

User and Measurement Guide with SCPI Programming

PIM Master™

Passive Intermodulation Analyzer

MW82119A

Anritsu

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DECLARATION OF CONFORMITY

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: MW82119A – 0700/0800/0850/0900/0180/0190/0192/0193/0210/0260

conforms to the requirement of:

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

Electromagnetic Compatibility: EN61326-1:2006

Emissions: EN55011:2009 +A1:2010 Group 1 Class A

Immunity:	EN 61000-4-2:2009	4 kV CD, 8 kV AD
	EN 61000-4-3:2006 +A2:2010	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: 2009	3 V
	EN 61000-4-11: 2004	100% @ 20 ms

Electrical Safety Requirement:

Product Safety: EN 61010-1:2010

Morgan Hill, CA


Eric McLean, Corporate Quality Director

18 DEC 2013
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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For Chinese Customers Only YL(NM)YB

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印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
LCD	×	○	×	×	○	○
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4/2011

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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 risk from a very dangerous condition or procedure that could result in serious injury or death and possible loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Warning



This indicates a risk from a hazardous condition or procedure that could result in light-to-severe injury or loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Caution



This indicates a risk from a hazardous procedure that could result in loss related to equipment malfunction. Follow all precautions and procedures to minimize this risk.

Safety Symbols Used on Equipment and in Manuals

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



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



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



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



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



These indicate that the marked part should be recycled.

For Safety

Warning



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

Warning



or



When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Warning

WARNING 

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

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.

Warning



This product is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container. Follow the environmental storage requirements specified in the product technical data sheet.

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Chapter 1 — General Information

1-1 Introduction

This chapter provides a description of the Anritsu PIM Master, its available options and accessories, a description of Passive Intermodulation (PIM) and how it is tested, and the reasons for testing PIM.

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.

Scope of the PIM Master User Guide

This User Guide describes the operation of the PIM Master battery operated PIM Analyzer for performing PIM versus Time, Noise Floor, Distance-to-PIM (DTP), and Swept PIM measurements.

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.

Note

Throughout this user guide, screen images are provided as examples. The image and measurement details on your instrument may differ from the examples in this user guide.

1-2 Contacting Anritsu

To contact Anritsu, please visit:

<http://www.anritsu.com/contact.asp>

Here, you can find sales, customer service, and support contact information for your country or region, provide online feedback, complete a “Talk to Anritsu” form to have your questions answered, or obtain other services offered by Anritsu.

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

<http://www.anritsu.com/>

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

Example URL for MW82119A:

<http://www.anritsu.com/en-us/products-solutions/products/MW82119A.aspx>

1-3 Anritsu Service Centers

For the latest service and sales information in your area, please visit the following URL:

<http://www.anritsu.com/contact.asp>

and choose a country for regional contact information.

1-4 Additional Documentation

Refer to the PIM Master Product Brochure (part number: 11410-00679) for specifications and options data. Refer to [Appendix A](#) for other related documents.

The PIM Master



Figure 1-1. MW82119A PIM Master Showing a DTP Measurement

1-5 PIM Master Options

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

Table 1-1. PIM Master Options

Instrument Option	Description
MW82119A-0700	LTE 700 MHz (Lower and Upper)
MW82119A-0702	APT 700 MHz
MW82119A-0800	LTE 800 MHz
MW82119A-0850	Cellular 850 MHz
MW82119A-0900	E-GSM 900 MHz
MW82119A-0180	DCS 1800 MHz
MW82119A-0193	PCS/AWS 1900/2100 MHz
MW82119A-0210	UMTS 2100 MHz
MW82119A-0260	LTE 2600 MHz
MW82119A-0031	GPS Receiver (requires antenna)
MW82119A-0019	High Accuracy Power Meter (requires external power sensor)
MW82119A-0098	Standard Calibration Certification
MW82119A-0099	Premium Calibration Certification

Note For ordering information and for option and accessory part numbers, refer to the product brochure and technical data sheet (listed in [Appendix A](#)).

1-6 PIM Master Performance Specifications

Refer to the Brochure / Technical Data Sheet (listed in [Appendix A](#)) for general specifications, detailed measurement specifications for all available measurements and measurement modes, ordering information, powers sensors, and available accessories. The product brochure is available on the Anritsu Web site:

<http://www.anritsu.com/en-us/products-solutions/products/MW82119A.aspx>

Calibration Requirements

Field calibrate your PIM Master daily, or as required by your company standards. Anritsu recommends annual factory calibration and performance verification by local Anritsu service centers.

1-7 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.
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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 PIM Master. 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.

1-8 Anritsu Line Sweep Tools (LST)

Anritsu Line Sweep Tools is a PC software program that is used for report generation and post-task analysis. A PC equipped with LST can download measurement data directly from the instruments or from a USB memory device (if you saved measurements on, or transferred them to, a USB memory device). A complete suite of computer software applications (including LST) are available for download:

<http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx>

1-9 Wireless Remote Control of PIM Analyzer

Browser based control allows you to remotely control the PIM Master from any Wi-Fi enabled device with web browser software. This includes a wide range of tablets and phones running Android or iOS operating systems as well as the traditional Linux and Windows laptop and desktop computers.

Wi-Fi links are useful in the field, particularly when the PIM Master is on a tower, and you are on the ground.

For wireless remote control, a Wi-Fi router must be connected to the PIM Master.

Refer to [Appendix C, “Wireless Remote Control”](#) for more details on using this capability to enable wireless control.

1-10 PIM Master Firmware Update

Refer to [Section F-5 “PIM Master Firmware Update”](#) on page F-6 for firmware upgrade procedures.

1-11 PIM Master Option Update

Refer to [Section F-6 “Adding Options with a License File”](#) on page F-9 for instructions to purchase and enable an option.

1-12 Standard and Optional Accessories

The Anritsu PIM Master warranty is described in [Section “WARRANTY”](#) on page TG-3. The standard and optional accessories are listed in the Product Brochure and Technical Data Sheet (part number 11410-00679). The brochure is available on the Anritsu web site:

<http://www.anritsu.com/en-us/products-solutions/products/MW82119A.aspx>

1-13 What is PIM?

PIM is a form of intermodulation distortion that occurs in passive components normally thought of as linear, such as filters, combiners, surge protectors, cables, connectors, and antennas. When subject to the high RF powers found in cellular systems, however, these devices can generate spurious signals.

Passive Intermodulation (PIM) shows up as a set of unwanted signals created by the mixing of two or more strong RF signals in a non-linear device, such as in a loose or corroded connector, or in nearby rust. Other names for PIM include the “diode effect” and the “rusty bolt effect”.

Many symptoms could be indicators of PIM problems, which include the following:

- Receiver desensitization (raised noise floor)
- Rx Diversity alarms
- Spectral regrowth in the transmitter mask
- Excessive dropped or blocked calls, or both
- Reduced data rates
- Cell site coverage shrinking
- Complaints of interference from neighboring cell site owners

PIM signals in the cell receive band can raise the receive noise floor, increase the bit error rate, and shrink the reception area for cellular communications. PIM can come from junctions; from improperly tightened, damaged, or corroded connectors; from filters, combiners, and surge protectors; and from damaged antennas. Other sources include rusty components, such as mounts and bolts or nearby metal structures.

Power in dBm and dBc

A measurement reading in dBm is absolute power. A measurement value with units of dBc is relative power.

For example, if you set TX₁ and TX₂ to 43 dBm and get a measurement result of -120 dBm (the measurement result as absolute power), this represents a relative power of -163 dBc. The calculation is as follows:

$$-120 \text{ dBm} - 43 \text{ dBm} = -163 \text{ dBc}$$

[measured power in dBm] minus [transmitted power in dBm]
equals [relative power in dBc]

The term relative power, in this example, is referring to the original output power setting of 43 dBm. When stated in units of dBc, the received PIM power is relative to (is being compared to) the transmitted power level of one test tone. The difference between the transmitted power (in dBm) and the measured PIM power (in dBm) is the relative power, which is then expressed in units of dBc.

Note	The use of dBc units is not applicable to Noise Floor measurements, because the transmitters are not On during this measurement.
-------------	--

1-14 Why Test for PIM?

Anritsu has developed the PIM Master to verify and troubleshoot Passive Intermodulation (PIM). The PIM Master generates two high-power tones, usually in the transmit band of interest. It displays and measures the third-order, fifth-order, or seventh-order intermodulation products returning from the DUT to the PIM Master. (The third, fifth, and seventh-order intermodulation products can be measured only if they fall into the range of the receive band.) Using Distance-to-PIM technology, the PIM Master can identify the location of PIM sources both inside the antenna system and beyond.

PIM testing provides a measurement of the overall linearity of the antenna system and the surrounding environment. A formula for determining third order intermodulation (IM3) frequencies is provided in section [“Intermodulation Distortion”](#) on page 1-10.

When more carriers are added to a site and transmit power is increased, the impact of PIM on site performance becomes more severe. A low-traffic may not exhibit the same performance problems as a busy site.

Line Sweeping and PIM testing

Line Sweep testing and PIM testing are very different tests. Both are very important and accurate measures of the ability of the cell site to provide service and to perform optimally.

PIM testing measurements indicate the overall linearity of an antenna feed line, the antenna, and the area illuminated by the transmitted signal. The Line Sweep measurements indicate the overall impedance matching of all of the components in an antenna feed line. Both tests need to be performed in order to ensure the overall quality on a site.

PIM testing requires both low system loss and good return loss (VSWR) to achieve an accurate measurement. If PIM testing is performed prior to line sweep testing, then you may not be aware of the impedance characteristics of the transmission line. High insertion loss attenuates the PIM test signals, which prevents full test power from reaching the specific components that require stringent PIM testing. Poor return loss reflects a percentage of the PIM test signals back into the test set, which causes some signal cancellation that can report a false pass. In other words, poor line sweep performance can lead to a false pass for a PIM test.

By performing the line sweep test prior to PIM testing, you can be confident the insertion loss and return loss data are at acceptable levels. This data in turn ensures that the PIM test signals actually reach all components at the correct signal level, offering the most accurate indicator of true PIM performance. By constructing a system using modern low PIM practices, the need to break the transmission system back open will be minimized. If the lines are disassembled again to repair or clean a connector, the line sweep and PIM testing will need to be repeated.

Causes of PIM

PIM is caused by 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.

PIM can be generated anywhere in the RF path. The RF path includes not only the antenna feed system but also the antenna itself, as well as objects illuminated by the antenna. Because RF currents are strongest inside the coaxial cables and physically close to the antenna radiating aperture, non-linear junctions or materials in these locations are more likely to generate harmful PIM than non-linearities away from these regions.

The following list provides guidelines for preventing PIM at cellular installations:

- Visually inspect RF connectors and RF cables before assembly to remove all metal flakes.
- Verify that RF mating surfaces are clean and free of mechanical damage prior to assembly.
- Wipe mating surfaces with a lint-free wipe, moistened with alcohol to remove dirt and oils.
- Face coaxial cables downward while cutting so that any metal flakes that are produced fall out rather than into the coaxial cable.
- Always use sharp cutting tools when preparing the ends of coaxial cables.
- Use the correct cable preparation tools for the type and size coaxial cable with which you are working.
- Remove any metal burrs from the cut edges of coaxial cables prior to connector attachment.
- Prevent foam dielectric material from getting trapped between metal contacting surfaces.
- Remove all adhesive residue from the mating region of the coaxial cable center conductor.
- Properly align RF connectors prior to assembly in order to prevent damage to mating surfaces.
- Apply the torque that is specified by the manufacturer to all mated pairs of RF connectors.
- Do not over-torque RF connectors because doing so may cause damage to contacting surfaces.
- Prevent excessive vibration and shock to RF components when transporting them to the site.
- Prevent RF components from impacting the tower while hoisting.
- Leave protective caps on RF connectors until you are ready to attach the mating cable.
- Avoid loose metal objects within the half-power beamwidths of basestation antennas, cable trays, vent pipes, air conditioning units, metal flashing, guy wires, and so forth.

PIM Testing Example

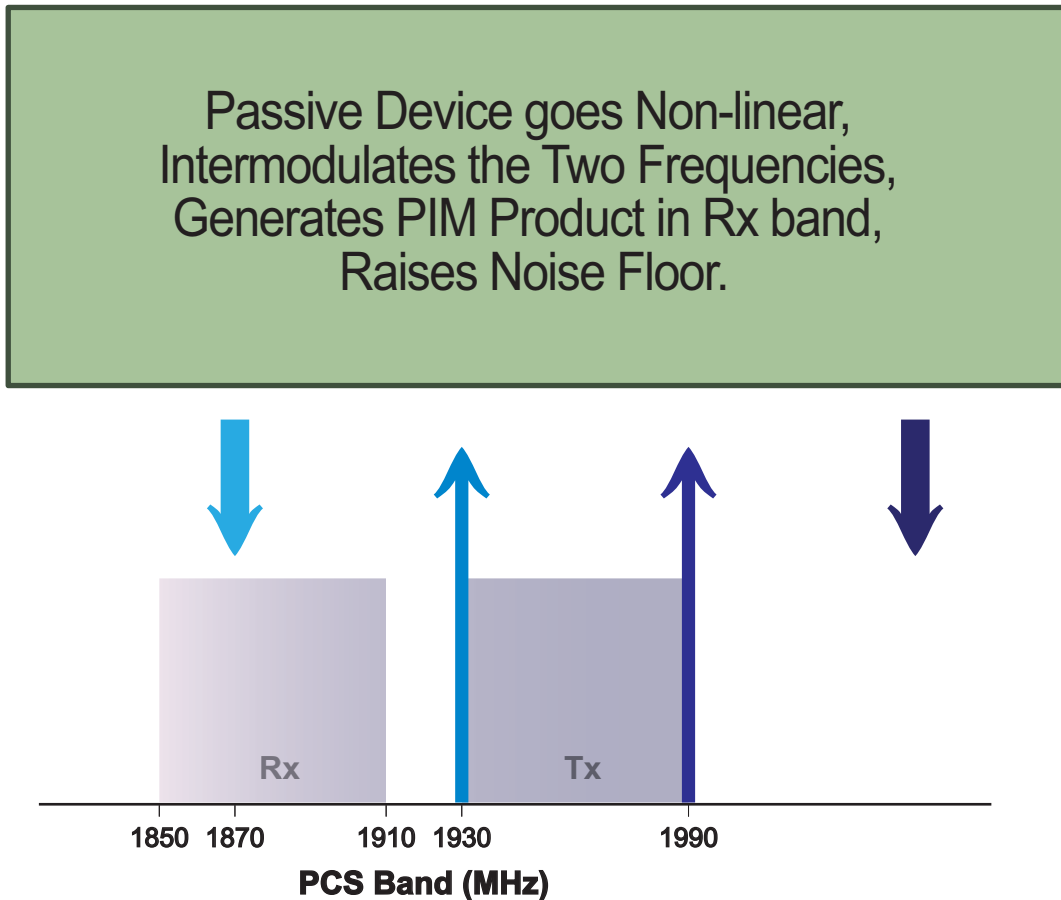


Figure 1-2. PCS Band PIM Testing

Intermodulation Distortion

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

$$\text{3rd Order Intermodulation (IM}_3\text{)} = 2F_1 - F_2 \text{ or } (\text{IM}_3) = 2F_2 - F_1$$

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

$$\text{IM}_3 = 2F_1 - F_2 = 2(1930) - 1990 = 1870 \text{ MHz (within Rx band)}$$

or

$$\text{IM}_3 = 2F_2 - F_1 = 2(1990) - 1930 = 2050 \text{ MHz (not within Rx band)}$$

1-15 PIM Testing Procedure

Before testing for PIM, ensure that line sweeping has been performed so that you can be confident that the insertion loss and return loss data are at acceptable levels. These results ensure that the PIM test signals actually reach all components at the correct signal level, and therefore offer the most accurate indication of true PIM performance.

See [Figure 1-3 on page 1-12](#) for a work flow chart of the recommended site testing procedure.

Typically, a PIM versus Time test is used to certify PIM performance. Anritsu recommends that you perform a Noise Floor measurement before you begin PIM testing. Refer to [Chapter 7, “PIM versus Time”](#) and [Chapter 8, “Noise Floor Measurements”](#) for setup and measurement procedures. The Noise Floor test is basically a signal level measurement with the PIM transmit tones turned off and the PIM Master receiver activated.

The Noise Floor measurement reveals external signals from mobile subscribers that might interfere with your PIM measurement. If high interference is found, then adjust your F1 or F2 test signals. This will shift the IM3 frequency and may provide you with a clear IM3 frequency for the PIM versus Time measurement. See [Figure 1-2 on page 1-10](#).

After the IM3 frequency has been verified to be clear of interference, perform a PIM versus Time measurement to search for any static PIM sources.

If static PIM sources are found that exceed the pass / fail criteria, then use Distance-to-PIM (DTP) to locate and eliminate these static PIM sources. If DTP identifies multiple PIM sources, then correct the largest magnitude fault and repeat the DTP measurement. Repeat this process until magnitudes of all reported PIM faults appear acceptable.

Return to PIM vs. Time and perform a dynamic PIM test to verify that all RF connections and components are robust. A dynamic PIM test involves lightly tapping on all RF connections and components in the system while measuring PIM versus Time. If the peak PIM observed during the dynamic test is below the customer's pass/fail threshold, then save the measurement.

Recommended Testing Procedure

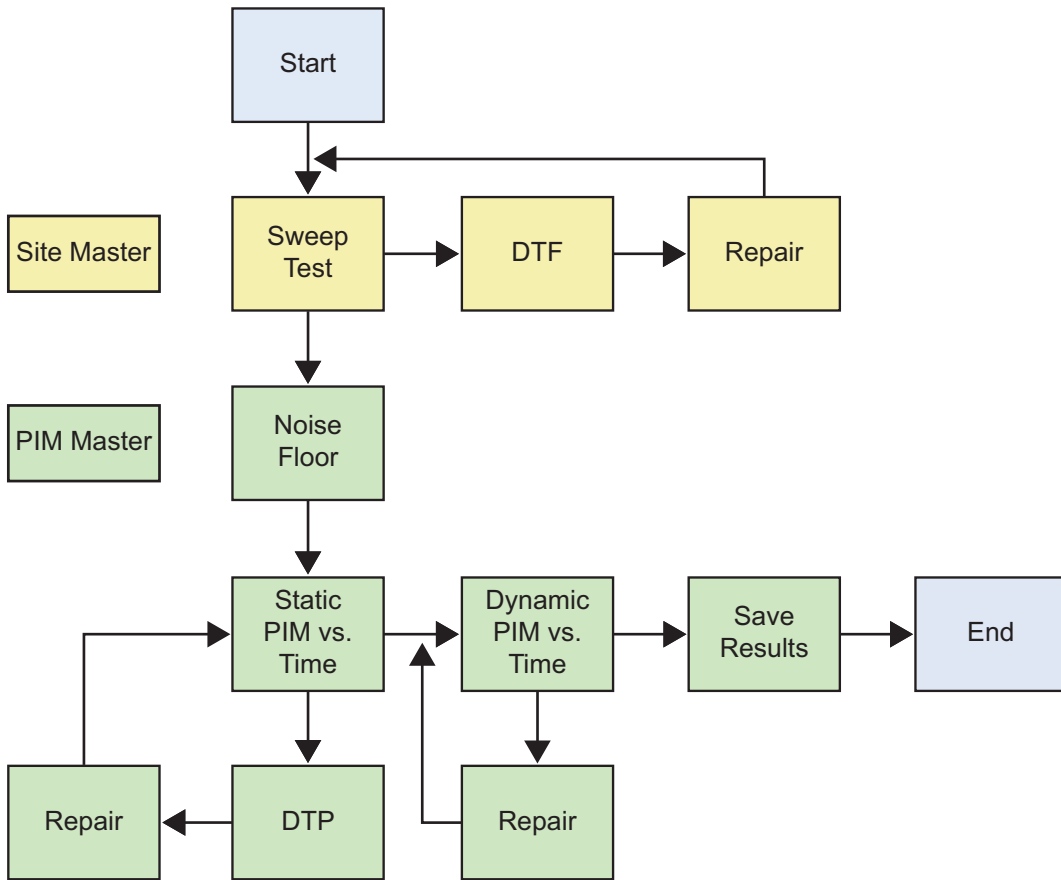
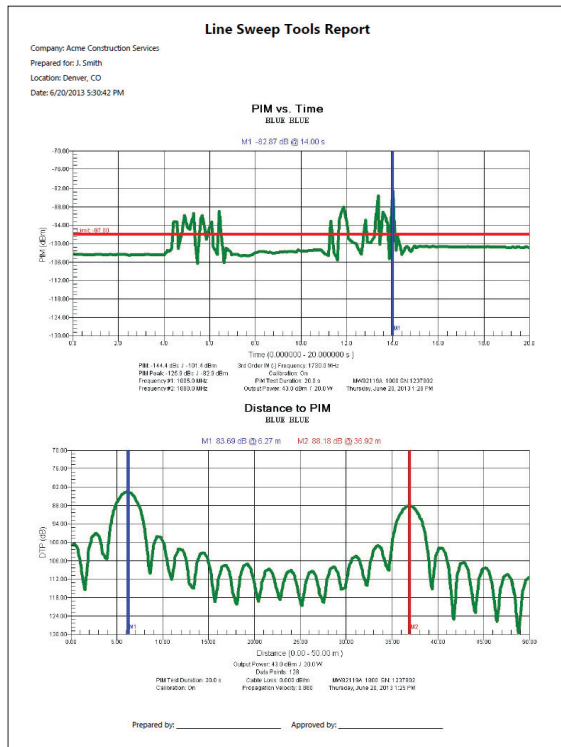


Figure 1-3. Recommended Testing Procedure Work Flow

1-16 Test Reports

Use Line Sweep Tools (LST) to view and create reports from saved PIM measurements. Line Sweep Tools can generate a standard report showing plots of the measured results. LST can also generate a special PIM report to display PIM versus TIME results in a tabular format.



Passive Intermodulation (PIM) Test Report
 ACME CONST SVS

Site Details

Site	Operator	Certification
GA3001	John Smith	PM100301

Test Parameters

Tone 1 Frequency (MHz)	Tone 2 Frequency (MHz)	IM3 Frequency (MHz)
1930	1990	1870

Test Results

Test Point Description	Time	GPS	Power (dBm)	Limit (dBm)	PIM (dBm)	PIM Peak (dBm)	Result
_LOW PIM LOAD	10/16/2013 9:02 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-132.7	-125.4	Pass
_PIM STANDARD	10/16/2013 9:16 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-78.7	-78.7	Fail
BLUE BLUE	10/16/2013 9:09 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-103.9	-100.0	Pass
BLUE BLUE WHITE	10/16/2013 9:09 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-102.4	-99.0	Pass
BLUE GRAY	10/16/2013 9:10 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-113.6	-108.7	Pass
BLUE GRAY WHITE	10/16/2013 9:11 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-115.6	-114.2	Pass
RED BLUE	10/16/2013 9:04 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-115.8	-114.7	Pass
RED BLUE WHITE	10/16/2013 9:05 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-105.3	-97.6	Pass
RED GRAY	10/16/2013 9:06 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-103.8	-97.8	Pass
RED GRAY WHITE	10/16/2013 9:07 PM	N 37°8'49" W 121°39'21"	43.0	-97.0	-117.3	-116.0	Pass

Anritsu
 Model: MW82119A 1900 Serial Number: 1316851 Calibration Due: 9/20/2014 Software Version: VL14

Page 1

Figure 1-4. Example Report Formats

Chapter 2 — PIM Master Overview

2-1 Introduction

This chapter provides a description of the MW82119A PIM Master. It also includes a brief description of preventive maintenance, calibration requirements, and additional PIM Master documents.

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

2-2 Instrument Description

Anritsu has developed the PIM Master to verify if receiver interference at a cell site is due to an intermodulation product of two or more transmit frequencies, also known as passive intermodulation (PIM).

The Anritsu PIM Master features patented technology – Distance-to-PIM. In just a few seconds, Distance-to-PIM can find the distance and relative magnitude of all static PIM sources in an antenna system and beyond the antenna. For example, Distance-to-PIM can find the location of the following fault conditions:

- Dirty connectors
- Corroded connectors
- Over torqued connectors
- Microscopic arcing connectors
- PIM outside the antenna system

PIM is power sensitive, and as signal technologies develop, more power continues to be transmitted at cell sites. The PIM Master features up to 2 x 40 Watts of RF power to activate sources of PIM in the feed system as well as beyond the antenna.

2-3 Connector Care

Visually inspect connectors for general wear, for cleanliness, and for damage such as bent pins or connector rings. Repair or replace damaged connectors immediately. Inspect and clean all RF connectors to remove metal flakes and contamination. Dirty connectors can limit the accuracy of your measurements. Damaged connectors can damage the instrument.

Connection of cables with inadequate torque settings can affect measurement accuracy. Over torquing connectors can damage the cable, the connector, the instrument, or all of these items.

Connecting Procedure

1. Carefully align the connectors.

The male connector center pin must slip concentrically into the contact fingers of the female connector.

2. Push connectors straight together. Do not twist or screw them together.
3. To tighten, turn the connector nut, not the connector body. Major damage can occur to the center conductor and to the outer conductor if the connector body is twisted.
4. When you use a torque wrench, initially tighten by hand so that approximately 1/8 turn or 45 degrees of rotation remains for the final tightening with the torque wrench.

Relieve any side pressure on the connection (such as from long or heavy cables) in order to assure consistent torque. Use an open-end wrench to keep the connector body from turning while tightening with the torque wrench.

Do not over torque the connector.

Test Cable from PIM Master to DUT

Remove o-rings from the test cable and be sure that the connectors are clean. If the DUT connector has an o-ring, then use a torque wrench to tighten the connector.

Note

When testing, cables are connected and disconnected many times. In order to save wear on these test cables and RF adapters, Anritsu recommends removing the o-rings. This allows getting a sufficiently tight connection without unnecessary stress on the connectors. In the field, o-rings are important to maintain connection integrity over long time periods. Connections must be torqued to specifications in order to ensure that they prevent water intrusion.

During your test, if the DUT connector has an o-ring, leave it in place and tighten to the correct torque.

Disconnecting Procedure

1. Use an open-end wrench to keep the connector body from turning while loosening with a second wrench.
2. Complete the disconnection by hand, turning only the connector nut.
3. Pull the connectors straight apart without twisting or bending.

Connector Saver

Anritsu recommends attaching an adapter to the 7/16 DIN female RF Out connector and using the adapter for the working connector. This connector saver reduces wear on the instrument RF Out connector. Typically, 500 matings is the life of a connector for PIM testing. The connector saver can remain on the PIM Master inside the soft case.

Adapter: 7/16 DIN(f) to 7/16 DIN(m), 50 Ω (Connector Saver). One connector saver is provided with your test instrument. Replacement connector savers can be purchased from Anritsu. The part number is in your Technical Data Sheet.

2-4 Hardware Overview

The PIM Master is a handheld, battery-operated PIM analyzer with a touch screen user interface. The RF output connector is on the top panel, and all other connectors are located behind a cover on the side panel. The battery compartment is on the bottom. Refer to [Section F-3 “Battery Care” on page F-2](#) for battery care and [Section F-4 “Battery Replacement” on page F-3](#) for battery replacement instructions.

Accessory items such as a PIM standard, Low PIM termination, and Low PIM test cable are required in order to calibrate and operate the PIM Master. Accessory items can be purchased together in a kit or individually from Anritsu.

MW82119A PIM Master Front Panel

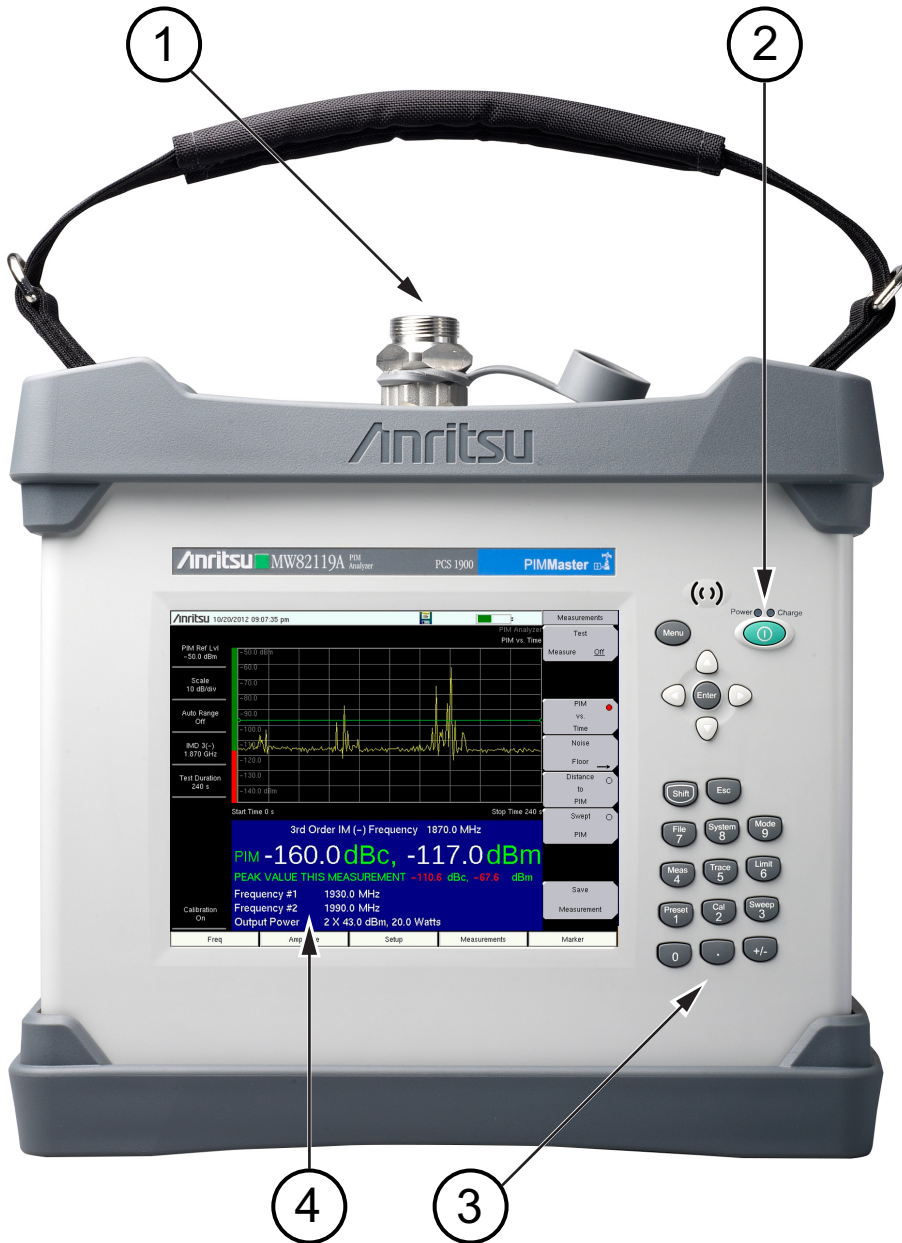


Figure 2-1. MW82119A PIM Master Front Panel

1.	RF Out Connector (connector saver attached), 7/16 DIN, female, 50 Ω
2.	On/Off Button
3.	Number Keypad
4.	Measurement Display (a Touch Screen)

RF Out Connector

(item 1 in [Figure 2-1](#))

The PIM Master fits into its soft carrying case and transit case with a 7/16 DIN, female, 50 Ω connector saver attached. Refer to “[Connector Saver](#)” on page 2-3 and “[RF Out Connector](#)” on page 2-8.

On/Off Button

(item 2 in [Figure 2-1](#))

Press to turn On the PIM Master. Press and hold to turn Off the PIM Master.

Number Keypad

(item 3 in [Figure 2-1](#))

Refer to “[Number Keypad](#)” on page 2-7.

Measurement Display

(item 4 in [Figure 2-1](#))

Touch Screen information begins in [Section 2-11 “Touch Screen”](#) on page 2-19.

Other Features On The Front Panel**Battery Charge LED (Green)**

The Battery Charge LED flashes if the battery is charging, and remains on steady when the battery is fully charged.

Power LED (Green)

The Power LED remains on when the PIM Master is on.

Features not shown in [Figure 2-1](#)**Battery Compartment**

The battery compartment access is on the bottom of the PIM Master. Refer to [Section F-4 “Battery Replacement”](#) on page F-3.

2-5 Front Panel Keys

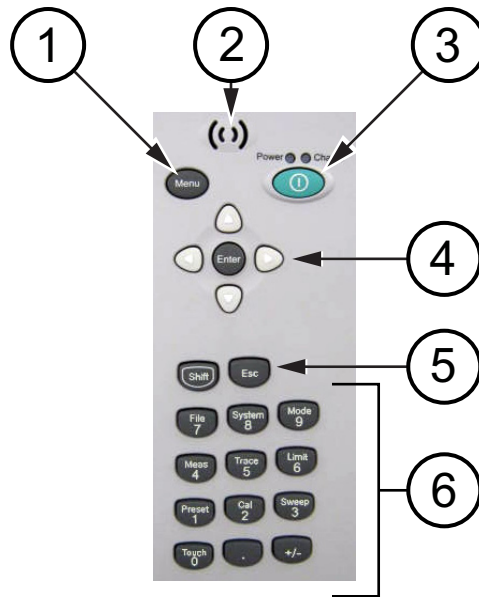


Figure 2-2. Front Panel Layout

1.	Menu Button
2.	Speaker Grill
3.	On/Off Button
4.	Arrow Keys and Enter Key in center
5.	Shift Key and Escape Key
6.	Number Keypad

The terms button and hard key refer to all of the buttons on the instrument face. These keys perform as follows:

Menu Key

(item 1 in [Figure 2-2](#))

Press the **Menu** key to display the Menu Key Screen, a grid of shortcut icons for installed measurement modes and user-selected menus and setup files.

On/Off Button

(item 3 in [Figure 2-2](#))

Press this button to turn on power to the PIM Master. Press and hold this button to turn off power.

Arrow Keys

(item 4 in Figure 2-2)

The four **Arrow** keys are used to scroll up, down, left, or right. The **Arrow** keys can often be used (depending upon measurement selection) to change a value or to change a selection from a list. In some measurements, the **Left/Right** arrow keys change values by different increments than the **Up/Down** arrow keys. The **Arrow** keys are also used to move markers.

Enter Key

(item 4 in Figure 2-2)

Press this key to finalize data input.

Shift Key

(item 5 in Figure 2-2)

Press the **Shift** key and then press a number key to open the menu that is indicated in text above the key number. When the **Shift** key is active, its icon is displayed at the top-right of the measurement display area between the battery charge indicator and the submenu key labels.



Figure 2-3. Shift Key Icon

Esc Key

(item 5 in Figure 2-2)

Press this key to cancel any setting that is currently being made.

Number Keypad

(item 6 in Figure 2-2)

Press these keys to directly input numbers. Number keys are also used to open menus when used with the “**Shift Key**”. For example, press **Shift** and **Touch (0)** to initiate Touch Screen Calibration.

+/- Key

(item 6 in Figure 2-2)

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

2-6 Top Connector Panel

The top connector panel includes the test port connector, the Radio Frequency ON light, and the Emergency Stop button.

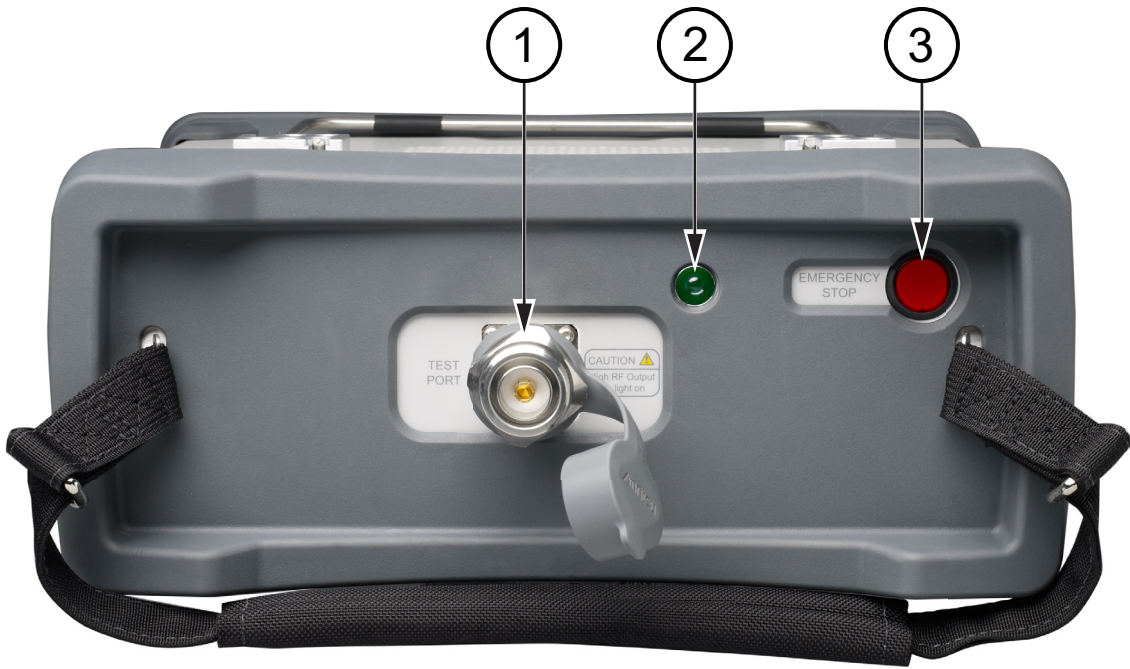


Figure 2-4. PIM Master Connection Diagram – Top

1.	RF Out Connector, 7/16 DIN, female, 50 Ω
2.	Indicator Light for RF On (Green)
3.	Emergency Stop Button (turns Off RF output)

RF Out Connector

(item 1 in [Figure 2-4](#))

Type 7/16 DIN(f), 50 Ω connector. To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the DIN connector. Do not overtighten the connector. The recommended torque is 25 N · m (~18 lbf · ft). To prevent rotation, secure the RF Out connector or the recommended connector saver ("[Connector Saver](#)" on [page 2-3](#)) with a wrench when attaching a test lead.

Radio Frequency ON Light

(item 2 in [Figure 2-4](#))

This green indicator is illuminated when RF output power is On.

Emergency Stop Button

(item 3 in [Figure 2-4](#))

Press this red button to turn Off the RF output power.

2-7 Side Panel Connectors

The side connector panel includes connectors for External Power, Ethernet/LAN, USB interface, and GPS.

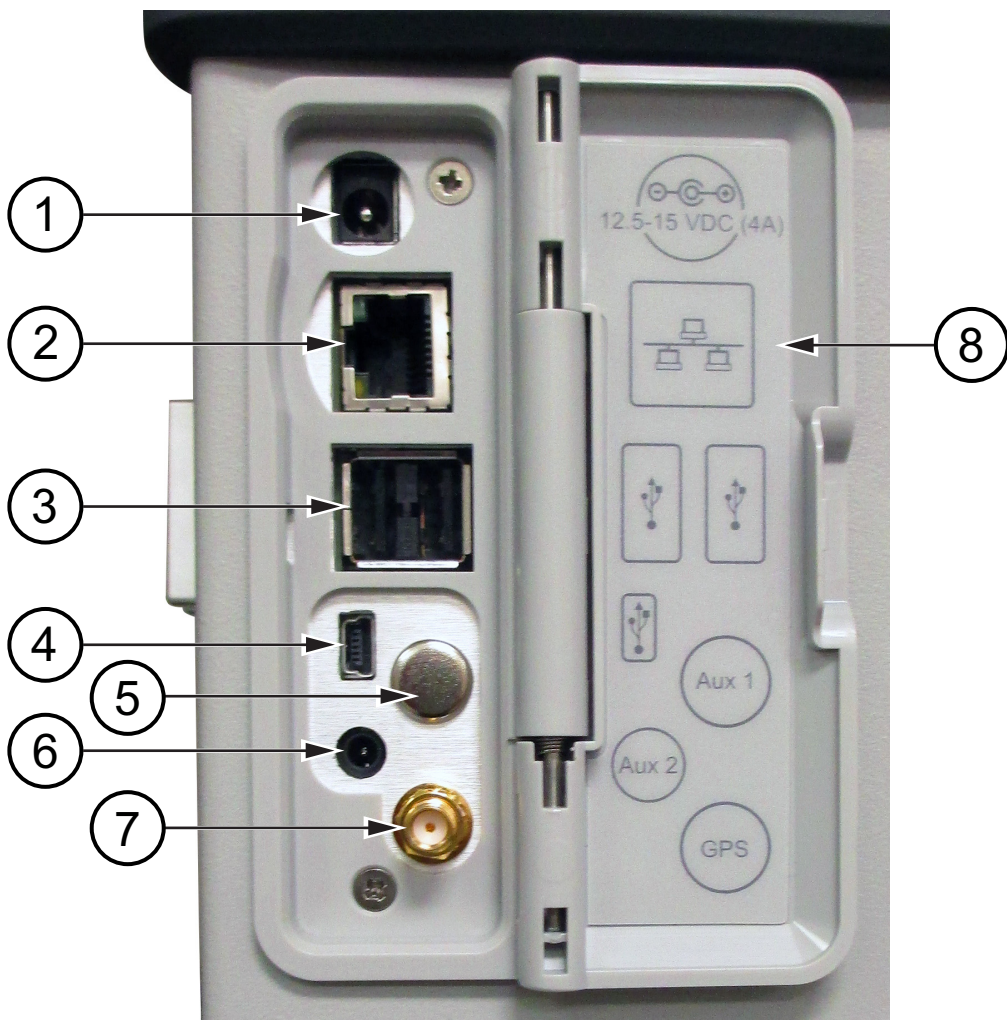


Figure 2-5. Side Panel Overview

1.	External Power
2.	LAN Connection, RJ45
3.	USB Interface, Type A
4.	USB Interface, 5-pin mini-B
5.	Auxiliary 1 (factory use only)
6.	Auxiliary 2 (factory use only)
7.	GPS Connector, SMA female (with Option 31)
8.	Legend (icons identify connection types)

External Power

(item 1 in [Figure 2-5](#))

This 2.1 mm by 5.5 mm barrel connector is used to power the unit and for battery charging. Input is 12 VDC to 15 VDC at up to 5.0 A. A green flashing indicator light near the power switch shows that the instrument battery is being charged by the external charging unit. The indicator is steadily illuminated when the battery is fully charged.

Warning

When using the AC-DC Adapter, always use a three-wire power cable that is connected to a three-wire power line outlet. If power is supplied without grounding the equipment in this manner, then the user is at risk of receiving a severe or fatal electric shock.

LAN Connection

(item 2 in [Figure 2-5](#))

The RJ45 connector is used to connect the PIM Master to a local area network. Integrated into this connector are two LEDs. The amber LED shows the presence of a 10 Mbit/s LAN connection when on, and a 100 Mbit/s LAN connection when off. The green LED flashes to show that LAN traffic is present. For additional information about the LAN connection, Ethernet connection, and DHCP, refer to [Appendix G, “LAN and DHCP”](#).

USB Interface – Type A

(item 3 in [Figure 2-5](#))

This interface has two connectors for flash drive and USB Power Sensor. The MW82119A PIM Master can also be a USB Host and allow various USB Flash Memory devices to be connected to the instrument for storing measurements, setups, files, and firmware upgrades. Either USB connection can be used with a USB power sensor (but only one power sensor at a time).

USB Interface – Type Mini-B

(item 4 in [Figure 2-5](#))

The USB 2.0 interface can be used to connect the MW82119A PIM Master directly to a PC for data transfer. The first time the PIM Master is connected to a PC, the normal USB device detection by the computer operating system will take place. The CD-ROM that shipped with the instrument contains a driver for Windows XP (or later) that is installed when Line Sweep Tools is installed. Drivers are not available for earlier versions of the Windows operating system. During the driver installation process, place the CD-ROM in the computer drive and specify that the installation wizard should search the CD-ROM for the driver.

Note

For proper detection, Line Sweep Tools should be installed on the PC prior to connecting the PIM Master to the USB port.

GPS Antenna Connector (Option 31)**(item 7 in Figure 2-5)**

The GPS antenna connection on the PIM Master is type SMA(F). Selectable +3 VDC or +5 VDC antenna power.

To prevent damage to your instrument, do not use pliers or a plain wrench to tighten the SMA connector. Do not overtighten the connector. The recommended torque is 8 lbf · in (0.9 N · m or 90 N · cm).

2-8 Front Panel Overview

Throughout this manual, typical measurement displays are shown for the basic PIM Analyzer mode of the PIM Master. Note that the images shown in this manual may be different from any images that are displayed on your PIM Master.

Front Panel Display Areas

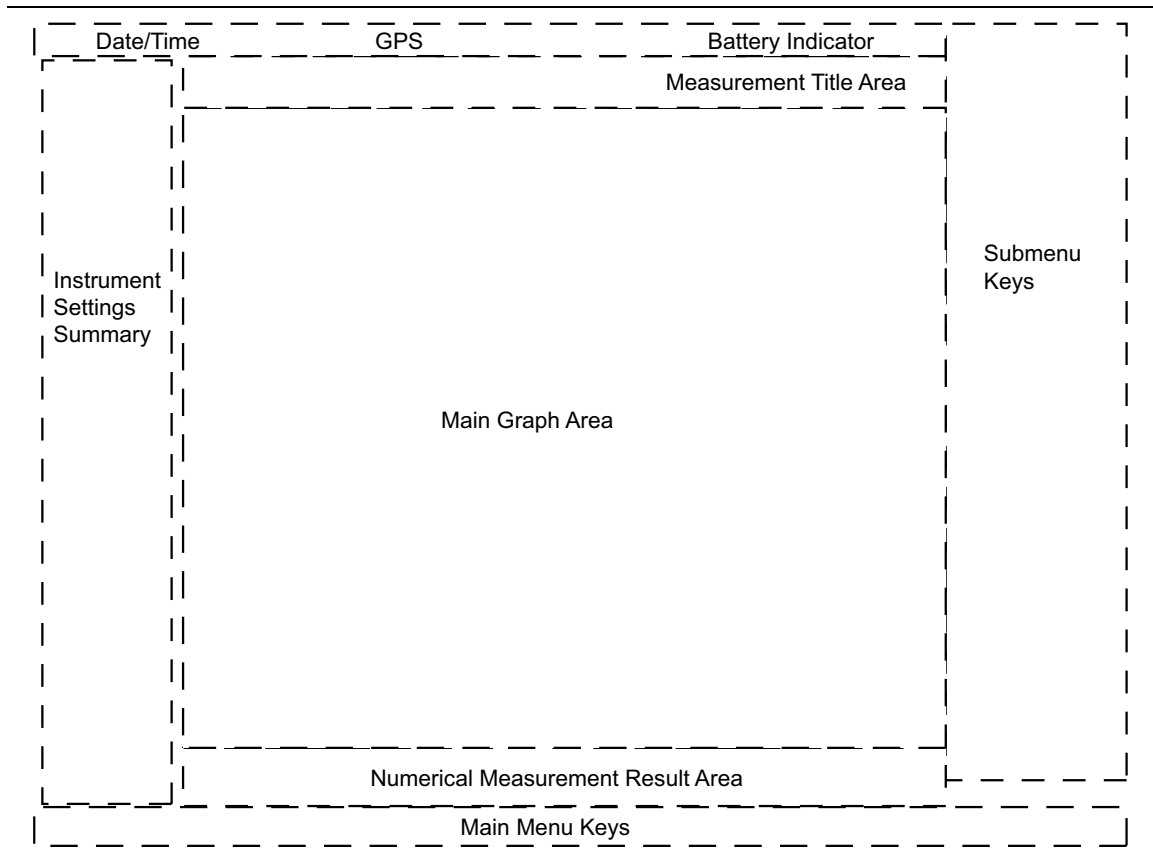


Figure 2-6. Front Panel Overview

The PIM Master menu-driven interface is easy to use and requires little training. Main menu keys on the front panel are used to initiate function-specific menus. See [Figure 2-1](#).

All of the hard keys and an **On/Off** button are located to the right of the measurement display. Ten of the hard keys (**0** through **9** in the number keypad) are dual purpose, depending upon the current mode of operation. The dual-purpose keys are labeled with a number on the key itself and with the alternate function printed on the key above the number. The **Shift** key is above the number keypad and is used to access the functions that are printed on the nine number keys. The escape (**Esc**) key (which is used for aborting data entry) is located next to the **Shift** key. The four **Arrow** keys (above the number keypad) surround the **Enter** key. The **Arrow** keys and the number keypad can be used to change the value of an active parameter. The **Menu** key is above the **Arrow** keys and is used to display the Menu Key Screen, a grid of shortcut icons for installed measurement modes and user-selected menus. The **On/Off** button is above the **Arrow** keys and to the right of the **Menu** key.

Arranged in a vertical column along the right edge of the measurement display are 8 submenu keys. They change function depending upon the current menu selection. The current submenu key function is indicated in the active function block (submenu key labels) on the right edge and within the measurement display. An example of the keys is shown in [Figure 2-7 on page 2-14](#).

Front Panel Layout, PIM vs. Time

The following three figures are provided to identify display components in different measurement modes. The image and measurement details shown on your instrument may differ from the examples in this user guide. For a description of red PIM values in the PIM Summary Table, refer to [Section 3-4 “Limit Alarm and Pass Indicator”](#) on page 3-14.

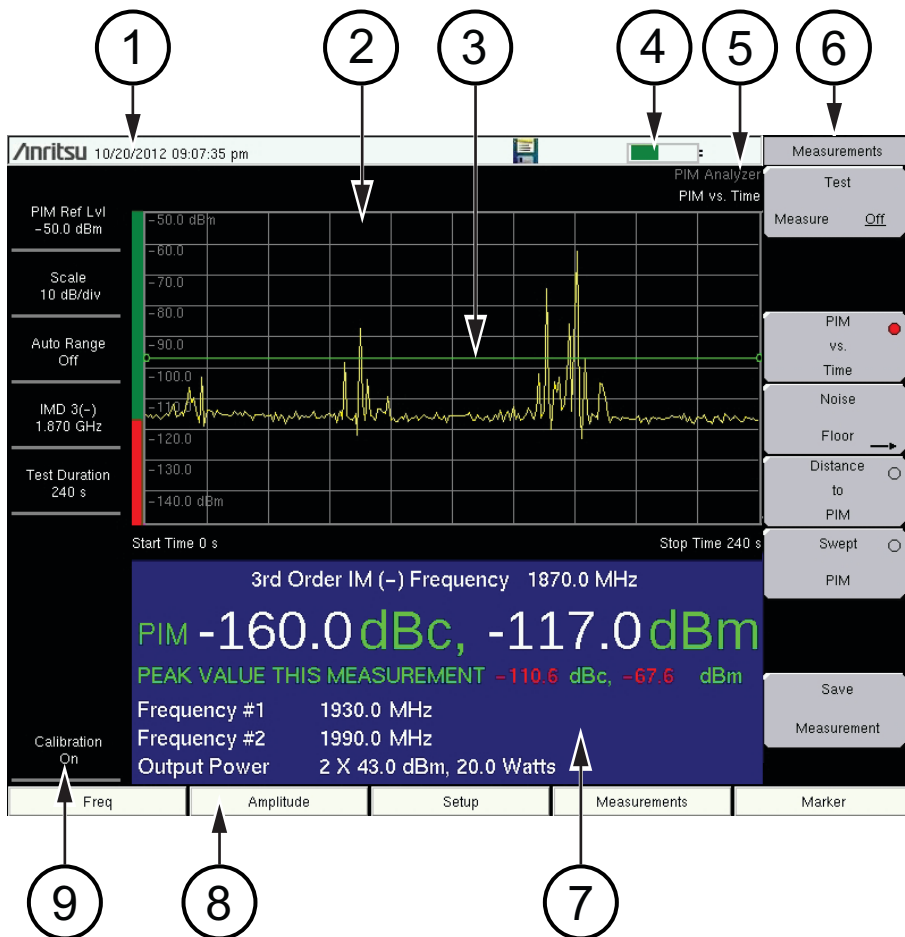


Figure 2-7. Front Panel Layout with PIM vs. Time Display

1.	Real Time Clock (followed by GPS Coordinates if Option 31 is installed)
2.	Main Graph Area or Sweep Window or Measurement Grid
3.	Limit Line (Green line, set from Limit menu)
4.	Battery Status Icon
5.	Instrument Mode and Measurement Title
6.	Submenu Keys or Active Function Block
7.	PIM Summary Table
8.	Main Menu Keys
9.	Instrument Settings Summary

Front Panel Layout, Distance-to-PIM

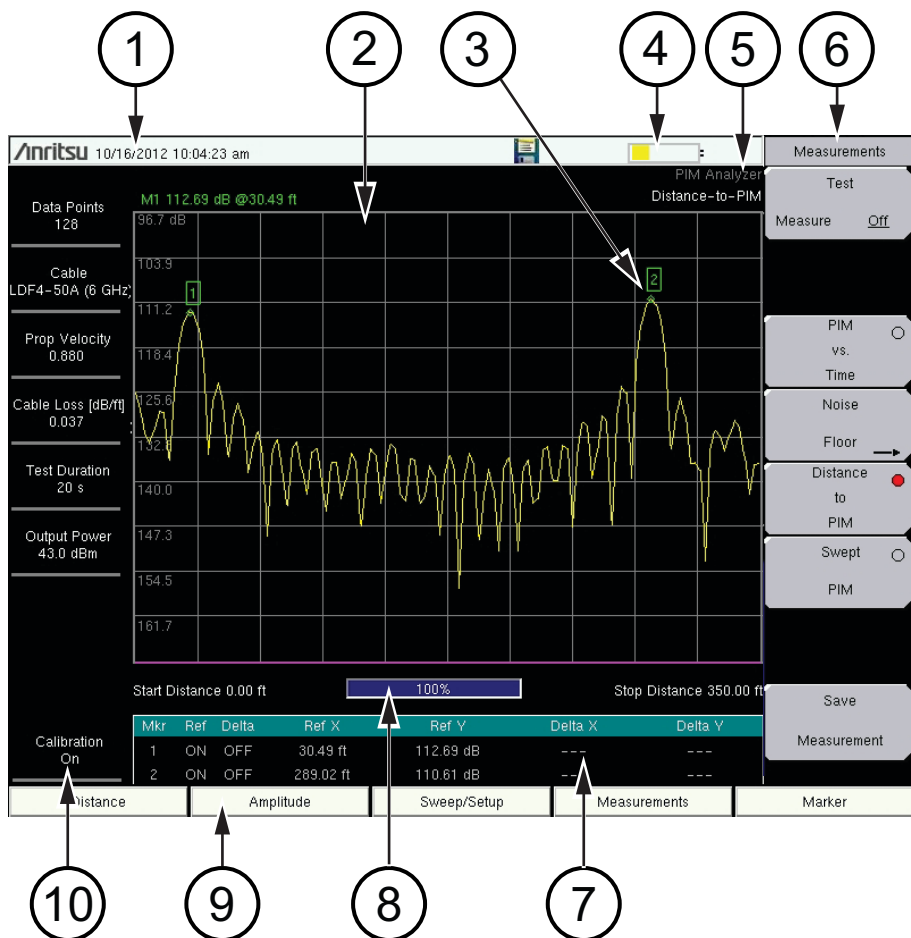


Figure 2-8. Front Panel Layout with Distance-to-PIM Display

1.	Real Time Clock (followed by GPS Coordinates if Option 31 is installed)
2.	Main Graph Area or Sweep Window or Measurement Grid
3.	Marker on Distance-to-PIM Measurement Trace
4.	Battery Status Icon
5.	Instrument Mode and Measurement Title
6.	Submenu Keys or Active Function Block
7.	Marker Table
8.	Progress Indicator
9.	Main Menu Keys
10.	Instrument Settings Summary

Front Panel Layout, Swept PIM

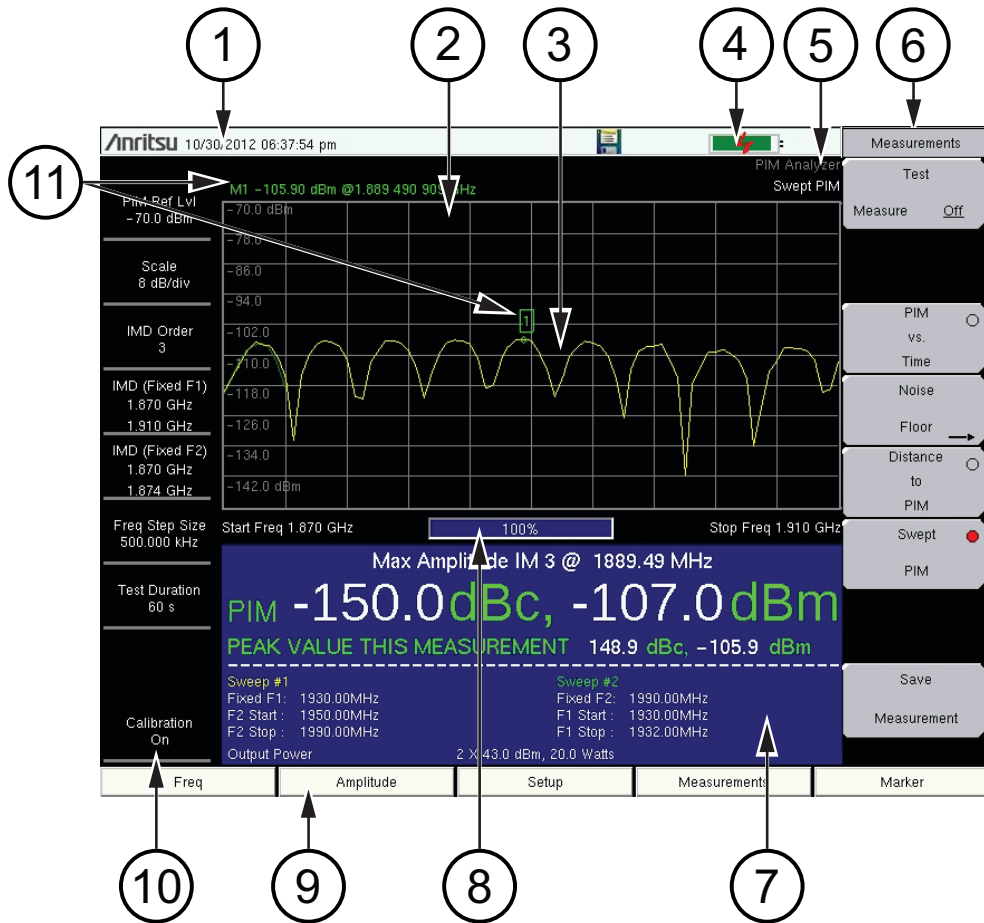


Figure 2-9. Front Panel Layout with Swept PIM Display

1.	Real Time Clock (followed by GPS Coordinates if Option 31 is installed)
2.	Main Graph Area or Sweep Window or Measurement Grid
3.	Swept PIM Measurement Trace (green trace and yellow trace – see footnote) ^a
4.	Battery Status Icon
5.	Instrument Mode and Measurement Title
6.	Submenu Keys or Active Function Block
7.	PIM Summary Table
8.	Progress Indicator
9.	Main Menu Keys
10.	Instrument Settings Summary
11.	Marker data automatically displayed

a. The yellow trace is created by holding F1 fixed and sweeping F2. The green trace is created by holding F2 fixed and sweeping F1. The PIM Summary Table displays the frequencies that are used to generate each sweep. In this display, the green trace (Sweep #2) is visible only in the first 4 MHz of the sweep. Note that the PIM Summary Table displays the Sweep numbers in yellow and green.

2-9 Mode Selector Menu

To access the functions under the Mode menu, select the **Shift** key, then the **Mode (9)** key. Use the directional **Arrow** keys to highlight the selection, and press the **Enter** key to select. The list of modes that appears in this menu will vary depending upon the options that are installed and activated in your instrument. [Figure 2-10](#) is an example of the Mode menu. Your instrument may not show the same list.

