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Table 1 - Tower Series PIM Analyzer Specifications

Description	Typical Specifications	
Electrical Specifications		
Frequency Bands	Receive Range (MHz)	Transmit Range (MHz)
LTE 700 (Tower Series Dual Band 700)	698 - 722 (RX1), 780 - 798 (RX2)	745.6 - 769.4 (TX1), 732.6 - 734.4 (TX2)
APT 700 (Tower Series Dual Band 700A)	703 - 748 (RX1), 825 - 845 (RX2)	758 - 776 (TX1), 788 - 807 (TX2)
LTE 800 (Tower Series 800)	832 - 862	811 - 821 (TX1), 791 - 795 (TX2)
Cellular 850 (Tower Series 850)	824 - 849	864 - 871 (TX1), 881.6 - 894 (TX2)
GSM 900 (Tower Series 900)	890 - 915	925 - 937.5 (TX1), 951.5 - 980 (TX2)
DCS 1800 / UMTS 2100 (Tower Series Dual Band 1821)	1710 - 1785 (RX1), 1920 - 1980 (RX2)	1805 - 1833 (TX1), 1855 - 1880 (TX2)
PCS/AWS (Tower Series Dual Band 1921)	1710 - 1755 (RX1), 1850 - 1910 (RX2)	1965 - 1995 (TX1), 1930 - 1945 (TX2)
		2110 - 2155 (TX1)
LTE 2600 (Tower Series 2600)	2500 - 2570 (RX1)	2620 - 2644 (TX1) 2690 Fixed (TX2)
Transmitter	<b>Frequency Accuracy:</b> ±1 ppm @ +23°C; Stability ±1 ppm (-10°C to +55°C)	
	<b>Frequency Aging:</b> ±1 ppm/yr	
	<b>Output Accuracy:</b> ± 0.3 dB	
	<b>Frequency Step Resolution:</b> ± 200 KHz	
	<b>Output Power Resolution:</b> ± 0.1 dB	
Receiver	<b>Adjustable Power Range:</b> 20 to 46 dBm x 2 (100 mW – 40 W x 2)	
	<b>Residual Intermod Level :</b> < -120 dBm (< -163 dBc at 20 W); -125 dBm (-168 dBc) Typical	
	<b>Measurement Range:</b> -60 to -140 dBm	
	<b>Noise Floor:</b> -136 dBm	
Measurement Modes	<b>Reverse Power Protection:</b> 13 dBm (20 mW) continuous	
	<b>Measurement Method:</b> One Port, Reverse PIM	
	<b>Real Time PIM:</b> 3 <sup>rd</sup> and 5 <sup>th</sup> order IMD	
	<b>Return Loss:</b> Measured in dB	
	<b>Frequency Sweep:</b> Frequency Response	
	<b>PIM vs. Time:</b> 3 <sup>rd</sup> and 5 <sup>th</sup> order IMD	
	<b>RX Interference:</b> Receive Only Mode – Noise Floor Measurements	
	<b>Noise Floor Measurement:</b> Up-Link noise level with TX off	
	<b>PIM Location (PiMPoint):</b> Distance to PIM Location in Feet or Meters with VP Settings	
	<b>Distance to Fault/Cable Loss:</b> One Port Open-Short Calibration	
Measurement Range	<b>DAS Feature:</b> Path Loss Characteristics (at Low Power over time)	
	<b>Return Loss:</b> Directivity >25 dB; <b>Resolution:</b> >0.1 dB	
	<b>VSWR:</b> Measurement Range 17:1 to 1.12:1; <b>Resolution:</b> >0.01 dB	
	<b>Cable Loss:</b> Measurement Range 0 to 30 dB; <b>Resolution:</b> >0.01 dB	
System	<b>Distance to Fault:</b> VSWR Range 17:1 to 1.02:1; <b>RL Range:</b> 0 to 40 dB	
	<b>Battery:</b> >3 hours (Full Charge)	
	<b>Power:</b> AC (90 - 256 VAC, 50 - 60 Hz)	
	<b>Alarms:</b> Audio & Visual Display	
	<b>Display Size &amp; Type:</b> 8." (203.2 mm) Capacitive TFT, Industrial Grade Screen	
	<b>Data Ports:</b> 3 – USB 2.0, 1 x Ethernet LAN Port	
	<b>Remote Control:</b> WiFi Enabled (802.11n)	
	<b>Control:</b> GUI Control Via Touch Screen Display	
	<b>Battery Power:</b> 28 VDC	
	<b>Battery Capacity:</b> 3.5 AH (99.4 WH)	
Electrical	<b>Battery Type:</b> Li-Polymer Removable Battery Pack	
	<b>Max Power Consumption:</b> <340 W	
Mechanical	<b>Weight:</b> < 18 to 27 lbs. (8.5 to 12.5 kg) (Model Dependent)	
	<b>RF Output Connector:</b> 1 x 7/16 DIN Female	
	<b>Dimensions (W x H x D):</b> 14" x 9" x 4.5" (350 x 230 x 114 mm)	
	<b>Operating Temperature:</b> -10°C to +45°C (14°F to 113°F), 95% RH	
	<b>Storage Temperature:</b> -30°C to +60°C (-22°F to 140°F), 85% RH	

## 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. Tower Series 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.

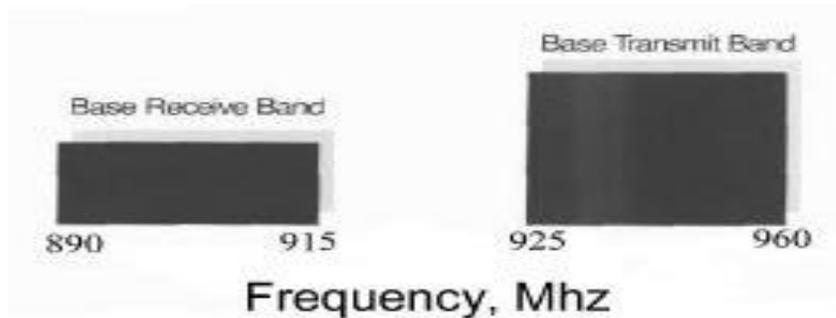
#### 1.1.2 Why is PIM a Problem?

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.

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

For example,  $(2 \cdot f_1 \pm f_2)$ , where  $m = 2$  and  $n = 1$  is a 3<sup>rd</sup> order intermodulation product. Similarly  $(3 \cdot f_1 \pm 2 \cdot f_2)$ , where  $m = 3$  and  $n = 2$  is a 5<sup>th</sup> 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 Tower Series exhibits an exceptional -176 dBc PIM measurement sensitivity.

## 1.1.5 Technical Assistance

For Technical Assistance in the use of the Tower Series 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)

## 1.2 Abbreviations

<b>Abbreviation</b>	<b>Definition</b>
A.C.	Alternating Current
ANT	Antenna
AWS	Advanced Wireless Services
BTS	Base Transceiver Station
CE	Conformité Européenne
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
DUT	Device Under Test
ESD	Electro-Static Discharge
f <sub>1</sub>	Lower Transmit (Test Tone) Frequency
f <sub>2</sub>	Upper Transmit (Test Tone) Frequency
f <sub>IM</sub>	Intermod Frequency (n <sup>th</sup> 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 <sub>L</sub>	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 Tower Series PIM Analyzer can be found in **Table 1** of this manual. The section below provides a brief product overview and block diagram of the Tower Series PIM Analyzer.

## 1.3.1 Tower Series PIM Analyzer Functional Description

CCI's Tower Series 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 Tower Series Precision Passive Intermod Analyzer provides precise measurement of the 3<sup>rd</sup> and 5th 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 Tower Series PIM Analyzer. *Please note that the CCI Tower Series 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 (RL) readings are performed in the Tx Band only.*

Tower Series 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.

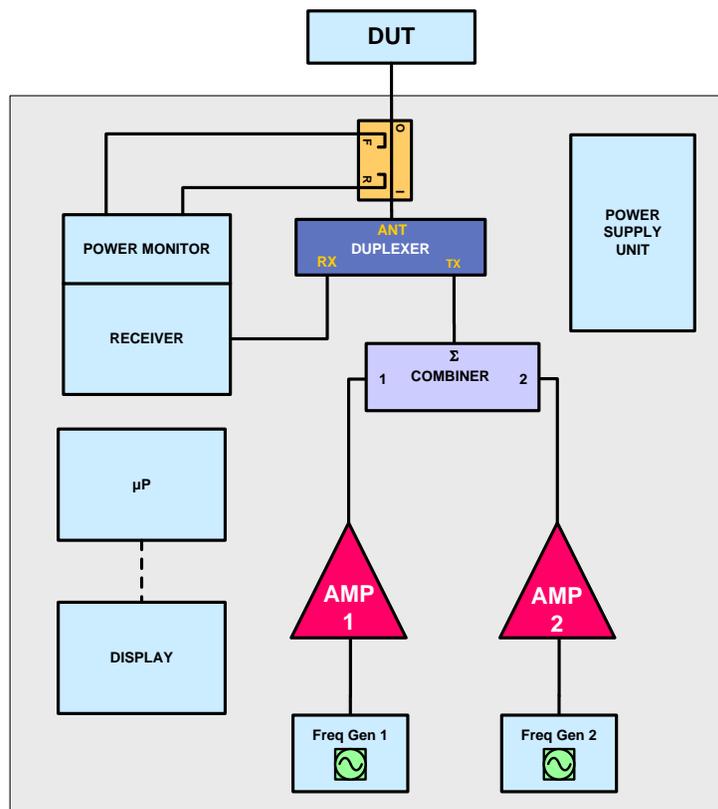


Figure 2 - Tower Series Block Diagram

### 1.3.1.1 Overview

### 1.3.1.2 Analyzer Frequencies Available

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

Model	Frequency Band	TX1 (MHz)	TX2 (MHz)	RX1 (MHz)	RX2 (MHz)
Tower 700 (Dual Band)	LTE 700	745.6 - 769.4	732.6 - 734.4	698 - 722	780 - 798
Tower 700A (Dual Band)	APT 700	758 - 776	788 - 807	703 - 748	825 - 845
Tower 800	LTE 800	811 - 821	791 - 795	832 - 862	
Tower 850	Cellular 850	864 - 871	881.6 - 894	824 - 849	
Tower 900	GSM 900	925 - 935.4	951.6 - 980	880 - 915	
Tower 1821 (Dual Band)	DCS & UMTS 1800	1805 - 1833	1855 - 1880	1710 - 1785	1920 - 1980
Tower 1921 (Dual Band)	PCS & AWS	1965 - 1995	1930 - 1945	1710 - 1755	1850 - 1910
		2110 - 2155			
Tower 2600	LTE 2600	2620 - 2644	2690 Fixed	2500 - 2570	

### 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.

#### 1.3.2.1 Cable Assembly Measurement

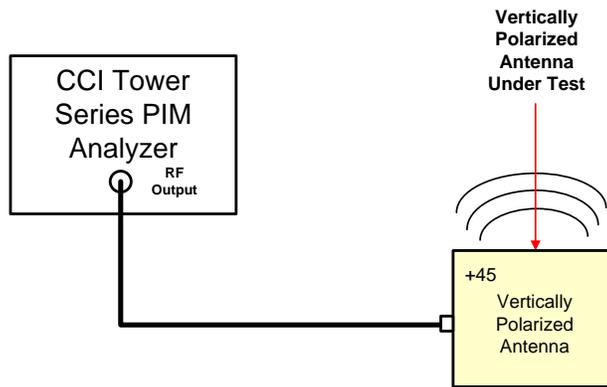
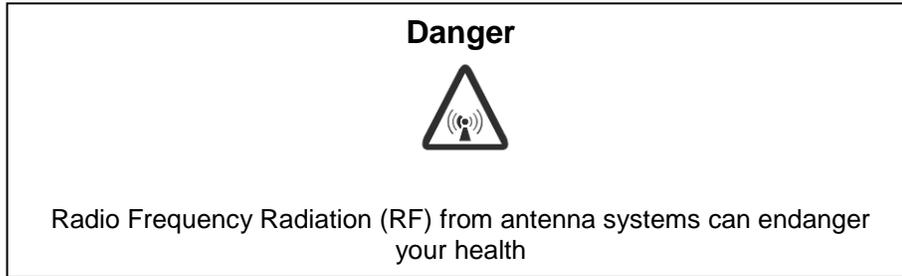
See Multiport Device Measurement. A cable assembly is a 2 port device.

#### 1.3.2.2 Vertical Polarized or Omni-directional Antenna Measurement

In order to measure the PIM for a Vertical Polarized or Omni-directional Antenna see **figure 3** and follow the detailed instructions below:

- I. Connect the RF Output port of the Tower Series PIM Analyzer to the input port of the Vertical Polarized or Omni-directional Antenna.
- II. Perform PIM 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 Omni-directional 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.)



**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 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:

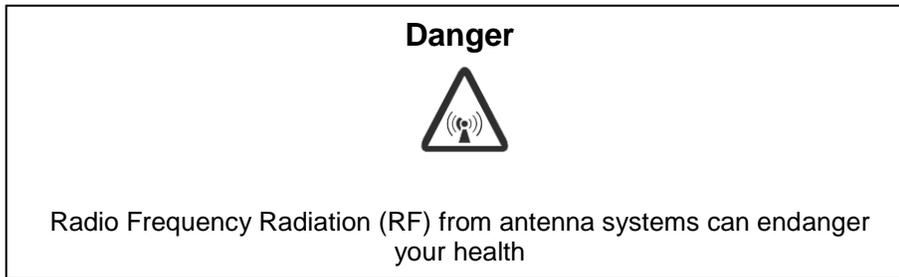
- I. Connect the RF Output port of the Tower Series PIM Analyzer to appropriate input port for the given device type.
  1. **Cable Assemblies** - connect either end of the cable assembly to the Tower Series PIM Analyzer RF Output port.
  2. **Cross Polar Antennas** - connect a test cable to the RF Output port of the Tower Series 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 Tower Series 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 Tower Series 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 Tower Series 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 Tower Series 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 Tower Series 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 Tower Series 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.)

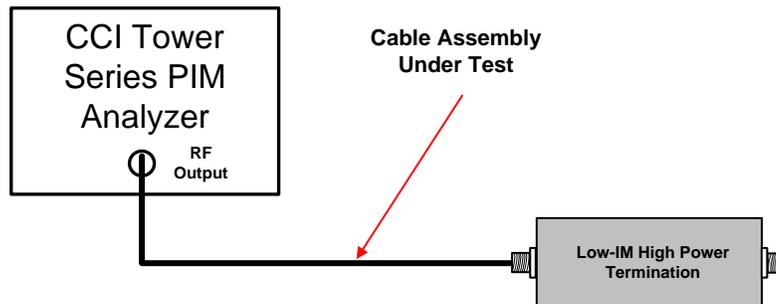
- II. Terminate the appropriate output port(s) of the device to be tested with a Low-IM High Power Termination.
  1. **Cable Assemblies** - terminate the other (far) end of a cable assembly with the Low-IM High Power termination.
  2. **Cross Polar Antennas** - terminate the other port of the Cross-Polar 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 Tower Series Analyzer with a Low-IM High Power Termination. Note the output port of the Diplexer that does not match the operating band of the Tower Series 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 3<sup>rd</sup> 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.
  3. **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 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.*

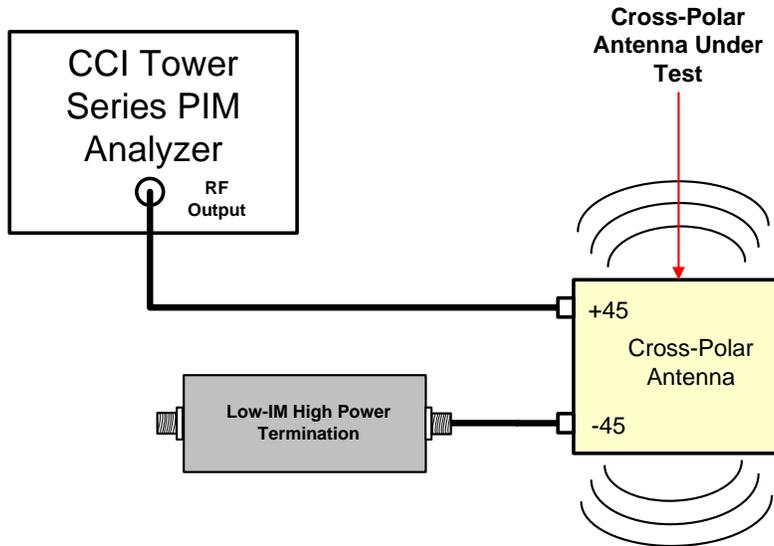


*Please note that some transmit-only devices like an NBLCC (or a particular path in a Low Loss Combiner (LLC)) will not pass Rx frequencies. Any PIM measurements must bypass this device, or at least bypass the path that does not pass the Rx frequencies.*

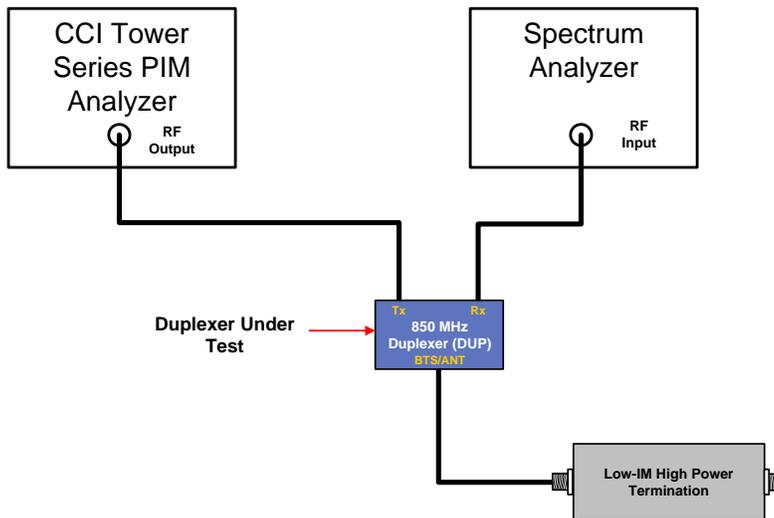


**Figure 4 - Cable Assembly PIM Measurement Test Setup**

**1.3.2.3 Multiport Device Measurement (Cont.)**

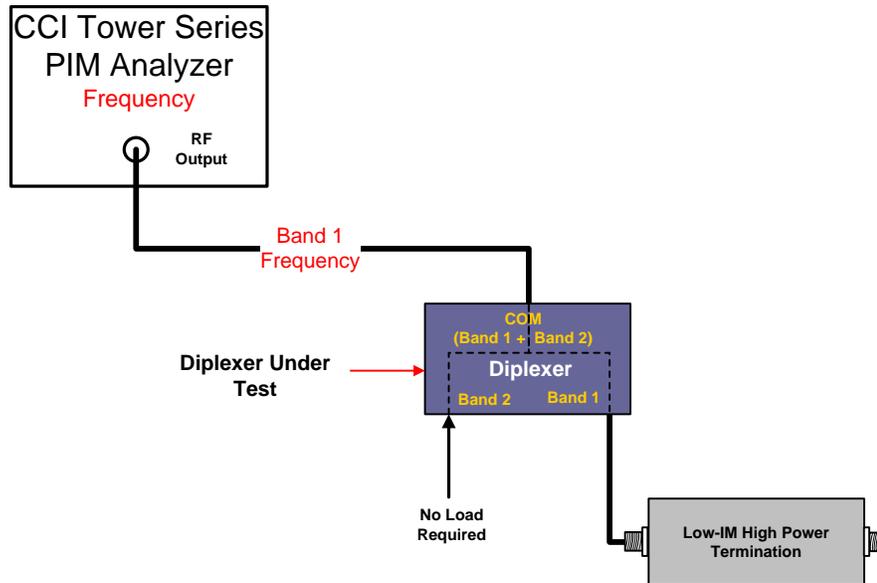


**Figure 5 - Cross-Polar Antenna PIM Measurement Test Setup**

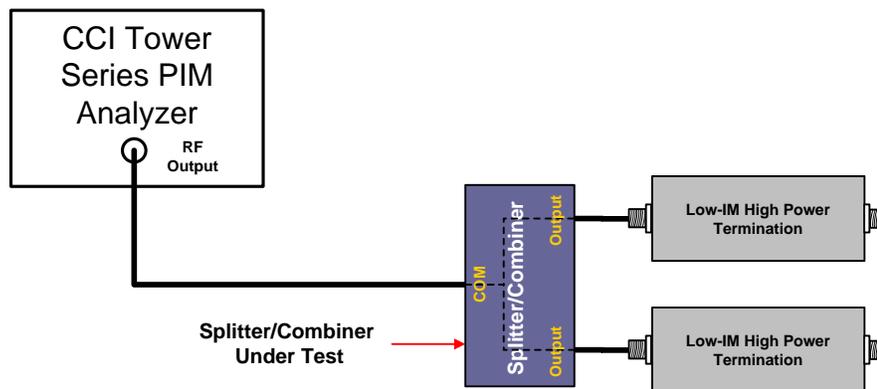


**Figure 6 - Duplexer PIM Measurement Test Setup**

### 1.3.2.3 Multiport Device Measurement (Cont.)

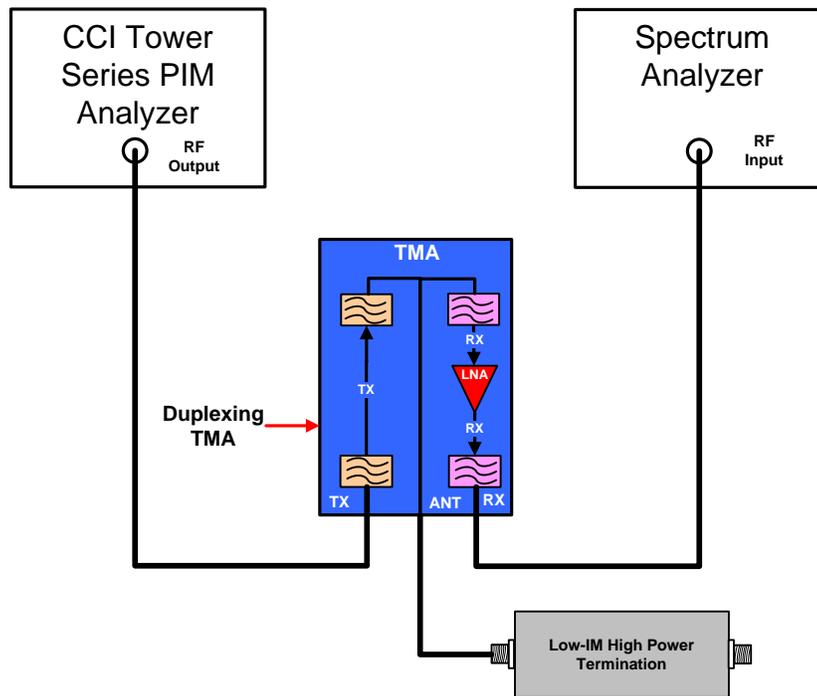


**Figure 7 - Diplexer PIM Measurement Test Setup**

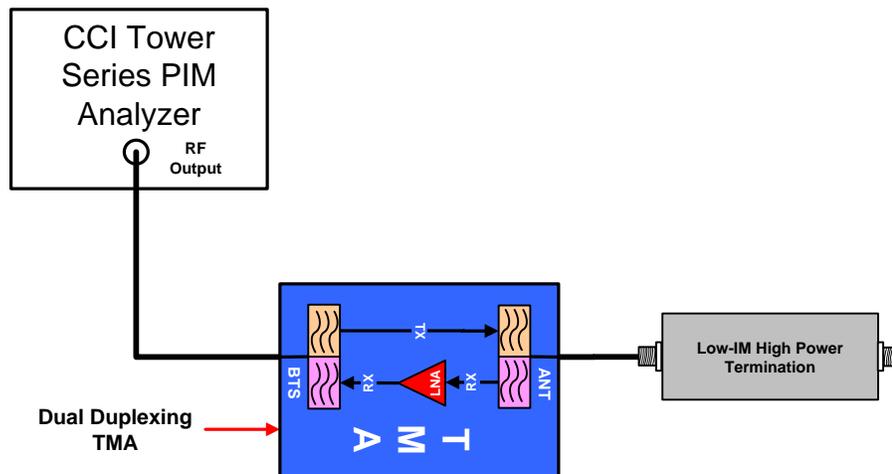


**Figure 8 - Splitter/Combiner PIM Measurement Test Setup**

### 1.3.2.3 Multiport Device Measurement (Cont.)



**Figure 9 - Duplexing TMA PIM Measurement Test Setup**



**Figure 10 - Dual Duplexing TMA PIM Measurement Test Setup**

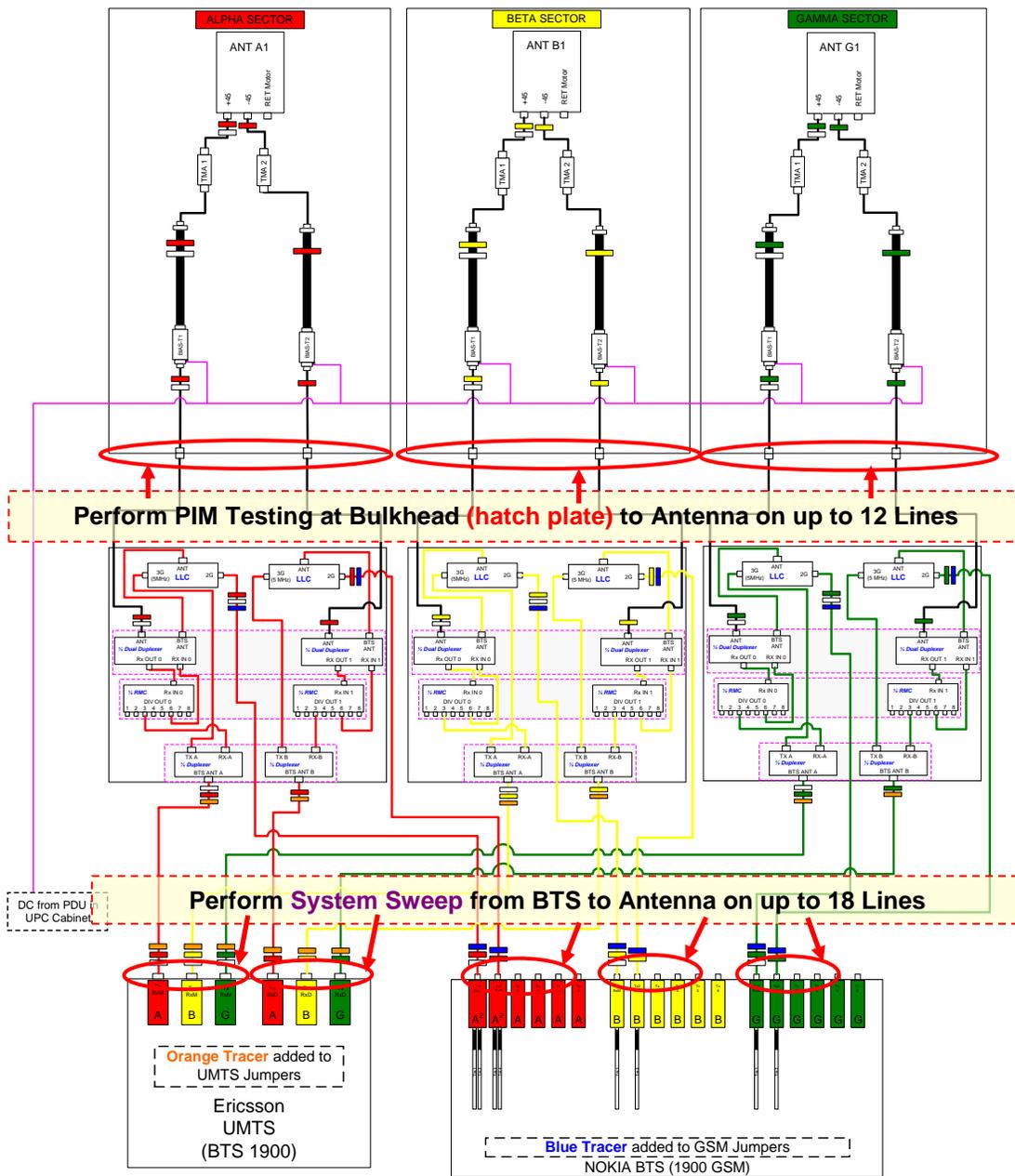
### 1.3.2.4 System PIM Measurement

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 (PPT-AK) for CCI's Tower Series 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.*

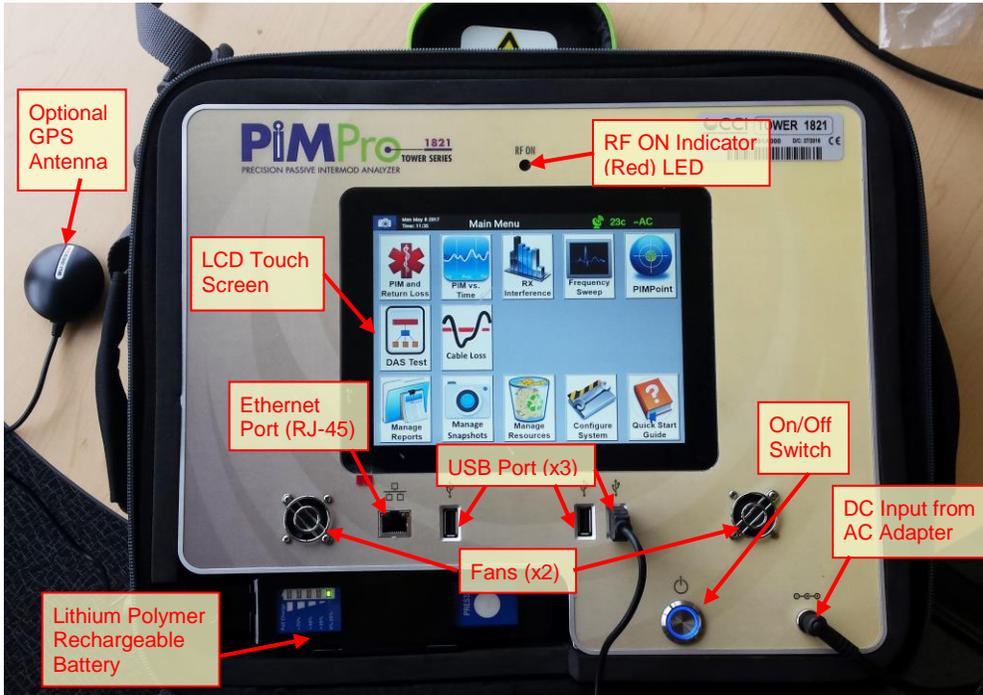
## 1.3.2.4 System PIM Measurement (Cont.)



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

### 1.3.3 Construction and Layout

**Figure 12** shows an overall view of the Tower Series PIM Analyzer with locations of the DC Input (from AC Adapter, On/Off Switch, Fans, LCD Touch Screen, USB Port and Ethernet (RJ45) port. **Figure 13** shows the Location of the RF Output port.



**Figure 12 - Overall view of the CCI Tower Series PIM Analyzer**



**Figure 13 – Tower Series RF Output Port**

### 1.3.3.1 LCD Touch Screen

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

- 1) LCD size - 8.0 inch (Diagonal); Old and/or Discontinued units – 7.0 inch (Diagonal)
- 2) LCD Type – RGB TFT (Thin Film Transistor) Capacitive Screen (Industrial Grade)
- 3) Resolution 800X600

### 1.3.3.2 Fans

There are two fans in the CCI Tower Series 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 Tower Series 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 Tower Series PIM Analyzer. See **figure 12** for location of the On/Off switch.

### 1.3.3.4 “RF ON” Indicator

A “**RF ON**” (Red LED) indicator is located on the above the LCD touch screen on the Tower Series PIM Analyzer as shown in **figure 12** above.

### 1.3.3.5 DC Input from AC Adapter

The DC Input from the AC Adapter is located in the top of the Tower Series PIM Analyzer between the ON/OFF Power Switch and the RHS Fan when facing the Tower Series PIM Analyzer. See **figure 12** for location of the DC Input from the AC Adapter.

