User Guide

Anritsu

PIM Master™

Passive Intermodulation Analyzer

MW8219A, 1930 MHz – 1990 MHz, 2110 MHz – 2155 MHz
MW8209A, 925 MHz – 960 MHz
MW8208A, 869 MHz – 894 MHz

User Guide

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MW8208A, 869 MHz – 894 MHz

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Part Number: 10580-00280
Revision: F
Published: January 2012

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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: PIM Master

Model Number: MW8208A, MW8209A, MW8219A

conforms to the requirement of:

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

Electromagnetic Compatibility: EN61326:2006

Emissions: EN55011: 2007 Group 1 Class A

Immunity:	EN 61000-4-2:1995 +A1:1998 +A2:2001	4 kV CD, 8 kV AD
	EN 61000-4-3:2006 +A1:2008	3 V/m
	EN 61000-4-4:2004	0.5 kV S-L, 1 kV P-L
	EN 61000-4-5:2006	0.5 kV L-L, 1 kV L-E
	EN 61000-4-6: 2007	3 V
	EN 61000-4-11: 2004	100% @ 20 ms

Electrical Safety Requirement:

Product Safety: EN 61010-1:2001

Eric McLean, Corporate Quality Director

Morgan Hill, CA

20 DEC 2011
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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印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
LCD	×	×	×	×	○	○
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Safety Symbols

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

Symbols Used in Manuals

Danger

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

Warning

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

Caution

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

Safety Symbols Used on Equipment and in Manuals

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

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

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

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

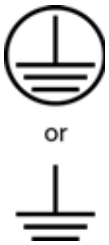
This indicates a note. The contents are described in the box.

These indicate that the marked part should be recycled.

Warning

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

Warning



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

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

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

Warning	The Anritsu PIM Master is capable of producing up to 100 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields: Always terminate the output port of the test equipment into a load, a loaded line, or a line that will radiate or absorb the energy before beginning a PIM test. Confirm that the PIM Master RF power is off after a PIM test. Always confirm that the RF power is off before disconnecting a coaxial connection, otherwise RF burns may result. Immediate burns to fingers or eyes can result from exposure to live connectors. RF power can be immediately turned off with the Emergency Stop button (Figure 2-1). Ensure all antenna's under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

1-1 Introduction

The PIM Master is an integrated source and receiver that generates a high-power signal that excites micro arching and PIM. These signals are picked up by the on-board receiver.

Anritsu has developed the PIM Master to verify and troubleshoot Passive Inter-Modulation (PIM). The PIM Master generates two high-power tones, usually in the transmit band of interest. The Anritsu family of handheld RF instruments has a PIM Analyzer mode for controlling the PIM Master. These handheld instruments display and measure the third-order, fifth-order, or seventh-order lower intermodulation product reflecting back from the DUT to the PIM Master. In addition, the PIM Master can measure the Distance-to-PIM of multiple PIM sources, providing the distance to the source and its relative magnitude, both inside the antenna system and beyond.

The current standard of PIM testing utilizes this system of two primary carriers and a calculated PIM frequency. This system is monitored via a spectrum analyzer. This provides a measurement of the overall linearity of the antenna system and the surrounding environment.

As more power goes up the antenna lines, a coaxial connection is more likely to cause a fault on a tower. Traffic through the site plays a big part. A relatively quiet site will not usually exhibit the same performance problems as a busy site.

PIM testing is a measure of construction quality. Poor construction quality results in self-interference. Line Sweep testing and PIM testing are distinctly different tests. Both are important and are accurate measures of the ability of a cell site to provide service and to perform optimally. Line sweeping measures the signal losses and reflections of the transmission system.

PIM testing measurements reflect the overall linearity of an antenna feed line, and Line Sweep measurements reflect the overall impedance matching of all of the components in an antenna feed line. Both tests need to be performed to ensure the overall quality of an antenna feed line.

The main reason to use a PIM test is that it is the most comprehensive measure of electrical connection quality that is commercially available.

1-2 Scope of the PIM Master User Guide

The PIM Master User Guide describes the connection and operation of the PIM Master and also the PIM Analyzer and Distance-to-PIM Analyzer modes that are associated with supported Anritsu handheld instruments.

This chapter provides a general overview of PIM analysis and the Anritsu PIM Master. It also includes instructions on care and user maintenance, describes frequency range pairs, illustrates a typical PIM analysis setup, and reviews updating the PIM Master firmware.

Chapter 2 provides an instrument overview, parameter setup, and connection setup for PIM analysis. It also includes a comprehensive review of the menus that are available in the PIM Analyzer mode on Anritsu handheld instruments.

Chapter 3 provides an instrument overview, parameter setup, and connection setup for Distance-to-PIM analysis. It also includes a comprehensive review of the menus that are available in the Distance-to-PIM Analyzer mode on Anritsu handheld instruments.

Chapter 4 lists available SCPI commands for remote setup of the PIM Master and PIM Analyzer mode through the remote control of the Anritsu handheld product.

Appendix A lists reference, error, and warning messages.

Appendix B describes windowing, which reduces side lobes by smoothing out the sharp transitions at the beginning and at the end of a frequency sweep.

Appendix C describes preset states for Distance-to-PIM analysis.

Note	Images of measurement results and display screens that are shown in this manual are typical examples. Images on your instrument may differ.

1-3 Why Test for PIM?

Lack of linearity can limit the receive sensitivity of a cellular system. This limits the reliability, data rate, capacity, coverage, and return on investment of the system. The PIM test is an excellent indicator of linearity and construction quality.

PIM results from two or more strong RF signals mixing in a non-linear device. These non-linear devices, or junctions, occur in improperly tightened, damaged, or corroded connectors or in damaged antennas. Rusty components, such as mounts and bolts, are also suspect when hunting for sources of PIM.

Many common frequency combinations can produce PIM in a cell receive band. PIM signals in the cell receive band will:

- Raise the receive noise floor
- Increase the bit error rate

- Decrease the coverage area
- Cause early handoff
- Increase dropped calls
- Increase early termination
- Require the mobiles in the cell to increase Tx power (increase battery drain)

Avoiding PIM begins with quality construction methods. Increasing capacity, new services, and aging infrastructure, however, are all working against this strategy, and PIM testing is becoming more important every day.

Proper care and maintenance of connectors is essential to keeping PIM low. Inspection and cleaning is a central part of good performance. Proper torque is important, because the seals and interface areas are designed for this pressure.

PIM testing is becoming more important as cellular systems age and as the carrier count is increased. A test that was not as important when cellular systems were lightly loaded is becoming a critical part of modern cellular maintenance.

A cell site that is constructed with PIM in mind will cost less to maintain over time. This same site will show cleaner performance than similar sites that were not PIM tested.

1-4 Additional Documentation

Refer to the Anritsu handheld instrument User Guide for basic operation information including frequency, amplitude, GPS, limit lines, markers, and file management.

Refer to the PIM Master Product Brochure (part number: 11410-00546) for specifications and a list of handheld models that support the Passive Inter-Modulation (PIM) Analyzer.

1-5 PIM Master Models

Table 1-1 lists the current available models. Refer to the Anritsu web site for the latest information on available PIM Master models and frequency ranges.

Table 1-1. PIM Master Models

Model Number	Carrier Band	Frequency Range for F1 and F2	Power Levels
MW8219A	PCS	1930 MHz to 1990 MHz	20W, 30W, or 40W
	AWS(1)	2110 MHz to 2155 MHz	20W, 30W, or 40W
MW8209A	E-GSM UTRA/FDD VIII E-UTRA 8	925 MHz to 960 MHz	20W, 30W, or 40W
MW8208A	US Cellular	869 MHz to 894 MHz	20W, 30W, or 40W

1. For AWS, F1 will be in the PCS frequency range, and F2 will be in the AWS range.

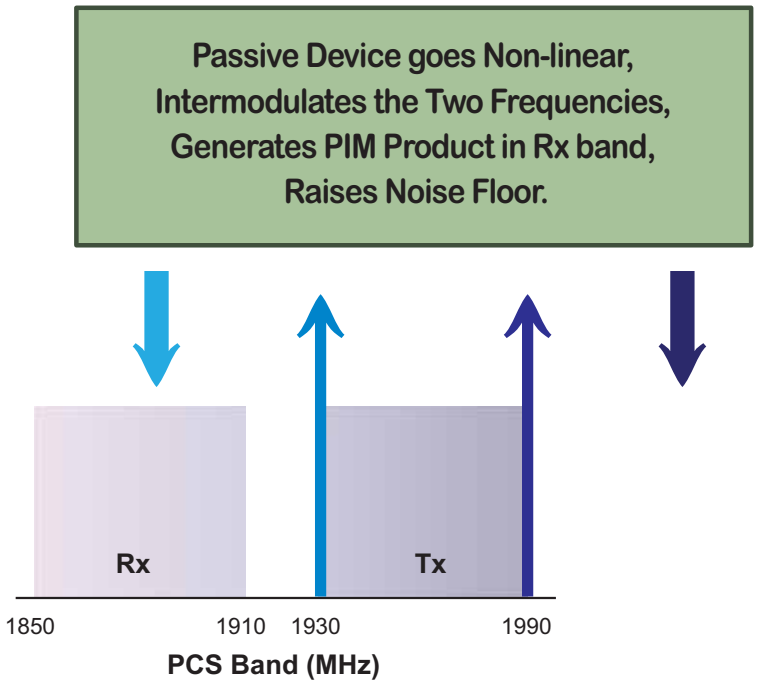


Figure 1-1. PCS Band PIM Testing

1-6 Standard Accessories

The Anritsu PIM Master includes a one year warranty which includes: hardware, firmware, and a Document of Calibration and Conformance. The following items are supplied with the product.

Table 1-2. Standard Accessories for PIM Master Models

Part Number	Description
10580-00280	PIM Master User Guide (this document)
2000-1635-R	Interconnect cable assembly (includes the 3 required cables to connect the PIM Master to an Anritsu handheld instrument).
11410-00546	PIM Master Product Brochure

Note	The PIM Master is not removable from the wheeled plastic case. The handles on the face plate are for lifting the PIM Master.

Warning	The PIM Master weighs more than 60 pounds (27 kg). Use care when raising it off the ground.

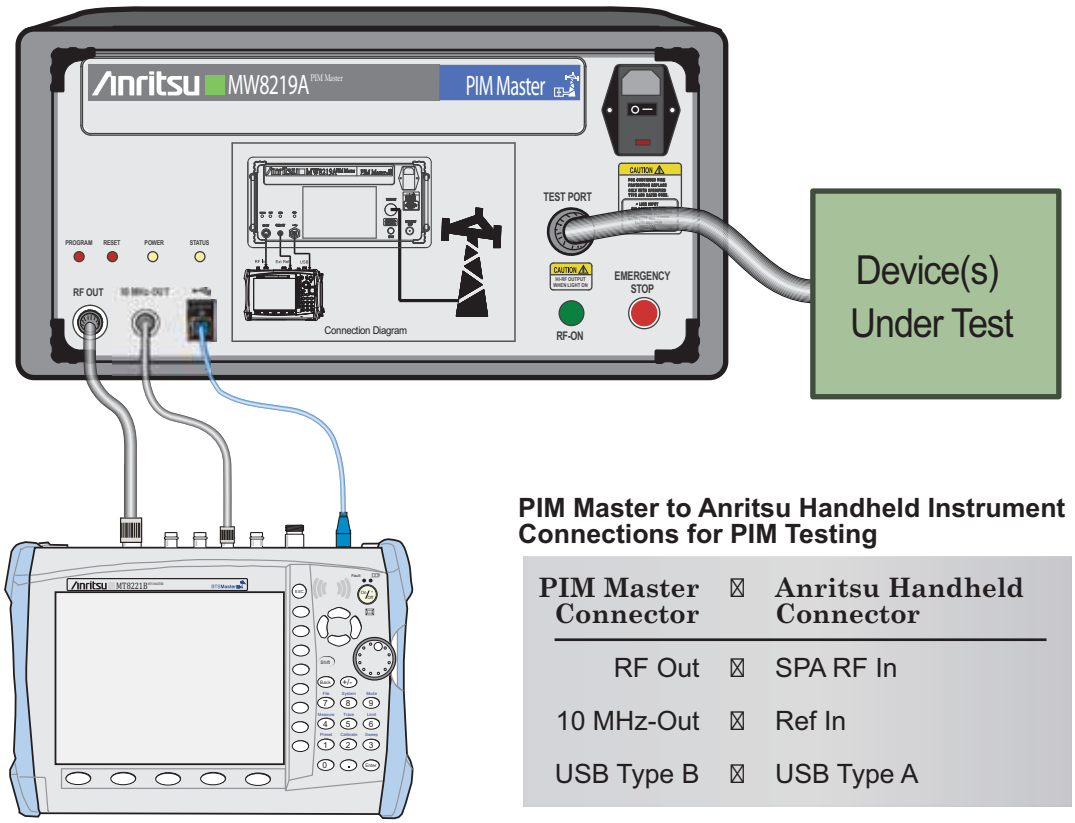
1-7 Optional Accessories

The PIM Master Product Brochure (part number 11410-00546) contains a list and description of available optional accessories, including torque wrenches, connector savers, and PIM termination. The brochure is also available on the Anritsu web site: http://www.anritsu.com.

1-8 Connection Diagram

The PIM Master is shipped with an Anritsu Interconnect Cable Assembly (part number: 2000-1635-R). The assembly includes the 3 cables that are needed to connect the PIM Master to a PIM Compatible Anritsu handheld instrument.

- BNC to BNC cable (2000-1627-R)
- USB Type A to USB Type B (2000-1628-R)
- Test Port Extension Cable, Armored, 1.5 meters (15NN50-1.5C)



PIM Master to Anritsu Handheld Instrument Connections for PIM Testing

PIM Master Connector	⊠	Anritsu Handheld Connector
RF Out	⊠	SPA RF In
10 MHz-Out	⊠	Ref In
USB Type B	⊠	USB Type A

NOTE: Connector location varies between Anritsu handheld instruments.

Figure 1-2. PIM Master Connection Diagram

The 7/16 DIN connector cable (useful for connecting the PIM Master to the device under test) is not included but can be ordered from Anritsu:

- Test Port Cable, 3 meters (2000-1626-R)

Note	PIM testing is not a replacement for line sweeping but is an additional tool to test a cellular system. PIM is a measure of system linearity as compared to line sweeping, which is a measure of system impedance. Both tests are critical to validate a cellular system.

1-9 PIM Analysis Display Overviews

Figure 1-3 and Figure 1-4 show typical PIM and Distance-to-PIM measurements with descriptive labels to help you become familiar with display screen (sweep window) elements.

