

# Kaelus

## iPA A-SERIES OPERATING MANUAL

THE BATTERY OPERATED INTERMODULATION TEST SYSTEM



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**SUMMITEK**  
ADVANTAGE

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## PRECAUTIONS

### W A R N I N G- INTERFERENCE

This instrument has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an industrial installation. The instrument generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this instrument does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the instrument and receiver
- Connect the instrument into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

### W A R N I N G – RF HAZARD

This series of instrument is capable of producing up to 50 Watts of radio frequency (RF) power in the 700 MHz to 2600 MHz frequency band. Users are reminded that proper precautions must be taken to minimize exposure to these RF fields to the recommended limits. Please pay particular care to the following areas:

- Switch off the RF power from the test equipment before removing or connecting the cables to the test port. Burns to fingers and permanent damage to eyes can result from exposure to connectors carrying high levels of RF power
- Ensure that any antennas being tested are placed so that no personnel are exposed to RF field levels in excess of the maximum exposure limits [Ref ARPANSA RPS No. 3 for Australian Users or Australia]

Also, the unit should be operated by a suitably qualified operator in order to ensure interference is not caused to other spectrum users. Radiation through an antenna requires authorization by the frequency license holder to do so.

### WARNING – BATTERY

The iPA Series Portable Passive Intermodulation Analyzer is fitted with a removable Lithium-Ion battery. Rechargeable lithium ion batteries contain organic solvents and reactive materials. Erroneous handling of lithium ion batteries may result in heat generation, explosion or fire, possibly leading to injury.

Observe correct handling and disposal of Li-Ion batteries.

### WARNING – HEAVY INSTRUMENT

The packed weight of the instrument exceeds the 18kg (40lb) guideline for manual handling by a single person (it weighs < 22.7kg/50lbs). To avoid risk of injury, an assessment should be carried out prior to handling to check individual capability, the equipment weight and the required workplace conditions, accordance with the European Directive 90/269 or equivalent National Regulations for manual handling.

### DISCLAIMER- INTERFERENCE

The instrument uses similar frequencies and power levels to several cellular telephone systems. Kaelus and its agents or distributors accept no responsibility for interference to existing communications services as a result of improper operation or misuse. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

### WARNING – ELECTRICAL HAZARD

This unit is powered by a 25.9V Li-ion battery pack. The unit is routinely charged with a supplied smart charger. This charger is supplied with a protective ground lead for AC supply safety reasons. To maintain this level of protection, the supply lead must always be connected to the supply via a socket with an earth contact.

This product must only be used with the supplied charger.

Do not remove covers as there are no user serviceable parts inside.

## GENERAL CONDITIONS OF USE

This equipment should be protected from the ingress of liquids and precipitation such as rain and snow. The equipment must be operated within the environmental conditions specified in **Chapter 1.4**. This equipment is not approved for use in hazardous atmospheres or medical applications.

## WARRANTY

Kaelus warrants all of its products<sup>1</sup> and services to be free from defects in material and workmanship for a period of 60 months from first receipt into customer store. The limit of liability under this warranty shall be to repair or replace any product, or part thereof, which proves to be defective after inspection by Kaelus provided that:

- The products are returned properly packed, carriage paid, to Kaelus or their agent or distributor, at the customer's risk within the warranty period
- An adequate description of fault conditions is included with the returned products
- The products have not been misused, mishandled, overloaded, modified or repaired in anyway, or used for any purpose other than that for which they were designed

Kaelus shall be responsible for one way freight charges, from the nearest Kaelus Service Centre to customer store destinations.

Repair and replacement work carried out by Kaelus on products manufactured by them, shall be warranted against the same defects re-occurring in a period of 60 months, or until the expiration of the original product warranty, which ever shall be the latter.

Kaelus shall not be liable for any direct or consequential injury, loss or damage incurred through the use, or the inability to use, any Kaelus product. Kaelus reserves the right to make design changes to Kaelus product without incurring any obligation to make the same changes to previously purchased products.

<sup>1</sup> This Warranty does not apply: (a) to consumable parts, such as batteries or protective coatings that are designed to diminish over time, unless failure has occurred due to a defect in materials or workmanship; (b) to cosmetic damage, including but not limited to scratches, dents and broken plastic on ports; (c) to damage caused by use with another product; (d) to damage caused by accident, abuse, misuse, liquid contact, fire, earthquake or other external cause; (e) to damage caused by operating the Product outside published

guidelines; (f) to damage caused by service (including upgrades and expansions) performed by anyone who is not a representative of Kaelus or a Kaelus Authorized Service Provider; (g) to a Kaelus Product that has been modified to alter functionality or capability without the written permission of Kaelus; (h) to defects caused by normal wear and tear or otherwise due to the normal aging of the Kaelus Product, or (i) if any serial number has been removed or defaced from the Kaelus Product.

## UNPACKING

Ensure that the total number of boxes of equipment is checked off against the delivery documentation. At the same time inspect for any obvious transit damage. Should any damage be noted, notify the carrier immediately to file a transit damage claim. Do not discard any packing material until notified by the carrier or Kaelus. Carefully unpack all containers and check that all items listed on the delivery documentation. Please notify Kaelus of any damaged or missing items from the shipment.

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# 1. OPERATING INSTRUCTIONS

## 1.1 INTRODUCTION

This manual describes the operation of the iPA (Interconnect Portable Analyzers) A&B series type of portable intermodulation test instruments developed by Kaelus.

The iPA Series Portable Passive Intermodulation (PIM) Analyzer enables measurements of the PIM quality of RF components. The iPA is a fully portable battery powered test instrument, that can be locally controlled using a touch screen interface or remotely controlled via wireless connection to a computer or smart device.

The iPA Series Portable Passive Intermodulation Analyzer is predominantly used to find IM3 sources such as badly terminated or loose connectors and faulty components.

The IPA series portable passive intermodulation analyzer measures the PIM quality of a component by monitoring reverse PIM fluctuations whilst a component is moved, knocked or stressed in some way.

The iPA is a light, small, affordable, highly portable, rugged, easy to use, battery powered, remote controllable, market leading interconnect tester.

## 1.2 FUNCTIONAL DESCRIPTION

The iPA is designed to carry out reverse Passive Intermodulation (PIM) measurements in accordance with IEC62037. PIM occurs in passive devices whenever two or more RF signals encounter non-linear electrical junctions or materials. The interference generated is mathematically related to the localized downlink frequencies and can result in a noise rise in the uplink band of one or more systems sharing the RF infrastructure. The impact of PIM on the network performance can be severe, especially for wideband systems such as CDMA, UMTS or LTE. PIM interference can lead to desensitization of the receiver causing increased dropped calls, increased access failures, pre-mature hand-offs, decreased data transmission rates and decreased system coverage and capacity. Any component in the RF path can be the source of the PIM interference including antennas, TMAs, diplexers, duplexers, surge arrestors, cables and connectors. In addition, loose mechanical connections or rusty surfaces external to the antenna system can generate PIM when subjected to high radiated RF power.

Two synthesized carriers can be set to specific frequencies in the transmit band. With the RF output switched on, these tones will be present at the test port and stabilized to the predefined output level. The resulting 3<sup>rd</sup> and 5<sup>th</sup> order intermodulation product is automatically calculated and the receiver is tuned to the required product. The detected voltage is processed by a microcontroller and the relevant reading shown on the display unit.

### 1.3 FEATURES

- Rugged and reliable; designed with tower climbers in mind
- Tablet PC included for remote control of device
- Capable of connecting to any Wi-Fi device
- 4.3" LCD touch screen for local control
- Automatic detection and shut down when high Return Loss is detected
- Spectrum monitor, frequency sweep and time trace modes
- Measures reverse PIM of greater than -153dBc when using two 20W carriers
- Internal detector circuits with narrow IF bandwidth provide low noise floor
- Internal carrier power monitors
- Complete frequency agility in steps of 100 kHz to any frequency in the specified transmit bands
- Automatic internal calculation of IM product frequencies for receiver tuning
- Onboard report generation and exportation in PDF format
- All electronic systems are monitored and alarmed. This ensures that each measurement made is faultless
- An optional (RTF) Range To Fault Unit can assist to locate the point where either Return Loss or PIM may be occurring.
- Geotag function can provide geographical tagging on reports (Geotag service device such as mobile smart phone or Tablet PC required)
- Advance report generating features that can include smartphone or tablet Photo's Plots or screen shots
- Files, reports, status files and photos can be uploaded and downloaded from the device. SEE Note 1
- Eco Mode to conserve battery life when the instrument is not in use

Note 1 : File upload size limit 100Mb, SD card formatted to fat32 filesize limit 2GB

## 1.4 SPECIFICATIONS

### Transmitter

---

Transmit band	<b>Per product data sheet</b>
Channel steps	<b>100kHz</b>
Frequency accuracy	<b><math>\pm 5</math>ppm (max), aging <math>\pm 1</math>ppm (max) after first year</b>
Power per tone (adjustable)	<b>100mW - 20W (+20 to +43dBm)</b>
Power Accuracy/ALC Leveling (per tone)	<b><math>\pm 0.5</math>dB (max) across the full temperature range</b>

### Receiver

---

Receive band (100kHz steps)	<b>Per product data sheet</b>
Receiver noise floor	<b>&lt; -128dBm typical</b>
Measurement range	<b>-50dBm to -128dBm</b>

### System

---

Measurement method	<b>Reflected PIM, 3<sup>rd</sup> and 5<sup>th</sup> order Also 7<sup>th</sup> order for iPA-0901</b>
Residual PIM	<b>&lt; -117dBm max (&lt; -125dBm typ)</b>
Operating System	<b>Based on Android 4.2.2</b>
Ports	<b>1x USB 2.0 Host, 1x USB 2.0 Slave, 1x SD, 1x monitor port (SMB female), 1x SMA-RP (Wi-Fi external antenna), RF Output Port (7-16/F)</b>
User Interface	<b>Local – touch screen display 4.3 in (109mm) Remote – Tablet PC, Wi-Fi (included), any user device Wi-Fi and Web browser</b>
Return Loss Alarm	<b>Automatic detection and shut down when high RL is detected</b>

### Electrical

---

Battery Power	<b>25.9 VDC, 2.6Ah , 67 Wh LI-ion battery pack (removable)</b>
Battery Operating Time	<b>Depends on usage, 2 hr min. per battery pack</b>
Battery Charger	<b>Output: 29.4 VDC, 1.2 Amp</b>

Mechanical Dimensions	<b>369 x 240 x 160mm</b>
Weight	<b>&lt; 12kg</b>
Cooling	<b>Natural Convection</b>

### **Environmental**

---

Max. Operating Temperature	<b>-10°C to +45°C (Operating)</b> <b>-10°C to +60°C (Storage)</b>
Ingress Protection (IP)	<b>IP54. IP67 when enclosed in optional hard case</b>
Relative Humidity	<b>5% to 95% RH non-condensing</b>
Mechanical Shock	<b>40G shock/vibrating rating</b>

### 1.5 CONSTRUCTION AND LAYOUT

The external details of the iPA test set are shown below in Figure 1.



Figure 1: iPA and Tablet PC Front View

### 1. Red LED (RF on indicator) \_\_\_\_\_

The high intensity, red LED flashes when RF power is present on the RF output Port.

### 2. RF Output Port \_\_\_\_\_

The 7/16 RF output port is used for all measurements.

### 3. Inbuilt Wi-Fi Antenna \_\_\_\_\_

A 7dBi inbuilt antenna for Wi-Fi connection to the Tablet PC and other Wi-Fi devices.

### 4. LCD Touch Screen \_\_\_\_\_

Care should be taken at all times to prevent accidental damage to the touch screen. At no time should any item be stored on top of the Touch Screen.

### 5. Monitor Port , External Wi-Fi Antenna Port, DC input socket \_\_\_\_\_

Monitor port is used for Range TO Fault (RTF), Spectrum Analyzer mode and as a Receiver monitor port. An external Wi-Fi antenna may be connected to the Reverse SMA Wi-Fi socket.

The Charger may be connected to the DC input socket for recharging the replaceable battery (See figure 2 for details).

### 6. Power ON/OFF Switch \_\_\_\_\_

Pressing the Power button (until a beep is heard) will initiate the instrument's start-up procedure. (Three beeps indicates a battery low condition) During operation the instrument can be switched off by pressing this button.

### 7. Removable Battery Pack \_\_\_\_\_

A removable 26 volt Li-ion battery pack. The iPA has an in-built charging function and is supplied with a 29 volt charger. The iPA should not be run with the battery removed.

### 8. 2x USB Ports, SD card port \_\_\_\_\_

Used for loading state files and upgrades, and downloading reports and states. USB Host port is typically used for COMMS with the RTF plug-on module. (See figure 3 for details)

### 9. Handles \_\_\_\_\_

Rugged handles allow easy handling of the iPA during installation.

### 10. Lifting Lugs \_\_\_\_\_

Lifting lugs allow easy lifting of the iPA during installation and lowering.