### 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 13** 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 Tower Series in future units. This port is available for connection to a wireless router when the “Remote Control” option is purchased. See **figure 12** for location of the RJ-45 Ethernet port.

### 1.3.3.8 USB Ports

For data storage, S/W storage transfer, license storage and setup table storage. A second USB Port is available for connection of a GPS Antenna (when the GPS Option is ordered). Also, a third USB Port can be used to power the wireless router when the “Remote Control” option is purchased. See **figure 12** for locations of the USB ports.

### 1.3.3.9 Tower Series PIM Analyzer in Backpack

CCI’s Tower Series PIM Analyzer is protected by a reinforced backpack case, which can easily strap to a climber’s back for top-of-the-tower performance testing. Additionally, the unit can be safely secured to most any tower structure with its integrated industrial grade clips.

### 1.3.3.10 Lithium Polymer Rechargeable Battery

A Lithium Polymer rechargeable Battery is included for portable operation of the Tower Series PiMPro.

### 1.3.3.11 “WARNING HIGH POWER RF” Label

The “WARNING HIGH POWER RF”  Label is placed inside the “pocket” (see in **figure 13**) that is unzipped for access of the output port on the Tower Series PiMPro backpack. 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 touch-screen.

### 1.3.4 Future Use (Place Holder)

Place holder for future usage.



**Figure 14 – Future Use**

### 1.3.5 Functional and Physical Specifications

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

### 1.3.6 Tower Series Included Accessories

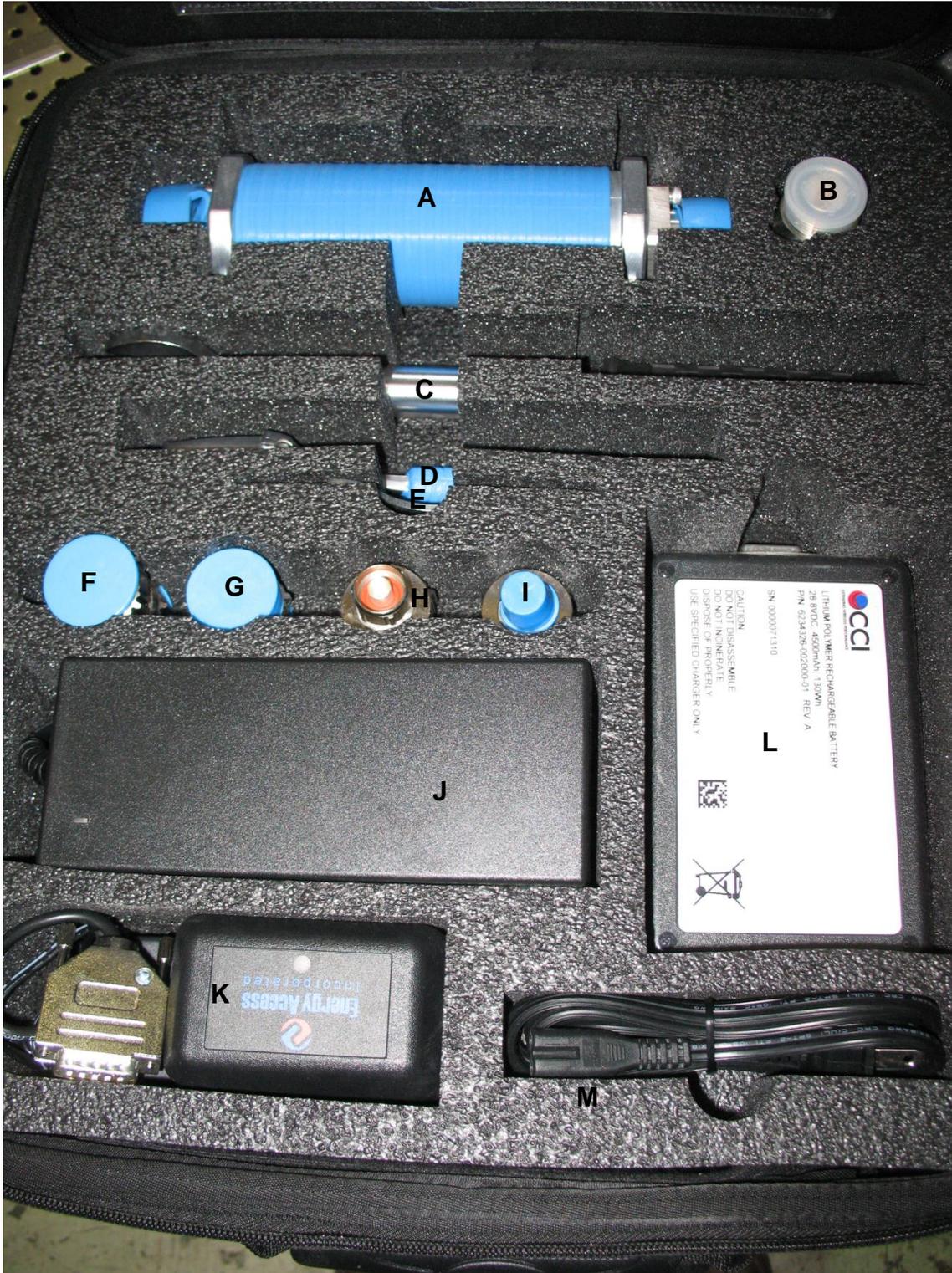
Accessories included with the CCI Tower Series PIM Analyzer include an AC Power Cord, and an Operating Manual.

### 1.3.7 Tower Series Accessory Kit (PPT-AK)

An accessory kit (CCI Model Number PPT-AK) with a soft carrying case for the CCI Tower Series PIM Analyzer (**figure 15**) is available for purchase. This accessory kit contains the following items:

- A) Qty. 1 - Low PIM Low Power Termination DIN-Male and DIN-Female (2 connectors on one termination) → **Rated at 50 Watts for a 4 minute period; Rated PIM ≤ -168 dBc** (Model Number PP-AK-LOAD)
- B) Qty. 1 - -80 dBm PIM Standard (DIN Connector) to be used as a verification tool (Model Number PP-AK-PSTAN-80)
- 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 4.3-10-Male Adapter (Model Number PP-AK-DMMM)
- I) Qty. 1 - Low PIM DIN-Male to 4.3-10-Female Adapter (Model Number PP-AK-DMMF)
- J) Qty. 1 – AC Adaptor (Model Number PP-AKT-AC) → **Note that this is not part of the accessory kit, it is shipped with the Tower Series PiMPro units only**
- K) Qty. 1 – Stand Alone Battery Charger (Model Number PP-AKT-CHRGR)
- L) Qty. 1 – Battery (Model Number PP-AKT-BATT) → **Note that this is not part of the accessory kit, it is shipped with the Tower Series PiMPro units only**
- M) Qty. 1 – Power Cord (Model Number PP-AK-ACC) → **Note that this is not part of the accessory kit, it is shipped with the Tower Series PiMPro units only**
- N) Qty. 1 - Low PIM DIN-Male to DIN-Female 3 M (10 ft.) Jumper Cable (Not Shown) (Model Number PP-AK-CBL-DMDF)
- O) Qty. 1 - Low PIM DIN-Male to DIN-Male 3 M (10 ft.) Jumper Cable (Not Shown) (Model Number PP-AK-CBL-DMDM)
- P) Qty. 1 – Soft Carrying Case (**Not Shown**) (Model Number - AKC)

**1.3.7 Tower Series Accessory Kit (AK) (Cont.)**



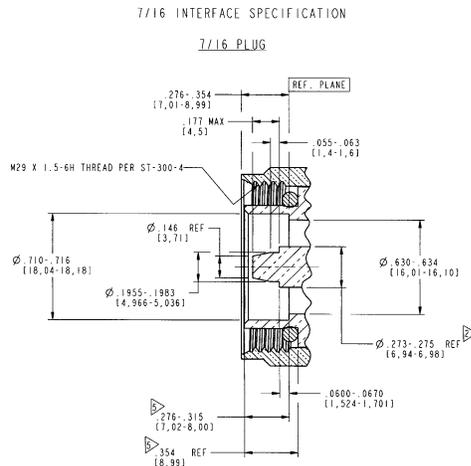
**Figure 15 - Tower Series Accessory Kit (PPT-AK)**

## 1.3.7.1 DIN 7/16 Connector Technical Information

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

### 1.3.7.1.1 DIN-Male Connector

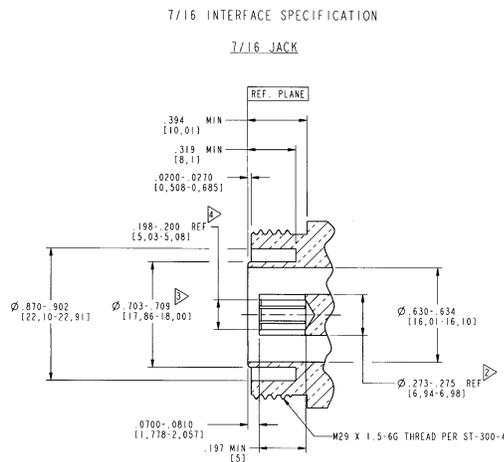
DIN 7/16 male connectors must meet the dimensional requirements shown in the interface drawing shown in **figure 16** below.



**Figure 16 - 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 17** below.



**Figure 17 - DIN-Female Interface Drawing**

### 1.3.8 PiMPro Tower Series Carrying Case (PPT-TC)

A Carrying Case (or Transport Case) (CCI Model Number PPT-TC) for the CCI Tower Series PIM Analyzer (**figure 18**) without the Accessory Kit is available for purchase. This Carrying Case (Transport Case) contains the following items:

- A) Qty. 1 – PiMPro Tower Series Transport Case (used to carry and protect the PiMPro Tower Series PIM Analyzer and PiMPro Tower Series Accessory Kit)



**Figure 18 – Tower Series Carrying Case (PPT-TC)**

### 1.3.9 PiMPro Tower B System with Carrying Case & Accessory Kit (Tower XXXB SP)

The PiMPro Tower B Series System Package includes a Tower xxxB PiMPro unit, a Carrying Case (a.k.a. Transport Case) for the CCI Tower Series PIM Analyzer (**figure 18**), and the Standard Accessory Kit is available for purchase. This Carrying Case (Transport Case) with Accessory Kit contains the following items:

- A) Qty. 1 – PiMPro Tower B Series PIM Analyzer (Model Number **PiMPro Tower xxxB**)
- B) Qty. 1 – PiMPro Tower Series Transport Case (Model Number **PPT-TC**) used to carry and protect the PiMPro Tower Series PIM Analyzer and PiMPro Tower Series Accessory Kit.
- C) Qty. 1 – PiMPro Tower Series Standard Accessory Kit (Model Number **PPT-AK**).

### 1.3.10 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 Tower Series PIM Analyzer

The CCI Tower Series 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 Tower Series PIM Analyzer and the Low PIM Load. If the Tower Series is not properly terminated, dangerous RF Radiation will be present when the unit is turned on. Additionally, the Tower Series can malfunction due to the possibility that the High Power RF can be reflected back into the Tower Series 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 Tower Series Operation

### 3.1 Turn-On Tower Series PIM Analyzer

To start the CCI Tower Series PIM Analyzer:

- A. Plug in the CCI Tower Series PIM Analyzer to an AC source (120 or 220 VAC), or operate from Battery.
- B. Turn on the power switch on the top of the unit. The Tower Series will initially show PiMPro Loading... window (see **figure 19**) for approximately 30 seconds.
- C. Once the Tower Series has completed its start-up cycle the *Main Menu* window (see **figure 20**) opens.

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

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

- 1) Toolbar – a) Camera  Icon allows user to take a Snapshot (.png image) of the LCD Screen for later use, b) Date and Time  Listing, b) GPS  Antenna icon note GPS Enabled, c) Temp  icon note unit temp, and d) AC or Batt  Icons  note if the Tower Series is powered by AC or battery.
  - a. Green GPS  Antenna Icon – GPS Antenna connected and data available
  - b. Orange GPS  Antenna Icon – GPS Antenna not presently connected, data from previous connection available.
  - c. Red GPS  Antenna Icon – GPS Antenna not connected and data not available
- 2) PIM - for setting up “Real Time measurements” of PIM including access to *F1/F2 Power, F1 & F2 Frequency, IM Order # @ IM Frequency* to be tested, *Record Reading, Report Menu, Load/Save Menu* and *Exit*
- 3) 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*
- 4) RX Interference – An “Amplifiers OFF” check of the appropriate RX Band.
- 5) Frequency Sweep - Holds the 1<sup>st</sup> TX tone (f1) steady and changes frequency of the 2<sup>nd</sup> test tone (f2), and then it reverses (holding the 2<sup>nd</sup> TX tone (f2) steady and changes the frequency of the 1<sup>st</sup> TX tone (f1)).
- 6) PIMPoint – A Distance to PIM/Distance to Fault test.
- 7) DAS Test – A low power single tone output test used to provide a companion diagnostic tool for DAS Installation and Primary Propagation Loss Testing. Includes Tx Generator and Rx Capture functions.
- 8) Cable Loss – Adds ability to measure the Insertion Loss of a cable of any length by specifying the cable type.
- 9) Remote – Enables connection to Remote Tablet(s), when this Option” is ordered (see **Fig. 21** for this screen).
- 10) Manage Reports - Access to *Local Drive or USB Memory, Saved Files, Open Report, Copy Report, Rename Report, Delete Report and Exit.*
- 11) Manage Resources – Indication of memory usage and Bulk Copy (Backup), Bulk Clear, Bulk Delete of Old S/W Versions, and Bulk Delete of Snapshots.
- 12) 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*
- 13) Manage Snapshots – To manage the recently added function of saving screenshots as .png images.
- 14) Quick Start Guide - A Quick Start Guide (QSG) is loaded on the Tower Series PIM Analyzer.



**Figure 19 - Initial Window indicating Loading of Tower Series S/W**

## 3.1 Starting the Tower Series (Cont.)



Figure 20 - **Main Menu** Screen

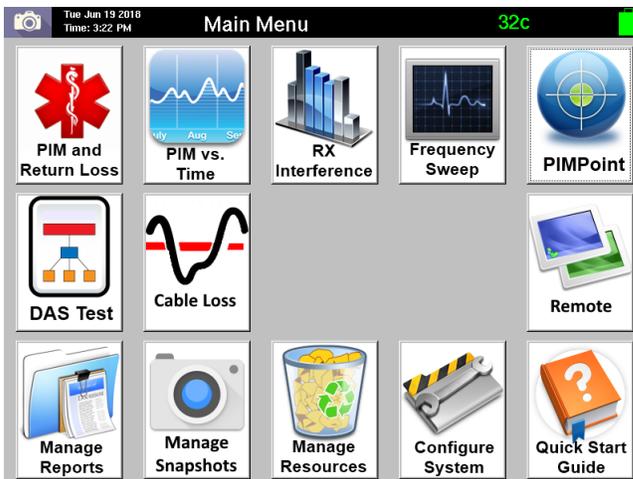


Figure 21 - **Main Menu** Screen (with Remote Option installed)

### 3.1.1 Select **Quick Start Guide** Icon

If you are unfamiliar with the Tower Series and have not been through Tower Series 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 Setting the Date & Time (First Time Only)

The date and time need to be set the first time the Tower Series PIM Analyzer is used, or whenever the unit is moved to a different time zone. Follow the steps below to set the time and date:

### 3.1.2.1 Select **Configure System** Icon

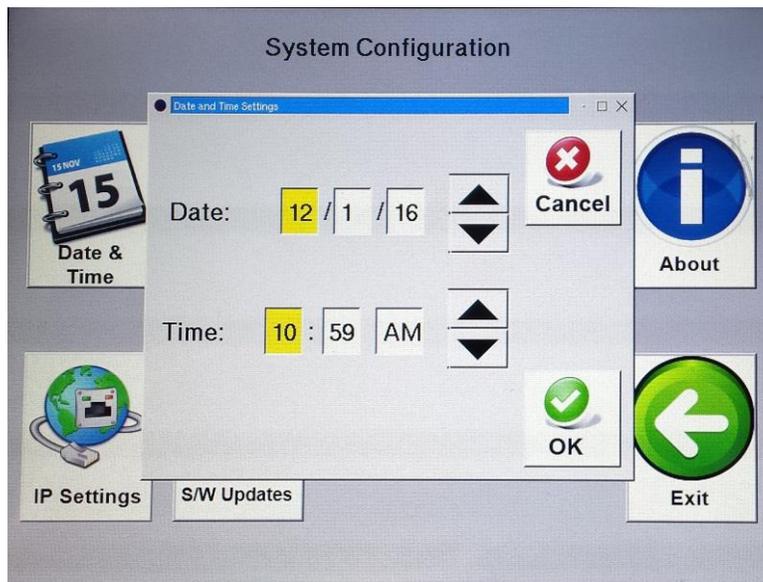
Press the **Configure System** icon found in the **Main Menu** screen shown in **Figure 20** above. This will open the **System Configuration** screen as shown in **Figure 21** below.



**Figure 22 - System Configuration Screen**

### 3.1.2.2 Select **Date & Time** Icon

Press the **Date & Time** icon to open the **Date and Time Settings** Menu in **Figure 22**. 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. The next step is to return to the Main Menu. Finally turn the power to the Tower Series PIM Analyzer off, and after a short duration turn the power to the Tower Series PIM Analyzer on. The **Date & Time** should now be properly set.

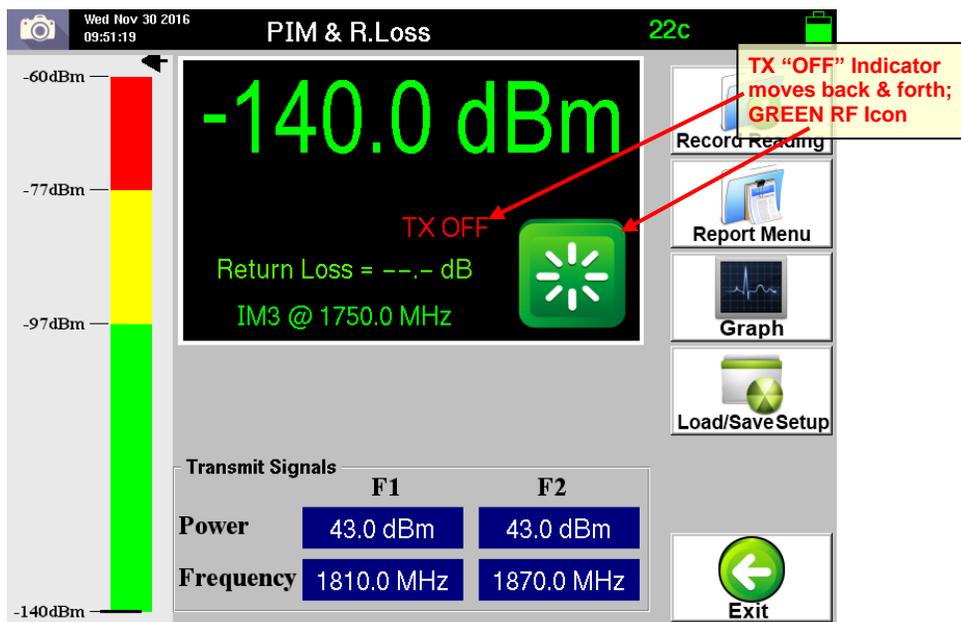


**Figure 23 - Date and Time Settings Menu**

### 3.1.3 Select *PIM and Return Loss* Icon

Press the *PIM and Return Loss* icon found in the *Main Menu* screen shown in **Figure 20**. This will open the *PIM and Return Loss* screen as shown in **Figure 23** 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 pressing 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) **Load/Save Setup** - indicates the "setups" available in either the "Local Drive" or the "USB memory," and offers other load/save menu options
- 10) **Exit** - allows for return to the previous (original) menu



**Figure 24 - *PIM and Return Loss* Window with "TX OFF"**

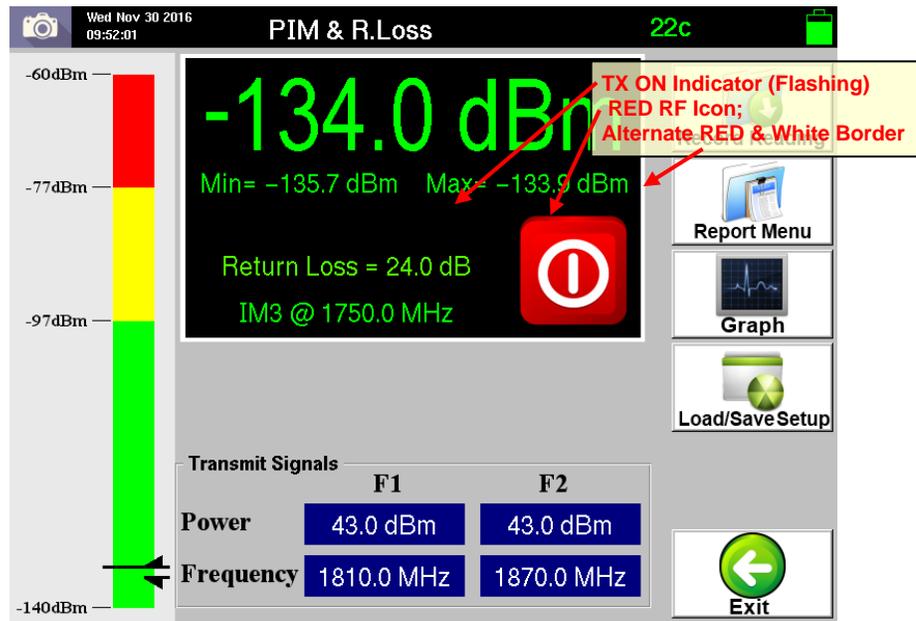
### 3.1.3.1 Connect the Tower Series to a High Power Termination

The Tower Series Accessory Kit (CCI PN# Tower Series-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 Tower Series 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.

### 3.1.3.2 Turn On RF Output

Press the **GREEN RF** icon as shown in **Figure 23** 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. See **paragraph 3.1.3.4** below to record the measurement of the High Power Low PIM Load (if required).

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 25 – PIM and Return Loss Window with “TX ON”**

### 3.1.3.3 Connect Tower Series 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 Tower Series 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. See **paragraph 3.1.3.4** below to record the measurement of the Feeder Line.

### 3.1.3.3.1 PIM Verification (if Required)

If the PIM measurement is ever in question the “Unit Under Test” (UUT) can be disconnected, after insuring that the Tower Series 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 Tower Series 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 Tower Series 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.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

### 3.1.3.3.2 Return Loss (RL) Verification (if Required)

If the RL measurement is ever in question the “Unit Under Test” (UUT) can be disconnected, after insuring that the Tower Series 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 Tower Series 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 Tower Series can be turned “ON” and the RL reading can be taken. The RL 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.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

### 3.1.3.4



### Record Measurement

The Tower Series PIM Analyzer will display the current PIM 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 Tower Series 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.**

### 3.1.3.5 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.

### 3.1.3.5 Turn On RF Output (Cont.)



**Site Information**

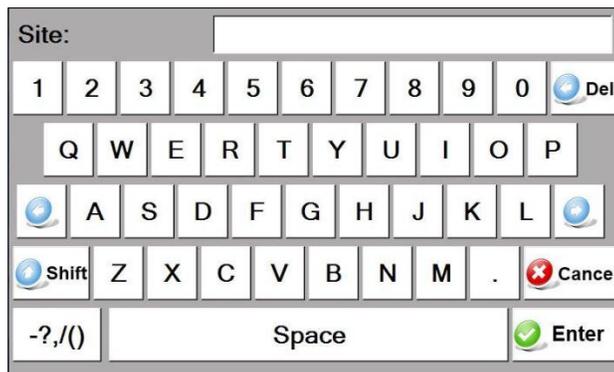
Operator:

Site #:

Technician:

 OK

**Figure 26 - *Site Information* Window**



Site:

1 2 3 4 5 6 7 8 9 0 

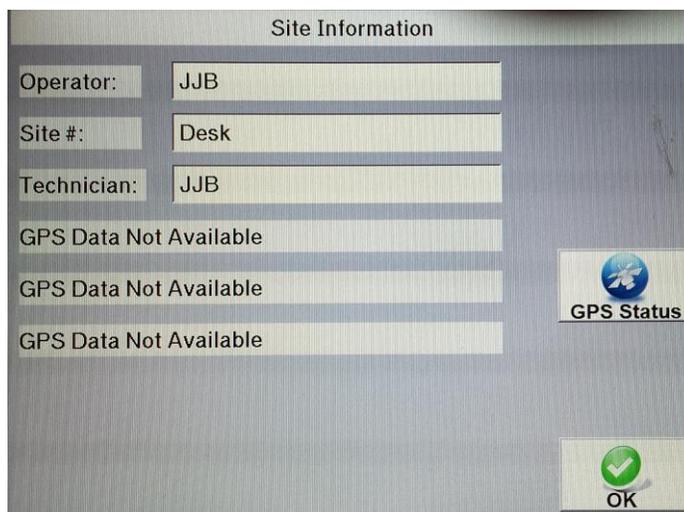
Q W E R T Y U I O P

 A S D F G H J K L 

 Shift Z X C V B N M .  Cancel

-?,/( ) Space  Enter

**Figure 27- *Keyboard Entry* Screen**



**Site Information**

Operator: JJB

Site #: Desk

Technician: JJB

GPS Data Not Available

GPS Data Not Available

GPS Data Not Available

 GPS Status

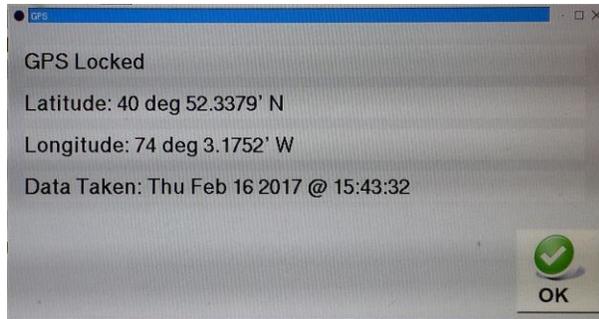
 OK

**Figure 28 - *Site Information* Screen after Data Entry**

### 3.1.3.5.1 GPS Status

GPS Status can be determined by depressing the GPS Status Icon. This opens the GPS Status pop-up window (see **figure 28**). This will give the following information:

- 1) GPS Status (Locked, not Locked, Unavailable)
- 2) Latitude (Detailed)
- 3) Longitude (Detailed)
- 4) Data Taken (Date and Time Info.)



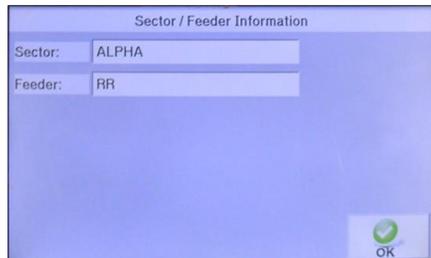
**Figure 29 – GPS Status Details Screen**

### 3.1.3.6 Enter **Sector/Feeder Information**

After completing the Site Information above, the **Sector/Feeder Information** Screen is displayed as depicted in **Figure 29** below. Press 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 30** for an example of the display after Sector, and Feeder information has been entered and prior to pressing the **OK** Icon.



**Figure 30 - Sector/Feeder Information Screen**



**Figure 31 - Sector/Feeder Information Screen after Data Entry**

### 3.1.3.7 *Select Label* Menu

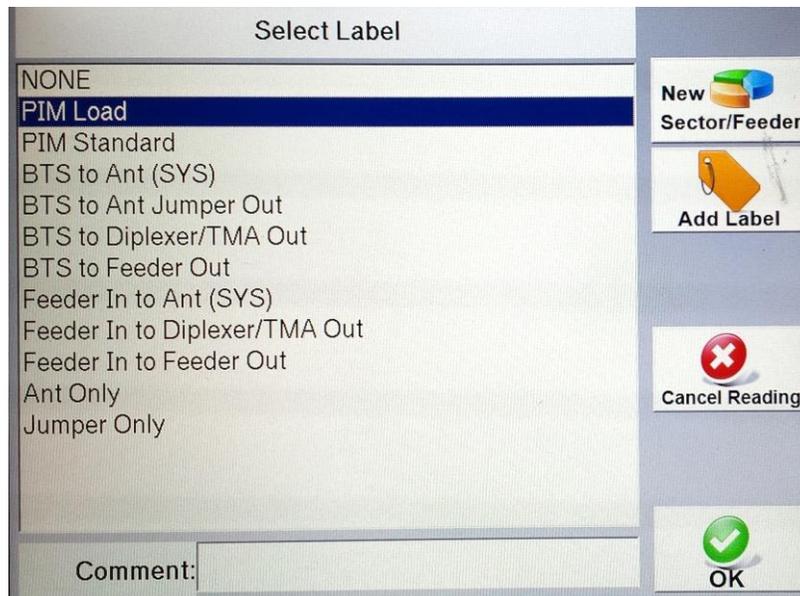
Once the *Site Information* and *Sector/Feeder Information* data entry has been completed, the *Select Label* Pop-up window is displayed as shown in **Figure 31**. The Tower Series PIM Analyzer provides an extensive list of default labels that describe typical measurement points at most cell sites. Select 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



**Figure 32 - *Select Label* Pop-up Window**

### 3.1.3.7.1 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.

### 3.1.3.7.2 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 3.1.3.6** above for details.

### 3.1.3.7.3 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.

### 3.1.3.7.4 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.

### 3.1.3.7.5 OK

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

### 3.1.3.8



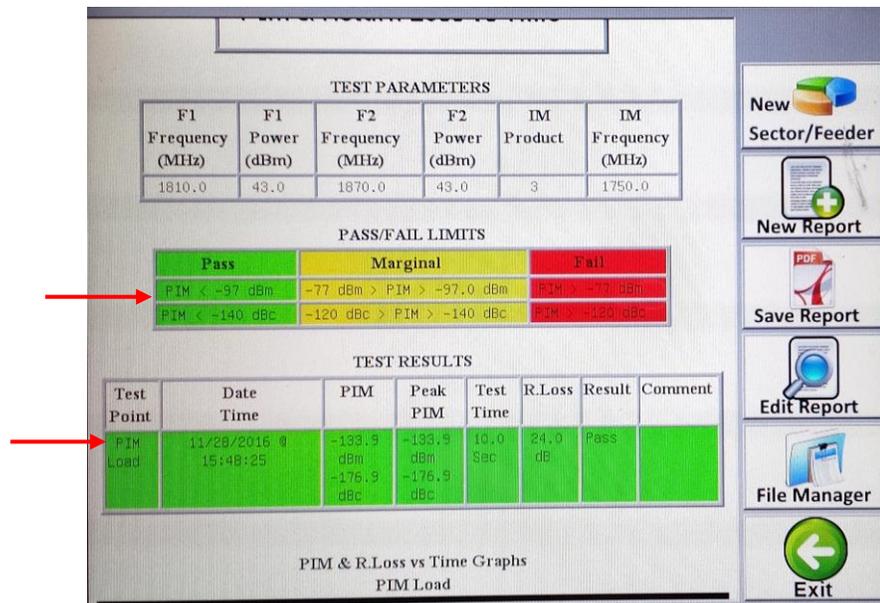
### Report Menu

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 32-33** below. The Report Menu also allows for other menu-type functions to be performed. These functions include the following:

- 1) New Sector/Feeder
- 2) New Report
- 3) Save Report
- 4) Edit Report
- 5) File Manager
- 6) Back

#### 3.1.3.8.1 Viewing the Test Report

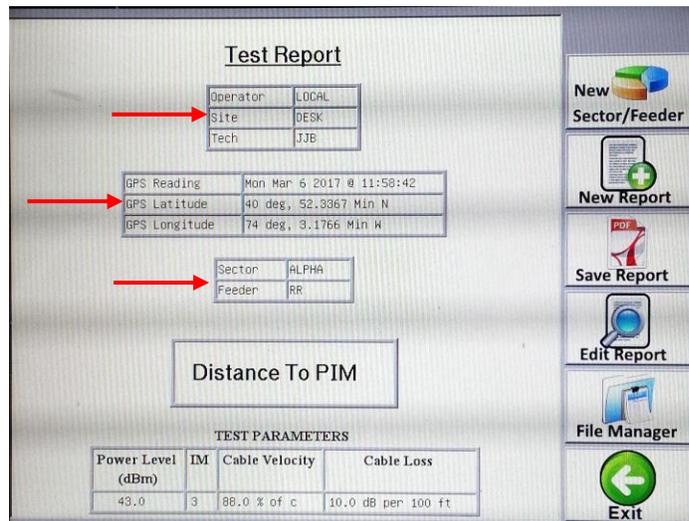
The test report that appears on the touch screen can be “scrolled” up or down by dragging your finger up or down on the screen. *Please note that when the Test Report is opened it always starts at the last test performed (bottom of the report), and can be scrolled up to see previous tests or Site and 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 32**. *Note: The Tower Series Users Guide provides detailed information on how to change these factory default parameters.*



**Figure 33 - Test Report Screen (Pass/Fail Limits and Test Results)**

Scrolling up, the Site Information, GPS Data (when GPS Option is Enabled), and the Sector/Feeder Information that were entered in **steps 3.1.3.5 and 3.1.3.6** displayed at the top of the test report (See **figure 33**).