PIM Analyzer

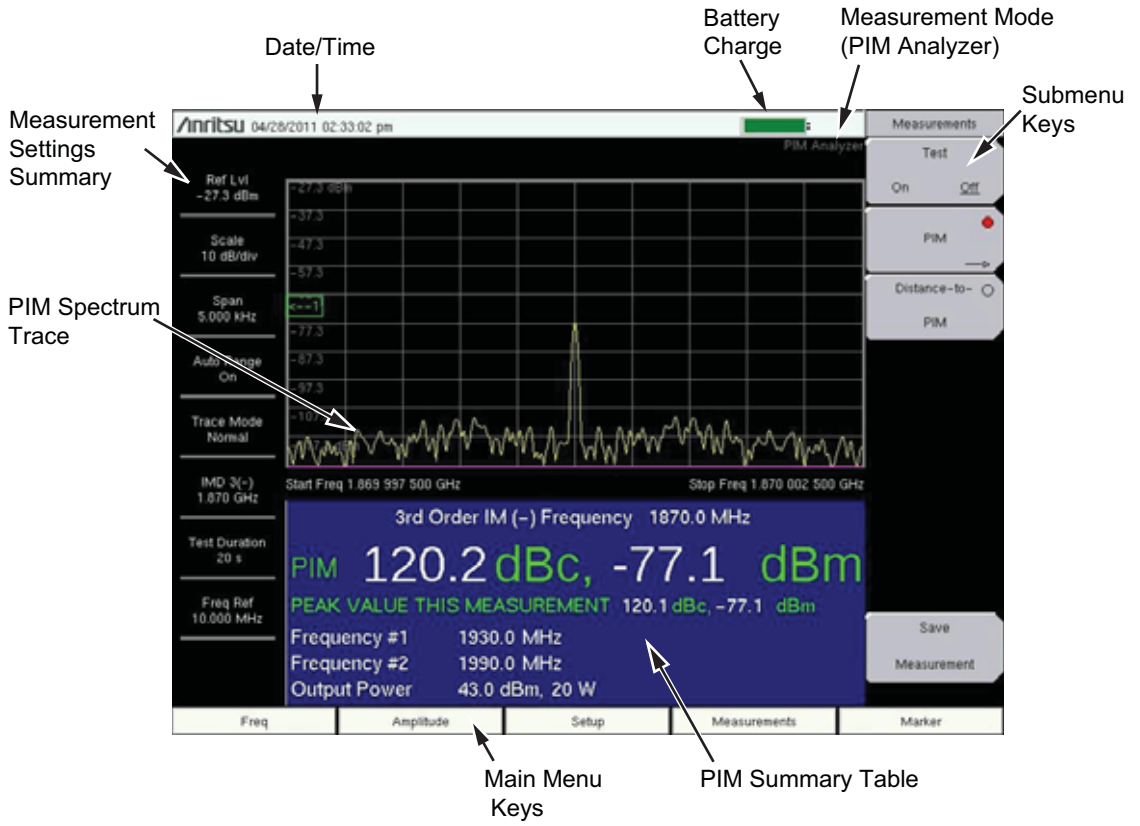


Figure 1-3. PIM Analyzer Display

DTP PIM Analyzer

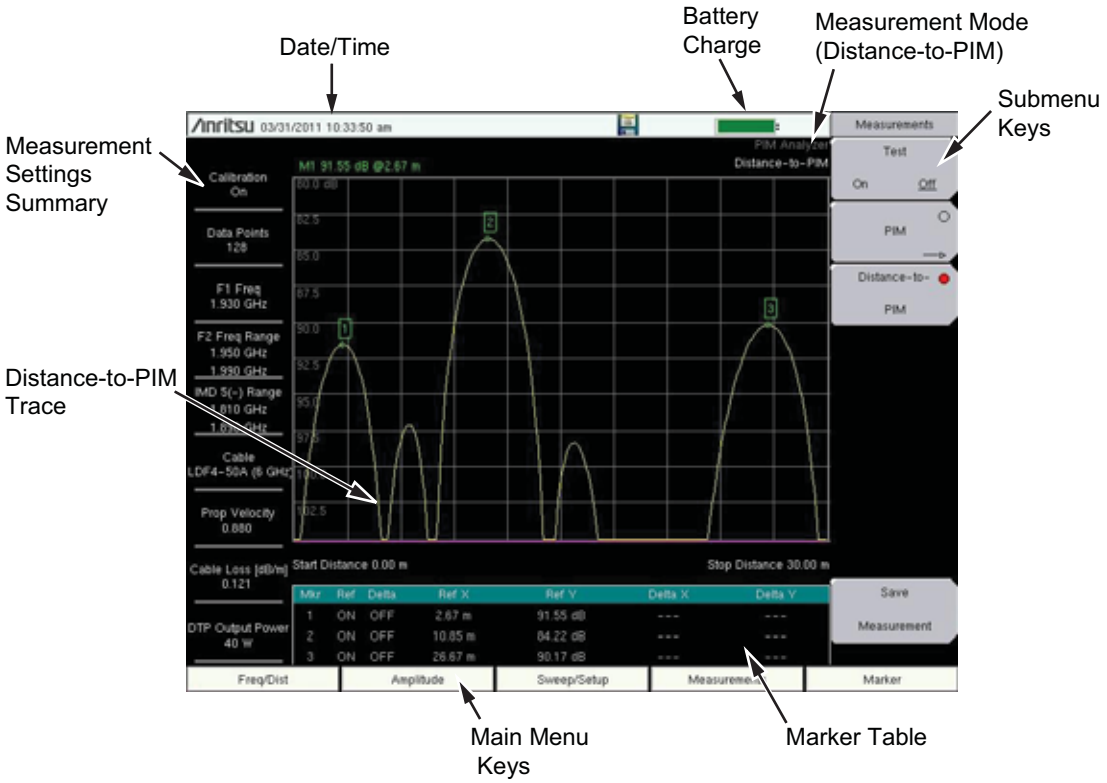


Figure 1-4. Distance-to-PIM Analyzer Display

1-10 Performance Specifications

Refer to the PIM Master Product Brochure (part number: 11410-00546) for general specifications, detailed measurement specifications, ordering information, and available accessories. The product brochure is included with the instrument and is available on the Anritsu web site: http://www.anritsu.com.

1-11 Preventive Maintenance

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

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

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

1-12 Calibration Requirements

Anritsu recommends annual calibration and performance verification by local Anritsu service centers.

1-13 Verification

Two quick tests can be performed in the field to verify that the PIM Master and the support equipment that you are using in your PIM measurements are all ready for testing. First perform a residual PIM test, then perform a second test that verifies a known PIM standard. Together, these two tests verify that both the Rx and Tx paths of the instrument are functioning properly.

Anritsu recommends testing the residual PIM at least daily using the optional Low PIM Termination (Anritsu part number MA82103A), which has good PIM performance. Do this prior to conducting cellular system tests.

Residual PIM Test:

1. Connect the PIM Master to the Anritsu handheld instrument as shown in Section 1-8 “Connection Diagram” on page 1-6.
2. For PIM Analysis, set the PIM Master (via the Anritsu handheld instrument) as follows:

Table 1-3. Residual PIM Test Settings

Model	F1	F2	Power	Test Duration
MW8208A	869 MHz	894 MHz	20 W	20 seconds
MW8209A	925 MHz	960 MHz	20 W	20 seconds
MW8219A	1930 MHz	2140 MHz	20 W	20 seconds

Refer to Chapter 2, “PIM Analyzer” for details on setting the measurement parameters.

3. Connect the Low PIM termination to the PIM Master TEST PORT and make a measurement by pressing the **Measurements** main menu key, then by pressing the Test submenu key.

   The measured result should be better than –112 dBm/155 dBc.

Verification PIM Test:

4. After the residual PIM measurement is complete, connect the PIM standard (refer to Table 1-4) to the Test Port, and connect the Low PIM termination to the PIM standard, and then make another measurement.

The result should be –80 dBm/123 dBc, ± 3 dB.

Table 1-4. PIM Standards

Part Number	Use With	Specifications
1091-403-R	MW8209A MW8208A	–80 dBm ± 3 dB at 910 MHz, 2x20 W, 7/16 DIN(m) to 7/16 DIN(f), 50 Ω
1091-390-R	MW8219A	–80 dBm ± 3 dB @ 1775 MHz, 2x20 W, 7/16 DIN(m) to 7/16 DIN(f), 50 Ω

These checks are not calibrations, and no field-adjustable components are involved. To ensure consistently accurate measurements, the PIM Master must be returned to an authorized service center annually for calibration.

If your PIM Master does not show similar results, contact Anritsu customer service at:

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

Note	Anritsu recommends an annual calibration and performance verification of the PIM Master.

1-14 ESD Caution

The PIM Master, like other high performance instruments, is susceptible to electrostatic discharge (ESD) damage. Coaxial cables and antennas often build up a static charge, which (if allowed to discharge by connecting directly to the PIM Master without discharging the static charge) may damage the PIM Master input circuitry.

Caution	Operators must be aware of the potential for ESD damage and take all necessary precautions.

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

1-15 Supply Voltage and Replacing a Fuse

Input power for the PIM Master is auto-sensing for operation with 100 VAC to 240 VAC, 47 Hz to 63 Hz. Confirm that the electrical service at the current location is within these ranges.

To replace a fuse:

1. Insert a flathead screwdriver in the slot at the bottom of the fuseholder door and gently rotate to unlatch the door.
2. Remove the red fuseholder by inserting the flathead screwdriver under the fuseholder edge and gently pushing down. Lift the fuseholder out of the PIM Master.
3. Insert the new fuse into the PIM Master fuseholder. Replace fuses as required with Anritsu part number: 3-631-127 (10 A fast acting fuse, Cooper Bussman AGC-10-R, or equivalent).

1-16 Anritsu Handheld Instruments

Anritsu handheld instruments that have a touch screen offer additional operator interface options for some features. You can touch a submenu key or a screen feature (such as the button for the Preset State entry in the DTP Parameters window shown in Figure 3-1).

1-17 Anritsu Line Sweep Tools (LST)

Anritsu Line Sweep Tools can download and open PIM files and DTP files. LST provides a means of reviewing and analyzing traces on a PC.

1-18 PIM Master Firmware Update

Please check the Anritsu PIM Master Web page for firmware upgrade procedures. If further assistance is needed, then contact Anritsu at +1-800-ANRITSU (+1-800-267-4878).

To determine the current firmware version of your PIM Master, use the following procedure on your Anritsu Handheld instrument, which must be connected to the PIM Master (refer to Figure 1-2, “PIM Master Connection Diagram” on page 1-6):

1. Press the **Shift** and **System** (8) keys to display the System menu.
2. Press the Application Self Test submenu key to display the PIM Self Test menu.

   The Application Self Test list box displays the result of testing the current application, which is the PIM analyzer or the DTP analyzer, whichever you are using.
3. Press the PIM Self Test submenu key.
4. The Application Self Test list box provides the results of the PIM Self Test and also displays the firmware version number. Refer to Figure 1-5.

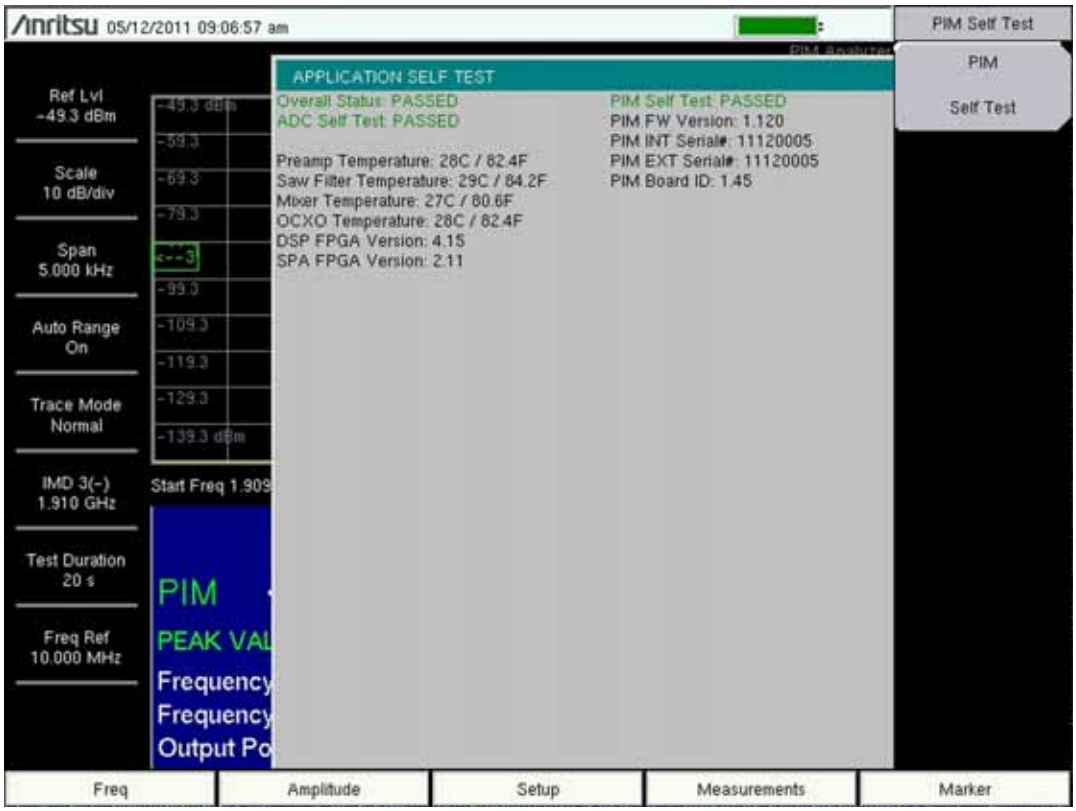


Figure 1-5. PIM Self Test Displays Firmware Version

1-19 Secure Environment Workplace

Refer to the Anritsu handheld instrument User Guide.

Note	For USB storage, Anritsu recommends part number 2000-1520-R USB Flash Drive.

Chapter 2 — PIM Analyzer

Warning	The Anritsu PIM Master is capable of producing up to 100 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields: Always terminate the output port of the test equipment into a load, a loaded line, or a line that will radiate or absorb the energy before beginning a PIM test. Confirm that the PIM Master RF power is off after a PIM test. Always confirm that the RF power is off before disconnecting a coaxial connection, otherwise RF burns may result. Immediate burns to fingers or eyes can result from exposure to live connectors. RF power can be immediately turned off with the Emergency Stop button (Item 2 in Figure 2-1). Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

2-1 Chapter Overview

This chapter contains the following sections:

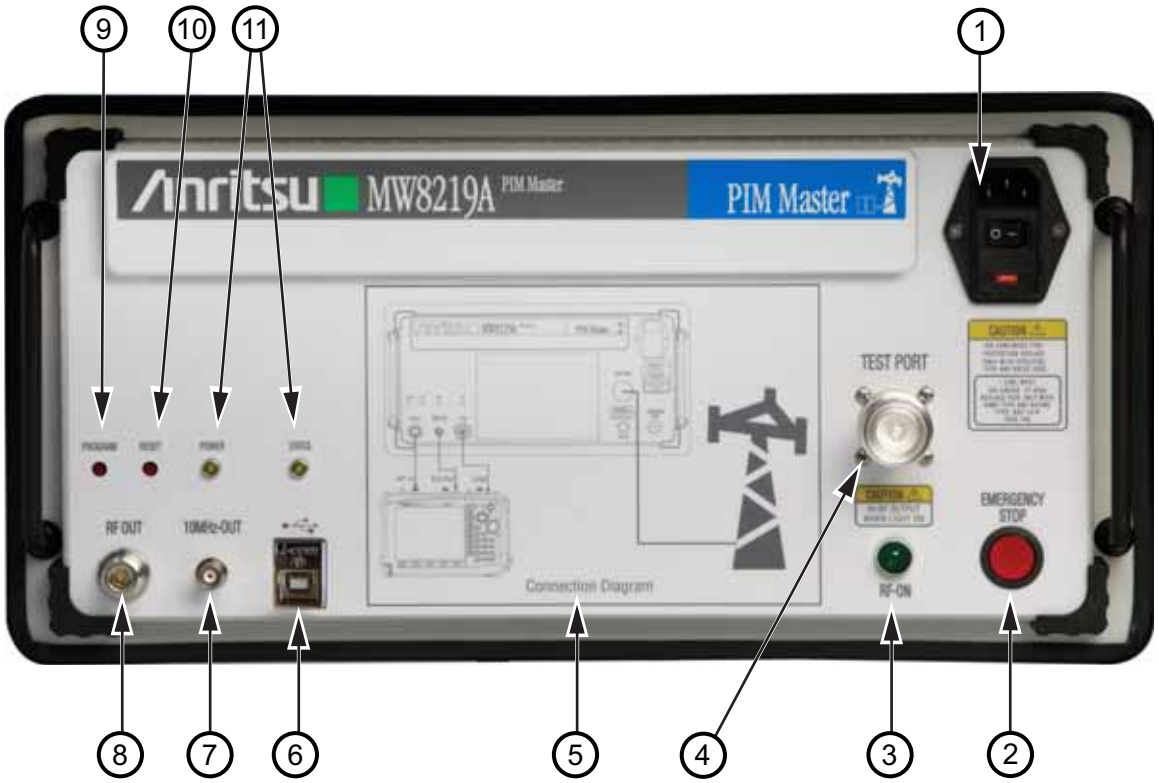
- Section 2-2 “Connection Panel Overview” on page 2-2
- Section 2-3 “PIM Analysis Setup” on page 2-4
- Section 2-4 “Making the PIM Measurement” on page 2-11
- Section 2-5 “Menu Map” on page 2-13
- Section 2-6 on page 2-15 through Section 2-16 on page 2-22 describe the menus and submenus available in the PIM Analyzer

Anritsu handheld instruments with a touch screen offer additional options for some features. You can touch a submenu key or a screen feature (such as the button for the Preset State entry in the DTP Parameters window shown in Figure 3-1).

Note	Images of measurement results and display screens that are shown in this manual are typical examples. Images on your instrument may differ.

2-2 Connection Panel Overview

The PIM Master has the connectors that are shown in Figure 2-1.



1.	Power Connector and Switch
2.	Emergency Stop button
3.	Radio Frequency ON Light
4.	Test Port Connector, 7/16 DIN
5.	Connection Diagram
6.	USB Type-B Connection (connect to Anritsu handheld instrument)
7.	10 MHz Reference Output Signal, BNC (female) (connect to Anritsu handheld instrument)
8.	RF Out Connector, N Type (female) (connect to the Spectrum Analyzer RF In connector of your Anritsu handheld instrument)
9.	Program Button
10.	Reset Button
11.	Indicator Lights

Figure 2-1. PIM Master Connector Panel

PIM Master Connection to Handheld Instrument

When an Anritsu handheld instrument is operating in PIM Analyzer mode, the instrument attempts to connect through the USB connection to the PIM Master. If you want to work in PIM Analyzer mode without connecting to the PIM Master, then you can press **Shift** + **5** on the handheld instrument to disable USB communications. Refer to the Attention message on the left side of Figure 2-2.

While the connection is disabled, you can set or change frequency, amplitude, and setup parameters as desired. When you press the Measurement main menu key, the instrument again attempts to connect through the USB connection to the PIM Master. If the connection has not yet been established, an Attention message directs you to press **Shift** + **5** on the handheld instrument to enable USB communications. Refer to the Attention message on the right side of Figure 2-2. If you want to continue working in PIM Analyzer mode without connecting to the PIM Master, then press **ESC** to clear the message box.

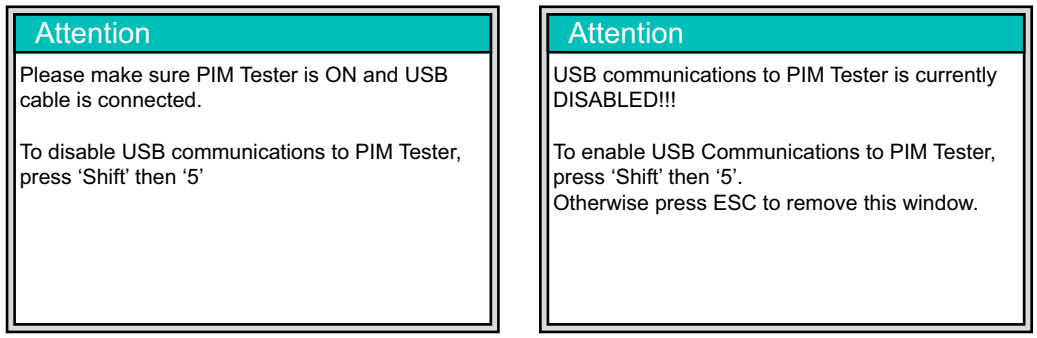


Figure 2-2. USB Connection Messages

2-3 PIM Analysis Setup

Before turning on power on the PIM Master or on the connected Anritsu handheld instrument, connect the cables between the instruments and the DUT as shown in the diagram in Figure 1-2. A connection diagram is also printed on the PIM Master connection panel.

