PiMPro PIM Analyzer

User Guide

PiMPro 900
PCTRL-900
PENCLR-900

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Table 1 - PiMPro PIM Analyzer Specifications

Description	**Typical Specifications**	
Electrical Specifications		
Frequency Bands	**Receive Range (MHz)**	**Transmit Range (MHz)**
LTE 700L (PiMPro 700, PiMPro 700RM)	698 - 716	728 - 746
LTE 700U (PiMPro 700, PiMPro 700RM)	776 - 798	746 - 768
Cellular 850 - (PiMPro 850, PiMPro 850RM)	824 - 849	869 - 894
GSM 900 (PiMPro 900, PiMPro 900RM)	880 - 915	925 - 960
GSM 1800 (PiMPro 1800, PiMPro 1800RM)	1710 – 1785 (**Discontinued**)	1805 – 1880 (**Discontinued**)
GSM 1800 (PiMPro 1821, PiMPro 1821RM)	1710 – 1785 (**New**)	1805 – 1880 (**New**)
UMTS 2100 (PiMPro 1821, PiMPro 1821RM)	1920 – 1910 (**New**)	–
PCS (PiMPro 1921, PiMPro 1921RM)	1850 - 1910	1930 - 1990
AWS (PiMPro 1921, PiMPro 1921RM)	1710 - 1755	2110 - 2155
IM Measurement Capability	Measures 3rd, 5th, 7th, and 9th order reflected passive intermodulation of transmission lines, connectors, filters and combiners, jumpers, splitters, tower mounted devices and other passive components	
Alarms	Audio & Visual Display	
Residual Intermod Level	< -125 dBm (< -168 dBc at 20W, < -171 dBc at 40W)	
RF Output (Test Port) "-LPC" added to Model #'s	2 Variable signals adjustable from 20 - 46 dBm (100mW - 40W)	
RF Output (Test Port) Model #'s without "-LPC"	2 Variable signals adjustable from 33 - 46 dBm (2W - 40W)	
Output Power Resolution	± 0.1 dB	
Output Accuracy	± 0.3 dB	
PIM Measurement Accuracy	± 2.0 dB	
Frequency Step Resolution	± 200 KHz	
Directivity	➢ 25 dB	
Measurement Modes	Instantaneous PIM and Return Loss	
	Frequency Sweep (Graph)	
	PIM vs. Time (Graph)	
	RX Interference (Graph)	
Control	Via Touch Screen Display; SCPI Programming - Rack Mount PiMPro PIM Analyzers (Optional - Portable PiMPro PIM Analyzers)	
Communication Ports	USB and Ethernet (RJ-45)	
Power Requirement	90 - 256 VAC, 50 - 60 Hz	
Power Supply	500 Watts	
RF Ports	1 x 7/16 DIN-female	
Ethernet Port	1 x RJ45	
Data Storage Port	1 x USB	
Display	7" Diagonal TFT Color Touch Screen	
AC Input	Type C14 (IEC 60320)	
Dimensions (Portable Unit)	18.7" × 14.8" × 7.0" (475.0 × 375.9 × 177.8 mm) (W × H × D)	
Dimensions (Rack Mount (**RM**) Unit)	19.0" × 12.25" × 7.25" (482.6 × 311.2 × 184.2 mm) (W × H × D)	
Weight	< 36 Lbs. (16.3 kg) PiMPro 700 / PiMPro 850	
	< 36 Lbs. (16.3 kg) PiMPro 1921, 1800 (**Discontin.**) 1821 (**New**)	
	< 36 Lbs. (16.3 kg) PiMPro 900	
Alarms	Audio & Visual Display	
Enclosure (Water Resistant)	IP67 Rated (Dust / Immersion) Certified: ASTM D4169 (Rain / Vibration / Drop Test) MIL-STD-810F (Immersion)	
Operating Temperature:	0°C to +40°C (32°F to 113°F)	
Storage Temperature:	-10°C to +60°C (14°F to 140°F)	
Relative Humidity	≤ 85%	

1 Introduction

1.1 Purpose

Passive Intermodulation (PIM), the new benchmark in antenna system health, has become one of the greatest challenges of frequency planners in today's mobile communication systems. System planners, equipment and component vendors alike are faced with the ever changing dynamics of higher transmit signals and basestation sensitivity and the nonlinear response of two or more frequency signals causing serious interference and network signal degradation. With the uncertainty of the root cause of PIM in any given system, the need to deploy specific testing solutions in a professional, reliable instrument has become paramount in maintaining the overall antenna health for system providers. PiMPro has been designed to meet these challenges. Its compact, portable yet rugged features provide maximum power in a reliable, field proven design without compromising the accuracy and precision of intermodulation measurements.

1.1.1 PIM Defined

PIM is the unwanted signal or signals generated by the non-linear mixing of two (2) or more frequencies in a passive (or linear) device such as a connector or cable. Filtering can reduce or eliminate the PIM generated by the active devices in the system such as amplifiers, but components such as cable assemblies in the transmission path that cause PIM cannot be filtered. These passive coaxial Components can be common to many if not all channels. The only way to reduce PIM in the transmission path is to design low PIM devices.

1.1.2 Why is PIM a Problem?

If the circuit has non-linear characteristics, then the fundamental frequency components will become distorted in the time domain and generate a decaying series of higher order harmonic frequency components in the frequency domain. If these generated harmonic frequency components fall within the receive band and are of sufficient magnitude, they can effectively block a channel by making the base station receiver think that a carrier is present when one is not. Generally, the components of concern are 3rd, 5th and 7th order where the third order is of greatest signal strength, and therefore, of primary concern. If the fundamental frequencies are f_1 and f_2, then the possible intermodulation frequency components can be described by Equation (1), where the sum of m and n is the product order.

$f_{IM} = m \cdot f_1 \pm n \cdot f_2$ (1)

For example, $(2 \cdot f_1 \pm f_2)$, where m = 2 and n = 1 is a 3rd order intermodulation product. Similarly $(3 \cdot f_1 \pm 2 \cdot f_2)$, where m = 3 and n = 2 is a 5th order intermodulation product, etc. **Figure 1** shows the Global System for Mobile Communications (GSM) network band plan (900 MHz) in order to illustrate the actual risk of interference arising from the generation of IM products. If f_1 = 930 MHz and f_2 = 955 MHz, then f_{IM} = 905 MHz, which falls within the uplink (receive) band.

1.1.2 Why is PIM a Problem? (Cont.)

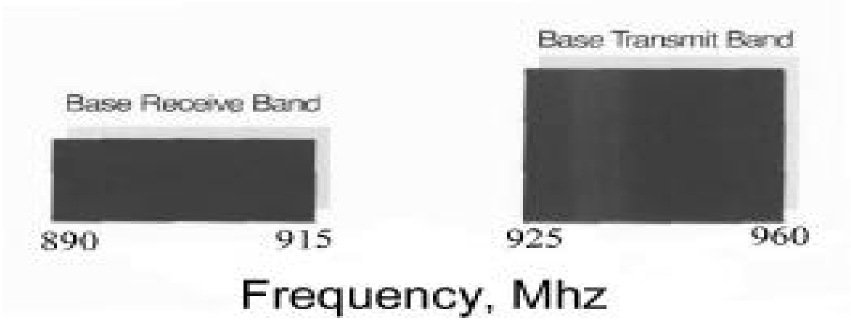


Figure 1 - GSM Band Plan

1.1.3 Causes of PIM

Contact nonlinearities occur when a current carrying contact zone becomes separated. This usually occurs on a microscopic level and can be due to insufficient contact pressure, irregular contact surfaces, or oxidation causing a metal/oxide junction, contact impurities or corrosion. This small separation of contact surfaces can generate a voltage potential barrier, where electron tunneling (known as the diode effect) or microscopic arcing may take place resulting in a nonlinear voltage to current ratio.

The use of ferromagnetic materials such as nickel or steel within the current path, especially at high power levels, can also generate PIM due to the nonlinear voltage to current ratio and hysteresis effect of these materials. Contaminants such as metal particles from machining operations that touch current carrying surfaces can also cause intermittent nonlinearities, generating PIM.

To summarize the causes of PIM include:

1) Poor contact junctions
2) Components made with, or plated with materials that exhibit some level of hysteresis
3) Contamination

1.1.4 PIM Specifications

PIM is normally specified in terms of dBm or dBc. dBm is a measure of power relative to 1 milliwatt. Zero dBm is 1 milliwatt into a 50 ohm load. dBc is a measure of dB below a specified carrier level. For example, 20 watts, or +43 dBm is a typical input power level specified for testing passive devices. A normal test requirement for allowable PIM might be -110 dBm. This would make the specification -110-43, or -153 dBc. The typical range seen today is -100 dBm to -120 dBm with two +43 dBm carriers. PIM-Pro can output two +46 dBm carriers with better than -130 dBm receiver sensitivity. Hence, the PiMPro exhibits an exceptional -176 dBc PIM measurement sensitivity.

1.1.5 Technical Assistance

For Technical Assistance in the use of the PiMPro PIM Analyzer please contact CCI (Communication Components, Inc.) at the following address and phone numbers:

CCI
89 Leuning Street
South Hackensack, NJ 07606
Phone Number: 201-342-3338 (9:00 A.M. to 5:00 P.M. - Eastern Standard Time)
Phone Number: xxx-yyy-tttt (5:00 P.M. to 9:00 A.M. - Eastern Standard Time)

1.2 Abbreviations

Abbreviation	**Definition**
A.C.	Alternating Current
ANT	Antenna
AWS	Advanced Wireless Services
BTS	Base Transceiver Station
dBc	Power Ratio in Decibels (dB) of the Measured Power Referenced to a Carrier Signal
dBm	Power Ratio in Decibels (dB) of the Measured Power Referenced to One milliwatt (mW)
D.C.	Direct Current
DUP	Duplexer
ESD	Electro-Static Discharge
f_1	Lower Transmit (Test Tone) Frequency
f_2	Upper Transmit (Test Tone) Frequency
f_{IM}	Intermod Frequency (nth order)
GSM	Global System for Mobile Communications
IMD	Intermodulation Distortion
LCD	Liquid Crystal Display
LTE	Long Term Evolution
PCS	Personal Communications Service
PIM	Passive Intermodulation
R_L	Return Loss
Rx	Receiver
RMA	Return Material Authorization
SYS	System
TFT	Thin Film Transistor
TMA	Tower Mounted Amplifier
Tx	Transmitter
UUT	Unit Under Test

1.3 Product Overview

Specifications for the PiMPro PIM Analyzer can be found in Table 1 of this manual. The section below provides a brief product overview and block diagram of the PiMPro PIM Analyzer.

1.3.1 PiMPro PIM Analyzer Functional Description

CCI's PiMPro performs reflected passive IM measurements by utilizing two synthesized carriers (tones) that can be placed at frequencies anywhere in the appropriate transmit band at a pre-defined output level of up to 40 Watts (+46 dBm). *Please note that the Analyzer defaults to 20 Watts (+43 dBm) output power specified for PIM testing.* By design, the PiMPro Precision Passive Intermod Analyzer provides precise measurement of the 3rd, 5th, 7th and 9th order of intermodulation of any system or component under high-power conditions. The intermodulation product is automatically calculated based on the transmit frequencies chosen for test performance. *Note that IM readings are performed in the Rx Band only.* The Analyzer will also indicate to the user which IM Product falls within the Rx Band. Please see **figure 2** for a block diagram of the CCI PiMPro PIM Analyzer. *Please note that the CCI PiMPro automatically detects which Model (frequency band) is being used. Also note that software updates are relatively simple to perform, and again no identification of the model is required from the user.*

In addition to passive intermodulation measurements, the unit will provide Return Loss values. *Note that Return Loss (R_L) readings are performed in the Tx Band only.*

PiMPro can be used to verify the integrity of individual passive components including connectors, cable assemblies, antennas, filters, making it an integral performance tool in the field and in the lab.

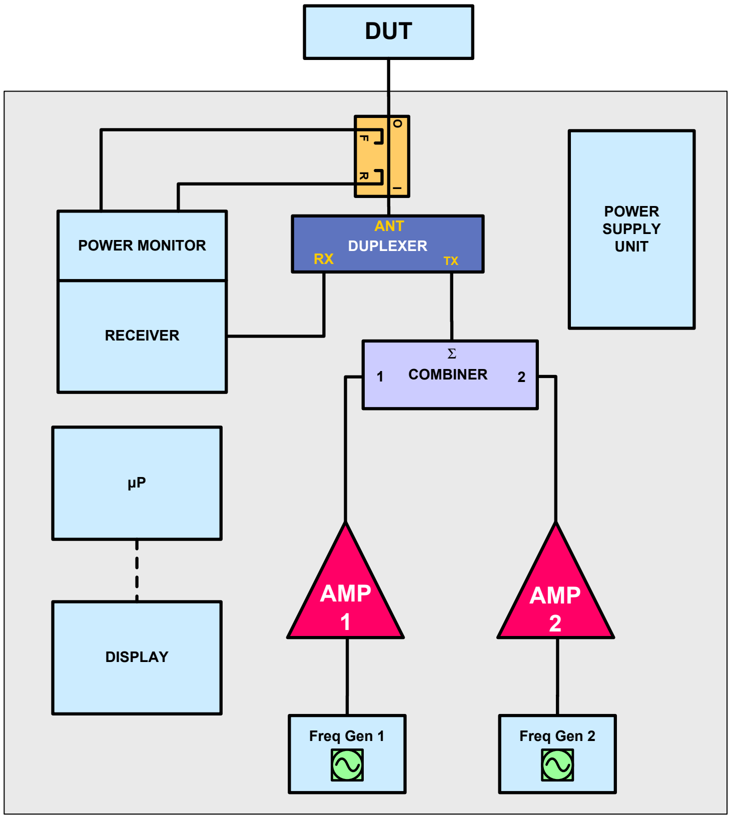


Figure 2 - PiMPro Block Diagram

1.3.1.1 Overview

1.3.1.2 Analyzer Frequencies Available

CCI's PiMPro Analyzer is presently available for the following frequency bands:

Model	Frequency Band	Tx Band	Rx Band
PiMPro 700 (Dual Band)	LTE 700L	728 - 746 MHz	698 - 716 MHz
	LTE 700U	746 - 768 MHz	776 - 798 MHz
PiMPro 850	Cellular 850	869 - 894 MHz	824 - 849 MHz
PiMPro 900	GSM 900	925 - 960 MHz	880 - 915 MHz
PiMPro 1800 **Discontinued**	GSM 1800	1805 - 1880 MHz	1710 - 1785 MHz
PiMPro 1821 (Dual Band) **New**	GSM 1800	1805 - 1880 MHz	1710 - 1785 MHz
	UMTS 2100	–	1920 - 1980 MHz
PiMPro 1921 (Dual Band)	PCS	1930 - 1990 MHz	1850 - 1910 MHz
	AWS	2110 - 2155 MHz	1710 - 1755 MHz

1.3.2 Application

See **paragraphs 1.3.2.1** through **1.3.2.4** below for details of PIM Measurement applications for 1, 2 or 3 port devices. *Note: Always be sure that the PiMPro PIM Analyzer is calibrated prior to performing any measurements.*

1.3.2.1 Cable Assembly Measurement

See Multiport Device Measurement. A cable assembly is a 2 port device.

1.3.2.2 Vertical Polarized or Omni-directional Antenna Measurement

In order to measure the PIM and Return Loss for a Vertical Polarized or Omnidirectional Antenna see **figure 3** and follow the detailed instructions below:

I. Connect the RF Output port of the PiMPro PIM Analyzer to the input port of the Vertical Polarized or Omni-directional Antenna.

II. Perform PIM and Return Loss measurement of the appropriate device at the predetermined RF Output level (generally +43 dBm or if required +46 dBm). *Please note that as most measurements will be made in the "field," antennas should be placed such that the output path of the Vertical Polarized Antenna should have an unobstructed path (generally in an upward direction into the air). That is no items shall be located anywhere near the Antenna that could cause reflections to the Antenna's output/input. Additionally be sure that no personnel are in the Antenna's output path. If an Omnidirectional Antenna is to be tested, it must be mounted at the top of a tower to prevent reflections from any metallic objects.*

1.3.2.2 Vertical Polarized Antenna Measurement (Cont.)

Danger

Radio Frequency Radiation (RF) from antenna systems can endanger your health

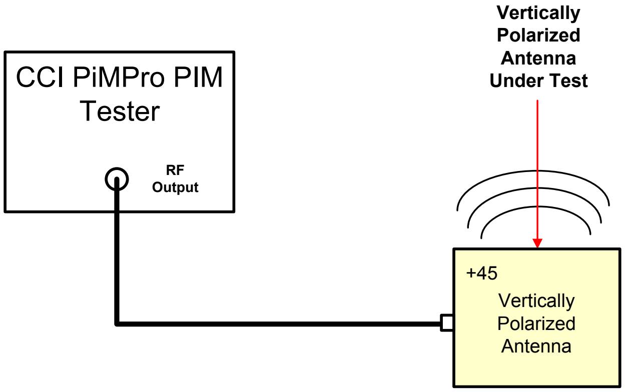

CCI PiMPro PIM Tester
RF Output
Vertically Polarized Antenna Under Test
+45
Vertically Polarized Antenna

Figure 3 - Vertically Polarized or Omni-directional Antenna PIM Measurement Test Setup

1.3.2.3 Multiport Device Measurement

Multi-port devices include the following:

1) **Cable assemblies** (2-port)
2) **Cross Polar Antennas** (2-port)
3) **Duplexers** (3-port)
4) **Diplexers** (a.k.a. Cross Band Combiners) - depending on the direction used the Diplexer may be used to combine multiple frequency inputs (ports) to a common feeder (port); or the Diplexer may be used to separate the combined frequencies on a common feeder to separate output ports (one for each frequency band).
5) **Splitters or Combiners** - divide the RF Power at the input port between two or more output ports; or combine the Input RF Power from 2 or more ports and output the combined power to a single port.
6) **Tower Mounted Amplifiers (TMA)** - TMA's pass Tx signals from a BTS in the forward direction and amplify Rx signals from the mobiles in the reverse direction. The configuration of the TMA (Duplexing or Dual Duplexing) will determine how the TMA will be tested. TMA's should not be powered during test. If powered, PIM generated at or beyond the TMA will be amplified by the gain of the TMA.
    a. **Duplexing Tower Mounted Amplifiers** - Duplexing TMA's have a common port that is connected to the antenna, and separate Tx and Rx ports going to the BTS.

1.3.2.3 Multiport Device Measurement (Cont.)

b. **Dual Duplexing Tower Mounted Amplifiers** - Dual Duplexing TMA's have one port that connects to the BTS and one port that connects to the Antenna. Please note that the above is true for "Single" units. However there are Dual units and other specialized TMA's available. Dual units shall be treated as if each ½ of the Dual Duplexing TMA is a single unit. See item 7 below for treatment of specialized TMA's.

7) **Other - Specific testing method shall be discussed with the Operator prior to performing PIM measurement of any other device type.**

In order to measure the PIM and Return Loss for each device type see **figures 4 thru 10** for **Cable Assemblies, Cross-Polar Antenna, Duplexer, Splitter/Combiner,** test setup and follow the detailed instructions below:

I. Connect the RF Output port of the PiMPro PIM Analyzer to appropriate input port for the given device type.

1. **Cable Assemblies** - connect either end of the cable assembly to the PiMPro PIM Analyzer RF Output port.
2. **Cross Polar Antennas** - connect a test cable to the RF Output port of the PiMPro PIM Analyzer and connect the other end of the test cable to either input (-45° or +45°) of a Cross-Polar Antenna. *After performance of the measurement, the connection of the RF Output port of the PiMPro PIM Analyzer can be switched to the other port (+45° or -45°) and the measurement can be performed again for the opposite port of the Cross-Polar Antenna. The note regarding "field" measurement of Antennas in paragraph 1.3.2.2 II applies here as well.*
3. **Duplexers** - connect a test cable to the RF Output port of the PiMPro PIM Analyzer and connect the other end of the test cable to the Tx port of the Duplexer.
4. **Diplexers** - connect a test cable to the RF output port of the PiMPro PIM Analyzer and connect the other end of the test cable to the common port of the Diplexer.
5. **Splitters or Combiners** - connect a test cable to the RF Output port of the PiMPro PIM Analyzer and connect the other end of the test cable to the input of port of the splitter (combiner).
6. **TMA's**
   a. **Duplexing Tower Mounted Amplifiers** - connect a test cable to the RF Output port of the PiMPro PIM Analyzer and connect the other end to the Tx port of the Duplexing TMA. *Do **NOT** transmit PIM test signals into the Rx port of the TMA.* Duplexing TMA's require a Spectrum Analyzer in order to monitor the IM signal. *Note: TMA's should not be powered during test.* See **section III.** below
   b. **Dual Duplexing Tower Mounted Amplifiers** - connect a test cable to the RF Output port of the PiMPro PIM Analyzer and connect the other end to the BTS port of the Dual Duplexing TMA. *Note: TMA's should not be powered during test.*

1.3.2.3 Multiport Device Measurement (Cont.)

II. Terminate the appropriate output port(s) of the device to be tested with a Low-IM High Power Termination.

1. **Cable Assemblies** - terminate the other (far) end of a cable assembly with the Low-IM High Power termination.
2. **Cross Polar Antennas** - terminate the other port of the Cross-Polar Antenna with the Low-IM High Power termination. *The note regarding "field" measurement of Antennas in paragraph 1.3.2.2 II applies here as well.*
3. **Duplexers** - terminate the ANT/BTS (or COM) port of the Duplexer with the Low-IM High Power termination.
4. **Diplexers** -terminate the output port that matches the operating band of the PiMPro Analyzer with a Low-IM High Power Termination. Note the output port of the Diplexer that does not match the operating band of the PiMPro Analyzer does not require a load (it may be left "open").
5. **Splitters or Combiners** - terminate all of the splitter/combiner output ports with Low-IM High Power Terminations.
6. **TMA's**
    - a. **Duplexing Tower Mounted Amplifiers** - terminate the Antenna port of the Duplexing TMA with a Low-IM High Power Termination. *Note: TMA's should not be powered during test.*
    - b. **Dual Duplexing Tower Mounted Amplifiers** - terminate the Antenna port of the Dual Duplexing TMA with a Low-IM High Power Termination. *Note: TMA's should not be powered during test.*

III. **Duplexers and Duplexing Tower Mounted Amplifiers** shall have the 3rd port terminated with a Spectrum Analyzer and may require the addition of a bandpass filter (with the same operating band as the Rx band of the Duplexer) in cases where the isolation of the device is less than 80 dB.

4. **Duplexers** - terminate the Rx port of the Duplexer with the Spectrum Analyzer (add a Bandpass filter if the isolation of the Duplexer is <80 dB.
   ***Warning*: Do *not* connect the Spectrum Analyzer to the Tx port.**
   Recommended Spectrum Analyzer settings: Center Frequency = PIM Frequency, Span = 10 kHz, Resolution Bandwidth = 100 Hz.
6. **TMA's**
    - a. **Duplexing Tower Mounted Amplifiers** - terminate the Rx port of the Duplexer with the Spectrum Analyzer. *Note: TMA's should not be powered during test.*
      ***Warning*: Do *not* connect the Spectrum Analyzer to the ANT port of the Duplexing TMA.**
      Recommended Spectrum Analyzer settings: Center Frequency = PIM Frequency, Span = 10 kHz, Resolution Bandwidth = 100 Hz.

1.3.2.3 Multiport Device Measurement (Cont.)

IV. Perform PIM and Return Loss measurement of the appropriate device at the predetermined RF Output level (generally +43 dBm (20 Watts) or if required +46 dBm (40 Watts)). *Please note that as most measurements will be made in the "field," antennas should be placed such that the output path of the Antenna should have an unobstructed path (generally in an upward direction into the air). That is, no items shall be located anywhere near the Antenna that could cause reflections to the Antenna's output/input. Additionally be sure that no personnel are in the Antenna's output path.*

Danger

⚠

Radio Frequency Radiation (RF) from antenna systems can endanger your health

Please note that some transmit-only devices like an NBLLC (or a particular path in a Low Loss Combiner (LLC)) will not pass Rx frequencies. Any PIM measurements must bypass this device, or at least bypass the path that does not pass the Rx frequencies.

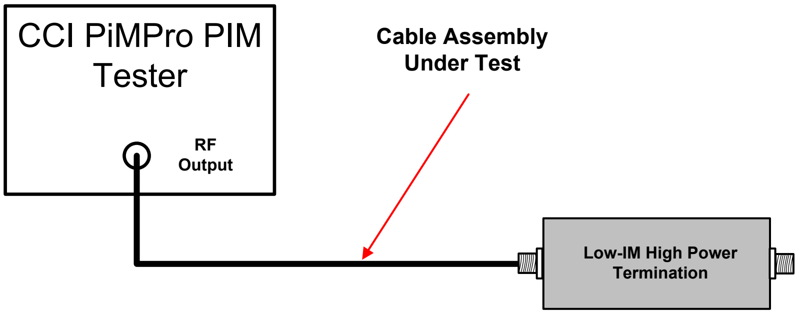


Figure 4 - Cable Assembly PIM Measurement Test Setup

1.3.2.3 Multiport Device Measurement (Cont.)

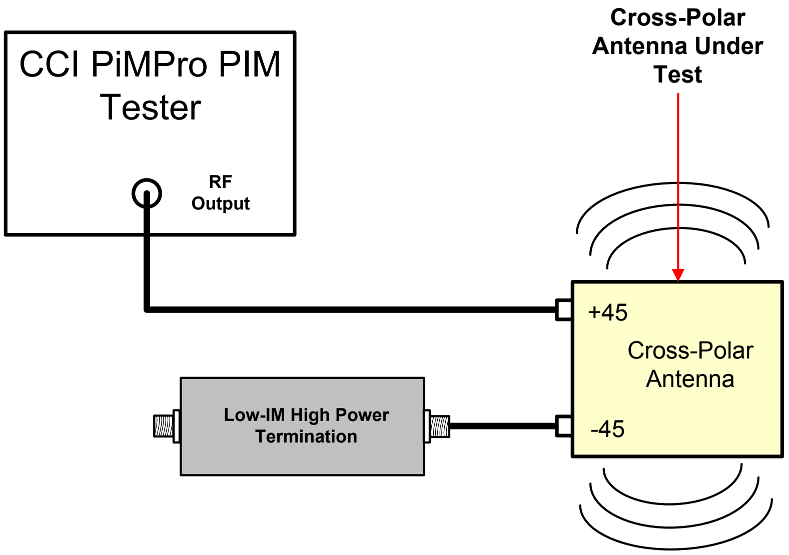

Cross-Polar Antenna Under Test
CCI PiMPro PIM Tester
RF Output
+45
Cross-Polar Antenna
-45
Low-IM High Power Termination

Figure 5 - Cross-Polar Antenna PIM Measurement Test Setup

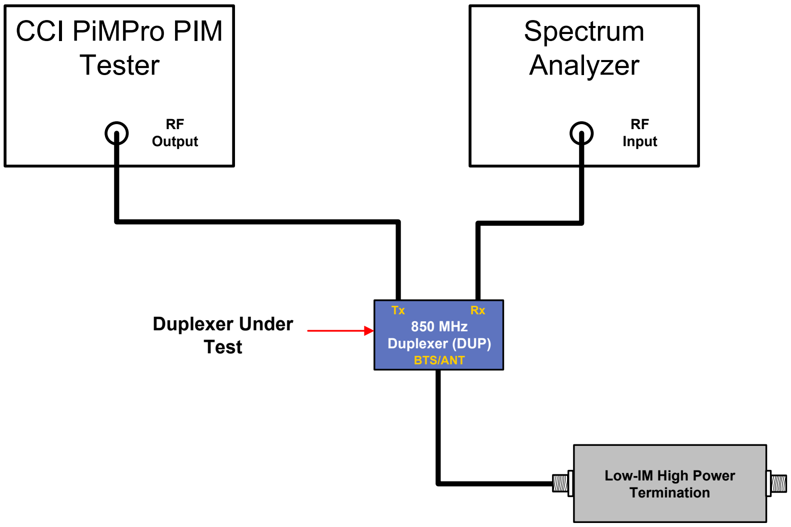

CCI PiMPro PIM Tester
RF Output
Spectrum Analyzer
RF Input
Duplexer Under Test
Tx
Rx
850 MHz
Duplexer (DUP)
BTS/ANT
Low-IM High Power Termination

Figure 6 - Duplexer PIM Measurement Test Setup

1.3.2.3 Multiport Device Measurement (Cont.)

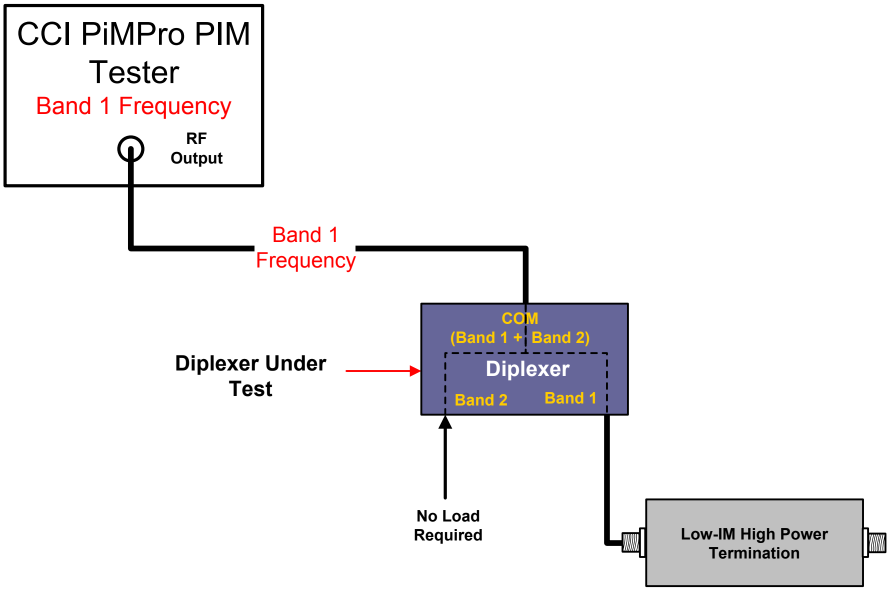

CCI PiMPro PIM Tester
Band 1 Frequency
RF Output
Band 1 Frequency
COM
(Band 1 + Band 2)
Diplexer
Band 2
Band 1
Diplexer Under Test
No Load Required
Low-IM High Power Termination