## 3.1.3.8.1 Viewing the Test Report (Cont.)



**Figure 34 - Test Report Screen (Site, GPS and Sector Info)**

### 3.1.3.8.2 New Sector/Feeder

Pressing the *New Sector/Feeder* icon opens up the *Sector/Feeder Information* window described in paragraph 3.1.3.6 and gives access to the Sector, and Feeder as described above.

### 3.1.3.8.3 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 34** below. The report can be saved to either the **Local Drive**  or the **USB Drive**  by selecting the appropriate icon. The file name for the report is automatically generated by the Tower Series 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 Tower Series 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.*

### 3.1.3.8.3 New Report (Cont.)

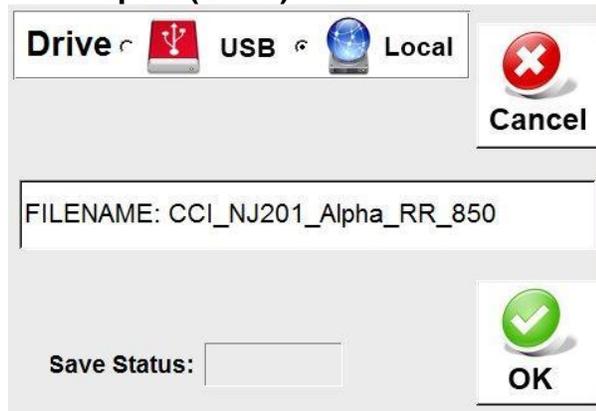


Figure 35 - **Save Report** Screen

### 3.1.3.8.4



### 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 34** above. The report can be saved to either the **Local Drive**  or the **USB Drive**  by selecting the appropriate icon. *Please note that the user should be sure to depress the icons and not the radio buttons in order to properly select which "Drive" the Test Report will be stored in.* The file name for the report is automatically generated by the Tower Series 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 Tower Series 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 Tower Series has been accidentally turned off the report can be saved when the "Auto Save" pop-up appears at Tower Series turn-on. Pressing the Record Reading icon does not save the report.*

Also note that the user may not be able to save Test Reports if the Memory in the Tower Series PIM Analyzer is full. This may occur if files have not been deleted after transferring to a USB Memory. Also it is possible that Tower Series PIM Analyzer units that have been rented may have been previously used and the files have not been deleted by the previous user(s). Please see **paragraphs 3.1.10 and 3.1.10.7** below to **Clear Reports**.

### 3.1.3.8.5



### Edit Report

Edit Report is covered in **paragraphs 3.1.4.6.4 and 3.1.4.6.4.1 through 3.1.4.6.4.6**, see **pages 66 & 67** for details.

### 3.1.3.8.6



### File Manager

File Manager is covered in **paragraph 3.1.4.6.5** see **page 67** for details.

### 3.1.3.8.7



### Exit

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

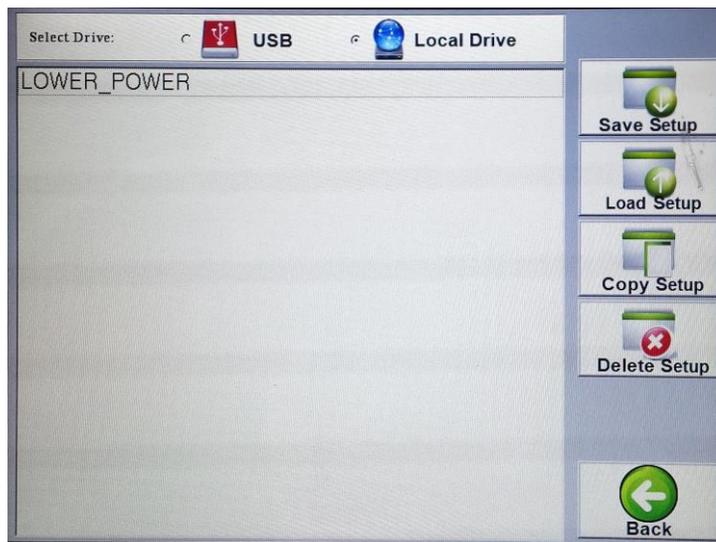
### 3.1.3.9 Graph

The Graph function (see **figure 24**) allows the user to view the Instantaneous PIM & RL in a graph format as an alternative to viewing the instantaneous data, along with the Maximum and Minimum data points. This may be useful to the user, as it captures “jumps” in the PIM & RL which might be missed when viewing the “Display” while in the PIM & RL test mode.

### 3.1.3.10 Load/Save Setup

Pressing 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 Tower Series PIM Analyzer and more. *Note that Load/Save Setups are a “description” of the measurement function, power levels and frequency settings for the Tower Series 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 Tower Series PIM Analyzer **Local Drive**  and/or to the **USB Drive** .  The options available on the *Load/Save Setup* Window Menu (see **figure 35**) 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



**Figure 36 - Load/Save Setup Screen**

#### 3.1.3.10.1 Select Drive

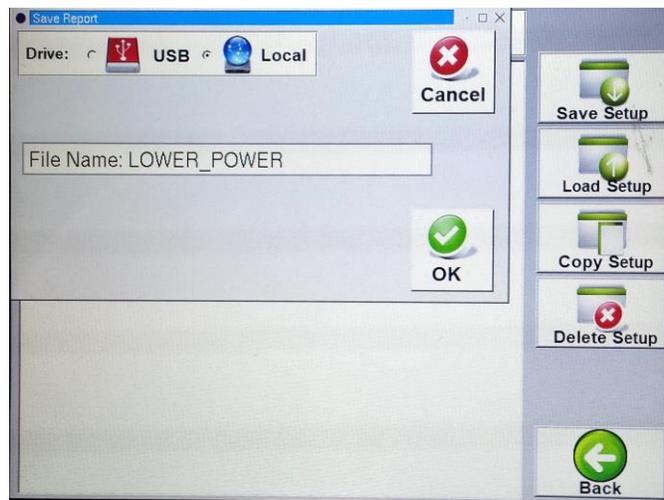
*Select Drive* (found at the top of the window) allows the user to choose whether the setup to be saved, opened, copied or deleted is located (or to be located) on the **Local Drive**  or the **USB Drive**  by depressing the touch screen next to the appropriate icon.

### 3.1.3.10.2 Existing Setup(s)

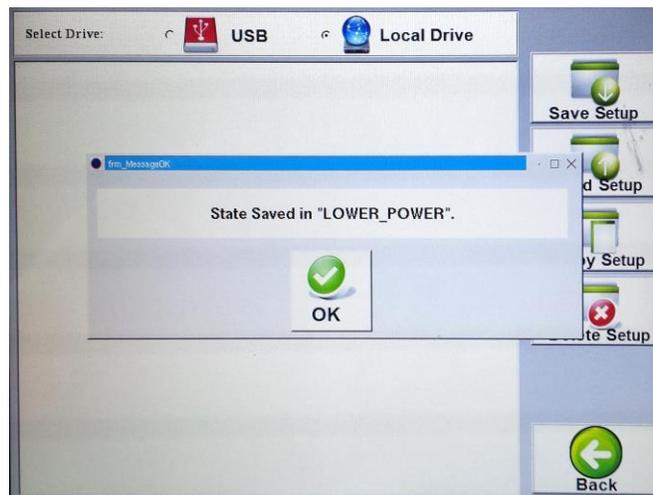
Existing Setups are the setups that are listed with a “filename” in the large portion of the *Load/Save Setup Menu* screen. These listings are located below the “Select Drive” portion of this display. The user can select the existing setup required for testing by depressing the appropriate “filename”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

### 3.1.3.10.3 Save Setup

Pressing the *Save Setup* icon allows the user to save a setup as modified by the user on either the **Local Drive**  or the **USB Drive** . Pressing the “File Name:” bar in the “Save Setup” (Save Report) pop-up window will open up the keyboard and allow the user to type in a file name. Once the keyboard entry is completed the user is brought back to the “Save Setup” (Save Report) pop-up window as seen in **figure 36** below. After pressing the OK button this will open another pop-up window (**figure 37**) showing confirmation that the “State” has been “Saved.”



**Figure 37 – Save Setup (Save Report) pop-up window**



**Figure 38 – “State Saved” pop-up window**

### 3.1.3.10.4 Load Setup

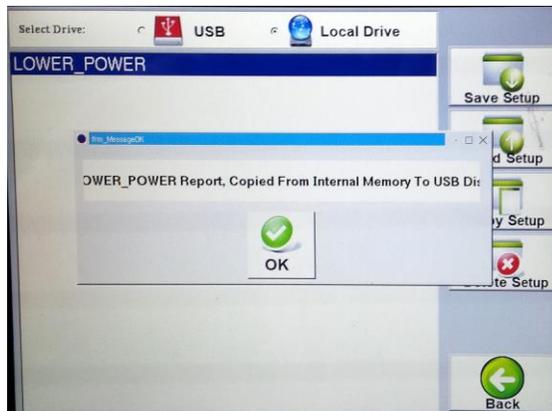


Pressing the *Load Setup* icon allows the user to select the setup that is desired for use in *PIM* (real time measurement) testing by highlighting the applicable setup name on the touch screen display. When the *Load Setup* icon is depressed, the *PIM and Return Loss* window will display on the touch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

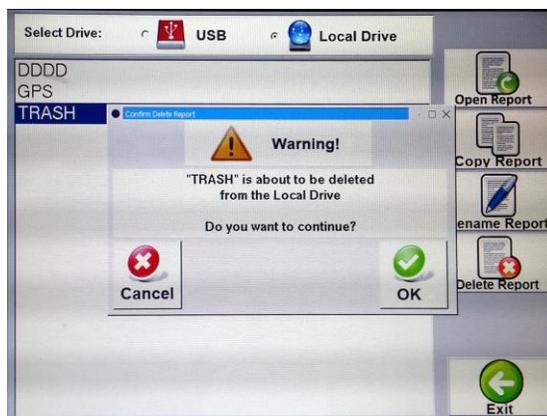
### 3.1.3.10.5 Copy Setup



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 Tower Series PIM Analyzer and then copied to the USB Drive. The user can then bring the USB Drive to all other Tower Series 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 38** for an example when copying a file from the “Internal” memory to a USB memory, and see **figure 39** for an example of an “overwrite” warning.



**Figure 39 – Copy from Internal Memory to USB pop-up window**



**Figure 40 - “Copy” Warning Message Window**

### 3.1.3.10.6



### 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 40 for an example of this warning.



Figure 41 - “Delete” Warning Message Window

### 3.1.3.10.7

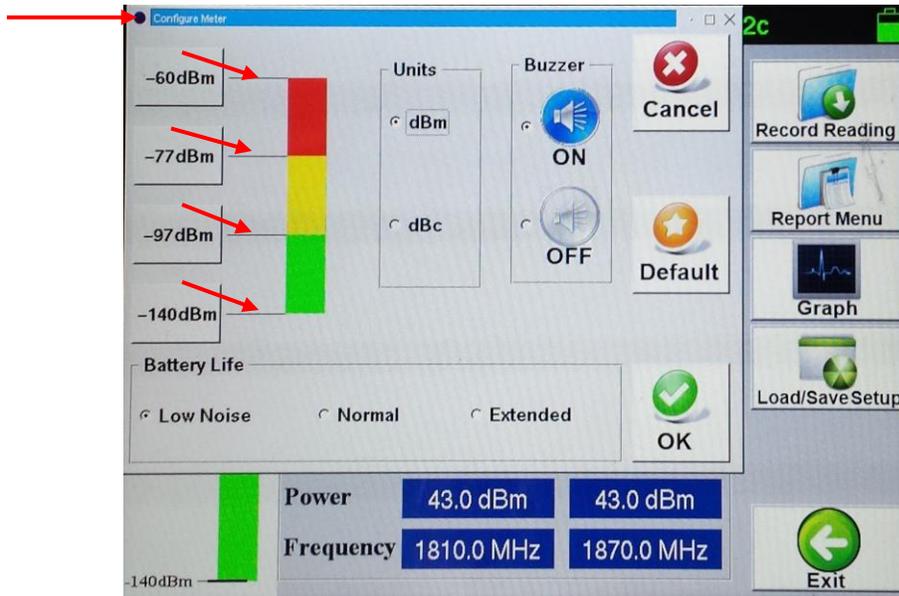


### Back

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

### 3.1.3.11 IM Pass/Fail Bar Chart

Pressing 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 41**) on the touch screen. *Configure meter* allows the user to set different IM Pass/Fail limits.



**Figure 42 - *Configure Meter* Window**

#### 3.1.3.11.1 Configure Meter Window

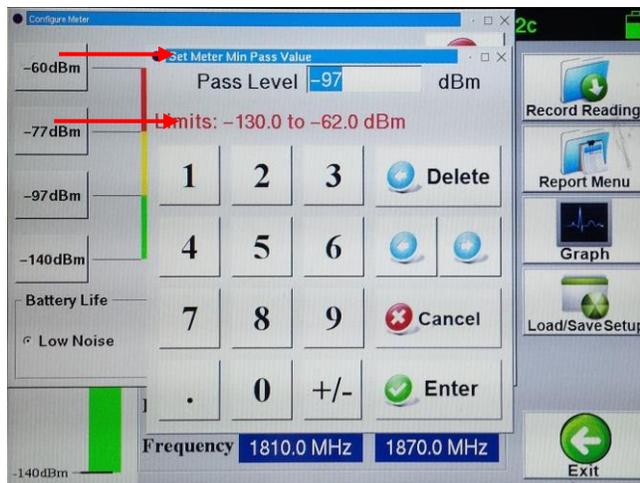
The *Configure Meter* pop-up window allows the following items to be modified or actions to be performed:

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

### 3.1.3.11.2 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. Pressing 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 42**. 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



**Figure 43 - “Set Meter Min Pass Value” Window**

### 3.1.3.11.3 ON OFF Buzzer On/Off

Pressing either the *Buzzer On* or *Buzzer Off* icons shown in **figure 41** will set the Tower Series PIM Analyzer’s buzzer to on or off.

### 3.1.3.11.4 Cancel

Pressing the *Cancel* icon shown in **figure 41** will return the user to the *PIM and Return Loss* (real time measurement) window.

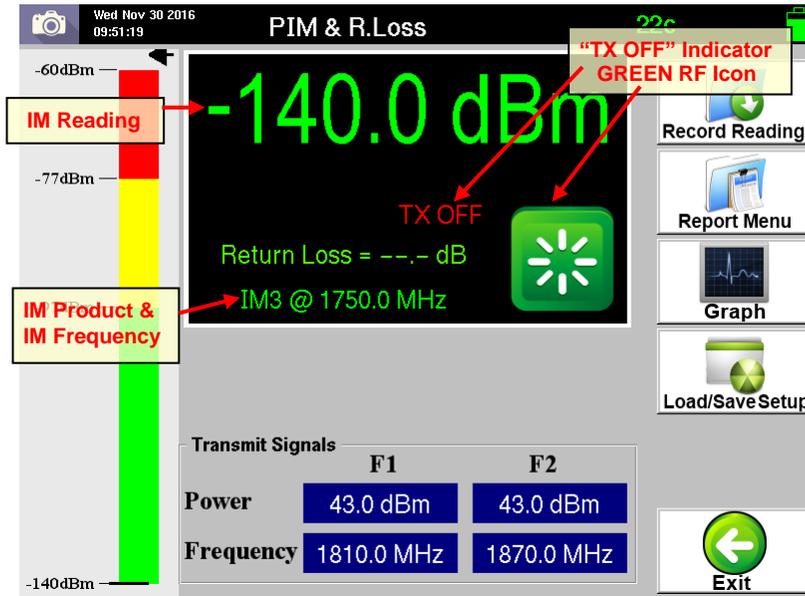
### 3.1.3.11.5 Default

Pressing the *Default* icon shown in **figure 41** will reset the IM Limits to the following values:

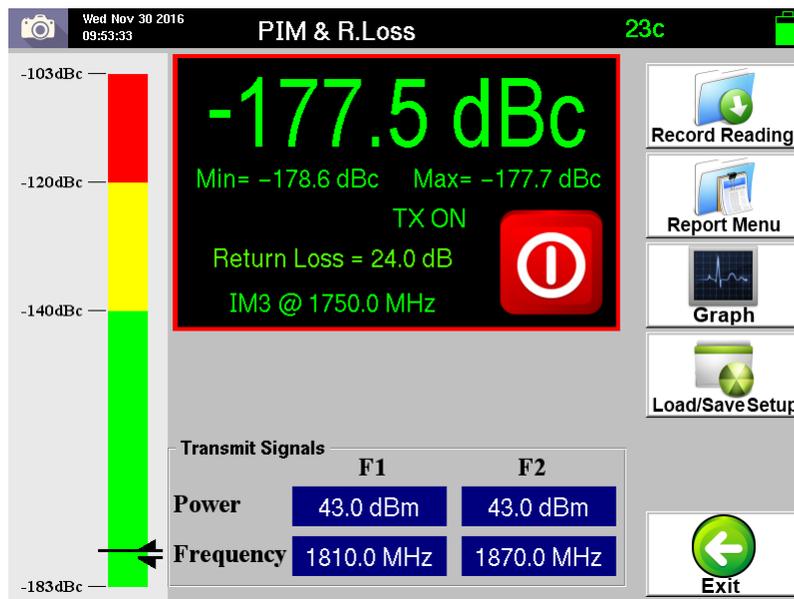
- 1) Min IM Value → -140 dBm
- 2) Min IM Pass Value → -97 dBm
- 3) Max IM Fail Value → -77 dBm
- 4) Max IM Value → -60 dBm

### 3.1.3.12 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 43**. **IM Reading** can be changed from dBm to dBc (see **figure 44**) 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.*



**Figure 44 - *PIM and Return Loss* Window during “TX OFF” (Reading in dBm)**



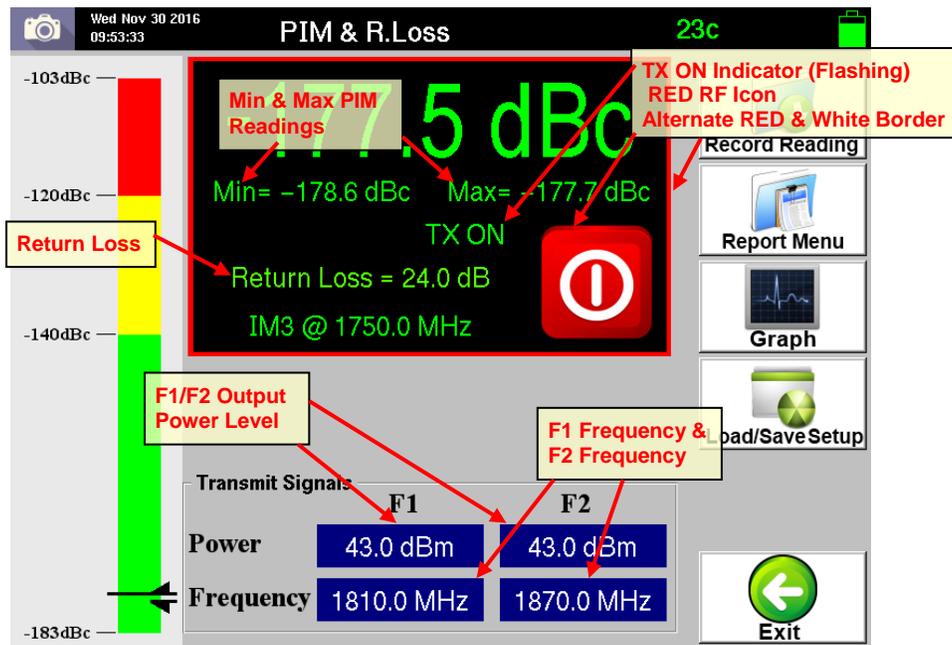
**Figure 45 - *PIM and Return Loss* Window during “TX ON” (Reading in dBc)**

### 3.1.3.13 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 43**.

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 45**. Additionally, an alternating RED and WHITE border will appear around the “measurement” portion of the screen.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 46 - PIM and Return Loss Window during “TX ON”**

### 3.1.3.14 Return Loss (R<sub>L</sub>) Reading

The Return Loss (R<sub>L</sub>) value is shown in green text in the location indicated in **figure 45**. The R<sub>L</sub> is only available when the RF output is “ON”. *Note that Return Loss readings are performed in the Tx Band only.*

### 3.1.3.15 IM Product @ f<sub>(IM Product)</sub>

The IM Product to be measured at the calculated IM Product Frequency appears in white text and is in the location indicated in **figure 43**. The IM Product and IM Product Frequency will be discussed in the following paragraphs.

### 3.1.3.15.1 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 48** below. At this point the user can verify that the correct IM Product and IM frequency ( $f_{(IM\ Product)}$ ) are set to be tested. In this example, if the 1800 Band frequencies for F1=1810.0 MHz and F2=1870.0 MHz have been chosen as in normal (default) operation, then the IM3 block will appear green and list 1750.0 MHz and 1930.0 MHz. The IM5, IM7 and IM9 blocks will appear red and list the frequencies as shown in **figure 48**. Note that the Tower Series automatically calculates the IM3 through IM9 frequencies, and highlights with a “green” background any frequencies that fall within the Rx Band. Similarly the Tower Series highlights any frequencies that fall outside of the RX band with a “red” background.

### 3.1.3.16 F1/F2 Power Level Set Windows

Pressing the F1 or F2 Transmit Power displays where shown in **figure 45** (white text in dark blue background) opens the “Set Tx Power Per Channel” pop-up window. 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 46**. Note that the “Set Tx Power Per Channel” display screen includes an indication of applicable limits (+24.0 dBm to +46.0 dBm) for the Tower Series PiMPro. Finally, note that setting either the F1 or F2 Power really sets the power for both F1 and F2 outputs.

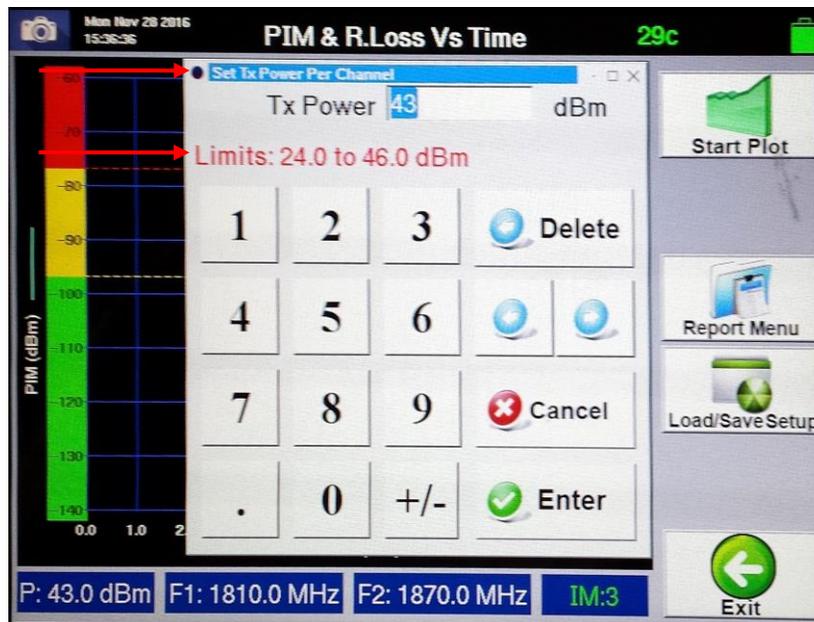


Figure 47 - *Set Tx Power Per Channel* Window

### 3.1.3.17 F1/F2 Frequency Set Windows

Pressing the F1 or F2 Frequency displays where shown in **figure 45** (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 (1805.0 MHz to 1833.0 MHz for Tone 1, and 1855.0 MHz to 1870.0 MHz for Tone 2).* 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 47**. Note that this example lists the values for the Tower Series PiMPro 1821.



**Figure 48 - *Set Tone 1 Frequency* Window**

#### 3.1.3.17.1 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 Tower Series automatically calculates the IM3 through IM9 frequencies, and highlights with a “green” background any frequencies that fall within the Rx Band. Similarly the Tower Series 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 48** for the standard IM3 frequency display when the 1810.0 and 1870.0 MHz Tx (Tone 1 and Tone 2) frequencies are used for PIM testing. See **figure 49** for the select IM screen that will show a lower and an upper IM5 measurement (1750.0 MHz and 1930.0 MHz) where the lower IM5 frequency (1750.0 MHz) falls within the Rx band (based on F1 and F2 frequencies of **1815.0 MHz and 1865.0 MHz**), and **figure 50** for the actual measurement screen (indicating that the measurement is being performed for IM5 at 1750.0 MHz).

**3.1.3.17.1 IM Select Window (Cont.)**

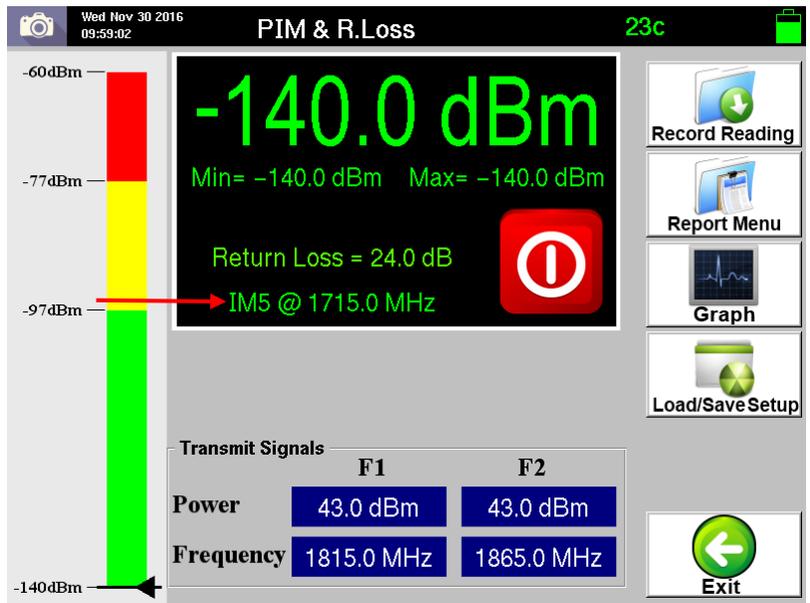


**Figure 49 - *IM Select* Window for (IM3) @ Standard F1 = 1810.0 MHz and F2 = 1870.0 MHz**



**Figure 50 - *IM Select* Window for IM5 at F1 = 1815.0 MHz and F2 = 1865.0 MHz**

**3.1.3.17.1 IM Select Window (Cont.)**



**Figure 51 - *PIM and Return Loss* Measurement Window when Set for IM5 Readings**

## 3.1.4 Making PIM (& RL) versus Time Measurements

CCI's Tower Series PIM Analyzers also allow the user to perform PIM measurements over a period of time. The default mode is a continuous measurement over a period of 10 seconds. *Note: The Tower Series User Manual describes how to change the default test time period.*

### 3.1.4.1



#### Select **PIM vs. Time** Icon

Press the **PIM vs. Time** icon found in the **Main Menu** screen shown in **Figure 20**. This will open the **PIM vs. Time** screen as shown in **Figure 51** below. CCI's Tower Series 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

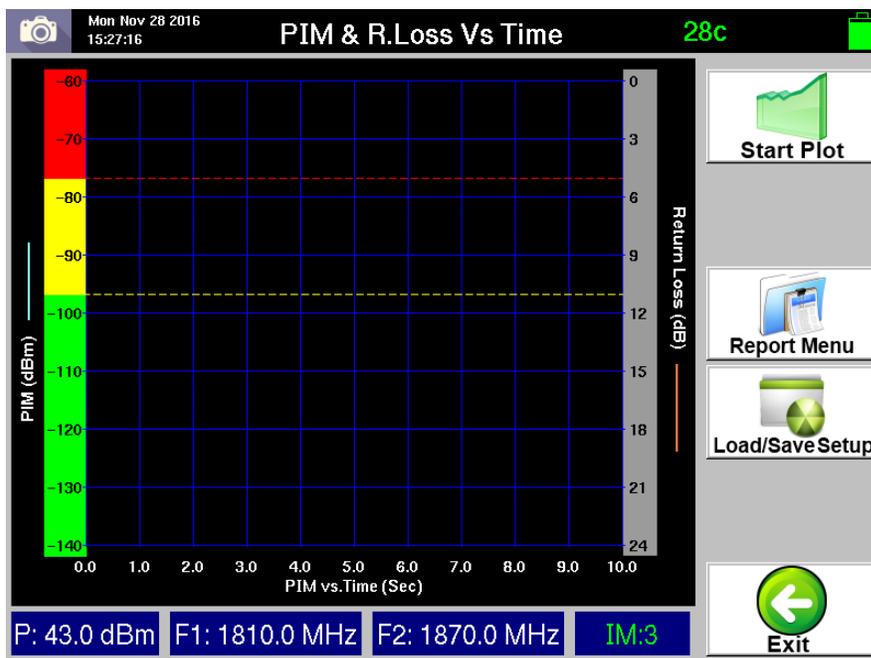


Figure 52 - Initial **PIM vs. Time** Screen

### 3.1.4.2 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 52**). This Menu has the following options available:

- 1) Continuous Test Mode Duration (Sweep time)
- 2) Cancel
- 3) Default
- 4) OK



**Figure 53 - *Configure PIM vs. Time Parameters* Window**

### 3.1.4.2.1 Continuous Test Mode

Pressing 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 53**. *Note that the display screen includes an indication of allowable test time from 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.**



**Figure 54 - Continuous Test Time Window**

### 3.1.4.3 Configure PIM Limit Levels

Pressing the PIM Scale on the touch screen display opens the *Configure PIM Scale* pop-up window (see **figure 54**). 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) Battery Life (Low Noise, Normal & Extended)
- 6) Cancel
- 7) Default
- 8) OK

### 3.1.4.3 Configure PIM Limit Levels (Cont.)

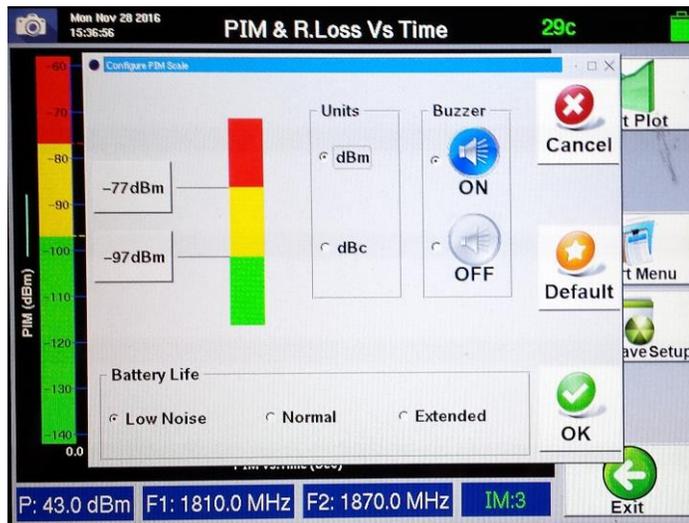


Figure 55 - **Configure PIM Scale** Window

#### 3.1.4.3.1 Min Pass Value, Max Fail Value PIM Level Setting

Pressing either of the IM Level (Pass or Fail) Setting icons opens a *Set Meter* pop-up window similar to the one shown in **figure 55**. 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

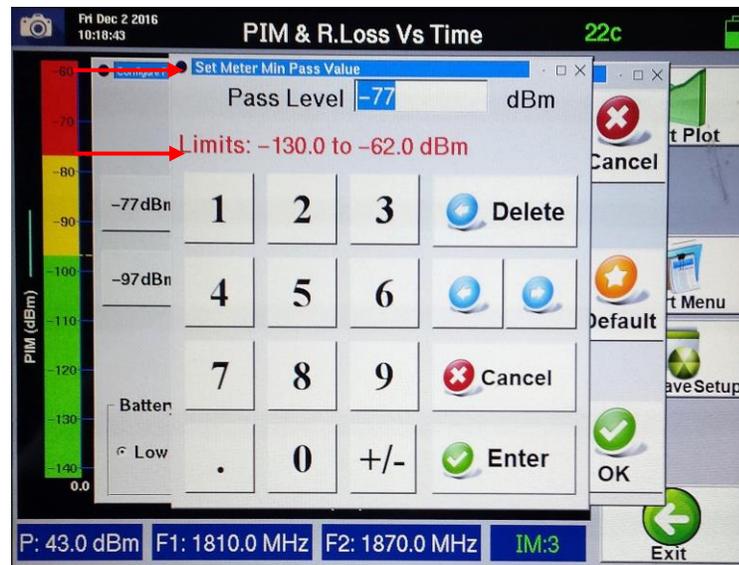


Figure 56 - **Set Meter Min Pass Value** Window

### 3.1.4.3.2 Units

Pressing the dBc unit's portion of the popup window shown in **figure 54** changes the Tower Series PIM Analyzer scale unit's to dBc. Pressing the dBm unit's portion of the popup window changes the Tower Series PIM Analyzer scale units back to dBm.