Note	In most cases, information and parameters can be entered through the keypad, the directional arrows, or the rotary knob. The numeric keypad enters the information directly. The **Up** and **Down** arrow keys change a frequency parameter by 1 MHz. The **Left** and **Right** arrow keys change the frequency parameter by 10 MHz. The rotary knob changes the frequency parameter in 1 MHz increments. Choose whichever method is most convenient to enter the required information. Refer to your Anritsu handheld instrument User Guide for additional information.

Handheld Instrument Connection and Power Up

A cable harness is part of the standard accessories included with the PIM Master to connect to an Anritsu handheld instrument. Use this cable harness to make the following connections:

1. Connect the USB cable between the USB Type-B receptacle connector of the PIM Master and the Type-A USB receptacle connector of the handheld instrument.
2. Connect the N-Type cable between the RF Out connector of the PIM Master to the RF In connector of the handheld instrument.

Caution	Some handheld instruments contain both a VNA RF port and a SPA RF port. Be sure that you connect the to the Spectrum Analyzer RF In port.

3. Connect the BNC cable between the 10MHz-OUT BNC connector of the PIM Master to the Ref In BNC connector of the handheld instrument.
4. Connect the Test Port Cable between the Test Port connector of the PIM Master to the device under test (DUT).

Warning	Confirm that connections are secure. High power RF signals are emitted from the test port and can cause bodily injury. Anritsu recommends using a torque wrench for this connection, Anritsu part number 01-507 and open ends (01-508 for 1-inch, 01-509 for 1.25-inch). The torque wrench and parts are included in the PIM accessory package, part number 2000-1637-R.

This device (DUT) may be the main feeder cable from the tower or a simple jumper cable. The DUT must be connected to a termination device, such as a low PIM termination or an Antenna.

Caution	Do not use a precision load as the termination device because they are not designed to handle the power of the PIM Master and will become damaged immediately.

5. Power on the PIM Master.
6. Power on the handheld instrument and select the PIM Analyzer mode. Refer to the Anritsu handheld instrument User Guide for additional information on selecting the PIM Analyzer mode.

Configure the PIM Test

Frequency Setup

1. Press the **Freq** main menu key to display the frequency menu. Set Carrier F1 and Carrier F2 to generate the passive inter-modulated signal (refer to Table 2-1). Carriers can be set anywhere in the stated ranges with a 0.1 MHz resolution. Attempting to set F1 or F2 outside of these ranges causes a message box to appear (refer to Figure 2-3). Also, the software does not allow frequency pairs that create a PIM product (IMx) outside of the test system limits. The IMx is used to set the receiver center frequency. Figure 2-4 is displayed when ranges outside of the limit are entered. Press **ESC** to clear the error message.

Table 2-1. Carrier Frequency Setup

Model	F1	F2
MW8208A	869 MHz to 894 MHz	869 MHz to 894 MHz
MW8209A	925 MHz to 960 MHz	925 MHz to 960 MHz
MW8219A	1930 MHz to 1990 MHz 2110 MHz to 2155 MHz	1930 MHz to 1990 MHz 2110 MHz to 2155 MHz

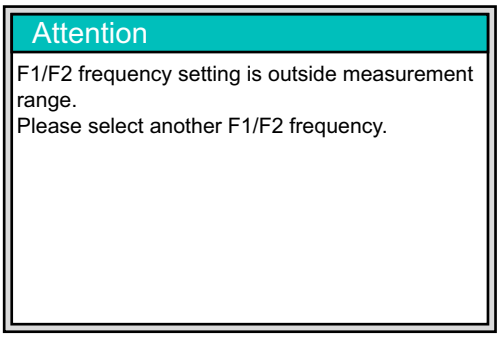


Figure 2-3. Carrier F1 or Carrier F2 Outside Frequency Range Error Message

The intermodulation distortion (IMx) is a mathematical function of F1 and F2.

```
3rd Order Intermodulation (IM3) = 2F1–F2 or  2F2–F1
5th Order Intermodulation (IM5) = 3F1–2F2 or  3F2–2F1
7th Order Intermodulation (IM7) = 4F1–3F2 or  4F2–3F1
```

Finding IM3 when F1 = 1930 MHz and F2 = 1990 MHz:

```
IM3 = 2F1–F2 = 1870 MHz  or  2F2–F1 = 2050 MHz
```

The PIM Master will use 1870 MHz (low-side IMx) as the center frequency. The PIM Master will always use the lower IMx value and will not set to the high-side IMx frequency.

If you switch the F1 and F2 values such that:

Note

F1 = 1990 MHz and F2 = 1930 MHz, then the PIM Master will still use 1,870 MHz as the center frequency.

In addition, for the MW8219A, the IMx selection must be inside one of the two PIM Master receiver bands (listed below) to make a PIM measurement, and the MW8209A and MW8208A must be inside the listed receiver bands:

MW8219A: 1710 MHz to 1785 MHz
MW8219A: 1850 MHz to 1910 MHz
MW8209A: 880 MHz to 915 MHz
MW8208A: 824 MHz to 849 MHz

If the IMx frequency does not fall within one of these bands, then the PIM Master displays an error message (Figure 2-4) and does not allow the measurement to occur.

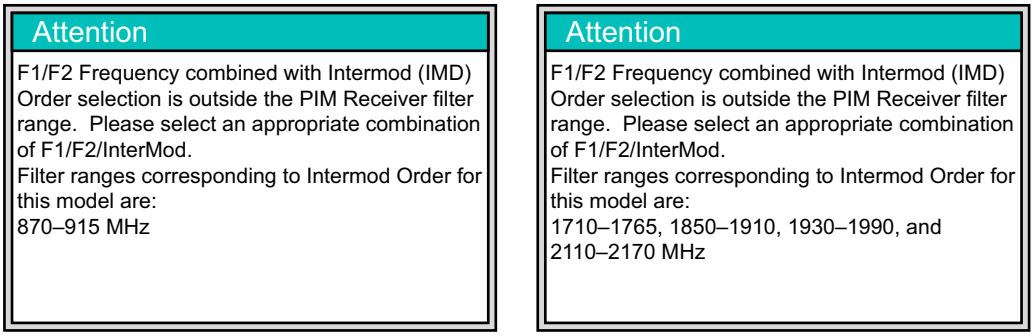


Figure 2-4. IMx Frequency Range Error Messages

2. Press the Carrier F1 submenu key to enter the frequency of Carrier F1 by using the keypad, the arrow keys, or the rotary knob. When entering a frequency by using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key.

3. Repeat for Carrier F2.

4. Press the Intermod Order submenu key so that the desired inter-modulation frequency order to be viewed is underlined. 3rd order is the most commonly chosen measurement.
5. Use the Span setting to set the frequency width in the display. Press the Span submenu key. The numeric value and units turn red ready for editing. Change the span to the desired width and press **Enter**. The preset span of 5 kHz is suitable for typical testing.

Amplitude Setup

6. Press the **Amplitude** main menu key to display the Amplitude menu.
7. Press the Reference Level submenu key. The numeric value and units turn red indicating the settings are ready for editing. Enter the desired reference level using the keypad, the arrow keys, or the rotary knob. Press **Enter**.
8. Press the Scale submenu key to change the division of the graticule to a setting other than the default value of 10 dBm.
9. Press the Auto Range submenu key so that On is underlined. This allows the reference level to be adjusted automatically.
10. Press the Amplitude Tone submenu key to have the handheld instrument broadcast a tone. The frequency of the tone increases as PIM level increases.

Power and Display Setup

11. Press the **Setup** main menu key to display the Setup menu.
12. Press the Output Power submenu key to enter the power level of the RF test signal.
13. Press the Test Duration submenu key. Enter the desired test time (time that the RF signal from the PIM Master is On) by using the keypad, the arrow keys, or the rotary knob. Then press **Enter**. The maximum time is 60 seconds.
14. Press Normal->A to display the current sweep or Max Hold -> to display the cumulative maximum value of each display point from a series of sweeps.
15. Press the Display Type submenu key to select the desired measurement view, Trace or Bar. Refer to Figure 2-5 and Figure 2-6 on page 2-8.

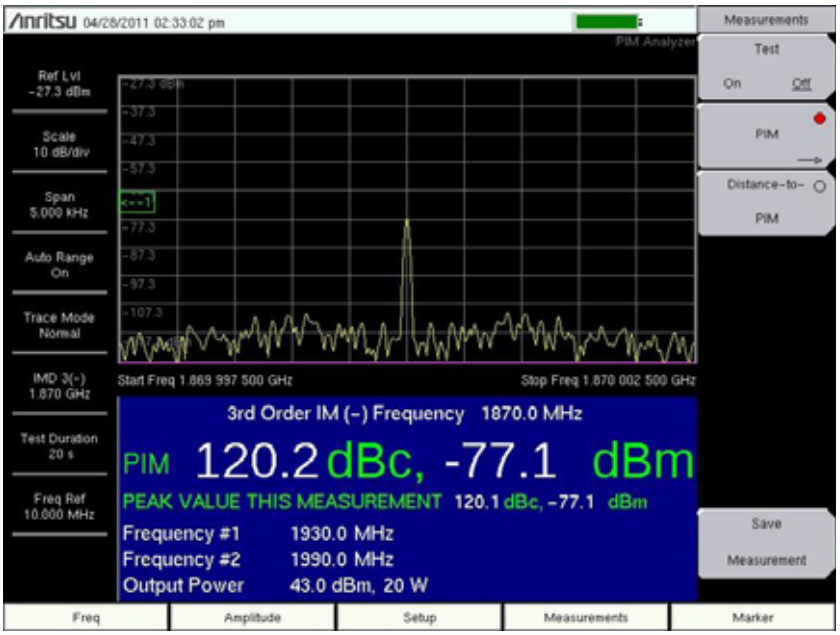


Figure 2-5. Spectral Trace View

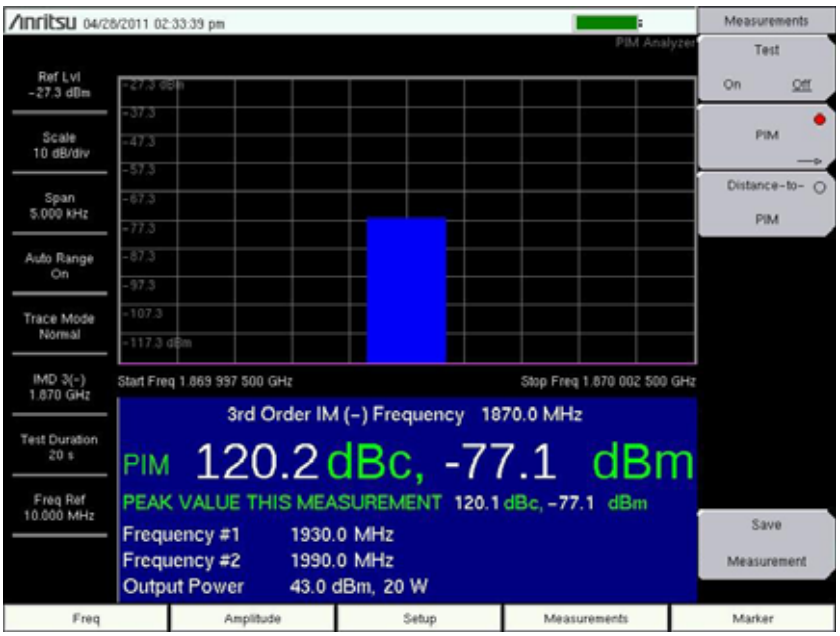


Figure 2-6. Bar Graph View

Parameter Setup Dialog Box

The Parameter Setup submenu (under the Freq main menu or Setup main menu) opens the Frequency Configuration dialog box (Figure 2-7). This dialog box displays the current carrier frequencies, power, and intermodulations. In addition, frequencies for F1 and F2 as well as the carrier power can be changed in this dialog box. Use the arrow keys or the rotary knob to scroll through the 3 settings (F1, F2, and Power). When one of these parameters is highlighted, press the **Enter** key. The chosen value changes color to indicate that the value is ready for editing. After editing the value, you must press the **Enter** key. The highlighted color changes to indicate that the new value has been set. For the power setting, pressing **Enter** for editing opens a drop-down list. Highlight the desired power level and again press the **Enter** key. When all 3 settings are satisfactory, scroll to highlight the Accept button and press the **Enter** key. Instruments with a touch screen must use this same procedure, as indicated in the dialog box for those instruments (refer to Figure 2-8).

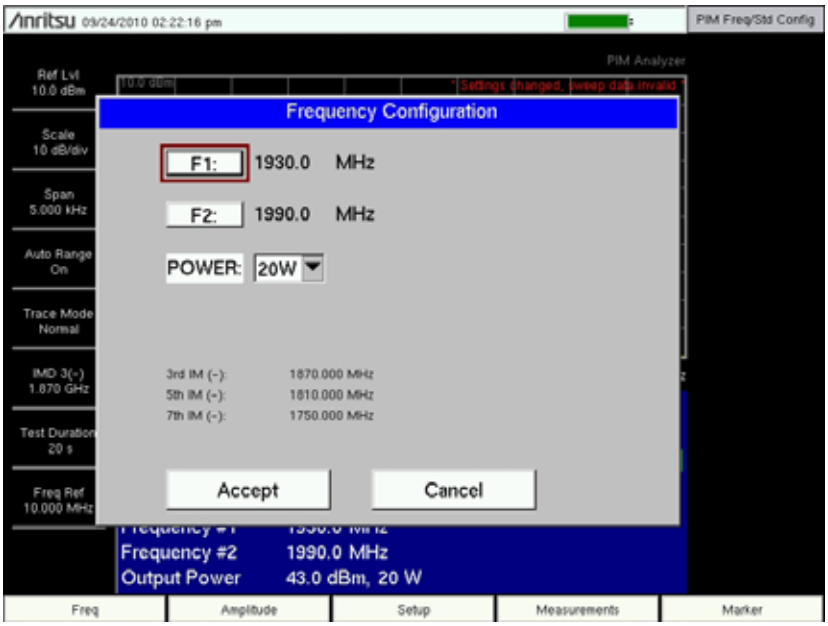


Figure 2-7. Parameter Setup Display

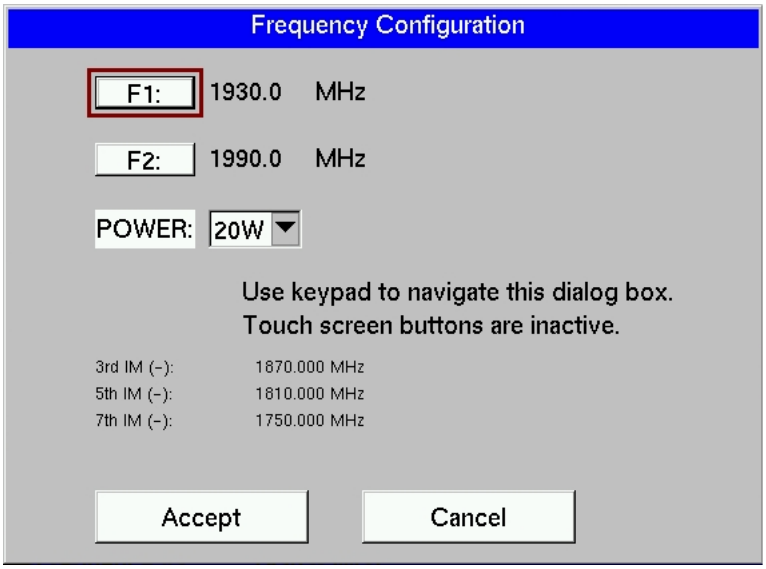


Figure 2-8. Parameter Setup Display for Touch Screen Instruments

2-4 Making the PIM Measurement

1. Press the **Measurements** main menu key. The Measurements menu is displayed.
2. Begin testing by pressing the Test submenu key, On is underlined while the test signal is being transmitted. Two high-power test signals are transmitted from the PIM Master Test Port to the DUT. PIM distortion is returned through the PIM Master to the Anritsu handheld instrument. The results are displayed on screen in either spectrum view or bar graph. The RF-On light on the PIM Master front panel illuminates during the PIM test. Test duration is specified under the **Setup** main menu. You can terminate the test early by pressing the Test submenu key so that Off is underlined.

Note

Attempting to make a PIM measurement when the intermod product is out of the filter range of the instrument causes display of the error message shown in Figure 2-9 and shown larger in Figure 2-10.

Notice the instrument settings summary on the left side of the sweep window. The IMD 5(–) is at 1,810 MHz and is outside of the listed filter ranges.

Either change the frequency values for F1 and F2, or change the IMD order (3rd, 5th, or 7th) under the **Frequency** main menu so that the IM product of F1 and F2 is in the frequency filter bands of the instrument.

Press **Esc** to clear the message.