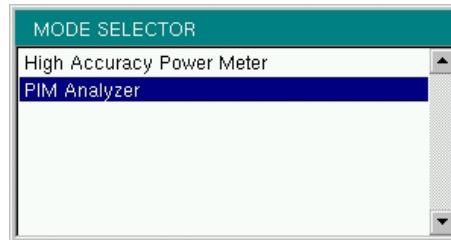


Figure 2-10. Mode Selector Menu

2-10 Secondary Function Menus

Pressing the **Shift** key and then a number key selects the menu function that is printed above the number keypad (Figure 2-11).



Figure 2-11. Keypad and Secondary Function Menus

Not all Secondary Function Menus are active in various operation Modes. If any one of these menus is available in a specific instrument Mode of operation, then it can be called from the number keypad. It may also be available from a main menu key or a submenu key. The ten Secondary Function Menus are:

- 0 Touch Screen Calibration (and Arrow Navigation)
- 1 Preset
- 2 Calibration
- 3 Sweep
- 4 Measurements
- 5 Trace
- 6 Limit
- 7 File
- 8 System
- 9 MODE

2-11 Touch Screen

The touch screen and keypad are used for data entry. The sweep window and surrounding screen areas provide measurement information (see [Figure 2-6, “Front Panel Overview” on page 2-12](#)).

Graphical User Interface (GUI)

The measurement display, or sweep window, provides measurement trace data. Above the grid and trace data, additional measurement data is displayed, and the analyzer mode is shown in the top-right corner. The lower area of the grid may be reduced in size to display an optional data window, such as a table of measurement data or marker data. To the left of the grid and trace data is the instrument settings summary, below the grid are the five main menu touch keys, and to the right are the submenu touch keys. For a list of the main menu keys in different instrument modes, refer to [Section 2-15 “Firmware Overview” on page 2-26](#).

The five main menu touch keys and (up to) eight submenu touch keys are available in all analyzer Modes, providing control of measurement settings. In addition, you can touch other areas of the display screen to perform tasks that are also available from the menu keys.

For example:

- If you touch the **Scale** setting on the left side of the display (Instrument Settings Summary), then the Amplitude menu is displayed, and the **Scale** submenu key is active. **Scale** is displayed in PIM vs. Time and Swept PIM measurements.
- If you touch **Data Points** (Instrument Settings Summary), then the DTP Parameters setup window is displayed, and the Data Points parameter is selected (Distance-To-PIM measurements, see [Figure 9-5 on page 9-7](#)).
- If you touch **Cable** (Instrument Settings Summary), then the “[Cable List](#)” on [page 9-23](#) is displayed (Distance-To-PIM measurements).
- If you place a marker on the screen, then you can touch the measurement trace to relocate the marker.
- If you touch the file type list box in one of the file management dialog boxes, then you can open the Filetype drop-down list to select a file type.

Main Menu Touch Screen Keys

The main menu key functions change to match specific instrument Mode settings. The main menu keys generate function-specific submenus. The measurement modes are selected by pressing the **Shift** key and then the **Mode (9)** key. For more details about the Mode menu, refer to “[Mode Selector Menu](#)” on [page 2-17](#).

Submenu Touch Screen Keys

The submenu touch keys are located in the active function block (submenu key labels) along the right edge of the display. The submenu labels change as instrument measurement and parameter settings change. The current submenu title is shown at the top of the submenu key block. An example of the keys is shown in [Figure 2-7 on page 2-14](#). Additional details are described in [Section 2-8 “Front Panel Overview” on page 2-12](#).

Menu Key

Press the **Menu** key to display the Menu Key Screen, a grid of shortcut icons for installed measurement modes and user-selected menus and setup files.

Figure 2-12 shows the **Menu** key screen. Touch one of the icons in the top two rows to change modes. The icons that are shown here are preinstalled and cannot be moved or deleted. The display of the Menu screen will vary depending on instrument model, firmware version, and installed options. Note that the High Accuracy Power Meter icon is present only if Option 19 is installed. The image in **Figure 2-12** may differ from the menu on your instrument.

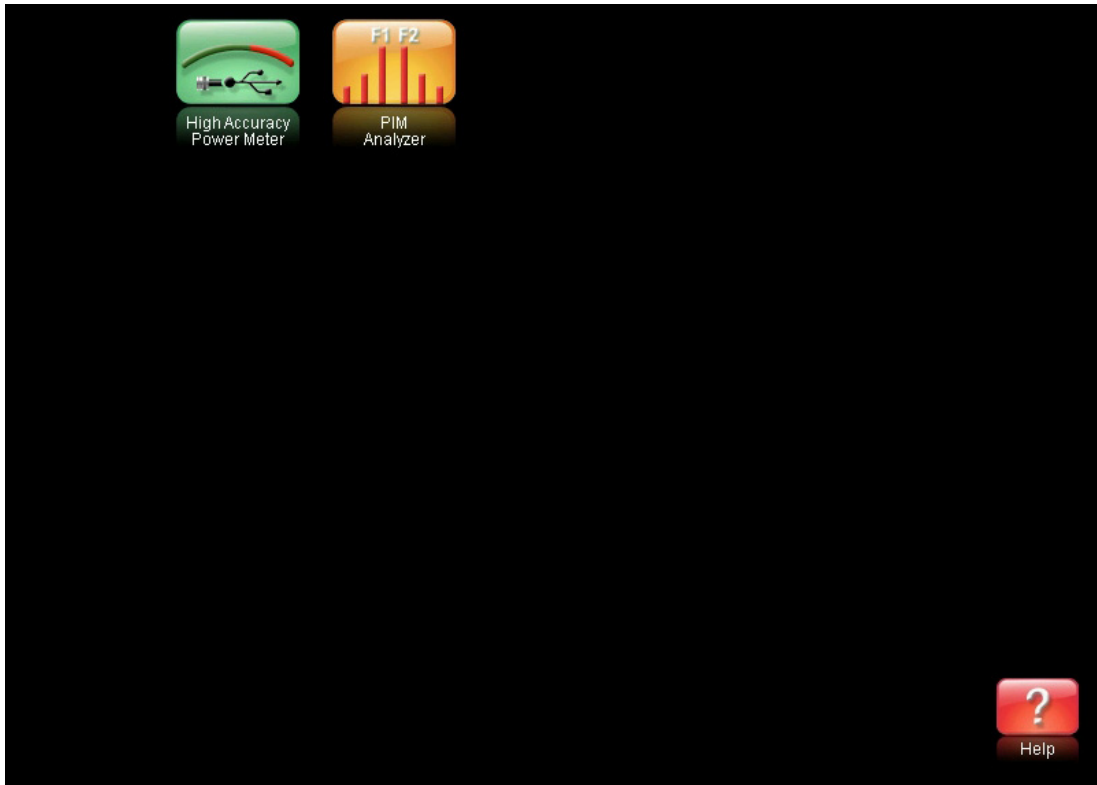


Figure 2-12. Menu Key Screen, Icons for Installed Measurements and Shortcuts

Figure 2-13 shows the **Menu** key screen with shortcut icons for the installed measurement modes and additional user-defined shortcuts to menus and setup functions.

Press and hold down any key for a few seconds to add a shortcut to this screen. For example, to create a shortcut for PIM versus Time measurements, open the Measurements menu and hold down on the PIM vs. Time submenu key for several seconds. Then select the location for the shortcut. The display of the Menu screen will vary depending on instrument model, firmware version, and installed options. The image in Figure 2-13 may differ from the menu on your instrument.

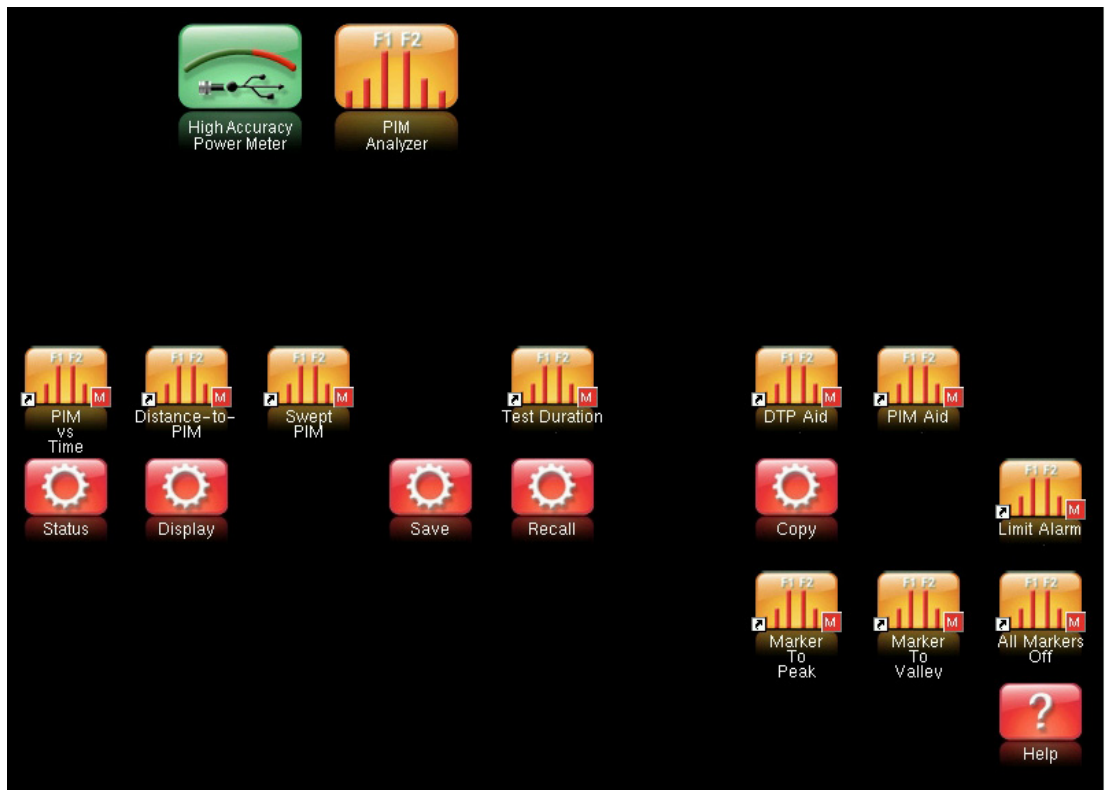


Figure 2-13. Menu Key Screen

User-defined shortcuts stay in memory until deleted. To delete or move a shortcut button, press the **Menu** key, then press and hold the shortcut for approximately 3 seconds. The Customize Button dialog box opens to allow a button to be deleted or moved. Press **Esc** to exit the Menu shortcut display.

Note

The Factory Default reset will delete all user created shortcut icons from the Menu screen. Refer to the [“Reset Menu”](#) on page 5-7 for additional information.

Help for the Menu shortcut screen is available by pressing the question mark icon in the lower-right corner of the display.

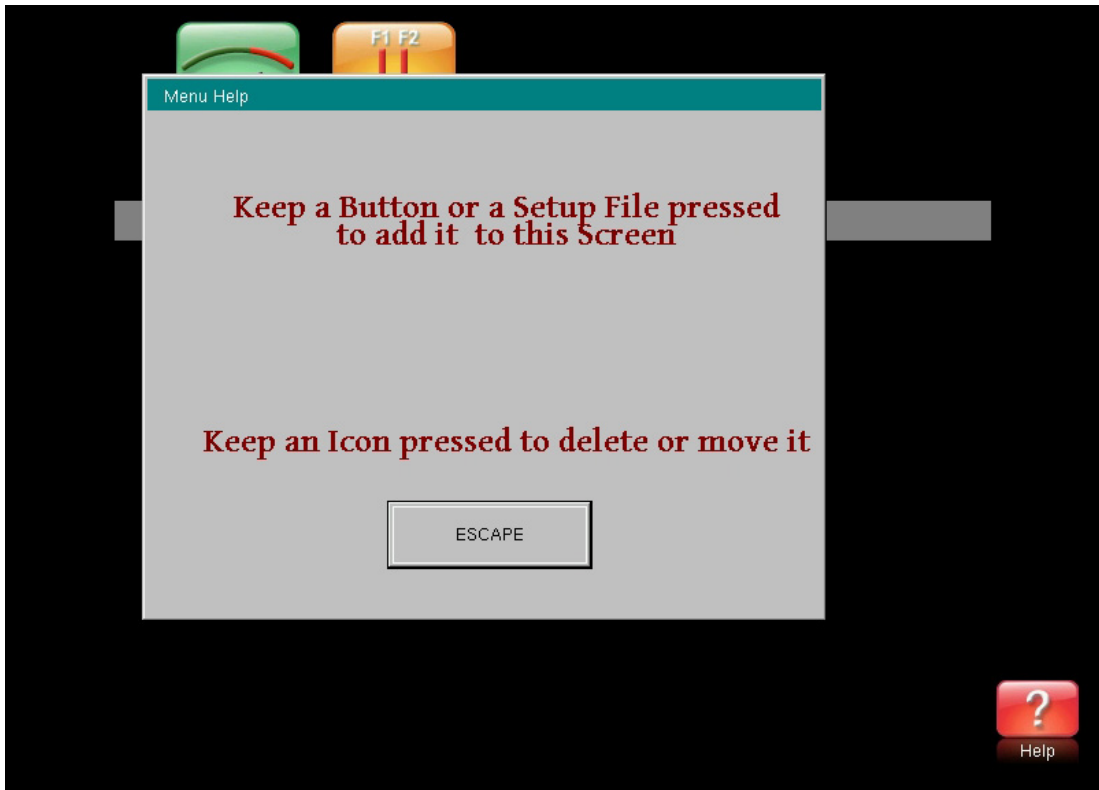


Figure 2-14. Menu Help

2-12 Touch Screen Calibration

The Calibrate Touch Screen submenu key is in the “[System Menu](#)” on page 5-3. When pressed, the touch screen calibration message box is displayed with instructions for calibration. Calibration optimizes the response of touch input. You touch targets in sequence as they are displayed on the touch screen. This requires less than one minute.

Calibration is recommended if your touch inputs do not correspond to the appropriate locations on the screen. After the information box is displayed, press **Enter** to begin calibration, or press **Esc** to cancel.

You can also press **1** to use arrow navigation.

Calibrate Touch Screen Shortcut

You can access touch screen calibration by pressing **Shift** then **Touch (0)**. This displays the touch screen calibration message box. Press **Enter** to begin calibration, or press **Esc** to cancel. This shortcut can be used if your touch inputs do not correspond to the appropriate locations on the screen to such an extent that you cannot access the Calibrate Touch Screen submenu key.

Arrow Navigation

If the touch screen is not functioning, you can use Arrow Navigation to simulate pressing the touch screen main menu keys and submenu keys. From the touch screen calibration message box, press **1** to use arrow navigation. This displays the arrow navigation message box. Press **1** again to enter the arrow navigation mode, or press **Esc** to cancel. Note that entering arrow navigation mode disables the touch function of the touch screen.

In arrow navigation mode, a red selection box surrounds a key (see [Figure 2-15](#) on page 2-24 in which the Carrier F1 submenu key is selected). To move the red selection box, use the **Arrow** keys above the number keypad. Then press the **Menu** key to activate the selected touch screen key. Note that only the main menu keys and submenu keys can be activated using the red selection box. Press the **+/-** key to move the red selection box into areas of the touch screen, and press **+/-** again to return focus to the red selection box on the menu keys.

Use the **+/-** key for access to the Copy, Delete, and Recall dialog boxes. Then use the **Arrow** keys to navigate within file lists.

To save a measurement in arrow navigation mode, press **Shift** then **File (7)**. Use the **Arrow** keys to move the red selection box to the **Save Measurement As** submenu key. This submenu key must be used because the arrow navigation mode cannot be used to change data in popup windows in the measurement display. Filenames are determined by the current setting of the **Save Measurement As** submenu key. Refer to “[Save Measurement As](#)” on page 4-11.

You can save a JPEG image of the current display screen by pressing three keys, **Shift**, then **Decimal**, then **+/-**. The JPEG image shows screen data, but does not contain the additional measurement information that accompanies a saved measurement in a *.pim measurement file.

To return to normal touch entry mode, reboot the instrument (turn power Off and then On). If your touch screen has been damaged, then refer to [Section 1-2 “Contacting Anritsu”](#) on page 1-2.

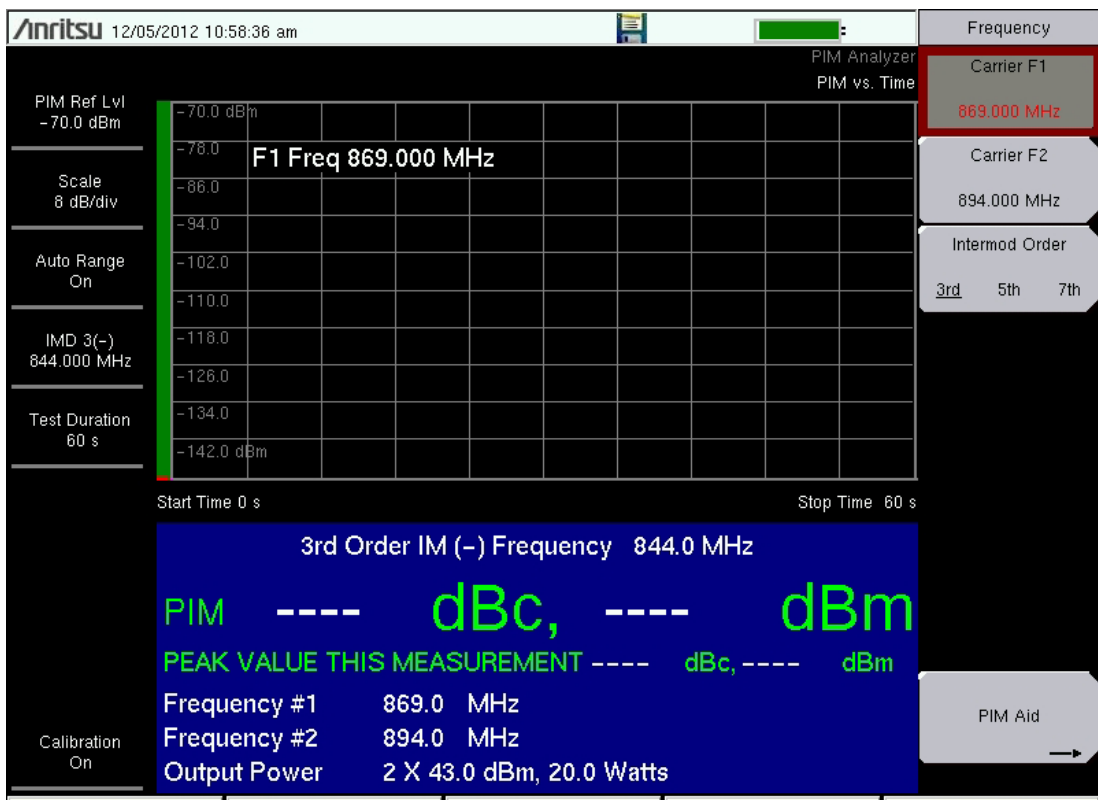


Figure 2-15. Arrow Navigation Mode

2-13 Parameter Setting









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

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

2-14 Symbols and Indicators

The following symbols, icons, and indicators convey the instrument status or condition on the display. The colors shown here are in the standard or default display mode.

Table 2-1. Symbols and Icons

Symbol	Description
	Green: Battery is 30 % to 100 % charged
	Yellow: Battery is 10 % to 30 % charged
	Red: Battery 0 % to 10 % charged
	Green with Black Plug body: Battery is fully charged and external power is applied
	Lightning Bolt: Battery is being charged (any color symbol)
	Red Plug body: External power is applied, and no battery is installed, or battery has lost communications with the instrument
	Storage Icon: Image of a 3.5 inch floppy disk drive, shortcut to the Save Menu
	Camera Icon: Saves a JPEG image of the current screen display
GPS	GPS images are shown in Chapter 6, “GPS (Option 31)” .

The battery symbol above the display indicates the charge remaining in the battery. The colored section inside the symbol changes size and color with the charge level. The Battery Charge LED (adjacent to the On/Off button) flashes when the battery is charging, and remains on steady when the battery is fully charged.

Caution Use only Anritsu-approved batteries, adapters, and chargers with this instrument. Anritsu Company recommends removing the battery for long-term storage of the instrument.

Touch the storage icon to open the touch screen keyboard for saving measurements, setups, limit lines, or screen display JPEG files (see [Figure 4-1, “Save Dialog Box” on page 4-3](#)).

2-15 Firmware Overview

Main Menu Keys

The PIM Master menu-driven interface is easy to use and requires little training. The 5 Main Menu keys are located below the measurement display. These 5 keys are used to display the function-specific menus in the active menu (submenu labels). These Main Menu keys vary in function based on the selected mode of operation (**Shift, Mode (9)**) or measurement type within a mode. Refer to [“Mode Selector Menu” on page 2-17](#) for more information on changing the instrument mode. [Table 2-2](#) lists from left to right the Main Menu Key labels for each mode of instrument operation.

Table 2-2. Mode-Dependent Main Menu Keys Located Below Measurement Display

Mode/Measurement Type	Key 1	Key 2	Key 3	Key 4	Key 5
PIM vs. Time	Freq	Amplitude	Setup	Measurements	Marker
Noise Floor	Freq	Amplitude	Setup	Measurements	Marker
DTP	Distance	Amplitude	Setup	Measurements	Marker
Swept PIM	Freq	Amplitude	Setup	Measurements	Marker
High Accuracy Power Meter		Amplitude	Average	Zero/Cal	Limit

Submenu Keys

The 8 submenu keys are located to the right of the measurement display. They change function depending upon the current mode and current menu selection. The current submenu title is shown at the top of the active function block (submenu key labels). Refer to [Figure 2-7 on page 2-14](#).

Initial Measurement

Measurement selection is made in the Measurements menu. The measurement types that are available include: PIM versus Time, Noise Floor, Distance-to-PIM (DTP), and Swept PIM. Refer to [Chapter 3, “Quick Start Guide”](#).

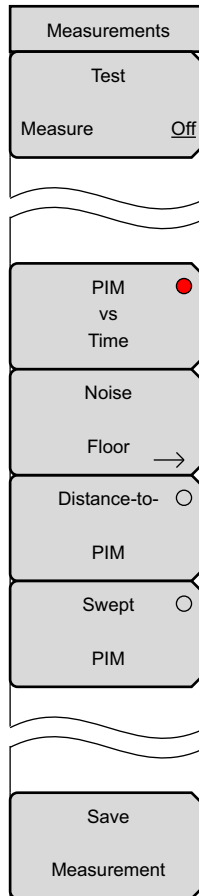


Figure 2-16. Measurements Menu

Chapter 3 — Quick Start Guide

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

3-1 Introduction

This chapter describes the basic setup and use of the PIM Master. Tasks common to all PIM measurements are introduced here.

3-2 Turning On the PIM Master for the First Time

The Anritsu MW82119A PIM Master is capable of more than 3.0 hours of continuous operation from a fully charged, field-replaceable battery (refer to [Section F-4 “Battery Replacement” on page F-3](#)). The PIM Master can also be operated from a 12 VDC source (which will also simultaneously charge the battery). This can be achieved with either the Anritsu AC Adapter or Automotive 12 Volt Adapter. Both items are included as standard accessories (refer to the list of accessories in the Technical Data Sheet for your specific instrument, as listed in [Appendix A](#)).

Caution

When using the Automotive Adapter, always verify that the supply is rated for a minimum of 60 Watts at 12 VDC and that the socket is clear of any dirt or debris. If the adapter plug becomes hot to the touch during operation, then discontinue use immediately.

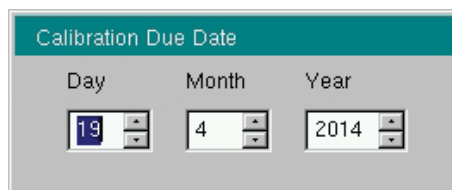
To turn on the MW82119A PIM Master, press the **On/Off** button on the front panel ([Figure 2-1 on page 2-4](#)). The PIM Master takes approximately forty seconds to complete power-up and to load the application software. At the completion of this process, the instrument is ready to be used.

Note

Anritsu recommends that you turn on your PIM Master and let it warm up for 10 minutes before performing your first calibration.

Calibration Due Date

On first use, or if the Calibration Reminder setting is greater than the due date, a menu is displayed requesting that you enter the **Calibration Due Date** for this instrument. This date is available on the calibration sticker that is provided with the instrument. Enter the correct day, month, and year and then press **Enter**.



Calibration Due Date		
Day	Month	Year
19	4	2014

Figure 3-1. Calibration Due Date Dialog Box

The initial calibration due date is set to one year from the Factory Calibration Date, unless you enter a different date.

Calibration Reminder

You can set a reminder of the due date by pressing the Days Before Calibration Reminder submenu key and entering a number with the number keypad. Complete the entry by pressing the Enter submenu key or the instrument **Enter** key.

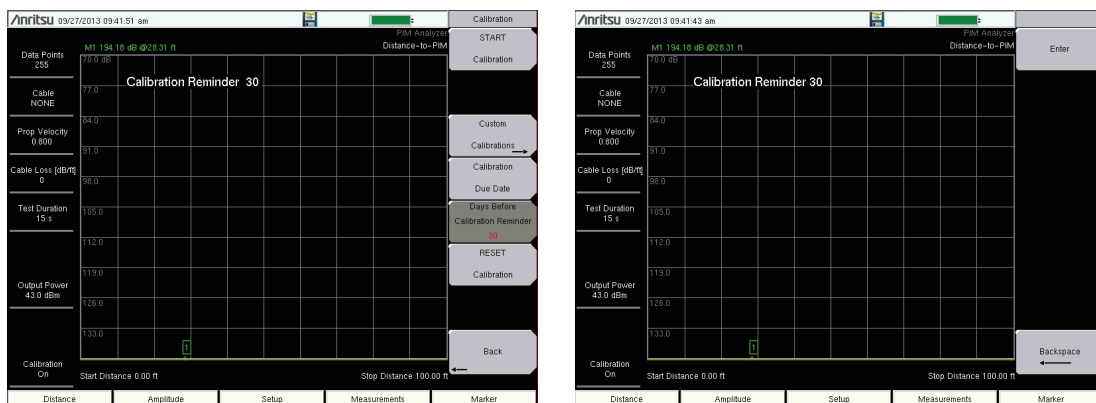


Figure 3-2. Days Before Calibration Reminder

Preparing for Measurements

Along with your PIM Master, you need tools and components that are provided in the accessory kit, and you need to set up the instrument for your planned measurements.

Checking Required Tools and Components

The following items are supplied with your PIM Master accessory kit or can be ordered separately as individual components. Consult your Technical Data Sheet for part numbers.

- Test cable
- Connector Saver (included with instrument, 7/16 DIN(f) to 7/16 DIN(m), 50 Ω adapter)

Note

Install the connector saver on the test port (RF output) of the PIM Master using a torque wrench. The recommended torque is 25 N·m (~18 lbf·ft). This protects the test port from wearing out. Typically, 500 matings is the life of a connector for PIM testing. The connector saver can remain on the PIM Master while inside the soft case or the transit case.

- RF Adapters
- PIM Standard
- Low PIM Termination
- Torque Wrench
- Adjustable Wrench
- Cleaning Kit

Setting Up the PIM Master

With the PIM Master on, check the upper-right corner of the display screen to verify that the PIM Master is in PIM Analyzer mode, or press **Shift** and **Mode (9)** and verify that the PIM Analyzer mode is selected. Press **Esc**, if necessary, to close the Mode Selector window.

1. If necessary, press the **Menu** key and then press the PIM Analyzer icon.
2. Before calibrating the PIM Master, set the parameters for all three measurement types. This will eliminate the need for recalibrating due to changing parameters. To set up the parameters for all three measurement modes, perform the following steps.
3. Press the **Measurements** main menu key and then press the PIM vs. Time submenu key.
4. Press the **Freq** main menu key, then select the input frequencies for the F1 and F2 carriers, and then select the intermodulation order.
 - a. Press the Carrier F1 submenu key and set the desired frequency.
 - b. Press the Carrier F2 submenu key and set the desired frequency.
 - c. If necessary, press the Intermod Order submenu key until the desired setting is underlined (3rd, 5th, or 7th).
5. Press the **Setup** main menu key to set the power level and test duration.
6. Press the **Measurements** main menu key and then press the Distance-to-PIM submenu key.
7. Press the **Setup** main menu key, then the DTP Aid submenu key.
8. On the DTP Parameters screen, use the touch screen to enter or select values for Distance, Data Points, and Cable type (or enter Cable Loss and Propagation Velocity).
9. Press the **Measurements** main menu key and then press the Swept PIM submenu key.
10. Press the **Setup** main menu key,
11. Set the Output Power level and Test Duration.
12. Press the **Freq** main menu key
13. Set the Step Size and Intermod Order.
14. Visually inspect all RF connectors on the test instrument, test lead, PIM standard, and Low PIM termination. Clean connections each day prior to first use.

Note	Save your instrument settings in a setup file to allow easy recall of frequently used settings.
-------------	---

Measurement Types

From the measurements menu (see [Figure 3-8 on page 3-19](#)), you can select four measurement types:

PIM versus Time

This measurement tracks instantaneous PIM and also records Peak PIM levels throughout a fixed frequency PIM test. It is useful for dynamic PIM tests and provides a visual indication of the stability of the system under test.

Noise Floor

Two different Noise Floor measurements are available to evaluate Rx interferers before making a PIM measurement. For each measurement, Tx power is Off. The Time View allows you to check for external interference at the IM frequency that is being measured. The Spectrum View allows you to view interference levels across the current Rx frequency range.

The IM products of interest are in the same frequency range that is used by mobile user equipment to communicate with the base station. It is therefore possible for nearby mobile equipment to generate signals that are high enough to interfere with your PIM measurement.

Distance-to-PIM

Distance-to-PIM (DTP) is similar to Distance-to-Fault (DTF), which Anritsu introduced in the Site Master for identifying the location of impedance mismatches in a feed line. DTP quickly and accurately identifies the location of PIM faults inside the feed system as well as beyond the antenna.

Distance-to-PIM is a swept measurement that enables identification of the location of multiple PIM sources in the RF path. Distance-to-PIM is an analysis feature only, and it should not be used as a pass / fail test.

Swept PIM

PIM measurements are the vector sum of all PIM signals that are generated on a line at the IM frequency being tested. When multiple PIM sources exist, it is possible for the signals to combine out of phase at a particular test frequency to indicate a passing result when the individual PIM levels are actually failures. A Swept PIM test varies the IM frequency over a range of frequencies to provide you with a clearer picture of the true PIM performance of the system.

Calibrating

A full calibration is good for all measurement types at a single power level. A custom calibration is available to generate PIM versus Time and Noise Floor calibrations for all power levels at the current frequency settings.

Caution During calibration, RF is present, and the green RF On light is illuminated.

Calibrations are temperature-dependent. A temperature deviation of approximately 20 degrees Celsius voids an existing calibration. Two temperatures are displayed in a white font (in all measurement modes) in the Instrument Settings Summary, just above the Calibration On/Off message. One is the temperature in the PIM Master now, and the other is the temperature at calibration. When the current temperature (labeled **now**) changes up or down to within 2 degrees of the calibration limit, the font color of the current temperature is displayed in yellow. This color changes to red if the current temperature exceeds the calibration limit. **N/A** is displayed for the calibration temperature when no valid calibration file exists for the current instrument settings. See [Figure 3-3 on page 3-7](#).

All calibrations have a 12-hour timeout. If the PIM Master remains On, and if all settings remain consistent, then the current calibration file remains effective. If any setting is changed after 12 hours, including a power cycle of the PIM Master (Off and On), then the calibration expires.

After a calibration is performed, that calibration can be used again after settings are changed and then returned to the previous settings for which the calibration was performed (within 12 hours).

Distance-to-PIM and Swept PIM must use the full calibration. If output power, test frequencies, or IM Order are changed, then a new calibration is required. A PIM vs. Time Only calibration is available as a Custom Calibration ([refer to](#) section “Custom Calibration” on page 3-11). ... “Custom Calibrations Menu” on page 3-24

Ref Lvl -70.0 dBm	Ref Lvl -70.0 dBm	Ref Lvl -70.0 dBm
Scale 7 dB/div	Scale 7 dB/div	Scale 7 dB/div
Auto Range Off	Auto Range Off	Auto Range Off
IMD 3 1.870 GHz	IMD 3 1.870 GHz	IMD 3 1.870 GHz
Test Duration 60 s	Test Duration 60 s	Test Duration 60 s
Trace Mode Fast	Trace Mode Low Noise	Trace Mode Low Noise
Temperature 37.0 °C (now) 36.5 °C (cal)	Temperature 42.8 °C (now) 23.8 °C (cal)	Temperature 44.5 °C (now) 23.8 °C (cal)
Calibration On	Calibration On	Calibration Off

Figure 3-3. Temperature and Calibration

Calibrating the PIM Master

This calibration applies to the current settings for PIM vs. Time, Noise Floor, Distance-to-PIM, and Swept PIM.

1. Press **Shift** then **Cal (2)**.
2. In the Calibration menu, press the **Start Calibration** submenu key.
3. Connect a PIM standard onto the test port of the PIM Master or at the end of the PIM test cable. Connect a Low PIM Termination onto the PIM standard.

Note	If you have a connector saver on your PIM test port, then that connector saver is considered to be your PIM test port during calibrations and measurements. This may be the point of calibration, or you may be using a PIM test cable.
-------------	---

4. Press **Enter** to calibrate or **Esc** to exit.
5. During the calibration, CALIBRATION IN PROCESS... is displayed on the measurement screen in red letters.
6. When prompted, remove the PIM standard and the Low PIM Termination, and then connect only the Low PIM Termination.
7. Press **Enter** to calibrate or **Esc** to exit.
8. If the Low PIM Termination is better than -88 dBm, then the calibration continues, as in [Step 9](#).

If the Low PIM Termination just installed has high PIM, then this calibration will not be useful. If the measured PIM is worse than -88 dBm, then a warning is displayed. See [Figure 3-4 on page 3-9](#). The displayed warning provides 3 options.

a. Verify again

After you have made corrections, press this button to continue the calibration.

b. Bypass verification

Press this button to ignore the warning and continue the calibration.

c. Exit calibration

Press the button to abort the current calibration.

9. During the calibration, CALIBRATION IN PROCESS... is displayed on the measurement screen in red letters.
10. When prompted, remove the Low PIM Termination, leaving nothing connected at the point of calibration (Open circuit.)
11. Press **Enter** to calibrate or **Esc** to exit.
12. During the calibration, CALIBRATION IN PROCESS... is displayed on the measurement screen in red letters. When calibration is complete, two beeps are emitted, and **Calibration On** is displayed at the bottom of the Instrument Settings Summary.

Bad Load Detection Feature

The second step of a calibration requires removal of the PIM Standard and reattachment of the Low PIM Termination. If the Low PIM Termination has measured PIM worse than -88 dBm, then the **WARNING: High PIM detected** dialog box is displayed (as shown in Figure 3-4).

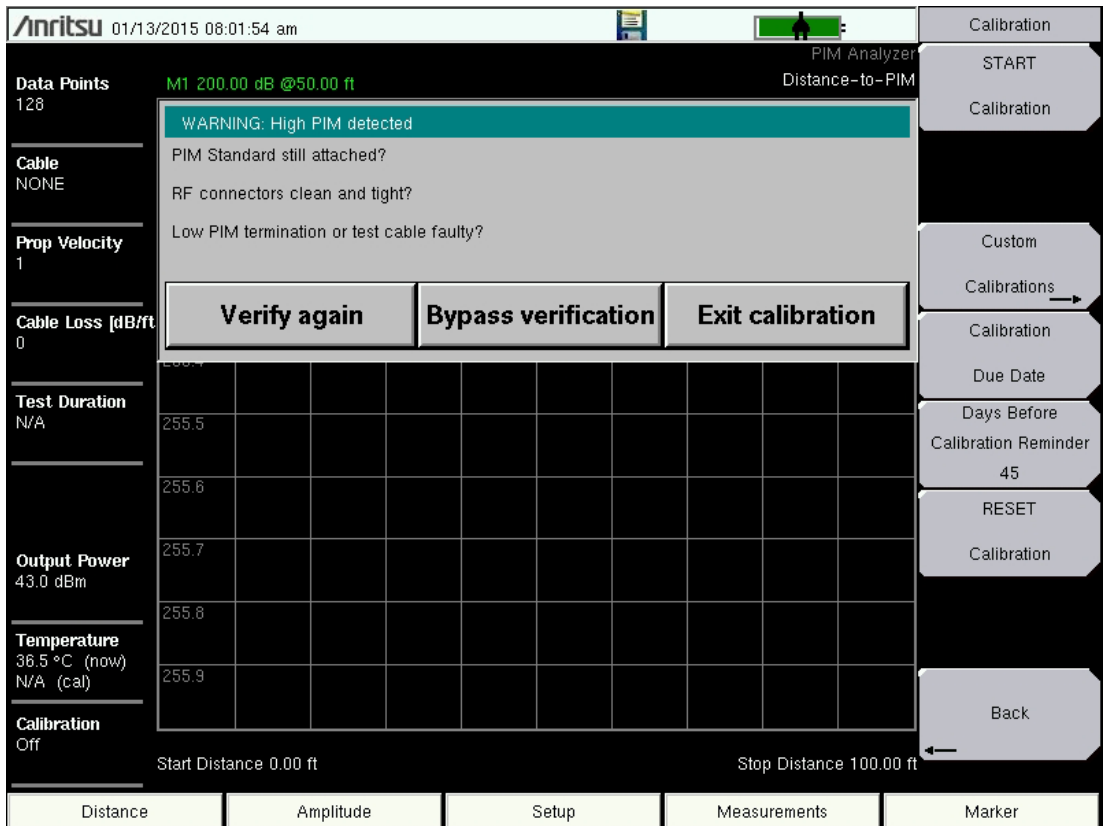


Figure 3-4. Bad Load Detection Warning

Verifying Residual PIM

Perform this test immediately following calibration while the Low PIM Termination is still connected to the Test Port.

1. From the Measurements menu, press the PIM vs. Time submenu key followed by the Test submenu key so that Measure is underlined.
2. Lightly tap on the Low PIM Termination during the PIM vs. Time test. The peak PIM value should be at least 10 dB below the pass/fail criteria for the DUT.

If the measured PIM is outside of the limit in [Step 2](#), then you may have one of the following problems:

- Metal flakes inside one or more RF connectors
- Loose RF connector
- Faulty Low PIM Termination
- Worn connector saver
- Damaged Test Port connector

Investigate and repair the source of any problem, and then repeat the calibration process.

Verifying the PIM Standard

1. Connect a PIM Standard to the Test Port.
2. Connect a Low PIM Termination to the PIM Standard.
3. From the Measurements Menu, press the PIM vs. Time submenu key, followed by the Test submenu key so that Measure is underlined.
4. The peak PIM value for the PIM Standard that you are testing should be within ± 3 dB of the numbers shown in [Table 3-1 on page 3-11](#). If the measured PIM is outside of the ± 3 dB limit, contact Anritsu customer service.
<http://www.anritsu.com/contact.asp>

PIM Standards

Table 3-1 provides PIM values and frequencies for two PIM Standards. The PIM values in this table represent PIM power for typical IM3 at 2 X 20 W.

Table 3-1. PIM Value Versus Frequency for PIM Standards – with Typical IM3 at 2 X 20 W

Option	F1	F2	IM3	-80 dBm at 1775 MHz PN: 1091-390-R
700 (lower)	734 MHz	757 MHz	711 MHz	-87 dBm -130 dBc
700 (upper)	734 MHz	757 MHz	780 MHz	-86 dBm -129 dBc
702 (lower)	768 MHz	803 MHz	733 MHz	-87 dBm -130 dBc
702 (upper)	768 MHz	803 MHz	838 MHz	-86 dBm -129 dBc
850	869 MHz	894 MHz	844 MHz	-86 dBm -129 dBc
800	791 MHz	821 MHz	851 MHz	-86 dBm -129 dBc
900	935 MHz	960 MHz	910 MHz	-86 dBm -129 dBc
180	1805 MHz	1880 MHz	1730 MHz	-80 dBm -123 dBc
192, 193 (PCS/AWS)	1930 MHz	2130 MHz	1730 MHz	-80 dBm -123 dBc
190, 193 (PCS)	1930 MHz	1990 MHz	1870 MHz	-78 dBm -121 dBc
210	2110 MHz	2170 MHz	2050 MHz	-78 dBm -121 dBc
260	2620 MHz	2690 MHz	2550 MHz	-75 dBm -118 dBc

Note Typical values are shown. PIM Standards can vary ± 3 dB due to manufacturing variation. Record the starting value of your PIM Standard, and use that value for test equipment verification.

Verifying the Test Cable

Note

When testing, cables are connected and disconnected many times. In order to save wear on these test port cables and adapters, Anritsu recommends removing the o-rings. This allows getting a sufficiently tight connection without unnecessary stress on the connectors. In the field, o-rings are important to maintain connection integrity over long time periods. Connections must be torqued to specifications in order to ensure that they prevent water intrusion.

During your test, if the DUT connector has an o-ring, leave it in place and tighten to the correct torque.

Next, check the condition of the test cable. If you should accidentally calibrate with an out-of-specification Low PIM termination, this verification will reveal the problem.

1. Connect a test cable to the PIM Master and terminate the other end with a Low PIM Termination.
2. From the Measurements Menu, press the PIM vs. Time submenu key followed by the Test submenu key so that **Measure** is underlined.
3. During the test, flex the test cable and verify that the PIM level of the test cable and the Low PIM Termination are at least 10 dB below the pass / fail criteria for the DUT.
If the test cable fails, inspect the connections to ensure that they are clean and tight. If poor performance persists, then repeat the calibration process.
4. If the PIM level of the setup is within specification, then disconnect the Low PIM Termination and connect the test cable to the DUT for a PIM measurement.

Checking for External Interference

Before performing a PIM test on an antenna system, verify that external interference is not present at the selected IM frequency.

1. Connect a test cable from the PIM Master to the DUT.
2. Press the **Measurements** main menu key and then press **Noise Floor** to open the Noise Floor submenu.
3. From the Noise Floor submenu, press the **Test** submenu key so that **Measure** is underlined.
4. Verify that the external noise level at the selected IM frequency is below the required system pass / fail threshold for PIM.

Making PIM Measurements

1. Press the **Measurements** main menu key and then press one of the measurement submenu keys (PIM vs. Time, Distance-to-PIM, or Swept PIM).
2. From the Measurements menu, press the **Test** submenu key so that **Measure** is underlined.
3. During a PIM versus Time test, tap connectors and the antenna.
Note: Set the test duration time so that you can tap all desired areas.
4. After the measurement is complete, press the **Save Measurement** submenu key, provide an appropriate name, and save the measurement. (Refer to [Section 4-3 “File Management”](#) on page 4-2.)

Note

The PIM Master continually monitors Return Loss at the two PIM test frequencies. If the Return Loss exceeds -6 dB, then the PIM test will be terminated, and a warning message will appear saying, “Warning! High Reflection from measurement path!”

If this message appears, use a Site Master DTF measurement to identify the location of the high reflections.

3-3 Setting Up Limit Lines

Press the **Shift** key then the **Limit (6)** key on the number keypad to display the Limit menu. The limit lines and Limit menu are not available in Distance-to-PIM measurements.

Changing Limit Line Settings

1. Press the **Shift** key and then the **Limit (6)** key.
2. Press the Limit (Upper / Lower) submenu key to select the desired limit line, Upper or Lower.
3. Activate the selected limit line by pressing the On Off submenu key so that On is underlined.
4. If necessary, press the Set Default Limit submenu key to redraw the limit line in view.
5. Press the Amplitude submenu key to set the Limit value.
6. Press the Limit Alarm submenu key to toggle the alarm setting On and Off. The current setting is underlined.

3-4 Limit Alarm and Pass Indicator

The upper limit must be On to use the Limit Alarm or the Pass Indicator.

The Limit Alarm is an audible alarm that emits a chirp each time a measurement trace exceeds an upper limit. If a measurement trace remains below the upper limit setting, then the measured values (instantaneous PIM) are displayed normally in the PIM Summary Table. If a measurement trace exceeds the upper limit setting at any time during a measurement, then the measured values are displayed in red numerals until the trace is below the upper limit setting. Although the instantaneous PIM values may be displayed in white numerals at the end of a measurement, if the measured PIM value exceeded the upper limit setting at any time during the measurement, then the Peak PIM values will remain displayed with red numerals when the measurement is complete. See [Figure 7-3 on page 7-6](#) for an example of this condition.

The Pass Indicator displays a visual message but has no audible sound. If a measurement trace remains below the upper limit setting, then the measured values are displayed normally. As the measurement is in progress, the word PASS is displayed in large green letters in the sweep window as long as the trace is below the limit. If a measurement trace exceeds the upper limit setting at any time during a measurement, then the measured values are displayed in red numerals, and the word FAIL is displayed in large red letters in the sweep window. The large PASS and FAIL display allows you to see this result on the display screen from a distance.

See [Figure 3-5 on page 3-15](#) for PASS and FAIL display examples.

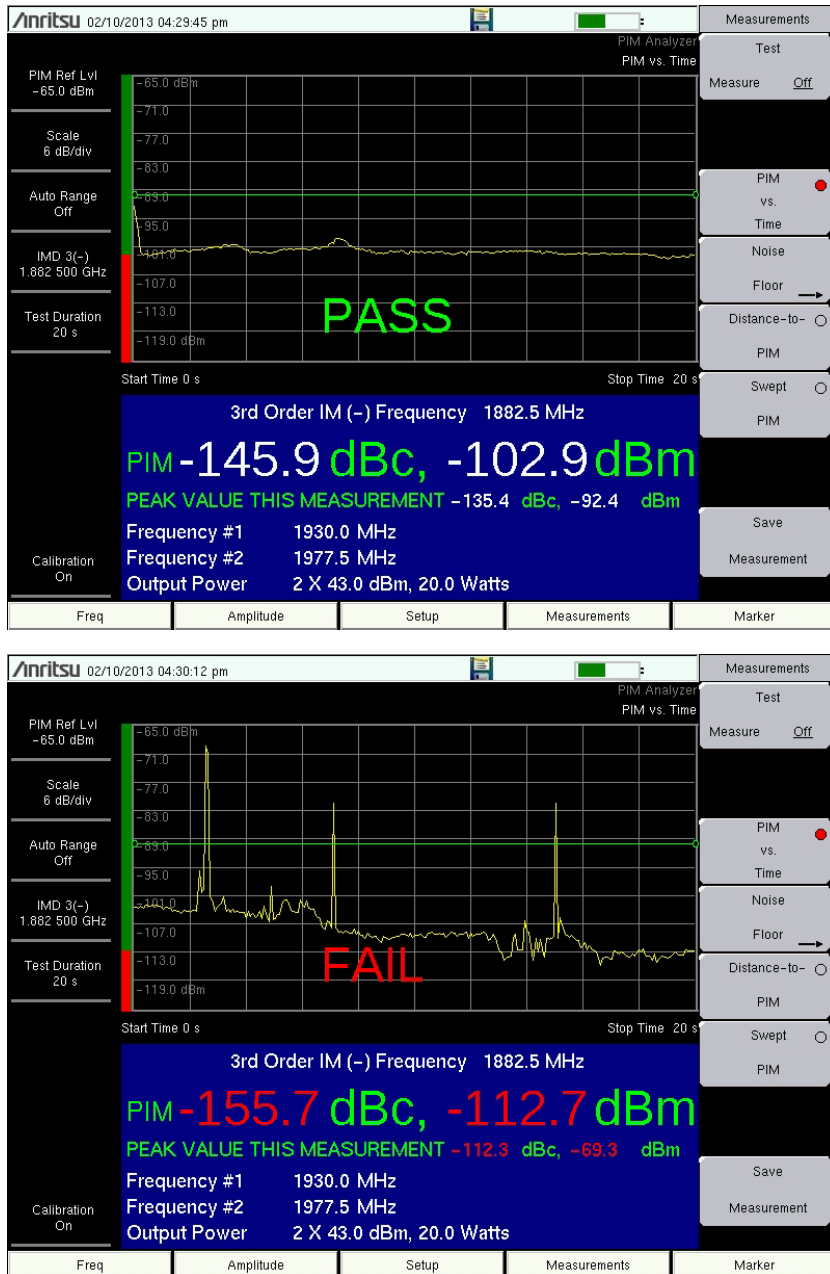


Figure 3-5. PASS and FAIL Indication

3-5 Setting Up Markers

Press the Marker main menu key to display the Marker menu.

Note

Marker menu is not available in Swept PIM measurement mode. Refer to “Marker 1” on page 11-5.

Selecting, Activating, and Placing a Marker

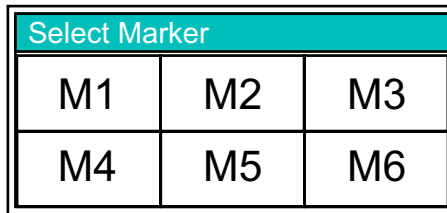


Figure 3-6. Marker Selection Box

1. Press the Marker submenu key to display the Select Marker box, as shown in [Figure 3-6](#). Press the desired marker number. The selected marker number is displayed in the sweep window and is also underlined on the Marker submenu key.
2. Press the On Off submenu key so that On is underlined. The selected marker is displayed in red, ready to be moved.
3. Use an **Arrow** key or the touch screen to place the marker on the desired frequency.
4. Press the Marker To Peak submenu key to move the active marker to the highest signal amplitude that is currently displayed on screen. Press the Marker To Valley submenu key to move the active marker to the lowest signal amplitude that is currently displayed on screen.
5. Repeat [Step 1](#) and [Step 2](#) to activate and move multiple markers.

Selecting, Activating, and Placing a Delta Marker:

1. Press the Marker submenu key and then press the desired delta marker number in the Select Marker box.
2. Press the Delta On Off submenu key so that On is underlined. The selected marker is displayed in red, ready to be moved. The marker number that is displayed in the sweep window changes from **M#** to **Δ#** (for delta marker).
3. Use an **Arrow** key or the touch screen to place the delta marker on the desired offset frequency from the associated reference marker.

Example: Delta Marker 4 is associated with reference Marker 4 (same number).

4. Repeat [Step 1](#) and [Step 2](#) to activate and move multiple markers.

Marker 1 is turned On by default for DTP and Swept PIM measurements. After each measurement, Marker 1 is always placed at the peak value of the measurement. This is also true for PIM versus Time measurements if Marker 1 is turned On before making the measurement.

Viewing Marker Data in a Table Format

The marker table is available only in Distance-to-PIM measurements. In PIM vs. Time measurements and DTP measurements, the active marker number and the x-axis and y-axis values are displayed in green characters just above the measurement graph at the left side.

Press the **Marker Table** submenu key so that **On** is underlined. All marker and delta marker data are displayed (when **On**) in a table under the measurement graph. The table column heading are in white characters in the blue table heading.

Press the **Marker Table** submenu key so that **Large** is underlined. The values displayed are for the active marker, and the marker number is displayed in white characters in the blue table heading and also in green characters above the upper-left corner of the measurement display grid. When you change the active marker, the table data is updated.

3-6 Selecting a Mode and a Measurement Type

1. Change the instrument measurement mode (if required). Press **Shift** then **Mode (9)**.
2. Select the measurement type. Press **Shift** then **Measure (4)**. Select the appropriate measurement type with the submenu key.

3-7 Saving Measurements

1. Press the **Save Measurement** submenu key.
2. Press the **Change Save Location** submenu key and set the current location to be the USB flash drive or internal memory, and then press **Set Location**.
3. Press **Change Type (Setup/JPG/...)** and select **Measurement**. Then press the **JPEG Capture** submenu key (to select **Full** or **Graph Only**), if desired. Then press **Enter**.
4. Enter the file name using the touch keyboard and press **Enter** (touch screen or hard key).

Note

After the **Save Location** and **File Type** are changed, these settings will remain in effect until manually changed again.

Refer to [Chapter 4, “File Management”](#) for additional file management information.

3-8 Menu Map

[Figure 3-7](#) shows the map of the general PIM Analyzer menus that are common to all PIM measurements. The following sections describe the associated menus and submenus. Refer to the PIM Analyzer chapters for specific menus and measurements. Menu maps typically display all possible submenu keys, although some keys and some menus are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages).

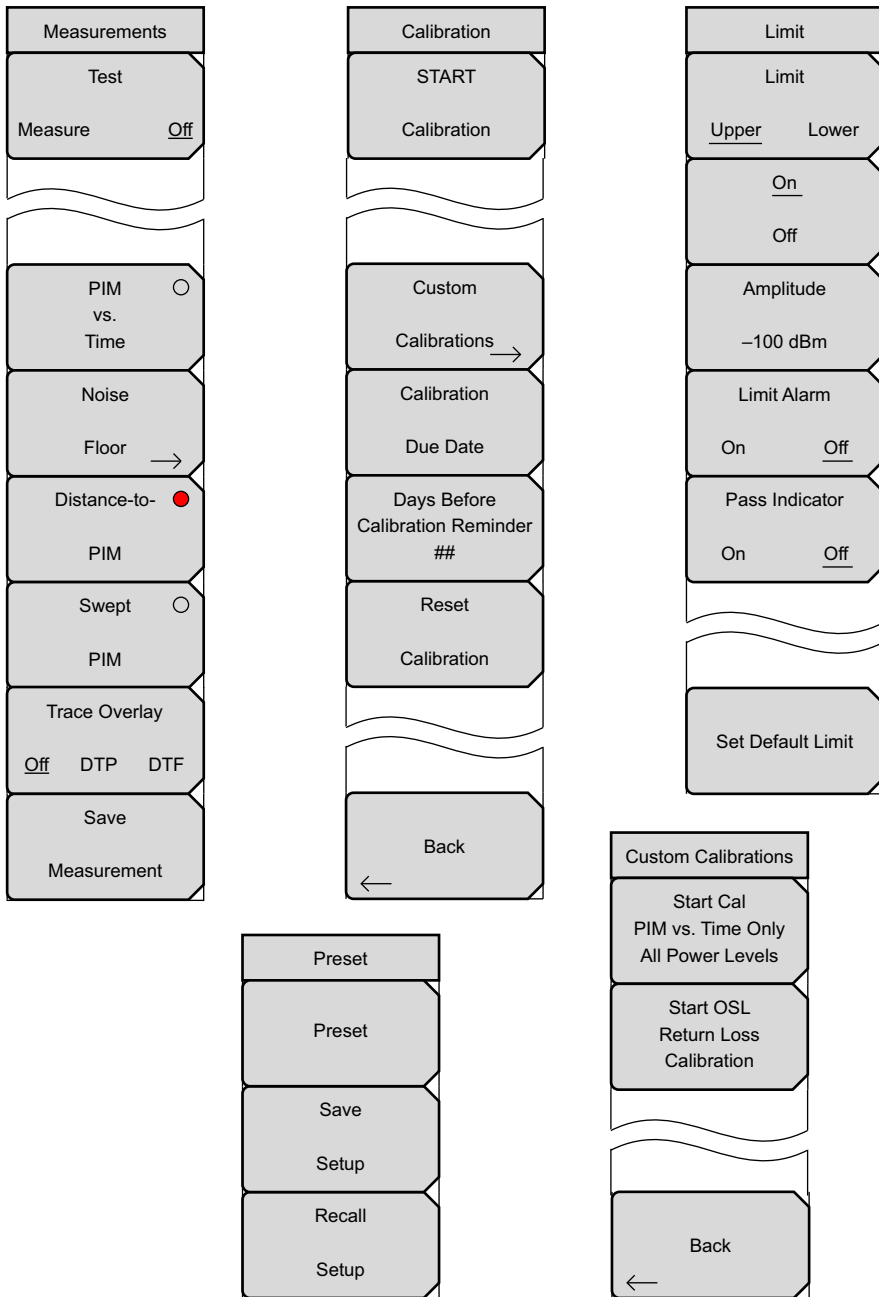


Figure 3-7. PIM Analyzer Menu Map

3-9 Measurements Menu

Key Sequence: **Measurements**

<div style="border: 1px solid black; padding: 2px;">Measurements</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px;">Test</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px;">Measure Off</div>	<p>Test Measure Off: Press this submenu key to start any measurement. When a measurement is being made, Measure is underlined on this submenu key, and the key is highlighted in red (see Figure 3-9 on page 3-20). Also, the green RF-ON light on the top of the PIM Master is On during a measurement (except Noise Floor).</p>
	<p>When the measurement time is completed (Setup > Test Duration), Off is underlined on this submenu key. While a measurement is being made, press this submenu key to immediately terminate the active measurement.</p>
<div style="border: 1px solid black; padding: 2px;">PIM vs. Time ●</div>	<p>PIM vs. Time: Press this submenu key to set the instrument into the PIM versus Time measurement mode. In this measurement, Tx power is On.</p>
<div style="border: 1px solid black; padding: 2px;">Noise Floor →</div>	<p>Noise Floor: Press this submenu key to test for Rx interferers before making a PIM versus Time measurement. In this measurement, Tx power is Off. The Noise Floor Test key is shown in the “Noise Floor Menu” on page 3-21.</p>
<div style="border: 1px solid black; padding: 2px;">Distance-to-PIM ○</div>	<p>Distance-to-PIM: Press this submenu key to set the instrument into the Distance-to-PIM measurement mode.</p>
<div style="border: 1px solid black; padding: 2px;">Swept PIM ○</div>	<p>Swept PIM: Press this submenu key to set the instrument into the Swept PIM measurement mode.</p>
<div style="border: 1px solid black; padding: 2px;">Trace Overlay</div> <div style="border: 1px solid black; padding: 2px; margin-top: 2px;">Off DTP DTF</div>	<p>Trace Overlay Off DTP DTF: Press this submenu key to toggle Trace Overlay Off and On for Distance-to-PIM or Distance-to-Fault. This submenu key is displayed only in Distance-to-PIM measurement mode. Use this key to view the trace, as described in Section 9-6 “Trace Overlay” on page 9-11. If no previous DTP trace is stored, then setting this key to DTP automatically copies the active trace to memory. DTF toggles on the current DTF trace or a DTF trace from memory as an overlay for subsequent DTP measurements. If no DTF trace has been loaded, then DTF cannot be selected. Refer to “Trace Menu, Distance-to-PIM” on page 10-6 for instructions for loading a DTF trace.</p>
<div style="border: 1px solid black; padding: 2px;">Save Measurement</div>	<p>Save Measurement: Press this submenu key to open the “Save Menu” on page 4-12 and its dialog box. Then enter a name and save the current measurement to file. The file type defaults to measurement, and the appropriate extension is added, based on the current measurement mode.</p>

Figure 3-8. DTP Measurements Menu

Test Submenu Key During Measurement

When a measurement is being made, Measure is underlined on this submenu key, and the whole Test key is highlighted in red (as shown in [Figure 3-9](#)).

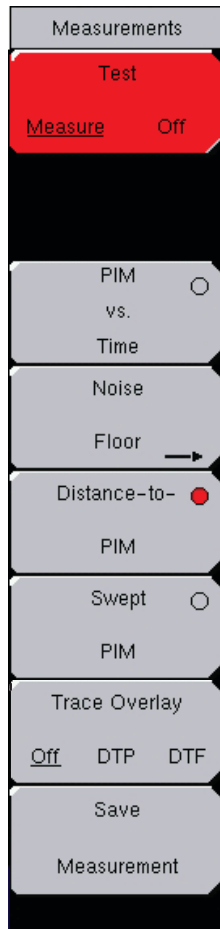


Figure 3-9. Test Submenu Key Highlighted in Red

Also, during PIM vs. Time and Swept PIM measurements, RF ON is displayed in red in the PIM Summary Table (See [Figure 7-3](#) on page 7-6).

3-10 Noise Floor Menu

Key Sequence: **Measurements** > Noise Floor

Refer to “[Noise Floor Menu](#)” on page 8-6.