### 3.1.4.3.3 Buzzer On/Off

Pressing either the *Buzzer On* or *Buzzer Off* icons shown in **figure 54** will set the Tower Series PIM Analyzer buzzer to on or off.

### 3.1.4.3.4 Battery Life

Selection of one of the Battery Life radio buttons as shown in **figure 54** allows selection as follows:

- 1) Low Noise – allows for “Low Noise” operation of the Tower Series PiMPro
- 2) Normal - allows “Normal” operation of the Tower Series PiMPro.
- 3) Extended - allows for an “Extended” battery life.

### 3.1.4.3.5 Cancel

Pressing the *Cancel* icon shown in **figure 54** will return the user to the PIM vs. Time window.

### 3.1.4.3.6 Default

Pressing the *Default* icon shown in **figure 54** will reset the IM Limits to the following values:

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

### 3.1.4.3.7 OK

Pressing the *OK* icon on the touch screen display accepts any changes that have been made to any of the selections available on the “Configure PIM Scale” pop-up window.

### 3.1.4.4 Take Measurement

Press the *Start Plot* icon on the *PIM vs. Time* window to begin the measurement plot generation based on the **Continuous Test Mode** selected earlier.

*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 measurement plot can be interrupted at any time by pressing the *Stop Plot* icon in **Figure 56**. The PIM readings are indicated by a “blue” line, while the *Return Loss* (RL) 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 57** for a view of the *PIM & Return Loss vs. Time* Plot on the *PIM vs. Time* window. See **figure 58** for a screen capture of the recently added dBc unit functionality in the PIM vs. Time test. **Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

## 3.1.4.4 Take Measurement (Cont.)

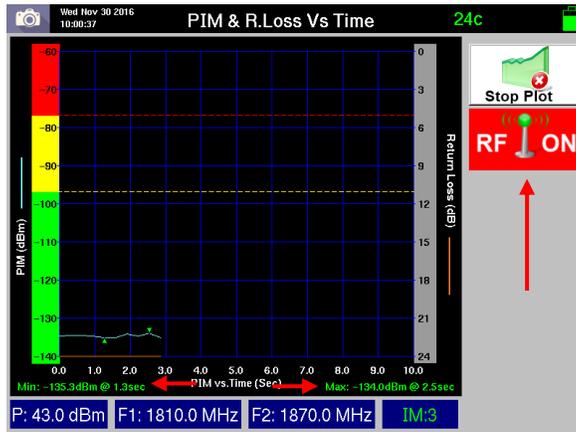


Figure 57 - Partial *PIM & Return Loss vs. Time* Plot on the *PIM vs. Time* Window Showing *Stop Plot* and *RF ON*

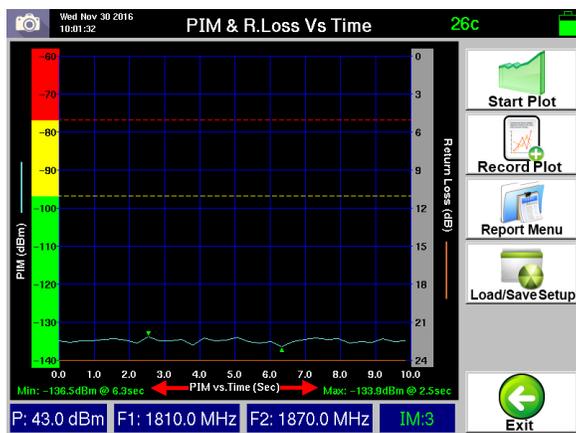


Figure 58 - *PIM & Return Loss vs. Time* Plot on the *PIM vs. Time* Window

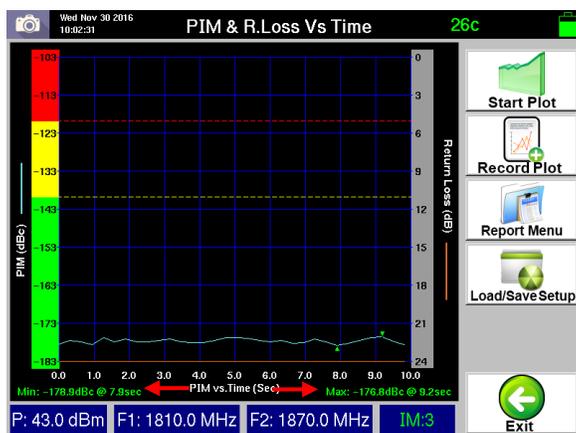


Figure 59 - *PIM & Return Loss vs. Time* Plot (in dBc) on the *PIM vs. Time* Window

## 3.1.4.5



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.

#### 3.1.4.5.1 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 27** for an example of the display after Operator, Site # and Technician information has been entered and prior to pressing the *OK* Icon.

#### 3.1.4.5.2 Enter *Sector/Feeder Information*

After completing the Site Information above, the *Sector/Feeder Information* Screen is displayed as depicted in **Figure 28**. Press 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.

#### 3.1.4.5.3 Select Label Menu

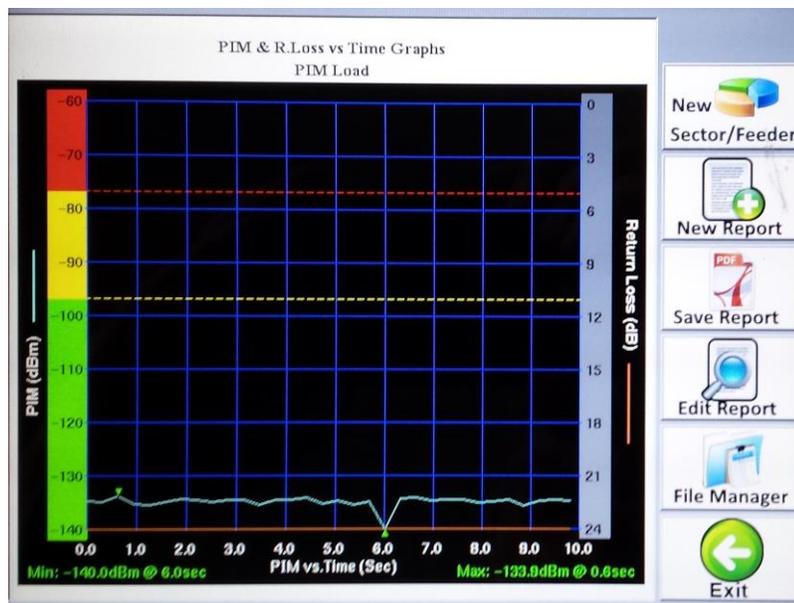
Please refer to **paragraph 3.1.3.7** for details on the Select Label Menu and sub-**paragraphs 3.1.3.7.1 through 3.1.3.7.6** the other options/menu choices available under the Select Label Menu.

## 3.1.4.6 Report Menu



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

- a) Company, Site # and Technician (Site Information) → (see **figure 33**)
- b) Frequency, Sector and Feeder → (see **figure 33**)
- c) PIM (Real Time Measurement) Test → (see **figure 32**)
  - 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 59**), and Comment.



**Figure 60 - PIM & Return Loss vs. Time Plot in Report Window**

### 3.1.4.6.1 New Sector/Feeder



Pressing the *New Sector/Feeder* icon opens up the *Sector/Feeder Information* window described in **paragraph 3.1.3.6** and gives access to the Sector, and Feeder as stated.

### 3.1.4.6.2 New Report



Pressing the *New Report* icon opens the *Save Report* window (see **figure 34**). This new screen allows for the report to be saved to either the **Local Drive**  or the **USB Drive** . This screen also allows the following functions to be performed:

- 1) File name - Pressing 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

### 3.1.4.6.3



### Save Report

Save Report

Pressing the *Save Report* icon also opens the *Save Report* window (see **figure 34**). This new screen allows for the report to be saved to either the **Local Drive**  or the **USB Drive** . 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 Tower Series 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.

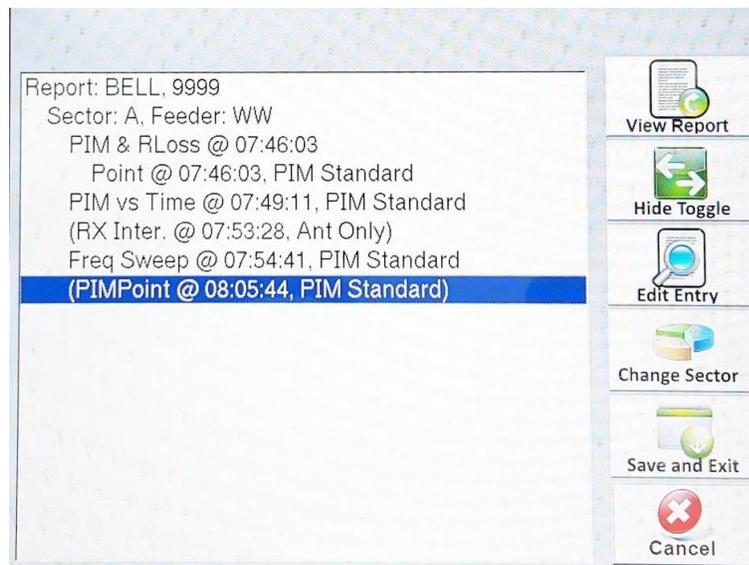
### 3.1.4.6.4



### Edit Report

Pressing the Edit Report Icon brings you to a window such as shown in **figure 60** below, and it is available in **PiMPro Tower B Series units from May 2016 onwards**. This feature is used to allow changes to be made during and after measurements, as well as to make changes to a saved report without throwing away any of the original data taken. The functions available in the Edit Report feature include:

- 4) Open report
- 5) Hide Toggle
- 6) Edit Entry
- 7) Change Sector
- 8) Save and Exit
- 9) Cancel



**Figure 61 – Edit Report Window**

### 3.1.4.6.4.1 **Open Report**

Pressing the Open Report icon allows the user to go back and view the report after edits have been made. The user can then determine if the desired change has actually been made.

### 3.1.4.6.4.2 **Hide Toggle**

Pressing the Hide Toggle icons allows the user to visually remove a measurement from a report (without deleting it), and then save the removal(s) with a new file name (if desired). This means that the report remains intact with its original file name, then a new file name can be created which is the edited version, with some measurements hidden. It is possible to then toggle and add the measurement back in if need be. Highlighting a specific measurement allows the user to proceed to the next step of hiding that measurement. The action of hiding is only completed when it is in parentheses ( ). The “hide-toggle” icon allows the “hide-unhide” to switch back and forth. In **figure 60** above the PIMPoint measurement is actually hidden from the report because it is in parentheses. Toggling again will unhide the measurement.

### 3.1.4.6.4.3 **Edit Entry**

Pressing the Edit Entry icon allows the user to edit a report by changing a label, file name, sector, technician, within the title section, or delete or change any measurement section including editing the description.

### 3.1.4.6.4.4 **Change Sector**

Pressing the Change Sector icon allows the user to edit the Sector information.

### 3.1.4.6.4.5 **Save and Exit**

Pressing the Save and Exit icon allows the user to save the changes made during any/all of the functions listed above and exit back to the previous screen.

### 3.1.4.6.4.6 **Cancel**

Pressing the Cancel icon allows to user to go back to the previous screen without making any of the changes performed during any of the steps listed above.

### 3.1.4.6.5 **File Manager**

File Manager (also referenced in paragraph 3.1.3.8.6) allows the user access to the following functions:

- 1) Open Report - Open Report details can be found in paragraph 3.1.10.1 on page 96.
- 2) Copy Report - Copy Report details can be found in paragraph 3.1.10.2 on page 97
- 3) Rename Report - Rename Report details can be found in paragraph 3.1.10.3 on page 98
- 4) Delete Report - Delete Report details can be found in paragraph 3.1.10.4 on page 99

### 3.1.4.6.6 **Back**

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

### 3.1.4.7 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 Tower Series 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 Tower Series 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 Tower Series PIM Analyzer **Local Drive**  and/or to the **USB Drive**.  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

#### 3.1.4.7.1 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.

#### 3.1.4.7.2 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.

### 3.1.4.7.3 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**  or the **USB Drive** .

### 3.1.4.7.4 Load Setup

Load/Save Setup

Pressing the *Load Setup* icon allows the user to select the setup that is desired for use in *PIM* 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.

### 3.1.4.7.5



### 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 Tower Series PIM Analyzer and then copied to the **USB Drive**. The user can then bring the **USB Drive** to all other Tower Series 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 38** for an example of this warning.

### 3.1.4.7.6



### 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 that 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.

### 3.1.4.7.7



### Back

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

### 3.1.4.8



### Exit

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

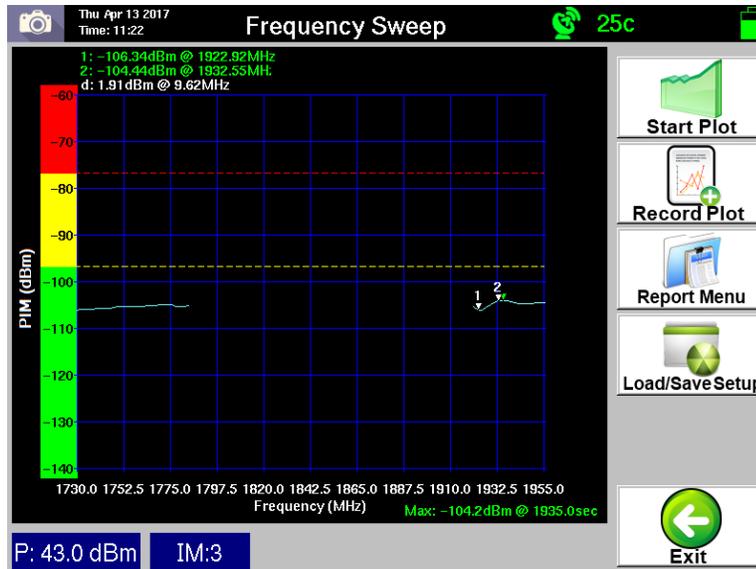
### 3.1.4.9 Graph Markers and Delta Measurements

All graphical measurements (PIM vs. Time, Rx Interference, Frequency Sweep, and PiMPoint) can now be further processed to set two markers. The analyzer will automatically calculate and display the difference (delta) between the two markers. Marker placement is simplified with a variety of “marker helpers” including:

- Move Right  ,
- Move Left  ,
- Select Left Peak  ,
- Select Right Peak  ,
- Select Left Valley  , and
- Select Right Valley  .

### 3.1.4.9.1 Set Marker 1

Note that you must select the “1” button to create the 1<sup>st</sup> marker of your choosing. Press the “trace” near the first point you want to highlight. The display shown in **Figure 61** will appear. You can then drag the marker to a point close to where you want to measure. Use the appropriate marker arrow (move right, move left, left peak, right peak, left valley and right valley) listed above to move to the point to be measured. For example press the “move right” arrow to nudge the marker to the right, then press the “Right Valley” arrow to move to the lowest point to the right of the last point the marker was moved to.



**Figure 62 – Graph Marker Window**

### 3.1.4.9.2 Set Marker 2

Note that you must select the “2” button to create the 2<sup>nd</sup> marker of your choosing. Press the “trace” near the second point you want to highlight. The display shown in Figure 61 will appear. You can then drag the marker to a point close to where you want to measure. Use the appropriate marker arrow (move right, move left, left peak, right peak, left valley and right valley) listed above to move to the point to be measured. For example press the “move left” arrow to nudge the marker to the left, then press the “Left Valley” arrow to move to the lowest point to the left of the last point the marker was moved to.

### 3.1.4.9.3 Display and Delta Calculation

The top of the display will show the “1” and “2” marker levels and frequencies in “Green” text. The calculated “Delta” will appear below the “1” and “2” as “d” and will list the delta in level (dBm or dBc), and the delta in frequency in “White” text.

### 3.1.4.9.4 Saving Marker and Delta Screens

The display showing the “markers” and “delta” can only be saved as a “Snapshot.”

### 3.1.4.9.5 Extra paragraph in case needed

## 3.1.5 RX Interference



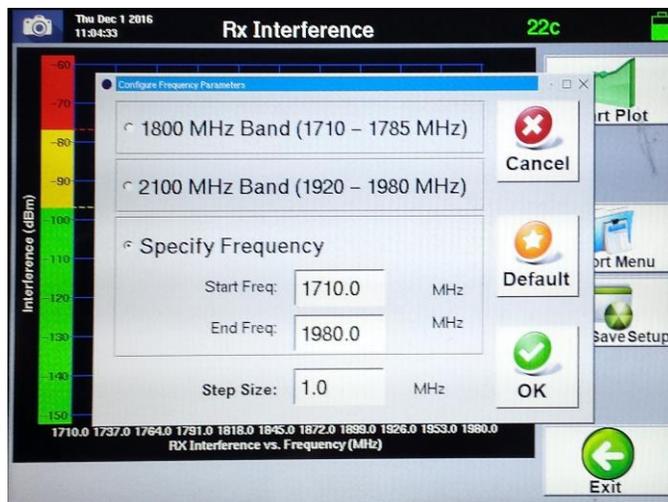
Pressing the *RX Interference* icon will open up the “*RX Interference*” function window. This is a new test function that looks for external interference in the Rx band. The test works by keeping the transmitter(s) (amplifier(s)) off and sweeping the receiver across the entire Rx band. Note that the “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 64** for a view of the initial graph and **figure 65** 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 62**), which can be accessed by pressing the X-axis on the graph as seen previously. In this example (for the Tower Series PiMPro 1821) this can be set for the 1800 MHz Band Only, the 2100 MHz Band Only, or for specific Start and End Frequencies between 1710 MHz and 1980 MHz. Also, note that the Step Size can be set in the bar at the bottom of the Configure Frequency Parameters pop-up window.

### 3.1.5.2 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 3.1.4.3 through 3.1.4.3.6**. Please note that this pop-up window is only being shown below (in **figure 63**) 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.*



**Figure 63 - *Configure Frequency Parameters* Pop-up Window**

## 3.1.5.2 Configure PIM Scale (Cont.)

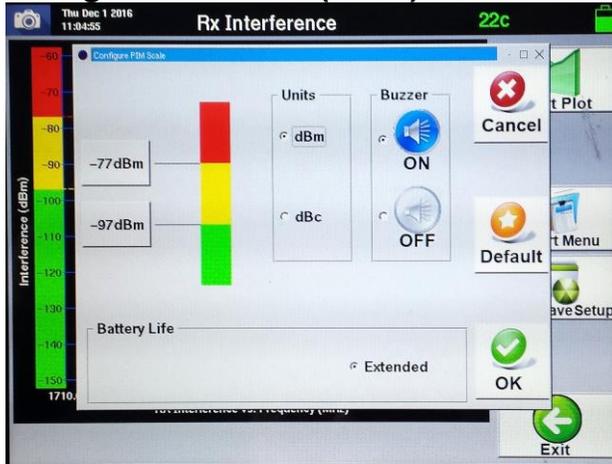


Figure 64 - *Configure PIM Scale* Pop-up Window

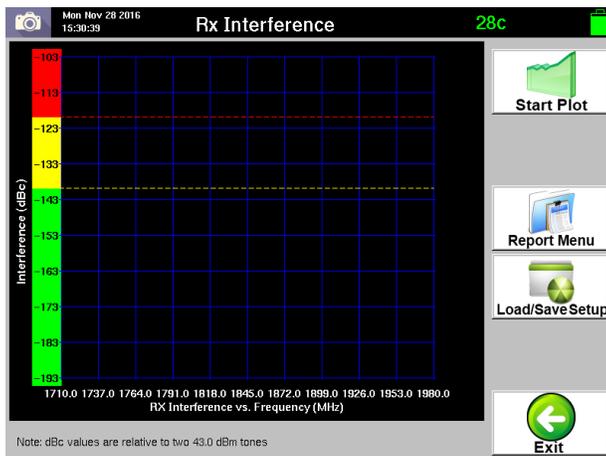


Figure 65 – Initial *RX Interference* Sweep Window

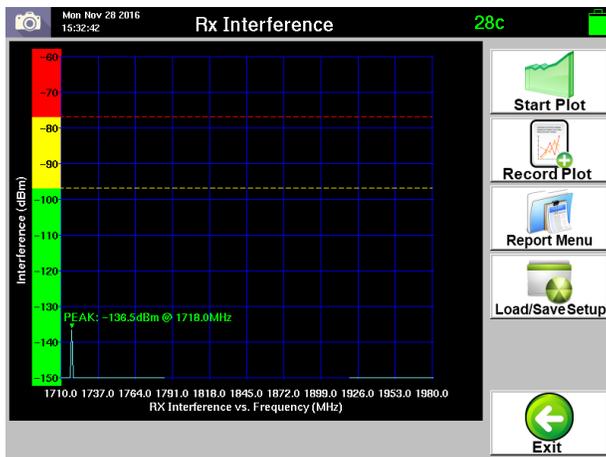


Figure 66 - Completed *RX Interference* Sweep Window

## 3.1.6 Frequency Sweep



Pressing 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 69** 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.*

**Warning:** Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.

### 3.1.6.1 Configure Frequency Parameters

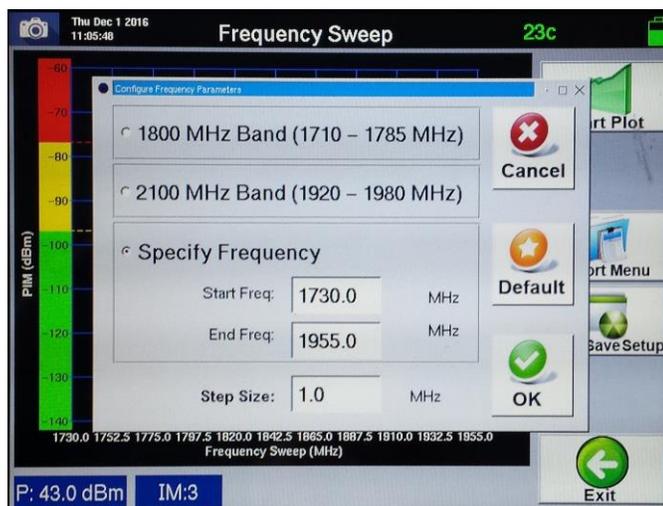
The “*Start*” and “*End*” RX frequencies and frequency step size can be adjusted from the “*Configure Frequency Parameters*” pop-up window (see **figure 66**), which can be accessed by pressing the X-axis on the graph. Remember that in this example the frequencies listed are for the Dual Band Tower Series PiMPro 1821.

### 3.1.6.2 IM Select

The *IM Order* to be measured can also be selected by pressing the *IM Box* in the display. This opens up the *IM Select* pop-up window as shown in **figure 67** 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*.”

### 3.1.6.3 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 3.1.4.3 through 3.1.4.3.6**. Please note that this pop-up window is only being shown below (in **figure 68**) 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.*



**Figure 67 - *Configure Frequency Parameters* Pop-up Window**

## 3.1.6.3 Configure PIM Scale (Cont.)

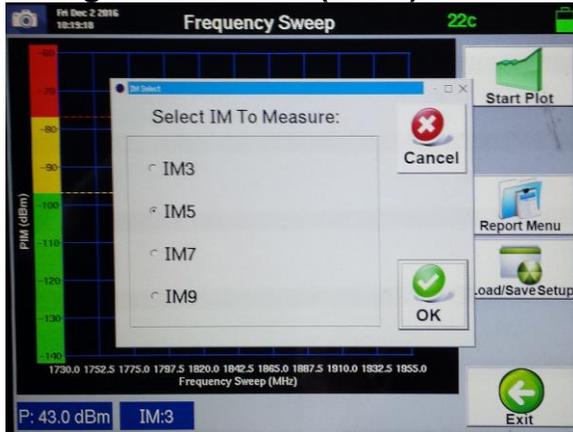


Figure 68 - *IM Select* Pop-up Window (IM5 Being Selected)

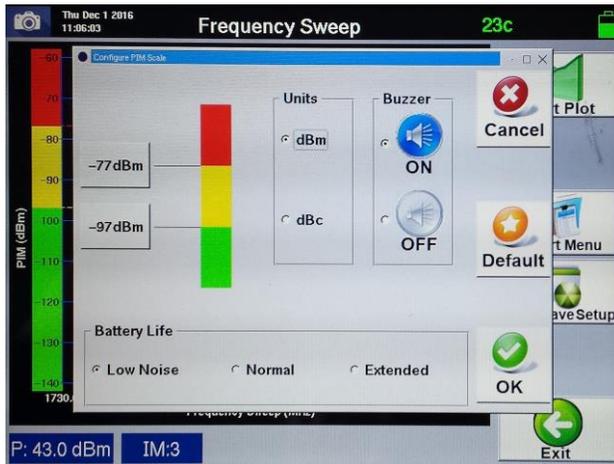


Figure 69 - *Configure PIM Scale* Pop-up Window

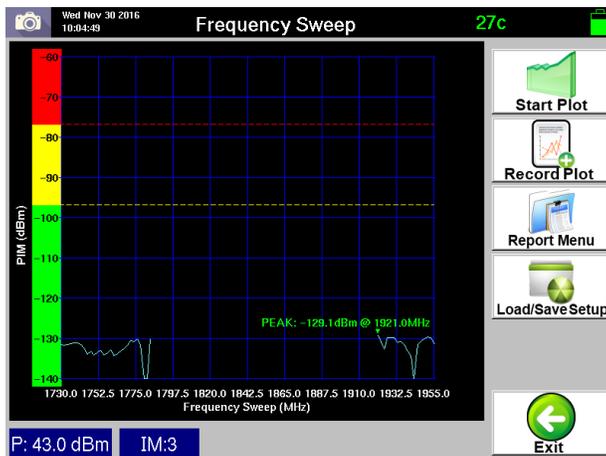


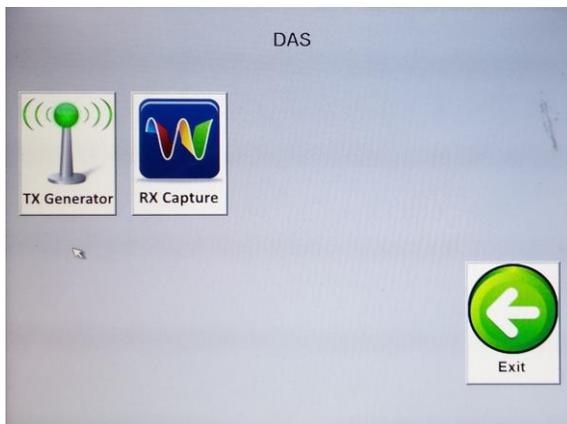
Figure 70 - Completed *Frequency Sweep* Display

### 3.1.7 DAS Test (Optional on Tower Series PiMPro)

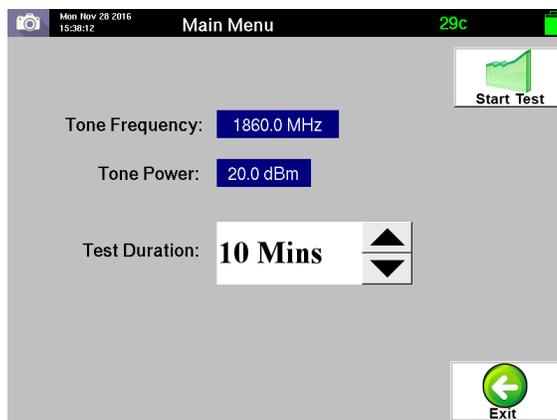
As of S/W Version 4.0.37 the DAS Test has become a “Standard” feature, and no longer requires a license. Pressing the DAS Test icon in the Main Menu will open up the “DAS Test” function window (see **figure 70**). Two methods of DAS Testing are available on the Tower Series units. The TX Generator test is used to inject a single tone signal into a DAS System at low power for extended periods of time. The RX Capture testing can be used to determine if a signal is present at a specific frequency in the RX Band.

#### 3.1.7.1 TX Generator

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 +30 dBm (1,000 mW)) for extended periods of time (i.e. 10 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 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, cabling and other components. Note that the TX Generator testing does not generate a report, as with the other PIM Testing performed with the PiMPro. Pressing the TX Generator Icon will open up the window shown in **figure 71** below.



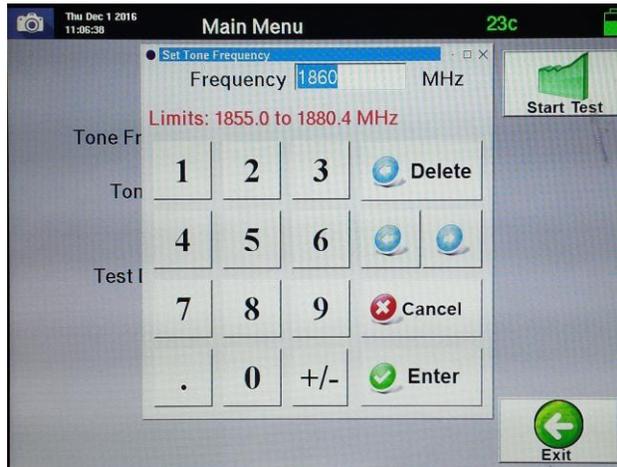
**Figure 71 – DAS Menu Window**



**Figure 72 – DAS TX Generator Test Window**

### 3.1.7.1.1 Tone Frequency

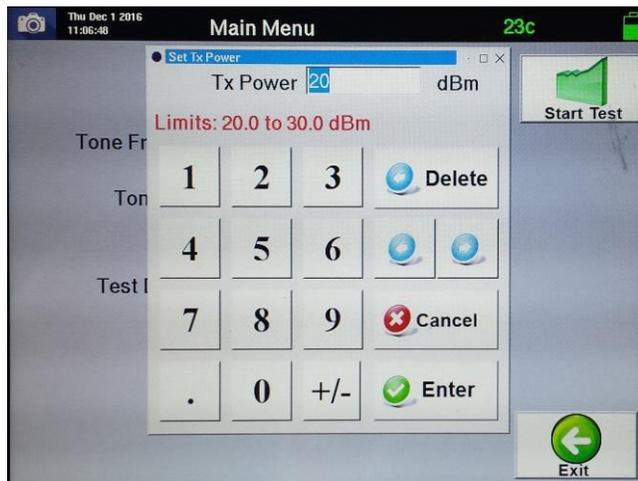
Pressing the Tone Frequency bar will open up the Set tone Frequency pop-up window. This allows the user to set the TX frequency within the frequency range shown in the pop-up window. For this example the frequency range is 1855.0 to 1880.4 MHz (for the Tower Series PiMPro 1821), as shown in **figure 72** below.



