypad, the directional arrow keys, or the rotary knob to enter the center frequency of the signal to be demodulated. This frequency does not have to be within the current frequency sweep range to which the instrument is set.

Demod Time

Use the keypad, the directional arrow keys, or the rotary knob to increase or decrease the demodulation time, and press the **Enter** key to select. The demodulation time can be set from 100 milliseconds to 500 seconds. The instrument sweeps one time for every demodulation period. Sweeping pauses during the demodulation time.

Set Demod Freq to Current Marker Freq

Sets the demodulation frequency to the frequency of the current marker.

Beat Freq Osc

Sets the beat frequency of the oscillator to exactly set the demodulation frequency of USB and LSB signals.

Volume

The current volume setting is displayed on the screen. Use the **Up/Down** arrow keys or rotary knob to change the volume, and press the **Enter** key to select.

Back

Returns to the previous menu.

C/I

The Carrier to Interference ratio is a two-step measurement sequence that first measures the amplitude of a carrier, then (with the carrier turned off) measures the amplitude of all other interfering signals within the channel bandwidth.

On/Off (C/I)

Starts and stops the carrier to interference measurement.

Center Freq

Use the keypad, the directional arrow keys, or the rotary knob to enter the center frequency.

Span

Use the keypad, the directional arrow keys, or the rotary knob to enter the frequency span.

Carrier Signal Type

Opens a menu to select the carrier signal type.

NB FHSS (Narrow Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11b.

WB FHSS (Wide Band Frequency Hopping Spread Spectrum)

Use this setting when the signal being measured is 802.11a or 802.11g.

Broadband

Use this setting when the signal being measured is a digital modulation format such as CDMA, GSM, and so forth.

Back

Returns to the previous menu.

Min Sweep Time

Set the minimum sweep time for the measurement.

Back

Returns to the previous menu.

Tracking Generator (MS2717B with Option 20 only)

For information on the Tracking Generator (Option 20) for the MS2717B Economy Microwave Spectrum Analyzer, refer to Chapter 6, "Tracking Generator".

Measurement Off

Pressing this soft key turns off any active measurement, including demodulation.

3-9 Mode

To access the functions under the Mode menu, press the **Shift** key, then the **Mode** (9) key.

3-10 Preset Menu

To access the functions under the Preset menu, press the **Shift** key, then the **Preset** (1) key. The Preset menu soft keys are shown in Figure 3-10:

```
┌─────────────┐
│   Preset    │
└─────────────┘
┌─────────────┐
│   Preset    │
└─────────────┘
┌─────────────┐
│    Save     │
│   Setup     │
└─────────────┘
┌─────────────┐
│   Recall    │
│   Setup     │
└─────────────┘
```
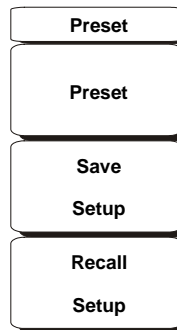
Figure 3-10. Preset Menu Soft Keys

Preset

This soft key resets the instrument to the default starting conditions of full band sweep, 10 dBm log reference level, 10 dB/division scaling, 0 dB reference level offset, all measurements turned off, and trigger set to free run.

Save Setup

Opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

3-11   Span Menu

The Span menu is used to set the frequency range over which the instrument will sweep. For the MS271xB, the span can be set from 10 Hz to the upper frequency limit. The Span can also be set to zero span for all models.

Press the **Span** function key located below the display to access the Span menu. The Span menu soft keys are shown in Figure 3-11:

```
┌──────────────────┐
│       Span       │
└──────────────────┘
┌──────────────────┐
│       Span       │
│    7.100 GHz     │
└──────────────────┘
┌──────────────────┐
│     Span Up      │
│      1-2-5       │
└──────────────────┘
┌──────────────────┐
│    Span Down     │
│      1-2-5       │
└──────────────────┘
┌──────────────────┐
│    Full Span     │
└──────────────────┘
┌──────────────────┐
│    Zero Span     │
└──────────────────┘
┌──────────────────┐
│    Last Span     │
└──────────────────┘
┌──────────────────┐
│       Back       │
│       <--        │
└──────────────────┘
```
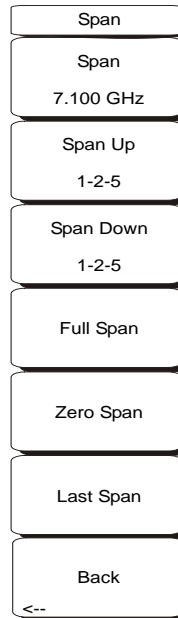
Figure 3-11.   Span Menu Soft Keys

Span

This soft key shows the current value for span in units of GHz, MHz, kHz, or Hz. When the Span button is pressed, span becomes the active parameter and may be changed. Use the keypad, the directional arrow keys, or the rotary knob to increase or decrease the span frequency. If the span is changed by using the **Up/Down** arrow keys, then the span changes in a 1-2-5 sequence, in a manner that is similar to the Span Up or Span Down soft keys described in the next two sections.

Span Up 1-2-5

This is a convenient way to quickly arrive at a wider span value. The first time the soft key is pressed, the span value increases to the nearest even value that starts with 1, 2, or 5. For example, if the span is 1.8 MHz, then pressing the soft key for the first time changes the span to 2.0 MHz. The next press takes the value to 5.0 MHz and so on.

Span Down 1-2-5

This is a convenient way to narrow the frequency span. The first time the soft key is pressed, the span value decreases to the nearest even value that starts with 1, 2, or 5. For example, if the span is 1.8 MHz, then pressing the soft key for the first time changes the span to 1.0 MHz. The next press takes the value to 500 kHz, then 200 kHz, and so on.

Full Span

Pressing this button sets the span to cover the entire tunable spectrum of the instrument.

Zero Span

This soft key sets zero span. In this mode, the display shows amplitude changes at a single frequency. This function is frequently used to allow the easy monitoring of power variations over time. For example, if information about the amplitude of an 802.11a access point signal is needed, then the access point frequency would be set as the center frequency; resolution bandwidth would be set to a value wide enough to encompass the signal; and the tester would walk around the access point usable area while the Spectrum Analyzer would record the amplitude using slow sweep.

Last Span

This soft key returns the span to the most recent span value immediately before a change was made.

3-12   Sweep Menu

To access the functions under the Sweep menu, press the **Shift** key, then the **Sweep** (3) key. The Sweep menu soft keys are shown in Figure 3-12:
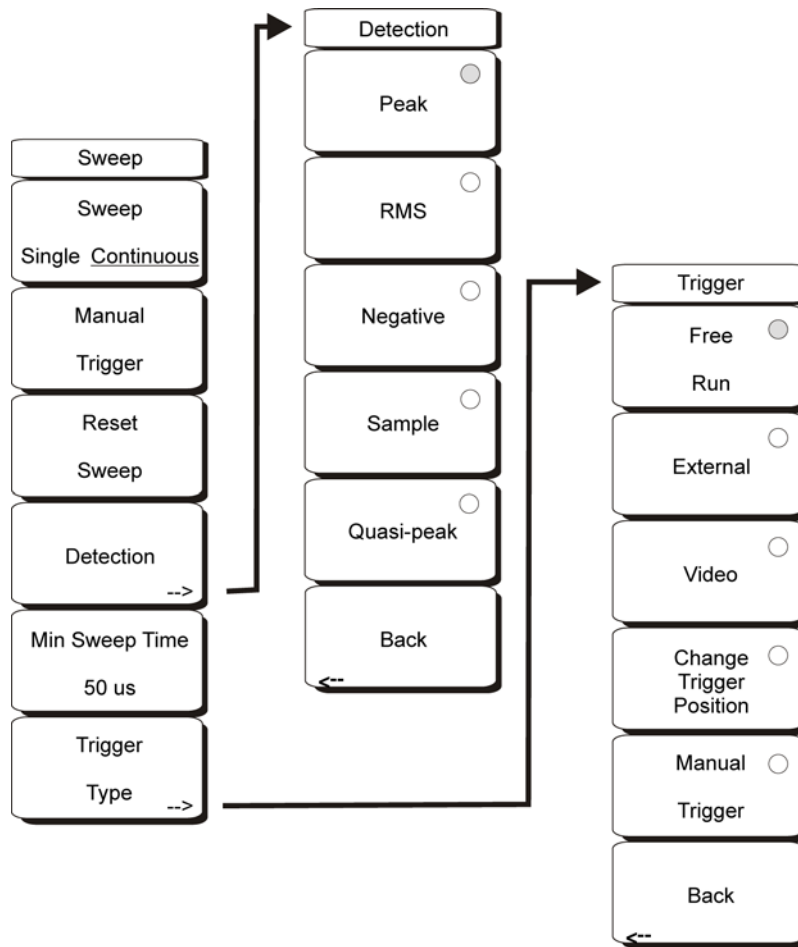
Figure 3-12. Sweep Menu Soft Keys

Sweep
Single Continuous

This soft 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.

Manual Trigger

Pressing this soft 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.

If Averaging is active while the unit is in single sweep mode, then pressing the Manual Trigger button resets the average count, and causes the unit to complete a number of sweeps equal to the value set by the # of Averages soft key. (For more information on averaging, refer to Section 3-14, "Trace Menu" on page 3-36.)

Reset Sweep

This soft key stops the current sweep, clears trace averaging results, clears the maximum hold results (if selected), and restarts the sweep at the left side of the screen.

Detection

Several detection methods tailor the performance of the instrument to meet specific measurement requirements. In general, more points are measured across the screen than are displayed as points. The various detection methods are different ways of dealing with selecting which measurement point will be shown at each display point.

Peak

This method causes the largest measurement point to be shown for each display point. It assures that a narrow peak is not missed.

RMS

This method performs a root-mean-square calculation of all the measurement points in each display point. It is particularly useful in displaying the average value of noise.

Negative

This method causes the smallest measurement point to be shown for each display point. Typically, this mode is used to help detect small discrete signals in the presence of nearly equal values of noise. The display points that contain only noise will tend to show lower amplitudes than those that contain discrete signals.

Sample

This is the fastest detection method because for each display point, only one frequency point is measured. Use this method when speed is of paramount importance, and when the possibility of missing a narrow peak is not important.

Quasi-peak

Selects the quasi-peak detector. When the quasi-peak detector is selected, the allowed resolution bandwidths are 200 Hz, 9 kHz and 120 kHz. Also, the RBW/VBW ratio is set to 1 (one) so that the video bandwidth is the same as the resolution bandwidth. Quasi-peak detection is not available when the analyzer is set to Zero Span.

Back

Returns to the previous menu.

Min Sweep Time

This function allows a minimum sweep time to be specified. Use the keypad, the directional arrow keys or the rotary knob to set the minimum sweep time from 10 microseconds to 600 seconds. When using the keypad, the available time units are minutes, seconds, milliseconds, and microseconds.

If the required sweep time for accurate measurement is longer than the specified minimum, then the time required for accurate measurements will prevail.

Trigger Type

Sets the type of trigger to be used.

Free Run

In this mode, a new sweep is started immediately upon completion of an old sweep. No trigger event is required to initiate a sweep.

External

A TTL signal applied to the External Trigger BNC input connector causes a single sweep to occur. This mode is used in zero span, and triggering occurs on the rising edge of the signal. After the sweep is complete, the resultant trace is displayed until the next trigger signal arrives.

Video

This mode is used in zero span to set the power level at which a sweep is initiated. The power level can be set from −130 dBm to +20 dBm. The trigger is based on the measured signal level. If no signal reaches or exceeds the trigger level, then no trace appears on the screen. This mode is used in Zero Span.

Change Trigger Position

This soft key is used in conjunction with video triggering to set the horizontal position on the display where a signal that meets the video triggering criterion will be placed. The value can be from 0% to 100%. Zero percent places the triggering event at the left edge of the screen while 100% places the triggering at the right edge of the screen. When the trigger position is any value other than 0%, the portion of the trace before the trigger event is displayed very quickly because the trace data is stored in memory. The portion of the trace after the trigger point is displayed on the screen at the normal rate as the signal is swept. This mode is used in Zero Span.

Back

Returns to the previous menu.

3-13   System Menu

To access the functions under the System menu, press the **Shift** key, then the **System** (8) key. The System menu soft keys are:
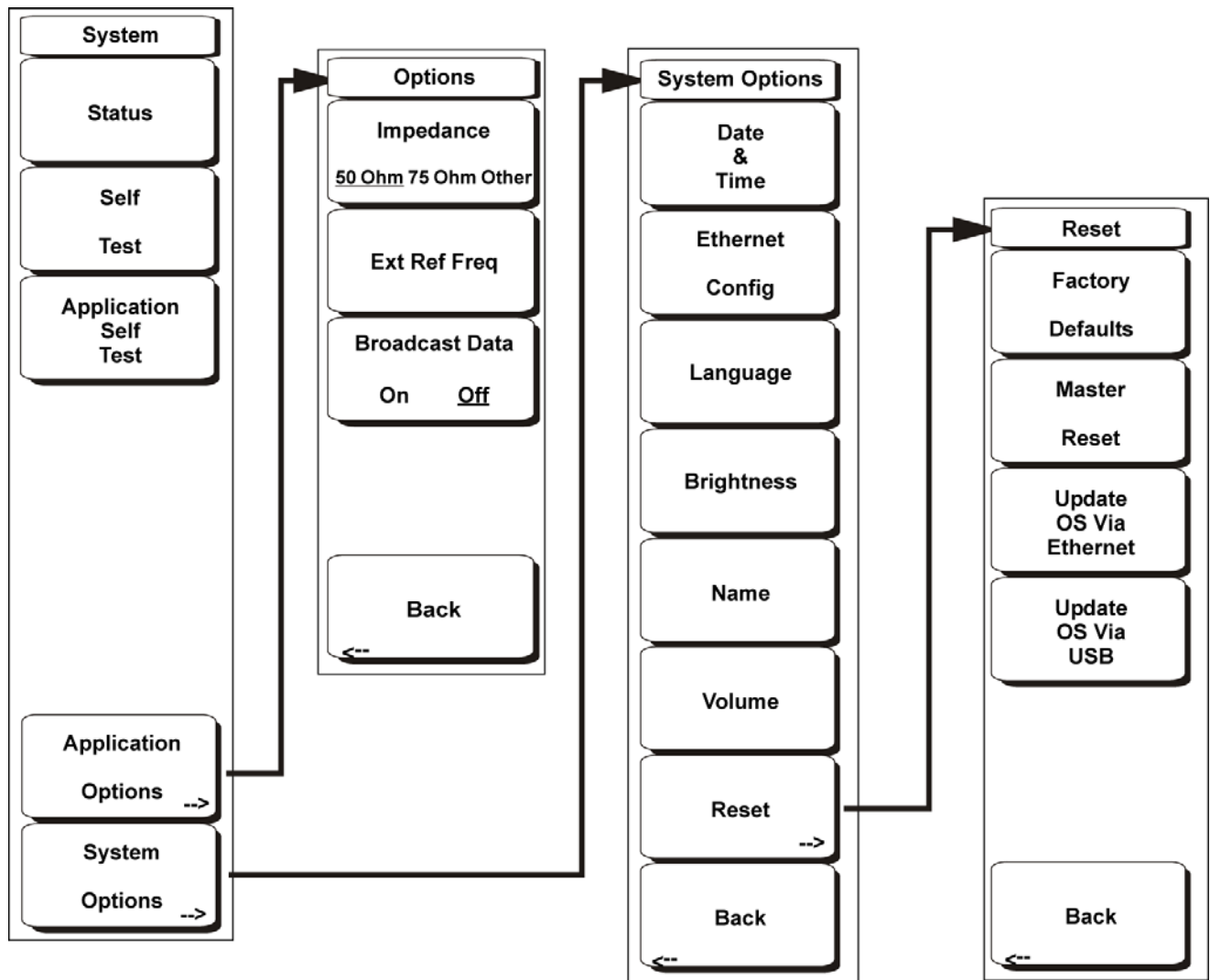
Figure 3-13. System Menu Soft Keys

Status

Pressing this soft key displays the current system status, including the operating system and firmware versions, temperatures, and other system details. Press **Esc** or **Enter** to return to normal operation.

Self Test

This soft key initiates a series of diagnostic tests that test the components of the instrument. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Self Test

This soft key initiates a series of diagnostic tests related to the performance of the Spectrum Analyzer. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Options

This soft key presents a menu to select application options.

Options Menu

Impedance 50 Ohm/75 Ohm/Other

Select either 50 ohm, 75 ohm, or other impedance value. Selecting 75 ohm selects the 7.5 dB loss of the Anritsu 12N50-75B adapter. For other adapters, select Other and enter the appropriate loss.

Ext Ref Freq

Select the frequency of the external reference from the list presented. Valid frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz at amplitude from −10 dBm to +10 dBm.

Broadcast Data On/Off

Enables event broadcast of measurement data at the end of sweeps. Default state is Off. Turn Broadcast Data On for use in remote control and data collection while using `.dll` programming.

Back

Returns to the previous menu.

System Options

This key opens a selection of system option soft keys.

System Options Menu

Date and Time

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

Ethernet Configuration

This soft key opens a dialog box to set the IP address of the instrument.

Type Manual/DHCP

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

Language

This soft key opens a selection box allowing selection from a list of built-in languages for the Spectrum Analyzer displays. The languages available are Chinese, English, French, German, Italian, Japanese, Korean, and Spanish. In addition, up to two custom languages may be selected if they have been defined using the Master Software Tools software and loaded into the instrument. If a mode does not have an available language translation, then English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changing anything.

Brightness

The brightness of the display can be adjusted to optimize viewing under a wide variety of lighting conditions. Use the keypad, the **Up/Down** arrow keys or the rotary knob to select a brightness level from 1 (low) to 9 (high). Press **Enter** to accept the change.

Name

Opens a dialog box to name the instrument. The unit can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the name.

Volume

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

Reset

Opens a menu of reset and update options.

Factory Defaults

Restores the instrument to the factory default values, including Ethernet, language and brightness settings. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Master Reset

This will restore factory setting to all system parameters, including Time/Date, Ethernet, language and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored.

Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete.

Press **Esc** to return to normal operation without resetting.

Update OS Via Ethernet

This soft key should only be used in conjunction with Anritsu Master Software Tools (MST) to update the instrument operating system using an Ethernet connection. Use this soft key only as instructed by MST.

Update OS Via USB

This soft key should only be used in conjunction with Anritsu MST to update the instrument operating system using a USB connection. Use this soft key only as instructed by MST.

Back

Returns to the previous menu.

3-14 Trace Menu

To access the functions under the Trace menu, press the **Shift** key and then the **Trace** (5) key. The Anritsu MS271xB Spectrum Analyzer is capable of displaying up to six traces. Trace A shows live data, Traces B and C can show stored or trace math data, and the Recalled A-C traces allow the user to see three recalled traces without overwriting the three current traces.
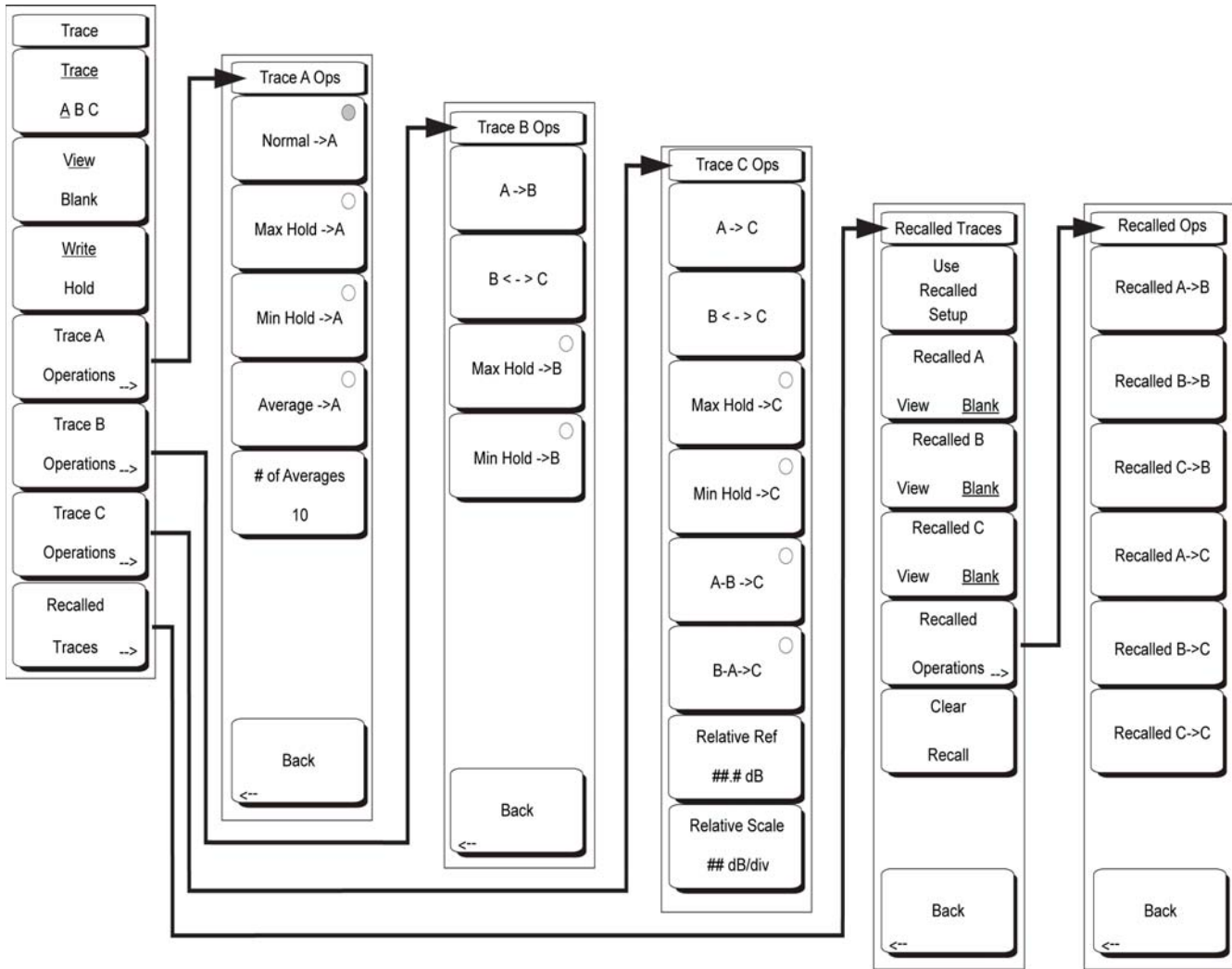
Figure 3-14. Trace Menu Soft Keys

Trace A, B, C

This soft key selects which trace is the active trace. The active trace is the one that is underlined. As the key is pressed, the underline advances from A to B to C and back to A.

View Blank

This soft key toggles the currently active trace to be either visible or hidden.

Write/Hold

Selects if the currently active trace continues to sweep and be updated or f the currently active trace is held on screen. This is not applicable to Trace B or Trace C unless trace math involving Trace A is active.

Trace A Operations

Allows the user to select from the operations that can be applied to Trace A.

Trace A Ops Menu

Normal -> A

The trace displays current data for the current sweep

Max Hold -> A

The trace shows the cumulative maximum value of each display point over many sweeps

Min Hold -> A

The trace shows the cumulative minimum value of each display point over many sweeps

Average -> A

The trace shows an exponential average of a number of traces, determined by the # of Averages key, below

# of Averages

Sets the number of traces that are used for the calculation of the average display value from 1 (one) to 65535.

Back

Returns to the previous menu.

Trace B Operations

Allows the user to select from the operations that can be applied to Trace A.

Trace AB Ops Menu

A -> B

Copies the contents of Trace A into Trace B. Doing so overwrites the previous contents of Trace B.

B <--> C

Swaps the contents of Trace B and Trace C.

Max Hold -> B

Trace B shows the cumulative maximum value of each display point over many sweeps

Min Hold -> B

The trace shows the cumulative minimum value of each display point over many sweeps

Back

Returns to the previous menu.

Trace C Operations

Allows the user to select from the operations that can be applied to Trace C.

Trace C Ops Menu

A -> C

Copies the contents of Trace A into Trace C. Doing so overwrites the previous contents of Trace C.

B <--> C

Swaps the contents of Trace B and Trace C.

Max Hold -> C

The trace shows the cumulative maximum value of each display point over many sweeps.

Min Hold -> C

The trace shows the cumulative minimum value of each display point over many sweeps.

A - B -> C

Subtracts the value of Trace B from Trace A and places the results in Trace C. This function is very useful for observing the changes in values of live Trace A compared to a trace stored in Trace B. When trace math is active, a relative scale shows on the right side of the graph, and is applied to Trace C. This allows the user to optimize the display of Trace C without affecting the display of Trace A and Trace B.

B - A -> C

Subtracts the value of Trace A from Trace B and places the results in Trace C. This function is very useful for observing the changes in values of live Trace A compared to a trace stored in Trace B. When trace math is active, a relative scale shows on the right side of the graph, and is applied to Trace C. This allows the user to optimize the display of Trace C without affecting the display of Trace A and Trace B.

Relative Ref, #dB

Sets the value applied to the top graticule for the relative scale that appears on the right side of the graph when trace math is active. Change this value by using the rotary knob, **Up/Down** arrows, or entering the value on the numeric keypad and pressing the dB soft key or the **Enter** key. This entry is valid only when trace math is active

Rel Scale, # dB/div

Sets the value applied to the scaling of the relative scale that appears on the right side of the graph when trace math is active. Change this value by using the rotary knob, **Up/Down** arrows, or entering the value on the numeric keypad and pressing the dB soft key or the **Enter** key.

This entry is valid only when trace math is active.

Recalled Traces

Opens the Recalled Traces menu with available operations for measurement traces that have been recalled from a storage device.

Recalled Traces Menu

Use Recalled Setups

Pressing this soft key will change the instrument sweep state from its current settings to those that apply to Trace Recalled A. Frequency, amplitude, attenuation, detection method, RBW, and VBW are all among those settings that will convert to the Recalled A settings

Recalled A View/Blank

This soft key toggles the Recalled A Trace to be either visible or hidden.

Recalled B View/Blank

This soft key toggles the Recalled B Trace to be either visible or hidden.

Recalled C View/Blank

This soft key toggles the Recalled C Trace to be either visible or hidden.

Recalled Operations

Pressing this soft key opens the Recalled Ops menu to allow recalled traces to be moved into active trace locations so that Trace math and marker operations can be performed.

Recalled Ops Menu

Recalled A -> B

Copies the contents of Trace Recalled A into Trace B. Doing so overwrites the previous contents of Trace B.

Recalled B -> B

Copies the contents of Trace Recalled B into Trace B. Doing so overwrites the previous contents of Trace B.

Recalled C -> B

Copies the contents of Trace Recalled C into Trace B. Doing so overwrites the previous contents of Trace B.

Recalled A -> C

Copies the contents of Trace Recalled A into Trace C. Doing so overwrites the previous contents of Trace C.

Recalled B -> C

Copies the contents of Trace Recalled B into Trace C. Doing so overwrites the previous contents of Trace C.

Recalled C -> C

Copies the contents of Trace Recalled C into Trace C. Doing so overwrites the previous contents of Trace C.

Back

Returns to the previous menu.

Clear Recall

Removes the recalled traces from memory so that they are no longer available for display.

Back

Returns to the previous menu.

Chapter 4 — Measurement Fundamentals

4-1   Introduction

Measurement fundamentals include the use of additional Spectrum Analyzer functions beyond frequency, span, amplitude and marker functions. In particular, this section focuses on resolution bandwidth, video bandwidth, sweep, and attenuator functions.

4-2   Resolution Bandwidth

Resolution Bandwidth is determined by the intermediate frequency (IF) filter bandwidth. The Spectrum Analyzer traces the shape of the IF filter as it tunes past a signal. If more than one IF filter is used in a Spectrum Analyzer, then the narrowest one dominates and is considered the resolution bandwidth. The choice of resolution bandwidth depends on several factors. Filters take time to settle. That is, when a signal first appears at the input of the filter, it will take a while before the signal appears at the output. Additionally, the output of the filter will take some time to settle to the correct value, so that it can be measured. The narrower the filter bandwidth (resolution bandwidth) the longer the settling time needs to be and so the slower the sweep speed.

The choice of resolution bandwidth will depend on the signal being measured. If two closely-spaced signals are to be measured individually, then a narrow bandwidth is required. If a wider bandwidth is used, then the energy of both signals will be included in the measurement. Thus, the wider bandwidth does not have the ability to look at frequencies selectively but instead simultaneously measures all signals falling within the resolution bandwidth. Therefore, a broadband measurement would include all signals and noise within the measurement bandwidth into a single measurement.

On the other hand, a narrow-band measurement will separate the frequency components, resulting in a measurement that includes separate peaks for each signal. Each has advantages. The ultimate decision will depend on the type of measurement required by the user.

Some amount of noise is always present in a measurement. Noise is often broadband in nature; that is, it exists at a broad range of frequencies. If the noise is included in the measurement, then the measured value could be in error (too large) depending upon the noise level. With a wide bandwidth, more noise is included in the measurement. With a narrow bandwidth, less noise enters the resolution bandwidth filter, and the measurement is more accurate. If the resolution bandwidth is narrower, then the noise floor will drop on the Spectrum Analyzer display. This is because the IF filter of the analyzer has been made narrower in bandwidth, which lets in less noise. As the measured noise level drops, smaller signals that were previously obscured by the noise can now be measured.

4-3   Video Bandwidth

Spectrum Analyzers typically use another type of filtering after the detector called video filtering. This filter also affects the noise on the display but in a different manner than the resolution bandwidth. In video filtering, the average level of the noise remains the same but the variation in the noise is reduced. Hence, the effect of video filtering is a "smoothing" of the signal noise. The resultant effect on the analyzer's display is that the noise floor compresses into a thinner trace, while the position of the trace remains the same.

Changing the video bandwidth (VBW) does not improve sensitivity, but it does improve repeatability when making low-level measurements. As a general rule of thumb, most field Spectrum Analyzer measurements are made at a video bandwidth that is a factor of 10 to 100 less than the resolution bandwidth. In the Spectrum Analyzer, this ratio can be specified in the BW menu. For a resolution bandwidth of 30 kHz, the typical video bandwidth setting options are either 3 kHz or 300 Hz.

4-4 Sweep Limitations

With some Spectrum Analyzers, the user has control over sweep time (the elapsed time of each sweep, sometimes called scan time). An analyzer cannot be swept arbitrarily fast while maintaining its specified accuracy, but will have a sweep rate limitation depending on the resolution bandwidth, video bandwidth, and frequency range selected. The sweep rate is not usually chosen by the user but is determined by the frequency range swept divided by the sweep time. The limitation on sweep rate comes from the settling or response time of the resolution and video bandwidth filters. If an analyzer is swept too quickly, then the filters do not have time to respond, and the measurement is inaccurate. Under such conditions, the analyzer display tends to have a "smeared" look to it, with the spectral lines being wider than normal and shifted to the right.

Fortunately, the MS271xB Spectrum Analyzer is designed to relieve the user from having to calculate the sweep speed or experiment to discover a sweep speed that yields accurate results. When changing the RBW and VBW with the Spectrum Analyzer, the sweep speed automatically changes to the fastest sweep speed that will yield accurate results. The sweep speed will be faster for a wide RBW or VBW and slower for a narrow RBW or VBW. The sweep speed can also be changed manually, by pressing the **Shift** and **Sweep** keys, then selecting the Min Sweep Time soft key. Enter a sweep time from 0.05 ms to 600 seconds. If the minimum sweep time entered by the user is less than the value needed to assure accurate results, then the value that delivers accurate results will be used. Regardless of the minimum sweep time setting, the Spectrum Analyzer will never sweep faster than the RBW and VBW settings will allow. The Spectrum Analyzer is designed to assure that no uncalibrated measurement conditions will occur.

4-5 Attenuator Functions

Attenuation adjusts the hand held Spectrum Analyzer input attenuator. In Auto mode, as the reference level is increased, the attenuation is increased. In Manual mode, the input attenuation can be adjusted using the keypad or the **Up/Down** arrow keys. The attenuator range is 0 to 65 dB, in 5 dB steps. When the preamplifier is on, input attenuation can be either 0 dB or 10 dB.

4-6 Preamplifier Operation

The preamplifier can be turned on and off by pressing the **Amplitude** key, then selecting the Preamp On/Off soft key.

MS2717B Preamplifier Operation

The preamplifier in the MS2717B has a gain of approximately 25 dB and generally will lower the noise floor by that amount. When the preamplifier is on, input attenuation can be either 0 dB or 10 dB.

MS2718B and MS2719B Preamplifier Operation

The preamplifier in the MS2718B and MS2719B has a gain of approximately 10 dB from 9 kHz to 4 GHz and no gain above 4 GHz. Setting a frequency greater than 4 GHz will turn off the preamplifier (MS2718B and MS2719B only).

Preamplifier Measurement Example

In the section below, Figure 4-1 shows a signal with the preamplifier off. Figure 4-2 shows the same signal with the preamplifier on. Notice that when the preamplifier is turned on, the noise floor drops significantly, allowing spectral regrowth components that were lost in the noise without the preamplifier to become easily visible.
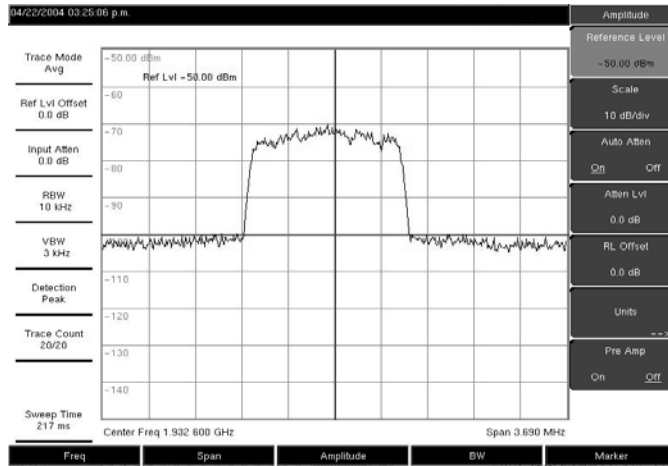
Figure 4-1.   Preamplifier Off
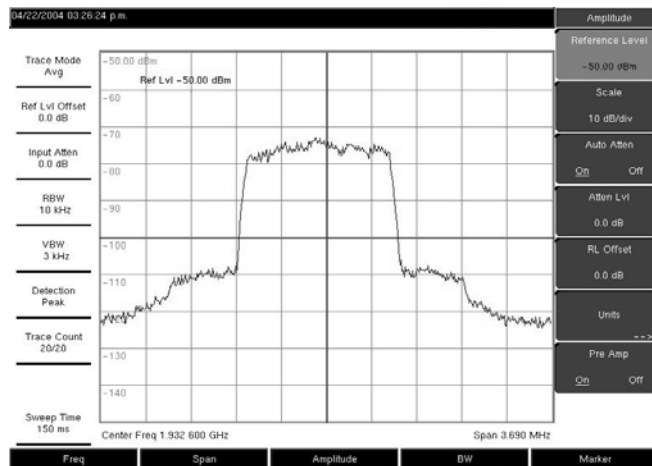
Figure 4-2.   Preamplifier On in the MS271xB

4-7   Option 07, Secure Data Operation

Secure Data Operation (Option 07) prevents the instrument from storing measurement setup or data information onto the internal file storage location. Setup and measurement files can be stored only to the external Compact Flash memory module or to a USB memory device that is attached to the MS271xB USB type A port.

Option 07 is a permanent configuration set at the factory. Instruments that are shipped with this option may not be switched between secure and non-secure operation

Information about the last setup is stored internally and is used as a convenience to the User, but this information can be cleared and overwritten with factory default setup information by holding down the Escape key while turning on the instrument.

Note	Users of Option 07 must update all versions of Anritsu Master Software Tools to version V2.10 or later in order to take full advantage of the security of Option 07. In earlier versions, use of the Master Software Tools feature called "Capture Current Measurement" will unavoidably record some information to the internal memory location, which cannot be cleared or sanitized by the MS271xB.

4-8   Option 89, IF Output (MS2718B and MS2719B only)

Option 89 provides a 37.8 MHz IF signal out of a BNC female connector.

- The IF output signal is present only when the instrument span is set to zero.
- The user can select the three fixed IF bandwidths (shown below) in addition to the bandwidths set by the instrument RBW filters.
- The output level of the IF signal ranges from -20 dBm to -45 dBm for a full-scale signal on the Spectrum Analyzer display.

The IF output amplitude varies in proportion to the input signal level and its position on the screen.
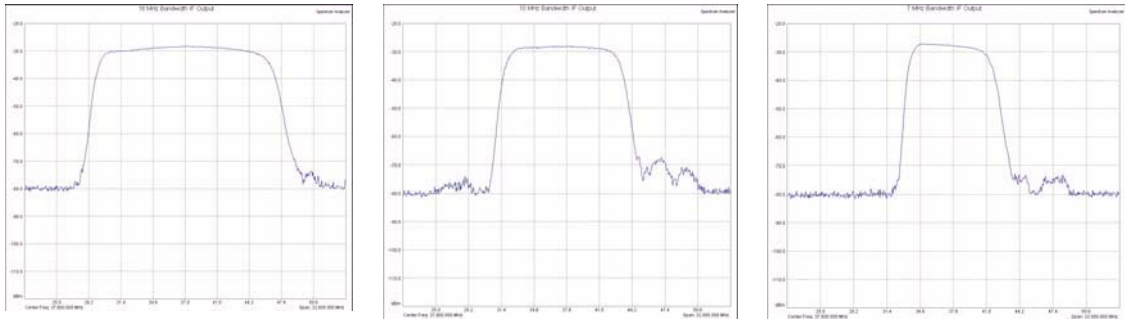
Figure 4-3.   IF Output Bandwidths: 16 MHz, 10 MHz, 7 MHz

Operation of IF Output

1. Set the instrument center frequency as desired.
2. Set Span to zero by pressing **Span** and Zero Span.
3. Select desired IF bandwidth by pressing the Zero Span soft key again to get to the Zero Span IF Bandwidth menu.
4. Use the IF Out connector to access signals that are to be analyzed.

Bandwidth Settings

Normal

7 MHz BW

10 MHz BW

16 MHz BW

The RBW settings should not be used during IF Output operation.

Chapter 5 — Transmitter Measurements

5-1 Introduction

One-button measurements are built into the MS271xB for field strength, occupied bandwidth, channel power, adjacent channel power ratio, and carrier to interference ratio (C/I) tests. In addition, AM/FM/SSB demodulation is available to aid in the identification of interfering signals. This chapter presents brief examples demonstrating the use of these measurements.

5-2 Occupied Bandwidth Measurement

Occupied bandwidth (OBW) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. Two different methods of calculation are available depending upon the technique used to modulate the carrier.

% Down Method

The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.

dBc Down Method

The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is a desired number of dB below the peak carrier level.

Required Equipment

- Anritsu MS271xB Spectrum Analyzer
- Test Port Extension Cable, Anritsu part number 15NNF50-1.5C
- 30 dB, 50 Watt, bi-directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is > +30 dBm)

OBW Measurement Procedure

1. Using the test port extension cable and the 30 dB, 50 Watt, bi-directional attenuator (if needed) connect the MS271xB to the appropriate transmitter test port or signal source.

2. Press the **Freq** key followed by the Center Freq soft key and enter the center frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as the MHz soft key.

3. If the attenuator was connected in Step 1, then press the **Amplitude** key and press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss in the attenuator.

4. Press the **Amplitude** key then press the Reference Level soft key to set the appropriate reference level.

5. Press the Atten Lvl soft key to set the input attenuation level or leave Auto Atten set to On.

6. Press the **BW** key to set the resolution bandwidth and video bandwidth if desired.

7. Press the **Shift** key then the **Measure** (4) key followed by the OCC BW soft key. Choose the measurement method (dBc Down or % Down) by pressing the Method soft key. The selected method is underlined.

8. Press the dBc or % soft keys to adjust the settings as needed. Common values are 99% and 30 dBc.

9. Press the On/Off soft key to start the measurement. An information box will appear below the graph while occupied bandwidth measurement is on.
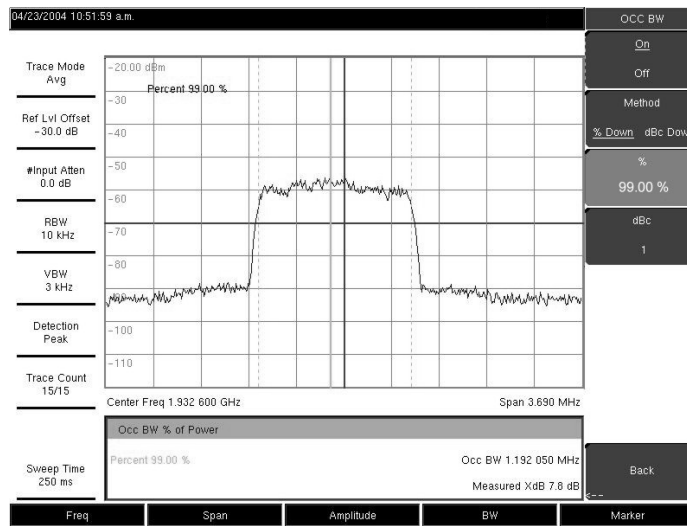
Figure 5-1.   Occupied Bandwidth Results Using the % of Power Method

The occupied bandwidth results using the % of power method on a CDMA signal is shown in Figure 5-1. Occupied Bandwidth is a constant measurement; after it is turned on, it remains on until it is turned off by pressing the On/Off soft key again. Occupied bandwidth is calculated at the end of each sweep.

5-3   Channel Power Measurement

Channel power measurement is one of most common measurements for a radio transmitter. This test measures the output power, or channel power, of a transmitter over the frequency range. Out-of-specification power measurements indicate system faults, which can be in the power amplifiers or in filter circuits. Channel Power measurements can be used to validate transmitter performance, comply with government regulations, or to keep overall system interference at a minimum.

Frequency and span settings for many signal standards can be automatically set by pressing the **Frequency** key and then the Signal Standard soft key. Choose the desired standard and press **Enter**. Press the Channel # soft key to enter the channel number at which the measurement is to take place.

5-4   CDMA Channel Power Measurement

The MS271xB can be used to measure CDMA signals in terms of channel power. It is important to use the proper settings to accurately measure a CDMA signal because a CDMA signal is different from a CW signal in many respects.

The following are the recommended settings for IS-95 CDMA measurements:

- CDMA Channel Bandwidth: 1.23 MHz
- Auto RBW setting: 10 kHz
- Auto VBW setting: 3 kHz

These values are set automatically when the appropriate signal standard is selected. Averaging may be used if desired.

Required Equipment

- MS271xB Spectrum Analyzer
- 30 dB, 50 Watt, Bi-Directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is > +30 dBm)
- Test Port extension cable, Anritsu 15NNF50-1.5C

CDMA Channel Power Measurement Procedure

1. Using the test port extension cable and 30 dB attenuator (if needed), connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS271xB.

2. Press the **Freq** key followed by the Signal Standard soft key. Scroll through the dialog box using the rotary knob or **Up/Down** arrow keys to highlight the desired air interface standard. In this case, select CDMA US PCS - Downlink and press **Enter**.

3. Press the Channel# soft key and enter the channel number using the keypad, the arrow keys, or the rotary knob. In this case, select channel 50.

4. If the attenuator was connected in Step 1, then press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss of the attenuator.

5. Press the **Amplitude** key and press the Reference Level soft key. Set the reference level to −50 dBm.

6. Press the Scale soft key and set the scale to 10 dB/division.

7. Press the **Shift** key then the **Measure** (4) key, and press the Channel Power soft key.

8. Press the Center Freq soft key and verify that the center frequency of the Spectrum Analyzer is set to that of the CDMA signal, 1.9325 GHz in this example. This value is automatically set when the air interface standard and channel number are selected.

9. Press the Channel Power Width soft key and verify that the integration bandwidth is set to 1.25 MHz.

10. Press the Span soft key and verify that the span is set to 3.75 MHz.

Note	The integration bandwidth is defined as the frequency span in which the Spectrum Analyzer integrates measured power readings, while the channel span is the frequency range of the analyzer sweeps.

11. Make the measurement by pressing the On/Off soft key. The instrument displays the measurement results in the message area

Note	Channel power is a constant measurement. After it is turned on, it will remain on until it is turned off by pressing the On/Off key again.

5-5   GSM Channel Power Measurement

Global Systems for Mobile (GSM) communication is a globally accepted standard for digital cellular communication. Three frequency bands are allocated to GSM mobile phones:

- 850 MHz
- 900 MHz
- 1800 MHz

GSM uses a combination of Frequency Division Multiple Access (FDMA) and Time Division Multiple Access (TDMA). Within each band are approximately one hundred available carrier frequencies on 200 kHz spacing (FDMA), and each carrier is broken up into time-slots so as to support eight separate conversations (TDMA). Each channel has an uplink and a downlink, 80 MHz apart. GSM uses the Gaussian Minimum Shift Keying (GMSK) modulation method. Due to the nature of TDMA, GSM transmitters ramp RF power rapidly. If the transmitter keys on too quickly, then users on different frequencies (especially those close to the channel of interest) may experience significant interference. This is one of the reasons that spurious measurements are used extensively in GSM applications.

Required Equipment

- MS271xB Spectrum Analyzer
- Test Port extension cable, Anritsu 15NNF50-1.5C

GSM Channel Power Measurement Procedure

1. Using the test port extension cable, connect the signal source to the RF In test port of the MS271xB.

2. Press the **Amplitude** key and press the Reference Level soft key to set the reference level to −20 dBm. Adjust the values given in this procedure to match your measurement conditions.

3. Press the Scale soft key and set the scale to 10 dB/division.

4. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

5. Press the **Freq** key followed by the Signal Standard soft key. Scroll through the dialog box using the rotary knob or **Up/Down** arrow keys to highlight the GSM900 Downlink standard for the measurement and press **Enter**.

6. Press the Channel# soft key and enter the channel number using the keypad, the arrow keys, or the rotary knob. For this example, select Channel 60.

7. Press the **Shift** key then the **Measure** (4) key and press the Channel Power soft key.

8. Press the Center Freq soft key and verify that the center frequency of the Spectrum Analyzer is set to that of the GSM signal, in this case 947.0 MHz.

9. Press the Int BW soft key and enter 200 kHz for the integration bandwidth, or set the integration bandwidth appropriate for the particular application.

10. Press the Span soft key and enter 800 kHz as the channel span, or set the channel span to a value appropriate for the particular application.

11. Make the measurement by pressing the Measure soft key. The MS271xB displays the measurement results in the message area

Note	Channel Power is a constant measurement. After it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

5-6   AMPS Channel Power Measurement

The MS271xB can be used to test Advanced Mobile Phone System (AMPS) base stations. These systems are narrow-band FM voice transceivers with system control functionality. The energy of the AMPS signal is represented by multiple narrow band FM channels spread over a wide frequency range. AMPS frequency allocations are within the 800 MHz and 900 MHz cellular telephone spectrum. Each service provider can use half of the 825-845 MHz range for receiving signals from cellular phones and half the 870-890 MHz range for transmitting to cellular phones. The bands are divided into 30 kHz channels with 12 kHz maximum frequency deviation.

Required Equipment

- MS271xB Spectrum Analyzer
- Test Port extension cable, Anritsu 15NNF50-1.5C
- 30 dB, 50 Watt, Bi-Directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30 (required if the power level being measured is > +30 dBm)

AMPS Channel Power Measurement Procedure

1. Using the test port extension cable, and the 30 dB attenuator if needed, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS271xB.

2. If the attenuator was connected in Step 1, then press the **Amplitude** key and press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss in the attenuator.

3. Press the **Amplitude** key and press the Reference Level soft key to set the reference level to −50 dBm.

4. Press the Scale soft key and set the scale to 10 dB/division.

5. Press the **Amplitude** key followed by the Auto Atten soft key (if needed) to turn On auto attenuation.

6. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

7. Press the **Shift** key then the **Trace** (5) key. Press the Trace Mode soft key as needed to select Max (maximum hold).

8. Press the **Shift** key then the **Measure** (4) key and press the Channel Power soft key.

9. Press the Center Freq soft key and set the center frequency of the Spectrum Analyzer to that of the signal, in this example 888.852728 MHz.

10. Press the Int BW soft key and enter 30 kHz for the integration bandwidth.

11. Press the Channel Span soft key and enter 90 kHz as the channel span, or set the channel span to a value appropriate for the particular application.

Make the measurement by pressing the On/Off soft key.

Note	Channel Power is a constant measurement. After it is turned on, it remains on until it is turned off by pressing the On/Off soft key again.

5-7   Adjacent Channel Power Ratio Measurement

Another common transmitter measurement is that of Adjacent Channel Power Ratio (ACPR), or adjacent channel leakage power. This is defined as the ratio of the amount of leakage power in an adjacent channel to the total transmitted power in the main channel. This measurement can be used to replace the traditional two-tone intermodulation distortion (IMD) test for system non-linear behavior.

The result of an ACPR measurement is expressed as a power ratio. In order to calculate the upper and lower adjacent channel values, the MS271xB needs to know the values of four parameters:

- Main Channel Center Frequency
- Measurement Channel Bandwidth
- Adjacent Channel Bandwidth
- Channel Spacing

When a signal standard is selected from the list in the MS271xB, these four values are automatically set for that signal standard.

Required Equipment

- MS271xB Spectrum Analyzer
- 30 dB, 50 Watt, Bi-Directional, DC - 18 GHz, N(m) - N(f), Attenuator, Anritsu 42N50A-30 (if needed for the power level being measured)
- Test Port extension cable, Anritsu 15NNF50-1.5C

Adjacent Channel Power Ratio Measurement Procedure

1. Using the test port extension cable, and the 30 dB attenuator (if needed), connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS271xB.

2. If the attenuator was connected in Step 1, then press the **Amplitude** key and press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss of the attenuator.

3. Press the **Amplitude** key and press the Reference Level soft key to set the reference level to the appropriate reference level.

4. Press the Atten Lvl soft key to set the input attenuation level needed for the measurement. This value depends on the input power level and any external attenuator. Enter an attenuation level to achieve roughly −40 dBm at the input mixer.

5. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

6. You have two ways to set the measurement parameters. If the signal standard and channel are known, then press the **Freq** key and set the Signal Standard and Select Channel soft keys for the signal to be measured then skip to Step 12. If the signal standard and channel are not known, then follow the procedure in Step 6 through Step 11 below.

7. Press the **Freq** key, press the Center Freq soft key, and enter the desired center frequency.

8. Press the **Shift** key then the **Measure** (4) key, and press the ACPR soft key.

9. Press the Main Ch BW soft key, and enter the desired main channel bandwidth. For an IS-95 CDMA signal, enter 1.23 MHz.

10. Press the Adj Ch BW soft key, and enter the desired adjacent channel bandwidth. For an IS-95 CDMA signal, enter 1.23 MHz.

11. Press the Ch Spacing soft key, and enter the desired channel spacing. For an IS-95 CDMA signal, enter 1.23 MHz.

12. Begin making measurement by pressing the On/Off soft key. The instrument displays the measurement results in the message area.

Note	Adjacent Channel Power Ratio is a constant measurement. After it is turned on, it remains on until it is turned off by pressing the On/Off key again.

5-8   GSM Adjacent Channel Power Measurement

Required Equipment

- Anritsu MS271xB Spectrum Analyzer
- 30 dB, 50 Watt, Bi-Directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30 (if required for the power level being measured)
- Test Port extension cable, Anritsu 15NNF50-1.5C

Procedure

1. Using the test port extension cable and 30 dB attenuator, connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS271xB.

2. If the attenuator was connected in Step 1, then press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss of the attenuator.

3. Press the **Amplitude** key and press the Reference Level soft key to set the reference level to 60 dBm.

4. Press the Atten Lvl soft key to set the input attenuation level needed for the measurement. This value depends on the input power level and any external attenuator. Enter an attenuation level to achieve roughly −40 dBm at the input mixer.

5. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

6. The measurement parameters can be set in two ways. If the signal standard and channel are known, then press the **Freq** key and set the Signal Standard and Select Channel soft keys for the signal to be measured then skip to Step 12. If the signal standard and channel are not known, then follow the procedure in Step 7 through Step 12 below.