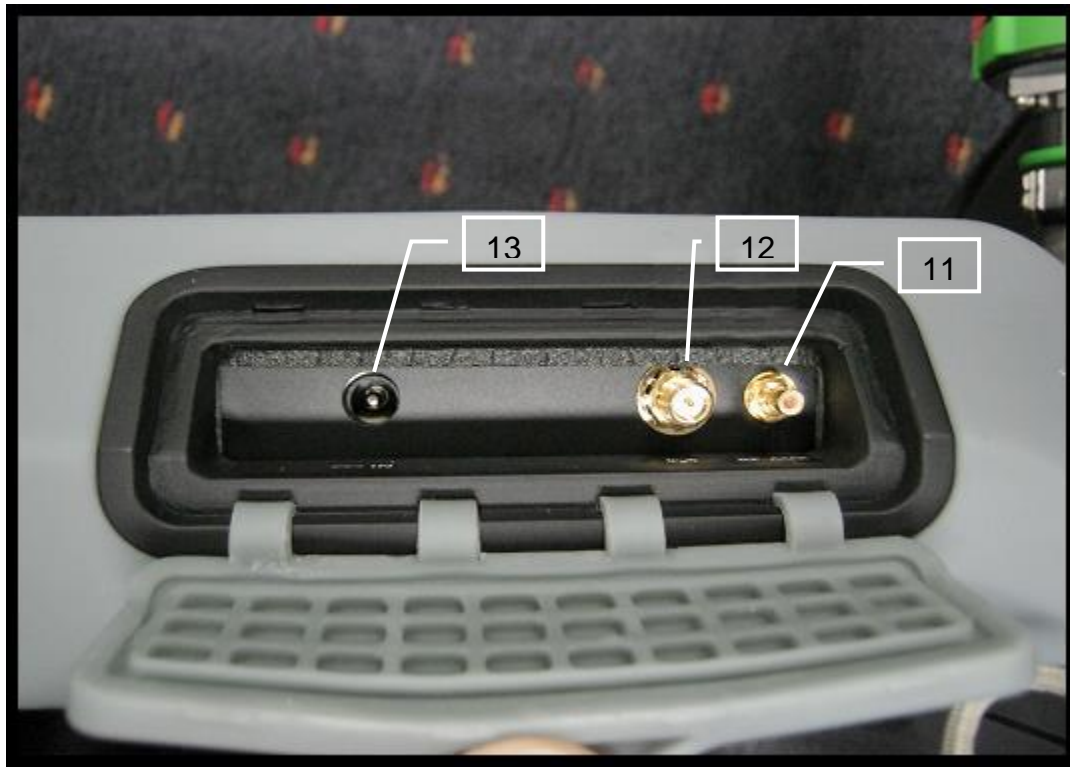


Figure 2: Monitor Port, External Wi-Fi Port and DC input socket

### 11. Monitor Port

The Monitor Port performs the following functions:

Receiver Monitor Port: Outputs Receiver RF signal spectrum for external Spectrum Analyzer.

RTF Mode: Output +12 volts and RF signal spectrum for RTF operation.

### 12. External Wi-Fi Port

Reverse SMA socket available for connecting an external Wi-Fi 5GHz Antenna.

### 13. External DC/Charging Socket

DC Charging socket for charging Li-ion battery. Charger may be connected to the iPA during operation with Li-ion battery inserted. It is not recommended that the charger be connected without the Li-ion battery being installed.

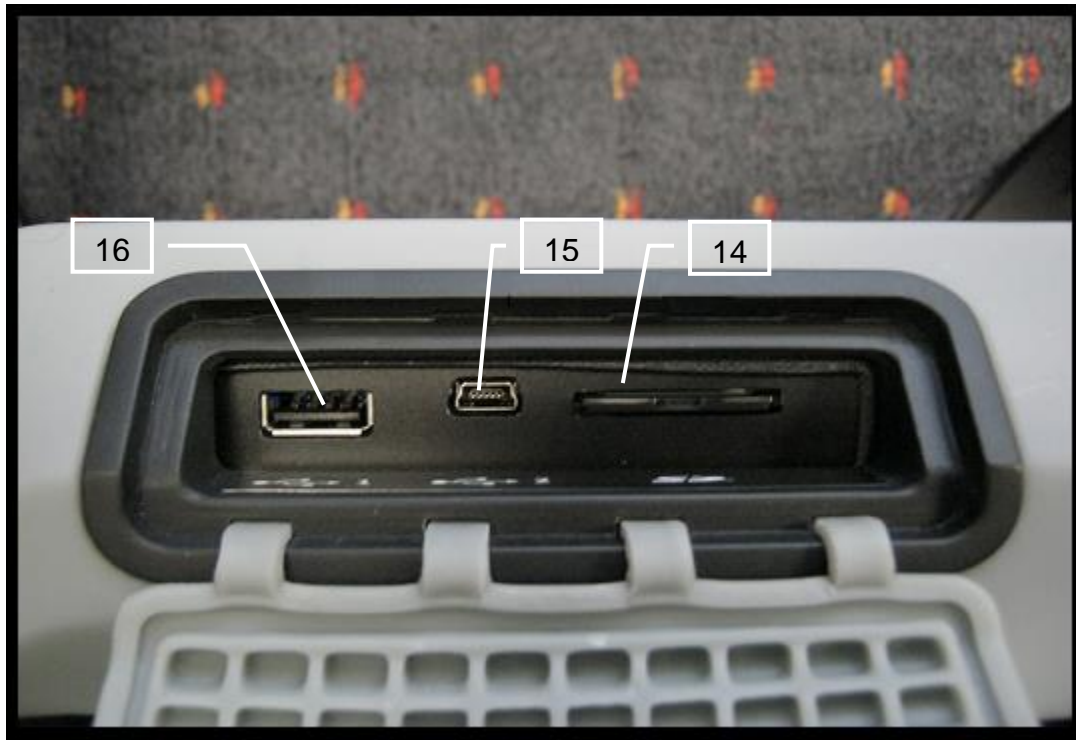


Figure 3: SD Card, USB and Mini USB Port

#### 14. SD Card Port

Allows the connection of external memory device (SD Card) for the recording of Reports , State files and Screen Shots.

#### 15. Mini USB Port

Accesses the internal memory of the iPA and allows the User to use the iPA as a mass storage device.

#### 16. USB Port

Allows connection to the External RTF module.

## 1.6 EQUIPMENT OPERATION – FIXED FREQUENCY MODE

The fixed frequency mode is the default measurement mode of the iPA. In this mode the two test frequencies remain fixed during the duration of the test. When the RF is switched on, the instantaneous PIM value will be displayed by the test equipment.

### 1.6.1 Starting the equipment - iPA

Press and hold the Power button until a beep is heard and the instrument will begin its start-up procedure. The iPA Start up Window will appear. The user can expect the boot and start-up process to take 70 seconds.



Figure 4: iPA Start up Window

## 1.6.2 The Main Application Window - iPA

When the instrument is ready to use it will show the Fixed Frequency Window as per Figure 5 below.

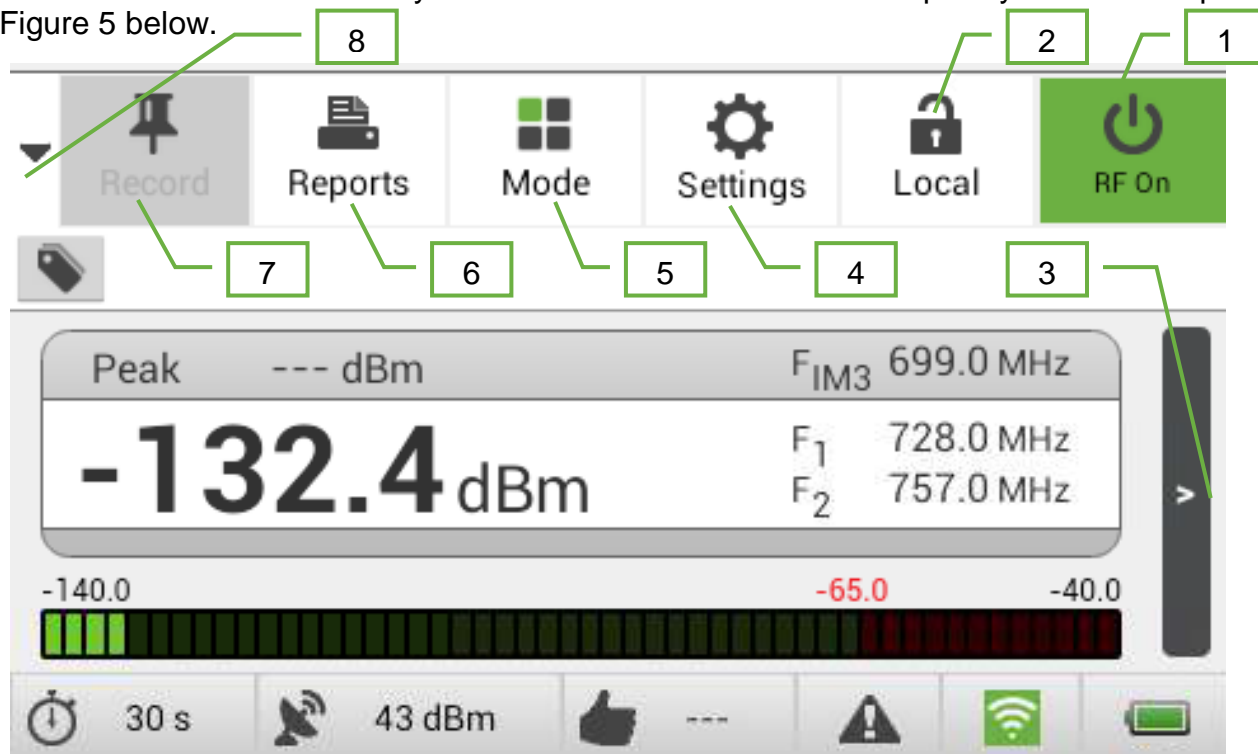


Figure 5 : iPA Fixed Frequency Window (Default Measurement Mode)

iPA Initial Fixed Frequency Window features:

1. RF "On/Off" button
2. Wi-Fi Control/Status Icon
3. Change to time trace mode button
4. Settings menu selections button.
5. Changed between Fixed Mode, Swept Mode, Monitor Mode , RTF Mode (If Fitted)
6. Reports menu, for saving, viewing, recalling reports. (Reports display recorded points)
7. Record button. Records a point during a test for a report.
8. Insert graphics menu button

The iPA screen features mirror those of the Tablet PC display and are explained in Figure 13.

## 1.6.3 Screen zoom functions (Local Control)

Zoom control is available on the local console for all modes including the RTF option.

Zoom control is supported in remote consoles in RTF mode, see the RTF Operating manual for more details.



Figure 6 :Zoom select region Local control

Touch the shaded region to enable the zoom function .

1.6.3.1 Adjusting Horizontal Zoom .

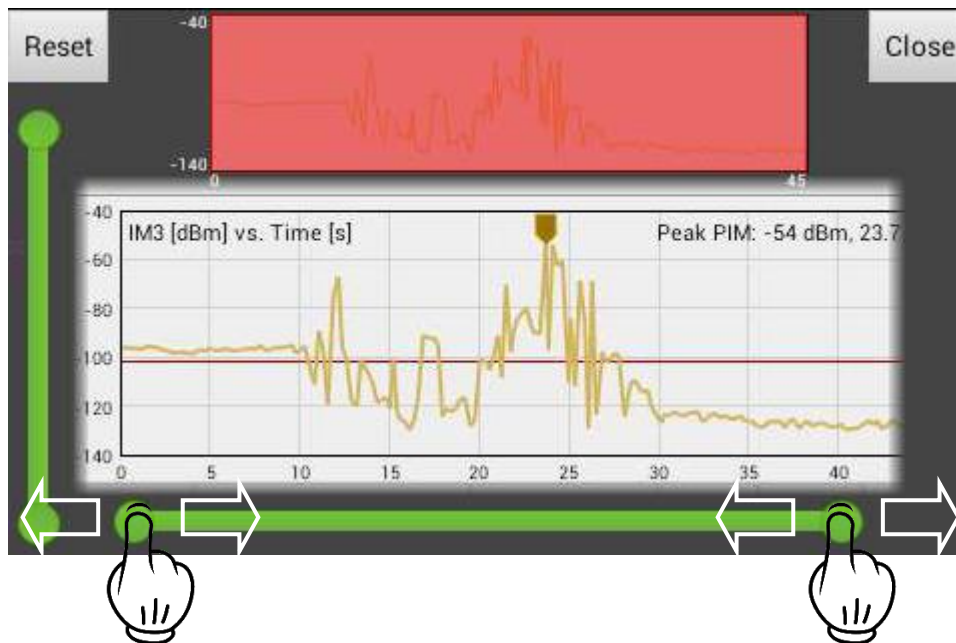


Figure 7: Zoom Adjustment Horizontal (Local control)

### 1.6.3.2 Adjusting Vertical Zoom



Figure 8: Zoom Adjustment Vertical (Local control)

### 1.6.3.3 Adjusting Pan window position



Figure 9: Pan Window Adjustment (Local control)



### 1.6.4 Starting the Equipment – Samsung Galaxy Tab

Turn on “on” the Tablet PC .

Install the Chrome Web Browser or update it to a recent version. This is the preferred browser for use with the iPA. This can be done via the internet on your local Wi-Fi network or mobile phone hotspot. First attend to your internet connection via the settings menu.