3-11 Limit Menu

When measurement type is PIM versus Time, Noise Floor, or Swept PIM:

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 pass/fail criteria or for visual reference only.

Limit	Limit
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.
Upper Lower	On/Off: This submenu key turns On or Off the active limit (upper or lower).
On	Amplitude: Press this submenu key to set the amplitude value of the active limit line, Upper or Lower. A value is entered by using the number keypad. Press the +/- key for negative values.
Off	After entering a value, press the dBm or dBc submenu key and then the Enter key, or press the Enter key twice.
Amplitude	
-100 dBm	
Limit Alarm	Limit Alarm
On Off	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 in the PIM Summary Table, and an audible alarm sounds. The Limit Alarm does not function with the lower limit line.
Pass Indicator	
On Off	Pass Indicator
	On Off: Pressing this submenu key toggles the Pass Indicator 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. If the measurement trace remains below the limit line, then at the end of the measurement, PASS is displayed in large green letters in the measurement display. If any measured point exceeds the limit, then FAIL is immediately displayed in large red letters in the measurement display. This message display allows you to see the pass or fail indication from a distance. The Pass Indicator does not function with the lower limit line. See Figure 3-5 on page 3-15 .
Set Default Limit	Set Default Limit: Pressing this submenu key sets the active limit line to the default limit line value, depending upon which limit is active. The inactive limit line is not altered.

Figure 3-10. Limit Menu

3-12 Reference (Limit) Menu

When measurement type is Distance-to-PIM:

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

A reference limit is available for Distance-to-PIM measurements to place a visual reference line on the screen for evaluating PIM magnitudes. This line is for reference only and cannot be used for PASS/FAIL indication.

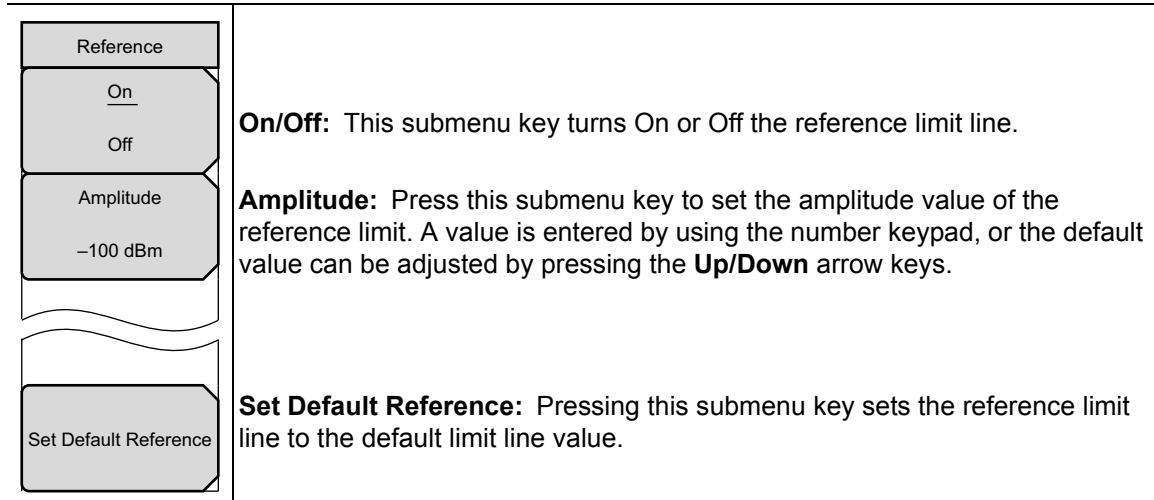


Figure 3-11. Reference (Limit) Menu

3-13 Calibrate Menu

Key Sequence: **Shift > Cal (2)**

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Calibration</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">START Calibration</div>	<p>Start Calibration: Press this submenu key to begin calibration of the PIM Master. You need a PIM standard and a Low PIM Load. Follow screen prompts until calibration is complete.</p>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Custom Calibrations →</div>	<p>Custom Calibrations: Press this submenu key to display the “Custom Calibrations Menu” on page 3-24.</p>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Calibration Due Date</div>	<p>Calibration Due Date: Press this submenu key to enter the date (Day, Month, and Year) when your PIM Master requires calibration.</p>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Days Before Calibration Reminder ##</div>	<p>Calibration Reminder: Press this submenu key to display a Calibration Reminder notice in Days. You can use the number keypad to key in a new reminder duration. Press Esc or any other main menu key or submenu key to dismiss the reminder notice. Set to zero to disable.</p>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Reset Calibration</div>	<p>If calibration is due in less time than this setting, then the reminder notice is displayed when instrument power is turned On.</p>
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">Back ←</div>	<p>Reset Calibration: Press this submenu key to reset the calibration of the PIM Master. This deletes any saved calibration files that match the current instrument settings (power level, PIM Order, and so forth). These can be calibrations for any PIM analyzer function at the set power level.</p> <p>Back: Press the Back submenu key to return to the previous menu.</p>

Figure 3-12. Calibration Menu

Note

During calibration, RF is On, but the RF ON message is not displayed. The CALIBRATION IN PROCESS... message is displayed in red letters on the measurement screen.

3-14 Custom Calibrations Menu

Key Sequence: **Shift > Cal (2) > Custom Calibrations**

Custom Calibrations	Start Cal PIM vs. Time Only All Power Levels: Press this submenu key to begin the calibration for PIM versus Time. You need a Low PIM Termination. Follow screen prompts until calibration is complete.
Start Cal PIM vs. Time Only All Power Levels	In Custom Calibrations, the calibrations are generated at integer power levels within the power level range (for example: 46.0 dBm, 45.0 dBm, 44.0 dBm, ... 25.0 dBm).
Start OSL Return Loss Calibration	Start OSL Return Loss Calibration: Press this submenu key to begin calibration of the PIM test port using an Open-Short-Load (OSL) precision calibration standard. A less accurate calibration method is used during the Standard Calibration process to support DTF measurements through the PIM test port. This OSL calibration is provided to support cases where higher DTF magnitude accuracy is desired.
Back ←	Back: Press the Back submenu key to return to the “Calibrate Menu” on page 3-23.

Figure 3-13. Custom Calibrations Menu

3-15 Other Menus

Noise Floor Menu

Refer to [Chapter 8, “Noise Floor Measurements”](#).

Marker Menu

Refer to [Section 7-10 “Marker Menu” on page 7-16 in Chapter 7, “PIM versus Time”](#).

Refer to [Section 9-18 “Marker Menu” on page 9-29 in Chapter 9, “Distance-to-PIM \(DTP\)”](#).

Markers are not available for Swept PIM measurements.

Trace Menu

Refer to [Chapter 10, “Trace”](#).

GPS Menu

Refer to [Chapter 6, “GPS \(Option 31\)”](#).

System Menu

Refer to [Chapter 5, “System Operation”](#).

File Menu

Refer to [Chapter 4, “File Management”](#).

Sweep Menu

Not applicable in PIM Analyzer modes.

Preset Menu

Refer to [Section 5-4 “Preset Menu” on page 5-8](#).

Chapter 4 — File Management

4-1 Introduction

This chapter describes the file management features of the PIM Master and the file management menus. The submenus under the **File** menu allow you to save, recall, copy, and delete files in the internal memory or in an external USB flash drive. Files can also be managed using an external PC running Line Sweep Tools (LST).

4-2 Managing Files

Press the **Shift** key then the **File (7)** key on the number keypad to display the **File** menu. The following steps describe file management.

Note	When navigating through the File menu, pressing the Esc key returns the menu display to the previous menu.
-------------	--

File Types

In the Save, Recall, Copy, and Delete menus, a submenu key is used to select the type of files to be managed. The **Change Type Setup/JPEG/...** and **File Type_ALL** submenu keys open the Select File Type list box, which displays all of the file types that can be selected in the current instrument mode.

The Select File Type list box may contain some of the following entries:

- ALL (displays all file types)
- Setup, *.stp
(Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.)
- Measurement, *.pim
(Measurement files contain all of the measurement data and all of the information in the setup files.)
- JPEG, *.jpg
- Limit Lines, *.lim
(The Limit line file contains limit line data details. The Limit function is available only in PIM versus Time and Swept PIM measurements.)

You can also use the touch screen to open the drop down list for the Filetype entry box, as shown in [Figure 4-1 on page 4-3](#), [Figure 4-4 on page 4-6](#), [Figure 4-5 on page 4-8](#), and [Figure 4-6 on page 4-9](#).

File types *.map and *.kml (for two-dimensional and three-dimensional map functions) are not use by the PIM Master.

4-3 File Management

You can Save, Recall, Copy, and Delete files, starting from the File menu.

Saving Files

The submenu keys that are available for file management may vary with instrument options and analyzer modes.

Set the Save Location

Press the **Save** submenu key then the **Change Save Location** key and select the location to save files (refer to [“Save Location Menu” on page 4-13](#)). You can save files to the internal memory or to an external USB flash drive. You can also create new folders. If an external USB flash drive is connected or disconnected, press **Refresh Directories** to update the location tree. Press the **Set Location** submenu key to store the save location.

Save a Measurement As

The **Save Measurement As** submenu key is used to quickly save measurements with a specific filename. The PIM Master saves the measurement with the latest filename that was used to save a measurement and with a number that is automatically incremented and appended to the end of the filename. For instance, if the last measurement was saved with the name ACPR, pressing **Save Measurement As** saves the next measurement as ACPR_#1, ACPR_#2, and so forth. The filename that is used can be changed by using the **Save** dialog box ([Figure 4-1](#)).

Save a Measurement

Press the **Save Measurement** submenu key and enter the name for the measurement file. The file type defaults to measurement, and the appropriate extension is added based on the current measurement mode. For more information about file types, refer to [“File Types” on page 4-1](#). Saving and recalling measurements provides a convenient reference for comparing site conditions at subsequent visits.

Save a Setup

Press the **Save** submenu key, type a name for the setup file, confirm that the file type is **Setup** by using the **Change Type** submenu key or the touch screen, and then press **Enter** to save.

Note A setup also can be saved and recalled from the Preset menu.
--

Saving and recalling setups allows you to run the same tests again and again at different sites.

Create a Menu Shortcut for a Setup file

Press the **Recall** submenu key to display saved setup files. Locate the setup file to be the shortcut and then press and hold on the filename (on the touch screen) for a few seconds. Select a location in the shortcut grid to save the setup file. The shortcut grid is for the touch screen shortcut buttons that are displayed by pressing the **Menu** key.

Save a Measurement Screen as JPEG

Press the **Save** submenu key, type a name for the JPEG file, confirm that the file type is JPEG, and press **Enter** to save.

Save Dialog Box

The save dialog box (Figure 4-1) is used to store files on the internal memory or on an external flash drive. The file type, filename, and save location are set at this display. Refer to “Save Menu” on page 4-12 and “Save Location Menu” on page 4-13 for details.

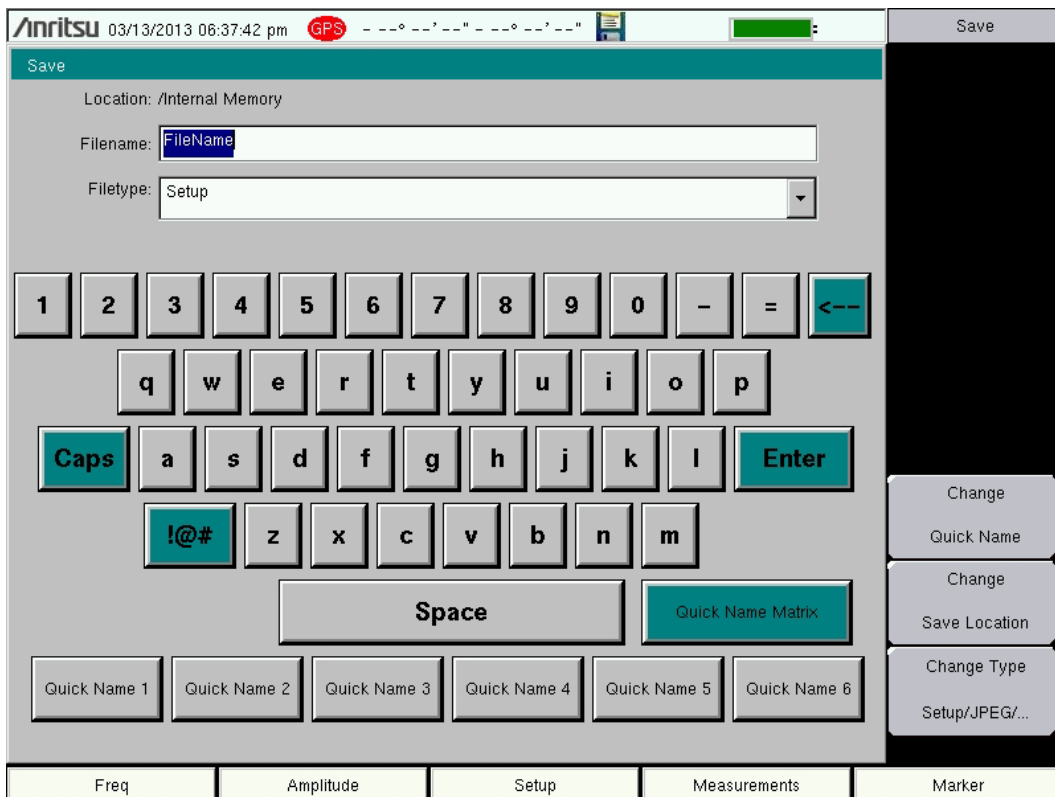


Figure 4-1. Save Dialog Box

Quick Name Keys

Quick Name keys, displayed below the keyboard in [Figure 4-1](#), allow you to enter quick names or name parts for frequently used file names.

Editing Quick Names

To edit the keys, press the **Shift** key, then the **File (7)** key. Press **Save**, then press the **Change Quick Name** key. Select one of the Quick Names for editing, press **Enter**, and type in the new name for the key. This is the text that will be inserted into the Filename edit box. Press **Enter** again and the new name is displayed on the key.

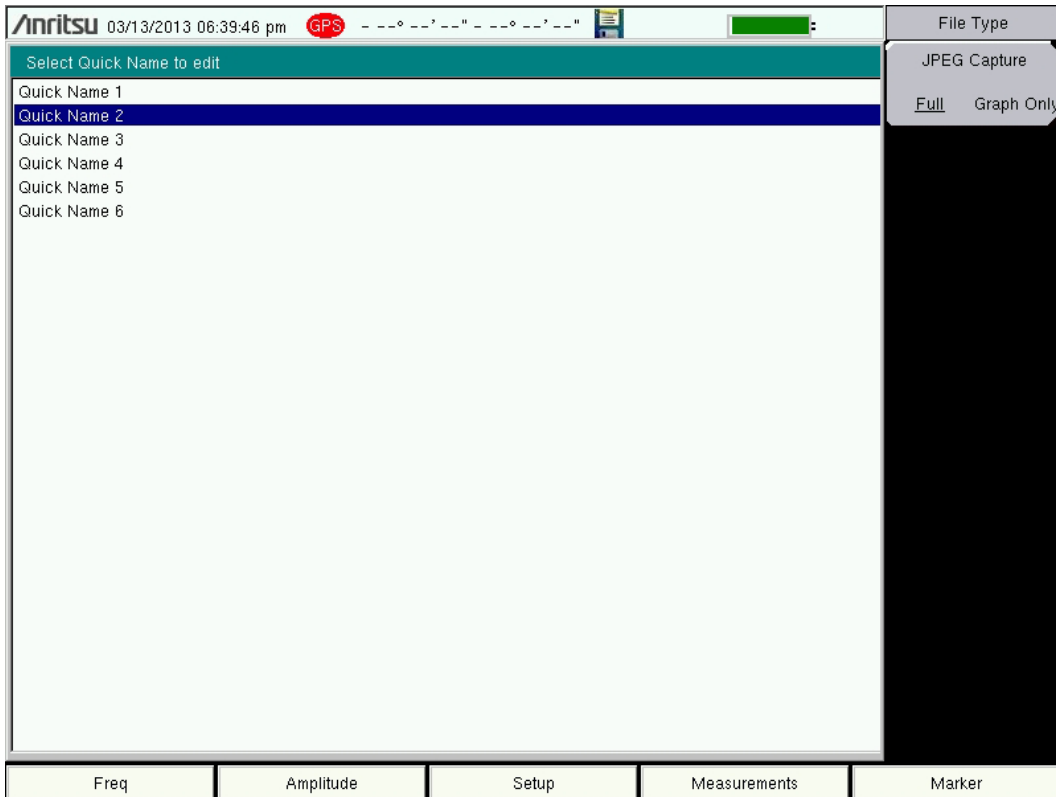


Figure 4-2. Select Quick Name Dialog Box

Using the Quick Name Matrix

From the Save dialog box (Figure 4-1 on page 4-3), press the Quick Name Matrix key (to the right of the Space key) to display the Quick Name Matrix dialog box.

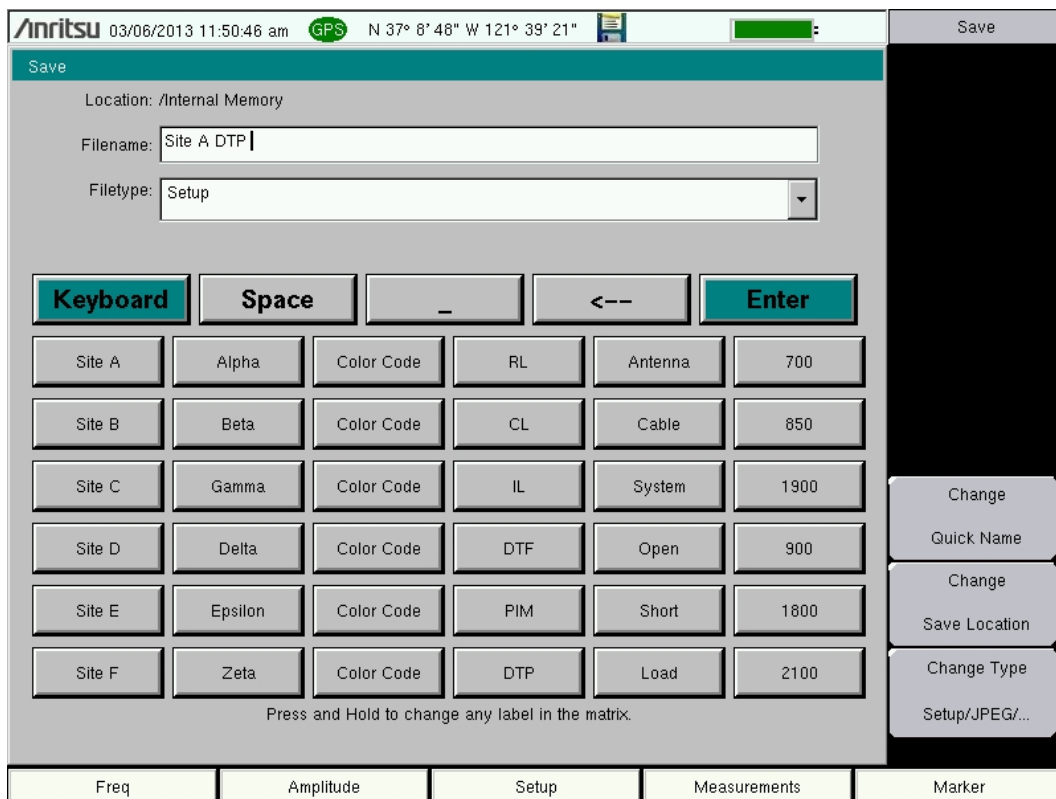


Figure 4-3. Quick Name Matrix Dialog Box

Press any key in the matrix to add text to the Filename. As noted under the matrix of keys, you can press and hold a key to change its text, which is shown on its label. The maximum numbers of characters is 18 per key. When the filename is complete, press the **Enter** key (either in the Matrix or above the number keypad).

To return to the Save keyboard, press the **Keyboard** key in the top row. You can then continue typing in the filename edit box. You can use the instrument **Left** and **Right Arrow** keys (above the number keypad) to scroll through the filename for editing.

Note Entries that you make for the Quick Name Matrix and Quick Name keys can be saved and recalled by using Setup files.

Recalling Files

The recall menu enables you to view all the Measurement and Setup files in the internal memory and the external USB flash drive.

You can sort files in the recall menu by name, date, or type. You can also choose to view only measurement files or only setup files by pressing **File Type** on the Recall dialog box and by selecting the file type that you want to view. For more information about file types, refer to “[File Types](#)” on page 4-1.

Recall a Measurement

From the **File** menu, press the **Recall Measurement** submenu key, select the measurement file (*.pim) with the touch screen or the **Up/Down** arrow keys, and then press **Enter**.

Recall a Setup

Press the **Recall** submenu key. Confirm that the file type is **Setup** or **All**. Select the setup file (*.stp) with the touch screen or the **Up/Down** arrow keys, and then press **Enter**.

Recall Dialog Box

The Recall dialog box ([Figure 4-4](#)) allows you to open previously saved measurements and setups. Refer to the “[Recall Menu](#)” on page 4-16 for additional information.

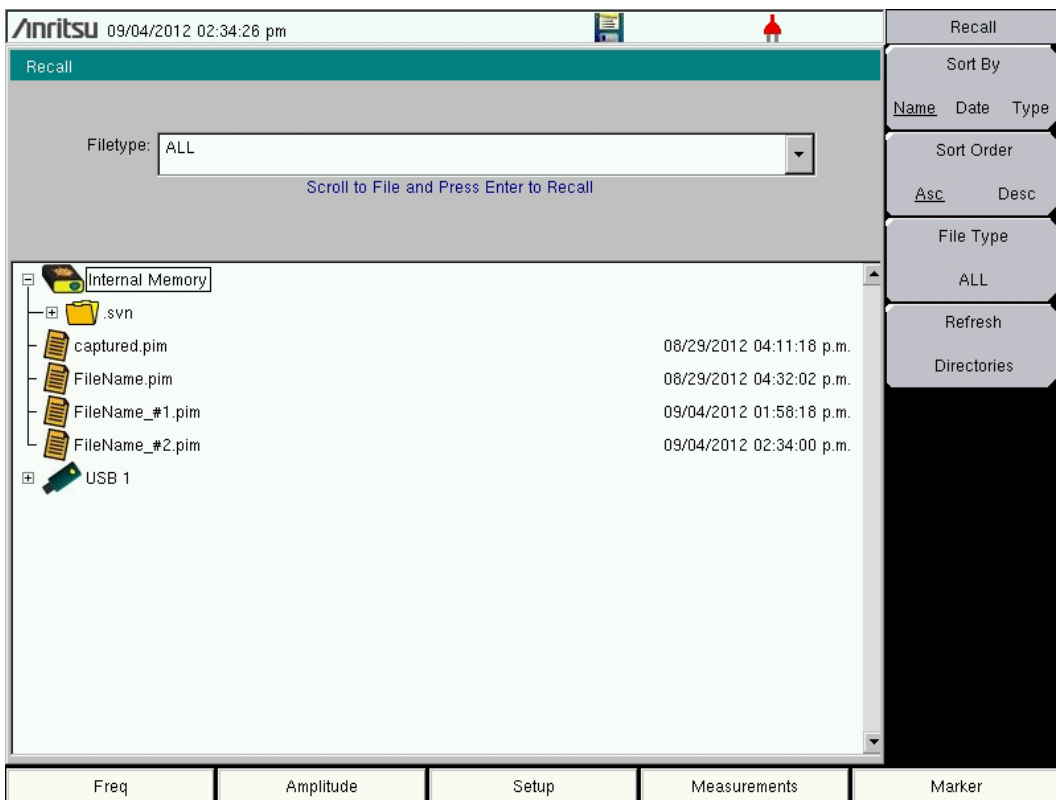


Figure 4-4. Recall Dialog Box

Copying Files

The steps below describe copying a file from internal memory to an external USB flash drive. Select the files to be copied in the top window and select the destination for the files in the bottom window (Figure 4-5). Refer to the “Copy Menu” on page 4-18 for additional information.

1. Insert a USB drive into either of the USB Type A ports of the PIM Master.
2. From the **File** main menu, press the **Copy** submenu key. The Copy submenu and Copy dialog box are displayed.
3. Select the files to be copied. To select multiple files, highlight the first file, then press the **Select** or **De-Select** key to keep the desired files selected. A selected file will be outlined in blue. Repeat with all the files to be copied. To display files in a folder, select the folder and press the **Enter** key.
4. Press the **Scroll** submenu key and highlight the USB drive in the lower window by using the touch screen or the **Up/Down** arrow keys. The **Scroll** submenu key toggles between **Src** (source, top window) and **Dst** (destination, bottom window).

To choose a subdirectory on a USB drive as the save destination, select the desired USB drive (with **Arrow** keys or with the touch screen) and press the **Enter** key to see available subdirectories. When a directory or subdirectory is highlighted, subdirectories can be displayed or closed by pressing the **Right** and **Left** arrow keys.

5. Press the Copy key to copy the files to the flash drive.

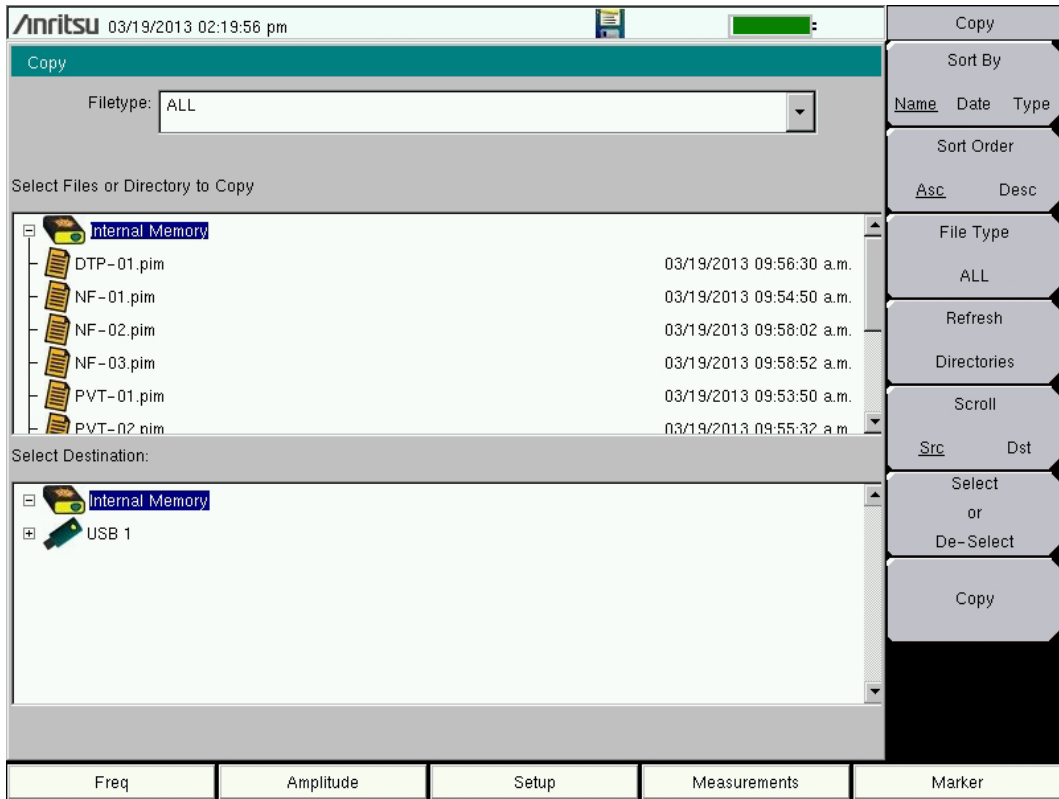


Figure 4-5. Copy Dialog Box

Note Use the **Left/Right** arrow keys to Collapse/Expand folders.

Deleting Files

Delete a Selected File or Files

Press the **Delete** submenu key. Highlight the file to be deleted with the touch screen or with the **Up/Down** arrow keys. Press the **Select or De-Select** key to include desired files. A selected file will be outlined in blue. Press the **Delete** key and then press **Enter** to delete the selected file.

Delete Dialog Box

Press the **Delete** submenu key to open the **Delete** dialog box (Figure 4-6). The submenus allow sorting files by type, name, and saved date. Refer to the “[Delete Menu](#)” on page 4-20 for additional information.

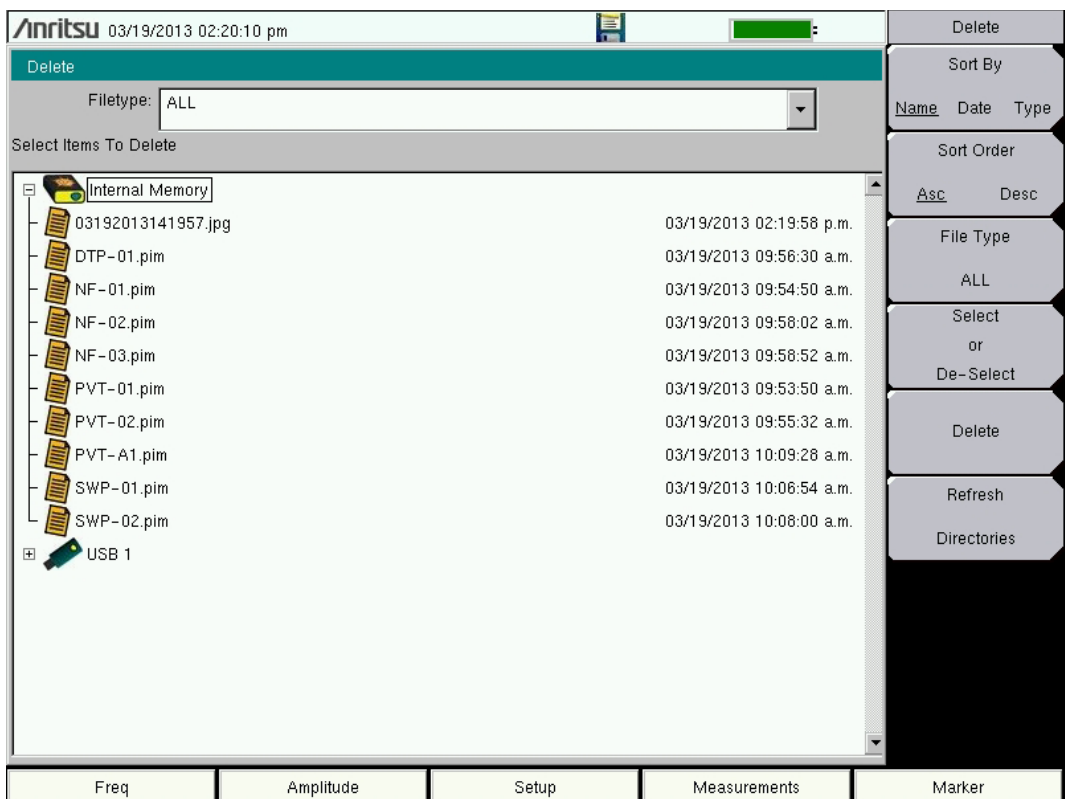


Figure 4-6. Delete Dialog Box

4-4 File Menu Overview

Open the File menu by pressing the **Shift** key, then the **File (7)** key. Menu maps typically display all possible submenu keys, although some keys are displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

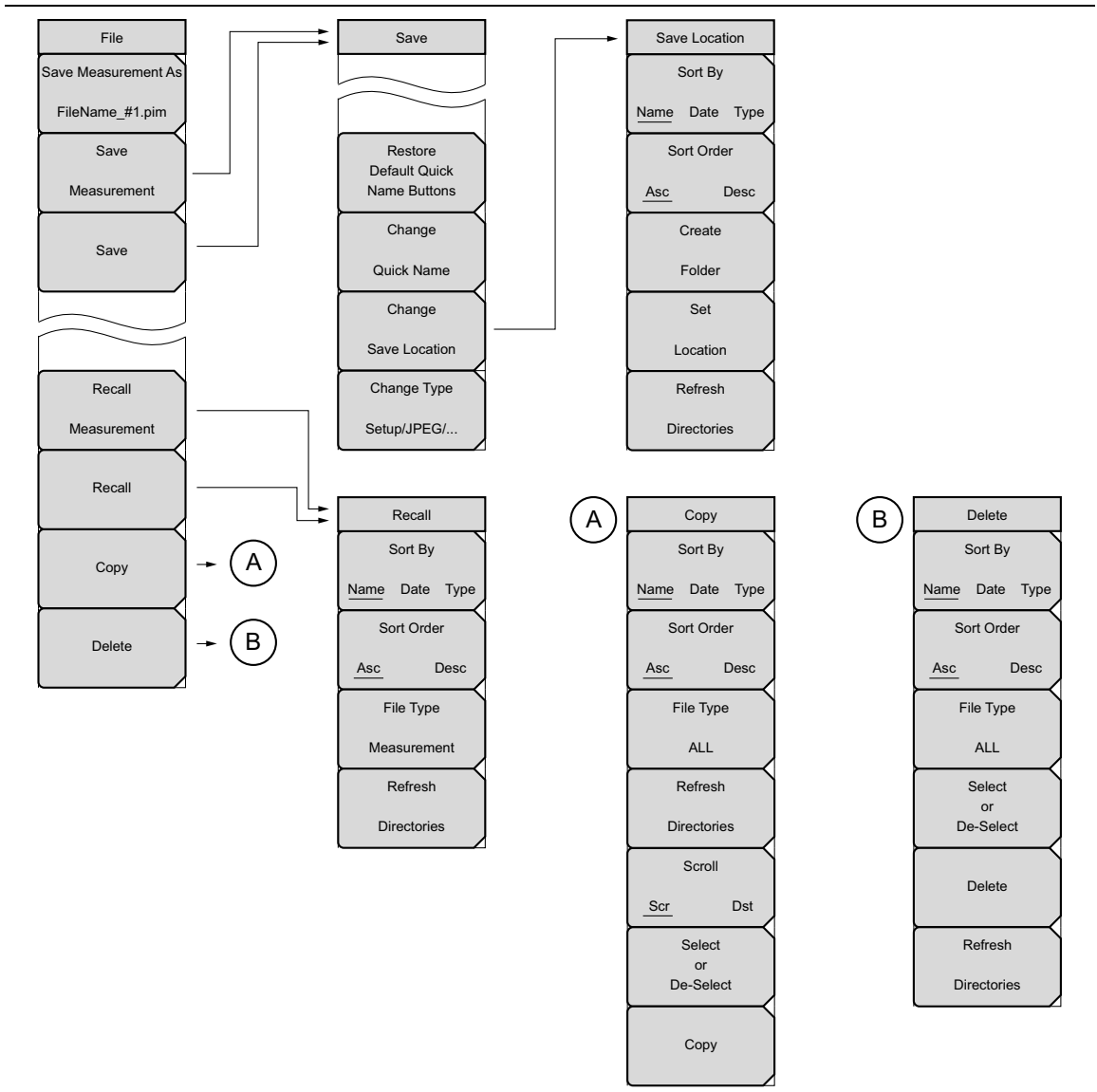


Figure 4-7. File Menu Overview

4-5 File Menu

Key Sequence: **File**

File	<p>Save Measurement As: Press this key to save the current setup with a user-defined filename. The default filename is changed using the Save submenu. To change the default filename, press the Save Measurement submenu key to open the Save dialog box. Enter the new measurement filename with the letter keys. Refer to “Save Menu” on page 4-12. Press Enter to save the name and return to the File menu. The Save Measurement As submenu key displays the new entered name appended with <code>_#1.pim</code>. After a few seconds, the screen returns to the File menu. Press the Save Measurement As key again, and the new filename will be used. Each press of this submenu key saves the current measurement with the same base filename while incrementing the final number. Measurement file names have a <code>.pim</code> extension.</p> <p>Save Measurement: Press this submenu key to display the “Save Menu” and the Save dialog box (see Figure 4-1 on page 4-3). Measurements can be saved to internal memory or to a USB flash drive. The saved measurement can be named using the text entry keys in the dialog box. By default, measurements are saved to internal memory in a directory named <code>/user</code>. The save destination is set with the “Save Location Menu” on page 4-13.</p> <p>Save: Press this submenu key to display the “Save Menu” on page 4-12. Measurements can be saved to internal memory or to a USB flash drive. The saved setup, measurement, or JPEG file can be named by using the text entry keys in the dialog box. By default, measurements are saved to internal memory in a directory named <code>/user</code>. The save destination is set with the “Save Location Menu” on page 4-13.</p> <p>Recall Measurement: Press this submenu key to display the “Recall Menu” on page 4-16. This menu is for recalling measurements from internal memory or from a USB flash drive.</p> <p>Recall: Press this submenu key to display the “Recall Menu” on page 4-16. This menu is for recalling measurements or setup data from internal memory or from a USB flash drive.</p> <p>Copy: Press this submenu key to display the “Copy Menu” on page 4-18. This submenu is for copying files or folders to and from internal memory and a USB flash drive.</p> <p>Delete: Press this submenu key to display the “Delete Menu” on page 4-20 and a selection box that shows the setup and measurement names, the file type, and the date and time that the information was saved. Use the Up/Down arrow keys or the touch screen to highlight the file that is to be deleted and press the Delete submenu key, then confirm your selection by pressing Yes or No in the dialog box. Press the Esc key at any time to cancel the operation. Note that deleted files cannot be recovered.</p>
Save Measurement As	
FileName_#1.pim	
Save	
Measurement	
Save	
Recall	
Measurement	
Recall	
Copy	
Delete	

Figure 4-8. File Menu

Caution Deleted files cannot be recovered.

4-6 Save Menu

Key Sequence: **File** > Save

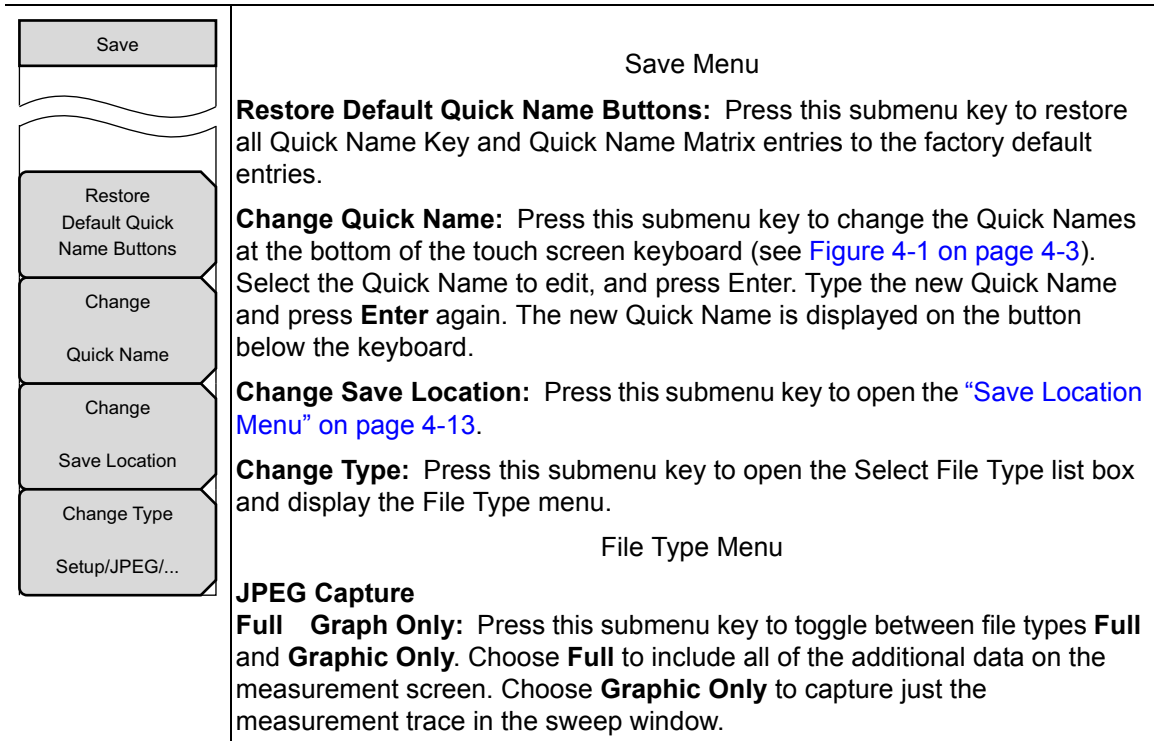


Figure 4-9. Save Menu

4-7 Save Location Menu

Key Sequence: **Shift** > **File (7)** > Save > Change Save Location

This menu and dialog box ([Figure 4-11 on page 4-14](#)) are used to create folders and to select the location that the PIM Master will use to save the current file. Select folders or drives with the **Up/Down** arrow keys or the touch screen.

Note

Only folders (not files) are visible in the Save Location dialog box. To view files, use the [“Save Menu” on page 4-12](#) or the [“Recall Menu” on page 4-16](#).

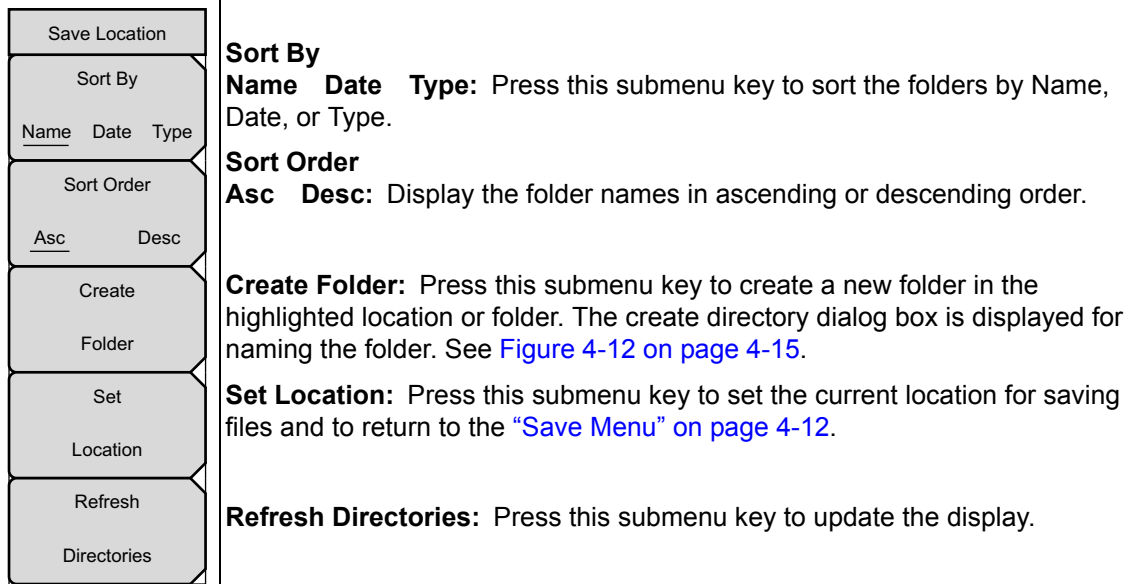


Figure 4-10. Save Location Menu

Select Save Location Dialog Box

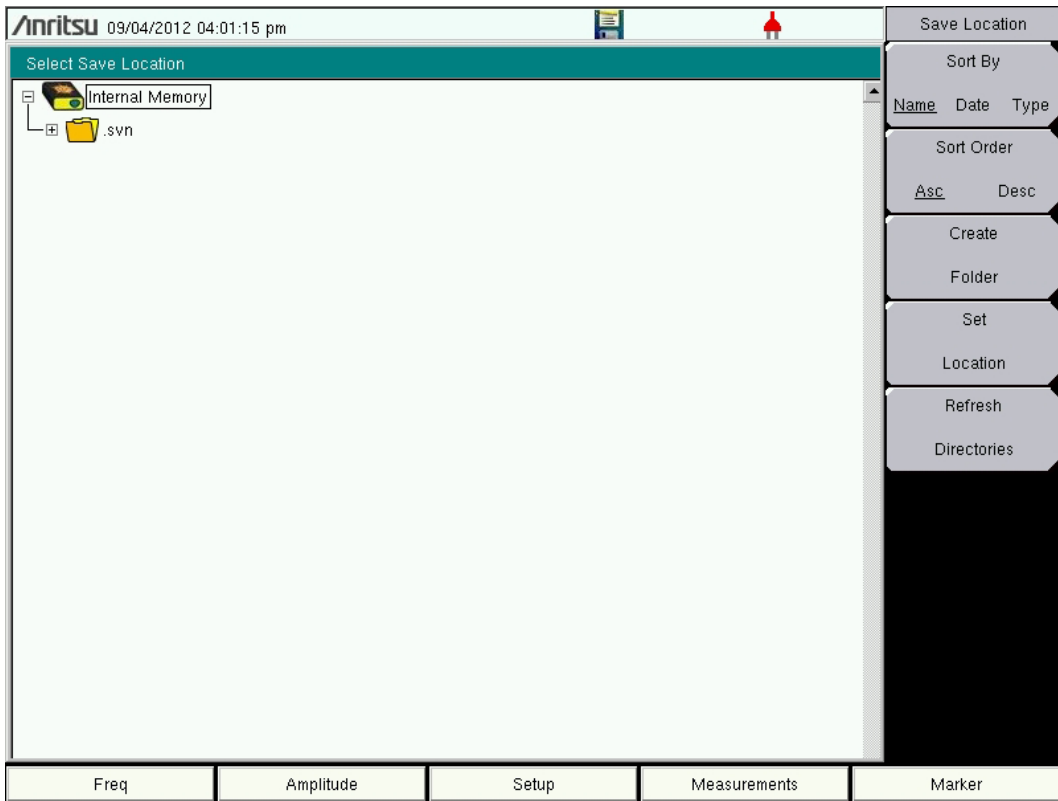


Figure 4-11. Select Save Location Dialog Box

Create Directory Dialog Box

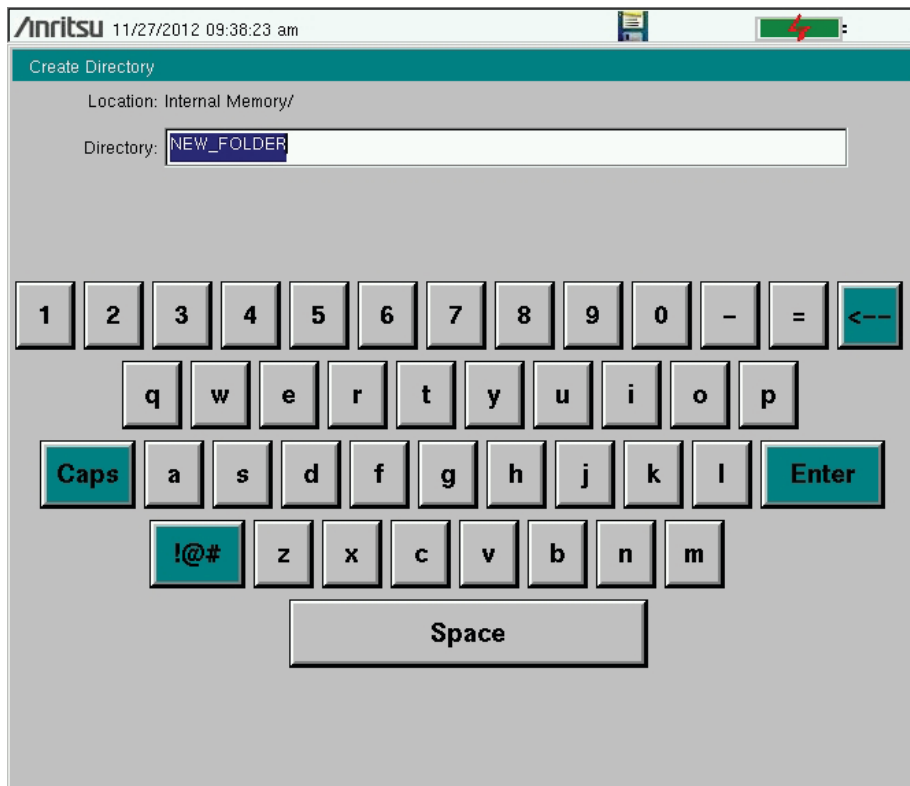


Figure 4-12. Create Directory Dialog Box

4-8 Recall Menu

This menu and the dialog box shown in [Figure 4-14 on page 4-17](#) are used to navigate folders and select files to be recalled to the PIM Master. Select folders or files with the **Up/Down** arrow keys or the touch screen.

Key Sequence: **Shift > File (7) > Recall**

Recall	<p>Sort By Name Date Type: Press this submenu key to sort file and folders by the file name, by the date that the file or folder was saved, or by the type of file.</p> <p>Sort Order Asc Desc: Press this submenu key to display the folders or files in ascending or descending order based on the selection in the Sort By key.</p> <p>File Type: Press this submenu key to open the Select File Type list box and select the type of file to be viewed. The file type can be changed with the Up/Down arrow keys. Press Enter to make the selection. Some examples of file types are:</p> <p>Setup: Setup files contain basic instrument information, measurement mode setup details, measurement marker data, and limit data.</p> <p>Measurement: Measurement files contain all of the information in the setup files and the measurement data.</p> <p>Limit Lines (.lim): The Limit line file contains limit line data details. (The Limit function is available only in PIM versus Time and Swept PIM measurements.)</p> <p>ALL: Displays all file types.</p> <p>For more information about file types, refer to “File Types” on page 4-1.</p> <p>Refresh Directories: Press this submenu key to update the display.</p>
Sort By	
Name Date Type	
Sort Order	
Asc Desc	
File Type	
ALL	
Refresh	
Directories	

Figure 4-13. Recall Menu

File Types in the list box include Map, KML 2D, and KML 3D, which are not use by the PIM Master.

Recall Dialog Box

Select folders or files with the **Up/Down** arrow keys or the touch screen.

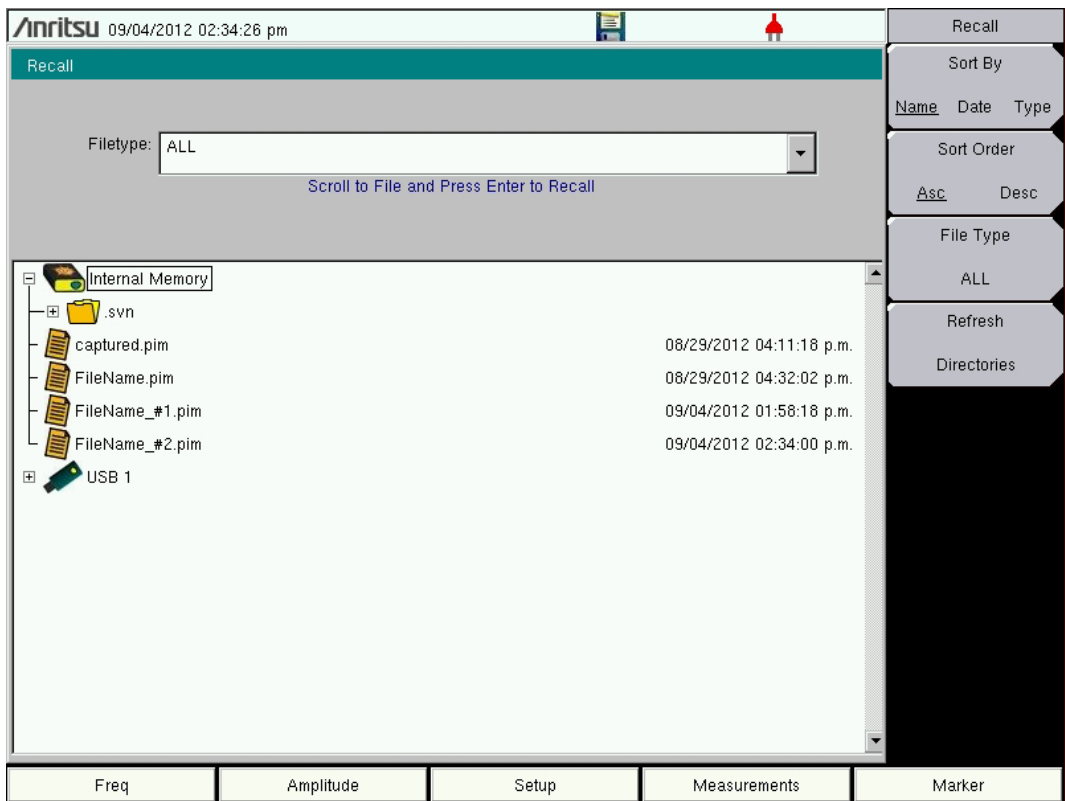


Figure 4-14. Recall Dialog Box

4-9 Copy Menu

This menu and dialog box are used to copy folders and files. Select folders or files with the **Up/Down** arrow keys or the touch screen. [Figure 4-16 on page 4-19](#) shows the Copy dialog box with two JPEG images selected and ready to be copied to the USB flash drive. Highlight a folder and then press either **Enter** or the **Right** arrow key to view the contents.

Key Sequence: **File** > Copy

Copy	Sort By Name Date Type: Press this submenu key to sort file and folder lists by name, by type of file, or by the date that the file was saved.
Sort By Name Date Type	Sort Order Asc Desc: Press this submenu key to display the folders or files in ascending (Asc) or descending (Desc) order based on the selection in the Sort By key.
Sort Order Asc Desc	File Type: Press this submenu key to select the type of files to view for copying. The file type can be changed with the Up/Down arrow keys or by using the touch screen. Press Enter to make the selection. For more information about file types, refer to “File Types” on page 4-1 .
File Type ALL	Refresh Directories: Press this key to update the display.
Refresh Directories	Scroll Src Dst: Press this submenu key to use the scroll function in either the Source Window (Scr - top pane) or the Destination Window (Dst - bottom pane). See Figure 4-16 .
Scroll Src Dst	Select or De-Select: Use this key to select or deselect the files or folders to be copied. When selected, a file or folder is highlighted in blue (see Figure 4-16).
Select or De-Select	Copy: Press this submenu key to copy the files or folders that are selected in the top pane to the destination that is selected in the bottom pane. A dialog box is displayed when the copy function is complete. If a file with the same name exists in the destination folder, then a warning box is displayed to allow file overwrite or to allow cancel.
Copy	

Figure 4-15. Copy Menu

Copy Dialog Box

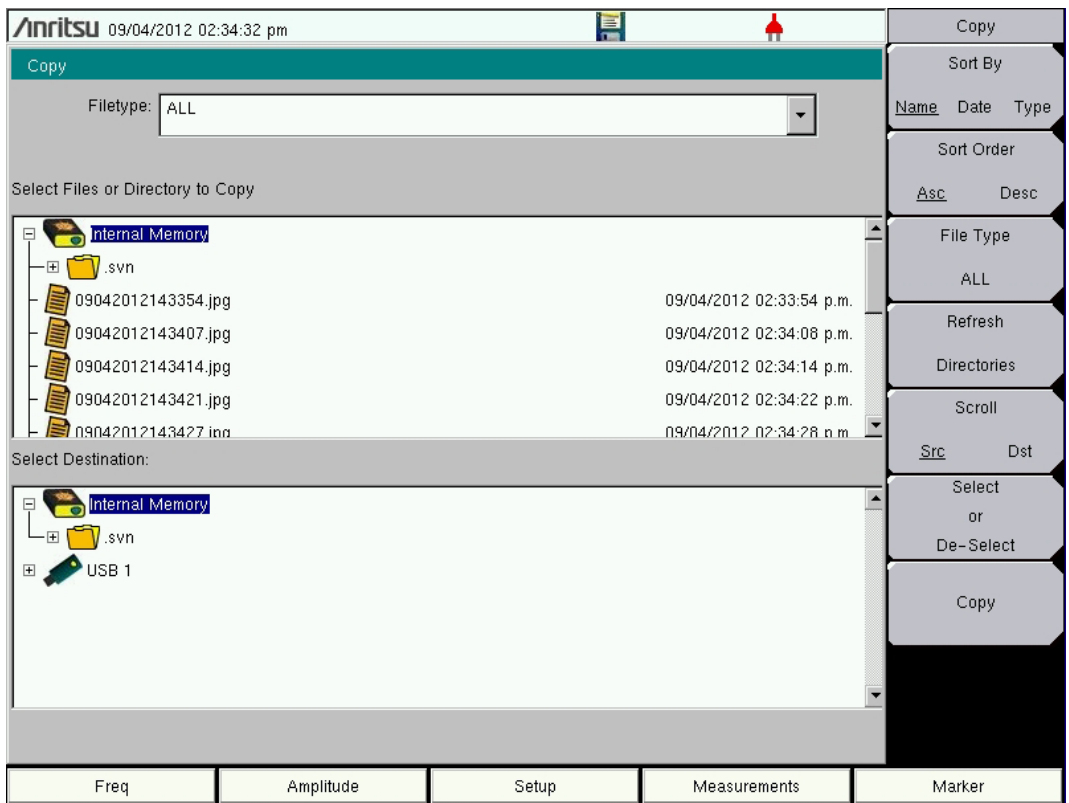


Figure 4-16. Copy Dialog Box

4-10 Delete Menu

Key Sequence: **Shift** > **File (7)** > **Delete**

Delete	This menu and dialog box is used to delete folders and files. Select folders or files with the Up/Down arrow keys.
Sort By	Sort By
Name Date Type	Name Date Type: Press this submenu key to sort files and folders by name, by the type of file, or by the date that the file or folder was saved.
Sort Order	Sort Order
Asc Desc	Asc Desc: Displays the folder or file in ascending or descending order based on the selection in the Sort By key.
File Type	File Type: Press this submenu key to select what type of file view for deleting. The options are ALL, Measurement, Setup, Limit Lines, or JPEG. The file type can be changed with the Up/Down arrow keys. Press Enter to make the selection.
ALL	For more information about file types, refer to “File Types” on page 4-1 .
Select or De-Select	Select or De-Select: Use this key to select or deselect the file(s) or folder(s) to be deleted. When selected, a file or folder will be outlined in blue.
Delete	Delete: Press this key to open the Delete dialog box (Figure 4-16 on page 4-19). Press Enter to delete the selected item or Esc to Cancel.
Refresh	Refresh Directories: Press this key to update the display.
Directories	

Figure 4-17. Delete Menu

See [Figure 4-6 on page 4-9](#) for an illustration of the Delete dialog box.

Chapter 5 — System Operation

5-1 Introduction

This chapter describes PIM Master system operations. Other menus are described in the PIM analyzer measurement chapters.

5-2 System Menu Overview

To access the functions under the System menu, press the **Shift** key, then the **System (8)** key. [Figure 5-1](#) show the menu group that is accessible from the System menu. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to the menu descriptions on the following pages).

System Menu Map

Menu maps typically display all possible submenu keys, although some keys are displayed on the instrument only under special circumstances (refer to menu descriptions on the following pages).