7. Press the **Freq** key, press the Center Freq soft key, and enter the desired center frequency.

8. Press the **Shift** key then the **Measure** key and press the ACPR soft key.

9. Press the Main Ch BW soft key, and enter the main channel bandwidth.

10. Press the Adj Ch BW soft key, and enter the adjacent channel bandwidth.

11. Press the Ch Spacing soft key, and enter the channel spacing.

12. Make the measurement by pressing the On/Off soft key. The detection method is automatically changed to RMS Average.

Solid vertical lines are drawn on the display to indicate the main channel. Dashed vertical lines define the adjacent channels. The instrument will display the measurement results in the message area.

Note	Adjacent Channel Power Ratio is a constant measurement. After it is turned on, it remains on until it is turned off by pressing the On/Off soft key again.

5-9   AMPS (TDMA) Adjacent Channel Power Measurement

Required Equipment

- MS271xB Spectrum Analyzer
- 30 dB, 50 Watt, Bi-Directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30 (if needed for the power level being measured)
- Test Port extension cable, Anritsu 15NNF50-1.5C

AMPS (TDMA) Adjacent Channel Power Measurement Procedure

1. Using the test port extension cable, and the 30 dB attenuator (if needed), connect the signal source to the input of the attenuator, and connect the output of the attenuator to the RF In test port of the MS271xB.

2. If the attenuator was connected in Step 1, then press the **Amplitude** key and press the RL Offset soft key and set the reference level offset to −30 dB to compensate for the loss in the attenuator.

3. Press the **Amplitude** key and press the Reference Level soft key to set the reference level to −50 dBm.

4. Press the RL Offset soft key to set the reference level offset to −30 dB.

5. Press the Auto Atten soft key and set automatic attenuation to On.

6. Press the **Freq** key, press the Center Freq soft key, and enter 835 MHz.

7. Press the **Shift** key then the **Measure** (4) key, and press the ACPR soft key.

8. Press the Main Ch BW soft key to enter the main channel bandwidth. For an AMPS signal, enter 30 kHz.

9. Press the Adj Ch BW soft key, and enter the adjacent channel bandwidth. For an AMPS signal, enter 30 kHz.

10. Press the Ch Spacing soft key, and enter the channel spacing. For an AMPS signal, enter 30 kHz.

11. Make the measurement by pressing the On/Off soft key.

The detection method is automatically changed to RMS Average. Solid vertical lines are drawn on the display to indicate the main channel. Dashed vertical lines define the adjacent channels. The instrument will display the measurement results in the message area.

Note	Adjacent Channel Power Ratio is a constant measurement. After it is turned on, it will remain on until it is turned off by pressing the On/Off soft key again.

5-10 Out-of-Band Spurious Emission Measurement

Required Equipment

- MS271xB Spectrum Analyzer
- Test Port extension cable, Anritsu 15NNF50-1.5C

Out-of-Band Spurious Emission Measurement Procedure

1. Using the test port extension cable, connect the signal source to the RF In test port of the MS271xB.

2. Press the **Freq** key, press the Center Freq soft key, and enter the center frequency.

3. Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

4. Press the **Amplitude** key, then press the Reference Level soft key and set the reference level to –20 Bm.

5. Press the Auto Atten soft key set the attenuation to On.

6. Press the **BW** key and use the RBW and VBW soft keys to set the resolution bandwidth to 3 kHz and the video bandwidth to 300 Hz.

7. Press the **Marker** key and press the Marker 1 2 3 4 5 6 soft key to select Marker 1. The underlined number indicates the active marker.

8. Press the On/Off soft key and use the arrow keys, the keypad and the knob to move the marker over one of the spurs.

9. Compare the value of the marker to the specified allowable level of out-of-band spurious emissions for the corresponding channel transmit frequency.

10. Repeat Steps 9 and 10 for the remaining spurs. Use either Marker 1 again, or choose another marker. A simulated out-of-band spurious signal 21.000 MHz from the carrier using a delta marker is shown in Figure 5-2.
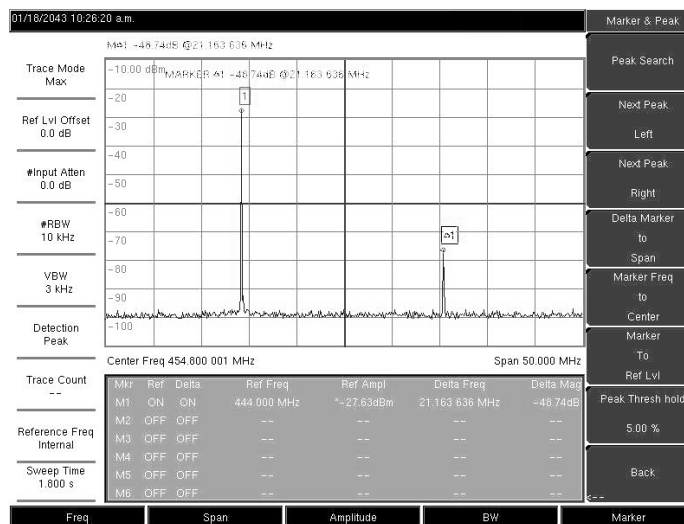
Figure 5-2.   Simulated Out-of-Band Spurious Emission Measurement

5-11   In-Band/Out-of-Channel Measurements

The in-band/out-of-channel measurements are those measurements that measure distortion and interference within the system band, but outside of the transmitting channel. These measurements include in-band spurious emissions and adjacent channel power ratio (also called spectral regrowth). Stringent regulations control the amount of interference that a transmitter can spill to neighboring channels. In order to determine compliance with the allowable level of spurious emissions, two parameters need to be specified:

- Measurement channel bandwidth
- Allowable level of spurious emissions

5-12   In-Band Spurious Measurement

Required Equipment

- MS271xB Spectrum Analyzer
- 30 dB, 50 Watt, Bi-Directional, DC to 18 GHz, N(m)-N(f), Attenuator, Anritsu 42N50A-30
- Test Port extension cable, Anritsu 15NNF50-1.5C

Procedure

1. Using the test port extension cable and 30 dB, 50 Watt, Bi-directional attenuator, connect the MS271xB to appropriate transmit test port.

2. Press the **Freq** key, press the Center Freq soft key, and enter the center frequency.

3. Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

4. Press the **Amplitude** key and then press the Reference Level soft key to set the reference level to −20 dBm.

5. Press the RL Offset soft key to set the reference level offset to −30 dB to compensate for the loss of the attenuator

6. Press the Auto Atten soft key set the attenuation to On.

7. Press the **BW** key and use the RBW and VBW soft keys to set the resolution bandwidth to 10 kHz and the video bandwidth to 300 Hz.

8. Press the **Marker** key and press the Marker 1 2 3 4 5 6 soft key to select Marker 1. The underlined number indicates the active marker.

9. Press the On/Off soft key and use the arrow keys, the keypad and the knob to move the marker over one of the spurs.

10. Compare the value of the marker to the specified allowable level of in-band/out-of-channel spurious emissions for the corresponding channel transmit frequency.

11. Repeat steps 9 and 10 for the remaining spurs. Use either Marker 1 again, or choose another marker.

A simulated in-band spur at 1.625 MHz from the carrier frequency is shown in Figure 5-3. The carrier is measured by M1. The delta marker on M1 shows the signal at f_c + 1.625 MHz to be 60.17 dB down from the carrier. These values should be compared against the specification for the transmitter being tested.
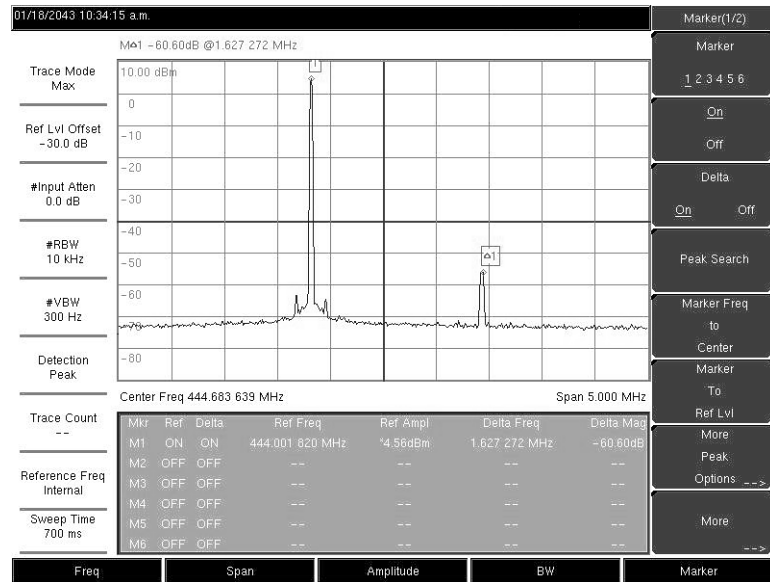
Figure 5-3. In-band Spurious Measurement

Note	The resolution bandwidth of a Spectrum Analyzer is determined by the intermediate frequency (IF) filter bandwidth. The instrument traces the shape of the IF filter as it sweeps past a signal. Therefore, if two equal-amplitude signals are very close to each other, then the measurement result can appear to be one single response because the IF or resolution bandwidth is not small enough to resolve the two signals. Similarly, if two signals are not equal in amplitude but are very close together, then the smaller signal may not be seen because it is hidden under the large response.

5-13   Field Strength

Required Equipment

- MS271xB Spectrum Analyzer
- Portable Antenna for which antenna factors or antenna gain and bandwidth data are available.

Field Strength Measurement Procedure

1. Press the **Shift** key then the **Measure** key and press the Field Strength soft key.

2. Press the Antenna soft key and use the **Up/Down** arrow keys or the rotary knob to select the desired antenna. Press the **Enter** key to select.

Note	Select an antenna from the standard list available in the MS271xB, or use the Antenna Editor feature of Anritsu Master Software Tools to define a custom antenna and upload the antenna information to the MS271xB antenna list.

3. Connect the antenna to the MS271xB.

4. Press the **Freq** key, press the Center Freq soft key, and enter the center frequency.

5. Press the **Span** key. Set the span wide enough to include the primary channel bandwidth and upper and lower channel bandwidths.

6. Press the **BW** key and verify that RBW Auto and VBW Auto are On.

7. To change the units of measurement, press the **Amplitude** hard key, then press the Units soft key and select dBm, dBV, dBmV, or dBµV.

8. Press either the Volts or Watts soft key, as required. The MS271xB automatically adjusts the measurement by the antenna factors selected. Marker values will be displayed in the same units as selected for the amplitude.

Antenna Calculations

The following is a list of various antenna calculations should you find it necessary to convert from one to another:

Conversion of Signal Levels

Conversion of signal levels from Watts (W) to Volts (V) in a 50 ohm system:

$$P = \frac{V^2}{R}$$

where:

    P = power in Watts
    V = voltage level in Volts
    R = resistance in Ohms

and note that:

$1\text{mW} = 10^{-3}\,\text{W}$ and $1\mu\text{V} = 10^{-6}\,\text{V}$

Power in dBm and Voltage in dBµV

For power in dBm, and voltage in dB(µV):

$$V_{dB(\mu V)} = P_{(dBm)} + 107\,\text{dB}$$

Power Density to Field Strength

An alternate measure of field strength to electric field is power density:

$$P_d = \frac{E^2}{120\pi}$$

where:

E = field strength in V/m
P = Power density in W/m

Power Density at a Point

Power density at a point, in the far field, where electric and magnetic fields are related by the impedance of free space:

$$P_d = \frac{P_t G_t}{(4\pi r^2)}$$

where:

P_d = power density in W/m
P_t = power transmitted in Watts
G_t = gain of transmitting antenna
r = distance from the antenna in meters

5-14   AM/FM/SSB Demodulation

The MS271xB built-in demodulator for AM, narrowband FM, wideband FM and single sideband (selectable USB and LSB) allows a technician to hear an interfering signal to ease identification. The demodulated signal can be heard using either the built-in speaker, or through a monaural cellular headset connected to the 2.5-mm jack on the test panel.

Demodulation Procedure

1. Press the **Shift** key followed by the **Measure** (4) key and the AM/FM Demod soft key.

2. Press the Demod Type soft key and select FM Wide Band, FM Narrow Band, AM, USB, or LSB to match the modulation format of the signal.

3. Press the Back soft key.

4. Press the Demod Freq soft key and use the keypad or rotary knob to enter the center frequency of the signal to be demodulated.

   • For USB and LSB signals, fine tune the signal by adjusting the Beat Freq Osc.
   • By default the BFO frequency is set to zero, meaning that the re-injected carrier is exactly at the demodulation frequency.
   • The Beat Freq Osc soft key allows adjustment of the beat frequency oscillator to fine tune the signal through a span of ±10000 Hz.

5. Press the On/Off soft key to enable the measurement.

6. Press the Volume soft key and use the **Up/Down** arrow keys or rotary knob to change the audio volume from 0% to 100%. For most cellular headsets a volume of 40% is adequate.

7. The Demod Time soft key sets the time the Spectrum Analyzer will demodulate the signal. Enter a value from 100 ms to 500 seconds.

5-15   Carrier to Interference Ratio Measurement

Carrier to Interference Ratio (C/I) Measurement is a two-step process, first measuring the carrier level and then, with the carrier turned off, measuring the remaining signals and noise in the band of interest. After the two measurements are complete, the ratio of the carrier level to the noise plus interference is displayed using three assumptions:

• The interferer is a narrowband frequency hopping signal (NB FHSS)
• The interferer is a wideband frequency hopping signal (WB FHSS)
• The interferer is a broadband signal (BB).

The primary application for this type of measurement is determining the magnitude of interference problems for 802.11b, 802.11g, and 802.11a access points (hot spots).

C/I Ration Measurement Procedure

1. Press the **Frequency** key followed by the Signal Standard soft key. Select the appropriate signal standard based on the signal to be measured and press **Enter**.

2. Press the Select Channel soft key, select the operating channel of the access point being measured and press **Enter**.

3. Press the **Shift** key followed by the **Measure** (4) key and the C/I soft key.

4. Press the Center Freq soft key and enter the desired frequency, unless a Signal Standard and Channel have already been selected in the **Frequency** menu.

5. If needed, press the Span soft key and set an appropriate span width for the signal to be measured.

6. If the signal environment includes slow frequency hopping signals, such as cordless telephones, then press the Min Sweep Time soft key to set a sweep time of one second or more to give a good chance of capturing instances of the interfering signal.

7. Press the On/Off soft key and follow the on-screen prompts to complete the measurement.

Note	Access to the transmitter is required to complete this procedure as the transmitted carrier must be turned off for the second portion of the measurement.

8. After the measurement is complete, the measurement box gives results for the three different signal types. Some measurement results may show as Error, and this is to be expected.

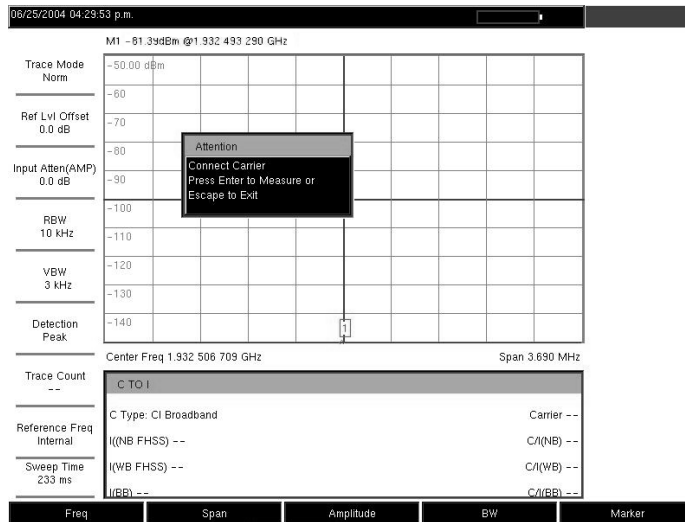**9.** The following figures show the C/I measurement steps.

Figure 5-4.   C/I Measurement, Ready to Measure the Carrier
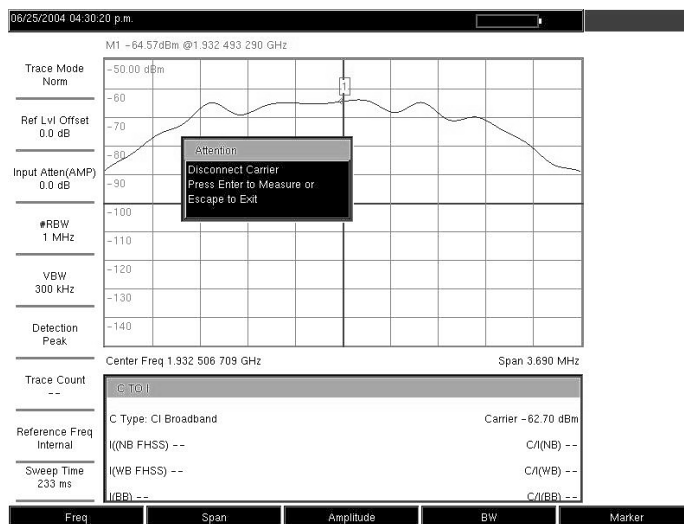

Figure 5-5.   C/I Measurement, Carrier Measured
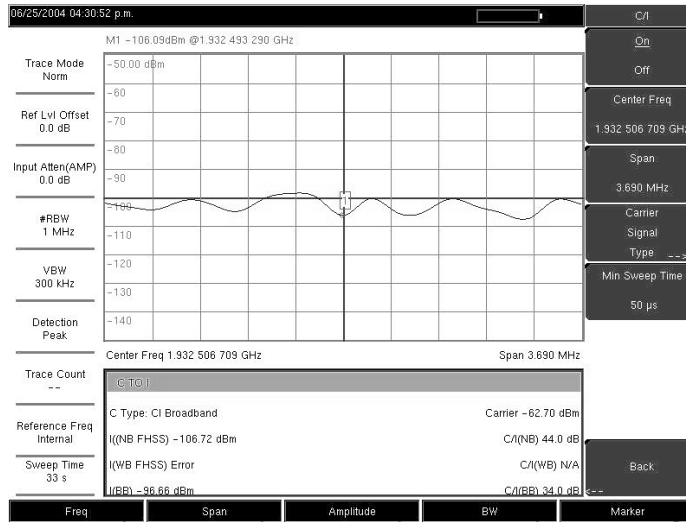
Figure 5-6.   C/I Measurement, Results

Chapter 6 — Tracking Generator

6-1 Introduction

This chapter provides a description of the optional Tracking Generator (Option 20) for the MS2717B. The Tracking Generator operates over a frequency range of 100 kHz to 7.l GHz, and provides a signal with an output frequency that is the same as the tuning frequency of the Spectrum Analyzer. The output power and flatness is specified from 400 kHz to 7.1 GHz. When the Spectrum Analyzer is set to zero span, the output frequency becomes a CW signal. The output power is leveled and can be adjusted from 0 dBm to −40 dBm in 0.1 dB steps.

6-2 Menu Structure

The tracking generator frequency is controlled with the Spectrum Analyzer Frequency and Span menus. For more information on these menus, refer to Section 3-5, "Freq (Frequency) Menu" on page 3-11 and Section 3-11, "Span Menu" on page 3-28 in Chapter 3, "Key Functions".

The other tracking generator control is in the Measure menu. To access the functions under the Measure menu, press the **Shift** key, then the **Measure** (4) key. The Measure menu is described in Section 3-8, "Measure Menu" on page 3-23). The addition of Option 20 adds the Tracking Generator soft key and subsequent soft key menus shown below.
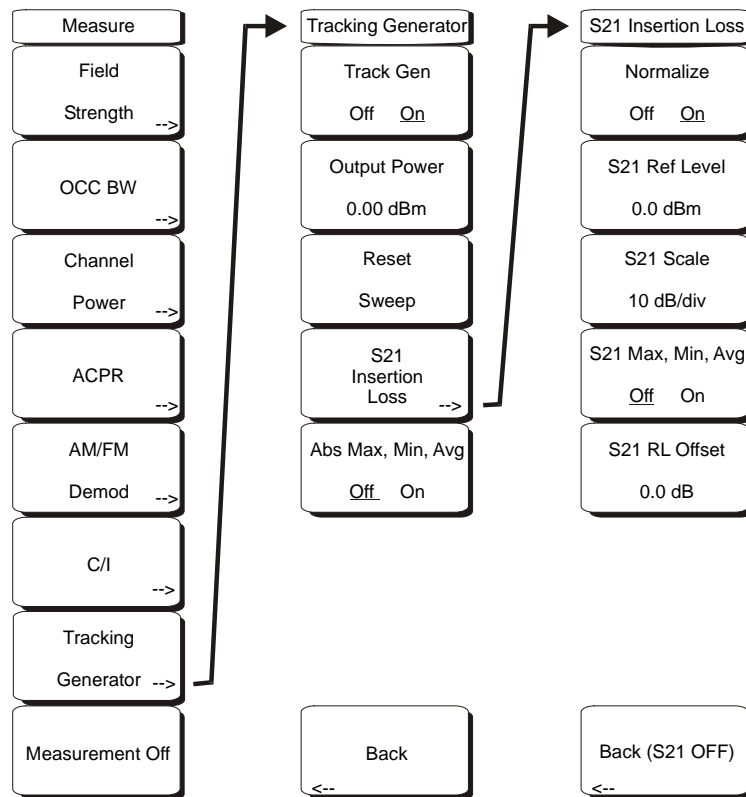
Tracking Generator menu

Figure 6-1. Measure Menu with Tracking Generator (Option 20)

Tracking Generator Menu

Track Gen
Off   On

Turns the output of the tracking generator on and off. The output power turns on at the level set with the Output Power soft key.

Output Power

Sets the output power from 0 dBm to −40 dBm, in 0.1 dB steps, at the output connector. The output is leveled and flat over the specified frequency range of the tracking generator.

Reset Sweep

Restarts the sweep at the lowest frequency selected and restarts Averaging.

S21 Insertion Loss

Opens a secondary menu to manage relative measurements. The Tracking Generator must be On before this button will access the S21 Insertion Loss menu below.

S21 Insertion Loss Menu

Normalize
Off   On

Starts a calibration process. Make a through connection between the Tracking Generator Output and the Spectrum Analyzer Input connectors before doing normalization. For the most accurate results, use the same cables and adapters that will be used for the measurement while performing normalization.

S21 Ref Level

Sets the value of the top graticule line in dB relative to the through connection made when normalization was performed.

S21 Scale

Sets the scale factor from 1 dB/division to 15 dB/division in 1 dB steps.

S21 Max, Min, Avg
Off   On

Toggles a measurement box that shows the maximum signal, the minimum signal and the numeric average of all data points in dB.

S21 RL Offset

Compensates for amplifiers or attenuators added to the measurement path after normalization. Use negative values for added attenuation and positive values for added amplification.

Back (S21 Off)

Turns off S21 normalization and returns to the main tracking generator menu.

Abs Min, Max, Avg
Off   On

Shows the power in dBm of the lowest and highest points along with the numeric average of all data points.

6-3   Normalization

Normalization is a scalar process designed to remove the loss and variation caused by cables and adapters and to display a 0 dB reference level. After normalization is complete, the display changes from dBm to dB, relative to the calibrated 0 dB reference.

6-4   Tracking Generator Operation

1. Press the Track Gen Off/On soft key to turn the output of the tracking generator on and off. The output power turns on at the level set with the Output Power soft key.

2. Press the Output Power soft key and set the output power from 0 dBm to −40 dBm, in 0.1 dB steps, at the output connector. The output is leveled and flat over the specified frequency range of the tracking generator.

3. The Reset Sweep soft key restarts the sweep at the lowest frequency selected and restarts Averaging.

6-5   Measurement Example

This example demonstrates how to calibrate the instrument and make a measurement.

1. Set the frequency range to cover the range of the DUT being tested. In this example, the center frequency is set to 1.96 GHz with a 500 MHz span.

2. Press the **Shift** key, then the **Sweep** (3) key.

3. Press the Detection soft key and select the Sample detector for the fastest sweeps.

4. Press the **Shift** key, then the **Measure** (4) key.

5. Press the Tracking Generator soft key.

6. Press the Track Gen Off/On soft key to turn the output of the tracking generator on.

7. Press the Output Power soft key and set the output power from 0 dBm to −40 dBm, in 0.1 dB steps, for the device being measured. In this example, measuring a bandpass filter, the power level is set to 0 dBm (zero dBm) to get the maximum signal through the filter.

8. Connect the DUT between the RF Out and RF In connectors on the instrument. Use good quality cables and adapters to make the connections.

9. Observe the measurement to confirm that the frequency range covers the frequency range that was intended.
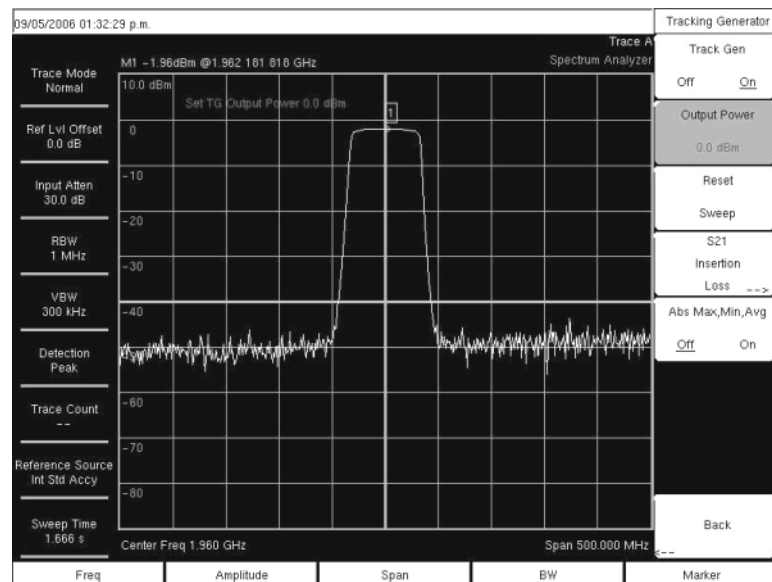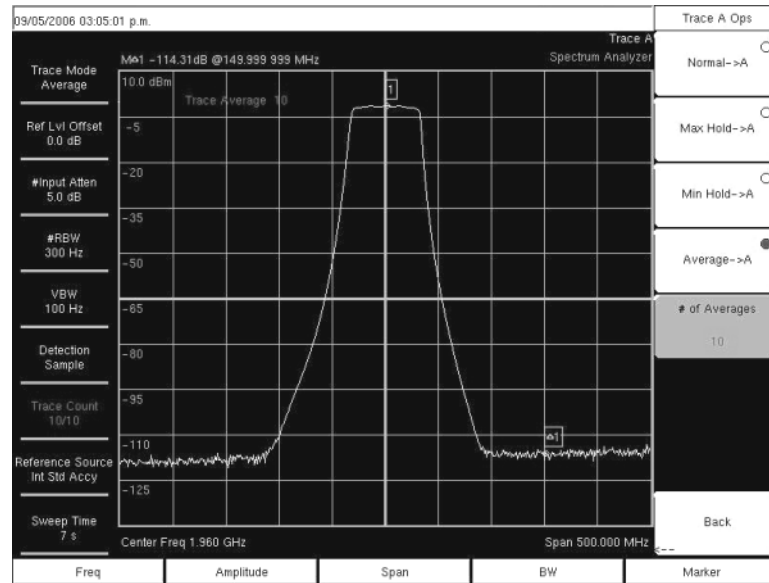

Figure 6-2.   Measurement Before Normalization

10. If the dynamic range is not sufficient for the necessary measurements, then reduce the input attenuation and RBW to maximize the dynamic range. It is likely that the scale will have to be changed from 10 dB/division to a higher value to see the stop band of a good filter. In this example the scale was changed to 15 dB/division.

11. When measuring a filter with a very high insertion in the stop band, press the **Shift** key, then the **Trace** (5) key. Press the Trace A Operations soft key, then the Average -> A soft key to turn on averaging and clean up the stop band area. An averaging value of 10 (ten) will probably be adequate for most filters.

Figure 6-3.   Instrument Set for Good Measurement Before Normalization

12. After the frequency range and other settings are satisfactory, disconnect the DUT and make a through connection between the RF Out and RF In connectors. For the most accurate results, use the same cables and adapters for this connection as were used to connect the DUT.

13. Confirm that the display shows a nearly flat signal when the through is connected. If the signal is not reasonably flat, then verify that the cables and connections are in good condition and that the connectors are properly tightened.

14. Press the S21 Insertion Loss soft key.

15. Press the Normalize soft key to set Normalization On.
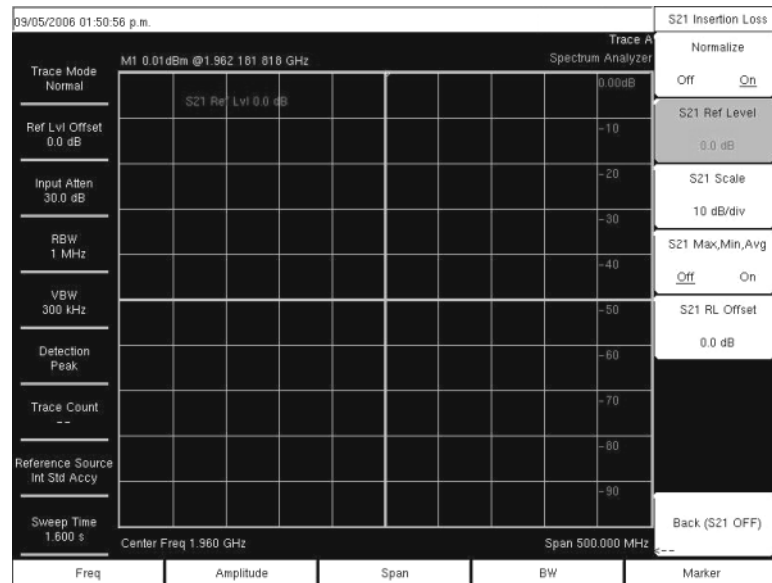
Figure 6-4.   Flat Sweep After Normalization

16. After the normalization sweep is finished, reconnect the DUT between the RF Out and RF In connectors. The following figure shows the measurement after normalization. If desired, the resolution bandwidth and video bandwidth can be changed after normalization without needing to renormalize. If the input attenuation is changed, then a new normalization sweep is required.

Figure 6-5.   Measurement After Normalization (scale at 10 dB/division)

17. If necessary, press the S21 Scale soft key and change the scale to view the entire measurement.

Figure 6-6. S21 Scale Changed to 15 dB/division

Chapter 7 — WCDMA/HSDPA Measurements

7-1   Introduction

The MS271xB Spectrum Analyzer offers two WCDMA/HSDPA options and one WCDMA option:
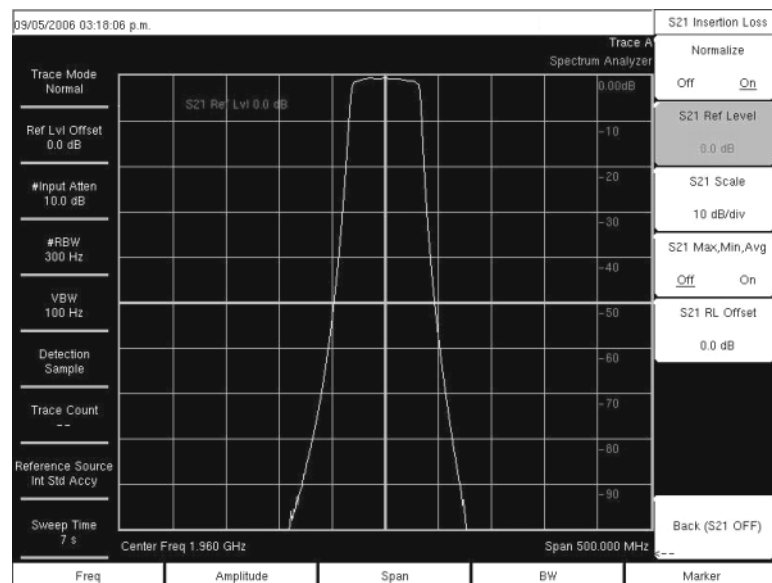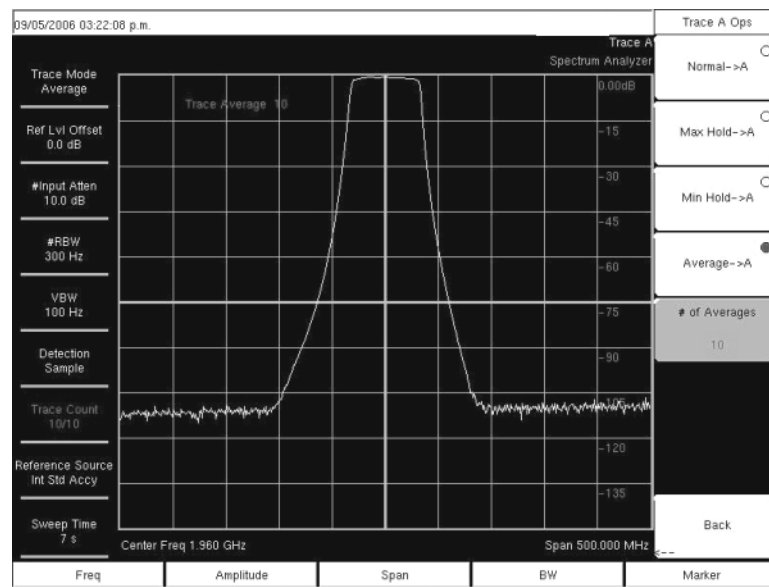
- WCDMA/HSDPA RF Measurements (Option 44)
- WCDMA Demodulator (Option 45)
- WCDMA/HSDPA Demodulator (Option 65).

Note	The WCDMA/HSDPA Demodulator option demodulates both WCDMA and HSDPA signals. The WCDMA Demodulator only demodulates WCDMA signals.

The Economy Microwave Spectrum Analyzer can measure node B transmitter performance over the air by connecting an antenna or by connecting the node B equipment directly to the Spectrum Analyzer. To measure a WCDMA signal over the air, connect the appropriate frequency band antenna to the Economy Microwave Spectrum Analyzer RF In connector. To connect the node B equipment directly to the Economy Microwave Spectrum Analyzer, connect the power amplifier of the node B equipment to the RF In connector using a coupler or attenuator.

Note	The maximum input damage level of the MS2717B **RF In** port is +43 dBm.
	The maximum input damage level of the MS2718B or the MS2719B **RF In** port is +30 dBm.
	To prevent damage always use a coupler or high power attenuator. The maximum usable input for measurements is +30 dBm for all models.

7-2   WCDMA/HSDPA Signal Analyzer Mode - Amplitude Menu

```
┌─────────────────┐
│    Amplitude    │
├─────────────────┤
│      Scale      │
│                 │
│      — —        │
├─────────────────┤
│  Power Offset   │
│     0.0 dB      │
├─────────────────┤
│   Auto Range    │
│  On       Off   │
├─────────────────┤
│     Adjust      │
│     Range       │
└─────────────────┘
```
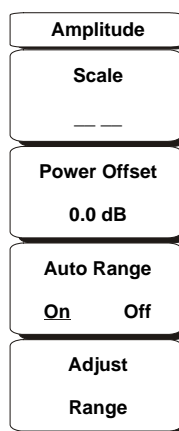
Figure 7-1.   WCDMA/HSDPA Amplitude Menu

Scale

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

Power Offset

Choose power offset to have the Spectrum Analyzer automatically adjust for the loss 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 soft key.

Auto Range
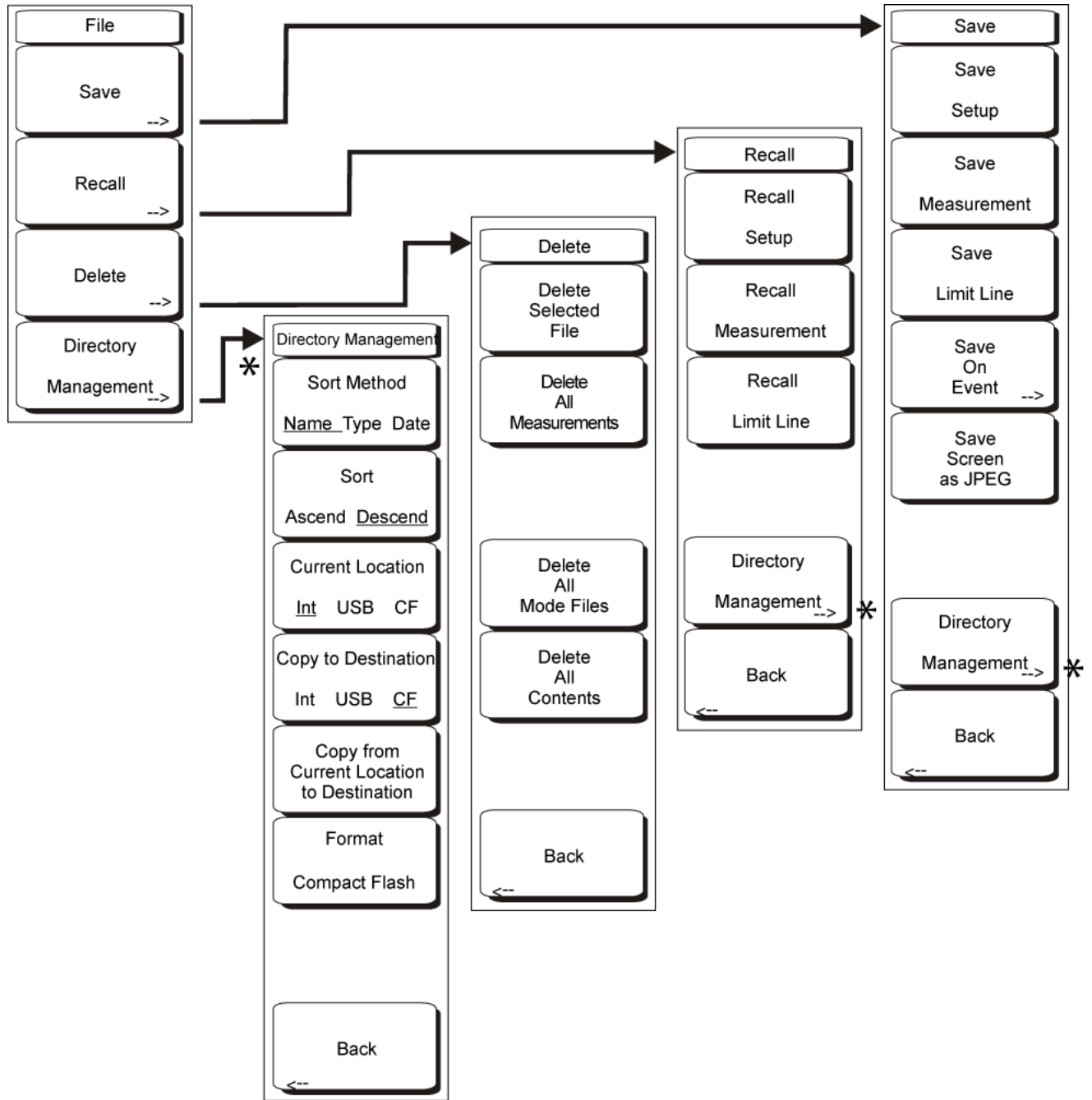On   Off

Adjusts the reference level automatically when Auto Range is activated. Toggles between On and Off.

Adjust Range

Adjust the range adjusts the reference level to be optimal based on the measured signal.

7-3   File Menu

Figure 7-2.   WCDMA/HSDPA File Menu

To access the functions under the File menu, press the **Shift** key, then the **File** (7) key.

Save

The Save soft key opens the Save menu.

Measurements may be saved to the internal memory, an external Type-1 Compact Flash module, or a USB Flash Drive. Anritsu recommends saving to external storage if a large number of measurements are to be saved. The Spectrum Analyzer is shipped with a Compact Flash module and a USB Flash Drive. In order to hold the entire contents of the internal memory, external memory devices must be at least 256 MB. Compact Flash modules greater than 512 MB storage capacity may not function properly.

For information on external memory part numbers, refer to Section 1-3, " MS271xB Options and Accessories" on page 1-2 in Chapter 1, "General Information".

Save Menu

Save Setup

Opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/ Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement

Initiates a dialog box to name and save the current active trace A. The saved measurement trace can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement trace. Measurements are saved in a directory called /usr on the Compact Flash memory module.

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

Save Limit Line

This selection is not available in WCDMA/HSDPA Signal Analyzer mode.

Save On Event…

This selection is not available in WCDMA/HSDPA Signal Analyzer mode.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with .jpg appended.

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

Recall

Opens the Recall options menu.

Recall Menu

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

Recall Measurement

Opens a selection box that allows recall of a previously stored measurement trace from the currently selected storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved measurement trace, and press **Enter**, the rotary knob, or the Recall soft key to select. A recalled trace may be displayed as trace A, in place of the live trace, or as trace B or C along with the live trace. Use the rotary knob or the **Up/Down** arrow keys to highlight the recalled trace option, and press the **Enter** key to select. Press the **Esc** key to cancel the recall.

To remove a recalled measurement trace from the screen, press the **Shift** key and the **Trace** (5) key to open the Trace menu. Use the Trace soft key to select the trace to be removed from the screen and use the View/Blank soft key to view or blank the trace. Use the Trace key to select an active trace after blanking a recalled trace.

Recall Limit Line

This selection is not available in WCDMA/HSDPA Signal Analyzer mode.

Directory Management

Opens the Directory Management menu. For a complete description, refer to "Directory Management" on page 7-5.

Back

Returns to the previous menu.

Delete

Opens a selection box that shows all stored setups and traces in the currently selected location (refer to "Directory Management" on page 7-5). The list shows the setup and measurement names, the type (stp for a saved setup, spa for a saved trace, jpg for a JPEG file) and the date and time the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file to be deleted, and press **Enter**, or the Delete soft key to delete. Press the **Esc** key to cancel the operation. Note that no mechanism is available to retrieve deleted files.

Delete Menu

Delete Selected File

Use the up and down arrow buttons or the rotary knob to select the file that is to be deleted. Press **Enter** to confirm that you want to delete the file or **Esc** to exit without deleting.

Delete ALL Measurements

Deletes all measurements of the current mode in the currently selected storage location. The memory from which measurements will be deleted is set in the Directory Management menu and is the Current Location.

Delete ALL Mode Files

Deletes all measurements of the type saved in the current operating mode of the instrument. In addition all jpg and setup files (regardless of the mode) are deleted.

Delete ALL Contents

Deletes all measurements, jpg files and setup files of ALL measurement types.

Back

The Back key returns to the previous menu.

Directory Management

The Directory Management soft key opens the Directory Management menu. Note that this menu is available under the File, Recall, and Save menus.

Directory Management menu

Sort Method Name Type Date

File lists can be sorted by the name of the file, the type of file (SPA file, STP file, and so forth) or by the date that the file was saved.

Sort Ascending Descending

Selects whether the selected sort is sorted from lowest to highest (ascending) or highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort).

Current Location Int USB CF

This choice lets you select where measurements and setups will be saved. Pressing the soft key selects the location for storing files on the internal memory, USB flash drive, or a compact flash memory module. The "current location" and the "copy to destination" can never be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location.

Copy to Destination Int USB CF

This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, then the current location is automatically changed if the current location is the same as the selected copy to destination.

Copy From Current Location To Destination

Pressing this soft key causes all measurements, setups and jpg files stored in the user selected "current location" to be copied to the "copy to destination". If no storage module installed in the instrument, then an error message is displayed.
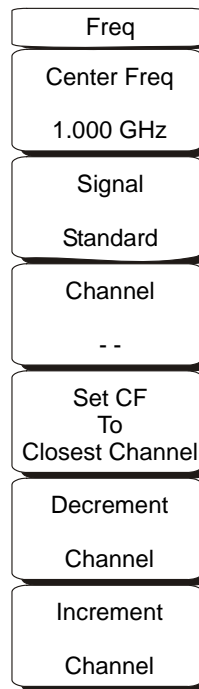
Format Compact Flash

This selection erases all files on an installed Compact Flash module. A message is displayed warning that all files will be erased. Press Enter to confirm that you want to erase and Esc to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups, and jpg files.

Back

The Back key returns to the previous menu.

7-4 Freq (Frequency) Menu

Freq
Center Freq
1.000 GHz
Signal
Standard
Channel
- -
Set CF To Closest Channel
Decrement
Channel
Increment
Channel

Figure 7-3. WCDMA/HSDPA Freq Menu

Center Freq

Press the **Freq** key followed by the Center Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

Signal Standard

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

Channel

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

Set CF To Closest Channel

The instrument will choose the channel closest to the currently selected center frequency.

Decrement Channel

The channel number will be decremented one channel.

Increment Channel

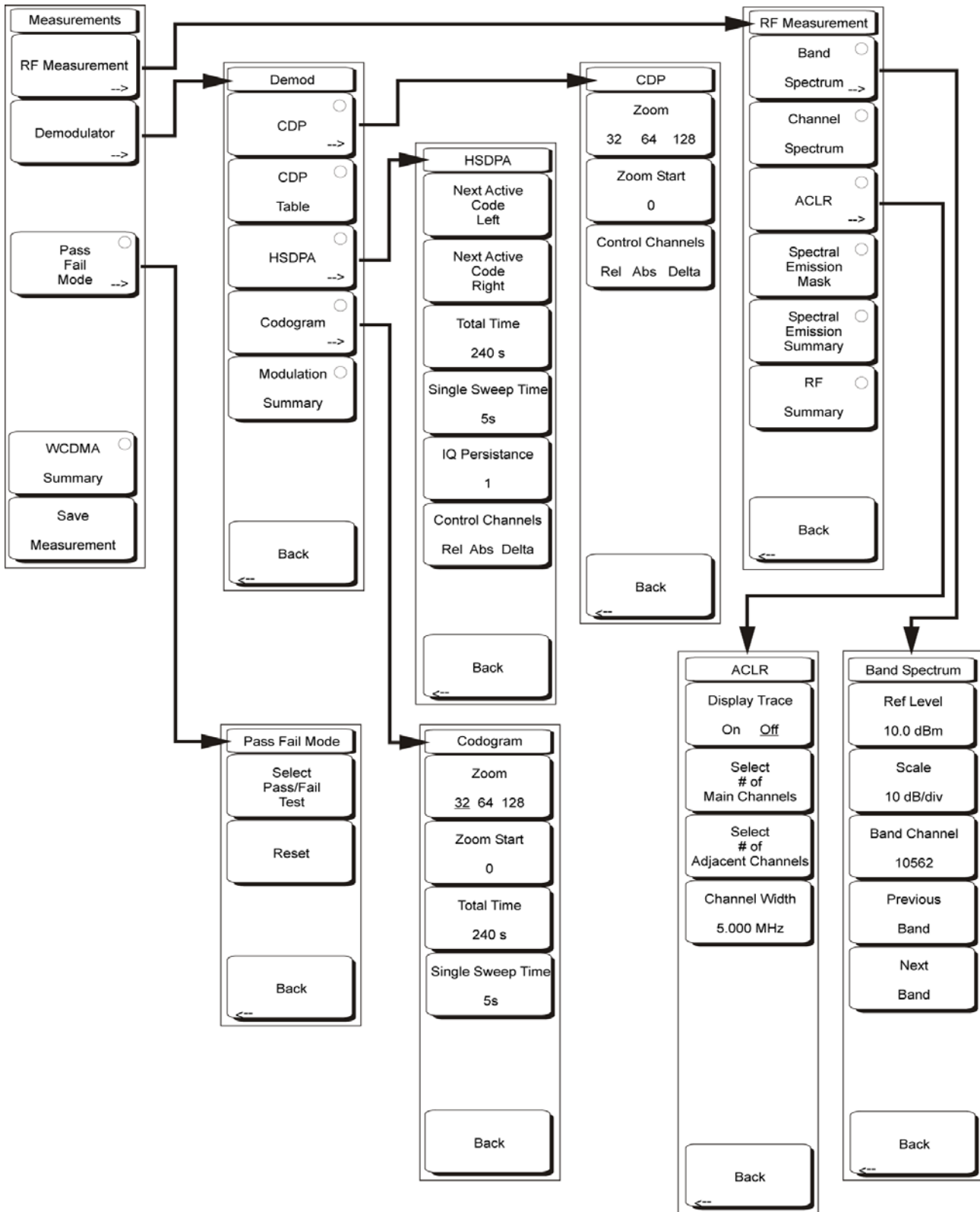The channel number will be incremented one channel.

7-5   Measurements Menu

Figure 7-4.   WCDMA/HSDPA Measurements Menu

Measurements Menu

RF Measurement

Opens the RF measurement menu.

RF Measurement Menu

Band Spectrum

Displays the spectrum of the selected band.

Band Spectrum Menu

Ref Level

Sets the required reference level.

Scale

Change the scale.

Band Channel

Use the cursor to select the required channel and the unit analyzes the selected channel signal.

Previous Band

The unit automatically selects the previous band.

Next Band

The unit automatically selects the next band.

Back

Returns to the previous (RF Measurement) menu.

RF Measurement Menu

Channel Spectrum

Displays the spectrum of the selected channel. The screen also displays Channel Power in dBm and watts, Peak to Average power, and Occupied Bandwidth.

ACLR

Displays the Adjacent Channel Leakage Ratio (ACLR). The user can set the main channels and adjacent channels from 1-4 channels. This screen can display up to 12 channels total.

ACLR Menu

Display Trace
On   Off

Select ON to display the trace.

Select # of Main Channels

Set the main channels from 1-4 channels.

Select # of Adjacent Channels

Set the adjacent channels from 1-4 channels.

Channel Width

Change the WCDMA Channel width setting by pressing the Channel Width soft key. Enter the desired value using the numeric keypad, the **Up/Down** arrow keys or the rotary knob and press the Enter soft key. The default value is 5 MHz.

Back

Returns to the previous (RF Measurement) menu.

RF Measurement Menu

Spectra Emission Mask

Displays the received signal and the mask based on received signal strength.

Spectral Emission Summary

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

RF Summary

Displays the RF measurements in table form.

Back

Returns to the previous (Measurements) menu.

Measurements Menu

Demodulator

Spectrum Analyzer in demodulator mode demodulates the received WCDMA signal. The demodulator has up to five displays, CDP, CDP Table, HSDPA, Codogram, and Modulation Summary.

Demod Menu

CDP

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

CDP Menu

Zoom
32   64   128

Press this (toggle) soft key to select a zoom function of 32, 64, or 128 codes.

Zoom Start

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

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

Control Channels
Rel   Abs   Delta

The Control Channels soft key selects relative power, absolute power or the delta power using CPICH as the reference. Typically node-B control channels will be configured the same throughout a network. The delta power value makes it possible to quickly check whether the control channels are set to the correct power levels.

Back

Returns to the previous (Demod) menu.

Demod Menu

CDP Table

When Code Domain Power Table (CDP Table) is selected, the screen displays a list of all the active OVSF codes in a tabular format. The display show the Spreading Factor, Code Number, Status, EVM, Modulation type, Relative Power in dB, and Absolute Power in dBm for each active OVSF code. Use the rotary knob to scroll up and down the CDP Table when the list has more codes than a single page can display.

HSDPA

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

HSDPA Menu

Next Active Code Left

Select the next active code left.

Next Active Code Right

Select the right side active code.

Total Time

Set the time for the power versus time screen. The minimum total time is 240 seconds and the maximum total time is 72 hours.

Single Sweep Time

Set the single sweep time. The unit automatically calculates the total time.

IQ Persistence

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

Control Channels
Rel   Abs   Delta

The Control Channels soft key selects relative power, absolute power or the delta power using CPICH as the reference. Typically node-B control channels will be configured the same throughout a network. The delta power value makes it possible to quickly check whether the control channels are set to the correct power levels.

Back

Returns to the previous (Demod) menu.

Demod Menu

Codogram

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

Codogram Menu

Zoom

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

Zoom Start

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

Total Time

Use the keypad, the **Up/Down** arrow keys, or the rotary knob to enter the total time to display the changes in code power levels. The maximum total time for Codogram is 72 hours.

Single Sweep Time

Single sweep time is related to total time. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to set the single sweep time.

Back

Returns to the previous (Demod) menu.

Demod Menu

Modulation Summary

Displays the demodulation parameters in the table format.

Back

Returns to the previous (Measurements) menu.

Measurements Menu

Pass/Fail Mode

The Spectrum Analyzer saves the five test model conditions specified in the 3GPP specification to test the base station. After the selected test model, the unit displays whether the base station passed or failed the test. Using Master Software Tools, a custom test list can be created and downloaded into the unit. All critical measurements can be selected for pass fail testing including each individual code power, spreading factor and symbol EVM. The results are displayed in table format with clear identification of pass/fail results including minimum/maximum thresholds and measured results.