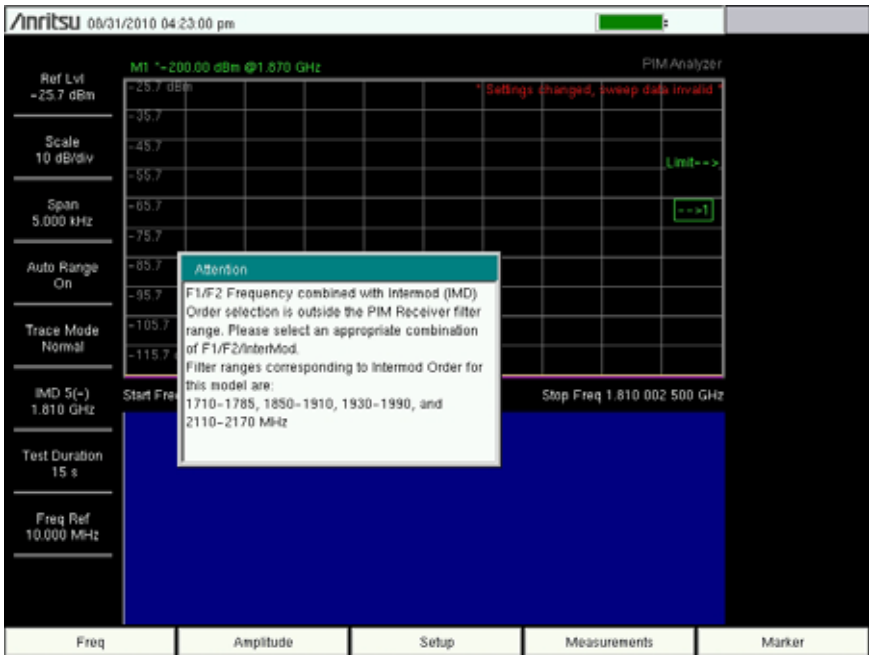


Figure 2-9. display with IM Range Error Attention Message

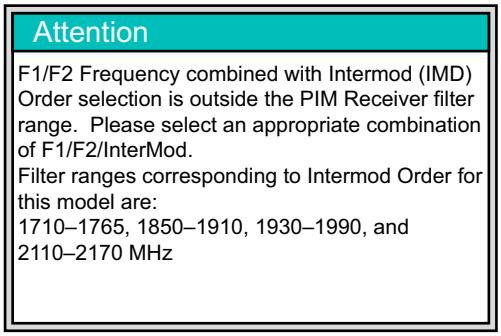


Figure 2-10. Attention Message for IM Range Error

3. Save the current measurement by pressing the Save Measurement submenu key. The Save dialog box opens.
4. Type a name for the measurement to be saved and press **Enter**. Refer to the Anritsu handheld instrument User Guide for additional information.

Measure Noise Floor

Use this submenu key to check for external transmitted signals that may affect the PIM receiver with no PIM RF output enabled. Press the PIM submenu key, then press the Measure Noise Floor submenu key. If an external signal is present, then try changing F1 or F2 carrier frequencies to place the 3rd order product at a frequency that is not affected by off-air signals. Any signal that is present should be investigated.

2-5 Menu Map

Figure 2-11 shows the map of the PIM Analyzer mode menus. The following sections describe main menus and associated submenus. Refer to your instrument Spectrum Analyzer Measurement Guide for additional information on the screen display and Spectrum Analyzer measurements.

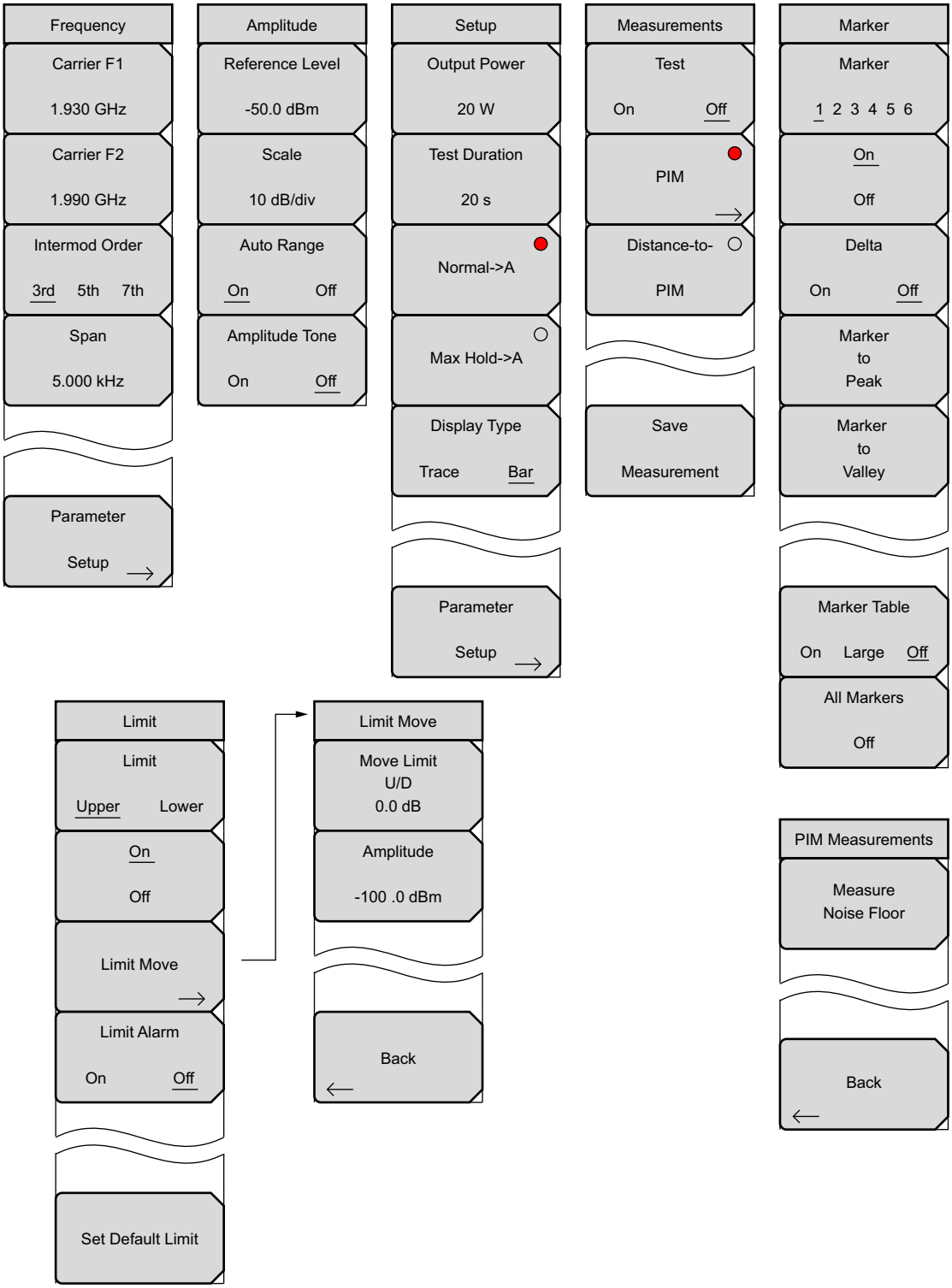
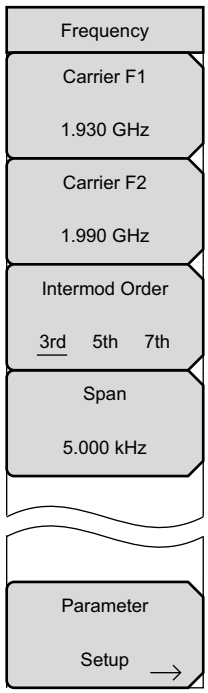


Figure 2-11. PIM Analyzer Menu Map

2-6 Frequency (Freq) Menu

Key Sequence: **Freq**.



Carrier F1: Press the **Freq** main menu key followed by the Carrier F1 submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If the frequency is outside of the range of the PIM Master model, Figure 2-4 on page 2-6 will display. Enter a frequency within the acceptable range by referring to Table 1-1 on page 1-3. Press **ESC** to clear the error message.

Carrier F2: Press the **Freq** main menu key followed by the Carrier F2 submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If the frequency is outside of the range of the PIM Master model, Figure 2-4 on page 2-6 will display. Enter a frequency within the acceptable range by referring to Table 1-1 on page 1-3. Press **ESC** to clear the error message.

Intermod Order: Select the 3rd, 5th or 7th order of intermodulation. The Anritsu handheld will automatically set the center frequency based on the new intermod.

Span: Press the **Freq** main menu key followed by the Span submenu key and enter the desired span. The Span menu is used to set the frequency range over which the instrument will sweep. The span can be set from 1 kHz to 100 kHz. Reducing the span will lower the noise floor of the instrument. The default setting of 5 kHz is recommended for most measurements.

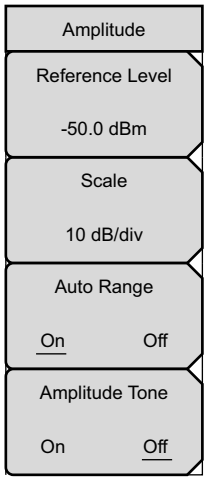
Use the keypad, the directional arrow keys, or the rotary knob to increase or decrease the span frequency. If the span is changed using the arrow keys, the span changes in 1-2-5 steps for each key press.

Parameter Setup: Displays Figure 2-7 on page 2-9. This dialog box allows editing of the current carrier frequencies and carrier power. It also displays the intermodulations of the carrier frequencies.

Figure 2-12. Frequency Menu

2-7 Amplitude Menu

Key Sequence: **Amplitude**



Reference Level: The reference level is the top graticule line on the display, and can be set from +30 dBm to –150 dBm. A value may be entered from the keypad, use the ± key for a minus sign. After entering the value press the dBm submenu 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 click.

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 arrow keys.

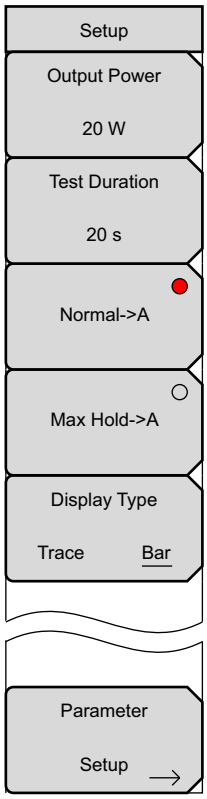
Auto Range: Automatically adjusts the reference level based on the input power and Y-axis scale to display the trace on screen.

Amplitude Tone: Toggles On and Off. The frequency of the tone increases as PIM level increases.

Figure 2-13. Amplitude Menu

2-8 Setup Menu

Key Sequence: **Setup**



Output Power: Press this submenu key to set the output power level for both carrier frequencies F1 and F2. Options are 20 W (43 dBm), 30 W (45 dBm), 40 W (46 dBm).

> **Note:** Power output value from the Test port is twice the set output value. For example, when **Setup** > Output Power is set to 20 W. Total output power is 40 W.
>
> `40 W = 20 W (F1) + 20 W (F2)`

Test Duration: Press this submenu key to set the length of time that the Test Port will deliver power after **Measurements** > Test is pressed. Range for the test is 1 second to 60 seconds.

Normal->A: Press this submenu key to display the current trace sweep, and to repeat the sweep.

Max Hold->A: Press this submenu key to display the maximum value for data points from continuous trace sweeps.

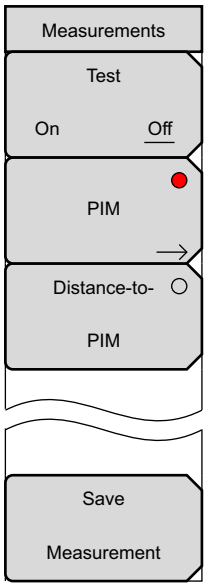
Display Type
Trace Bar: Press this submenu key to toggle the display of the PIM measurement as a trace or a bar graph. Refer to Figure 2-5 on page 2-8.

Parameter Setup: Press this submenu key to display the Frequency Configuration dialog box (Figure 2-7 on page 2-9). This dialog box displays and allows editing of the current carrier frequencies, carrier power, and intermodulations.

Figure 2-14. Setup Menu

2-9 Measurements Menu

Key Sequence: **Measurements**



Test
On Off: Press this submenu key to start a measurement (PIM or DTP). When a measurement is being made, **On** is underlined on this submenu key, and the **RF-ON** light on the PIM Master is **On**. When the measurement time is completed (Setup > Test Duration), **Off** is underlined on this submenu key. When a measurement is being made, press this submenu key to terminate the active measurement early.

PIM: Press this submenu key to set the instrument in the PIM Analyzer measurement mode. After the indicating circle is red, press this key again to open the PIM Measurements menu.

Distance-to-PIM: Press this submenu key to set the instrument in the Distance-to-PIM Analyzer measurement mode. After the indicating circle is red, your instrument is in Distance-to-PIM Analyzer measurement mode.

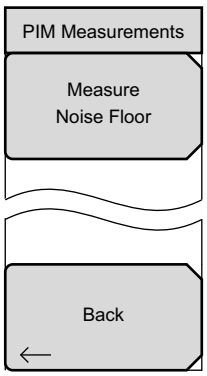
Save Measurement: Press this submenu key to open a dialog box to enter a name and to save the current measurement to file. The file type defaults to measurement, and the appropriate extension is added, based on the current measurement mode.

Figure 2-15. Measurements Menu

If your Anritsu handheld instrument is in the Distance-to-PIM mode, then pressing **PIM** changes the **Freq/Dist** main menu key to **Freq** and displays the Frequency submenu keys accordingly.

2-10 PIM Measurements Menu

Key Sequence: **Measurements** > PIM



Measure Noise Floor: Press this submenu key to measure the received PIM without turning on the PIM Master Test Port. This measurement is used to test PIM interference that may be present beyond the cellular system being tested.

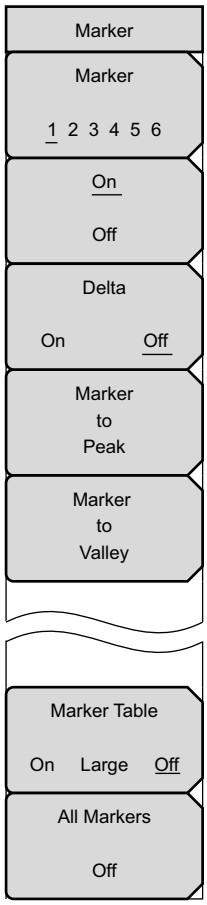
Back: Press the Back submenu key to return to the Measurements menu.

Figure 2-16. PIM Measurements Menu

2-11 Marker Menu

Key Sequence: **Marker**

Press the **Marker** main menu key to open the Marker menu. The instrument is equipped with six markers. Any or all markers can be employed simultaneously.



Marker: Press this submenu key to selects which marker (1, 2, 3, 4, 5, 6) is desired to be active. The underlined marker number is the active marker.

On/Off: Press this submenu key to turn On or Off the selected (underlined) marker in the **Marker** submenu key.

Delta
On Off: Press this submenu key to turn on a delta marker and to prompt for a delta offset frequency, either positive or negative from the frequency of the currently active marker.

Marker to Peak: Press this submenu key to place the currently active marker on the highest signal amplitude that is currently displayed on screen.

Marker to Valley: Press this submenu key to place the currently active marker on the lowest signal amplitude that is currently displayed on screen.

Marker Table
On Large Off: Operation not permitted in PIM Analyzer mode.

All Markers Off: Turns off all displayed markers.

Figure 2-17. Marker Menu

2-12 Sweep Menu

Not applicable in PIM Analyzer mode.

2-13 Measure Menu

Opens the "Measurements Menu" on page 2-18.

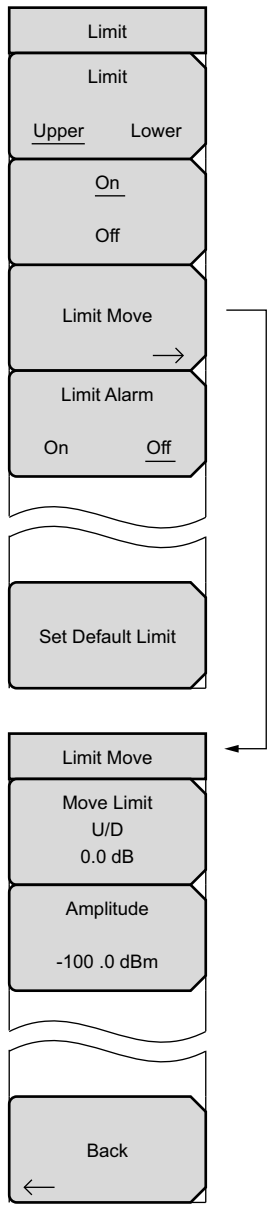
2-14 Trace Menu

Not applicable in PIM Analyzer mode.

2-15 Limit Menu

Key Sequence: **Shift > Limit** (6) key

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 Save-On-Event (from **Shift** (7), for the File menu). a signal that exceeds a limit line can be automatically saved. Refer to your Anritsu handheld instrument User Guide for details.



Limit

Upper Lower: This submenu key selects which limit line (Upper or Lower) will be active for editing. The limit line that is currently selected for editing is underlined.

On/Off: This submenu key turns On or Off the active limit (upper or lower).

Limit Move: Press this submenu key to display the Limit Move Menu.

Limit Alarm

On Off: Pressing this submenu key toggles the alarm function ON and OFF for the Upper limit line. When ON and when the upper limit is exceeded, the measurement text is displayed in red, and an audible alarm sounds. The Limit Alarm does not function with the lower limit line.

Set Default Limit: Pressing this submenu key sets the default limit line value, which is a limit whose position is 2.5 grid lines from the top of the screen (for the upper limit line) or 2.5 grid 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.

Limit Move Menu

Move Limit U/D ## dB: Use this submenu key to move the limit line. Use the keyboard to enter the desired value. 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. The **Up/Down** arrow keys move the limit line by 5% of the screen height. The **Left/Right** arrow keys move the limit line by 0.2% of the screen height, or 0.2 dB when the scale is set to 10 dB/division.

Amplitude: Press this submenu key to move the limit line to a specific dBm value. Use the arrow keys, the rotary knob, or the numeric keypad to set the value.

Back: Press this submenu key to return to the Limit Menu.

Figure 2-18. Limit Menu

2-16 Other Menus

Preset, **File**, **System,** and **Mode** menus are described in your Anritsu handheld instrument User Guide.

Chapter 3 — Distance-to-PIM™ (DTP)

3-1 Introduction – Distance-to-PIM™ (DTP) Analyzer

In addition to PIM testing, Anritsu Company offers the Distance-to-PIM™ (DTP) Analyzer. DTP analysis offers distance information to PIM sources for cellular sites with internal PIM problems and antenna PIM problems. This DTP analysis includes the surrounding outside environment with external PIM problems.