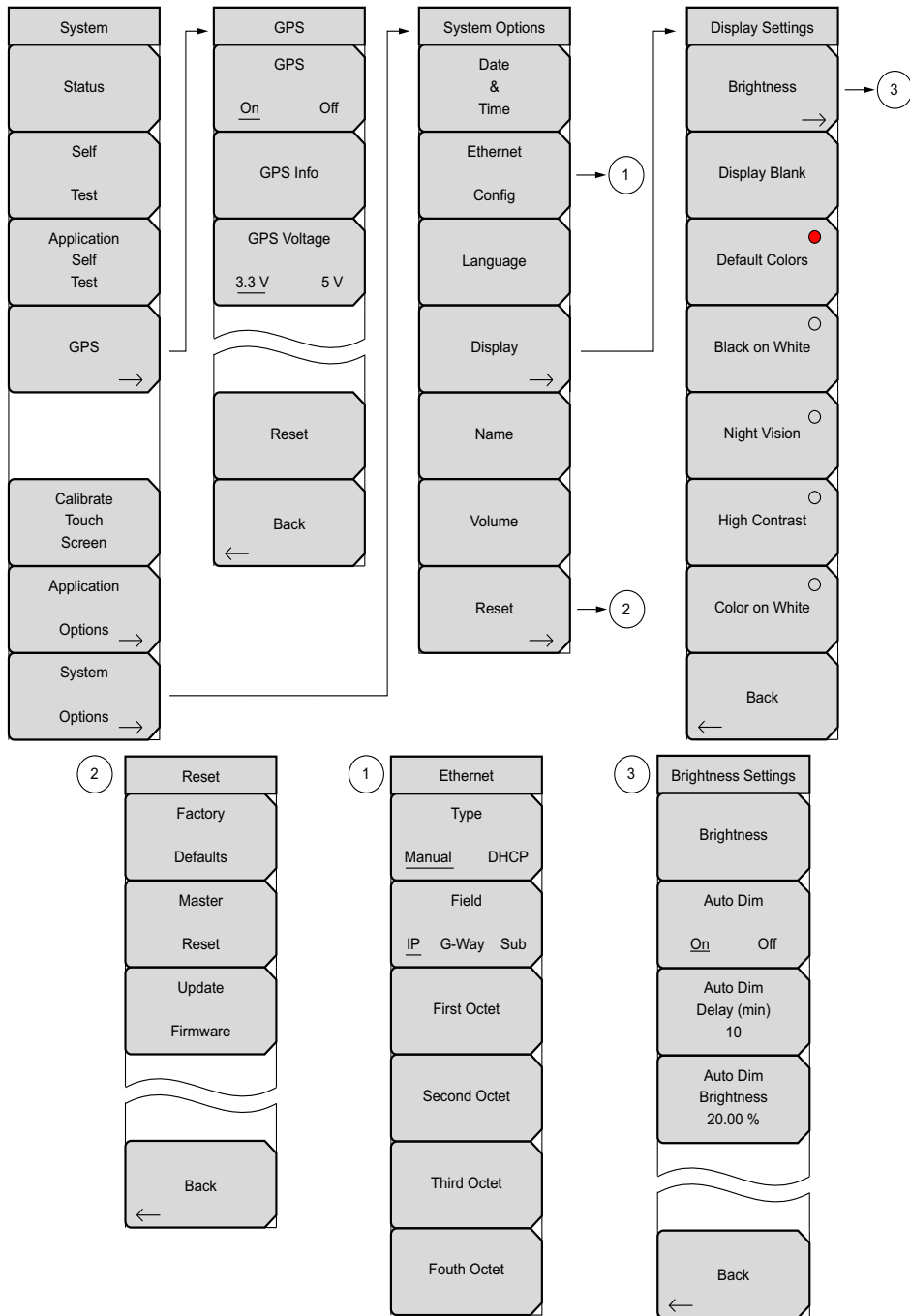


Figure 5-1. System Menu Map

5-3 System Menu

Key Sequence: **Shift > System (8)**

System	Status: Press this submenu key to display the current system status, including the operating system and firmware versions, temperatures, and other details such as current battery information. Press Esc or Enter to return to normal operation.
Status	
Self	Self Test: Press this submenu key to run a series of tests that are related to the performance of the motherboard hardware. Press the Esc key to abort, or press the Enter key to continue. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification.
Test	
Application Self Test	If the Self Test fails when the battery is fully charged and the instrument is within the specified operating temperature, then contact your Anritsu Service Center (refer to “Anritsu Service Centers” on page 1-2) and report the test results. Press Esc or Enter to return to normal operation.
GPS →	Application Self Test: Press this submenu key to run a series of tests that are related to the performance of the instrument hardware and that are specific to the current instrument application (refer to Section 2-9 “Mode Selector Menu” on page 2-17). Press the Esc key to abort, or press the Enter key to continue. The display lists a summary of those tests that have passed. If any test fails, then all of the performed tests are listed with Pass/Fail notification. If any test fails, then contact your Anritsu Service Center and report the test results (refer to “Contacting Anritsu” on page 1-2).
Calibrate Touch Screen	Some of the hardware that is tested may also be used in different operating modes. One or more additional submenu keys may be displayed to allow running additional application self tests.
Application Options →	GPS: Press this submenu key to open the GPS Menu. Refer to Chapter 6, “GPS (Option 31)” for additional information. This submenu key is displayed only when Option 31 is installed.
System Options →	Calibrate Touch Screen: Press this submenu key to begin touch screen calibration. Additional details and related features are described in Section 2-12 “Touch Screen Calibration” on page 2-23 .
	Application Options: Submenu keys are specific to each measurement mode. No menu options are available for PIM Analyzer modes. For other modes, please refer to a specific Measurement Guide, as listed in Appendix A .
	System Options: Press this submenu key to open the “System Options Menu” on page 5-4 .

Figure 5-2. System Menu

System Options Menu

Key Sequence: **Shift** > **System (8)** > System Options

System Options	<p>Date & Time: Press this submenu key to display a dialog box for setting the current date and time. Use the submenu keys or the Left/Right arrow keys to select the field to be modified. Use the keypad, the Up/Down arrow keys to select the date and time. Press Enter to accept the changes, or press the Esc key to return to normal operation without changing anything.</p>
Date & Time	<p>Ethernet Config: Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box to set the IP address of the instrument. For details, refer to section “Ethernet Configuration” on page G-1 in Appendix G, “LAN and DHCP”.</p>
Ethernet Config	<p>Language: Press this submenu key to open a list box and select a built-in language for the PIM Master displays. The languages that are currently available are: English, French, German, Spanish, Japanese, Chinese, Korean, Italian, and Russian. In addition, a custom language may be selected if it has been defined by using Line Sweep Tools and loaded into the PIM Master. Two custom languages may be loaded into the instrument via Line Sweep Tools. If a mode does not have language translations available, then English is the default language. Press Enter to accept the change, or press the Esc key to return to normal operation without changes.</p>
Language	<p>In addition, any existing language (except English) may be edited for a better local translation.</p>
Display →	<p>Caution: A reset will overwrite any custom settings within the PIM Master and will require that you reload the custom language files via Line Sweep Tools.</p>
Name	<p>Display: The Display submenu key opens the “Display Settings Menu” on page 5-5 allowing brightness control and the selection of different display attributes.</p>
Volume	<p>Name: Press this submenu key to open a dialog box to name the instrument. The PIM Master can be named by using the text entry keys, which are similar to those shown in Figure 4-1 on page 4-3. Press Enter to save the name.</p>
Reset →	<p>Volume: Press this submenu key to set the speaker volume. The current volume setting is displayed on the screen. Use the keypad, the Up/Down arrow keys to change the volume, and press the Enter key to accept the change.</p>
	<p>Reset: Press this submenu key to open the “Reset Menu” on page 5-7.</p>

Figure 5-3. System Options Menu

Display Settings Menu

Key Sequence: **Shift** > **System (8)** > System Options > Display

Display Settings	
Brightness →	Brightness: Press this submenu key to display the “Brightness Settings Menu” on page 5-6.
Display Blank	Display Blank: Opens a note box. Press Enter to turn off the display, or press Esc to abort. When the display is off, turn on the display with three rapid key presses of any key except the power key (or turn instrument power Off and On).
Default Colors ●	Default Colors: Sets the display colors to their factory default condition and is used for normal viewing. The measurement grid is black (or a shade of gray), and the background is black.
Black on White ○	Black on White: Sets the display colors to black (data) and white (background). This setting is used for printing and viewing in broad daylight conditions.
Night Vision ○	Night Vision: Sets the display to a red-tinted color (data) with a black background. Optimized for night-time viewing.
High Contrast ○	High Contrast: Increases the black and white contrast of the default display. This setting is used for challenging viewing conditions.
Color on White ○	Color on White: Sets the display background to white, the grid to gray, and leaves sweep data in color. This setting is used for printing and viewing in broad daylight conditions.
Back ←	Back: Press this submenu key to return to the “System Options Menu” on page 5-4.

Figure 5-4. Display Settings Menu

Brightness Settings Menu

Key Sequence: **Shift** > **System (8)** > System Options > Display > Brightness

Brightness Settings	<p>Brightness: The brightness of the display can be adjusted to optimize viewing under a wide variety of lighting conditions. Use the Up/Down arrow keys (increment changes of 25), the Left/Right arrow keys (0 or 100) to select a brightness level from 0 to 100, with 100 being the brightest. Press Enter to accept the change. All of the visible display options are affected by the Brightness setting.</p> <p>Auto DIM On Off: In order to extend battery life, the PIM Master can be configured to automatically dim the screen to a lower brightness setting after a specified amount of inactive time. Setting Auto DIM to ON enables this feature, and setting Auto DIM to OFF disables this feature. The Auto DIM feature is also disabled while the PIM Master is connected to a DC power source. To revive the screen to the default brightness setting, touch the touch screen or press any number key.</p> <p>Auto Dim Delay (min): Sets the amount of time to wait after the last screen touch or number key entry before dimming the screen. This value can be set between 1 minute and 15 minutes.</p> <p>Auto DIM Brightness: Sets the brightness level to which the instrument can dim (0 % to 25 %). The lower the brightness level, the more the gain in battery life.</p> <p>Back: Press this submenu key to return to the “System Options Menu” on page 5-4.</p>
Brightness	
Auto Dim On Off	
Auto Dim Delay (min) 10	
Auto Dim Brightness 20.00 %	
Back ←	

Figure 5-5. Display Settings Menu

Reset Menu

Key Sequence: **Shift** > **System (8)** > System Options > Reset

Reset	<p>Factory Defaults: Press this submenu key to restore the PIM Master to its factory default parameter values and Mode settings, including Ethernet, language, and brightness settings. Press the Enter key to initiate the reset. The PIM Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press Esc rather than pressing Enter.</p>
Factory Defaults	<p>Note: This same reset sequence can be initiated when turning the PIM Master On by pressing and holding the Esc+On keys until the Anritsu splash screen is displayed.</p>
Master Reset	<p>Master Reset: Press this submenu key to restore the factory setting to all system parameters, including Ethernet, language, and brightness settings. Also, all user files in the internal memory are deleted, and the original language files are restored. Press the Enter key to initiate the reset. The PIM Master is automatically rebooted as part of this operation. To return to normal operation without resetting, press Esc rather than pressing Enter.</p>
Update Firmware	<p>Note: This same reset sequence can be initiated when turning the PIM Master On by pressing and holding the System (8)+On keys until the Anritsu splash screen is displayed.</p>
Update Firmware	<p>Update Firmware: Press this submenu key to update the instrument operating system using an external USB drive. Press Enter to begin the update, or press Esc to return to normal operation without updating. Refer to Section F-5 “PIM Master Firmware Update” on page F-6 for additional information.</p>
Back	<p>Back: Press this submenu key to return to the “System Options Menu” on page 5-4.</p>

Figure 5-6. Reset Menu

Caution

A Factory Defaults reset or Master Reset will require that you reload any custom language files via Line Sweep Tools.

5-4 Preset Menu

Key Sequence: **Shift > Preset (1)**

Preset	<p>Preset: This key resets the instrument to the default starting conditions.</p> <p>Save Setup: Opens the Save dialog box to name and save the current operating settings, allowing them to be recalled later to return the instrument to the state it was in at the time the setup was saved.</p> <p>Recall Setup: This key allows the selection and recall of a previously stored instrument setup. All current instrument settings are replaced by the stored setup information.</p>
Preset	
Save	
Setup	
Recall Setup	

Figure 5-7. Preset Menu

5-5 Self Test

At power on, the PIM Master runs through a series of quick checks to ensure that the system is functioning properly. The System Self Test runs a series of tests that are related to the instrument hardware. The Application Self Test runs a series of tests that are related to the instrument hardware that is used in the current operating mode of the instrument.

If the PIM Master is within the specified operating range with a charged battery, and if the self test fails, then contact your Anritsu Service Center.

To initiate a self test when the system is already powered up:

1. Press the **Shift** key and then the **System (8)** key.
2. Press the **Self Test** submenu key. The Self Test results are displayed.

Press the **Esc** key to continue.

Also refer to **Self Test** and **Application Self Test** in the [“System Menu” on page 5-3](#).

Chapter 6 — GPS (Option 31)

6-1 Introduction

The PIM Master MW82119A is available with a built-in GPS receiver feature (Option 31) that can provide latitude, longitude, altitude, and UTC timing information. When GPS is actively locked to satellites, this information is saved with all saved measurements and can be displayed with Line Sweep Tools.

6-2 Setting Up GPS (Option 31)

In order to acquire data from the GPS satellites, you must have line-of-sight to the satellites, or the antenna must be placed outside without any obstructions. In addition to having Option 31 installed, the PIM Master requires a GPS antenna.

Anritsu GPS antenna part numbers:

- 2000-1528-R (with 15-foot cable)
- 2000-1652-R (with 1-foot cable)
- 2000-1760-R (no cable)

Activating the GPS Feature

1. Attach the GPS antenna to the GPS Antenna connector in the side connector panel (see [Figure 2-5 on page 2-9](#)).
2. Press the **Shift** key then the **System (8)** key on the number keypad to display the System menu.
3. Press the GPS submenu key to display the GPS menu.
4. Activate GPS by pressing the GPS, On/Off submenu key so that **On** is underlined. When GPS is first turned On, the GPS icon is displayed in red to indicate that less than 3 satellites are currently being tracked.



Figure 6-1. GPS Icon, Red

5. Press the GPS Info submenu key to open the GPS Info window, which displays:

- Tracked Satellites
- Latitude
- Longitude
- Altitude
- UTC timing information
- Fix Available
- Almanac Complete
- Antenna Status
- Receiver Status
- GPS Antenna current and voltage

6. When the GPS receiver is tracking at least 3 satellites, the GPS icon changes to green.



Figure 6-2. GPS Icon, Green

Note

To reset the GPS, press the Reset submenu key. The green GPS icon with a red cross appears when GPS satellite tracking is lost (see [Figure 6-3](#)).



Figure 6-3. GPS Icon, Green with Red Cross

6-3 GPS Menu

Key Sequence: **Shift, System (8)** > GPS

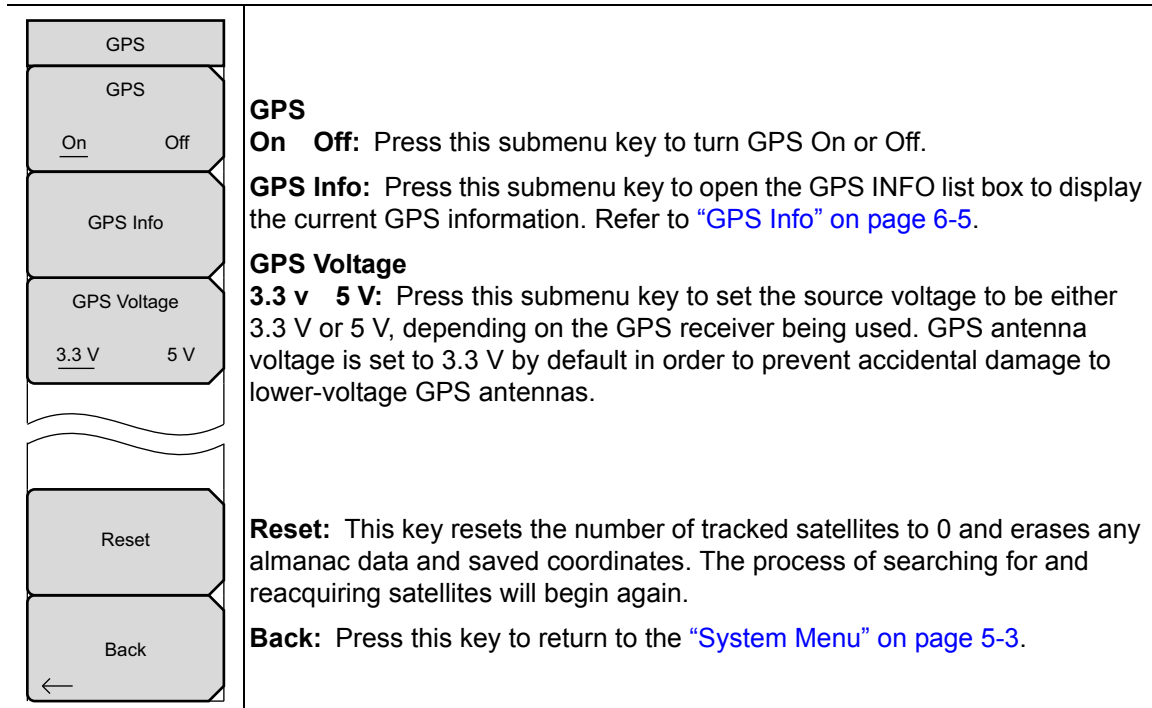


Figure 6-4. GPS Menu

GPS Info

Tracked Satellites: Shows the number of tracked satellites (three are required to retrieve latitude and longitude, four are required to resolve altitude). Generally, the larger the number of satellites tracked, the more accurate the GPS information.

Latitude and Longitude: Shows location in degrees, minutes, and seconds.

Altitude: Shows altitude information in meters.

Fix Available: The cold start search sets are established to ensure that at least three satellites are acquired within the first couple of minutes. When the three satellites are found, the receiver computes an initial fix (typically in less than two minutes). **Fix Available: No** means that the initial position has not been established.

Almanac Complete: The system Almanac contains information about the satellites in the constellation, ionospheric data, and special system messages. In a cold start, the GPS receiver does not have any navigation data, so the receiver does not have a current almanac. A complete system almanac is not required to achieve a first position fix. The availability of the almanac, however, can significantly reduce the time to first fix.

Antenna Status: OK and Short/Open

- **OK:** Antenna is connected properly and is working properly.
- **Short/Open:** A short or open exists between the antenna and the connection. If this message is displayed, then remove and reconnect the GPS antenna. If the message persists, then try another Anritsu GPS antenna. If the message persists, then contact your nearest Anritsu Service Center (refer to [Section 1-3 “Anritsu Service Centers”](#) on page 1-2).

Receiver Status: Current status of the receiver.

GPS Antenna Voltage and Current: Shows voltage and current.

Chapter 7 — PIM versus Time

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

7-1 Introduction – PIM versus Time Analyzer

The PIM Master includes a PIM versus Time measurement that tracks not only the instantaneous PIM level but also records the Peak PIM level experienced throughout a fixed frequency PIM test. This measurement is useful for dynamic PIM tests because it not only captures the Peak PIM value for pass/fail determination but also provides a visual indication of the stability of the system under test.

A PIM versus Time measurement is the basic test to pass or fail a site. Distance-to-PIM and Swept PIM are diagnostic tools to find any PIM that is detected in the PIM versus Time measurement. Noise Floor measurements reveal any external interference that might produce undesirable PIM test results.

7-2 Trace Mode

Two trace modes are available to optimize performance. They are based on the type of measurement being conducted. The instrument settings summary displays the Trace Mode setting.

Fast mode is available for dynamic PIM testing, in which maximum responsiveness is desired. New data points are reported to the user approximately eight times per second to provide rapid feedback during dynamic impacts.

Low Noise mode is available to increase accuracy for low signal level measurements. This mode increases the number of samples collected by a factor of five for each reported data point. Noise variation is distributed over a larger number of samples, which results in reduced peak-to-peak variation for low signal level measurements.

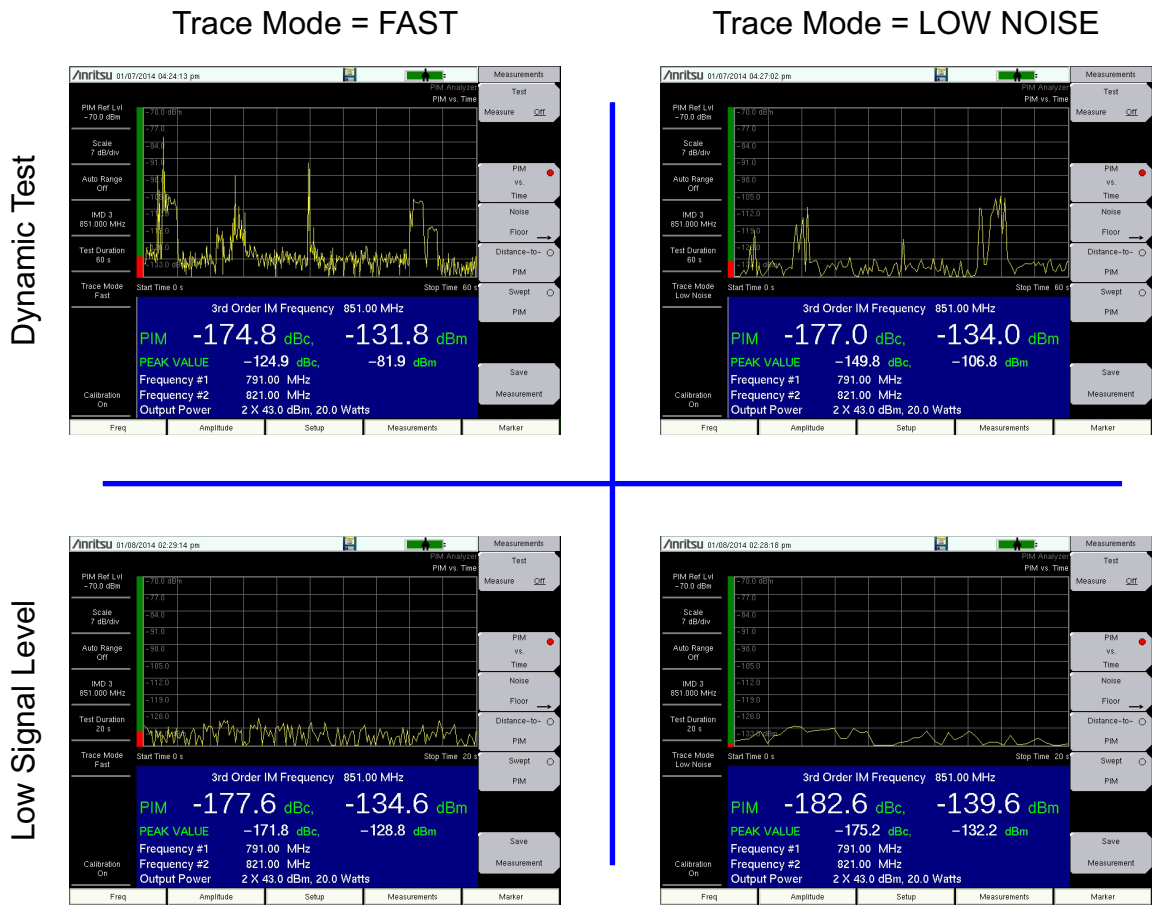


Figure 7-1. Fast and Low Noise Trace Modes

7-3 PIM vs. Time Measurement Setup

Before performing a PIM vs. Time measurement, the PIM Master must be calibrated (refer to section “[Calibrating](#)” on page 3-6).

1. Turn on the PIM Master.
2. Connect the DUT to the test port connector of the PIM Master.

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. The torque wrench is included in the PIM accessory kit (refer to your Technical Data Sheet for part numbers).

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.

Configure the PIM Test

3. Frequencies F1 and F2 must be within the ranges that are defined in [Table B-1](#), “[PIM Master Carrier Bands and Frequencies](#)” on page B-2. If an incorrect entry is made, then an error message appears to indicate the allowable frequency range for F1 or F2.
4. Press the **Measurements** main menu key and then press the PIM vs. Time submenu key.
5. Verify that the Output Power is set to the desired power level.

Intermodulation Distortion

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

$$3\text{rd Order Intermodulation (IM}_3) = 2F_1 - F_2 \text{ or } 2F_2 - F_1$$

$$5\text{th Order Intermodulation (IM}_5) = 3F_1 - 2F_2 \text{ or } 3F_2 - 2F_1$$

$$7\text{th Order Intermodulation (IM}_7) = 4F_1 - 3F_2 \text{ or } 4F_2 - 3F_1$$

Example Intermodulation Calculation

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

$$IM_3 = 2F_1 - F_2 = 2(1930) - 1990 = 1870 \text{ MHz}$$

or

$$IM_3 = 2F_2 - F_1 = 2(1990) - 1930 = 2050 \text{ MHz}$$

The PIM Master uses 1870 MHz (low-side IM_x) as the center frequency. The PIM Master always uses the lower IM_x value and does not set to the high-side IM_x frequency, except for instruments that are designed to measure the high-side product (the MW82119A-0700, for example).

In addition, the IMx selection must be inside one of the PIM Master receiver bands in order to make a PIM measurement (refer to [Table B-1, “PIM Master Carrier Bands and Frequencies”](#) on page B-2).

If the IMx frequency does not fall within one of these bands, then the PIM Master displays a warning message indicating the acceptable IMx range. The font color for the IMx frequency in the PIM summary table changes to red until acceptable frequency selections are made.

6. Press the **Carrier F1** submenu key to enter the frequency of Carrier F1 by using the keypad or the **Arrow** keys. When entering a frequency by using the keypad, the submenu key labels change to GHz, MHz, kHz, and Hz. Press the appropriate unit key.
7. Repeat [Step 6](#) for Carrier F2.
8. Press the **Intermod Order** submenu key so that the desired intermodulation frequency order to be viewed is underlined. **3rd order** is the most commonly chosen measurement .

Note	The PIM Parameters screen (press the PIM Aid submenu key) displays the IM frequencies for the F1 and F2 frequencies that are entered.
-------------	---

Amplitude Setup

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

Power and Display Setup

14. Press the **Setup** main menu key to display the Setup menu.
High Output Power and Low Output Power submenu keys are available for setting output power.
15. Press the **High Output Power** submenu key to set the output power range between 37 dBm and 46 dBm.
16. Press the **Low Output Power** submenu key to set the output power range between 25 dBm and 37 dBm.
17. Press **Test Duration** to set the number of seconds from 1 s to 1200 s.
18. Press the **Trace Mode** submenu key (if desired) to toggle between **Fast** and **Low Noise** modes. For additional information, refer to [Section 7-2 “Trace Mode”](#) on page 7-2.

Sample Measurement

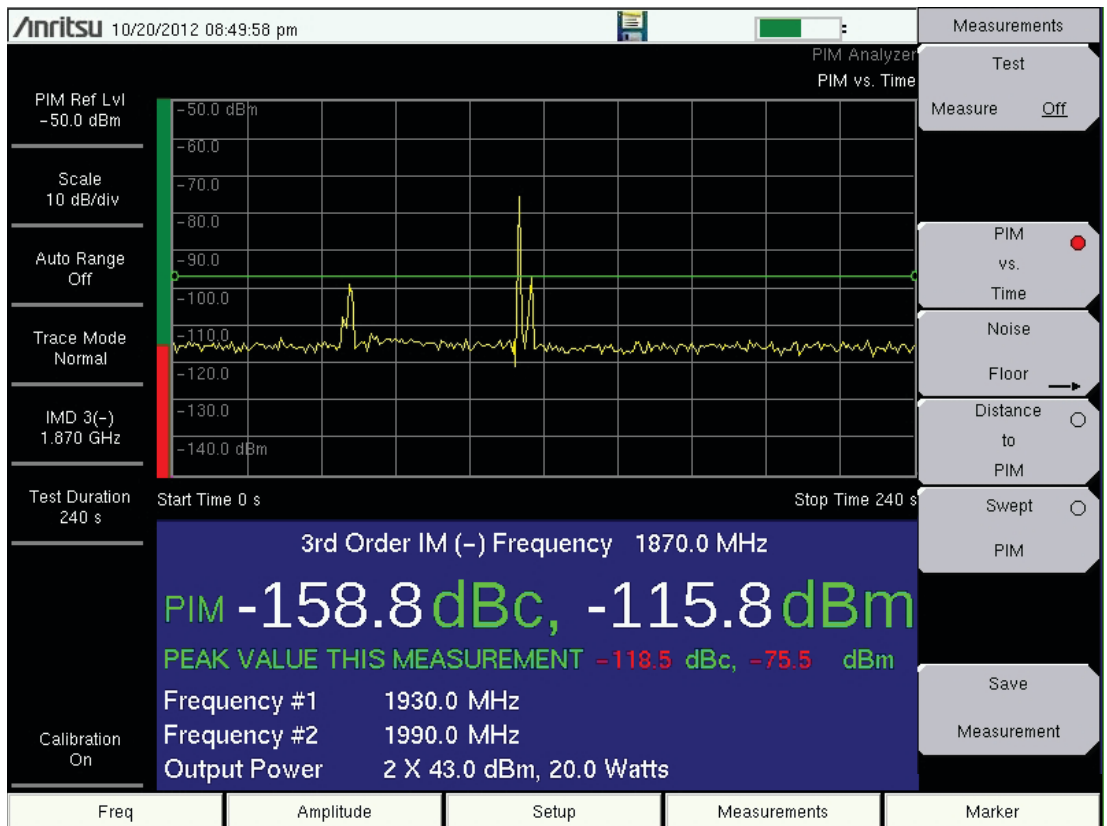


Figure 7-2. Sample Measurement with PIM at 1870.0 MHz

PIM problems can be intermittent and power sensitive. This is often the case when PIM problems first begin to appear. This can be due to light corrosion, to high traffic loading, or to changing weather conditions that are activating environmental diodes. Using higher power levels can often force otherwise intermittent failures to become visible. Higher power levels may be required to find faults in a multicarrier system and to discover microscopic arcing in connectors.

In [Figure 7-2](#), note that the instantaneous PIM levels are displayed in white numerals even though the PIM value exceeded the upper limit line setting during the measurement. The instantaneous measurement values turn red while the measurement is above the limit, but return to white while the measurement is below the limit. The peak PIM values are shown in red (and remain in red) because the measurement exceeded the limit at some time during the measurement.

PIM Summary Table

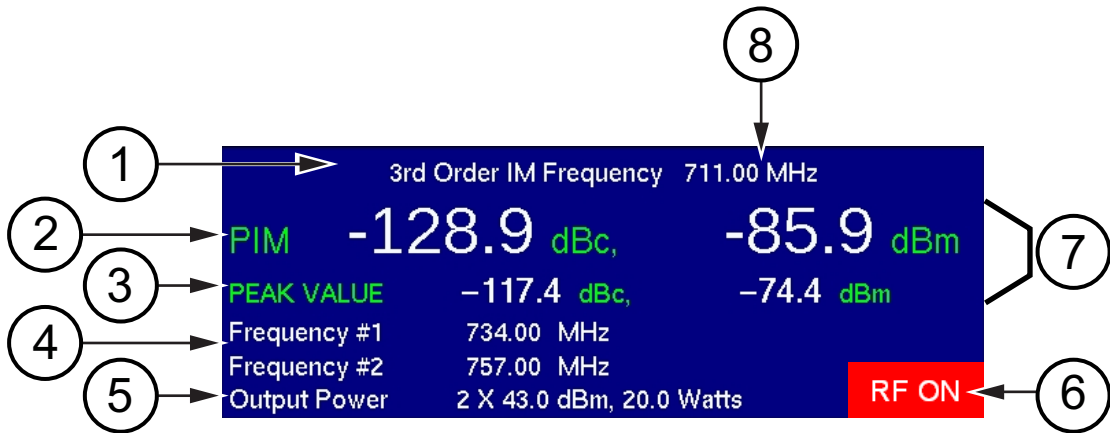


Figure 7-3. PIM Summary Information

1.	PIM Order
2.	Instantaneous PIM
3.	Peak PIM
4.	Transmit Frequencies
5.	Test Power Level
6.	RF ON Indicator
7.	Pass / Fail Indication (White = Pass, Red = Fail)
8.	PIM Frequency

In this example of the PIM Summary Table, the instantaneous PIM values (item 2) are displayed with white numerals, indicating that these values are below the upper limit value that was set for this measurement. The peak PIM values (item 3) are also displayed with white numerals, indicating that those values are within the upper limit value setting. If the measurement trace exceeds the upper limit line setting at any time during a measurement, then the peak values are displayed in red and remain red after the measurement is completed. The instantaneous PIM values (item 2) are displayed with red numerals only while the measurement exceeds the limit.

The RF ON indicator (item 6) is displayed in the PIM Summary Table only while the measurement is in progress, that is, while RF is being transmitted. The Test submenu key, in which the word Measure is underlined while the measurement is in progress, is also highlighted in red while RF is present.

Bar Graph of Instantaneous PIM

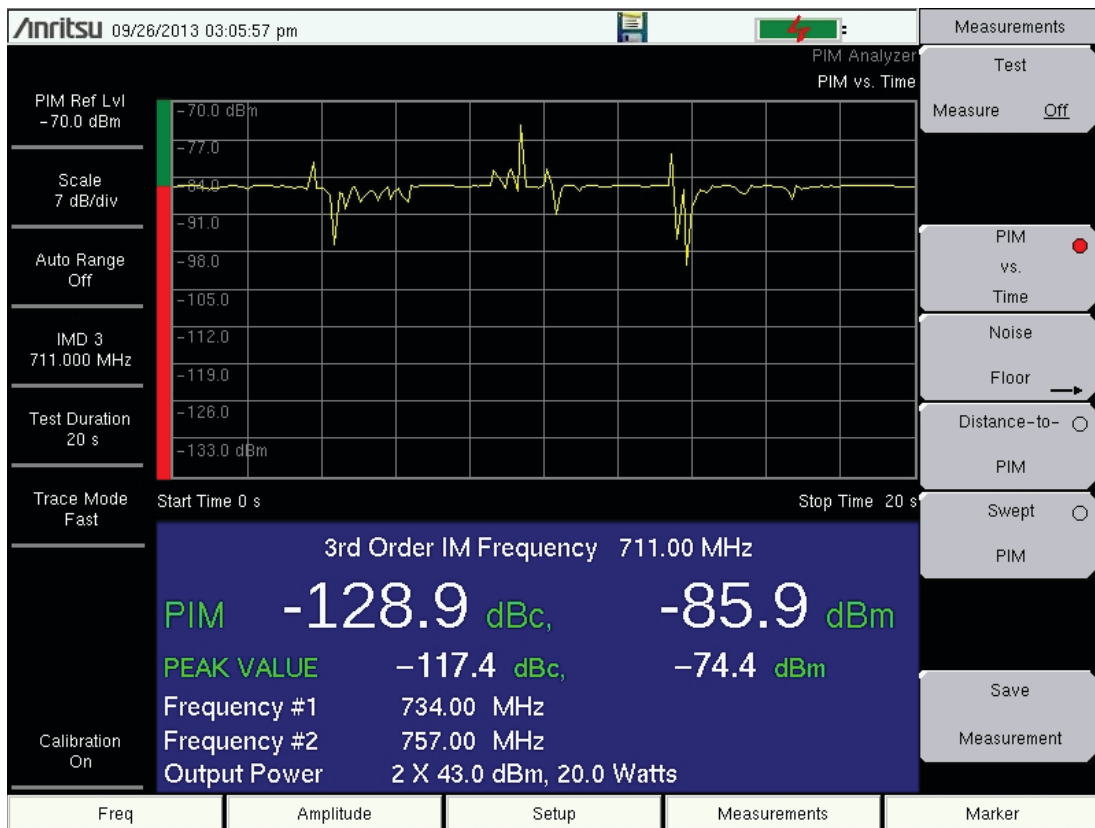


Figure 7-4. PIM versus Time

Note the PIM bar graph at the left edge of the sweep window. In this graph, the instantaneous PIM level is displayed in units of dBm by the red bar on the vertical axis. No limit was set for this particular measurement.

PIM Parameters Dialog Box

The PIM Parameters dialog box (Figure 7-5) is displayed by pressing the PIM Aid submenu key, which is available by pressing the **Freq** main menu key or the **Setup** main menu key. This dialog box displays the current carrier frequencies, power, and intermodulation product generated by the selected carrier frequencies. In addition, frequencies for F1 and F2 and the carrier power can be changed in this dialog box. Use the **Arrow** keys or the touch screen to scroll through the 3 settings (F1, F2, and Power). The chosen value changes color to indicate when the value is ready for editing. Then use the number keypad to enter a value, which must be within the range that is indicated on the screen. After editing the value, you must press the **Enter** key or the appropriate submenu key (MHz for frequency or Enter for power). The highlighting changes to indicate that the new value has been set. When all 3 settings are satisfactory, scroll to highlight the Continue button and press the **Enter** key, or use the touch screen to press the Continue button, or press the Back submenu key. To abort a setting, before pressing **Enter** or the MHz submenu key or the Enter submenu key, press the **Esc** key or an **Arrow** key, which allows you to enter a different value. Pressing the **Esc** key when no setting is pending returns the display to the previous menu. To abort a setting, before pressing **Enter** or the MHz submenu key or the Enter submenu key, touch the Continue button, which returns to the same previous menu as when pressing the Back submenu key.

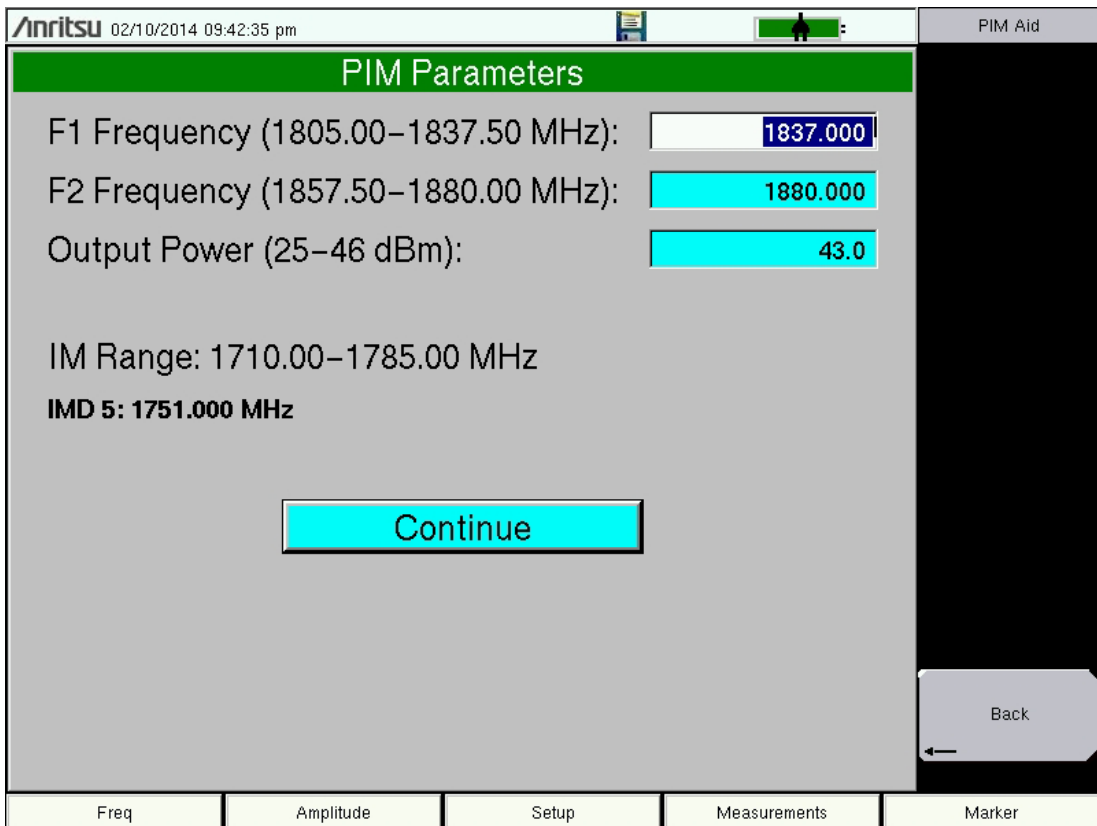


Figure 7-5. PIM Parameters Dialog Box

7-4 Making the Measurement

1. Press the **Measurements** main menu key. The Measurements menu is displayed.
2. Begin testing by pressing the **Test** submenu key, **Measure** is underlined while the test signal is being transmitted, and the **Test** submenu key is outlined in Red. Two high-power test signals are transmitted from the PIM Master test port to the DUT. PIM generated by the DUT is returned to the PIM Master. The results are displayed. The green RF On light on the PIM Master top panel illuminates during the PIM test, and **RF ON** is displayed in red in the PIM Summary Table on the measurement display screen.

Note	During calibration, RF is On, but the RF ON message is not displayed. The CALIBRATION IN PROCESS... message is displayed in red letters on the measurement screen.
-------------	--

Test duration is specified in the **Setup** main menu. You can terminate the test early by pressing the **Test** submenu key so that **Off** is underlined. RF power can be immediately turned off by pressing the **Emergency Stop** button on top of the PIM Master (refer to item 3 in [Figure 2-4 on page 2-8](#)).

Note	When changing the IMD order, if the IM frequency is outside the Rx range, then the PIM Master will reset the F1 and F2 carrier frequencies to the default values.
-------------	---

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 [Chapter 4, “File Management”](#) for additional information about file handling.

7-5 Sample of PIM versus Time Measurement

PIM testing should be conducted while subjecting the device or line under test to a dynamic stimulus. If the magnitude of the PIM that is being measured exceeds the pass / fail limit during the test, then the device or line has failed even if the PIM returns to a low level after the dynamic stress has stopped. [Figure 7-6](#) shows this. This trace was created by tapping on a loose RF connection, which shows that PIM in this test situation is very unstable under dynamic stress and then very good when the stress has stopped. Definitions for how to apply dynamic stimulus are defined by IEC62037 for RF cable assemblies, RF cables, Filters, and Antennas. The only problem is that this work was done with FACTORY testing in mind. The IEC specification does not currently address how to apply dynamic stress in the field. Operators, therefore, need to define their preferred test methods. The MW82119A PIM Master has the PIM versus Time measurement mode, which supports dynamic testing and keeps track of the worst case value for the duration of the test. It also compares the measured values to the pass / fail limit that you have set.

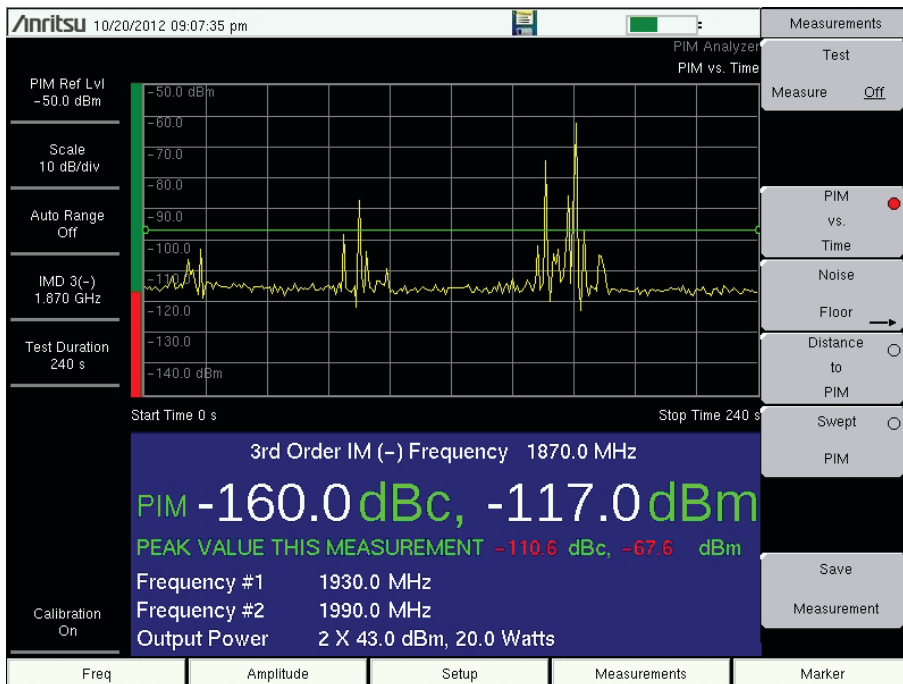


Figure 7-6. Dynamic Stress by Tapping a Loose Connection

Note that the peak PIM values are displayed in red because the measurement exceeded the upper limit setting.

Measurement with Pass Indicator

In this example, the measurement exceeds the set limit at three locations. The Pass Indicator displays FAIL in red letters. Also note that the measured PIM and Peak PIM values are displayed in red numerals.

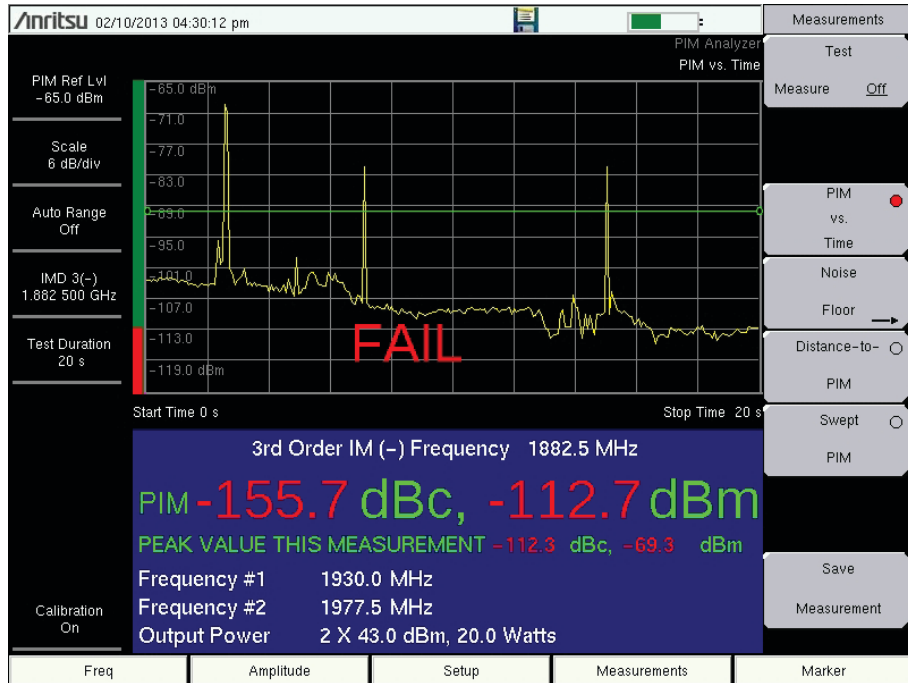


Figure 7-7. FAIL Indication in PIM vs. Time Measurement

7-6 Menu Map

Figure 7-8 shows the map of the PIM versus Time Analyzer menus. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages). The following sections describe main menus and associated submenus.

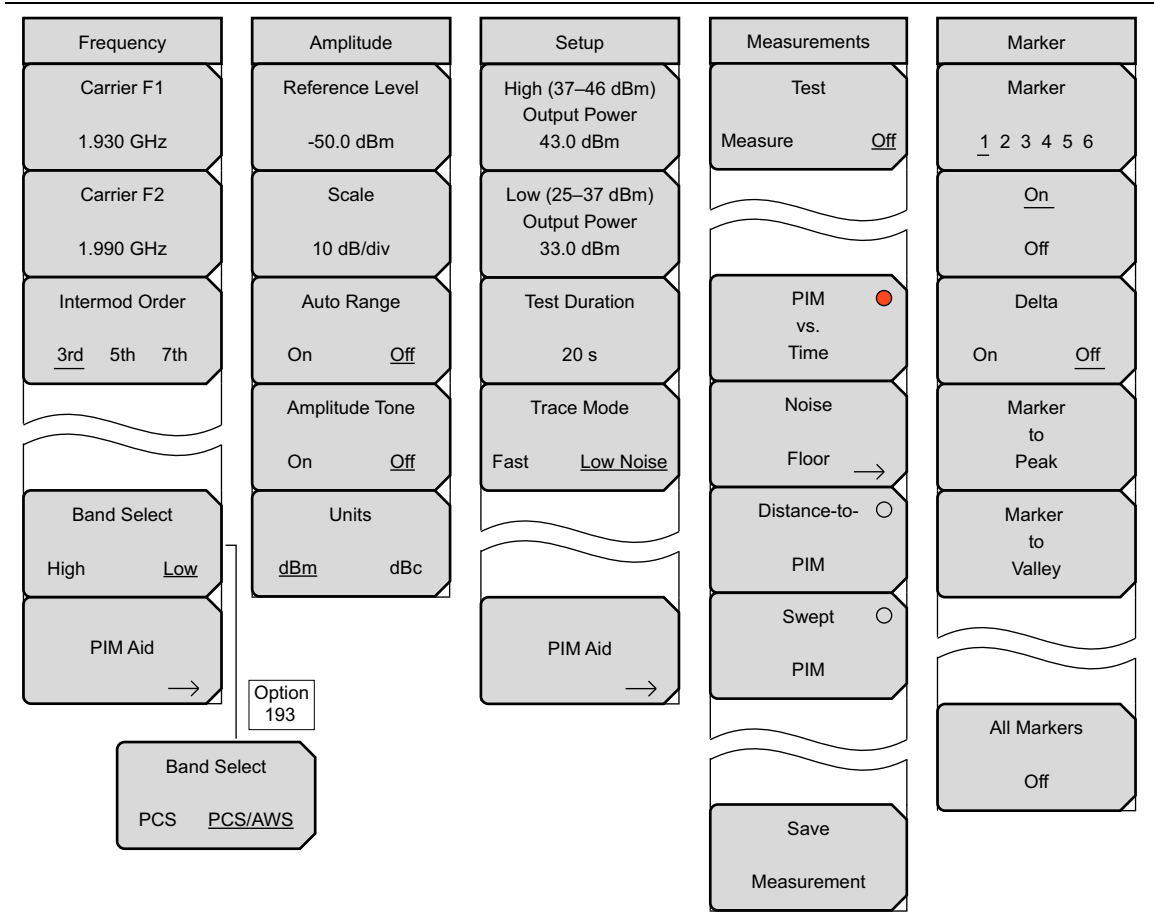


Figure 7-8. PIM vs. Time Menu Map

7-7 Frequency (Freq) Menu

Key Sequence: **Freq**

Frequency	<p>Carrier F1: Press this submenu key and enter the desired frequency using the number keypad or the Arrow keys. Enter a frequency within the acceptable range by referring to Table B-1 on page B-2.</p> <p>Carrier F2: Press this submenu key and enter the desired frequency using the keypad or the Arrow keys. Enter a frequency within the acceptable range by referring to Table B-1 on page B-2.</p> <p>Intermod Order 3rd 5th 7th: Select the 3rd, 5th, or 7th order of intermodulation. If the selected F1 and F2 do not produce the desired IM product, the PIM Master automatically changes F1 and F2 to factory default frequencies that will generate an in-band IM product. F1 and F2 can be further adjusted if desired.</p>
Carrier F1 1.930 GHz	
Carrier F2 1.990 GHz	
Intermod Order <u>3rd</u> 5th 7th	
~ ~ ~	
Band Select High <u>Low</u>	<p>Band Select High Low: Press this submenu key to toggle the band selection to High or Low. This submenu key appears only on instruments with multiple receive ranges. For Option 193, the toggle choices are PCS and PCS/AWS.</p>
PIM Aid →	<p>PIM Aid: Press this submenu key to display the PIM Parameters dialog box (see Figure 7-5 on page 7-8). This dialog box allows editing of the current carrier frequencies and carrier power. It also displays the intermodulation products generated by the carrier frequencies.</p>
Option 193	
Band Select PCS <u>PCS/AWS</u>	

Figure 7-9. Frequency Menu

Note

The left-most main menu key is labeled **Freq** in the PIM vs. Time and the Swept PIM measurement settings. It is labeled **Distance** in the Distance-to-PIM measurement setting.

7-8 Amplitude Menu

Key Sequence: **Amplitude**

Amplitude	<p>Reference Level: The reference level is the top graticule line on the display, and can be set from –50 dBm to –140 dBm. A value may be entered from the number keypad. Use the +/- key for negative values. 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.</p> <p>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 number keypad or the Arrow keys.</p> <p>Auto Range On Off: Automatically adjusts the reference level based on the input power and y-axis scale in order to display the trace on screen.</p> <p>Amplitude Tone On Off: Toggles On and Off. The frequency of the tone increases as PIM level increases.</p> <p>Units dBm dBc: Toggles the measurement display units between dBm and dBc. The amplitude for upper and lower limits automatically adjusts to the equivalent level for the selected units.</p>
Reference Level	
-50.0 dBm	
Scale	
10 dB/div	
Auto Range	
On Off	
Amplitude Tone	
On Off	
Units	
dBm dBc	

Figure 7-10. Amplitude Menu

7-9 Setup Menu

Key Sequence: **Setup**

	<p>High (37–46 dBm) Output Power: Press this submenu key to set the output power level within the higher range for both carrier frequencies, F1 and F2 when a high power test is desired.</p> <p>Low (25–37 dBm) Output Power: Press this submenu key to set the output power level within the lower range for both carrier frequencies, F1 and F2 when a low power test is desired.</p> <p>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.</p> $20 \text{ W (F1)} + 20 \text{ W (F2)} = 40 \text{ W}$ <p>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 1200 seconds. Use the Arrow keys or the number keypad. If you use the number keypad, then the Units menu of the Test Duration menu is displayed.</p> <p>Trace Mode Fast Low Noise: Press this submenu key to change Trace Mode from the Fast to the Low Noise setting. Refer to Section 7-2 “Trace Mode” on page 7-2.</p> <p>PIM Aid: Press this submenu key to display the PIM Parameters dialog box (see Figure 7-5 on page 7-8). This dialog box displays and allows editing of the current carrier frequencies and carrier power.</p>
--	--

Figure 7-11. Setup Menu for PIM vs. Time

Measurements Menu

Refer to [Section 3-9 “Measurements Menu” on page 3-19](#).