Pass Fail Mode Menu

Select Pass/Fail Test

Select the parameters file from the list.

Reset

Restart the measurement.

Back

Returns to the previous (Measurements) menu

Measurements Menu

WCDMA Summary

Displays the critical WCDMA measurements in a table format.

Save Measurement

Initiates a dialog box to name and save the current measurement. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement WCDMA measurements are saved with a `.wcd` extension.

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

7-6   Mode

To access the functions under the Mode menu, press the **Shift** key, then the **Mode** (9) key. Use the directional arrow keys or the rotary knob to highlight the selection and press the **Enter** key to select.

7-7   Preset Menu
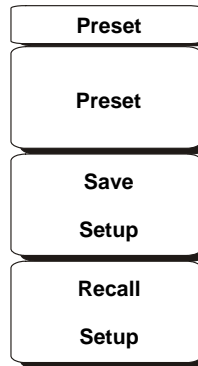
Figure 7-5.   WCDMA/HSDPA Preset Menu

To access the functions under the Preset menu, press the **Shift** key, then the **Preset** (1) key.

Preset Menu

Preset

This key resets the instrument to the default starting conditions of full band sweep, 10 dBm log reference level, 10 dB/division scaling, 0 dB reference level offset, all measurements turned off and trigger set to free run.

Save Setup

Opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

7-8   Setup Menu
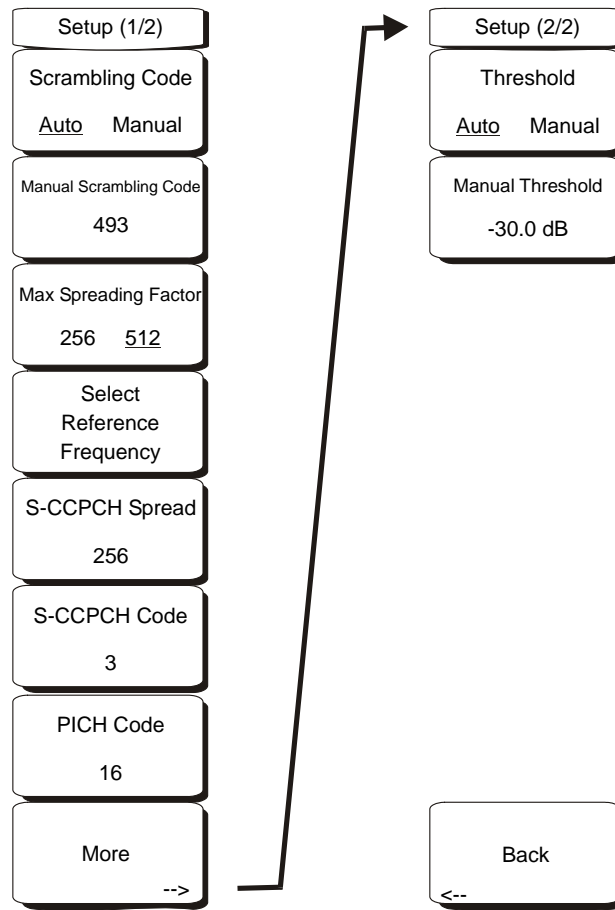
Figure 7-6.   WCDMA/HSDPA Setup Menu

Setup (1/2) Menu

Scrambling Code
Auto   Manual

Press the Scrambling Code (toggle) soft key to alternate between Auto and Manual scrambling code.

Manual Scrambling Code

Press the Manual Scrambling Code (input) soft key to manually enter the scrambling code using the number keys or the rotary knob.

Max Spreading Factor
256   512

Press the Max Spreading Factor (toggle) soft key to alternate between 256 codes and 512 codes.

Select Reference Frequency

Press the Select Reference Frequency (input) soft key and select from the displayed list using **Up/Down** arrow keys or rotary knob, and press enter.

S-CCPCH Spread

Press the S-CCPCH (Secondary Common Control Physical Channel) (input) soft key to enable the S-CCPCH spreading factor and enter the desired code. The default value is 256.

S-CCPCH Code

Press the S-CCPCH Code (input) soft key to enable and enter the S-CCPCH code. The default value is 3.

PICH Code

Press the PICH Code (input) soft key to activate Paging Indicator Channel and enter the desired code. The default value is 16.

More

Opens the Setup (2/2) menu.

Setup (2/2) Menu

Threshold
Auto   Manual

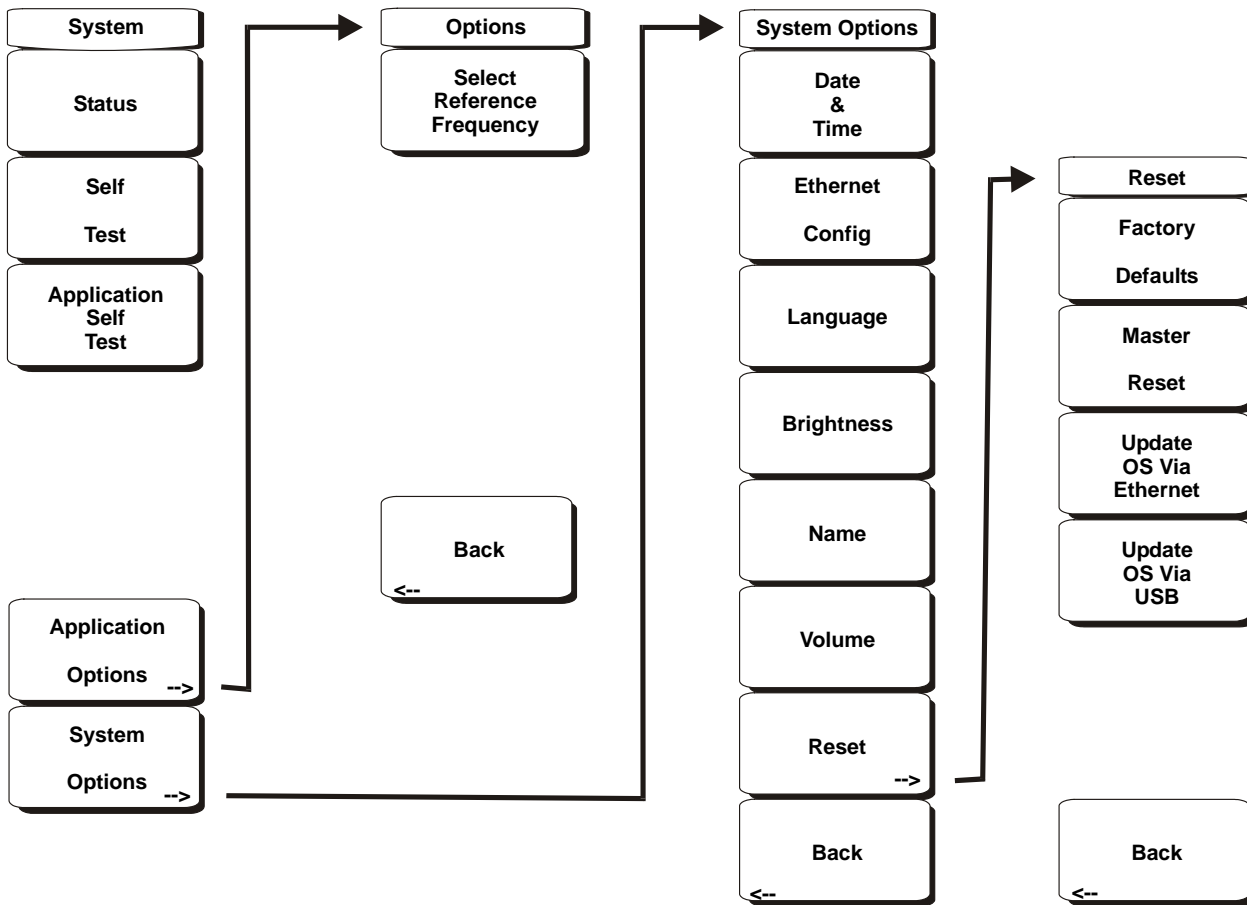Press the Threshold Auto/Manual (toggle) soft key to alternate from Auto to Manual.

Manual Threshold

Press the Manual Threshold (input) soft key, enter the desired value, and press Enter. The default value is -30 dB.

Back

Returns to the previous (Setup (1/2)) menu.

7-9   System Menu

Figure 7-7.   WCDMA/HSDPA System Menu

To access the functions under the System menu, press the **Shift** key, then the **System** (8) key.

System Menu

Status

Pressing this soft key displays the current system status, including the operating system and firmware versions, temperatures, and other system details. Press **Esc** or **Enter** to return to normal operation.

Self Test

This soft key initiates a series of diagnostic tests that test the components of the instrument. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Self Test

This soft key initiates a series of diagnostic tests related to the performance of the Spectrum Analyzer in WCMDA mode. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Options

This soft key presents a menu to select application options.

Options Menu

Select Reference Frequency

This soft key opens a dialog box for selecting the Reference Frequency. Use the rotary knob or the **Up/Down** arrow keys to highlight the Reference Frequency and press **Enter** to select, or press the **Esc** key to cancel.

Back

Returns to the previous (System) menu.

System Menu

System Options

This key opens a selection of system option soft keys.

System Options Menu

Date and Time

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

Ethernet Configuration

This soft key opens a dialog box to set the IP address of the instrument.

Type Manual/DHCP

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

Language

This soft key opens a selection box allowing selection from a list of built-in languages for the Spectrum Analyzer displays. The languages currently available are Chinese, English, French, German, Italian, Japanese, Korean, and Spanish.

In addition, a custom language may be selected if it has been defined using the Master Software Tools software and loaded into the Spectrum Analyzer. Two custom languages may be loaded into the instrument using Master Software Tools. If a mode does not have language translations available, then English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changing anything.

Brightness

The brightness of the display can be adjusted to optimize viewing under a wide variety of lighting conditions. Use the keypad, the **Up/Down** arrow keys or the rotary knob to select a brightness level from 1 (low) to 9 (high). Press **Enter** to accept the change.

Name

Opens a dialog box to name the instrument. The unit can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the name.

Volume

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

Reset

Opens a menu of reset and update options.

Reset Menu

Factory Defaults

Restores the instrument to the factory default values, including Ethernet, language and brightness settings. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Master Reset

This will restore factory setting to all system parameters, including Time/Date, Ethernet, language and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored.

Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Update OS Via Ethernet

This soft key should only be used in conjunction with Anritsu Master Software Tools (MST) to update the instrument operating system using an Ethernet connection. Use this soft key only as instructed by MST.

Update OS Via USB

This soft key should only be used in conjunction with Anritsu MST (Master Software Tools) to update the instrument operating system using a USB connection. Use this soft key only as instructed by MST.

Caution	The Update OS via Ethernet and Update OS via USB selections are accomplished in conjunction with the Master Software Tools program.
	Improper use of the Master Software Tools program could render the system unusable.

Back

Returns to the previous (System Options) menu.

System Options Menu

Back

Returns to the previous (System) menu.

7-10   WCDMA/HSDPA Measurements

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

Carrier Frequency

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

Carrier Feedthrough

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

CDP

Code Domain Power displays how much of the channel power is in each Orthogonal Variable Spreading Factor (OVSF). Power is normalized to the channel power, so if a code reads −10 dB, then this means that the code is 1/10th of the channel power. Colors are applied according to the following table:

Table 7-1.   Code Domain Power Color Coding

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

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

Channel Power

Channel power is the total power transmitted in the 3.8 MHz WCDMA channel specified. Channel Power measures the node B/base station transmitting power across the entire 3.84 MHz WCDMA (UMTS) channel. Channel power is displayed in dBm and Watts.

Codogram

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

Constellation

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

Ec

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

Ec/Io

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

EVM (Error Vector Magnitude)

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. The 3GPP standard requires the EVM not to exceed 17.5%.

Freq Error

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

HSDPA Power versus Time Display

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

Noise Floor

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

Occupied Bandwidth

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

Peak to Average Power

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

Peak CD Error (Peak Code Domain Error)

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

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

Pilot Dominance

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

PICH

PICH is the paging indicator channel power.

CPICH Abs Power

CPICH Abs power is the energy over one chip of the Common Pilot Channel power displayed in dBm.

P-CCPCH Abs Power

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

S-CCPCH Abs Power

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

P-SCH Abs Power

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

S-SCH Abs Power

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

Scrambling Code

In the WCDMA specification the scrambling code can be from 0 to 511. If the scrambling code is known, then its value can be entered and the test set can decode and display the code domain power of the signal. If the scrambling code is unknown, then the Spectrum Analyzer can be set to auto scrambling so that the test set can lock on to the strongest code to decode and display the code domain power of the signal.

Spreading Factor (also called OVSF codes)

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

Symbol EVM (@EVM)

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

Threshold

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

Total Power

The total power of all the scrambling codes, also called (Io) and displayed in dBm.

7-11   Measurement Setup

WCDMA/HSDPA Mode

Note	UMTS/WCDMA mode supports HSDPA measurements when Option 65, WCDMA/HSDPA Demod, Option 44, WCDMA/HSDPA RF Meas are installed and the name of the mode is labeled as *WCDMA/HSDPA Signal Analyzer*. When Option 45, WCDMA Demod is installed, the mode is labeled as *WCDMA Signal Analyzer*.

To prepare for WCDMA measurements, the Spectrum Analyzer must be configured for WCDMA mode, as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

Setting up the Measurement Frequency

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the Spectrum Analyzer to automatically set the frequency.

To enter the center frequency:

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key.

3. Enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

4. Press the **Enter** key to set the Center Frequency. The current setting is shown on the left side of the display.

Signal Standard

To select a signal standard:

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key.

3. 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 for the first channel of the selected standard is automatically tuned.

4. Press the Channel soft 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.

The current settings are displayed on the left side of the screen.

Power Offset for Compensating External Loss

To get accurate results the external attenuation should be compensated using power offset. In power offset mode the compensation factor is in dB. The external attenuation is caused by using an external cable or external high power attenuator.

1. Press the **Amplitude** function hard key.

2. Press the Power Offset soft key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. Press the **Enter** key to set the Power Offset. The value entered is displayed on the left side of the screen.

Scrambling Code Setup

The Spectrum Analyzer can set up a scrambling code automatically or manually.

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

Auto Scrambling

To set up auto scrambling:

1. Press the **Setup** function hard key.

2. Press the Scrambling Code soft key to select Auto

Scrambling Code

To manually set up a Scrambling Code:

1. Press the **Setup** function hard key.

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

Maximum Spreading Factor Setup

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

1. Press the **Setup** function hard key.

2. Press the Max Spreading Factor soft key to select either 256 or 512.

External Reference Frequency Setup

In order to get the best frequency accuracy measurements, it is important to use an external reference frequency attached to the Spectrum Analyzer Ext Ref In connector. Most node B equipment has a reference frequency available on a BNC connector.

External Reference Frequency

To configure the Spectrum Analyzer to use an external reference frequency:

1. Press the **Setup** function hard key.

2. Press the Select Reference Frequency soft key to display a list of the available reference frequencies: 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz.

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list and press the **Enter** key to set the reference frequency.

As the Spectrum Analyzer locks to the source, the Reference Freq value is displayed in the user settable parameters to the left of the display.

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

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

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

1. Press the **Setup** function hard key.
2. Press the S-CCPCH Spread soft key and manually enter the desired spreading factor.
3. Press the S-CCPCH Code soft key and manually enter the desired spreading code.
4. Press the PICH Code soft key and manually enter the desired spreading code.

Note	The S-CCPCH spreading factor default value is 256. The default S-CCPCH Code is 3 and the default PICH code is 16.

Threshold Setup

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

1. Press the **Setup** function hard key.
2. Press the More soft key.
3. Press the Threshold soft key and select either Auto or Manual.
4. If Manual is selected, then press the Manual Threshold soft key and enter a value, followed by the Enter soft key.

Note	Threshold can only be set in Codogram or Code Domain Power modes. The default threshold level is −30 dB.

Filtered versus Unfiltered Power

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

7-12   WCDMA/HSDPA RF Measurements

The WCDMA/HSDPA RF Measurements consist of three measurements:

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

To make WCDMA RF measurements, connect the Spectrum Analyzer to the node B equipment following the instructions.

Band Spectrum

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

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

Band Spectrum Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the **Measurements** function hard key and the RF Measurements soft key.

6. Press the Band Spectrum soft key to display the band spectrum.

7. Move the cursor, using the directional arrow keys or the rotary knob, to select the desired channel. The Channel Number can also be directly entered using the numerical keypad.
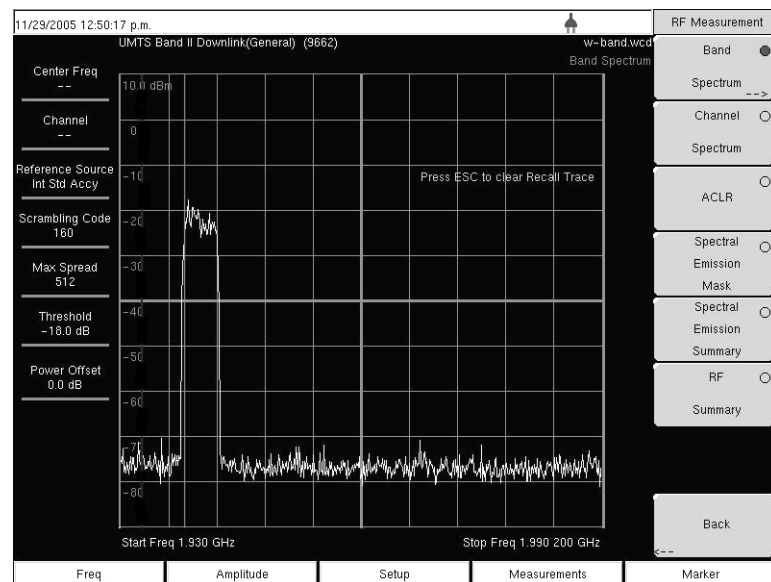
Figure 7-8. Band Spectrum

Channel Spectrum

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

Channel Spectrum Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Setup** function hard key.

7. For the most accurate frequency measurements, press the Select Reference Frequency soft key to display a list of the available reference frequencies and select the desired reference frequency.

8. Press the **Measurements** function hard key.

9. Press the RF Measurements soft key.

10. Press the Channel Spectrum soft key to activate the spectrum measurement. The red dot on the soft key indicates that it is selected.

Note	When in Band Spectrum measurement, use the cursor to select the desired channel. Entering Channel Spectrum measurement will automatically display data for the selected channel.
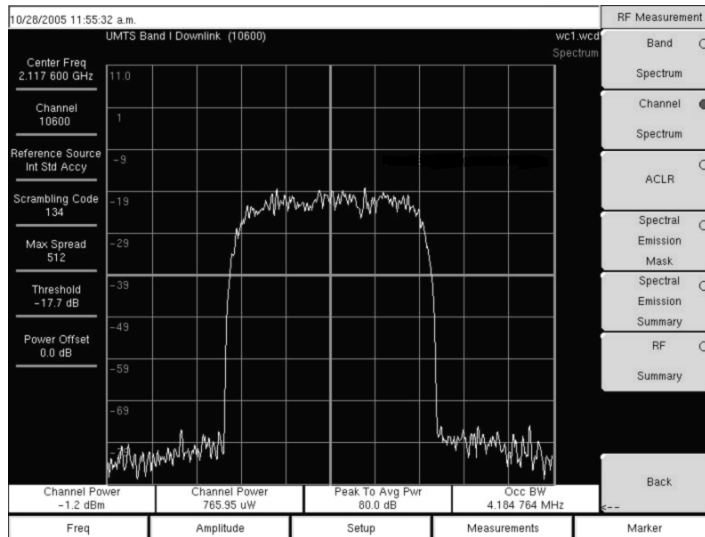
Figure 7-9. RF Measurement Example

ACLR Measurement Screen

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

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

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

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

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

ACLR Measurement Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Measurements** function hard key.

7. Press the RF Measurement soft key.

Note	In the Spectrum Analyzer the ACLR measurement uses the filtered channel power to determine the ACLR values and it is listed as filtered on the display. In all other screens the unfiltered channel power is displayed as channel power.1

8. Press the ACLR soft key to activate the ACLR measurement. The red dot on the soft key indicates that it is selected.

Note	When in Band Spectrum measurement, use the cursor to select the desired channel. Entering ACLR measurement will automatically display data for the selected channel.
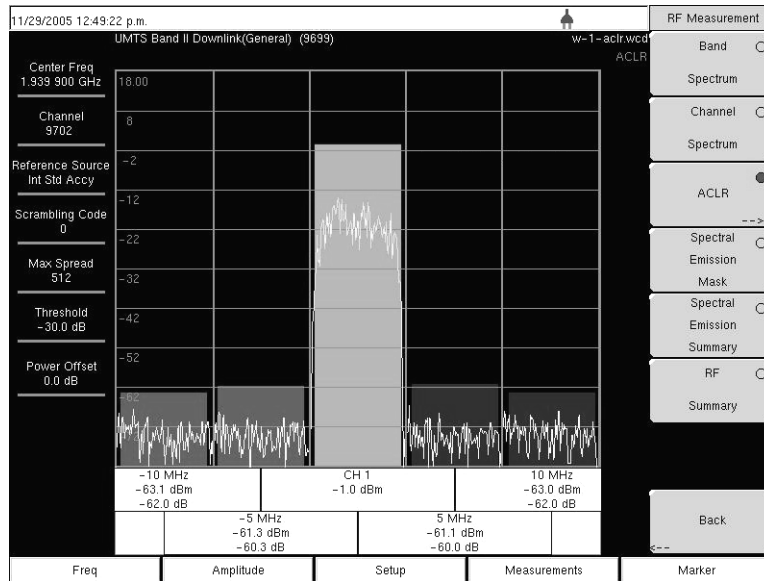
Figure 7-10. ACLR Measurement Example

   9. Press the ACLR soft key again and select one main channel and two adjacent channels.

Multi-Channel ACLR Procedure

   1. Press the **Shift** key, then the **Mode** (9) key.

   2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

   3. Press the **Freq** function hard key.

   4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

   5. Press the Channel soft 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.

   6. Press the **Measurements** function hard key.

   7. Press the RF Measurement soft key.

   8. Press the ACLR soft key to activate the ACLR measurement. The red dot on the soft key indicates that it is selected.

   9. Press the ACLR soft key again and select the number of main and adjacent channels. For this example four main channels and four adjacent channels are selected.
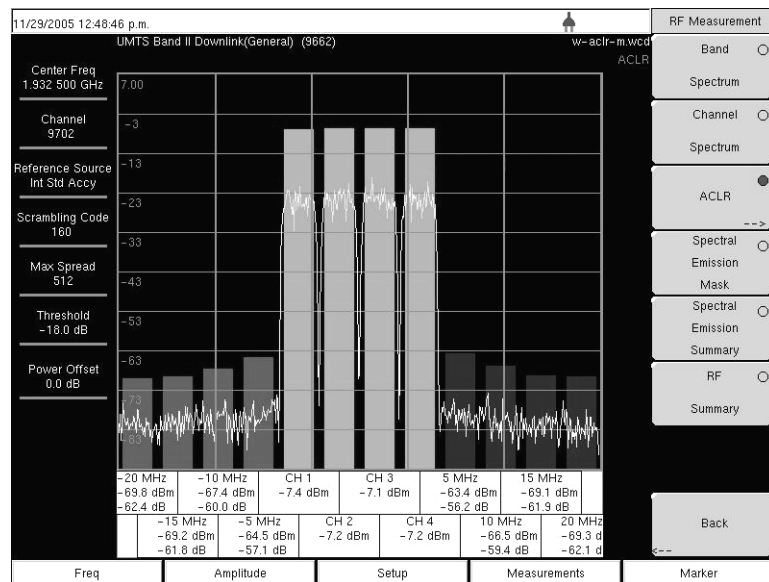
Figure 7-11. ACLR Multi-channel Measurement Example

Spectral Emission Mask

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

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

- P ≥ 43 dBm
- 39 ≤ P < 43 dBm
- 31 ≤ P < 39 dBm
- P < 31 dBm

Spectral Emission Mask Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Measurements** function hard key.

7. Press the RF Measurements soft key.

8. Press the Spectral Emission Mask soft key to activate the Spectral Emission Mask measurement. The red dot on the soft key indicates that it is selected.

9. Press the Spectral Emission Summary soft key to display the Spectral Emission Summary table. The red dot on the soft key indicates that it is selected.
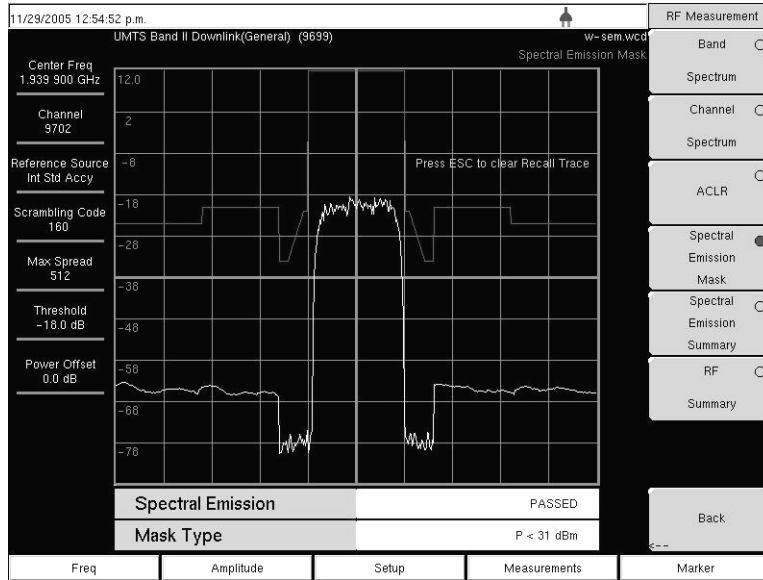
Figure 7-12. Spectral Emission Mask Measurement Example

For a Spectral Emission Summary:
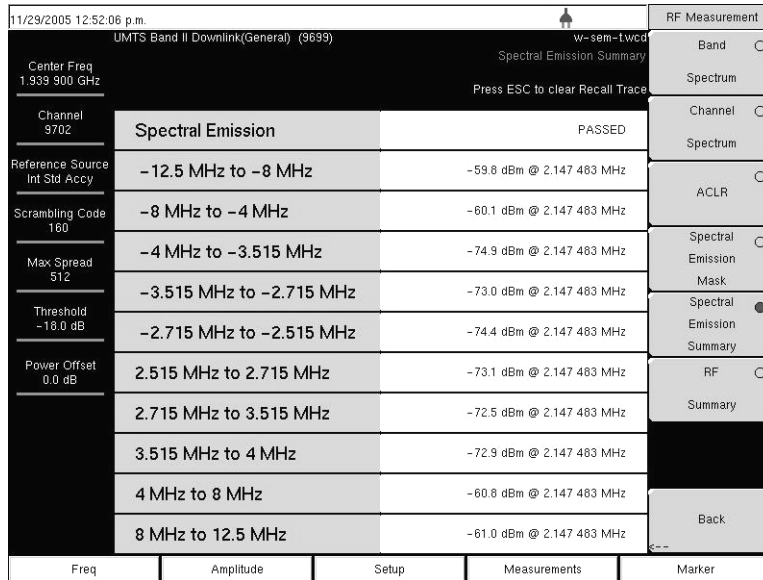
Figure 7-13. Spectral Emission Mask Measurement Summary Example

RF Summary

The RF Summary displays the critical transmitter performance measurements in the table format, without demodulating the WCDMA/HSDPA signal. The parameters displayed in the RF Summary table are Channel Power (in dBm and Watts), Carrier Frequency, Frequency Error, Spectral Emission Pass/Fail criteria, Occupied Bandwidth, Peak to Average Power, and ACLR at −10 MHz, −5 MHz, 5 MHz, and 10 MHz channels.

Figure 7-14. RF Summary Example

7-13 Demodulator

In the demodulator mode the MS271xB Spectrum Analyzer is connected to the node B equipment and the unit will demodulate the WCDMA signal. The WCDMA/HSDPA demodulator has Code Domain Power (CDP), HSPDA, Codogram and Modulation Summary screens.

Note	The WCDMA/HSDPA Demodulator option demodulates both WCDMA and HSDPA signals. The WCDMA Demodulator only demodulates WCDMA signals.

Zoom Function

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

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

Code Domain Power (CDP)

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

CDP Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Setup** function hard key.

7. Press the Scrambling Code soft key to select Auto so that the Spectrum Analyzer will automatically detect the scrambling code.

8. Press the Select Reference Frequency soft key to display a list of the available reference frequencies and select the desired reference frequency to get accurate frequency measurements.

9. Connect the external reference to the Ext RF Input BNC connector and wait for the unit to recognize the external reference and lock up to it (For more information on external references, refer to "External Reference Frequency Setup" on page 7-23).

10. Press the S-CCPCH Spread soft key to manually set the S-CCPCH spreading. The Spectrum Analyzer will display the default S-CCPCH spreading factor of 256 in all the views. Set the S-CCPCH spreading factor to show accurate results.

11. Press the S-CCPCH Code soft key to enter the correct S-CCPCH code. The Spectrum Analyzer will display the default S-CCPCH code of 3 in all the views. Set the S-CCPCH code to show accurate results.

12. Press the PICH Code soft key to enter the correct PICH code. The Spectrum Analyzer will display the default PICH code of 16 in all the views. Set the PICH code to show accurate results.

13. Press the Threshold soft key to manually set the Threshold level which determines which codes are active. The default value is -30 dB.

14. Press the **Measurements** function hard key.

15. Press the Demodulator (switching) soft key to activate the demodulator menu.

16. Press the CDP soft key to activate the CDP measurement. The red dot on the soft key indicates that it is selected.

17. Press the CDP soft key again to activate the zoom function.

18. Press the Zoom soft key to select the appropriate zoom level. The Zoom key toggles between 32, 64, and 128.

19. Press the Zoom Start soft key to manually enter the zoom start code.

20. Press the Back soft key to go back to the CDP measurement.

Note	The blue color block on the CDP screen represents the selected zoom codes and the same codes are displayed in the zoom screen
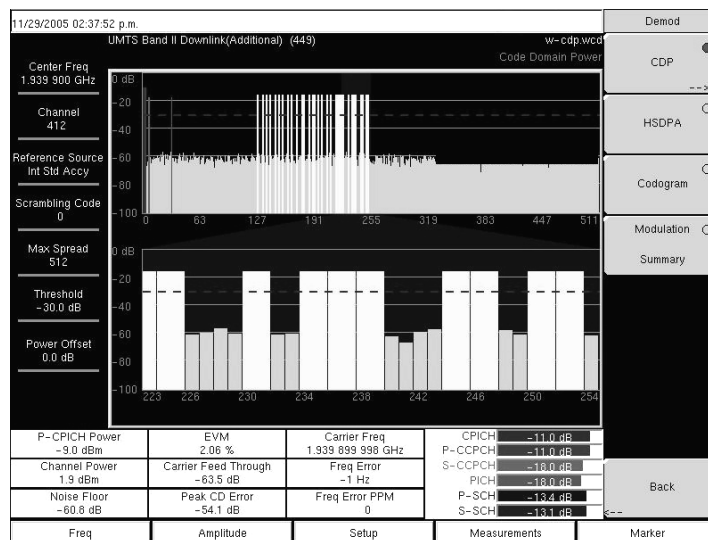
Figure 7-15. WCDMA Code Domain Power Measurement Screen Example

Code Domain Power Table (CDP Table)

The Code Domain Power Table (CDP Table) display includes all active spreading factor (OVSF codes). The table displays every OVSF, Code (Spreading Factor and code number), Status, Symbol EVM, Modulation Type, Relative Power (dB) and Absolute power (dBm) in a table format. For WCDMA/HSDPA Demodulator, the HSDPA codes and modulation type are also displayed.

CDP Table Procedure

1. Press the Demodulator soft key to activate the demodulator menu.

2. Press the CDP Table soft key to activate the CDP Table measurement. The red dot on the soft key indicates CDP Table is selected.

3. Use the scroll wheel to scroll up and down the CDP Table.

Figure 7-16. Code Domain Power Table Measurement Screen Example

Note	This screen is available with the WCDMA/HSDPA demod option only.

Activating Markers

Procedure

1. Press the **Marker** function hard key to display the Marker menu.

2. Press the Marker soft key to select the appropriate marker (1-6). The underlined marker number is the currently selected marker.

3. Press the On/Off soft key to activate the selected marker.

4. Press the Marker Table soft key to display the Marker table. The marker table is displayed on the screen below the CDP measurements table.

Note	Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the WCDMA/HSDPA measurements.
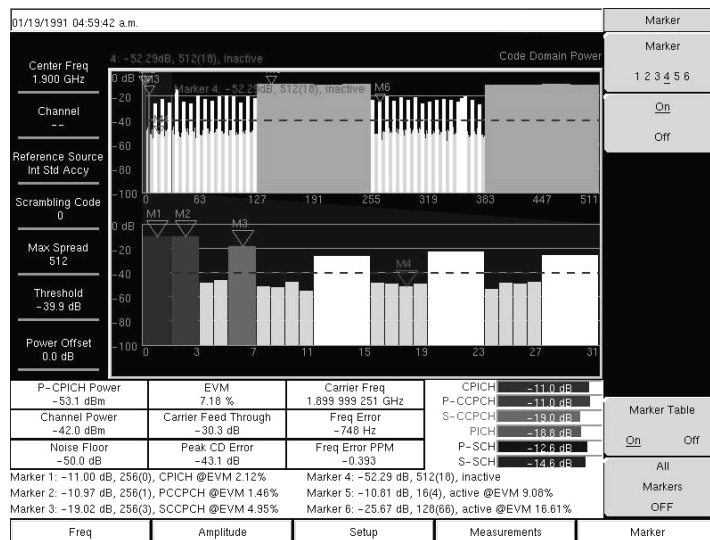
Figure 7-17. Code Domain Power Measurement Screen Example with Markers Activated

HSDPA

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

HSDPA Procedure

1. Press the Demodulator soft key to activate the demodulator menu.

2. Press the HSDPA soft key to activate the HSDPA measurement. The red dot on the soft key indicates HSDPA is selected.

3. Press the HSDPA soft key again to display the HSDPA measurement signal parameters.

4. Press the Total Time soft key to set the time or the Single Sweep Time soft key to set the time for the power versus time display. The maximum time is 72 hours.

5. Use the cursor to select the desired code. The code parameters are displayed on the screen.

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

Note	The WCDMA modulation type is QPSK, and the HSDPA modulation is 16QAM or QPSK.

Activating Markers

1. Press the **Marker** function hard key to display the Marker menu.

2. Press the Marker soft key to select the appropriate marker (1-6). The underlined marker number is the currently selected marker.

3. Press the On/Off soft key to activate the selected marker.

4. Press the Marker Table soft key to display the Marker table. The marker table is displayed on the screen below the measurements table.

Note	Markers can be used to read the individual code power, symbol EVM (@ EVM) and type of code and can be activated in all the WCDMA/HSDPA measurements

Codogram

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

Codogram Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Setup** function hard key.

7. Press the Scrambling Code soft key to select Auto so that the Spectrum Analyzer will automatically detect the scrambling code.

8. Press the Select Reference Frequency soft key to display a list of the available reference frequencies and select the desired reference frequency to get accurate frequency measurements.

9. Press the S-CCPCH Spread soft key to manually set the S-CCPCH spreading. The Spectrum Analyzer will display the default S-CCPCH spreading factor of 256 in all the views. Set the S-CCPCH spreading factor to show accurate results.

10. Press the S-CCPCH Code soft key to enter the correct S-CCPCH code. The Spectrum Analyzer will display the default S-CCPCH code of 3 in all the views. Set the S-CCPCH code to show accurate results.

11. Press the PICH Code soft key to enter the correct PICH code. The Spectrum Analyzer will display the default PICH code of 16 in all the views. Set the PICH code to show accurate results.

12. Press the More soft key, then the Threshold soft key to manually set the Threshold level which determines which codes are active. The default value is −30 dB.

13. Press the **Measurements** function hard key.

14. Press the Demodulator soft key to activate the demodulator menu.

15. Press the Codogram soft key to activate the Codogram measurement.

16. Press the Codogram soft key to activate the zoom function and to set the time for the measurement.

17. Press the Zoom soft key to select the appropriate zoom level. The Zoom key toggles through 32, 64 and 128.

18. Press the Zoom Start soft key to manually enter the zoom start code.

19. Press the Total Time or Single Sweep Time soft key to set the required time.

20. Press the Back soft key to go back to the Codogram measurement.

Note	The blue color block on the Codogram screen represents the selected zoom codes and the same codes are displayed in the zoom screen.
	Save the data before making any measurements, otherwise the data will be lost.
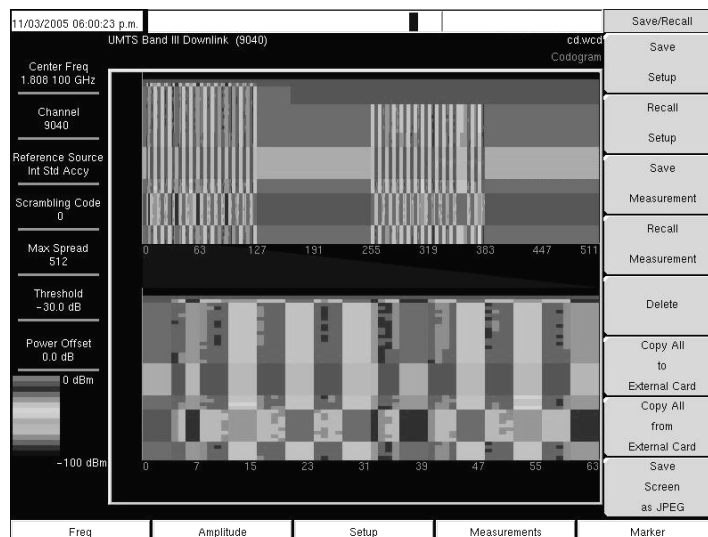
Figure 7-18. Codogram Measurement Screen Example

WCDMA Summary

WCDMA summary displays the critical WCDMA measurements from RF and demodulation measurements.
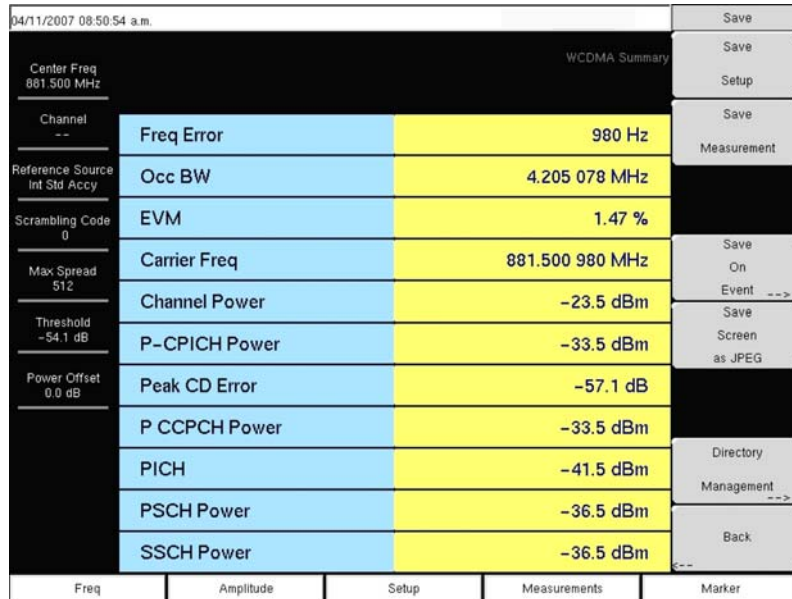
Figure 7-19. WCDMA Summary Measurement Screen Example

WCDMA Summary Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

5. Press the Channel soft 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.

6. Press the **Setup** function hard key.

7. Press the Scrambling Code soft key to select Auto so that the Spectrum Analyzer will automatically detect the scrambling code.

8. Press the Select Reference Frequency soft key to display a list of the available reference frequencies, Select the desired reference frequency to get accurate frequency measurements.

9. Connect the external reference to the Ext RF Input BNC connector and wait for the unit to recognize the external reference and lock to it.

10. Press the S-CCPCH Spread soft key to manually set the S-CCPCH spreading. The Spectrum Analyzer will display the default S-CCPCH spreading factor of 256 in all the views. Set the S-CCPCH spreading factor to show accurate results.

11. Press the S-CCPCH Code soft key to enter the correct S-CCPCH code. The Spectrum Analyzer will display the default S-CCPCH code of 3 in all the views. Set the S-CCPCH code to show accurate results.

12. Press the PICH Code soft key to enter the correct PICH code. The Spectrum Analyzer will display the default PICH code of 16 in all the views. Set the PICH code to show accurate results.

13. Press the Threshold soft key to manually set the Threshold level which determines which codes are active. The default value is −30 dB.

14. Press the **Measurements** function hard key.

15. Press the WCDMA Summary soft key.

7-14 Pass/Fail Mode

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

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

Pass/Fail Mode Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight WCDMA/HSDPA Signal Analyzer and press the **Enter** key to select.

3. Connect the appropriate signal to the RF In connector.

4. Press the **Freq** function hard key.

5. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable WCDMA standard.

6. Press the Channel soft 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.

7. Press the **Measurements** function hard key.

8. Press the Pass/Fail Mode soft key to display the pass/fail mode menu.

9. Press the Select Pass/Fail Test soft key and select the applicable Test Model to activate the measurement.
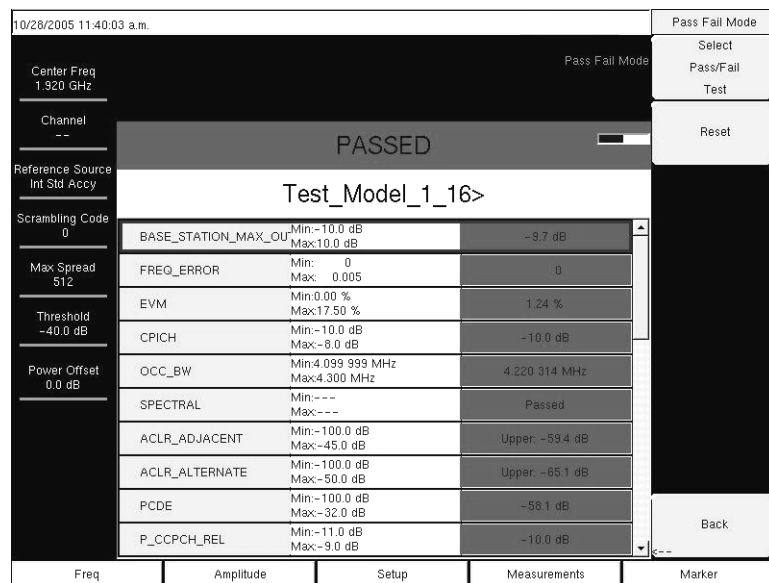
Figure 7-20. Pass/Fail Mode Example Screen

Chapter 8 — High Accuracy Power Meter

8-1 Introduction

The Spectrum Analyzer with Option 19 and sensor PSN50 can be used to make High Accuracy Power Measurements from 50 MHz to 6 GHz. This high performance sensor option provides true RMS measurements from −30 dBm to +20 dBm with accurate measurements for both CW and complex digitally modulated signals.

Note	The PSN50 sensor is not included with Option 19.

8-2 High Accuracy Power Meter (HAPM) Display

The display shows the power values in both dBm and Watts. The Relative Power feature allows the display of power changes with respect to a desired reference value in both dB and % (percent). Limit values can be turned on as needed to indicate if a measurement is within or outside specified limits. Running averaging and a Max/Hold feature are also available.

The Spectrum Analyzer connects to the PSN50 High Accuracy Power Sensor with a USB A/mini-B cable.

The zeroing feature improves the accuracy between −20 dBm and −30 dBm by removing measured system noise. Calibration factors can be used to correct both efficiency and mismatch loss.

Attenuators can be used to ensure that the power does not exceed the specified measurement range. The Enter Offset feature allows entering offset values for any cables and attenuators.

Required Equipment

- Spectrum Analyzer
- High Accuracy Power Sensor, PSN50
- USB cable, Type A/Mini-B
- 30 dB, 50 W, bi-directional, DC-8.5 GHz, N(m)-N(f), Attenuator

Note	For more information on cable accessories, options, and their Anritsu part numbers, refer to Section 1-3, "MS271xB Options and Accessories" on page 1-2 in Chapter 1, "General Information".

8-3 HAPM General Operating Procedure

Turn On the Spectrum Analyzer and the Sensor

1. Connect the USB A/mini-B cable between the High Accuracy Power Sensor and the Spectrum Analyzer.
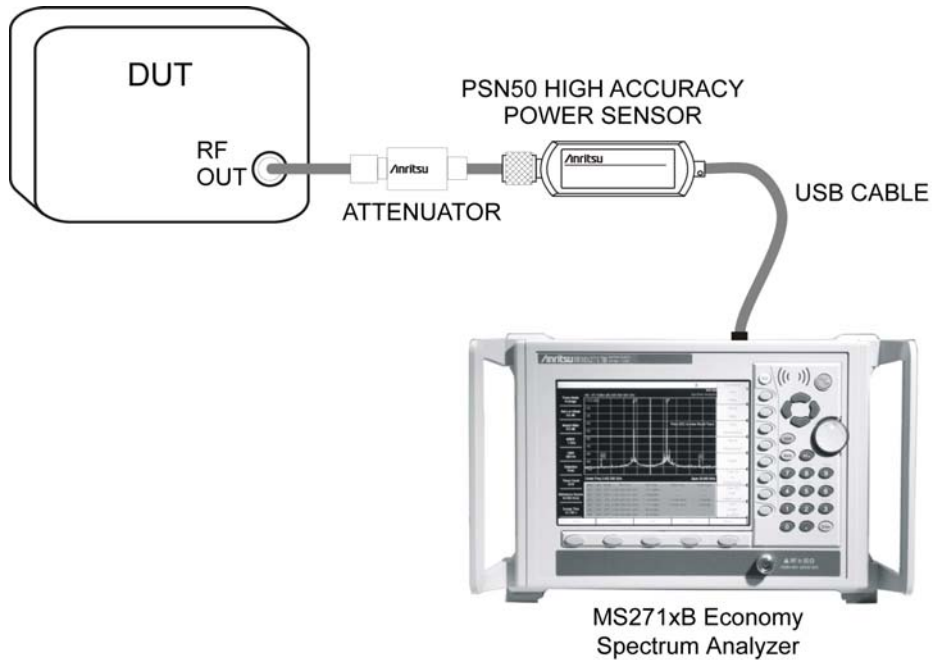
Figure 8-1.   High Accuracy Power Meter Setup Example

2. Press the **ON/OFF** key on the Spectrum Analyzer.

3. Press the **Shift** and **Mode** (9) keys. Use the **Up/Down** arrow keys or rotary knob to select High Accuracy Power Meter mode and press **Enter.**

Zero/Cal (Calibration) and Cal Factor

1. Press the **Zero/Cal** key, the Zero/Cal menu appears, and press the Cal Factor soft key. The Cal Factor submenu appears.

2. For a description of the Zero/Cal and Cal Factor menu soft keys, refer to Section 8-5, "Zero/Cal and Cal Factor Menus" on page 8-7.
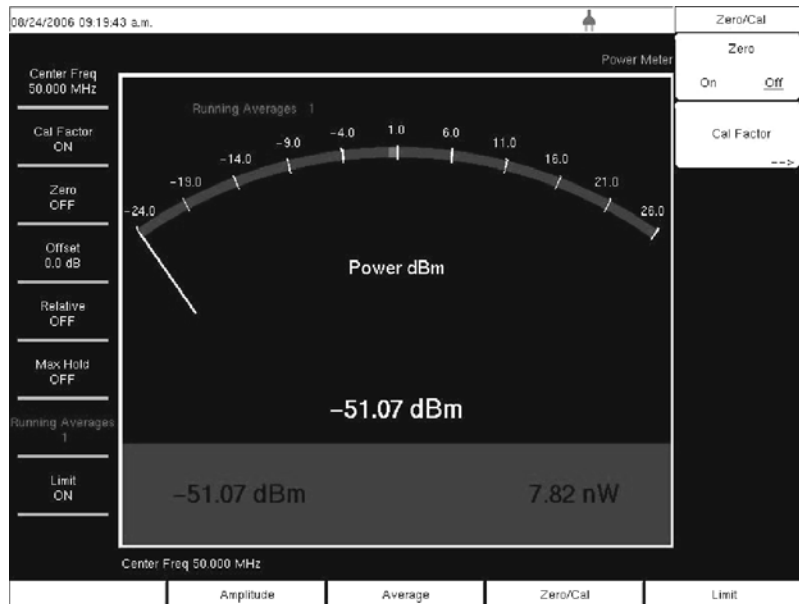
Figure 8-2.   Power Meter Display and Zero/Cal Menu
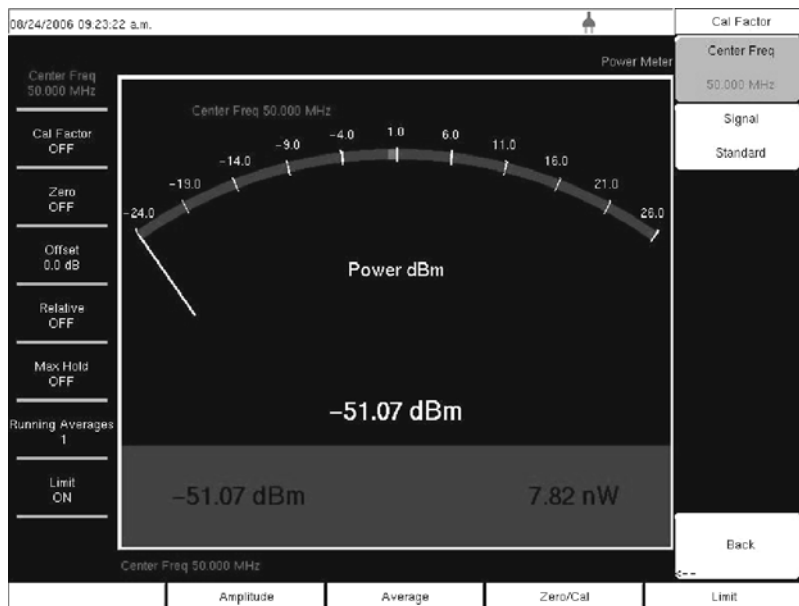
Figure 8-3.   Power Meter Display and Cal Factor Menu

3. Enter the Center Frequency or press the Signal Standard key and the **Up/Down** arrows to select a particular standard. The Cal Factors will be derived for the corresponding center frequency. The channel number is not required as the Cal Factor frequencies are rounded to the nearest 500 MHz. The Cal Factor message in the display window will show ON if the Cal Factor command has been properly sent to the sensor.

4. With no power applied to the sensor, press the **Zero** soft key to zero the sensor. This step is recommended when making power measurements below –20 dBm.

Change the Analog Scale Display

1. Press the **Amplitude** key. The Amplitude menu appears.

- For a description of the Amplitude menu soft keys, refer to Section 8-6, "Amplitude and Units Menus" on page 8-8.
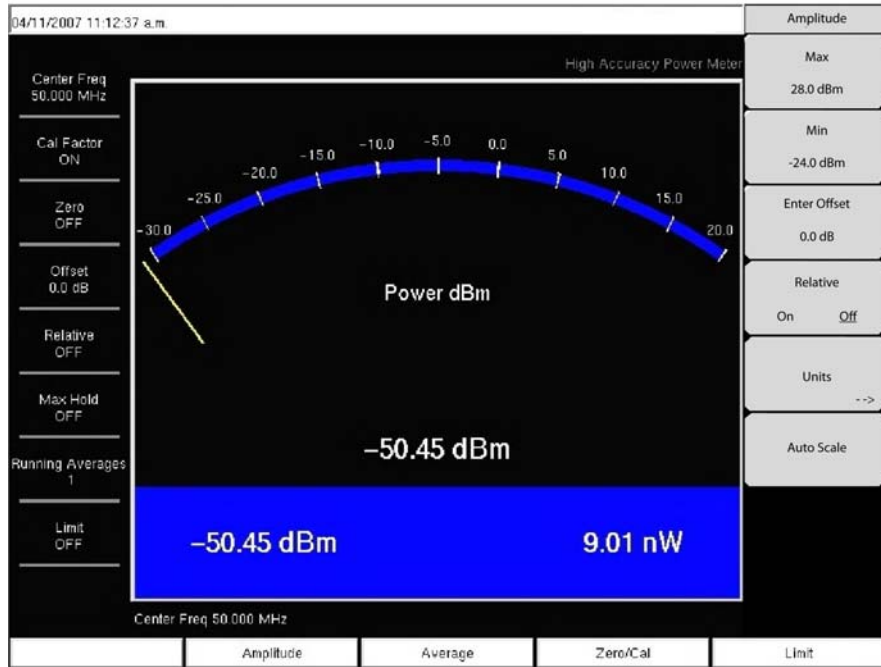
Figure 8-4. Amplitude Menu

2. Press the Auto Scale soft key to align the needle in the middle of the analog display. The maximum and minimum values will align accordingly.