Figure 7 - Diplexer PIM Measurement Test Setup

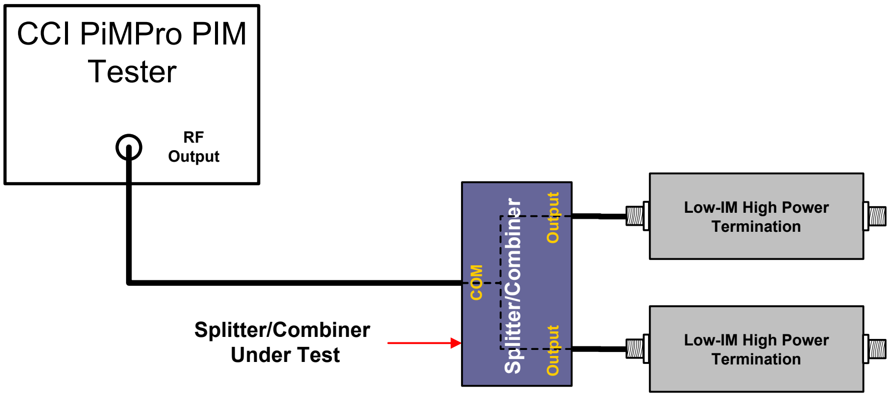

CCI PiMPro PIM Tester
RF Output
COM
Splitter/Combiner
Output
Output
Splitter/Combiner Under Test
Low-IM High Power Termination
Low-IM High Power Termination

Figure 8 - Splitter/Combiner PIM Measurement Test Setup

1.3.2.3 Multiport Device Measurement (Cont.)

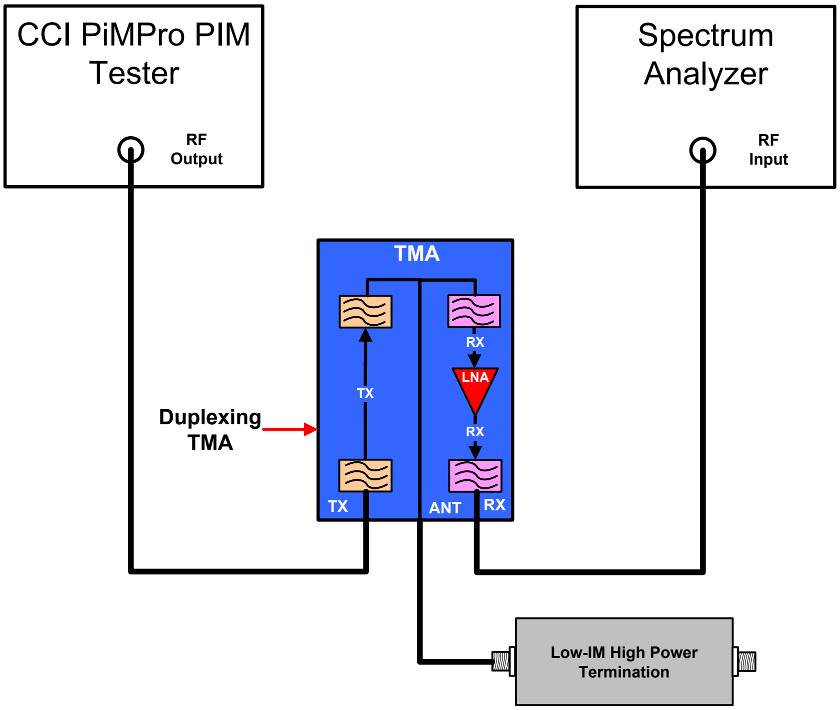

CCI PiMPro PIM Tester
RF Output
Spectrum Analyzer
RF Input
TMA
TX
RX
LNA
RX
Duplexing TMA
TX
ANT
RX
Low-IM High Power Termination

Figure 9 - Duplexing TMA PIM Measurement Test Setup

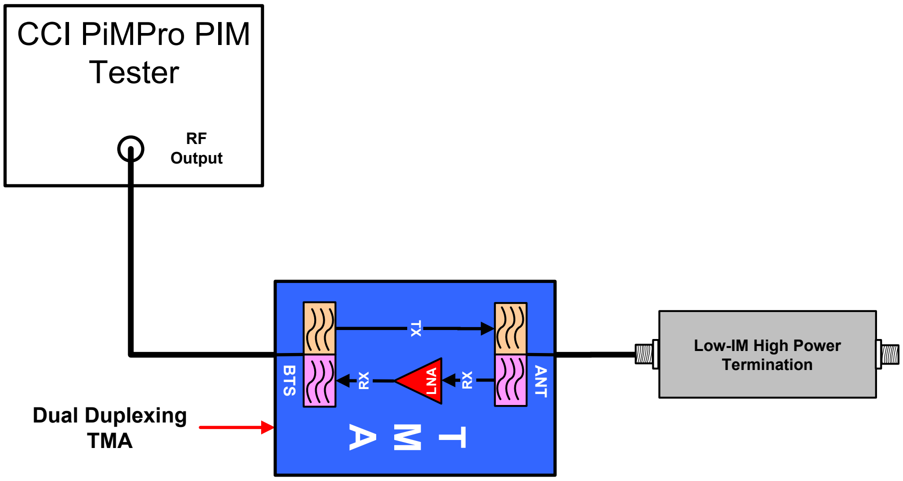

CCI PiMPro PIM Tester
RF Output
TX
BTS
RX
LNA
RX
ANT
TMA
Dual Duplexing TMA
Low-IM High Power Termination

Figure 10 - Dual Duplexing TMA PIM Measurement Test Setup

1.3.2.4 System PIM Measurement

Prior to measurement of PIM in any given sector at a site, the following criteria should be verified:

A. Verify that all site plumbing matches the RFDS, System Diagram or other appropriate documentation.

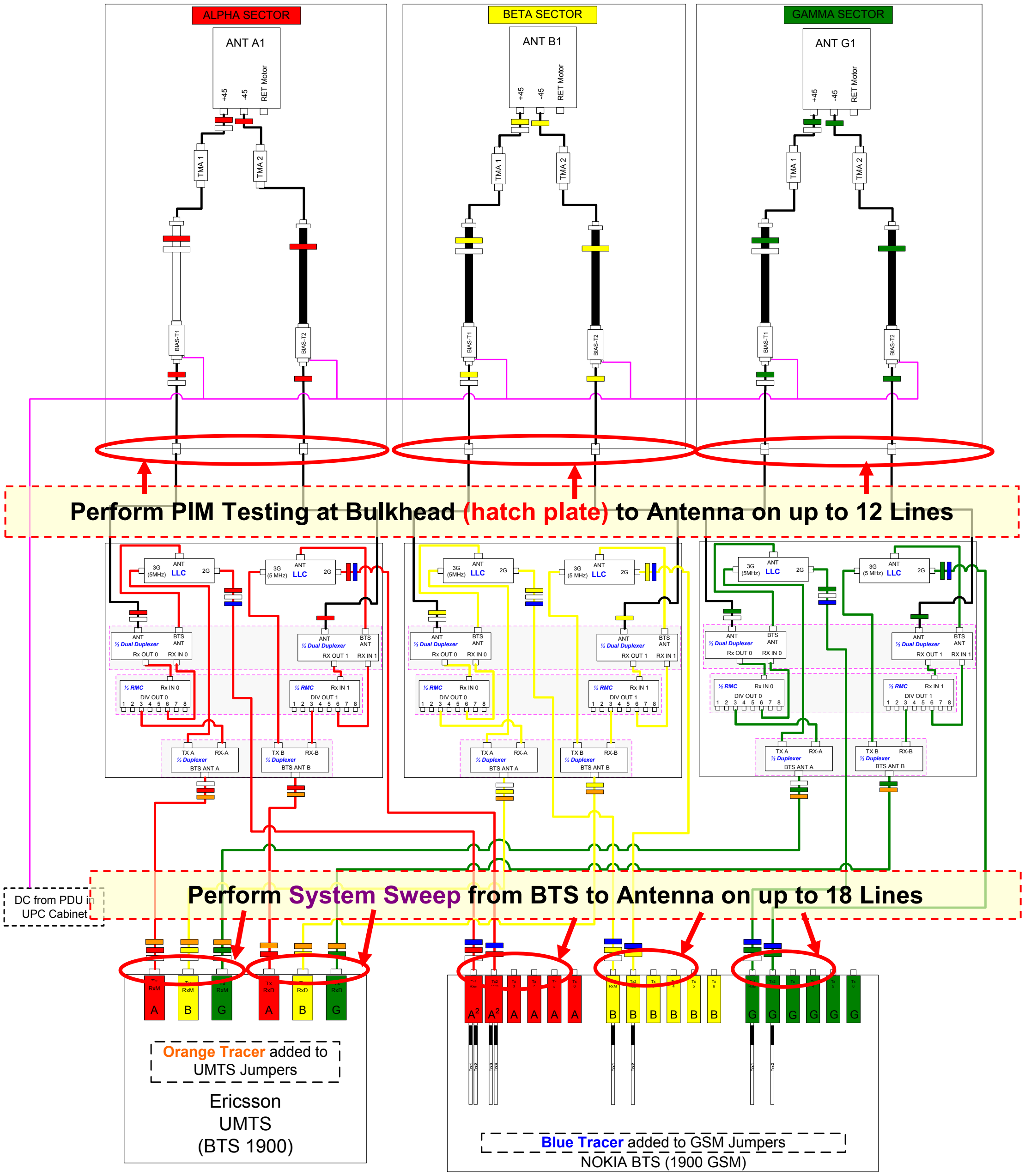
B. Ensure that all connectors are tightened (torque is set) to specified value(s) for the specified connector type.

C. Perform system sweep testing to verify Return Loss and DTF. *Note: Standard high power loads have poor IM because of the absorbing element. Be sure to use a Low-IM High Power Termination (available from the CCI as part of an Accessory Kit (AK) for CCI's PiMPro PIM Analyzer).*

D. Turn off the UMTS carrier to verify that it is an internal interference. If the interference does not go away, then it is not a PIM, but an external interference source from outside of the antenna system.

Figure 11 shows a typical RF plumbing diagram for a site with RX-AIT installed. There are several measurement points available. "System PIM" is measured at the bottom jumper before the GSM BTS or Node B BTS as shown in Measurement Point **#1 in Figure 11**. *Please note that "Transmit Only" devices like the LLC must be bypassed. That is, when the measurement path would occur in a "Transmit Only" path for those devices that have both a "Transmit Only" path and a Transmit/Receive (Tx/Rx) path, that path must be bypassed.*

1.3.2.4 System PIM Measurement (Cont.)


Perform PIM Testing at Bulkhead (hatch plate) to Antenna on up to 12 Lines

Perform System Sweep from BTS to Antenna on up to 18 Lines

DC from PDU in UPC Cabinet

Orange Tracer added to UMTS Jumpers

Ericsson UMTS (BTS 1900)

Blue Tracer added to GSM Jumpers

NOKIA BTS (1900 GSM)
ALPHA SECTOR
BETA SECTOR
GAMMA SECTOR
ANT A1
ANT B1
ANT G1
+45
-45
RET Motor
TMA 1
TMA 2
BIAS-T1
BIAS-T2
3G (5MHz)
ANT
LLC
2G
½ Dual Duplexer
BTS
Rx OUT 0
RX IN 0
RX OUT 1
RX IN 1
½ RMC
Rx IN 0
Rx IN 1
DIV OUT 0
DIV OUT 1
1 2 3 4 5 6 7 8
TX A
RX-A
TX B
RX-B
½ Duplexer
BTS ANT A
BTS ANT B
A
B
G
RxM
RxD
A¹
A²

Figure 11 - Required PIM Measurement Points (CCI System Diagram)

1.3.3 Construction and Layout

Figure 12 shows an overall view of the PiMPro PIM Analyzer with locations of the AC Input Connector, On/Off Switch, Fans, LCD Touch Screen, RF Output Connector, Vents, USB Port and Ethernet (RJ45) port.

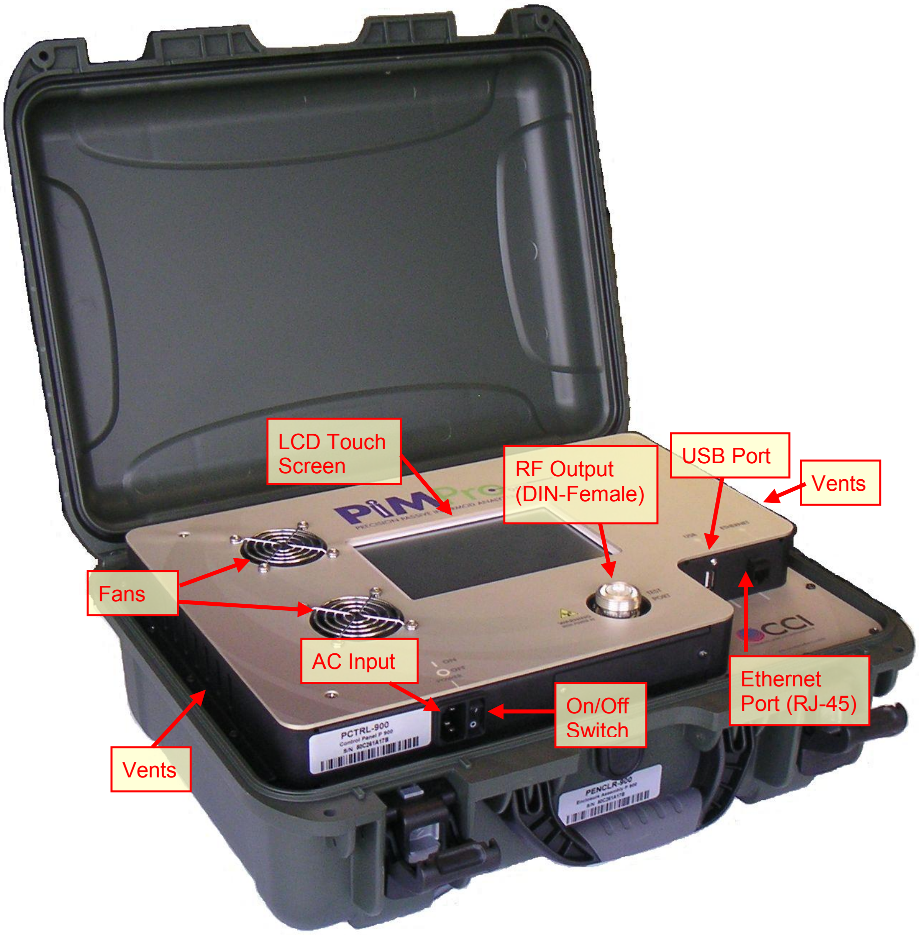

LCD Touch Screen
RF Output (DIN-Female)
USB Port
Vents
Fans
AC Input
On/Off Switch
Ethernet Port (RJ-45)
Vents

Figure 12 - Overall view of the CCI PiMPro PIM Analyzer

1.3.3.1 LCD Touch Screen

There is an LCD touch screen located on the front panel of the PiMPro PIM Analyzer. The On/Off switch is located on the front panel of the PiMPro PIM Analyzer. See **figure 12** for location of the LCD touch screen. The LCD Touch Screen display has the following characteristics:

1) LCD size - 7.0 inch (Diagonal)
2) LCD Type - TFT (Thin Film Transistor)
3) 2 Driver element a-Si TFT active matrix
4) Resolution 800X480
5) Operation Temperature T_{OP} -20°C to +70°C
6) Storage Temperature T_{ST} -30°C to +80°C

1.3.3.2 Fans

There are two fans in the CCI PiMPro PIM Analyzer. They are located on the front panel of the Analyzer to the left of the LCD touch screen. See **figure 12** for location of the fans. Please note that there are vents between the front panel and the transit case of the PiMPro PIM Analyzer. Please be sure not to block these vents. See **figure 12** for location of the Analyzer vents.

1.3.3.3 ON/OFF Switch

The On/Off switch is located on the front panel of the PiMPro PIM Analyzer. See **figure 12** for location of the On/Off switch.

1.3.3.4 "TX ON" Indicator

A "**TX ON**" indicator is located on the LCD touch screen, when in measurement mode. See **figure 23** for location of the "**TX ON**" indicator.

1.3.3.5 AC Input

The AC Input is located in the front of the PiMPro PIM Analyzer between the "raised" portion of the Analyzer and the transit case. See **figure 12** for location of the AC Input.

1.3.3.6 RF Output Port

The RF Output port is a DIN 7/16-Female connector located below the LCD touch screen. *Please note that a "Connector Saver" is placed on the RF Output port to protect the output connector.* See **figure 12** for location of the RF Output port.

1.3.3.7 RJ-45 Ethernet Port

An Ethernet (RJ-45) port connection can be made to a laptop for control of the PiMPro in future units. This port is not functional at present. See **figure 12** for location of the RJ-45 Ethernet port.

1.3.3.8 USB Port

For data storage, S/W storage transfer, license storage and setup table storage. See **figure 12** for location of the USB port.

1.3.3.9 Transit Case

CCI's PiMPro Transit Case is made of a polycarbonate water resistive material. The Transit Case meets an Ingress Protection rating of IP67 for dust and immersion. It is certified to ASTM D4169 for Rain / Vibration / Drop. The Transit Case meets MIL-STD-810F test for immersion. Additionally, the Transit Case meets airline carry-on regulations.

WARNING
HIGH POWER RF

1.3.3.10 "WARNING HIGH POWER RF" Label

The "WARNING HIGH POWER RF" Label is placed to the left side of the RF Output (Test) Port. This label is utilized to warn the user that RF Output Power at this port (if unterminated) is at a "High" Level (up to +46 dBm (40 Watts)) when the "TX ON" indicator is displayed on the LCD touchscreen.

1.3.4 Model Number/Serial Number and Rated Input Labels

The Model Number/Serial Number and Rated Input labels shall be located on either side of the AC Input connector as seen in **figure 13** below. The Model Number label shall include the Model Number, Serial Number, Operating Frequency and Date Code. The Rated Input Label shall include the AC Input Voltage, AC Input Frequency and the Rated Maximum Input Power.

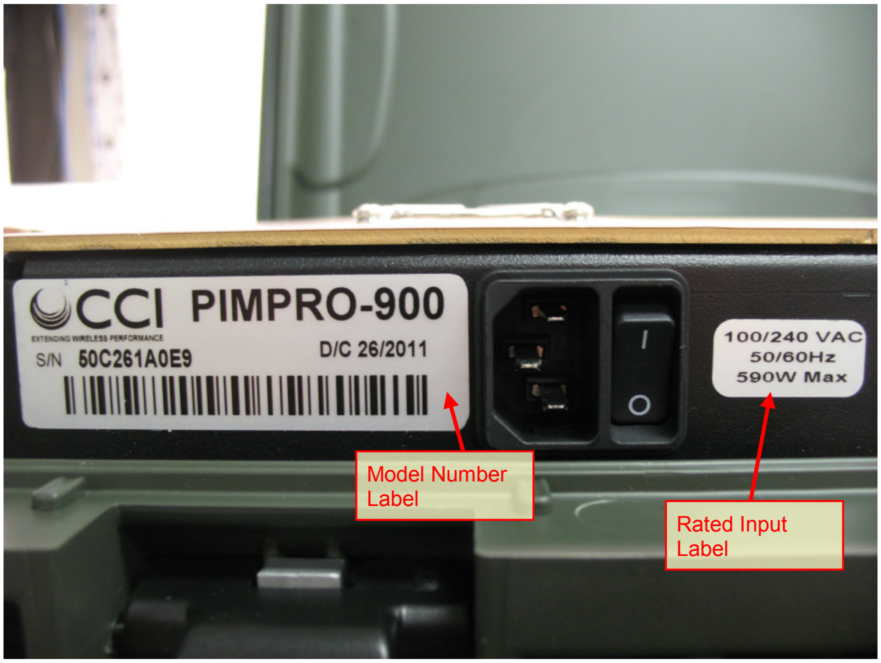

CCI PIMPRO-900
EXTENDING WIRELESS PERFORMANCE
S/N 50C261A0E9
D/C 26/2011
I
O
100/240 VAC
50/60Hz
590W Max
Model Number Label
Rated Input Label

Figure 13 - Model Number and Rated Input Label Location

1.3.5 Functional and Physical Specifications

Electrical and mechanical specifications for the CCI PiMPro product line can be found in **Table 1**.

1.3.6 PiMPro Included Accessories

Accessories included with the CCI PiMPro PIM Analyzer include an AC Power Cord, and an Operating Manual.

1.3.7 PiMPro Accessory Kit (AK)

An accessory kit (CCI PN# PiMPro-AK) for the CCI PiMPro PIM Analyzer (**figure 14**) is available for purchase. This accessory kit contains the following items:

A) Qty. 1 - Low PIM High Power Termination DIN-Male and DIN-Female (2 connectors on one termination) → ***Rated at 80 Watts for a 10 minute period; Rated PIM ≤ -168 dBc*** (Model Number PP-AK-LOAD)

B) Qty. 1 - PIM Standard (DIN Connector) to be used as a verification tool (Model Number PP-AK-PSTAN-800)

C) Qty. 1 - 32 mm Break Over Open End Torque Wrench (14 ft-lbs) (Model Number PP-AK-TORW)

D) Qty. 1 - 8 inch Adjustable Wrench (Model Number PP-AK-ADJW)

E) Qty. 1 - 8 inch Fixed 32 mm Wrench (Model Number PP-AK-FIXW)

F) Qty. 1 - Low PIM DIN-Male to DIN-Male Adapter (Model Number PP-AK- DMDM)

G) Qty. 1 - Low PIM DIN-Female to DIN-Female Adapter (Model Number PP-AK-DFDF)

H) Qty. 1 - Low PIM DIN-Male to N-Female Adapter (Model Number PP-AK-DMNF)

I) Qty. 1 - Low PIM DIN-Male to N-Male Adapter (Model Number PP-AK-DMNM)

J) Qty. 1 – Q-Tips/Alcohol Swabs (Pkg.) (Model Number PP-AK-ALCH)

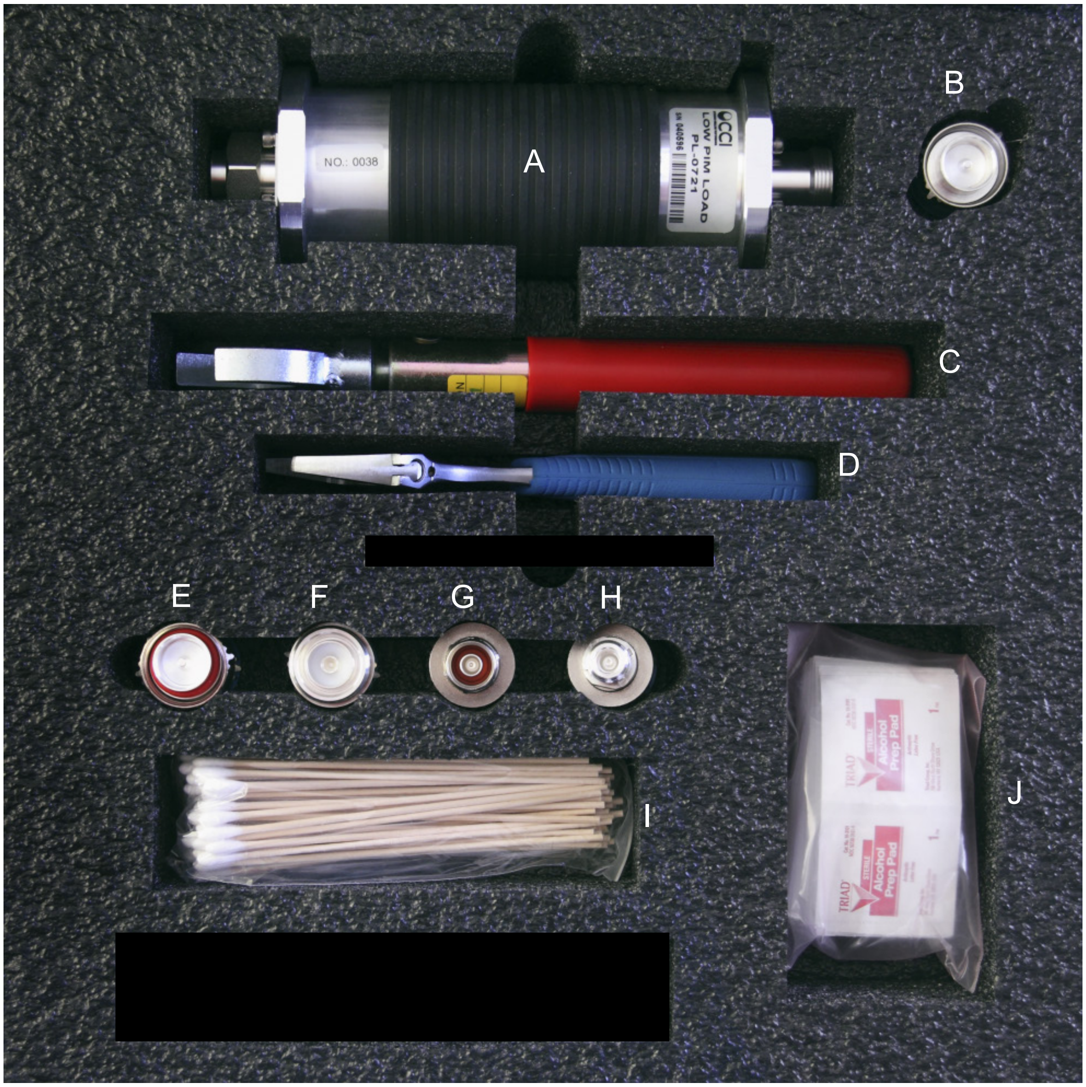
K) Qty. 1 – Power Cord (Model Number PP-AK-ACC)

L) Qty. 1 - Low PIM DIN-Male to DIN-Female 3 M (10 ft) Jumper Cable (Not Shown) (Model Number PP-AK-CAB-DMDF)

M) Qty. 1 - Low PIM DIN-Male to DIN-Male 3 M (10 ft) Jumper Cable (Not Shown) (Model Number PP-AK-CAB-DMDM)

N) Qty. 1 - Component Case (Not Shown) (Model Number - PP-AK-CASE)

1.3.7 PiMPro Accessory Kit (AK) (Cont.)


A
NO.: 0038
CCI LOW PIM LOAD PL-0721
B
C
D
E
F
G
H
I
J
Alcohol Prep Pad
Alcohol Prep Pad

[redacted]

[redacted]

Figure 14 - PiMPro Accessory Kit

1.3.7.1 DIN 7/16 Connector Technical Information

All DIN 7/16 connectors utilized in the PiMPro PIM Analyzer accessory kit items 1 through 8 shall meet the requirements stated for both male and female connector types as listed below.

1.3.7.1.1 DIN-Male Connector

DIN 7/16 male connectors must meet the dimensional requirements shown in the interface drawing shown in **figure 15** below.

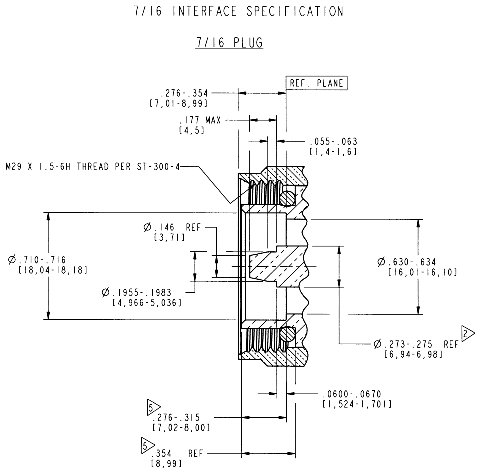

7/16 INTERFACE SPECIFICATION
7/16 PLUG
REF. PLANE
.276-.354 [7,01-8,99]
.177 MAX [4,5]
.055-.063 [1,4-1,6]
M29 X 1.5-6H THREAD PER ST-300-4
Ø.146 REF [3,71]
Ø.710-.716 [18,04-18,18]
Ø.1955-.1983 [4,966-5,036]
Ø.630-.634 [16,01-16,10]
Ø.273-.275 REF [6,94-6,98]
2
.0600-.0670 [1,524-1,701]
5
.276-.315 [7,02-8,00]
5
.354 REF [8,99]

Figure 15 - DIN-Male Interface Drawing

1.3.7.1.2 DIN-Female Connector

DIN 7/16 female connectors must meet the dimensional requirements shown in the interface drawing shown in **figure 16** below.