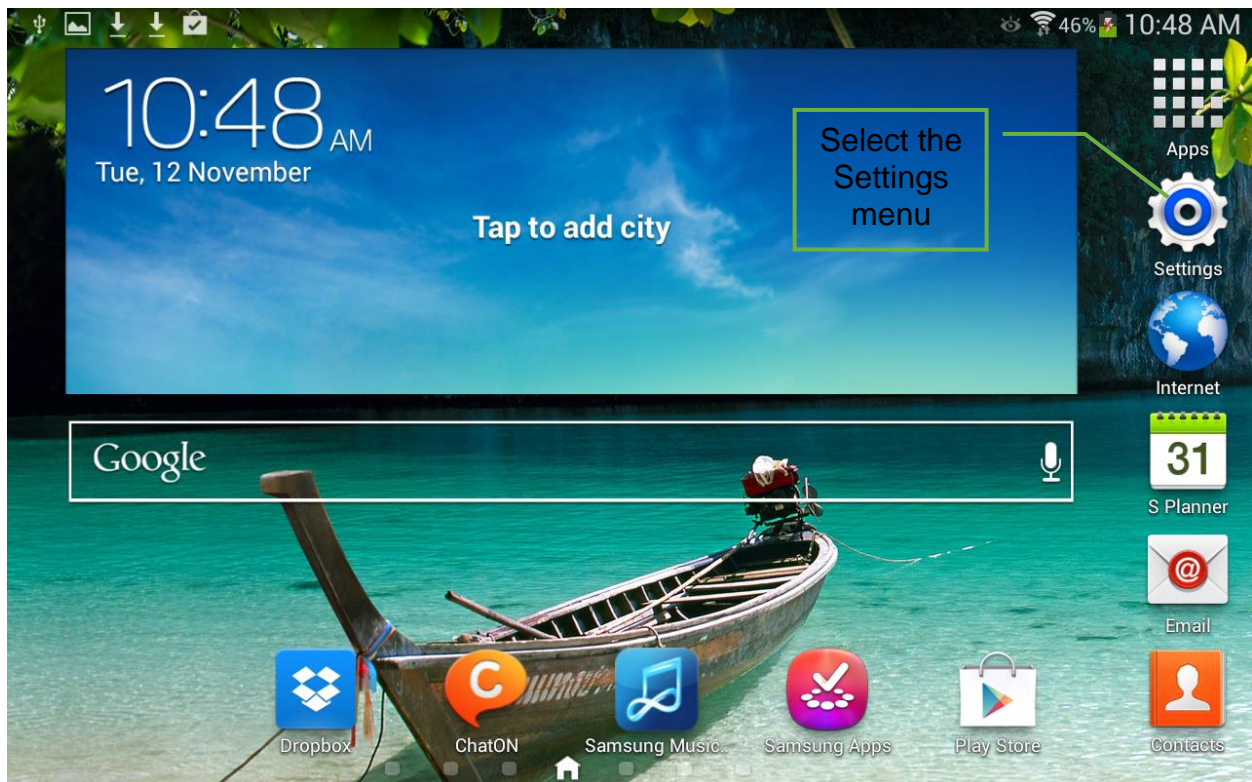


Figure 10: Settings Window Table PC

### 1.6.5 Starting the Equipment - iPad

Turn iPad “on” the iPad Start Up Window will appear as below:



Figure 11: iPad Start up Window

- Go to iPad “Settings” menu,
- Select Wi-Fi
- Set Wi-Fi to “On”
- Choose a network TX2131100XXX (Serial No of iPA)
- Key in password “kaelusap”
- Exit Settings
- Open Web browser: Chrome, Safari, etc
- Type in IP address: “192.168.0.1” into Address bar and hit “Go”



- iPA Front Panel display should appear on iPad (as below).



**Figure 12: iPad Initial Front Panel Display (Fixed Frequency Window)**

iPAD Initial PIM Window features:

1. RF “On/Off” button (initially disabled on start-up)
2. Wi-Fi Request Control/Connect button (Ready to connect to iPA on start up), see section 1.6.4 below.
3. iPA IP Address (preset to 192.168.0.1)

Other screen features are the same as for the iPA (see figure 5).  
Fixed Frequency Window features are explained in Figure 8.

### 1.6.6 Controlling the iPA via Wi-Fi

To control the iPA with the Tablet PC via the Wi-Fi link, follow the connection procedure below:

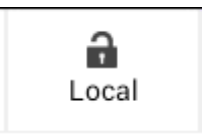


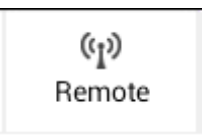


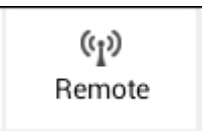

State/Action	iPA Wi-Fi Icon	Tablet PC Wi-Fi Icon	Description
1			iPA unlocked in Local mode, Tablet PC ready for remote connection
Action Button Press			Press Control on Tablet PC to transfer control of iPA to the Tablet PC via Wi-Fi
2			iPA in Remote mode, multiple remote access available
Action Button Press			Press Control on Tablet PC to lock remote access to Tablet PC only. (Note: The iPA can always take back control – see table 2, State 3)
3			iPA in remote mode, remote access locked to Tablet PC

Table 1: Procedure to Control iPA with Tablet PC remotely via Wi-Fi

- iPA is now locked in Remote mode and Remote access is locked and exclusive to the Tablet PC. (The iPA is always able to be returned to Local mode by pressing “Remote” (see table 2, state 3))
- The iPA is now able to be controlled and monitored remotely from the Tablet PC.
- To return the iPA to Local mode, see Table 2 below.

### 1.6.7 Return iPA to Local Mode

To return iPA to Local mode and disengage Tablet PC Wi-Fi link, follow the procedure below:

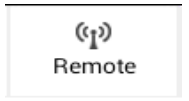
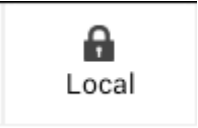


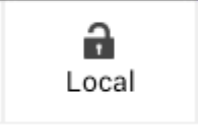

State/Action	iPA Wi-Fi Icon	Tablet PC Wi-Fi Icon	Description
Action Button Press			Press Remote on iPA to return iPA to local operation
4			iPA locked in Local mode, no remote access available
Action Button Press			Press Local on iPA to unlock iPA Local Mode and allow remote access
1			iPA unlocked in Local mode, Tablet PC ready for remote connection (Initial start-up state of iPA, as per state 1 above).

Table 2: Procedure to Return iPA to Local Mode and Disable Wi-Fi

Further detail on Wi-Fi connection and operation is shown in Section 2.

### 1.6.8 Turning RF “On” Via the remote Browser

- Before turning RF “On” ensure an RF load is attached to the iPA Test Port. (Note: If RF Test Port is not properly terminated, a Return Loss Error will occur and PIM measurement will not be allowed.)
- To turn RF “On” on iPA remotely via remote Browser:

- Ensure RF “On” icon is enabled on the Tablet PC (see table 1 above for Wi-Fi connect procedure)
- Press “RF On” Icon on the Tablet PC (below):



- The “RF On” icon will turn Red and the RF Indicator LED will flash on the iPA unit.

### 1.6.9 Fixed Frequency Window

The Fixed Frequency Window is operation is shown below in Figure 13

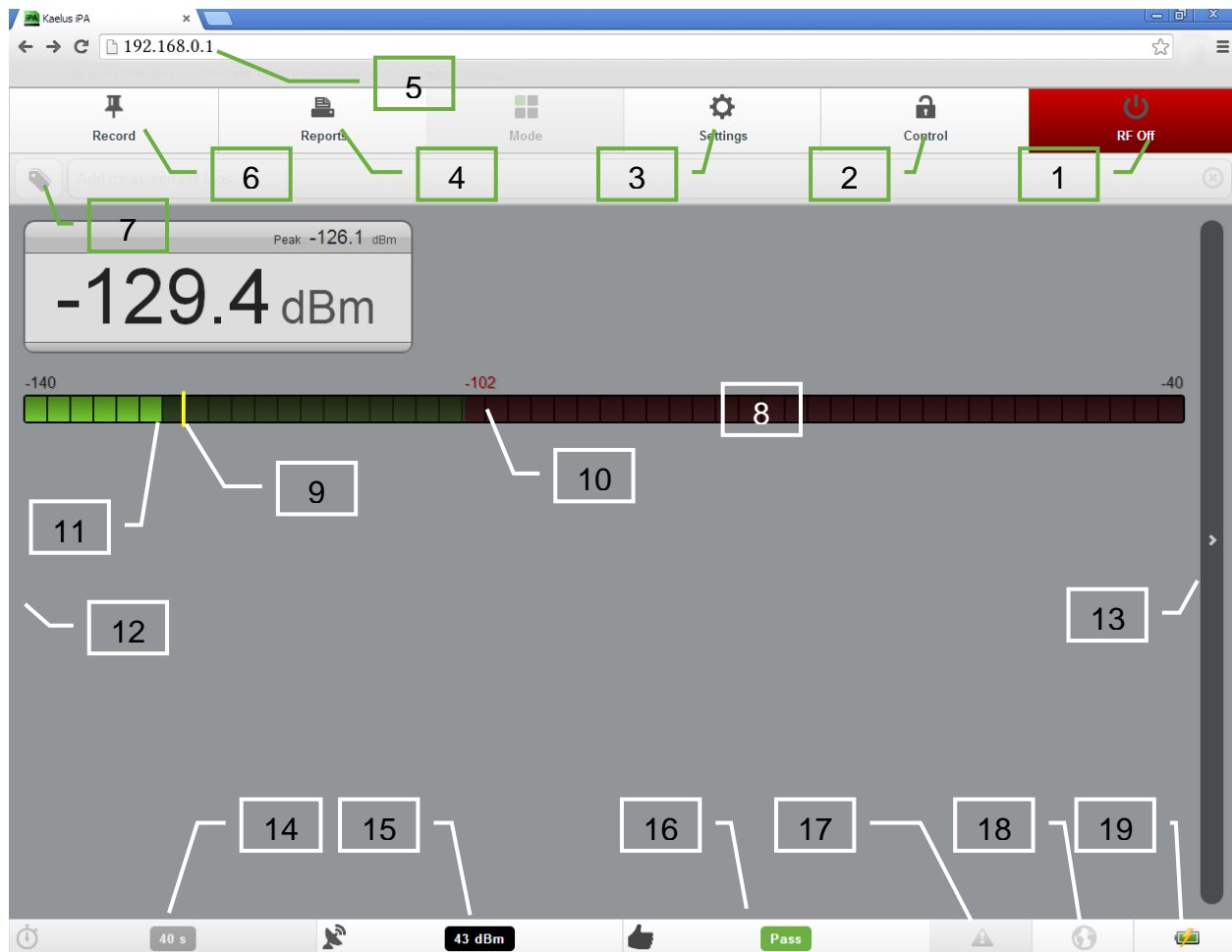


Figure 13: Browser/iPA Fixed Frequency Window (RF “on”)

The Fixed Frequency Window features are explained below:

### **1. RF ON/OFF Button**

The RF ON/OFF button is used for switching the RF either on or off. As a visual aid, this button will turn red when the RF has been switched on. In the default state (RF off) this button will be green. Additional text appears on this button to show what will happen when the button is pressed (RF On or RF Off).

### **2. iPA/Browser Wi-Fi Remote Interface Control**

Local/Remote Control and State indicator of the Wi-Fi link to the iPA (see table 1 for Connection details).

### **3. Settings Menu**

Settings menu for iPA (see section 1.7.7 for details).

### **4. Reports Menu**

Reports menu for iPA (see sections 1.6.8, 1.6.11, 1.6.12 for details).

### **5. IP Address for iPA**

IP Address of iPA (set to 192.168.0.1) Set in Tablet PC Browser window, see section 1.6.3

### **6. Record Button**

Records instrument settings and Maximum PIM readings during a RF “on” time period. Information may be retrieved and stored by pressing the Reports button.

### **7. Measurement Tags Button**

Add Measurement Tag Title to IM display and Reports (see section 1.6.10 for details).

### **8. IM Level Indicator**

The IM Level Indicator shows the instantaneous IM level in numerical form. The large font size allows for easy reading of the IM level. In addition to the instantaneous IM level, the “peak” level is also displayed to the top-right of the instantaneous level.

### **9. Peak PIM Reading**

Displays the peak PIM measurement as taken in a measurement interval (Yellow Bar).

### **10. PIM Fail Limit**

Displays the peak PIM Fail limit as a Red line (see section 1.7.5 for details).

### **11. PIM Level Bar Indicator**

---

Displays the Instantaneous PIM level as a Green Bar while below the PIM Fail limit, and Red when above the PIM Fail limit.

### **12, 13. Mode Selector Scroll Bar**

---

Is used to Scroll between Numeric or line graph mode.

#### Default Mode (Fixed Frequency PIM Window)

This mode is used for measuring the instantaneous IM level of a device under test. The IM level is shown in numerical form and with a corresponding IM sliding bar

#### Time Trace Window

This mode shows a trace of the instantaneous IM level as it changes with time

#### Frequency Sweep

This mode incorporates swept TX tones, for a resulting swept IM trace

#### Spectrum Analyzer

This mode allows monitoring of the full RX band with TX powers on or off

#### RTF

This mode allows Range To Fault operation of the iPA with an external RTF module.

Scroll bars are to be used to change between mode screens on the iPA. To change screens on the Tablet PC, the screen may be dragged across with the operator's finger.

### **14. RF Power Timer/Settings menu**

---

Shows the remaining time before the output power is turned off.

### **15. Tone Output Power/ Settings Menu**

---

The default TX tone output power is 43dBm (20W) per tone, but the power is adjustable to as low as 20dBm (100mW) per tone in 1 dB steps. The 3<sup>rd</sup> or 5<sup>th</sup> order IM product can also be chosen. The IM frequency is automatically calculated and takes into account the TX tone frequencies, the desired order of the IM product and the instrument's RX band.

### **16. IM Pass/Fail Indicator/Settings Menu**

---

The IM Pass/Fail level may be set.

### **17. Notifications Menu**

---

Notifications Menu shows alarms and system notifications.

### **18. Geo Tag Status**

---

Show the Operation of the Geo tag function .Grey "Turned off", Flashing "Acquiring location", Solid on "Fix of sufficient accuracy acquired"

## 19. Battery Level/Charging Indicator

Shows the charge level of Battery pack and shows when iPA is in Charge mode. The average Monitor Port gain is included, and System Temperature data is recorded.

### 1.6.10 Recalling State Files

For quick and easy instrument configuration, a state file can be pre-loaded on an SD card. The SD card can be inserted into the SD card slot and the file recalled for setting up the instrument. The setup information is stored in a \*.sta file and contains:

- Frequency information for the two test tones
- IM order selection (3<sup>rd</sup> or 5<sup>th</sup>) ie., the frequency that the instrument's receiver will be tuned to
- Test tone RF power
- Pass/Fail thresholds
- Pre-configured test tags
- Test timer setting

1. Insert the SD Card into the SD card slot.
2. Press the **Open State** button. A window will be displayed with a list of the states stored on the SD card.