3. Press the Max soft key and use the key pad to manually set the maximum value of the analog display.

4. Press the Min soft key and use the key pad to manually set the minimum value of the analog display.

Note	With no offset, the maximum value for the display is the upper measurement range, which is +20 dBm. With an offset, such as with 10 dB of attenuation, the upper value can be set to +30 dBm. With an offset of XX dB, the upper value can be set to +20 dBm plus xx dB.

Using Attenuators

1. Press the **Amplitude** key and press the Enter Offset soft key.

2. Enter the offset value for the attenuator at the frequency of operation.

Displaying Relative Power

1. Press the **Amplitude** key.

2. With the desired base power level input to the sensor, press the Relative soft key. The power reading will show 0 dB and 100%. If measuring a 10 dBm signal, and if the Relative key is selected, then a drop to 7 dBm will show −3 dB and 50%.

Averaging/Max Hold/Run Hold

1. Press the **Average** key. The Averages soft menu appears.

- For a description of the Average menu soft keys, refer to .
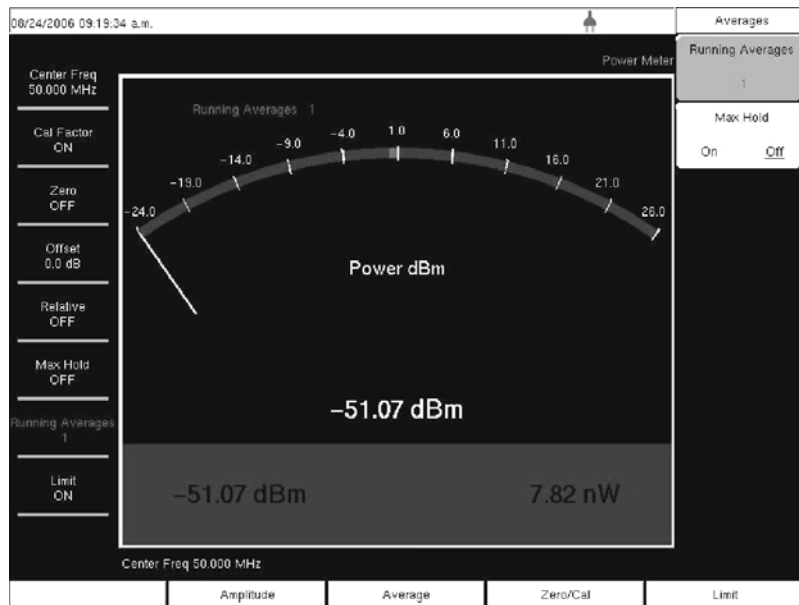
Figure 8-5.   Averages Menu

2. Press the Running Averages key. Use the keypad to enter the desired number of averages.

3. Press the Max Hold (toggle) soft key to alternate between Max Hold On and Max Hold Off. If averaging is selected, then Max Hold will display the maximum value of the non-averaged data.

Limits

1. Press the **Limit** key. The Limits menu appears. For a description of the Limits menu soft keys, refer to .
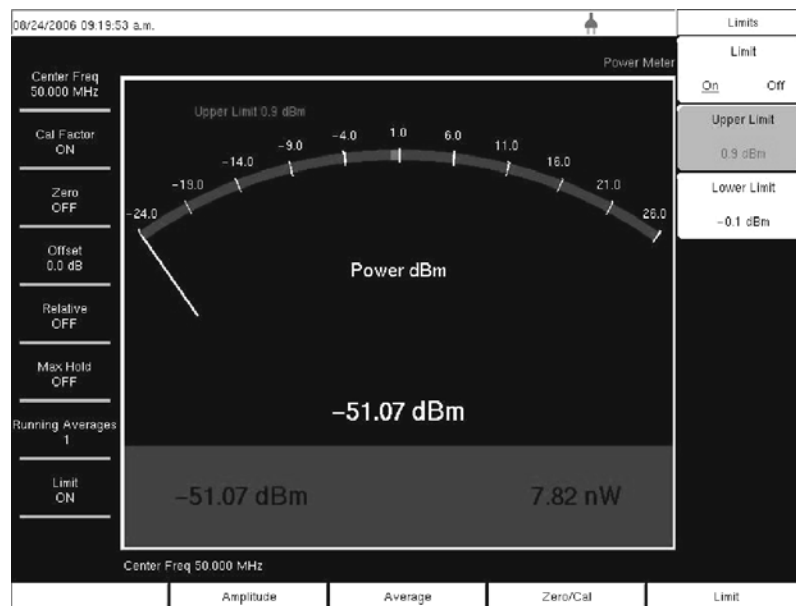
Figure 8-6.   Limits Menu

2. Press the Lower Limit soft key. Enter the lower limit value in dBm or in Watts.

3. Press the Upper Limit soft key. Enter the upper limit value in dBm or in Watts.

4. Press the Limit On/Off soft key to turn the Limits ON and OFF. The number display will turn green or red if the measurement is passing of failing.

5. Press the **Amplitude** key and press the Units soft key to change between dBm and Watts.
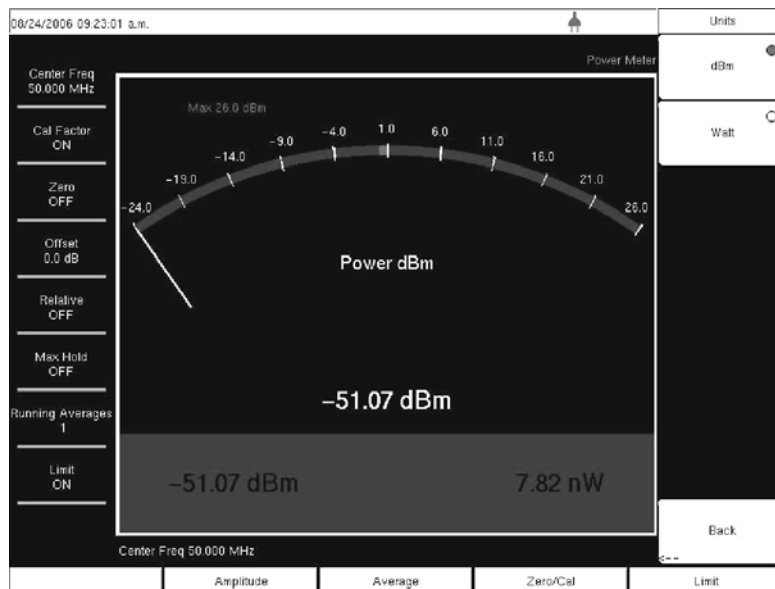
Figure 8-7. Units Menu

Saving the Measurement

1. Press the **Shift** key and the **File** (7) key.

2. Press the Save soft key.

3. Press the Save Measurement soft key and use the Text Entry soft keys to enter the desired file name.

4. Press the Save Screen as JPEG soft key to save an image of the screen as a JPEG. file.

8-4   Menus

The High Accuracy Power Meter is controlled by menus available from the hard keys at the bottom of the screen.

- Zero/Cal menu and the Cal Factor submenu
- Amplitude menu and the Units submenu
- Averages menu
- Limit menu

8-5 Zero/Cal and Cal Factor Menus

Zero/Cal and Cal Factor Menus are displayed in Figure 8-8.
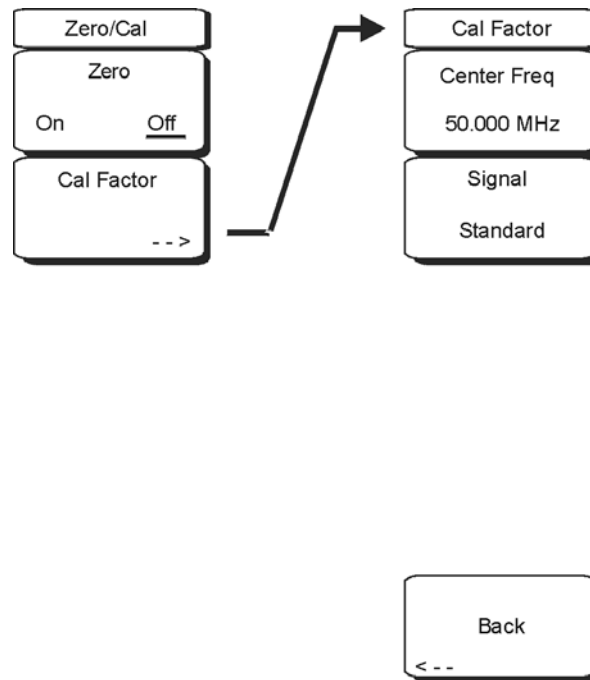
Figure 8-8. Zero/Cal and Cal Factor Soft Key Menus

Access the Zero/Cal menu pressing the **Zero/Cal** hard key at the bottom of the screen.

Zero/Cal Menu

Zero
On   Off

With no signal applied to the power sensor, press this (toggle) soft key to alternately turn the meter zeroing function ON or OFF. This step is recommended when making power measurements below −20 dBm.

Cal Factor

Press this (switching) soft key to open the Cal Factor (Calibration Factor) menu

Zero/Cal Menu

Center Frequency ##.### MHz

Press this (input) soft key to select the center frequency required. Enter the selected frequency from the number keypad or by using the rotary knob.

Signal Standard

Press this (input) soft key and then the **Up/Down** arrows to select a particular signal standard. The Cal Factors, (calibration factors) presented will be derived from the selected Center Frequency.

Back

Returns to the Zero/Cal menu.

8-6   Amplitude and Units Menus

The Amplitude and Units Menus are displayed in Figure 8-9.
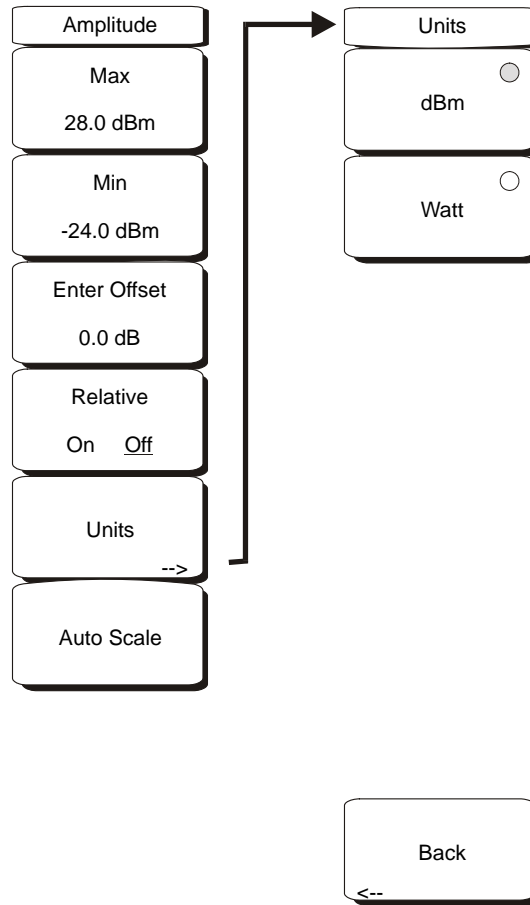
Figure 8-9.   Amplitude and Units Soft Key Menus

Access the Amplitude menu pressing the **Amplitude** hard key at the bottom of the screen.

Amplitude Menu

Max ##.# dBm

Press the Max soft key to set the maximum value of the analog meter display. Use the keypad to manually set the maximum dBm value.

Min ##.# dBm

Press the Min soft key to set the maximum value of the analog meter display. Use the keypad to manually set the maximum dBm value.

Enter Offset #.# dB

Turns the offset ON or OFF. A value of ±100 dB can be entered.

Relative
On Off

Selects whether relative power is ON or OFF. This measurement shows the relative level of the desired base power level input to the power sensor. When ON, the message Relative On ### dB (where ### dB is the current reference value) is shown in the message area.

Units

Opens the Units submenu

> **Units Menu**
>
> dBm
>
> Selects dBm as the measurement units. If selected, then the circle in upper right corner of the soft key is red.
>
> Watt
>
> Selects Watts as the measurement units. If selected, then the circle in upper right corner of the soft key is red.
>
> Back
>
> Returns to the Amplitude menu.

Amplitude Menu

Auto Scale

Press the Auto Scale soft key to align the needle in the middle of the analog display. The maximum and minimum values will align accordingly.

8-7 Averages Menu

The Averages menu is displayed in Figure 8-10.
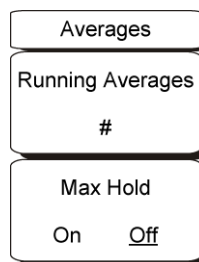
Figure 8-10. Averages Soft Key Menu

Access the Averages menu by pressing the **Average** hard key at the bottom of the screen.

> Running Averages
>
> Press this soft key to select the number of averages that will be used in calculating the running average. Use the keypad numbers to enter the required number.
>
> Max Hold
> On   Off
>
> Use this soft key to toggle between Max Hold On and Max Hold Off. If averaging is selected, then the Max Hold will display the maximum value of the non-averaged data.

8-8   Limits Menu

The Limits menu is displayed in Figure 8-11.
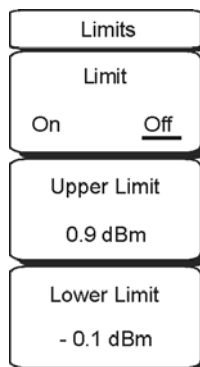
Figure 8-11. Limits Soft Key Menu

Access the Limits menu by pressing the **Limits** hard key at the bottom of the screen.

Limit
On   Off

Turns the limits on or off.

Upper Limit #
dBm

Sets the upper limit to the indicated value. Use the arrow keys, rotary knob, or the keypad to enter the required value.

Lower Limit #
dBm

Sets the lower limit to the indicated value. Use the arrow keys, rotary knob, or the keypad to enter the required value.

Chapter 9 — Fixed WiMAX Signal Analyzer

9-1   Introduction

Two Fixed WiMAX options are available for the MS271xB:

- Fixed WiMAX RF Measurements (Option 46)
- Fixed WiMAX Demodulator (Option 47)

Connect the instrument to any Fixed WiMAX BTS for accurate RF and demodulator measurements. The MS271xB works for FDD and TDD networks.

The MS271xB 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 MS271xB, connect the power amplifier of the BTS equipment to the RF In connector of the instrument using a coupler or attenuator. To measure a WiMAX signal over the air, connect the appropriate frequency band antenna to the MS271xB RF In connector.

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

Chapter Contents

The following sections describe the available menus for Fixed WiMAX Signal Analyzer Mode:

9-2   Amplitude Menu

```
┌─────────────────────┐
│      Amplitude      │
└─────────────────────┘
┌─────────────────────┐
│        Scale        │
│                     │
│      10 dB/div      │
└─────────────────────┘
┌─────────────────────┐
│    Power Offset     │
│                     │
│       0.0 dB        │
└─────────────────────┘
┌─────────────────────┐
│     Auto Range      │
│                     │
│    On        Off    │
└─────────────────────┘
┌─────────────────────┐
│       Adjust        │
│                     │
│       Range         │
└─────────────────────┘
┌─────────────────────┐   *
│                     │
│     Y Axis Max      │
│                     │
└─────────────────────┘
```
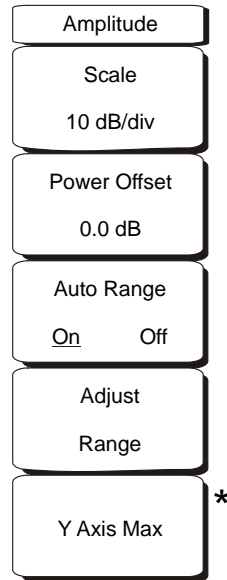
* (Only in Spectral Flatness and
  EVM vs. Symbol/Sub-carrier views)

Figure 9-1.   Fixed WiMAX Signal Analyzer Mode Amplitude Menu

Scale

Scale changes the Y-axis scale and can be set from 1 dB/div to 15 dB/div. The units change from dB/div to % when EVM is the Y-axis value. The default value changes from 10 dB/div to 1 dB/div when the Spectral Flatness view is selected.

Power Offset

Choose power offset to have the instrument automatically adjust for the loss through any external cables, attenuators and couplers. The power can be offset from -100 dB to 100 dB. To set a power offset, press the Power Offset soft key, use the keypad to enter the offset values and press the dB soft key.

Auto Range

When Auto Range is activated the reference level is automatically adjusted. Press the Auto Range soft key to switch between on and off.

Adjust Range

Adjust Range adjusts the internal reference level to be optimal based on the measured signal. Auto Range is set to the off state and a manual Auto Range operation is performed once.

Y Axis Max

Sets the maximum value of the Y-axis. In combination with the Scale control, this allows the user to zoom in and out on the Y-axis. This control is available only in the Spectral Flatness and EVM vs. Symbol/Sub-carrier views.

9-3 File Menu

To access the functions under the File menu, press the **Shift** key, then the **File** (9) key.
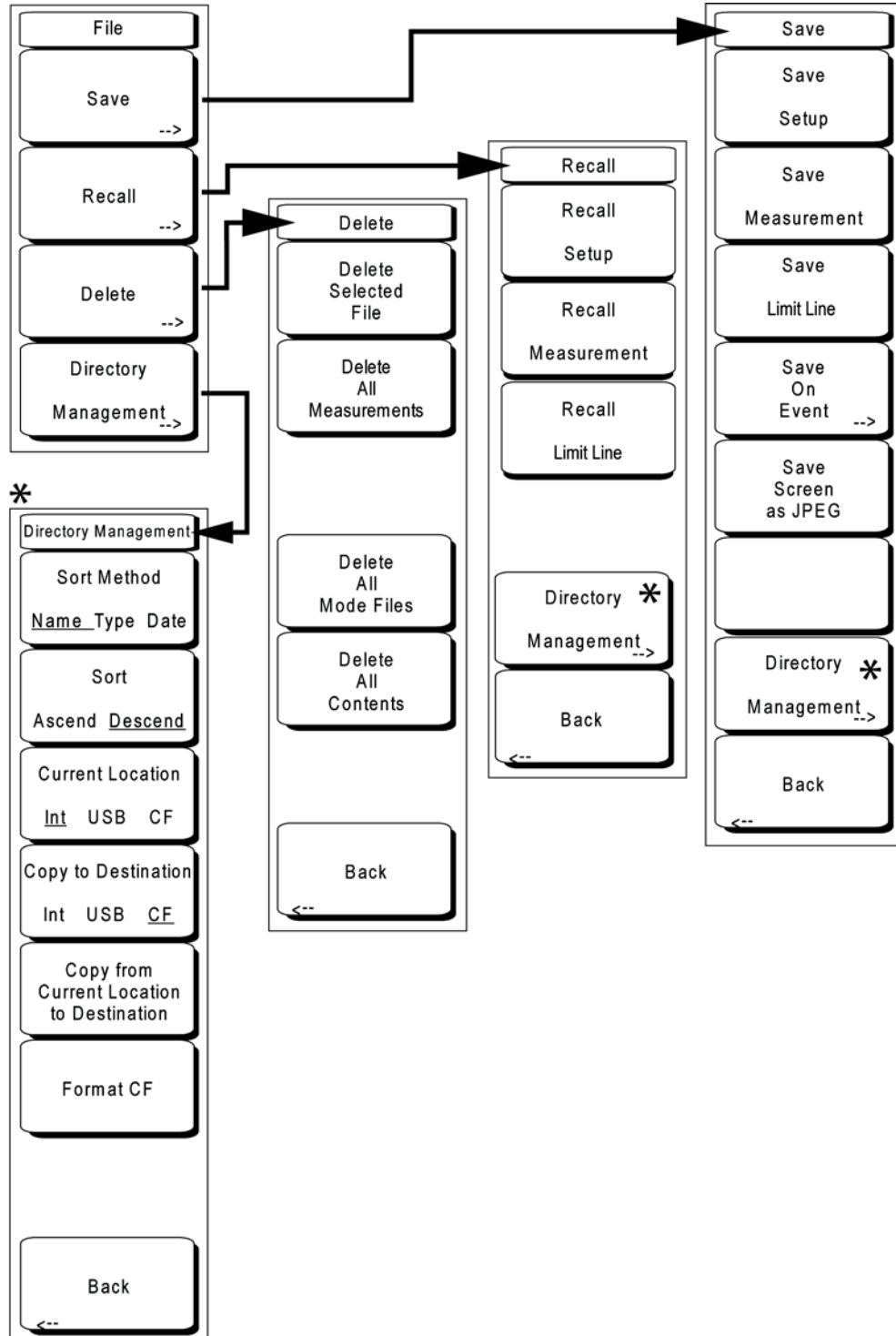
Figure 9-2. Fixed WiMAX Signal Analyzer Mode File Menu

The File menu provides soft key options for Save, Recall, Delete, and Directory Management.

File Menu

Save

Measurements may be saved to the internal memory, an external Type-1 Compact Flash module, or a USB Flash Drive. Anritsu recommends saving to external storage if a large number of measurements are to be saved. The Spectrum Analyzer is shipped with a Compact Flash module and a USB Flash Drive. In order to hold the entire contents of the internal memory, external memory devices must be at least 256 MB. Compact Flash modules greater than 512 MB storage capacity may not function properly.

For information on external memory part numbers, refer to Section 1-3, "MS271xB Options and Accessories" on page 1-2 in Chapter 1, "General Information".

Save Menu

Save Setup

Opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/ Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Save Measurement

Initiates a dialog box to name and save the current active trace A. The saved measurement trace can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter.

Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement trace. Measurements are saved in a directory called /usr on the Compact Flash memory module and the USB Flash Drive. nonaveraged data

Note	If a measurement has been previously saved, then the Save Measurement dialog box will open with the previously saved name displayed. To save the new measurement with a similar name (for example, Trace-1, Trace-2, and so forth) simply press the Right directional arrow and add the changes. To create a completely new name, use the keypad, the rotary knob or press the soft key for each letter. For more detailed naming assistance, refer to "Text Entry" on page 2-6.

Save Limit Line

This selection is not available in fixed WiMAX mode.

Save On Event…

Not implemented in WiMAX mode.

Save Screen as JPEG

This function saves a measurement trace as a graphics file. The saved measurement can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the Left/Right directional arrows to move the cursor position. Press **Enter** to save the measurement after entering the file name. The file is saved in the internal memory with the specified name, with `.jpg` appended.

Directory Management

Opens the Directory Management menu. This menu is available as a soft key option under File, Recall, and Save menus. For the menu description, refer to "Directory Management" on page 9-5.

Back

The Back key returns to the previous (File) menu.

File Menu

Recall

The Recall menu options are: Recall Setup, Recall Management, and Directory Management.

Recall Menu

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

Recall Measurement

Opens a selection box that allows recall of a previously stored measurement trace from the currently selected storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved measurement trace, and press **Enter**, the rotary knob, or the Recall soft key to select. Press the **Esc** key to cancel the recall.

Recall Limit Line

This selection is not available in Fixed WiMax mode.

Directory Management

Opens the Directory Management menu. This menu is available as a soft key option under File, Recall, and Save menus. For the menu description, refer to "Directory Management" on page 9-5.

Back

The Back key returns to the previous (File) menu.

File Menu

Delete

Opens a selection box that shows all stored setups and traces in the currently selected location (refer to "Directory Management" on page 9-5). The list shows the setup and measurement names, the type (stp for a saved setup, spa for a saved trace, jpg for a JPEG file) and the date and time the information was saved. Use the rotary knob or the **Up/Down** arrow keys to highlight the file to be deleted, and press **Enter**, or the Delete soft key to delete. Press the **Esc** key to cancel the operation. Note that no mechanism is available to retrieve deleted files.

Delete Menu

Delete Selected File

Use the up and down arrow buttons or the rotary knob to select the file that is to be deleted. Press **Enter** to confirm that you want to delete the file or **Esc** to exit without deleting.

Delete ALL Measurements

Deletes all measurements of the current mode in the currently selected storage location. The memory from which measurements will be deleted is set in the Directory Management menu and is the Current Location.

Delete ALL Mode Files

Deletes all measurements of the type saved in the current operating mode of the instrument. In addition all jpg and setup files (regardless of the mode) are deleted.

Delete ALL Contents

Deletes all measurements, jpg files, and setup files of ALL measurement types.

Back

The **Back** key returns to the previous (File) menu.

File Menu

Directory Management

Opens the Directory Management menu. Note that this menu is available as a soft key option in the File, Recall, and Save menus.

Directory Management Menu

Sort Method
Name   Type   Date

File lists can be sorted by the name of the file, the type of file (SPA file, STP file, and so forth), or by the date that the file was saved.

Sort
Ascend   Descend

Selects whether the selected sort is sorted from lowest to highest (ascending) or highest to lowest (descending). When sorting by name, the sort will place file names that start with numbers before file names that start with letters (an ASCII sort).

Current Location
Int   USB   CF

This choice lets you select where measurements and setups will be saved. Pressing the soft key selects the storage location to be the internal memory, USB Flash drive, or Compact Flash memory module. The "current location" and the "copy to destination" will never be the same. Changing the current location to save files causes the "copy to destination" to be automatically changed if the selected storage location is the same as the selected current location.

Copy to Destination
Int   USB   CF

This choice lets you select where measurements and setups in the "current location" will be copied. The "current location" and the "copy to destination" may not be the same. If you change the destination to which the instrument will copy files, then the current location is automatically changed if the current location is the same as the selected copy to destination.

Copy From Current Location To Destination

Pressing this soft key causes all measurements, setups and jpg files stored in the user selected "current location" to be copied to the "copy to destination". If no storage module installed in the instrument, then an error message is displayed.

Format CF

This selection erases all files on an installed Compact Flash (CF) module. A message is displayed warning that all files will be erased. Press **Enter** to confirm that you want to erase and **Esc** to quit without erasing. In addition to erasing all files stored on the Compact Flash, the /usr directory is created for storage of measurements, setups, and jpg files.

Back

The Back key returns to the previous (File) menu.

9-4 Freq (Frequency) Menu

Freq
Center Freq
2.5 GHz
Signal
Standard
Channel
- -
Set CF To Closest Channel
Decrement Channel
Increment Channel
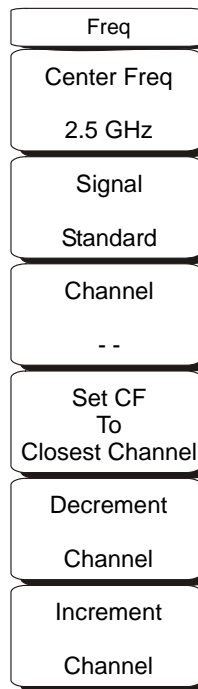
Figure 9-3. Fixed WiMAX Signal Analyzer Mode Freq Menu

Center Freq

The Center Freq soft key is used to set the receiver center frequency to the desired value. Enter the frequency using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft key labels will change to GHz, MHz, kHz, and Hz. Press the appropriate units soft key. Pressing the **Enter** key has the same affect as selecting the MHz soft key.

Signal Standard

Use the **Up/Down** arrow keys or the rotary knob to highlight a signal standard and press **Enter** to select. When a signal standard is selected, the center frequency and span for the first channel of the selected standard is automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered.

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

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 channel. The listed channels are from 0 to 199.

Set CF to Closest Channel

This soft key moves the current Center Frequency to the closest frequency that matches a channel number in the current Signal Standard.

Decrement Channel

Press this soft key to decrease the selected channel number by one channel.

Increment Channel

Press this soft key to increase the selected channel number by one channel.

9-5   Limit

This function is not implemented in this mode.

9-6   Measure

To access the functions under the Measure menu, press the **Shift** key, then the **Measure** (4) key. The Measure key opens the same menus as the **Measurements** function hard key. Refer to "Measurements Menu" for information on these menus.

9-7   Measurements Menu
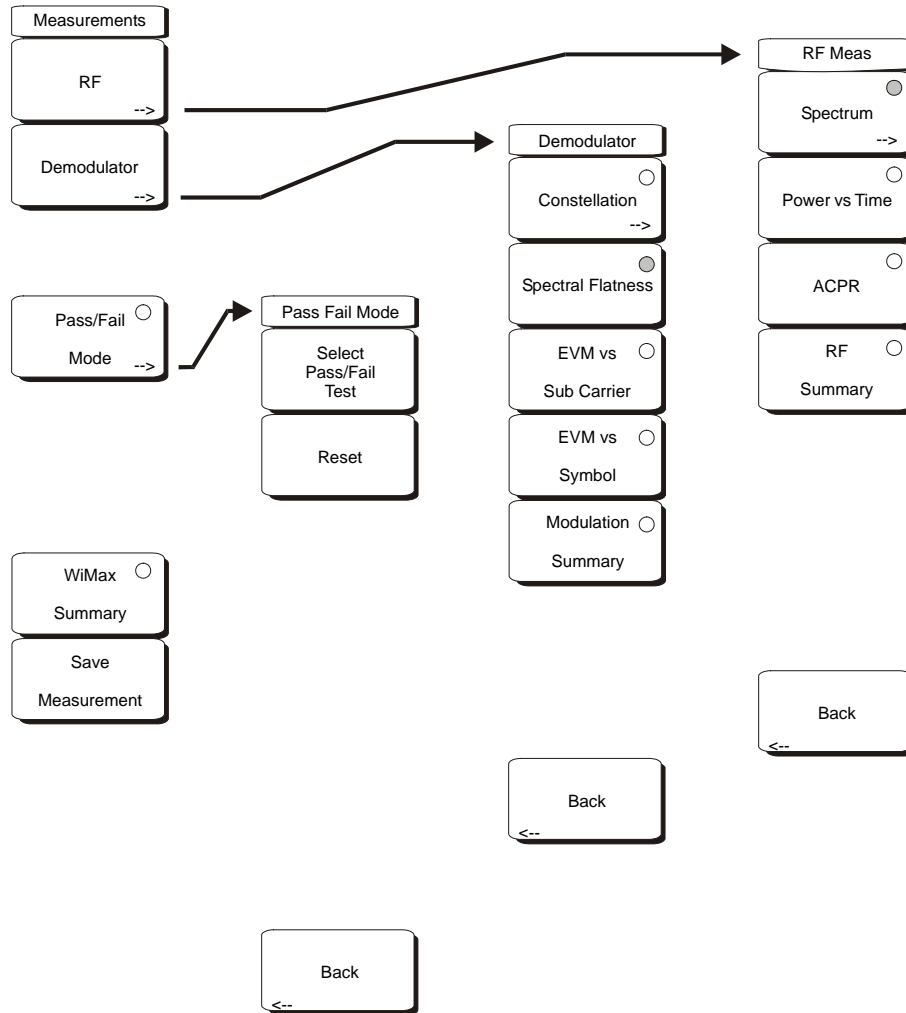
Figure 9-4.   Fixed WiMAX Signal Analyzer Mode Measurements Menu

Measurements Menu

RF

Displays the RF Meas menu options of Spectrum, Power versus Time, ACPR, RF Summary, and Back.

RF Meas Menu

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 (input) soft 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 choices of 5 MHz, 10 MHz, 20 MHz, and 30 MHz.

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

Back

Press the Back (switching) soft key to return to the previous (RF Meas) menu.

Power vs Time

Press this (select) soft key for the Power versus Time, which 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

Press this (select) soft key for the ACPR (Adjacent Channel Power Ratio) view, which shows one main channel and two adjacent channels and displays the power levels for each channel (both absolute and relative).

RF Summary

Press this (select) soft key to display a summary of all the RF numerical measurement results.

Back

Returns to the previous (Measurements) menu.

Measurements Menu

Demodulator

Press this (switching) soft key to display the Demodulator menu options of Constellation, Spectral Flatness, EVM vs Sub Carrier, and Modulation Summary.

Demodulator Menu

Constellation

Press this (select) soft key to display the constellation view, which shows the constellation of the demodulated data symbols over one frame. The various constellations are color coded 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 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.

Constellation Menu

Reference Points
Off   On

Press this (toggle) soft key to display reference points for the various constellations. The default state is On.

Back

Press the Back (switching) soft key to return to the Demodulator menu.

Demodulator Menu

Spectral Flatness

The Spectral Flatness view shows the data collected from the preamble at the channel estimation step. The deviation of the spectral flatness from the average over 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 indicates regions of the mask where it fails. The specification for the mask is ±0 to 50 subcarriers < ±2 dB and ±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 in dB is displayed as a numerical value.

EVM vs Sub Carrier

This view shows the EVM (rms) values versus OFDM subcarriers. The pilot subcarriers are shown in orange.

EVM vs Symbol

This view shows the EVM (rms) values versus OFDM symbols.

Modulation Summary

Displays a summary of all the modulation-related numerical measurement results.

Back

Returns to the previous (Measurements) menu.

Measurements Menu

Pass/Fail Mode

Press this (select) soft key to allow the selection of a user-defined file that specifies a list of measurements with pass/fail criteria. This mode will sequence through the appropriate measurements and indicate a pass or fail state based on the criteria. A custom test list can be created with Master Software Tools and downloaded into the unit.

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/maximum thresholds and measured results.

When active, this soft key becomes a switching soft key. Press the soft key again to display the Pass Fail Mode menu options.

Pass Fail Mode Menu

Select Pass/Fail Test

Press this (input) soft key to display the list of available Pass/Fail tests.

Reset

Press this (input) soft key to reset the Pass/Fail test.

Back

Returns to the previous (Measurements) menu.

Measurements Menu

WiMAX Summary

Press this (select) soft key to display a summary of all the WiMAX related numerical measurement results.

Save Measurement

Press this (select) soft key to initiate a dialog box that is used to name and to 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 selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save. WiMax measurements are saved with a .wmxd extension. For additional instructions about entering filenames, refer to section "Text Entry" on page 2-6.

9-8   Mode

The contents of the Mode list box depend on the options installed in the instrument. The current mode is highlighted by default.

To access the functions under the Mode menu, press the **Shift** key, then the **Mode** (9) key. Use the directional arrow keys or the rotary knob to highlight the desired mode and press **Enter** to implement.

9-9   Setup Menu

```
         ┌─────────────────┐
         │      Setup      │
         ├─────────────────┤
         │       BW        │
         │                 │
         │    1.25 MHz     │
         ├─────────────────┤
         │   CP Ratio (G)  │
         │                 │
         │       1/4       │
         ├─────────────────┤
         │      Span       │
         │                 │
         │      5 MHz      │
         ├─────────────────┤
         │  DL Frame Length│
         │                 │
         │     2.5 ms      │
         ├─────────────────┤
         │ Ext. Reference  │
         │   Frequency     │
         └─────────────────┘
```
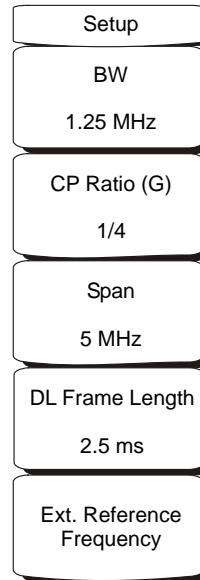
Figure 9-5.   Fixed WiMAX Signal Analyzer Mode Setup Menu

BW

Press this (input) soft key to select the Bandwidth by using the **Up/Down** arrow keys or the rotary knob, and then press **Enter**. Available bandwidths are 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 (input) soft key to select the desired Cyclic Prefix Ratio by using the **Up/Down** arrow keys or the rotary knob, and then 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 (input) soft 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**. 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 above values to override the automatic selection.

DL Frame Length

Pressing this (input) soft key will currently show a message "Frame lengths of >2.5 ms not supported." This is a place holder for future updates which will allow larger frame lengths.

Ext. Reference Frequency

Press this (input) soft key to select the desired External Reference Frequency by using the **Up/Down** arrow keys or the rotary knob, and then press **Enter**. Available External Reference Frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz. The default External Reference Frequency is 10 MHz.

9-10 System Menu

To access the functions under the System menu, press the **Shift** key, then the **System** (8) key.

```
┌─────────────┐      ┌─────────────┐      ┌──────────────┐
│   System    │ ──►  │   Options   │ ──►  │System Options│
├─────────────┤      ├─────────────┤      ├──────────────┤
│   Status    │      │ Ext Ref Freq│      │    Date      │
├─────────────┤      └─────────────┘      │     &        │
│    Self     │                           │    Time      │
│    Test     │                           ├──────────────┤
├─────────────┤                           │   Ethernet   │       ┌─────────────┐
│ Application │                           │   Config     │ ──►   │    Reset    │
│    Self     │                           ├──────────────┤       ├─────────────┤
│    Test     │                           │   Language   │       │   Factory   │
└─────────────┘                           ├──────────────┤       │   Defaults  │
                                          │  Brightness  │       ├─────────────┤
                                          ├──────────────┤       │   Master    │
                      ┌─────────────┐     │    Name      │       │   Reset     │
                      │    Back     │     ├──────────────┤       ├─────────────┤
                      │    <--      │     │   Volume     │       │  Update     │
                      └─────────────┘     ├──────────────┤       │  OS Via     │
┌─────────────┐                           │   Reset      │       │  Ethernet   │
│ Application │                           │    -->       │       ├─────────────┤
│  Options -->│                           ├──────────────┤       │  Update     │
├─────────────┤                           │    Back      │       │  OS Via     │
│  System     │                           │    <--       │       │  USB        │
│  Options -->│                           └──────────────┘       └─────────────┘
└─────────────┘                                                  ┌─────────────┐
                                                                 │    Back     │
                                                                 │    <--      │
                                                                 └─────────────┘
```
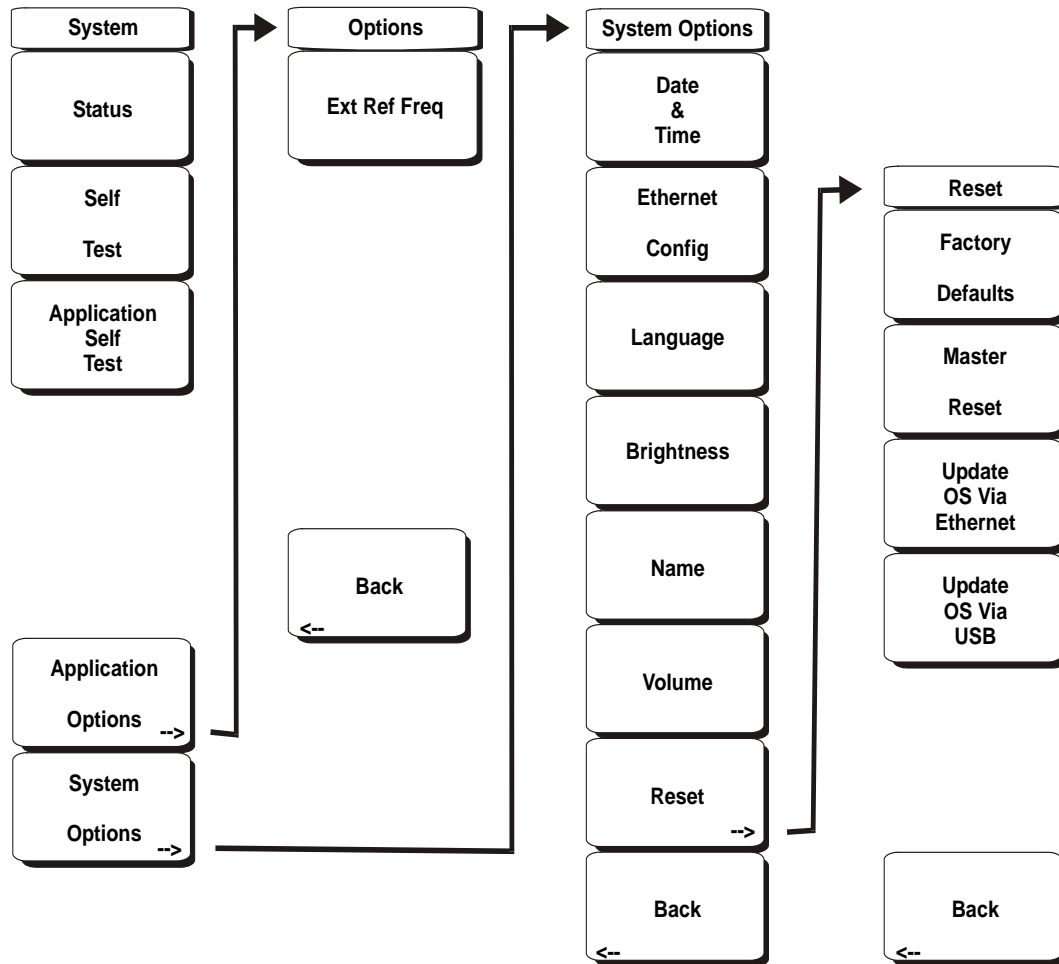
Figure 9-6.   Fixed WiMAX Signal Analyzer Mode System Menu

System Menu

Status

Pressing this soft key displays the current system status, including the operating system and firmware versions, temperatures and other system-level details. Press **Esc** or **Enter** to return to normal operation.

Self Test

This soft key initiates a series of diagnostic tests that test the components of the instrument. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Self Test

This soft key initiates a series of diagnostic tests related to the performance of the Spectrum Analyzer. A display will list the individual tests with a pass or fail indication. Press **Esc** or **Enter** to return to normal operation.

Application Options

This soft key presents a menu to select application options.

Options Menu

Ext Ref Freq

Select the frequency of the external reference from the list presented.

Back

Returns to the previous (System) menu.

System Menu

System Options

This key opens a selection of system option soft keys.

System Options Menu

Date & Time

This soft key opens a dialog box for setting the current date and time. Use the soft keys or the **Left/Right** arrow keys to select the field to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to select the date and time. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation.

Ethernet Config

This soft key opens a dialog box to set the IP address of the instrument.

Type Manual/DHCP

This softkey selects whether the address will be entered manually, or supplied automatically by a network DHCP server.

If Manual is selected, then use the soft keys or the **Left/Right** arrow keys to select the field to be modified. Use the keypad, the **Up/Down** arrow keys, or the rotary knob to enter the input. Press **Enter** to accept the changes, or press the **Esc** key to return to normal operation without changing anything.

Language

This soft key opens a selection box allowing selection from a list of built-in languages for the MS271xB displays. The languages currently available are Chinese, English, French, German, Italian, Japanese, Korean, and Spanish. In addition, up to two custom languages may be selected if they have been defined using the Master Software Tools software and loaded into the instrument. If a mode does not have a language translation available, then English is the default language. Press **Enter** to accept the change, or press the **Esc** key to return to normal operation without changing anything.

Brightness

The brightness of the display can be adjusted to optimize viewing under a wide variety of lighting conditions. Use the keypad, the **Up/Down** arrow keys or the rotary knob to select a brightness level from 1 (low) to 9 (high). Press **Enter** to accept the change.

Name

Opens a dialog box to name the instrument. The unit can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Press the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the name.

Volume

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

Reset

Opens a menu of reset and update options.

Reset Menu

Factory Defaults

Restores the instrument to the factory default values, including Ethernet, language and brightness settings. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Master Reset

This will restore factory setting to all system parameters, including Time/Date, Ethernet, language and brightness settings. Also, all user files in the internal memory are deleted, and the original language and antenna files are restored. Press the **Enter** key to initiate the reset, and turn the unit off, then on again to complete. Press **Esc** to return to normal operation without resetting.

Update OS Via Ethernet

This soft key should only be used in conjunction with Anritsu Master Software Tools (MST) to update the instrument operating system using an Ethernet connection. Use this soft key only as instructed by MST.

Update OS Via USB

This soft key should only be used in conjunction with Anritsu MST to update the instrument operating system using an USB connection. Use this soft key only as instructed by MST.

Back

Returns to the previous (System Options) menu.

System Options Menu

Back

Returns to the previous (System) menu.

9-11 Preset Menu

To access the functions under the Preset menu, press the **Shift** key, then the **Preset** (1) key.

Preset

Preset

Save
Setup

Recall
Setup
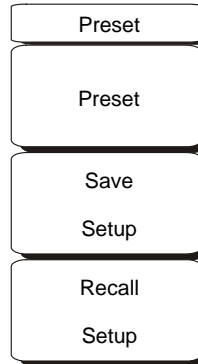
Figure 9-7. Fixed WiMAX Signal Analyzer Mode Preset Menu

Preset

This soft key resets the instrument to the default starting conditions.

Save Setup

This soft key opens a dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved. The saved setup can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/ Right** directional arrows to move the cursor position. Press **Enter** to save the setup.

Recall Setup

This soft key opens a selection box that allows selection and recall of a previously stored instrument setup in the current storage location. Use the rotary knob or the **Up/Down** arrow keys to highlight the saved setup, and press **Enter**, the rotary knob, or the Recall soft key to select. All current instrument settings are replaced by the stored setup information. Press the **Esc** key to cancel the recall.

9-12 Sweep Menu

To access the functions under the Sweep menu, press the **Shift** key, then the **Sweep** (9) key.

```
        Sweep

        Sweep
Continuous  Single

       Trigger

        Sweep
```
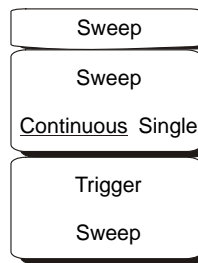
Figure 9-8. Fixed WiMAX Signal Analyzer Mode Sweep Menu

Sweep
Continuous   Single

Press this (toggle) soft key to alternate between Continuous and Single. When Continuous is selected, the instrument continuously makes measurements. When Single is selected, the instrument makes one measurement and then waits for a Trigger Sweep key press to sweep again.

Trigger Sweep

When the Sweep state is set to Single, pressing this (input) soft key triggers a new measurement sweep. This key does nothing when the Sweep state is set to Continuous.

9-13 Trace Menu

To access the functions under the Trace menu, press the **Shift** key, then the **Trace** (5) key.

```
        Trace

       Max Hold
```
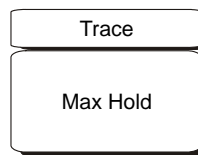
Figure 9-9. Fixed WiMAX Signal Analyzer Mode Trace Menu

Max Hold

Pressing this (toggle) soft key turns Max Hold on and off. This function applies to Spectrum View, EVM versus Subcarrier, and EVM versus Symbol views. This function allows the Spectrum Trace to hold its peak value from trace to trace. This helps in capturing a representative spectrum of a bursted RF signal such as WiMAX. All Max Hold operations show two traces – one trace shows the max hold values and the other is a live trace with the current measurement results.

9-14 Fixed WiMAX Measurements

The following measurements can be made when the MS271xB is set to Fixed WiMAX mode.

Adjacent Subcarrier Flatness (Peak)

Adjacent Subcarrier Flatness is the absolute difference between the adjacent subcarriers.

Base Station ID

Each transmitter has a unique ID. The instrument displays the ID as Base Station ID by decoding the FCH part of the downlink frame.

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.

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.

Crest Factor

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

Data Burst Power

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

EVM (Error Vector Magnitude)

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 an entire downlink subframe are displayed.

Freq Error

The difference between the received frequency and the specified frequency is the frequency error. This number is only as accurate as the frequency reference used. Frequency error is displayed in both Hz and ppm.

Occupied BW

The occupied bandwidth is calculated as the bandwidth containing 99% of the transmitted power in the given RF Span.

Preamble Power

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

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.

9-15   Measurement Setup

Preparation

To prepare for Fixed WiMAX measurements, the instrument must be configured for Fixed WiMAX mode, as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

Setting up the Measurement Frequency

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the instrument to automatically set the frequency.

To set the measurement frequency by entering the center frequency:

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key.

3. Enter the required frequency using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

4. Press the **Enter** key to set the Center Frequency. The current setting is shown on the left side of the display.

Select Signal Standard

To set the measurement frequency by selecting a signal standard:

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key.

3. 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 for the channel of the selected standard is automatically tuned.

4. Press the Channel soft 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. The current settings are displayed on the left side of the screen.

Power Offset for Compensating External Loss

To get accurate results, any external attenuation should be compensated using power offset. In power offset mode the compensation factor is in dB. External attenuation can be caused by using an external cable or external high power attenuator.

1. Press the **Amplitude** function hard key.

2. Press the Power Offset soft key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. Press the **Enter** key to set the Power Offset. The value entered is displayed on the left side of the screen.

Bandwidth Setup

The 802.16-2004 standard specifies a bandwidth from 1.25 MHz to 20 MHz. The bandwidth can be manually set from 1.25 MHz to 10 MHz.

To set the bandwidth:

1. Press the **Setup** function hard key.

2. Press the Bandwidth soft key to display a set of bandwidths. Available bandwidths are 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.

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 user settable parameters to the left of the display.

CP Ratio (G) Setup

The 802.16-2004 standard specifies CP ratios from 1/4 to 1/32. With the MS271xB, a specific CP ratio can be manually set. The instrument offers support for CP ratios of 1/4, 1/8, 1/16, or 1/32.

To set the CP ratio:

1. Press the **Setup** function hard key.

2. Press the CP Ratio (G) soft key to display the available CP ratios: 1/4, 1/8, 1/16, or 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** function hard key.

2. Press the Span soft key to display the available spans: 5 MHz, 10 MHz, 20 MHZ, or 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.

External Reference Frequency Setup

In order to get the best frequency accuracy measurements, it is important to use an external reference frequency attached to the Ext Ref In connector. Most base stations have a reference frequency available on a BNC connector. To configure the instrument to use an external reference frequency:

1. Press the **Setup** function hard key.

2. Press the Ext. Reference Frequency soft key to display a list of the available reference frequencies: 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, or 19.6608 MHz.

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list and press the **Enter** key to set the reference frequency. As the instrument locks to the source, the Reference Freq value is displayed in the user settable parameters to the left of the display.

9-16   Fixed WiMAX RF Measurements

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

Spectrum Screen

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

Spectrum Screen Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the RF soft key.

11. Press the Spectrum soft key to activate the spectrum measurement. The red dot on the soft key indicates that it is selected.

Figure 9-10. Spectrum View

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.

Power versus Time Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the RF soft key.

11. Press the Power vs. Time soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
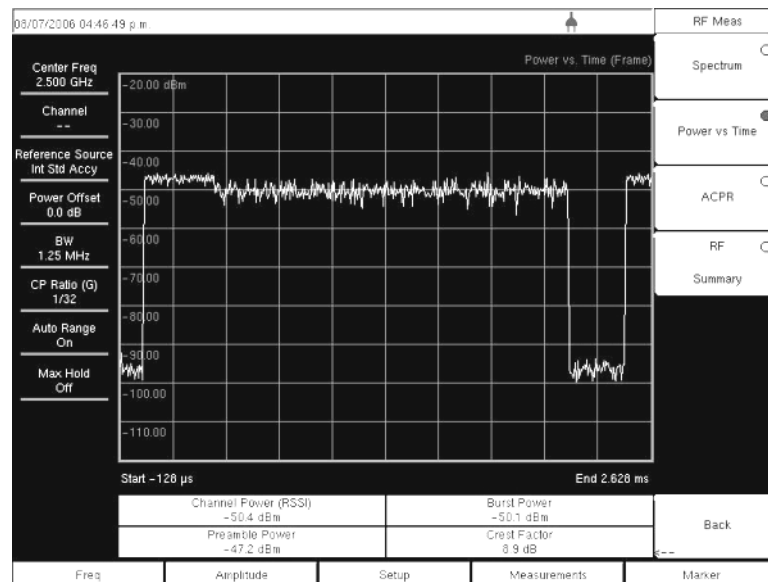
Figure 9-11. Power versus Time View

Adjacent Channel Power Ratio (ACPR)

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

ACPR Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the RF soft key.