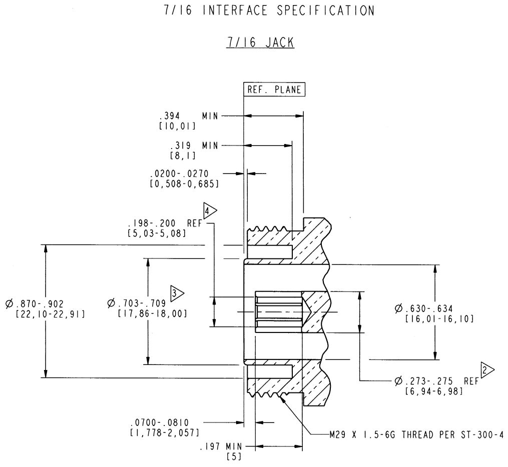

7/16 INTERFACE SPECIFICATION
7/16 JACK
REF. PLANE
.394 MIN [10,01]
.319 MIN [8,1]
.0200-.0270 [0,508-0,685]
4
.198-.200 REF [5,03-5,08]
Ø.870-.902 [22,10-22,91]
3
Ø.703-.709 [17,86-18,00]
Ø.630-.634 [16,01-16,10]
2
Ø.273-.275 REF [6,94-6,98]
.0700-.0810 [1,778-2,057]
.197 MIN [5]
M29 X 1.5-6G THREAD PER ST-300-4

Figure 16 - DIN-Female Interface Drawing

1.3.8 PiMPro Basic Accessory Kit (PP-B-AK)

An accessory kit (CCI PN# PiMPro-AK) for the CCI PiMPro PIM Analyzer (**figure 17**) is available for purchase. This accessory kit contains the following items:

A) Qty. 1 - Low PIM High Power Termination DIN-Male and DIN-Female (2 connectors on one termination)
→ ***Rated at 80 Watts for a 10 minute period; Rated PIM ≤ -168 dBc***
(Model Number PP-AK-LOAD)
B) Qty. 1 - Low PIM DIN-Male to DIN-Male Adapter (Model Number PP-AK- DMDM)
C) Qty. 1 - Low PIM DIN-Female to DIN-Female Adapter (Model Number PP-AK-DFDF)
D) Qty. 1 – Q-Tips/Alcohol Swabs (Pkg.) (Model Number PP-AK-ALCH)
E) Qty. 1 - 32 mm Break Over Open End Torque Wrench (14 ft-lbs)
(Model Number PP-AK-TORW)
F) Qty. 1 - 8 inch Adjustable Wrench (Model Number PP-AK-ADJW)
G) Qty. 1 - Low PIM DIN-Male to DIN-Female 3 M (10 ft) Jumper Cable (Not Shown)
(Model Number PP-AK-CAB-DMDF)
H) Qty. 1 - Low PIM DIN-Male to DIN-Male 3 M (10 ft) Jumper Cable (Not Shown)
(Model Number PP-AK-CAB-DMDM)

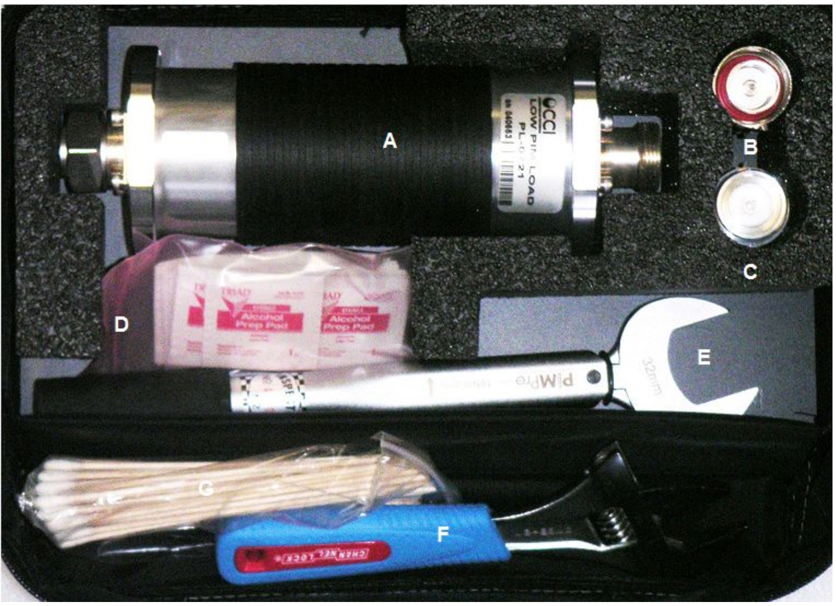


Figure 17 – PiMPro Basic Accessory Kit (PP-B-AK)

1.3.9 Equipment Changes

CCI reserves the right to make changes to the equipment, including but not necessarily limited to component substitution and circuitry changes. Changes that impact this manual may subsequently be incorporated in a later revision of this manual.

2 Safety

2.1 Safety Instructions

This section illustrates the systems used for presenting safety information.

Note: Reduce the risk of accidents by studying all of the instructions carefully before starting work. If questions arise regarding the safety instructions, contact your supervisor or CCI Technical Support (information below).

Where local regulations exist, these are to be followed first. The safety information in this manual is a supplement to local regulations.

It is your responsibility to make certain that local regulations are known and followed.

This manual including safety information and specific instructions supplied by CCI personnel must be followed in any work performed on these products. A sufficient knowledge of English or any other languages in which the manuals or instructions are printed is required.

The safety information in this manual presupposes that any person performing work on CCI products or systems has the necessary education, training, and competence required to perform that work correctly. For certain work, additional training may be required.

2.2 Warnings

Warnings are used to indicate hazardous activities. The warnings are preceded by the common hazard symbol.

⚠

Hazard Symbol

Danger

⚠

Danger means that an accident may occur if the safety precautions are neglected. This type of accident is likely to be fatal.

Warning

⚠

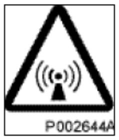
Warning means that an accident may occur if the safety precautions are neglected. This type of accident may be fatal or cause serious injury. Product damage can occur.

Caution

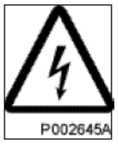
⚠

Caution means that an accident may occur if the safety precautions are neglected. This type of accident may cause serious injury. Product damage can occur.

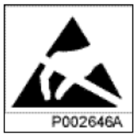
The following special symbols are used to indicate the risk of radio frequency radiation, electrical hazards, and ESD:



Radio frequency radiation



Electrical hazard



Electrostatic discharge

Warnings are used throughout this manual to alert the reader to special instructions concerning a particular task or operation that may be hazardous if performed incorrectly or carelessly. Therefore, read the instructions carefully.
Strict compliance with the special instructions while performing a task is the best way to prevent accidents.

2.3 Electrical Hazards

High Voltage

Danger

High Voltage is used in the operation of this equipment. Either direct contact with the mains power or indirect contact via dampness or collected moisture can be harmful and/or fatal

The A.C. Installation must be carried out according to local regulations. These regulations may require the work to be carried out by a qualified and authorized electrician.

Remove metal objects from your person that may come in contact with the equipment.
Switch off power if the equipment becomes wet or damp.
Prevent damp or water from entering the equipment in bad weather.

Electrical

Danger

Improper electrical installation may cause fire or electrical shock. Approved circuit breakers for the AC mains and the cable's cross sectional areas must always be selected in accordance with local laws and regulations. Only a qualified and authorized electrician is permitted to install or modify the electrical installation.

Cable marking – Verify cable markings correspond before connecting cables

2.4 ESD

Caution

Sensitive Components such as Integrated Circuits (ICs) can be damaged by discharges of static electricity

2.5 Working at Heights

Caution must be taken when working at heights installing racks. Please ensure that you are trained and have the appropriate equipment for this type of installation.

2.6 Radio Frequency Radiation

Danger

Radio Frequency Radiation (RF) from antenna systems can endanger your health

2.7 Specific Safety for the PiMPro PIM Analyzer

The CCI PiMPro PIM Analyzer shall always be terminated with a "High Power Low PIM Load" connected either to its RF Output connector or at the end of a Device Under Test (DUT) which is connected between the CCI PiMPro PIM Analyzer and he Low PIM Load. If the PiMPro is not properly terminated, dangerous RF Radiation will be present when the unit is turned on. Additionally, the PiMPro can malfunction due to the possibility that the High Power RF can be reflected back into the PiMPro itself.

2.8 RF, Interference & Grounding Protection

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3 PiMPro Operation

3.1 Turn-On PiMPro PIM Analyzer

To start the CCI PiMPro PIM Analyzer, plug in the CCI PiMPro PIM Analyzer to an AC source (120 or 220 VAC). Turn on the power switch on the side of the unit. The PiMPro will initially show PiMPro Loading… window (see **figure 18**) for approximately 30 seconds. If required the user can tap the touch-screen 3X (or more) while the PiMPro Loading… screen is visible to access the Touch-Screen Calibration routine. This function is useful in case the touch-screen has become unusable during normal operation. Once the PiMPro has completed its start up cycle the Main Menu window (see **figure 19)** opens. ***Note: Only perform testing with the PiMPro if both fans are operating!***

Note: Do not perform any PIM Measurement until the PiMPro has warmed up for a minimum of 30 minutes!

On this menu the following items appear (with a brief description herein):

1) PIM and Return Loss - for setting up “Real Time measurements” of PIM and Return Loss including access to *F1/F2 Power, F1 & F2 Frequency, IM Order # @ IM Frequency* to be tested*, Record Reading, Report Menu, Calibrate, Load/Save Menu* and *Exit*
2) PIM vs. Time - for setting up a “PIM vs. Time” plot *including access to F1/F2 Power, F1 & F2 Frequency, IM Order # to be tested, Report Menu, Start Plot, Report Plot, Load/Save Setup and Exit*
3) RX Interference - Amps “OFF” check of the appropriate RX Band.
4) Frequency Sweep - Holds the 1st TX tone (f1) steady and changes frequency of the 2nd test tone (f2), and then it reverses (holding the 2nd TX tone (f2) steady and changes the frequency of the 1st TX tone (f1)).
5) DAS Test – Special DAS Test that is performed at a lower output level (i.e. between +20 dBm (100 mW) and +27 dBm (500 mW)) for extended periods of time (i.e. 15 to 240 minutes).
6) Manage Reports - Access to *Local Drive or USB Memory, Saved Files, View Report, Copy Report, Rename Report, Delete Report and Exit.*
7) Manage Resources – Indication of memory usage and Bulk Copy, Bulk Clear and Bulk Delete of Old S/W Versions.
8) Configure System - Access to System Level Settings *for setting Date & Time, Audio Settings, RF Power On Timer, Manage Labels, About, IP Settings, Licenses and Exit*
9) Quick Start Guide - A Quick Start Guide (QSG) is loaded on the PiMPro PIM Analyzer.

PiMPro
PRECISION PASSIVE INTERMOD ANALYZER
LOADING.........

Figure 18 - Initial Window indicating Loading of PiMPro S/W

3.1 Starting the PiMPro (Cont.)

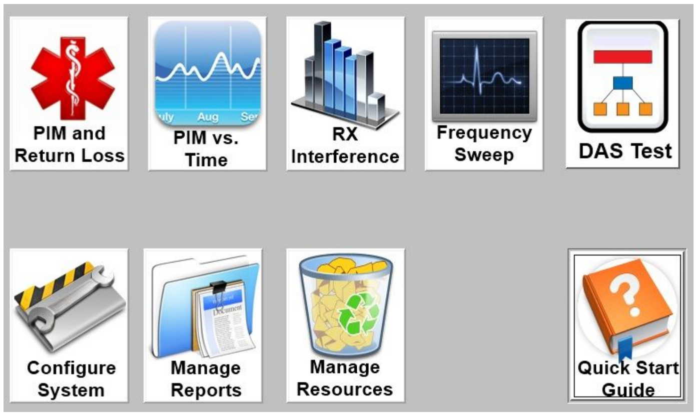

PIM and
Return Loss
PIM vs.
Time
RX
Interference
Frequency
Sweep
DAS Test
Configure
System
Manage
Reports
Manage
Resources
Quick Start
Guide

Figure 19 - *Main Menu* Screen

3.1.1 *Quick Start Guide*

If you are unfamiliar with the PiMPro and have not been through PiMPro training, this guide can be viewed directly from the touch-screen by depressing the *Quick Start Guide* icon on the Main Menu.

3.1.2 PIM and Return Loss *PIM and Return Loss* **Icon**

Press the ***PIM and Return Loss*** icon found in the ***Main Menu*** screen shown in **Figure 19**. This will open the ***PIM and Return Loss*** screen as shown in **Figure 20** below. A listing of the available or viewable items on this screen and a brief description follow:

1) **IM Bar Chart** - indicates upper, pass, fail and lower IM limits. *Access to modify the IM limits is available by depressing the IM Bar Chart on the touch-screen. This opens up the "Configure Meter" menu.*
2) **IM Value** - indicates the IM Order # (for IM Order # selected) value (reading) in either dBm or dBc by alternately touching the screen in the area of the IM Value. *Note that this measurement is performed in "**real time**" and is "**not averaged**" while RF Power is applied.*
3) **RF Off/On Icon** - the green icon (shows the text "**TX OFF**" just to the left of the icon). This icon becomes red when depressed (turns on the RF Output Power at the appropriate TX frequencies and the associated text changes to "**TX ON**").
4) **Return Loss Value** - indicates the Return Loss value in dB while being measured and continues to show the last value after a measurement has been performed.
5) **F1/F2 Power Level** - indicates the power level for the F1 & F2 RF Signal
6) **F1 & F2 Frequencies** - indicates the F1 & F2 frequencies
7) **Record Reading** - Temporarily saves the recorded data or chart into a report until the user decides to save the report.
8) **Report Menu** - shows the report in its present state and offers menu icons for other report related information
9) **Calibrate** - performs a calibration of the RF power level and signal frequencies
10) **Load/Save Setup** - indicates the "setups" available in either the "Local Drive" or the "USB memory," and offers other load/save menu options
11) **Exit** - allows for return to the previous (original) menu

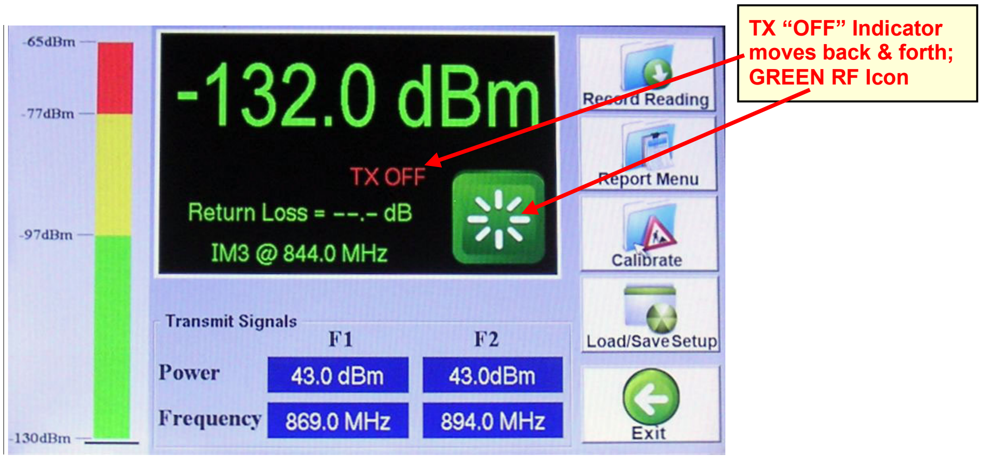

-65dBm
-77dBm
-97dBm
-130dBm
-132.0 dBm
TX OFF
Return Loss = --.- dB
IM3 @ 844.0 MHz
Transmit Signals
F1
F2
Power
43.0 dBm
43.0dBm
Frequency
869.0 MHz
894.0 MHz
Record Reading
Report Menu
Calibrate
Load/Save Setup
Exit
TX "OFF" Indicator moves back & forth; GREEN RF Icon

Figure 20 - *PIM and Return Loss* Window with "TX OFF"

3.1.2.1 Calibrate the PiMPro

Calibration ensures that the PiMPro is generating the right transmit tones at the desired power levels to ensure an accurate PIM measurement. We recommend that you always calibrate the PiMPro before you take your first measurement (this is done automatically by the software in case you forget). We also recommend that you occasionally re-calibrate the PiMPro as you are conducting various PIM tests throughout the day. ***Note: Only perform testing with the PiMPro TX signals "ON" if the output is "loaded" (i.e. a Low PIM Load is last item in line, except when testing Feed-Lines to the Antenna)!***

3.1.2.1.1 Power Level and Frequency

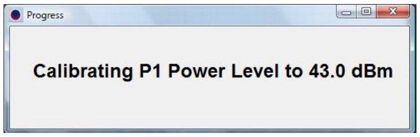
In this example it is assumed that the user will allow PIM testing to be performed at the standard RF Output Power Levels (+43 dBm (20 Watts)) and standard f_1/f_2 test tone frequencies (869.0 MHz and 894.0 MHz - *for the 850 MHz CCI PiMPro PIM Analyzer*).

3.1.2.1.2 Connect the PiMPro to a High Power Termination

The PiMPro Accessory Kit (CCI PN# PiMPro-AK) provides a Low-PIM High-Power Termination and a calibrated Torque Wrench for PIM measurement and calibration purposes. Connect the Low-PIM High-Power Termination to the RF Output of the CCI PiMPro PIM Analyzer. Ensure that the connectors are all "clean" prior to making the connections. Hand-tighten all connectors while ensuring that the connectors are not misaligned. Once the connectors are hand-tightened, use the Torque Wrench to tighten the connectors.

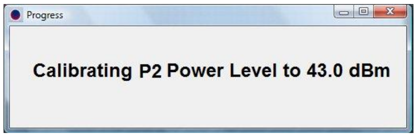
3.1.2.1.3 Calibrate Select the ***Calibrate*** Icon

Press the ***Calibrate*** icon in the ***PIM and Return Loss*** screen shown in **Figure 20**. The CCI PiMPro PIM Analyzer will begin to perform the calibration of the P1 & P2 RF Output Power, and the f_1/f_2 test tone frequencies. The pop-up windows that appear while the PiMPro performs a calibration of RF Outputs P1 and P2 are shown in **figures 21 & 22**. *Note: As the PiMPro is performing its calibration the RF Output Power will be swept from 2 to 20 Watts. This will be performed unless the user manually changes the output power level to 40 Watts prior to performing the calibration. Also note that the output power is swept to ensure a better than ± 0.35 dB accuracy.*



Calibrating P1 Power Level to 43.0 dBm

Figure 21 - P1 Calibration Pop-up Window

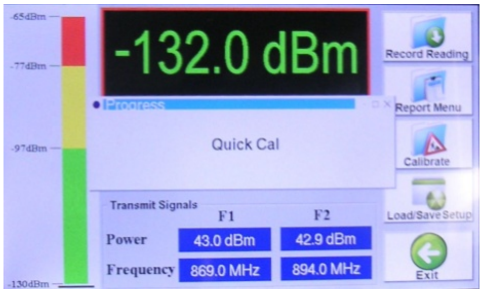


Calibrating P2 Power Level to 43.0 dBm

Figure 22 - P2 Calibration Pop-up Window

3.1.2.1.4 *Quick Cal*

In the *PIM & RL* menu, after turning on the power to begin a measurement, you may encounter an occasional popup window (see **Figure 23**) that indicates that a *"Quick Cal"* is being performed. *"Quick Cal"* is a fine tuning of the power output that occurs very quickly to ensure that the PiMPro is delivering accurate TX power and making high precision PIM measurements.


-65dBm
-77dBm
-97dBm
-130dBm
-132.0 dBm
Progress
Quick Cal
Record Reading
Report Menu
Calibrate
Load/Save Setup
Exit

Transmit Signals

	F1	F2
Power	43.0 dBm	42.9 dBm
Frequency	869.0 MHz	894.0 MHz

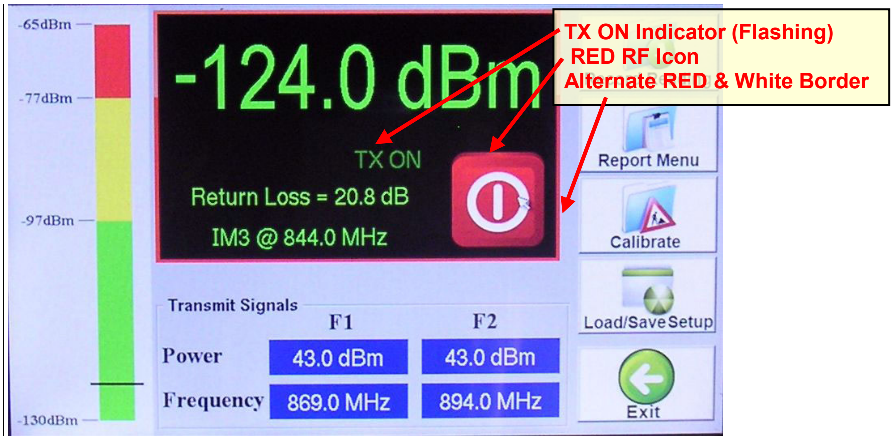
Figure 23 - *Quick Cal* Pop-up Window

3.1.2.2 Connect PiMPro to Feeder Line to be Tested

Loosen and disconnect the Low PIM High Power Termination. Connect the RF Cable (System, Feeder or other) to be tested to the RF Output of the CCI PiMPro Analyzer. Ensure that the connectors are all "clean" prior to making the connections. Hand-tighten all connectors while ensuring the connectors are not misaligned. Once the connectors are hand-tightened, use the CCI-supplied Torque Wrench to tighten the connectors.

3.1.2.3 Turn On RF Output

Press the GREEN RF icon as shown in **Figure 20** to turn on the RF Output Power. The RF Indicator text will change to ***"TX ON"*** and will begin flashing in green as shown in **Figure 24** below. The RF icon will turn ***RED*** to enable you to turn off the RF when desired. Additionally, an alternating ***RED*** and ***WHITE*** border will appear around the "measurement" portion of the screen.


-65dBm
-77dBm
-97dBm
-130dBm
-124.0 dBm
TX ON
Report Menu
Calibrate
Load/Save Setup
Exit

Return Loss = 20.8 dB
IM3 @ 844.0 MHz

Transmit Signals

	F1	F2
Power	43.0 dBm	43.0 dBm
Frequency	869.0 MHz	894.0 MHz

TX ON Indicator (Flashing)
RED RF Icon
Alternate RED & White Border

Figure 24 – *PIM and Return Loss* Window with "TX ON"

3.1.2.3.1 PIM Verification (if Required)

If the PIM measurement is ever in question the “Unit Under Test” (UUT) can be disconnected, after insuring that the PiMPro is turned “OFF.” At this time the connections to the UUT can be disconnected. Insure that the connectors from the removed UUT and any cables are “clean.” The PIM Standard can now be placed on the RF output connector of the PiMPro PIM Analyzer after also insuring that it is “clean” and free of any debris. Place the High Power Low PIM Load on the PIM Standard and hand tighten the Load. Once the PIM Standard and Low PIM Load are hand tightened and torqued to the proper value with the supplied torque wrench the PiMPro can be turned “ON” and the PIM reading can be taken. The PIM value read on the touch screen display should be reasonably close to the PIM value that the known PIM Standard is supposed to produce.

3.1.2.3.2 Return Loss (R_L) Verification (if Required)

If the R_L measurement is ever in question the “Unit Under Test” (UUT) can be disconnected, after insuring that the PiMPro is turned “OFF.” At this time the connections to the UUT can be disconnected. Insure that the connectors from the removed UUT and any cables are “clean.” A high power attenuator (with DIN 7/16 connectors) can now be placed on the RF output connector of the PiMPro PIM Analyzer after also insuring that it is “clean” and free of any debris. Once the high power attenuator is hand tightened and torque to the proper value with the supplied torque wrench the PiMPro can be turned “ON” and the R_L reading can be taken. The R_L value read on the touch screen display should be double the attenuation value of the high power attenuator, as the RL is affected by the attenuation in both the forward and reverse (reflected) directions.

3.1.2.4 Record Reading Record Measurement

The PiMPro PIM Analyzer will display the current PIM and Return Loss readings of the feeder or device it is connected to. When you are ready to record the reading being displayed (Note: the PIM readings should be stable before recording the measurement – consult the PiMPro User Manual for more detailed information) press the ***Record Reading*** icon on the ***PIM and Return Loss*** screen. ***Data can (should) only be recorded when the Transmit RF Power is “ON.” Note: Pressing the Record Reading does not save the report.***

3.1.2.5 Enter Site Information

“When the ***Record Reading*** icon is depressed, the ***Site Information*** Screen opens as depicted in **Figure 25**. Enter information on the Operator (i.e. AT&T, Verizon, T-Mobile, Sprint, etc.) and the Site Number. Also, enter your initials into the Technician field. Pressing the bar on the right side of each field will bring up the ***Keyboard Entry*** Screen depicted in **Figure 26** which will allow you to enter the desired information. When you have finished entering the required site information, press the ***OK*** Icon. See **figure 27** for an example of the display after Operator, Site # and Technician information has been entered and prior to pressing the ***OK*** Icon.

3.1.2.5 Turn On RF Output (Cont.)

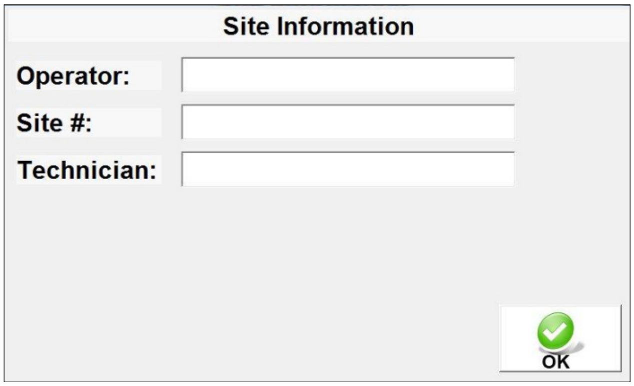

Site Information
Operator:
Site #:
Technician:
OK

Figure 25 - ***Site Information*** **Window**

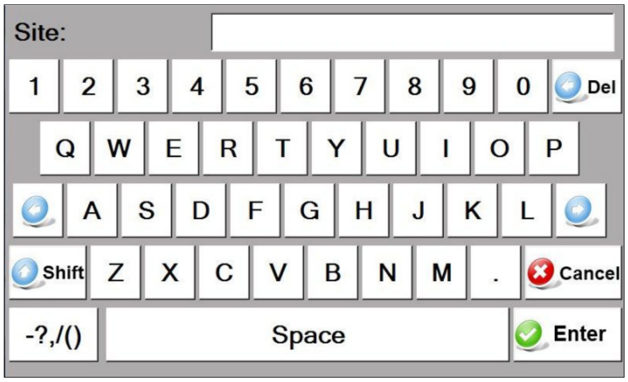
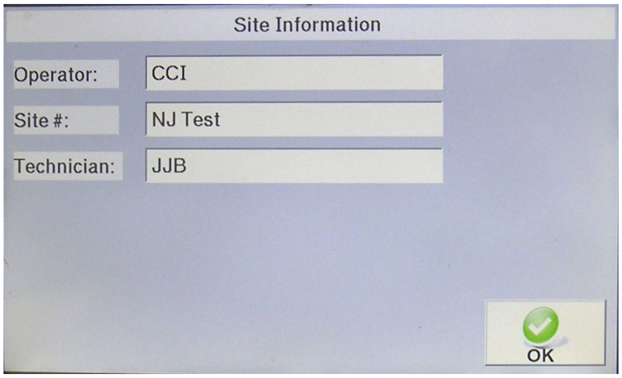

Site:
1 2 3 4 5 6 7 8 9 0 Del
Q W E R T Y U I O P
A S D F G H J K L
Shift Z X C V B N M . Cancel
-?,/() Space Enter

Figure 26- ***Keyboard Entry*** **Screen**


Site Information
OK

Operator: CCI
Site #: NJ Test
Technician: JJB

Figure 27 - ***Site Information*** **Screen after Data Entry**

3.1.2.6 Enter *Sector/Feeder Information*

After completing the Site Information above, the ***Sector/Feeder Information*** Screen is displayed as depicted in **Figure 28** below. Depress the bar to the right hand side of each field to enter the Sector and the Feeder information. Once the information has been entered, press the *OK* icon at the bottom of the screen. Note that the Site and Sector/Feeder Information are required only on the first PIM measurement. Subsequent PIM measurements do not require re-entry of this information. See **figure 29** for an example of the display after Sector, and Feeder information has been entered and prior to pressing the *OK* Icon.

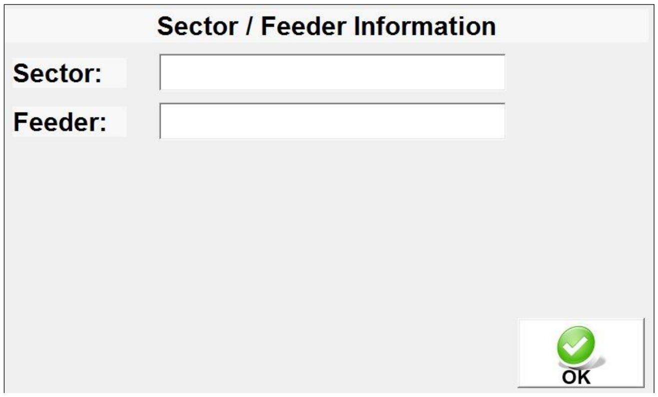
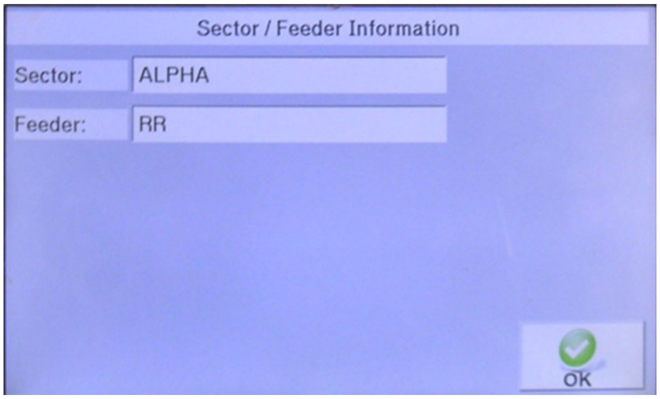


Figure 28 - *Sector/Feeder Information* Screen



Sector: ALPHA
Feeder: RR

Figure 29 - *Sector/Feeder Information* Screen after Data Entry

3.1.2.7 *Select Label* Menu

Once the ***Site Information*** and ***Sector/Feeder Information*** data entry has been completed, the ***Select Label*** Pop-up window is displayed as shown in **Figure 30**. The PiMPro PIM Analyzer provides an extensive list of default labels that describe typical measurement points at most cell sites. Select the label that best matches your measurement point.