Figure 14: Test State Settings Window

3. Select the state information required, and press **OK**. The instrument setup will be updated accordingly.

### 1.6.11 Shutting down the Instrument

1. To shut down the instrument, press and hold the **Power** button. A shut-down window will be displayed.

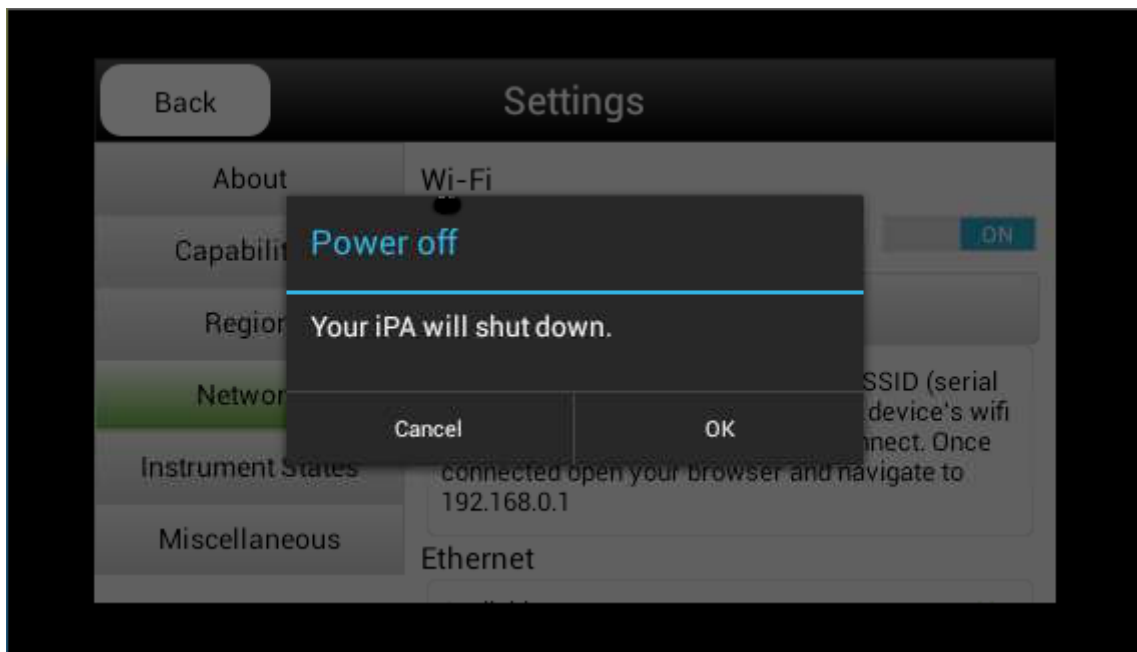


Figure 15: Shutdown Window

2. Press **OK** to initiate the shutdown procedure. The on-board computer will shut down all the internal modules automatically.



## 1.7 EQUIPMENT OPERATION – SETTINGS MODE

### 1.7.1 Changing Instrument Settings

The setup of the instrument can be modified via the instrument icons at the bottom of the Main Display Window. Instrument parameters such as RF “on” Timer, TX tone Power and Frequency and IM Threshold level may be adjusted by pressing the relevant icon at the bottom of the Main Display Window.

### 1.7.2 Modifying RF “on” Timer Setting

As a general parameter, the Power Timer limit is used to control the length of time the test tones are transmitted. The timer operates in seconds, and counts down until it reaches zero, at which point the RF is turned off. The RF may be switched off at any time by pressing the RF On/Off button..

- When the Timer icon is pressed, a Timer menu is displayed. (The current setting is highlighted with a green dot.)

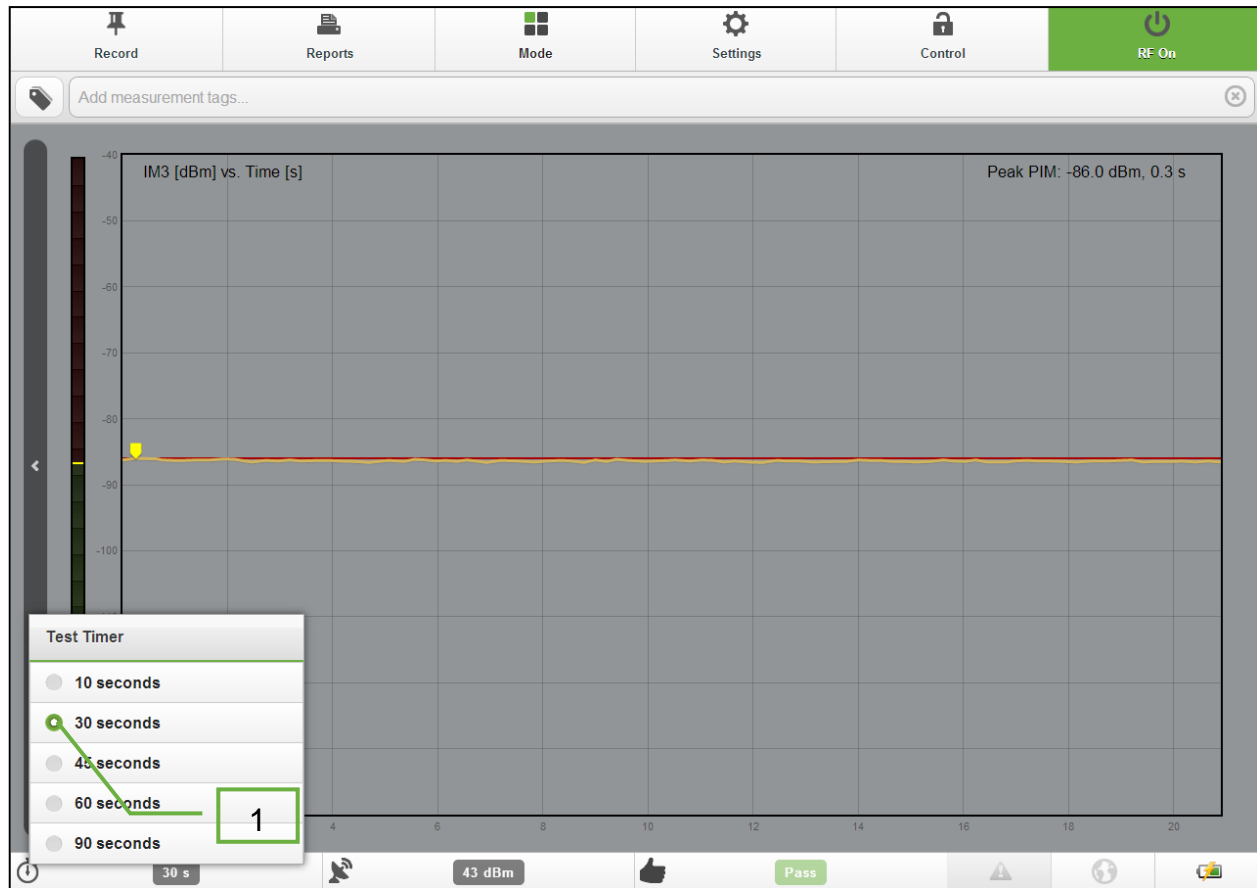


Figure 16: iPA RF “on” Timer Window

1. RF “On” Timer setting (Maximum “On” time is 90 seconds) .

The RF “on” Timer may be set to a predefined period between 10 and 90 seconds.

### 1.7.3 Modifying Test Tone Frequency and Power Level

- Press the TX Power icon on the Main Display Window and the TX Tone Powers and frequencies will be displayed.
- Press a test tone power field (P1 or P2). A numeric keypad is displayed.
- Input the new test tone power in dBm, and press Return.
- The TX Tone frequencies and powers may also be modified using the slide bars shown below the numeric displays.
- Tone 2 power may be locked or unlocked to Tone 1 power by the Power Lock button shown as “3” in figure below:

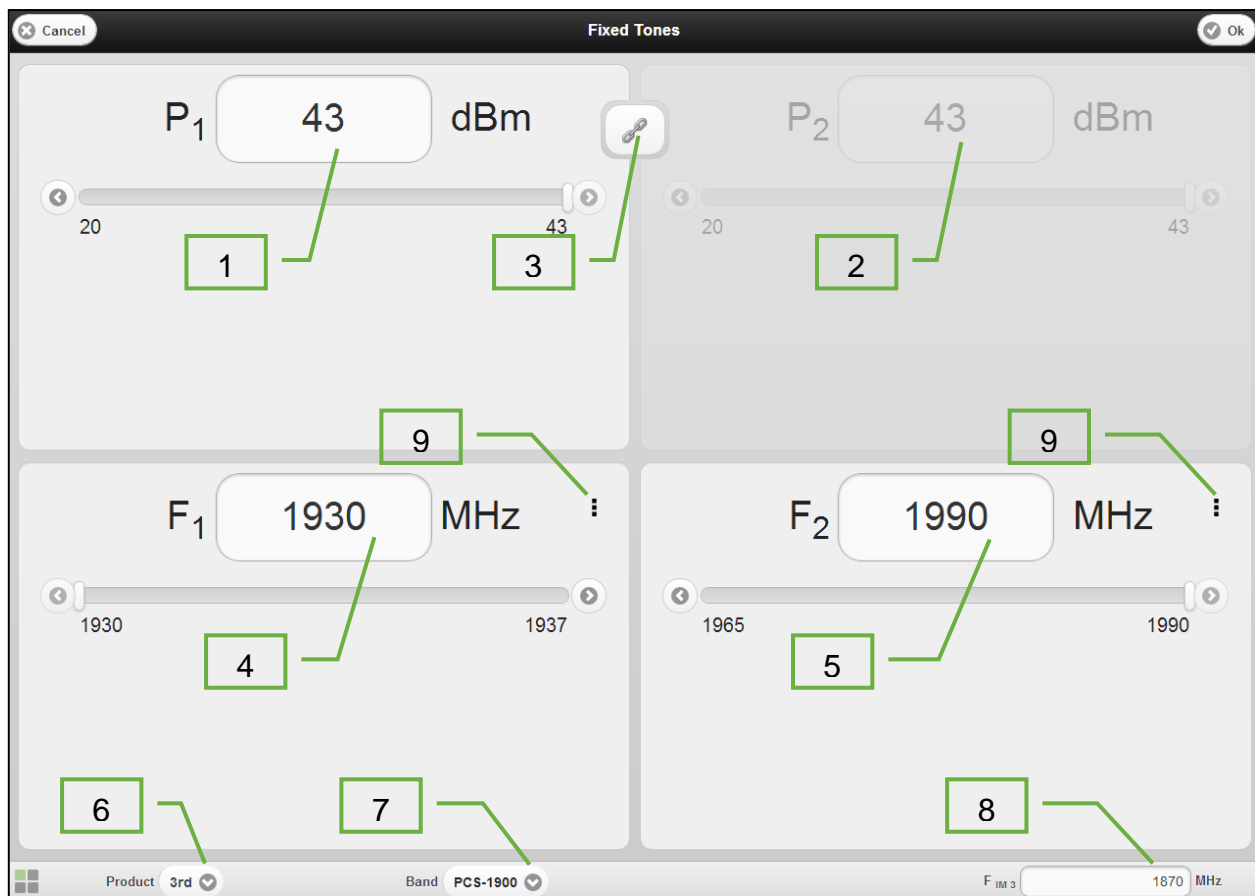


Figure 17: TX Tones Power and frequency Settings Menu (Tablet PC):

1. TX1 Power Level
2. TX2 Power Level
3. TX1, TX2 Power Locking Toggle (P2 shown locked to P1 power level)
4. TX1 Frequency

5. TX2 Frequency
6. IM Product (3<sup>rd</sup>, 5<sup>th</sup>) and 7<sup>th</sup> order on the iPA-0901
7. TX, RX Cellular Band
8. IM Receiver Frequency
9. Brings up the Tone enable/disable menu (Allows a test tone to be turned off individually Tone 1 or 2)

### 1.7.4 Modify the IM Product

- Press the IM Product field. The instrument will calculate the various order IM frequencies and a window will be displayed with relevant options.

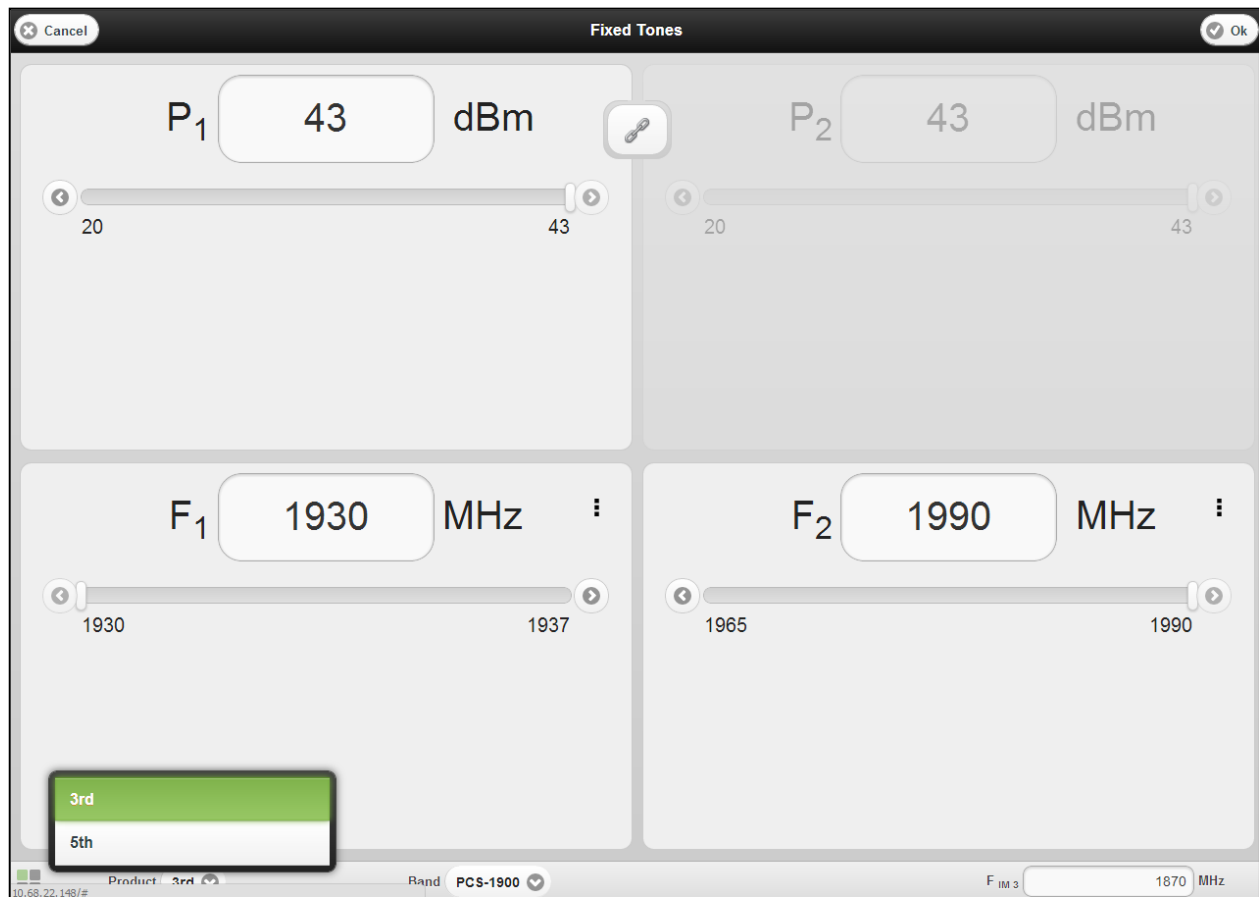


Figure 18: Calculated IM Products

- Select the IM product to be measured and press OK. The IM receiver will be switched to the appropriate frequency.