This chapter describes the setup, calibration, and testing procedures for DTP analysis. The Distance-to-PIM™ (DTP) Analyzer firmware resides within the PIM Master, not within the handheld instrument. When the PIM Master is connected to your PIM-supported Anritsu handheld instrument, a software handshake informs the handheld instrument, and the Distance-to-PIM™ (DTP) analyzer features are displayed in the relative menus. The choice between PIM analysis and Distance-to-PIM™ analysis is made in the Measurements menu.

Warning	The Anritsu PIM Master is capable of producing up to 100 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields: Always terminate the output port of the test equipment into a load, a loaded line, or a line that will radiate or absorb the energy before beginning a PIM test. Confirm that the PIM Master RF power is off after a PIM test. Always confirm that the RF power is off before disconnecting a coaxial connection, otherwise RF burns may result. Immediate burns to fingers or eyes can result from exposure to live connectors. RF power can be immediately turned off with the Emergency Stop button (Item 2 in Figure 2-1). Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

3-2 Chapter Overview

This chapter contains the following sections:

- Section 3-3 “Connection Panel Overview” on page 3-2
- Section 3-4 “DTP Measurement” on page 3-2
- Section 3-5 “DTP Measurement Setup” on page 3-4
- Section 3-6 “DTP Testing Calibration” on page 3-6
- Section 3-7 “Making a DTP Measurement” on page 3-8
- Section 3-8 “Menu Map” on page 3-8

Note	Images of measurement results and display screens that are shown in this manual are typical examples. Images on your instrument may differ.

3-3 Connection Panel Overview

Review and follow the connection procedures outlined in Section 1-8 “Connection Diagram” on page 1-6 and Section 2-2 “Connection Panel Overview” on page 2-2.

3-4 DTP Measurement

F1 Carrier Source and Swept F2 Carrier Source

PIM analysis requires two source carrier frequencies (F1 and F2) in order to make a measurement. DTP analysis includes the two carrier frequency sources for the measurement, but only one of the sources is swept. In the DTP measurement setup, F1 Frequency is the stationary source. F2 is the second source and will be swept from the F2 Start Frequency to the F2 Stop Frequency. The default frequencies have been selected to optimize the distance resolution. Changing these frequencies will lower measurement resolution.

Dmax and Data Points

Dmax is the maximum horizontal distance that can be analyzed. The distance range between the Start Distance and the Stop Distance setting cannot exceed Dmax. If the cable is longer than Dmax, then Dmax needs to be improved by increasing the number of data points or by lowering the frequency span (ΔF). Note that the data points can be set to either 64 points or 128 points. For best results, Data Points should always be set to the maximum number of steps available, given the F2 swept bandwidth. You can choose 64 data points if measurement speed is critical.

DTP Parameter Settings

When the DTP Parameters setup window is displayed, the DTP Aid menu is also displayed. The **Up** and **Left** arrow keys move the selection highlight up in the window. The **Down** and **Right** arrow keys move the selection highlight down in the window. The rotary knob moves the selection highlight in both directions. The bottom selection is the Continue button.

When any parameter is highlighted, keying in a value and pressing the **Enter** key or a menu key completes the setting, and the selection highlight is incremented downward in the list. You can also press the **Esc** key to abort these settings and return to the Freq/Dist menu or the Sweep/Setup menu, depending upon your starting point.

When numeric values are highlighted, the numeric keypad must be used to enter a value. An additional menu is displayed for distance, frequency, propagation velocity, or cable loss ((dB/ft or (dB/m). Press the appropriate units submenu key or press the **Enter** key to set the value. The selection highlight is incremented to the next lower parameter in the DTP Parameters setup window.

Additional selection menus are displayed when the following parameter buttons are highlighted in the DTP Parameters window:

- Preset State > "Preset State Menu" on page 3-18
- Data Points > "Resolution Menu" on page 3-18
- Cable > "Cable Menu" on page 3-19
- Output Power > "Output Power Menu" on page 3-19

The last item in the DTP Parameters setup window is the Continue button. Select this button and press the **Enter** key to close the DTP Parameters setup window and continue with your measurement. The menu display returns to either the Freq/Dist menu or the Sweep/Setup menu, depending upon your starting point.

Note	F1 and F2 carrier frequencies can also be set in the Freq/Dist menu. Cable Loss, Propagation Velocity, and Cable specifications can also be set in the DTP Setup menu. Output Power can also be set in the Sweep/Setup menu.

3-5 DTP Measurement Setup

The main menu keys and submenu keys for Distance-to-PIM™ analysis differ from the PIM Analyzer menus as described in Chapter 2, "PIM Analyzer". For a description of the key functions in the Distance-to-PIM™ menus, refer to section "Menu Map" on page 3-8.

Note	Anritsu handheld instruments with a touch screen offer additional options for some features. You can touch a submenu key or a screen feature (such as the button for the Preset State entry in the DTP Parameters window shown in Figure 3-1).

1. Press the **Measurements** main menu key to display the Measurements menu.
2. Press the Distance-to-PIM submenu key.
3. Press the **Freq/Dist** main menu key.
4. Press the DTP Aid submenu key to set up the DTP measurement parameters. The DTP Parameters setup window is displayed, and the DTP Aid menu is displayed.

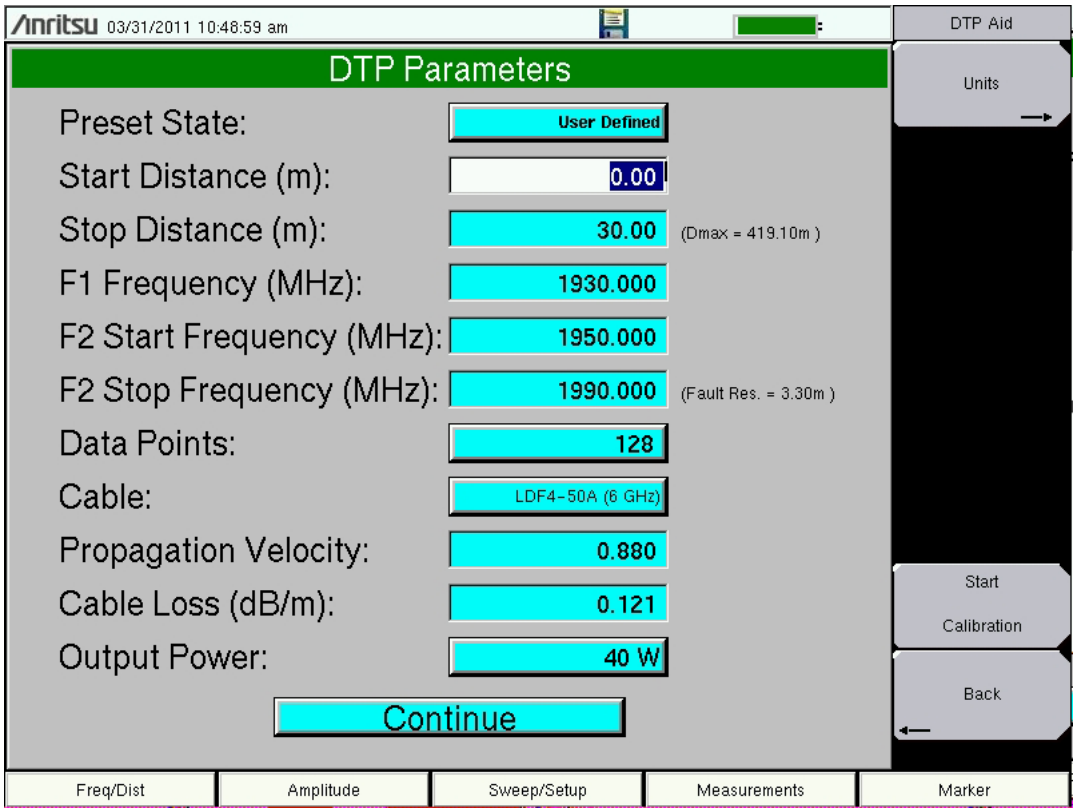


Figure 3-1. DTP Parameters Window

5. In the DTP Parameters window, highlighting the Preset State button displays the Preset State menu. Press the Preset State List submenu key (or touch the Preset State button on the screen) to open a list box. Select from the list of preset states (with differing frequencies and output powers). The Preset State that is shown in Figure 3-1 is set to User Defined. When this touch-screen button or the Preset State List submenu key is pressed, the Select DTP Preset State list box is displayed on screen. Use an arrow key or the rotary knob to highlight a selection, and then press the **Enter** key. The menu display returns to the DTP Aid menu. Refer to Appendix C, "Preset State Definitions" for a list of the available preset states.
6. From the DTP Aid menu, press the Units submenu key to display the Units submenu. Press the Meters or Feet submenu key to select the desired units to be used in the measurement. The menu display returns to the DTP Aid menu.
7. Highlight one of the distance setting buttons. Use the numeric keypad to set the Start and Stop distances. The Units menu is displayed with a submenu key for either meters or feet, depending upon the units setting (from the DTP Aid menu Units key).

   The Stop Distance needs to be smaller than Dmax. Dmax is the maximum horizontal distance that can be analyzed. The Stop Distance cannot exceed Dmax. If the cable is longer than Dmax, then Dmax needs to be improved by increasing the number of data points or by lowering the frequency span (ΔF).

   Note that the number of data points can be set to either 64 points or 128 points. The number of data points should always be set to the maximum amount of steps available, with respect to the F2 swept bandwidth. When the start and stop distances have been set, the menu display returns to the DTP Aid menu.
8. Highlight (or touch) the Data Points button to open the Resolution menu. Select the number of data points that best fits the measurement: 64 points or 128 points.
9. Enter a value for F1 Stationary Frequency (MHz).
10. Enter the F2 Swept Frequency (F2 Start Frequency and F2 Stop Frequency).

Note	Carrier frequencies F1 and F2 must be separated by a minimum of 20 MHz for the MW8219A and by a minimum of 10 MHz for the MW8209A and the MW8208A. For example: F2 Start – 20 MHz must be greater than or equal to F1 (MW8219A) F2 Start – 10 MHz must be greater than or equal to F1 (MW8209A)

11. Highlight (or touch) the Cable button to display the available cable specifications. Use the Standard List submenu keys along with the rotary knob to navigate to the desired cable specification, and then press **Enter** (or press the **Esc** key to abort without selecting a cable).

Note	When a cable is selected from this list, propagation velocity and cable loss are automatically set by the instrument.

12. If the Cable selection is "None", then, for the cable in use, enter an applicable Propagation Velocity and enter an applicable Cable Loss value in dB/ft or dB/m.

13. Highlight (or touch) the Output Power button to open the Select PIM Output Power list box. Select an appropriate power level and press **Enter**.
14. Press the Continue button and, if the Anritsu handheld instrument is calibrated, then continue with Step 15. Otherwise, follow the calibration instructions in Section 3-6 "DTP Testing Calibration" on page 3-6, and then return to this procedure (before connecting the device under test (DUT) to the PIM Master) and continue with Step 15.

Note	The DTP Analyzer includes several menus with buttons for setting up measurement parameters. All of these parameter settings are also available in one convenient location in the DTP Parameters window, which is opened by pressing the DTP Aid submenu key.

15. Press the More submenu key to open the DTP Setup menu.
16. Press the Window submenu key to open the Windowing menu. Select the desired windowing format by pressing one of the four submenu keys – Rectangular, Nominal Side Lobe, Low Side Lobe, and Minimum Side Lobe. Refer to Appendix B, "Windowing".
17. Press the **Measurements** main menu key. Then press the Test submenu key to begin your measurement.

    If you need to terminate the measurement before the allotted Test Duration time is complete, then you can press the Test submenu key to turn off the measurement. Also, RF power can be immediately turned off with the Emergency Stop button on the PIM Master (Item 2 in Figure 2-1 on page 2-2).

3-6 DTP Testing Calibration

The calibration that is used for a DTP measurement is a normalized calibration using a –80 dBm PIM standard. At this point, the following procedure is the only required step in the calibration process. After the –80 dBm PIM standard (refer to Table 1-4 on page 1-10) has been attached and measured, the Anritsu handheld instrument is considered calibrated.

1. Attach the –80 dBm PIM Standard and a Low PIM Termination to the TEST PORT of the PIM Master.
2. Press the **Freq/Dist** menu button.
3. Press the DTP Aid submenu key.
4. Initiate the normalization process by pressing the Start Calibration submenu key. An Attention dialog box is displayed to confirm that the PIM Standard and low PIM termination are connected. Press **Enter** to calibrate. The test instrument calibration is run. After the calibration is completed, you are ready to connect the device under test (DUT) to the PIM Master.

Post-Calibration Measurement

A good practice is performing a DTP measurement after the calibration in order to verify that measurements appear normal after the calibration. Figure 3-2 represents a typical Distance-to-PIM post-calibration measurement.

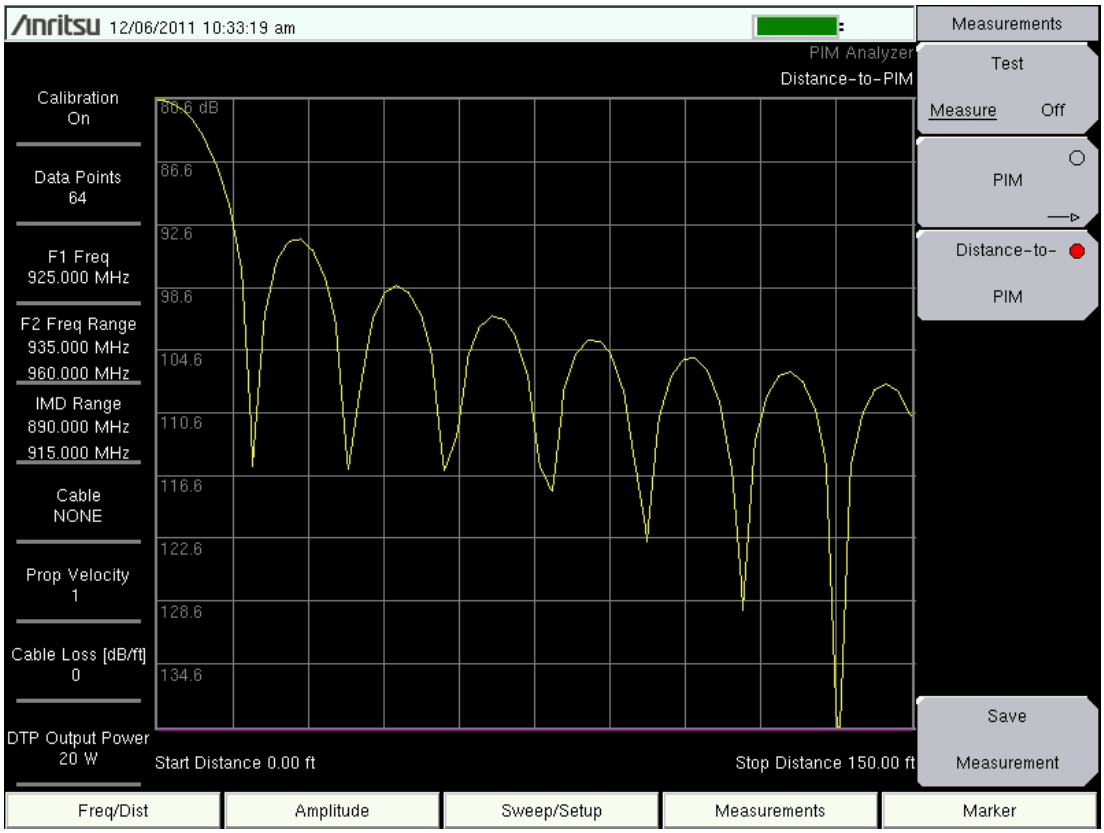


Figure 3-2. Typical DTP Measurement After a Calibration

3-7 Making a DTP Measurement

1. Connect the DUT to the TEST PORT of the PIM Master.
2. Press the **Measurements** main menu key to display the Measurements menu.
3. Press the Test submenu key so that On is underlined. **Testing begins.**
4. Save the current measurement by pressing the Save Measurement submenu key. The Save Measurement dialog box opens.
5. Type a name for the measurement to be saved and press **Enter**. Refer to your Anritsu handheld instrument User Guide for additional information about file handling.

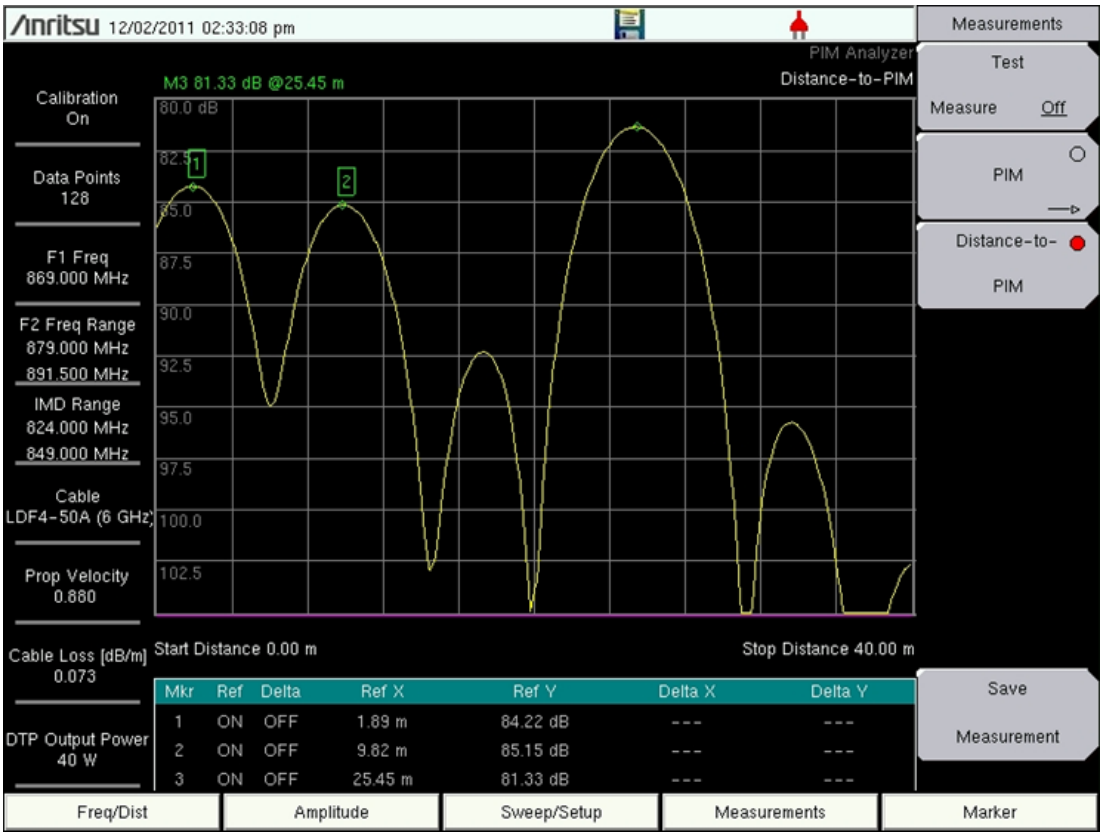


Figure 3-3. DTP Measurement Example

The example DTP measurement that is shown in Figure 3-3 displays three faults along the DUT. With the aid of Markers, the exact location and amplitude is displayed in the Marker Table.