11. Press the ACPR soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
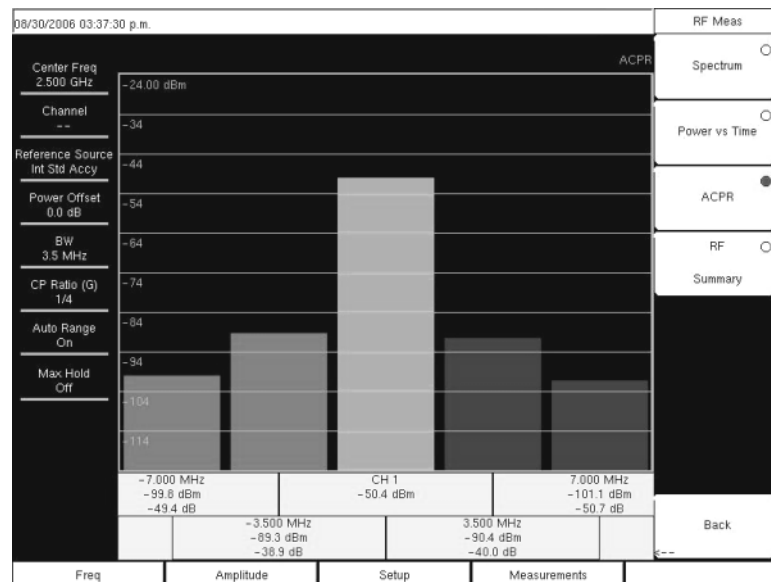
Figure 9-12. ACPR View

RF Summary

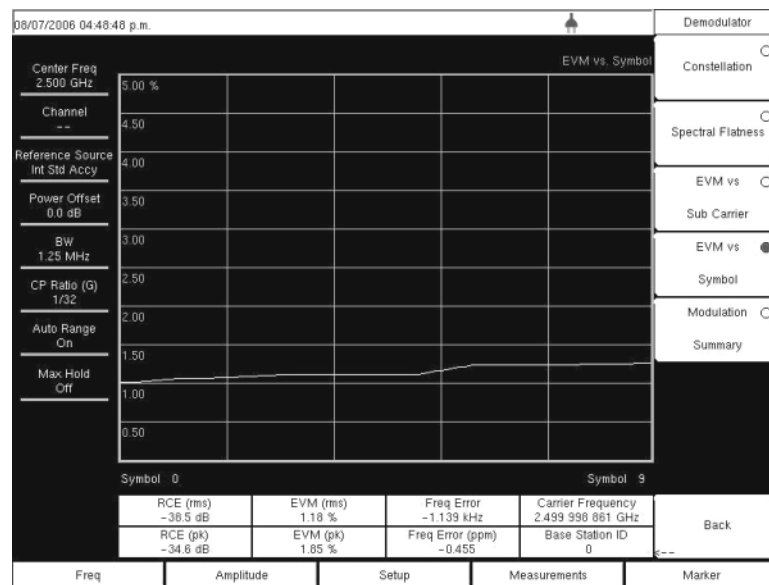The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the WiMAX signal. The parameters displayed in the RF summary table are Channel Power in dBm, Data Burst power in dBm, Preamble power in dBm, Occupied Bandwidth, and Crest Factor.

RF Summary Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the RF soft key.

11. Press the RF Summary soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
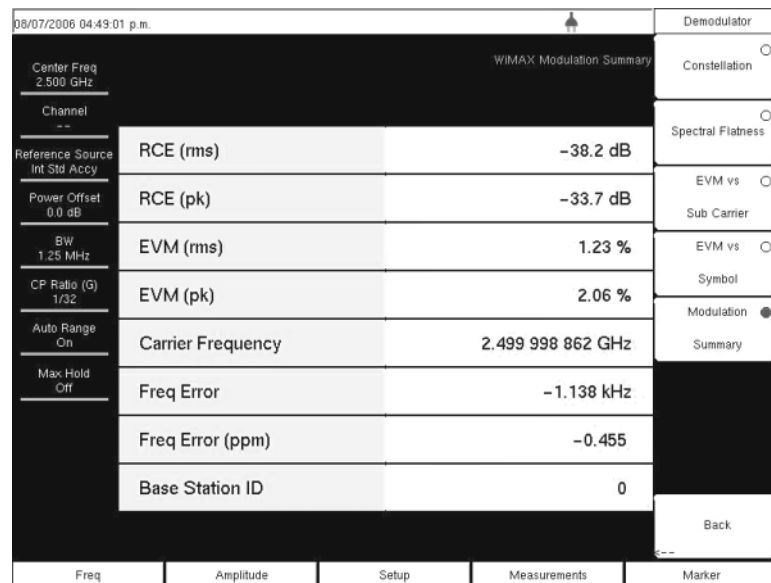

Figure 9-13. RF Summary View

9-17 Fixed WiMAX Demodulator

The MS271xB will 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.

Constellation

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

Constellation Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Demodulator soft key.

11. Press the Constellation soft key to activate the measurement. The red dot on the soft key indicates that it is selected.

12. Press the Constellation soft key again to activate the reference points menu.

13. Press the Reference Points soft key to switch the reference points On or Off (refer to and below).
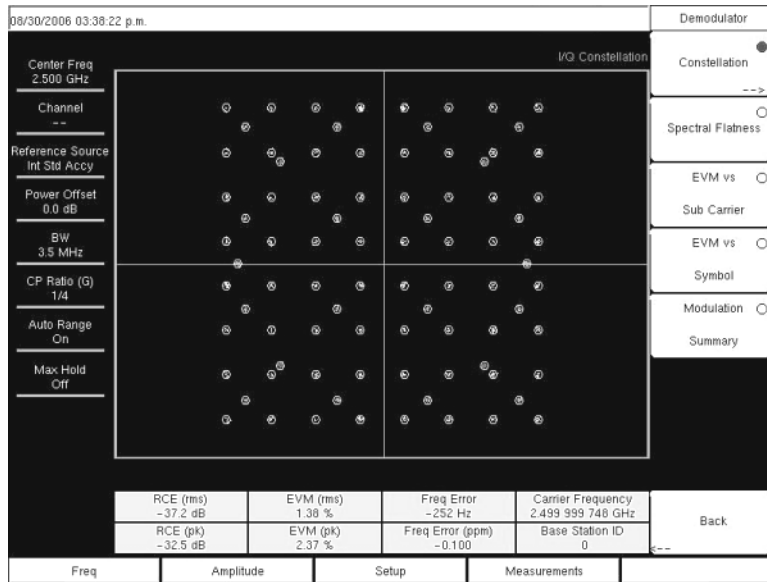
Figure 9-14. Constellation with Reference Points On
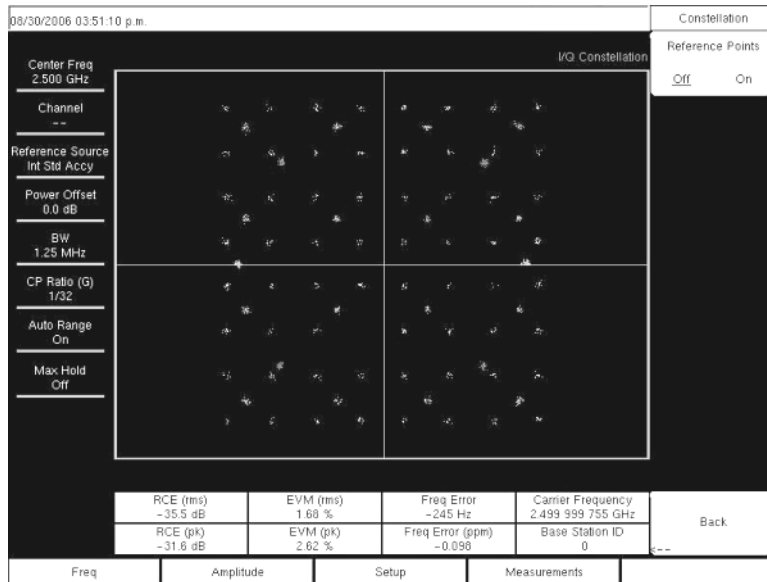
Figure 9-15. Constellation with Reference Points Off

Spectral Flatness

The Spectral Flatness view shows the data collected from the preamble at the channel estimation step. The deviation of the Spectral Flatness from the average over 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 indicates regions of the mask where it 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. The numerical result displayed in this view is the adjacent sub-carrier flatness (in dB).

Spectral Flatness Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard, and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Demodulator soft key.

11. Press the Spectral Flatness soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
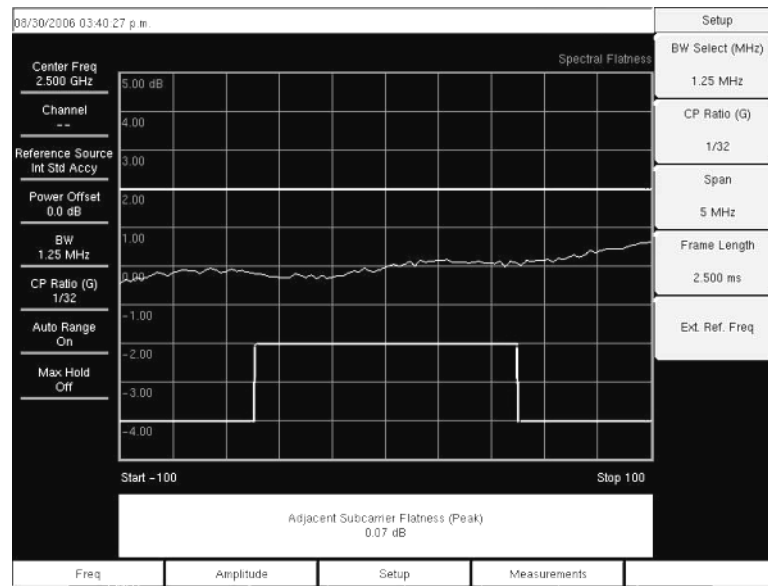
Figure 9-16. Spectral Flatness View

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 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

EVM versus SubCarrier Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Demodulator soft key.

11. Press the EVM vs. SubCarrier soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
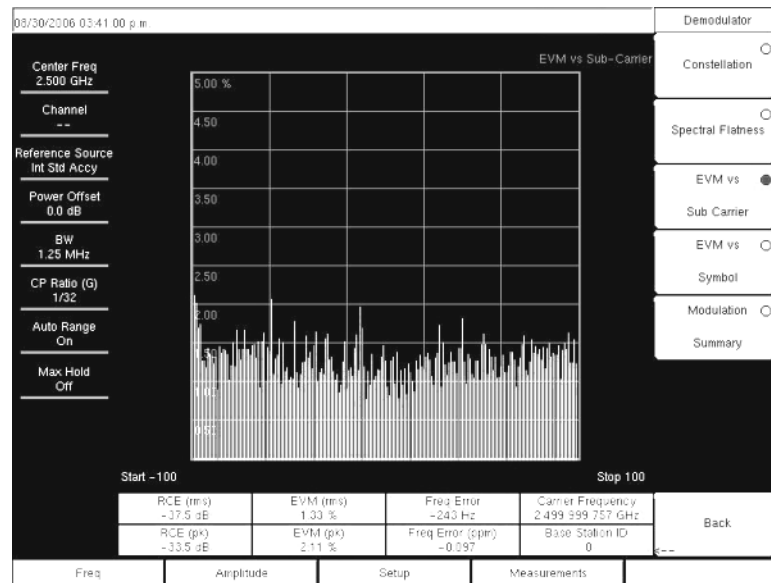
Figure 9-17. EVM versus SubCarrier View

EVM versus Symbol

This view shows the EVM (rms) values versus OFDM symbols. The numerical results 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

EVM versus Symbol Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Demodulator soft key.

11. Press the EVM vs. Symbol soft key to activate the measurement. The red dot on the soft key indicates that it is selected.

Figure 9-18. EVM versus Symbol View

Modulation Summary

The Modulation Summary displays the critical Modulation transmitter performance measurements in a table format by demodulating the WiMAX signal. The parameters 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

Modulation Summary Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Demodulator soft key.

11. Press the Modulation Summary soft key to activate the measurement. The red dot on the soft key indicates that it is selected.

Figure 9-19. Modulation Summary View

9-18   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. Using Master Software Tools, a custom test list can be created and downloaded into the unit. All critical measurements can be selected for pass fail testing. The results are displayed in a table format with clear identification of pass/fail results including minimum/maximum thresholds and measured results.

Pass/Fail Mode Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the Pass/Fail Mode soft key.

11. Press the Pass/Fail Mode soft key again to activate the sub-menu.

12. Press the Select Pass/Fail Test soft key to view a list of pass/fail test definition files.

13. 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.
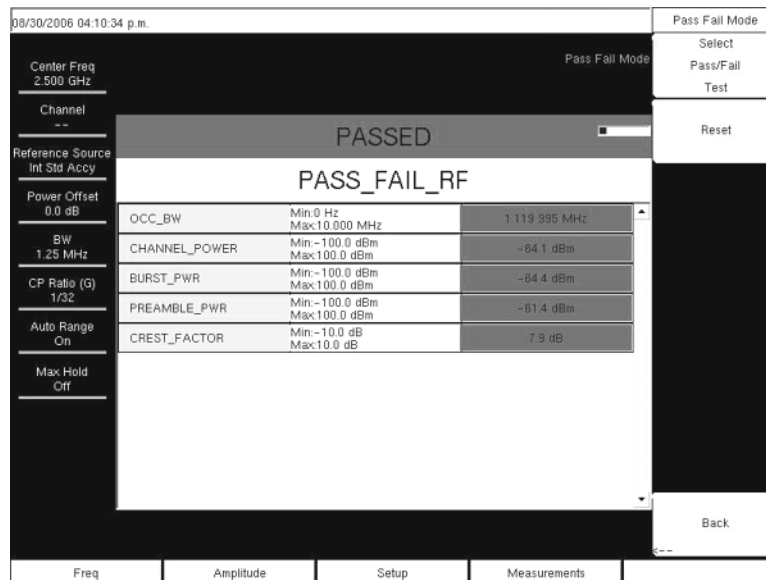
Figure 9-20. Pass/Fail Mode

9-19   WiMAX Summary

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

WiMax Summary Procedure

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight Fixed WiMAX Signal Analyzer and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable standard from the Signal Standards list presented and press the **Enter** key.

5. Press the Channel soft key and use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number for the selected signal standard and press the **Enter** key. The center of the channel is tuned to the center of the display.

6. Press the **Setup** function hard key.

7. Set the bandwidth and CP Ratio as described in the measurement setup section.

8. For the most accurate frequency measurements, press the Ext. Ref. Freq soft key to display a list of the available reference frequencies and select the desired reference frequency and synchronize the instrument to Internal High Accuracy.

9. Press the **Measurements** function hard key.

10. Press the WiMAX Summary soft key.
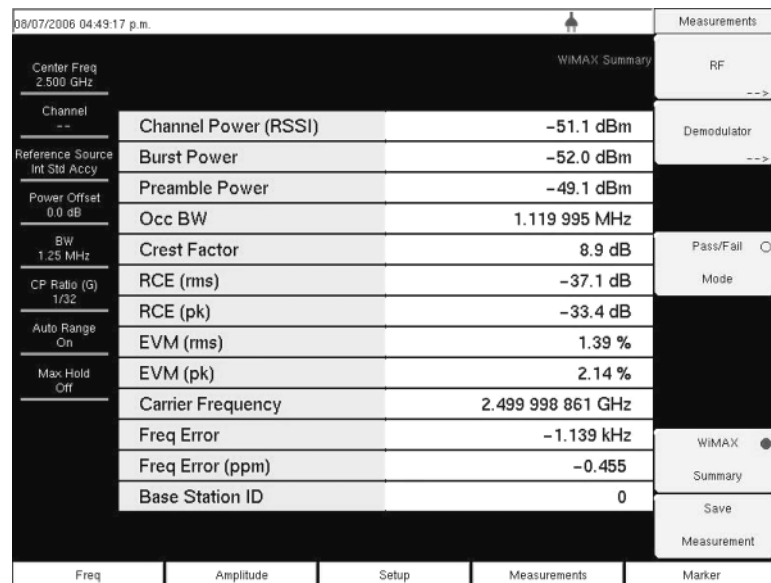
Figure 9-21. WiMAX Summary View

Chapter 10 — Mobile WiMAX Signal Analyzer

10-1 Introduction

Two Mobile WiMAX options are available for the MS271xB for testing WiMAX BTS transmitter performance:

- Mobile WiMAX RF Measurements (Option 66)
- Mobile WiMAX Demodulator (Option 67)

Attach a coupler or attenuator to the RF In 50 ohm connector on the Economy Microwave Spectrum Analyzer 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 high power attenuator.

10-2 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 given RF Span.

Downlink Burst Power

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

Uplink Burst Power

Uplink Burst power is the RMS power over the uplink portion 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.

Sector ID

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

Adjacent Subcarrier Flatness (Peak)

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

10-3 Measurement Setup

Set Mode

To prepare for Mobile WiMAX measurements, the Economy Microwave Spectrum Analyzer must be configured for Mobile WiMAX Signal Analyzer mode, as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the **Up/Down** arrow keys or the rotary knob to highlight Mobile WiMAX Signal Analyzer and press the **Enter** key to select.

For additional information about the Mode menu, refer to section Section 3-9, "Mode" on page 3-26 in Chapter 3, "Key Functions".

Hard Keys and Soft Keys

For a general description of these key functions, refer to Section , "Front Panel Keys and Connectors" on page 2-3 in Chapter 2, "Quick Start Guide".

Setting up the Measurement Frequency

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the Economy Microwave Spectrum Analyzer to automatically set the frequency.

To Set the Measurement Frequency by Entering the Center Frequency

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key.

3. Enter the required frequency by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key. Pressing the **Enter** key has the same affect as pressing the MHz soft key.

4. Press the **Enter** key to set the Center Frequency. The current setting is shown at the top of the instrument settings summary column on the left side of the screen.

To Set the Measurement Frequency by Selecting a Signal Standard

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key.

3. 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 for the channel of the selected standard is automatically tuned.

4. Press the Channel soft 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. The current settings are displayed in the instrument settings summary column on the left side of the screen.

Power Offset for Compensating External Loss

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

1. Press the **Amplitude** function hard key.

2. Press the Power Offset soft key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. When using the rotary knob, the value changes in increments of 0.1 dB. When using the **Left/Right** arrow keys, the value changes in increments of 1.0 dB. When using the **Up/Down** arrow keys, the value changes in increments of 10.0 dB. The value that is entered is displayed in the instrument settings summary column on the left side of the screen.

Bandwidth Setup

The Economy Microwave Spectrum Analyzer bandwidth can be manually set to 5 MHz, 8.75 MHz, or 10 MHz.

1. Press the **Setup** function hard key.

2. Press the BW (bandwidth) soft key to display a set of available bandwidths: 5 MHz, 8.75 MHz, and 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 and Power versus Time measurements, frame length needs to be set correctly for successful preamble synchronization.

1. Press the **Setup** function hard key.

2. Press the Frame Length (toggle) soft key to alternate between 5 ms and 10 ms.

Demod Type Setup

The Economy Microwave Spectrum Analyzer can demodulate the signal in three ways: It can demodulate the signal by decoding the downlink map (DL-MAP). It can demodulate the signal based upon manually entered parameters for the DL-MAP (by using an .xml file). It can demodulate only the frame control header (FCH) portion of the signal.

1. Press the **Setup** function hard key.

2. If Manual needs to be selected, then press the Load Parameter File soft key to load an .xml file with the DL-MAP parameters defined using the Anritsu IQProducer software.

3. Press the Demod Type soft key repeatedly to cycle through Auto, Man, and FCH.

Span Setup

1. Press the **Setup** function hard key.

2. Press the Span soft key to display the available spans: 5 MHz, 10 MHz, 20 MHZ, or 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.

External Reference Frequency Setup

In order to get the best frequency accuracy measurements, the use of an external reference frequency is important. Attach it to the Economy Microwave Spectrum Analyzer Ext Ref In connector. Most base stations have a reference frequency that is available on a BNC connector.

1. Press the **Setup** function hard key.

2. Press the Ext. Ref. Freq soft key to display a list of the available reference frequencies. Available reference frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, or 19.6608 MHz.

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list, and press the **Enter** key to set the reference frequency. As the Economy Microwave Spectrum Analyzer locks to the source, the reference frequency value is displayed in the user settable parameters in the instrument settings summary column.

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

10-4   Mobile WiMAX RF Measurements

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

Setup for RF Measurements

1. Press the **Measurements** function hard key.

2. Press the RF soft key to select one of the following RF measurements.

Spectrum

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

1. Press the Spectrum soft key to select the spectrum measurement.

2. Press the Spectrum soft key again to open the Spectrum menu and change the Span, if desired. Span choices are 5 MHz, 10 MHz, 20 MHz, or 30 MHz.
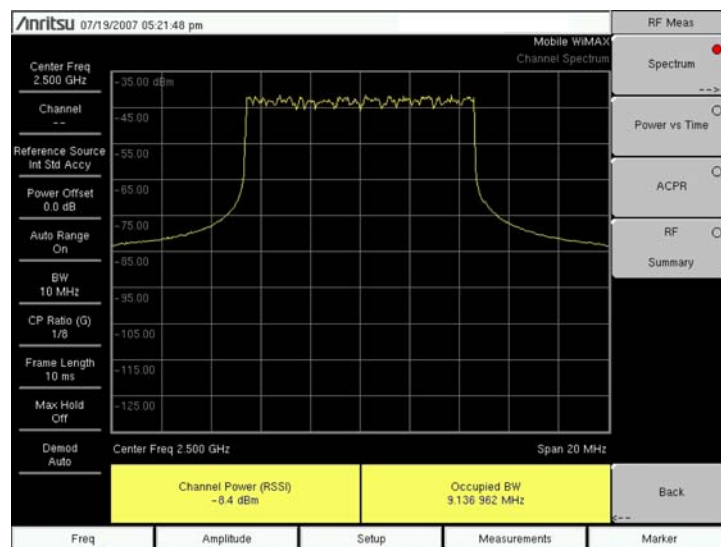
Figure 10-1. Channel Spectrum Measurement

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.

- Press the Power vs. Time soft key to select the measurement.
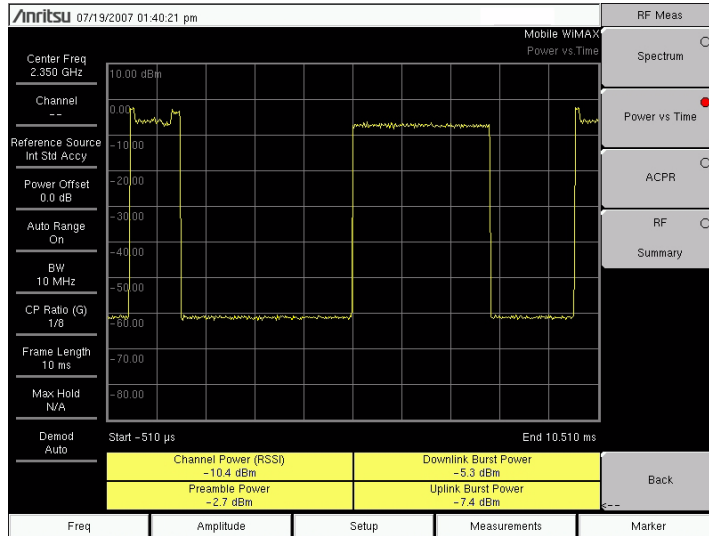
Figure 10-2. Power versus Time Measurement

Adjacent Channel Power Ratio (ACPR)

The ACPR view shows one main channel and two adjacent channels on each side, and 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.

- Press the ACPR soft key to select the measurement.
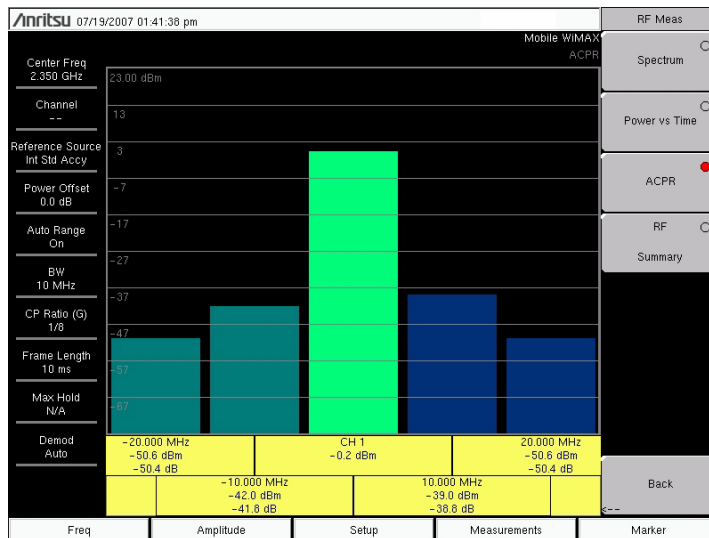
Figure 10-3. Adjacent Channel Power Ratio Measurement

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).

- Press the RF Summary soft key to activate the measurement.
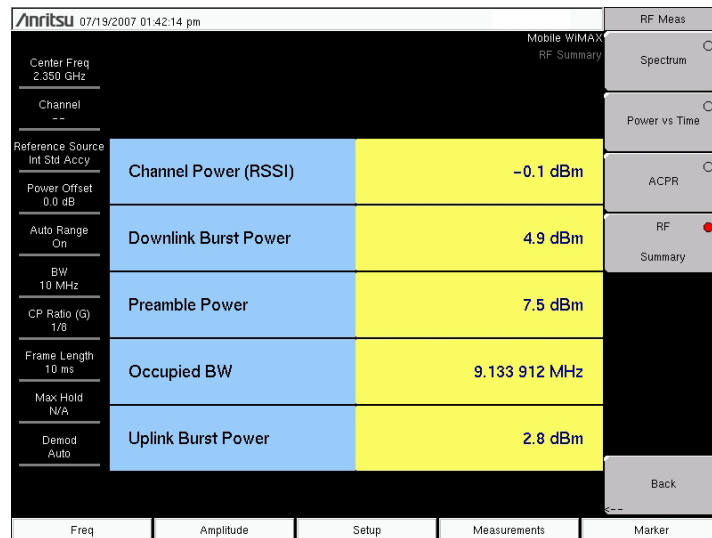
Figure 10-4. RF Summary Measurement

10-5   Mobile WiMAX Demodulator

The Economy Microwave Spectrum Analyzer will 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 views.

Setup for Demodulator Measurements

1. Press the **Measurements** function hard key.

2. Press the Demodulator soft key to open the Demodulator menu and select one of the following demodulator measurements.

Constellation

The Economy Microwave Spectrum Analyzer 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
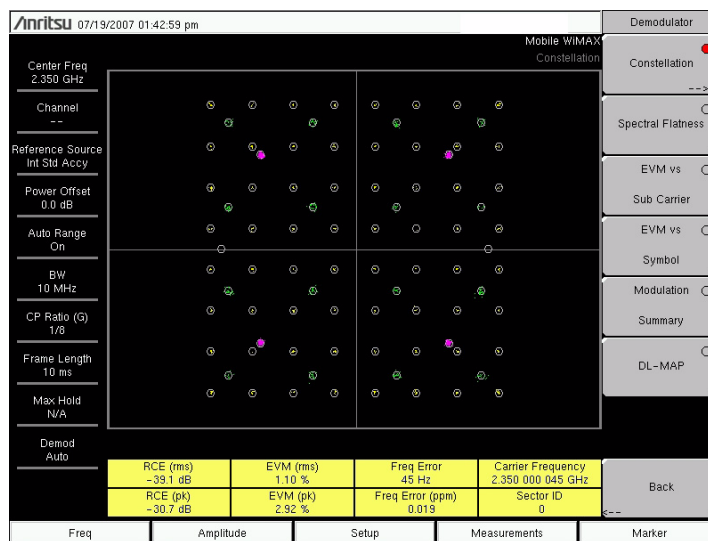
Figure 10-5. Constellation Measurement

The numerical results that are displayed in this view are: RCE_{RMS} (dB), RCE_{PEAK} (dB), EVM_{rms} (%), EVM_{peak} (%), Freq Error (Hz), Freq Error (ppm), Carrier Frequency (Hz), and Sector ID.

1. Press the Constellation soft key to activate the measurement.

2. Press the Constellation soft key again to activate the reference points menu.

3. Press the Reference Points (toggle) soft key to alternate 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 displayed in this view is the adjacent subcarrier flatness (in dB).

- Press the Spectral Flatness soft key to select the measurement.
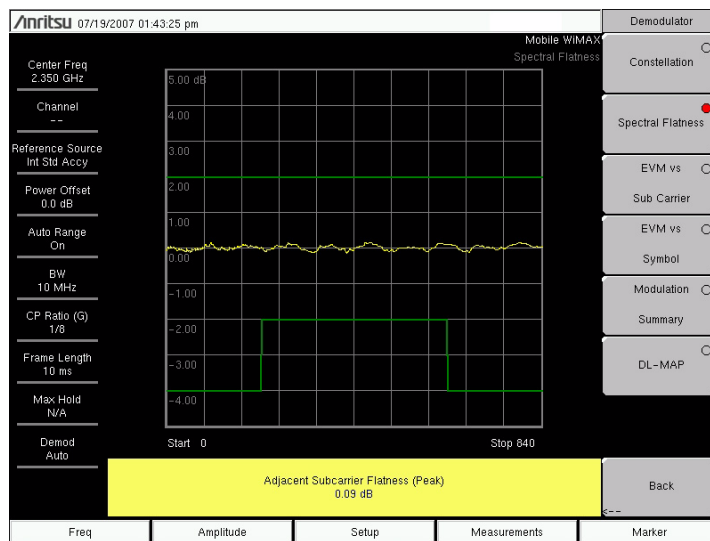
Figure 10-6. Spectral Flatness View

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} (dB), RCE_{peak} (dB), EVM_{rms} (%), EVM_{peak} (%), Freq Error (Hz), Freq Error (ppm), Carrier Frequency (Hz), and Sector ID.

- Press the EVM vs. Sub Carrier soft key to select the measurement.
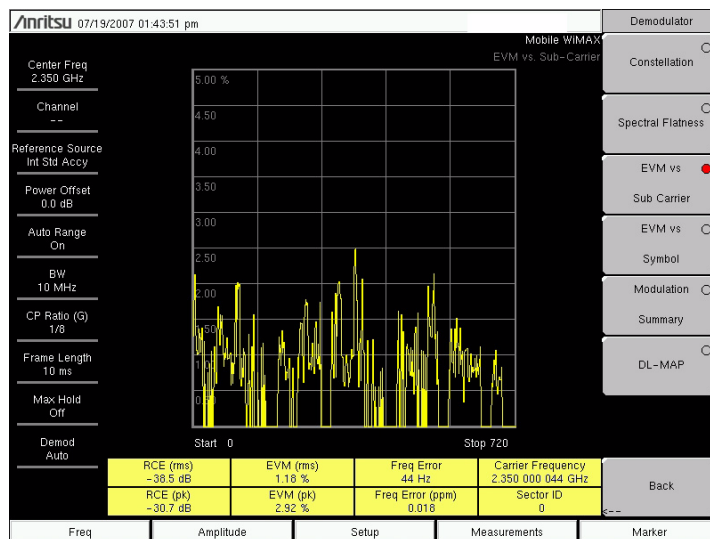
Figure 10-7. EVM versus Sub Carrier Measurement

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} (dB), RCE_{peak} (dB), EVM_{rms} (%), EVM^{peak} (%), Freq Error (Hz), Freq Error (ppm), Carrier Frequency (Hz), and Sector ID.

• Press the EVM vs. Symbol soft key to select the measurement.
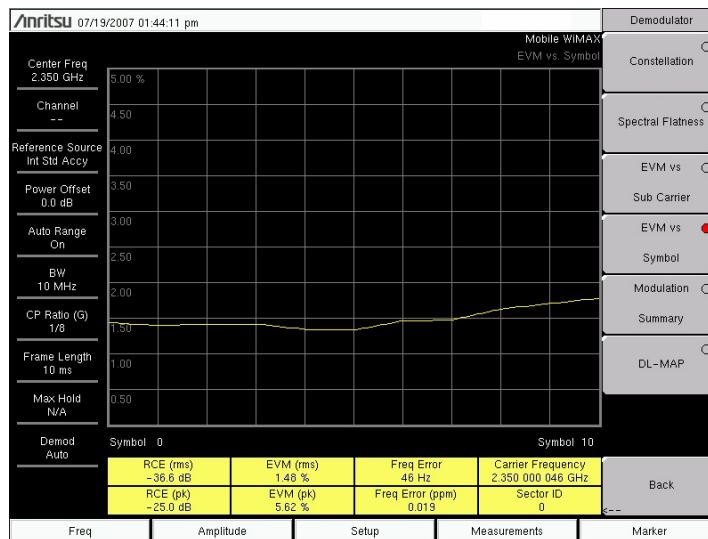
Figure 10-8. EVM versus Symbol Measurement

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} (dB), RCE_{peak} (dB), EVM_{rms} (%), EVM_{peak} (%), Freq Error (Hz), Freq Error (ppm), Carrier Frequency (Hz), and Sector ID.

• Press the Modulation Summary soft key to select the measurement.
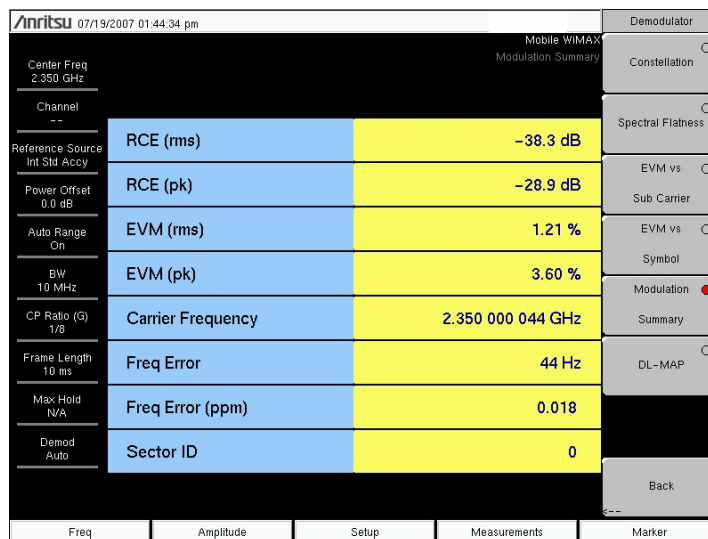
Figure 10-9. Modulation Summary Measurement

DL-MAP

The DL-MAP measurement displays the DL-MAP information either from the decoded results (Auto mode) or from the parsed information, which is from the `.xml` parameter file (Manual mode).

1. Press the DL-MAP soft key to open the DL-MAP Tree, which displays a list of WiMAX parameters.

2. Use the **Up/Down** and **Left/Right** arrow keys to close or open subordinate lists within the map.
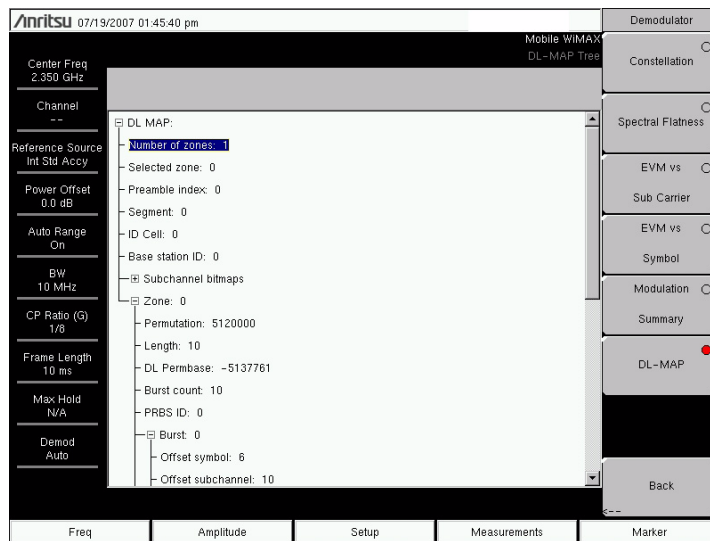
Figure 10-10. DL-MAP Measurement

10-6 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 Economy Microwave Spectrum Analyzer 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 downloaded into the unit. 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.

1. Press the **Measurements** function hard key.

2. Press the Pass/Fail Mode soft key.

3. Press the Pass/Fail Mode soft key again to activate the Pass Fail Mode menu.

4. Press the Select Pass/Fail Test soft 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 soft key to begin a new pass/fail test measurement.

10-7   WiMAX Summary

The WiMAX Summary is a summary of critical Mobile WiMAX measurements from the RF and Demodulator measurements.

    1. Press the **Measurements** function hard key.

    2. Press the WiMAX Summary soft key.
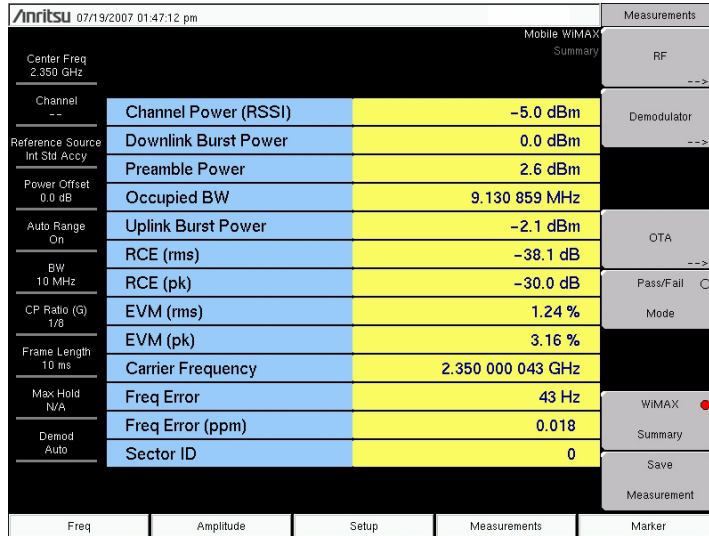
Figure 10-11. WiMAX Summary Display

The following sections describes function hard keys menus, associated soft keys, and submenus.

10-8   Freq (Frequency) Menu

Figure 10-12. Frequency Menu

Center Freq, ##

Press the Center Freq (input) soft key to set the receiver center frequency to the desired value. Enter the frequency using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit soft key. Pressing a unit soft key finalizes the data input. Pressing the **Enter** key has the same affect as pressing the MHz soft key.

Signal Standard

Pressing this (input) soft key opens 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 entered automatically.

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 (input) soft 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 Economy Microwave Spectrum Analyzer measurement display is automatically tuned to the center frequency of the selected channel.

Set CF to Closest Channel

Pressing this (input) soft key moves the current Center Frequency to the closest frequency that matches a channel number in the current Signal Standard.

Decrement Channel

Press this (input) soft key to decrease the selected channel number by the specified channel step size for the selected standard.

Increment Channel

Press this (input) soft key to increase the selected channel number by the specified channel step size for the selected standard.

10-9   Amplitude Menu
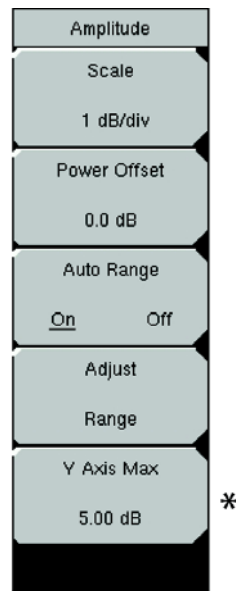
Figure 10-13. Amplitude Menu

Scale, ##

Press this (input) soft 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 is 10 dB/div. When EVM is the y-axis value, the units change from dB/div to %/div. When the Spectral Flatness view is selected, the default value changes from 10 dB/div to 1 dB/div.

Power Offset, ##

Press the Power Offset (input) soft key to set the instrument to automatically adjust for loss through external cables, attenuators, and couplers. Power can be offset (–100 dB to +100 dB) by using the rotary knob or the **Up/Down** and **Left/Right** arrow keys. Set the offset value, then press the **Enter** key.

Auto Range, On/Off

Press this (toggle) soft key to alternate between On and Off. The on or off state is underlined on the virtual soft key face. When On (the default state), the reference level is adjusted automatically (automatic gain ranging).

Adjust Range

Press this (input) soft key to modify the internal reference level to be optimally based upon the measured signal. When the Adjust Range soft key is pressed, Auto Range is set to the Off state, and a manual Auto Range operation is performed once. The Economy Microwave Spectrum Analyzer no longer adjusts the internal gain automatically because Auto Range has been set to Off by pressing this soft key. Press the Auto Range (toggle) soft key to alternate the setting to On in order to resume automatic gain ranging.

Y Axis Max, ##

Press this (input) soft key to set the maximum value of the y-axis. In combination with the Scale control, this setting allows zooming in and out on the y-axis. This control is available only in the Spectral Flatness view, EVM versus Symbol view, EVM versus Sub Carrier view, and Channel Power Monitor view.

10-10 Setup Menu
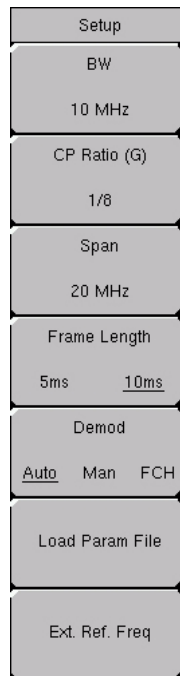
Figure 10-14. Setup Menu

BW, ##

Press this (input) soft key to open the Select Bandwidth list box. Use the **Up/Down** arrow keys or the rotary knob, and then press the **Enter** key. The available bandwidths are 5 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. Users cannot change this parameter.

Span, ##

Press this (input) soft 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
5 ms   10 ms

Press this (toggle) soft key to alternate between 5 ms and 10 ms for frame length.

Demod
Auto   Man   FCH

Press this (toggle) soft key to alternate through the available selections for Automatic, Manual, and Frame Control Header:

Automatic, Manual, and Frame Control Header:

Auto: When Auto is chosen, the Economy Microwave Spectrum Analyzer attempts to demodulate the signal, decode the DL-MAP, and use that information to demodulate the data portion of the frame.

Manual: 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 Economy Microwave Spectrum Analyzer 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.

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

Load Param File

Press this (input) soft 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.

Ext. Ref. Freq

Press this (input) soft key to open the External Reference Frequency list box and select a frequency from the list. Available External Reference Frequencies are 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, or 19.6608 MHz. The default External Reference Frequency is 10 MHz.

10-11 Measurements Menu
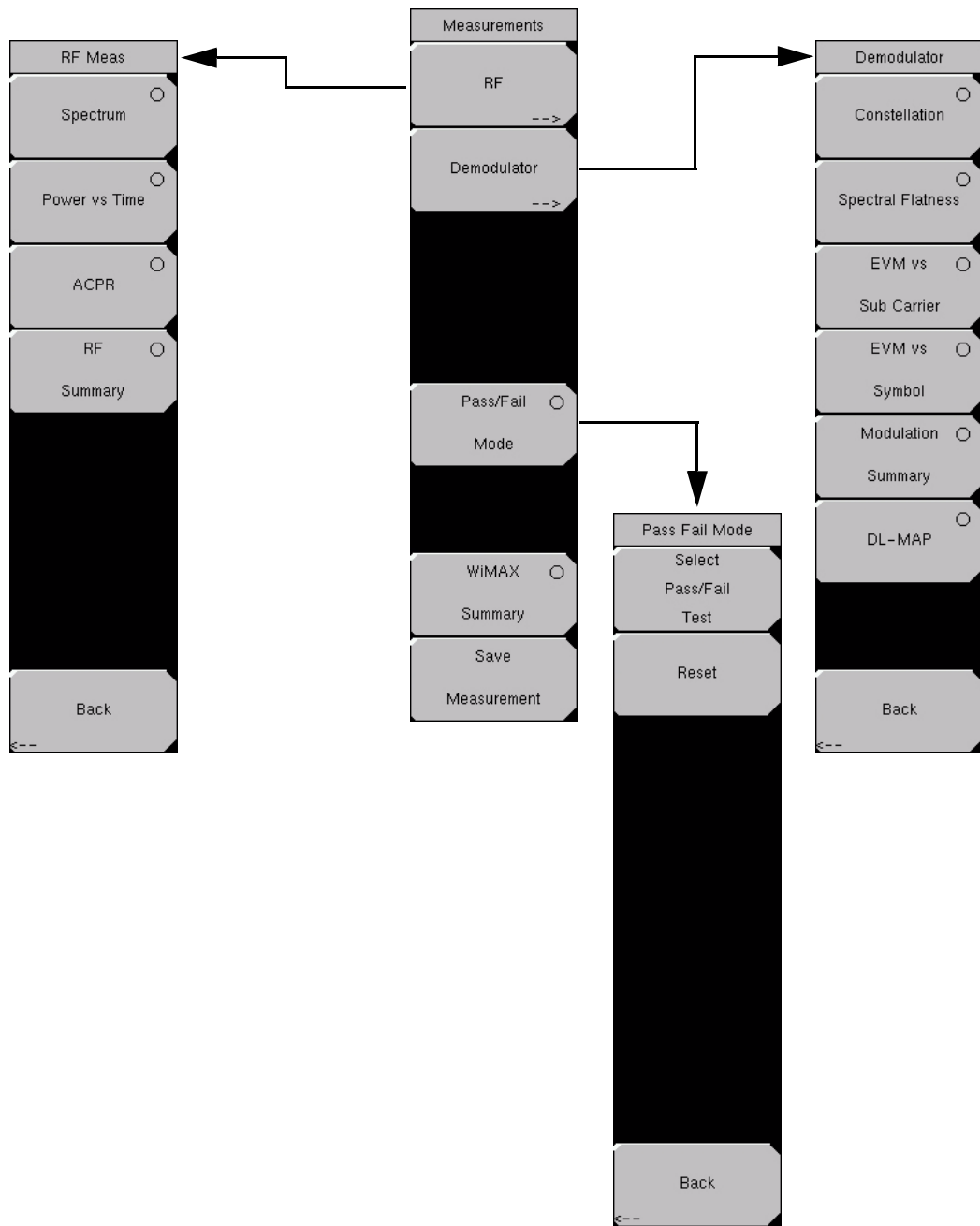
Figure 10-15. Measurements Menu

The Measurements menu has five soft keys: RF, Demodulator, Pass/Fail Mode, WiMAX Summary, and Save Measurement.

Measurements Menu

RF

Press the RF soft key to open the RF Meas menu with options of Spectrum, Power versus Time, ACPR, and RF Summary.

RF Meas Menu

Spectrum

Press this (select) soft key to set the RF measurement type to 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. The Spectrum (select) soft key becomes a switching soft key that opens the Spectrum soft key menu. The Spectrum soft key menu has only two soft keys: Span and Back.

Spectrum Menu

Span, #

Press this (input) soft key to open the Span list box and to select the desired span for the Spectrum measurement. The list displays the following Span options of 5 MHz, 10 MHz, 20 MHz, or 30 MHz. The default value is 10 MHz.

Back

Press the Back (switching) soft key to return to the previous menu.
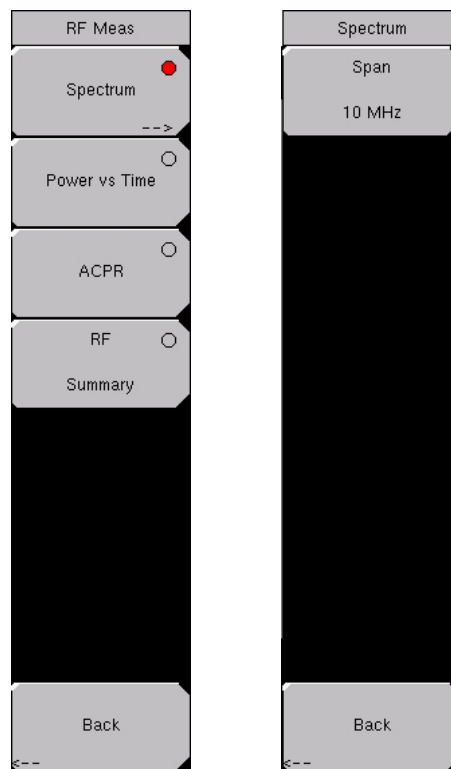
Figure 10-16. RF Spectrum Measurements

Note	The span value is automatically adjusted to the next largest available span when the bandwidth setting is changed (by using the **Setup** function hard key and the BW soft key). You can override the automatic selection by using the Span soft key.

RF Meas Menu

Power vs. Time

Press the Power vs. Time (select) soft key to use this measurement display. The power versus time view shows the time domain view of a WiMAX 802.16e signal over approximately one frame. The Economy Microwave Spectrum Analyzer automatically tries to synchronize to the downlink preamble without the need for an external trigger. If the frame length setting does not match the input signal frame length, then the synchronization will not be reliable.

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

ACPR

Press the ACPR (Adjacent Channel Power Ratio) (select) soft key to show one main channel and two adjacent channels, and to display the power levels for each channel (both absolute power and relative power).

RF Summary

Press the RF Summary (select) soft key to display a summary of all of the RF numerical measurement results.

Back (from the RF Meas soft key menu)

Press the Back (switching) soft key to return to the **Measurements** menu.

Measurements Menu

Demodulator

Press the Demodulator (switching) soft key to open the Demodulator soft key menu with key options of Constellation, Spectral Flatness, EVM vs. Sub Carrier, EVM vs. Symbol, Modulation Summary, DL-MAP, and Back.
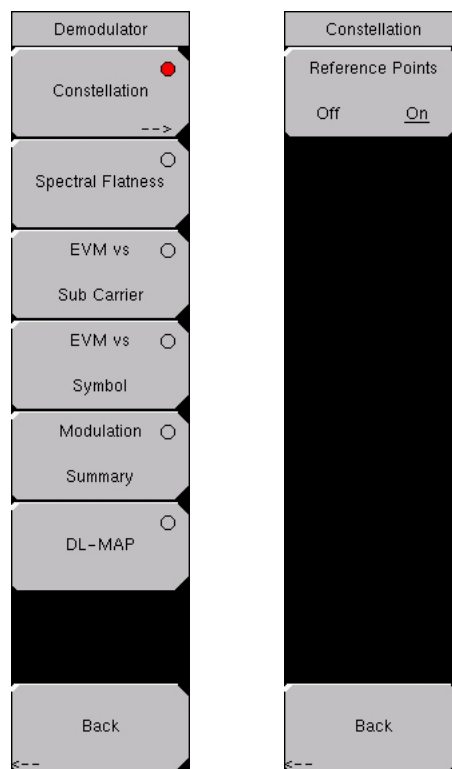
Figure 10-17. Demodulator Menu

Demodulator Menu

Constellation

Press the Constellation (select) soft 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 as follows:

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

Sector ID

The Constellation (select) soft key becomes a switching soft key that opens the Constellation soft key menu. The Constellation soft key menu has only two soft keys: Reference Points, Off/On and Back.

Constellation Soft Key Menu

Reference Points
Off   On

Press this (toggle) soft key to alternately turn On and Off the display of reference points for the various constellations. The default state is On.

Back

Press the Back (switching) soft key to return to the Demodulator menu.

Demodulator Menu

Spectral Flatness

Press this (select) soft 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.

EVM vs. Sub Carrier

Press this (select) soft key to display the EVM (rms) values versus subcarriers. Because some subcarriers are not used in OFDMA, their values are set to 0.

EVM vs. Symbol

Press this (select) soft key to display the EVM (rms) values versus OFDM symbols.

Modulation Summary

Press this (select) soft key to display a summary 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
- Freq Error (ppm)
- Sector ID

DL-MAP

Press this (select) soft key to display the DL-MAP information from either the decoded results (Auto mode) or the parsed information from the .xml parameter file (Manual mode).

Back (from the Demodulator soft key menu)

Press the Back (switching) soft key to return to the **Measurement** menu.

Measurements Menu

Pass/Fail Mode

Press this (select) soft key to display the PASS_FAIL table. The Pass/Fail Mode soft key changes to a switching soft key. Press this (switching) soft key to open the Pass Fail Mode soft key menu, which has three soft keys: Select Pass/Fail Test, Reset, and Back. Refer to Figure 10-15, "Measurements Menu" on page 10-17.

A custom list can be created with Master Software Tools and downloaded into the Economy Microwave Spectrum Analyzer. 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 threshold values and measured results.

Pass/Fail Mode allows the selection of a user-defined file (created with Master Software Tools) that specifies a list of measurements with pass/fail criteria. You can select just those measurements that are of interest to you and create a pass/fail test file. When you press the Select Pass/Fail Test soft key, select a test file, and press the **Enter** key, then the Economy Microwave Spectrum Analyzer measures each parameter and displays the results in the Pass/Fail table.

Pass Fail Mode Soft Key Menu

Select Pass/Fail Test

Press this (input) soft 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

Reset

Press this (input) soft key to restart a Pass/Fail test.

Back (from the Pass Fail Mode soft key menu)

Returns to the **Measurements** menu.