The “Pre-Loaded” Labels include items from the following list:

1) NONE
2) PIM LOAD
3) PIM STANDARD
4) BTS to Ant (SYS)
5) BTS to Ant Jumper Out
6) BTS to Diplexer/TMA Out
7) BTS to Feeder Out
8) Feeder In to Ant (SYS)
9) Feeder In to Diplexer/TMA Out
10) Feeder In to Feeder Out
11) Ant Only
12) Jumper Only

If the existing labels are not appropriate the menu allows for modification of labels as deemed necessary per the appropriate “Menu” functions. The “Menu” icons available are described in the paragraphs below, and include the following:

1) New Sector/Feeder
2) Add Label
3) Cancel Reading
4) OK

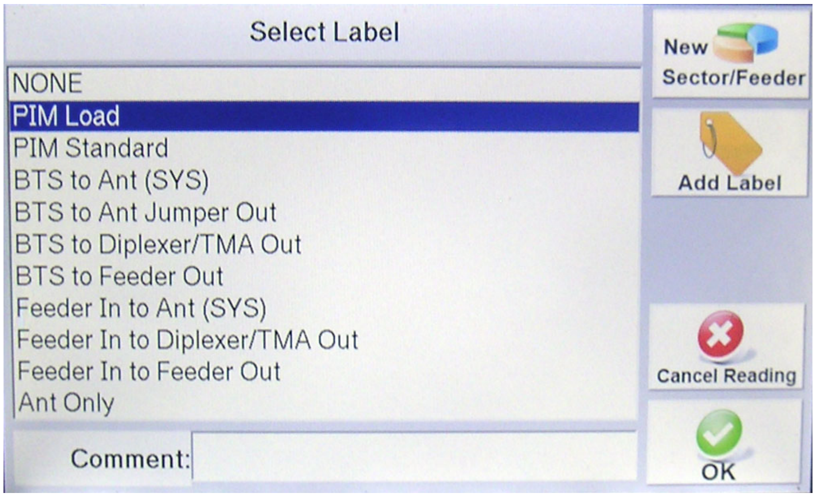

Select Label
NONE
PIM Load
PIM Standard
BTS to Ant (SYS)
BTS to Ant Jumper Out
BTS to Diplexer/TMA Out
BTS to Feeder Out
Feeder In to Ant (SYS)
Feeder In to Diplexer/TMA Out
Feeder In to Feeder Out
Ant Only
Comment:
New Sector/Feeder
Add Label
Cancel Reading
OK

Figure 30 - *Select Label* Pop-up Window

3.1.2.7.1 Comment

The ***Comment*** bar allows for extra information to be added to further update whatever information the "User" feels is necessary. Pressing the comment bar will open the ***Keyboard Entry*** Screen. For instance, the comment can indicate that this is a "return to the site..." for retest after cable or component replacement has been performed. See **figure 26** above for an example of ***Keyboard Entry*** Screen.

3.1.2.7.2 New Sector/Feeder

New Sector/Feeder

Press the ***New Sector/Feeder*** icon if it is desired to perform PIM testing on a new sector, or a new feeder within the same sector. This opens the ***Sector/Feeder Information*** Screen. See **paragraph 3.1.2.6** above for details.

3.1.2.7.3 Add Label

Add Label

Press the ***Add Label*** icon if a brand new label is required. The ***Keyboard Entry*** Screen will appear on the touch screen and the new label name that is desired can be entered.

3.1.2.7.4 Cancel Reading

Cancel Reading

Press the ***Cancel Reading*** icon if the user has inadvertently pressed the ***Record Reading*** icon (i.e. the user was not prepared to take a reading at that time) in the ***PIM & RL*** window.

3.1.2.7.5 OK

OK

When the select label process is complete, depress the ***OK*** icon to return to the ***PIM and Return Loss*** (real time measurement) screen.

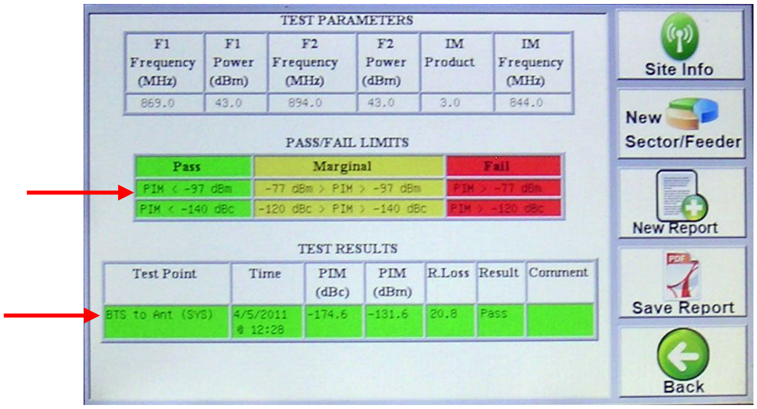
3.1.2.8 Report Menu Report Menu

The PIM measurements taken thus far can be viewed at any time and a report can be created by pressing the ***Report Menu*** icon on the ***PIM and Return Loss*** screen. This action brings up the ***Test Report*** Screen shown in **Figures 31-32** below. The Report Menu also allows for other menu-type functions to be performed. These functions include the following:

1) Site Info.
2) New Sector/Feeder
3) New Report
4) Save Report
5) Back

3.1.2.8.1 Viewing the Test Report

The test report that appears on the touch screen can be "scrolled" up or down by dragging your finger up or down on the screen. *Please note that when the Test Report is opened it always starts at the last test performed (bottom of the report), and can be scrolled up to see previous tests or Site and Sector/Feeder information.* You will notice the test report will contain the factory default test parameters and pass/fail limit points (in both dBm and dBc units) and the test results (if this was the last test performed) in **figure 30**. *Note: The PiMPro Users Guide provides detailed information on how to change these factory default parameters.*



TEST PARAMETERS

F1 Frequency (MHz)	F1 Power (dBm)	F2 Frequency (MHz)	F2 Power (dBm)	IM Product	IM Frequency (MHz)
869.0	43.0	894.0	43.0	3.0	844.0

PASS/FAIL LIMITS

Pass	Marginal	Fail
PIM < -97 dBm	-77 dBm > PIM > -97 dBm	PIM > -77 dBm
PIM < -140 dBc	-120 dBc > PIM > -140 dBc	PIM > -120 dBc

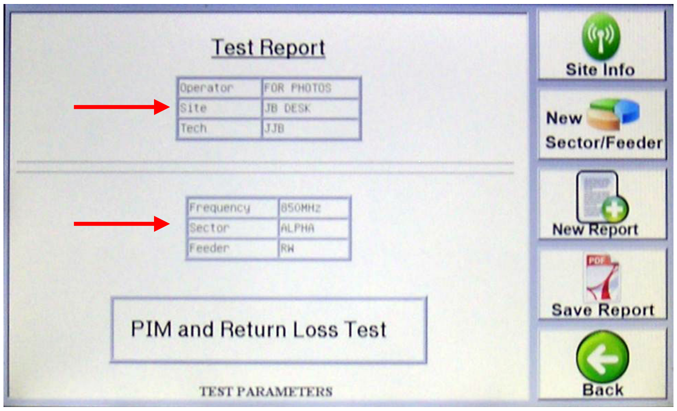
TEST RESULTS

Test Point	Time	PIM (dBc)	PIM (dBm)	R.Loss	Result	Comment
BTS to Ant (SYS)	4/5/2011 @ 12:28	-174.6	-131.6	20.8	Pass	

Figure 31 - Test Report Screen (Pass/Fail Limits and Test Results)

Scrolling up, the Site Information and the Sector/Feeder Information that were entered in **steps 3.1.2.5 and 3.1.2.6** displayed at the top of the test report (See **figure 32**).

3.1.2.8.1 Viewing the Test Report (Cont.)



Test Report

Operator	FOR PHOTOS
Site	JB DESK
Tech	JJB

Frequency	850MHz
Sector	ALPHA
Feeder	RH

PIM and Return Loss Test

TEST PARAMETERS

Figure 32 - Test Report Screen (Site and Sector Info)

3.1.2.8.2 Site Info

Site Info

Depressing the ***Site Info*** icon opens up the ***Site Information*** window described in **paragraph 3.1.2.5** and gives access to the Operator, Site # and Technician as described above.

3.1.2.8.3 New Sector/Feeder

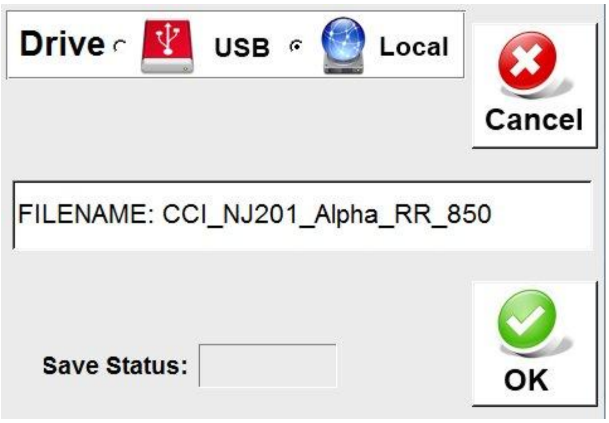
New Sector/Feeder

Depressing the ***New Sector/Feeder*** icon opens up the ***Sector/Feeder Information*** window described in **paragraph 3.1.2.6** and gives access to the Sector, and Feeder as described above.

3.1.2.8.4 New Report

New Report

If a New test report as displayed is required, it can be saved by pressing the ***New Report*** icon. This action opens the ***Save Report*** pop-up window as shown in **Figure 33** below. The report can be saved to either the **Local Drive** Local Drive or the **USB Drive** USB by selecting the appropriate icon. The file name for the report is automatically generated by the PiMPro Analyzer but can be changed by tapping on the File Name bar. This action will bring up the ***Keyboard Entry*** Screen which will allow you to override or modify the default file name. This automatically generated file name is created by the PiMPro Analyzer as a concatenation of the Operator, Site # and Sector information that was previously entered. Press the ***OK*** icon to save the report. *The "suggested" filename no longer contains the sector information. Please note that special characters are not allowed.*



FILENAME: CCI_NJ201_Alpha_RR_850

Figure 33 - ***Save Report*** **Screen**

3.1.2.8.5 Save Report Saving the Test Report

If the test report as displayed is satisfactory, it can be saved by pressing the ***Save Report*** icon. This action opens the ***Save Report*** pop-up window as shown in **Figure 33** above. The report can be saved to either the **Local Drive** Local Drive or the **USB Drive** USB by selecting the appropriate icon. The file name for the report is automatically generated by the PiMPro Analyzer but can be changed by tapping on the File Name bar. This action will bring up the ***Keyboard Entry*** Screen which will allow you to override or modify the default file name. This automatically generated file name is created by the PiMPro Analyzer as a concatenation of the Operator, Site # and Sector information that was previously entered. Press the ***OK*** icon to save the report. *The "suggested" filename no longer contains the sector information. Please note that special characters are not allowed.*

Note that ***Reports are only saved when performing this action,*** *or if PiMPro has been accidentally turned off the* ***report can be saved when the "Auto Save" pop-up appears at PiMPro turn-on. Pressing the Record Reading icon does not save the report.***

3.1.2.8.6 Back Back

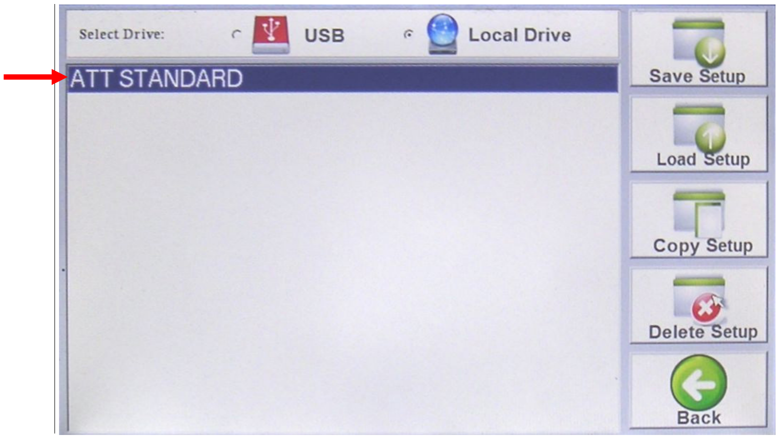
Depressing the ***Back*** icon returns the user to the ***PIM and Return Loss*** "real time measurement" window.

3.1.2.9 Load/Save Setup

Load/Save Setup

Depressing the ***Load/Save Setup*** icon on the touch screen while on the ***PIM and Return Loss*** screen display allows the user to load a previously saved setup, save a modified setup to the PiMPro PIM Analyzer and more. *Note that Load/Save Setups are a "description" of the measurement function, power levels and frequency settings for the PiMPro PIM Analyzer.* For instance if the user has a need to perform testing at 40Watts (+46 dBm) operation they could save the setup as "40Watts." However, as most testing is performed at 20 Watts (+43 dBm) the user could save the setup as "20Watts." Similarly, if the user has a special condition to test at frequencies, power levels, IM Products different from the "standard" settings they can save this as a setup to the PiMPro PIM Analyzer Local Drive **Local Drive** and/or to USB the **USB Drive** . The options available on the ***Load/Save Setup*** Window Menu (see **figure 34**) are as follows:

1) Select Drive - USB or Local Drive
2) Previously stored setups
3) Save Setup
4) Load Setup
5) Copy Setup
6) Delete Setup
7) Back


Select Drive: ○ USB ● Local Drive

ATT STANDARD

Figure 34 - *Load/Save Setup* Screen

3.1.2.9.1 Select Drive

Select Drive (found at the top of the window) allows the user to choose whether the setup to be saved, opened, copied or deleted is located (or to be located) on the **Local Drive** Local Drive or the **USB Drive** USB by depressing the touch screen next to the appropriate icon.

3.1.2.9.2 Existing Setup(s)

Existing Setups are the setups that are listed with a “filename” in the large portion of the ***Load/Save Setup Menu*** screen. These listings are located below the “Select Drive” portion of this display. The user can select the existing setup required for testing by depressing the appropriate “filename” on the touch screen.

3.1.2.9.3 Save Setup

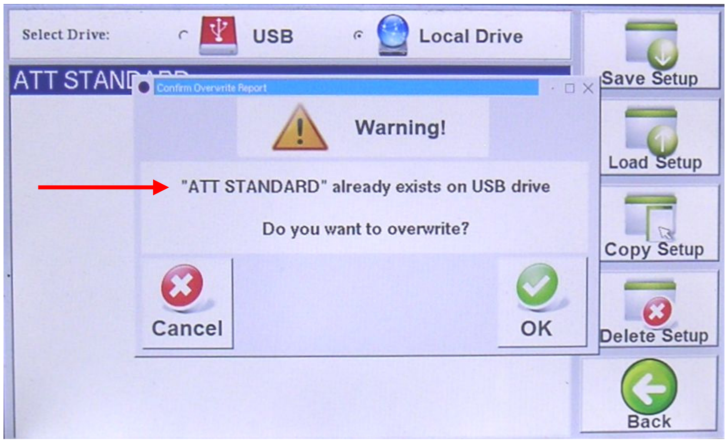
Pressing the ***Save Setup*** icon allows the user to save a setup as modified by the user on either the **Local Drive** Local Drive or the **USB Drive** USB .

3.1.2.9.4 Load Setup

Pressing the ***Load Setup*** icon allows the user to select the setup that is desired for use in ***PIM and Return Loss*** (real time measurement) testing by highlighting the applicable setup name on the touch screen display. When the ***Load Setup*** icon is depressed, the ***PIM and Return Loss*** window will display on the touch screen and details within the window will indicate the setup chosen including any “special” conditions.

3.1.2.9.5 Copy Setup

Pressing the ***Copy Setup*** icon allows the user to copy the desired setup to/from the Local Drive/USB Drive as desired. In this manner a “special setup” can be setup on one PiMPro PIM Analyzer and then copied to the USB Drive. The user can then bring the USB Drive to all other PiMPro PIM Analyzers in the field and copy this setup to the other analyzers. In this manner all testing can be performed with the “same” conditions between all users in any region. *Please note: A warning will appear if the user attempts to copy the setup from/to the same location. The warning given is* ***“Warning! “Filename” already exists on “Local Drive” or “USB Drive” Do you want to overwrite?”*** See **figure 35** for an example of this warning.



Warning!

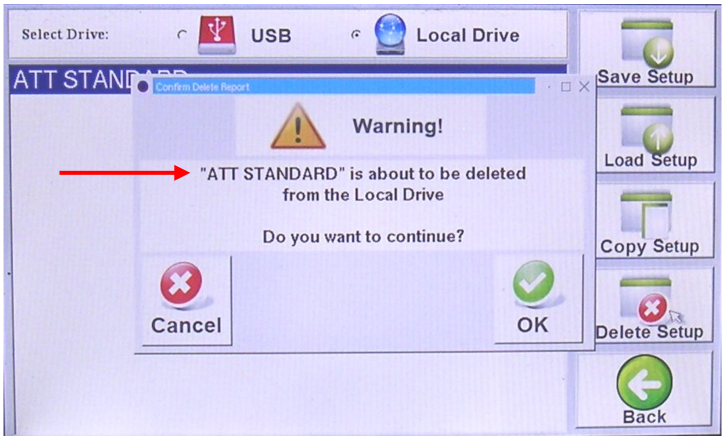
"ATT STANDARD" already exists on USB drive

Do you want to overwrite?

Figure 35 - “Copy” Warning Message Window

3.1.2.9.6 Delete Setup

Pressing the ***Delete Setup*** icon allows the user to delete an unwanted setup. For instance if a special setup was created for use in a specific region and for a specific "Operator" and the user has traveled to a different region or is performing testing for a different "Operator" the previously valid setup could be deleted so that it is not accidentally used in the new situation. *Please note that a warning message will appear the setups "**Warning! "Filename" is about to be deleted from the "Local Drive" or "USB Drive" Do you want to continue?"*** See **figure 36** for an example of this warning.


Select Drive:
○ USB
● Local Drive
ATT STANDARD
Confirm Delete Report
Save Setup
Load Setup
Copy Setup
Delete Setup
Cancel
OK
Back

Warning!

"ATT STANDARD" is about to be deleted from the Local Drive

Do you want to continue?

Figure 36 - "Delete" Warning Message Window

3.1.2.9.7 Back

Pressing the ***Back*** icon returns the user to the ***PIM and Return Loss*** (real time measurement) window.

3.1.2.10 IM Pass/Fail Bar Chart

Depressing the **IM Pass/Fail Bar Chart** on the ***PIM and Return Loss*** (real time measurement) window will open the ***Configure Meter*** pop-up window (see **figure 37**) on the touch screen. ***Configure meter*** allows the user to set different IM Pass/Fail limits.

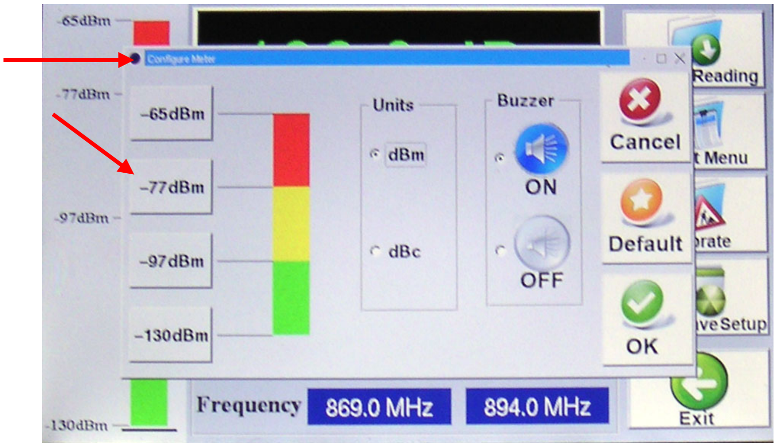

-65dBm
-77dBm
-97dBm
-130dBm
Configure Meter
-65dBm
-77dBm
-97dBm
-130dBm
Units
dBm
dBc
Buzzer
ON
OFF
Cancel
Default
OK
Reading
t Menu
rate
ve Setup
Exit
Frequency
869.0 MHz
894.0 MHz

Figure 37 - *Configure Meter* Window

3.1.2.10.1 Configure Meter Window

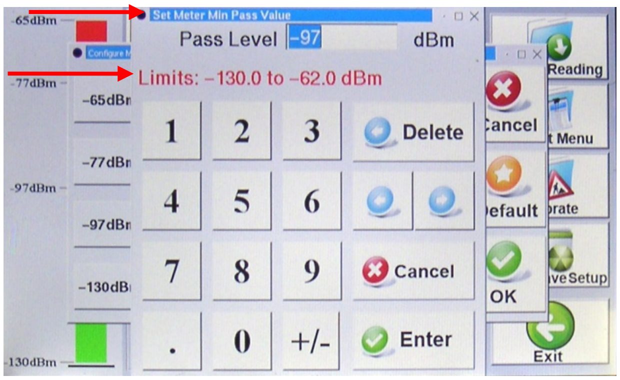
The ***Configure Meter*** pop-up window allows the following items to be modified or actions to be performed:

1) Min, Pass, Fail and Max IM Level Settings
2) Buzzer On / Buzzer Off
3) Cancel
4) Default
5) OK

3.1.2.10.2 Min, Pass, Fail and Max IM Level Setting

If the “Default” IM Levels are not appropriate for the testing to be performed the IM Levels can be modified. Depressing any of the IM Level (Min, Pass, Fail or Max) Setting icons opens a ***Set Meter*** pop-up window similar to the one shown in **figure 38**. Each of the ***Set Meter*** pop-up windows has a keypad that looks like a calculator and allows for entry of the appropriate limit in dBm. *Note that the display screen includes an indication of applicable power limits (-130.0 dBm to -62.0 dBm).* Each window will have a title as follows:

1) Set Meter Min Value
2) Set Meter Min Pass Value
3) Set Meter Max Fail Value
4) Set Meter Max Value


Set Meter Min Pass Value

Pass Level -97 dBm

Limits: –130.0 to –62.0 dBm

Figure 38 - “Set Meter Min Pass Value” Window

3.1.2.10.3 Buzzer On/Off

ON OFF

Pressing either the ***Buzzer On*** or ***Buzzer Off*** icons shown in **figure 37** will set the PiMPro PIM Analyzer’s buzzer to on or off.

3.1.2.10.4 Cancel

Cancel

Pressing the ***Cancel*** icon shown in **figure 37** will return the user to the ***PIM and Return Loss*** (real time measurement) window.

3.1.2.10.5 Default

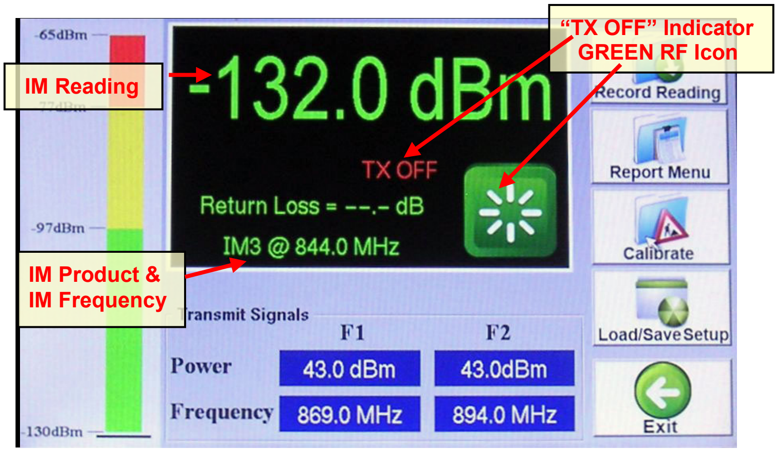
Default

Pressing the ***Default*** icon shown in **figure 37** will reset the IM Limits to the following values:

1) Min IM Value → -130 dBm
2) Min IM Pass Value → -97 dBm
3) Max IM Fail Value → -77 dBm
4) Max IM Value → -65 dBm

3.1.2.11 IM Reading

The **IM Reading** is the largest font size numeric value on the ***PIM and Return Loss*** (real time measurement) window as shown in **figure 39**. **IM Reading** can be changed from dBm to dBc (see **figure 40**) by depressing the touch screen display in the area of the **IM Reading**. *Note that IM readings are performed in the Rx Band only. Also note that when the IM reading is converted from dBm to dBc or vice versa, the IM Bar Chart also changes from dBm to dBc respectively.*


-65dBm
-77dBm
-97dBm
-130dBm
Record Reading
Report Menu
Calibrate
Load/Save Setup
Exit

IM Reading

"TX OFF" Indicator
GREEN RF Icon

IM Product &
IM Frequency

-132.0 dBm

TX OFF

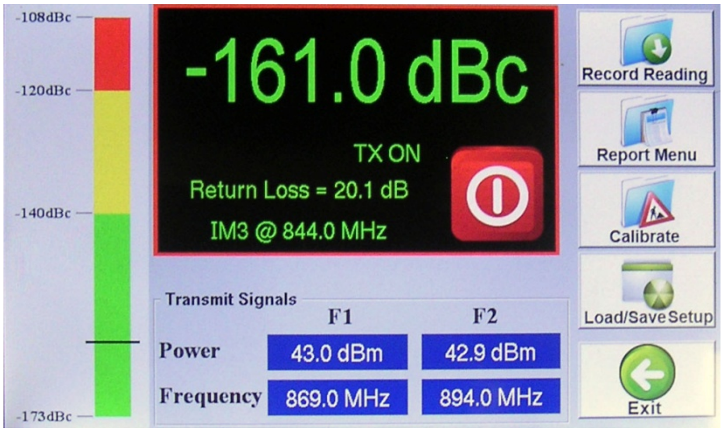
Return Loss = --.– dB

IM3 @ 844.0 MHz

Transmit Signals

	F1	F2
Power	43.0 dBm	43.0dBm
Frequency	869.0 MHz	894.0 MHz

Figure 39 - *PIM and Return Loss* Window during "TX OFF" (Reading in dBm)


-108dBc
-120dBc
-140dBc
-173dBc
Record Reading
Report Menu
Calibrate
Load/Save Setup
Exit

-161.0 dBc

TX ON

Return Loss = 20.1 dB

IM3 @ 844.0 MHz

Transmit Signals

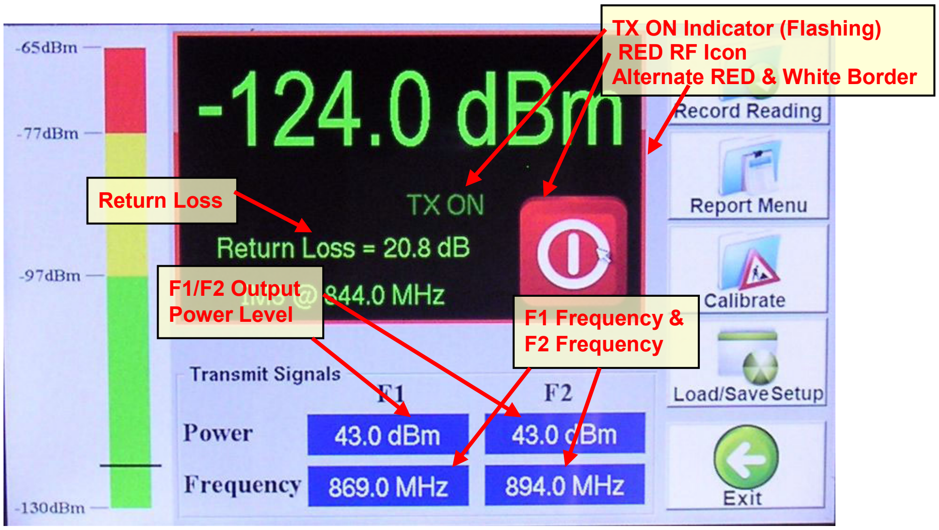
	F1	F2
Power	43.0 dBm	42.9 dBm
Frequency	869.0 MHz	894.0 MHz

Figure 40 - *PIM and Return Loss* Window during "TX ON" (Reading in dBc)

3.1.2.12 RF Off/On

When the RF is “Off” the “RF” icon appears as a large green icon with a symbol inside of the icon (that appears to be similar to an asterisk (*)) at the lower right of the black background display. Near the upper left hand corner of the “**TX OFF**” icon is red text indicating “**TX OFF**” as shown in **figure 39**.

When the RF is switched to “On” by depressing the icon the icon changes to a red color and has a circle with a vertical line in the center. Near the upper left hand corner of the “**TX ON**” icon is flashing green text indicating “**TX ON**” as shown in **figure 41**. Additionally, an alternating RED and WHITE border will appear around the “measurement” portion of the screen.



-124.0 dBm

TX ON

Return Loss = 20.8 dB

IM3 @ 844.0 MHz

	F1	F2
Power	43.0 dBm	43.0 dBm
Frequency	869.0 MHz	894.0 MHz

TX ON Indicator (Flashing)
RED RF Icon
Alternate RED & White Border

Return Loss

F1/F2 Output Power Level

F1 Frequency & F2 Frequency

Figure 41 - *PIM and Return Loss* Window during *“TX ON”*

3.1.2.13 Return Loss (R_L) Reading

The **Return Loss (R_L)** value is shown in green text in the location indicated in **figure 41**. The R_L is only available when the RF output is “ON”. *Note that Return Loss readings are performed in the Tx Band only.*

3.1.2.14 IM Product @ $f_{(\text{IM Product})}$

The **IM Product** to be measured at the calculated **IM Product Frequency** appears in white text and is in the location indicated in **figure 39**. The **IM Product** and **IM Product Frequency** will be discussed in the following paragraphs.