3-8 Menu Map

Figure 3-4 shows a map of the Distance-to-PIM Analyzer mode menus. The sections that follow the menu map describe main menus and associated submenus. Refer to your instrument Spectrum Analyzer Measurement Guide for additional information on the screen display and Spectrum Analyzer measurements.

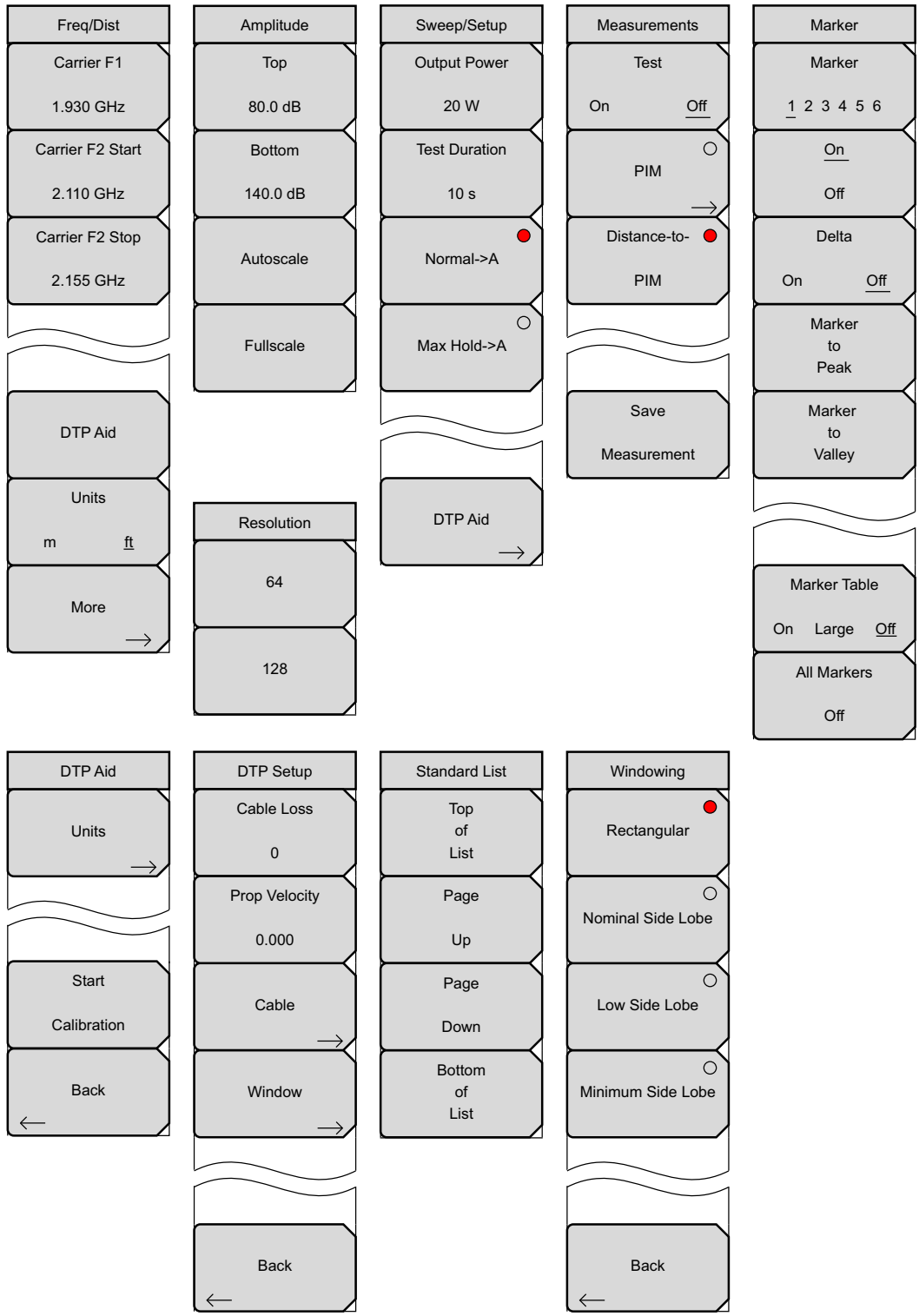
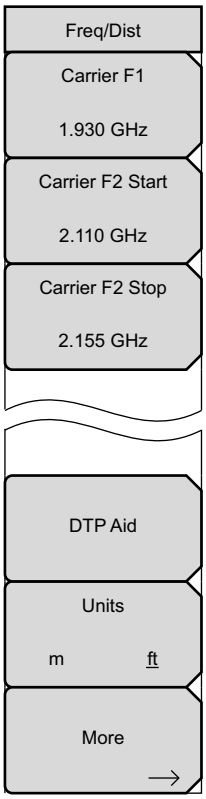


Figure 3-4. DTP Analyzer Menu Map

3-9 Freq/Dist Menu

Key Sequence: **Freq/Dist**.



Carrier F1: Press the **Freq/Dist** main menu key followed by the Carrier F1 submenu key and enter the desired frequency using the keypad, the arrow keys, or the rotary knob. If the frequency is outside of the range of the PIM Master model, Figure 2-4 on page 2-6 will display. Enter a frequency within the acceptable range by referring to Table 1-1 on page 1-3. Press **ESC** to clear the error message.

Carrier F2 Start: Press this submenu key to set the start frequency of the swept carrier source.

Carrier F2 Stop: Press this submenu key to set the stop frequency of the swept carrier source.

DTP Aid: Press this submenu key to open the DTP Parameters window and the DTP Aid submenu to set up the test parameters for DTP testing.

Units: Press this submenu key to toggle the units setting between meters and feet. The selection is underlined.

More: Press this submenu key to open the DTP Setup menu.

Figure 3-5. Freq/Dist Menu

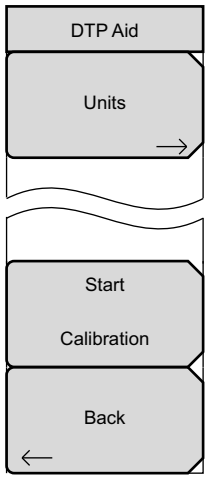
Carrier F1 and Carrier F2 settings can also be initiated by highlighting their values in the DTP Parameters window. Refer to Figure 3-1 on page 3-4.

3-10 DTP Aid Menu

Key Sequence: **Freq/Dist** > DTP Aid

or

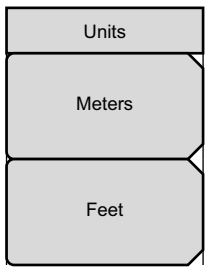
Key Sequence: **Sweep/Setup** > DTP Aid



Units: Press this submenu key to display the Units menu.

Start Calibration: Press this submenu key to initiate the calibration process. The calibration that is used for a DTP measurement is a normalized calibration using a –80 dBm PIM standard.

Back: Press this submenu key to return to the previous menu (Freq/Dist or Sweep/Setup).



Units Menu

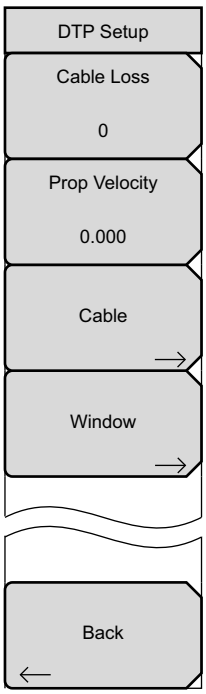
Meters: Press this submenu key to set the units to meters.

Feet: Press this submenu key to set the units to feet.

Figure 3-6. DTP Aid Menu

3-11 DTP Setup Menu

Key Sequence: **Freq/Dist** > More



Cable Loss: Press this submenu key to enter the loss in dB/ft or dB/m for the selected cable by using the keypad, the arrow keys, or the rotary knob, and then press **Enter**.

Prop Velocity: Press this submenu key to enter the applicable propagation velocity for the selected cable by using the keypad, the arrow keys, or the rotary knob, and then press **Enter**.

Cable: Press this submenu key to open a list of available cable specifications (refer to Figure 2-10). Using the arrow keys, the rotary knob, or the touch screen, select the desired cable and then press **Enter**.

If a cable is selected from this list, then the cable loss and propagation velocity are set automatically, and you do not need to set those values with the other submenu keys.

Window: Press this submenu key to open the Windowing menu. The options are: Rectangular, Nominal Side Lobe, Low Side Lobe, and Minimum Side Lobe. Refer to Appendix B for more information about windowing.

Back: Press this submenu key to return to the Freq/Dist menu.

Figure 3-7. DTP Setup Menu

Settings for Cable Loss, Propagation Velocity, and the Cable list box can also be initiated by highlighting their values in the DTP Parameters window. Refer to Figure 3-1 on page 3-4.

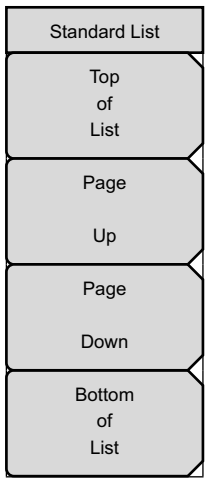
3-12 Standard List Menu

Key Sequence: **Freq/Dist** > More > Cable

or

Highlight Cable in the DTP Parameters window.

The Cable List Box and the Standard List menu are displayed simultaneously



Top of List: Press this submenu key to highlight the cable at the top of the list.

Page Up: Press this submenu key to scroll upward by one page (within the cable list) from the currently highlighted cable.

Page Down: Press this submenu key to scroll downward by one page (within the cable list) from the currently highlighted cable.

Bottom of List: Press this submenu key to highlight the cable at the bottom of the list.

Select a Cable in the list box and then press the **Enter** key use that cable loss and propagation velocity in your measurement. Press the **Esc** key to return to the Freq/Dist menu without making a selection.

Figure 3-8. Standard List Menu

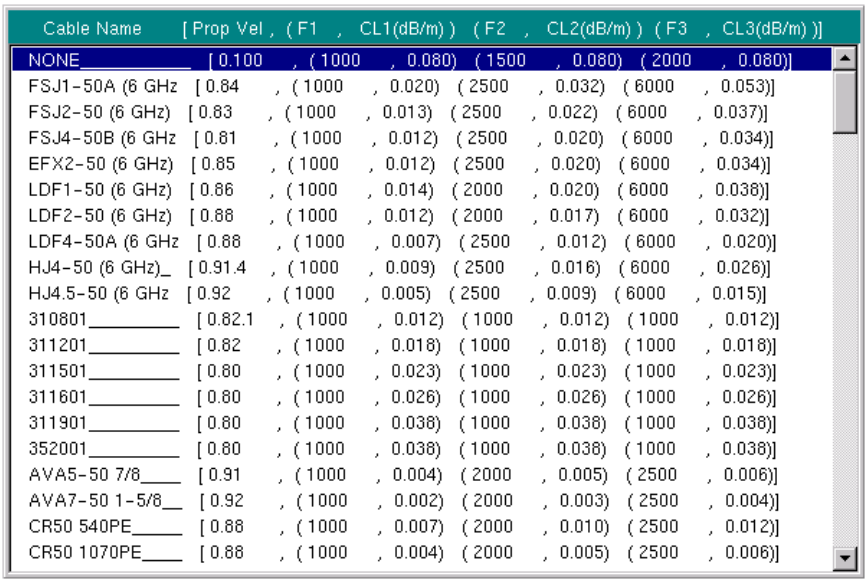
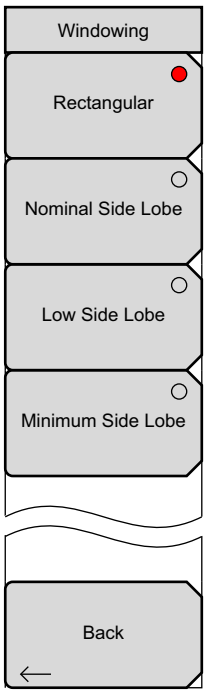


Figure 3-9. Cable List Box, Table of Specifications

3-13 Windowing Menu

For a description of these windowing features, refer to Appendix B, "Windowing".

Key Sequence: **Freq/Dist** > More > Window



Rectangular: Press this submenu key to select Rectangular windowing.

Nominal Side Lobe: Press this submenu key to select Nominal Side Lobe windowing.

Low Side Lobe: Press this submenu key to select Low Side Lobe windowing.

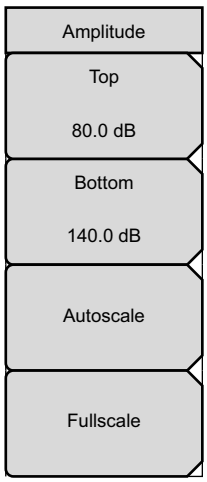
Minimum Side Lobe: Press this submenu key to select Minimum Side Lobe windowing.

Back: Press this submenu key to return to the DTP Setup menu.

Figure 3-10. DTP Windowing Menu

3-14 DTP Amplitude Menu

Key Sequence: **Amplitude**



Top: Press this submenu key to set the top amplitude value.

Bottom: Press this submenu key to set the bottom amplitude value.

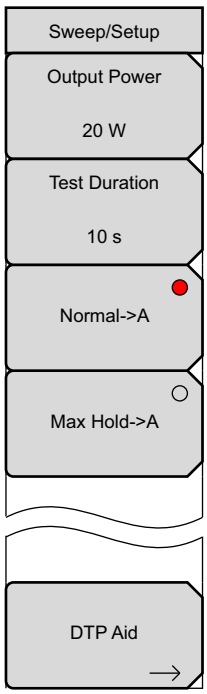
Autoscale: Press this submenu key to adjust the Top and Bottom amplitude values so that the trace is shown in the middle of the display.

Fullscale: Press this submenu key to automatically set the scale to the default setting (0 dB to 60 dB for Return Loss and 1 dB to 65 dB for VSWR).

Figure 3-11. DTP Amplitude Menu

3-15 Sweep/Setup Menu

Key Sequence: **Sweep/Setup**



Output Power: Press this submenu key to set the output power level for both carrier frequencies, F1 and F2. Options are 20 W (43 dBm), 30 W (45 dBm), 40 W (46 dBm).

> **Note:** Power output value from the Test port is twice the set output value. For example, when **Setup** > Output Power is set to 20 W, total output power is 40 W.
>
> `20 W (F1) + 20 W (F2) = 40 W`

Test Duration: Press this submenu key to set the length of time that the Test Port will deliver power after **Measurements** > Test is pressed. Range for the test is 1 second to 60 seconds. Use the arrow keys, the rotary knob, or the numeric keypad. If you use the numeric keypad, then the Units menu of the Test Duration menu is displayed.

Normal->A: Press this submenu key to display the current trace sweep, and to repeat the sweep.

Max Hold->A: Press this submenu key to display the maximum value for data points from continuous trace sweeps.

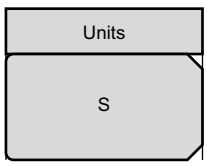
DTP Aid: Press this submenu key to display the DTP Parameters window (Figure 3-1 on page 3-4) and the DTP Aid menu.

Figure 3-12. DTP Sweep/Setup Menu

The Output Power setting can also be initiated by highlighting its value in the DTP Parameters window. Refer to Figure 3-1 on page 3-4.

3-16 Units Menu

This menu is displayed when the Test Duration submenu key is pressed followed by the use of the numeric keypad to enter a number of seconds for the desired test duration. The Test Duration submenu key is in the Sweep/Setup menu.

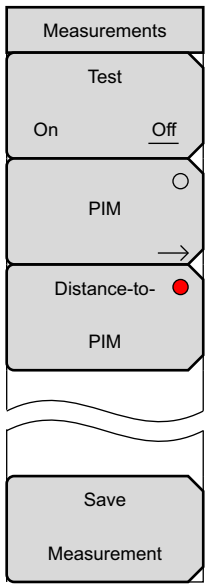


S: Press this submenu key after keying in a test duration (in seconds) with the numeric keypad. Pressing the **Enter** key also sets the value in seconds.

Figure 3-13. DTP Test Duration (Units) Menu

3-17 Measurements Menu

Key Sequence: **Measurements**



Test

On Off: Press this submenu key to start a measurement (PIM or DTP). When a measurement is being made, **On** is underlined on this submenu key, and the **RF-ON** light on the PIM Master is **On**. When the measurement time is completed (Setup > Test Duration), **Off** is underlined on this submenu key. When a measurement is being made, press this submenu key to terminate the active measurement early.

PIM: Press this submenu key to set the instrument in the PIM Analyzer measurement mode. After the indicating circle is red, press this key again to open the PIM Measurements menu.