Measurements Menu

WiMAX Summary

Press this (select) soft key to display a summary of all of the WiMAX related numerical measurement results. Refer to Figure 10-15, "Measurements Menu" on page 10-17. These measurements include the following:

- 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
- Freq Error (ppm)
- Sector ID

Save Measurement

Pressing this (input) soft key opens the Save Measurement entry window. Refer to Figure 10-15. A suggested filename is placed in the edit box by default. Use the Text Entry soft keys to enter a different filename. WiMAX measurements are saved with a `.wmxe` extension. For more information about the Text Entry soft keys, refer to section Section , "Text Entry" on page 2-6 in.

10-12 Marker Menu
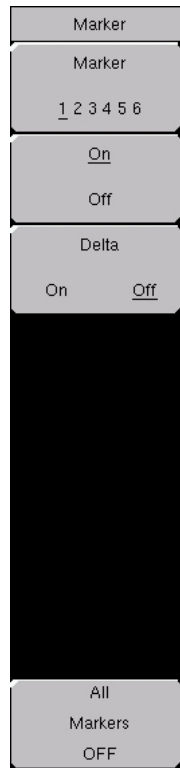
Figure 10-18. Marker Menu

This feature is available only when the Power vs. Time measurement is activated. This function hard key opens the Marker menu.

Using Markers in Power versus Time Measurements

Six regular line markers and six delta markers are available. Marker information includes time and power level in dBm. Delta marker information includes delta time and delta power.

Marker
1 2 3 4 5 6

Press this (toggle) soft key to alternate through the markers and to select and set up a marker for display.

On/Off (turn Marker On or Off)

Press this (toggle) soft key to turn On and Off the selected (underlined) marker in the Marker virtual soft key face.

Delta
On   Off

Press this (toggle) soft key to turn On and Off a delta marker. You can move the delta marker to read offsets in time and power by using the scroll wheel or by entering a time offset using the number keypad.

All Markers Off

Press this (input) soft key to turn Off all markers and remove them from the display.

10-13 Secondary Function Menus

Pressing the **Shift** key and a number key selects the menu function that is printed in blue characters above the number key. Refer to "Shift Key" on page 2-4 in Chapter 2, "Quick Start Guide".

File

The **File** (7) key menu is the same as the File menu described in Section 9-3, "File Menu" on page 9-3 in Chapter 9, "Fixed WiMAX Signal Analyzer".

Limit

The **Limit** (6) key function is not implemented in the *Mobile WiMAX Signal Analyzer* mode.

Measure

The **Measure** (4) key opens the same menu as the **Measurements** function hard key. For information about the Measure and Measurements menus, refer to section Section 10-11, "Measurements Menu" on page 10-17.

Mode

The **Mode** (9) key opens the Mode Selector list box. For information about setting the mode, refer to Section 3-9, "Mode" on page 3-26 in Chapter 3, "Key Functions".

System

The **System** (8) key menu is the same as the *System* menu described in Section 9-10, "System Menu" on page 9-13 in Chapter 9, "Fixed WiMAX Signal Analyzer".

Preset

The **Preset** (1) key menu is the same as the *Preset* menu described in Section 9-11, "Preset Menu" on page 9-16.

Sweep

Press the **Shift** key, then the **Sweep** (3) key to open the Sweep sub menu that allows control over the measurements.

Sweep
Continuous   Single

Press this (toggle) soft key to alternate between Continuous and Single. When Continuous is selected, the instrument continuously makes measurements. When Single is selected, the instrument makes one measurement and then waits for a press of the Trigger Sweep soft key to sweep again.

Trigger Sweep

When the Sweep state is set to Single, pressing this (input) soft key triggers a new measurement sweep. This soft key does nothing when the Sweep state is set to Continuous.

Trace

Press the **Shift** key, then the **Trace** (5) key to open the sub menu for Trace functions.

Max Hold
Off   On

Pressing this (toggle) soft key to turn Max Hold to 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.

Chapter 11 — GSM, GPRS, & EDGE Signal Analyzer

11-1 Introduction

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

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

The GSM/GPRS/EDGE frequency ranges are:

- 380-400 MHz
- 410-430 MHz
- 450-468 MHz
- 478-496 MHz
- 698-746 MHz
- 747-792 MHz
- 806-866 MHz
- 824-894 MHz
- 890-960 MHz
- 880-960 MHz
- 876-960 MHz
- 870-921 MHz
- 1710-1990 MHz

The MS271xB Spectrum Analyzer features two GSM/GPRS/EDGE measurement modes: RF Measurements (Option 40) and Demodulator (Option 41). The MS271xB can be directly connected to any GSM/GPRS/EDGE base station for accurate measurements. When a physical connection is not available or required, the MS271xB can receive and demodulate GSM/GPRS/EDGE signals over the air.

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

The spectrum view displays channel spectrum and multichannel spectrum. The channel spectrum screen includes channel power, burst power, average burst power, frequency error, modulation type and Training Sequence Code (TSC). The multichannel spectrum displays as many as ten channels and, using the cursor to select a channel, can display the measurements for just the selected channel.

GSM/GPRS/EDGE Demodulator (Option 41) demodulates GSM/GPRS/EDGE signals and displays the results of detailed measurements to analyze transmitter modulation performance. Results are shown for phase error (rms), phase error peak, EVM (rms), EVM (peak), origin offset, C/I, modulation type and magnitude error (rms) and a vector diagram of the signal.

This chapter describes the MS271xB Economy Microwave Spectrum Analyzer keys in GSM/GPRS/EDGE Signal Analyzer mode. The major sections are arranged in alphabetical order with soft key menus listed in the order they appear from top to bottom.

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

11-2 Getting Started

GSM/GPRS/EDGE Signal Analyzer Mode

To prepare for GSM/GPRS/EDGE signal analyzer measurements, the MS271xB must be configured for GSM/GPRS/EDGE Signal Analyzer Mode, as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight GSM/GPRS/EDGE Signal Analyzer and press the **Enter** key to select.

For additional information about the Mode menu, refer to section "3-9 Mode" on page 3-26 in Chapter 3, "Key Functions".

Hard Keys and Soft Keys

For a general description of Hard and Soft Key functions, refer to section " Front Panel Keys and Connectors" on page 2-3 in Chapter 2, "Quick Start Guide".

11-3 External Reference Frequency Setup

For the best frequency accuracy measurements, it is important to use an external reference frequency attached to the MS271xB Spectrum Analyzer Ext Ref In connector. Most base stations have a reference frequency available on a BNC connector that can be used for this purpose. To configure the Economy Microwave Spectrum Analyzer to use an external reference frequency:

1. Press the **Setup** function hard key.

2. Press the Ext Ref Freq soft key to display a list of the available reference frequencies.

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list and press the **Enter** key to set the reference frequency.

As the Economy Microwave Spectrum Analyzer locks to the source, the Reference Source value is displayed in the Instrument Setting Summary to the left of the display.

11-4　GSM/GPRS/EDGE RF Measurements

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

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

1. Press the **Shift** key, then the **Mode** (9) key, using rotary knob or up/down arrow keys select GSM/GPRS/EDGE Signal Analyzer and press the **Enter** key to select.

2. Press the **Freq** function hard key.

3. Press the Center Freq soft key and enter the desired frequency, or press the Signal Standard soft key and select the applicable GSM standard.

4. Press the Channel soft 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.

5. Press the **Setup** function hard key.

6. Press the GSM/EDGE (select) soft key and highlight Auto to automatically select the GSM or EDGE signal.

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

7. Press the Ext Ref Freq soft key to display a list of the available reference frequencies and select the desired reference frequency to get accurate frequency measurements as described in the previous section.

Measurement Display

Press the **Measurements** function hard key to select measurement display options.

To display Spectrum, press the Spectrum soft key. The red dot on the soft key indicates that it is selected. Press the Channel Spectrum soft key for a single channel, or the Multi-Channel Spectrum soft key to display the multi-channel spectrum.
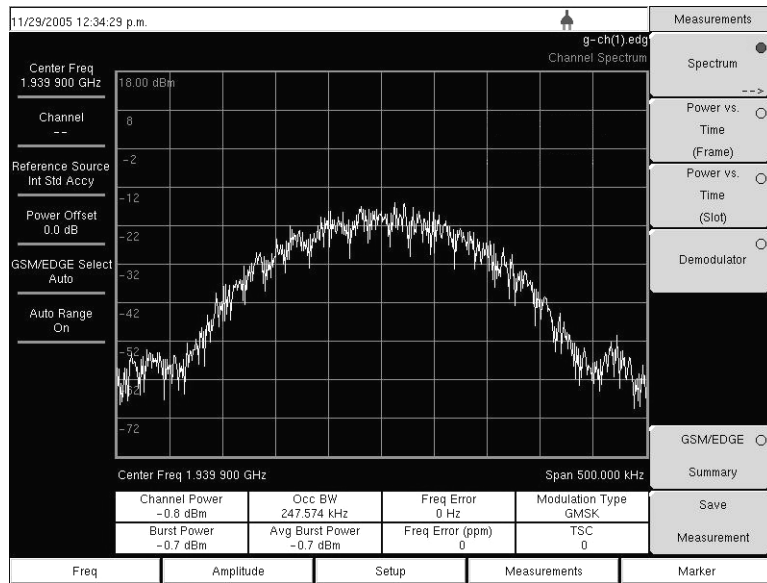
Figure 11-1. GSM Single Channel Measurement Example
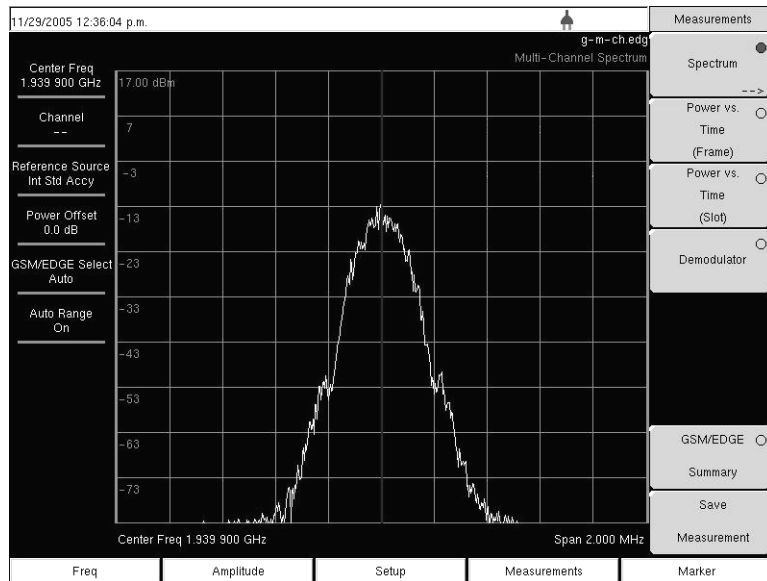
Figure 11-2. GSM Multi-channel Measurement Example

To display Power versus Time (Frame) press the Power versus Time (Frame) soft key to activate the Power versus Time (Frame) measurement. The red dot on the soft key indicates that it is selected.
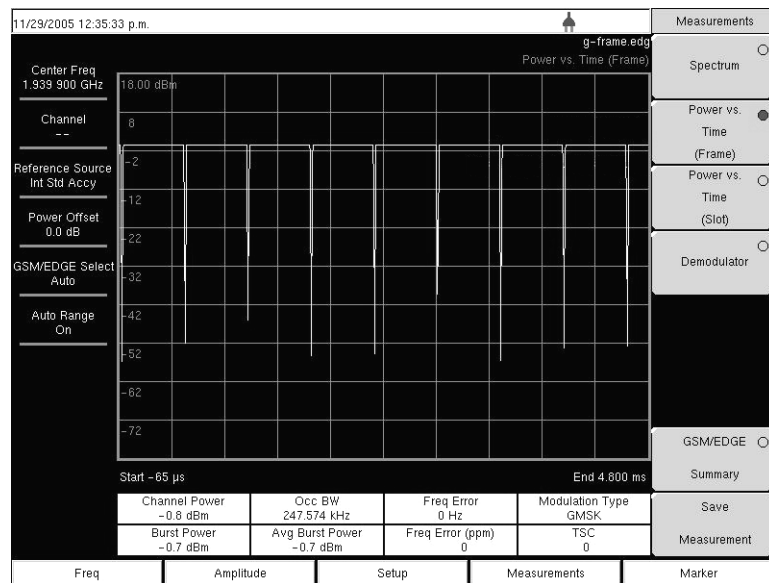
Figure 11-3. GSM Power versus Time (Frame) Measurement Example
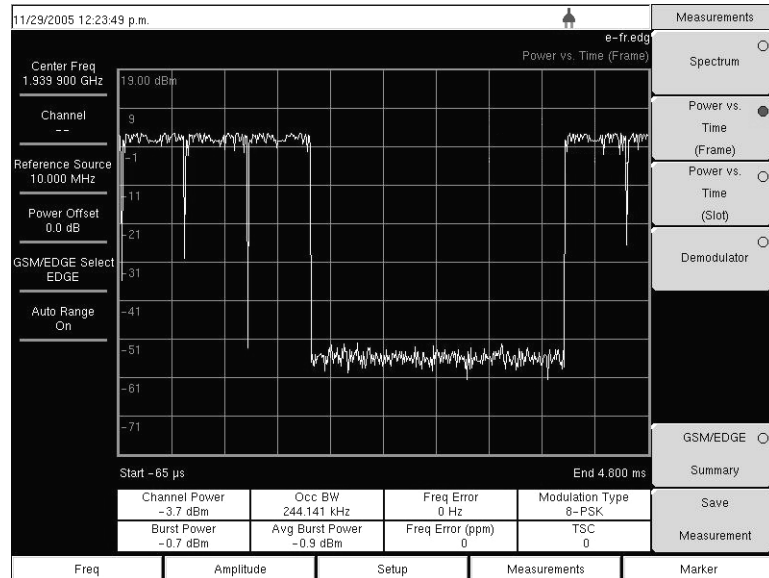
Figure 11-4. EDGE Power versus Time (Frame) Measurement Example

To display Power versus Time (Slot) press the Power versus Time (Slot) soft key to activate the Power versus Time (Slot) measurement. The mask is according to the 3GPP TS 05.05 specification. The MS271xB displays the first slot information. The red dot on the soft key indicates that it is selected.
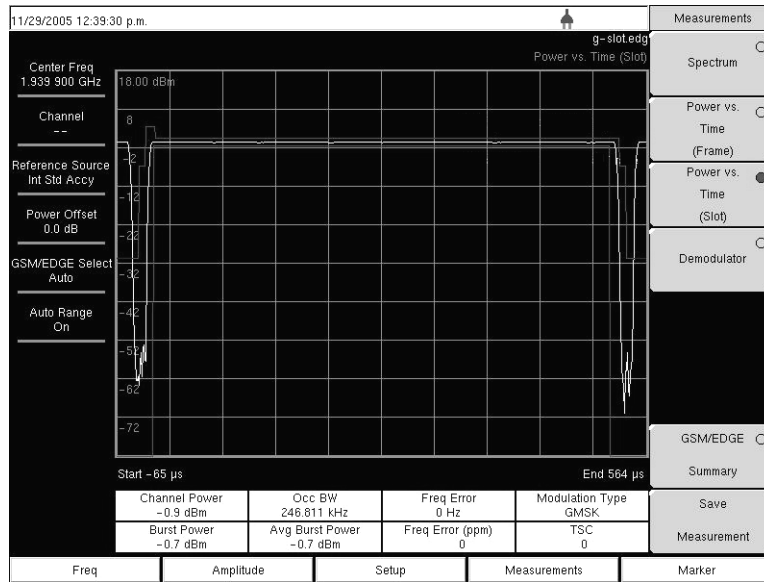
Figure 11-5. GSM Power versus Time (Slot) Measurement Example
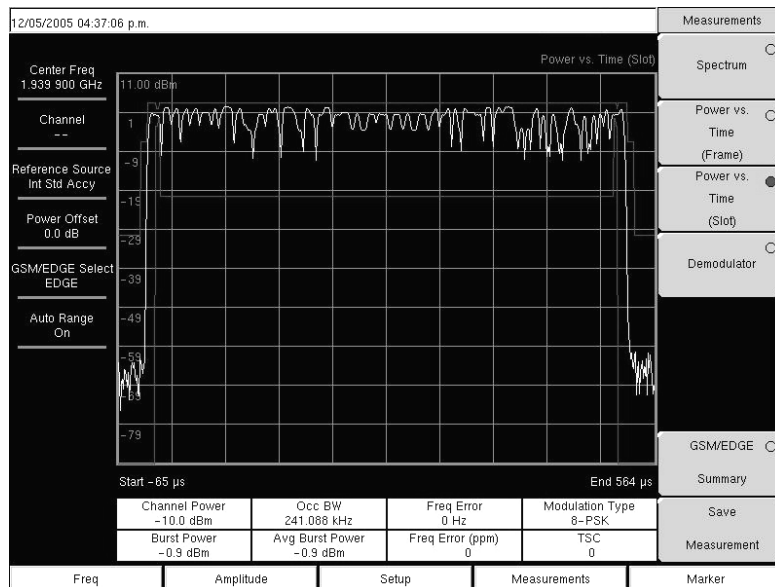
Figure 11-6. EDGE Power versus Time (Slot) Measurement Example

11-5 Demodulator

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

1. Press the **Shift** key, then the **Mode** (9) key, using rotary knob or up/down arrow keys select GSM/GPRS/EDGE Signal Analyzer and press the **Enter** key to select.

2. Press the **Freq** function hard key.

3. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable GSM standard.

4. Press the Channel soft 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.

5. Press the **Setup** function hard key.

6. Press the GSM/EDGE (select) soft key and highlight Auto to automatically select the GSM or EDGE signal.

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

7. Press the Ext Ref Freq soft key to display a list of the available reference frequencies and select the desired reference frequency to get accurate frequency measurements as described in the previous section.

8. Press the **Measurements** function hard key.

9. Press the Demodulator soft key. The red dot on the soft key indicates that it is selected.
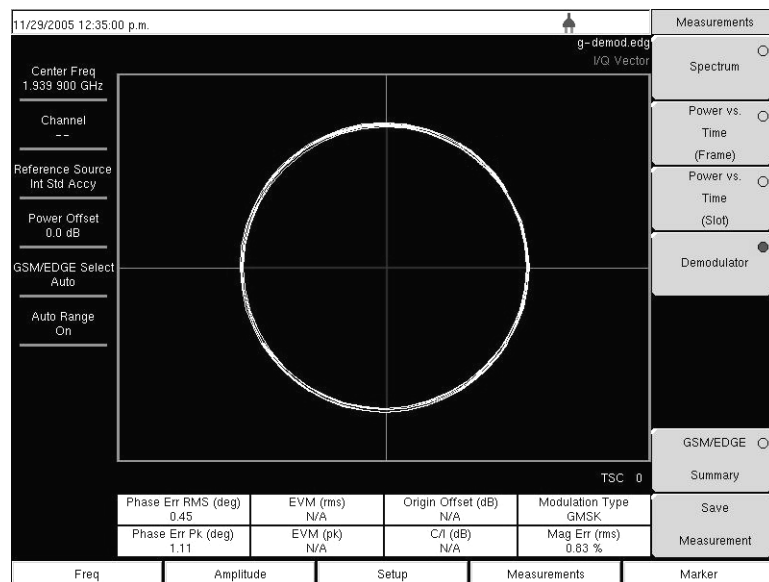
Figure 11-7. GSM Demodulator Measurement Example

Note	Using multichannel spectrum, channel cursor, select the channel and press the Demodulator soft key and the unit will demodulate the selected channel.
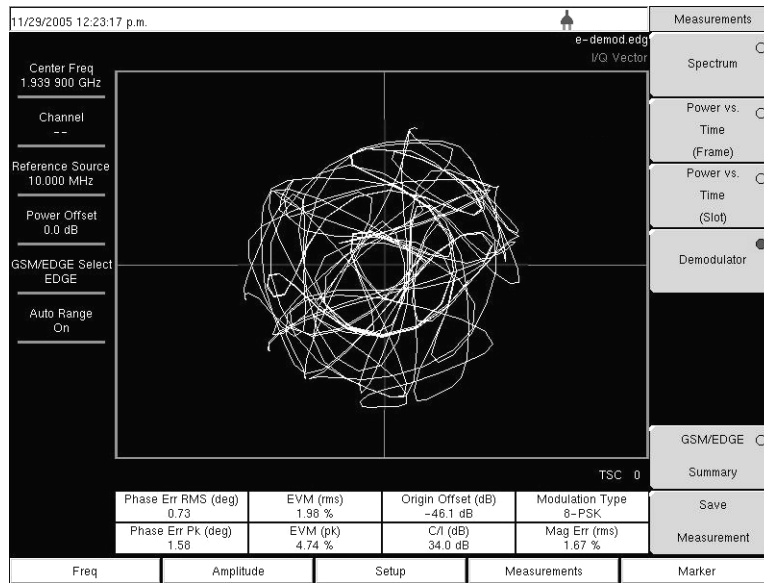
Figure 11-8. EDGE Demodulator Measurement Example

To display the GSM/EDGE Summary screen, press the GSM/EDGE Summary soft key. The red dot on the soft key indicates that it is selected.
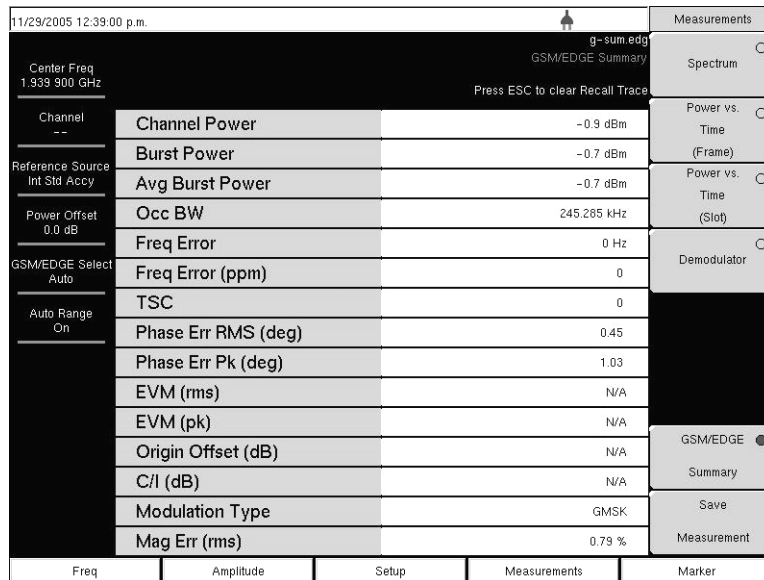
Figure 11-9. GSM Summary Screen Example
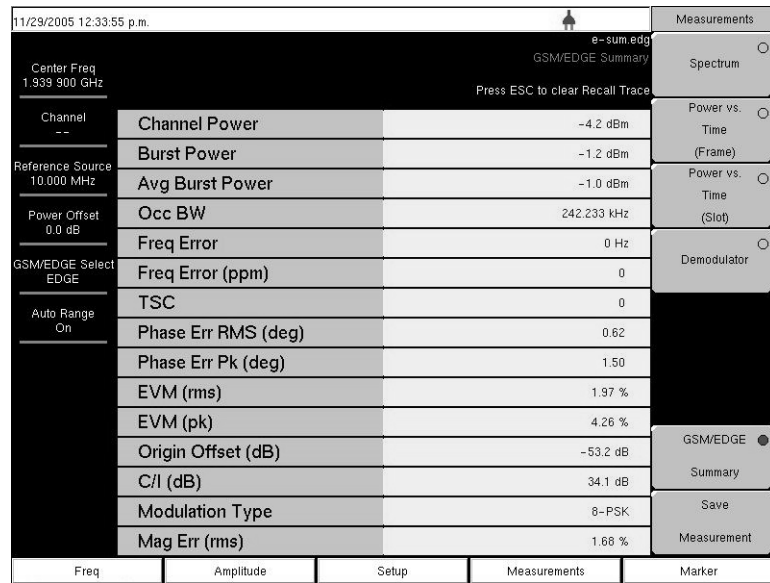
Figure 11-10. EDGE Summary Screen Example

11-6   GSM/GPRS/EDGE Mode Pass/Fail

The Economy Microwave Spectrum Analyzer can store test sets for testing base station performance and can recall these test sets for quick, easy measurements. These test sets are for reference only and can be edited using Master Software Tools. When a test set is selected, the Economy Microwave Spectrum Analyzer displays the test results in a tabular format with PASS or FAIL indications that include minimum/maximum thresholds.
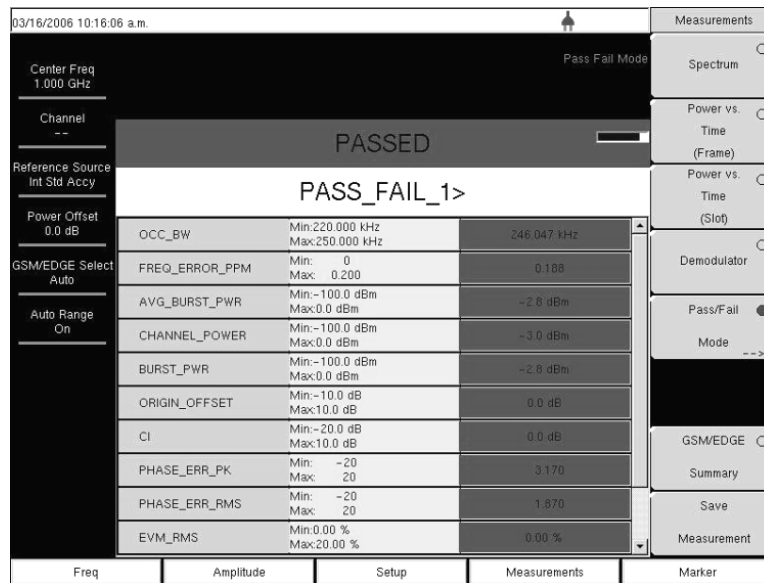
Figure 11-11. Pass/Fail Mode Example Screen

Using Master Software Tools, a custom test set can also be created and downloaded into the Economy Microwave Spectrum Analyzer. All measurement parameters can be selected for pass/fail testing.

Pass/Fail Mode Procedure

1. Press the **Shift** key, then the **Mode** (9) key, using rotary knob or **Up/Down** arrow keys select GSM/GPRS/EDGE Signal Analyzer and press the **Enter** key to select.

2. Press the **Freq** function hard key.

3. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable GSM standard.

4. Press the Channel soft 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.

5. Press the **Measurements** function hard key.

6. Press the Pass/Fail Mode soft key to activate Pass/Fail Mode.

7. Press the Pass/Fail Mode soft key to display the Pass/Fail Mode menu and then press the Select Pass/Fail Test soft key to display the available test sets.

8. Use the rotary knob or **Up/Down** arrow keys to select the applicable test set and to activate the measurement.
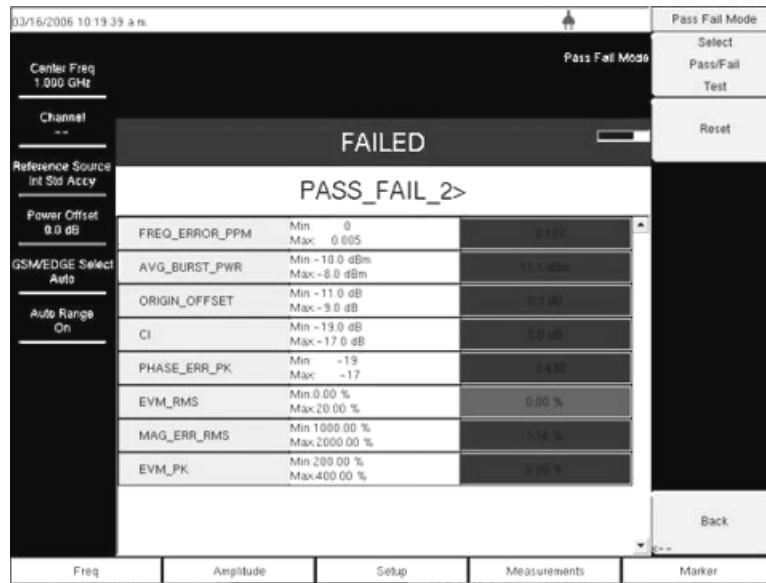
Figure 11-12. Pass/Fail Mode Test Results Example

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

11-7   Measurement Results

Average Burst Power

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

Channel Power

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

Freq Error

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

Meas Occ BW

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

Burst Power

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

TSC

The Training Sequence Code detected in the first active burst is displayed. GSM/EDGE base stations may use Training Sequence Codes 0-7. If no valid TSC is detected, then a "Not Found" message is displayed.

Phase Err RMS (deg)

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

Phase Err Pk (deg)

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

EVM (rms)

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

EVM (pk)

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

Origin Offset (dB)

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

Carrier to Interference Ratio – C/I (dB)

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

Modulation type

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

Mag Err (rms)

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

11-8   GSM/GPRS/EDGE Menus

Amplitude Menu

The **Amplitude** function hard key opens the following soft key menu keys:
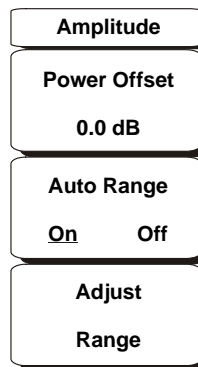
Figure 11-13. GSM/GPRS/EDGE Mode Amplitude Menu

Power Offset

Choose power offset to have the Economy Microwave Spectrum Analyzer automatically adjust for the loss through any external cables, attenuators and couplers. The power can be offset from –100 dB to +100 dB. Press the Power Offset key, enter the values and press the dB soft key. Press **Esc** to cancel.

Note	By default, the Economy Microwave Spectrum Analyzer will automatically change attenuation, preamplifier, and digital gain settings to make the best GSM measurements.

Auto Range
On   Off

When Auto Range is activated, the Economy Microwave Spectrum Analyzer adjusts the reference level automatically. Pressing the Auto Range (toggle) soft key alternates between On and Off.

Adjust Range

This (select) soft key adjusts the reference level to be optimal based on the measured signal. Adjust range is used only when the Auto Range setting is Off.

Freq (Frequency) Menu

The **Freq** function hard key opens the following soft key menu:

```
        Freq
    ┌──────────────┐
    │ Center Freq  │
    │              │
    │  1.000 GHz   │
    ├──────────────┤
    │    Signal    │
    │              │
    │   Standard   │
    ├──────────────┤
    │   Channel    │
    │              │
    │     - -      │
    ├──────────────┤
    │   Set CF     │
    │  To Closest  │
    │   Channel    │
    ├──────────────┤
    │  Decrement   │
    │              │
    │   Channel    │
    ├──────────────┤
    │  Increment   │
    │              │
    │   Channel    │
    └──────────────┘
```
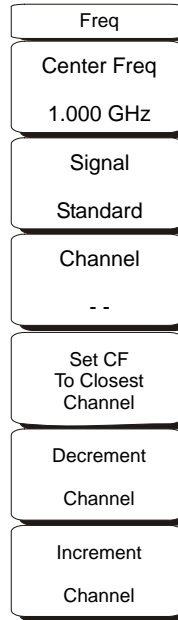
Figure 11-14. WCDMA/HSDPA and GSM/GPRS/EDGE Mode Freq Menu

Center Freq

Press the **Freq** key followed by the Center Freq soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

Signal Standard

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

Set CF to Closest Channel

Press the soft key to change the center frequency to the closest channel.

Decrement Channel

Use the **Up/Down** arrow keys or the rotary knob to decrease the channel number one channel.

Increment Channel

Use the **Up/Down** arrow keys or the rotary knob to increase the channel number one channel.

Setup Menu

The Setup function hard key opens the following soft key menu:
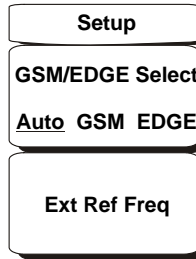
Figure 11-15. GSM/GPRS/EDGE Mode Setup Menu

GSM/EDGE Select
Auto   GSM   EDGE

Pressing this (toggle) soft key alternates among Auto, GSM and EDGE. Auto allows the instrument to search for a GSM or EDGE signal automatically. Selecting GSM or EDGE sets the instrument to measure only a GSM or EDGE signal.

Ext Ref Freq

Press the Ext Ref Freq (select) soft key to select the frequency of the external reference from the list. Use the arrow keys or the rotary knob to highlight the desired frequency and press the **Enter** key to select. Press the **Esc** key to cancel.

Measurements Menu

The Measurements function hard key opens the following soft key menu:
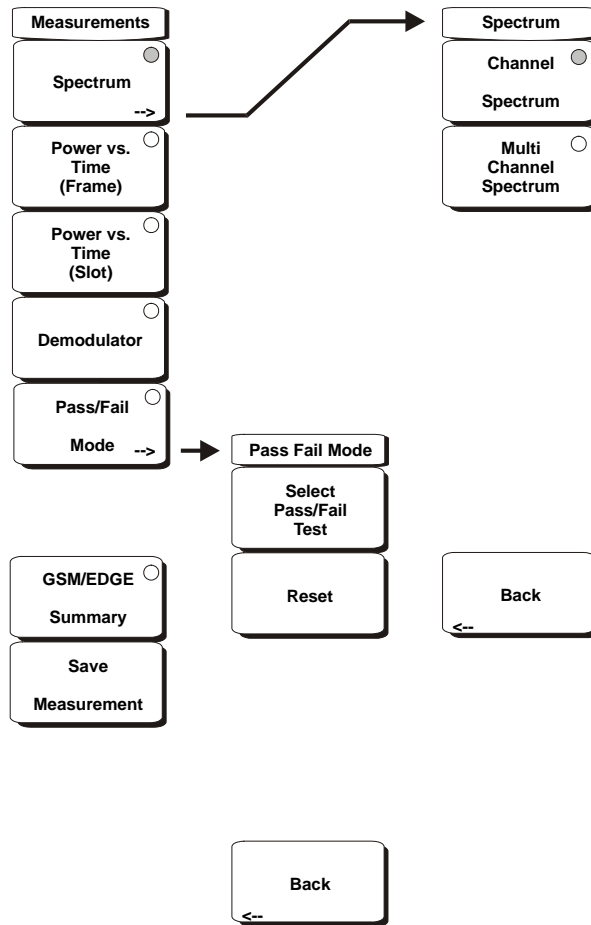
Figure 11-16. GSM/GPRS/EDGE Mode Measurements Menu

Measurements Menu

Spectrum

Opens the spectrum menu.

Spectrum Menu

Channel Spectrum

Displays the spectrum of the selected channel. The screen also displays Channel Power, Burst Power, Frequency Error in PPM and Hz, Occupied Bandwidth, and the Training Sequence Code (TSC).

Multi-Channel Spectrum

Displays the spectrum of ten GSM/EDGE channels.

Channel Cursor

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

Freq Cursor

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

Measurements Menu

Power Vs Time (Frame)

Displays approximately eight and a half slots of the GSM/EDGE signal frame starting from the first active slot found. The screen also displays Channel Power, Burst Power, Frequency Error in PPM and Hz, Occupied Bandwidth and Training Sequence Code (TSC).

Power Vs Time (Slot)

Displays the first active slot of the GSM/EDGE signal capture. The mask is as specified in 3GPP TS 05.05. The screen also displays Channel Power, Burst Power, Frequency Error in PPM and Hz, Occupied Bandwidth, and Training Sequence Code (TSC).

Demodulator

Displays the IQ vector of the GSM/EDGE signal. The screen also displays Phase Err RMS, Phase Err Pk, EVM (rms), EVM (pk), Origin Offset (dBc), C/I (dB), Modulation Type, and Magnitude Error (rms).

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

Pass/Fail Mode

Displays the Pass/Fail measurements in a table format with clear pass or fail indicators that include minimum/maximum thresholds and actual measured results.

Pass Fail Mode Menu

Select Pass/Fail Test

Display the available test sets.

Reset

Resets the Pass/Fail Mode test.

Back

Returns to the previous menu.

Measurements Menu

GSM/EDGE Summary

Displays the measurement results in a table format.

Save Measurement

Initiates a dialog box to name and save the current measurement. The saved measurement trace can be named using the keypad to select numbers, the rotary knob to highlight a number or character and pressing the knob to select, or by selecting the soft key for each letter. Use the **Shift** key to select an upper case letter. Use the **Left/Right** directional arrows to move the cursor position. Press **Enter** to save the measurement trace.

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

Chapter 12 — CDMA Signal Analyzer

12-1   Introduction

The Economy Microwave Spectrum Analyzer MS271xB offers two CDMA options:

- Option 42, CDMA RF measurements
- Option 43, cdmaOne and CDMA2000 1xRTT demodulator

The Economy Microwave Spectrum Analyzer can measure CDMA signals by directly connecting the Economy Microwave Spectrum Analyzer to the base station.

12-2   Getting Started

CDMA Mode

To prepare for CDMA measurements, the MS271xB must be configured for CDMA mode as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight CDMA Signal Analyzer and press the **Enter** key to select.

For additional information about the Mode menu, refer to Section 3-9, "Mode" on page 3-26 in Chapter 3, "Key Functions".

Hard Keys and Soft Keys

For a general description of these key functions, refer to Section , "Front Panel Keys and Connectors" on page 2-3 in Chapter 2, "Quick Start Guide".

12-3   CDMA Measurement Setup

The Economy Microwave Spectrum Analyzer can measure CDMA performance by connecting the base station directly to the Economy Microwave Spectrum Analyzer.

To connect the base station to the Economy Microwave Spectrum Analyzer, connect the power amplifier of the base station to the RF In port of the Economy Microwave Spectrum Analyzer by 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.

Measurement Frequency Setup

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the Economy Microwave Spectrum Analyzer to automatically set the frequency.

To Enter the Center Frequency

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key.

3. Enter desired frequency by using the keypad, the arrow keys, or the rotary knob. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

4. Press the **Enter** key to set the Center Frequency. The current setting is shown on the left side of the measurement screen.
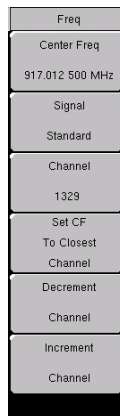
Figure 12-1. Frequency Setup

To Select A Signal Standard:

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key.

3. 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 for the first channel of the selected standard is automatically tuned.

4. Press the Channel soft 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 screen. The current settings are displayed on the left side of the measurement screen.

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

Power Offset Setup (for Compensating External Loss)

To get accurate results, the external attenuation should be compensated using power offset. In power offset mode, the compensation factor is in dB. The external attenuation is caused by using an external cable or by using an external high power attenuator.

1. Press the **Amplitude** function hard key.

2. Press the Power Offset soft key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. Press the **Enter** key to set the Power Offset. The entered value is displayed on the left side of the measurement screen.

Figure 12-2. Power Offset

PN Select Setup

The Economy Microwave Spectrum Analyzer 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 Economy Microwave Spectrum Analyzer. The setup for this function is as follows:

1. Press the **Setup** function hard key.

2. Press the PN Setup soft key to open the PN Setup menu.
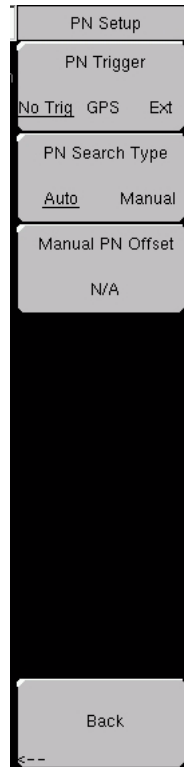
Figure 12-3. PN Setup

3. Press the PN Trigger (toggle) soft key to alternate through No Trig, GPS, or Ext.

   No Trigger: If external timing is unavailable, then you may choose No Trigger for the PN search.

   GPS: GPS is not available in the Economy Microwave Spectrum Analyzer.

   External: Economy Microwave Spectrum Analyzer 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 Economy Microwave Spectrum Analyzer.

4. Press the PN Search Type (toggle) soft key to alternate between Auto or Manual. In Auto mode, the Economy Microwave Spectrum Analyzer 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 the 128 codes option is selected, the upper CDP (Code Domain Power) graph displays the CDP in bit-reversed order.

1. Press the **Setup** function hard key.

2. Press the Walsh Codes soft key, and the key is toggled between 64 codes and 128 codes.
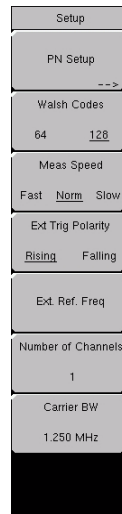
Figure 12-4. Walsh Codes Setup

External Reference Frequency Setup

In order to get the best frequency accuracy measurements, an external reference frequency must be attached to the Economy Microwave Spectrum Analyzer Ext Ref In connector. Most base stations have a reference frequency that is available on a BNC connector.

To configure the Economy Microwave Spectrum Analyzer to use an external reference frequency, perform the following:

1. Press the **Setup** function hard key.

2. Press the external reference frequency (Ext. Ref. Freq) soft key to display a list of the available reference frequencies:

Table 12-1. External Reference Frequencies for EVDO

EVDO External Reference Frequencies		
1 MHz	2.4576 MHz	9.8304 MHz
1.2288 MHz	4.8 MHz	10 MHz
1.544 MHz	4.9152 MHz	13 MHz
2.048 MHz	5 MHz	19.6608 MHz

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list, and then press the rotary knob or the **Enter** key to set the reference frequency. As the Economy Microwave Spectrum Analyzer locks to the source, the Reference Freq value is displayed within the user-definable parameters that are shown to the left of the measurement screen.

12-4   CDMA RF Measurement Setup

To make CDMA RF measurements, connect the Economy Microwave Spectrum Analyzer to the base station and follow these setup instructions:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight CDMA Signal Analyzer, and press the **Enter** key to select.

3. Follow the setup instructions in the measurement section to make accurate measurements.

4. Press Measurement and RF Measurement soft keys to open 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 Measurement menu, use the following procedure for Channel Spectrum:

1. Press the RF Measurement soft key to open the RF Measurement menu.

2. Press Channel Spectrum to display the active measurement.
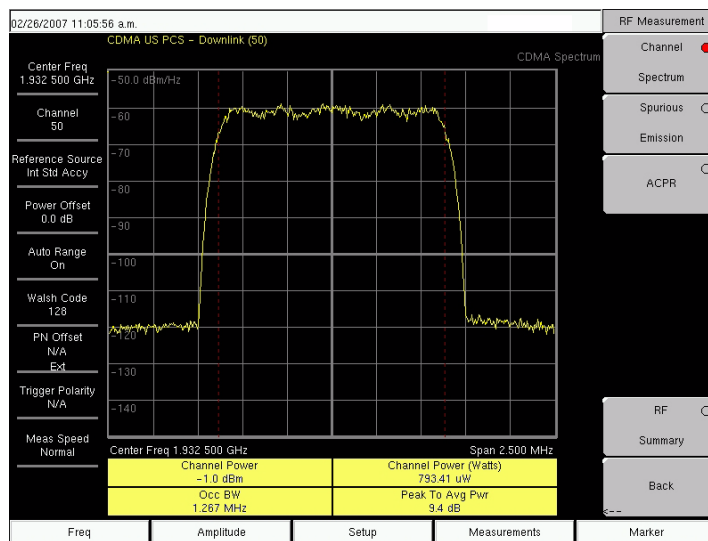
Figure 12-5. Channel Spectrum RF Measurement

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 soft key.

2. Press the Spurious Emission soft key to activate the measurement. The red dot on the soft key indicates that it is selected.
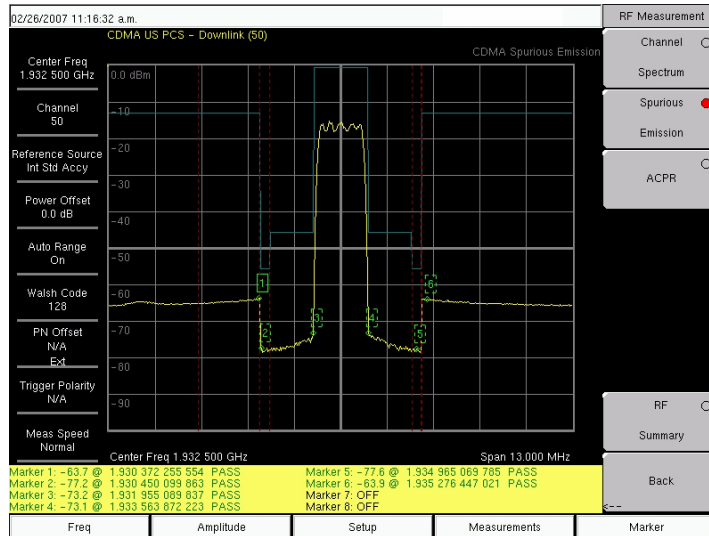
Figure 12-6. RF Measurement, Spurious Emission

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 Measurement menu, use the following procedure for ACPR:

1. Press the RF Measurement soft key.

2. Press the ACPR soft key to activate the ACPR measurement. The red dot on the soft key indicates that it is selected.

3. Press the ACPR soft key again to specify the Number of Carriers in a multi-carrier configuration and to specify Carrier BW.
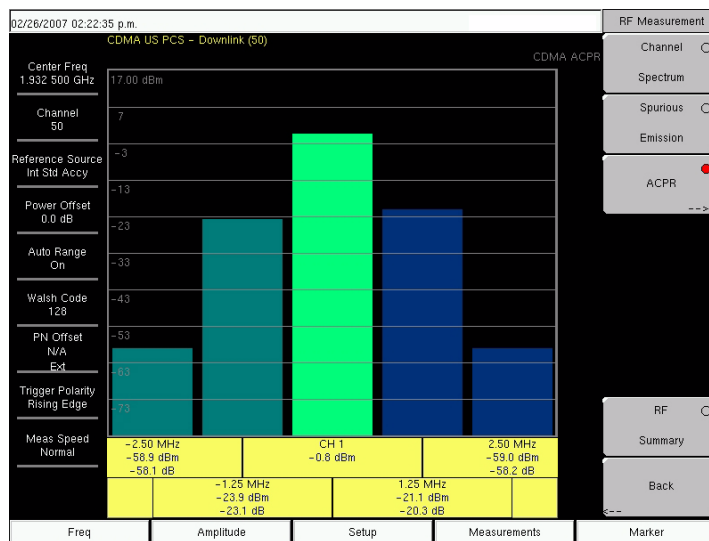
Figure 12-7. RF Measurement, ACPR

12-5   CDMA Demodulator Measurements Setup

CDMA demodulator measurements are selected by pressing the **Measurements** hard key.

CDMA demodulator measurements include Code Domain Power (CDP), CDP table, and modulation summary. To demodulate cdmaOne and CDMA2000 1xRTT signals, connect the Economy Microwave Spectrum Analyzer to the base station following the setup instructions.

Making CDMA Demodulator Measurements

To make CDMA Demodulator measurements, connect the Economy Microwave Spectrum Analyzer to the base station and follow these setup instructions:

1. Press the **Shift** key, then the **Mode** (9) key.
2. Use the directional arrow keys or the rotary knob to highlight CDMA Signal Analyzer, and press the **Enter** key to select.
3. Follow the setup instructions in the measurement section to make accurate measurements.
4. Press the **Freq** function hard key.
5. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable CDMA standard.
6. Press the Channel soft 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.
7. Press the **Setup** key to open the Setup menu.
8. Press the PN Setup soft key and choose No Trig, GPS, or External.
9. Press the PN Search Type soft key and select Auto search or Manual search by toggling the soft key.

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

10. Press Back to go to the previous (**Setup**) menu.
11. Press the Walsh Codes soft key to choose 64 codes or 128 codes depending upon the transmitting signal.
12. Press the **Measurement** key to open measurements menu.
13. Press the Demodulator soft 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 measurement menu, use the following procedure for CDP:

1. Press the CDP soft key to display the Code Domain Power menus. This may require pressing the CDP soft key a second time.
2. Press the Zoom soft key to activate zoom for 16, 32, or 64 codes.
3. Press the Zoom Start Index soft key and enter desired location manually.
4. Press CDP Units to select either Relative Power (in dB) or Absolute power (in dBm).
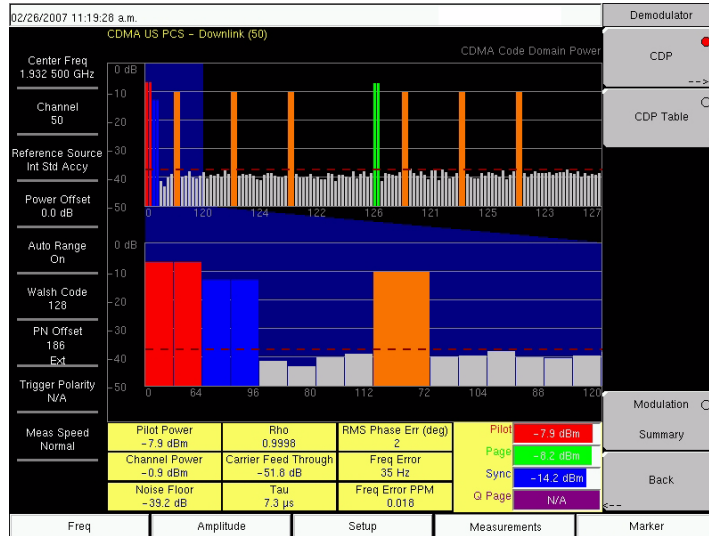
Figure 12-8. Demodulator Menu with CDP Measurement

CDP Table View Setup

The CDP table view displays all of the active codes in a tabular format.
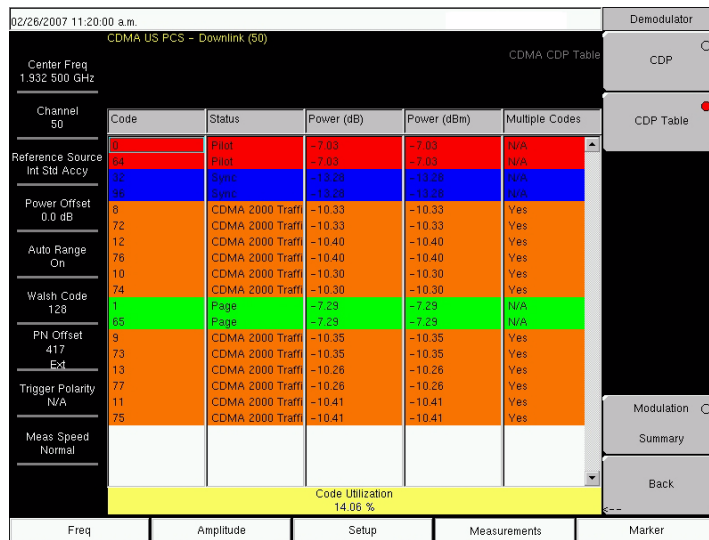
Figure 12-9. CDP Table

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

1. Press the CDP soft key to display the Code Domain Power menus.

2. Press the Zoom soft key to activate zoom for 16, 32, or 64 codes.

3. Press the Zoom Start Index soft 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 soft key to display the measurements.

12-6   Pass Fail Setup

The Economy Microwave Spectrum Analyzer 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 Economy Microwave Spectrum Analyzer displays test results in tabular format with clear PASS or FAIL indications that include minimum/maximum threshold.
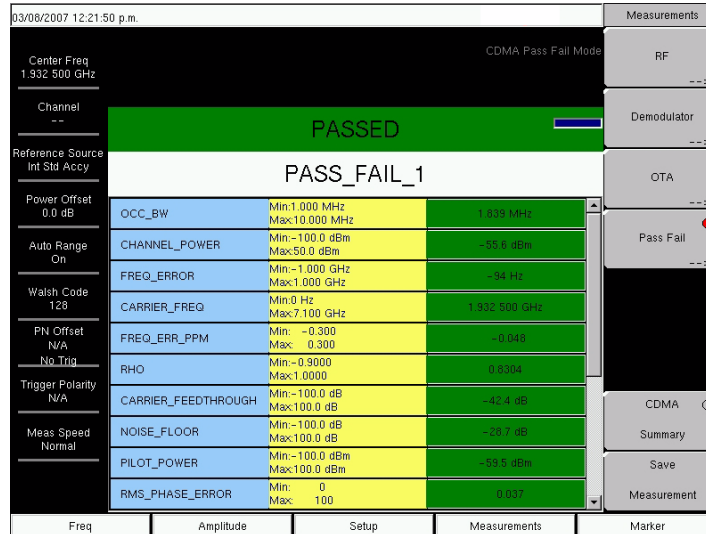
Figure 12-10. Pass Fail Measurement

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

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

1. Press the Pass Fail Mode soft key to display the pass fail measurements.

2. Press the Pass Fail Mode soft key again to display the Pass Fail Mode menu.

3. Press the Select Pass/Fail Test soft 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.

12-7   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 Measurement Descriptions

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 Measurement Descriptions

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 soft 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 the following table:

Table 12-2. Demodulator Colors

Area	Area 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.