3.1.2.14.1 IM Select Window

Pressing the IM Product@$f_{(IM\ Product)}$ portion of the touch screen display will open up the ***IM Select*** pop-up window as seen in **figure 44** below. At this point the user can verify that the correct IM Product and IM frequency ($f_{(IM\ Product)}$) are set to be tested. If the lowest and highest Cellular TX band frequencies have been chosen as in normal (default) operation, then the IM3 block will appear green and list 844.0 MHz. IM5, IM7 and IM9 blocks will appear red and list the frequencies 819.0 MHz, 794.0 MHz and 769.0 MHz respectively. *Note that the PiMPro automatically calculates the IM3 through IM9 frequencies, and highlights with a "green" background any frequencies that fall within the Rx Band. Similarly the PiMPro highlights any frequencies that fall outside iof the RX band with a "red" background.*

3.1.2.15 F1/F2 Power Level Set Windows

Depressing the F1 or F2 Transmit Power displays where shown in **figure 39** (white text in dark blue background) opens the ***Set Tx Power Per Channel*** pop-up window. *Note that if the power levels in the blocks in **figure 39** show an asterisk (*), this indicates that a calibration has not yet been performed.* The ***Set Tx Power Per Channel*** pop-up window has a keypad that looks like a calculator and allows for entry of the appropriate limit in dBm and is shown in **figure 42**. *Note that the "**Set Tx Power Per Channel**" display screen includes an indication of applicable limits (+20.0 to +46.0 dBm, for "–LPC" labeled PiMPro's and +33.0 to + 46.0 dBm for PiMPro's not labeled with "–LPC"). Finally, note that setting either the F1 or F2 Power really sets the power for both F1 and F2 outputs.*

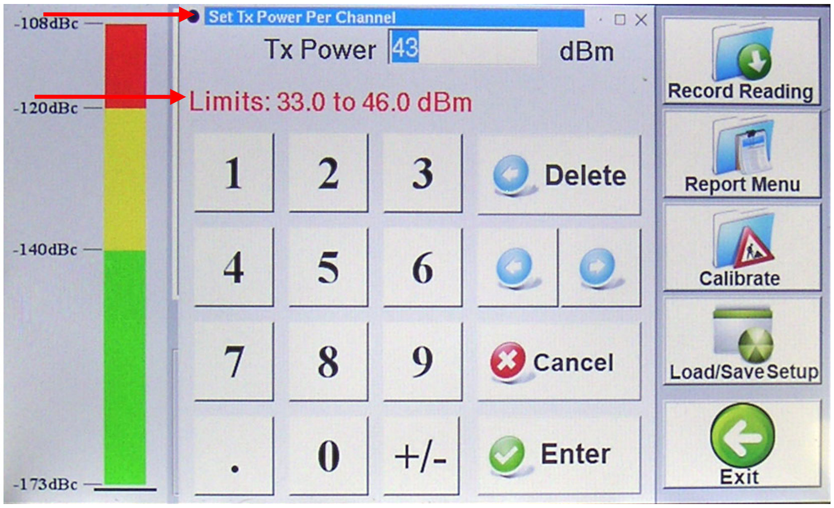


Figure 42 - *Set Tx Power Per Channel* Window

3.1.2.16 F1/F2 Frequency Set Windows

Depressing the F1 or F2 Frequency displays where shown in **figure 39** (white text in dark blue background) opens the ***Set Tone 1 Frequency*** or ***Set Tone 2 Frequency*** windows as applicable. *Note that the display screen includes an indication of applicable frequency limits (869.0 MHz to 894.0 MHz).* The ***Set Tone 1 Frequency*** and ***Set Tone 2 Frequency*** windows have a keypad that looks like a calculator and allows for entry of the appropriate frequency in MHz and is shown in **figure 43**.

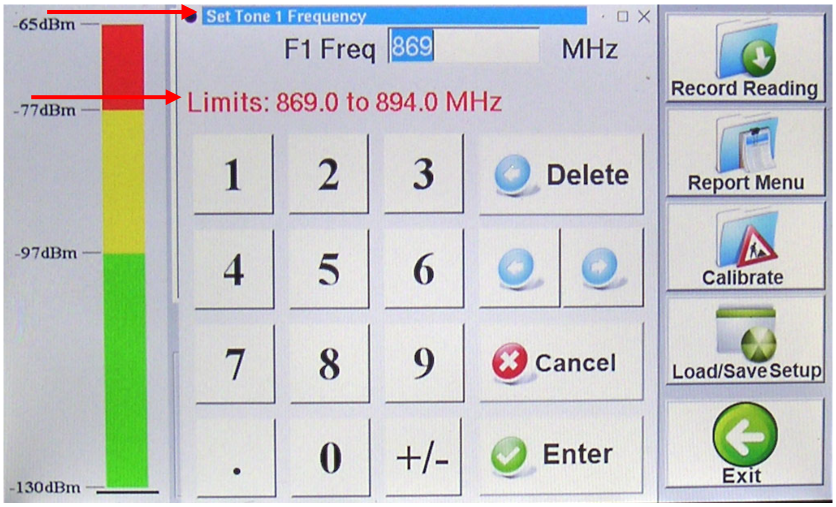
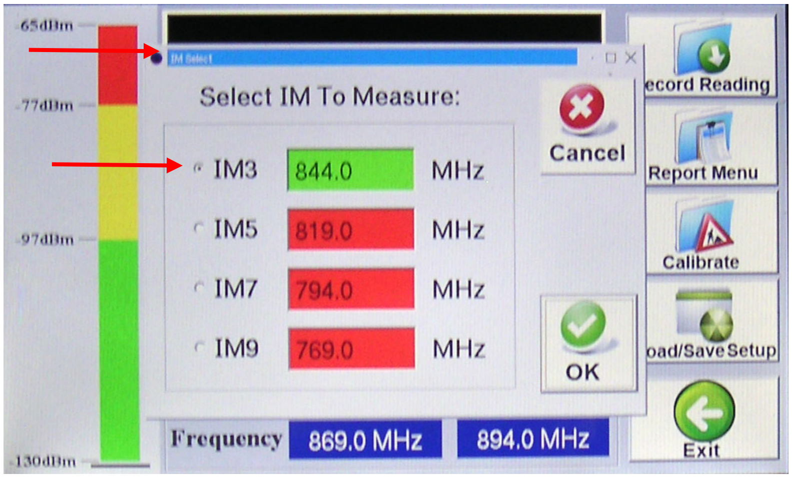


Figure 43 - *Set Tone 1 Frequency* Window

3.1.2.16.1 IM Select Window

When the ***Set Tone 1 Frequency*** or ***Set Tone 2 Frequency*** data is entered and either enter or cancel icons are depressed an ***IM Select*** pop-up window appears. This window indicates the IM3, IM5, IM7 and IM9 product frequencies that are nearest to the Rx Band. *Note that the PiMPro automatically calculates the IM3 through IM9 frequencies, and highlights with a "green" background any frequencies that fall within the Rx Band. Similarly the PiMPro highlights any frequencies that fall outside of the RX band with a "red" background.* The user can then decide which IM product frequency to perform the test on. This decision is required no matter whether there are only one or more IM product frequencies that appear in the Rx Band. The user must depress the desired IM Product frequency to perform the PIM test at. See **figure 44** for the standard IM3 frequency display when the 869.0 and 894.0 MHz Tx frequencies are used for PIM testing. See **figure 45** for the select IM screen that will show the IM5 measurement as being in the Rx band (based on F1 and F2 frequencies of 869.0 MHz and 888.0 MHz), and **figure 46** for the actual measurement screen (indicating that the measurement is being performed for IM5).

3.1.2.16.1 IM Select Window (Cont.)

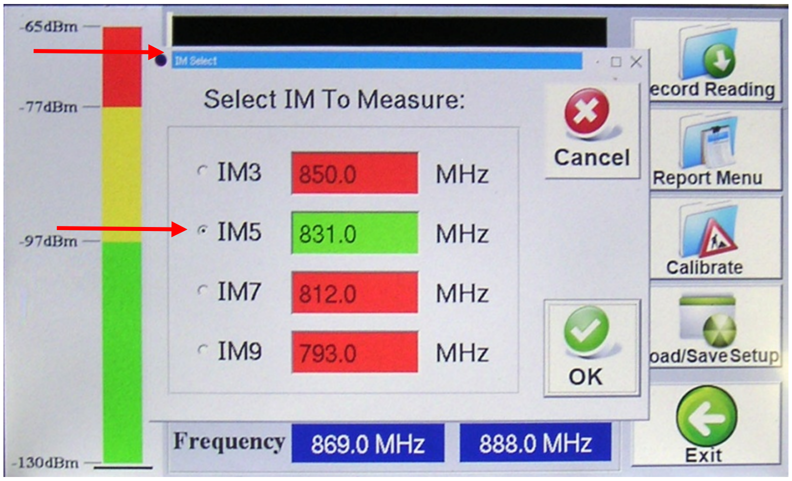

-65dBm
-77dBm
-97dBm
-130dBm
IM Select
Cancel
OK
ecord Reading
Report Menu
Calibrate
oad/Save Setup
Exit

Select IM To Measure:

● IM3 844.0 MHz
○ IM5 819.0 MHz
○ IM7 794.0 MHz
○ IM9 769.0 MHz

Frequency 869.0 MHz 894.0 MHz

Figure 44 - ***IM Select*** **Window for (IM3) @ Standard F1 = 869.0 MHz and F2 = 894.0 MHz**


-65dBm
-77dBm
-97dBm
-130dBm
IM Select
Cancel
OK
ecord Reading
Report Menu
Calibrate
oad/Save Setup
Exit

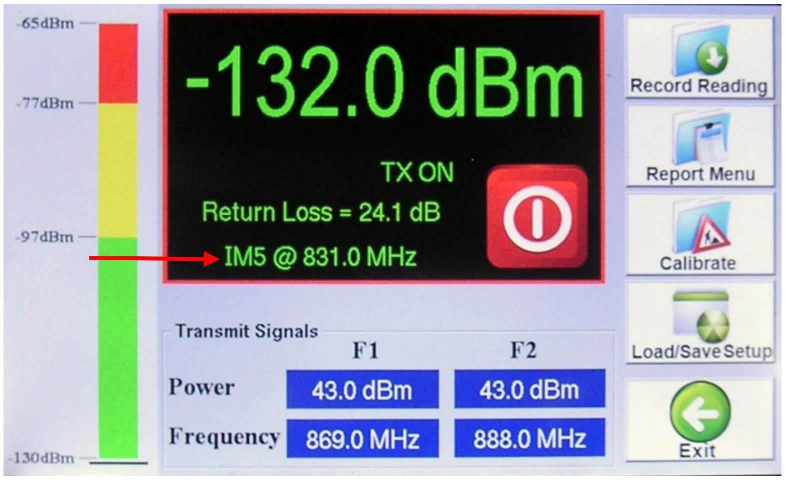
Select IM To Measure:

○ IM3 850.0 MHz
● IM5 831.0 MHz
○ IM7 812.0 MHz
○ IM9 793.0 MHz

Frequency 869.0 MHz 888.0 MHz

Figure 45 - ***IM Select*** **Window for IM5 at F1 = 869.0 MHz and F2 = 888.0 MHz**

3.1.2.16.1 IM Select Window (Cont.)


-65dBm
-77dBm
-97dBm
-130dBm
Record Reading
Report Menu
Calibrate
Load/Save Setup
Exit

-132.0 dBm

TX ON

Return Loss = 24.1 dB

IM5 @ 831.0 MHz

Transmit Signals

	F1	F2
Power	43.0 dBm	43.0 dBm
Frequency	869.0 MHz	888.0 MHz

Figure 46 - ***PIM and Return Loss*** **Measurement Window when Set for IM5 Readings**

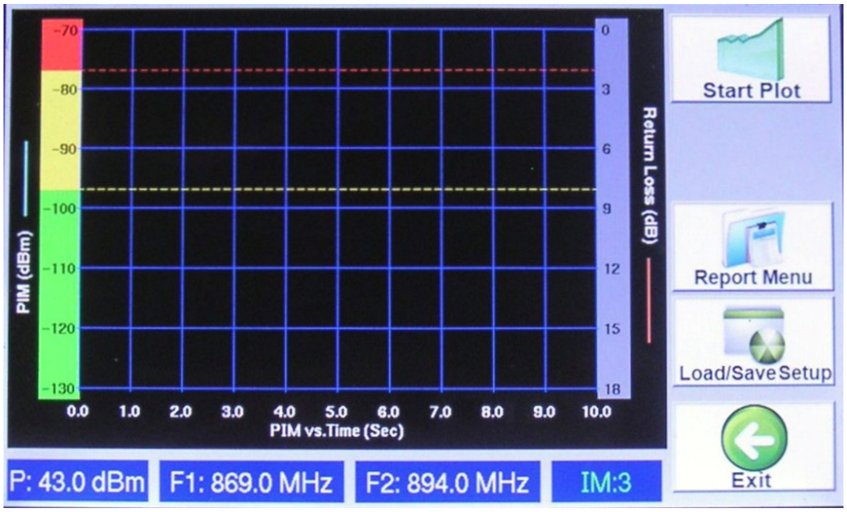
3.1.3 Making PIM (& R_L) versus Time Measurements

CCI's PiMPro PIM Analyzers also allow the user to perform PIM and Return Loss measurements over a period of time. The default mode is a continuous measurement over a period of 10 seconds. *Note: The PiMPro User Manual describes how to change the default test time period. Also, a more complex "Non-continuous" test mode is available where the test time and test intervals can be customized.*

3.1.3.1 Select ***PIM vs. Time*** Icon

Press the ***PIM vs. Time*** icon found in the ***Main Menu*** screen shown in **Figure 19**. This will open the ***PIM vs. Time*** screen as shown in **Figure 47** below. CCI's PiMPro PIM Analyzer includes a test menu to measure PIM over a period of time. Note that the "Marginal" and "Failing" PIM values are indicated by yellow and red dashed lines across the PIM vs. Time graph. Available settings for the ***PIM vs. Time*** measurement include the following items which are described in detail within the following paragraphs:

1) Configure PIM vs. Time Parameters
2) Configure PIM Scale
3) Start Plot
4) Record Plot
5) Report Menu
6) Load/Save Setup
7) Exit


PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
PIM vs.Time (Sec)
Return Loss (dB)
0
3
6
9
12
15
18
Start Plot
Report Menu
Load/Save Setup
Exit

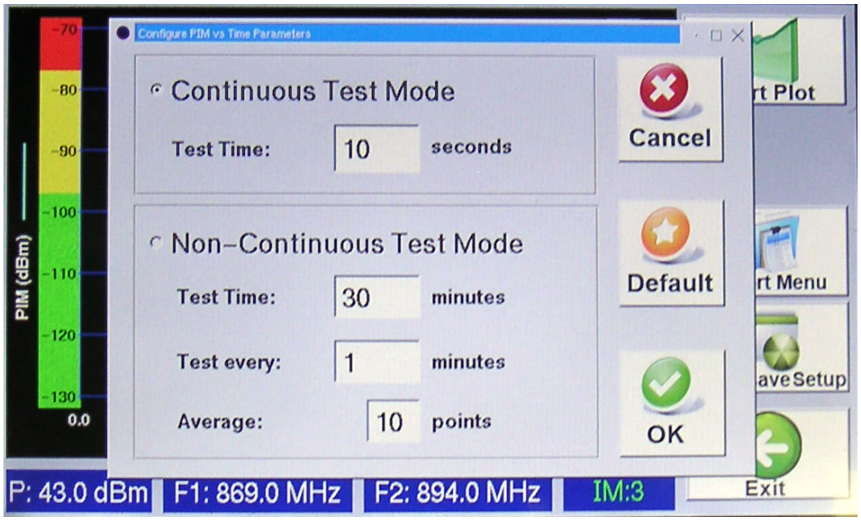
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 47 - Initial *PIM vs. Time* Screen

3.1.3.2 Configure *PIM vs. Time Parameters*

Pressing the touch screen display on the Time axis opens the ***Configure PIM vs. Time Parameters*** pop-up window on the touch screen display (see **figure 48**). This Menu has the following options available:

1) Continuous Test Mode
2) Non-Continuous Test Mode
3) Cancel
4) Default
5) OK



Configure PIM vs Time Parameters

● Continuous Test Mode
Test Time: 10 seconds

○ Non-Continuous Test Mode
Test Time: 30 minutes
Test every: 1 minutes
Average: 10 points

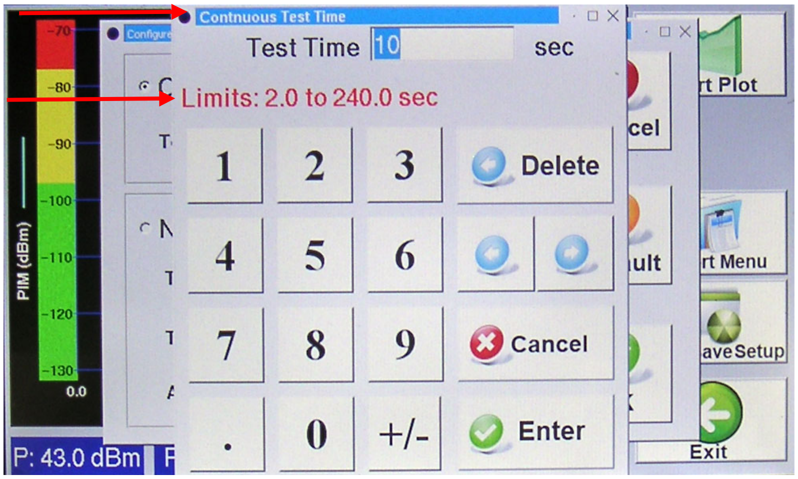
Cancel
Default
OK
rt Plot
rt Menu
ave Setup
Exit
PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
0.0
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 48 - *Configure PIM vs. Time Parameters* Window

3.1.3.2.1 Continuous Test Mode

Depressing the **Test Time** portion of the ***Continuous Test Mode*** touch screen display allows the PiMPro PIM Analyzer to be set by the user for the test time duration of a PIM sweep. The default mode is a continuous measurement over a period of 10 seconds. The ***Continuous Test Time*** window has a keypad that looks like a calculator and allows for entry of the appropriate time duration in seconds and is shown in **figure 49**. *Note that the display screen includes an indication of allowable test time 2 to 240 seconds.*

****Note: Do not perform more than two (2) "Continuous" tests (at the maximum 240 Seconds "Test Time") in a row without shutting the PiMPro unit down and allowing it to cool for a period of at least 5 minutes.***



Test Time 10 sec

Limits: 2.0 to 240.0 sec

Contnuous Test Time
1
2
3
Delete
4
5
6
7
8
9
Cancel
.
0
+/-
Enter
PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
0.0
P: 43.0 dBm
rt Plot
cel
ult
rt Menu
ave Setup
Exit

Figure 49 - ***Continuous Test Time*** **Window**

3.1.3.2.2 Non-Continuous Test Mode

***Note: The Non-Continuous Test Mode does not exist for this PiMPro Model**

3.1.3.2.3 Cancel

Pressing the ***Cancel*** icon on the touch screen display closes the ***Configure PIM vs. Time Parameters*** without any changes to the **Continuous** or **Non-Continuous** parameters.

3.1.3.2.4 Default

Pressing the ***Default*** icon on the touch screen display when in the **Continuous Mode** sets the ***Test Time*** to 10 seconds. Similarly, depressing the ***Default*** icon on the touch screen display when in the **Non-Continuous Mode** sets the ***Test Time*** to 30 minutes, the ***Test Every*** time to 1 Minute, and the ***Average*** to 10 points.

3.1.3.2.5 OK

Pressing the ***OK*** icon on the touch screen display accepts any changes that have been made to either the **Continuous** or **Non-Continuous Test Modes** as applicable.

3.1.3.3 Configure PIM Scale

Pressing the PIM Scale on the touch screen display opens the ***Configure PIM Scale*** pop-up window (see **figure 50**). This function can be used to modify the PIM Pass/Fail limits if required. In this manner both the one time measurements and the PIM vs. Time measurements would match if different PIM limits are invoked by the "Operator." The following items are accessible to the user from this menu:

1) Set Meter Min Pass Value
2) Set Meter Max Fail Value
3) Units (dBm or dBc)
4) Buzzer On/Off
5) Cancel
6) Default
7) OK

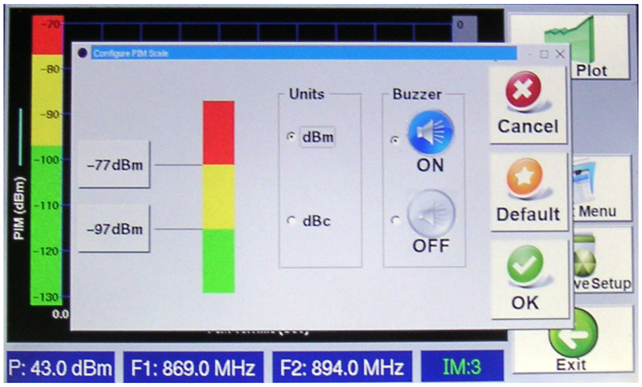
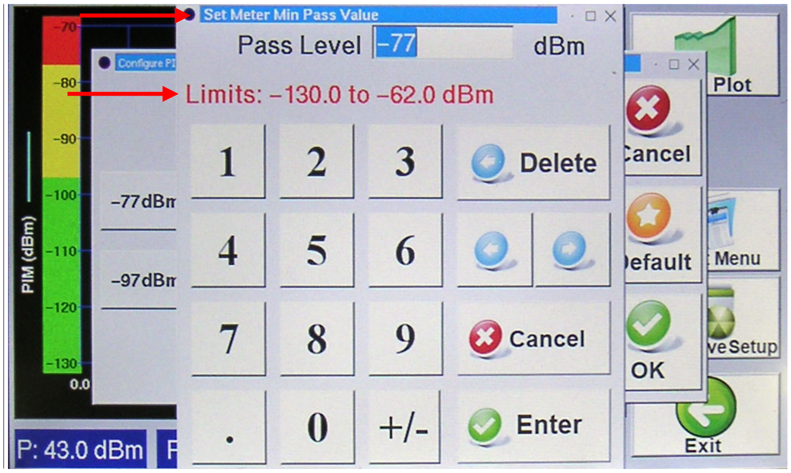

Configure PIM Scale
PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
0.0
-77dBm
-97dBm
Units
dBm
dBc
Buzzer
ON
OFF
Cancel
Default
OK
Plot
Menu
ve Setup
Exit
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 50 - *Configure PIM Scale* Window

3.1.3.3.1 Min Pass Value, Max Fail Value PIM Level Setting

Depressing either of the IM Level (Pass or Fail) Setting icons opens a ***Set Meter*** pop-up window similar to the one shown in **figure 51**. Each of the ***Set Meter*** pop-up windows has a keypad that looks like a calculator and allows for entry of the appropriate limit in dBm. *Note that the display screen includes an indication of applicable power limits (-130.0 dBm to -62.0 dBm).* Each display screen will have a title as follows:

1) Set Meter Min Pass Value
2) Set Meter Max Fail Value


Set Meter Min Pass Value

Pass Level -77 dBm

Limits: –130.0 to –62.0 dBm

-77dBm
-97dBm
P: 43.0 dBm

Figure 51 - Set Meter Min Pass Value Window

3.1.3.3.2 Units

Depressing the dBc unit's portion of the popup window shown in **figure 50** changes the PiMPro PIM Analyzer scale unit's to dBc. Depressing the dBm unit's portion of the popup window changes the PiMPro PIM Analyzer scale units back to dBm.

3.1.3.3.3 ON OFF Buzzer On/Off

Pressing either the ***Buzzer On*** or ***Buzzer Off*** icons shown in **figure 50** will set the PiMPro PIM Analyzer buzzer to on or off.

3.1.3.3.4 Cancel Cancel

Pressing the ***Cancel*** icon shown in **figure 50** will return the user to the PIM vs. Time window.

3.1.3.3.5 Default Default

Pressing the ***Default*** icon shown in **figure 50** will reset the IM Limits to the following values:

1) Min IM Pass Value → -97 dBm
2) Max IM Fail Value → -77 dBm

3.1.3.3.6 OK OK

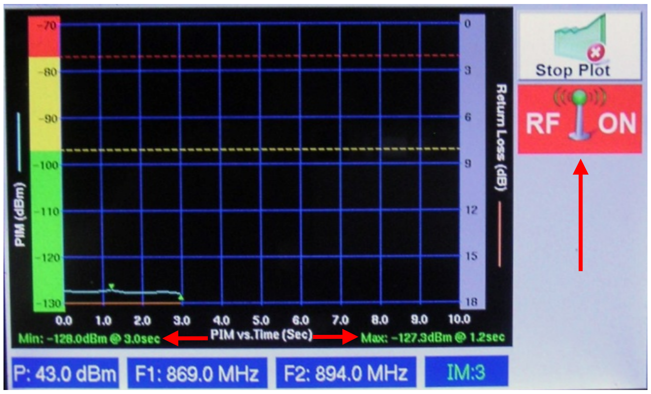
Pressing the ***OK*** icon on the touch screen display accepts any changes that have been made to either the “Configure PIM Scale.”

3.1.3.4 Start Plot Stop Plot Take Measurement

Press the ***Start Plot*** icon on the ***PIM vs. Time*** window to begin the measurement plot generation based on the **Continuous** or **Non-Continuous Test Mode** selected earlier. Note that if the PiMPro PIM Analyzer has not been calibrated, the system will automatically start a calibration cycle as described in **section 3.1.2.1**.

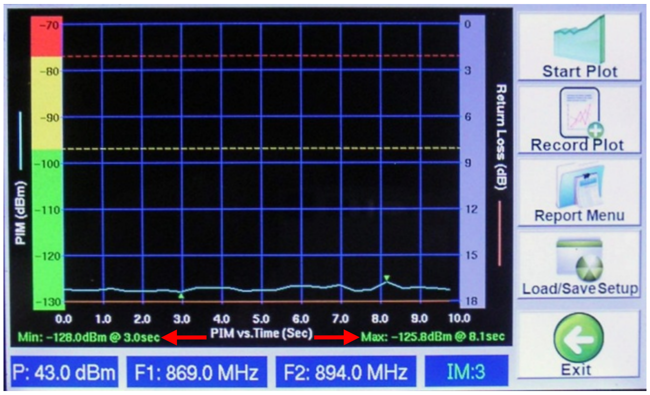
*Note that the “**Start Plot**” icon changes to read “**Stop Plot**” when the test is initiated. Also note that while the PIM vs. time test is being performed an “**RF ON**” icon with a little Antenna appears in the location where the Record Plot icon normally appears.* Once the “PIM vs. Time” test is initiated, the RF ON measurement plot can be interrupted at any time by pressing the “***Stop Plot”*** Stop Plot icon in **Figure 52**. The PIM readings are indicated by a “blue” line, while the Return Loss (R_L) readings are indicated by a “red” connecting line. As stated previously note the “Marginal” and “Failing” PIM values are indicated by yellow and red dashed lines across the PIM vs. Time graph. **MIN & MAX PIM** values are also listed at the bottom of the PIM vs. Time graph both during test, and at completion of test. **MIN & MAX PIM** readings will be in either **dBm** or **dBc** depending on the unit’s chosen for this test. See **figure 53** for a view of the ***PIM & Return Loss vs. Time*** Plot on the ***PIM vs. Time*** window. See **figure 54** for a screen capture of the recently added dBc unit functionality in the PIM vs. Time test.

3.1.3.4 Take Measurement (Cont.)


Stop Plot
RF ON
PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
Return Loss (dB)
0
3
6
9
12
15
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
PIM vs.Time (Sec)

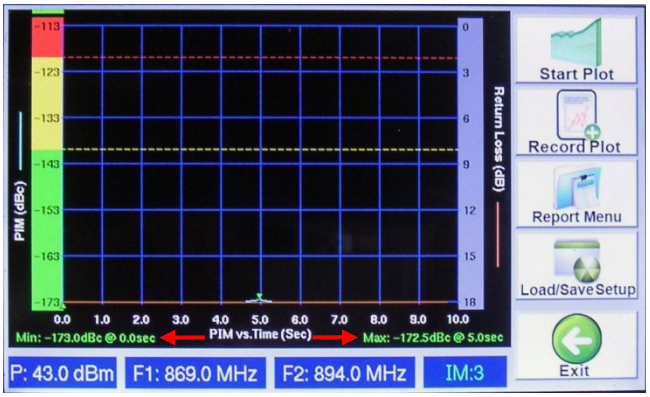
Min: -128.0dBm @ 3.0sec
Max: -127.3dBm @ 1.2sec
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 52 - Partial *PIM & Return Loss vs. Time* Plot on the *PIM vs. Time* Window Showing *Stop Plot* and *RF ON*


Start Plot
Record Plot
Report Menu
Load/Save Setup
Exit
PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
Return Loss (dB)
0
3
6
9
12
15
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
PIM vs.Time (Sec)

Min: -128.0dBm @ 3.0sec
Max: -125.8dBm @ 8.1sec
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 53 - *PIM & Return Loss vs. Time* Plot on the *PIM vs. Time* Window


Start Plot
Record Plot
Report Menu
Load/Save Setup
Exit
PIM (dBc)
-113
-123
-133
-143
-153
-163
-173
Return Loss (dB)
0
3
6
9
12
15
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
PIM vs.Time (Sec)

Min: -173.0dBc @ 0.0sec
Max: -172.5dBc @ 5.0sec
P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 54 - *PIM & Return Loss vs. Time* Plot (in dBc) on the *PIM vs. Time* Window

3.1.3.5 Record Plot Record Plot

Pressing the ***Record Plot*** icon processes the user through the steps required to perform PIM testing on a system or a device. The overall screen will now open the ***Site Information*** menu (see **figure 25**). Perform the required steps.

3.1.3.5.1 Enter *Site Information*

"When the ***Record Reading*** icon is depressed, the ***Site Information*** Screen opens as depicted in **Figure 25**. Enter information on the Operator (i.e. AT&T, Verizon, T-Mobile, Sprint, etc.) and the Site Number. Also, enter your initials into the Technician field. Pressing the bar on the right side of each field will bring up the ***Keyboard Entry*** Screen depicted in **Figure 26** which will allow you to enter the desired information. When you have finished entering the required site information, press the ***OK*** Icon. See **figure 26** for an example of the display after Operator, Site # and Technician information has been entered and prior to pressing the ***OK*** Icon.