7-10 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	<p>Marker: Press this submenu key to select which marker (1, 2, 3, 4, 5, 6) is active. The underlined marker number is the active marker. See Figure 7-13.</p> <p>On/Off: Press this submenu key to turn On or Off the selected (underlined) marker in the Marker submenu key.</p> <p>Delta On Off: Press this submenu key to turn on a delta marker and to prompt for a delta offset value, either positive or negative from the value of the currently active marker.</p> <p>Marker to Peak: Press this submenu key to place the currently active marker on the highest signal amplitude that is currently displayed on screen.</p> <p>Marker to Valley: Press this submenu key to place the currently active marker on the lowest signal amplitude that is currently displayed on screen.</p> <p>All Markers Off: Turns off all displayed markers.</p>	
Marker <u>1</u> 2 3 4 5 6		
<u>On</u> Off		
Delta On <u>Off</u>		
Marker to Peak		
Marker to Valley		
~~~~~		
All Markers Off		

Figure 7-12. Marker Menu

Select Marker		
M1	M2	M3
M4	M5	M6

Figure 7-13. Marker Selection Box

# Chapter 8 — Noise Floor Measurements

## 8-1 Introduction

Noise Floor measurements test for Rx interferers that can effect a PIM measurement. In these measurements, transmit (Tx) power is Off, which allows you to check for external interference at the IM frequency being measured. The intermodulation distortion (IM) products of interest are in the same frequency range that is used by mobile equipment to communicate with the base station. Nearby mobiles can generate signals high enough to interfere with a PIM measurement.

The Noise Floor Time View measurement displays the signal level that is received by the PIM Master at the IM product frequency as a function of time with TX₁ and TX₂ turned Off. The PIM Master is in PIM vs. Time analyzer mode during a Noise Floor Time View measurement, but only the PIM Master receiver is being used. A typical noise floor Time View measurement is approximately -120 dBm, as shown in [Figure 8-1 on page 8-3](#). Refer to [Section 1-15 “PIM Testing Procedure” on page 1-11](#).

The Noise Floor Spectrum View measurement displays the signal level that is received by the PIM Master over the current Rx band. Because the Spectrum View sweeps across a range of frequencies, you are likely to see bands that are free of mobile traffic and bands with significant mobile traffic. The marker functions can be used to identify your current IM test frequency as well as identify frequencies that are free of traffic. A typical Noise Floor, Spectrum View measurement is shown in [Figure 8-3 on page 8-5](#).

Anritsu recommends that you make a Noise Floor measurement before making a PIM measurement in order to rule out external interference. If external interference is present, change the TX₁, the TX₂, or both test frequencies in order to move the IM product frequency into clear spectrum.

## 8-2 Noise Floor Measurement Setup

Before performing a Noise Floor measurement, the PIM Master must be calibrated (refer to section “[Calibrating the PIM Master](#)” on page 3-8). Setup is the same as the PIM vs. Time setup, which is described in [Chapter 7](#). If you have already set up the PIM Master for a PIM vs. Time measurement and performed a calibration, then skip to [Step 11](#).

If you are performing a Noise Floor Spectrum View measurement, an additional calibration step is required. Press the **Start Cal** button in the Noise Floor menu, and then follow the on-screen instructions to calibrate the Spectrum View.

1. Turn on the PIM Master.
2. Connect the DUT to the test port connector of the PIM Master.  
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.
3. Press the **Freq** main menu key.
4. Set the frequencies of Carrier F1 and Carrier F2.
5. Press the Intermod Order submenu key so that the desired intermodulation frequency order to be viewed is underlined. 3rd order is the most commonly chosen measurement .

<b>Note</b>	The PIM Parameters screen (press the PIM Aid submenu key) displays the IM frequencies. Output Power can be ignored for the Noise Floor measurement.
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6. Press the **Setup** main menu key and then press the Test Duration submenu key to set a time from 1 second to 1200 seconds.
7. To set a limit, press the **Shift** and **Limit (6)** keys.
8. In the Limit menu, press the Limit key to choose Upper or Lower limit. You can then press the Set Default Limit submenu key or the Amplitude submenu key to set a limit value. Only the upper limit line has alarm and pass indicator functions.
9. Press the Limit Alarm submenu key to turn On the audible alarm.
10. Press the Pass Indicator submenu key to turn On the PASS / FAIL indication.

## 8-3 Performing the Noise Floor Test

11. Press the **Measurements** main menu key and then press the Noise Floor submenu key.
12. Select either the Time View or Spectrum View measurement option.
13. Press the Test submenu key to begin the test.

While the test is in progress, the Test submenu key is highlighted in red. See [Figure 3-9 on page 3-20](#).



## 8-4 Noise Floor Time View Measurements

Noise Floor Time View measurement displays the signal level that is received by the PIM Master at the IM product frequency as a function of time with TX₁ and TX₂ turned Off.

The Noise Floor Measurement in Figure 8-1 shows no external interference. A very good noise floor is below -120 dBm. After verifying that no interference is present, begin PIM testing. Note that units of dBc are not applicable to Noise Floor measurements.

### Noise Floor Measurement with No External Interference

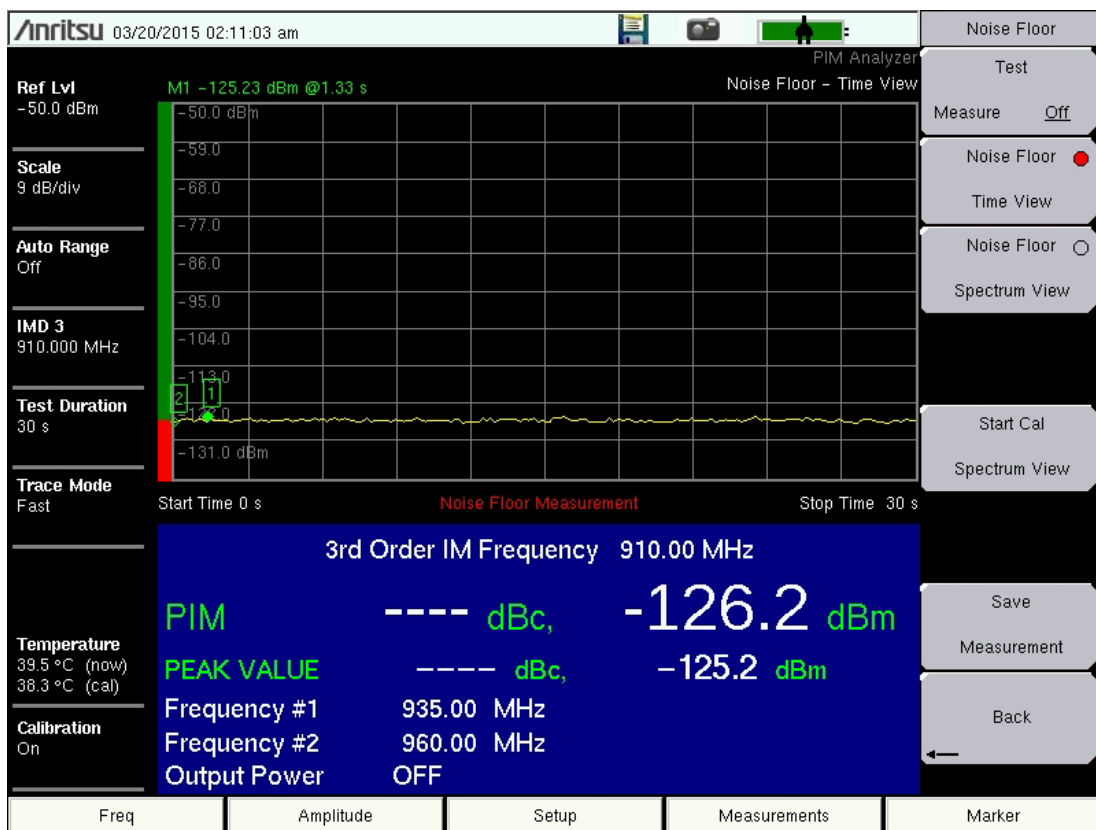


Figure 8-1. Typical Noise Floor (No External Interference, No Limit Line)

### External Interference Example

In the example shown in Figure 8-2 external interference is seen in the failing measurement trace, which exceeded the set limit.

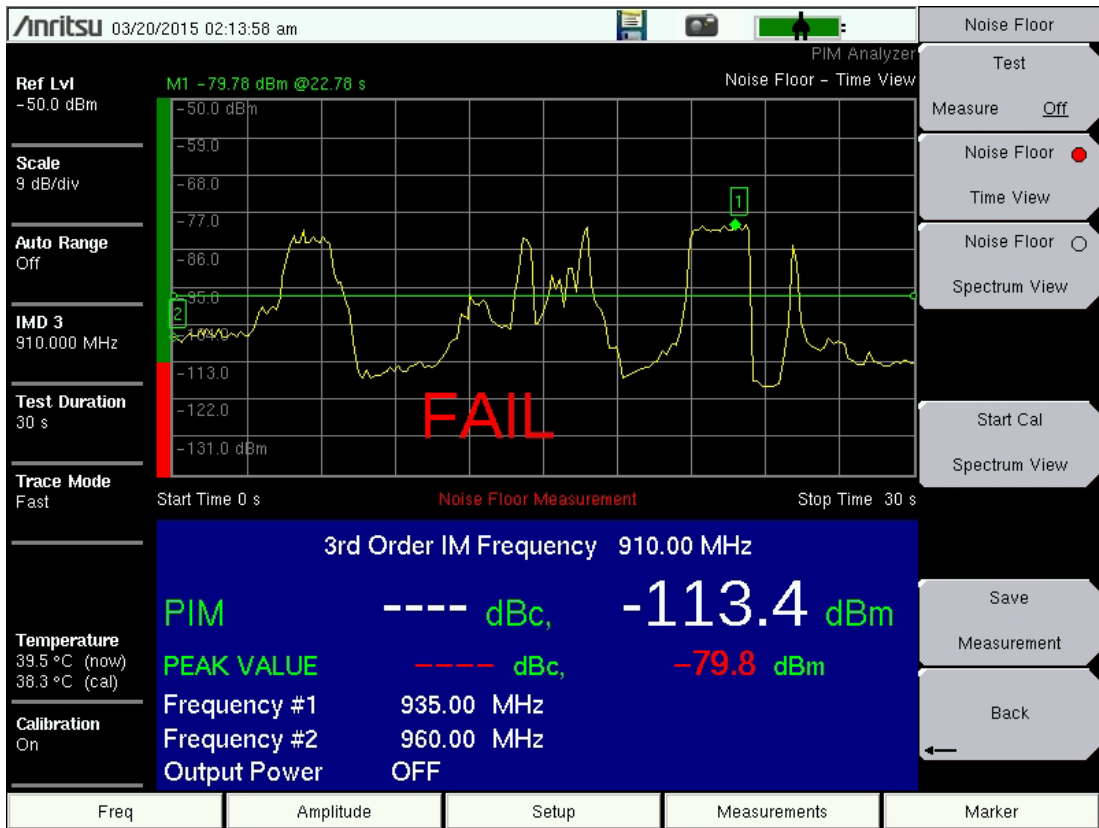
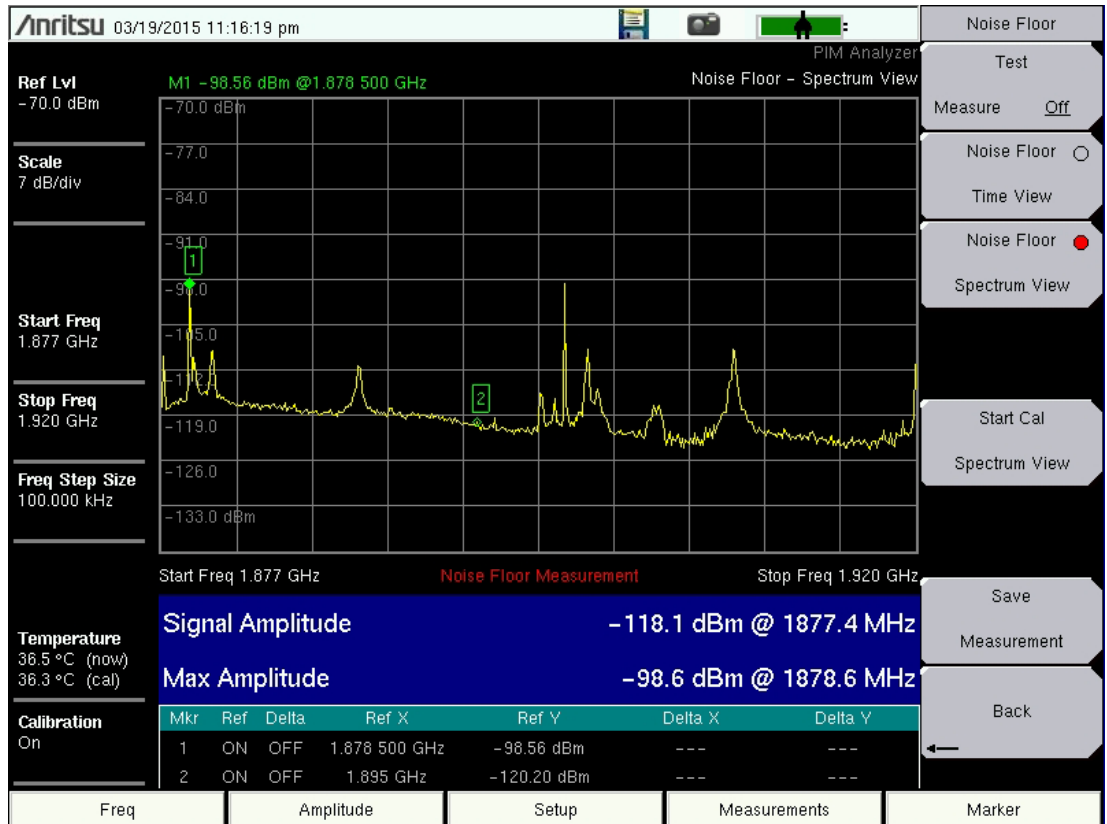


Figure 8-2. Noise Floor Measurement with External Interference

Resolve this external interference before further PIM testing.

## 8-5 Noise Floor Spectrum View Measurement

Noise Floor Spectrum View Measurements display the signal level that is received by the PIM Master over the current Rx band as a function of frequency with TX1 and TX2 turned Off. The Noise Floor Measurement in [Figure 8-3](#) shows mobile traffic at some frequencies and clear spectrum at other frequencies. Before performing a PIM test, make sure that the selected IM product frequency falls in clear spectrum to prevent unwanted interference.



**Figure 8-3.** Typical Noise Floor Spectrum View Measurement

### Saving a Noise Floor Measurement

To save a Noise Floor measurement, press **Shift** and **File (7)**, then press the **Save** or the **Save Measurement** submenu key.

## 8-6 Noise Floor Menu

Key Sequence: **Measurements** > Noise Floor

Noise Floor	<b>Test</b>
Test	<b>Measure Off:</b> Press this submenu key to start a Noise Floor measurement. When a measurement is being made, <b>Measure</b> is underlined on this submenu key, and the submenu key is highlighted in red color. The <b>RF-ON</b> light on the PIM Master is <b>Off</b> (no transmit power, receive only).
Measure <span style="float: right;">Off</span>	
Noise Floor <span style="float: right;">●</span>	
Time View	When the measurement time is completed (Setup > Test Duration), <b>Off</b> is underlined on this submenu key. When a measurement is being made, press this submenu key to immediately terminate the active measurement.
Noise Floor <span style="float: right;">○</span>	
Spectrum View	<b>Noise Floor Time View:</b> Press this submenu key to measure the signal level that is entering the PIM Master at the IM product frequency.
~ ~ ~	
Start Cal	
Spectrum View	<b>Noise Floor Spectrum View:</b> Press this submenu key to perform a swept measurement that shows the signal level that is entering the PIM Master over the current Rx band.
~ ~ ~	
Save	
Measurement	<b>Start Cal Spectrum View:</b> Press this submenu key to calibrate the Spectrum View. Follow the on-screen instructions.
~ ~ ~	
Back	<b>Save Measurement:</b> Press this submenu key to save a Noise Floor measurement.
←	<b>Back:</b> Press this submenu key to return to the <a href="#">“Measurements Menu”</a> on page 3-19.

**Figure 8-4.** Noise Floor Menu

## Measurements Menu

Refer to [“Measurements Menu”](#) on page 3-19.

# Chapter 9 — Distance-to-PIM (DTP)

## 9-1 Introduction – Distance-to-PIM (DTP) Analyzer

Distance-to-PIM (DTP) is similar to Distance-to-Fault (DTF), which Anritsu introduced in the Site Master in 1997 for identifying the location of impedance mismatches in a feed line. DTP quickly and accurately identifies the location of PIM faults inside the feed system as well as beyond the antenna. This capability eliminates the guesswork involved in isolating PIM sources and speeds site repairs.

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

### Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

Distance-to-PIM is a swept measurement that enables identification of the location of multiple PIM sources in the RF path. It provides the ability to observe the impact of multiple PIM sources on the magnitude of the PIM signal. Distance-to-PIM is an analysis feature only, and it should not be used as a pass / fail test.

## 9-2 DTP Measurement

### F1 and F2 Carrier Sources

The default frequencies are selected by the Distance-to-PIM analyzer to optimize the distance resolution.

### Dmax and Data Points

Dmax is the maximum horizontal distance that can be analyzed. 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. Note that the data points can be set to either 128 points or 255 points. For best results, Data Points should always be set to the maximum number of steps available. You can choose 128 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.

DTP Parameters can be set individually in the Distance and Setup menus or can conveniently be set in one location using the DTP Aid (DTP Parameters screen) from the Setup menu. 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 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 Distance menu or the Setup menu, depending upon your starting point.

When numeric values are highlighted, the number 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 parameter (below) in the DTP Parameters setup window.

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

- Data Points > “Resolution Menu” on page 9-30
- Cable > “Cable Menu” on page 9-30

Refer to “Graphical User Interface (GUI)” on page 2-19 for examples of touch screen navigation for **Data Points** and **Cable** in the instrument settings summary.

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 Distance menu or the Setup menu, depending upon your starting point.

**Note**

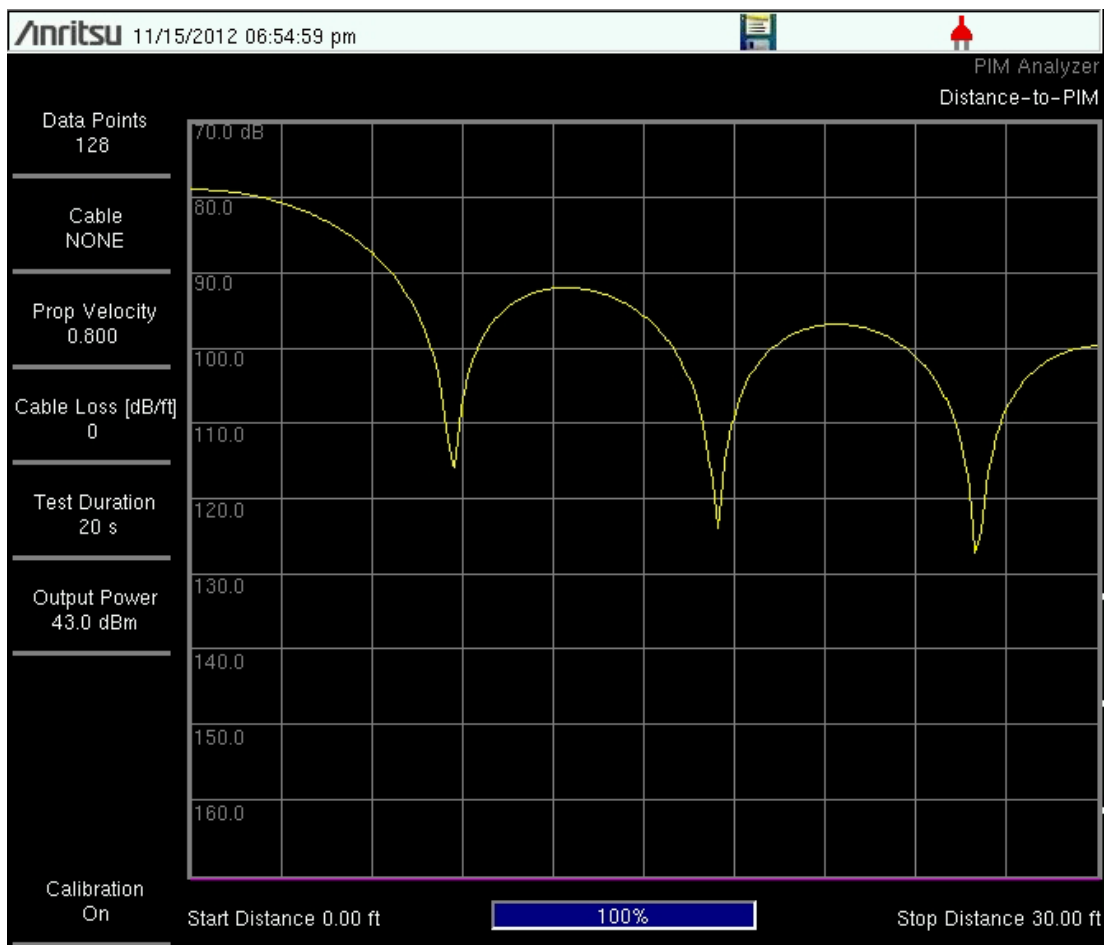
Start and Stop distances can also be set in the Distance menu. Cable Loss, Propagation Velocity, and Cable specifications can also be set in the DTP Setup menu. Output Power can also be set in the Setup menu.

## 9-3 Post-Calibration Measurement

When necessary, calibrate the PIM Master. Refer to section “Calibrating” on page 3-6.

A good practice is performing a DTP measurement after the calibration in order to verify that measurements appear normal after the calibration. Figure 9-1 represents a typical Distance-to-PIM measurement of a PIM standard and a low PIM termination right after calibration. Figure 9-2 on page 9-4 is another measurement of the same PIM standard and PIM termination, but from 0 feet to 100 feet. Note that a normal calibration can look very different when the measurement distance is changed.

**Distance: 0 ft to 30 ft**



**Figure 9-1.** DTP Measurement of PIM Standard and Termination after Calibration

Distance: 0 ft to 100 ft

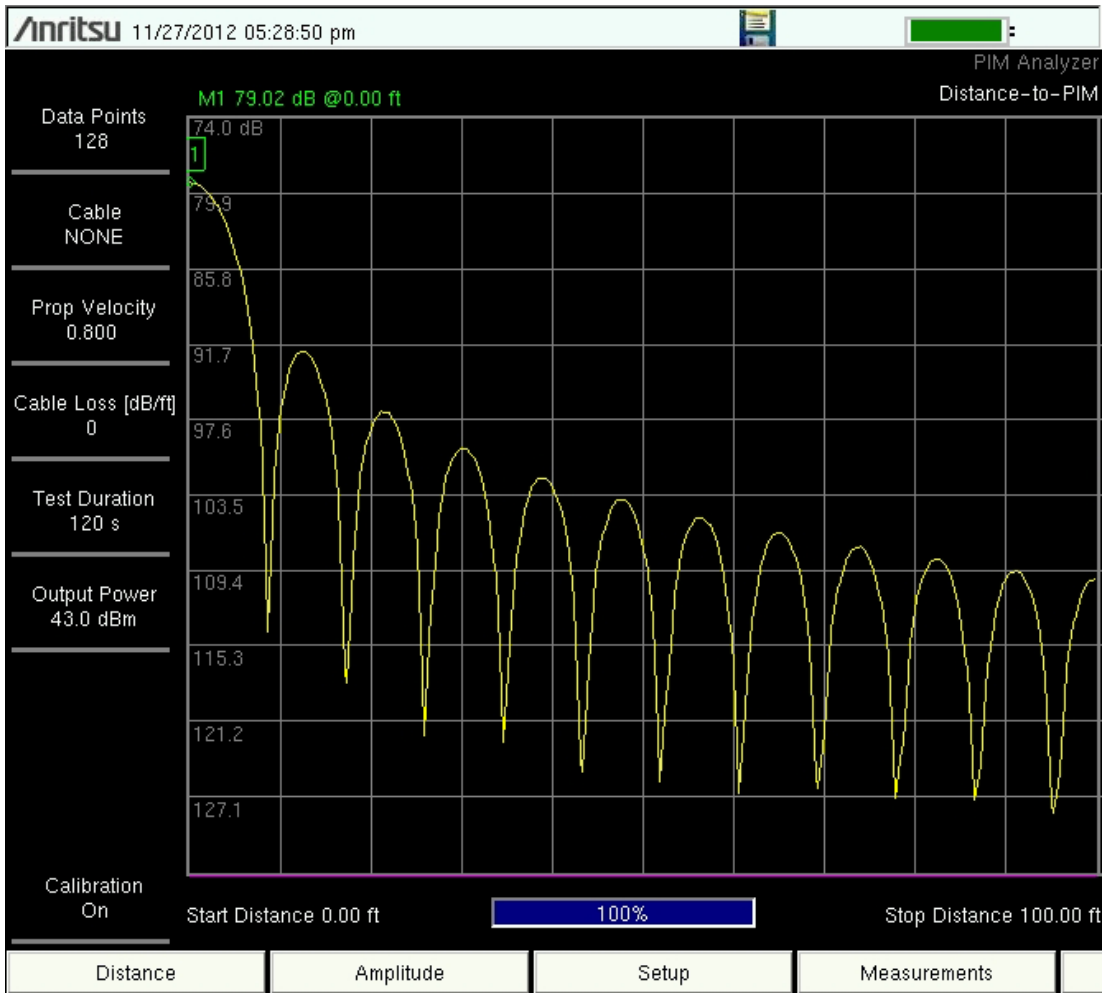


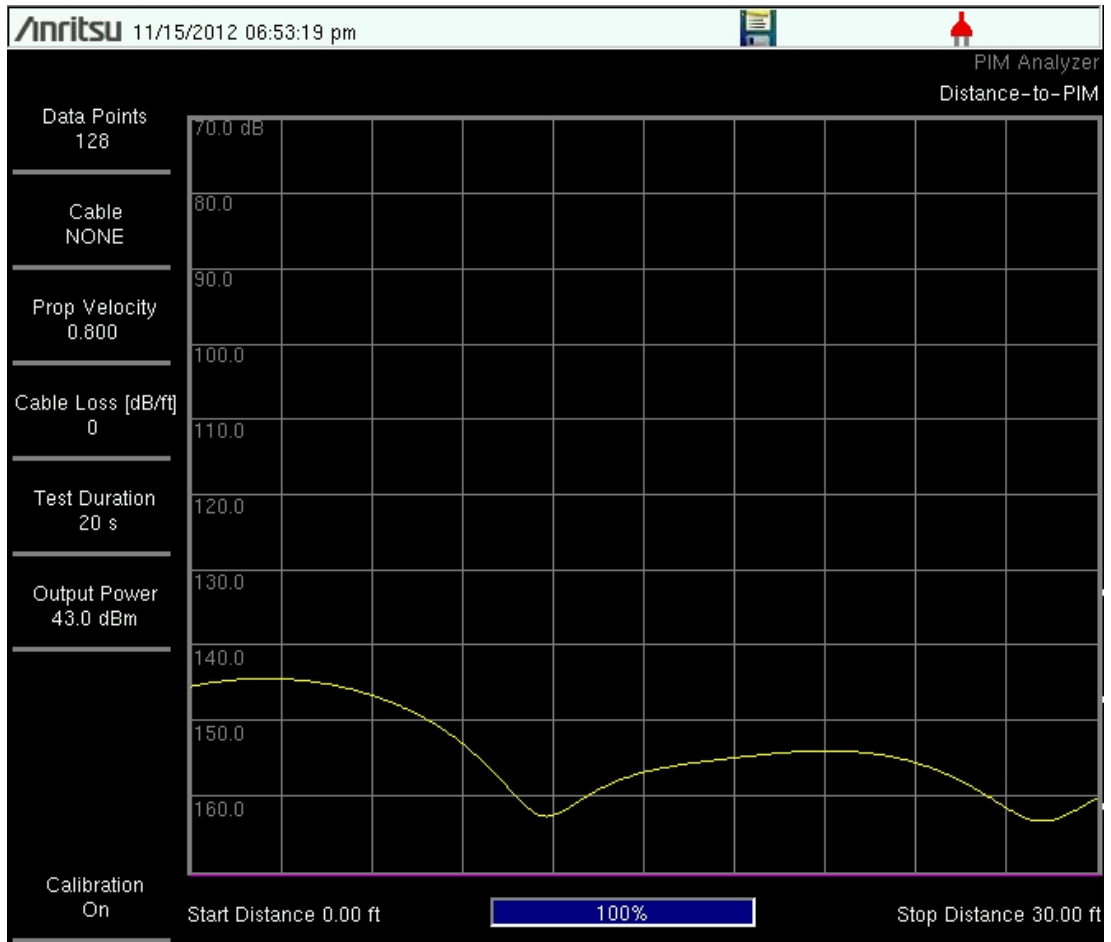
Figure 9-2. DTP Measurement of PIM Standard and Termination after Calibration



## Measuring a Connected Load

Figure 9-3 represents a typical Distance-to-PIM measurement of a connected load (the Low PIM Termination) right after calibration. Figure 9-4 on page 9-6 shows another measurement of the same load with a different distance setting. Note the differences in these two traces of the same load when measured with different distance settings.

**Distance: 0 ft to 30 ft.**



**Figure 9-3.** Typical DTP Measurement After a Calibration

Distance: 0 ft to 100 ft

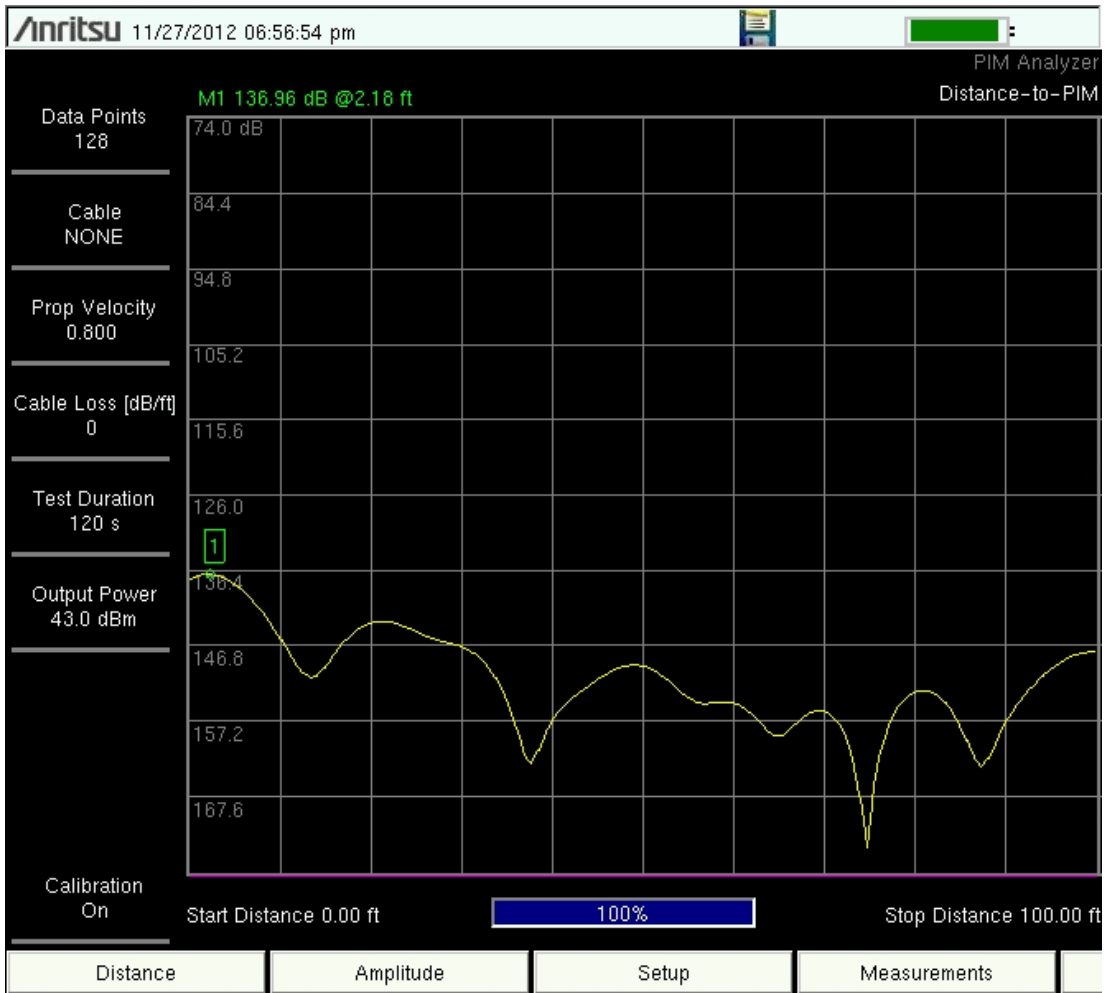


Figure 9-4. Typical DTP Measurement After a Calibration

## 9-4 DTP Measurement Setup

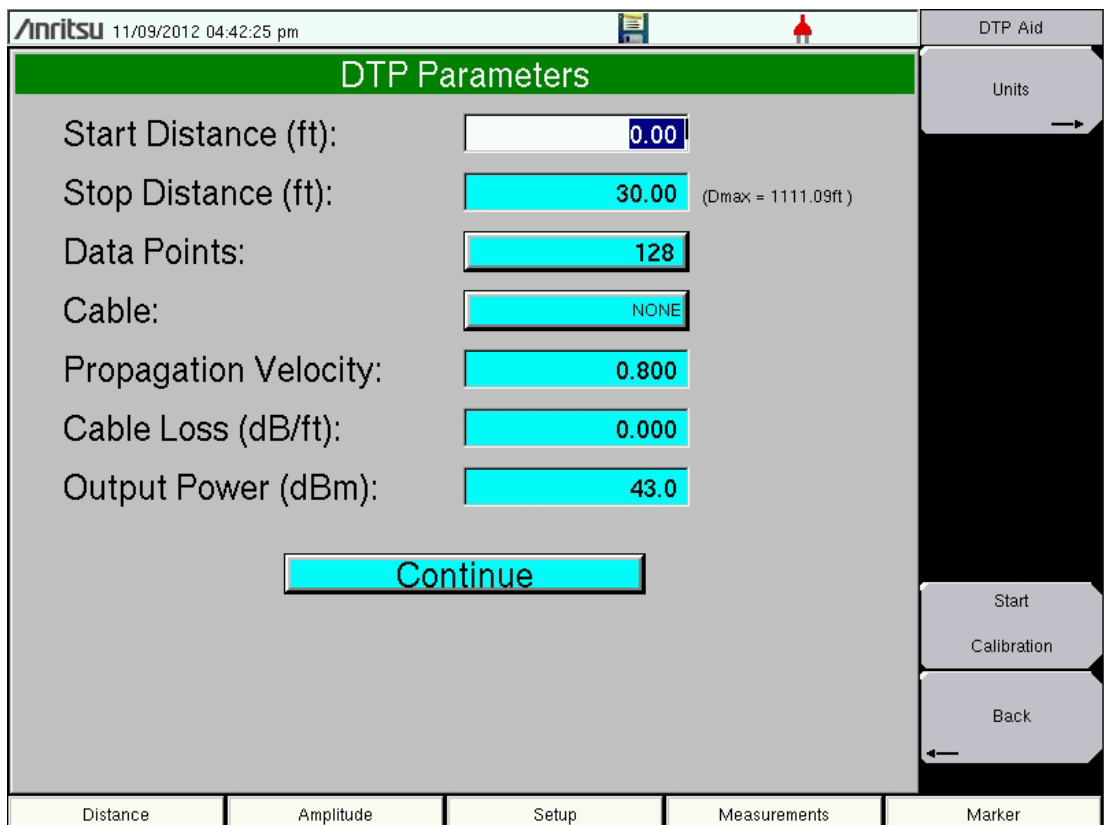
The main menu keys and submenu keys for Distance-to-PIM analysis differ from the PIM versus Time menus as described in [Chapter 7, “PIM versus Time”](#). For a description of the key functions in the Distance-to-PIM menus, refer to section [“Menu Map 1” on page 9-17](#).

1. Press the **Measurements** main menu key to display the Measurements menu.
2. Press the Distance-to-PIM submenu key.
3. Press the **Distance** main menu key.

**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.

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 9-5.** DTP Parameters Window

5. 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.

6. Highlight one of the distance values. Use the number keypad to set the Start and Stop distances.

The Stop Distance needs to be smaller than Dmax. Dmax is the maximum horizontal distance that can be analyzed, and it is displayed next to the Stop Distance value. Because 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. Dmax is also affected by the cable propagation velocity.

Note that the number of data points can be set to either 128 points or 255 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.

7. Highlight (or touch) the Data Points button to open the Resolution menu. Select the number of data points that best fits the measurement: 128 points or 255 points.
8. Highlight (or touch) the Cable button to display the available cable specifications. Use the Cable List submenu keys along with the **Arrow** keys to navigate to the desired cable specification, and then press **Enter** (or press the **Esc** key to abort without selecting a cable).

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

9. If the Cable selection is “None”, then, for the cable in use, enter an applicable Propagation Velocity. Entering a Cable Loss value is optional because this variable is not currently used by the PIM Master software for PIM fault distance analysis.
10. Highlight (or touch) the Output Power button to set an appropriate power level and press **Enter**.
11. Press the Continue button. If changes have been made to parameters that affect calibration, then a Calibration OFF indication will appear on the screen. Proceed to [“Calibrating” on page 3-6](#) to initiate a calibration prior to performing a DTP analysis. Otherwise, continue at [Step 12](#).  
  
If you press the **Back** submenu key from the Calibration menu, then the display returns to the Distance menu (or to the menu that was being displayed before you began calibration).
12. Press the **More** submenu key to open the DTP Setup menu. **More** is found in the Distance menu. After pressing **More**, the DTP Setup menu is displayed, allowing you to get cable parameters or to set windowing.
13. 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, or Minimum Side Lobe. Refer to [Appendix E, “Windowing”](#).

14. Press the **Measurements** main menu key. Then press the **Test** submenu key to begin your measurement.

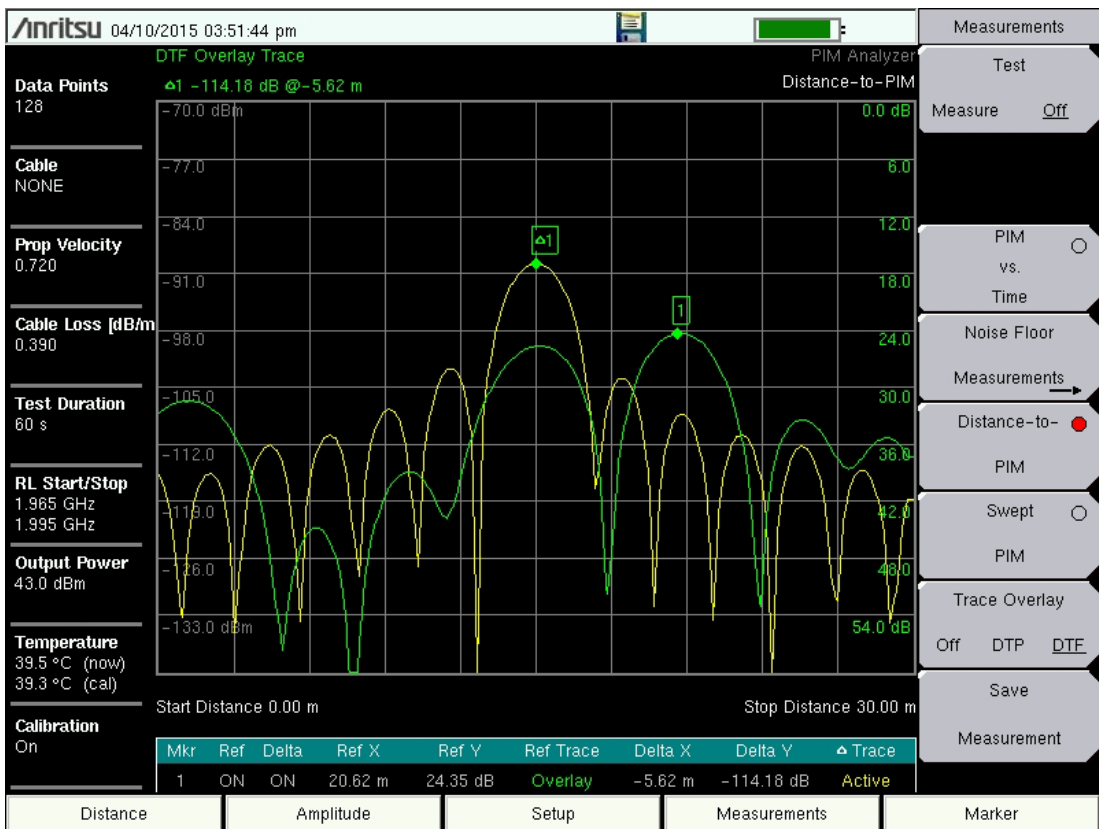
<b>Caution</b>	Make sure that you have attached a test lead to the instrument and that it is attached to the system under test before pressing the test button.
----------------	--------------------------------------------------------------------------------------------------------------------------------------------------

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 3 in [Figure 2-4 on page 2-8](#)).

For additional actions, refer to [Section 9-5 “Making a DTP Measurement” on page 9-10](#).

## 9-5 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 and the **Test** submenu key is outlined in Red. **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 [Chapter 4, “File Management”](#) for additional information about file handling.



**Figure 9-6.** DTP Measurement Example

As shown in [Figure 9-6](#), Distance-to-PIM (yellow trace with peak near 15 m) and Distance-to-Fault (green trace with peak near 21 m) are both automatically measured and presented when a DTP measurement is made. Distance-to-Fault (DTF) acts like a map to identify RF connector locations in the system. In this example, the two traces indicate that the PIM problem is located at the first connector past the input.

Up to six markers can be placed at points of interest on the DTF and DTP traces, and the marker table will display the signal parameters at each marker point. After each measurement, Marker 1 is always placed at the peak value of the DTF measurement, and Delta Marker 1 is always placed at the peak of the DTP measurement.

## 9-6 Trace Overlay

Trace Overlay is a feature allowing comparison in the field between an active Distance-to-PIM trace and an overlay trace (a second Distance-to-PIM or Distance-to-Fault trace.) This is useful for determining (at a site) the distance between an unknown PIM source and a known PIM source or reflection.

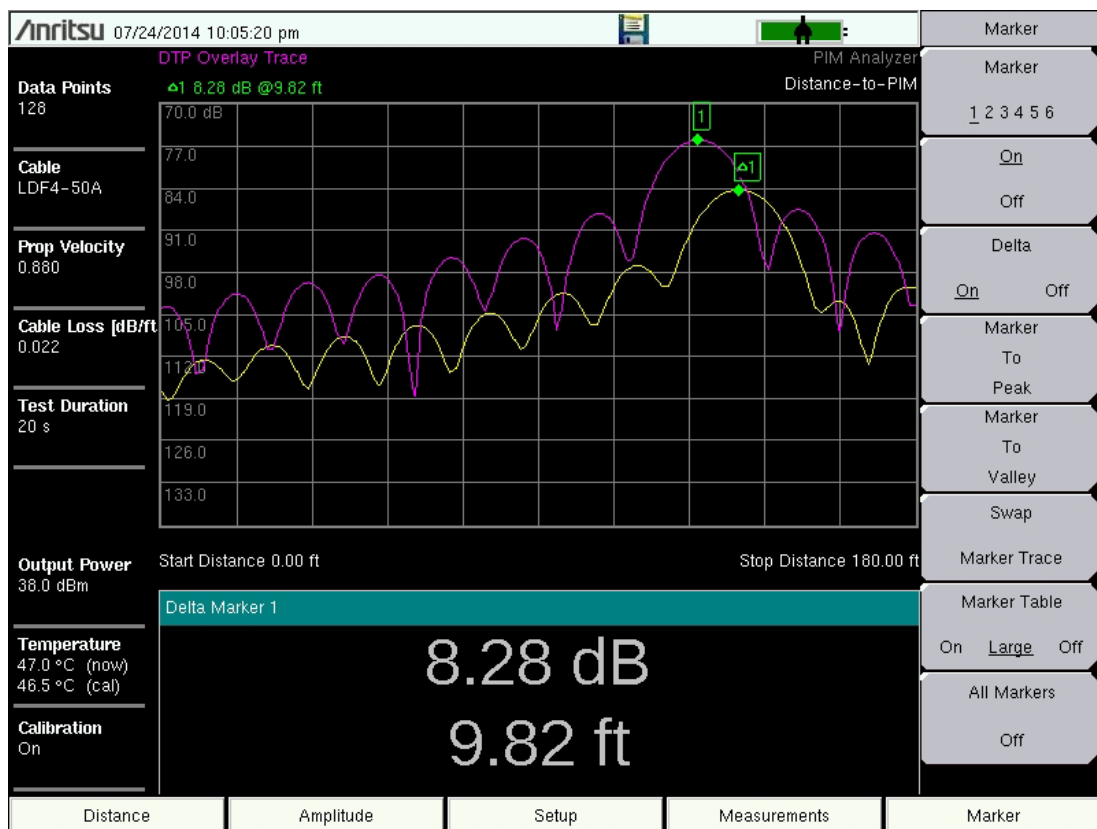


Figure 9-7. Trace Overlay Example

### DTP/DTP Overlay

To determine if a PIM source is beyond the antenna or inside the feed system, you need to know exactly where the antenna radiating surface is located. This can be determined by placing a bag of steel wool on an antenna radome and performing a Distance-to-PIM measurement. The resulting peak in the measurement marks the location of the antenna radiating surface. Place this trace into memory (overlay trace), and then measure Distance-to-PIM again with the steel wool removed. This new active trace shows the distance to the actual PIM sources at the site. The distance between the peak of the active trace (site PIM) and the overlay trace (PIM marker) shows how far in front of the antenna the PIM source is located if the distance value is positive. If the distance value is negative, then the unknown PIM source is before the antenna, inside the feed system. Refer to [Chapter 10, "Trace"](#).

### DTP/DTF Overlay (Manual Method)

Comparing the PIM location to known reflections on the line is also useful for troubleshooting PIM locations. Before beginning PIM measurements, the cable system sweep tests should already have been performed. Often, operators require a system DTF measurement and a cable length measurement (DTF with a short circuit at the end of the cable) as part of the close-out package. If these measurements were made using a compatible Anritsu Site Master product, then these measurements can be transferred to the PIM Master for future overlays.

Use the Trace function to select the desired DTF trace (refer to [Chapter 10](#)). Using the Trace Overlay submenu key, select DTF. The selected DTF trace appears on the screen along with the active Distance-to-PIM trace (site PIM). A delta marker is automatically generated, and it shows the relative distance between the DTF peak and the DTP peak.

The example in [Figure 9-8](#) shows an active Distance-to-PIM measurement (site PIM) with a Cable Length DTF trace. The DTF trace accurately identifies the end of the cable. In this case, the PIM source is 18.65 ft beyond the end of the cable, indicating that the site PIM is likely beyond the antenna.

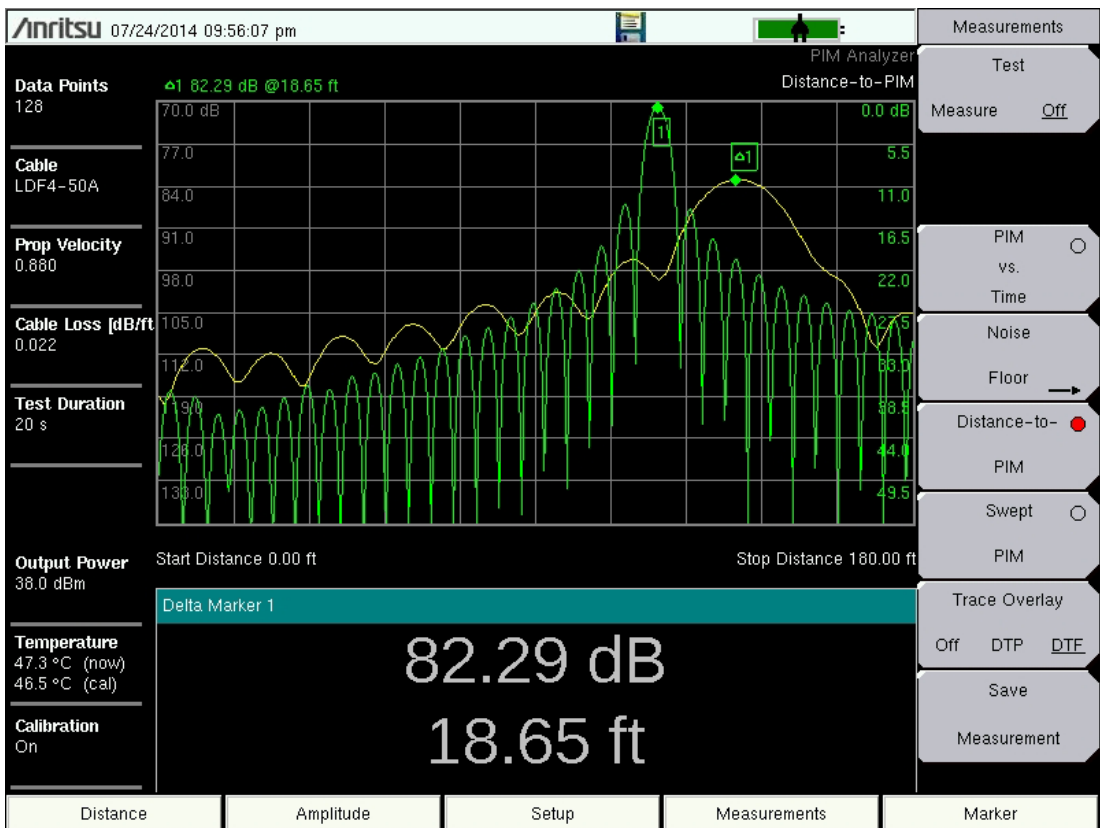


Figure 9-8. Trace Overlay Example



### DTP/DTF Overlay (Automatic Method)

In cases where high resolution DTF traces are not available to import, low resolution DTF traces can be generated through the PIM test port. By default, Distance-to-PIM measurements have this low resolution DTF measurement turned on. If not desired, then the automatic DTF overlay can be turned off in the Setup menu.

DTF measurements made through the PIM test port have limited swept frequency range due to filters inside the PIM analyzer. Each PIM analyzer has a different internal filter, resulting in different swept frequency ranges for each model number. As a result, the DTF resolution is different for each PIM Master model. For short measurement distances, a manually loaded DTF measurement may be preferred in order to distinguish closely spaced connections. For longer measurement distances, the automatic DTF overlay is sufficient.

The example in [Figure 9-9](#) shows an example of an automatic DTP – DTF overlay made at 900 MHz in a distributed antenna system (DAS), where the length of the system was more than 140 m. As can be seen, the DTF resolution in this case is sufficient to identify splitters and antenna locations along the DAS branch. The PIM locations can be compared to these known reflections to help isolate PIM faults in the sector. The red bars seen here are the DTP enhanced resolution feature described in [Section 9-7](#) on [page 9-15](#).

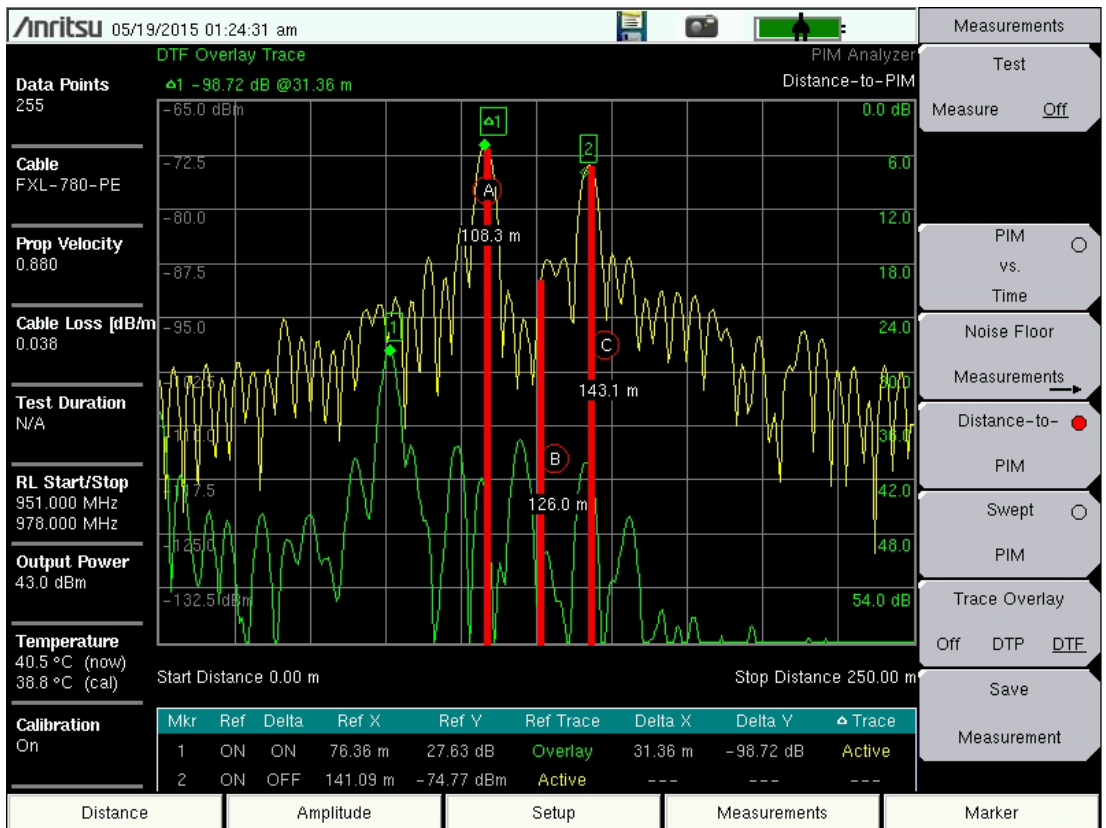
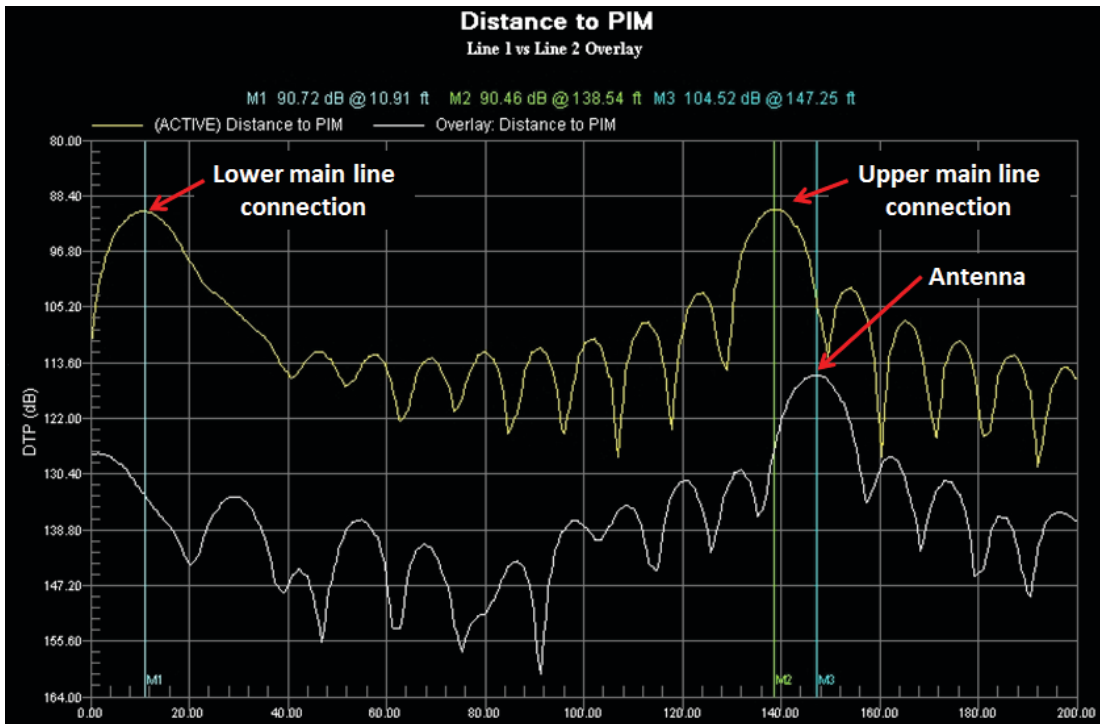


Figure 9-9. DTP/DTF Overlay Example

## Line Sweep Tools

After you leave the site, Anritsu Line Sweep Tools (LST) also provides a method to overlay multiple DTP results. **Figure 9-10** shows an overlay of two DTP measurements from the main receive path and the diversity receive path of a sector. One line has very good PIM performance, but the other line needs repair. Using the good line (lower trace) as a reference, you can clearly see that the PIM problems on the bad line are 11 feet away from the radio at the main line connection and 11 feet behind the antenna at the top (also at a main line connection). LST also could be used to report site improvements by creating an overlay of saved measurements that are taken before and after repairs.



**Figure 9-10.** Distance-to-PIM Overlay of Sector Main and Diversity Paths

## 9-7 Enhanced Resolution

When making Distance-to-PIM measurements, the ability to individually resolve two PIM sources that are physically close together is determined by the swept bandwidth of the IM (intermodulation product) product being measured. The more IM product frequency bandwidth available, the closer together two PIM sources can be resolved. [Table 9-1](#) shows the calculated resolution for several of the MW82119A frequency bands, assuming a propagation velocity factor of 0.88. As can be seen in the table, some frequency bands have inherently better resolution than others.

**Table 9-1.** Typical Calculated Resolution of Sample Frequency Bands^a

Frequency Band	Standard Resolution
850 MHz	5.5 m (18.0 ft)
900 MHz	5.3 m (17.3 ft)
1800 MHz	2.4 m ( 7.9 ft)
1900 MHz	3.3 m (10.8 ft)

a. With propagation velocity factor of 0.88

The Enhanced Resolution feature typically improves the standard resolution by a factor of two during Distance-to-PIM measurements. This feature is enabled by default (refer to [Figure 9-23 on page 9-27](#)). In Enhanced Resolution mode, the location of PIM sources on the line is estimated, and up to 4 impulse bars are displayed. The impulse bars mark the predicted location of the measured PIM sources. The vertical impulse bars are easy to read, and they clearly identify the location of multiple PIM sources (when they exist). See [Figure 9-11 on page 9-16](#).

An error checking function is employed to compare the magnitude of the enhanced resolution prediction to the magnitude of the standard resolution prediction. If correlation between the two estimates is not good, then the impulse bars are not displayed.

Occasionally, false PIM locations will be predicted by the enhanced resolution algorithm. False predictions are more likely to occur when measuring an unstable PIM source (magnitude changing versus time), when measuring very low magnitude PIM signals, or when testing in a noisy RF environment. Even with the occasional false prediction, this technology can help operators find and eliminate PIM sources more quickly in the field.

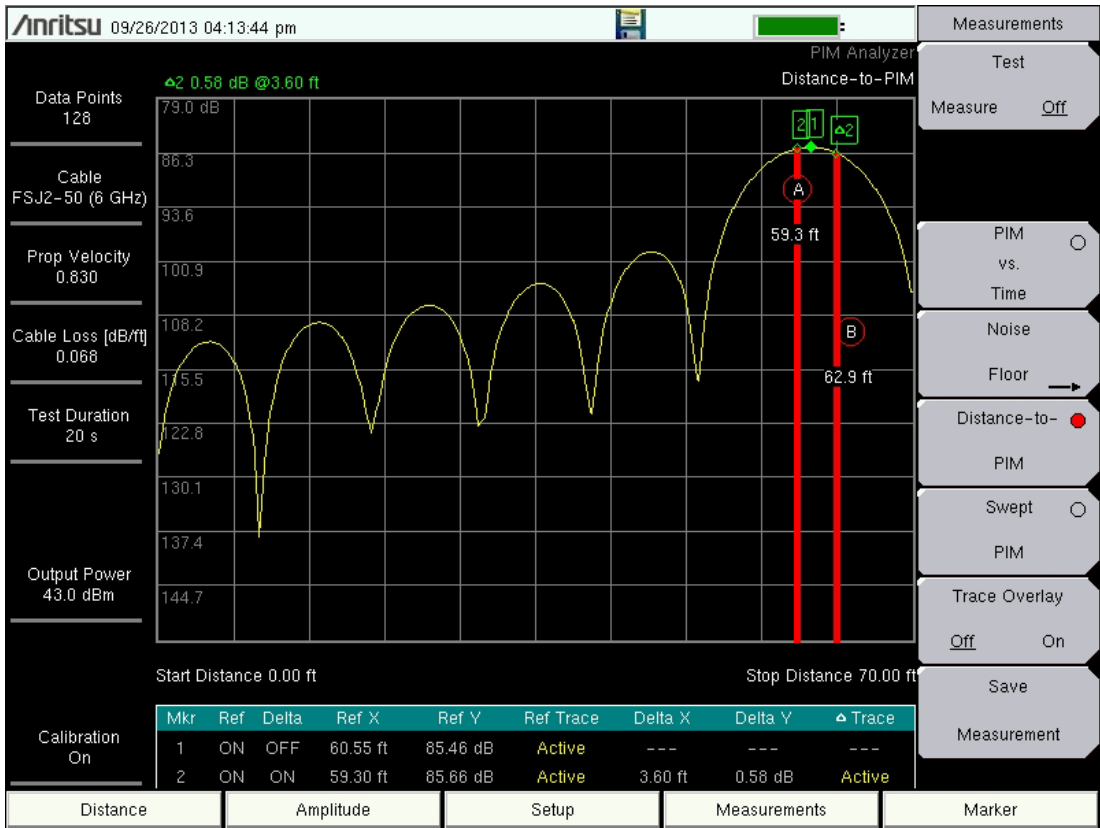


Figure 9-11. Example of Impulse Bars with Enhanced Resolution

## 9-8 Menu Map 1

Figure 9-12 shows a map of the Distance-to-PIM Analyzer mode menus. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages). The following sections describe main menus and associated submenus.

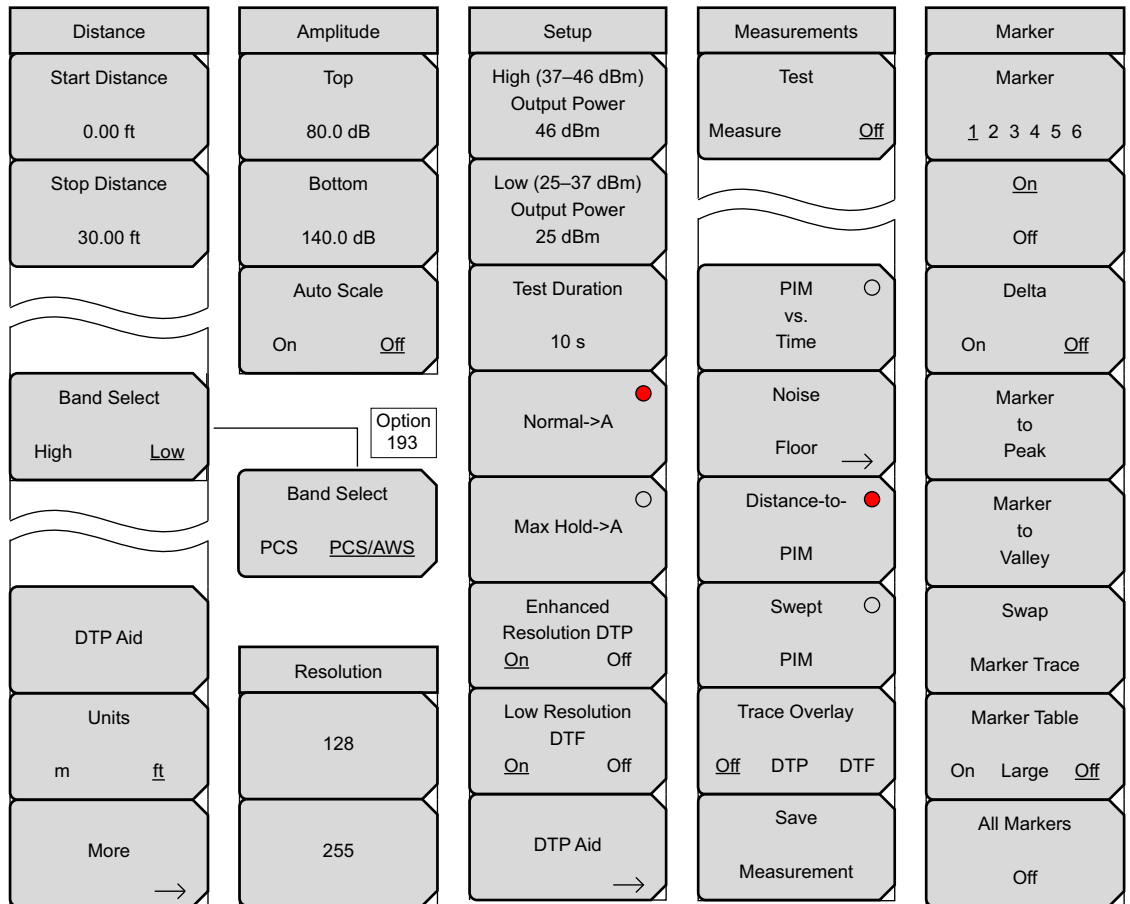


Figure 9-12. DTP Analyzer Menu Map 1

## 9-9 Menu Map 2

Figure 9-13 shows a map of the supplemental menus for the Distance-to-PIM Analyzer mode.

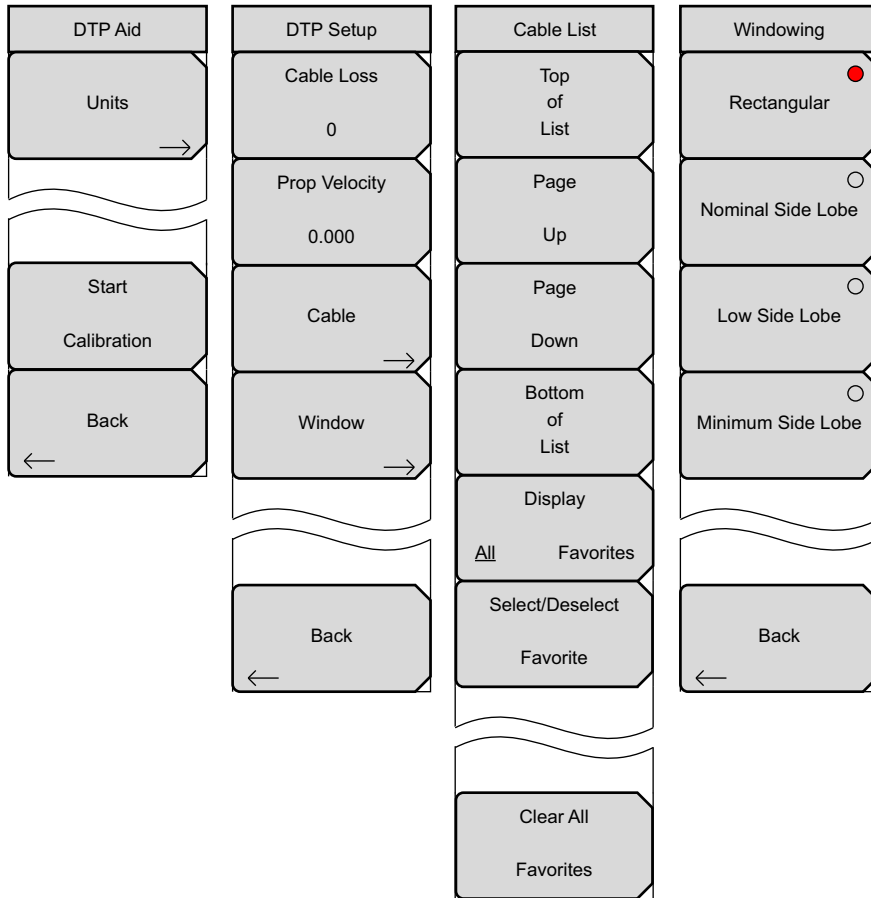


Figure 9-13. DTP Analyzer Menu Map 2

## 9-10 Distance Menu

Key Sequence: **Distance**

Distance	<p><b>Start Distance:</b> Press the <b>Distance</b> main menu key followed by the Start Distance submenu key and enter the desired length in feet by using the keypad or the <b>Arrow</b> keys. The maximum Start Distance setting is equal to the Stop Distance setting.</p> <p><b>Stop Distance:</b> Press this submenu key to set the desired length in feet by using the keypad or the <b>Arrow</b> keys. The minimum Stop Distance setting is equal to or greater than the Start Distance setting. Refer to the Dmax value reported in the DTP Parameters window. Dmax is influenced by factors such as the number of data points and the propagation velocity of the cable. Refer to <a href="#">Step 6 in Section 9-4 “DTP Measurement Setup” on page 9-7</a>.</p> <p>Note: The Start Distance and Stop Distance can be the same, but neither setting can override the other. Change settings in an order that avoids any overlap. The <b>Up/Down</b> arrow keys change the distance settings by 1 ft increments, and the <b>Left/Right</b> arrow keys change the distance settings by 0.1 ft increments. With the number keypad, you can set distances by 0.01 ft increments (or by 0.01 m increments). If the settings include a digit other than zero in the second decimal position, then the <b>Up/Down</b> arrow keys cannot change a value if that change would exceed a limit. Use the <b>Left/Right</b> arrow keys or the number keypad to increase or decrease the remaining value.</p> <p><b>Band Select</b> <b>High Low:</b> This submenu key appears only on instruments with multiple receive ranges. Press this submenu key to toggle the band selection. This submenu key is displayed either with <b>High</b> and <b>Low</b> settings or with <b>PCS</b> and <b>PCS/AWS</b>.</p> <p><b>DTP Aid:</b> Press this submenu key to open the DTP Parameters window and the DTP Aid submenu to set up the test parameters for DTP testing.</p> <p><b>Units:</b> Press this submenu key to toggle the units setting between meters and feet. The selection is underlined.</p> <p><b>More:</b> Press this submenu key to open the DTP Setup menu.</p>
Start Distance 0.00 ft	
Stop Distance 30.00 ft	
Band Select High <u>Low</u>	
DTP Aid →	
Units m <u>ft</u>	
More →	
Option 193	
Band Select PCS <u>PCS/AWS</u>	

**Figure 9-14.** Distance Menu

Start Distance and Stop Distance settings can also be initiated by highlighting their values in the DTP Parameters window. Refer to [Figure 9-5 on page 9-7](#).

**Note**

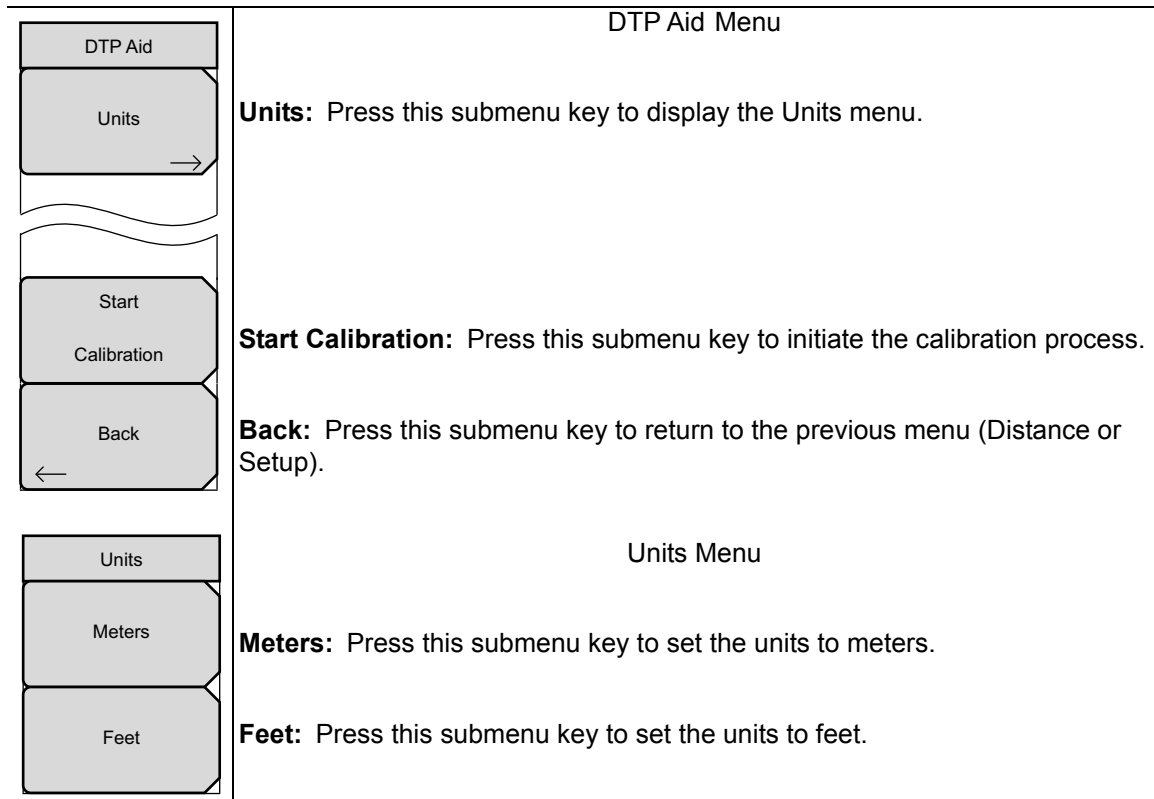
The left-most main menu key is labeled **Freq** in the PIM vs. Time and the Swept PIM measurement settings. It is labeled **Distance** in the Distance-to-PIM measurement setting.

## 9-11 DTP Aid Menu

Key Sequence: **Distance** > DTP Aid

or

Key Sequence: **Setup** > DTP Aid



**Figure 9-15.** DTP Aid Menu



## 9-12 DTP Setup Menu

Key Sequence: **Distance** > More

DTP Setup	
Cable Loss 0	<b>Cable Loss:</b> Press this submenu key to enter the loss in dB/ft or dB/m for the selected cable by using the keypad or the <b>Arrow</b> keys, and then press <b>Enter</b> .
Prop Velocity 0.000	<b>Prop Velocity:</b> Press this submenu key to enter the applicable propagation velocity for the selected cable by using the keypad or the <b>Arrow</b> keys, and then press <b>Enter</b> .
Cable →	<b>Cable:</b> Press this submenu key to open a list of available cable specifications (see <a href="#">Figure 9-19 on page 9-23</a> ). Using the <b>Arrow</b> keys or the touch screen, select the desired cable and then press <b>Enter</b> .
Window →	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.
	<b>Window:</b> 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 <a href="#">Appendix E, “Windowing”</a> for more information.