### 1.7.5 Modifying the IM Pass/Fail Threshold

- Press the IM icon at the bottom of the Main Display Window. A Limits Window will be displayed.

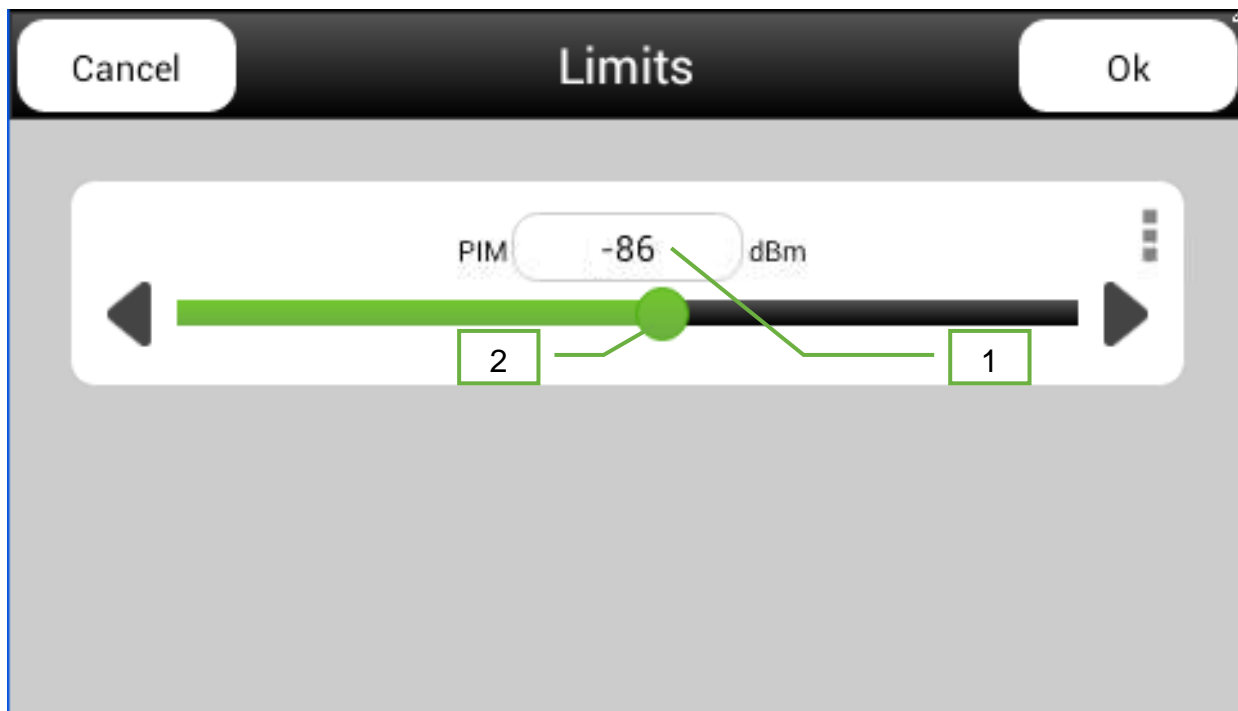


Figure 19: iPA IM Threshold Level Window

1. IM limit (dBm) or dBc if selected in Miscellaneous Menu
  2. IM limit adjust bar
- Press the IM field IM. A keypad is displayed.
    - Input the IM threshold level (in dBm).
    - Press **Return**. The red line on the Main Display Window will move to the new threshold level. It also will show a corresponding red numeric tag on the Fixed Frequency Window.
  - The IM threshold may also be modified using the slide bar shown below the numeric display.

### 1.7.6 Battery Charge Level Monitor, Monitor Port Gain and System Temperatures

- Press the Battery icon at the bottom of the Main Display Window. A Window detailing Battery voltage and monitoring limits will be displayed.
- Details on average Monitor Port Gain and System Temperatures will also be displayed.
- Unit Battery charging is managed by the Microcontroller, the iPA MUST BE SWITCHED ON. In order for the battery to charge.



Figure 20: iPA Battery Window

1. The battery records how long the battery has been connected to an iPA and switched on for. “d” signifies days followed by hrs minutes and seconds.
2. Shows how long the connected iPA/s have been in the RF on state when connected to this battery.
3. Operating temperature of the in line Tx isolators for F1 and F2 signal generators.

4. Battery temperature sensor temperature.

### 1.7.7 Instrument Settings Menus

To access the iPA Instrument Settings menu, press the Settings icon at the top of the Main Display Window.

#### 1.7.7.1 Instrument Settings - About Window

The Settings About Window details the iPA Model and Build details, Serial No. Software version and calibration dates. It also contains important information of Safety with the unit and Regulatory and Legal stipulations covering the use of the iPA. See figure below.

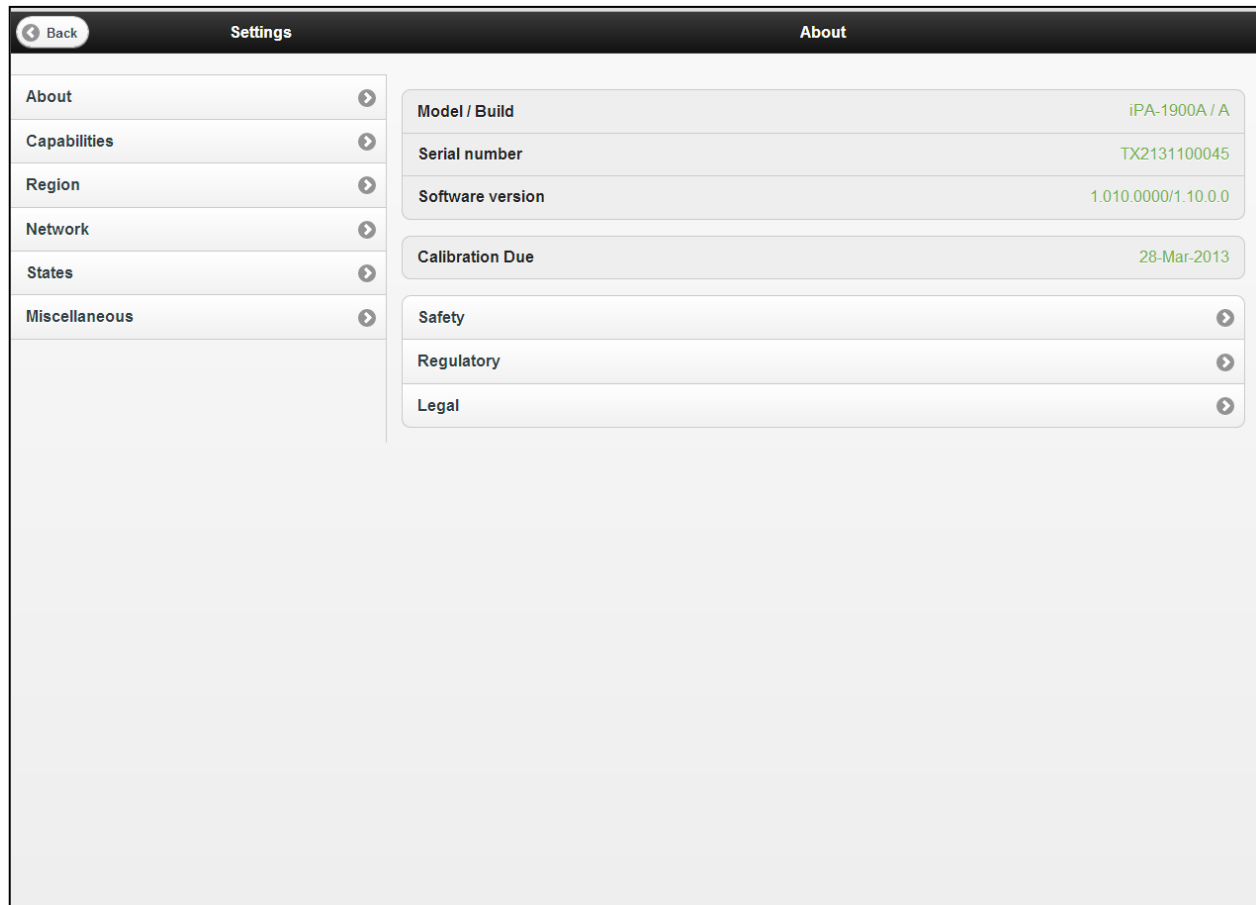


Figure 21: iPA Settings About Window

### 1.7.7.2 Instrument Settings - Capabilities Window

The Settings Capabilities Window details the Transmitter and Receiver Frequency ranges as well as Battery details including charge level, terminal voltage and shutdown levels. See Figure below.

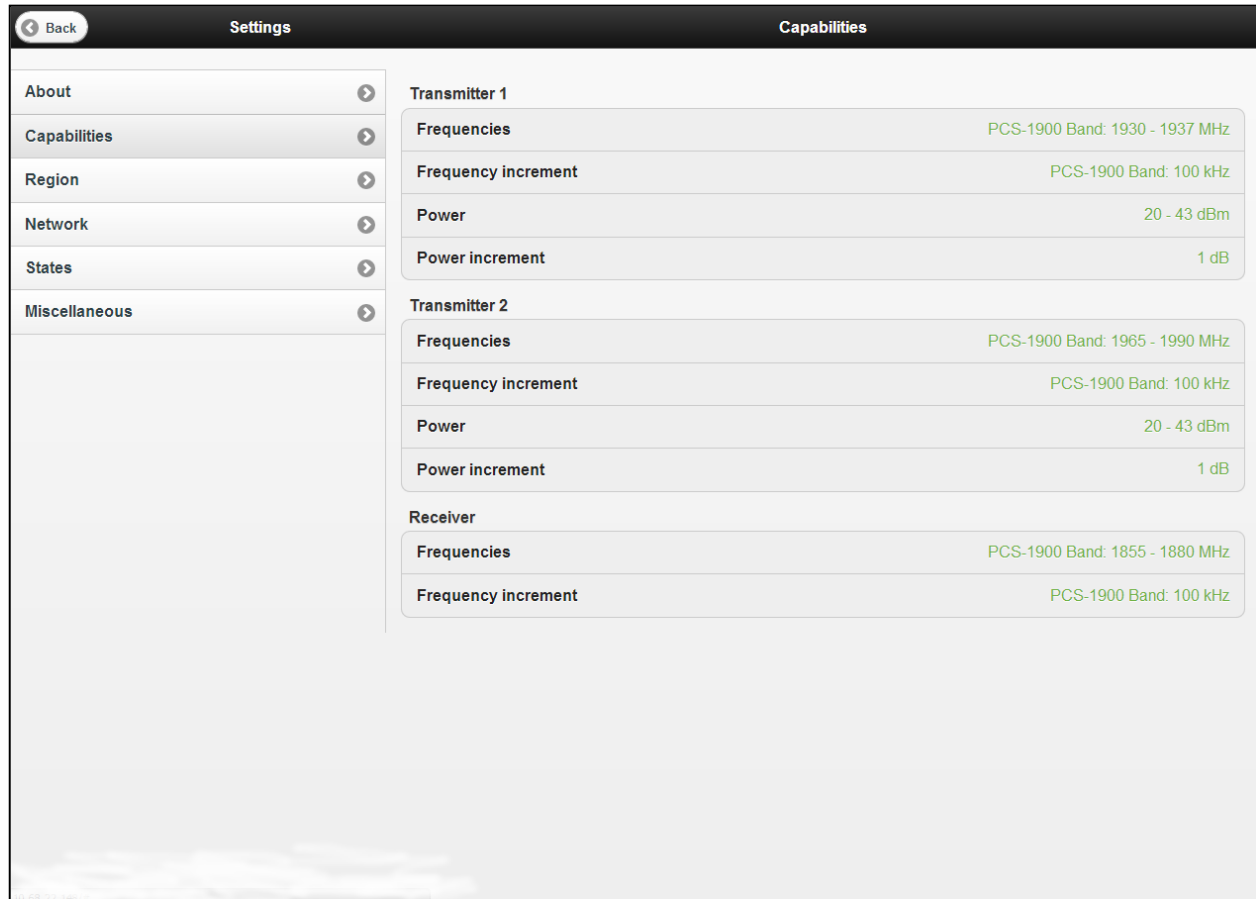


Figure 22: iPA Settings Capabilities Window



### 1.7.7.3 Instrument Settings - Region Window

The Settings Region Window includes the GUI user language, and date, time and time zone details. See Figure below.