3.1.3.5.2 Enter *Sector/Feeder Information*

After completing the Site Information above, the ***Sector/Feeder Information*** Screen is displayed as depicted in **Figure 28**. Depress the bar to the right hand side of each field to enter the Sector and the Feeder information. Once the information has been entered, press the ***OK*** icon at the bottom of the screen. Note that the Site and Sector/Feeder Information are required only on the first PIM measurement. Subsequent PIM measurements do not require re-entry of this information. See **figure 29** for an example of the display after Sector, and Feeder information has been entered and prior to pressing the ***OK*** Icon.

3.1.3.5.3 Select Label Menu

Please refer to **paragraph 3.1.2.7** for details on the Select Label Menu and sub-**paragraphs 3.1.2.7.1 through 3.1.2.7.6** the other options/menu choices available under the Select Label Menu.

3.1.3.6 Report Menu Report Menu

The test report that shows on the touch screen includes the following information:

a) Company, Site # and Technician (Site Information) → (see **figure 32**)
b) Frequency, Sector and Feeder → (see **figure 32**)
c) PIM and Return Loss (Real Time Measurement) Test → (see **figure 31**)
  a. Test Parameters including F1 frequency, F1 power, F2 frequency, F2 power, IM Product being tested and IM Product Frequency.
  b. Pass/Fail Limits
  c. Test results including Test Point Label, time, PIM Reading (dBm), Return Loss, PIM & Return Loss vs. Time Plot (see **figure 55**), and Comment.

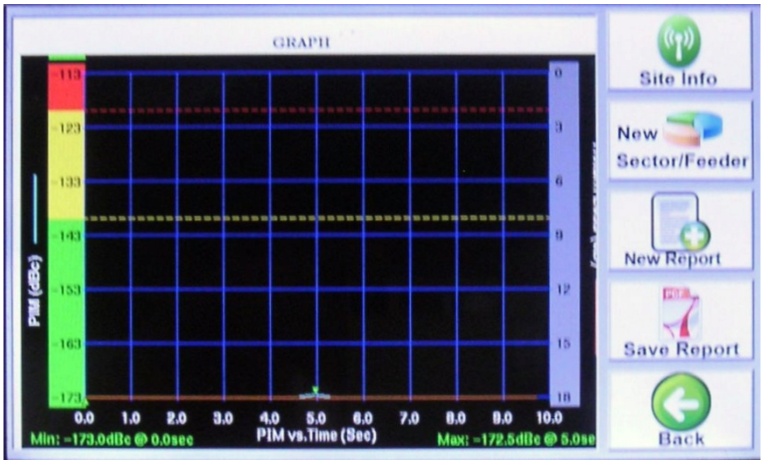

GRAPH
PIM (dBc)
-113
-123
-133
-143
-153
-163
-173
0
3
6
9
12
15
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
Min: -173.0dBc @ 0.0sec
PIM vs.Time (Sec)
Max: -172.5dBc @ 5.0se
Site Info
New Sector/Feeder
New Report
Save Report
Back

Figure 55 - ***PIM & Return Loss vs. Time*** **Plot in** ***Report*** **Window**

3.1.3.6.1 Site Info Site Info

Pressing the ***Site Info*** icon opens up the ***Site Information*** window described in **paragraph 3.1.2.5** and gives access to the Operator, Site # and Technician as stated.

3.1.3.6.2 New Sector/Feeder

Pressing the ***New Sector/Feeder*** icon opens up the ***Sector/Feeder Information*** window described in **paragraph 3.1.2.6** and gives access to the Sector, and Feeder as stated.

3.1.3.6.3 New Report

Pressing the ***New Report*** icon opens the ***Save Report*** window (see **figure 33**). This new screen allows for the report to be saved to either the **Local Drive** Local Drive or the **USB Drive** USB . This screen also allows the following functions to be performed:

1) File name - Depressing the filename bar opens up the keyboard for entry of the desired file name.
2) Cancel - Ability to cancel the save report
3) OK - Saves the report with the newly entered file name as appropriate

3.1.3.6.4 Save Report

Pressing the ***Save Report*** icon also opens the ***Save Report*** window (see **figure 33**). This new screen allows for the report to be saved to either the **Local Drive** Local Drive or the **USB Drive** USB . This window also allows the following functions to be performed:

1) File name - When using the ***Save Report*** function the file name is automatically generated by the PiMPro Analyzer as a concatenation of the Operator, Site # and Sector information that was previously entered. If desired this information can again be modified by depressing the filename bar and the keyboard will open for data entry. *Please note that if the filename is to be left intact, with the exception of another few characters, the user should utilize the arrow keys to place the cursor in the correct location for data entry. The "suggested" filename no longer contains the sector information. Please note that special characters are not allowed.*
2) Cancel - Ability to cancel the save report
3) OK - Saves the report with either the existing file name, the modified filename or newly entered file name as appropriate.

3.1.3.6.5 Back

Pressing the ***Back*** icon returns the user to the Real Time Measurement (***PIM and Return Loss***) window.

3.1.3.7 Load/Save Setup Load/Save Setup

Pressing the ***Load/Save Setup*** icon on the touch screen allows the user to load a previously saved setup, save the presently modified setup to the PiMPro PIM Analyzer and more. *Note that Load/Save Setups are a "description" of the measurement function, power levels, frequency, and "Continuous PIM vs. Time" or "Non-Continuous PIM vs. Time" settings for the PiMPro PIM Analyzer.* For instance if the user has a need to perform testing at 40Watts (+46 dBm) operation they could save the setup as "40Watts." However, as most testing is performed at 20 Watts (+43 dBm) the user could save the setup as "20Watts." Similarly, if the user has a special condition to test at frequencies, power levels, IM Products different from the "standard" settings they can save this as a setup to the PiMPro PIM Analyzer **Local Drive** Local Drive and/or to the **USB Drive** USB . The options available on the Load/Save Setup Menu are as follows:

1) Select Drive - USB or Local Drive
2) Previously stored setups
3) Save Setup
4) Load Setup
5) Copy Setup
6) Delete Setup
7) Back

3.1.3.7.1 Select Drive

Select Drive allows the user to choose whether the setup to be saved, opened, copied or deleted is located (or to be located) on the Local Drive or the USB port by depressing the touch screen next to the appropriate icon.

3.1.3.7.2 Existing Setup(s)

Existing Setups are the setups that are listed with a "filename" in the large portion of the Load/Save Setup window. These listings are located below the "Select Drive" portion of this display. The user can select the existing setup by depressing the "filename" on the touch screen.

3.1.3.7.3 Save Setup Save Setup

Pressing the ***Save Setup*** icon allows the user to save a setup as modified by the user on either the **Local Drive** Local Drive or the **USB Drive** USB .

3.1.3.7.4 Load/Save Setup Load Setup

Pressing the ***Load Setup*** icon allows the user to select the setup that is desired for use in ***PIM and Return Loss*** testing by highlighting the applicable setup name on the touch screen display. When the ***Load Setup*** icon is depressed, the ***PIM and Return Loss*** window will display on the touch screen and it will indicate the setup chosen including any "special" conditions.

3.1.3.7.5 Copy Setup

Copy Setup

Pressing the ***Copy Setup*** icon allows the user to copy the desired setup to/from the **Local Drive/USB Drive** as desired. In this manner a "special setup" can be setup on one PiMPro PIM Analyzer and ten copied to the **USB Drive**. The user can then bring the **USB Drive** to all other PiMPro PIM Analyzers in the field and copy this setup to the other analyzers. In this manner all testing can be performed with the "same" conditions between all users in any region. *Please note: A warning will appear if the user attempts to copy the setup from/to the same location. The warning given is "Warning! "Filename" already exists on "Local Drive" or "USB Drive" (as applicable). Do you want to overwrite?* See **figure 35** for an example of this warning.

3.1.3.7.6 Delete Setup

Delete Setup

Pressing the ***Delete Setup*** icon allows the user to delete an unwanted setup. For instance if a special setup was created for use in a specific region and for a specific "Operator" and the user has traveled to a different region or is performing testing for a different "Operator" the previously valid setup could be deleted so that it is not accidentally used in the new situation. *Please note that a warning message will appear the states Warning! "Filename" is about to be deleted from the "Local Drive" or "USB Drive" (as applicable). Do you want to continue?* See **figure 36** for an example of this warning.

3.1.3.7.7 Back

Back

Pressing the ***Back*** icon returns the user to the PIM vs. Time window on the touch screen.

3.1.3.8 Exit

Exit

Pressing the ***Exit*** icon from the PIM vs. Time window returns the user to the "Main Menu."

3.1.4 RX Interference

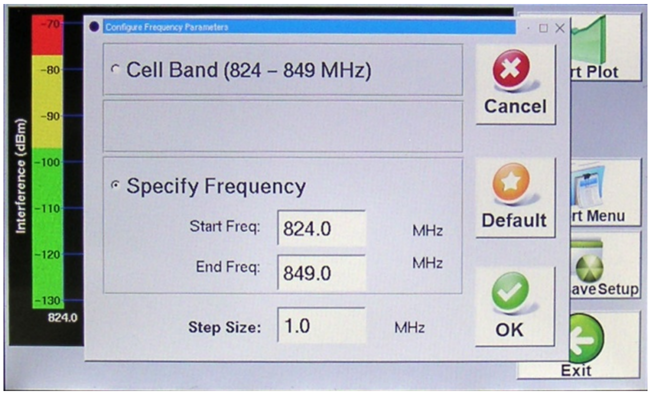
Depressing the ***RX Interference*** icon will open up the “RX Interference” function window. This is a new test function that looks for external interference in the Rx band. The test works by keeping the transmitter(s) (amplifier(s)) off and sweeping the receiver across the entire Rx band. Note that the “Marginal” and “Failing” PIM values are indicated by yellow and red dashed lines across the RX Interference graph. These dashed lines appear in both the initial and completed graphs (prior to and after readings are measured). Please see **figure 58** for a view of the initial graph and **figure 59** for a view of the completed sweep. *Please note that as before if Record Plot is selected the RX Interference Plot will be appended below the last measurement taken prior to this measurement.*

3.1.4.1 Configure Frequency Parameters

The “Start” and “End” RX frequencies and frequency” Step Size” can be adjusted from the ***Configure Frequency Parameters*** pop-up window (see **figure 56**), which can be accessed by touching the X-axis on the graph as seen previously.

3.1.4.2 Configure PIM Scale

Pressing the Y-Axis opens the ***Configure PIM Scale*** pop-up window. All of the functions are the same as described in **paragraphs 3.1.3.3 through 3.1.3.6**. Please note that this pop-up window is only being shown below (in **figure 57**) as the background window is different than shown in the paragraphs noted above (described for PIM vs. Time). *Note: Graphical testing may be performed in dBm or dBc units, but the pass/fail levels must be set in dBm.*



Configure Frequency Parameters

○ Cell Band (824 – 849 MHz)

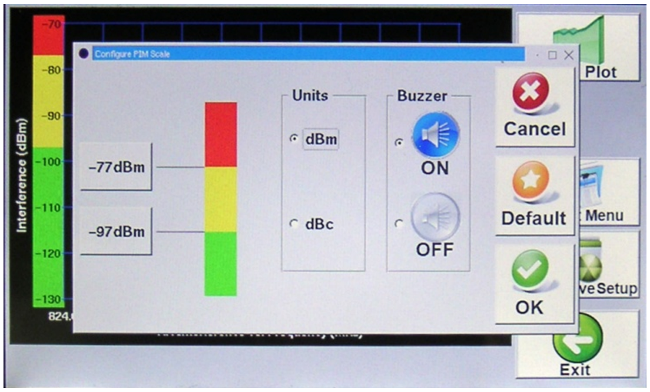
● Specify Frequency

Start Freq: 824.0 MHz

End Freq: 849.0 MHz

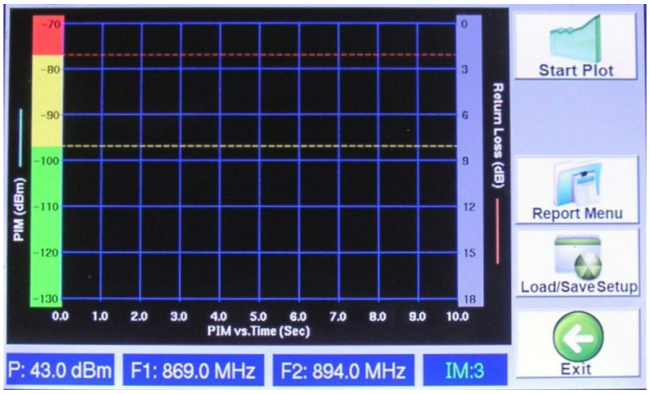
Step Size: 1.0 MHz

Figure 56 - *Configure Frequency Parameters* Pop-up Window


Configure PIM Scale
Interference (dBm)
-70
-80
-90
-100
-110
-120
-130
824.
Cancel
Default
OK
Plot
Menu
veSetup
Exit

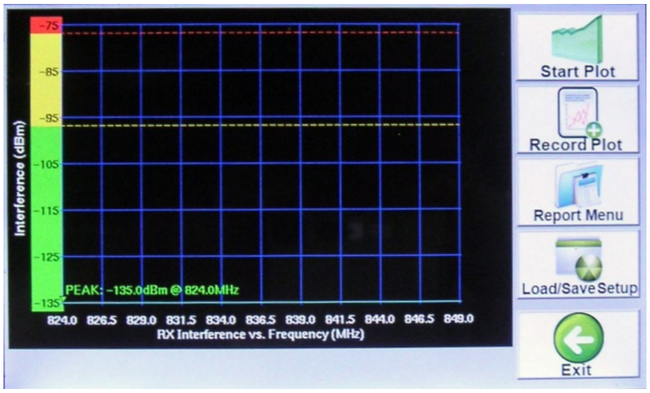
-77dBm
-97dBm
Units ● dBm ○ dBc
Buzzer ● ON ○ OFF

Figure 57 - *Configure PIM Scale* Pop-up Window


PIM (dBm)
-70
-80
-90
-100
-110
-120
-130
Return Loss (dB)
0
3
6
9
12
15
18
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
PIM vs.Time (Sec)
Start Plot
Report Menu
Load/Save Setup
Exit

P: 43.0 dBm
F1: 869.0 MHz
F2: 894.0 MHz
IM:3

Figure 58 – Initial *RX Interference* Sweep Window


Interference (dBm)
-75
-85
-95
-105
-115
-125
-135
824.0
826.5
829.0
831.5
834.0
836.5
839.0
841.5
844.0
846.5
849.0
RX Interference vs. Frequency (MHz)
Start Plot
Record Plot
Report Menu
Load/Save Setup
Exit

PEAK: -135.0dBm @ 824.0MHz

Figure 59 - Completed *RX Interference* Sweep Window

3.1.5 Frequency Sweep

Depressing the Frequency Sweep icon will open up the “Frequency Sweep” function window. This is a new test function that takes continuous PIM measurements at varying frequencies. The test works by keeping the first transmit tone fixed while moving the other. It then repeats the test by keeping the second tone fixed and varying the other. Please see **figure 63** for a view of the completed sweep. *Please note that as before if Record Plot is selected the RX Interference Plot will be appended below the last measurement taken prior to this measurement.*

3.1.5.1 Configure Frequency Parameters

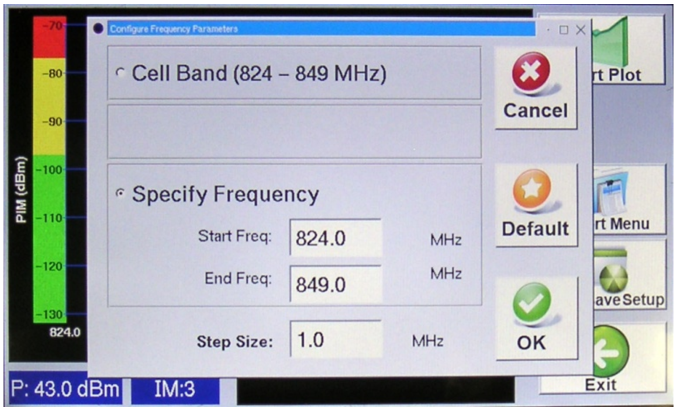
The “Start” and “End” RX frequencies and frequency step size can be adjusted from the “Configure Frequency Parameters” pop-up window (see **figure 60**), which can be accessed by touching the X-axis on the graph.

3.1.5.2 IM Select

The IM Order to be measured can also be selected by depressing the IM Box in the display. This opens up the ***IM Select*** pop-up window as shown in **figure 61** below. Now the user may select IM3, IM5, IM7 or IM9 measurement by pressing the appropriate IM order to be measured and then pressing “OK.”

3.1.5.3 Configure PIM Scale

Pressing the Y-Axis opens the ***Configure PIM Scale*** pop-up window. All of the functions are the same as described in **paragraphs 3.1.3.3 through 3.1.3.6**. Please note that this pop-up window is only being shown below (in **figure 62**) as the background window is different than shown in the paragraphs noted above (described for PIM vs. Time). *Note: Graphical testing may be performed in dBm or dBc units, but the pass/fail levels must be set in dBm.*



○ Cell Band (824 – 849 MHz)

● Specify Frequency

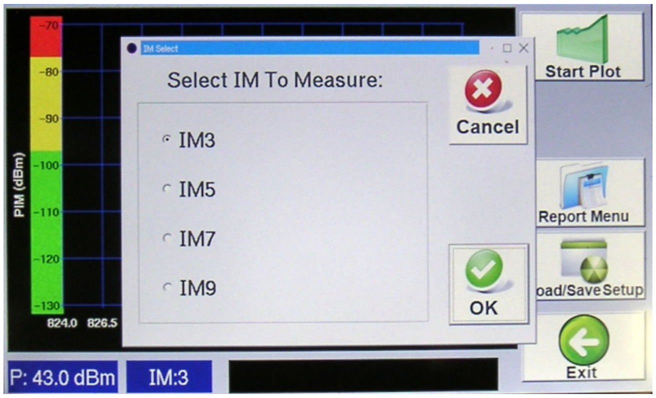
Start Freq: 824.0 MHz

End Freq: 849.0 MHz

Step Size: 1.0 MHz

P: 43.0 dBm IM:3

Figure 60 - *Configure Frequency Parameters* Pop-up Window



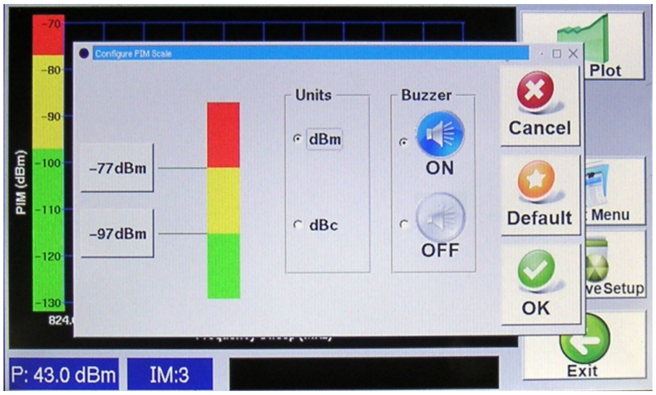
IM Select

Select IM To Measure:

● IM3
○ IM5
○ IM7
○ IM9

-70
-80
-90
-100
-110
-120
-130
PIM (dBm)
824.0
826.5
Cancel
OK
Start Plot
Report Menu
oad/Save Setup
Exit
P: 43.0 dBm
IM:3

Figure 61 - *IM Select* Pop-up Window



Configure PIM Scale

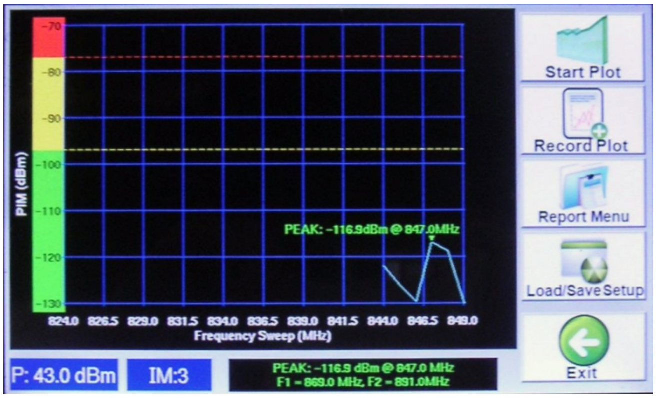
-77dBm
-97dBm

Units
● dBm
○ dBc

Buzzer
● ON
○ OFF

-70
-80
-90
-100
-110
-120
-130
PIM (dBm)
824.
Cancel
Default
OK
Plot
Menu
ve Setup
Exit
P: 43.0 dBm
IM:3

Figure 62 - *Configure PIM Scale* Pop-up Window



PEAK: -116.9dBm @ 847.0MHz

P: 43.0 dBm
IM:3
PEAK: -116.9 dBm @ 847.0 MHz
F1 = 869.0 MHz, F2 = 891.0MHz

-70
-80
-90
-100
-110
-120
-130
PIM (dBm)
824.0
826.5
829.0
831.5
834.0
836.5
839.0
841.5
844.0
846.5
849.0
Frequency Sweep (MHz)
Start Plot
Record Plot
Report Menu
Load/Save Setup
Exit

Figure 63 - Completed *Frequency Sweep* Display

3.1.6 DAS Test

Depressing the DAS Test icon in the Main Menu will open up the “DAS Test” function window (see figure 64). This function is used to perform a Special DAS Test that is performed with a single Transmit tone at a lower output level (i.e. between +20 dBm (100 mW) and +27 dBm (500 mW)) for extended periods of time (i.e. 15 to 240 minutes). The purpose of this test is to provide a companion diagnostic tool for DAS Installation and Primary Propagation Loss Testing. Note that the extended duration of the test allows for testing to be performed in large buildings including arenas and stadiums with multiple sectors. The “Walk-by” (or is it “walk-through”) testing would involve injection of the lower level single tone output into the DAS Network on site. It requires the use of a portable Spectrum Analyzer connected to an Omni-Antenna in order to measure Primary Propagation Loss. This testing allows the user to search for problems with the connections to the In-Building Antennas and cabling. Note that this test does not generate a report, as with the other PIM Testing performed with the PiMPro.

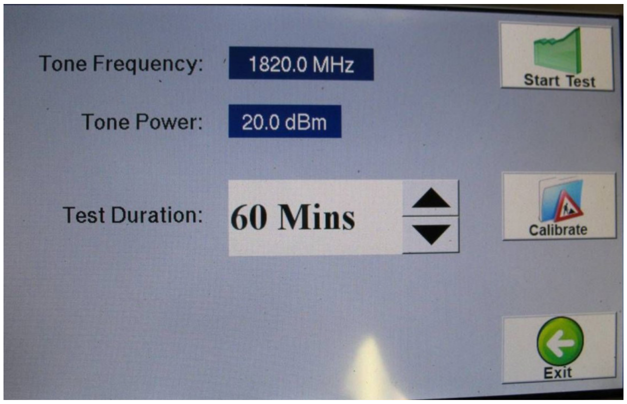

Tone Frequency: 1820.0 MHz
Tone Power: 20.0 dBm
Test Duration: 60 Mins

Figure 64 – DAS Test Window

3.1.6.1 Set Frequency for DAS Test Performance

Depressing the Tone Frequency box in the DAS Test window will open the Set Tone Frequency pop-up window as shown in figure 65 below. Tone frequencies are per the individual PiMPro F1 and F2 limits.

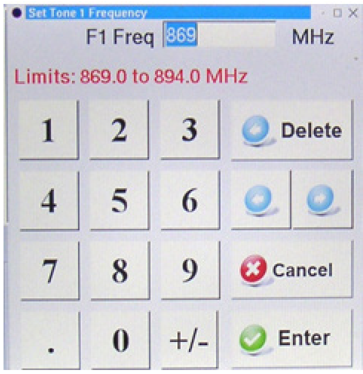
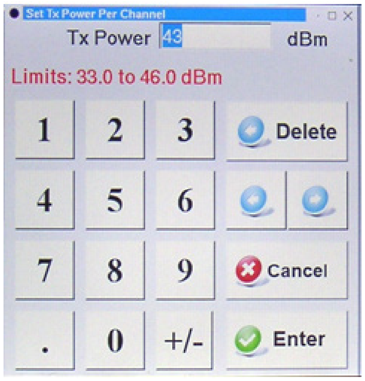

Set Tone 1 Frequency
F1 Freq 869 MHz
Limits: 869.0 to 894.0 MHz

Figure 65 - Set Tone Frequency Pop-up Window

3.1.6.2 Set Power Level for DAS Test Performance

Depressing the Tone Power box in the DAS Test window will open the Set Tone Power pop-up window as shown in figure 66 below. Tone power level limits can be set between +20.0 dBm to +46.0 dBm.


Set Tx Power Per Channel
1
2
3
Delete
4
5
6
7
8
9
Cancel
.
0
+/-
Enter

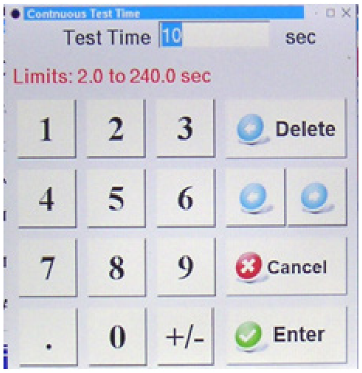
Tx Power 43 dBm

Limits: 33.0 to 46.0 dBm

Figure 66 - Set Tone Power Level Pop-up Window

3.1.6.3 Set Duration of DAS Test Performance

Depressing the Test Duration box in the DAS Test window will open the Continuous Test Time pop-up window show in figure 67 below. Note that the duration of the DAS Test can be set for a period of 15 minutes minimum to 240 minutes maximum.


Continuous Test Time
1
2
3
Delete
4
5
6
7
8
9
Cancel
.
0
+/-
Enter

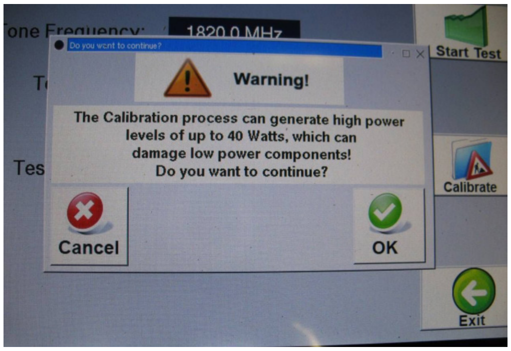
Test Time 10 sec

Limits: 2.0 to 240.0 sec

Figure 67 - Set Test Duration Pop-up Window

3.1.6.4 Perform Calibration

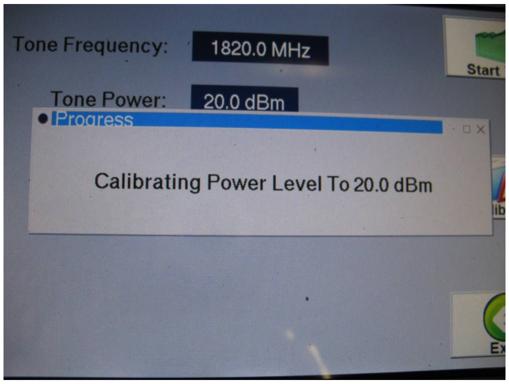
Perform Calibration of the PiMPro by depressing the Calibrate Icon. This will open a Warning pop-up window as seen in figure 68. This warning informs the User as follows: "The Calibration Process can generate high power levels of up to 40 Watts, which can damage low power components! Do you want to continue?" *Note the User should attach a High Power Low PIM Load to the PiMPro prior to performing the Calibration.*



The Calibration process can generate high power levels of up to 40 Watts, which can damage low power components! Do you want to continue?

Figure 68 – Calibration Warning Pop-up Window

Click OK and the Calibration in Process pop-up widow will appear as seen in figure 69 below.



Tone Frequency: 1820.0 MHz

Tone Power: 20.0 dBm

Calibrating Power Level To 20.0 dBm

Figure 69 – Calibration pop-up Window

3.1.6.5 Start DAS Test

Depress the Start Test Icon to begin testing. Then the user can begin to perform the Walk-Through testing with their portable Spectrum Analyzer and Omni-Directional Antenna during the 15 to 240 minute duration of the test as previously set by the user.

3.1.6.6 DAS Test Complete

When DAS Test is complete the User can either return to Standard PIM Testing, or if more time is required the User can restart the DAS Test.