**Figure 73 – Set Tone Frequency for DAS TX Generator**

### 3.1.7.1.2 Tone Power

Pressing the Tone Power bar will open up the Set tone Frequency pop-up window. This allows the user to set the Tx Power from +20.0 dBm to +30.0 dBm as shown in the pop-up window in **figure 73** below.



**Figure 74 – Set Tx Power for DAS Tx Generator**

### 3.1.7.1.3 Test Duration

Pressing the up or down arrows on the Test Duration (shown in **figure 71** above) allows the user to set the duration of the test to 10 minutes minimum, up to 240 minutes maximum.

### 3.1.7.1.4 Start TX Generator Test

Pressing the Start Test button initiates the single tone test at low power. This will last for the amount of time set in the Test Duration bar.

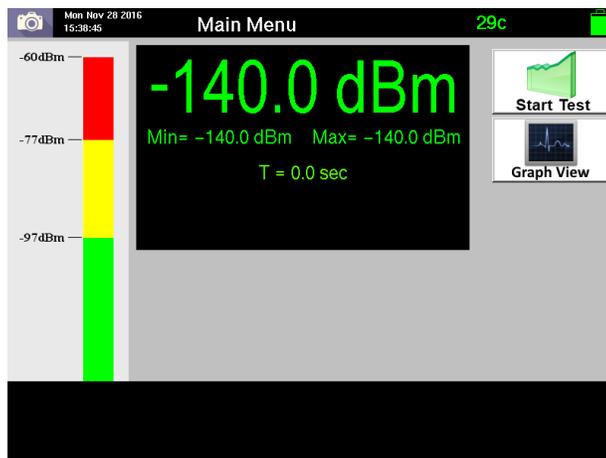
**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

### 3.1.7.1.5 Stop TX Generator Test

Pressing the Stop Test button allows to user to stop the TX Generator test before the test duration completion if it is needed.

### 3.1.7.2 RX Capture

The RX Capture function is used to perform Special DAS Testing where the user needs to determine if any signals in the RX Band are present when the BTS, BDA or other Radio is turned off. This test can be viewed in “Display View” which gives the present signal level in large font, while also listing the Minimum and Maximum levels read by the Tower Series PiMPro. Additionally, there is also a “Graph View” available which shows the present reading in the Graphical mode, while also still listing the Minimum and Maximum levels read at the bottom of the Graphical display. This test is performed continuously until the user presses the “Stop Test” button on the DAS Test RX Capture window. This testing allows the user to search for possible problems due to other sources of signal which could interfere with the operation of the DAS System. Note that the RX Capture testing does not generate a report, as with the other PIM Testing performed with the PiMPro. Pressing the RX Capture Icon will open up the window shown in **figure 74** below. Note that the PIM Scale limits can be changed as noted in previous sections of this User’s Manual.

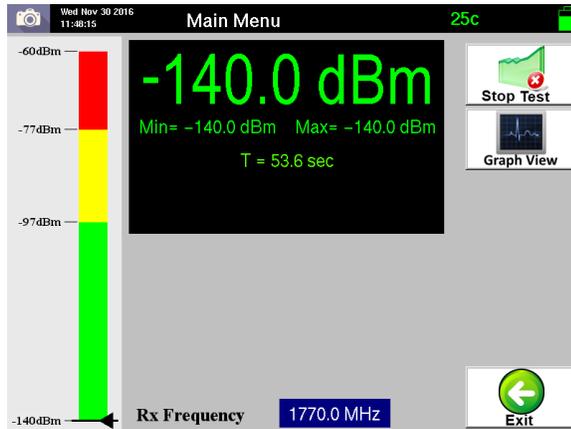


**Figure 75 - RX Capture Window in “Display View” with “RF OFF”**

### 3.1.7.2.1 Display View Test

When the RX Capture test is selected, the screen which comes up is the Display View screen as seen in **figures 74 and 75**. **Figure 75** shows the screen after the **Start Test** button has been depressed. That is, this example shows the results (present reading (in large font), minimum reading and maximum reading) after an elapsed time of 53.6 seconds.

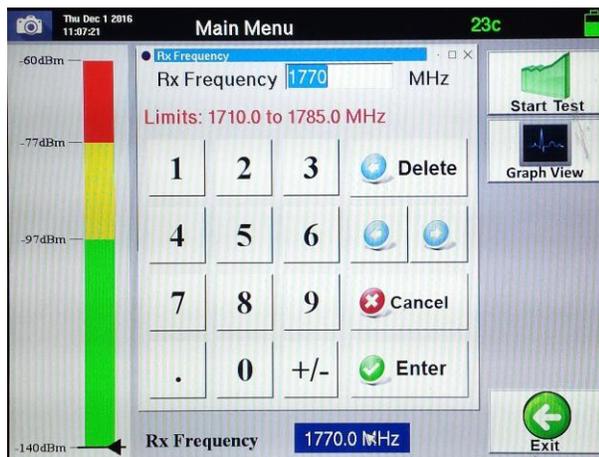
**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 76 – RX Capture Window in “Display View” after “Start Test” is Pressed**

### 3.1.7.2.2 RX Frequency

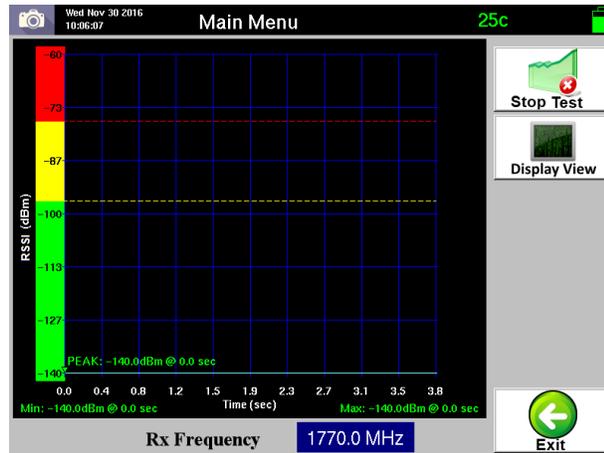
The RX Frequency bar becomes visible after the Start Test button has been depressed as shown in **figure 75**. The frequency bar is visible in either the Display View or the Graph View modes of testing. Pressing the RX Frequency bar allows the user to set the RX Frequency over the specified limits (1710.0 to 1785.0 MHz in this example for the Tower Series PIMPro 1821) to be sampled during the RX Capture test. See **figure 76** below for a view of the pop-up window which appears after pressing the RX Frequency bar.



**Figure 77 – Rx Frequency Setting Pop-up Window**

### 3.1.7.2.3 Graph View Test

Note that the Graph View of the RX Capture test is basically the same as the Display View, except that the representation is Graphical, rather than a listing of values on the screen. See **figure 77** below for an example of this Graph View test.



**Figure 78 – RX Capture Window in “Graph View” with “RF ON”**

### 3.1.7.2.4 Start Test (RX Capture)

Press the Start Test Icon to begin RX Capture testing. The user can verify whether any signals are present in the Rx band at the point of connection to the Tower Series PiMPro.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

### 3.1.7.2.5 Stop Test (RX Capture)

Pressing the Stop Test icon stops the RX Capture test. At this point the user can change the frequency to be scanned, and restart the test, or the user can disconnect the Tower Series PiMPro from the connection point, and then move to a different point to be tested.

## 3.1.8 PIMPoint



PIMPoint walks the user through a calibration sequence to establish a measurement reference plane. The reference plane can be set at the PIM Analyzer's output connector, or offset to the end of a jumper cable. This reference plane will thus become the "zero" distance reference from which all PIMPoint measurements will be taken. A PIM Standard of -80 dBm is used as a PIM level reference.

Using the accessory kit's -80 dBm PIM Standard at the chosen reference plane and terminating the PIM Standard with the CCI Low PIM Load allows for the analyzer to store calibration parameters which become the reference PIM magnitude and phase from which all further measurements are calculated. During this calibration process, it is imperative to have clean connectors as well as applying proper torque to all connections before pressing the "CAL" icon. A poor calibration will yield poor results.

The user can manually enter the approximate distance to the antenna which is highlighted on the screen as a marker reference and used by PIMPoint to set the crossover point at which a different velocity of propagation factor (air VP = 100%) is applied. This is to accurately discern the distance to external (outside the antenna) potential interfering energy sources. The biggest problem of which is in the form of broadband noise from metal objects near the antenna, which when detected in the network's uplink, can be construed as PIM, with similar effect.

PIMPoint is available as a Distance to PIM (DTP), Distance to Fault (DTF) or both can be measured at the same time. **Paragraph 3.1.8.1** and its sub-paragraphs will cover the DTP measurement requirements and setup. **Paragraph 3.1.8.2** and its sub-paragraphs will cover the DTF measurement requirements and setup. Samples of the screens (prior to measurement) will be shown in **Figures 78 thru 80** below.

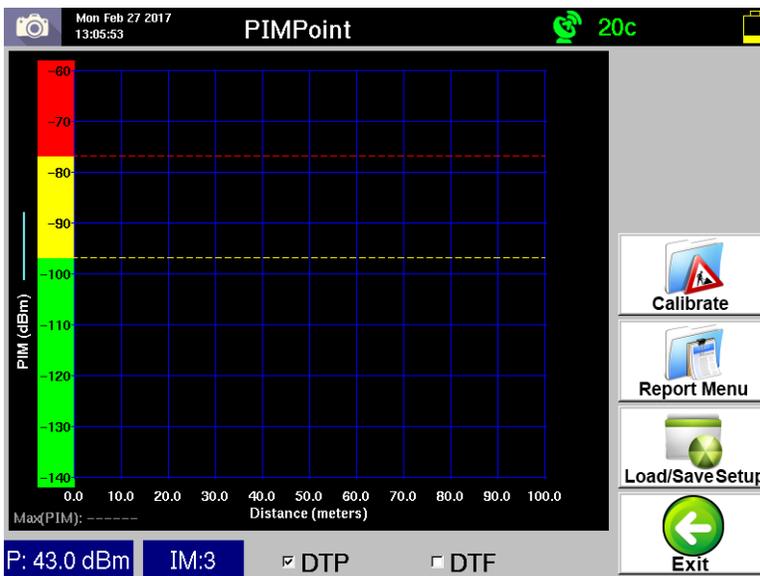


Figure 79 – Distance to PIM (DTP) Selected

## 3.1.8 PIMPoint (Cont.)

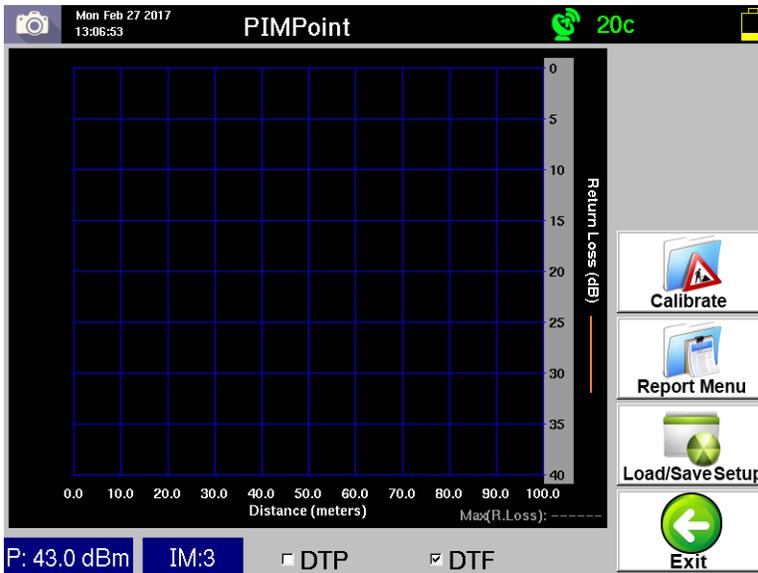


Figure 80 – Distance to Fault (DTF) Selected

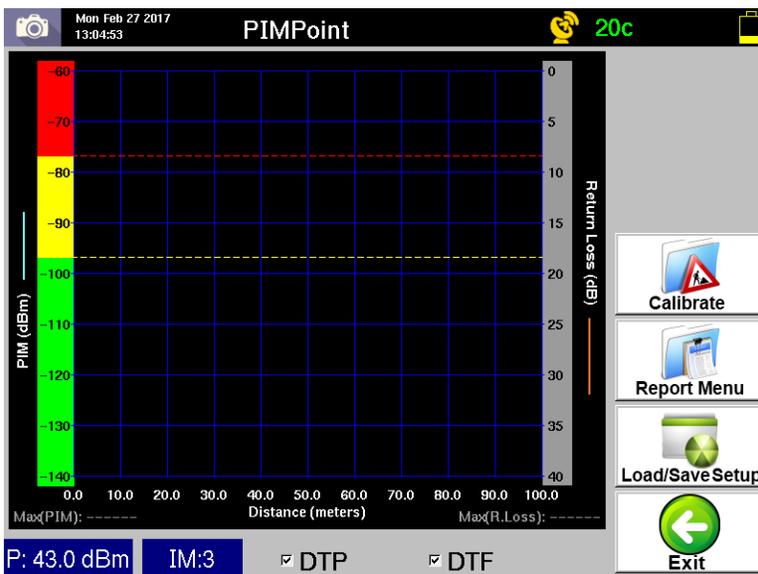
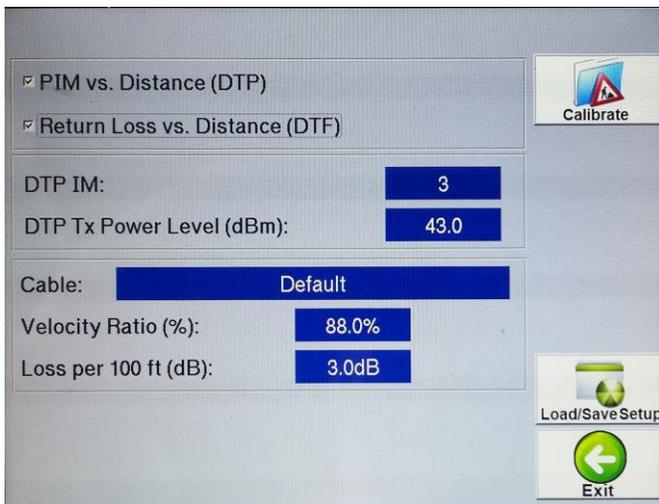


Figure 81 – Distance to PIM and Distance to Fault (DTP & DTF) Selected

1. **Calibration Parameters.** Various calibration parameters can be set by the user as seen in the **PIMPoint Details Window** shown in **figure 81** below.
  - a. **Selection of DTP or DTF.** The user can select whether to measure the Distance to PIM (DTP), Distance to Fault (DTF), or both parameters.
  - b. **DTP IM.** DTP IM is always IM3, this is only shown for User's Reference.
  - c. **DTP Tx Power Level (dBm).** The user can set the power level to a range from +20 dBm to +46 dBm for performance of the DTP testing.
  - d. **Cable Identification.** The user can select the cable type to be used by depressing the Cable bar
  - e. **Velocity of Propagation compensation (VP).** This is the cable's VP ratio compared to the speed of light. Typically 80 to 88%, can be input at the bottom of the window shown in **figure 86** below. The user can set the number to that of the cable's manufacturer. It is important to get the right number as the distance precision is directly affected.
  - f. **Loss per 100 ft (dB).** The other variable parameter is the cable Insertion Loss per 100 ft. length. If other than the Default value of 3 dB, this can be set to the appropriate loss value for the cable being used shown in **figure 87** below.



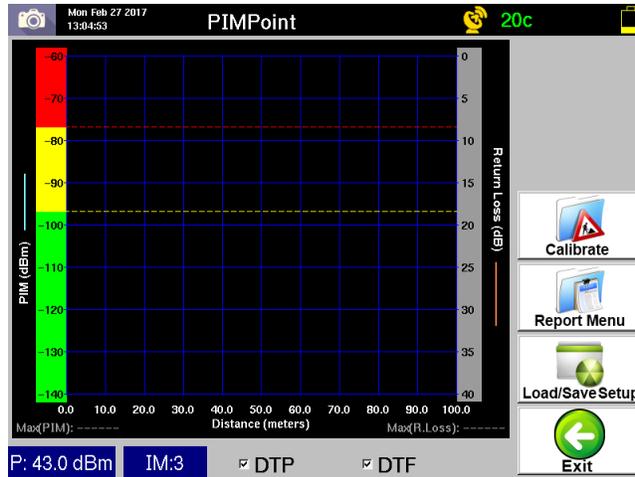
**Figure 82 - PIMPoint Details Window**

### 3.1.8.1 PIMPoint (Distance to PIM (DTP)) Calibration Setup

Place the -80 dBm PIM Standard at the RF Output of the Tower Series PIM Analyzer. Next the user must place the Low PIM Load at the output of the -80 dBm PIM Standard. Once the PIM Standard and Low PIM Load are hand-tightened, the User must use a Torque wrench to fully tighten both.

### 3.1.8.1.1 Initiate *PIMPoint*

Press the *PIMPoint*  icon in the Main Menu widow. This will open the widow shown in figure 82 below.



**Figure 83 – Initial PIMPoint Window**

#### 3.1.8.1.1.1 Select IM Order

If an IM order other than the 3<sup>rd</sup> Order is desired, the user can set the IM order by depressing the “*IM*” data bar below the graph, or in the “Calibration” parameter setup screen. This will open a pop-up window allowing selection of 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, or 9<sup>th</sup> order IM as previously described for other testing.

#### 3.1.8.1.1.2 Set DTP Tx Power Level

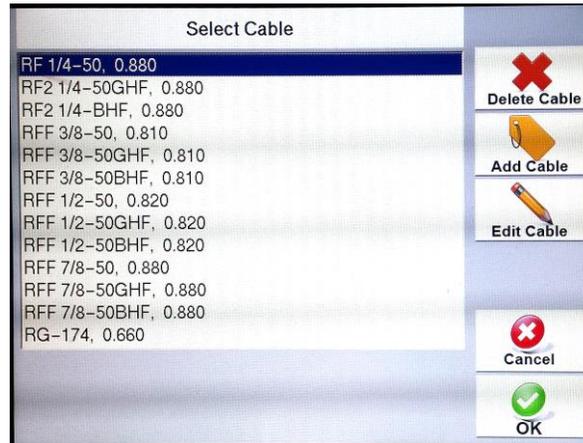
If an output power of other than +43 dBm (20W) is required the user can set the output power by depressing the “*Power*” data bar below the graph, or in the “Calibration” parameter setup screen. This will open an Output Power pop-up window as previously described for other testing. See figure 83 for the available output power limits (+20 dBm to +46 dBm).



**Figure 84 – Tx Power Level Pop-up window**

### 3.1.8.1.1.3 “Select Cable” Being Used

The user can select the “Default” RF Cable with settings of Velocity Ratio at 88%, and Loss per 100 ft. (dB) set to 3.0 dB. If other characteristics are desired, the user can select another cable as shown in the selection list which opens when the “bar” next to the word cable is depressed. The list of “Preset” cables is shown in **figure 84** below.



**Figure 85 - “Select Cable” Screen**

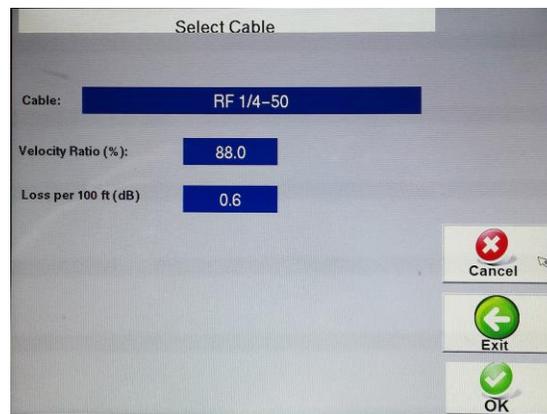
#### 3.1.8.1.1.3.1 Delete Cable

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

#### 3.1.8.1.1.3.2 Add Cable

Press the Add Cable icon if a brand new cable is required. The Cable Details window will appear on the touch screen as shown in **figure 85** below. This window requires input of three items as follows:

- 1) Cable Identification – Identification of the Cable
- 2) Velocity Ratio of Cable – Velocity of Propagation
- 3) Loss per 100 ft of Cable in dB



**Figure 86 – Cable Details Window**

### 3.1.8.1.1.3.3 **Edit Cable Information**

If it is desired to change existing cable by adding information to or removing information from the existing cable identification, or to change errors in the Relative Propagation Velocity or Loss per 100 feet of cable, press the *Edit Cable* icon after selecting the cable to be edited. Next use the keyboard keys to modify the cable identification, or change the Relative Propagation Velocity per **paragraph 3.1.8.1.1.4**, or to change the Loss per 100 feet of cable per **paragraph 3.1.8.1.1.5**.

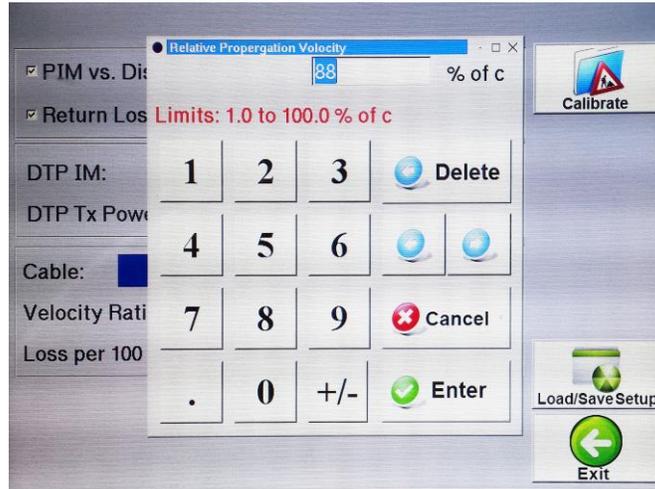
### 3.1.8.1.1.3.4 **Cancel**

Press the *Cancel* Icon if you have accidentally gotten to the Cable Details screen and do not wish to be editing the cable information.

### 3.1.8.1.1.3.5 **OK**

### 3.1.8.1.1.4 Set “Relative Propagation Velocity” Ratio

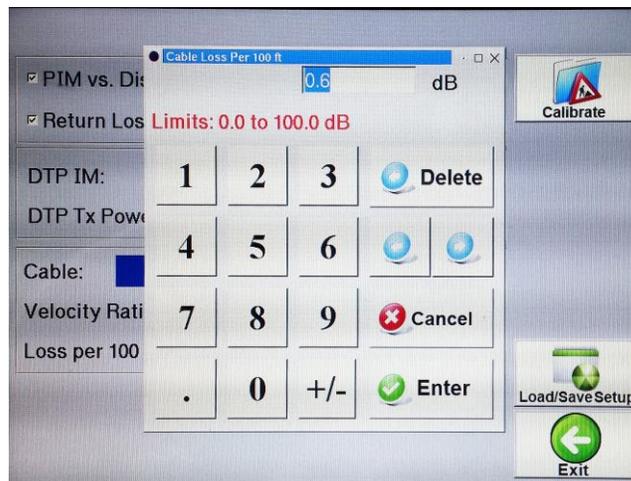
This is the cable's VP ratio compared to the speed of light. The values are typically 80 to 88% for most cables. When the Velocity Ratio (%) is depressed the Relative Propagation Velocity pop-up window opens. Values from **1.0% to 100.0% of “c”** (Speed of Light) can be input in the pop-up window shown in **figure 86** below. It is important to get the right number as the distance precision is directly affected.



**Figure 87 – Relative Propagation Velocity pop-up window**

### 3.1.8.1.1.5 Set “Loss per 100 ft (dB)”

The user can set the Insertion Loss per 100 ft of RF Cable, if the preset value is incorrect. Pressing the bar for the “Loss” will open up a pop-up window. This allows entry of the Loss per 100 ft of cable within the limits of 0 dB to 100 dB, as shown in **figure 87** below.



**Figure 88 - Cable Loss per 100 ft pop-up window**

### 3.1.8.1.1.6 Antenna Distance Details

The user can Set the actual Antenna Distance by depressing the “*Distance*” data bar below the graph. This will open the “*Antenna Distance Details*” pop-up window (shown in **figure 88**). The Start Distance is always 0 feet (or 0 meters) Entry of the “*End*” distance (some distance greater than the actual antenna distance) is performed in the pop-up entry windows shown in **figures 89 or 90** below. **Note: depressing the “Antenna Location” button opens a window where the user can specify the actual antenna distance.**



**Figure 89 –Antenna Distance Details Pop-up Window**



**Figure 90 – “Graph End Distance” in meters**



**Figure 91 – “Graph End Distance” in feet**

### 3.1.8.1.2 Zero Reference Calibration Sequence (Cal. with PIM Std & PIM Load)

With the PIM Standard and Low PIM Load connected to the Tower Series PiMPro depress the “*Calibrate*”  icon in order to begin the PIMPoint Calibration process. This will open a “*Connect PIM Std and PIM load to output for Cal.*” warning pop-up window as shown in **figure 91** below. Pressing the “*OK*” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “*Progress*” pop-up shown in **figure 92** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

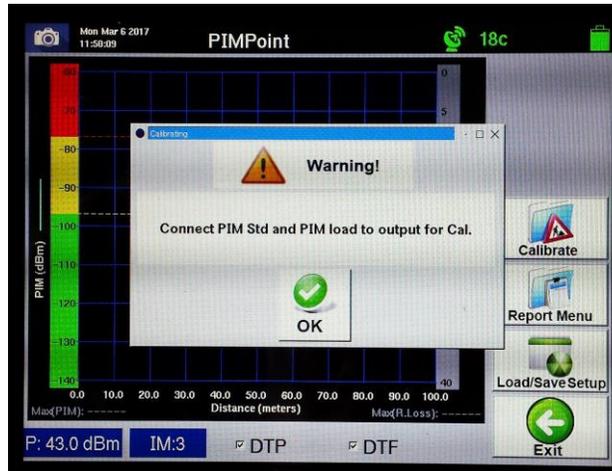


Figure 92– “*Connect PIM Std & PIM load ... Cal.*” Warning Pop-up Window

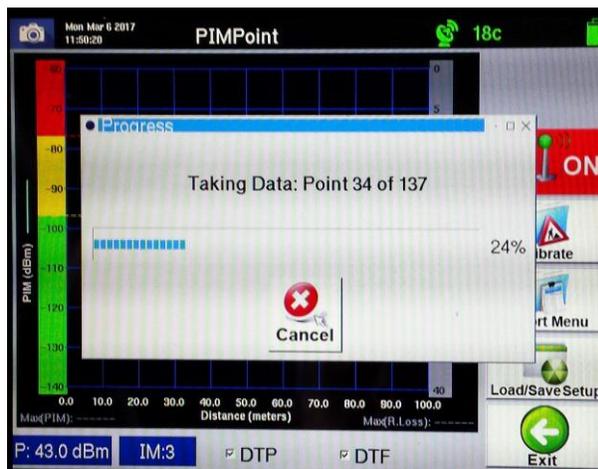
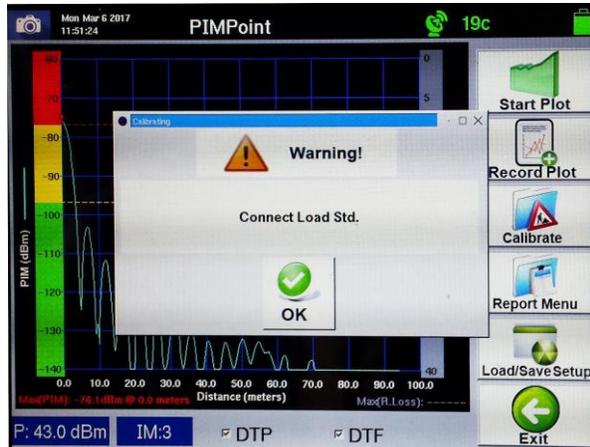


Figure 93 – Taking Data (PIM Std & PIM Load) Progress pop-up

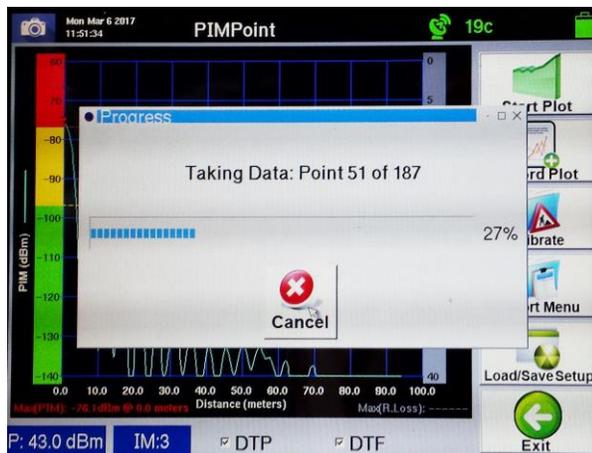
### 3.1.8.1.3 Calibration with PIM Load

Disconnect the PIM Load and PIM Std from the Tower Series PiMPro, and then connect the Low PIM Load to the PiMPro output. The “*Connect Load Std.*” warning pop-up window is already present as shown in **figure 93** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 94** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 94 - “*Connect Load Std.*” Warning Pop-up Window**



**Figure 95 - Taking Data (Load Std.) Progress pop-up**

### 3.1.8.1.4 Calibration with Open

Disconnect the PIM Load from the Tower Series PiMPro, and then connect the “Open” to the PIMPro output. The “*Connect Open Std.*” warning pop-up window is already present as shown in **figure 95** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 96** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

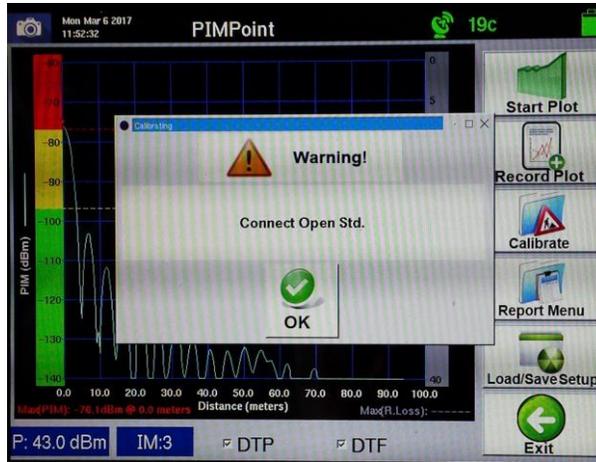


Figure 96 - “*Connect Open Std.*” Warning Pop-up Window

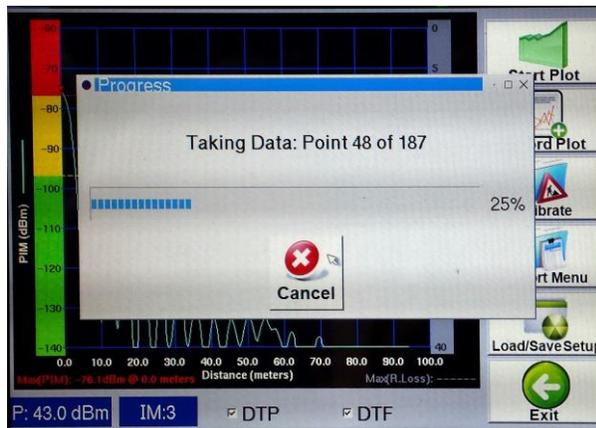


Figure 97 - Taking Data (Open) Progress pop-up

### 3.1.8.1.5 Calibration with Short

Disconnect the PIM Load from the Tower Series PiMPro, and then connect the “Short” to the PIMPro output. The “*Connect Short Std.*” warning pop-up window is already present as shown in **figure 97** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 98** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

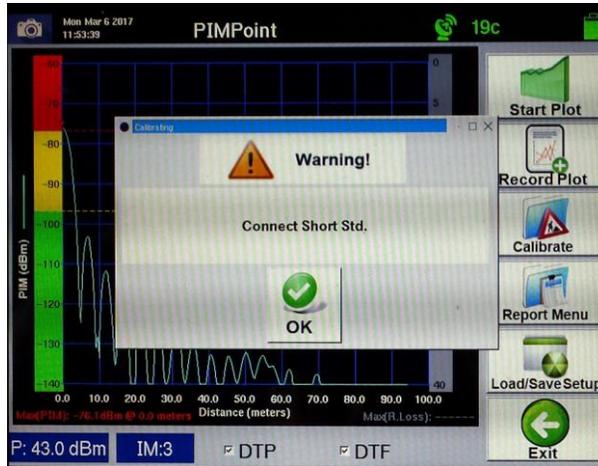


Figure 98 - “*Connect Short Std.*” Warning Pop-up Window

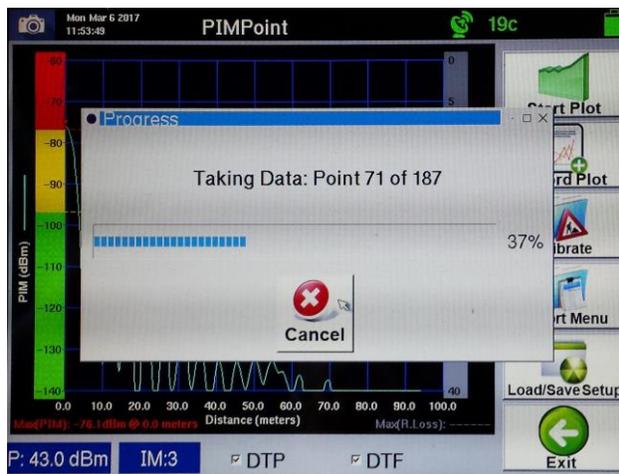


Figure 99 - Taking Data (Short) Progress pop-up

### 3.1.8.1.6 Disconnect Low PIM Load and PIM Standard

Disconnect the Low PIM Load and the PIM Standard from the RF Output of the Tower Series PIM Analyzer.