Distance-to-PIM: Press this submenu key to set the instrument in the Distance-to-PIM Analyzer measurement mode. After the indicating circle is red, your instrument is in Distance-to-PIM Analyzer measurement mode.

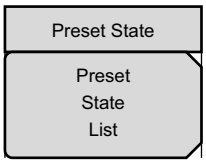
Save Measurement: Press this submenu key to open a dialog box to enter a name and to save the current measurement to file. The file type defaults to measurement, and the appropriate extension is added, based on the current measurement mode.

Figure 3-14. DTP Measurements Menu

If your Anritsu handheld instrument is in the PIM mode, then pressing **Distance-to-PIM** changes the **Frequency** main menu key to **Freq/Dist** and displays the Freq/Dist submenu keys accordingly.

3-18 Preset State Menu

This menu is displayed when the Preset State button is highlighted in the DTP Parameters window (Figure 3-1 on page 3-4).



Preset State List: Press this submenu key to open the Select DTP Preset State list box and select one of the following:

MW8208A:

A – User Defined: Allows you to choose all parameters for DTP.

B – US Cellular 850 20W

C – US Cellular 850 40W

MW8209A:

A – User Defined: Allows you to choose all parameters for DTP.

B – E-GSM 900 20W

C – E-GSM 900 40W

MW8219A:

A – User Defined: Allows you to choose all parameters for DTP.

B – PCS 1900 20W

C – PCS 1900 40W

D – PCS/AWS 1900/2100 20W

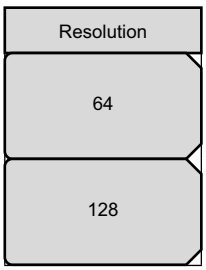
E – PCS/AWS 1900/2100 40W

Figure 3-15. DTP Preset State Menu

The Select DTP Preset State list box is shown in Figure C-1. A complete list of the parameters for each preset state is described in Appendix C, "Preset State Definitions".

3-19 Resolution Menu

This menu is displayed when the Data Points button is highlighted in the DTP Parameters window (Figure 3-1 on page 3-4).



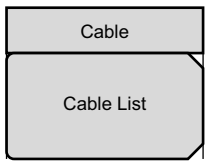
64: Press this submenu key to set the resolution to 64 data points

128: Press this submenu key to set the resolution to 128 data points

Figure 3-16. DTP Resolution Menu

3-20 Cable Menu

This menu is displayed when the Cable button is highlighted in the DTP Parameters window (Figure 3-1 on page 3-4).

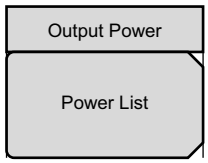


Cable List: Press this submenu key to display the Cable list box (refer to Figure 3-9 on page 3-13). Highlight a cable type in the list box and then press the **Enter** key to use those cable specifications for your measurement.

Figure 3-17. DTP Cable Menu

3-21 Output Power Menu

This menu is displayed when the Output Power button is highlighted in the DTP Parameters window (Figure 3-1 on page 3-4).



Power List: Press this submenu key to display a drop-down list of the available power settings. Use the arrow keys or the rotary knob to scroll to (and highlight) the desired power setting. Then press the **Enter** key.

Figure 3-18. DTP Output Power Menu

Chapter 4 — Programming Commands

Warning	The Anritsu PIM Master is capable of producing up to 100 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields: Always terminate the output port of the test equipment into a load, a loaded line or a line that will radiate or absorb the energy before beginning a PIM test. Confirm that the PIM Master RF power is off after a PIM test. Always confirm that the RF power is off before disconnecting a coaxial connection, otherwise RF burns may result. Immediate burns to fingers or eyes can result from exposure to live connectors. RF power can be immediately turned off with the Emergency Stop button (Figure 2-1). Ensure all antenna's under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

4-1 SCPI Commands

Please refer to your instrument programming manual for the use of SCPI commands.

The set of commands in this chapter are used to prepare the PIM Master hardware for the selected measurements. These commands activate a specified measurement and set the instrument to a wait-for-sweep mode, waiting for an `:INITiate` command to begin a measurement. Ensure that your handheld Controller is in the desired testing Mode before sending SCPI commands.

Example:

A typical command set for the PIM Master would include:

`[SENSe]:PIManalyzer:FREQuency:F1 1930000000` (Sets F1 to 1930 MHz)

`[SENSe]:PIManalyzer:FREQuency:F2 1990000000` (Sets F2 to 1990 MHz)

`[SENSe]:PIManalyzer:AUTorange 1` (Sets Amplitude to Auto Range)

`[SENSe]:PIManalyzer:IMD:ORDer 3` (Sets center frequency of Rx to IM3)

`[SENSe]:PIManalyzer:OUTPut:POWer 2` (Sets power to 20 Watts)

`[SENSe]:PIManalyzer:TEST:DURation 10` (Sets the POWER ON time)

`CONFigure:PIManalyzer:SETup` (Sends configuration to the `PIM Master`)

`INITiate:PIManalyzer:MEASure PIM` (Starts PIM measurement)

`SENSe:PIManalyzer:MODe PIM|DTP` (Sets mode to PIM or DTP)

`SENSe:PIManalyzer:MODe?` (Responds with mode type PIM or DTP)

4-2 Chapter Overview

Refer to the following sections in this chapter for details of the PIM Master commands:

- ":CALCulate Subsystem" on page 4-3
- ":CALibration Subsystem" on page 4-6
- ":CONFigure Subsystem" on page 4-6
- ":INITiate Subsystem" on page 4-7
- ":SENSe Subsystem" on page 4-8

4-3 Remote Access Password Protection

The purpose of this feature is to prevent unauthorized access to the handheld instrument when the instrument is connected to a network, especially when connected to the Internet. When a password has been set, unauthorized remote access is prevented. In addition, only one user can be connected at any one time.

Many Anritsu handheld instruments can accept a Remote Access Password. If a password has been set, then your remote access requires the password. Refer to your instrument user guide and programming manual for a description of this feature and for instructions to use it.

This function is valid only with Master Software Tools (MST) v2.21.1 or later. The password is first set into the instrument, then used in MST. Your MST pasword must match that in the instrument.

When prompted in MST, enter the password into the password text box. Upper case and lower case letters and the symbols - _ + . are the allowed password characters. For security, you must reboot the handheld instrument after setting the password. Turn power OFF then On. The password can be removed or reset by a Master Reset (**System** + **On**), by a Factory Default reset (**Esc** + **On**), or by a firmware update (which includes a restart).

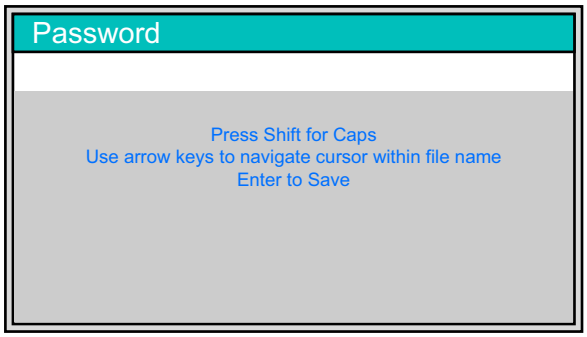


Figure 4-1. Remote Access Password Text Box

4-4 :CALCulate Subsystem

The commands in this subsystem process data that has been collected via the SENSe subsystem.

:CALCulate:DTPMeas:CABLoss
:CALCulate:DTPMeas:CABLoss?

Title: DTP cable loss

Description: Sets and queries DTP cable loss in dB/current distance unit.

Parameter: cable_loss_value

Default Value: None – Returns error

Example: To set the cable loss to 0.1 dB/ft:

```
:CALCulate:DTPMeas:CABLoss 0.1
```

Front Panel Access: **Freq/Dist**, More, Cable Loss

:CALCulate:DTPMeas:DISPlay:RESOlution
:CALCulate:DTPMeas:DISPlay:RESOlution?

Title: DTP data points

Description: Sets and queries DTP data points.

Parameter: 64, 128

Default Value: None – Returns error

Example: To set the data point to 64:

```
:CALCulate:DTPMeas:DISPlay:RESOlution 64
```

Front Panel Access: **Freq/Dist**, DTP Aid, Data Points

:CALCulate:DTPMeas:DMAX?

Title: DTP maximum measurable distance

Description: Queries DTP maximum maeasurable distance in current distance unit.

Parameter: None

Default Value: None – Returns error

Front Panel Access: **Freq/Dist**, DTP Aid, Dmax

:CALCulate:DTPMeas:FRESolution?

Title: DTP fault resolution

Description: Queries DTP fault resolution in current distance unit.

Parameter: None

Default Value: None – Returns error

Front Panel Access: **Freq/Dist**, DTP Aid, Fault Res

:CALCulate:DTPMeas:PVELocity
:CALCulate:DTPMeas:PVELocity?

Title: DTP cable propagation velocity index

Description: Sets and queries DTP cable propagation velocity index.

Parameter: 0.1 to 1.0

Default Value: None – Returns error

Example: To set the cable propagation velocity index to 0.75:

```
:CALCulate:DTPMeas:PVELocity 0.75
```

Front Panel Access: **Freq/Dist**, DTP Aid, Prop Velocity

:CALCulate:DTPMeas:STARt|STOP
:CALCulate:DTPMeas:STARt|STOP?

Title: DTP distance setup

Description: Sets and queries DTP distance start and stop. Parameters are `m` for meters and `ft` for feet.

Parameter: `distance_value` m|ft

Default Value: Values in meters

Example: To set the DTP start distance to 10 feet:

```
:CALCulate:DTPMeas:STARt 10 ft
```

Front Panel Access: **Freq/Dist**, DTP Aid, Start/Stop Distance

:CALCulate:DTPMeas:WINDow
:CALCulate:DTPMeas:WINDow?

Title: DTP Windowing

Description: Sets and queries the type of windowing in order of increasing side lobe reduction. Windowing settings are: rectangular, nominal side lobe, low side lobe, and minimum side lobe.

Parameter: `RECTangular` = Rectangular Windowing

`NSLobe` = Nominal Side Lobe Windowing

`LSLobe` = Low Side Lobe Windowing

`MSLobe` = Minimum Side Lobe Windowing

Default Value: None – Returns error

Example: To set the Nominal Side Lobe Windowing:

```
:CALCulate:DTPMeas:WINDow NSLobe
```

Front Panel Access: **Freq/Dist**, More, Window

:CALCulate:DTPMeas:UNIT
:CALCulate:DTPMeas:UNIT?

Title: DTP distance unit

Description: Sets and queries DTP distance unit. Parameters are `m` for meters and `ft` for feet.

Parameter: `m` = meter

`ft` = feet

Default Value: None – Returns error

Example: To set the unit to meter:

```
:CALCulate:DTPMeas:UNIT m
```

Front Panel Access: **Freq/Dist**, Units

4-5 :CALibration Subsystem

The commands in this subsystem control the system calibration.

:CALibration:DTPMeas:STATe
:CALibration:DTPMeas:STATe?

Title: Calibration State

Description: Starts calibration and reports its state. The calibration that is used for a DTP measurement is a normalized calibration using a –80 dBm PIM standard

Parameter: `0` = invalidate the current calibration

`1` = perform calibration

Example: To initiate calibration:

```
:CALibration:DTPMeas:STATe 1
```

Front Panel Access: **Freq/Dist**, DTP Aid, Start Calibration

4-6 :CONFigure Subsystem

The commands in this subsystem prepare the instrument for the selected measurement. They disable any currently-enabled measurements and activate the specified measurement. They set the instrument to single sweep mode, waiting for an `:INITiate` command. They do not initiate the taking of a measurement.

Current instrument settings may be changed to default values. These changes are identified with their respective measurement commands.

:CONFigure:PIManalyzer:SETup

Title: Configure PIM Master Hardware for Measurement

Description: Creates and sends a defined configuration to the PIM Master based on the previously set SCPI command configuration parameters.

Note	This command must be sent after any SCPI command that changes a PIM Master related measurement parameter. This command is required to update the PIM Master configuration for a PIM measurement, but NOT for a Distance-to-PIM™ (DTP) measurement.

4-7 :INITiate Subsystem

The commands in this subsystem control the triggering of measurements.

:INITiate:PIManalyzer:MEASure NOISe|PIM

Title: Trigger PIM Analyzer Measurement

Description: PIM triggers the sweep of the measurement receiver unit and turns on the RF PIM Analyzer unit so the measurement receiver can measure inter modulation distortion generated from the PIM Master and the system under test. The measurement will continue until the defined test duration time has elapsed. This command is NOT a prerequisite for Distance-to-PIM™ (DTP) measurements.

NOISe triggers the sweep of the measurement receiver unit but does not turn on the PIM Master Test Port. The measurement will continue until the defined test duration time has elapsed.

Sending either the NOISe or PIM command during an active measurement will cancel the measurement.

Parameter: NOISe or PIM

Front Panel Access (NOISe): **Measurements**, PIM, Measure Noise Floor

Front Panel Access (PIM): **Measurements**, Test (On underlined)

4-8 :SENSe Subsystem

The commands in this subsystem relate to device-specific parameters, not signal-oriented parameters.

:[SENSe:]:DTPMeas:AVERage:TYPE
:[SENSe:]:DTPMeas:AVERage:TYPE?

Title: DTP Trace Mode

Description: Sets and queries DTP trace mode

Parameter: `NONE` = normal

`MAXimum` = max trace hold

Default Value: None – Returns error

Example: To set DTP trace mode to normal:

```
:SENSe:DTPMeas:AVERage:TYPE NONE
```

Front Panel Access: **Sweep/Setup**, Normal -> A / Max Hold -> A

:[SENSe:]:DTPMeas:DISPlay:TOP|BOTTom
:[SENSe:]:DTPMeas:DISPlay:TOP?|BOTTom?

Title: DTP Display Top and Bottom

Description: Sets and queries DTP display magnitude

Parameter: top/bottom magnitude

Default Value: None – Returns error

Example: To set the DTP display top to 10 dB:

```
:SENSe:DTPMeas:DISPlay:TOP 10.0
```

Front Panel Access: **Amplitude**, Top/Bottom

:[SENSe:]:DTPMeas:FREQuency:BANd
:[SENSe:]:DTPMeas:FREQuency:BANd?

Title: DTP Preset State

Description: Sets and queries current DTP preset state. This sets up various parameters to some predetermined values.

Parameter:

Parameter	Description	PIM Master
PCS_20W	PCS band with 20 watts output power	MW8219A
PCS_40W	PCS band with 40 watts output power	MW8219A
PCS_AWS_20W	PCS/AWS band with 20 watts output power	MW8219A
PCS_AWS_40W	PCS/AWS band with 40 watts output power	MW8219A
E_GSM_900_20W	E-GSM band with 20 watts output power	MW8209A
E_GSM_900_40W	E-GSM band with 40 watts output power	MW8209A
US_CELL_850_20W	US Cellular band with 20 watts output power	MW8208A
US_CELL_850_40W	US Cellular band with 40 watts output power	MW8208A

Default Value: None – Returns error

Example: To set the preset state to PCS_20W:

```
:SENSe:DTPMeas:FREQuency:BANd PCS_20W
```

Front Panel Access: **Freq/Dist**, DTP Aid, Preset State

:[SENSe:]:DTPMeas:FREQuency:F1|F2:STARt|F2:STOP
:[SENSe:]:DTPMeas:FREQuency:F1|F2:STARt|F2:STOP?

Title: PIM Master Frequency Setup

Description: Sets the PIM Master LO frequencies, calculates the IMx Order frequency, and sets the Anritsu handheld instrument for the corresponding IMx frequency.

Parameter: MW8208A:

869 MHz to 894 MHz

MW8209A:

925 MHz to 960 MHz

MW8219A:

1930 MHz to 1990 MHz

2110 MHz to 2155 MHz

(Frequency ranges are valid ranges. Frequency input in Hz.)

Default Unit: Hz

Range: PIM Master Model

MW8208A:

869 MHz to 894 MHz

MW8209A:

925 MHz to 960 MHz

MW8219A:

1930 MHz to 1990 MHz

2110 MHz to 2155 MHz

Example: To set the PIM Test frequency F2 for 1990 MHz:

```
:SENSe:DTPMeas:FREQuency:F2 1990000000
```

Sets the measurement receiver center frequency to the 5th order IMD.

Front Panel Access: **Freq**, Carrier F1|Carrier F2

:[SENSe:]:DTPMeas:MEASure
:[SENSe:]:DTPMeas:MEASure?

Title: DTP Measurement

Description: Sets and queries DTP measurement

Parameter: 0 = Stop measurement

1 = Start measurement

Default Value: None – Returns error

Example: To start DTP measurement:

```
:SENSe:DTPMeas:MEASure 1
```

Front Panel Access: **Measurements**, Test

:[SENSe:]:DTPMeas:OUTput:POWer
:[SENSe:]:DTPMeas:OUTput:POWer?

Title: DTP Output Power

Description: Sets the deliverable output from the PIM Analyzer to the system under test.

Parameter: 0 = 40 Watts

1 = 30 Watts

2 = 20 Watts

Default Value: None – Returns error

Range: 0, 1, or 2

Example: To set the PIM Output Power:

```
:SENSe:DTPMeas:OUTput:POWer 0
```

Sets the DTP output to 40 Watts.

Front Panel Access: **Setup**, Output Power

:[SENSe:]:DTPMeas:TEST:DURation
:[SENSe:]:DTPMeas:TEST:DURation?

Title: DTP Test Duration

Description: Sets and queries DTP measurement time duration.

Parameter: Time in second

Default Value: None – Returns error

Example: To set DTP measurement to 60 seconds:

```
:SENSe:DTPMeas:TEST:DURation 60
```

Front Panel Access: **Measurements**, Test

:[SENSe:]PIManalyzer:AUTorange OFF|ON|0|1
:[SENSe:]PIManalyzer:AUTorange?