3.1.6.7

3.1.7 Configure System

Pressing the ***Configure System*** icon on the touch screen display Main Menu opens the ***System Configuration*** window (see **figure 70**). The configuration items available to view or modify include the following:

1) Date & Time
2) Audio Settings
3) RF Power On Timer
4) Manage Labels
5) About
6) IP Settings
7) Reserved
8) S/W Updates
9) Calibrate Screen
10) Exit

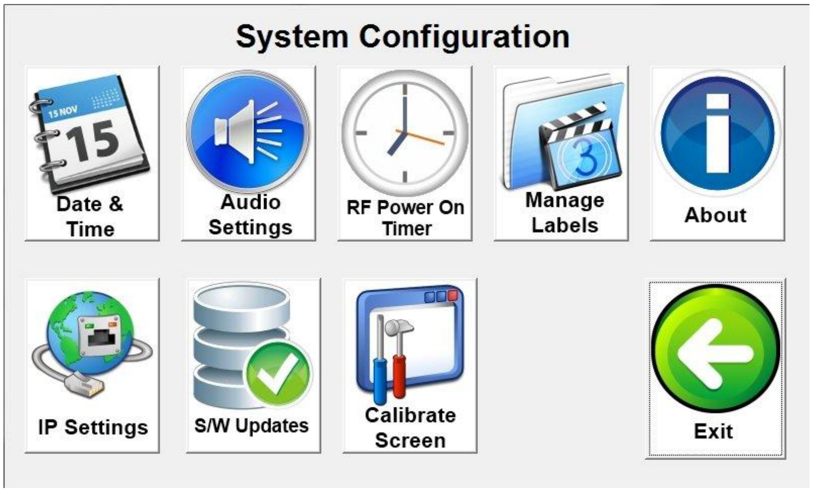
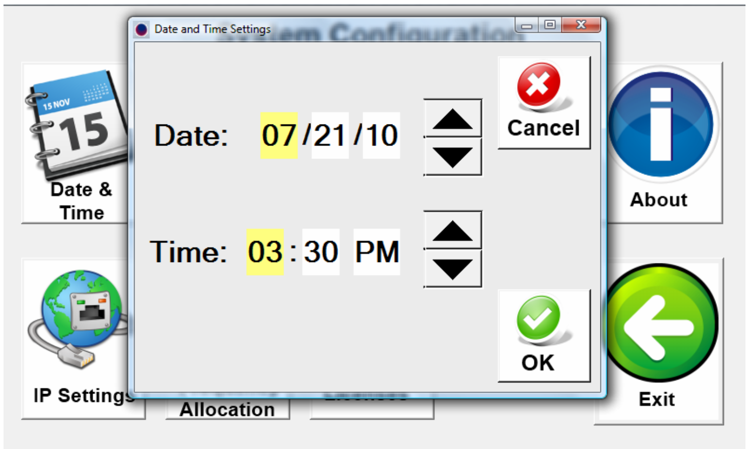

System Configuration
Date & Time
Audio Settings
RF Power On Timer
Manage Labels
About
IP Settings
S/W Updates
Calibrate Screen
Exit

Figure 70 - *System Configuration* Window

3.1.7.1 Date & Time

Press the ***Date & Time*** icon to open the ***Date and Time Settings*** Menu in **Figure 71**. Enter the correct date and time by selecting the appropriate field and using the up and down arrow keys to arrive at correct number. When done, press the ***OK*** icon to return to the ***System Configuration*** screen.


Date and Time Settings
Date & Time
IP Settings
Allocation
Cancel
OK
About
Exit

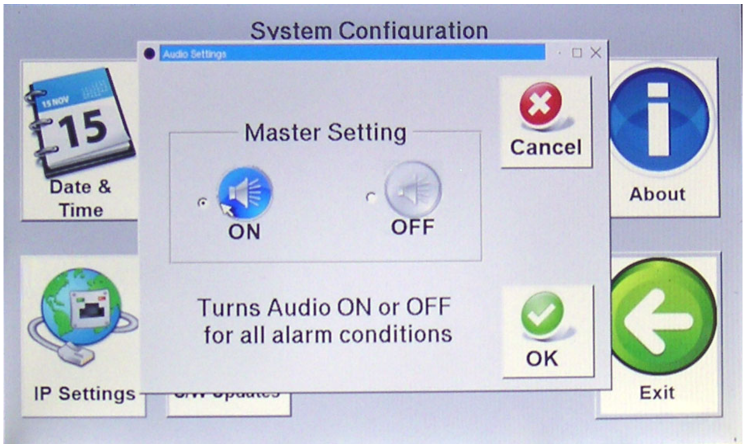
Date: 07/21/10

Time: 03:30 PM

Figure 71 - *Date and Time Settings* Window

3.1.7.2 Audio Settings

By depressing the ***Audio Settings*** icon on the System Configuration window, the ***Audio Settings*** Menu opens (see **figure 72**). This window allows the audio (buzzer) to be turned on or off for all alarm conditions. Depress the ***OK*** icon to accept the audio setting change, or depress the ***Cancel*** icon to cancel the audio settings change. The user will then be returned to the ***System Configuration*** window.


System Configuration
Audio Settings
Date & Time
IP Settings
Cancel
OK
About
Exit

Master Setting

● ON ○ OFF

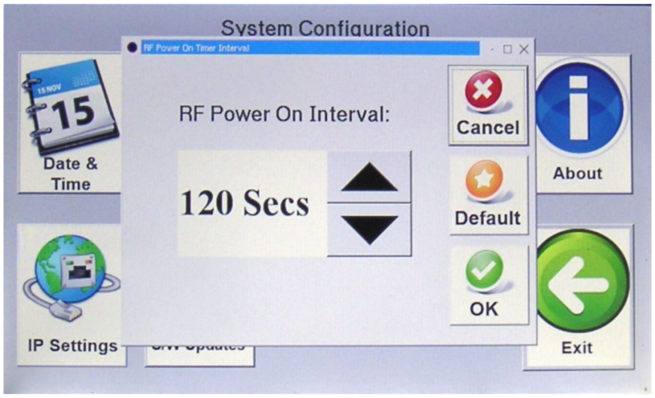
Turns Audio ON or OFF for all alarm conditions

Figure 72 - *Audio Settings* Window

3.1.7.3 RF Power On Timer

By depressing the ***RF Power On Timer*** icon on the ***System Configuration*** window, the ***RF Power On Timer Interval*** window opens (see **figure 73**). The RF Power On Timer is used to adjust the continuous duration that the TX outputs are "ON," and affects the PIM vs. Time and the PIM & Return Loss test duration. The RF Power On Interval may be changed in 15 second increments/decrements. The minimum RF Power On Interval is 15 seconds, and the maximum RF Power On Interval is 240 seconds. Press the ***Default*** icon if the user desires to reset the RF Power On Interval to 120 seconds. Otherwise press the ***OK*** icon to accept the RF Power On Interval changes, or press the ***Cancel*** icon to cancel any changes that are no longer desired. The user will then be returned to the ***System Configuration*** window.

___*Note: Do not perform more than two (2) "Continuous" tests (at the maximum 240 Seconds "Test Time") in a row without shutting the PiMPro unit down and allowing it to cool for a period of at least 5 minutes.___

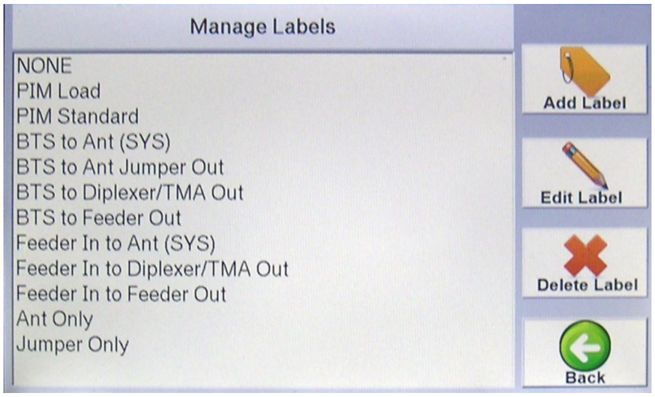


RF Power On Interval:
120 Secs

Figure 73 - *RF Power On Timer* Window

3.1.7.4 Manage Labels

By depressing the ***Manage Labels*** icon on the ***System Configuration*** window, the ***Manage Labels*** window opens (see **figure 74**). This window (Menu) allows the user to add labels to the list of Preset Labels, Edit a Preset Label, Delete a Label and return to the System Configuration window.



NONE
PIM Load
PIM Standard
BTS to Ant (SYS)
BTS to Ant Jumper Out
BTS to Diplexer/TMA Out
BTS to Feeder Out
Feeder In to Ant (SYS)
Feeder In to Diplexer/TMA Out
Feeder In to Feeder Out
Ant Only
Jumper Only

Figure 74 - *Manage Labels* Window

3.1.7.4.1 Pre-Loaded Labels

The ***Manage Labels*** window (see **figure 74**) contains “Pre-loaded” Labels. The “Pre-Loaded” Labels include items from the following list:

1) NONE
2) BTS to Ant (SYS)
3) BTS to Ant Jumper Out
4) BTS to Diplexer/TMA Out
5) BTS to Diplexer/TMA In
6) BTS to Feeder Out
7) Feeder In to Ant (SYS)
8) Feeder In to Diplexer/TMA Out
9) Feeder In to Diplexer/TMA In
10) Feeder In to Feeder Out
11) Ant Only

3.1.7.4.2 Add Label

Add Label

Press the ***Add Label*** menu icon if a brand new label is required. The keyboard window will appear on the touch screen and the new label name that is desired can be entered.

3.1.7.4.3 Edit Label

Edit Label

If it is desired to change an existing label by adding or removing information to/from the existing label press the ***Edit Label*** icon after selecting the label to be edited. Next use the keyboard keys to manipulate the label as desired. *Remember that the full label is highlighted initially on this screen. If you only want to change a portion of the label be sure to use the left or right arrows keys to maneuver to the point of the text that is desired to be changed. Otherwise if you start typing immediately this will fully delete the label and replace it with the information entered.*

3.1.7.4.4 Delete Label

Delete Label

If it is desired to delete an existing label, highlight the label to be deleted by locating it on the touch screen and depressing said label. Then press the ***Delete Label*** icon in order to remove the label from the Select Label menu.

3.1.7.4.5 Back

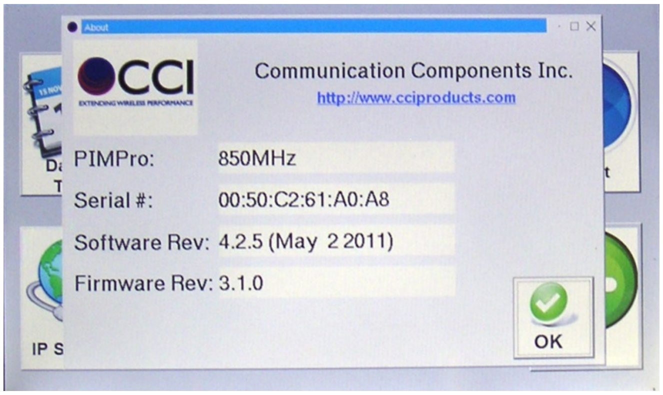
Back

Pressing the ***Back*** icon returns the user to the ***System Configuration*** window on the touch screen.

3.1.7.5 About

Pressing the ***About*** icon on the ***System Configuration*** window opens a window shown in **figure 75** that displays information as follows:

1) PiMPro Model **(Band Covered by Model Number)** - PiMPro 700-LPC **(LTE 700)**, PiMPro 850-LPC **(850 Cellular)**, PiMPro 900-LPC **(GSM 900)**, PiMPro 1800 **(1800) - Discontinued**, PiMPro 1821-LPC **(Dual Band (1800/PCS)) - New** or PiMPro 1921-LPC **(Dual Band (PCS/AWS))**
2) Serial Number - A six (6) position hexadecimal number **(AA:BB:CC:DD:EE:FF)**
3) Software Rev. - A three (3) position decimal number **(X.X.X)**, and date of release
4) Firmware Rev. - A three (3) position decimal number **(Y.Y.Y)**



Communication Components Inc.
http://www.cciproducts.com

PIMPro: 850MHz
Serial #: 00:50:C2:61:A0:A8
Software Rev: 4.2.5 (May 2 2011)
Firmware Rev: 3.1.0

Figure 75 - *About* Window

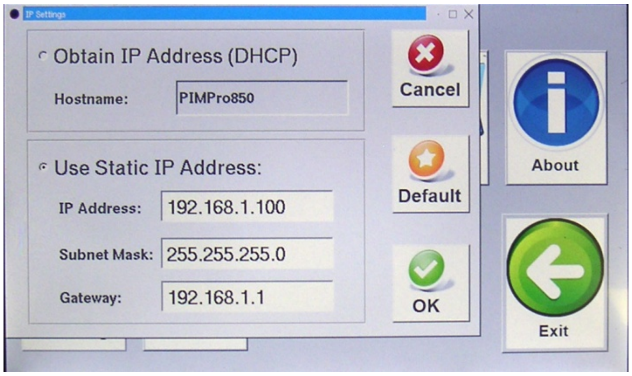
3.1.7.5.1 OK

Pressing the ***OK*** icon returns the user to the ***System Configuration*** window.

3.1.7.6 IP Settings

Depressing the ***IP Settings*** icon in the ***System Configuration*** window opens the ***IP Settings*** window as seen in **figure 76**. This window allows the user to select the following:

1) Obtain IP Address (DHCP)
    a. Hostname - PIMPro700, PIMPro850, PIMPro900, PiMPro 1800 - **Discontinued**, PiMPro 1821 - **New** or PIMPro1921
2) Use Static IP Address
    a. IP Address
    b. Subnet Mask
    c. Gateway
3) Cancel
4) Default
5) OK



○ Obtain IP Address (DHCP)
Hostname: PIMPro850
○ Use Static IP Address:
IP Address: 192.168.1.100
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.1

Figure 76 - *IP Settings* Window

3.1.7.6.1 Obtain IP Address Automatically (DHCP)

Not operational.

3.1.7.6.2 Static IP Address

Initially the Static IP Address is set to the following:

IP Address: 192.168.1.230

Subnet Mask: 255.255.255.0

Gateway: 192.168.1.1

The user may reset the Static IP Address if required. Just press the information bar located to the right-hand side of each item to open up the ***Keyboard*** screen (see **figure 26**). Once open the user may enter new information if required.

3.1.7.6.3 Cancel

Pressing the ***Cancel*** icon will return the user to the System Configuration window.

3.1.7.6.4 Default

Pressing the ***Default*** icon will **reset** the **Static IP Address** information to the following:
IP Address: 192.168.1.100
Subnet Mask: 255.255.255.0
Gateway: 192.168.1.1

3.1.7.6.5 OK

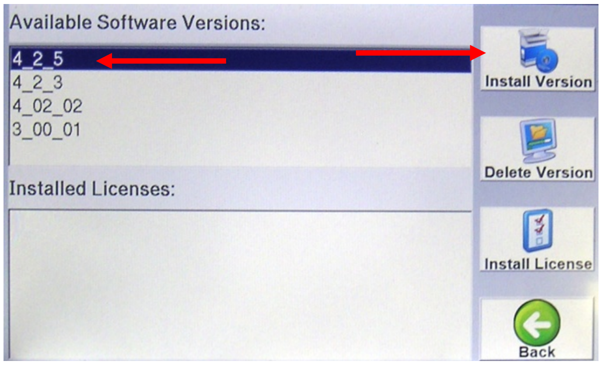
Pressing the ***OK*** icon accepts the changes and returns the user to the ***System Configuration*** window.

3.1.7.7 Reserved

3.1.7.8 S/W Updates

Pressing the ***S/W Updates*** icon on the ***System Configuration*** window opens the ***Available Software Versions / Installed Licenses*** window as shown in **figure 77**. In addition to listing Available Software Versions and Installed Licenses this window allows the user the following choices:

1) Install Version
2) Delete Version
3) Install License
4) Back



Available Software Versions:
4_2_5
4_2_3
4_02_02
3_00_01

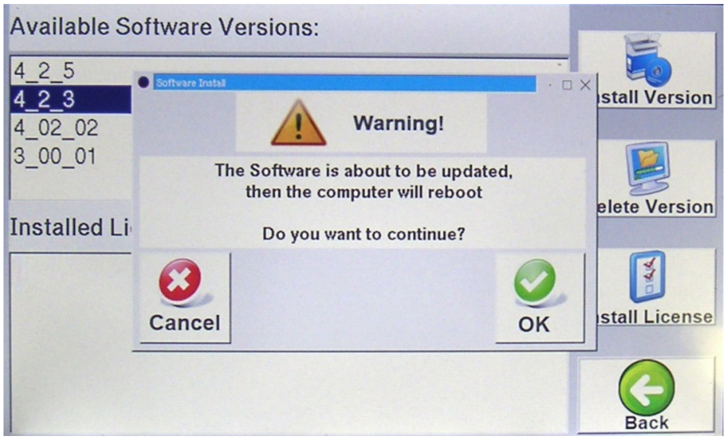
Installed Licenses:

Figure 77 - *Available Software Versions / Installed Licenses* Window

3.1.7.8.1 Install Version

Install Version

Pressing the ***Install Version*** icon shown in **figure 77** opens the ***Software Install*** **Warning** window shown in **figure 78**. If the user depresses the *Cancel* icon the ***Software Install*** **Warning** window will disappear. However, if the user depresses the ***OK*** icon this will install an available Software Version and then it will reboot the PiMPro.


Available Software Versions:
4_2_5
4_2_3
4_02_02
3_00_01
Installed Li
Software Install
stall Version
elete Version
stall License
Back
Cancel
OK

Warning!

The Software is about to be updated,
then the computer will reboot

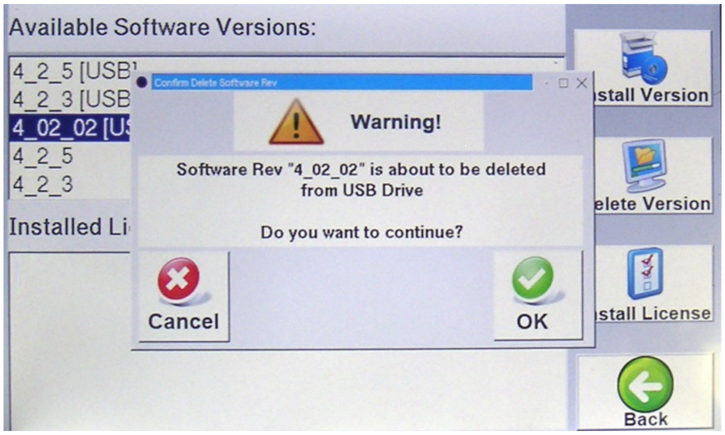
Do you want to continue?

Figure 78 - *Software Install* Warning Window

3.1.7.8.2 Delete Version

Delete Version

Selecting the Software Version to be deleted and depressing the ***Delete Version*** icon shown in **figure 77** opens the ***Confirm Delete Software Rev*** **Warning** window shown in **figure 79**. If the user depresses the ***Cancel*** icon the ***Confirm Delete Software Rev*** **Warning** window will disappear. However, if the user depresses the ***OK*** icon this will delete the highlighted Software Version.


Available Software Versions:
4_2_5 [USB
4_2_3 [USB
4_02_02 [U
4_2_5
4_2_3
Installed Li
Confirm Delete Software Rev
stall Version
elete Version
stall License
Back
Cancel
OK

Warning!

Software Rev "4_02_02" is about to be deleted
from USB Drive

Do you want to continue?

Figure 79 - *Confirm Delete Software Rev.* Warning Window

3.1.7.8.3 Install License Install License

Install License is not implemented at this time.

3.1.7.8.4 Back Back

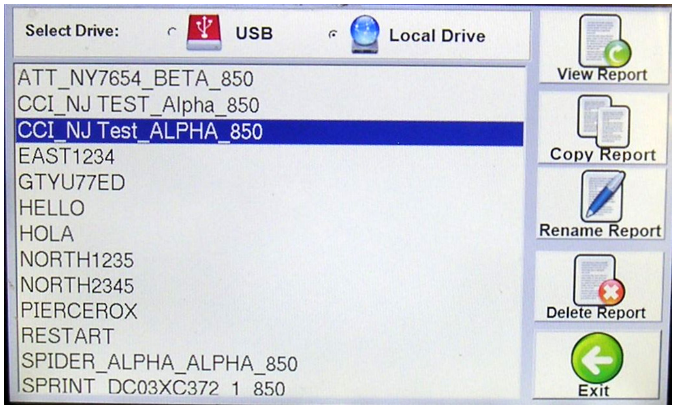
Pressing the ***Back*** icon returns the user to the ***System Configuration*** window.

3.1.7.9 Exit Exit

Pressing the ***Exit*** icon from the ***System Configuration*** window returns the user to the “Main Menu.”

3.1.8 Manage Reports

Pressing the ***Manage Reports*** icon on the Main Menu window opens the "Report" Listing and Menu shown in **figure 80**. Existing Reports found on the **Local Drive** Local Drive (if selected) or the **USB Drive** USB (if selected), are displayed on the left-hand side of the reports window.

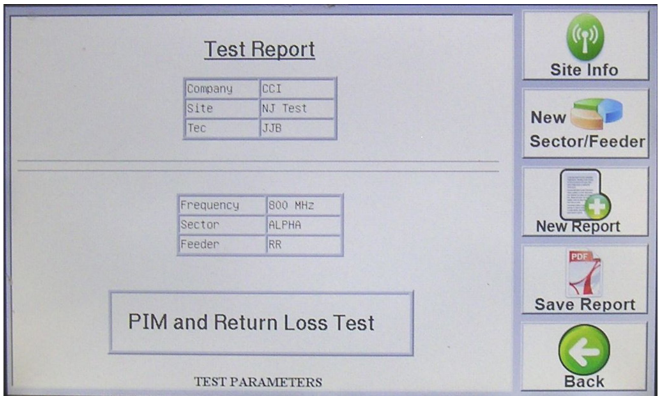

Select Drive:
○ USB
● Local Drive
View Report
Copy Report
Rename Report
Delete Report
Exit

ATT_NY7654_BETA_850
CCI_NJ TEST_Alpha_850
CCI_NJ Test_ALPHA_850
EAST1234
GTYU77ED
HELLO
HOLA
NORTH1235
NORTH2345
PIERCEROX
RESTART
SPIDER_ALPHA_ALPHA_850
SPRINT_DC03XC372_1_850

Figure 80 - Report Listing and Menu Window

3.1.8.1 View Report

Pressing the ***View Report*** icon on the Report Listing window (after highlighting a report to be viewed) opens the "Test Report" window shown in **figure 81**. Remember that the report can be located on either the **Local Drive** Local Drive or the **USB Drive** USB . The user can scroll through the report by moving the report down or up throughout the touch screen.


Site Info
New Sector/Feeder
New Report
PDF
Save Report
Back

Test Report

Company	CCI
Site	NJ Test
Tec	JJB

Frequency	800 MHz
Sector	ALPHA
Feeder	RR

PIM and Return Loss Test

TEST PARAMETERS

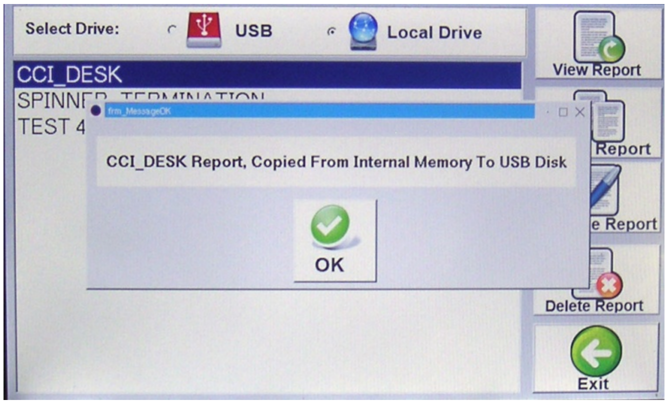
Figure 81 - *View Report* Window

3.1.8.1.1 Exit

Pressing the ***Exit*** icon returns the user to the Report Listing window.

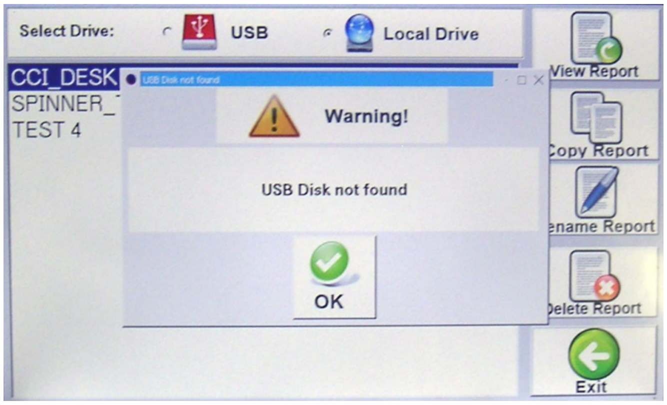
3.1.8.2 Copy Report

Pressing the ***Copy Report*** icon on the Report Listing window (after highlighting a report to be copied) may be successful (see **figure 82**) or may open a warning window for one of two types of warnings. These warnings include “USB Disk not found” (see **figure 83**), or an “Overwrite” warning if the report already exists on the device being copied “to.” Remember that the report to be copied can be located on either the **Local Drive** Local Drive or the **USB Drive** USB and would then be copied to the other drive/device.


Select Drive:
USB
Local Drive
CCI_DESK
SPINNER_TERMINATION
TEST 4
frm_MessageOK
OK
View Report
Report
e Report
Delete Report
Exit

CCI_DESK Report, Copied From Internal Memory To USB Disk

Figure 82 - *Copy Report* (Successful Copy) Window


Select Drive:
USB
Local Drive
CCI_DESK
SPINNER_
TEST 4
USB Disk not found
OK
View Report
Copy Report
ename Report
Delete Report
Exit

Warning!

USB Disk not found

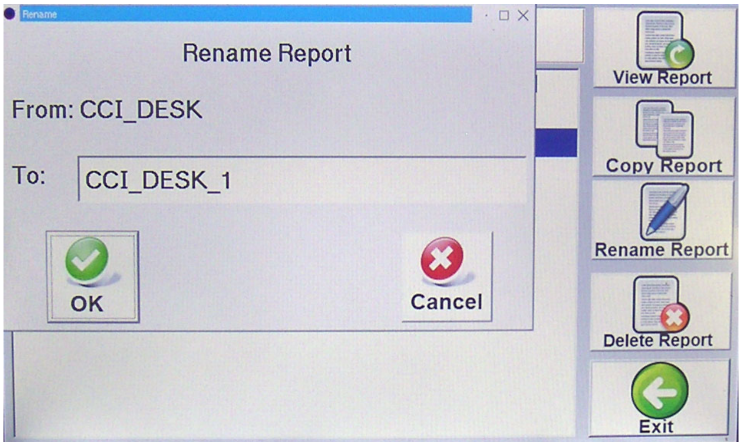
Figure 83 - *Copy Report* (Warning) Window

3.1.8.2.1 OK

Pressing the ***OK*** icon accepts the users request to perform the copy of the report that was highlighted, or acknowledges that the user has read the warning statement and wishes to proceed (or the user acknowledges that the USB device is not present to be copied to.

3.1.8.3 Rename Report Rename Report

Pressing the ***Rename Report*** icon after highlighting the appropriate report name in the Report Listing opens the "Rename" window shown in **figure 84**. *Please note that the "From: filename" cannot be modified.* If the user depresses the name bar next to the "To: filename" this opens up the keyboard display and the steps required to change the file name can then be performed. Remember that the report to be renamed can be located on either the **Local Drive** Local Drive or the **USB Drive** USB .



Rename Report

From: CCI_DESK

To: CCI_DESK_1

Figure 84 - *Rename Report* Window

3.1.8.3.1 OK OK

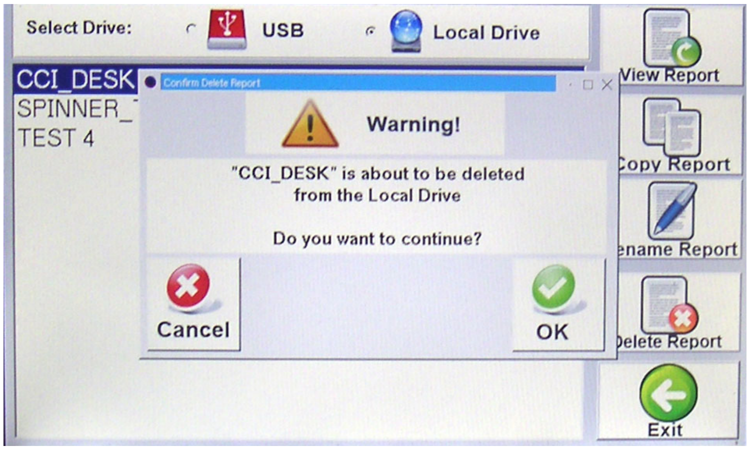
Pressing the ***OK*** icon accepts the requested filename change and returns the user to the Report Listing menu with the changed filename now appearing in place of the filename as it was prior to being renamed.

3.1.8.3.2 Cancel Cancel

Pressing the ***Cancel*** icon cancels the requested filename change and returns the user to the Report Listing menu with the "old" filename still appearing.

3.1.8.4 Delete Report

Pressing the ***Delete Report*** icon after highlighting the appropriate report name (report which is desired to be deleted) in the Report Listing opens the “Confirm Delete Report” warning window shown in **figure 85**. Remember that the report to be deleted can be located on either the **Local Drive** Local Drive or the **USB DRIVE** USB .


Select Drive:
○ USB
● Local Drive
CCI_DESK
SPINNER_
TEST 4
Confirm Delete Report
View Report
Copy Report
ename Report
Delete Report
Exit
Cancel
OK

Warning!

"CCI_DESK" is about to be deleted from the Local Drive

Do you want to continue?

Figure 85 - *Delete Report* Warning Window

3.1.8.4.1 Cancel

Pressing the ***Cancel*** icon cancels the requested file delete request and returns the user to the Report Listing menu with the “old” filename still appearing.

3.1.8.4.2 OK

Pressing the ***OK*** icon accepts the requested file delete request and returns the user to the Report Listing menu with previously highlighted file is now deleted from the filename listing.

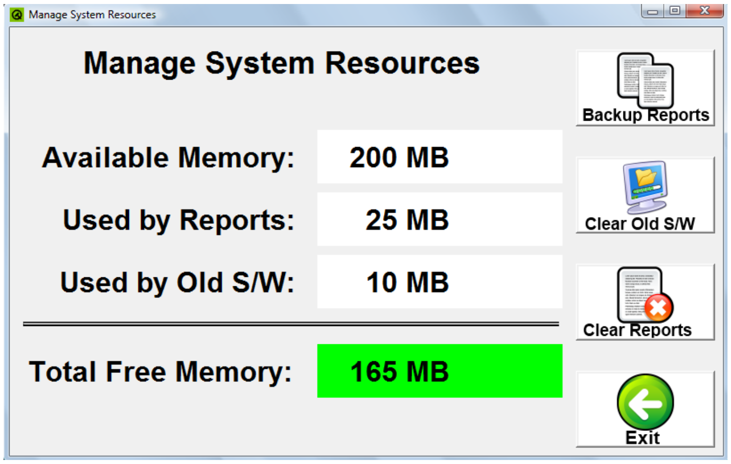
3.1.8.5 Exit

Pressing the ***Exit*** icon from the Manage Reports window returns the user to the “Main Menu.”