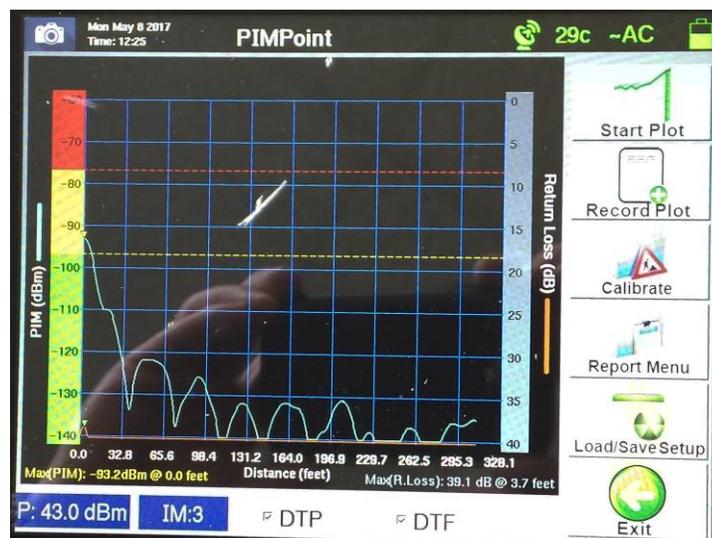
### 3.1.8.1.7 Connect Feed-Line to be Measured

Connect the Feed-Line (which is connected to an Antenna) to be measured to the RF Output of the Tower Series PIM Analyzer. Hand-tighten the Feed-Line and then use a torque wrench to properly torque the connector.

### 3.1.8.1.8 Perform PIMPoint Measurement of Feed-Line

Perform the PIMPoint measurement of the Feed-Line by depressing the **Start Plot**  icon in the PIMPoint window. During the test the pop-up window “**Taking Data: Point XX of YY**” will be visible until the test run is complete. When the test run is complete the trace will indicate where the highest PIM reading has been measured. See **figure 99** for an example where the maximum PIM measurement of -86.7 dBm has been found at a distance of 9.8 feet. *Note that for this example a test jumper of 10.0 feet was terminated with the PIM Standard which was in turn terminated by the PIM Load.*

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 100 – PIMPoint Measurement of Feed-Line to Antenna**

### 3.1.8.1.9 Comment About Distance Readings

Please note that if the Maximum PIM Reading is shown to be greater than the distance to the antenna, the user should then look for other possible sources of PIM other than the feed-line or the components connected to the Feed-Line.

### 3.1.8.2 PIMPoint (Distance to Fault (DTF)) Calibration Setup

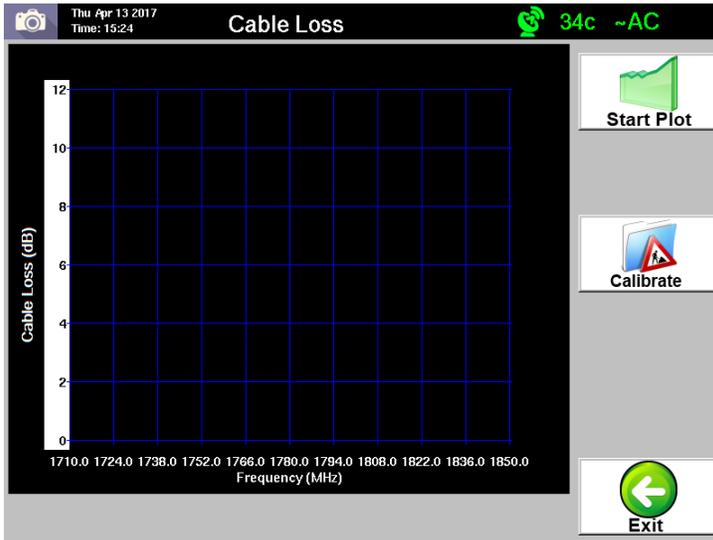
Distance to Fault setup and measurement will be added in a future revision of this Tower Series PiMPro User Manual.

### 3.1.8.3 Distance to PIM (DTP) and Distance to Fault (DTF) Combined Measurements

DTP and DTF can be measured together at the same time if desired, once the setup for each has been completed per paragraphs 3.1.8.1.2 thru 3.1.8.1.5.

### 3.1.9 Cable Loss Measurement

The ability to measure Insertion Loss of a cable of any length by specifying the cable type has been added to the Tower Series PiMPro. In order to accurately measure the insertion loss, cables can be left OPEN (unterminated), or can be terminated with a SHORT. *Note: The DTF Option, when licensed, is provided with an OPEN/SHORT termination.* See **Figure 100** for the Initial Cable Loss screen prior to “Calibration.”



**Figure 101 – Initial Cable Loss Window**

### 3.1.9.1 Calibration with PIM Load

Connect the Low PIM Load to the PiMPro output. The “*Connect Load Std.*” warning pop-up window is already present as shown in **figure 101** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 102** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

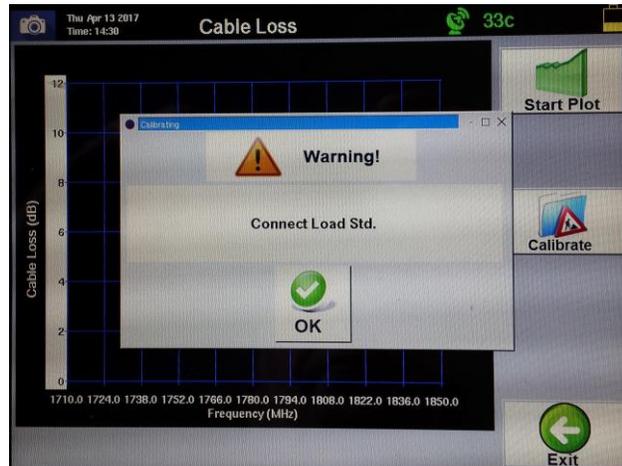


Figure 102 - “*Connect Load Std.*” Warning Pop-up Window

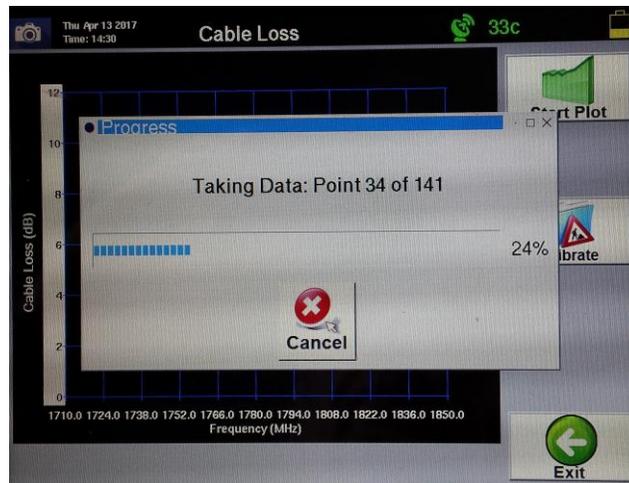


Figure 103 - Taking Data (Load Std.) Progress pop-up

### 3.1.9.2 Calibration with Open

Disconnect the PIM Load from the Tower Series PiMPro, and then connect the “Open” to the PiMPro output. The “*Connect Open Std.*” warning pop-up window is already present as shown in **figure 103** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 104** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

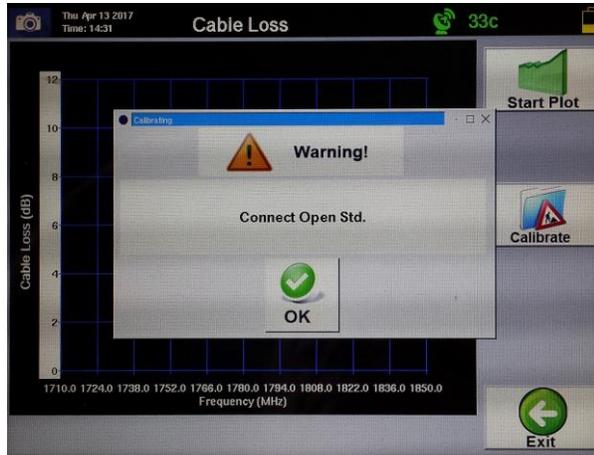


Figure 104 - “*Connect Open Std.*” Warning Pop-up Window

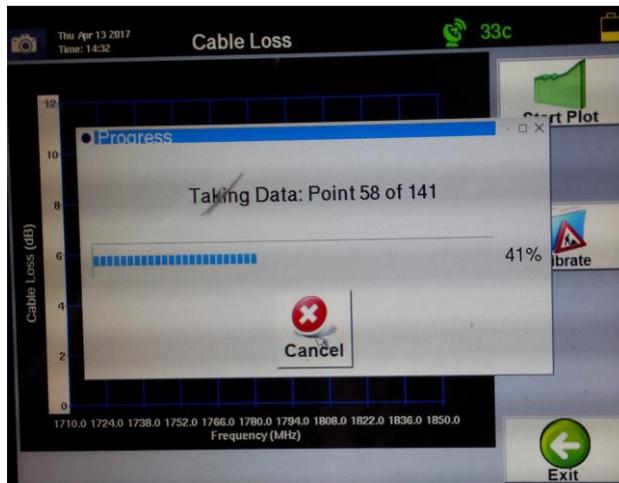
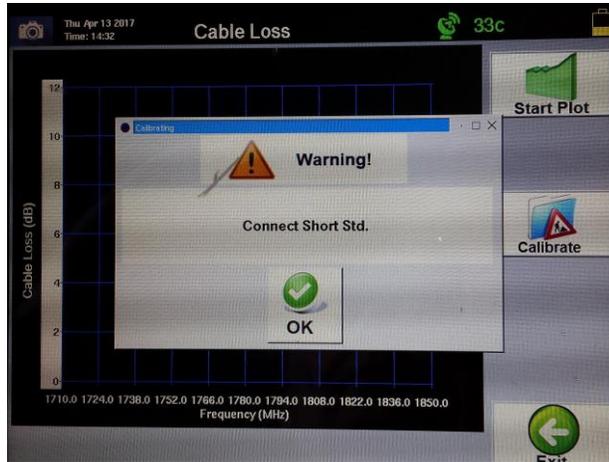


Figure 105 - Taking Data (Open) Progress pop-up

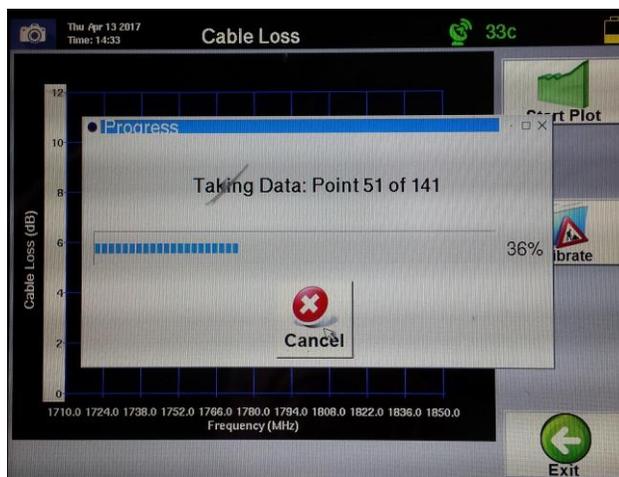
### 3.1.9.3 Calibration with Short

Disconnect the PIM Load from the Tower Series PiMPro, and then connect the “Short” to the PiMPro output. The “*Connect Short Std.*” warning pop-up window is already present as shown in **figure 105** below. Pressing the “OK” Icon in the pop-up warning window initiate the calibration process. The Tower Series PiMPro will start taking data points as seen in the Taking Data “Progress” pop-up shown in **figure 106** below.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 106 - “*Connect Short Std.*” Warning Pop-up Window**



**Figure 107 - Taking Data (Short) Progress pop-up**

### 3.1.9.4 Disconnect Low PIM Load and PIM Standard

Disconnect the Low PIM Load and the PIM Standard from the RF Output of the Tower Series PIM Analyzer.

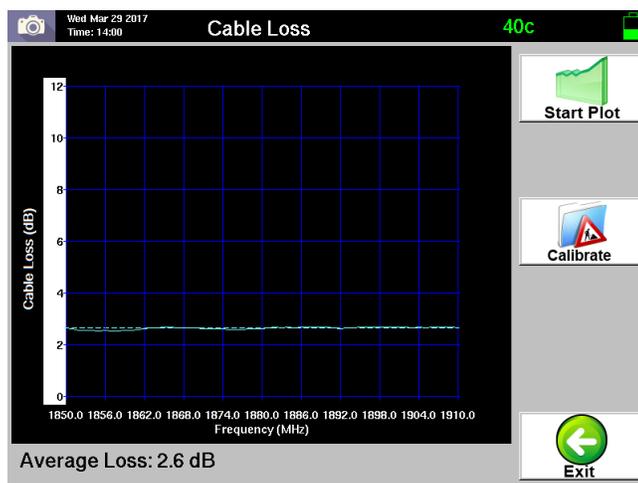
### 3.1.9.5 Connect Feed-Line to be Measured

Connect the Feed-Line (which is connected to an Antenna) to be measured to the RF Output of the Tower Series PIM Analyzer. Hand-tighten the Feed-Line and then use a torque wrench to properly torque the connector.

### 3.1.9.6 Perform Cable Loss Measurement of Feed-Line

Perform the Cable Loss measurement of the Feed-Line by depressing the *Start Plot* icon in the Cable Loss window. During the test the pop-up window “*Taking Data: Point XX of YY*” will be visible until the test run is complete. When the test run is complete the trace will list the average Cable Loss. See **Figure 107**, where this indicates a Cable Loss of 2.6 dB.

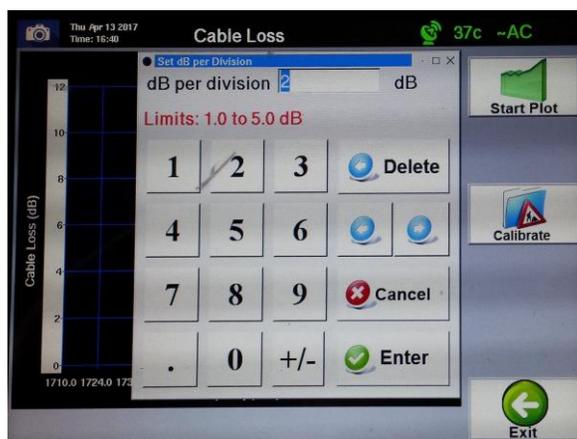
**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**



**Figure 108 – Cable Loss Measurement**

### 3.1.9.7 Cable Loss (Y-Axis)

The Cable Loss axis when depressed opens a pop-up (see **figure 108**) which allows the user to set the Cable Loss Scale between 1.0 dB and 5.0 dB per division.



**Figure 109 – Cable Loss per Division pop-up window**

### 3.1.9.8 Frequency (X-Axis)

The Frequency (X-Axis) is preset based on the model of Tower Series PiMPro being used to perform the Cable Loss test.

### 3.1.9.9 Exit

Exit returns the user to the Main Menu.

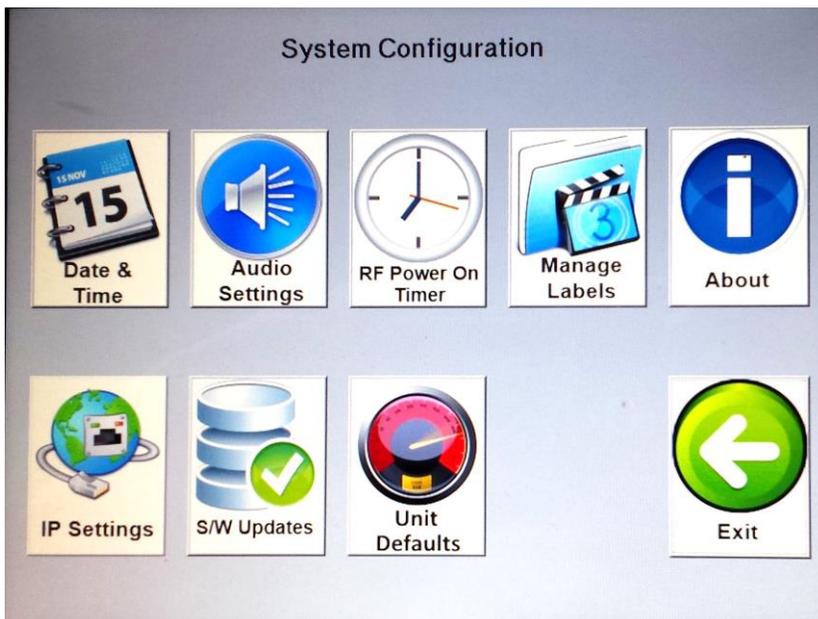
### 3.1.10



### Configure System

Pressing the *Configure System* icon on the touch screen display Main Menu opens the *System Configuration* window (see **figure 109**). 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) Unit Defaults
- 10) Exit

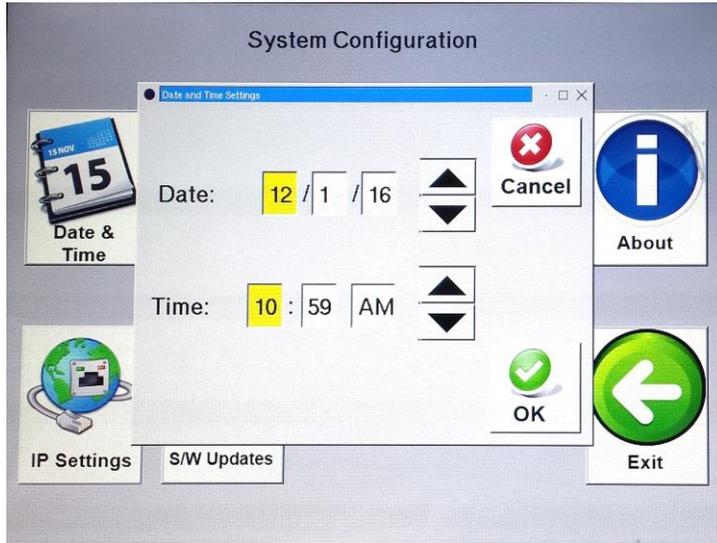


**Figure 110 - *System Configuration* Window**

## 3.1.10.1 Date & Time



Press the *Date & Time* icon to open the *Date and Time Settings* Menu in **Figure 110**. 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.

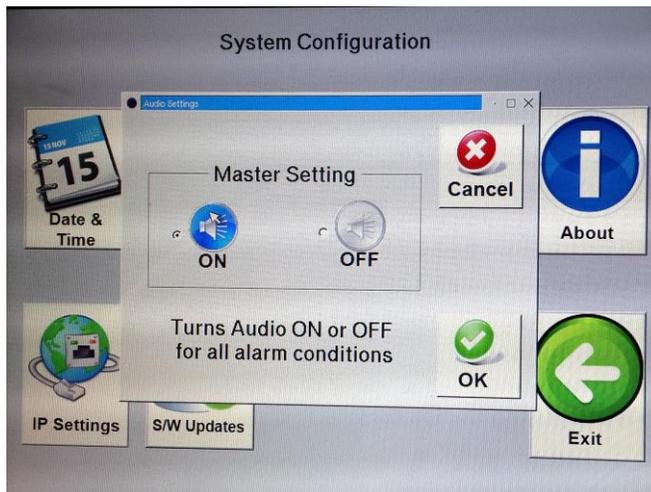


**Figure 111 - *Date and Time Settings* Window**

## 3.1.10.2 Audio Settings



**Note that the Audio ON/OFF controls do not work from the *System Configuration* screen.** However, the Audio ON/OFF controls are operational at the scale unit menu of all measurement screens. Pressing the *Audio Settings* icon on the *System Configuration* window does open the *Audio Settings* Menu (see **figure 111**). However, as stated above this control is not available at this level. Press the *OK* icon or *Cancel* icon return to the *System Configuration* window.

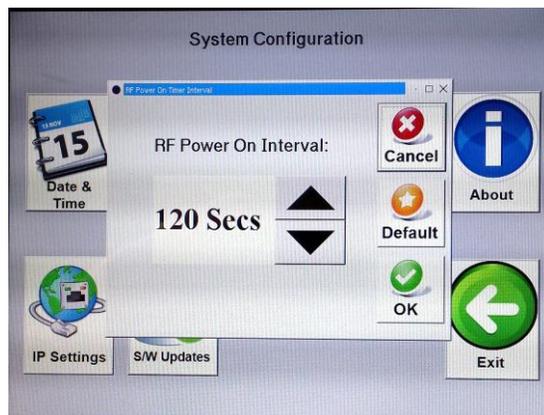


**Figure 112 - *Audio Settings* Window**

### 3.1.10.3 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 112**). 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 Tower Series unit down and allowing it to cool for a period of at least 5 minutes.**



**Figure 113 - *RF Power On Timer* Window**

### 3.1.10.4 Manage Labels

By depressing the *Manage Labels* icon on the *System Configuration* window, the *Manage Labels* window opens (see **figure 113**). 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.



**Figure 114 - *Manage Labels* Window**

### 3.1.10.4.1 Pre-Loaded Labels

The *Manage Labels* window (see **figure 113**) 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

### 3.1.10.4.2 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.

### 3.1.10.4.3 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.*

### 3.1.10.4.4 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.

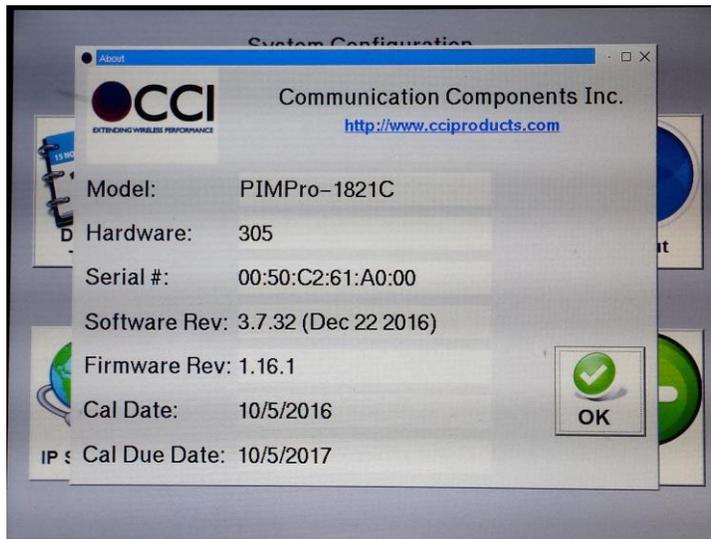
### 3.1.10.4.5 Back

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

### 3.1.10.5 About

Pressing the  *About* icon on the *System Configuration* window opens a window shown in **figure 114** that displays information as follows:

- 1) Tower Series Model (**Band Covered by Model Number**) – Tower Series 700 (**Dual Band 700(L)/700(U)**), Tower Series 850 (**850 Cellular**), Tower Series 900 (**GSM 900**), Tower Series 1821 (**Dual Band (1800/2100)**) or Tower Series 2600 (**Dual Band (2600)**)
- 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**)



**Figure 115 - *About* Window**

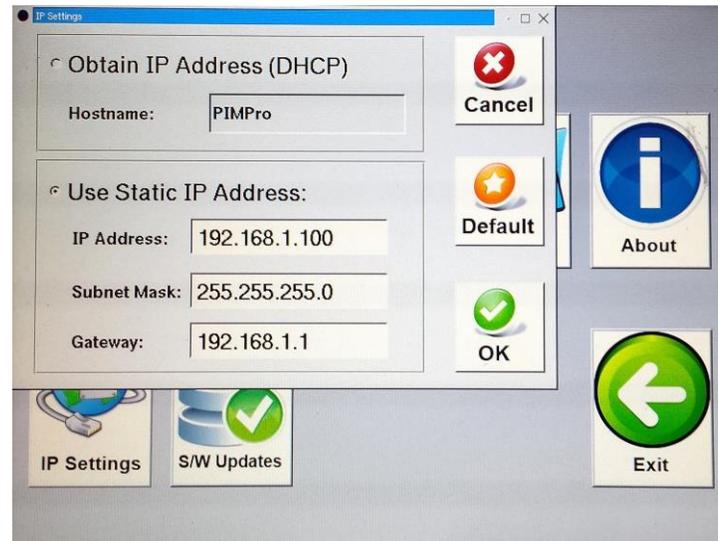
#### 3.1.10.5.1 OK

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

## 3.1.10.6 IP Settings

Pressing the *IP Settings* icon in the *System Configuration* window opens the *IP Settings* window as seen in **figure 115**. This window allows the user to select the following:

- 1) Obtain IP Address (DHCP)
  - a. Hostname – Tower Series 700, Tower Series 850, Tower Series 900, Tower Series 1821, tower Series 1900 or Tower Series 2600
- 2) Use Static IP Address
  - a. IP Address
  - b. Subnet Mask
  - c. Gateway
- 3) Cancel
- 4) Default
- 5) OK



**Figure 116 - *IP Settings* Window**

### 3.1.10.6.1 Obtain IP Address Automatically (DHCP)

Not operational.

### 3.1.10.6.2 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.

### 3.1.10.6.3 **Cancel**

Cancel

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

### 3.1.10.6.4 **Default**

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

### 3.1.10.6.5 **OK**

OK

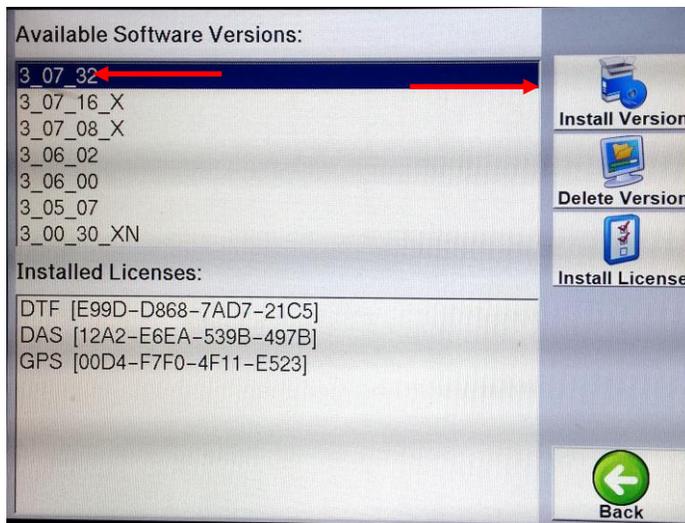
Pressing the *OK* icon accepts the changes and returns the user to the *System Configuration* window.

## 3.1.10.7 **Reserved**

### 3.1.10.8 **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 116**. 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



**Figure 117 - Available Software Versions / Installed Licenses Window**

### 3.1.10.8.1



### Install Version

Install Version

Pressing the *Install Version* icon shown in **figure 116** opens the *Software Install Warning* window shown in **figure 117**. 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 Tower Series.



**Figure 118 - *Software Install* Warning Window**

### 3.1.10.8.2



### Delete Version

Delete Version

Selecting the Software Version to be deleted and depressing the *Delete Version* icon shown in **figure 116** opens the *Confirm Delete Software Rev Warning* window shown in **figure 118**. 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.



**Figure 119 - *Confirm Delete Software Rev.* Warning Window**

### 3.1.10.8.3 Install License

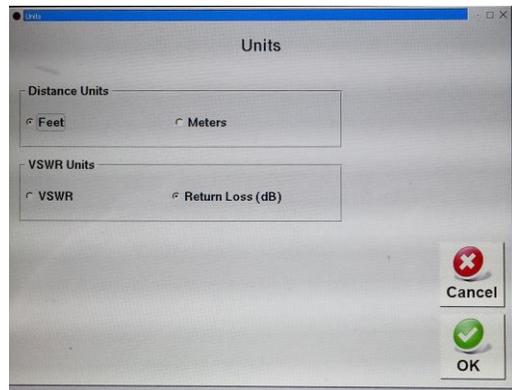
*Install License* is not implemented at this time.

### 3.1.10.8.4 Back

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

### 3.1.10.8.5 Unit Defaults

A Default Units Icon has been added to the Configuration Menu that allows the user to set the unit of distance to either feet or meters. The distance units are used for Distance-to-PIM, Distance-to-Fault, as well as cable data entry and display. The distance unit default (feet or meters) is saved and restored even after the analyzer is turned off. Default selection of Return Loss or VSWR is also performed in this menu. The Unit Default window is shown in **Figure 119** below.



**Figure 120 – Unit Default Window**

### 3.1.10.9 Exit

to the “Main

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

### 3.1.11 Manage Reports

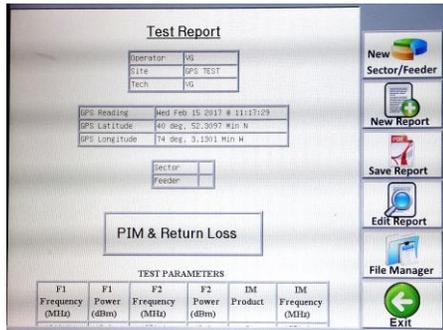
Pressing the *Manage Reports* icon on the Main Menu window opens the “Report” Listing and Menu shown in **figure 120**. Existing Reports found on the  **Local Drive** (if selected) or the  **USB Drive** (if selected), are displayed on the left-hand side of the reports window.



**Figure 121 - Report Listing and Menu Window**

### 3.1.11.1 Open Report

Pressing the *Open Report* icon on the Report Listing window (after highlighting a report to be viewed) opens the “Test Report” window shown in **figure 121**. Remember that the report can be located on either the  **Local Drive** or the  **USB Drive**. The user can scroll through the report by moving the report down or up throughout the touch screen.



**Figure 122 - *Open Report* Window**

#### 3.1.11.1.1 Exit

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

### 3.1.11.2 Copy Report

Pressing the *Copy Report* icon on the Report Listing window (after highlighting a report to be copied) may be successful (no confirmation pop-up occurs), or may open a warning window for one of two types of warnings. These warnings include “USB Disk not found” (see **figure 122**), 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** or the  **USB Drive** and would then be copied to the other drive/device.



**Figure 123 - *Copy Report* (Warning) Window**

#### 3.1.11.2.1 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).

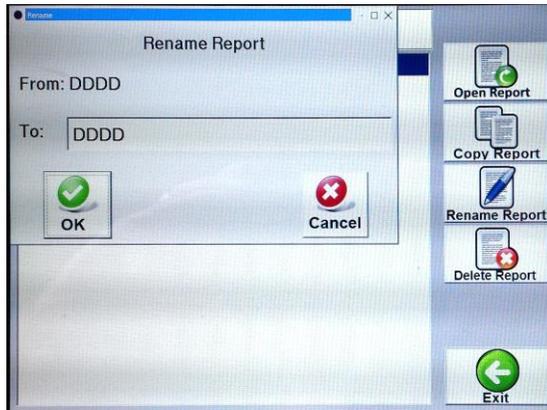
### 3.1.11.3



### 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 123**. *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 the  **Local Drive** or the  **USB Drive**.