If the Economy Microwave Spectrum Analyzer 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, then 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.

12-8   Amplitude Menu

| Amplitude |
| Scale / div |
| ## dB / div |
| Power Offset |
| ## dB |
| Auto Range |
| On   Off |
| Adjust |
| Range |
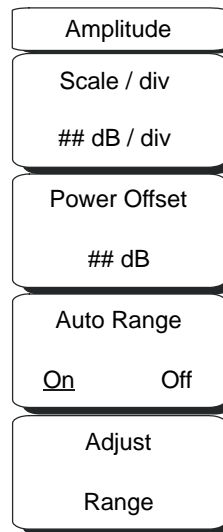
Figure 12-11. CDMA Amplitude Menu

Scale/div

Press this (input) soft key to set the scale 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

Press this (input) soft key to have the Economy Microwave Spectrum Analyzer 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 soft key.

Auto Range
On   Off

Pressing this (toggle) soft key alternates between On and Off. This function adjusts the reference level automatically when Auto Range is activated.

Adjust Range

Press this (input) soft key to change the Auto Range setting to Off and perform a manual Auto Range operation, which adjusts the internal reference level to be optimal, based upon the measured signal.

12-9   File Menu

The file menu soft keys are described in section "File Menu" on page 3-6.

12-10 Freq (Frequency) Menu
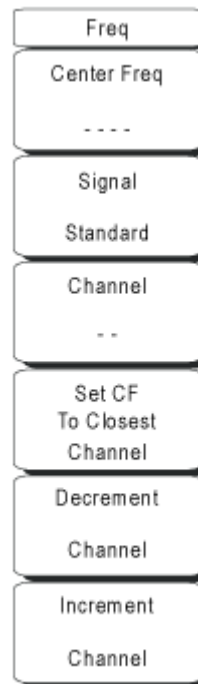
Figure 12-12. CDMA Frequency Menu

Center Freq

Press the **Freq** key followed by the Center Freq (input) soft key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If entering a frequency by using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Pressing the **Enter** key has the same affect as selecting the MHz soft 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. Appendix A, "Signal Standards" contains a table of the signal standards that are in the instrument firmware. 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 (input) soft key to change the center frequency to the closest channel.

Decrement Channel

Press this (input) soft key to decrease the channel number. Channel number is decremented by one channel or by a step size. Depending upon the signal standard and upon the selected channel, pressing this soft key decrements the channel number by a standard step size.

Increment Channel

Press this (input) soft key to increase the channel number. Channel number is incremented by one channel or by a step size. Depending upon the signal standard and upon the selected channel, pressing this soft key increments the channel number by a standard step size.

12-11 Limit Menu

This menu function is not implemented in the CDMA mode.

12-12 Marker Menu
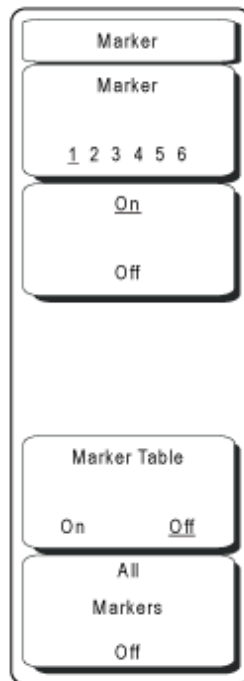
Figure 12-13.CDMA Marker Menu

Marker Soft Key Menu

In CDMA mode, markers are available only for CDP and Spectrum measurements.

Marker
1 2 3 4 5 6

Press this (toggle) soft key to select a marker. The selected marker is underlined on the soft key image. Each press of the soft key moves the selection to the next marker number. Use the On/Off soft key to turn the marker On or Off.

On/Off (turn Marker On or Off)

Press this (toggle) soft 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
On   Off

Pressing this (toggle) soft key opens a display of a marker table below the measurement display. The marker table indicates the values of all active markers.

All Markers Off

Pressing this (input) soft key turns OFF all markers.

12-13 Measurements Menu
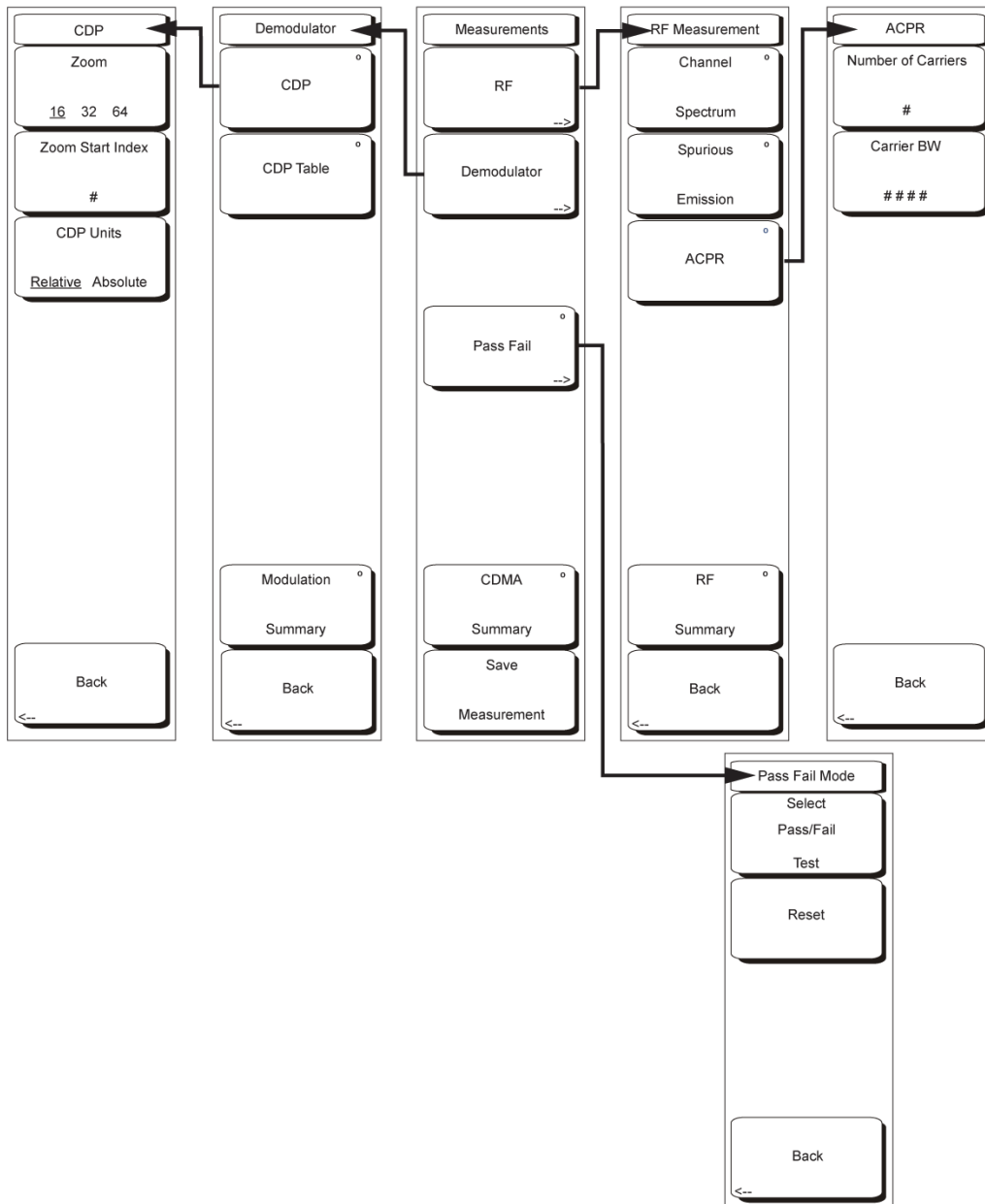
Figure 12-14. CDMA Measurements Menu

The CDMA Measurements menu provides links to the RF, Demodulator, Pass Fail, CDMA Summary, and Save Measurement soft keys and functions.

Measurements Menu

RF

Pressing this soft key opens the RF Measurement soft key menu.

RF Measurement Menu

Channel Spectrum

Pressing this soft 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).

Spurious Emission

Pressing this soft key displays the received signal and the mask, based upon received signal strength.

ACPR

Pressing this soft 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 soft key is active (an arrow on the key symbol indicates that a sub menu is available), another key press opens the ACPR soft key menu.

ACPR Menu

Number of Carriers #

Press this soft 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 soft key, and then press the **Enter** key. The adjacent channels remain displayed.

Carrier BW ####

Press this soft key and use the numeric keypad to enter a frequency. The soft 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 previous (RF Measurement) soft key menu.

RF Measurement Menu

RF Summary

Pressing this (input) soft key displays a summary of all the RF numerical measurement results in a table format.

Back

Returns to previous (Measurements) soft key menu.

Measurements Menu

Demodulator

In demodulator mode, the Economy Microwave Spectrum Analyzer demodulates the received CDMA signal. The demodulator has three measurement displays: CDP, CDP Table, and Modulation Summary.

Demodulator Menu

CDP

The first press of this soft key displays the Code Domain Power and also displays an arrow on the soft 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 option 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:

- 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 soft key opens the CDP soft key menu.

CDP Menu

Zoom
16   32   64

Pressing this soft key toggles through a zoom function of 16, 32, or 64 codes.

Zoom Start Index #

Press this (input) soft 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 soft key (which appears when the numeric keypad is used) or the **Enter** key.

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

CDP Units
Relative   Absolute

Use this (toggle) soft key to alternate 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 previous (Demodulator) soft key menu.

Demodulator Menu

CDP Table

This screen shows the power of the codes in a tabular format. The table displays the following five columns: Code number, Status (Pilot, Page, Sync, and All Traffic in 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 or traffic.)

Modulation Summary

Pressing this (input) soft 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 previous (Measurements) soft key menu.

Measurements Menu

Pass Fail

The first press of this (select) soft key puts the Economy Microwave Spectrum Analyzer into Pass Fail Mode and sets the soft key as a switching soft key. The next press of the (switching) soft key opens the Pass Fail Mode soft key menu.

Pass Fail Mode Menu

Select Pass/Fail Test

This (input) soft 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 (input) soft key to restart the measurement.

Back

Returns to previous (Measurements) soft key menu.

Measurements Menu

CDMA Summary

Pressing this soft key displays a summary of all of the CDMA-related numerical measurements in a table format.

Save Measurement

Pressing this soft key 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. For more information about saving CDMA measurements, refer to the soft key description in "Text Entry" on page 2-6 in Chapter 2, "Quick Start Guide".

12-14 Mode Menu

To access the functions under the Mode menu, press the **Shift** key, then the **Mode** (9) key. Use the directional arrow keys or the rotary knob to highlight the selection and press the **Enter** key to select. The list of modes that appears in this menu will vary depending upon the options that are installed and activated in your instrument. Your instrument may not show the same list. For more information on the Mode menu, refer to Section 3-9, "Mode" on page 3-26 in Chapter 3, "Key Functions".

12-15 Preset Menu

To access the functions under the Preset menu, press the **Shift** key, then the **Preset** (1) key.

Preset

This key resets the instrument to the default starting conditions.

Save Setup

Refer to the "Save" description in Section 3-4, "File Menu" on page 3-6.

Recall Setup

Refer to the "Recall" description in Section 3-4, "File Menu" on page 3-6.

12-16 Setup Menu

```
┌─────────────────────┐              ┌─────────────────────┐
│        Setup        │              │       PN Setup      │
├─────────────────────┤   ─────────▶ ├─────────────────────┤
│                     │              │      PN Trigger     │
│      PN Setup       │              │                     │
│                  -->│              │  No Trig   GPS   EXT │
├─────────────────────┤              ├─────────────────────┤
│     Walsh Codes     │              │   PN Search Type    │
│                     │              │                     │
│    64        128    │              │   Auto     Manual   │
├─────────────────────┤              ├─────────────────────┤
│     Meas Speed      │              │  Manual PN Offset   │
│                     │              │                     │
│  Fast  Norm  Slow   │              │        N/A          │
├─────────────────────┤              └─────────────────────┘
│   Ext Trig Polarity │
│                     │
│  Rising    Falling  │
├─────────────────────┤
│                     │
│   Ext. Ref. Freq    │
│                     │
├─────────────────────┤
│  Number of Carriers │
│                     │
│         -           │
├─────────────────────┤
│      Carrier BW     │
│                     │
│       - - - -       │              ┌─────────────────────┐
└─────────────────────┘              │        Back         │
                                     │                     │
                                     │                  <--│
                                     └─────────────────────┘
```
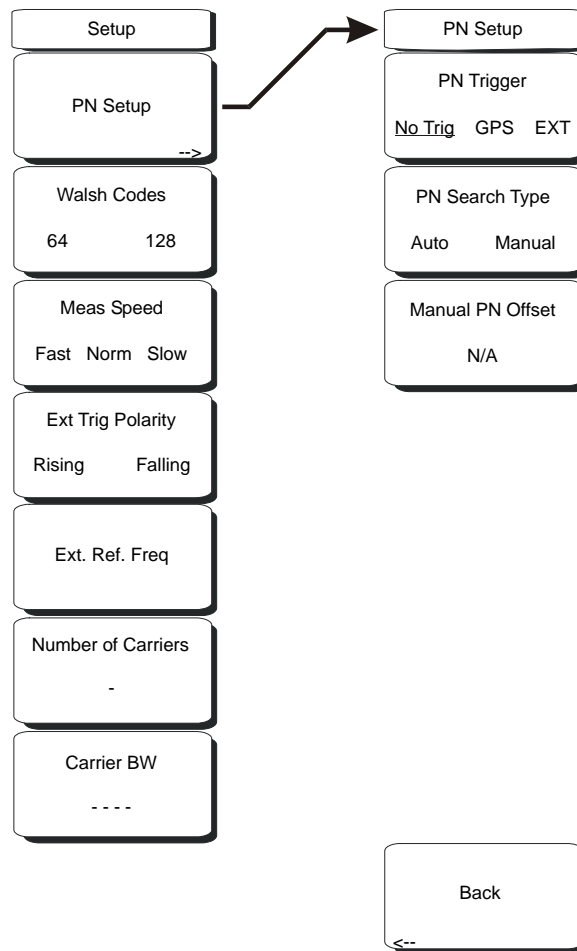
Figure 12-15.CDMA Setup Menu

Setup Menu

PN Setup

Press this soft key for the PN Setup menu.

> **PN Setup Menu**
>
> PN Trigger
> No Trig   GPS   Ext
>
> Press this (toggle) soft key to alternate through No Trig (no trigger), GPS, and Ext (external trigger).
>
> PN Search Type
> Auto   Manual
>
> Press this (toggle) soft key to alternate between Auto and Manual PN search.
>
> In the Auto mode, the Economy Microwave Spectrum Analyzer 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 External.
>
> If No Trig is selected, then pressing this soft key causes an error message to be displayed, stating "Applicable only when PN Type is GPS or External".

Manual PN Offset

Press this soft 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 External. If No Trig is selected, then pressing this soft key causes an error message to be displayed, stating "Applicable only when PN Type is GPS or External".

Back

Press this soft key to return to the previous (Setup) soft key menu.

Setup Menu

Walsh Codes
64   128

Press this (toggle) soft key to alternate between 64 codes and 128 codes.

Meas Speed
Fast   Norm   Slow

Press this (toggle) soft key to alternate among Fast, Norm (Normal), and Slow measuring speed.

Ext Trig Polarity
Rising   Falling

Press this (toggle) soft key to alternate between Rising edge and Falling edge trigger polarity.

Ext. Ref. Freq

Pressing this (input) soft key opens a list box of reference frequencies. Use the arrow keys or the rotary knob to choose a specific reference frequency, then press the rotary knob or the **Enter** key to select the frequency. Press the **Esc** key to keep the previously set reference frequency. Available CDMA External Reference Frequencies in the list box are: 1 MHz, 2.4576 MHz, 9.8304 MHz, 1.2288 MHz, 4.8 MHz, 10 MHz, 1.544 MHz, 4.9152 MHz, 13 MHz, 2.048 MHz, 5 MHz, and 19.6608 MHz.

Number of Carriers

Press this (input) soft key to set the number of required channels. After pressing the soft key, use the arrow keys, rotary knob, or number keypad to enter the number of channels. Press the rotary knob or the **Enter** key to set the new number. This affects the ACPR and Spurious Emissions measurements.

Carrier BW

Press this (input) soft key to set the carrier bandwidth. After pressing the soft key, use the arrow keys, rotary knob, or number keypad to enter the carrier bandwidth. Press the rotary knob or the **Enter** key to set the new number.

12-17 Sweep Menu

To access the functions under the Sweep menu, press the **Shift** key, then the **Sweep** (3) key. The Sweep menu has two soft keys:

Sweep
Single   Continuous

Press this (toggle) soft key to alternate between Single and Continuous sweep modes. Selecting Single sets the instrument to make 1 measurement and stop. Selecting Continuous sets the instrument to continuously make measurements.

Trigger Sweep

When the Sweep state is Single, pressing this (input) soft key triggers a new measurement every time it is pressed. It does nothing when Sweep state is Continuous.

12-18 System Menu

Figure 12-16. CDMA System Menu

For the soft key descriptions of the System menu, refer to section "System Menu" on page 3-33.

Chapter 13 — EVDO Signal Analyzer

13-1   Introduction

The MS271xB Economy Microwave Spectrum Analyzer offers two EVDO options:

- Option 62, EVDO RF measurements
- Option 63, EVDO Demodulator, Rev. A compatible

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, laptop personal computers, 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 Economy Microwave Spectrum Analyzer can measure EVDO signals by directly connecting the Economy Microwave Spectrum Analyzer to the base station.

13-2   Getting Started

EVDO Mode

To prepare for EVDO measurements, the MS271xB must be configured for EVDO mode, as follows:

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight EVDO Signal Analyzer and press the **Enter** key to select.

For additional information about the Mode menu, refer to Section 3-9 "Mode" on page 3-26 in Chapter 3, "Key Functions".

Hard Keys and Soft Keys

For a general description of these key functions, refer to Section "Front Panel Keys and Connectors" on page 2-3 in Chapter 2, "Quick Start Guide".

13-3 EVDO Measurement Setup

The Economy Microwave Spectrum Analyzer can measure EVDO performance by connecting the base station directly to the Economy Microwave Spectrum Analyzer.

Setting up the Measurement Frequency

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the Economy Microwave Spectrum Analyzer to automatically set the frequency.

To enter the center frequency

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key.

3. Enter the desired frequency by using the keypad, the arrow keys, or the rotary knob.

4. If entering a frequency using the keypad, then the soft key labels change to GHz, MHz, kHz, and Hz. Press the appropriate units key. Selecting the **Enter** key has the same affect as selecting the MHz soft key.

5. Press the **Enter** key to set the Center Frequency. The current setting is shown on the left side of the measurement screen.

To select a signal standard

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key.

3. 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 for the first channel of the selected standard is automatically tuned.

4. Press the Channel soft 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. The current settings are displayed on the left side of the measurement screen.

Power Offset for Compensating External Loss

In order to get accurate results, the external attenuation should be compensated by using power offset. In power offset mode, the compensation factor is in dB. The external attenuation is caused by using an external cable or by an external high power attenuator.

1. Press the **Amplitude** function hard key.

2. Press the Power Offset soft key and use the keypad, the arrow keys, or the rotary knob to enter the desired offset value. Press the rotary knob or the **Enter** key to set the Power Offset. The value that is entered is displayed on the left side of the measurement screen.

PN Select

The Economy Microwave Spectrum Analyzer 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 Economy Microwave Spectrum Analyzer.

The menu setup for this function is:

1. Press the **Setup** function hard key.

2. Press the PN Setup soft key to open the PN Setup menu.

3. Press the PN Trigger (toggle) soft key to alternate through No trigger, GPS, and External.

   No Trig: If external timing is unavailable, then you may choose No Trig (no trigger) for the PN search.

   GPS: GPS is not available in the Economy Microwave Spectrum Analyzer.

Ext: The Economy Microwave Spectrum Analyzer 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 **Ext. Trig. In** connector on the Economy Microwave Spectrum Analyzer.

4. Press the PN Search Type (toggle) soft key to alternate between Auto and Manual. In Auto mode, the Economy Microwave Spectrum Analyzer 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 go back to the previous (Setup) menu.

MAC Codes Setup

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

1. Press the **Setup** function hard key.

2. Press the Walsh Codes (toggle) soft key to alternate between 64 codes and 128 codes.

External Reference Frequency Setup

In order to get the best frequency accuracy measurements, an external reference frequency must be attached to the Economy Microwave Spectrum Analyzer Ext Ref In connector. Most base stations have a reference frequency that is available on a BNC connector.

To configure the Economy Microwave Spectrum Analyzer to use an external reference frequency, perform the following:

1. Press the **Setup** function hard key.

2. Press the external reference frequency (Ext. Ref. Freq) soft key to display a list of the available reference frequencies:

Table 13-1. External Reference Frequencies for EVDO

EVDO External Reference Frequencies		
1 MHz	2.4576 MHz	9.8304 MHz
1.2288 MHz	4.8 MHz	10 MHz
1.544 MHz	4.9152 MHz	13 MHz
2.048 MHz	5 MHz	19.6608 MHz

3. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list, and then press the rotary knob or the **Enter** key to set the reference frequency.

   • As the MS271xB locks to the source, the Reference Freq value is displayed within the user-defined parameters that are shown to the left of the measurement screen.

13-4 EVDO RF Measurements Setup

To make EVDO RF measurements, connect the Economy Microwave Spectrum Analyzer to the base station following the setup instructions.

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight EVDO Signal Analyzer and press the **Enter** key to select.

3. Follow the setup instructions in the measurement section to make accurate measurements.

4. Press the Measurement and RF Measurement soft 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.

From the RF Measurement menu, press Channel Spectrum to display the active measurement.
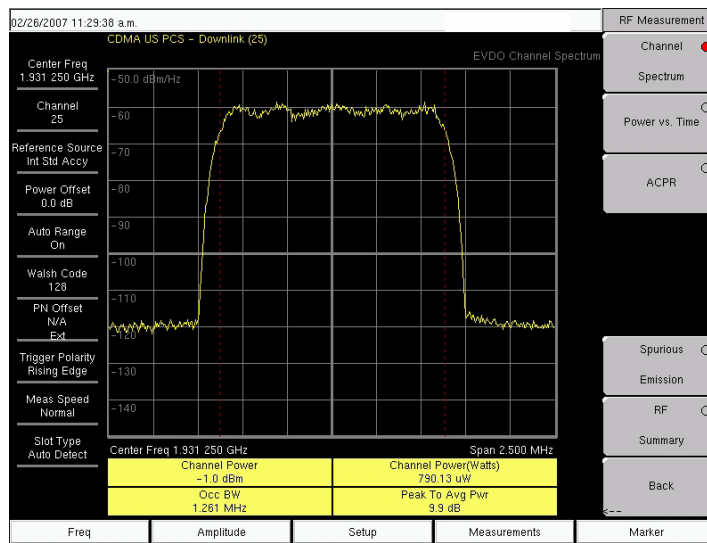
Figure 13-1. EVDO Channel Spectrum Measurement Display

Power versus Time Setup

From the RF Measurement menu, press Power vs. Time to display the active measurement
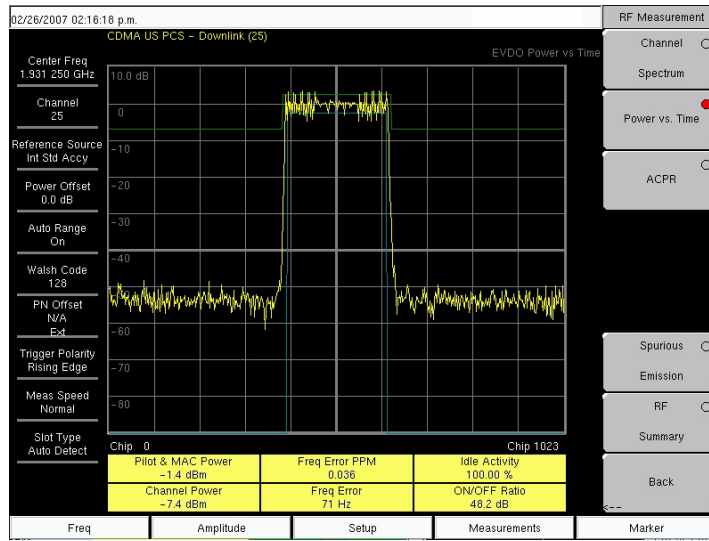
Figure 13-2. EVDO Power Versus Time Measurement Display

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 soft key to activate the ACPR measurement. The red dot on the soft key indicates that it is selected.

2. Press the ACPR soft key again to specify the Number of Carriers in a multi-carrier configuration and to specify Carrier BW.
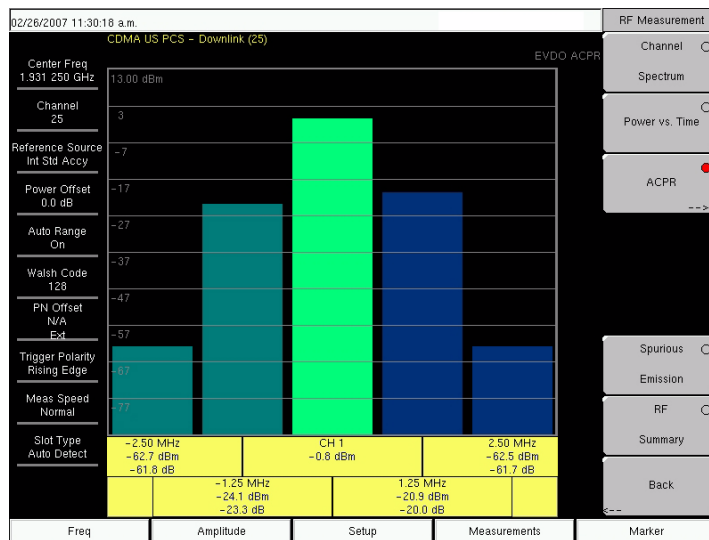
Figure 13-3. EVDO ACPR Measurement Display

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.
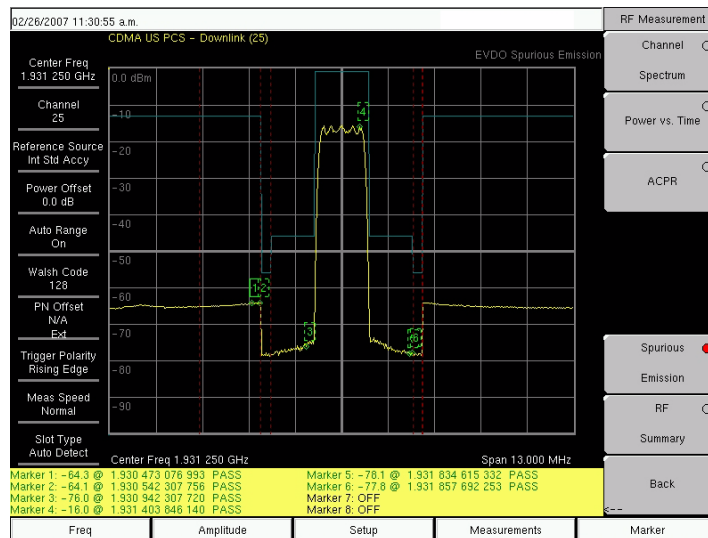
Figure 13-4. EVDO Spurious Emission Measurement Display

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 Economy Microwave Spectrum Analyzer slot setting accordingly. The emission mask is drawn according to the document ***Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Network.*** (Refer to 3GPP2 C.S0032-A or TIA-864-A for details.)

Note	1. In the case of a multi-carrier EVDO signal, the Economy Microwave Spectrum Analyzer "Number of Carrier" setting can be changed (setting it to a maximum of 5 carriers). 2. When the center frequency of a signal is entered directly (instead of giving Band Class and Channel Number info), the Economy Microwave Spectrum Analyzer 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 soft key to activate the measurement. The red dot on the soft key indicates that it is selected.

13-5   EVDO Demodulator Measurements Setup

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

1. Press the **Shift** key, then the **Mode** (9) key.

2. Use the directional arrow keys or the rotary knob to highlight EVDO Signal Analyzer, and press the **Enter** key to select.

3. Press the **Freq** function hard key.

4. Press the Center Freq soft key and enter the desired frequency manually, or press the Signal Standard soft key and select the applicable EVDO standard.

5. Press the Channel soft 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.

6. Press the **Setup** key to open Setup menu.

7. Press the PN Setup soft key and choose the trigger type: No Trigger (No Trig), GPS, or External (Ext).

8. Press PN Search Type (toggle) soft key to alternate between Auto and Manual search.

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

9. Press Back to go to the previous menu.

10. Press the Walsh Codes soft key to choose 64 codes or 128 codes.

11. Press the **Measurement** key to open the measurements menu.

12. Press the Demodulator soft key to activate the Demodulator measurements menu.

CDP MAC Setup

Pressing this soft key displays the CDP MAC codes. The lower part of the screen displays the zoom codes.
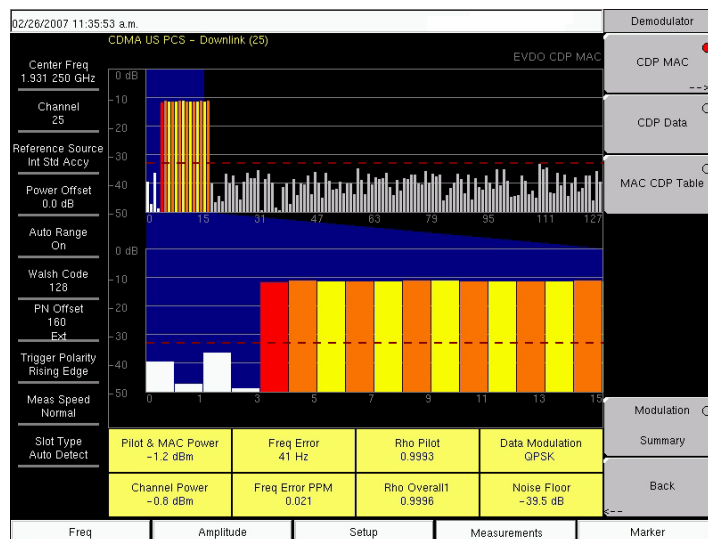
Figure 13-5. EVDO CDP MAC Measurement Display

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

1. Press the CDP MAC soft key to display MAC codes.

2. Press the CDP MAC soft key again to display the CDP MAC soft key menu.

3. Press the Zoom soft key and select 16 codes, 32 codes, or 64 codes.

4. Press the Zoom Start soft key and enter the desired zoom starting code.

5. Press the CDP Units soft key to select Relative Power (in dB) or Absolute Power (in dBm).

Marker Setup (Activating Markers)

1. Press the **Marker** function hard key to display the Marker menu.

2. Press the Marker soft key to select the appropriate marker (1 through 6). The underlined marker number is the currently selected marker.

3. Press the **On/Off** (toggle) soft key to alternate the selected marker On or Off.

4. Press the Marker Table soft 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.
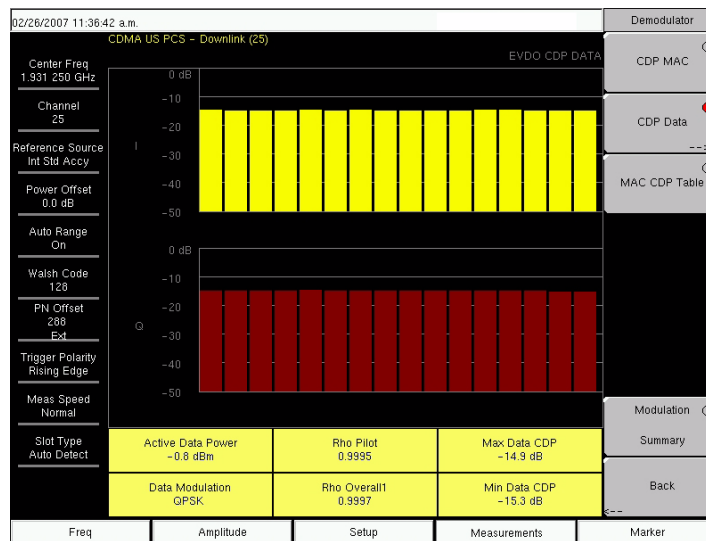
Figure 13-6. EVDO CDP Data Measurement Display

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

1. Press the CDP Data soft key to display the codes.

2. Press the CDP Data soft key again to display the CDP Data soft key menu.

3. Press the CDP Units soft 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.
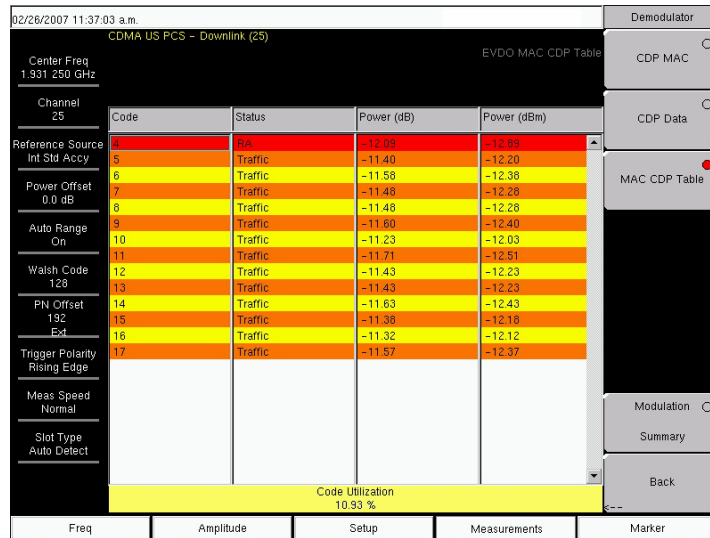
Figure 13-7. EVDO MAC CDP Table Measurement Display

From the Demodulator menu, use the following procedure to enter MAC CDP Table View:

    Step 1.   Press the MAC CDP Table soft key to display the Code Domain Power table view.

EVDO Modulation Summary Setup

The EVDO modulation summary view displays EVDO critical RF and demodulator measurements in tabular format.
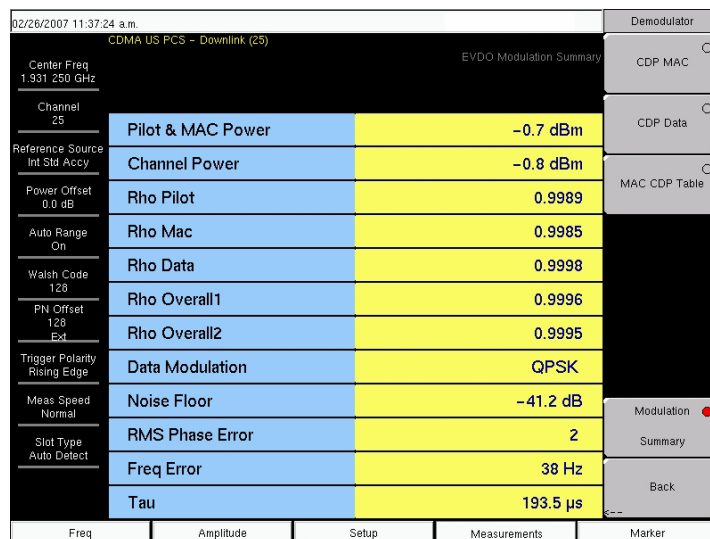
Figure 13-8. EVDO Demodulator Modulation Summary Measurement Display

The following is the procedure to enter the EVDO Demodulator Modulation Summary view:

From the Demodulator menu, press the Modulation Summary soft key to display the summary of measurements.

13-6   Pass Fail Setup

The Economy Microwave Spectrum Analyzer 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 Economy Microwave Spectrum Analyzer displays test results in tabular format with clear PASS or FAIL indications that include minimum/maximum threshold.

Using Master Software Tools, a custom test list can be created and downloaded into the Economy Microwave Spectrum Analyzer. All critical parameters can be selected for pass fail testing.
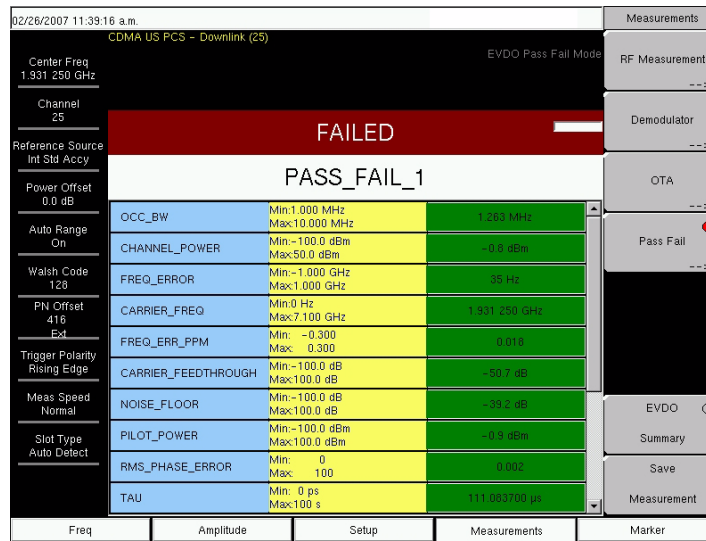
Figure 13-9. EVDO Pass Fail Measurement Display

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

1. Press the Pass Fail soft key to display pass fail criteria.

2. Press the Pass Fail soft key again to open the Pass Fail soft key menu.

3. Press the Select Pass/Fail Test soft key and select the applicable Test Model to activate the measurement.

4. Press the Reset soft key to reset the pass fail function and begin a new pass fail test.

13-7 EVDO Summary Setup

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

02/26/2007 11:38:31 a.m.	Measurements
CDMA US PCS – Downlink (25)	EVDO Summary
Center Freq 1.931 250 GHz	RF Measurement -->
Channel 25	
Channel Power	−1.0 dBm
Reference Source Int Std Accy	Demodulator -->
Pilot & MAC Power	−0.8 dBm
Power Offset 0.0 dB	
Active Data Power	−0.8 dBm
Auto Range On	OTA -->
Freq Error	33 Hz
Walsh Code 128	Pass Fail
Occ BW	1.265 MHz
PN Offset 176 Ext	
Data Modulation	QPSK
Trigger Polarity Rising Edge	
Rho Overall1	0.9995
Meas Speed Normal	
Rho Overall2	0.9994
Slot Type Auto Detect	EVDO
Rho Pilot	0.9987
	Summary
Tau	195.3 μs
	Save
Freq	Amplitude	Setup	Measurements	Marker	Measurement

Figure 13-10. EVDO Summary Measurement Display

From the Measurements menu, press the EVDO Summary soft key to display the measurements in tabular format.

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

13-8 EVDO Measurement Descriptions

Active Data Power

Active Data Power is the average power of the Data Channel portion of the active EVDO slot that is captured. 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 Economy Microwave Spectrum Analyzer is connected directly to a base station. If no active slots are captured, then the unit displays N/A.

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 (zero) or 1 (one)) or 128 sub-channels (physical layer Subtype 2). Refer to the menu description for CDP MAC for color code details.

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 Economy Microwave Spectrum Analyzer captured sample.

Data Modulation

The Economy Microwave Spectrum Analyzer can determine the data channel modulation type automatically. EVDO data channel has three modulation types: QPSK, 8PSK, and 16QAM. When the slot is idle, the Economy Microwave Spectrum Analyzer displays "Idle".

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.

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.

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.

Occ BW

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

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.

PN Offset

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

Power versus 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.

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, Rhos can drop dramatically.

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.

Rho Pilot

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

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. Therefore, when the user connects an external trigger that is poorly aligned with the EVDO signal slots, the Economy Microwave Spectrum Analyzer may report a Tau value that is very large in magnitude, in order to give the best possible PN Offset estimation.

13-9   EVDO Menus

Amplitude Menu

Refer to Section 12-8 "Amplitude Menu" on page 12-13 in Chapter 12, "CDMA Signal Analyzer".

File Menu

Refer to Section 12-9 "File Menu" on page 12-13.

Frequency Menu

Refer to Section 12-10 "Freq (Frequency) Menu" on page 12-14.

Limit Menu

Refer to Section 12-11 "Limit Menu" on page 12-15.

Marker Menu

Markers are available only in CDP MAC and Spectrum measurements. Refer to Section 12-12 "Marker Menu" on page 12-15 for other descriptions.

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.

13-10 Measurements Menu

Also refer to the similar CDMA Measurements menu in Section 12-13 "Measurements Menu" on page 12-16 in Chapter 12, "CDMA Signal Analyzer".
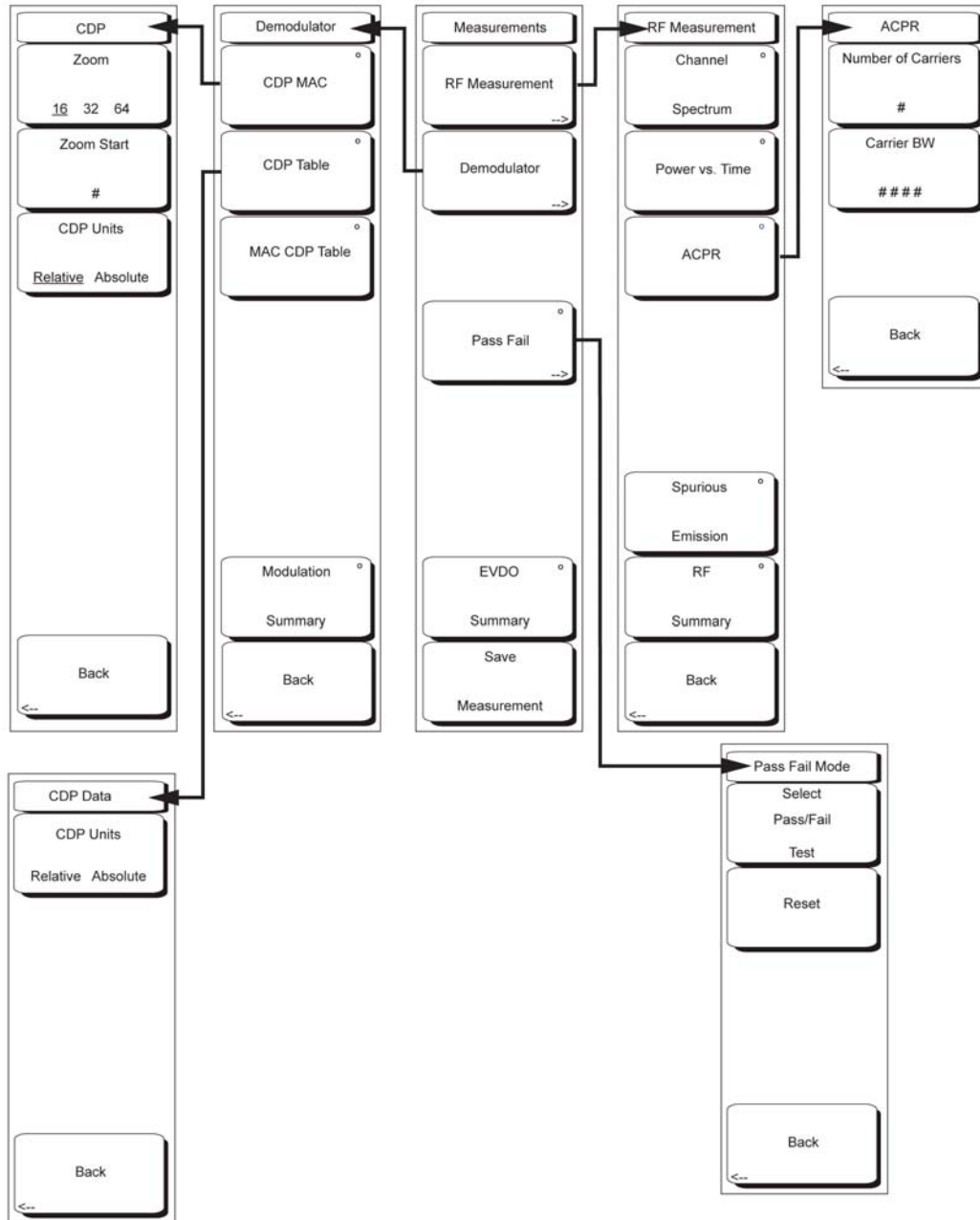
Figure 13-11. EVDO Measurements Menu

The EVDO Measurements menu provides soft keys for RF Measurement, Demodulator, Pass Fail, EVDO Summary, and Save Measurement.

Measurements Menu

RF Measurement

Pressing this (switching) soft key opens the RF Measurement soft key menu. EVDO includes the **Power vs. Time** soft key and the **Spurious Emission** soft key. The menu functions are similar to CDMA (refer to Chapter 12, "CDMA Signal Analyzer", "Measurements Menu" on page 12-16). The following EVDO Measurements menu soft key descriptions differ from those for CDMA:

RF Measurement Menu

Power vs. Time

Pressing this (input) soft 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 dB
- 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

Measurements Menu

Demodulator

Pressing this (switching) soft key opens the Demodulator soft key menu with the following four functions.

Demodulator Menu

CDP MAC

The first press of this (select) soft 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)
- Channel Power (dBm)
- Freq Error in Hz and PPM
- Rho Pilot
- Rho Overall1
- Data Modulation
- 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

After the CDP MAC soft key has become the active function, the soft key becomes a switching soft key. Press this key again to open the CDP menu. Only the functions that differ from those in the CDMA menu ("Measurements Menu" on page 12-16) are described here.

CDP Menu

Zoom
16   32   64

Press this (toggle) soft key to select one of these three settings in order to view 16, 32, or 64 carriers in the measurement display.

Zoom Start

Press this (input) soft 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 Enter soft key (which appears when the numeric keypad is used) or the **Enter** key.

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

Back

Returns to previous (Demodulator) soft key menu.

Demodulator Menu

CDP Table

The first press of this (select) soft key displays EVDO CDP Data, and the key becomes a switching soft key. The next press of the soft key opens the CDP Data soft key 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)
- Data Modulation Type
- Rho Pilot
- Rho Overall1
- Max Data CDP
- Min Data CDP

CDP Data Menu

CDP Units
Relative   Absolute

Press this (toggle) soft key to alternate 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 select Absolute to show power values in dBm.

Back

Returns to previous (Demodulator) soft key menu.

Demodulator Menu

MAC CDP Table

Press this (select) soft key to show 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)
- Relative Power (in dB)
- Absolute Power (in dBm)

Code Utilization is displayed in percent (%) at the bottom of the table. Code Utilization is a number indicating how many codes are used by a particular user (traffic).

Modulation Summary

Pressing this (select) soft 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 previous (Measurements) soft key menu.

Measurements Menu

Pass Fail

The first press of this (select) soft key puts the Economy Microwave Spectrum Analyzer into Pass Fail Mode, and the key becomes a switching soft key. The next press of the soft key opens the Pass Fail Mode soft key menu.

Pass Fail Mode Menu

Select Pass/Fail Test

This soft 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 (input) soft key to restart the measurement.

Back

Returns to previous (Measurements) soft key menu.

Measurements Menu

EVDO Summary

Pressing this (select) soft key displays a summary of all of the EVDO-related numerical measurements in a table format.

Save Measurement

Pressing this (input) soft key opens a dialog box that is used to name and to save the current measurement. Press **Enter** to save the EVDO measurement, which is saved with a .evdo extension. For more information about saving EVDO measurements, refer to the soft key description in "Text Entry" on page 2-6 in Chapter 2, "Quick Start Guide".

13-11 Mode Menu

To access the functions under the Mode menu, press the **Shift** key, then the **Mode** (9) key. Use the directional arrow keys or the rotary knob to highlight the selection and press the **Enter** key to select. The list of modes that appears in this menu will vary depending upon the options that are installed and activated in your instrument. Your instrument may not show the same list. For more information, refer to Section 3-9 "Mode" on page 3-26 in Chapter 3, "Key Functions".

13-12 Setup Menu

For an example of a Setup menu, refer to Figure 12-15, "CDMA Setup Menu" on page 12-20. Items that are different are shown below.

Walsh Codes
64   128

Press this (toggle) soft key to alternate between 64 and 128 MAC indices. Note that MAC 128 is applicable only to Rev. A physical layer subtype 2.

Slot Type
Auto   Active   Idle

Press this (toggle) soft key to alternate among 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.

13-13 System Menu

For more information on the system menu, refer to Section 12-18 "System Menu" on page 12-22.

13-14 Preset Menu

For more information on the preset menu, refer to Section 12-15 "Preset Menu" on page 12-19.

13-15 Sweep Menu

For more information on the sweep menu, refer to section Section 12-17 "Sweep Menu" on page 12-21.

13-16 Trace Menu

This menu is not available in EVDO mode.

Chapter 14 — TD-SCDMA Signal Analyzer

14-1   Introduction

The TD-SCDMA Signal Analyzer offers two options: RF Measurements and Demodulator measurements. Three display types are provided for RF Measurements: Channel Spectrum display, Power versus Time display, or the RF Summary table. Demodulator measurements can be viewed in either the CDP Data display or the Modulation Summary table.

Options for TD-SCDMA are:
  TD-SCDMA RF Measurements (Option 60)
  TD-SCDMA Demodulator (Option 61)

This chapter is divided into three major sections: setup and measurements, menu descriptions, and keypad functions.

Mode Selection

Set the instrument to TD-SCDMA Signal Analyzer measurement mode.

14-2   TD-SCDMA Measurements General Setups

The following measurements can be made when the test instrument is set to TD-SCDMA Signal Analyzer mode.

Frequency Setup

The measurement frequency can be set by entering the center frequency or by selecting the applicable signal standard and channel, which allows the test instrument to automatically set the frequency.

Setting the measurement frequency by entering the center frequency:

1. Press the **Freq** function hard key.

2. Press the Center Freq soft key. The frequency value on the face of the virtual soft key turns red, ready for editing.

3. Enter the required frequency using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft 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 soft key.

4. Press the **Enter** key to set the Center Frequency. The current setting is displayed in the Instrument Settings Summary on the left side of the measurement screen.

Setting the measurement frequency by selecting a signal standard:

1. Press the **Freq** function hard key.

2. Press the Signal Standard soft key to open the Signal Standards list box.

3. 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 for the channel of the selected standard is automatically tuned. Press the **Esc** key to abort any changes.

4. Press the Channel soft 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. The current settings are displayed in the Instrument Settings Summary on the left side of the measurement screen.

Amplitude Setup

Scale, Reference Level, and Units

Set up the amplitude parameters:

1. Press the **Amplitude** function hard key.

2. Press the Scale/div soft key. The value on the face of the virtual soft key turns red, which indicates that it is ready to be edited. Use the keypad, the arrow keys, or the rotary knob to change the desired scale value. Press the **Enter** key to set the new Scale/div value.

3. Press the Auto Range (toggle) soft key to alternately turn auto ranging On or Off. The active state is underlined on the face of the virtual soft key. If On, then the reference level is adjusted automatically. If Off, then press the Adjust Range soft key to manually adjust the reference level once.

4. Press the Units soft key to set the measurements to the desired units: dBm or Watts.

Power Offset for Compensating External Loss

To get accurate results, compensation must be provided for any external attenuation by using power offset. In power offset mode, the compensation factor is in dB. External attenuation can be caused by using an external cable or external high-power attenuator.

• Press the Power Offset soft key. The value on the face of the virtual soft key turns red, ready for editing. Use the keypad, the arrow keys, or the rotary knob to change the desired offset value. Press the **Enter** key to set the Power Offset. The current setting is displayed in the Instrument Settings Summary on the left side of the measurement screen.

General Setup

External Reference Frequency Setup

The use of an external reference frequency (that is attached to the Instrument Ext Ref In connector) is important in order to get the best frequency accuracy measurements. Most base stations have a reference frequency that is available on a BNC connector. To configure the Economy Microwave Spectrum Analyzer to use an external reference frequency:

1. Press the **Setup** function hard key.

2. Press the Advanced Settings soft key

3. Press the External Reference Frequency (Ext. Ref. Freq) soft key to display a list box of available reference frequencies: 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz.