Back ←	<b>Back:</b> Press this submenu key to return to the Distance menu.

**Figure 9-16.** 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. See [Figure 9-5 on page 9-7](#).

## 9-13 Cable List Menu

Key Sequence: **Distance** > More > Cable

or

Touch **Cable** in the DTP Parameters window:

**Distance** > DTP Aid > Cable

**Setup** > DTP Aid > Cable

The Cable List Box and the Cable List menu are displayed simultaneously (see Cable List in [Figure 9-19 on page 9-23](#)). Select a Cable in the list box and then press the **Enter** key to use those cable loss and propagation velocity values in your measurement. Press the **Esc** key to return to the Distance menu without making a selection.

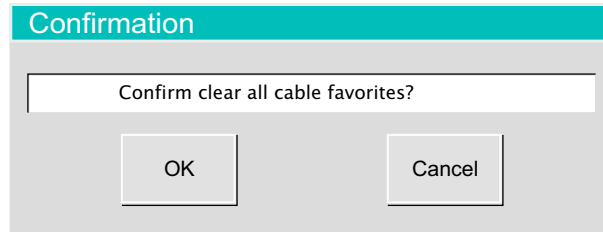
Cable List	
Top of List	<b>Top of List:</b> Press this submenu key to highlight the cable at the top of the list.
Page Up	<b>Page Up:</b> Press this submenu key to scroll upward by one page (within the cable list) from the currently highlighted cable.
Page Down	<b>Page Down:</b> Press this submenu key to scroll downward by one page (within the cable list) from the currently highlighted cable.
Bottom of List	<b>Bottom of List:</b> Press this submenu key to highlight the cable at the bottom of the list.
Display	<b>Display</b>
All Favorites	<b>All Favorites:</b> Press this submenu key to toggle between displaying all of the cables or only those cables that have been marked as favorites. If your selection of favorites fills more than one screen, then the other submenu keys can be used to shift the viewed list. See <a href="#">Figure 9-20 on page 9-24</a> .
Select/Deselect Favorite	<b>Select/Deselect Favorite:</b> Press this submenu key to select or deselect a highlighted cable type.
Clear All Favorites	<b>Clear All Favorites:</b> Press this submenu key to select or deselect a highlighted cable type. See <a href="#">Figure 9-18 on page 9-23</a> .

**Figure 9-17.** Cable List Menu

You can add cables to the list, remove cables, and modify cable specifications by using Line Sweep Tools.

## Confirmation Clear All Favorites

Key Sequence: **Distance** > More > Cable > Clear All Favorites



**Figure 9-18.** Clear All Favorites Confirmation Message

## Cable List

Key Sequence: **Distance** > More > Cable

Cable Name	[ Prop Vel	, (F1	, CL1(dB/m)	(F2	, CL2(dB/m)	(F3	, CL3(dB/m) ]]
NONE	[ 1.000,	( 1000	, 0.000)	( 2000	, 0.000)	( 2500	, 0.000)
FSJ1-50A (6 GHz	[ 0.840,	( 1000	, 0.196)	( 2500	, 0.322)	( 6000	, 0.527)
FSJ2-50 (6 GHz)	[ 0.830,	( 1000	, 0.133)	( 2500	, 0.223)	( 6000	, 0.374)
FSJ4-50B (6 GHz	[ 0.810,	( 1000	, 0.118)	( 2500	, 0.201)	( 6000	, 0.344)
EFX2-50 (6 GHz)	[ 0.850,	( 1000	, 0.121)	( 2500	, 0.202)	( 6000	, 0.341)
LDF1-50 (6 GHz)	[ 0.860,	( 1000	, 0.136)	( 2000	, 0.200)	( 6000	, 0.377)
LDF2-50 (6 GHz)	[ 0.880,	( 1000	, 0.115)	( 2000	, 0.170)	( 6000	, 0.323)
LDF4-50A (6 GHz	[ 0.880,	( 1000	, 0.073)	( 2500	, 0.121)	( 6000	, 0.200)
HJ4-50 (6 GHz)_	[ 0.914,	( 1000	, 0.092)	( 2500	, 0.156)	( 6000	, 0.257)
HJ4.5-50 (6 GHz	[ 0.920,	( 1000	, 0.054)	( 2500	, 0.089)	( 6000	, 0.148)
310801_____	[ 0.821,	( 1000	, 0.115)	( 1000	, 0.115)	( 1000	, 0.115)
311201_____	[ 0.820,	( 1000	, 0.180)	( 1000	, 0.180)	( 1000	, 0.180)
311501_____	[ 0.800,	( 1000	, 0.230)	( 1000	, 0.230)	( 1000	, 0.230)
311601_____	[ 0.800,	( 1000	, 0.262)	( 1000	, 0.262)	( 1000	, 0.262)
311901_____	[ 0.800,	( 1000	, 0.377)	( 1000	, 0.377)	( 1000	, 0.377)
352001_____	[ 0.800,	( 1000	, 0.377)	( 1000	, 0.377)	( 1000	, 0.377)
AVA5-50 7/8____	[ 0.910,	( 1000	, 0.038)	( 2000	, 0.055)	( 2500	, 0.063)
AVA7-50 1-5/8__	[ 0.920,	( 1000	, 0.022)	( 2000	, 0.034)	( 2500	, 0.038)
CR50 540PE_____	[ 0.880,	( 1000	, 0.069)	( 2000	, 0.103)	( 2500	, 0.116)
CR50 1070PE_____	[ 0.880,	( 1000	, 0.037)	( 2000	, 0.055)	( 2500	, 0.064)

**Figure 9-19.** Cable List Box, Table of Specifications

## Favorites (in Cable List)

Key Sequence: **Distance** > More > Cable > Display

Press Display, if necessary, until **Favorites** is underlined in the submenu key.

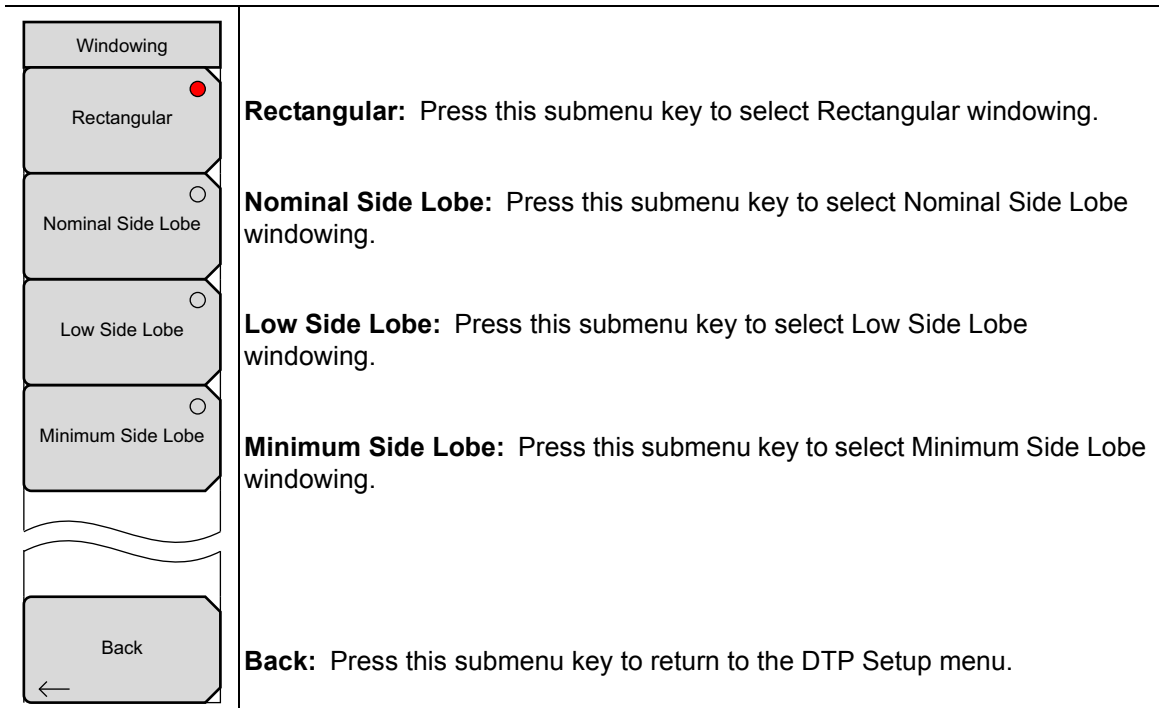
Cable Name	[ Prop Vel , ( F1 , CL1(dB/m) ) ( F2 , CL2(dB/m) ) ( F3 , CL3(dB/m) ) ]
* LDF4-50A (6 GHz)	[ 0.880, ( 1000 , 0.073) ( 2500 , 0.121) ( 6000 , 0.200)]
* AVA5-50 7/8	[ 0.910, ( 1000 , 0.038) ( 2000 , 0.055) ( 2500 , 0.063)]
* AVA7-50 1-5/8	[ 0.920, ( 1000 , 0.022) ( 2000 , 0.034) ( 2500 , 0.038)]
* LMR400	[ 0.850, ( 1000 , 0.135) ( 2000 , 0.196) ( 2500 , 0.222)]
* RF1 5/8-50GHF	[ 0.880, ( 1000 , 0.024) ( 2000 , 0.036) ( 2500 , 0.042)]
* RF2 1/4-50	[ 0.880, ( 1000 , 0.021) ( 2000 , 0.032) ( 2500 , 0.041)]
* LCF78-50JA	[ 0.900, ( 1000 , 0.039) ( 2000 , 0.058) ( 2500 , 0.066)]
* AR158J50	[ 0.910, ( 1000 , 0.026) ( 2000 , 0.042) ( 2500 , 0.052)]
* AT114FX50	[ 0.910, ( 1000 , 0.029) ( 2000 , 0.044) ( 2500 , 0.052)]
* AT158FX50	[ 0.910, ( 1000 , 0.022) ( 2000 , 0.033) ( 2500 , 0.039)]

**Figure 9-20.** Cable List Box Showing Favorites

## 9-14 Windowing Menu

For a description of these windowing features, refer to [Appendix E, “Windowing”](#).

Key Sequence: **Distance** > More > Window



**Figure 9-21.** DTP Windowing Menu

## 9-15 DTP Amplitude Menu

Key Sequence: **Amplitude**

Amplitude	
Top 80.0 dB	<b>Top:</b> Press this submenu key to set the top amplitude value. 0.0 dB is the upper limit.
Bottom 140.0 dB	<b>Bottom:</b> Press this submenu key to set the bottom amplitude value. 260 dB is the lower limit.
Auto Scale On      Off	<b>Auto Scale:</b> Press this submenu key to toggle Auto Scale On or Off.

**Figure 9-22.** DTP Amplitude Menu

## 9-16 Setup Menu

Key Sequence: **Setup**

Setup	<p><b>High (37–46 dBm) Output Power:</b> Press this submenu key to set the output power level within the higher range for both carrier frequencies, F1 and F2.</p> <p><b>Low (25–37 dBm) Output Power:</b> Press this submenu key to set the output power level within the lower range for both carrier frequencies, F1 and F2.</p> <p><b>Note:</b> Power output value from the test port is twice the set output value. For example, when <b>Setup</b> &gt; Output Power is set to 20 W, total output power is 40 W.</p> $20\text{ W (F1)} + 20\text{ W (F2)} = 40\text{ W}$ <p><b>Test Duration:</b> Press this submenu key to set the length of time that the test port will deliver power after Test is pressed. Range for the test is 1 second to 1200 seconds. Use the <b>Arrow</b> keys or the number keypad. If you use the number keypad, then the “Units Menu” on page 9-28 is displayed.</p> <p><b>Note:</b> When Enhanced Resolution is <b>On</b>, Test Duration does not apply, and <b>N/A</b> is displayed. Refer to the Enhanced Resolution submenu key description.</p> <p><b>Normal-&gt;A:</b> Press this submenu key to display the current trace sweep, and to repeat the sweep.</p> <p><b>Max Hold-&gt;A:</b> Press this submenu key to display the maximum value for data points from continuous trace sweeps.</p> <p><b>Enhanced Resolution DTP</b> On Off</p> <p><b>Low Resolution DTF</b> On Off</p> <p><b>DTP Aid</b> →</p>
High (37–46 dBm) Output Power 46 dBm	
Low (25–37 dBm) Output Power 25 dBm	
Test Duration  10 s	
Normal->A	
Max Hold->A	
Enhanced Resolution DTP On Off	
Low Resolution DTF On Off	
DTP Aid →	

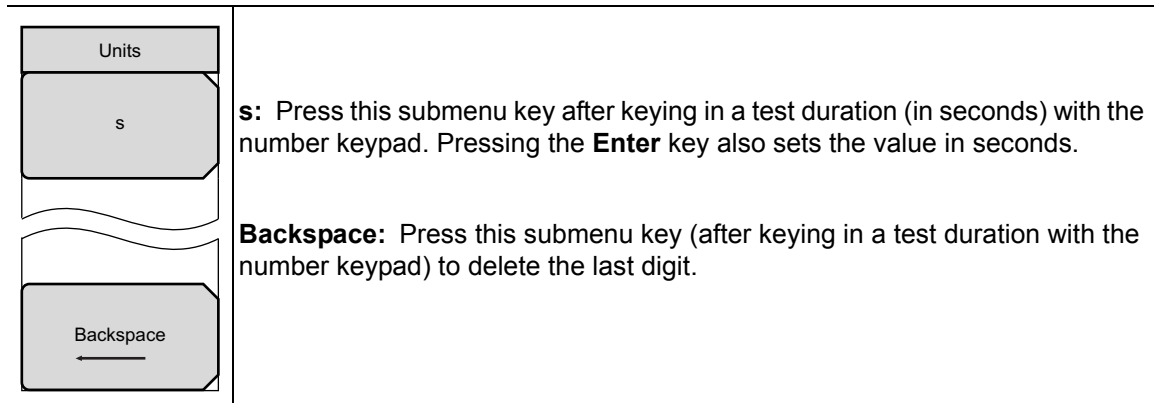
**Figure 9-23.** DTP Setup Menu

The Output Power setting can also be initiated by highlighting its value in the DTP Parameters window. Refer to [Figure 9-5 on page 9-7](#).

## 9-17 Units Menu

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

Key Sequence: **Setup** > **Numerals** (from number keypad)



**Figure 9-24.** DTP Test Duration (Units) Menu

## Measurements Menu

Refer to [Section 3-9 “Measurements Menu”](#) on page 3-19.



## 9-18 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	<b>Marker:</b> Press this submenu key to select which marker (1, 2, 3, 4, 5, 6) is active. The underlined marker number is the active marker. See <a href="#">Figure 9-26</a> .
Marker <u>1</u> 2 3 4 5 6	<b>On/Off:</b> Press this submenu key to turn On or Off the selected (underlined) marker in the <b>Marker</b> submenu key.
On Off	
Delta	<b>Delta</b>
On <u>Off</u>	<b>On Off:</b> 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	<b>Marker to Peak:</b> Press this submenu key to place the currently active marker on the highest signal amplitude that is currently displayed on screen.
Marker to Valley	<b>Marker to Valley:</b> Press this submenu key to place the currently active marker on the lowest signal amplitude that is currently displayed on screen.
Swap Marker Trace	<b>Swap Marker Trace:</b> Press this submenu key to move markers from one trace to another (when Trace Overlay is On). See <a href="#">Figure 10-4 on page 10-6</a> .
Marker Table	<b>Marker Table</b>
On   Large <u>Off</u>	<b>On Large Off:</b> Press this submenu key to toggle the marker table On, Off, or on and Large. The Large marker display shows only the x-axis and y-axis values of the active marker.
All Markers Off	<b>All Markers Off:</b> Turns off all displayed markers.

**Figure 9-25.** Marker Menu

Select Marker		
M1	M2	M3
M4	M5	M6

**Figure 9-26.** Marker Selection Box

## 9-19 Resolution Menu

This menu is displayed when the Data Points button is highlighted in the DTP Parameters window (Figure 9-5 on page 9-7).

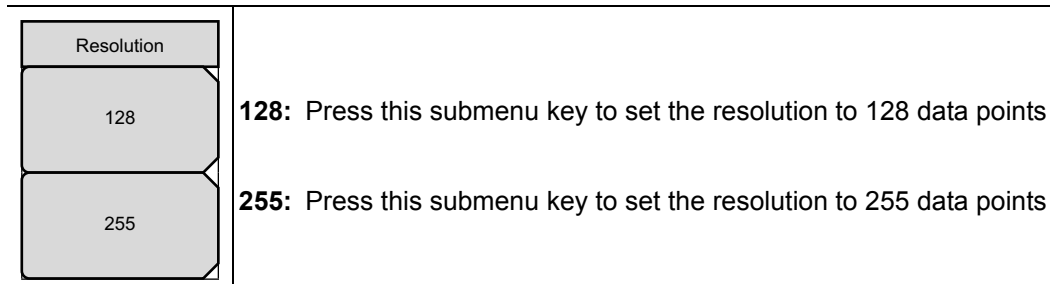


Figure 9-27. DTP Resolution Menu

## 9-20 Cable Menu

This menu is displayed when the Cable button in the DTP Parameters window is highlighted (by using the **Arrow** keys). See Figure 9-29.

Key Sequence: **Distance** > DTP Aid > **Arrow Key**

Key Sequence: **Setup** > DTP Aid > **Arrow Key**

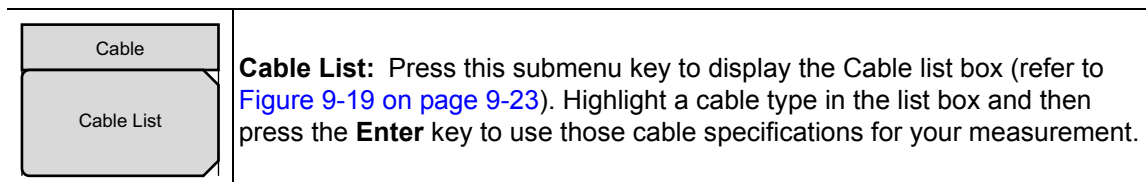


Figure 9-28. DTP Cable Menu

## DTP Parameters window

Cable edit box selected via **Arrow** keys

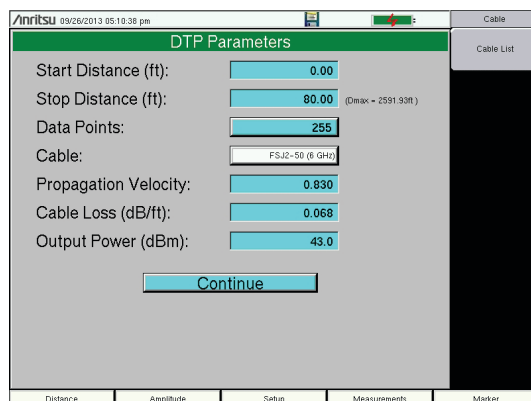
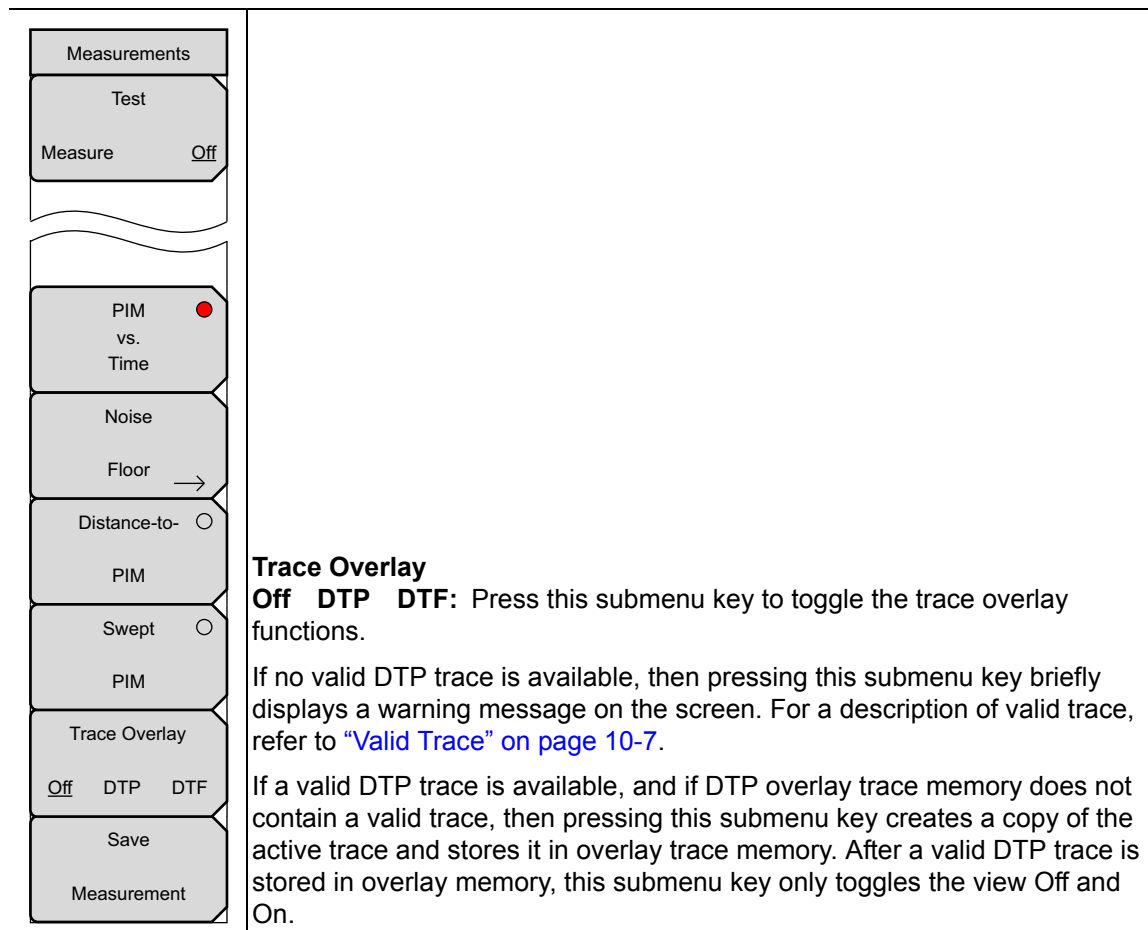


Figure 9-29. Cable List Submenu Key

## 9-21 Trace Overlay Submenu Key

For the complete Measurements menu description, refer to [“Measurements Menu” on page 3-19](#). For the Trace menu description, refer to [“Trace Menu, Distance-to-PIM” on page 10-6](#). The Measurements menu Trace Overlay submenu key is described here:



**Figure 9-30.** Trace Menu – Distance-to-PIM

## 9-22 Reference (Limit) Menu

Refer to [Section 3-12 “Reference \(Limit\) Menu”](#) on page 3-22.

# Chapter 10 — Trace

## 10-1 Introduction

The Trace menu is available only in Distance-to-PIM (DTP) measurement mode. The PIM Master can display two different traces simultaneously in the sweep window. The active trace is the current measurement. The overlay trace is the trace of a previous DTP or DTF measurement that has been stored into memory. This capability is particularly useful for identifying the location of an unknown PIM source relative to a known PIM marker placed in the system.

## 10-2 DTP/DTP Trace Overlay

Perform a Distance-to-PIM measurement with a known PIM marker in place. Remove that PIM marker and perform the same measurement again. Then compare measurement traces to determine a PIM location.

### Trace Comparison Example

1. Set your PIM Master measurement type to Distance-to-PIM by pressing **Measurements** > Distance-to-PIM.
2. Set up DTP measurement parameters.
3. Press **Measurements** > Test.
4. When the measurement is completed, press **Shift** then **Trace (5)**.
5. In the Trace menu (see [Figure 10-4 on page 10-6](#)), press Copy Active Trace to Overlay. When an active trace is copied to overlay, the Trace Overlay submenu key is automatically toggled to On (if not already On).

See [Figure 10-1 on page 10-2](#) for an example of Trace Overlay.

When the trace has been copied to overlay, the trace color immediately changes to the color that has been set in the Select Color choice box (see [Figure 10-5 on page 10-7](#)).

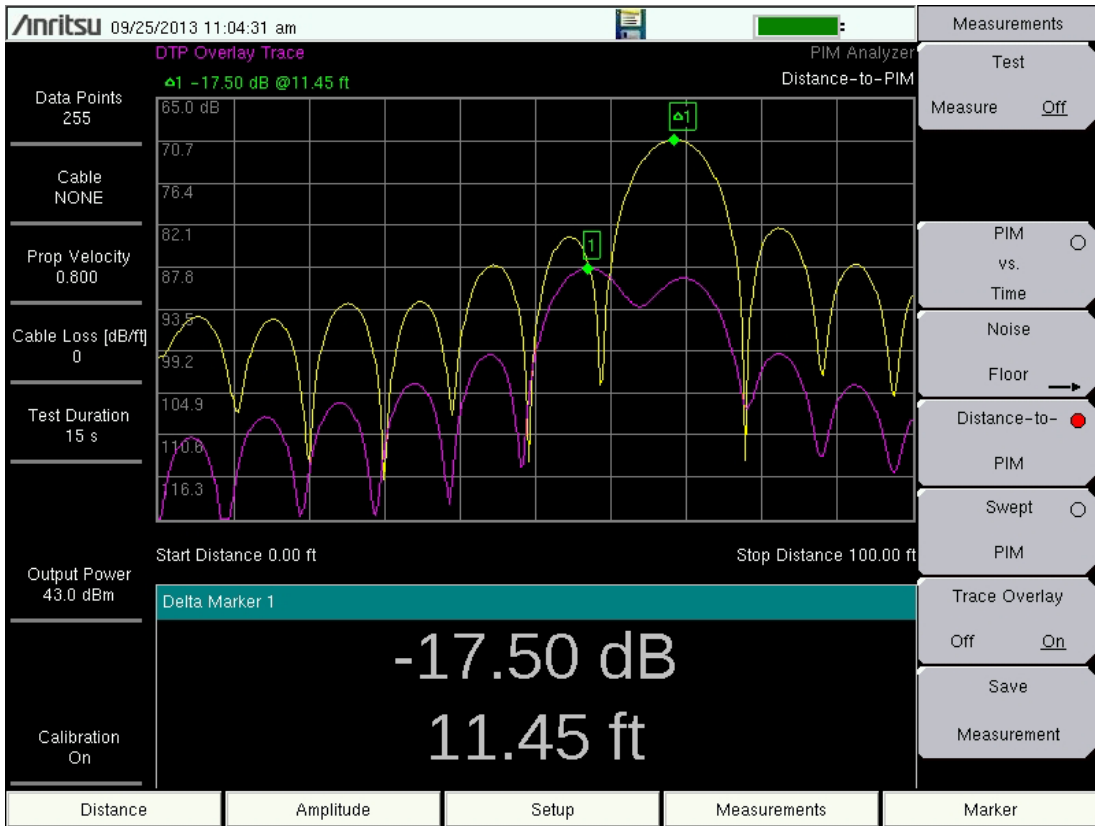


Figure 10-1. DTP/DTP Trace Overlay Example

6. Press **Select Trace Color**, if desired, to set a specific color for the overlay trace.
7. Set up for the next measurement. Press **Measurements > Test**.

The active trace is displayed along with the stored trace, and markers are automatically placed on the peaks. The marker table displays the relative distance between peaks. Refer to [Section 9-18 “Marker Menu” on page 9-29](#) and the marker menu for additional information. To view the table, toggle the Marker Table submenu key to On or to Large.

**Note** Trace Overlay can be toggled On and Off from the Trace menu or from the Measurements menu. Refer to [Section 9-21 “Trace Overlay Submenu Key” on page 9-31](#) and [Section 10-4 “Trace Menu, Distance-to-PIM” on page 10-6](#).

## 10-3 DTP/DTF Trace Overlay

Low resolution DTF measurements are generated automatically and are displayed with the active DTP trace. Higher resolution DTF measurements recorded in .DAT format using a compatible Site Master instrument can be transferred to the MW82119A and overlaid with the active DTP measurement. These high resolution DTF traces provide useful information, such as the exact length of the line and the location of closely spaced RF connectors on the line.

### Trace Comparison Example

1. Press **Shift** then **Trace (5)**
2. In the Trace menu, press **Load DTF Trace**. The displayed Recall menu allows you to select any saved DTF trace to load into memory.
3. Set the PIM Master measurement type to Distance-to-PIM by pressing **Measurements**, then **Distance-to-PIM**.
4. Press **Test**.

[Figure 10-2 on page 10-4](#) shows an example of a high resolution DTF measurement overlaid with the active DTP measurement. For comparison, [Figure 10-3 on page 10-5](#) shows the same measurement made by using the automatic DTP/DTF overlay function. Both measurements identify the RF connector locations, but the reduced resolution (due to the filter inside the PIM test instrument) is evident over this short test length.

DTF Trace Overlaid with DTP Trace

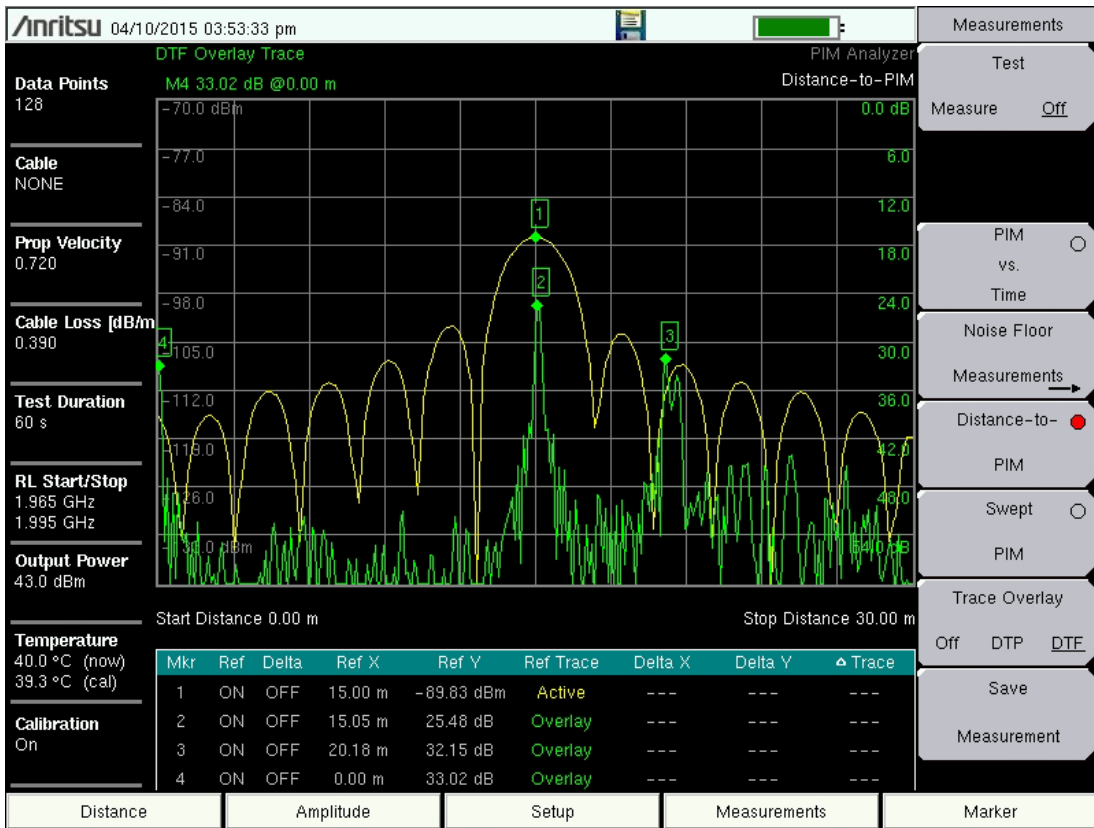


Figure 10-2. High resolution DTF Measurement Overlaid with DTP Measurement



Automatic DTP/DTF Trace Overlay

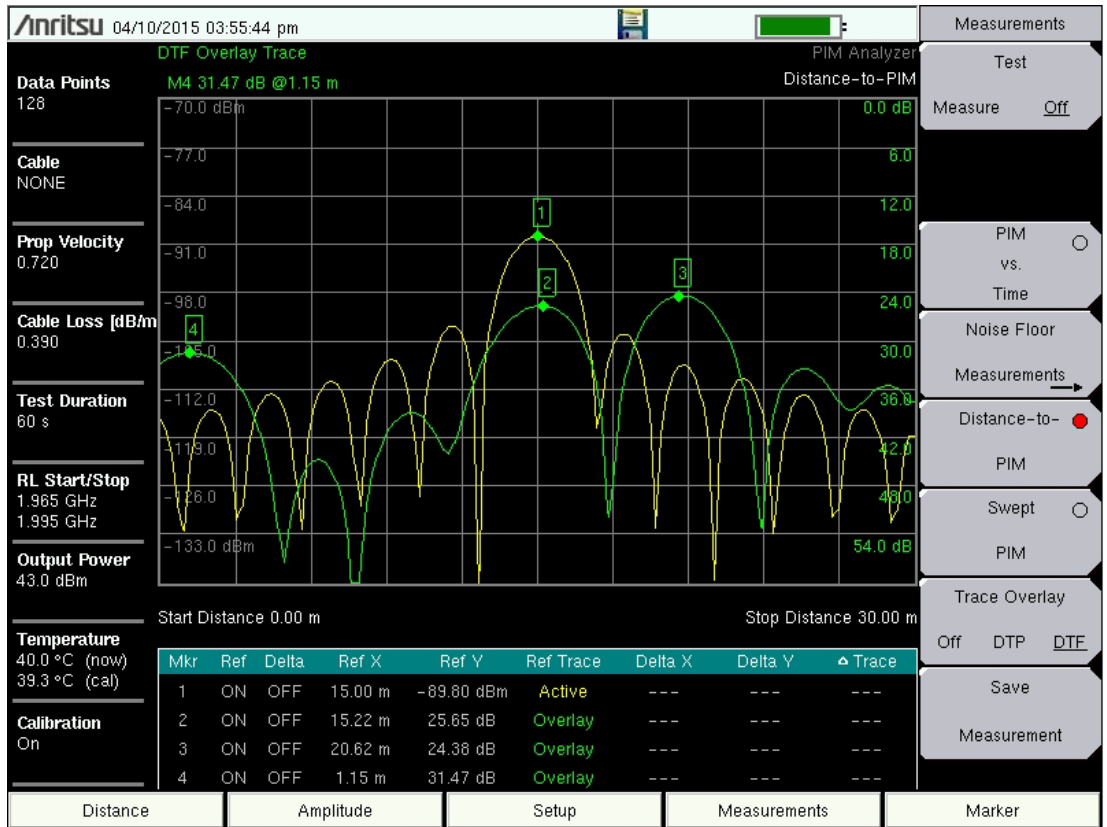


Figure 10-3. Automatic DTP/DTF Overlay

## 10-4 Trace Menu, Distance-to-PIM

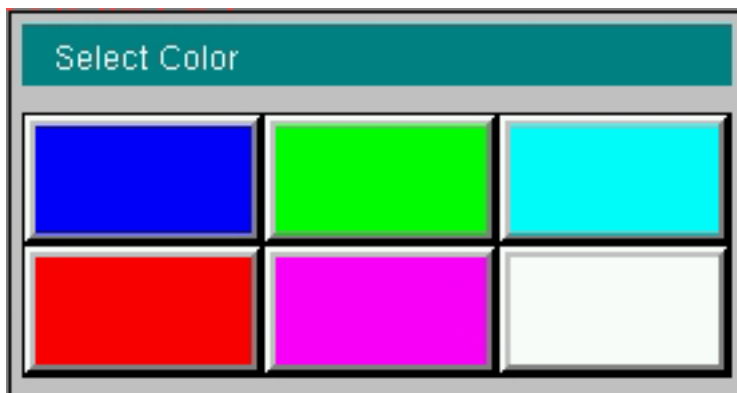
Key Sequence: **Shift, Trace (5)**

Trace	<b>Copy Active Trace to Overlay:</b> Press this submenu key to create a copy of the current (active) trace. The trace changes color (refer to Select Trace Color submenu key) when it has been stored to memory. If a valid DTP trace is not available, then pressing this submenu key briefly displays a warning message on the screen. Refer to <a href="#">“Valid Trace”</a> .
Copy Active Trace to Overlay	
Trace Overlay	<b>Trace Overlay</b>
Off DTP DTF	<b>Off DTF DTF:</b> Press this submenu key to toggle the trace overlay functions. If a valid DTP or DTF trace is not available, then pressing this submenu key briefly displays a warning message on the screen.
Select	
Trace Color	<b>Select Trace color:</b> Press this submenu key to select a color from the Select Color choice box. See <a href="#">Figure 10-5</a> . The chosen color is applied to the stored (overlay) trace. When the active trace is copied, it immediately changes to the color that has been set by this submenu key.
Load	
DTF Trace →	<b>Load DTF Trace:</b> Press this submenu key to display the Recall menu and dialog box. For more details, refer to <a href="#">Chapter 4, “File Management”</a> .
DTF Trace Top 0.0 dB	<b>DTF Trace Top:</b> Press this submenu key to move the upper portion of the DTF trace by expanding or contracting its vertical scale.
DTF Trace Bottom 60.0 dB	<b>DTF Trace Bottom:</b> Press this submenu key to move the lower portion of the DTF trace by expanding or contracting its vertical scale.

**Figure 10-4.** Trace Menu – Distance-to-PIM

Moving the top or bottom of the DTF trace allows you to visually compare the distances between key peaks of DTP versus DTF.

## Select Color Choice Box



**Figure 10-5.** Overlay Trace Color Selection

### Valid Trace

A valid active trace is required for using the trace overlay function. An active trace is valid after running a DTP measurement (using the **Test** submenu key). It remains valid until one of the following changes takes place:

- Changing the measurement mode.
- Performing any function that would require a recalibration.
- Turning the PIM Master Off and back On (rebooting).



# Chapter 11 — Swept PIM

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

## Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure that all antennas under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

## 11-1 Introduction – Swept PIM Analyzer

PIM measurements are the vector sum of all PIM signals that are generated on a line at the IM frequency being tested. When multiple PIM sources exist, it is possible for the signals to combine out of phase at a particular test frequency to indicate a passing result when the individual PIM levels are actually failures. A Swept PIM test varies the IM frequency over a range of frequencies to provide you with a clearer picture of the true PIM performance of the system.

## 11-2 Swept PIM Setup

**Note** In most cases, information and parameters can be entered through the keypad or the directional **Arrow** keys. The number 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. Choose whichever method is most convenient to enter the required information.

1. Turn on power to the PIM Master.
2. Select the PIM Analyzer mode. Refer to [Section 2-9 “Mode Selector Menu” on page 2-17](#).
3. Select the Swept PIM measurement from the Measurements menu (refer to [Section 3-9 “Measurements Menu” on page 3-19](#)).
4. Connect the test 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.

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.

## Configure the PIM Test

### Frequency Step Size Setup

1. Press the **Freq** main menu key to display the frequency menu. Set the **Step Size**, the desired Intermod Order.
2. Press the Swept PIM Aid submenu key.

### Swept PIM Parameters Dialog Box

1. Use the **Arrow** keys or the touch screen to select a Start or Stop frequency box, then use the number keypad to enter a frequency.
2. Press **Continue** on the touch screen or press the **Back** submenu key to return to the frequency menu.

### Amplitude Setup

3. Press the **Amplitude** main menu key to display the Amplitude menu.
4. Press the **Reference Level** submenu key. The numeric value and units turn red indicating that the settings are ready for editing. Enter the desired reference level using the keypad or the **Arrow** keys. Press **Enter**.
5. Press the **Scale** submenu key to change the divisions of the grid to a setting other than the default value of 8 dB.
6. Press the **Units** submenu key to choose dBm or dBc.

### Power and Display Setup

7. Press the **Setup** main menu key to display the Setup menu.
8. Press the **High Output Power** or the **Low Output Power** submenu key to enter the power level of the RF test signal.
9. 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 or the **Arrow** keys. Then press **Enter**. The maximum time is 1200 seconds.

### Calibration

If calibration is needed, refer to section [“Calibrating” on page 3-6](#).

## 11-3 Making the Swept PIM Measurement

1. Press the **Measurements** main menu key. The Measurements menu is displayed.

<b>Note</b>	Calibration must be On to make accurate measurements. If the Instrument Settings Summary shows Calibration Off, you must calibrate before measuring.
-------------	------------------------------------------------------------------------------------------------------------------------------------------------------

2. Begin testing by pressing the **Test** submenu key, **Measure** is underlined while the test signal is being transmitted, and the **Test** submenu key is highlighted in Red (see [Figure 3-9 on page 3-20](#)). Two high-power test signals are transmitted from the PIM Master test port to the DUT. PIM generated by the DUT is returned to the PIM Master. The results are displayed. The green RF On light on the PIM Master top panel illuminates during the PIM test, and **RF ON** is displayed in red in the PIM Summary Table on the measurement display screen (see [Figure 7-3 on page 7-6](#) for a sample of the RF ON red indication).

Test duration is specified in the **Setup** main menu. You can terminate the test early by pressing the **Test** submenu key so that **Off** is underlined. RF power can be immediately turned off by pressing the **Emergency Stop** button on top of the PIM Master (refer to item 3 in [Figure 2-4 on page 2-8](#)).

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 [Chapter 4, “File Management”](#) for additional information about file handling.



## 11-4 Measurement Examples

Three measurements were made on a line with two PIM sources that were spaced 100 feet apart. The Start Frequency is 1.870 GHz and the Stop Frequency is 1.910 GHz in a PIM Master with Option MW82119A-1900 (PCS 1900 MHz).

The frequency step size for these three measurements was set to 100 kHz, then 500 kHz, and then 1000 kHz. As step size decreased, resolution improved, but time to scan increased dramatically. The three measurements are shown in [Figure 11-1](#), [Figure 11-2](#), and [Figure 11-3](#). Note that Sweep #2 is a green trace, which is visible only in the first 4 MHz of the sweep window. The PIM Summary table displays the Sweep #1 title in yellow text and the Sweep #2 title in green text, which matches the trace colors in the sweep window.

### 100 kHz Frequency Step Size

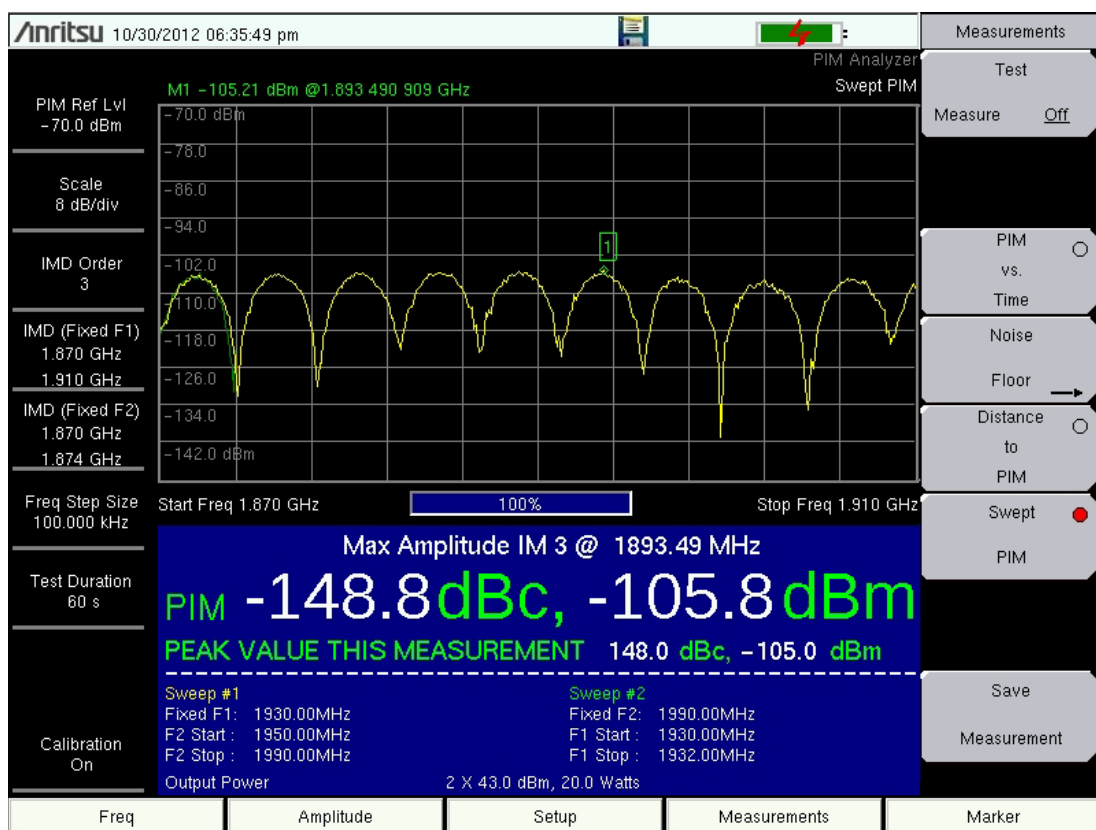


Figure 11-1. Swept PIM 100 kHz Step Size

#### Marker 1

Note Marker 1 on the Swept PIM trace in [Figure 11-1](#). Although the Marker menu is not available, Marker 1 is always On and always set to the trace peak. Also note that the marker values are reported in green type above the measurement grid, upper-left. No delta marker is available.

500 kHz Frequency Step Size

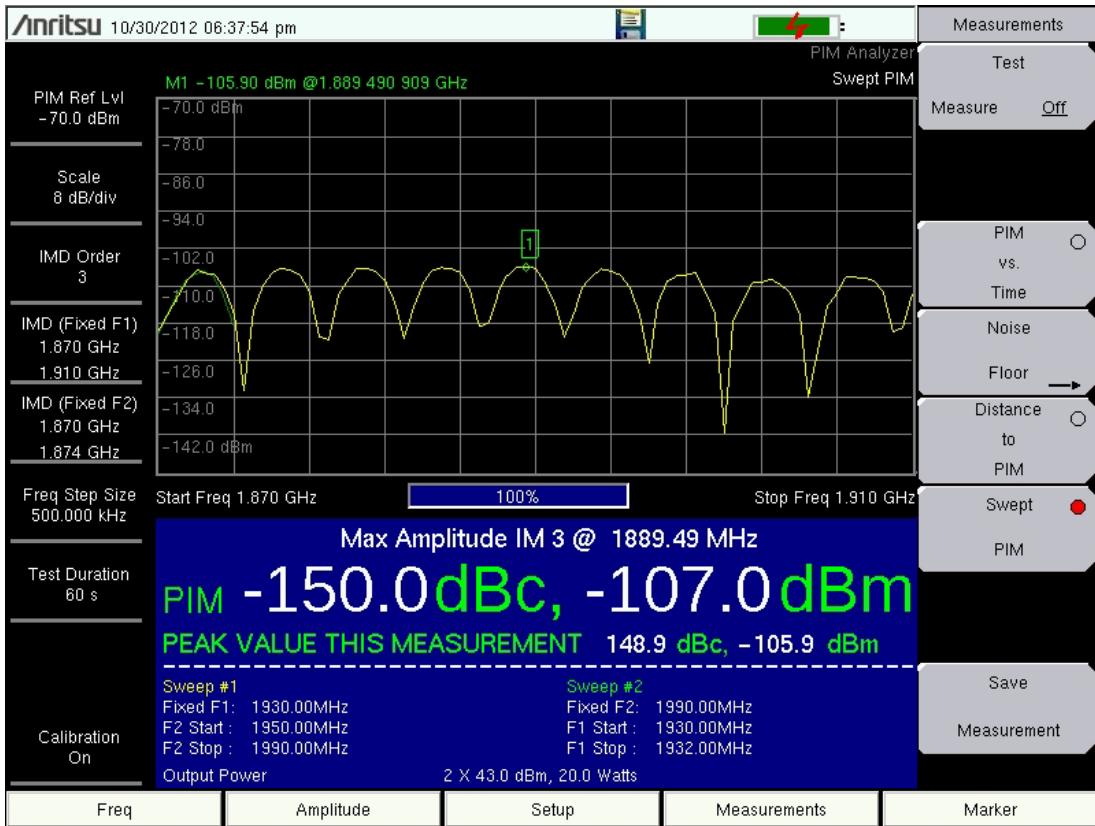


Figure 11-2. Swept PIM 500 kHz Step Size

1000 kHz Frequency Step Size

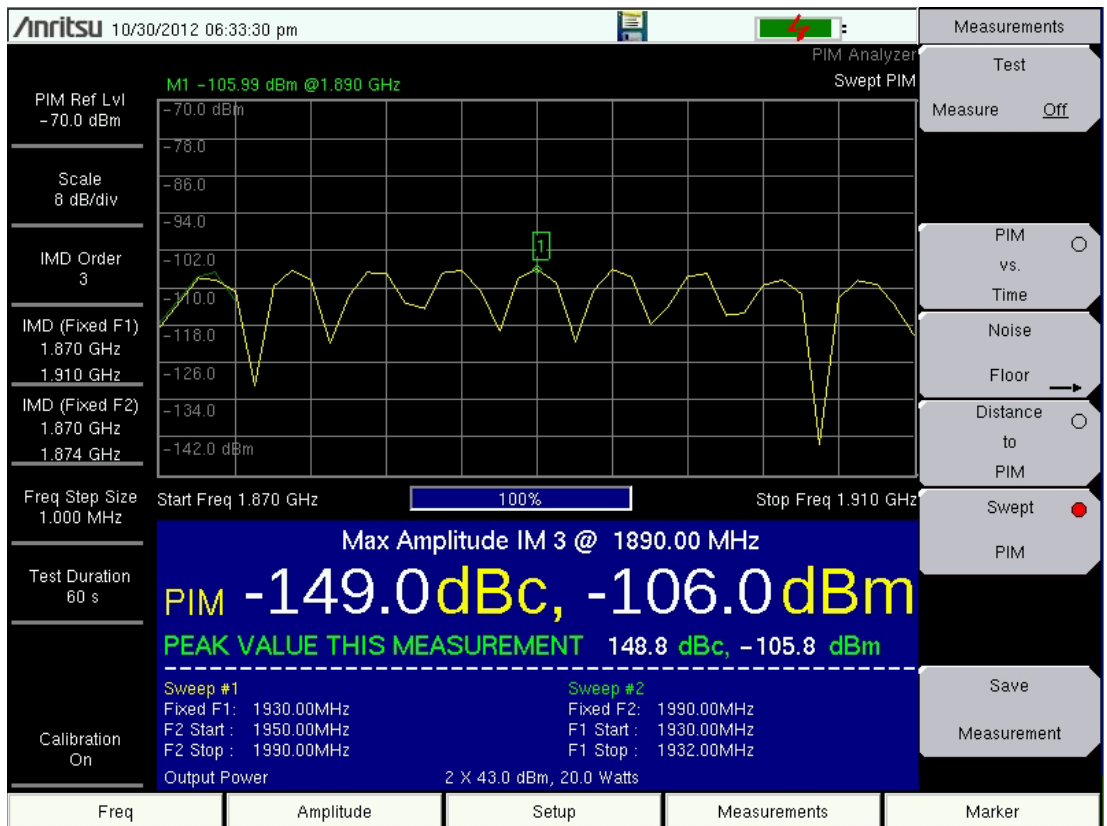


Figure 11-3. Swept PIM 1000 kHz Step Size

## 11-5 Swept PIM Measurement of Two PIM Sources

Swept PIM measurements are made by holding one test tone fixed and sweeping the other test tone across a range of transmit frequencies causing the IM frequency to also change. When a system has one dominant PIM source, the magnitude of the PIM tends to be relatively flat versus frequency. When more than one PIM source is present in a system, you may see that the PIM signals add or subtract based on the phase difference between the two signals. This is what is shown in the sample measurement that is shown in [Figure 11-4](#).



Figure 11-4. Swept PIM IM3 Measurement

In this measurement, two PIM sources are spaced 6 meters apart. Each source is a loose RF connection, and they create PIM sources of approximately equal magnitude. The limit line is set at  $-97$  dBm ( $-140$  dBc), which is typical for site testing. You can see that at some frequencies, the PIM signals subtract (resulting in a Pass measurement), and at other frequencies, they add together (resulting in a Fail measurement). If this test had used fixed, two-tone testing and happened to select two transmit tones that put the IM signal into one of the nulls, then the trace would have indicated that this site was very good, when it is actually bad. Using Swept PIM is a method to verify this condition.

## 11-6 Menu Map

Figure 11-5 shows the map of the Swept PIM Analyzer menus. Menu maps typically display all possible submenu keys, although some keys are displayed on the instruments only under special circumstances (refer to menu descriptions on the following pages). The following sections describe main menus and associated submenus.

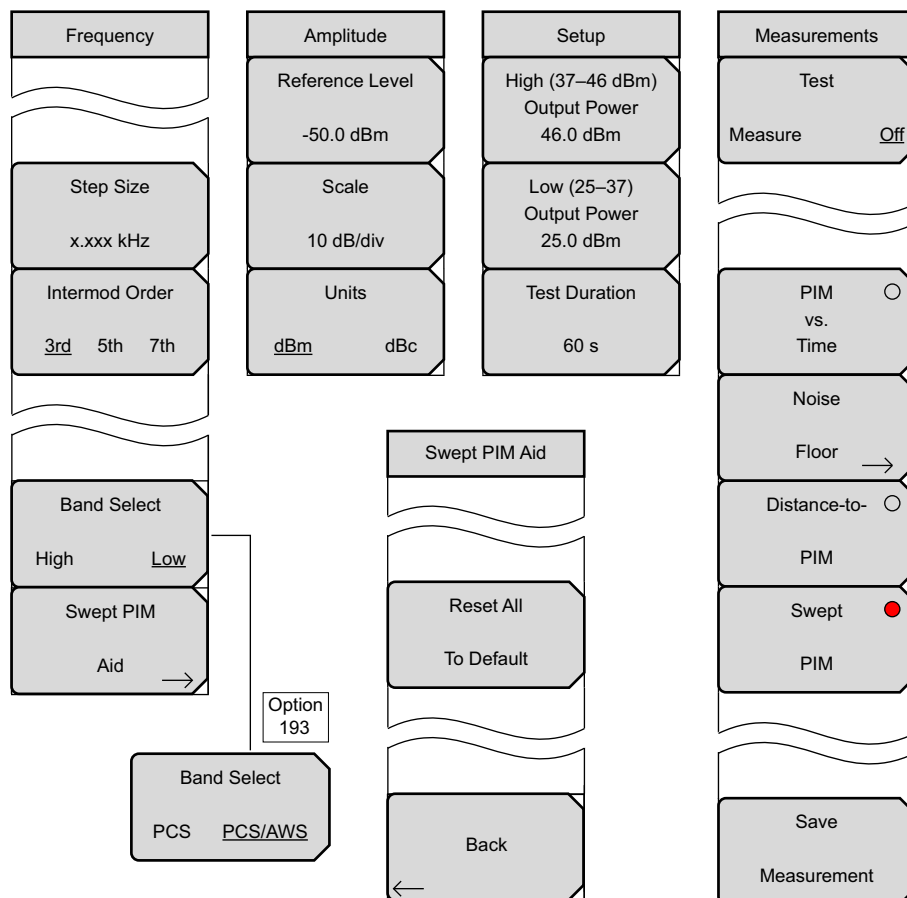
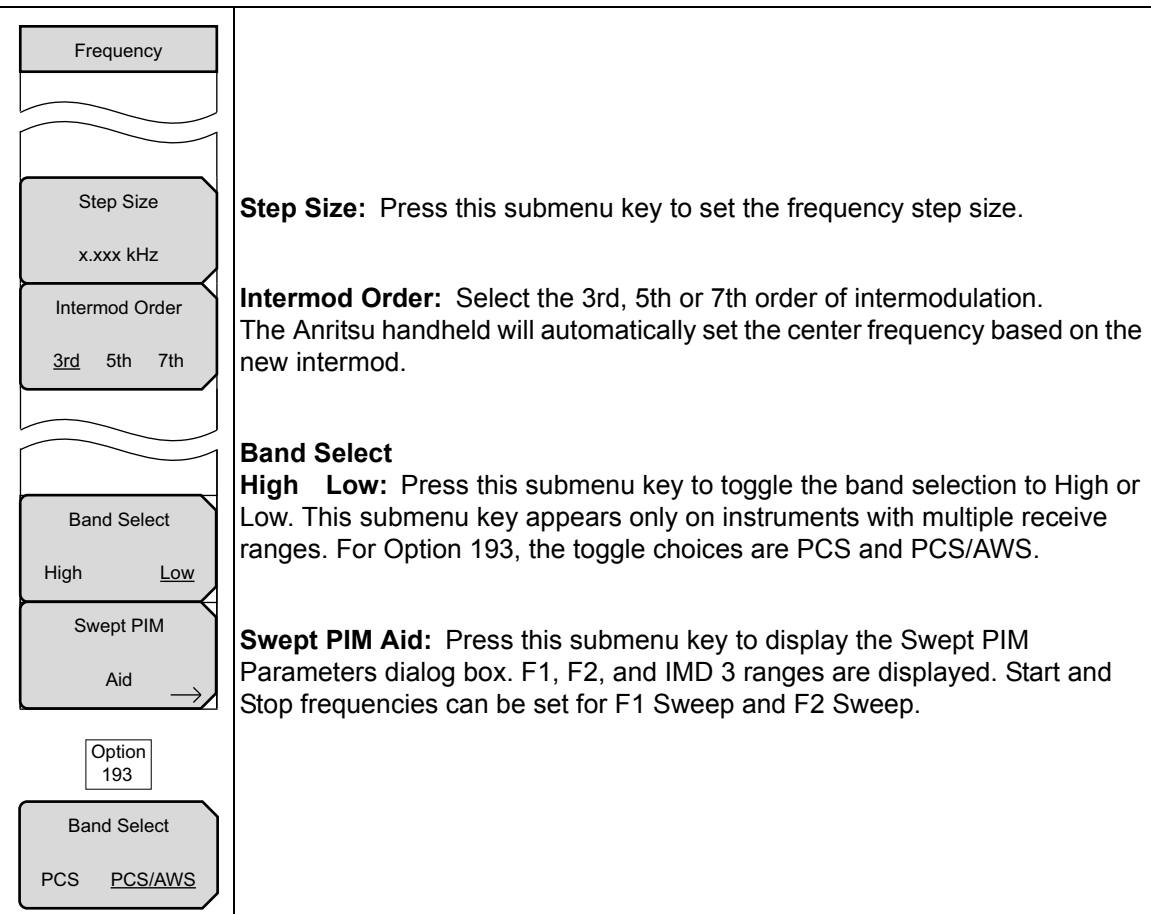


Figure 11-5. Swept PIM Analyzer Menu Map

## 11-7 Frequency (Freq) Menu

Key Sequence: **Freq**



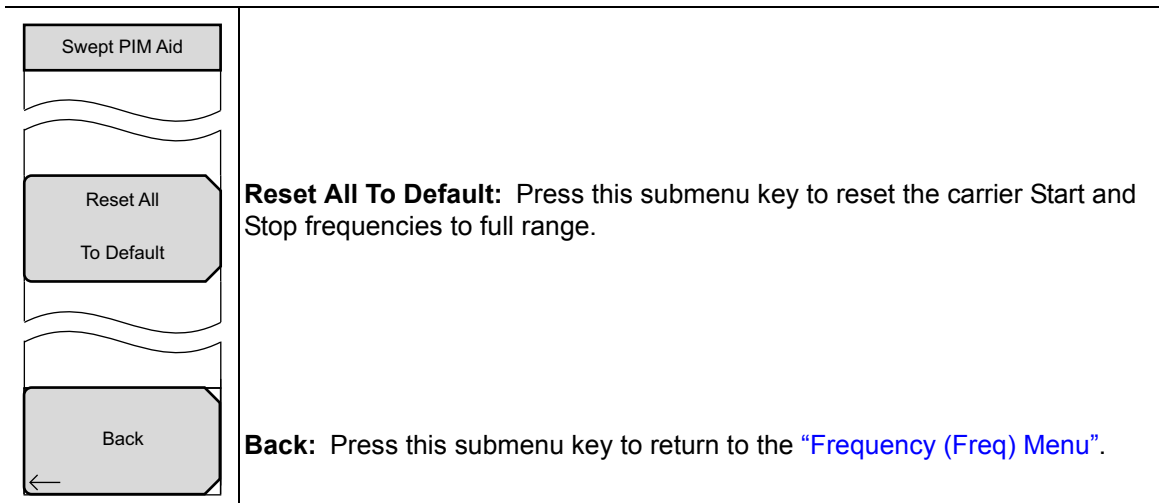
**Figure 11-6.** Frequency Menu

**Note**

The left-most main menu key is labeled **Freq** in the PIM vs. Time and the Swept PIM measurement settings. It is labeled **Distance** in the Distance-to-PIM measurement setting.

## 11-8 Swept PIM Aid Menu

Key Sequence: **Freq** > Swept PIM Aid



**Figure 11-7.** Swept PIM Aid Menu

### Swept PIM Parameters Dialog Box

Key Sequence: **Freq** > Swept PIM Aid

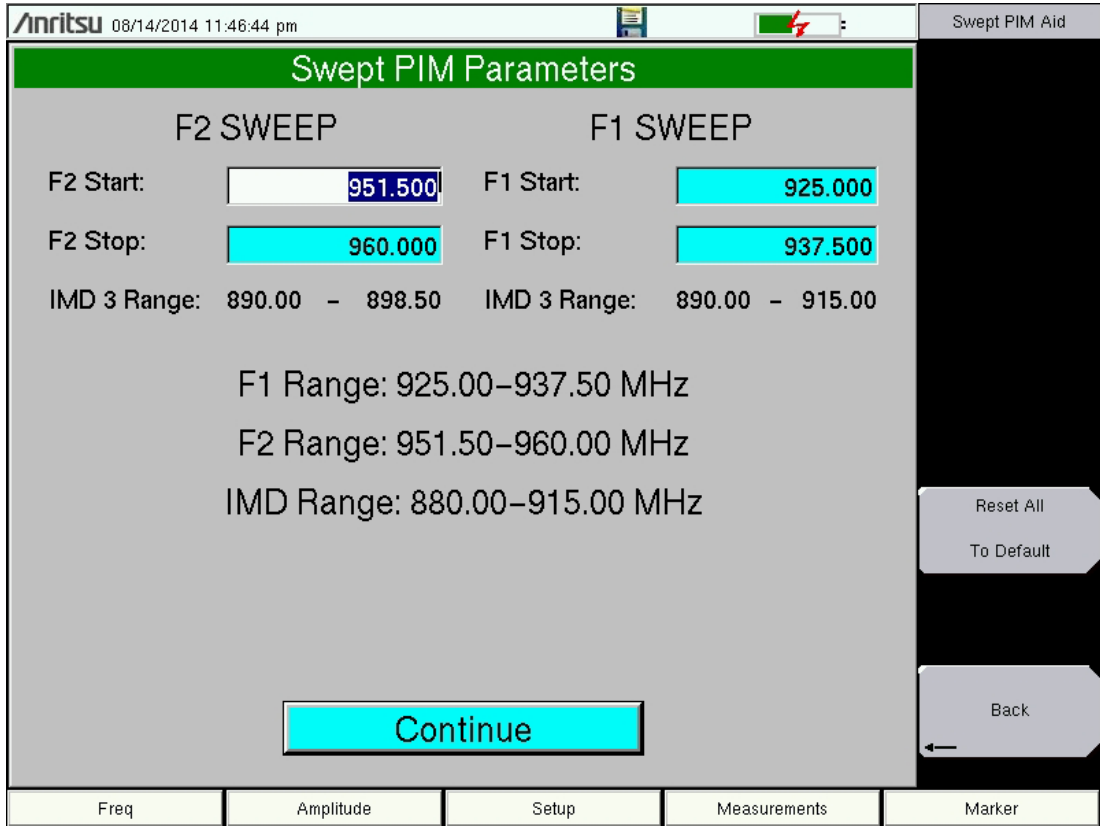


Figure 11-8. Swept PIM Parameters Dialog Box



## 11-9 Amplitude Menu

Key Sequence: **Amplitude**

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Amplitude</td></tr> <tr><td style="text-align: center;">Reference Level</td></tr> <tr><td style="text-align: center;">-50.0 dBm</td></tr> <tr><td style="text-align: center;">Scale</td></tr> <tr><td style="text-align: center;">10 dB/div</td></tr> <tr><td style="text-align: center;">Units</td></tr> <tr><td style="text-align: center;">dBm      dBc</td></tr> </table>	Amplitude	Reference Level	-50.0 dBm	Scale	10 dB/div	Units	dBm      dBc	<p><b>Reference Level:</b> The reference level is the top graticule line on the display, and can be set from -50 dBm to -140 dBm. A value may be entered from the keypad, use the $\pm$ key for a minus sign. After entering the value press the dBm submenu key or the <b>Enter</b> key. The <b>Up/Down</b> arrow keys change the reference level in 10 dB steps, and the <b>Left/Right</b> arrow keys change the value by 1 dB.</p> <p><b>Scale:</b> 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 or the <b>Arrow</b> keys.</p> <p><b>Units</b>  <b>dBm   dBc:</b> Toggles the measurement display units between dBm and dBc. The amplitude for upper and lower limits automatically adjusts to the equivalent level for the selected units.</p>
Amplitude								
Reference Level								
-50.0 dBm								
Scale								
10 dB/div								
Units								
dBm      dBc								

**Figure 11-9.** Amplitude Menu

## 11-10 Setup Menu

Key Sequence: **Setup**

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Setup</td></tr> <tr><td style="text-align: center;">High (37–46 dBm) Output Power 46.0 dBm</td></tr> <tr><td style="text-align: center;">Low (25–37) Output Power 25.0 dBm</td></tr> <tr><td style="text-align: center;">Test Duration  60 s</td></tr> </table>	Setup	High (37–46 dBm) Output Power 46.0 dBm	Low (25–37) Output Power 25.0 dBm	Test Duration  60 s	<p><b>High (37–46 dBm) Output Power:</b> Press this submenu key to set the output power level within the higher range for both carrier frequencies, F1 and F2.</p> <p><b>Low (25–37 dBm) Output Power:</b> Press this submenu key to set the output power level within the lower range for both carrier frequencies, F1 and F2.</p> <p><b>Note:</b> Power output value from the test port is twice the set output value. For example, when <b>Setup &gt; Output Power</b> is set to 20 W, total output power is 40 W.</p> $20 \text{ W (F1)} + 20 \text{ W (F2)} = 40 \text{ W}$ <p><b>Test Duration:</b> Press this submenu key to set the length of time that the test port will deliver power after Test is pressed in the <b>Measurements</b> menu. Range for the test is 1 second to 1200 seconds. Use the <b>Arrow</b> keys or the number keypad. If you use the number keypad, then the Units menu of the Test Duration menu is displayed.</p>
Setup					
High (37–46 dBm) Output Power 46.0 dBm					
Low (25–37) Output Power 25.0 dBm					
Test Duration  60 s					

**Figure 11-10.** Setup Menu for Swept PIM

## 11-11 Marker Menu

Marker 1 is always On and always set to the trace peak. Refer to “[Marker 1](#)” on page 11-5.

Key Sequence: **Marker**

Marker	
Marker <u>1</u> 2 3 4 5 6	<b>Marker:</b> Press this submenu key to select which marker (1, 2, 3, 4, 5, 6) is active. The underlined marker number is the active marker. See <a href="#">Figure 11-12</a> .
<u>On</u> Off	<b>On/Off:</b> Press this submenu key to turn On or Off the selected (underlined) marker in the <b>Marker</b> submenu key.
Delta On <u>Off</u>	<b>Delta On Off:</b> Press this submenu key to turn on a delta marker and to prompt for a delta offset value, either positive or negative from the value of the currently active marker.
Marker to Peak	<b>Marker to Peak:</b> Press this submenu key to place the currently active marker on the highest signal amplitude that is currently displayed on screen.
Marker to Valley	<b>Marker to Valley:</b> Press this submenu key to place the currently active marker on the lowest signal amplitude that is currently displayed on screen.
Swap Marker Trace	<b>Swap Marker Trace:</b> Press this submenu key to move the active marker from one trace to another (between F1 and F2).
~~~~~	
All Markers Off	All Markers Off: Turns off all displayed markers.