**Figure 124 - *Rename Report* Window**

#### 3.1.11.3.1



#### 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.

#### 3.1.11.3.2



#### 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.

### 3.1.11.4



### 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 124**. Remember that the report to be deleted can be located on either the  **Local Drive** or the  **USB Drive**.



**Figure 125 - Delete Report Warning Window**

#### 3.1.11.4.1



### 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.

#### 3.1.11.4.2



### 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.

#### 3.1.11.5

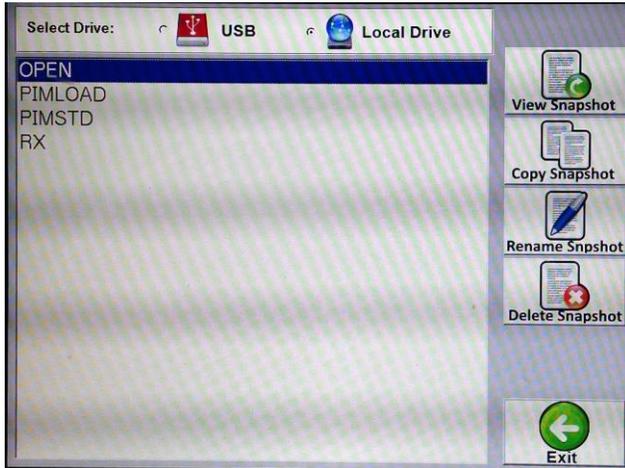


### Exit

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

## 3.1.11 Manage Snapshots

Pressing the Manage Snapshots icon in the Main Menu takes the user to the Manage Snapshots window shown in **figure 125** below. Manage Snapshots allows the user to view, copy, rename and delete snapshots (.png images) taken of the Tower Series PiMPro LCD Screen. Snapshots can be taken from PiMPro Tower screens where the  “Camera” icon is present.



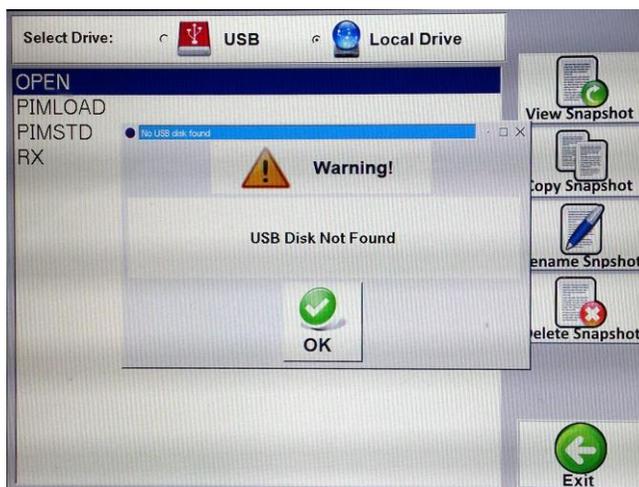
**Figure 126 – Manage Snapshots Window**

### 3.1.11.1 View Snapshot

View Snapshot allows the user to view the snapshot (.png image) taken. Highlight the snapshot of interest, and click on View Snapshot in order to open the image (.png) file.

### 3.1.11.2 Copy Snapshot

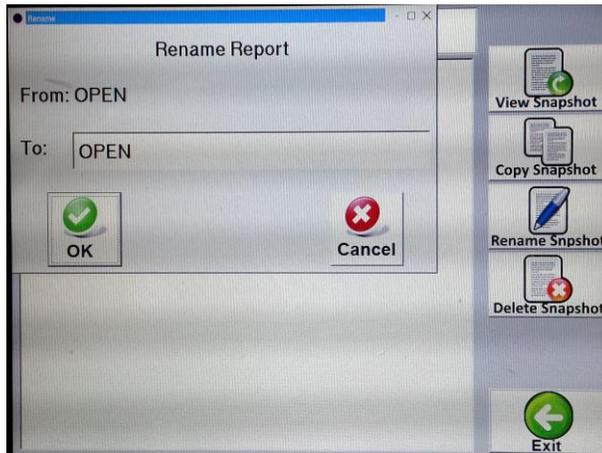
Copy Snapshot allows the user to make copies of the highlighted snapshot (.png image), or to copy the snapshot (.png image) from the internal memory of the PiMPro to a USB Memory stick. When the copy function is performed, there is no message if it is successful. However, if there is a problem such as the USB Memory is not present, a “Warning” message will appear as shown in **figure 126**.



**Figure 127 – USB Disk Not Found Warning Message Pop-up**

### 3.1.11.3 Rename Snapshot

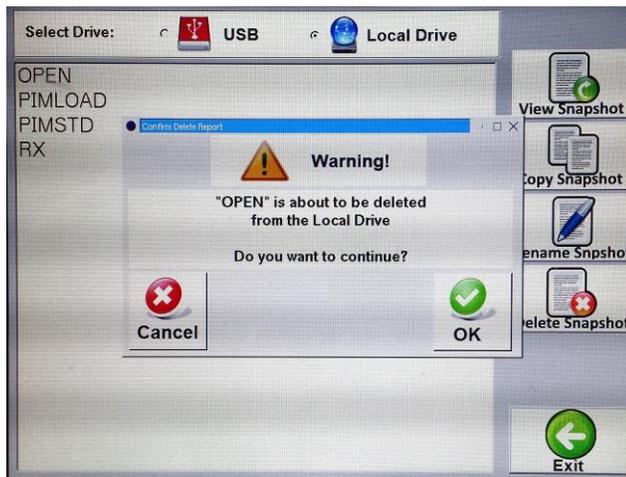
Rename Snapshot allows the user to rename the snapshot (.png image) with a different name if it is desired. Pressing the Rename Snapshot icon opens up the pop-up warning window shown in **figure 127** below. In order to change the name, depress the field with the To: "snapshot name," and this will open up the keyboard in order to allow the user to enter the desired name.



**Figure 128 – Rename Snapshot pop-up Window**

### 3.1.11.4 Delete Snapshot

Delete Snapshot allows the user to delete the snapshot (.png image) from the internal memory of the Tower Series PiMPro. Pressing the Delete Snapshot icon opens up the pop-up warning window shown in **figure 128** below.



**Figure 129 – Delete Snapshot Warning pop-up Window**

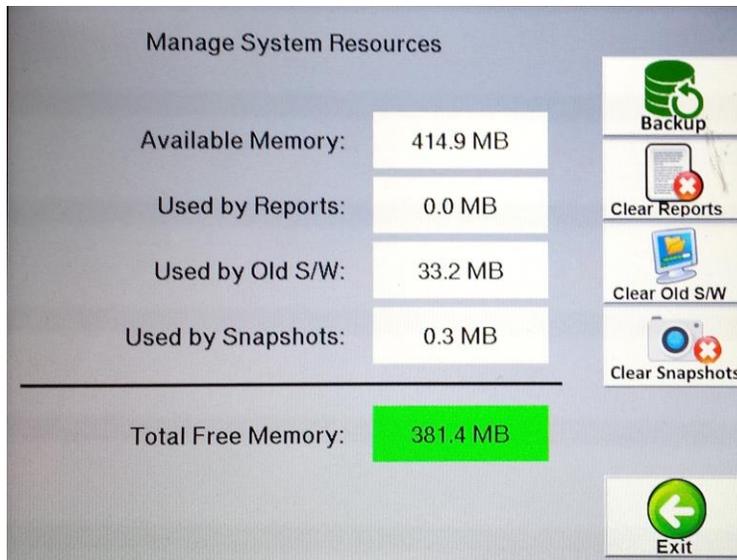
### 3.1.11.5 Exit

Exit allows the user to return to the Main Menu screen.

## 3.1.12 Manage Resources

Pressing the **Manage Resources** Icon in the Main Menu opens the Manage System Resources window as seen in **figure 129** below. The following items are available from this window:

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



**Figure 130 – Manage Resources Window**

### 3.1.12.1 Available Memory

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

### 3.1.12.2 Used By Reports

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

### 3.1.12.3 Used By Old S/W

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

### 3.1.12.4 Used by Snapshots

The amount of memory used by Snapshots in the fourth row shown in the Manage Resources window.

### 3.1.12.5 Total Free Memory

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

### 3.1.12.6 Backup (Reports)

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

### 3.1.12.7 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.

### 3.1.12.8 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 Tower Series. 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 Tower Series.

### 3.1.12.9 Clear Snapshots

**Clear Snapshots** allows the user to free up additional memory by deleting “all” snapshots (.png images), once the user has copied the snapshots to the USB memory.

### 3.1.12.10 Exit

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

## 3.2 Update of Tower Series Software

Ensure that the Tower Series 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 Tower Series Software

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

### 3.2.2 Copy Tower Series Software to USB Drive

The user should place a USB Drive into one of your PC's USB ports. After locating the latest Tower Series 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 Tower Series

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

### 3.2.4 Connect USB Drive to Tower Series

Take the USB Drive and connect it to the CCI Tower Series **USB**  port .

### 3.2.5 Select the Configure System Icon

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

### 3.2.6 Select the S/W Updates Icon

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 Tower Series touch screen, and then highlight it by pressing the touch screen on the latest version software's filename.

### 3.2.8 Perform Install

Press the *Install Version* icon on the Tower Series 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 117**. This message will indicate that the software is about to be updated and then the computer (Tower Series) 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 Tower Series)**

Cancel

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

### 3.2.11 **OK (Load Software Update onto Tower Series)**

OK

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

### 3.3 Optional “Remote” Operation of the Tower Series PiMPro

Optional Remote operation is available when purchased for the Tower Series PiMPro units. Remote operation can be purchased either at the same time as the Tower Series PiMPro is procured, or it can be purchased at a later date. When the Remote Operation option is purchased the following will be supplied by CCI:

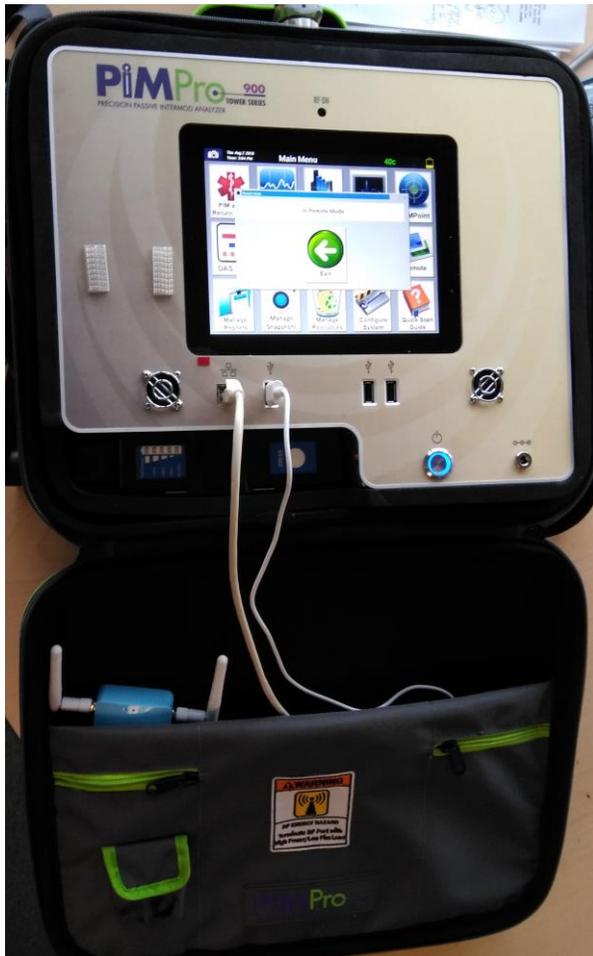
- 1) Wireless Router
- 2) Tablet (quantity to be specified at time of purchase)
- 3) Tower Series License
- 4) Ethernet Cable(s) – Long & short cables
- 5) USB Cable(s) – Long & short cables
- 6) Remote Operation Guide

The icon for Remote Operation can be seen in **figure 134** below. This function allows one or more tablets to control the operation of the Tower Series PiMPro. Presently remote control is available for PIM & R.Loss, PIMPoint and the Quick Start Guide functions on the Tower Series PiMPro. Note that the short USB & Ethernet cables are to be used when the wireless router is placed on the PiMPro unit itself (see **figure 131**), while the long USB & Ethernet cables can be used when placing the wireless router in the pocket of the Tower Series PiMPro (see **figure 132**).



**Figure 131 – Wireless Router Mounted on PiMPro**

### 3.1 Optional “Remote” Operation of the Tower Series PiMPro (Cont.)



**Figure 132 – Wireless Router Mounted in PiMPro Carrying Case**

### 3.3.1 Verify “Remote” Operation is Available

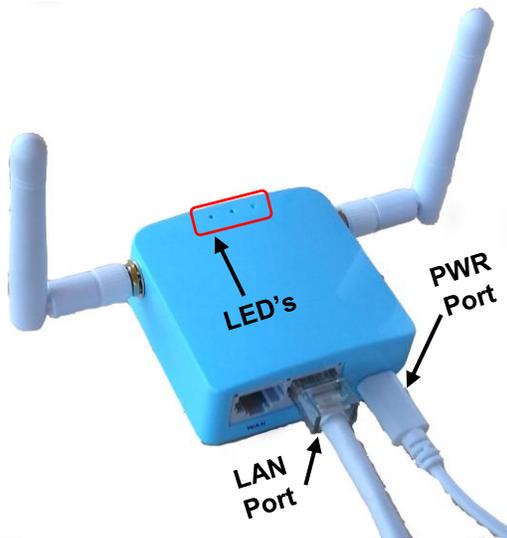
“Remote” operation is available when the “Remote” icon



is visible on the Main Menu Screen on the Tower Series PiMPro.

### 3.3.2 Connect Wireless Router

To prepare for remote operation, connect the LAN port of the supplied “Wireless Router” shown in **figure 132** to the Ethernet Port of the Tower PiMPro “for communication.” Connect the Power port of the supplied Wireless Router to one of the USB ports on the Tower Series PiMPro “to power” the wireless router. Note that there are LED’s on the wireless router. A Green LED indicates that the wireless router is “ON,” and a RED Blinking LED indicates that the wireless router is communicating with the tablet(s).



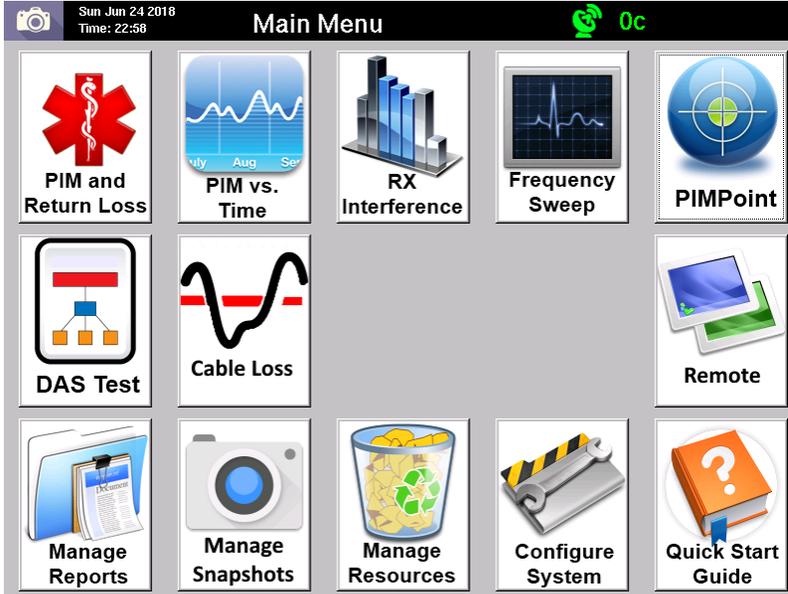
**Figure 133 – Wireless Router for Tower Series PiMPro**

### 3.3.3 Turn “ON” Tablet(s)

Turn on the tablet(s) to be used to control the Tower Series PiMPro.

### 3.3.4 Start Remote Operation

To start Remote Operation press the “Remote” Icon (see **figure 134**) on the Main Menu Screen of the Tower Series PiMPro. The “In Remote Mode” pop-up window will appear as shown in **figure 135** below.



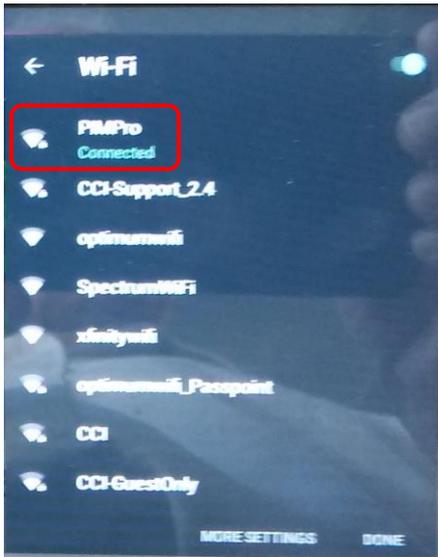
**Figure 134 – Tower PiMPro Main Menu Including “Remote”**



**Figure 135 – “In Remote Mode” Pop-up window**

### 3.3.5 Check for Wi-Fi from Tower Series PiMPro

Check to see that the Wi-Fi operation is available from the Tower Series PiMPro, by opening the available Wi-Fi connections on the tablet. See **figure 136** for an example of the Wi-Fi connections available, where the PiMPro is highlighted. Note: The SSID and Password for the wireless router are located on the wireless router, in case they are required to make the connection with the PiMPro.



**Figure 136 – Wi-Fi Connections Available**

### 3.3.6 Open Tower Series PiMPro on Tablet

Open the Tower Series PiMPro operation on the tablet by clicking on the PiMPro  icon on the Tablet's Main Menu as shown in **figure 137** below. This will open up the screen shown in **figure 138** below and the screen shows the functions presently available for "Remote Operation" on the Tower Series PiMPro. The functions include PIM & R.Loss (includes PIM vs. Time), PIMPoint and the Quick Start Guide.



**Figure 137 – Tablet Main Screen with PiMPro Icon Highlighted**

### 3.3.6 Open Tower Series PiMPro on Tablet (Cont.)



**Figure 138 – PiMPro Operating Modes on Tablet**

### 3.3.7 Verify Tower Series Wi-Fi Connection

When connected the following screen will appear on the remote tablet. Note that the unit’s RF is off initially. Check for the green computer to computer connection icon in the upper right hand corner of the tablet screen as shown in **figure 138** above.

#### 3.3.7.1 Computer Icons Show Green

If the computer to computer icons at the top right corner of the tablet screen are “green,” then the wireless connection is established.

#### 3.3.7.2 Computer Icons Show Red

If the computer to computer icons at the top right corner of the tablet screen are “red,” then the wireless connection is halted. In order to reset the communications, you should “Exit” the “Remote Mode” and then start up the Remote Mode once again. Or you can go to the Wi-Fi connections on the tablet in question, and try to disconnect and restart the Wi-Fi communications on the tablet.

### 3.3.8 Tablet Main Screen

When ready and communicating the Tablet screen will appear as shown in **figure 138** above. PIM & R.Loss, PIMPoint and the Quickstart Guide are initially available to access when using the tablet to Remote Operate the Tower Series PiMPro.

### 3.3.9 Prior to Start PIM & R<sub>L</sub> Test

When the remote tablet is connected, press the PIM & R<sub>L</sub> icon and the screen shown in **figure 139** below will appear. If the user needs to set the Tower Series PiMPro for values other than the default values (or wants to confirm the “default” values are correct), then the user should go through the steps listed in **3.3.9.1** and its subparagraphs below to set up the Tower Series PiMPro for PIM and R<sub>L</sub> testing as desired. Note that if the user has two tablets connected, the user can measure the PIM in dBm on one tablet, while the other tablet is performing readings in dBc. The hi-lighted “Flashing Blue Square” in the “PIM reading” portion of the screen indicates that the PiMPro is taking readings (even when “TX” is off).



**Figure 139 – PIM & R.Loss Screen Prior to Test**

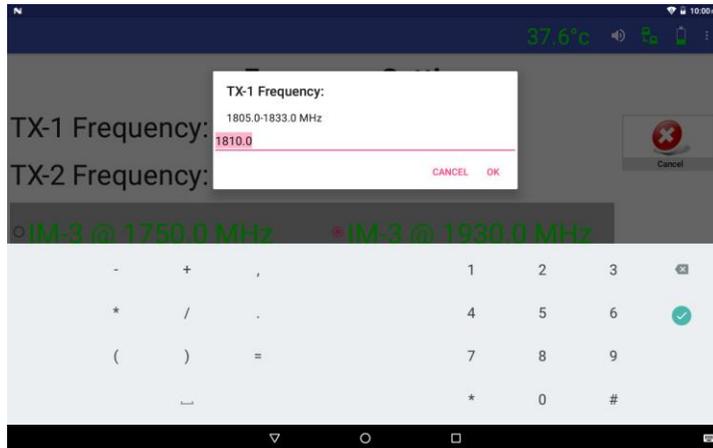
#### 3.3.9.1 Change PIM & R.Loss and PIM vs. Time Settings

Note that PIM & R.Loss settings can be changed from the tablet(s) when in remote operation. Settings available for change include:

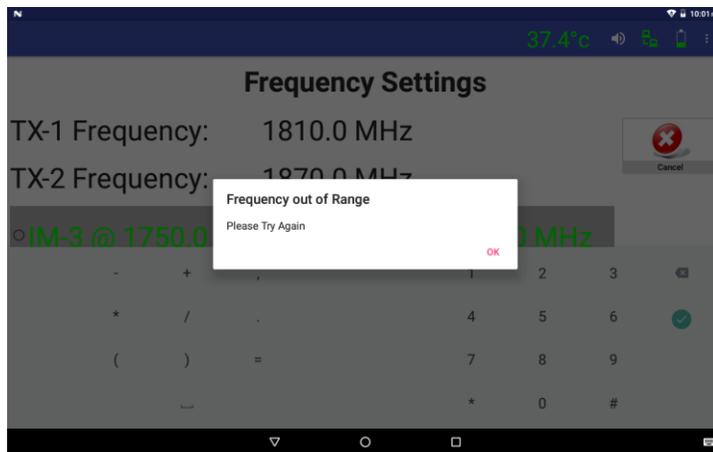
- 1) F1 and F2 Frequencies
- 2) Power Levels of F1 and F2
- 3) Test Duration
- 4) PIM Acceptance/Failure Limits
- 5) Turn-On and Turn-Off of the TX
- 6) IM Frequency
- 7) dBm/dBc Unit Change
- 8) Battery Life Selection
- 9) Record Reading
- 10) PIM vs. Time (Graph)

### 3.3.9.1.1 Change Frequencies

The F1 and F2 frequencies can be changed as on the Tower Series PiMPro itself. Pressing the associated frequency for F1 and F2 (see the highlighted area in **figure 139**) will open up the pop-up window to enter the new F1 or F2 frequency. See **figure 140** below for the TX-1 (or TX-2) pop-up window. If the user attempts to set a frequency outside the allowable range, a “Frequency out of Range” pop-up window appears (as seen in **figure 141**) and also indicates “Please Try Again.”



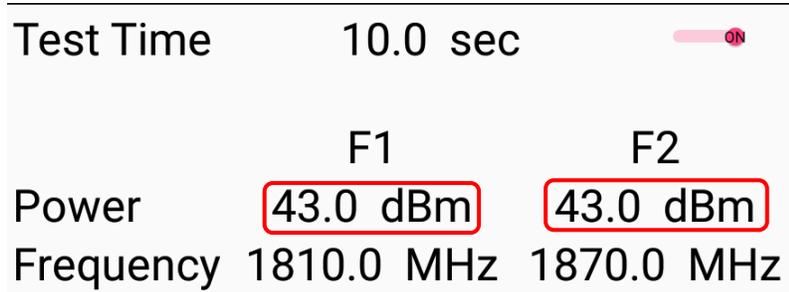
**Figure 140 – TX-1 Frequency Setting Pop-up Window**



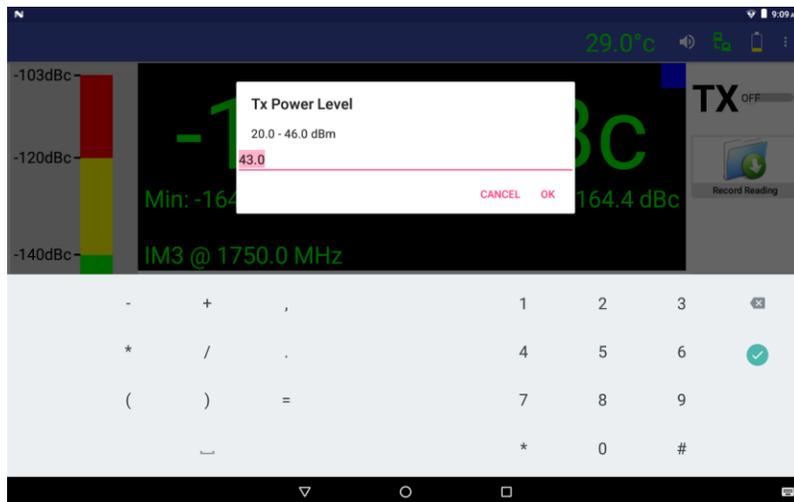
**Figure 141 – “Frequency out Of Range” Pop-up Window**

### 3.3.9.1.2 Change Power

The Power Level of the F1 and F2 frequencies can also be changed as on the Tower Series PiMPro. Pressing the “Power Level” shown will open up the pop-up window to enter the new power level for F1 or F2. See **figure 142** below for the location to press the F1 and F2 Power Level. This will open up the Power Setting pop-up window as shown in **figure 143**. *Note: if the user selects a power value which is outside of the available range, a pop-up window will appear similar to the one shown for the frequency range being out of range. However, it will indicate “Power Out of Range” and “Please Try Again.”*



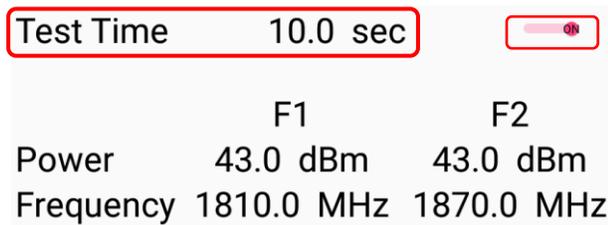
**Figure 142 – Location of F1 & F2 Power Level Icons**



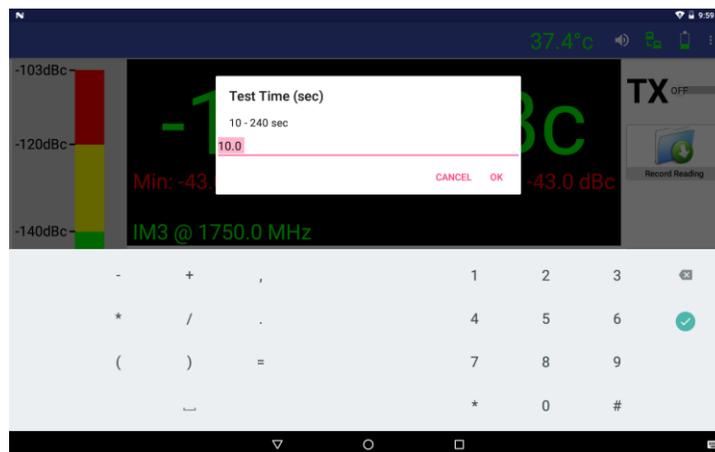
**Figure 143 – TX Power Level Setting Pop-up Window**

### 3.3.9.1.3 Change Test Duration

The duration of the PIM & R.Loss test can also be changed as on the Tower Series PiMPro. Pressing the “Test Time Icon” (as shown in **figure 144**) on the Screen will open up the pop-up (see **figure 145** below) to change the Test Duration, which has a duration of 10 to 240 seconds. Please note that there is an icon to the “right” of the Test Time which appears as if it is a slider. Clicking the icon (which changes the icon by showing the bar next to the letters Test Time as having shifted to the “right” and turning “red”) as shown in **figure 144**, tells the Tower Series PiMPro to only test for the “specified” amount of time. In the screen shown below, this would be 10 seconds. If the Icon is off (the icon will appear gray and what appears as if it is a slider is to the “left”) then the PIM and R.Loss test will stay on for the maximum allowable period of 4 minutes (240 seconds).



**Figure 144 – Location of PIM vs. Time “Slider”**

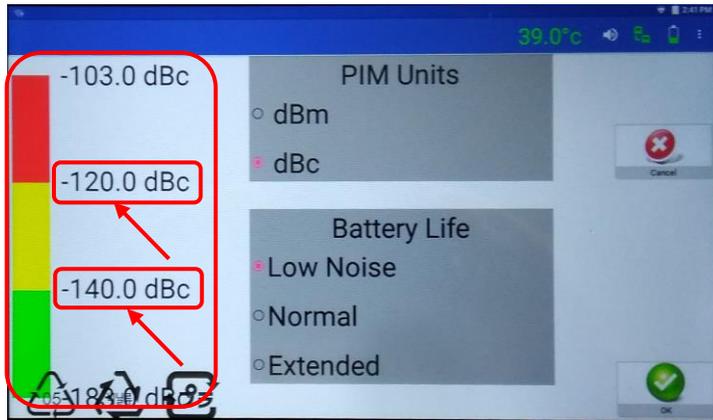


**Figure 145 – Time Duration Setting Pop-up Window**

### 3.3.9.1.4 PIM Units and Acceptance/Failure Limits

The PIM Acceptance/Failure Limits can be accessed by pressing the left side bar (icon) of the tablet screen. Clicking on the Acceptance/Failure Limit Icon on the left side of the screen will open up the pop-up window to allow for control of the Passing and Failing IM Criteria. Pressing on the -140 dBc portion of the icon opens up the PIM Pass Limit pop-up window, while pressing on the -120 dBc portion of the icon opens up the PIM Fail Limit pop-up window. The allowable Pass and Fail limits are -103 dBc to -183 dBc (-80 dBm to -140 dBm). See **figures 146 - 148** below for an example.

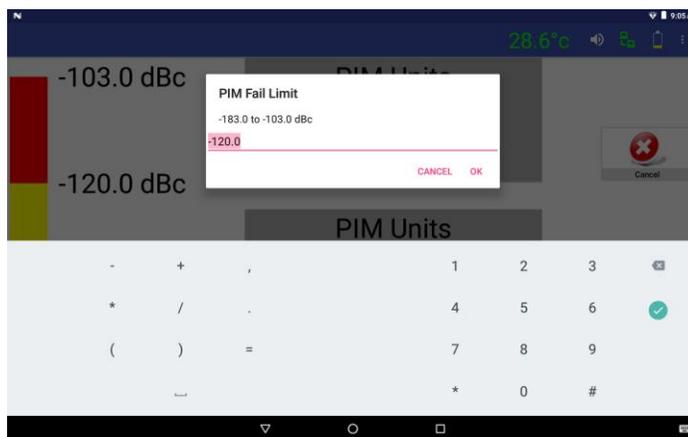
### 3.3.9.1.4 PIM Units and Acceptance/Failure Limits (Cont.)