3.1.9 Manage Resources

Depressing the Manage Resources Icon in the Main Menu opens the Manage System Resources window as seen in figure 86 below. The following items are available from this window:

1) Available Memory
2) Used By Reports
3) Used By Old S/W
4) Total Free Memory
5) Backup Reports
6) Clear Old S/W
7) Clear Reports
8) Exit



Manage System Resources

Available Memory: 200 MB
Used by Reports: 25 MB
Used by Old S/W: 10 MB
Total Free Memory: 165 MB

Figure 86 – Manage Resources Window

3.1.9.1 Available Memory

The amount of available memory for reports and S/W is shown in the first row shown in the Manage System Resources window.

3.1.9.2 Used By Reports

The amount of memory used by reports is shown in the second row shown in the Manage System Resources window.

3.1.9.3 Used By Old S/W

The amount of memory used by Old S/W is shown in the third row shown in the Manage System Resources window.

3.1.9.4 Total Free Memory

The total amount of free memory is shown in the fourth row shown in the Manage System Resources window.

3.1.9.5 Backup Reports

Backup Reports can be used to copy all reports located on the **Local Drive** Local Drive to the **USB Drive** USB . Utilizing this function allows the user to avoid the need to copy large numbers of reports individually.

3.1.9.6 Clear Old S/W

Clear Old S/W allows the user to delete any old versions of S/W that are loaded in the memory of the PiMPro. While keeping old S/W Versions allows the user to be able to revert to a former version which is known to function properly, performing “Clear Old S/W” allows additional memory to become available for use on the PiMPro.

3.1.9.7 Clear Reports

Clear Reports allows the user to free up additional memory by deleting “all” old reports, once the user has copied the reports to the USB memory.

3.1.9.8 Exit

Pressing the ***Exit*** icon from the Manage Resources window returns the user to the “Main Menu.”

3.2 Update of PiMPro Software

Ensure that the PiMPro PIM Analyzer Software is up to date. In order to ensure that the software is up to date perform the steps listed in **paragraphs 3.2.1 through 3.2.11** below.

3.2.1 Retrieve Latest PiMPro Software

The user can log onto CCI's Website and search for PiMPro Software updates, or if on CCI's mailing list the user will receive the latest PiMPro Software update via email.

3.2.2 Copy PiMPro Software to USB Drive

The user should place a USB Drive into one of your PC's USB ports. After locating the latest PiMPro Software update, copy the file from either the CCI Website or email attachment as applicable onto the USB Drive.

3.2.3 Turn-On the CCI PiMPro

Turn-On the CCI PiMPro PIM Analyzer, and wait for the Main Menu to appear.

3.2.4 Connect USB Drive to PiMPro

Take the USB Drive and connect it to the CCI PiMPro's USB port USB .

3.2.5 Select the Configure System Icon

Configure System

At the Main Menu select the ***Configure System*** icon.

3.2.6 Select the S/W Updates Icon

S/W Updates

At the System ***Configuration Menu*** select the ***S/W Updates*** icon.

3.2.7 Find and Select the Latest Software Version

Find and select the latest software version on the PiMPro's touch screen, and then highlight it by pressing the touch screen on the latest version software's filename.

3.2.8 Perform Install

Install Version

Press the ***Install Version*** icon on the PiMPro touch screen.

3.2.9 View Warning Message

Once the ***Install Version*** icon has been depressed, a Warning message (in a pop-up window) will appear as shown in **figure 79**. This message will indicate that the software is about to be updated and then the computer (PiMPro) will reboot. If an already existing version of software was selected in **paragraph 3.2.7**, then the Warning message will indicate that the software version is about to be overwritten.

3.2.10 Cancel (Existing Software already loaded on PiMPro)

If the user determines that the software version is already loaded in the PiMPro PIM Analyzer, the user should depress the ***Cancel*** icon on the Warning window.

3.2.11 OK (Load Software Update onto PiMPro)

If the user determines that the software version on the USB is not already loaded in the PiMPro PIM Analyzer, the user should depress the ***OK*** icon to load the newer software version in the PiMPro PIM Analyzer, and wait for the PiMPro to load this software and reboot.

3.3 Calibrate Screen

Perform an LCD Touch-Screen Calibration on the PiMPro PIM Analyzer Software when alignment of Icon(s) does not match area of the screen to be touched. In order to ensure that the LCD Touch-Screen is properly calibrated perform the steps listed in **paragraphs 3.3.1 through 3.3.6** below.

3.3.1 Initiate Calibrate Screen

Depress the Calibrate Screen Icon on the Configure System Menu. This will initiate the Screen Calibration.

3.3.2 Upper Left Corner on LCD Touch-Screen

Using an object with a fine point (no eraser heads, etc.) depress the Cross-Hair at the upper left corner of the touch-screen as see in **figure 87** below.

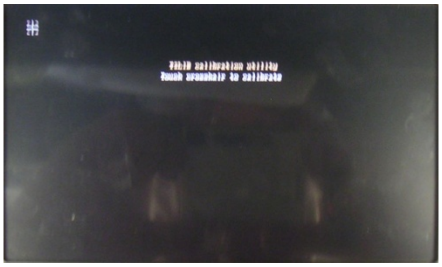


Figure 87 – Calibrate Screen Window with “Cross Hair” at Upper Left Corner

3.3.3 Upper Right Corner on LCD Touch-Screen

Using an object with a fine point (no eraser heads, etc.) depress the Cross-Hair at the upper right corner of the touch-screen as see in **figure 88** below.

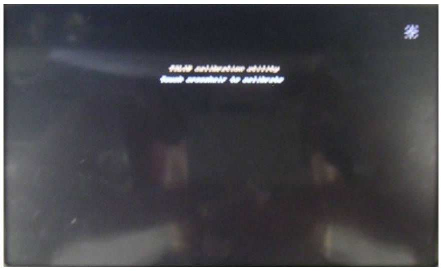


Figure 88 – Calibrate Screen Window with “Cross Hair” at Upper Right Corner

3.3.4 Lower Right Corner on LCD Touch-Screen

Using an object with a fine point (no eraser heads, etc.) depress the Cross-Hair at the lower right corner of the touch-screen as see in **figure 89** below.

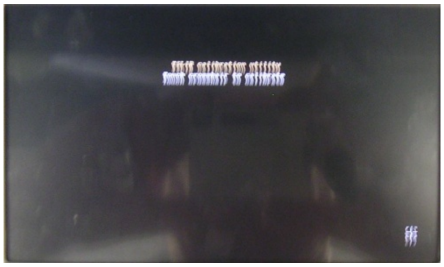


Figure 89 – Calibrate Screen Window with "Cross Hair" at Lower Right Corner

3.3.5 Lower Left Corner on LCD Touch-Screen

Using an object with a fine point (no eraser heads, etc.) depress the Cross-Hair at the lower left corner of the touch-screen as see in **figure 90** below.

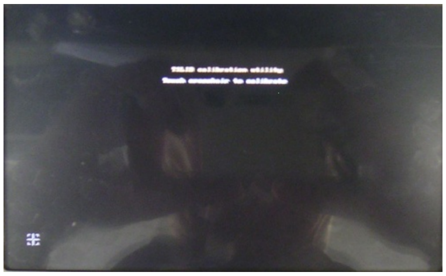


Figure 90 – Calibrate Screen Window with "Cross Hair" at Lower Left Corner

3.3.6 Center on LCD Touch-Screen

Using an object with a fine point (no eraser heads, etc.) depress the Cross-Hair at the center of the touch-screen as see in **figure 91** below.

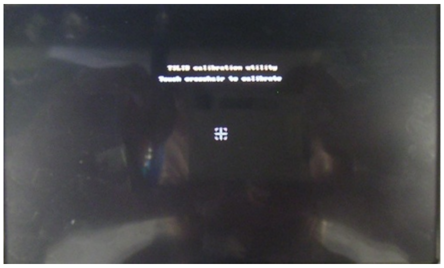


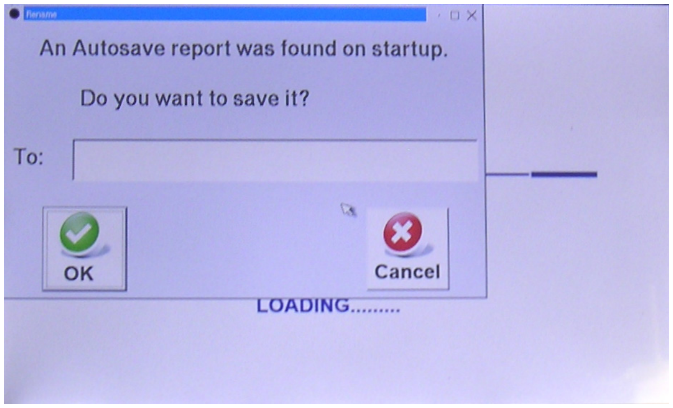
Figure 91 – Calibrate Screen Window with "Cross Hair" at Center

3.3.7 Screen Calibration Completion

Completion of the Touch-Screen Calibration returns the user to the System Configuration Menu.

3.4 Autosave

PIM-Pro now automatically saves unsaved data recordings from a prior measurement session in case power is lost or in case the user forgets to save measurements. This feature works very well in the event of a power outage. See **figure 92** for an example of the Autosave pop-up window after powering the PiMPro PIM Analyzer. *Please note that the Autosave screen will be seen at PiMPro turn-on, especially after a power failure or a session where the user did not save data.*



An Autosave report was found on startup.

Do you want to save it?

To:

LOADING.........

Figure 92 - Autosave Pop-up Window at PiMPro Power-up

3.5 Save Report

3.5.1 Length of Report Filenames

The number of characters allowed for filenames has been extended. Report filenames can now include spaces. This improvement applies to the entire report subsystem which includes Save, Copy, Rename and Open report. *Please note that special characters are not allowed.*

3.5.2 Default Report Filenames

PiMPro generates a default filename for saved reports that the user can override and change. *The "suggested" filename no longer contains the sector information. Please note that special characters are not allowed.*

4 Inspection and Maintenance

4.1 Inspection and Maintenance (Unpowered)

Inspection and Maintenance of the CCI PiMPro should be performed when the unit is not powered. The CCI PiMPro should be inspected for the following items:

1) RF Output Connector Saver
   a. The RF Connector Saver should be examined for dirt. If the RF Connector Saver is dirty please be sure to clean the connector with Q-Tips and Alcohol pads supplied in the PiMPro Accessory Kit.
   b. The RF Connector Saver should be examined for damage. If the connector saver is damaged, the PiMPro should be returned to CCI for replacement.
2) Fans/Fan Covers
   c. The fans/fan covers in the PiMPro should be kept clean to insure proper air flow through the PiMPro. The fans/fan covers can be wiped clean, and a vacuum cleaner can also be used for cleaning.
3) Vents
   d. The vents in the PiMPro should be kept clean to insure proper air flow through the PiMPro. The vents can be wiped clean, and a vacuum cleaner can also be used for cleaning.

4.2 Inspection and Maintenance (Powered)

A powered CCI PiMPro can be inspected for Software and Firmware Version Installed. In order to view the Software and Firmware version see paragraph 3.1.6 (Configure System) and paragraph 3.1.6.5 (About). These versions should be compared with the latest version of Software available for download from the CCI Website on the PiMPro webpage, and the Software Upgrade Instructions document also located on the PiMPro webpage on the CCI Website.

4.3 Battery Replacement

A battery is utilized for the Real Time Clock (RTC) located on the “Friendly ARM MINI24440 Single Board Computer” within the CCI PiMPro. The replacement battery for the RTC is a Panasonic CR1220 (or equivalent). Some equivalent batteries are listed below:

1) Duracell: DL1220
2) Energizer: CR1220
3) Maxell: CR1220
4) Panasonic: BR1220, CR1220
5) Sony: CR1220
6) Varta: CR1220

A Appendix A - PIM Analyzer Verification

A.1 Introduction

This chapter provides the Measurement Validation & Instrument Performance Verification ProcedureCCI PiMPro line of products. The PIM Analyzer operational verification tests consist of the following:

- “Reference PIM Measurement” on **page 96**
- “Frequency Accuracy and Output Power” on **page 98**
- “Residual PIM Measurement” on **page 102**

A.2 Reference PIM Measurement

The following test is used to verify the accuracy of PIM measurements. A known PIM reference (standard) is used for verification.

Equipment Required

- Low PIM Load/Termination, CCI Model PP-AK-LOAD
- PIM Standard, CCI Model PP-AK-PSTAN
- Adapter, 7/16 DIN(m) to 7/16 DIN(m), 50 Ω, CCI Model PP-AK-DMDM
- CCI PiMPro
- All components used in test & verification should be of Low PIM quality type

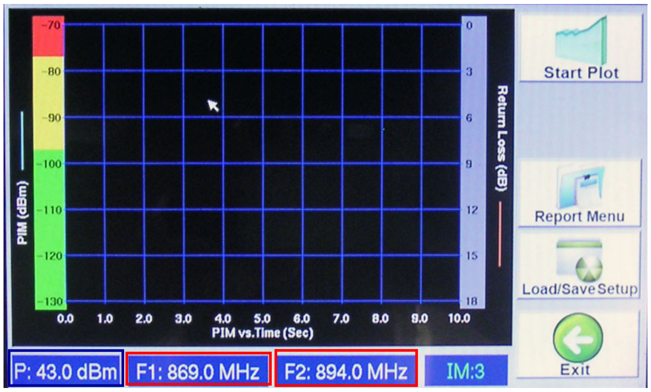
Procedure

1. Confirm that all of the connectors are clean because any debris or contamination may cause incorrect PIM measurement results.
2. Turn on power to the CCI PiMPro.
3. For all PiMPro models use an -80 dBm, -90 dBm or -100 dBm (±3.5 dB) PIM Standard. Connect the PIM Standard to the PiMPro Test Port using the necessary torque wrench. Connect the Low PIM Termination to the PIM Standard using the necessary torque wrench. The sequence of connecting the components is important, and you must adhere to this sequence for accurate results.

Caution	Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

A.2 Reference PIM Measurement (Cont.)

4. On the PiMPro press the PIM vs. Time Icon and verify that the values for Carrier F1 and Carrier F2 are as indicated in the table (**Table 2**) below. See **figure 93** to for reference. If the frequencies do not match **Table 2**, then press the F1 and F2 boxes (red outline on **figure 93**) on the PiMPro touch-screen.



P: 43.0 dBm F1: 869.0 MHz F2: 894.0 MHz IM:3

Figure 93 – Sample screen

Table 2 – Carrier Frequencies

PiMPro Model	Carrier F1	Carrier F2
PiMPro 700	730 MHz	746 MHz
PiMPro 850	869 MHz	894 MHz
PiMPro 900	925 MHz	960 MHz
PiMPro 1821	1805 MHz	1880 MHz
PiMPro 1921	1935 MHZ	1985 MHz

5. On the PiMPro, confirm that Output Power is set to 20 W (+43.0 dBm).
6. Verify that Test Duration is set to 20 s (see X-Axis on graph).
7. On the PiMPro press the Start Plot key to initiate the test. The RF ON icon will appear when the test is in progress.
8. Please wait until the Start Plot key reappears, along with the Record Plot, Report Menu, Load/Save Setup and Exit keys. Note the measurement result that is displayed on the PiMPro touch-screen. The measured result should be -143 dBc ± 3.5 dB (–100 dBm ± 3.5 dB).
9. Record the test results that are reported by the PiMPro touch-screen into **Table 3**, “Reference PIM Measurement with –100 dBm PIM Standard” on **page 101**.

A.3 Frequency Accuracy and Output Power

The following test is used to verify the frequency accuracy and output power of each tone from the PiMPro. The first phase of this procedure is to characterize the "Test Component", which consists of the Fixed Attenuator, the DIN Adapter, and the PIM Test Cable. Note that the Spectrum Analyzer used for measurement should have a minimum accuracy of 5 ppm (5 Hz/MHz) for the band of the frequency being tested.

Component Characterization

Equipment Required

- Signal Generator, Agilent XXXX or equivalent
- Adapter, 7/16 DIN(M) to N(M), CCI Model PP-AK-DMNM
- Power Meter, Agilent XXXX or equivalent
- Power Sensor
- "Test Component" from above consisting of:
  - Fixed Attenuator, 30 dB, 50 W,
  - Adapter, 7/16 DIN(M) to N(m), CCI Model PP-AK-DMNM
  - PIM Test Cable, 7/16 DIN(m) to DIN(m), CCI Model PP-AK-CAB-DMDM
- CCI PiMPro

Procedure

Follow this entire procedure for each instrument that you test.

1. Assemble the "Test Component" by connecting the Fixed Attenuator to the PIM test cable using a DIN adapter.

Caution	Leave the three components (fixed attenuator, PIM test cable, and DIN adapter) in the "*Test Component"* connected to each other until all of the test procedures in this section are completed.

2. Connect the Power Sensor to the Power Meter, zero the sensor, and set the calibration factor to the Carrier F1 frequency of the appropriate model in **Table 2**, "Carrier Frequencies" on **page 97**.
3. Connect the Power Sensor directly to the Signal Generator.
4. Set the Signal Generator to the Carrier F1 setting and adjust the level output to show 0 dBm ± 0.2 dB on the Power Meter. Record the Power Meter reading in the **Power Reading from Signal Generator** column of **Tables 4 thru 8**, "Test Component Characterization" on **page 101**. Turn off the RF Output on the Signal Generator.
5. Disconnect the Power Sensor from the Signal Generator. Connect the Power Sensor to the Fixed Attenuator end of the "Test Component", and connect the other end of the "Test Component" to the Signal Generator.
6. Turn on the RF Output of the Signal Generator. Record the Power Meter reading in the **Power Reading with Test Component** column in **Tables 4 thru 8** as appropriate. Turn off the RF Output on the Signal Generator.
7. Calculate the Test Component Correction Factor by subtracting the value of Power Reading from Signal Generator from the value of Power Reading with Test Component. Record this calculation in **Tables 4 thru 8**.
8. Calculate the Expected Power Reading by subtracting the value of Test Component Correction Factor in Step 8 from 43 dBm (43 dBm – "Test Component Correction Factor" dBm). Record this calculation in **Table 10**, "PIM Output Tone Power Accuracy" on **page 102**.
9. Repeat Step 2 through Step 8 using Carrier F2 as the frequency setting.
10. Remove the "Test Component" however keep it intact to maintain test integrity in order to continue with the next verification procedure.

A.3 Frequency Accuracy and Output Power (Cont.)

Equipment Required

- Spectrum Analyzer
- “Test Component” from above consisting of:
  - Fixed Attenuator, 30 dB, 50 W, 50 Ω
  - Adapter, 7/16 DIN(~~f~~m) to N(m), CCI Model PP-AK-DMNM
  - PIM Test Cable, 7/16 DIN(m) to DIN(m), CCI Model PP-AK-CAB-DMDM
  - CCI PiMPro

Procedure

Follow this entire procedure for each instrument that you test.

1. Turn on power to the PiMPro.
2. Press the **On/Off** key to turn on the Reference Spectrum Analyzer (Ref SPA).
3. Confirm that all of the connectors are clean because any debris or contamination may cause incorrect PIM measurement results.
4. Using the “Test Component”, connect the PIM Test Cable end to the PiMPro using the necessary torque wrench. Connect the Fixed Attenuator end of the “Test Component” to the Ref SPA. The sequence of connecting the components is important, and you must adhere to this sequence for accurate results.

Caution	Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

5. On the PiMPro press the **PIM vs. Time** PIM vs. Time Icon and verify that the values for Carrier F1 and Carrier F2 are as indicated in the table (Table 2) above.
6. On the PiMPro, confirm that Output Power is set to 20 W (+43.0 dBm).
7. Verify that Test Duration is set to 10 s (see X-Axis on graph).
8. On the Ref SPA, press the **Freq** main menu key and set the **Center Freq** to the F1 (in MHz) Carrier Frequency. Press the **Span** main menu and then se the **Span** to 1 kHz.
9. On the Ref SPA, press the **Amplitude** main menu key and set the **Reference Level** to 20 dBm and the **Scale** to 7 dB/Div. Confirm that Auto Atten is set to On.
10. On the Ref SPA, press the **BW** main menu key and set the **RBW** to 30 Hz.
11. On the Ref SPA, press the **Shift** key and then the **Trace** (5) key. Press the Trace A Operations submenu key. Press the Max Hold -> A submenu key.
12. On the PiMPro, press the **Start Plot** Start Plot icon to initiate the test. The **RF ON** RF ON icon will appear while the test is in progress. The test runs for 10 seconds. Please wait until RF ON icon no longer appears.
13. On the Ref SPA, press the **Marker** main menu key, select Marker 1 and press the On submenu key. Press the Peak Search submenu key, Marker 1 should move to the peak point of the signal displayed. Press the More submenu key, the press Counter Marker to turn on the frequency counter marker function. Note the Marker 1 measurement results that are displayed on the Ref SPA unit.
14. Record the test results that are reported by the Ref SPA unit in **Table 9**, **“PIM Output Tone Frequency Accuracy”** on **page 102** and **Table 10**, **“PIM Output Tone Power Accuracy**” on **page 102**.
15. Repeat Step 8 through Step 13, using the value of Carrier F2 as the Center Freq setting.
16. Calculate the **Output Tone Power Differential** by subtracting the value of **Carrier F1 Measured Power** from the value of **Carrier F2 Measured Power**. Record this calculation in **Table 10**.

A.4 Residual PIM Measurement

The following test is used to verify the residual PIM of the PiMPro. The procedure measures the internal residual PIM of the PiMPro. Note that connector cleanliness is very critical for the Residual PIM Measurement.

Equipment Required

- Low PIM Load/Termination, CCI Model PP-AK-LOAD
- CCI PiMPro

Procedure

Follow this entire procedure for each instrument that you test.

1. Turn on power to the PiMPro.
2. Confirm that all the connectors are clean because any debris or contamination may cause incorrect PIM measurement results.
3. Connect the Low PIM Termination to the PiMPro using the DIN adapter and the necessary torque wrench.

Caution	Before continuing, allow a 30-minute warm up for the internal circuitry to stabilize.

4. On the PiMPro press the **PIM vs. Time** PIM vs. Time Icon and confirm that the F1 and F2 frequencies are per the values from **Table 2**, "Carrier Frequencies" on **page 97**.
5. On the PiMPro, view the P1/P2 block and confirm that Output Power is set to 20 W (+43 dBm). Next verify that Test Duration is set to 10 s.
6. On the PiMPro, press the **Start Plot** Start Plot icon to initiate the test. The **RF ON** RF ON icon will appear while the test is in progress. The test runs for 10 seconds. Please wait until RF ON icon no longer appears.
7. Note the measurement result that is displayed on the PiMPro unit. The measured result should be > –158 dBc or > –115 dBm.
8. Record the test results that are reported by the PiMPro in **Table 11**, "Residual PIM Measurement" on **page 102**.

B Appendix B – Test Records

B.1 Introduction

This appendix provides test records that can be used to record the performance of the PiMPro. Make a copy of the following Test Record pages and document the measured values each time performance verification is performed. Continuing to document this process with each performance verification session provides a detailed history of the instrument performance.

PiMPro____ Firmware Rev: _______________ Operator: ______________________ Date: ______________
Serial Number: ________________ Options: ____

B.2 Reference PIM Measurement

Table 3 – Reference PIM Measurement with -100 dBm PIM Standard

PiMPro	PIM Frequency	Specification	Measurement Reading
PiMPro 700	714 MHz	143 dBc and -100 dBm ± 3 dB	dBc and dBm
PiMPro 850	844 MHz	143 dBc and -100 dBm ± 3 dB	dBc and dBm
PiMPro 900	890 MHz	143 dBc and -100 dBm ± 3 dB	dBc and dBm
PiMPro 1821	1730 MHz	143 dBc and -100 dBm ± 3 dB	dBc and dBm
PiMPro 1921	1885 MHz	143 dBc and -100 dBm ± 3 dB	dBc and dBm

B.3 Frequency Accuracy and Output Power

Table 4 - Test Component Characterization for PiMPro 700

Test Component Correction Factor	Signal Generator Frequency and Power	Power Reading from Signal Generator	Power Reading with Test Component
dBm at 730 MHz	730 MHz at 0 dBm ± 0.2 dB	dBm	dBm
dBm at 746 MHz	746 MHz at 0 dBm ± 0.2 dB	dBm	dBm

Table 5 - Test Component Characterization for PiMPro 850

Test Component Correction Factor	Signal Generator Frequency and Power	Power Reading from Signal Generator	Power Reading with Test Component
dBm at 869 MHz	869 MHz at 0 dBm ± 0.2 dB	dBm	dBm
dBm at 894 MHz	894 MHz at 0 dBm ± 0.2 dB	dBm	dBm

Table 6 - Test Component Characterization for PiMPro 900

Test Component Correction Factor	Signal Generator Frequency and Power	Power Reading from Signal Generator	Power Reading with Test Component
dBm at 925 MHz	925 MHz at 0 dBm ± 0.2 dB	dBm	dBm
dBm at 960 MHz	960 MHz at 0 dBm ± 0.2 dB	dBm	dBm

Table 7 - Test Component Characterization for PiMPro 1821

Test Component Correction Factor	Signal Generator Frequency and Power	Power Reading from Signal Generator	Power Reading with Test Component
dBm at 1805 MHz	1805 MHz at 0 dBm ± 0.2 dB	dBm	dBm
dBm at 1880 MHz	1880 MHz at 0 dBm ± 0.2 dB	dBm	dBm

Table 8 - Test Component Characterization for PiMPro 1921

Test Component Correction Factor	Signal Generator Frequency and Power	Power Reading from Signal Generator	Power Reading with Test Component
dBm at 1935 MHz	1935 MHz at 0 dBm ± 0.2 dB	dBm	dBm
dBm at 1985 MHz	1985 MHz at 0 dBm ± 0.2 dB	dBm	dBm

PiMPro____ Firmware Rev: ______________ Operator: ____________________ Date: _____________

Serial Number: _______________ Options: ____

B.3 Frequency Accuracy and Output Power (Cont.)

Output Tone Frequency Differential

Table 9 – PIM Output Tone Frequency Accuracy

PiMPro	Tone Frequency	Specification (± 5 ppm)	Measurement Reading
PiMPro 700	730 MHz	727.35 to 733.65 MHz (730 ± 3.65 MHz)	MHz
PiMPro 700	746 MHz	742.27 to 749.73 MHz (746 ± 3.73 MHz)	MHz
PiMPro 850	869 MHz	864.655 to 873.345 MHz (869 ± 4.345 MHz)	MHz
PiMPro 850	894 MHz	889.53 to 898.47 MHz (894 ± 4.47 MHz)	MHz
PiMPro 900	925 MHz	920.375 to 929.625 MHz (925 ± 4.625 MHz)	MHz
PiMPro 900	960 MHz	955.2 to 964.8 MHz (960 ± 4.8 MHz)	MHz
PiMPro 1821	1805 MHz	1795.975 to 1814.025 MHz (1805 ± 9.025 MHz)	MHz
PiMPro 1821	1880 MHz	1870.6 to 1889.4 MHz (1880 ± 9.4 MHz)	MHz
PiMPro 1921	1935 MHz	1925.325 to 1944.675 MHz (1935 ± 9.675 MHz)	MHz
PiMPro 1921	1985 MHz	1975.075 to 1994.925 MHz (1985 ± 9.925 MHz)	MHz

Output Tone Power Differential

Table 10 - PIM Output Tone Power Accuracy

PiMPro	Tone Frequency and Power	Expected Power Reading and tolerance	Measured Value
PiMPro 700	730 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 700	746 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 850	869 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 850	894 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 900	925 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 900	960 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 1821	1805 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 1821	1880 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 1921	1935 MHz at +43 dBm	dBm ± 1.0 dB	dBm
PiMPro 1921	1985 MHz at +43 dBm	dBm ± 1.0 dB	dBm

B.4 Residual PIM Measurement

Table 11 – Residual PIM Measurement

PiMPro	Carrier Frequencies (F1 and F2)	Tolerance	Measurement Reading
PiMPro 700 (L)	730 MHz and 746 MHz	-158 dBc and -115 dBm	dBc and dBm
PiMPro 850	869 MHz and 894 MHz	-158 dBc and -115 dBm	dBc and dBm
PiMPro 900	925 MHz and 960 MHz	-158 dBc and -115 dBm	dBc and dBm
PiMPro 1821	869 MHz and 894 MHz	-158 dBc and -115 dBm	dBc and dBm
PiMPro 1921	1935 MHz and 1985 MHz	-158 dBc and -115 dBm	dBc and dBm

Revision History

Revision	Date Released	Author	Changes
1.0	5/11/11	J. Baszak	Verify proper screenshots are present; Release Manual.
1.1	8/12/11	J. Baszak	Delete reference to RS-232 port from manual; remove “Non-Continuous” Testing from PIM vs. Time; Add note regarding RF Power “ON” time allowed; Added paragraph 2.8 about RF, Interference and Grounding Protection; Added paragraphs 4 to 4.3 regarding Inspection and Maintenance;
1.2	8/17/11	J. Baszak	Remove reference to license for RX Interference and Frequency Sweep testing; Removed invalid replacement battery part numbers; Added statement about PiMPro operation when both fans are operating at paragraph 3.1;
	1/4/13	J. Baszak	Add Manage Resources and Calibrate Screen Functions; Corrected formatting errors
	2/19/13	J. Baszak	Change Output power limit, output power accuracy and add Frequency Resolution Step Size.
1.3	5/29/13	J. Baszak	Add DAS Test Function and Maintenance Appendices