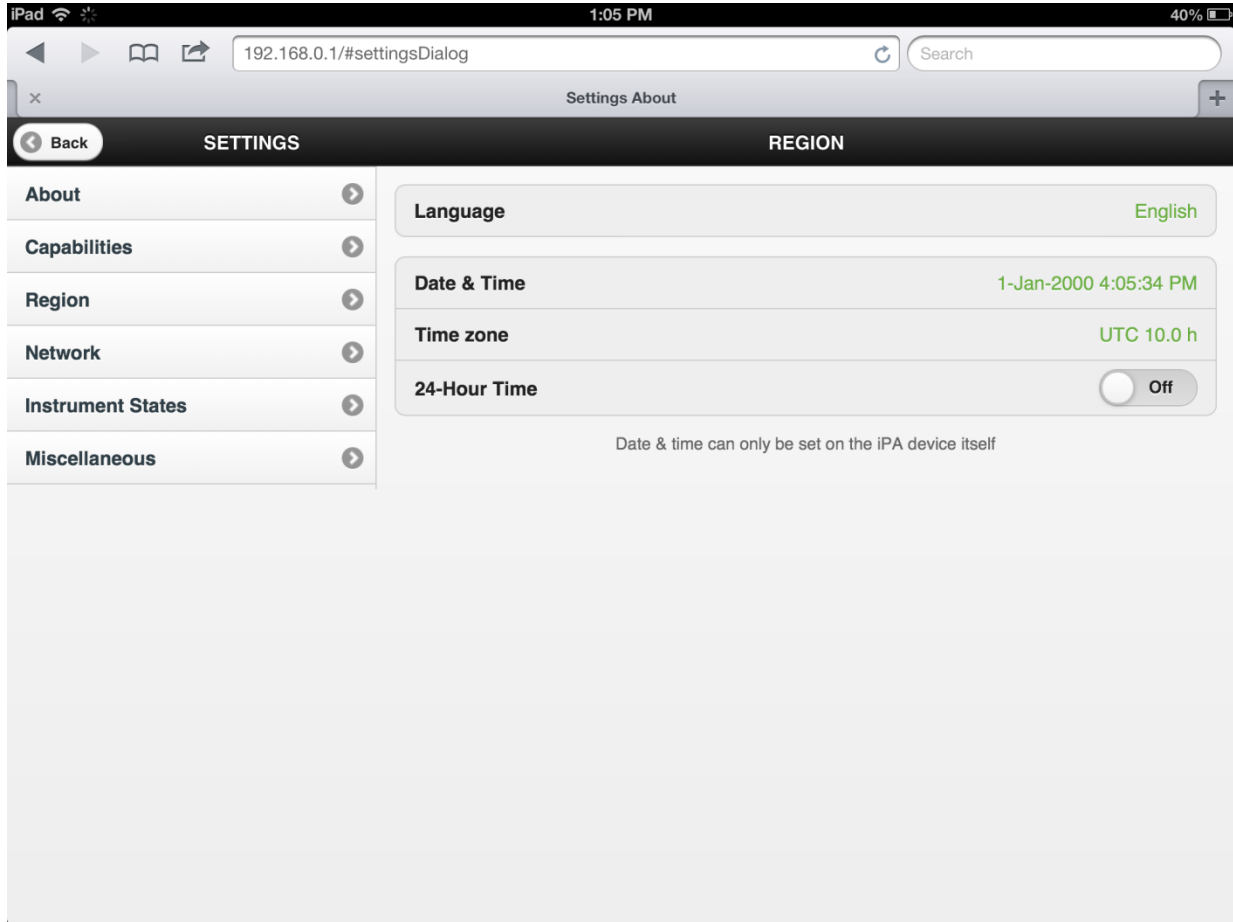


Figure 23: iPA Settings Region Window

1.7.7.4 Instrument Settings - Network Window (iPA and Tablet PC)

The Network Settings Window on the iPA and the Tablet PC displays Wi-Fi and Ethernet connectivity and allows the user to set the Wi-Fi Access point password, see figures below: Note: Configuring/ restarting the Wi-Fi and Network settings is available on the instrument local display only. Settings can be viewed by remote clients.

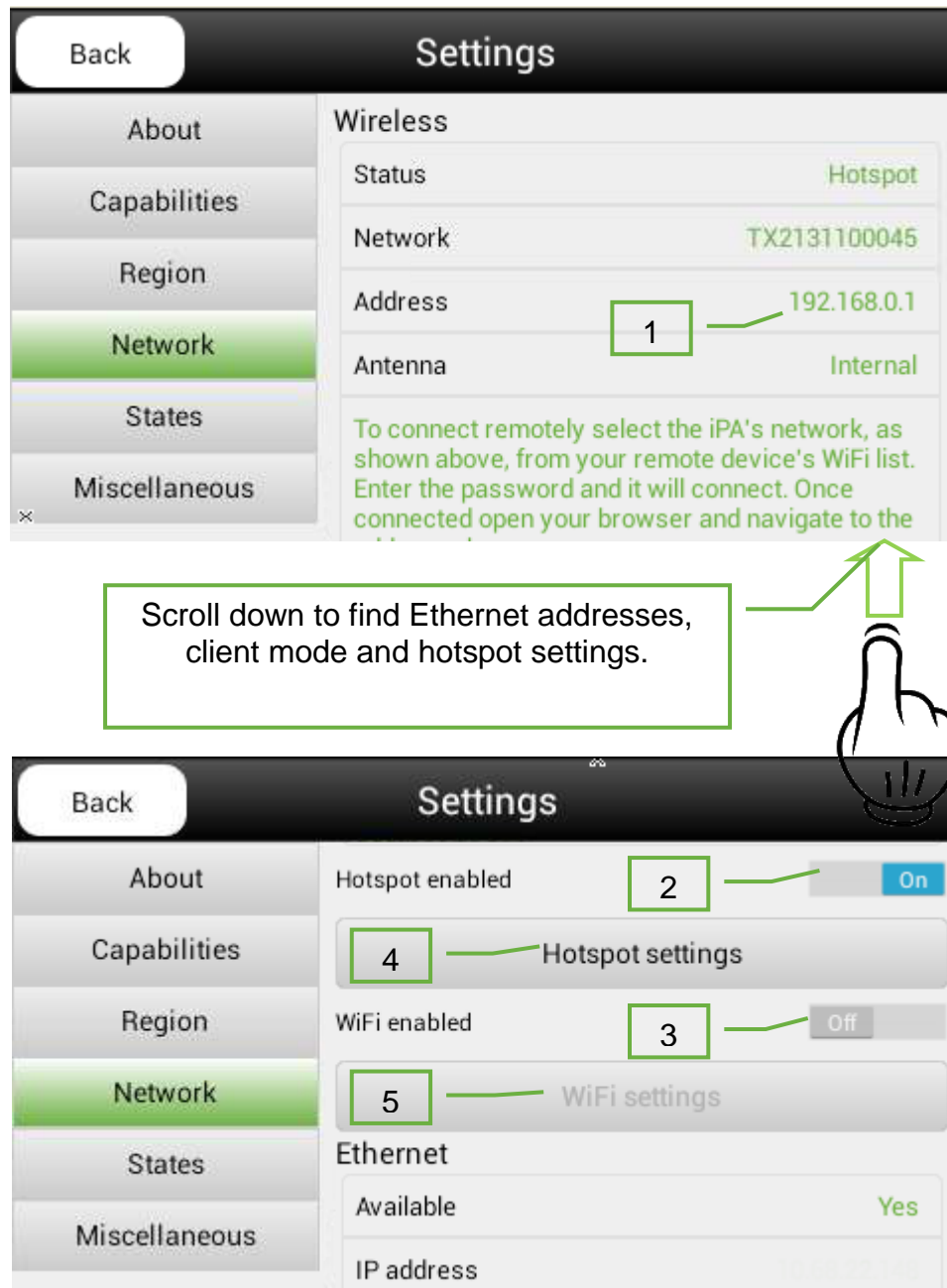


Figure 24: iPA Network Settings Window

1. Current Wi-Fi Hotspot IP address
2. Switch Hotspot mod on or off (Note : the unit can be in either hotspot or client mode or Wi-Fi Off)
3. Switch Wi-Fi enabled (Client mode) on or off.
4. Enter the hotspot settings menu.
5. Enter Wi-Fi Client settings menu.

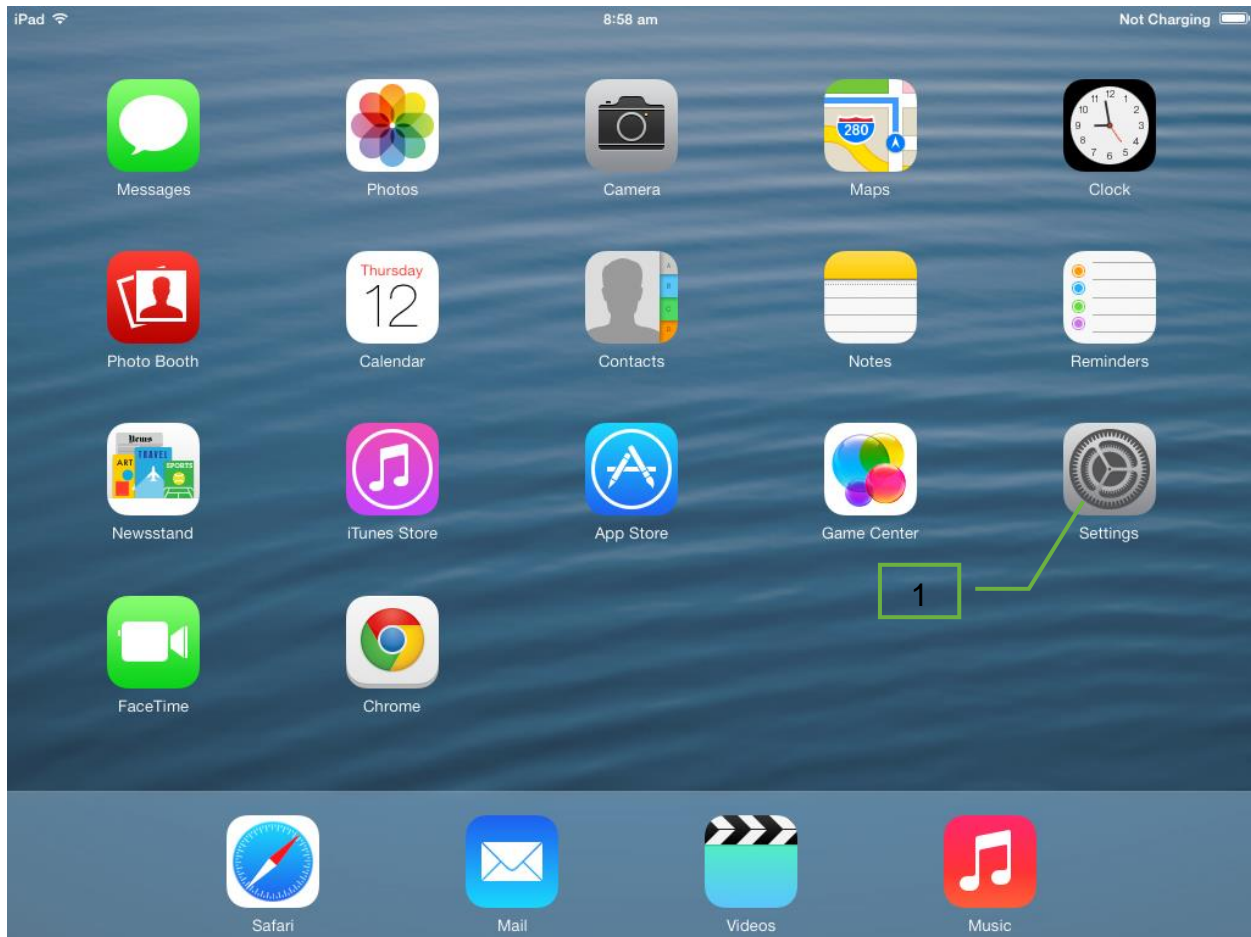
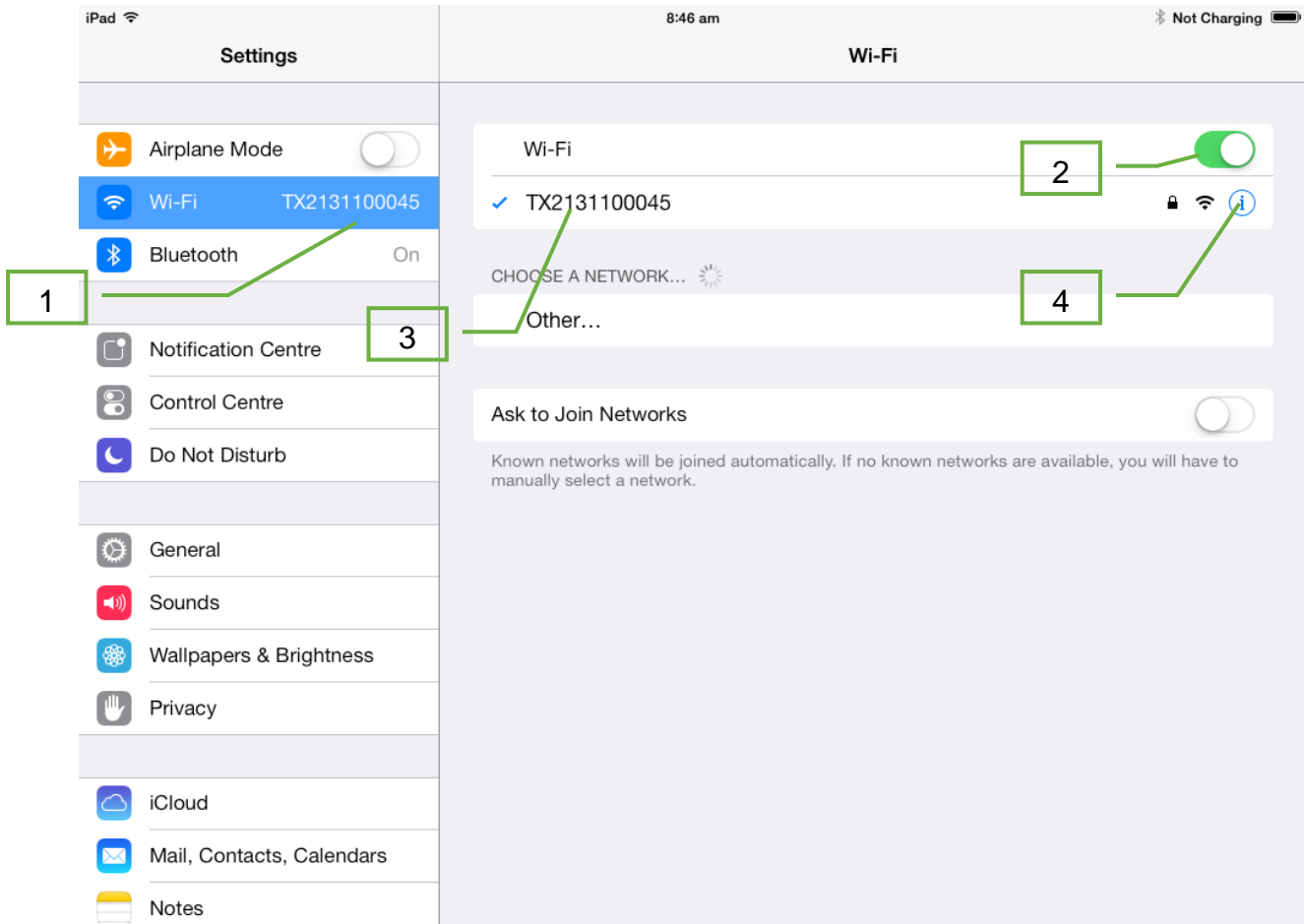