**Figure 146 – PIM Level Pop-up Window**



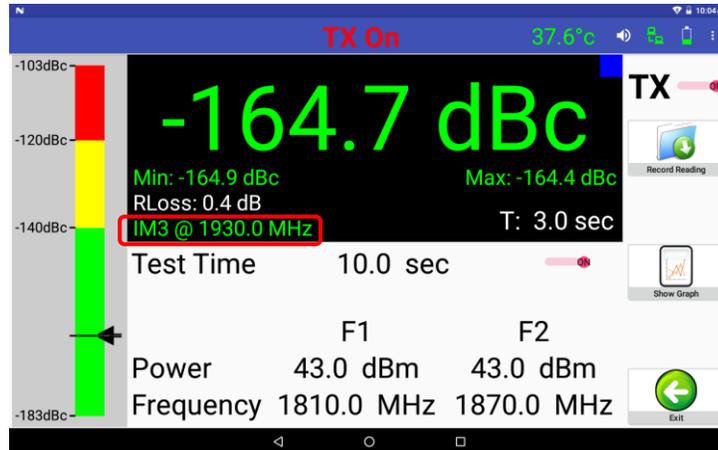
**Figure 147 – PIM Pass Limit Pop-up Window**



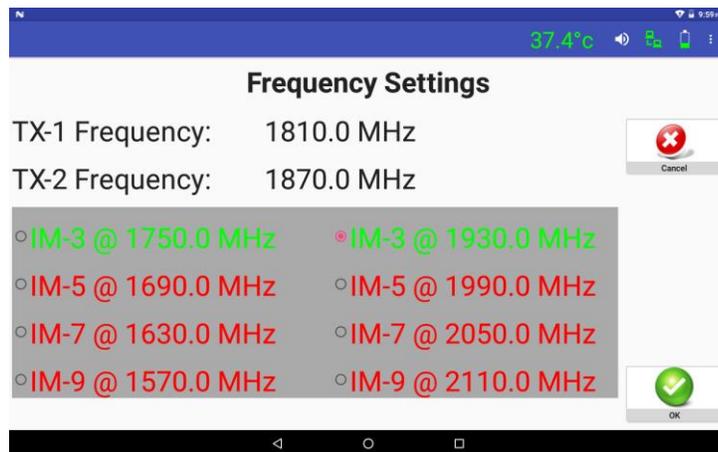
**Figure 148 – PIM Fail Limit Pop-up Window**

### 3.3.9.1.5 IM Frequency Change

The IM Frequency can be accessed by pressing the “IMx” (where “x” can be 3, 5, 7 or 9) portion of the screen as highlighted in **figure 149** below. This will open up the window shown in **figure 150**. Select the appropriate IM Frequency (“allowed values” are shown in “Green” text), and press the “OK” button. Note that the IM frequencies listed in “red” text are out of valid range for that band, hence, not “selectable.” If the IM frequencies showing are not acceptable, then change the F1 and F2 frequencies as needed to achieve the desired acceptable IM order and IM frequency. *Note: pressing a value which is shown in red and clicking the “OK” button will give the user a popup window indicating “IM Not Valid” and “Please Try Again.”*



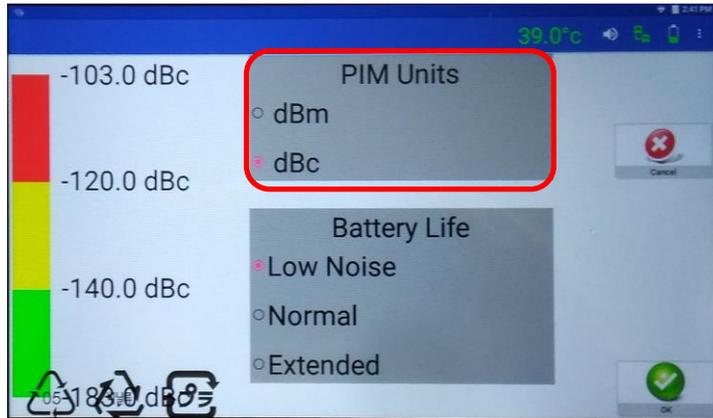
**Figure 149 – PIM & R.Loss Screen for Location of IM Product**



**Figure 150 – IM Selection Window**

### 3.3.9.1.6 dBm/dBc Unit Change

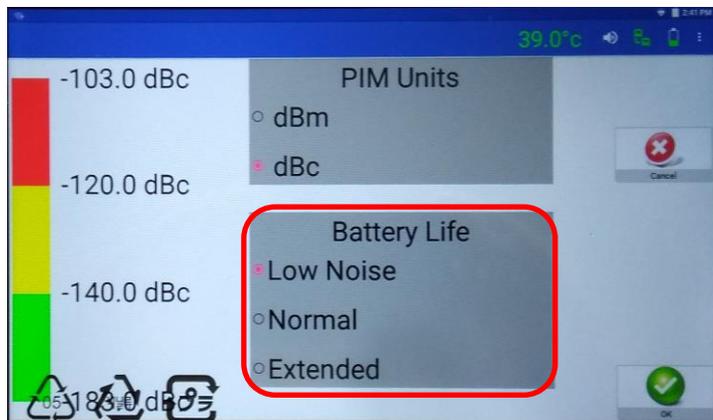
The dBm/dBc Units can be changed by the user accessing the screen in **figure 151** below and pressing the appropriate units “radio” button. Remember that if you have two tablets, one can be reading in dBm and the other can be reading in dBc.



**Figure 151 – dBm/dBc Unit Change Selection**

### 3.3.9.1.7 Battery Life Selection

The Battery Life options can be changed by the user accessing the screen in **figure 152** below and pressing the appropriate “radio” button (Low Noise, Normal or Extended).



**Figure 152 – Battery Life Selection Screen**

### 3.3.9.1.8 Turn-On and Turn-Off of Transmitter (TX)

Please note that there is an icon to the “right” of the PIM and Return Loss readings which appears as if it is a slider. Clicking the “TX icon” (which changes the icon by showing the bar next to the letters TX as having shifted to the “right” and turning “red”) as shown in **figure 153**, tells the Tower Series PiMPro to “Turn ON” the RF Power for PIM and Return Loss testing. If you are close to the PiMPro unit, you should see the “RF ON” RED LED turn on when you activate the “TX ON” on the Remote tablet. **Note: Prior to “Turning ON” the Tower Series PiMPro, make sure that it is terminated with the Low PIM Load, and not operating into an open.**

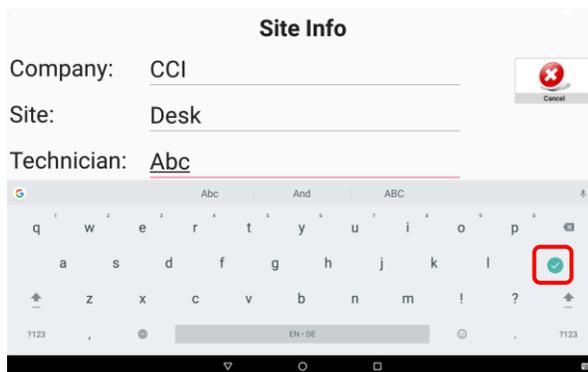
Clicking the “TX icon” again changes the position of the bar as having shifted to the left and turning gray. This “Turns RF Power OFF” on the Tower Series PiMPro.



**Figure 153 – Icon to Turn TX (RF) ON**

### 3.3.9.1.9 Record Reading

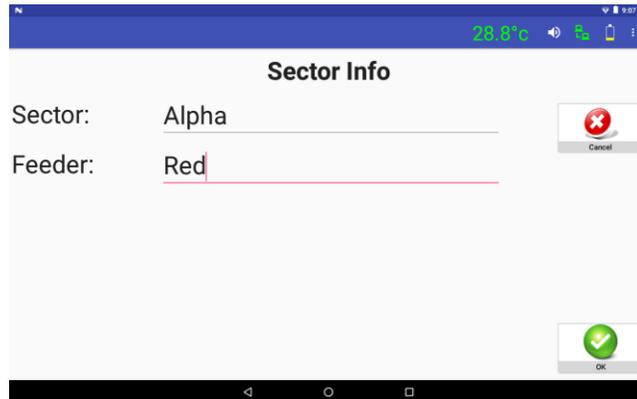
Record Reading can also be set-up as on the Tower Series PiMPro. Pressing the Record Reading icon on the Screen will open up the pop-up window to enter the Site Info. Once the Company, Site and Technician information is entered, the user must press the “check mark” (accept input information) on the tablet in order to get to the next screen. See **figure 154** below for an example.



**Figure 154 – Site Info Pop-up Window after Pressing Record Reading**

This now opens the “Sector Info” pop-up window. The user must enter the “Sector” and “Feeder” information. To accept the information entered in the “Sector Info” screen, press the “OK” button on the screen. See **figure 155** for an example.

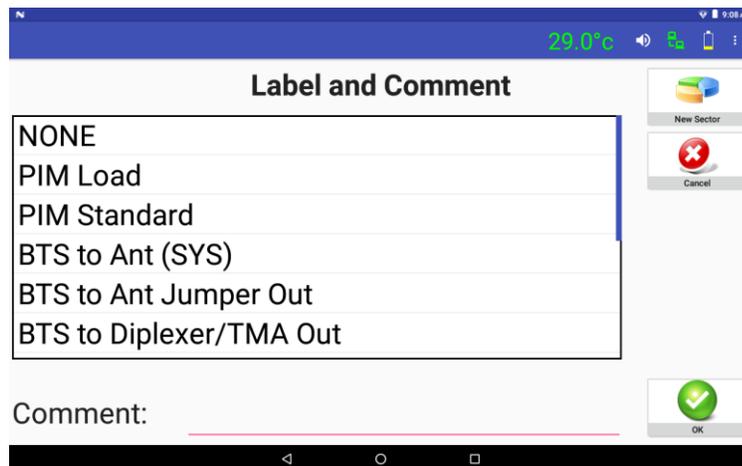
### 3.3.9.1.6 Record Reading (Cont.)



**Figure 155 – Sector Info Pop-up Window**

This will next bring up the Label and Comment window. The user can select the appropriate label by pressing on that label for the test condition (see **figure 156**), and add a comment (if needed for further definition) by pressing the bar next to “Comment:” and adding the appropriate text. After selecting the appropriate label and adding a comment (when required), the user must press the “OK” button in order to access a window (see **figure 157**) which contains the following choice of “PIM & R.Loss Record Reading” actions:

- 1) PIM vs. Time
- 2) TX Off Reading
- 3) Cancel



**Figure 156 – Label and Comment Pop-up Window**

### 3.3.9.1.6 Record Reading (Cont.)



**Figure 157 - Record Reading Pop-up Window**

When performing “PIM vs. Time” measurement the user can click on the “View Graph” Icon in order to open up the “Graph View” window (as shown in **figure 157**). “Record Reading” can be activated from the Graph View shown in **figure 158** to record the PIM Reading. **Note that this only records the PIM Reading, it does not record the plot (graph).**



**Figure 158 – PIM vs. Time “Graphical” Window**

### 3.3.9.1.10 Report Menu

The Report Menu can be generated from the Remote tablet, but reports can only be accessed from the main unit.

### 3.3.10 PIMPoint

Note that PIMPoint calibration must be performed from the Tower Series PiMPro itself before making any measurements by the Remote tablet. Calibration cannot be performed from the remote tablet(s). Once the PIMPoint calibration is completed from the Tower Series PiMPro the remainder of the PIMPoint operation is available on the tablet.

#### 3.3.10.1 PIMPoint Calibration

As noted earlier, the PIMPoint Calibration must be performed using the Tower Series PiMPro unit itself. Once the calibration sequence is completed, the PIMPoint testing can be performed using the remote tablet(s).

#### 3.3.10.2 PIMPoint Test

Pressing the PIMPoint Icon after calibration will initiate the PIMPoint testing, unless the calibration has not been performed (see **figure 159**). If the calibration has not been performed, than a pop-up window will appear to inform the user that the Calibration sequence has not been performed. If the calibration has not been performed, the user will see the window shown in **figure 160**.

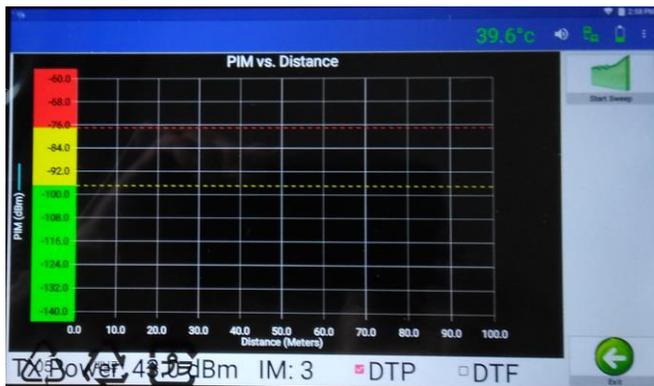


Figure 159 – Initial DTP Screen Prior to Reading

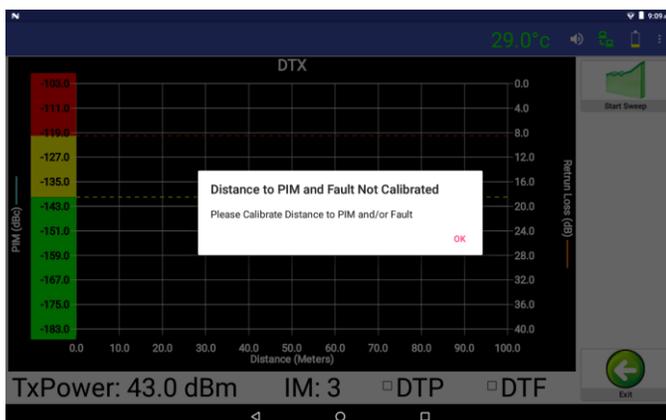
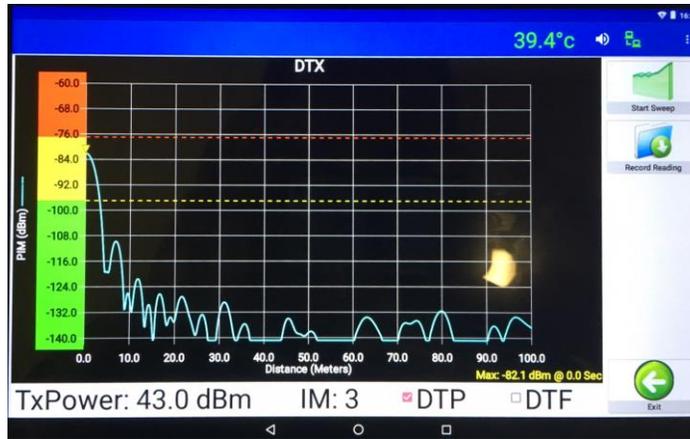


Figure 160 – PIMPoint Not Available Screen Due to No Calibration Performed

### 3.1.10.2 PIMPoint Test (Cont.)

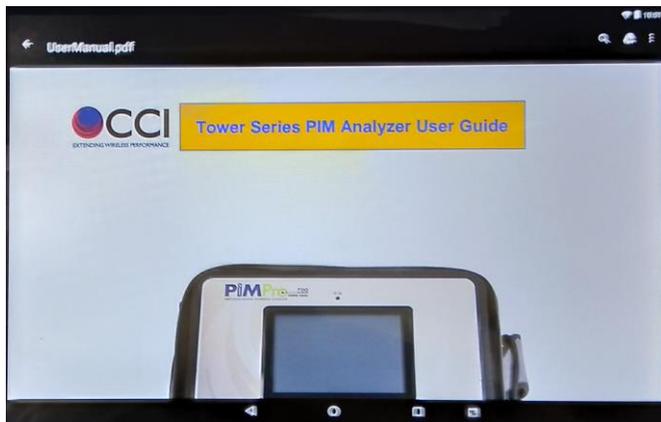
Once the user has completed the PIMPoint calibration, and initiates the PIMPoint test, the screen will change to add the “Record Reading” icon on the right hand side, as seen in **figure 161** below.



**Figure 161 – DTP and “Record Reading”**

### 3.3.11 Quick Start Guide

Finally, the Quick Start Guide can be opened and read from the tablet screen by pressing on the Quick Start Guide icon. See **figure 162** for the initial screen upon opening the Quick Start Guide.



**Figure 162 – Quick Start Guide as Viewed on a Tablet**

### 3.3.12 Multiple Tablets

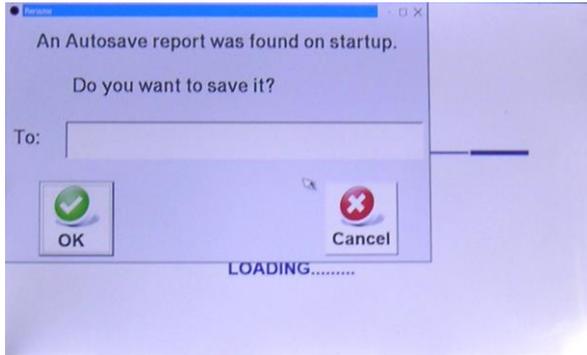
Note that multiple (or at least two) tablets can be connected to the Tower Series PiMPro with the “Remote” option enabled. See notes about the operation below.

#### 3.3.12.1 Notes About Operation with Two Tablets Connected

When two Tablets are connected, and you are performing PIM & R.Loss, one tablet can show the reading in dBm units, and the other can be set to show the reading in dBc units.

### 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 163** for an example of the Autosave pop-up window after powering the Tower Series PIM Analyzer. *Please note that the Autosave screen will be seen at Tower Series turn-on, especially after a power failure or a session where the user did not save data.*



**Figure 163 - Autosave Pop-up Window at Tower Series 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

Tower Series 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.*

### 3.6 Tower Series PiMPro Battery Usage (Older Models)

Please note that when the Battery is connected to **older** Tower Series PiMPro PIM Analyzer it is not being charged, even if the Tower Series PiMPro is connected to AC Power. Charging of the Battery can only be performed while using the AC Adaptor (Item J in the Tower Series Accessory Kit), Battery Charger item K in the Tower Series Accessory Kit, the Battery (item L in the Tower Series Accessory Kit), and the AC Power Cord (item M in the Tower Series Accessory Kit).

#### 3.6.1 Connecting the Tower Series PiMPro AC Adaptor, Battery Charger and Battery

Plug one end of the Battery Charger (with the 2.5 mm, center positive connector) into the AC Power Adaptor. Then take the loose Battery and screw the “D-Style” connector from the Battery Charger into the Battery. Finally, connect one end of the AC power cord into the AC Adaptor and then take the other end (C13 Connector) of the AC power cord and plug it into the AC power source.

#### 3.6.2 Status Indications When Charging the Tower Series PiMPro Battery is Fully Discharged

The Battery Charger LED will blink green when charging the Battery. When the Battery is fully discharged and the Battery Charge Status Button is depressed, the Battery LED will not come on until a small percentage of charge has been taken on by the battery.

#### 3.6.3 Status Indications When Charging the Tower Series PiMPro Battery

The Battery Charger LED will blink green when charging the Battery. When the Battery is charging and the Battery Charge Status Button is depressed, the Battery LED illuminates and shows the percentage of charge (0%-25%, >25%, >50%, >75%, and Full Charge) taken on by the battery. The Battery LED will stay illuminated while the Battery is charging will blink for the XX% level that is presently being charged to. The LED will continue to give the user the status of the battery charge while the charger remains plugged in and powered.

#### 3.6.4 Status Indications When Charging the Tower Series PiMPro Battery is Fully Charged

The Battery Charger LED will be solid green when the Battery is full charged. When the Battery is fully charged and the Battery Charge Status Button is depressed, the Battery LED will illuminate all percentages of charge and stay illuminated.

### 3.6.5 Status Indications When An Error Occurs in Charging the Tower Series PiMPro Battery

The Battery Charger LED will blink Red when an error occurs during the charging of the Tower Series PiMPro Battery. Possible reasons for the error include:

- 1) Battery is Fully Charged???
- 2) Connection between the Battery Charger and the Battery is improper.
- 3) Battery is Faulty
- 4) Etc.

### 3.7 Tower Series PiMPro Battery Usage (GEN2 Models)

The battery will be charged if the AC-DC Adaptor is plugged into the unit. Otherwise the unit is being run from the battery and not being charged.

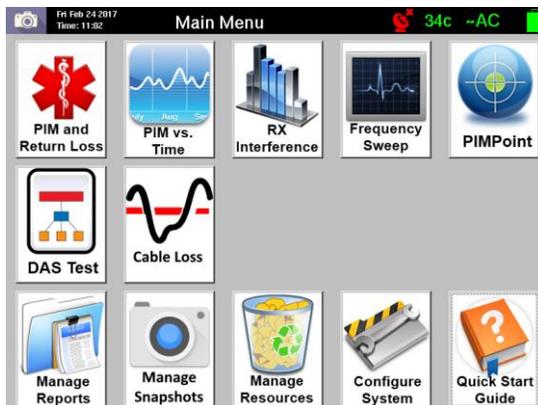
**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

#### 3.7.1 Connecting the Tower Series PiMPro AC Adaptor, Battery Charger and Battery

Plug one end of the Battery Charger (with the 2.5 mm, center positive connector) into the AC Power Adaptor on the Tower Series PiMPro PIM Analyzer. Then connect one end of the AC power cord into the AC Adaptor and then take the other end (C13 Connector) of the AC power cord and plug it into the AC power source.

#### 3.7.2 Status Indications When Charging the Tower Series PiMPro Battery is Fully Discharged

When fully discharged the Battery Status indicator on the Tower Series PiMPro LCD Screen battery icon will show a “green outline” as seen in **figure 164** below. If either the Battery Icon or the temperature readout is depressed, than the “Status and Alarms” window shown in **figure 165** will pop-up. This pop-up window indicates the battery charge state, as well as other information about the internal status of the Tower Series PiMPro. When the Battery is fully discharged and the Battery Charge Status Button is depressed, the Battery LED will not come on until a small percentage of charge has been taken on by the battery.



**Figure 164 – Main Menu (Press Battery Icon)**

### 3.7.2 Status Indications When Charging the Tower Series PiMPro Battery is Fully Discharged (Cont.)

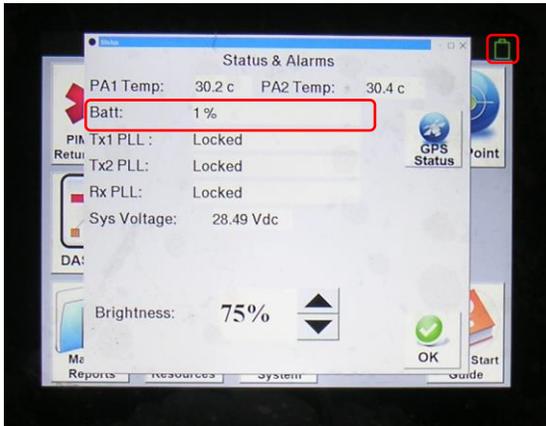


Figure 165 – Battery Status (1%) after Pressing Battery Icon

### 3.7.3 Status Indications When Charging the Tower Series PiMPro Battery

The battery status can be determined while charging by viewing the battery icon for an approximate idea of the charge level. Again, the battery icon can be depressed if an accurate battery status is desired. See figures 166 and 167 for detailed 23% and 65% battery charge levels respectively. When the Battery is charging and the Battery Charge Status Button is depressed, the Battery LED illuminates and shows the percentage of charge (0%-25%, >25%, >50%, >75%, and Full Charge) taken on by the battery. The Battery LED will stay illuminated while the Battery is charging will blink for the XX% level that is presently being charged to. The LED will continue to give the user the status of the battery charge while the charger remains plugged in and powered.

**Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

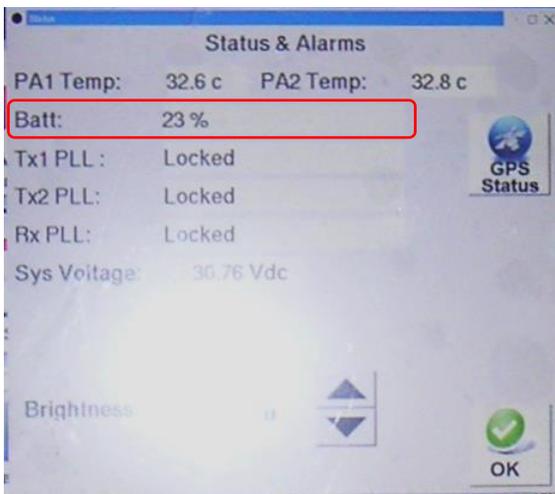


Figure 166 – Battery Status at 23% Charge

### 3.7.3 Status Indications When Charging the Tower Series PiMPro Battery (Cont.)

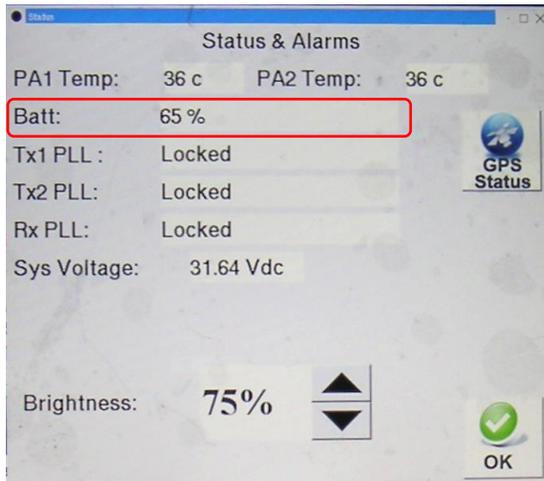


Figure 167 – Battery Status at 65% Charge

### 3.7.4 Status Indications When Charging the Tower Series PiMPro Battery is Fully Charged

When the Battery is fully charged and the Battery Charge Status Button is depressed, the Battery LED will illuminate all percentages (0%-25%, >25%, >50%, >75%, and Full Charge) of charge and stay illuminated as seen in figure 168 below.



Figure 168 – Fully Charged Battery LED Status Indicators

### 3.7.5 Lithium Polymer Rechargeable Battery Care and Precautions

Note that there are no indications of a faulty battery (no LED's, etc.). The only way of knowing there is a problem is if the user notices a seemingly endless charging process. As an example, if the battery never progresses beyond the 1<sup>st</sup> bar (0-25% charge) on the battery LED within the expected 2.5 to 3 hour charge time for a "drained" battery. As another example, if the charge time is exceeds the 2.5 to 3 hour charge time no matter what charge status the battery reads (without ever becoming fully" charged).

- 1) Handle the Lithium Polymer Battery with extreme care: Dropping the battery can result in permanent damage
- 2) Remove the battery from the PiMPro's battery slot prior to shipping the Tower Series PiMPro PIM Analyzer.
- 3) Use only CCI specified charger or Tower Series PiMPro Internal charging feature to recharge the battery.
- 4) **Warning: Do not swap battery while RF power is on. Also, never plug or unplug the AC Adaptor while the RF is on.**

### 3.8 Alternate Battery

There is an alternate Battery Model Number PPT-AK-BATT available with a higher battery capacity rating. This battery is rated at 28.8 VDC, with a battery capacity of 4.5 AH (or 130.0 WH). **Note: This battery cannot be shipped air freight.**

## 4 Inspection and Maintenance

### 4.1 Inspection and Maintenance (Unpowered)

Inspection and Maintenance of the CCI Tower Series should be performed when the unit is not powered. The CCI Tower Series 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 Tower Series Accessory Kit.
  - b. The RF Connector Saver should be examined for damage. If the connector saver is damaged, the Tower Series should be returned to CCI for replacement.
- 2) Fans/Fan Covers
  - c. The fans/fan covers in the Tower Series should be kept clean to insure proper air flow through the Tower Series. 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 Tower Series should be kept clean to insure proper air flow through the Tower Series. 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 Tower Series 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 Tower Series webpage, and the Software Upgrade Instructions document also located on the Tower Series webpage on the CCI Website.

### 4.3 RTC Battery Replacement

A battery is utilized for the Real Time Clock (RTC) located on the “Friendly ARM MINI24440 Single Board Computer” within the CCI Tower Series. 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

## C Appendix C –Declarations of Conformity

### c.1 CE Declaration of Conformity



Hereby, **Communication Components Inc.**  
**89 Leuning Street**  
**South Hackensack, NJ 07606**  
**USA**

declares that the following products are in compliance with the essential requirements of Directive 2014/30/EU (EMC Directive) and Directive 2014/35/EU (LVD Directive) if installed and operated in accordance with manufacturer’s instructions, per Certificate of Compliance No. 2G16129.CC0T74.

Part Number	Model Number	Description
Tower 700B	PiMPro Tower 700	Tower Series PIM Analyzer
Tower 700B APT	PiMPro Tower 700A	Tower Series PIM Analyzer
Tower 800B	PiMPro Tower 800	Tower Series PIM Analyzer
Tower 850B	PiMPro Tower 850	Tower Series PIM Analyzer
Tower 900B	PiMPro Tower 900	Tower Series PIM Analyzer
Tower 1821B	PiMPro Tower 1821	Tower Series PIM Analyzer
Tower 1900	PiMPro Tower 1900	Tower Series PIM Analyzer
Tower 1921B	PiMPro Tower 1921	Tower Series PIM Analyzer
Tower 2600B	PiMPro Tower 2600	Tower Series PIM Analyzer

These products are in conformity with the following European harmonized and published standards at the date of this declaration.

Referenced EMC Standard:	
EN 55022:2010 “Class B”	EN 61000-3-3: 2013
EN 55024: 2010	IEC 60950-1: 2005+A1: 2009+A2: 2013
EN 61000-3-2: 2014	EN 60950-1: 2006+A11: 2009+A1: 2010+A12: 2011+A2: 2013
EN 61000-3-3: 2013	

**c.2 KC Declaration of Conformity**



Hereby, **Communication Components Inc.**  
**89 Leuning Street**  
**South Hackensack, NJ 07606**  
**USA**

declares that the following products have been registered under Clause 3, Article 58-2 of Radio Waves Act, if installed and operated in accordance with manufacturer's instructions, per Registration No. MSIP-REM-1CI-PIMPROTOWER.

Part Number	Model Number	Description
Tower 700B	PiMPro Tower 700	Tower Series PIM Analyzer
Tower 700B APT	PiMPro Tower 700A	Tower Series PIM Analyzer
Tower 800B	PiMPro Tower 800	Tower Series PIM Analyzer
Tower 850B	PiMPro Tower 850	Tower Series PIM Analyzer
Tower 900B	PiMPro Tower 900	Tower Series PIM Analyzer
Tower 1821B	PiMPro Tower 1821	Tower Series PIM Analyzer
Tower 1921B	PiMPro Tower 1921	Tower Series PIM Analyzer
Tower 2600B	PiMPro Tower 2600	Tower Series PIM Analyzer

These products are in conformity with the following NRAA published standards at the date of this declaration.

Referenced EMC Standard and Test Method	
Specification	Method
KN 11	KN 11
KN 61326-1 (Table 1)	KN 61000-4-2
	KN 61000-4-3
	KN 61000-4-4
	KN 61000-4-5
	KN 61000-4-6
	KN 61000-4-8
	KN 61000-4-11

**c.3 Sample Label Showing CE "Mark" and KC "Mark" and MSIP Registration Number**



## Revision History

Revision	Date Released	Author	Changes
1.0	3/17/14	J. Baszak	Release Tower Series PIM Analyzer User Guide.
1.1	4/1/14	J. Baszak	Update Transport Case and Accessory Kit Model Numbers.
1.2	8/4/14	J. Baszak	Addition of Battery Charging information (steps); Also addition of other tests including DAS Test, etc.
1.3	12/1/14	J. Baszak	Modified Table I and Paragraph 1.3.1.2 to indicate the frequency ranges for the 3 <sup>rd</sup> and 5 <sup>th</sup> Order IMD Rx range for both the 1800 Band & the 2100 Band
1.4	12/11/14	J. Baszak	Adding Testing per updated Tower Series S/W (per input from Vahram); 10/7/15 → Also adds updated features (Larger Screen, Battery Indicator and charging while connected, added USB Ports); Added DTF Feature.
1.5	11/06/15	J. Baszak	Added Tower 800 & Tower 1921 (Dual Band). Remove Appendices due to different Test Method required. Indicate that GEN1 units have 7.0" Diagonal TFT Screen.
1.6	3/2/16	J. Baszak	Added CE Approval Documentation as Appendix C.
1.7	5/22/2017	J. Baszak	Update to include present functionality of the Tower PiMPro Series, and correct errors; New Screenshots throughout the User Guide; Add CE and KC Declarations of Conformity.
1.8	10/2/2017	J. Baszak	Change paragraph 3.6 "Tower Series PiMPro Battery Usage (GEN2 Models)
1.9	11/30/2017 & 6/14/2018, 8/15/2018	J. Baszak	Update to match all redlines: including TX/RX frequency listing and model availability; Changes to Accessory Kit; Alternate Battery paragraph added. Also adding Remote Control via Tablet (6/14/2018), corrected table 1 for 1821, 1921 and 900 models (6/21/2018)