4. Use the **Up/Down** arrow keys or the rotary knob to highlight the applicable reference frequency on the list and press the **Enter** key to set the reference frequency. As the Economy Microwave Spectrum Analyzer locks to the source, the Reference Frequency value setting is displayed in the Instrument Settings Summary on the left side of the measurement screen.

5. Press Back to return to the **Setup** menu.

Measure Speed

• Press the Meas Speed (toggle) soft key to alternate among Fast, Norm, and Slow speeds.

14-3   TD-SCDMA RF Measurements

The following parameters are measured in the RF Measurement mode.

Channel Power

Channel power measures the average time domain power within the 1.6 MHz channel bandwidth and is expressed in dBm.

Channel Power (RRC)

Channel Power (RRC) is similar to Channel Power but is measured after being filtered by using the Root Raised Cosine (RRC) filter. It is usually smaller than channel power.

Slot x Pwr

X denotes slots 0 through 6. This is the power in each of the 7 slots, excluding the gap.

Occ BW

Occupied bandwidth is the calculated bandwidth containing 99% of the total integrated power occupied in the span. Span is 5 MHz when Number of Carrier is set to 1. For all other values, span is set to 1.6 MHz.

DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

UpPTS Pwr

The power in the Uplink Pilot Slot, excluding the gap.

DL-UL Delta Power

The average difference between the active DL slots and the active UL slots, including pilot slots. UL and DL slots are selected according to the Uplink Switch Point setting. Without UL data slot and without UpPTS, the DL-UL Delta Power value is not applicable.

On/Off Ratio

The ratio of the power between the on and off portions of the Downlink slots.

Slot PAR

The peak to average power in the selected (or auto detected) slot. The highest 0.1% power of the slot is used as the peak.

Left Channel Power

The channel power of the 1.6 MHz channel left of the main channel. This is useful in the multi-carrier environments.

Right Channel Power

The channel power of the 1.6 MHz channel right of the main channel. This is useful in the multi-carrier environments.

Left Channel Occ BW

This is the occupied bandwidth of the channel left of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

Right Channel Occ BW

This is the occupied bandwidth of the channel right of the main channel and is useful in a multi-carrier environment. This value is N/A when Number of Carriers is set to 1.

Measurement Setup

- Follow the procedures in section .
- Continue with the following setups for the specific RF measurements.

Channel Spectrum
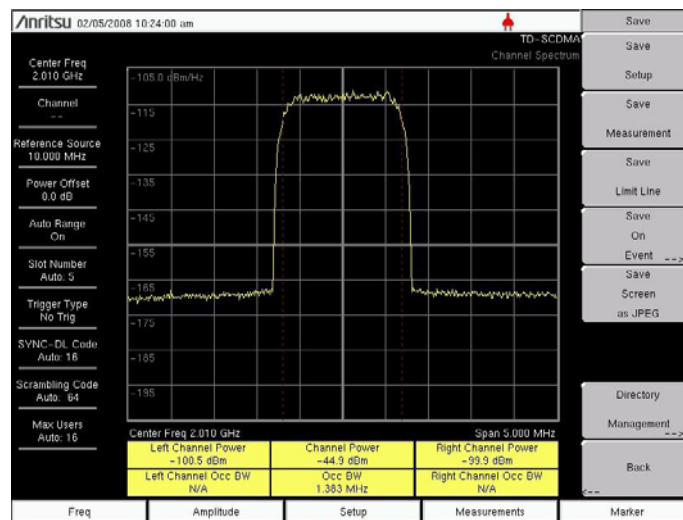
Figure 14-1. Channel Spectrum Measurement

1. Press the **Setup** function hard key.

2. Press the Advanced Settings soft key.

    a. Press the Number of Carriers soft key. The current value on the face of the virtual soft key turns red and is ready to be edited.

    b. Use the **Up/Down** arrow keys, the rotary knob, or the numeric keypad to set a new value. Then press **Enter**.

    c. Press the Back soft key to return to the **Setup** menu

3. Press the **Measurements** function hard key.

4. Press the RF Measurement soft key.

5. Press the Channel Spectrum soft key to activate this RF measurement view.

6. Press the Back soft key again to return to the **Measurements** menu.

Power versus Time

The Power versus Time view shows the time domain view.

1. Press the **Setup** function hard key.

    a. Press the Slot Selection soft key. The Slot Selection list box and menu open. Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or 0 through 6 and press the **Enter** key. Use the Auto soft key for a quicker means to select that option.

    b. Press the Trigger soft key. The **Trigger** menu opens.

2. Press the Trigger Type soft key to select No Trig, GPS, or Ext. The active state is underlined on the face of the virtual soft key.

3. Press the Ext Trigger Polarity soft key to select either Rising or Falling trigger edge.

4. Press the Back soft key to return to the **Setup** menu.

    a. Press the Advanced Settings soft key to continue with setups under the **Advanced Settings** menu.

    b. Press the Number of Carriers soft key. The current value on the face of the virtual soft key turns red and is ready to be edited. Use the **Up/Down** arrow keys, rotary knob, or numeric keypad to set a new value and press the **Enter** key.

    c. Press the Back soft key to return to the **Setup** menu.

    d. Press the Uplink Switch Point soft key. The current value on the face of the virtual soft key turns red and is ready to be edited. Use the **Up/Down** arrow keys, rotary knob, or numeric keypad to set a new value and press the **Enter** key.

5. Press the **Measurements** function hard key.

6. Press the RF Measurement soft key.

7. Press the Power vs. Time soft key to activate this RF measurement view. Press this key again to set up the Power versus Time measurement.

    a. Press the View (toggle) soft key to alternate the measurement view to either Sub-Frame or Slot.
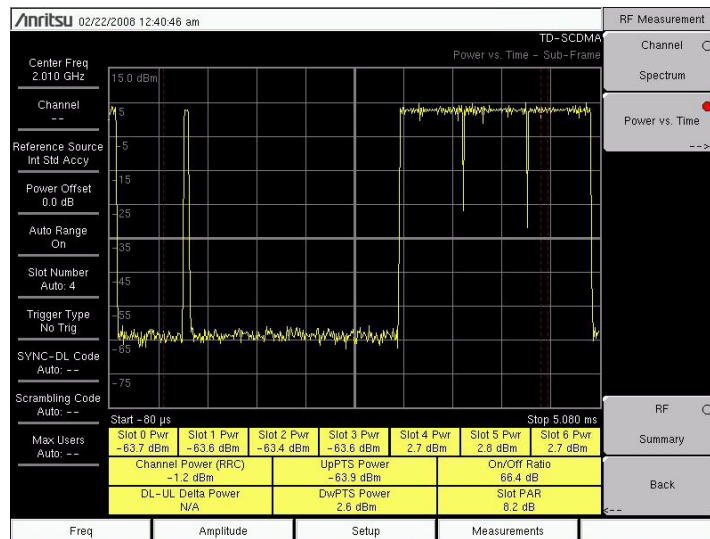
Figure 14-2. Power versus Time: Sub-Frame Measurement

    b. Press the Slot Selection soft key. The Slot Selection list box and menu open. Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or 0 through 6 and press **Enter**. Use the Auto soft key for a quicker means to select that option.

    c. Press the Back soft key to return to the **RF Measurement** menu.

8. Press the Back soft key again to return to the **Measurements** menu.
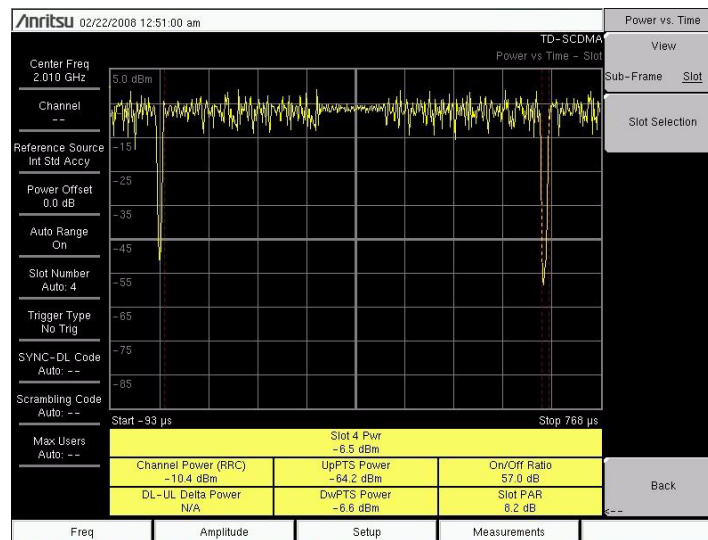
Figure 14-3. Power versus Time: Slot Measurement

RF Summary

The RF Summary displays the critical RF transmitter performance measurements in a table format, without demodulating the TD-SCDMA signal. The parameters that are displayed in the RF summary table are Channel Power (dBm), Channel Power (RRC) (dBm), Occupied Bandwidth (Hz), DwPTS Power (dBm), UpPTS Power (dBm), On/Off Ratio (dB), Slot PAR (dB), Left Channel Power (dBm), Right Channel Power (dBm), Left Channel Occupied Bandwidth, and Right Channel Occupied Bandwidth.

1. Press the **Setup** function hard key. (For a few of the setup parameters, you will have the choice of selecting the Auto option in a list box or an Auto soft key. The Auto soft key allows you a means of immediate selection rather the scrolling through the list box, highlighting Auto, and pressing the **Enter** key.)

   a. Press the Slot Selection soft key. The Slot Selection list box and menu open.

      • In the list box, Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or slot 1 through slot 6 and press the **Enter** key.

   b. Press the Trigger soft key. The Trigger menu opens.

   c. Press the Trigger Type (toggle) soft key to alternate through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the virtual soft key.

      1. Press the Ext Trigger Polarity (toggle) soft key to alternate either Rising or Falling trigger edge.

      2. Press the Back soft key to return to the **Setup** menu.

   d. Press the Uplink Switch Point soft key. The current value on the face of the virtual soft key turns red and is ready to be edited. Use the **Up/Down** arrow keys, rotary knob, or numeric keypad to set a new value and press the **Enter** key.

   e. Press the Advanced Settings soft key to continue with setups under the **Advanced Settings** menu.

   f. Press the Number of Carriers soft key. The current value on the face of the virtual soft key turns red and is ready to be edited. Use the **Up/Down** arrow keys, rotary knob, or numeric keypad to set a new value and press the **Enter** key.

   g. Press the Back soft key to return to the **Setup** menu.

2. Press the **Measurements** function hard key.

3. Press the RF Measurement soft key.

4. In the **RF Measurement** menu, press the RF Summary soft key to view the primary RF measurements in a table.

14-4   TD-SCDMA Demodulator
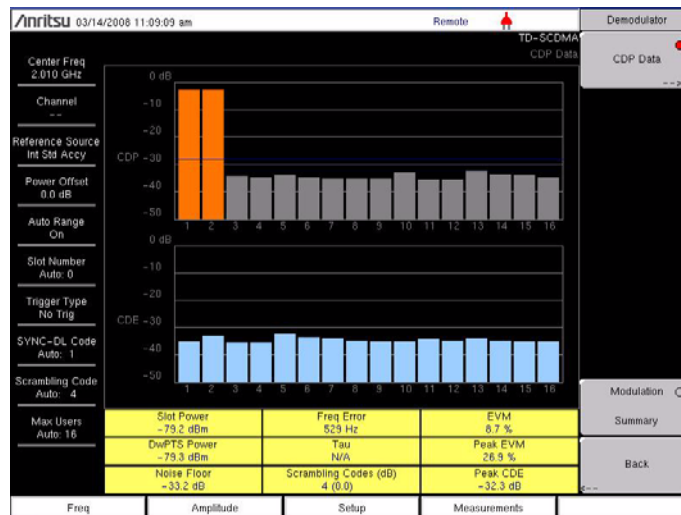
Figure 14-4. Demodulator Measurement – CDP Data

The following parameters are measured in the Demodulator option.

Slot Power

The power measured in the selected slot, excluding the gap. If Slot Selection is set to Auto, then the instrument searches for an active downlink slot and uses the detected slot number for measuring slot power.

DwPTS Pwr

The power in the Downlink Pilot slot, excluding the gap.

EVM

The Error Vector Magnitude (EVM) is the ratio (in percent) of the difference between the reference waveform and the measured waveform. EVM metrics are used to measure the modulation quality of a transmitter. The EVM value displayed by the Economy Microwave Spectrum Analyzer is the root mean square EVM of the measured downlink slot data.

Peak EVM

The peak of the measured EVM.

Freq Error

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

Freq Error PPM

Frequency error, expressed in parts per million (ppm).

Tau

Tau is the timing delay of the frame starting point in reference to the occurrence of a trigger. When no trigger is used, Tau values are relative to the most dominant SYNC-DL code.

Noise Floor

Noise floor is the average of inactive codes powers (dB) from the code domain power.

Peak CDE

The peak of the Code Domain Error (CDE) is the remnant power in the code domain after the useful signal is extracted.

Scrambling Codes

The display format is **Scrambling Code # (relative power in dB)**. A measure of the relative powers of the 4 scrambling codes (relative to Slot Power) that correspond to the detected SYNC-DL code. Only those scrambling codes with high relative power are displayed. Typically, only one scrambling code is displayed unless significant interference occurs from neighboring codes.

Measurement Setup

1. Follow the procedures described in section .

2. Press the **Setup** function hard key. (For a few of the setup parameters, you will have the choice of selecting the Auto option in a list box or an Auto soft key. The Auto soft key allows you a means of immediate selection rather than scrolling through the list box, highlighting Auto, and pressing the **Enter** key.)

    a. Press the Slot Selection soft key. The Slot Selection list box and menu open.

        • In the list box, Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or slot 1 through slot 6 and press the **Enter** key.

    b. Press the Trigger soft key. The Trigger menu opens.

    c. Press the Trigger Type (toggle) soft key to alternate through the three trigger types: No Trig, GPS, and Ext. The active state is underlined on the face of the virtual soft key.

        1. Press the Ext Trigger Polarity (toggle) soft key to alternate either Rising or Falling trigger edge.

        2. Press the Back soft key to return to the **Setup** menu.

    d. Press the Uplink Switch Point soft key. The numerical value on the face of the virtual soft key turns red and is ready to be edited. Use the **Up/Down** arrow keys, rotary knob, or numerical keypad to set a new value and press the **Enter** key.

    e. Press the SYNC-DL Code soft key. The SYNC-DL Code list box opens.

        • In the list box, Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or code 0 through code 31 and press the **Enter** key.

    f. Press the Scrambling Midamble Code soft key. The Scrambling/Midamble Code list box opens.

        • In the list box, Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or code 0 through code 127 and press the **Enter** key.

    g. Press the Max Users soft key. The Maximum Users list box opens.

        • In the list box, select Auto or 2 through 16 and press the **Enter** key.

    h. Press the Meas Speed (toggle) soft key to alternate through the measuring speeds: Fast, Norm, and Slow.

    i. Press the Advanced Settings soft key to continue with setups in the **Advanced Settings** menu.

    j. Press the Tau Offset soft key to enter a tau offset value.

    k. Press the Back soft key to return to the **Setup** menu.

CDP Data

1. Press the **Measurements** function hard key.

2. Press the Demodulator soft key.

3. Press the CDP Data soft key once to select the CDP Data measurement and again to open the **CDP Data menu**.

4. In the **CDP Data menu**, press the CDP Units (toggle) soft key to alternate between Relative and Absolute.

5. Press the Back soft key to return to **Demodulator** menu.

6. Press the Back soft key again to return to the **Measurements** menu.

Modulation Summary

The Modulation Summary displays the critical Modulation transmitter performance measurements in a table format by demodulating the TD-SCDMA signal that is displayed in the Modulation Summary table: Slot Power, EVM, Peak EVM, Freq Error, Freq Error PPM, Tau, Noise Floor, Carrier Feed Through, and Peak CDE.

1. Press the **Measurements** function hard key.

2. Press the Demodulator soft key.

3. Press the Modulation Summary soft key to display the modulation summary table.

4. Press the Back soft key to return to the **Measurements** menu.

CDP and CDE

Code Domain Power (CDP) and Code Domain Error (CDE) are displayed with color coding as described in the following table:

Table 14-1. Color Legend for CDP and CDE

Display Color	Code Type
Orange	Active Codes
Gray	Idle Codes
Light Blue	Code Domain Errors

14-5   TD-SCDMA Pass/Fail Measurements

The following is an example of a Pass/Fail measurement.

Measurement Setup

1. Follow the procedures described in section "TD-SCDMA Measurements General Setups" on page 14-1.

2. Press the **Measurements** hard key.

3. Press the Pass/Fail soft key to activate the test.

4. Press the Pass/Fail soft key again to display the **Pass/Fail** menu.

5. Press the Select Pass/Fail Test soft key. Use the **Up/Down** arrow keys or the rotary knob to highlight the desired test mode in the Select Test list box and press the Select Test soft key.

6. Press the Reset soft key to begin a new pass/fail test measurement.

7. Press the Back soft key to return to the **Measurements** menu.
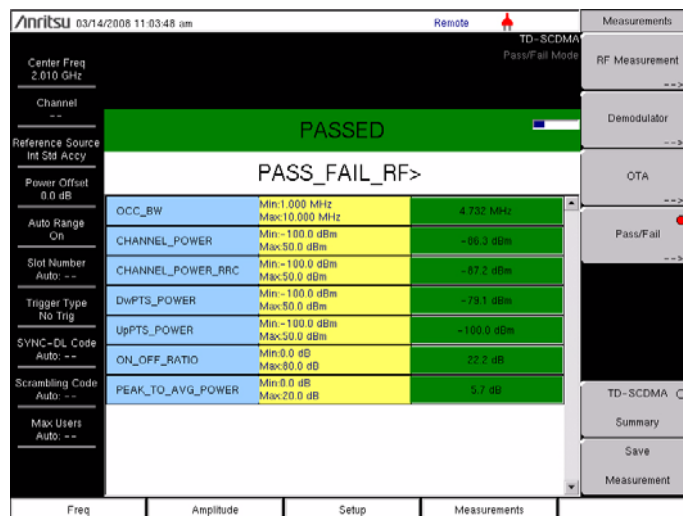
Figure 14-5. Pass/Fail Measurement

14-6   Menus

The following menus are specific to the TD-SCDMA Signal Analyzer mode.

14-7   Freq (Frequency) Menu

Figure 14-6. Freq Menu

Press the **Freq** function hard key to display the **Freq** soft key menu.

Center Freq

Press this (input) soft key to set the receiver center frequency to the desired value. Enter the frequency (2.7 GHz is the maximum value that can be entered) by using the keypad, the arrow keys, or the rotary knob. When entering a frequency using the keypad, the soft key labels will change to **Units**: GHz, MHz, kHz, and Hz. Press the appropriate units soft key. Pressing the **Enter** key has the same affect as pressing the MHz soft key.

Signal Standard

Press this (input) soft 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 for the first channel of the selected standard are automatically tuned. Other settings, such as channel spacing and integration bandwidth, are also automatically entered.

Channel

Press this (input) soft key to open the Channel Editor list box in order to select a channel number within the range of the selected signal standard. Use the **Up/Down** arrow keys, the keypad, or the rotary knob to select a channel number. The center of the channel is automatically tuned to the center frequency of the selected channel.

Set CF to Closet Channel

Press this (input) soft key to move the center frequency to the closest frequency that matches a channel number in the current signal standard.

Decrement Channel

Press this (input) soft key to decrement the channel by one channel.

Increment Channel

Press this (input) soft key to increment the channel by one channel.

14-8   Amplitude Menu
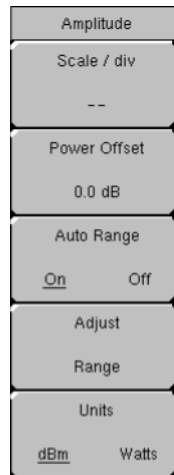
Figure 14-7. Amplitude Menu

Press the **Amplitude** function hard key to display the **Amplitude** soft key menu.

Scale/div

Press this (input) soft key to change the scale of the y-axis in the measurement display. This setting applies to the Channel Spectrum, and CDP Data views only. The range of the scale can be set from 1 dB/div to 15 dB/div in steps of 1 dB/div.

Power Offset

Press this (input) soft key to have the instrument automatically adjust for the loss through any external cables, attenuators, and couplers. The power can be offset from −100 dB to +100 dB with 0.1 dB resolution by using the rotary knob (larger step resolution using the **Up/Down** and **Left/Right** arrow keys.) You can also press the Power Offset soft key, use the keypad to enter the offset values, and press the dB soft key.

Auto Range
On   Off

Press this (toggle) soft key to alternate the Auto Range function between On and Off. The reference level adjusts automatically when On is underlined.

Adjust Range

Press this (input) soft key to perform an Auto Range operation once. Auto Range is automatically turned Off, and the Auto Range operation is performed one time when the Adjust Range soft key is pressed.

Units
dBm   Watts

Press this (toggle) soft key to view the power measurements in either dBm or Watts.

14-9   Setup Menu
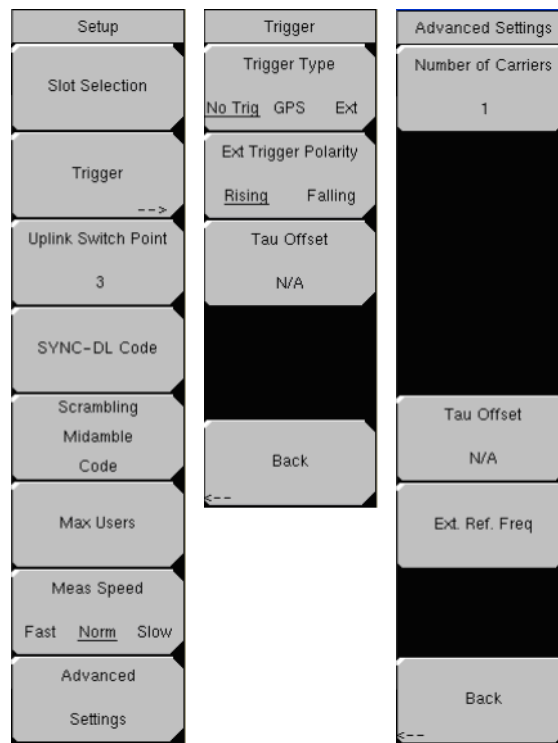
Figure 14-8. Setup Menu

Press the **Setup** function hard key to display the **Setup** soft key menu.

Setup Menu

Slot Selection

Press this soft key to open the Slot Selection list box. Use the arrow keys or the rotary knob to highlight Auto or one of the six slots. If Auto is selected, then the active slot is automatically detected. Press the **Enter** key to select.

Figure 14-9. Slot Selection Menu

Slot Selection Menu

Auto

Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto soft key have the same function. The Auto soft key allows for a slightly quicker selection of the Auto function.

Cancel

Disregards any entry and returns to the **Setup** menu.

Setup Menu

Trigger

Press this (switching) soft key to list the **Trigger** menu, to set up the trigger parameters, and to set up the Tau Offset.

Trigger Menu

Trigger Type
No Trig   GPS   Ext

Select a trigger type by pressing this (toggle) soft key to alternate among No Trig, GPS, or Ext. The active state is underlined on the face of the virtual soft key.

Ext Trigger Polarity
Rising   Falling

Press this (toggle) soft key to choose either Rising or Falling polarity of external trigger.

Tau Offset

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

Back

Press this soft key to return to the **Setup** menu.

Setup Menu

Uplink Switch Point

Press this (input) soft key to set an uplink switch point. This is the slot number of the last uplink timeslot. Slots from the next timeslot to the end of the sub-frame are considered downlink. The default value is 3. The range of values are 0 through 6, where 0 is no uplink.

SYNC-DL Code

Press this (input) soft key to open the SYNC-DL Code list box. Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or 0 through 31 and press **Enter**. If Auto is selected, then the active SYNC-DL code is displayed.

Slot Selection Menu

Auto

Automatically seeks the active SYNC-DL code. Auto in the SYNC-DL Code list box and the Auto soft key have the same function. The Auto soft key allows for a slightly quicker selection of the Auto function.

Cancel

Disregards any entry and returns to the **Setup** menu.

Setup Menu

Scrambling Midamble Code

Press this (input) soft key to open the Scrambling/Midamble Code list box. Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or 0 through 127 and press **Enter**. If Auto is selected, the active Scrambling/Midamble code is displayed.

Slot Selection Menu

Auto

Automatically looks for the Scrambling/Midamble code. "Auto" in the Scrambling/Midamble Code window and the "Auto" soft key have the same function. The Auto soft key allows for a slightly quicker selection of the Auto function.

Cancel

Disregards any entry and returns to the **Setup** menu.

Setup Menu

Max Users

Press this (input) soft key to open the Maximum Users window. Use the **Up/Down** arrow keys or the rotary knob to highlight Auto or 2 through 16 and press **Enter**. If Auto is selected, then the maximum number of users is listed.

Slot Selection Menu

Auto

Automatically looks for the maximum number of users. Auto in the Maximum Users list box and the Auto soft key have the same function. The Auto soft key allows for a slightly quicker selection of the Auto function.

Cancel

Disregards any entry and returns to the Setup menu.

Setup Menu

Meas Speed

Press this (toggle) soft key to alternate through the desired scan speeds: Fast, Norm, and Slow. The active state is underlined on the face of the virtual soft key.

Advanced Settings

Press this (switching) soft key to continue setting up the measurement parameters. The **Advanced Settings** soft key menu is displayed.

Advanced Settings Menu

Number of Carriers

Press this soft key to select the number or carriers present in the signal. Press this soft key to place the value in edit mode (value is colored red). Use the numeric keypad, **Up/Down** arrow keys, or rotary knob to enter the new value. Press the Enter key to set. Range of values is 1-5.

Tau Offset

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

Ext. Ref. Freq

Press this soft key to select the desired external Reference Frequency by using the **Up/Down** arrow keys or the rotary knob and then pressing **Enter**. The following external Reference Frequencies are available: 1 MHz, 1.2288 MHz, 1.544 MHz, 2.048 MHz, 2.4576 MHz, 4.8 MHz, 4.9152 MHz, 5 MHz, 9.8304 MHz, 10 MHz, 13 MHz, and 19.6608 MHz. The default external Reference Frequency is 10 MHz.

Back

Press this soft key to return to the **Setup** menu.

14-10 Measurements Menu
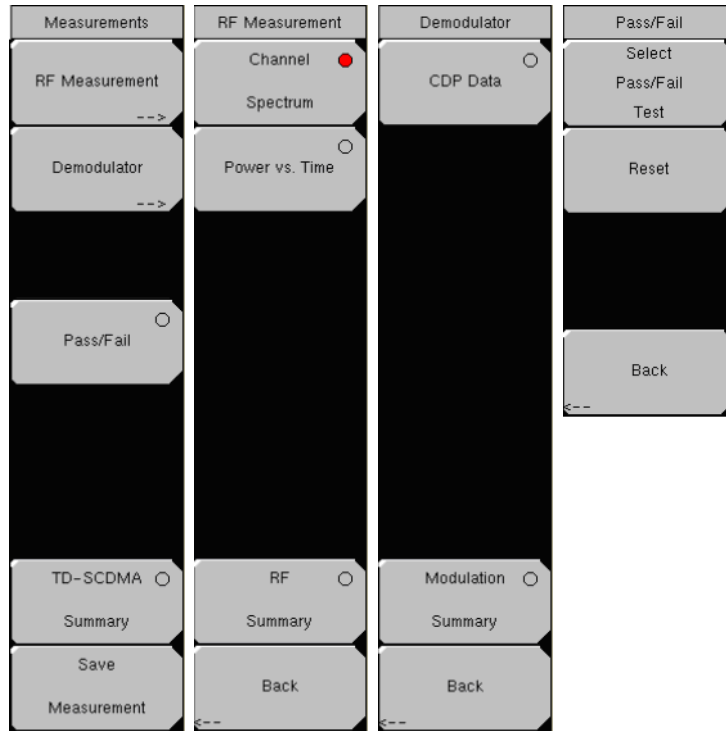
Figure 14-10. Measurements Menu

Measurements Menu

RF Measurements

Press this (switching) soft key to display the RF Measurement soft key menu.

RF Measurement Menu

Channel Spectrum

Press this soft key to displays the spectrum of the input signal. The span is automatically set to 5 MHz. Beneath the graph, values for the following, measurements are displayed: Left Channel Power, Channel Power, Right Channel Power, Occ BW, Left Channel Occ BW, and Right Channel Occ BW. Channel Power is displayed in dBm or watts depending on unit selection.

Power vs. Time

Press this (select) soft key once to place the measurement display in power versus time view. When active, this soft key becomes a switching soft key. Press this (switching) soft key to open the Power vs. Time soft key menu and further set up the display.
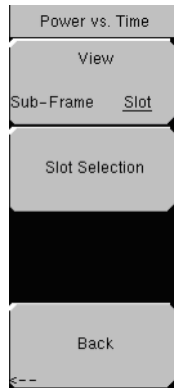
Figure 14-11. Power Versus Time Menu

Power vs. Time Menu

View
Sub-Frame   Slot

Press this (toggle) soft key to display the Power versus Time graph in either the Sub-Frame view or the Slot view.

Slot Selection

Press this (input) soft key to open the Slot Selection list box. This also opens the **Slot Selection** soft key menu with Auto and Cancel soft keys. Use the **Up/Down** arrow keys or the rotary knob in the list box to highlight Auto or one of the six slots. If Auto is highlighted, then the active slot is displayed. Press the **Enter** key to select.

Slot Selection Menu

Auto

Automatically looks for an active downlink slot. Auto in the Slot Selection window and the Auto soft key have the same function. The Auto soft key allows for a slightly quicker selection of the Auto function.

Cancel

Disregards any entry and returns to the Power versus Time menu.

Back

Press this soft key to return to the **RF Measurement** menu.

RF Measurement Menu

RF Summary

Press this (select) soft key to display the following RF measurements in table format:

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

Back

Press this soft key to return to the **Measurements** menu.

Measurements Menu

Demodulator

Press this (switching) soft key to display the **Demodulator** soft key menu and to set up demodulator testing.

Demodulator Menu

CDP Data

Press this (select) soft key once to activate this test. When active, the soft key becomes a switching soft key. Press this (switching) soft key to list the **CDP Data** menu and further set up the measurement.

CDP Data Menu

CDP Units
Relative   Absolute

Press this (toggle) soft key to alternately select either Relative units (dB) or Absolute units (dBm).

Back

Press this soft key to return to the **Demodulator** menu.

Demodulator Menu

Modulation Summary

Press this (select) soft key to view the performance of the transmitter demodulated TD-SCDMA signal in table format. The following parameters are displayed in the table:

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

Back

Press this soft key to return to the **Measurements** menu.

Measurements Menu

Pass/Fail

Press this (select) soft key to activate the Pass/Fail test. When active, the soft key becomes a switching soft key. Press this (switching) soft key to display the Pass/Fail soft key menu and to set up pass/fail testing.
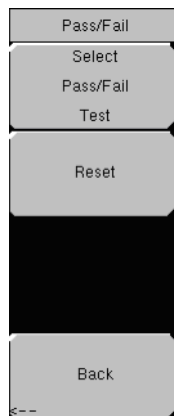
Figure 14-12. Pass/Fail Menu

Pass/Fail Menu

Select Pass/Fail Test

Press this (input) soft key open the Select Test list box and select a test type. Choose from: PASS_FAIL_RF>, PASS_FAIL_DEMOD>, and PASS_FAIL_ALL>. The soft key menu displays one key: Select Test. Press Select Test or press Esc to cancel your choice.

Reset

Press this (input) soft key to restart the measurement or to begin a new pass/fail test measurement.

Back

Press this soft key to return to the **Measurements** menu.

Measurements Menu

TD-SCDMA Summary

Press this (select) soft key to display a table of the TD-SCDMA measurements. The following measurement values are displayed in the table:

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

Save Measurement

Press this (input) soft key to save a measurement. You may accept the default filename or enter your own filename. For more information about naming files, refer to section "Text Entry" on page 2-6.

Appendix A Signal Standards

A-1 Table of Signal Standards

This appendix provides a list of the signal standards included in the MS271xB Economy Microwave Spectrum Analyzer. The standards that are displayed depend upon the operating mode selected.

Table A-1. Table of Signal Standards

Standard	Center (MHz)	Span (MHz)	Valid Channels
AMPS Signal Standards			
AMPS / EIA 553 - Uplink	859	70	1-799, 990-1023
AMPS / EIA 553 - Downlink	859	70	1-799, 990-1023
C-450 Signal Standards			
C-450 (P) - Uplink	463.5	21	1-800
C-450 (P) - Downlink	463.5	21	1-800
C-450 (SA) - Uplink	462.5	15	1-247
C-450 (SA) - Downlink	462.5	15	1-247
CDMA Signal Standards			
CDMA US Cellular - Uplink	859	70	1-799, 990-1023
CDMA US Cellular - Downlink	859	70	1-799, 990-1023
CDMA US PCS - Uplink	1920	140	1-1199
CDMA US PCS - Downlink	1920	140	1-1199
CDMA Korea PCS - Uplink	1810	120	1-599
CDMA Korea PCS - Downlink	1810	120	1-599
CDMA Japan / ARIB - Uplink	878.5	93	1-799, 801-1039, 1041-1199
CDMA Japan / ARIB - Downlink	878.5	93	1-799, 801-1039, 1041-1199
CDMA China - 1 - Uplink	916	88	0-1000, 1329-2047
CDMA China - 1 - Downlink	916	88	0-1000, 1329-2047
CDMA China - 2 - Uplink	910	76	0-1000
CDMA China - 2 - Downlink	910	76	0-1000

Table A-1. Table of Signal Standards *(Continued)*

Standard	Center (MHz)	Span (MHz)	Valid Channels
cdma2000 Signal Standards			
cdma2000 Class 0, Korea Cellular - Uplink	859	70	1-799, 990-1023
cdma2000 Class 0, Korea Cellular - Downlink	859	70	1-799, 990-1023
cdma2000 Class 0, N.A. Cellular - Uplink	859	70	1-799, 990-1023
cdma2000 Class 0, N.A. Cellular - Downlink	859	70	1-799, 990-1023
cdma2000 Class 1, N.A. PCS - Uplink	1920	140	0-1199
cdma2000 Class 1, N.A. PCS - Downlink	1920	140	0-1199
cdma2000 Class 2, (TACS Band) - Uplink	916	88	0-1100, 1329-2047
cdma2000 Class 2, (TACS Band) - Downlink	916	88	0-1100, 1329-2047
cdma2000 Class 3, (JTACS Band) - Uplink	878.5	93	1-799, 801-1039, 1041-1199
cdma2000 Class 3, (JTACS Band) - Downlink	878.5	93	1-799, 801-1039, 1041-1199
cdma2000 Class 4, Korea PCS - Uplink	1810	120	0-599
cdma2000 Class 4, Korea PCS - Downlink	1810	120	0-599
cdma2000 Class 5, (NMT-450-20 kHz) - Uplink	472.5	43	1039-1473, 1792-2016
cdma2000 Class 5, (NMT-450-20 kHz) - Downlink	472.5	43	1039-1473, 1792-2016
cdma2000 Class 5, (NMT-450-25 kHz) - Uplink	439.5	57	1-300, 539-871
cdma2000 Class 5, (NMT-450-25 kHz) - Downlink	439.5	57	1-300, 539-871
cdma2000 Class 6, IMT-2000 - Uplink	2045	250	0-1199
cdma2000 Class 6, IMT-2000 - Downlink	2045	250	0-1199
cdma2000 Class 7, N.A. 700 MHz Cellular - Uplink	770	48	0-359
cdma2000 Class 7, N.A. 700 MHz Cellular - Downlink	770	48	0-359
ETACS Signal Standards			
ETACS - Uplink	916	88	0-1000, 1329-2047
ETACS - Downlink	916	88	0-1000, 1329-2047
GSM Signal Standards			
GSM 900 - Uplink	897.4	40	1-124, 975-1023
GSM 900 - Downlink	942.4	40	1-124, 975-1023
GSM 1800 - Uplink	1747.4	80	512-885
GSM 1800 - Downlink	1842.4	80	512-885
GSM 1900 - Uplink	1879.8	80	512-810
GSM 1900 - Downlink	1959.8	80	512-810
JTACS Signal Standards			
JTACS - Uplink	878.5	93	0-1198 (even numbers only)
JTACS - Downlink	878.5	93	0-1198 (even numbers only)
MATS-AE Signal Standards			
MATS-E - Uplink	925	70	1-1000
MATS-E - Downlink	925	70	1-1000

Table A-1. Table of Signal Standards *(Continued)*

Standard	Center (MHz)	Span (MHz)	Valid Channels
N-AMPS Signal Standards			
N-AMPS / IS-88L - Uplink	859	70	1-799, 990-1023
N-AMPS / IS-88L - Downlink	859	70	1-799, 990-1023
N-AMPS / IS-88M - Uplink	859	70	1-799, 990-1023
N-AMPS / IS-88M - Downlink	859	70	1-799, 990-1023
N-AMPS / IS-88U - Uplink	897.5	147	1-799, 990-1023
N-AMPS / IS-88U - Downlink	897.5	147	1-799, 990-1023
NADC Signal Standards			
NADC IS136 Cellular - Uplink	859	70	1-799, 990-1023
NADC IS136 Cellular - Downlink	859	70	1-799, 990-1023
NADC IS136 PCS - Uplink	1920	140	1-1199
NADC IS136 PCS - Downlink	1920	140	1-1199
NMT Signal Standards			
NMT-411-25 kHz - Uplink	420.5	19	539-871
NMT-411-25 kHz - Downlink	420.5	19	539-871
NMT-450-20 kHz - Uplink	460.5	19	1039-1473
NMT-450-20 kHz - Downlink	460.5	19	1039-1473
NMT-450-25 kHz - Uplink	459	18	1-300
NMT-450-25 kHz - Downlink	459	18	1-300
NMT-470-20 kHz - Uplink	486.5	15	1972-2016
NMT-470-20 kHz - Downlink	486.5	15	1972-2016
NMT-900 - Uplink	925	70	1-1000
NMT-900 - Downlink	925	70	1-1000
NMT-900 (Offset) - Uplink	925	70	1025-2023
NMT-900 (Offset) - Downlink	925	70	1025-2023
NTACS Signal Standards			
NTACS - Uplink	878.5	93	1-1199
NTACS - Downlink	878.5	93	1-1199
PDC Signal Standards			
PDC 800 Analog - Uplink	891.5	97	0-1680
PDC 800 Analog - Downlink	891.5	97	0-1680
PDC 1500 (JDC) - Uplink	1513	72	0-960
PDC 1500 (JDC) - Downlink	1513	72	0-960
PHS Signal Standards			
PHS - Uplink	1906.5	23	1-77
PHS - Downlink	1906.5	23	1-77

Table A-1.   Table of Signal Standards *(Continued)*

Standard	Center (MHz)	Span (MHz)	Valid Channels
SMR Signal Standards			
SMR 800 - 12.5 kHz - Uplink	836	60	1-1199
SMR 800 - 12.5 kHz - Downlink	836	60	1-1199
SMR 800 - 25 kHz - Uplink	836	60	1-600
SMR 800 - 25 kHz - Downlink	836	60	1-600
SMR 1500 - Uplink	1483	60	1-479
SMR 1500 - Downlink	1483	60	1-479
TACS Signal Standards			
TACS - Uplink	925	70	1-1000
TACS - Downlink	925	70	1-1000
UMTS/WCDMA Signal Standards			
UMTS/WCDMA - Uplink	1920	70	9600-9900
UMTS/WCDMA - Downlink	2110	70	10550-10850
UMTS/Region 2 - Uplink	1850	70	9250-9550
UMTS/Region 2 - Downlink	1930	70	9650-9950
802.11 Signal Standards			
802.11a	5170	84	34-161 (not all valid)
802.11b	2442	84	1-14
802.11 DS	2448	72	1-14
802.11 FH	2448.5	93	2-95
802.11g	2442	84	1-14

Appendix B Error Messages

B-1 Introduction

This chapter provides a list of information and error messages that could be displayed on the MS271xB Economy Microwave Spectrum Analyzer. If any error condition persists, then contact your local Anritsu Service Center. Available error message types are described in the following sections:

B-2 Self Test or Application Self Test Error Messages

Overall Status FAILED

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

ADC Self Test FAILED

The Analog to Digital converter failed to return an answer. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

DDC FAILED

The Digital Down Converter failed to return a value. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Lock Test FAILED

One or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Over Power FAILED

RF Power applied to the input connector is too high. Remove or reduce the input power or add additional attenuation. Sometimes out of band frequencies may be present that can cause an Over Power Error. In highly rich RF environments it may be necessary to add an external band pass filter to reduce unwanted interference. Refer to the accessories section ("MS271xB Supplied Accessories" on page 1-4 and "MS271xB Optional Accessories" on page 1-4) for a list of available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the Span to maximum in the peak detect mode of operation. Another resolution may be to reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Over Power Start FAILED

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

Mixer Saturation - Increase Attenuation *or* Mixer Overdrive FAILED

Too much power applied with too little Attenuation. Increase attenuation. Sometimes even out of band frequencies may be present that would cause a Mixer Overdrive Error. In highly rich RF environments, you may need to add an external band pass filter in order to reduce unwanted interference. Refer to the accessories section ("MS271xB Supplied Accessories" on page 1-4 and "MS271xB Optional Accessories" on page 1-4) for a list available band pass filters from Anritsu. Out of band frequencies can often be detected by increasing the SPAN to maximum in peak detect mode of operation. Another resolution may be to Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, erases all user saved setups and measurement traces and returns the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

B-3   Operation Error Messages

ADC Over Range - Increase Reference Level

Input signal is too large for the Analog to Digital converter to process. Increase the internal or external attenuation or, if using Auto attenuation, increasing the Reference Level should resolve the error. Also refer to the Mixer Overdrive error above ("Mixer Saturation - Increase Attenuation or Mixer Overdrive FAILED") for information on Out of band RF power.

OTC Error

Input signal is too large for the Analog to Digital converter to process. Increase the internal or external attenuation or, if using Auto attenuation, increasing the Reference Level should resolve the error. Also refer to the Mixer Overdrive error above ("Mixer Saturation - Increase Attenuation or Mixer Overdrive FAILED") for information on Out of band RF power.

Calibrator Reading Error

Calibration reference source is not providing quality signal. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal Error

Usually caused by a failure to communicate with one section or another. Sometimes resolved by restarting the unit or by Factory Defaults, ESC+ON, resetting of the unit. Under extreme cases the use of MASTER RESET, System+ON, may resolve the issue.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, contact your Anritsu Service Center.

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

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

Measurement not valid in Zero Span

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

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

Choose a start and stop frequency that is within the defined frequency range for the selected antenna compensation table. Also refer to Master Software Tools for creation and upload of Antenna correction files.

Minimum permitted Sweep time is 50 μs

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

Invalid Attenuation for Preamp

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

Valid Attenuations with Preamp on are 0 dB and 10 dB

Same as above

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

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

Use Demod type USB or LSB to use Beat Frequency Osc

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

Trace A/B/C has no data to view

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

DSP Memory Failure, Address, Ext High, Ext Middle, Ext low, Ext1, Ext2

One of the DSP memory locations has failed. The DSP will attempt to resolve the memory Failure location and Byte. The two external memory banks (Ext1 = bank one, Ext2 = Bank 2) are three bytes wide (Ext High, Ext Middle, and Ext Low Byte)

Locking to Internal Ref failed

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

Locking to External Ref failed; Lock attempt Failed

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

EEPROM TEST: FAIL

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

EEPROM TEST: UNKNOWN ERROR

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal error, Unknown

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal error, EEPROM failed

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal error, no SPA board connected

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal error not decoded by DSP

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

UNKNOWN ERROR In SPA

Hardware communications between modules has failed. Insure that the that temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

DSP version different from released version

May occur during firmware update. Likely cause is incomplete firmware package installation. Finish complete firmware update with Master Code Loader.

Operation not Permitted in Recall Mode

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

Cannot change scale in Linear mode

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

Cannot turn on delta marker because Ref Marker is invalid

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

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

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

Current Marker is not ON

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

Marker must be ON to Use the feature

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

Triggering valid only in Zero Span

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

Cannot change Modes for Recalled/Inactive Traces

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

Cannot change average for Recalled/Inactive Traces

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

Pretune Calibration Table fault.

Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Lock failed during initialization

One or more of the Phase Lock Loops failed to achieve lock status during startup. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Reference LVL Cal is OFF

Factory Calibration is OFF. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

IF Cal is OFF

Factory Calibration is OFF. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Lock failure

One or more of the Phase Lock Loops cannot keep the frequency controlled accurately. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, erases all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Cannot set Delta Mkr Freq to Demod Freq

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

Fan Failure

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

It is important to keep the fan inlet and exhaust ports clear of obstructions. The cooling fan will vary the speed in relation to the internal temperature of the instrument. The fan will turn on at low speed when the internal temperature of the instrument reaches 44 °C, and will increase the fan speed to maximum at 54 °C. As the internal temperature of the instrument decreases, the fan will reduce speed until the temperature reaches 39 °C, at which point the fan will turn off.
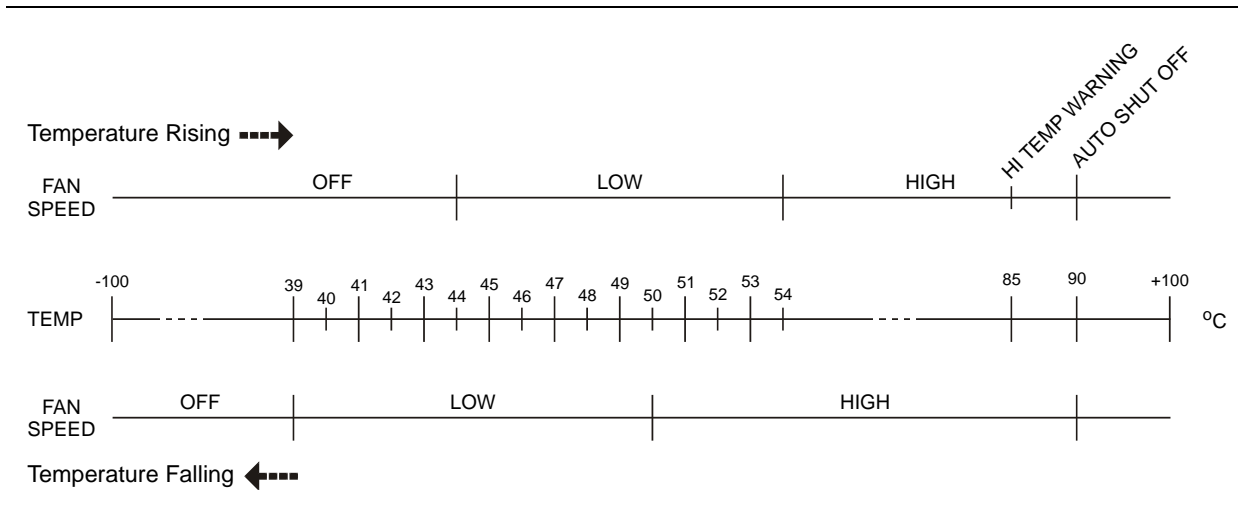
Figure B-1.   Fan Speed versus Temperature

High Temp Warning

The internal temperature has reached an excessive level, 85 °C. Verify that the ventilation openings are unobstructed and that the fan is running. Internal temperatures may be manually verified by using the SELF TEST function. Turn off the unit and allow the temperature to cool down. If the fault is not resolved, and if the internal temperature reaches 90 °C, then a countdown of 10 seconds begins, giving the user a chance to save the current setup before it will turn itself off (before internal temperatures can cause any damage). If the error persists after removing any obstructions and allowing the unit to cool, then reset to the factory defaults with either Factory Defaults or ESC+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Copy failed. Please check External Card

Attempt to copy user saved data to external the Compact Flash Card has failed. Do not attempt to remove or power down the unit before the copy has completed. Be sure that the CF is not already full and that it is fully inserted into the CF-Card slot.

PLL Lock Fail

Phase Lock Loop failed to lock.

Power Supply

Power Supply failed.

VNA EEPROM Fail

Writing and reading of test data to and from the VNA EEPROM failed.

VNA FPGA Fail

Unable to communicate with the VNA PCBA.

VNA Board ID Fail

Readings and voltages associated with the VNA board failed.

PMON PLD Fail

Unable to communicate with the Power Monitor PCBA.

Overall Status FAILED

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

Lock Test FAILED

One or more Phase Lock Loops Failed to properly achieve Lock Status. Insure that the temperature is within acceptable limits. Reset to factory defaults with Factory Defaults, ESC+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal Error

Usually caused by a failure to communicate with one section or another. Sometimes resolved by restarting the unit or by Factory Defaults, ESC+ON, resetting of the unit.

Trace not saved Please wait for complete sweep and try again

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

Unable to add additional limit points 41 points is the maximum

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

DSP Memory Failure, Address, Ext High, Ext Middle, Ext low, Ext1, Ext2

One of the DSP memory locations has failed. The DSP will attempt to resolve the memory Failure location and Byte. The two external memory banks (Ext1 = bank one, Ext2 = Bank 2) are three bytes wide (Ext High, Ext Middle, and Ext Low Byte).

EEPROM TEST FAIL

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

EEPROM TEST UNKNOWN ERROR

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

Fatal error EEPROM failed

Hardware communications between modules has failed. Insure that the temperature is within acceptable limits. Reset to factory defaults with either Factory Defaults, ESC+ON, or MASTER RESET, System+ON.

Caution	Use of MASTER RESET, System+ON, will erase all user saved setups and measurement traces and return the unit to a fully Factory Default condition.

If the error persists, then contact your Anritsu Service Center.

DSP version different from released version

May occur during firmware update. Likely cause is incomplete firmware package installation. Finish the complete firmware update with Master Code Loader.

B-4   High Accuracy Power Meter Messages

Warning! Power Supply Error.

Verify that the supply is connected properly.

Warning! RF Power Level is too high.

The specified upper measurement range is +20 dBm. Do not exceed this.

Warning! Sensor not zeroed properly.

The sensor should be zeroed with nothing connected to it.

Warning! Specified temperature range (0 to 50 ⁰C) exceeded.

The sensor is only specified from 0 to 50 ⁰C.

Warning! Temperature has changed. Zero sensor again.

Temperature changed more than allowable limit after zeroing sensor.

B-5   Fixed WiMAX Messages

Attempting to lock to External Reference

When an external reference frequency is connected and detected by the instrument, this message is briefly displayed.

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 a lock failure is 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 too much power is 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 a strong signal at another frequency is 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

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 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 an error is detected in the FCH decoder that is used to determine the base station ID.

B-6   Mobile WiMAX Messages

Attempting to lock to External Reference

When the instrument detects that 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 *or* Internal Reference Locked Successfully

This message is displayed when the instrument has detected an external reference but could not lock to the reference. The instrument automatically switches to the Internal Reference. This can happen if the external reference frequency does not match the specified external reference frequency in the Setup menu.

Lock Failure xx

When a lock failure is detected from any of the internal local oscillators (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 (Analog to Digital Converter) is being overloaded, this message is displayed. Depending upon the gain settings, either a "decrease input power" or an "adjust range" message is also displayed with this message.

Out Of Band Saturation

When the software detects that too much power is 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 a strong signal is present 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 continues to check the signal power and starts showing results when the power is increased.

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 64QAM
- 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.

B-7   WCDMA/HSDPA and GSM/GPRS/EDGE Messages

Warning Messages

1. External Reference not found. Internal reference Locked successfully

2. External Reference Locked Successfully

Notifications

1. RF Over Power

2. ADC over range

   A. If Auto Range is ON - ADC over range: Decrease input power.

   B. If Auto Range is Off and if Atten = 65, then ADC over range: Decrease input power.

   C. If Auto Range is Off and Atten is < 65, then ADC over range: Adjust range.

3. Level Under

   A. If Auto Range is ON - No signal detected: Increase input power.

   B. If Auto Range is Off and if Atten = 0 & Preamp is On, then no signal detected: Increase input power.

   C. If Auto Range is Off and not (b), then no signal detected: Adjust range.

4. Out of band saturation

5. Poor Range

   A. If Auto Range is ON - Weak signal: Increase input power.

   B. If Auto Range is Off and if Atten = 0 & Preamp is On, then Weak signal: Increase input power.

   C. If Auto Range is Off and not (b), then Weak signal: Adjust range

6. Lock Failure

7. Attempting to lock to Internal ref.

8. Attempting to lock to External ref.

B-8   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. Most demodulation measurement results are then cleared ('--' is seen in the result area).

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