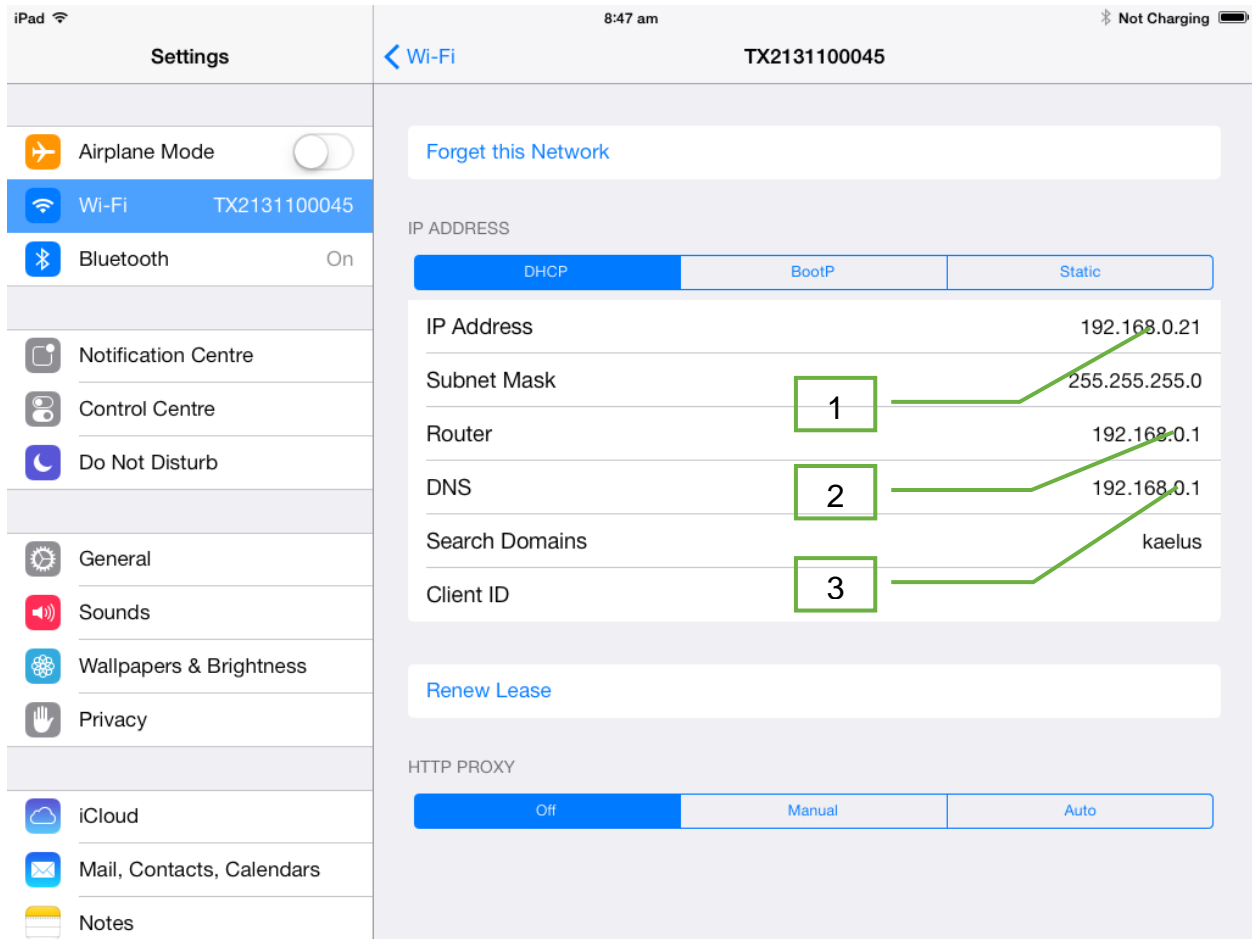
Figure 25: iPad settings menu selection .

1. The iPad Wi-Fi settings are accessed via the settings menu shown .



**Figure 26: iPad Selecting your Wi-Fi Hotspot (Serial Number) .**

1. Select the Wi-Fi menu .
2. Ensure Wi-Fi is switched on .
3. Select your iPA’s Serial number as the network from the list. (Note : Factory default only this can be changed in the hotspot setting on the local display)
4. More information on you iPad’s network address can be obtained via the information menu. See Figure 27



**Figure 27: iPad Network information Windows**

1. Network address allocated to your iPad from the iPA hotspot.
2. This shows the network address of the router, if the iPA is used as a hotspot this will be 192.168.0.1.
3. This shows the network address of the networks DNS, if the iPA is used as a hotspot this will be 192.168.0.1.

## 1.7.8 Instrument Settings – Instrument States

The Instrument State window shows the Test State of the iPA. The Test State may be created, edited and saved by the user to replicate and store instruments states for testing at similar sites.

### 1.7.8.1 Edit Test State

In Configuration mode, the user is able to create new states and recall, rename or delete states.

- Press the **Open State** button and the Open State screen will be displayed.

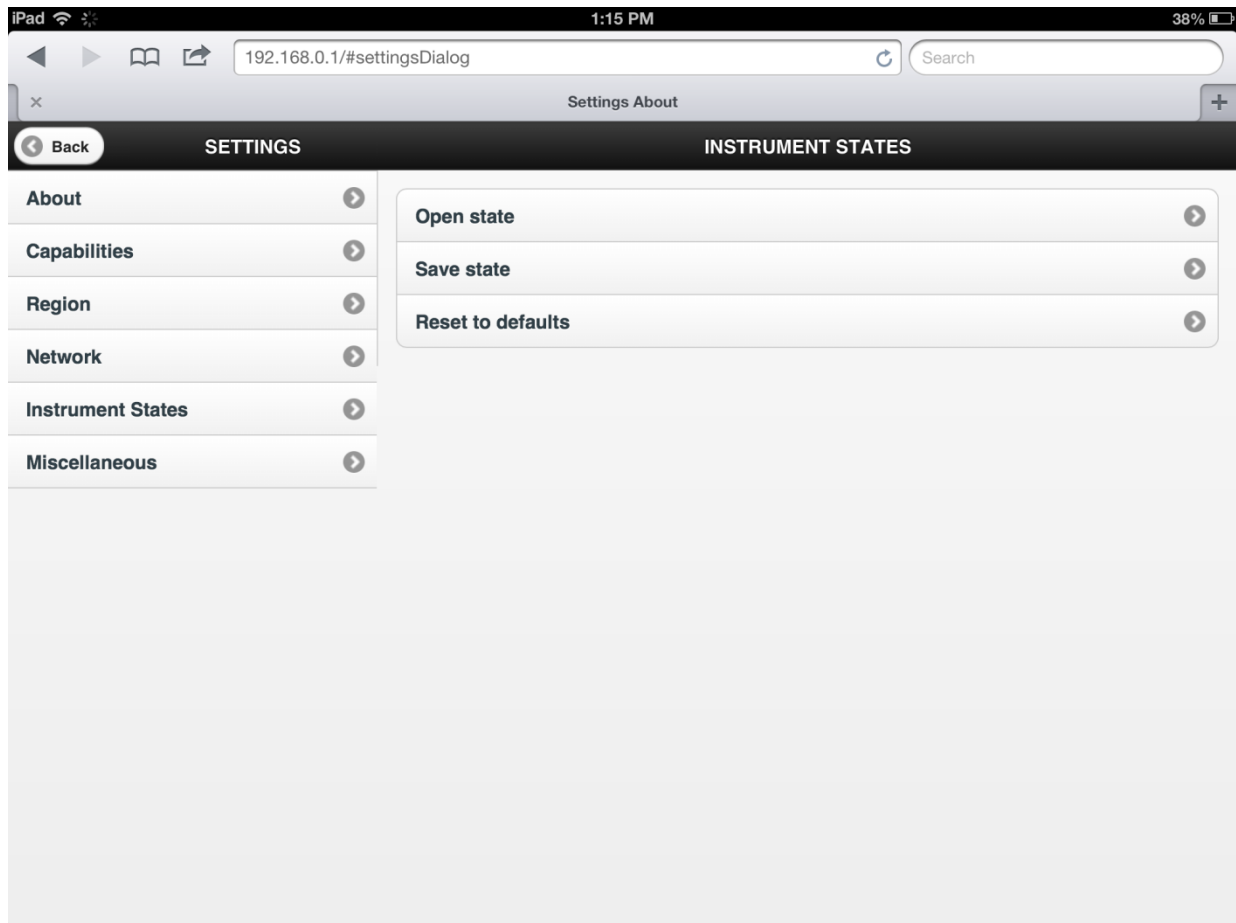


Figure 28: Instrument State Window

- Press the **Back** button to go back to the configuration screen.

#### 1.7.8.2 Recall a State

The instrument setup can be changed by uploading a new state file from the internal hard drive of the iPA or from an SD card.

- Select the file you wish to recall, and press the **Open State** button.

#### 1.7.8.3 Change Drive/SD card

- To toggle through the different drives, select the drive you wish to access.

#### 1.7.8.4 Rename a State File

- Select the file to be renamed, and press and hold the file name field and press the **Rename** button.
- Double press the file name field. A keyboard will be displayed.
- Type in or edit the new file name, and press **Done**, then press **Rename**.

#### 1.7.8.5 Create a New State File

The user can create a new state file from the current instrument configuration

- To create a new state file from the instrument, press the **Save State** button, select which drive you would like the state file saved in.
- Press and hold the filename field, a keyboard will appear.
- Type in the name of the new state file and press **Done**.
- Press the **Save** button to save the Instrument State. The instrument setup will be saved in a \*.sta state file.

#### 1.7.8.6 Delete a State File

- To delete a state file, select the file to be deleted, and press the **Delete** button, then press **Delete** to confirm.

1.7.8.7 Tags and state files.

- Use your state file to manage how you edit and use tags, if you are editing tags on an existing report , you may want to load in an existing state file so you don't have to re-create your old tags. Remember your instrument settings will be loaded with the state file also. If your instrument settings are important to you, you may wish to save them in a state file so they can be recovered.

1.7.9 Instrument settings miscellaneous Window (remote control).

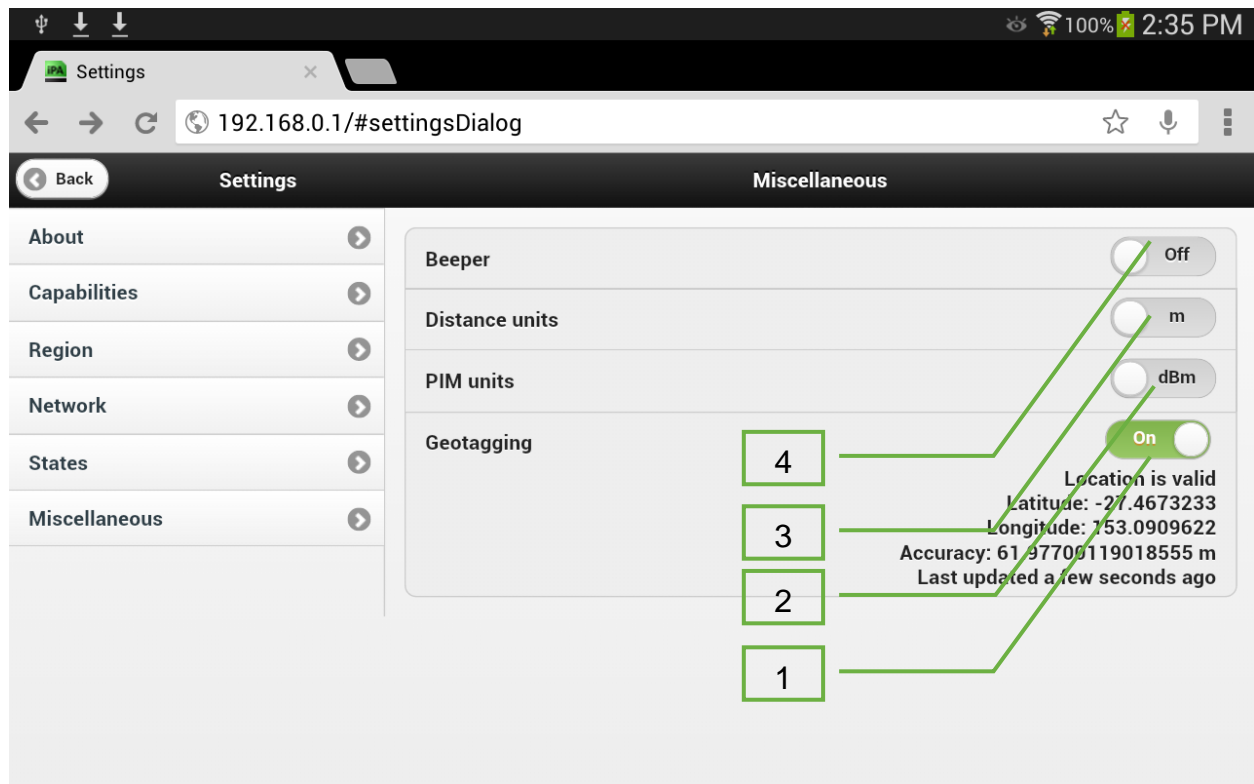


Figure 29: Miscellaneous settings window

1. Geotagging ON/OFF

Note : Location services will need to be enabled on your Tablet PC or Smartphone and the device will need to have accessed location services sufficient to resolve your location . If the Geotag Globe is flashing then your Smartphone/Tablet PC's Geotag service does not have adequate data for a sufficient fix. Look in the trouble shooting section for suggestions on improving your Geo fix .