Title: Auto Range Setup

Description: Sets the Anritsu handheld instrument to auto range the amplitude of the PIM signal received from the PIM Master. There is an initial 1 second measurement of the PIM power so the Anritsu handheld instrument can adjust reference level and span appropriately. This is followed by the actual measurement at the pre described test duration. The query part of the command returns the value of the current Auto Range setup.

Default Value: 0

Range: 0|Off, Auto Ranging is OFF
1|ON, Auto Ranging is ON

Example: To set the Anritsu handheld instrument for Auto range:

```
:SENSe:PIManalyzer:AUTorange 1
```

Front Panel Access: **Amplitude**, Auto Range

:[SENSe:]PIManalyzer:FREQuency:F1|F2
:[SENSe:]PIManalyzer:FREQuency:F1|F2?

Title: PIM Master Frequency Setup

Description: Sets the PIM Master LO frequencies, calculates the IMx Order frequency and sets the Anritsu handheld instrument for the corresponding IMx frequency.

Parameter: MW8208A:

869 MHz to 894 MHz

MW8209A:

925 MHz to 960 MHz

MW8219A:

1930 MHz to 1990 MHz

2110 MHz to 2155 MHz

(Frequency ranges are valid ranges. Frequency input in Hz.)

Default Unit: Hz

Range: PIM Master Model

MW8208A:

869 MHz to 894 MHz

MW8209A:

925 MHz to 960 MHz

MW8219A:

1930 MHz to 1990 MHz

2110 MHz to 2155 MHz

Example: To set the PIM Test frequency F2 for 1990 MHz:

```
:SENSe:PIManalyzer:FREQuency:F2 1990000000
```

Front Panel Access: **Freq**, Carrier F1 | Carrier F2

:[SENSe:]PIManalyzer:IMD:ORDer
:[SENSe:]PIManalyzer:IMD:ORDer?

Title: Measurement Receiver / PIM Master Inter-Modulation Distortion (IMD) Order Setup

Description: Sets the measurement receiver center frequency to receive one of the following IMDs from the PIM Master measurement system: 3/5/7. The query command returns the possible strings “3rd”, “5th” and “7th” depending on the current selection of IMD Order.

Default Value: 3

Range: 3, 5 and 7 are the only acceptable values.

Example: To set the measurement receiver for the 5th order IMD:

```
:SENSe:PIManalyzer:IMD:ORDer 5
```

Sets the measurement receiver center frequency to the 5th order IMD.

Front Panel Access: **Freq**, Intermod Order

:[SENSe:]PIManalyzer:MEASure:STATus?

Title: Measurement Receiver/ PIM Master Current Measurement Status

Description: The query returns the current measurement status of the measurement receiver/PIM Analyzer measurement system. Since the measurement system can run for 60 seconds, the query serves to indicate if the measurement is still in process.

Range: 0, Measurement is OFF
1, Measurement is ON

:[SENSe:]PIManalyzer:MEASure:VALue?

Title: Measurement Receiver Measured Value From PIM Master Measurement Setup

Description: The query returns an inter modulation measured value in both dBc and dBm.

Parameter: <amplitude>

Default Unit: dBc/dBm

Front Panel Access: N/A. Inter modulation distortion value is displayed in the lower measurement box as “PIM =”.

:[SENSe:]PIManalyzer:MODe
:[SENSe:]PIManalyzer:MODe?

Title: PIM Analyzer Mode, Set or Request

Description: Puts the system into either PIM measurement mode or Distance-to-PIM™ measurement mode. The query reports the current system mode.

Parameter: None

Query Response: `PIM` or `DTP`

Default Value: None

Example: To set the PIM Analyzer mode to measure Distance-to-PIM™:

```
:SENSe:PIManalyzer:MODe DTP
```

To query the state of the PIM Analyzer system:

```
:SENSe:PIManalyzer:MODe?
```

Front Panel Access: **Measurements**, PIM
Measurements, Distance-to-PIM

:[SENSe:]PIManalyzer:OUTput:POWer
:[SENSe:]PIManalyzer:OUTput:POWer?

Title: PIM Analyzer Output Power

Description: Sets the deliverable output from the PIM Analyzer to the system under test.

Parameter: 0 = 40 Watts

1 = 30 Watts

2 = 20 Watts

Default Value: 2 (20 Watts)

Range: 0, 1 or 2

Example: To set the PIM Output Power:

```
:SENSe:PIManalyzer:OUTput:POWer 0
```

Sets the PIM output to 40 Watts.

Front Panel Access: **Setup**, Output Power

:[SENSe:]PIManalyzer:TESt:DURation
:[SENSe:]PIManalyzer:TESt:DURation?

Title: PIM Test Measurement Test Duration

Description: Sets the amount of time in seconds the PIM Master will be on for intermodulation distortion measurements.

Parameter: <time>

Default Value: 20

Default Unit: Seconds

Range: 1.0 to 60.0 seconds

Example: To set the test duration time to 5 seconds:

```
:SENSe:PIManalyzer:TESt:DURation 5.0
```

Front Panel Access: **Setup**, Test Duration

Appendix A — Instrument Messages and Errors

A-1 Spectrum Analyzer Messages

External Reference Messages

Attempting to lock to External Reference

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

External Reference Locked Successfully

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

External Reference not found. Internal Reference Locked successfully

This message is displayed when the instrument has detected an external reference but couldn't lock to the reference. It automatically switches to the Internal Reference.

Failures (Errors) Messages

Lock Failure xx

When there is a lock failure detected from any of the internal LOs, this message is displayed. The xx is usually an error code in hex that can be interpreted by a service center to obtain more information on which LO had the failure.

Warning Messages

ADC over range

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

Out of band saturation

When the software detects that there is too much power outside the current frequency range, this message is displayed. This usually means that the instrument is currently tuned to a frequency with a very low amplitude signal or no signal and there is a strong signal at another frequency outside the current IF bandwidth.

Weak Signal: Increase input power

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

A-2 PIM Analyzer Messages

External Reference Messages

PIM External Reference Error

The Anritsu handheld instrument can not lock onto the reference signal from the PIM Master and switches to its own internal frequency reference.

Failures (Errors) Messages

48V PIM Power Supply Fail

This power supply failure will cause signal dropout with no PIM measurement capability.

Warning Messages

PIM Master EMERGENCY STOP Button Pressed

PIM front panel EMERGENCY STOP button has been pressed. This will turn off the PIM RF and cancel the measurement on the HHSPA side. Measurement results may be invalid.

PIM AMP(S) Exceeding Normal Temperature Range

The PIM Master internal amplifiers have exceeded their normal temperature range.

PIM UNIT Exceeding Normal Temperature Range

The entire PIM Master unit is beyond the normal temperature range and degradation in measurement or signal dropout can occur.

48V PIM Power Supply Voltage Out of Range

The amplifier power supply is out of range and degradation in measurement or signal dropout can occur.

PIM Reference LO Lock Error

Reference LO unable to lock. Measurement results may be invalid.

PIM RF On Max Time Reached. RF Has Been Turned Off.

If the PIM Master has exceeded an On Time greater than allowed (~68 seconds), then the unit will automatically turn RF Off. Possible communication failure between Anritsu handheld instrument and PIM unit. Disregard current measurement results and power cycle both units.

PIM EEPROM Error

Can not access on-board EEPROM. Measurement results may be invalid.

Appendix B — Windowing

B-1 Introduction

The theoretical requirement for inverse FFT is for the data to extend from zero frequency to infinity. Side lobes appear around a discontinuity because the spectrum is cut off at a finite frequency. Windowing reduces the side lobes by smoothing out the sharp transitions at the beginning and at the end of the frequency sweep. As the side lobes are reduced, the main lobe widens, thereby reducing the resolution.

In situations where a small discontinuity may be close to a large one, side lobe reduction windowing should be used. When distance resolution is critical, Rectangular windowing should be used.

B-2 Distance-to-PIM Windowing Examples

The types of windowing in order of increasing side lobe reduction are: **rectangular**, **nominal side lobe**, **low side lobe**, and **minimum side lobe**. Figure B-1 through Figure B-4 show examples of these types of windowing.

Rectangular Windowing

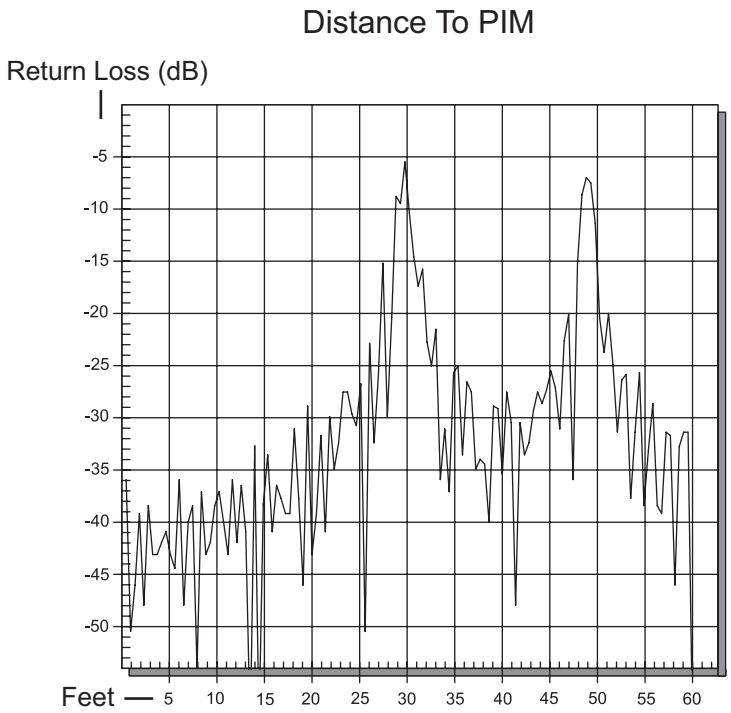


Figure B-1. Rectangular Windowing

Nominal Side Lobe Windowing

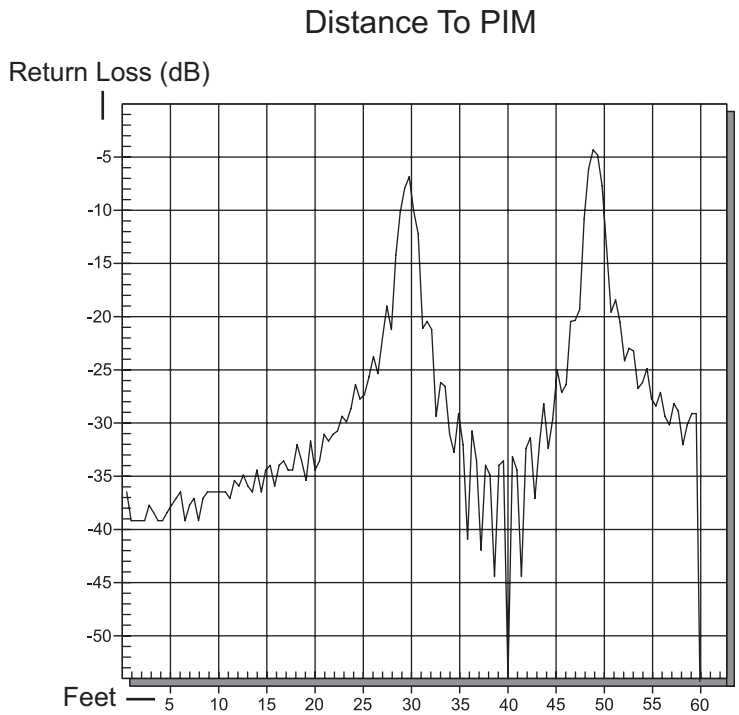


Figure B-2. Nominal Side Lobe Windowing

Low Side Lobe Windowing

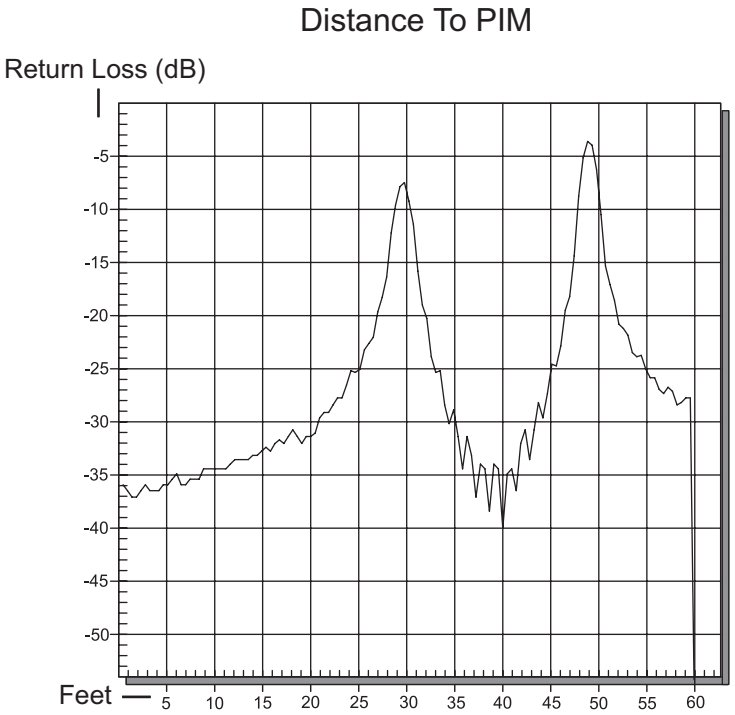


Figure B-3. Low Side Lobe Windowing

Minimum Side Lobe Windowing

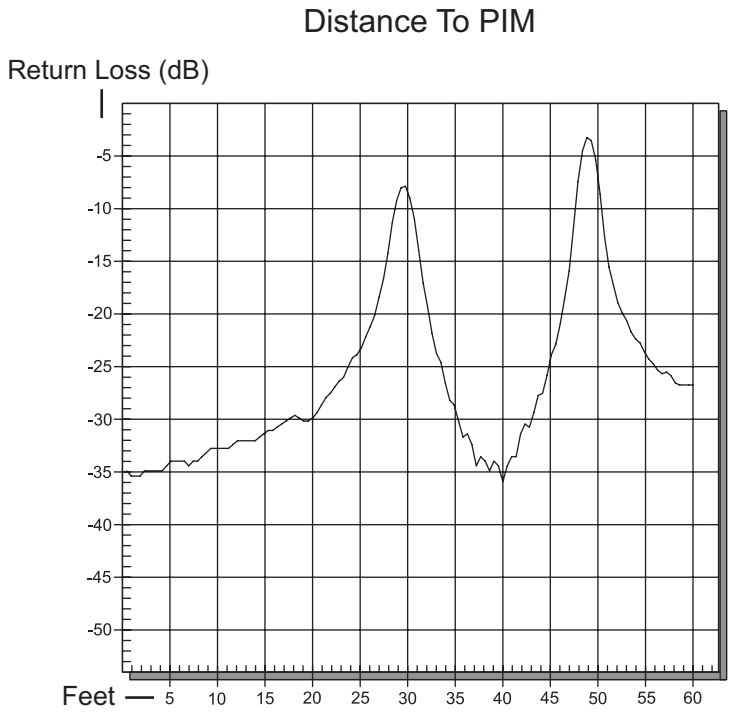


Figure B-4. Minimum Side Lobe Windowing

Appendix C — Preset State Definitions

C-1 Introduction

Preset state definitions are provided for convenience. The Select DTP Preset State list box is displayed by pressing the Preset State parameter button in the DTP Parameters window (refer to Figure 3-1 on page 3-4). Frequencies in the Select DTP Preset State list box change for different PIM Master models.

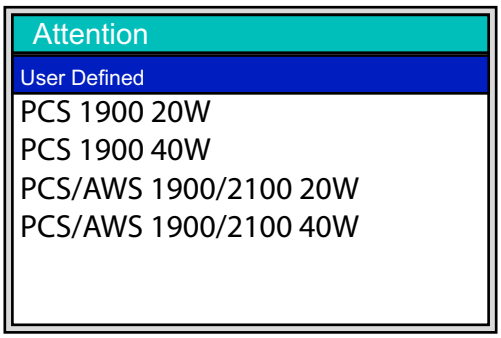


Figure C-1. Example Select DTP Preset State List Box

C-2 State – User-Defined

This state is user-defined. It allows you to choose all parameters for DTP.

Note	Data Points (64 points or 128 points) should always be set to the maximum amount of steps available. You can choose 64 data points if measurement speed is critical.

C-3 Preset States

Table C-1. MW8219A DTP Preset States

Parameter	PCS 1900 20W	PCS 1900 40W	PCS/AWS 1900/2100 20W	PCS/AWS 1900/2100 40W
Start Distance	0	0	0	0
Stop Distance	50	50	50	50
F1 Frequency	1930	1930	1930	1930
F2 Start Frequency	1950	1950	2110	2110
F2 Stop Frequency	1990	1990	2155	2155
Data Points	128	128	128	128
Cable	None	None	None	None
Propagation Velocity	1	1	1	1
Cable Loss	0	0	0	0
Output Power	20	40	20	40

Table C-2. MW8209A DTP Preset States

Parameter	E-GSM 900 20W	E-GSM 900 40W
Start Distance	0	0
Stop Distance	50	50
F1 Frequency	925	925
F2 Start Frequency	935	935
F2 Stop Frequency	960	960
Data Points	128	128
Cable	None	None
Propagation Velocity	1	1
Cable Loss	0	0
Output Power	20	40

Table C-3. MW8208A DTP Preset States

Parameter	US Cellular 850 20W	US Cellular 850 40W
Start Distance	0	0
Stop Distance	50	50
F1 Frequency	869	869
F2 Start Frequency	879	879
F2 Stop Frequency	891.5	891.5
Data Points	128	128
Cable	None	None
Propagation Velocity	1	1
Cable Loss	0	0
Output Power	20	40

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Anritsu prints on recycled paper with vegetable soybean oil ink.

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