Figure 11-11. Setup Menu for Swept PIM

Select Marker		
M1	M2	M3
M4	M5	M6

Figure 11-12. Marker Selection Box

Measurements Menu

Refer to [Section 3-9 “Measurements Menu”](#) on page 3-19.

Chapter 12 — PIM Analyzer

Programming Commands

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure all antenna's under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

12-1 SCPI Commands Introduction

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 PIM Master is in the desired testing Mode before sending SCPI commands.

Example:

A typical command set for the PIM Master would include:

```
SENSE:PIManalyzer:MODE PIM|PIMSwp|DTP
  (Sets mode to PIM vs. Time, Swept PIM, or DTP)

SENSE:PIManalyzer:MODE?
  (Responds with PIM|PIMSwp|DTP, mode type PIM vs. Time, Swept PIM, or DTP)

[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 20 (Sets power to 20 Watts)
[SENSE]:PIManalyzer:TEST:DURATION 10 (Sets the POWER ON time)
INITiate:PIManalyzer:MEASure ON (Starts PIM measurement)
```

12-2 :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 in units of dB/distance

Parameter range is 0 dB/ft to 5 dB/ft (0 dB/m to 16.404 dB/m).

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

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

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

To query the cable loss:

```
:CALC:DTPM:CABL?
```

Front Panel

Access: **Distance**, More, Cable Loss

:CALCulate:DTPMeas:DISPlay:RESOLution
:CALCulate:DTPMeas:DISPlay:RESOLution?

Title: DTP data points

Description: Sets and queries DTP data points.

Parameter: 128, 255

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the data point to 128:

```
:CALCulate:DTPMeas:DISPlay:RESOLution 128
```

To query the data point setting:

```
:CALC:DTPM:DISP:RESO?
```

Front Panel

Access: **Distance**, DTP Aid, Data Points

:CALCulate:DTPMeas:DMAX?

Title: DTP maximum measurable distance

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

Parameter: None

Default Value: None

Example: To query the DTP maximum measurable distance:

```
:CALC:DTPM:DMAX?
```

Related Command: :CALCulate:DTPMeas:START | STOP

```
:CALC:DTPM:STAR | STOP?
```

Front Panel

Access: **Distance**, DTP Aid, Stop Distance (Dmax)

Dmax is displayed (see [Figure 9-5 on page 9-7](#)) in the DTP Parameters window (DTP Aid). For additional description of Dmax, refer to “[Dmax and Data Points](#)” on page 9-2.

:CALCulate:DTPMeas:FRESolution?

Title: DTP fault resolution

Description: Queries DTP fault resolution in current distance unit.

Parameter: None

Default Value: None

Example: To query the DTP fault resolution:

```
:CALC:DTPM:FRES?
```

Front Panel

Access: **NA**

: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. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

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

```
:CALCulate:DTPMeas:PVELOCITY 0.75
```

To query the cable propagation velocity index:

```
:CALC:DTPM:PVEL?
```

Front Panel

Access: **Distance**, DTP Aid, Propagation Velocity

:CALCulate:DTPMeas:REFERENCE:AMPLITUDE
:CALCulate:DTPMeas:REFERENCE:AMPLITUDE?

Title: DTP Reference Line Amplitude

Description: Sets and queries the amplitude of the reference line in DTP mode.

Parameter: 0 to 260

Parameter Type: <float>

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the reference line to 100 dB:

```
:CALCulate:DTPMeas:REFERENCE:AMPLITUDE 100
```

To query the reference line amplitude:

```
:CALC:DTPM:REF:AMPL?
```

Front Panel

Access: **Shift-Limit (6)**, Amplitude

```
:CALCulate:DTPMeas:REfERENCE[:STATe] OFF|ON|0|1
:CALCulate:DTPMeas:REfERENCE[:STATe]?
```

Title: DTP Reference Line State

Description: Turns the reference line ON or OFF. If the value is set to ON or to 1, then the reference line is ON. If the value is set to OFF or to 0, then the reference line is OFF. The query version of the command returns a 1 if the reference line is ON and returns a 0 if it is OFF.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: None

Example: To turn On the reference line:

```
:CALCulate:DTPMeas:REfERENCE ON
:CALCulate:DTPMeas:REfERENCE:STATe ON
:CALCulate:DTPMeas:REfERENCE:STATe 1
```

To turn Off the reference line:

```
:CALCulate:DTPMeas:REfERENCE OFF
:CALCulate:DTPMeas:REfERENCE:STATe 0
:CALCulate:DTPMeas:REfERENCE 0
```

To query the reference line state:

```
:CALC:DTPM:REF?
:CALC:DTPM:REF:STAT?
```

Front Panel

Access: **Shift-Limit (6)**, On/Off

```
:CALCulate:DTPMeas:STARt
:CALCulate:DTPMeas:STARt?
```

Title: DTP Distance Start Setup

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

Parameter: m|ft

Default Value: Values in meters

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

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

To query the DTP start distance:

```
:CALC:DTPM:STAR?
```

Related Command: `:CALCulate:DTPMeas:STOP 100 ft`

```
:CALC:DTPM:STOP?
```

```
:CALCulate:DTPMeas:DMAX?
```

```
:CALC:DTPM:DMAX?
```

Front Panel

Access: **Distance**, DTP Aid, Start Distance

Dmax is displayed (see [Figure 9-5 on page 9-7](#)) in the DTP Parameters window (DTP Aid). For additional description of Dmax, refer to [“Dmax and Data Points” on page 9-2](#).

:CALCulate:DTPMeas:STOP

:CALCulate:DTPMeas:STOP?

Title: DTP Distance Stop Setup

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

Parameter: m|ft

Default Value: Values in meters

Example: To set the DTP stop distance to 100 feet:

```
:CALCulate:DTPMeas:START 100 ft
```

To query the DTP stop distance:

```
:CALC:DTPM:STOP?
```

Related Command: `:CALCulate:DTPMeas:START 10 ft`

```
:CALC:DTPM:STAR?
```

```
:CALCulate:DTPMeas:DMAX?
```

```
:CALC:DTPM:DMAX?
```

Front Panel

Access: **Distance**, DTP Aid, Stop Distance

Dmax is displayed (see [Figure 9-5 on page 9-7](#)) in the DTP Parameters window (DTP Aid). For additional description of Dmax, refer to [“Dmax and Data Points” on page 9-2](#).

:CALCulate:DTPMeas:UNIT METers | FEET
:CALCulate:DTPMeas:UNIT?

Title: DTP distance unit

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

Parameter: METers | FEET

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the unit to meter:

```
:CALCulate:DTPMeas:UNIT METers
```

```
:CALC:DTPM:UNIT MET
```

To query the distance unit:

```
:CALC:DTPM:UNIT?
```

Front Panel

Access: **Distance**, Units

: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. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the Nominal Side Lobe Windowing:

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

To query the type of Windowing:

```
:CALC:DTPM:WIND?
```

Front Panel

Access: **Distance**, More, Window

```
:CALCulate:LIMit:ALARm ON|OFF|0|1
:CALCulate:LIMit:ALARm?
```

Title: Upper Limit Alarm On/Off

Description: Sets and queries limit alarm for PIM vs. Time and Swept PIM measurement types. This alarm is associated only to the upper limit. Lower limit does not have an associated alarm.

Parameter: Limit Alarm ON|OFF|0|1 (0 = On, 1 = Off)

Parameter Type: <boolean>

Default Value: Off

Example: To set the limit alarm:

```
:CALCulate:LIMit:ALARm 0
```

To query the limit alarm:

```
:CALC:LIM:ALAR?
```

Front Panel

Access: **Shift-Limit (6)**, Limit Alarm

```
:CALCulate:LIMit:AMPLitude
:CALCulate:LIMit:AMPLitude?
```

Title: Set Limit Amplitude

Description: Sets and queries limit amplitude for PIM vs. Time and Swept PIM measurement types. The amplitude will be associated with the currently selected limit (upper/lower). The amplitude reference level range is -50 dBm to -140 dBm. The upper and lower limits can be set far beyond the reference level range, but such settings are of no practical value.

Parameter: Magnitude (dBm)

Resolution: 0.1 dB

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the limit amplitude to -120 dBm:

```
:CALCulate:LIMit:AMPLitude -120
```

To query the limit amplitude:

```
:CALC:LIM:AMPL?
```

Front Panel

Access: **Shift-Limit (6)**, Limit Move, Amplitude

:CALCulate:LIMit:FAIL?

Title: Upper Limit Fail Check

Description: Checks if current trace data is failing Upper Limit dBm setting. If one or more trace points fail, then the condition would indicate fail for a response.

Parameter: 0/1 for Pass/Fail

Default Value: None

Example: To query if the current trace data is failing Upper Limit dBm setting:
:CALC:LIM:FAIL?

Front Panel

Access: **NA**, no direct access

Adjusting Limit Amplitude shows a number display change to red when the limit line falls below the highest trace data point.

:CALCulate:LIMit[:STATe] OFF|ON|0|1**:CALCulate:LIMit[:STATe]?**

Title: Limit State

Description: Turns the limit line ON or OFF. If the value is set to ON or to 1, then the currently selected limit line is ON. If the value is set to OFF or to 0, then the currently selected limit line is OFF. The query version of the command returns a 1 if the currently selected limit line is ON and returns a 0 if it is OFF.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on the limit line:

```
:CALCulate:LIMit ON
:CALCulate:LIMit:STATe ON
:CALCulate:LIMit:STATe 1
```

To turn off the limit line:

```
:CALCulate:LIMit OFF
:CALCulate:LIMit:STATe 0
:CALCulate:LIMit 0
```

To query the limit line state:

```
:CALCul:LIM?
:CALC:LIM:STAT?
```

Front Panel

Access: **Shift-Limit (6)**, Limit On/Off

:CALCulate:LIMit:TYPE**:CALCulate:LIMit:TYPE?**

Title: Limit Type Selection

Description: Sets and queries limits for PIM vs. Time and Swept PIM measurement types. Selections are Upper/Lower.

Parameter: Limit value (0 = Upper, 1 = Lower)

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the upper limit:

```
:CALCulate:LIMit:TYPE 0
```

To query the limit type:

```
:CALC:LIM:TYP?
```

Front Panel

Access: **Shift-Limit (6)**, Limit

:CALCulate:LIMit:VALue

Title: Limit Value Magnitude Change

Description: Adds a magnitude change to the existing limit magnitude for PIM vs. Time and Swept PIM measurement types.

Parameter: Magnitude (dB)

Resolution: 0.1 dB

Default Value: None

Example: To decrease the currently selected limit magnitude by 5 dB:

```
:CALCulate:LIMit:VALue -5
```

Related Command: To query the limit amplitude:

```
:CALC:LIM:AMPL?
```

Front Panel

Access: **Shift-Limit (6)**, Limit Move, Move Limit U/D

:CALCulate:MARKer:AOFF

Title: Turn All Markers Off

Description: Turns off all markers

Example: To turn Off all markers:

```
:CALC:MARK:AOFF
```

Front Panel

Access: **Marker**, All Markers Off

```
:CALCulate:MARKer{1|2|3|4|5|6}:DELta[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}:DELta[:STATe]?
```

Title: Delta Marker State

Description: Sets the specified delta marker on or off. The query returns the state of the specified delta marker (0|1)

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn on the delta marker #3:

```
:CALCulate:MARKer3:DELta ON
:CALCulate:MARKer3:DELta 1
:CALCulate:MARKer3:DELta:STATe ON
:CALCulate:MARKer3:DELta:STATe 1
```

To turn off delta marker #6:

```
:CALCulate:MARKer6:DELta OFF
:CALCulate:MARKer6:DELta:STATe OFF
:CALCulate:MARKer6:DELta:STATe 0
```

To query the state of delta marker #2:

```
:CALC:MARK2:DELT?
:CALC:MARK2:DELT:STAT?
```

Front Panel

Access: **Marker**, Delta On Off

```
:CALCulate:MARKer{1|2|3|4|5|6}:DELTA:TRACe 0|1
:CALCulate:MARKer{1|2|3|4|5|6}:DELTA:TRACe?
```

Title: Delta Marker Trace

Description: Sets the specified delta marker to a desired trace. Valid only for Swept PIM mode.

Parameter: 0|1

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set delta marker #1 onto the fixed F2 sweep (Sweep #2):

```
:CALCulate:MARKer1:DELTA:TRACe 1
```

To set delta marker #2 onto the fixed F1 sweep (Sweep #1):

```
:CALC:MARK2:DELTA:TRAC 0
```

To query which trace delta marker #6 is on:

```
:CALC:MARK6:DELTA:TRAC?
```

Front Panel

Access: **Marker**, Marker, M#, Delta, Swap Marker Trace

```
:CALCulate:MARKer{1|2|3|4|5|6}:DELTA:X <x-parameter>
:CALCulate:MARKer{1|2|3|4|5|6}:DELTA:X?
```

Title: Delta Marker X Value

Description: Sets the location of the delta marker on the x-axis at the specified location <x-parameter> + the reference marker x-axis. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the delta marker on the x-axis.

Parameter: <x-parameter>

Default Unit: Current x-axis unit

Example: If both the reference and delta marker #1 are currently at 1 GHz on the x-axis, then send the command below to set the delta marker #1 to 2 GHz on the x-axis:

```
:CALCulate:MARKer1:DELTA:X 1GHz
```

Related Command: :CALCulate:MARKer [1] | 2 | 3 | 4 | 5 | 6 :X

Front Panel

Access: **Marker**, [Marker 1/2/3/4/5/6], Delta On, **Arrow** buttons

:CALCulate:MARKer{1 | 2 | 3 | 4 | 5 | 6}:DELta:Y?

Title: Delta Marker Read Y Value

Description: Reads the current Y value for the specified delta marker. The units are the units of the y-axis.

Default Unit: Current y-axis unit

Example: To query the Y value of delta marker #6:

:CALC:MARK6:DELT:Y?

Front Panel

Access: **NA**

```
:CALCulate:MARKer{1|2|3|4|5|6}[:STATe] OFF|ON|0|1
:CALCulate:MARKer{1|2|3|4|5|6}[:STATe]?
```

Title: Marker State

Description: Sets the specified marker on or off.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Default Value: OFF

Example: To turn off reference marker #1:

```
:CALCulate:MARKer1:STATe OFF
```

To query the state of marker #6:

```
:CALC:MARK6:STAT?
```

Front Panel

Access: **Marker**, Marker, M#, On/Off

```
:CALCulate:MARKer{1|2|3|4|5|6}:TRACe 0|1
:CALCulate:MARKer{1|2|3|4|5|6}:TRACe?
```

Title: Marker Trace

Description: Sets the specified marker to a desired trace. Valid only for Swept PIM mode.

Parameter: 0|1

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set marker #1 onto the fixed F2 sweep (Sweep #2):

```
:CALCulate:MARKer1:TRACe 1
```

To set marker #2 onto the fixed F1 sweep (Sweep #1):

```
:CALC:MARK2:TRAC 0
```

To query which trace marker #6 is on:

```
:CALC:MARK6:TRAC?
```

Front Panel

Access: **Marker**, Marker, M#, Swap Marker Trace

:CALCulate:MARKer{1|2|3|4|5|6}:X <x-parameter>

:CALCulate:MARKer{1|2|3|4|5|6}:X?

Title: Marker X Value

Description: Sets the location of the marker on the x-axis at the specified location. <x-parameter> is defined in the current x-axis units. The query version of the command returns the location of the marker on the x-axis. Note that the marker is snapped to the data point closest to the specified value. If the specified marker is not On, then it is set to On. In Swept PIM, Marker 1 is always On, but remains at trace peak and cannot be moved. The query command reports the x-axis position for Swept PIM.

Parameter: <x-parameter>

Default Unit: seconds in PIM versus Time measurement type
meters or feet in DTP measurement type
hertz in Swept PIM measurement type (query only)

Example: (In PIM vs. Time, DTP, or Swept PIM) To query the X value of reference marker #3:

```
:CALC:MARK3:X?
```

(In PIM vs. Time) To set reference marker #3 to 1.5 seconds on the x-axis:

```
:CALCulate:MARKer3:X 1.5
```

```
:CALCulate:MARKer3:X 1.5s
```

(In PIM vs. Time) To set reference marker #1 to 25 μ s:

```
:CALCulate:MARKer:X 25
```

```
:CALCulate:MARKer1:X 25 $\mu$ s
```

(In DTP) To set reference marker #1 to 15 ft on the x-axis:

```
:CALCulate:MARKer:X 15
```

```
:CALCulate:MARKer1:X 15ft
```

To query the location of the marker on the x-axis:

```
:CALC:MARK:X?
```

Front Panel

Access: **Marker**, [Marker 1/2/3/4/5/6]

:CALCulate:MARKer{1|2|3|4|5|6}:Y?

Title: Marker Read Y Value

Description: Reads the current Y value for the specified marker. The units are the units of the y-axis.

Default Unit: Current y-axis unit

Example: To query the Y value of reference marker #4:

```
:CALC:MARK4:Y?
```

Front Panel

Access: **NA**

:CALCulate:SCALE:UNIT DBM|DBC**:CALCulate:SCALE:UNIT?**

Title: Scale Unit

Description: Sets and queries scale unit for PIM vs. Time and Swept PIM.

Parameter: DBM|DBC

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the unit to dBm:

```
:CALCulate:SCALE:UNIT DBM
```

```
:CALC:SCAL:UNIT DBM
```

To query the scale unit:

```
:CALC:SCAL:UNIT?
```

Front Panel

Access: **Amplitude, Units**

12-3 :CALibration Subsystem

The commands in this subsystem control the system calibration.

:CALibration:PIManalyzer:FULL
:CALibration:PIManalyzer:FULL?

Title: Full Calibration

Description: Sets or resets the calibration for the instrument. This calibration is done for all 3 measurement types at their current configuration (in other words, output power, frequency (PVT only), and IMD order for PVT and Swept PIM). The query returns 0 for “CAL OFF” or 1 for “CAL ON”.

Parameter: OFF | ON | 0 | 1

Parameter Type: <boolean>

Default Value: None

Example: To start full calibration:

```
:CALibration:PIManalyzer:FULL ON
```

To query the calibration state:

```
:CAL:PIM:FULL?
```

Front Panel

Access: **Shift-Cal (2)**, Start Calibration
Shift-Cal (2), Reset Calibration

12-4 :DISPlay Subsystem

The commands in this subsystem control parameters in the measurement display (the sweep window).

:DISPlay:WINDow:Trace:Y[:SCALE]:PDIVision
:DISPlay:WINDow:Trace:Y[:SCALE]:PDIVision?

Title: PIM vs. Time and Swept PIM Scale (Not for DTP)

Description: Sets and queries Scale.

Parameter: Amplitude in dB/div

Default Value: 10 dB/div

Range: 1 dB/div to 15 dB/div

Example: To set PIM vs. Time or Swept PIM scale to 5 dB/div:

```
:DISPlay:WINDow:TRACe:Y[:SCALE]:PDIVision 5
```

Front Panel

Access: **Amplitude**, Scale

:DISPlay:WINDow:Trace:Y[:SCALE]:RLEVEL
:DISPlay:WINDow:Trace:Y[:SCALE]:RLEVEL?

Title: PIM vs. Time and Swept PIM Reference Level (Not for DTP)

Description: Sets and queries Reference Level.

Parameter: Amplitude in dBm

Default Value: -70 dBm

Range: -140 dBm to -50 dBm in 0.1 dB increments

Example: To set PIM vs. Time or Swept PIM reference level to -60 dBm:

```
:DISPlay:WINDow:TRACe:Y[:SCALE]:RLEVEL -60
```

Front Panel

Access: **Amplitude**, Reference Level

12-5 :INITiate Subsystem

The commands in this subsystem control the triggering of measurements.

:INITiate:PIManalyzer:MEASure OFF|ON|0|1

Title: Trigger PIM Analyzer Measurement

Description: This command triggers the start of the PIM Master measurement to measure intermodulation distortion generated between the PIM Analyzer and the system under test. It works with any of the available measurement types: PIM vs. Time, DTP, Swept PIM. The measurement will continue until the defined test duration time has elapsed.

Sending this command with the OFF parameter or the 0 parameter cancels the measurement.

Parameter: OFF|ON|0|1

Parameter Type: <boolean>

Front Panel

Access: **Measurements**, Test (Measure underlined)

:INITiate:PIManalyzer:PVT:ALLPower:CAL

Title: PvT All Power Levels Calibration

Description: This command triggers the start of the PIM vs. Time calibration for all power levels.

Front Panel

Access: **Shift-Cal (2)**, Custom Calibrations, Start Cal

(full name: Start Cal PIM vs. Time Only All Power Levels)

12-6 :MMEMory Subsystem

The commands in the Mass MEMory subsystem contain functions that provide access to the setup and data storage of the instrument.

:MMEMory:CABLeList:RESet

Title: Reset Cable List to Default

Description: Clears the Cable List favorites and restores the factory-default cable list information.

Front Panel

Access: **Distance**, More, Cable, Clear all Favorites

:MMEMory:LOAD:TRACe <integer>,<file name>

Title: Recall Measurement

Description: The instrument must be in the mode of the saved trace in order to recall that trace. Use :INSTRument:SELEct or :INSTRument:NSELEct to set the mode. Recalls a previously stored measurement trace from the current storage location. The saved measurement trace to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension. Note that the trace specified by <file name> should be available at the current mass storage location. Use the command :MMEMory:MSIS to set the current mass storage location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

File name extensions: ".pim" for PIM Analyzer

Note: Extensions not available for T1 and HI_PM.

Parameter: <integer>, <file name>

Example: To recall trace with file name "trace":

```
:MMEMory:LOAD:TRACe 1,"trace.pim"
```

Related Command: :MMEMory:STORe:TRACe

```
:MMEMory:MSIS INTernal|USB
```

Front Panel

Access: **Shift-File (7)**, Recall Measurement

:MMEMory:STORe:TRACe <integer>,<file name>

Title: Save Measurement

Description: Stores the trace into the file specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension. Use the command :MMEMory:MSIS to set the current storage location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: <integer>, <file name>

Example: To save the trace into the file name "trace":

```
:MMEMory:STORe:TRACe 0,"trace"
```

Related Command: :MMEMory:LOAD:TRACe

```
:MMEMory:MSIS INTernal|USB
```

Front Panel

Access: **Shift-File (7)**, Save Measurement

:MMEMory:LOAD:STATe <integer>,<file name>

Title: Recall Setup

Description: Recalls a previously stored instrument setup in the current storage location. The setup file to be loaded is specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should contain a file extension ".stp". Use the command :MMEMory:MSIS to set the current storage location. The <integer> parameter is not currently used, but it must be sent. Send a 1.

Parameter: <integer>, <file name>

Example: To recall a previously stored instrument setup:

```
:MMEMory:LOAD:STATe 1,"setup.stp"
```

Related Command: :MMEMory:STORe:STATe

```
:MMEMory:MSIS INTernal|USB
```

Front Panel

Access: **Shift-File (7)**, Recall, (select Setup from list)

:MMEMory:STORe:STATe <integer>,<file name>

Title: Save Setup

Description: Stores the current setup into the file specified by <file name>. <file name> should be enclosed in either single quotes (' ') or double quotes (" ") and should not contain a file extension ".stp". Use the command :MMEMory:MSIS to set the current storage location. The <integer> parameter is not currently used, but it must be sent. Send a 0.

Parameter: <integer>, <file name>

Example: To save the current instrument setup:
:MMEMory:STORe:STATe 0,"setup"

Related Command: :MMEMory:LOAD:STATe
:MMEMory:MSIS INTernal|USB

Front Panel

Access: **Shift-File (7)**, Save, Change Type, (select Setup from list)

12-7 :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: NORMAl = normal

MAXHold = max trace hold

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set DTP trace mode to normal:

```
:SENSE:DTPMeas:AVERage:TYPE NORMAl
```

Front Panel

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

[:SENSE] :DTPMeas :DISPlay :BOTTom

[:SENSE] :DTPMeas :DISPlay :BOTTom?

Title: DTP Display Bottom

Description: Sets and queries DTP display magnitude.

Parameter: Bottom magnitude

Range: Bottom = 260 (top = 0)

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the DTP display bottom to 100 dB:

```
:SENSE:DTPMeas:DISPlay:BOTTom 100.0
```

Related Command: :SENSE:DTPMeas:DISPlay:TOP 15.0

```
:SENS:DTPM:DISP:TOP?
```

Front Panel

Access: **Amplitude**, Bottom

[:SENSe] :DTPMeas :DISPlay :TOP

[:SENSe] :DTPMeas :DISPlay :TOP?

Title: DTP Display Top

Description: Sets and queries DTP display magnitude

Parameter: Top magnitude

Range: Top = 0 (bottom = 260)

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

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

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

Related Command: `:SENSe:DTPMeas:DISPlay:BOTTom 90.0`

```
:SENS:DTPM:DISP:BOTTP?
```

Front Panel

Access: **Amplitude**, Top

[:SENSe] :DTPMeas :ENREsolution ON | OFF

[:SENSe] :DTPMeas :ENREsolution?

Title: PIM Master Enhanced Resolution

Description: This feature estimates the location of PIM sources on the measurement trace and displays up to 4 vertical impulse bars from bottom of measurement grid to point on measurement trace that indicates a predicted PIM source location. This is useful for resolving PIM sources that are physically close together.

Parameter: ON | OFF

Example: To set Enhanced Resolution to On:

```
:SENSe:DTPMeas:ENREsolution ON
```

Front Panel

Access: **Setup**, Enhanced Resolution

```
[ :SENSe ] :PIMAnalyzer:AVERaging FAST | LOWNoise  
[ :SENSe ] :PIMAnalyzer:AVERaging?
```

Title: PIM vs. Time Trace Mode.

Description: Low Noise provides improvement in measurement range. Fast provides faster measurement updates (measurements per second). The query returns FAST or LOWN (LOWNoise).

Parameter: FAST | LOWNoise

Range: FAST, Averaging is minimum
LOWNoise, Averaging is maximum

Example: To set the PIM Master measurement for maximum averaging:
:SENSe:PIMAnalyzer:AVERaging LOWNoise

Front Panel

Access: **Setup**, Trace Mode

```
[ :SENSe ] :PIMAnalyzer:AUTorange OFF | ON | 0 | 1  
[ :SENSe ] :PIMAnalyzer:AUTorange?
```

Title: PIM vs. Time Auto Range

Description: Sets and queries the Auto Range condition for PIM vs. Time measurement.

Parameter: None

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

Example: To set the PIM Master for Auto Range:
:SENSe:PIMAnalyzer:AUTorange 1

Front Panel

Access: **Amplitude**, Auto Range

[:SENSe] :PIManalyzer:DTPMeas:LRDTf [:STATe]

[:SENSe] :PIManalyzer:DTPMeas:LRDTf [:STATe] ?

Title: PIM Master Low Resolution DTF Sweep State

Description: Sets and queries whether a Low Resolution DTF sweep is performed during a Distance-To-PIM measurement.

Parameter: ON|OFF

Example: To enable the Low Resolution DTF sweep:

:SENSe:PIManalyzer:DTPMeas:LRDTf ON

To query whether the Low Resolution DTF sweep is enabled:

:PIM:DTPM:LRDT?

Front Panel

Access: **Setup**, Low Resolution DTF

[:SENSe] :PIManalyzer:DTPMeas:LRDTf:STARt?

Title: PIM Master Low Resolution DTF Sweep Start Frequency

Description: Queries the DTF Sweep Start Frequency in Hz.

Parameter: Frequency in Hz

Example: To get the DTF Sweep Start Frequency:

:PIM:DTPM:LRDT:STAR?

Related Command: :SENSe:PIManalyzer:DTPMeas:LRDTf:STOP?

:PIM:DTPM:LRDT:STOP?

Front Panel

Access: **NA**

[:SENSe] :PIManalyzer:DTPMeas:LRDTf:STOP?

Title: PIM Master Low Resolution DTF Sweep Stop Frequency

Description: Queries the DTF Sweep Stop Frequency in Hz.

Parameter: Frequency in Hz

Example: To get the DTF Sweep Stop Frequency:

:PIM:DTPM:LRDT:STOP?

Front Panel

Access: **NA**

```
[ :SENSe ] :PIMAnalyzer:FREQUENCY:F1 | 2
[ :SENSe ] :PIMAnalyzer:FREQUENCY:F1 | 2?
```

Title: PIM Master Frequency Setup

Description: Sets the PIM vs. Time carrier frequencies, calculates the IMx Order frequency, and sets the instrument to display the corresponding IMx frequency.

Parameter: Frequency in Hz

Default Unit: Hz

Ranges: PIM Master option dependent (for a list of ranges, refer to [Table B-1, “PIM Master Carrier Bands and Frequencies”](#) on page B-2)

Example: To set the PIM vs. Time frequency F2 for 1990 MHz:

```
:SENSe:PIMAnalyzer:FREQUENCY:F2 1990000000
```

To get the PIM vs. Time frequency F1:

```
PIM:FREQ:F1?
```

Front Panel

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

```
[ :SENSe ] :PIMAnalyzer:IMD:ORDER
[ :SENSe ] :PIMAnalyzer:IMD:ORDER?
```

Title: Measurement Receiver / PIM Master Intermodulation 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:IMFReq:BAND LOW | HIGH

[:SENSe] :PIManalyzer:IMFReq:BAND?

Title: Option MW82119A-0700 High/Low IMD frequency band selection

Description: Sets the receive IMD measurement frequency band only for the LTE-based 700 MHz options. The command and the query are ignored by MW82119A PIM Masters with other instrument options.

Parameter: LOW | HIGH

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Example: To set the measurement receiver to High Band:

:SENSe:PIManalyzer:IMFReq:BAND HIGH

Front Panel

Access: PIM vs. Time and Swept PIM:

Freq, High/Low Band Select

Distance-to-PIM:

Distance, High/Low Band Select

[:SENSe] :PIManalyzer:MEASure:STATus?

Title: PIM Analyzer Current Measurement Status

Description: The query returns the current measurement status of the measurement receiver/PIM Analyzer measurement system. Because the measurement system can run for the maximum time duration, the query serves to indicate if the measurement is still in process. This command works with any of the available measurement modes: PIM vs. Time, DTP, and Swept PIM.

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 intermodulation measured value in both dBc and dBm.

Parameter: <amplitude>

Default Unit: dBc/dBm

Front Panel

Access: N/A. Intermodulation distortion value is displayed in the lower measurement box as "PIM".

[:SENSe] :PIMAnalyzer:MODE PIM | PIMSwp | DTP

[:SENSe] :PIMAnalyzer:MODE?

Title: PIM Analyzer Mode, Set or Request

Description: Puts the system into either PIM vs. Time (PIM), Swept PIM (PIMSwp), or Distance-to-PIM (DTP) measurement mode. The query reports the current system mode.

Parameter: PIM | PIMSwp | DTP

Query Response: PIM (PIM vs. Time)
PIMSwp (Swept PIM)
DTP (Distance-to-PIM)

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

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:

```
:SENS:PIM:MOD?
```

Front Panel

Access: **Measurements**, PIM | Distance-to-PIM | Swept PIM

[:SENSe] :PIMAnalyzer:OUTPut:POWER

[:SENSe] :PIMAnalyzer:OUTPut:POWER?

Title: PIM Analyzer Output Power

Description: Sets the deliverable output (in dBm) from the PIM Analyzer to the system under test.

Parameter: dBm input with 0.1 dBm resolution

Default Value: None. If no value is sent, then no action occurs. To verify that a value has been received, follow the command with a query.

Range: 25 dBm to 46 dBm

Example: To set the PIM Analyzer output power to 43.5 dBm:

```
:SENSe:PIMAnalyzer:OUTPut:POWER 43.5
```

Front Panel

Access: PIM vs. Time and Swept PIM: **Setup**, PIM Aid, Output Power

PIM vs. Time and Swept PIM: **Freq**, PIM Aid, Output Power

DTP: **Distance**, DTP Aid, Output Power

DTP: **Setup**, DTP Aid, Output Power

[:SENSE] :PIManalyzer:RF:OUTput ON | OFF

[:SENSE] :PIManalyzer:RF:OUTput?

Title: PIM vs. Time – Set RF Out On/Off

Description: This controls whether the RF is ON during a measurement, which corresponds to Normal and Noise Floor PVT measurements.

Parameter: ON | OFF

Default Value: ON | OFF

Range: 25 dBm to 46 dBm

Example: To turn on RF:

```
:SENSE:PIManalyzer:OUTPut:POWer 43.5
```

Front Panel

Access: **Measurements**, PIM vs. Time, Test

[:SENSE] :PIManalyzer:SWEEp:IMD:ORDer

[:SENSE] :PIManalyzer:SWEEp:IMD:ORDer?

Title: PIM Analyzer Swept PIM Intermodulation Distortion (IMD) Order Setup

Description: Sets the measurement receiver center frequency to receive one of the following IMDs from the PIM Analyzer 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 center frequency to the 5th order IMD:

```
:SENSE:PIManalyzer:SWEEp:IMD:ORDer 5
```

Front Panel

Access: **Freq**, Intermod Order


```
[ :SENSe ] :PIMAnalyzer:SWEEp:SPAN:TYPE IM | RX
```

```
[ :SENSe ] :PIMAnalyzer:SWEEp:SPAN:TYPE?
```

Title: Swept PIM Analyzer Sweep Span View

Description: In Swept PIM measurement mode, sets the Frequency Span to either the licensed range associated with the option (IM) or to the widest span capability between the Fixed F1 and Fixed F2 displayed sweeps (RX). The query command returns either IM or RX.

Parameter: IM | RX

Example: To set the span view to IM:

```
:SENSe:PIMAnalyzer:SWEEp:SPAN:TYPE IM
```

Front Panel

Access: **Freq**, Span Type

```
[ :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 1200.0 seconds

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

```
:SENSe:PIMAnalyzer:TEST:DURation 5.0
```

Front Panel

Access: **Setup**, Test Duration

12-8 :TRACe Subsystem

This subsystem contains commands related to the transfer of trace data to and from the instrument.

:TRACe [:DATA] ? X

Title: Trace Data Transfer

Description: This command transfers trace data from the instrument to the controller. Before executing this command, the instrument must be set to the desired measurement.

The parameter X is NULL for Distance-to-PIM and PIM vs. Time, and is either 1 or 2 for Swept PIM. For Swept PIM, 1 = Fixed F1 trace data, and 2 = Fixed F2 trace data.

Parameter: NULL | 1 | 2

Parameter Type: <char>

Example: To query the data points of a PIM vs. Time trace:

```
:TRAC:DATA?
```

```
:TRAC?
```

To query the data points of a Swept PIM Fixed F1 trace:

```
:TRAC:DATA? 1
```

```
:TRAC? 1
```

Front Panel

Access: **NA**

Chapter 13 — All Modes

Programming Commands

The Anritsu PIM Master is capable of producing 80 Watts of RF power in the cellular communications bands. Users must take precautions to minimize exposure to these RF fields:

Warning

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 3 in [Figure 2-4 on page 2-8](#)).

Ensure all antenna's under test are placed so that no personnel are exposed to RF levels that exceed the maximum allowable exposure.

The commands in this chapter are functional in all PIM Master modes of operation.

13-1 :INSTrument Subsystem

One instrument may contain many logical instruments “modes”. This subsystem controls the selection of the current instrument mode.

:INSTrument:CATalog:FULL?

Title: Query Available Modes

Description: Returns a comma-separated list of available modes. Mode names are enclosed in double quotes (“ ”). Immediately following the string name is the application number. For example, an instrument with the High Accuracy Power Meter (Option 19) would return the string: “HI_PM”10,”MINIPIM”46.

Front Panel

Access: **Shift-Mode (9)**, or **Menu**

:INSTrument:NSElect <integer>

:INSTrument:NSElect?

Title: Select Mode by Number

Description: Sets the instrument mode based on the value of <integer>. The query version returns the number associated with the current mode. Use :INSTrument:CATalog:FULL? to get a list of available mode names and their integer representations. After issuing the set command, wait a minimum of 60 seconds before issuing the next command.

Parameter: <integer>

Parameter Type: <integer>

Related Command: :INSTrument:CATalog:FULL?

:INITiate:CONTinuous

:INSTrument[:SElect]

:STATus:OPERation?

Front Panel

Access: **Shift-Mode (9)**, or **Menu**

Note

Switching modes can take longer than 80 seconds, depending on the application. Add a delay of at least 90 seconds between mode switch commands. Anritsu Company advises you to set the remote PC time-out to 120 seconds in order to avoid unexpected time-out errors.

:INSTRUMENT[:SELECT] <string>

:INSTRUMENT[:SELECT]?

Title: Select Mode by Name

Description: Sets the instrument mode based on the mode name specified by <string>. Enclose the <string> argument in single or double quotes. The query version returns the name of the current mode. Use :INSTRUMENT:CATALOG:FULL? to get a list of available modes.

Parameter: <string>

Related Command: :INSTRUMENT:CATALOG:FULL?

:INSTRUMENT:NSELECT

Front Panel

Access: **Shift-Mode (9)**, or **Menu**

Note

Switching modes can take longer than 80 seconds, depending on the application. Add a delay of at least 90 seconds between mode switch commands. Anritsu Company advises you to set the remote PC time-out to 120 seconds in order to avoid unexpected time-out errors.

13-2 :MMEMory Subsystem

The Mass MEMory subsystem contains functions that provide access to the instrument's setup and data storage.

:MMEMory:MSIS INTernal | USB

:MMEMory:MSIS?

Title: Storage Location

Description: Sets the storage location. Setting the storage location to INTernal will set the current storage location to be the internal memory. Setting the storage location to USB will set the current storage location to be the USB Flash drive. Note that the storage location can be set independently and can be different for remote operation and front panel operation. Changing the copy location remotely does not change the location that is set and displayed on the front panel. Similarly, changing the copy location via the front panel does not affect the location that is used by the remote operation commands.

Note that the storage location must be available in order for it to be set. Also note that the command will always succeed even if the external memory device is not present.

Parameter: INTernal | USB

Parameter Type: <char>

Related Command: :MMEMory:MSIS:DESTination

:MMEMory:MSIS:COPY

Title: Copy From Current Location To Destination

Description: Copies all measurements, setups, and JPEG files that are stored in the current storage location to the "copy to destination" location.

Related Command: :MMEMory:MSIS
:MMEMory:MSIS:DESTination

Front Panel

Access: **Shift-File (7)**, Copy

:MMEMory:MSIS:DESTination INTernal | USB
:MMEMory:MSIS:DESTination?

Title: Copy to Destination

Description: Sets the destination to which measurements and setups in the current storage location are copied. Setting the location to `INTernal` copies the files that are stored at the current storage location into the internal memory when the command `:MEMMory:MSIS:COPY` is sent.

Setting the location to `USB` copies the files that are stored at the current storage location into the USB Flash drive when the command `:MMEM:MSIS:COPY` is sent.

Note that the storage location can be set independently and can be different for remote operation and front panel operation. Changing the save location remotely does not change the location that is set and displayed on the front panel. Similarly, changing the save location via the front panel does not affect the location that is used by the remote operation commands. Also note that the command will always succeed even if the external memory device is not present.

Parameter: `INTernal | USB`

Related Command: `:MMEMory:MSIS`
`:MMEMory:MSIS:COPY`

Front Panel

Access: **Shift-File (7)**, Save (or Save Measurement), Change Save Location

:MMEMory:STORe:JPEG <file name>

Title: Save Screen as JPEG

Description: Saves the current screen measurement as a JPEG file. This will save the screen as a JPEG file specified by `<file name>` with the extension `.jpg` to the current storage location. `<file name>` should be enclosed in either single quotes (`'`) or double quotes (`"`) and should not contain a file extension. Use the command `MMEMory:MSIS` to set the current storage location.

Parameter: `<file name>`

Example: To save the screen into the file name "trace":
`:MMEMory:STORe:JPEG "trace"`

Related Command: `:MMEMory:DATA?`
`:MMEMory:MSIS INTernal | USB`

Front Panel

Access: **Shift-File (7)**, Save

13-3 :SYSTem Subsystem

This subsystem contains commands that affect instrument functionality that does not directly relate to data collection, display, or transfer.

:SYSTem:OPTions?

Title: Query Installed Options

Description: Returns a string of the installed options. Options are separated by a "/". The string will return "NONE" if no options are installed.

Related Command: *IDN?

Front Panel

Access: **NA**

:SYSTem:PRESet

Title: Preset

Description: This command restores all application parameters to their factory preset values. This does not modify system parameters such as language, volume, or brightness.

Front Panel

Access: **Shift-Preset (1), Preset**

Appendix A — Other Documents

A-1 Introduction

This appendix provides a list of supplemental documentation for PIM Master features and options. These measurement guides are available as PDF files on the Document Disc and as free downloads from the Anritsu Web site. To determine the PIM Analyzer firmware version in your instrument, refer to the submenu key description for “Status” on page 5-3.

PIM Master Options

Table A-1. Options

PIM Master Feature (Option)	Related Document (Part Number)
High-Accuracy Power Meter (Option 19)	Power Meter Measurement Guide (10580-00240)
GPS (Option 31)	Chapter 6 in this document

Related Documents

Table A-2. Related Documents

Document Description	Part Number
Performance Specifications PIM Master Brochure and Technical Data Sheet	11410-00679
Configuring the Anritsu PIM Master MW82119A for Wireless Browser Control	11410-00784

A complete suite of computer software applications are available for download:

<http://www.anritsu.com/en-US/Services-Support/Handheld-Tools-Tool-Box.aspx>

Additional documents are listed in the **Library** tab on the Anritsu product page for PIM Master.

URL for MW82119A:

<http://www.anritsu.com/en-us/products-solutions/products/MW82119A.aspx>

Appendix B — PIM Carrier Bands

B-1 Introduction

PIM tests are conducted by transmitting two test signals, F1 and F2, into the system under test and then measuring intermodulation products created by those test signals that fall within the receive band of the system. The PIM Master transmit signals are user adjustable within the range shown in [Table B-1](#).

B-2 PIM Master Carrier Bands

Table B-1. PIM Master Carrier Bands and Frequencies

Carrier Band	Frequency Range		Option Number	Rx Frequency Range, MHz
	F1	F2		
LTE 700 MHz	734 MHz to 734.5 MHz	752 MHz to 768 MHz	MW82119A-0700	698 to 717 777 to 806
APT 700 MHz	768 MHz to 776 MHz	788 MHz to 807 MHz	MW82119A-0702	713 to 738 825 to 845
LTE 800 MHz	791 MHz to 795 MHz	811.5 MHz to 821 MHz	MW82119A-0800	832 to 862
Cellular 850 MHz	869 MHz to 871 MHz	881.5 MHz to 894 MHz	MW82119A-0850	824 to 849
E-GSM 900 MHz	925 MHz to 937.5 MHz	951.5 MHz to 960 MHz	MW82119A-0900	880 to 915
DCS 1800 MHz	1805 MHz to 1837 MHz	1857.5 MHz to 1880 MHz	MW82119A-0180	1710 to 1785
PCS 1900 MHz	1930 MHz to 1932 MHz	1950 MHz to 1990 MHz	MW82119A-0190 (replaced by 0193)	1870 to 1910
PCS/AWS 1900/2100 MHz	1930 MHz to 1935 MHz	2110 MHz to 2155 MHz	MW82119A-0192 (replaced by 0193)	1710 to 1755
PCS 1900 MHz	1930 MHz to 1945 MHz	1955 MHz to 1995 MHz	MW82119A-0193	1850 to 1910
PCS/AWS 1900/2100 MHz	1930 MHz to 1945 MHz	2110 MHz to 2155 MHz	MW82119A-0193	1710 to 1755
UMTS 2100 MHz	2110 MHz to 2112.5 MHz	2130 MHz to 2170 MHz	MW82119A-0210	1920 to 1980 (IM7) 2050 to 2090 (IM3)
LTE 2600 MHz	2620 MHz to 2630 MHz	2650 MHz to 2690 MHz	MW82119A-0260	2500 to 2570

Appendix C — Wireless Remote Control

C-1 Introduction

The MW82119A PIM Master and a ZyXEL MWR102 (or equivalent) Portable Router can be used to remotely control your PIM test equipment from the bottom of a cellular tower using a Wi-Fi link. The control software is served by the PIM Master, and this allows you to remotely control the PIM Master from any Wi-Fi enabled device with web browser software (Chrome or Firefox preferred). This includes a wide range of tablets and smart phones running Android or iOS operating systems as well as the traditional Linux and Windows laptop and desktop computers.

C-2 Portable Router for Wireless Access

An Application Note in the PIM Library on the Anritsu Web site provides details regarding the equipment needed, the wireless router connection information, and the details for controlling your PIM Master remotely.

The Application Note title is “Configuring the Anritsu PIM Master for Wireless Browser Control” (refer to [Appendix A, “Other Documents”](#)).

Remote Control Option
for Tower-Top Testing

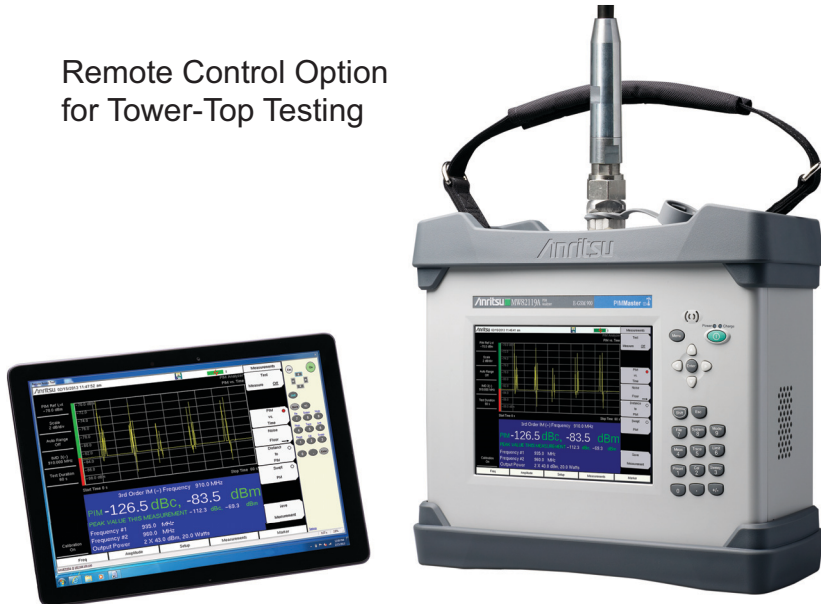


Figure C-1. Controlling the PIM Master Using a Tablet Computer

The control software is served by the PIM Master, so the existing browser software on your own computing device can be used to control the PIM Master from a remote location.

C-3 Configuring the PIM Master for Wireless Browser Control

Wi-Fi links are useful in the field, particularly when the PIM Master is on a tower, and you are on the ground. For wireless browser control, the PIM Master requires firmware version v1.15 or later. Firmware may be downloaded from the Anritsu Web site by following the links for “Downloads and Software” and “Handheld RF Firmware Updates”.

C-4 Using a ZyXEL MWR102 Travel Router

The ZyXEL MWR102 Travel Router is one of many suitable travel routers. All that you need to wirelessly connect to your analyzer is included with the router. This includes an Ethernet cable, a USB cable (for powering the MWR102), and instructions for use.

This router comes pre-programmed with a password for accessing the device. This password can be found on a sticker placed on the reverse side of the router. Write down the password and SSID for the router. You will need this information to access it.

Example Router Data:



Figure C-2. ZyXEL MWR102 Travel Router

Connecting the Router to the PIM Master

The router has two Ethernet ports. One is marked 'LAN' (colored black) and the other is marked 'WAN' (colored blue). Insert one end of the provided Ethernet cable into the black LAN port on the router ,and insert the other end into the Ethernet port of your PIM Master.

Insert the Mini-B (small) end of the provided USB cable into the router ,and insert the Type-A (larger) end of the cable into one of the USB ports of your PIM Master.

The router can be secured to your PIM Master chassis by using a small strip of Velcro or other hook-and-loop fastener.

Configuring PIM Master for use with Router

Configuring the MW82119A PIM Master for use with a Portable Router (such as ZyXEL MWR102 or equivalent).

1. Press **Shift** and **System (8)** to display the System Menu.
2. Press the System Options submenu key, then the Ethernet Config submenu key.
3. Configure the Ethernet connection. The example IP address is 192.168.100.5 in [Figure C-3](#).

[Figure C-3](#) is an example of the Ethernet Editor. Your information may differ. For example, 255.255.255.0 should be the subnet mask.

For additional configuration instructions, refer to [“Ethernet Configuration”](#) on page G-1 in Appendix H, “LAN and DHCP”.

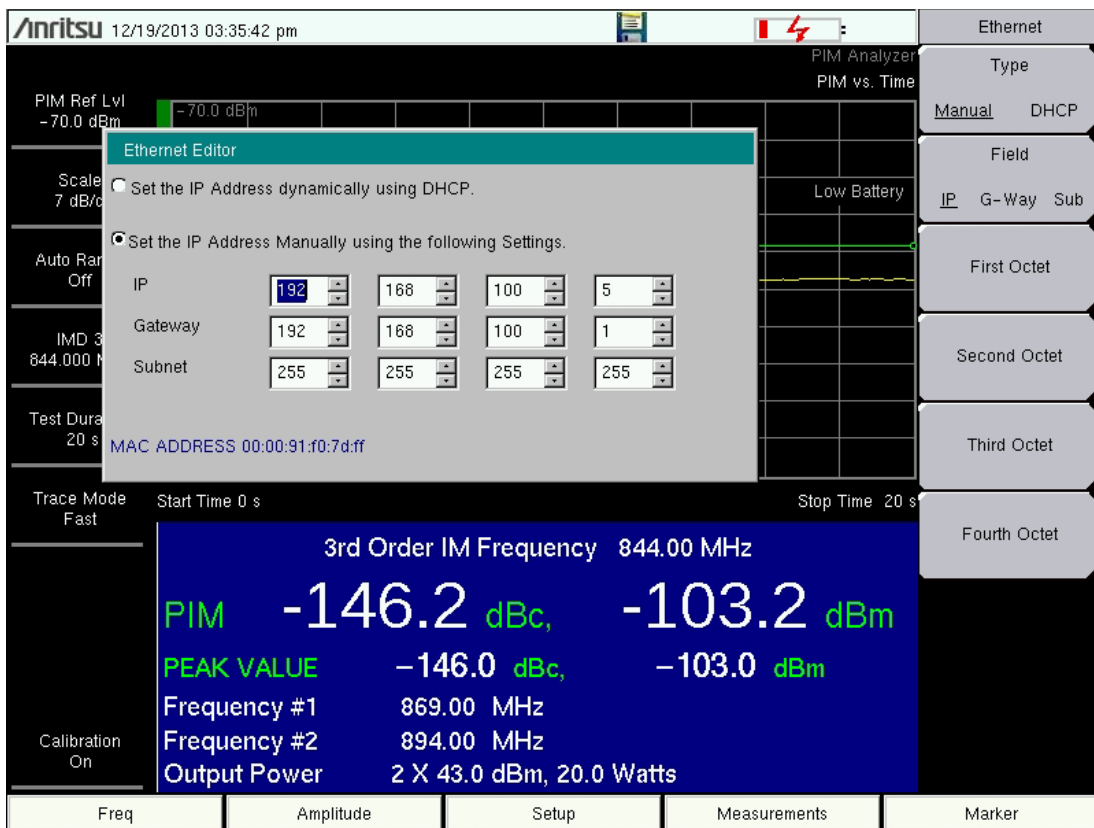


Figure C-3. Example of Entering Ethernet IP Address

4. Ensure that your wireless device (phone, tablet, laptop) is connected to the router. Then launch your browser.
5. Enter the PIM Master IP address in the browser URL field, and wait while the connection is made.

6. When the browser connection is complete, the initial instrument control window is displayed (see [Figure C-4 on page C-5](#)). This window provides instrument status information.

The example IP address (192.168.100.5) appears in the title bar of the instrument control window (as shown in [Figure C-4](#)).

The screenshot displays the Anritsu MW82119A browser control window. The title bar shows the Anritsu logo, the model number MW82119A, and the IP address 192.168.100.5. Below the title bar is a navigation menu with buttons for Home, Remote Control, Capture Screen, Capture Trace, File List, Device Management, and Logout. The main content area is titled 'System Information' and contains two tables: 'Versions' and 'Operating Status'. Below this is another section titled 'Installed Components' containing two tables: 'Applications' and 'Options'.

Versions	
Package	V1.15
OS	V3.49
Base	T4.02.0001
ATA Boot	V3.32
Keypad	V2.3.4

Operating Status	
Temperature	40.0 C / 104.0 F
Battery Charge	9 %
Battery Current	0 mA
Battery Voltage	11.9 V
Serial Number	1239802

Applications	
PIM Analyzer	V1.15

Options	
31	GPS
850	MW82119A Cellular 850

Figure C-4. Example of Browser Control Window

C-5 Remote Control via a Browser

Select the Remote Control tab of the browser control window to display a copy of the PIM Master measurement screen. Follow the same process on this screen as you would on the PIM Master itself.

A green communication activity indicator in the lower-right-hand corner indicates the connection status with the PIM Master. An example of the remote control screen is shown in [Figure C-5](#).

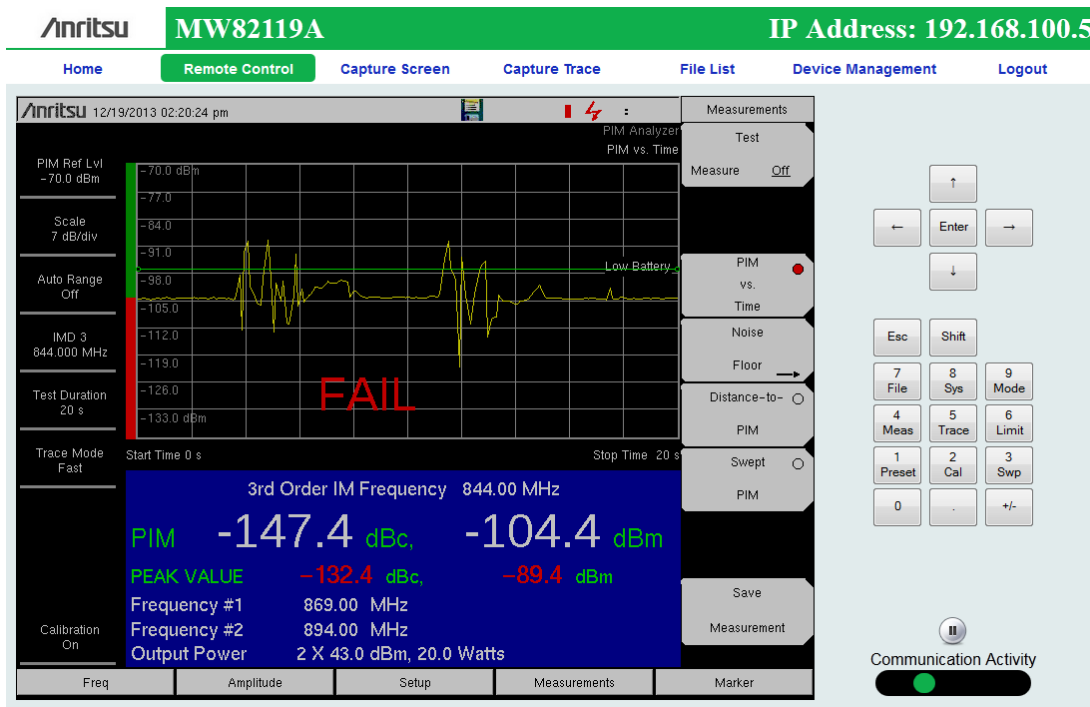


Figure C-5. Example of Browser Remote Control Window

Screen Capture

Selecting the Capture Screen tab of the browser control window saves a time-stamped screenshot of the instrument display, in both the PIM Master memory and the web browser. You can save the image, and you can also send it via e-mail from this screen.

Selecting the Capture Trace tab of the browser control window performs the same function as pressing the Save Measurement submenu key on the PIM Master. Enter a filename and click Save.

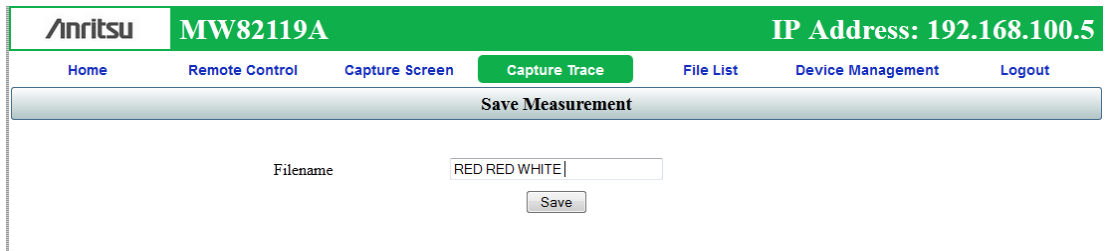


Figure C-6. Example of Browser Saving Captured Trace

List of Files

The File List tab of the browser control window displays a table of the files in the PIM Master internal memory.

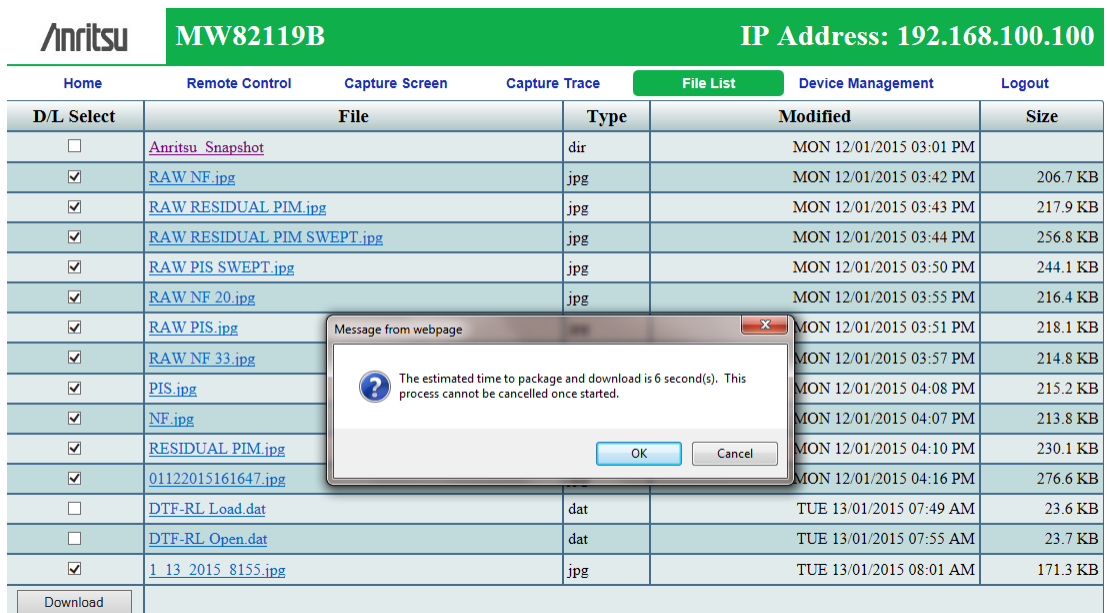


Figure C-7. Example of Browser File List Window

You can use the check boxes in the D/L Select column to download multiple files in one download action. A message box provides an estimated time for the download to be prepared. The Web page becomes unresponsive while the download package is being prepared, and then becomes responsive again when the download starts. The process cannot be canceled after it is started. If the process is interrupted, then you do not receive the requested files. Repeat your request.

Using Anritsu Line Sweep Tools

If your controlling device is a laptop computer with Anritsu Line Sweep Tools (LST) installed, then you can use LST to open the PIM Master measurement files directly from the Browser File List, and then generate site reports. [Figure C-9 on page C-9](#) shows LST working with the same trace as shown in [Figure C-5 on page C-6](#).

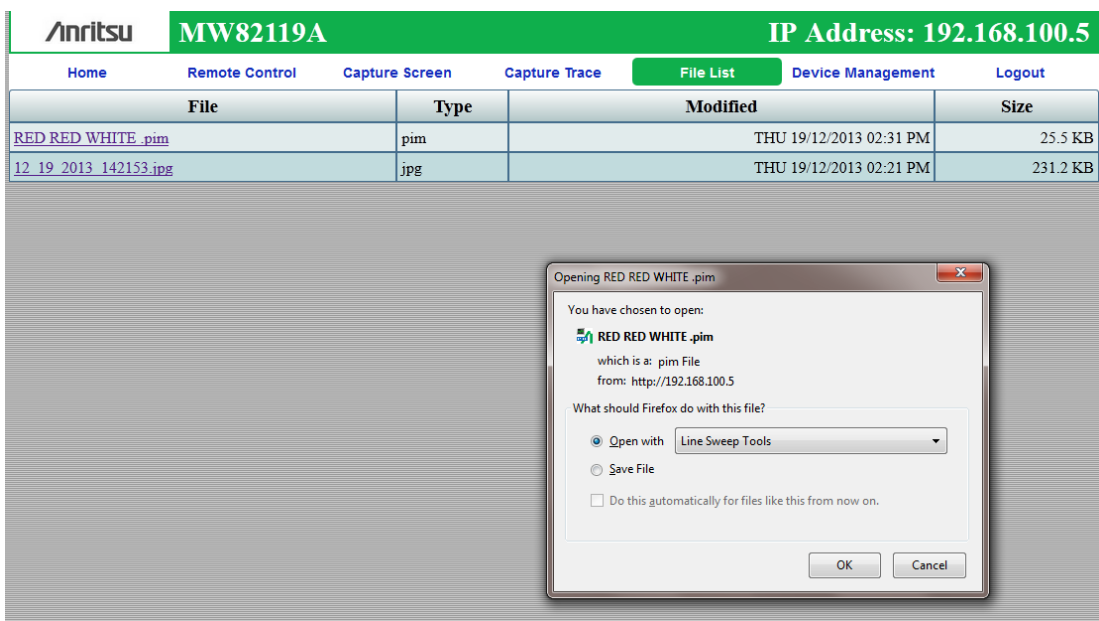


Figure C-8. Example Using LST to Open a File in Browser List

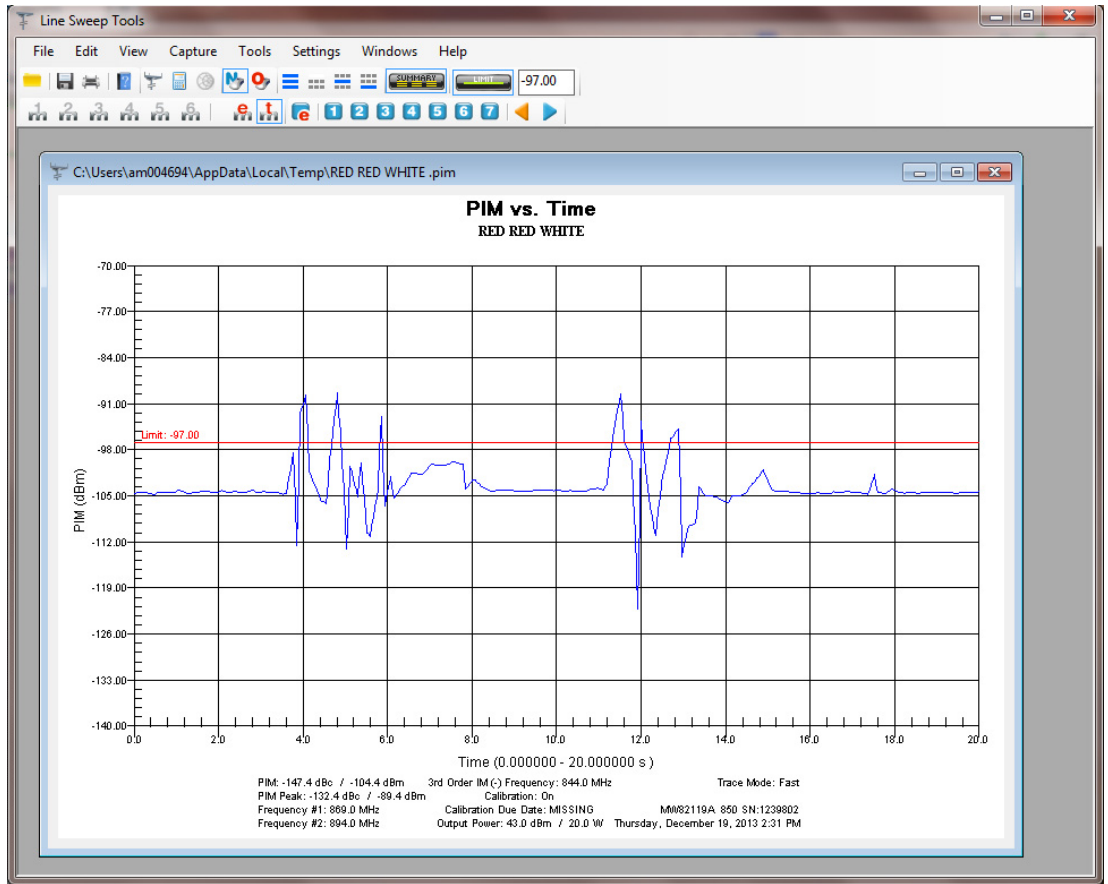


Figure C-9. Example of Trace in Line Sweep Tools

Saving Measurements

Saving a measurement with the browser is similar to saving on the PIM Master itself. The Save dialog box is shown in [Figure C-10 on page C-10](#). A saved measurement is shown in the Delete dialog box in [Figure C-11 on page C-10](#).



Figure C-10. Example of Save Dialog Box

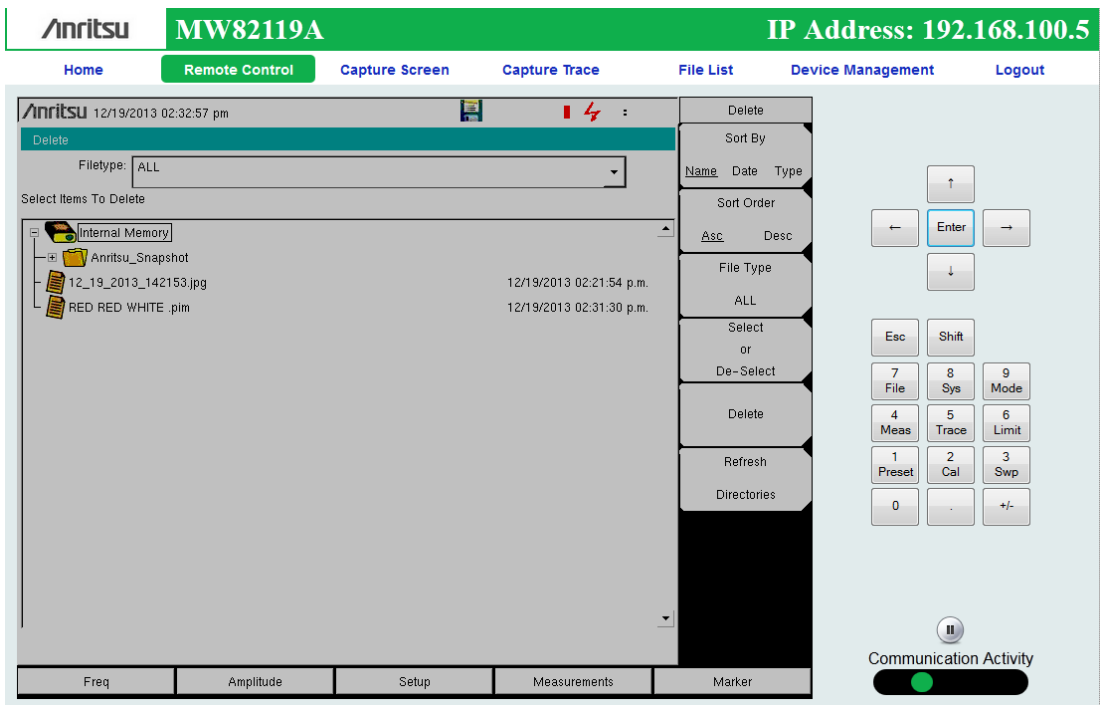


Figure C-11. Example of Delete Dialog Box

Password Protection

Access via router and browser can be password protected. If your router does not have a password, or if you chose not to use it, then you can set a password in the browser remote control window by using the Device Management tab. By default, no password protection is set for browser access. [Figure C-12](#) shows a password example.

After a password has been set, you must use the password to gain access to the PIM Master. [Figure C-13](#) shows the password request window. After the password has been entered, access to the PIM Master is open via the router to any computer device with router access until you log out. Use Logout in the browser tab bar to end your access.

The screenshot shows the Anritsu MW82119A browser interface. The top navigation bar includes 'Home', 'Remote Control', 'Capture Screen', 'Capture Trace', 'File List', 'Device Management' (highlighted), and 'Logout'. The IP address is 192.168.100.5.

Change Password

New Password:

Confirm Password:

Default: None

Buttons: Save, Reset

The instrument Master Reset function will restore the defaults, Master Reset is found under *Shift, 8, System Options, Reset, Master Reset*.
Clicking the **Reset** button above will clear the current password.

Change Instrument Name

New Name:

Default: None

Button: Save

This is a name that can be used to identify this instrument.
The instrument name can be viewed and set from the system menu. The *Name* option is found under *Shift, 8, System Options, Name*.

Figure C-12. Browser Device Management Window

The screenshot shows the Anritsu MW82119A browser interface. The top navigation bar includes 'Anritsu', 'MW82119A', and 'IP Address: 192.168.100.5'.

Password:

Button: Login

Enter your password and press Login to continue.

Figure C-13. Browser Password Request Window

Instrument Name

You can set a name for the PIM Master from the Device Management tab (Figure C-14). This is the same as using the System menu in the PIM Master to enter a name. An instrument name can be a convenient addition when creating measurement reports.

The screenshot shows the Anritsu MW82119A web interface. At the top, there is a green header bar with the Anritsu logo, the model number 'MW82119A', and the IP address '192.168.100.5'. Below the header is a navigation menu with tabs: Home, Remote Control, Capture Screen, Capture Trace, File List, Device Management (highlighted), and Logout. The main content area is titled 'Change Password' and contains two input fields for 'New Password' and 'Confirm Password', a 'Default: None' label, and 'Save' and 'Reset' buttons. Below this is a section titled 'Change Instrument Name' with a 'New Name' input field containing 'CELL 850 MHz', a 'Default: None' label, and a 'Save' button. The page also includes explanatory text about the Master Reset function and the instrument name.

Anritsu MW82119A IP Address: 192.168.100.5

Home Remote Control Capture Screen Capture Trace File List **Device Management** Logout

Change Password

New Password Default: None

Confirm Password

The instrument Master Reset function will restore the defaults,
Master Reset is found under *Shift, 8, System Options, Reset, Master Reset*.

Clicking the **Reset** button above will clear the current password.

Change Instrument Name

New Name Default: None

This is a name that can be used to identify this instrument.

The instrument name can be viewed and set from the system menu.
The *Name* option is found under *Shift, 8, System Options, Name*.

Figure C-14. Changing the PIM Master Instrument Name

Appendix D — Instrument Messages and Errors

D-1 PIM Analyzer Warning Messages

Warning messages provide information but allow measurements to continue.

RF PLL Lock Error **REF PLL Lock Error**

These indicate a potential hardware failure that could compromise measurements. If the failure persists, please contact your Anritsu Service Center.

EMERGENCY Shut Down switch pressed!

PIM front panel EMERGENCY STOP button has been pressed. This will turn off the PIM RF. 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.

PIM EEPROM Error

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

IM OVERLOAD

This is a warning message that the measured signal level is approaching the saturation limit of the instrument. The actual signal level may be higher than the reported signal level under this condition. IM Overload is displayed in PIM vs. Time and Swept PIM measurement modes if PIM values exceed this saturation limit.

Receiver Amplitude Low

This message can occur if signal amplitude degrades within the instrument. It can have an impact on overall measurement accuracy and is an indicator to send the unit to the Anritsu Service Center for repair.

High PIM Detected

This is a warning message that is presented during calibration if a high PIM level is detected before the step requiring that a low PIM termination be attached.

D-2 Operation Error Messages

Error Messages Stop Current Measurements

Emergency Shut Down switch pressed!

This message acknowledges that the red Emergency Stop button (on top of the PIM Master) has been pressed. Refer to [“Emergency Stop Button” on page 2-8](#).

Warning! High Reflection from measurement path!

This message occurs when the connection to the test port produces large reflections back into the instrument. This can compromise measurement accuracy. To fix this error, check all junction connections, or remove the RF connection or component that is causing the high reflection. If a cable or antenna is connected, then it could be an indication of poor RF transmission capability.

Appendix E — Windowing

E-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.

E-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 E-1](#) through [Figure E-4](#) show examples of these types of windowing.

These four measurements were taken on a line with two PIM sources that were spaced 100 feet apart. Rectangular windowing provides the highest resolution, or ability to distinguish closely spaced PIM sources.

Rectangular Windowing

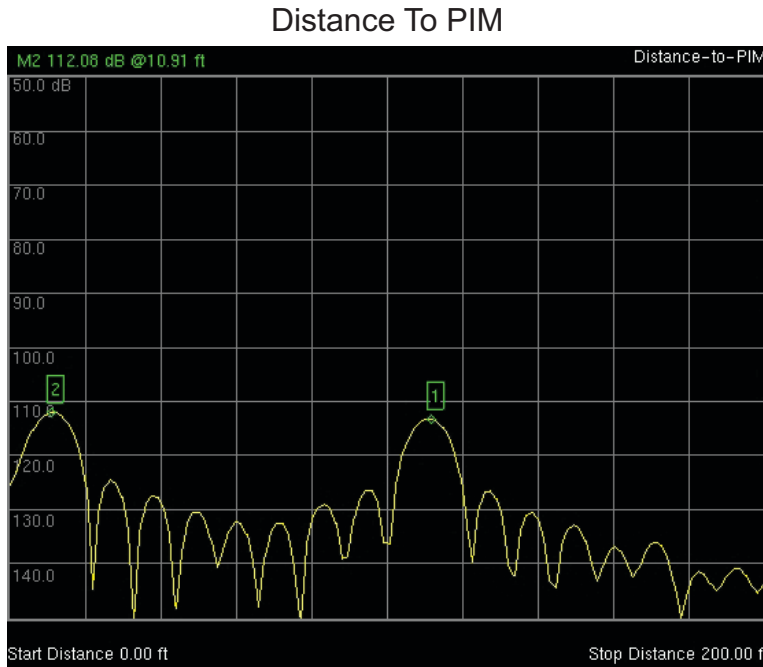


Figure E-1. Rectangular Windowing

Total distance is 200 feet. The PIM sources are separated by 100 feet.

This view of Rectangular Windowing shows the maximum side lobe display and the greatest waveform resolution.

Nominal Side Lobe Windowing

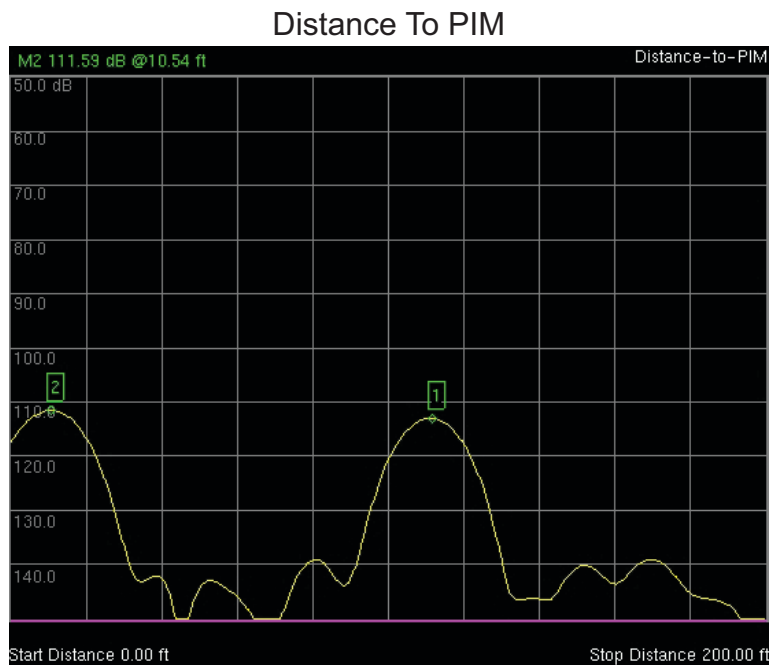


Figure E-2. Nominal Side Lobe Windowing

Total distance is 200 feet. The PIM sources are separated by 100 feet.

This view of Nominal Side Lobe Windowing shows less side lobe resolution than Rectangular Windowing and more side lobe resolution than Low Side Lobe Windowing. This level of windowing displays intermediate resolution.

Low Side Lobe Windowing

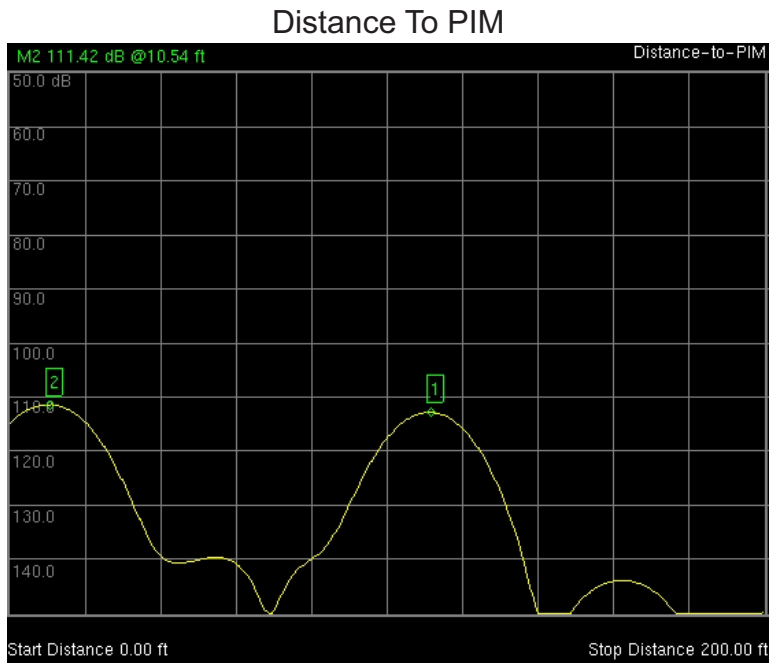


Figure E-3. Low Side Lobe Windowing

Total distance is 200 feet. The PIM sources are separated by 100 feet.

This view of Low Side Lobe Windowing shows less side lobe resolution than Nominal Side Lobe Windowing and more side lobe resolution than Minimum Side Lobe Windowing. This level of windowing displays intermediate resolution.

Minimum Side Lobe Windowing

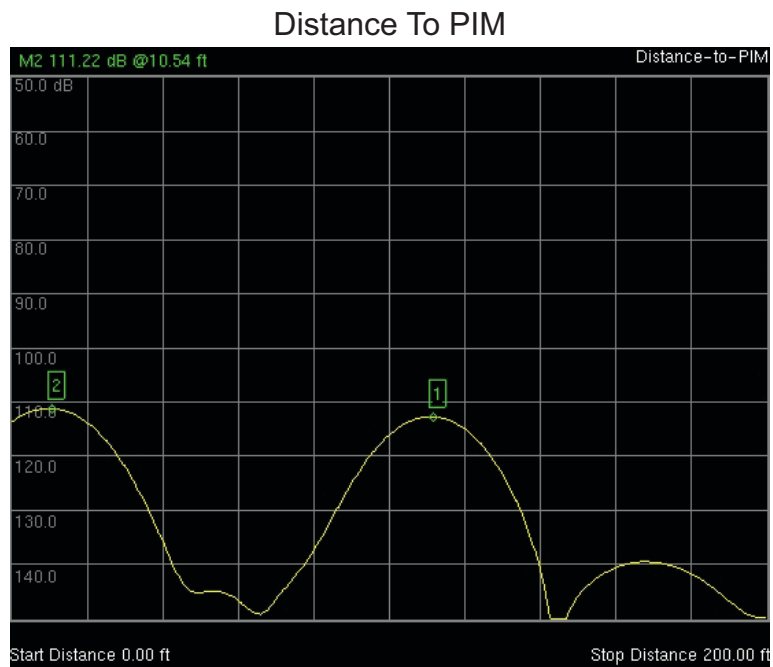


Figure E-4. Minimum Side Lobe Windowing

Total distance is 200 feet. The PIM sources are separated by 100 feet.

This view of Minimum Side Lobe Windowing shows less side lobe resolution than Low Side Lobe Windowing and displays the lowest side lobe and waveform resolution.

Appendix F — Instrument Care

F-1 Introduction

This appendix provides instructions for preventive maintenance, battery care, and firmware updates.

F-2 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 lint-free wipe or cotton swab dampened with isopropyl alcohol. Use a non-metallic object (such as the wooden end of a cotton swab) to push the lint-free wipe into the connector RF interface to remove metal flakes. 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. To obtain accurate readings within instrument specifications, test port cables must be: free of metal flakes, uniform in appearance, and not stretched, kinked, dented, or broken.

F-3 Battery Care

The PIM Master is supplied with a rechargeable battery that could potentially leak hazardous compounds into the environment. These hazardous compounds present a risk of injury or loss due to exposure. Anritsu Company recommends removing the battery for long-term storage of the instrument and storing the battery in a leak-proof, plastic container.

Environmental storage requirements:

Storage Temperature Limits: $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$, Relative Humidity $\leq 80\%$

The battery packs should be stored in an environment with low humidity, free from corrosive gas, at a recommended temperature range $<20\text{ }^{\circ}\text{C}$. Extended exposure to temperatures above $+40\text{ }^{\circ}\text{C}$ could degrade battery performance and life.

Battery charging limits: $0\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$, Relative Humidity $\leq 80\%$

The battery supplied with the PIM Master may need charging before use. Before using the instrument, the internal battery may be charged either in the instrument, using either the AC Adapter or the 12-Volt DC adapter, or separately in the optional Dual Battery Charger. Anritsu part numbers for these accessories are in your Technical Data Sheet/Product Brochure.

Use only Anritsu approved battery packs. Anritsu part numbers are in the Technical Data Sheet/Product Brochure.

Recharge the battery only in the PIM Master or in an Anritsu approved charger.

When the PIM Master or the charger is not in use, disconnect it from the power source.

Do not charge batteries for longer than 24 hours. Overcharging may shorten battery life.

If left unused, a fully charged battery will discharge itself over time.

To prevent instrument damage, Anritsu Company recommends removing the battery for long-term storage of the instrument.

Temperature extremes affect the ability of the battery to charge: allow the battery to cool down or warm up as necessary before use or charging.

The battery can be charged and discharged hundreds of times, but it will eventually wear out.

The battery may need to be replaced when the operating time between chargings becomes noticeably shorter than normal.

Never use a damaged or worn out charger or battery.

Storing the battery in extreme hot or cold places will reduce the capacity and lifetime of the battery.

F-4 Battery Replacement

The battery compartment access is on the bottom of the PIM Master.



Figure F-1. Battery Compartment - Open

The battery snaps into the compartment door assembly. Orientation of the battery is important. A diagram inside the battery door assembly and another diagram inside the PIM Master compartment show an image of the battery. Notice that the connector end of the battery is oriented away from the latch mechanism, and the battery connection openings are up, or away from the plate of the door assembly.

The image in the battery door assembly shows the orientation in which you should see the battery as you place the battery into the door assembly (see [Figure F-3](#)). Inside the PIM Master compartment is a reflected image of the battery (see [Figure F-2](#)) to show how the battery connectors align with the pins inside the compartment. As you place the battery door assembly into the battery compartment, the battery connectors and the reflected image should match, as if you were seeing the connectors reflected in a mirror.

To avoid connector pin damage, you must not press the battery downward onto the connector pins within the battery compartment. You must position the battery door assembly so that the battery connections can slide lengthwise onto the connector pins as you seat the door assembly against the bottom of the PIM Master. The tab on the door fits into a slot located on the edge of the case adjacent to the connector pins.

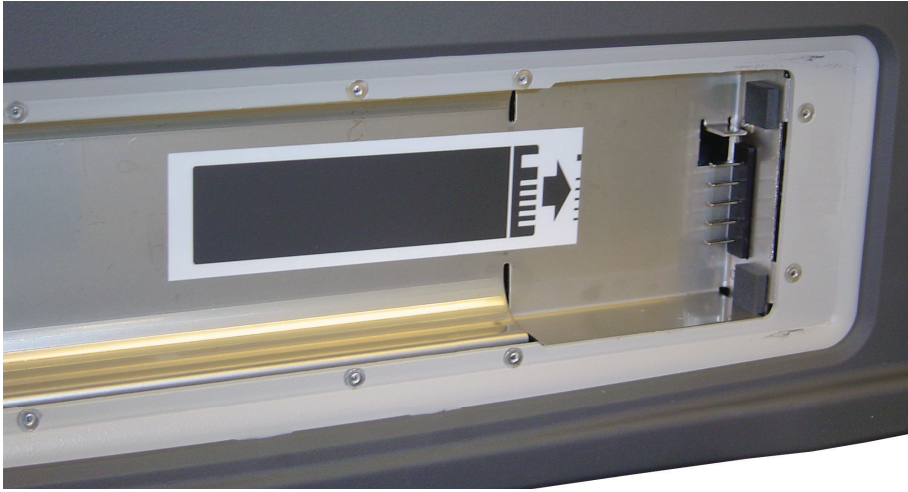


Figure F-2. Battery Orientation Diagram Inside Battery Compartment



Figure F-3. Battery and Cover Plate

Inserting the Battery into the Case



Figure F-4. Closing the Battery Cover Plate

Place the blank edge of the door assembly into the PIM Master first and ensure that the connector end of the battery is as deep into the case as possible. This is to orient the battery connector openings with the connection pins inside the pm.

Slide the door assembly lengthwise into the PIM Master case making sure that the tab on the door assembly engages with the slot in the case. Continue moving the door assembly to seat the battery connections. When the latch is aligned, close the door and twist the latch to lock the door in place. Turn the latch handle flat so that the PIM Master can sit flat when upright.

F-5 PIM Master Firmware Update

Please check the Anritsu PIM Master product page for firmware upgrade procedures.

<http://www.anritsu.com/en-us/products-solutions/products/MW82119A.aspx>

If further assistance is needed, then contact Anritsu at 1-800-ANRITSU (1-800-267-4878).

Determining the Firmware Version

To determine the current firmware version of your PIM Master, use the following procedure:

1. Press the **Shift** and **System (8)** keys to display the System menu.
2. Press the **Status** submenu key to display instrument status.
The Status list box displays instrument conditions and firmware versions.
3. Note the “Package Version” number and the “MINIPIM Version” number.

The latest available version of firmware can be determined by visiting the product link (shown above) or by visiting the “[Generic Firmware Download](#)” page.

Downloading the Firmware

You can search the Anritsu Web site in two ways to find the firmware for your PIM Master, either “[Generic Firmware Download](#)” or “[PIM Master Product Page Firmware Download](#)”.

Generic Firmware Download

1. Enter the Anritsu Web page:
<http://www.anritsu.com>
2. In the upper-left corner, enter ‘firmware update’ (do not use the quotes) in the Search box, and then press Enter.
3. Click the link for ‘Handheld RF Firmware Updates’ near the top of the page.
4. On The Anritsu Tool Box page, click the Firmware Updates link for PIM Master.
5. On the Firmware for PIM Master page, click the Download Now link for Model MW82119A.
6. In the table on the download page, click the green Download button. Note the file details in the download dialog box, which include the file size and its release date.
7. In the download dialog box, click **Save** and direct the download to your USB memory device. You can also download to your PC and copy to a USB memory device later.

PIM Master Product Page Firmware Download

1. Navigate to the PIM Master product page:
<http://www.anritsu.com/en-US/Products-Solutions/Products/MW82119A.aspx>
2. Click the Library tab.
3. Scroll to the section labeled Drivers, Software Downloads.
4. Click Firmware Update for the PIM Master MW82119A.

5. On the Firmware Update page, click the **Download** button. Note the file details in the download dialog box, which include the file size and its release date.
6. In the download dialog box, click **Save** and direct the download to your USB memory device. You can also download to your PC and copy to a USB memory device later.

Updating with a USB Memory Device

The PIM Master contains a feature that allows you to update its firmware by using a USB memory device. First, you must load the USB memory device with the firmware (refer to “[Downloading the Firmware](#)” on page F-6). Anritsu recommends that you format the USB memory device before loading the firmware. After the firmware is loaded onto a blank USB memory device, follow the instructions below to update the firmware on your PIM Master.

Caution	Before beginning the firmware update process, connect an external power supply (either the AC/DC power supply or the automotive 12 VDC adapter) to your PIM Master. The power must remain On until the firmware update is complete.
----------------	---

1. With the PIM Master off, insert the USB Memory device into the USB port and turn on your PIM Master. The PIM Master will recognize the new firmware in the USB device.
The USB Memory device can be inserted while the PIM Master is On, but the update firmware is not checked until the instrument is turned Off and then On.
2. A message is displayed to inform you that new firmware is ready for update, and you are asked to choose whether to update now, by pressing the **Yes** or the **NO** submenu key. Press **Yes** to begin the update.
3. The Firmware Update menu is displayed, the Firmware Update dialog box ([Figure F-5](#)) shows “Save none” selected, and a cautionary statement is displayed regarding user data. Use the **Arrow** keys to select an option. The choices are:
 - a. Save none
No attempt will be made to save any user data.
 - b. Save user data
User data will be saved in the selected external media device.
WARNING: If there is not enough available memory space for all user data then some data may be lost during the process.
 - c. Save and restore user data
User data will be saved in the selected external media device. The instrument will also attempt to restore the files to the instrument after the update.
WARNING: If there is not enough available memory space for all user data then some data may be lost during the process.

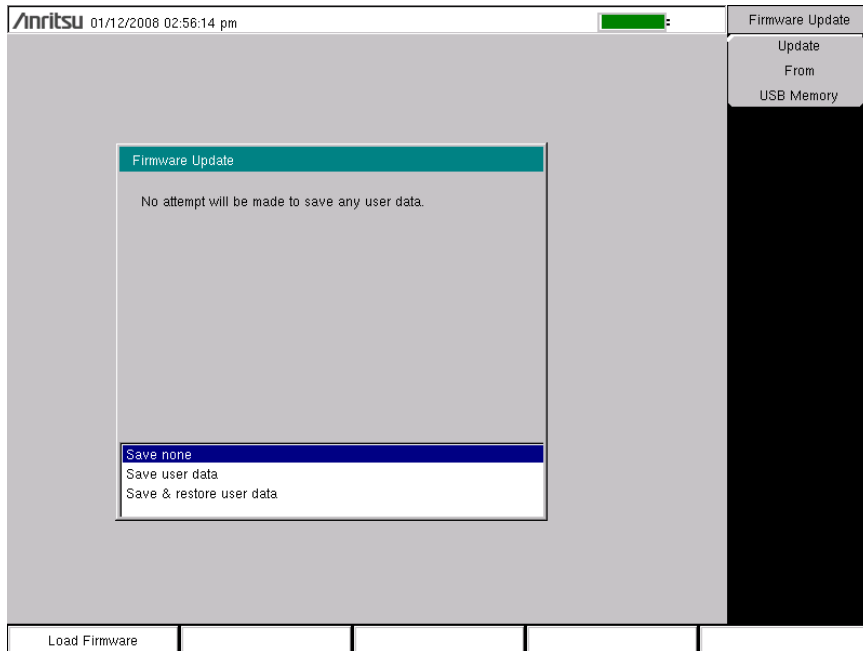


Figure F-5. Firmware Update Menu

4. Read through each choice carefully, select the desired save mode, and then press the Update From USB Memory submenu key or press **Enter** to begin the firmware update process.
5. The Firmware Update message box is displayed and directs you to press ENTER to continue or to press ESC to abort ([Figure F-6](#)).

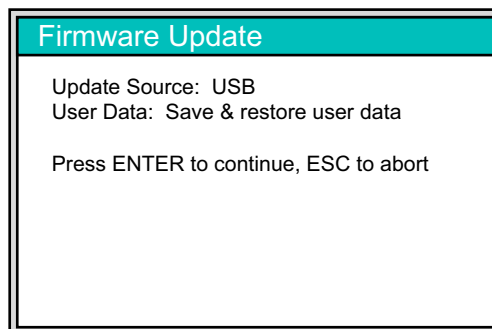


Figure F-6. Firmware Update Message Box

6. Press **Enter** to begin the firmware update process. The Firmware Update dialog box displays the following message:
Updating firmware. Please Wait.
7. When complete, the instrument reboots.

F-6 Adding Options with a License File

The license file installation process allows you to enable instrument software options. Only option retrofits that do not require additional hardware or calibration are qualified for enabling via a license file.

After you purchase an option, a license file is sent via e-mail or secure FTP. You copy that license file to a USB memory device and enable the option in your PIM Master.

First, to purchase an option, you need the PIM Master model number, serial number, and auxiliary serial number. Provide this to Customer Service when you place your order. When your purchase order is placed, Customer Service will advise you whether the option qualifies for enabling via a license file. If applicable, Customer Service will send you a license file via email or secure FTP.

1. To determine the serial number, press **Shift** and **System (8)** to display the System menu.
2. Press the **Status** submenu key and find the Serial Number and Auxiliary Serial Number in the displayed list.
3. Contact Anritsu Customer Service to arrange purchase of the option.

To install a license file onto an instrument, you must load it onto a blank USB memory device. Anritsu recommends that you format the USB memory device before loading the file. Use the following procedure to enable an option on your PIM Master:

1. When you receive the “MW82119A xxxxxxxx.license” file, where “xxxxxxx” is the instrument serial number, copy that file to a blank USB memory device.
2. With the PIM Master Off, place the USB memory device into the USB Interface (Type A). See [Figure 2-5 on page 2-9](#) for a description of the side panel connectors.
3. Turn On the PIM Master, and the instrument proceeds with the normal boot process and automatically installs the license file. A message is displayed to indicate that the options were changed and that you must restart the PIM Master.
4. Turn Off the PIM Master, remove the USB memory device, and turn On the PIM Master.
5. The instrument is ready for use with the new option enabled.

Appendix G — LAN and DHCP

G-1 Introduction

This appendix describes network connections for the PIM Master.

G-2 Ethernet Configuration

LAN Connection

The RJ-45 connector is used to connect the PIM Master to a local area network. Integrated into this connector are two LEDs. The amber LED shows the presence of a 10 Mbit/s LAN connection when on, and a 100 Mbit/s LAN connection when off. The green LED flashes to show that LAN traffic is present. The instrument IP address is set by pressing the **Shift** key, then the **System** (8) key followed by the **System Options** submenu key and the **Ethernet Config** submenu key. The instrument Ethernet address can be set automatically using DHCP, or manually by entering the desired IP address, gateway address, and subnet mask.

Note

If the port becomes disabled, then ensure that an active Ethernet cable is attached to the instrument before cycling the power OFF and back ON.

Dynamic Host Configuration Protocol (DHCP) is an Internet protocol that automates the process of setting IP addresses for devices that use TCP/IP, and is the most common method of configuring a device for network use. To determine if a network is set up for DHCP, connect the PIM Master to the network and select DHCP protocol in the **Ethernet Config** menu.

Turn the PIM Master off, and then on. If the network is set up for DHCP, then the assigned IP address should be displayed briefly after the power up sequence.

To display the IP address with the instrument on, press the **Shift** key, then the **System** (8) key, then the **System Options** submenu key and the **Ethernet Config** submenu key. The IP address will be displayed as shown in [Figure G-1](#). The image on the display panel of your PIM Master may differ from the image shown here.

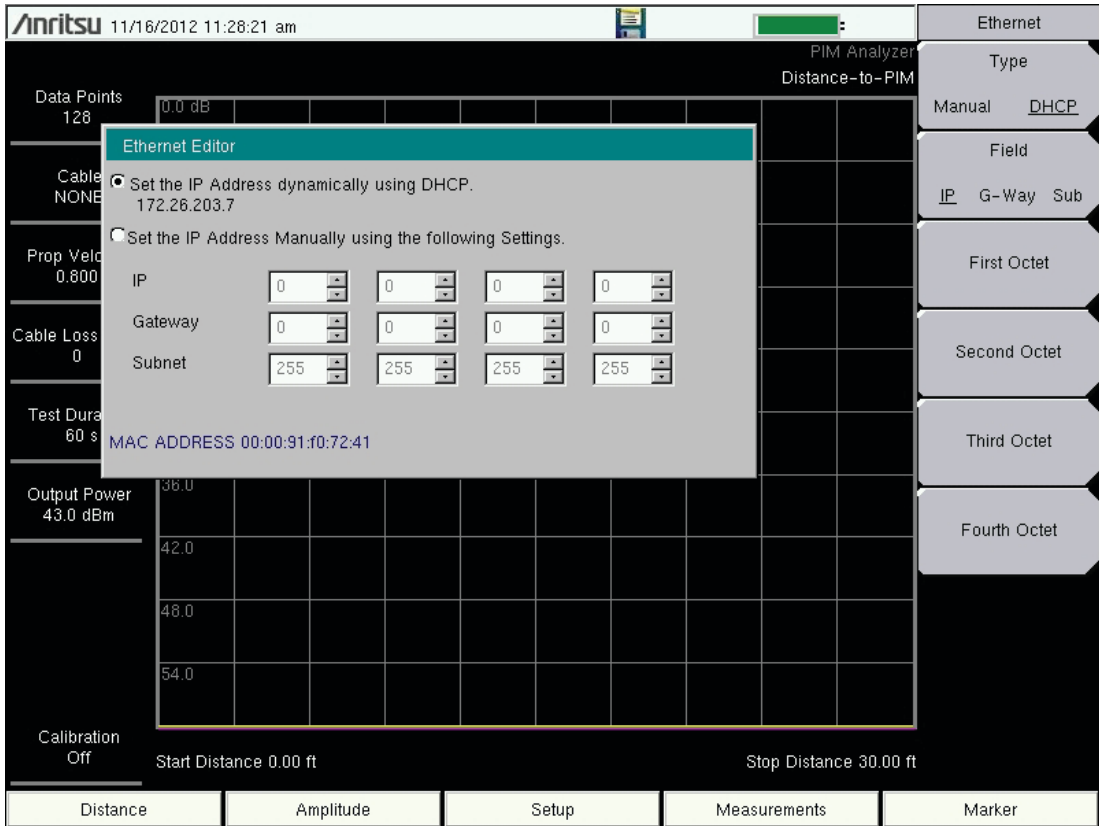


Figure G-1. IP Address Assigned Using DHCP

Ethernet Config

Press this submenu key to display the Ethernet submenu and to open the Ethernet Editor dialog box in order to set the IP address of the instrument.

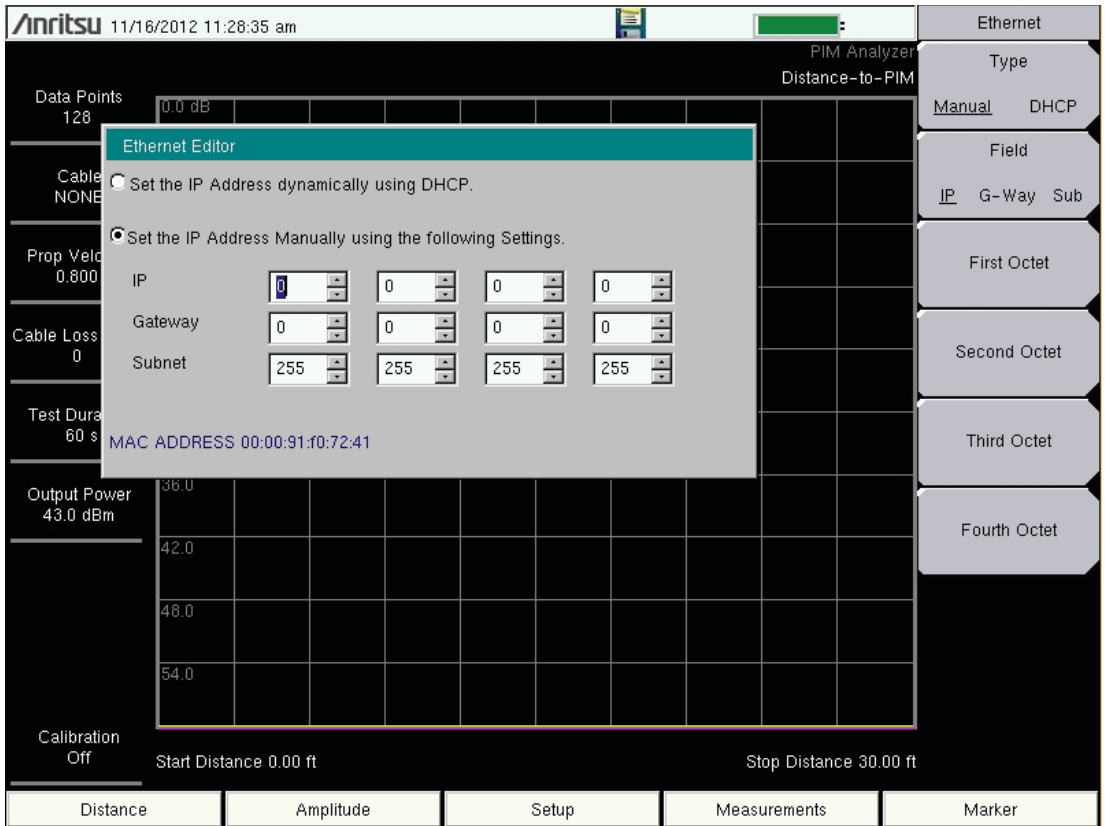


Figure G-2. Setting IP Address Manually

Ethernet Menu

Key Sequence: **Shift, System (8) > System Options > Ethernet Config**

Ethernet	<p>Type Manual DHCP: Press this submenu key to select whether the address will be entered manually, or will be supplied automatically by a network DHCP server. If Manual is selected, then use the submenu keys or the Left/Right arrow keys to select the field that is to be modified. Use the keypad or the Up/Down arrow keys to enter the input. Press Enter to accept the changes, or press the Esc key to return to normal operation without changing anything.</p>
Type Manual DHCP	
Field IP G-Way Sub	<p>Field IP G-Way Sub: Press this submenu key to select the desired Internet Protocol Property to be edited.</p>
First Octet	<p>First Octet: Moves the cursor to the left most column of the selected IP properties field.</p>
Second Octet	<p>Second Octet: Moves the cursor to the second column from the left of the selected IP properties field.</p>
Third Octet	<p>Third Octet: Moves the cursor to the third column from the left of the selected IP properties field.</p>
Fourth Octet	<p>Fourth Octet: Moves the cursor to the forth column from the left of the selected IP properties field.</p>

Figure G-3. Ethernet Menu

G-3 DHCP

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

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

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

When using a static IP address on an established network, always request the Static IP address from the network administrator. Randomly choosing a Static IP address on an established network may result in duplicate IP addresses or other conflicts.

Three parameters must be set prior to using a Static IP address:

IP Address

This is the Static IP address on the network.

Default Gateway

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

Subnet Mask

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

Example 1

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

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

Example 2

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

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

G-4 ipconfig Tool

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

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

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


G-5 Ping Tool

Another tool that can find out if a selected IP address is already on the network is ping. Ping is a harmless way to determine if an address is found on the network, and (if it is found) to receive a reply. Basically, the ping function sends out a request to a specific address to determine if a computing device is connected to the network at that address. If a valid connection is found, then a copy of the signal (that was sent) is returned. If a connection is not found, then the response is “request timed out”, which means that no reply was received from that IP address.

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


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