2. PIM Units dBm/dBc

Sets the measurement units of the PIM product produced. dBm (Decibels with respect to 1 milliwatt). dBc (Decibels with respect to Carrier Power set).



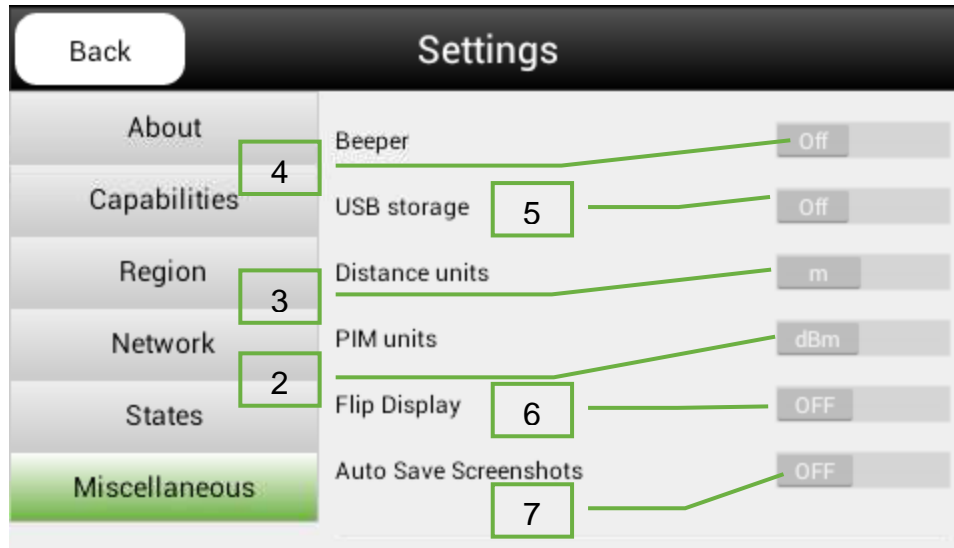
3. Distance units ft/m

Sets the measurement distance units , ft ( feet ) , m ( meters ).

4. Beeper off/on

Switch a tone beeper on to warn when iPA’s carrier/s are transmitting. The beeper repetition rate is also an indicator of the IM level being measured. Higher levels have a higher repetition rate.

**1.7.10 Instrument settings miscellaneous Window (local control).**



**Figure 30: Miscellaneous settings window (Local control)**

The functions of 2,3,4 are the same as described in Section 1.7.9 there is no Geo tag switch on the local display as external geotag devices are needed for it’s function.

5. USB storage

This enables the iPA to be used as a USB storage device, connect a cable form the mini USB port to your PC and see the files stored on both the SD card or the iPA’s internal memory.

6. Flip display

When using the iPA in local mode it isn’t always possible to orient the instrument for most convenient viewing of the local display, this switch allows the local display to be flipped upside down so you can view the display from the other direction.

7. Auto Save Screenshots

This enables the iPA to automatically select a storage name and location for your screenshots as outlined in Section **Error! Reference source not found..**

### 1.7.11 Editing Measurement Tag Points

Measurement Tag labels identify the physical point(s) in the system that the measurement is taking place. The user can add, delete or modify Measurement Tag Labels.

#### 1.7.11.1 Add a Measurement Tag Label

- Press the **Measurement Tag** button. A keyboard will be displayed.
- Enter the new title and press **Return**.

Pressing the **Return** button will return user to the main screen.

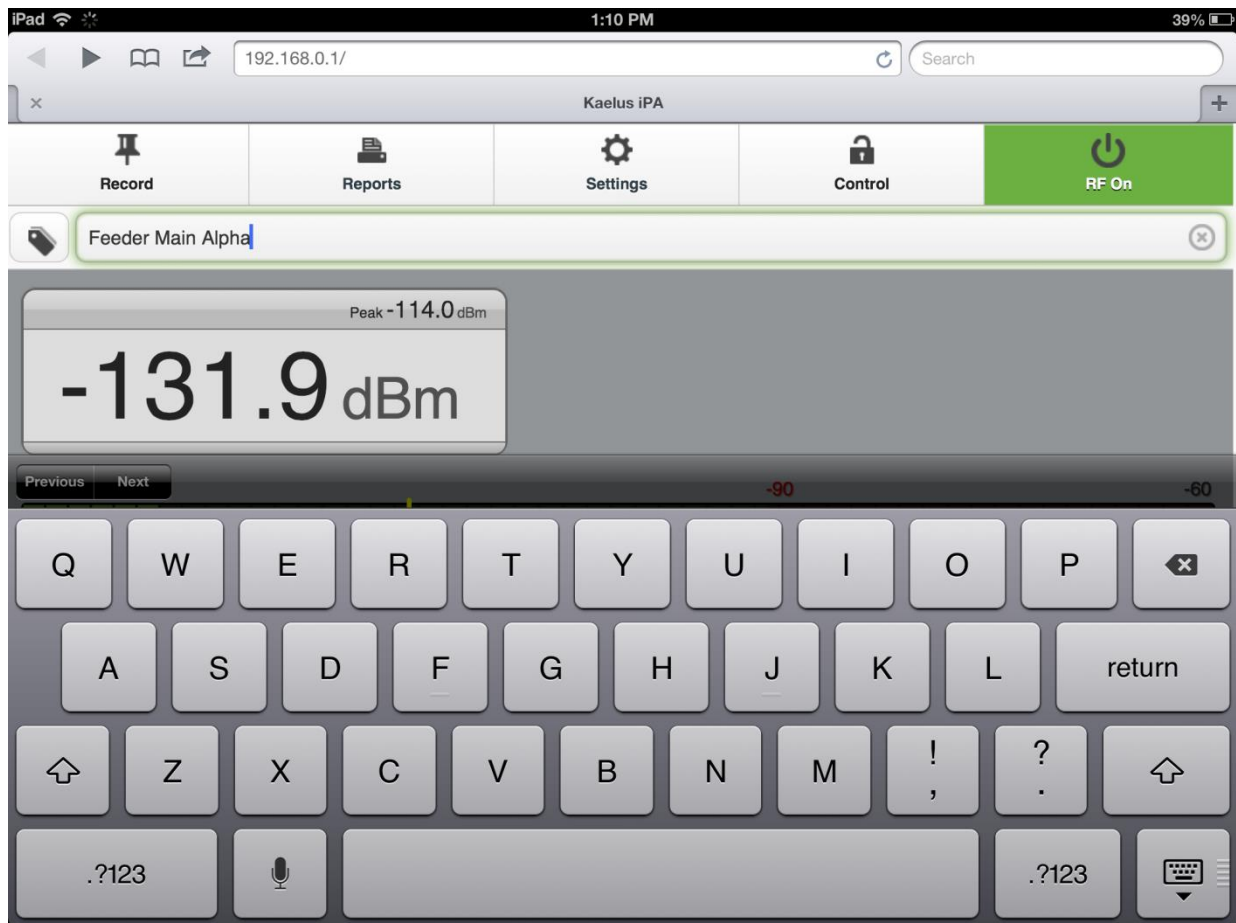


Figure 31: Add Measurement Tag Label

#### 1.7.11.2 Modify a Measurement Tag Label

- Select the label to be modified.
- Select the label title at the top of the screen. A key board will be displayed.
- Enter the new title and press **Return**.
- Pressing the **Return** button to return to the main screen

#### 1.7.11.3 Delete Measurement Tag Labels

- Press the Delete (X) button on the right side of the Measurement Tag field.

### 1.8 EQUIPMENT OPERATION – MEASUREMENT MODES

The measurement modes offer added IM measurement and diagnostics capability. The measurement modes presently offered are Fixed Tones, Swept Tones, Spectrum Monitor and Range to Fault (RTF) mode.

Note: The user needs to take due care in ensuring that no unlicensed broadcasting of the TX carriers occurs. In this regard it is best practice to ensure that the device under test is always terminated in a low PIM cable load.

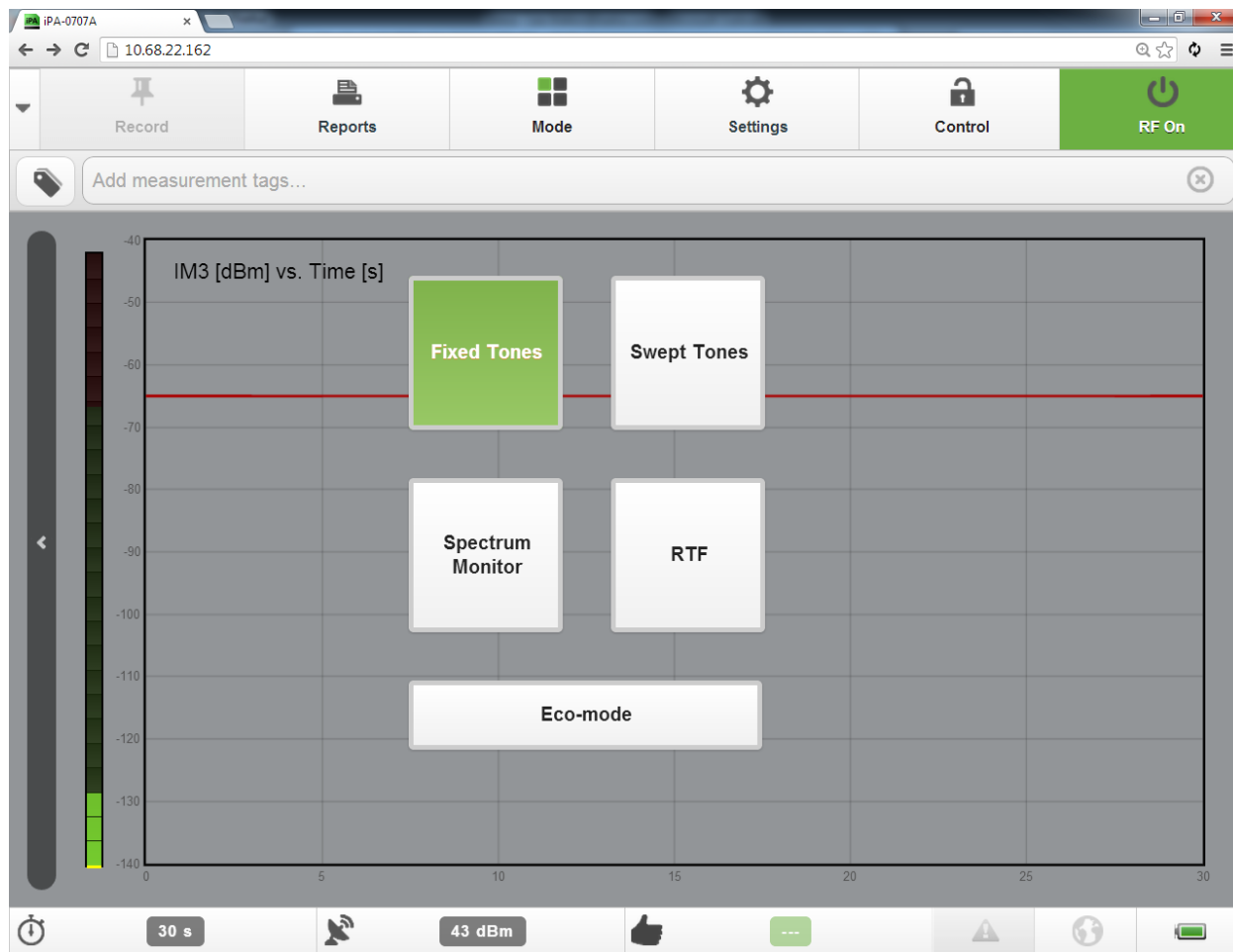


Figure 32 : Mode selection menu

### 1.8.1 Fixed Tone

Fixed Tones mode can be displayed in two different forms. The iPA will always on first load display the Fixed Tones measurement mode in the Numerical PIM display our default measurement mode. The alternate display the PIM vs Time (sometimes called the Time Trace mode) is particularly useful for illustrating IM performance during a set time interval and under percussive testing. The measurement trace gives a “timeline view” on how the IM level changed within the set time interval. As with the default measurement mode, the TX tones remain fixed whilst the IM measurement is taken at the corresponding IM frequency. Before the IM measurement is shown, time is allowed to stabilize the output tone powers to within +/-0.5dB of the preset level.

The features offered by this mode are as follows:

- A peak level marker (Yellow line) highlights the peak IM level

- The time axis is automatically scaled as per the Power Timer setting mentioned earlier
- User adjustable Pass/Fail limit line (Red Line)
- Manual Measurement recording

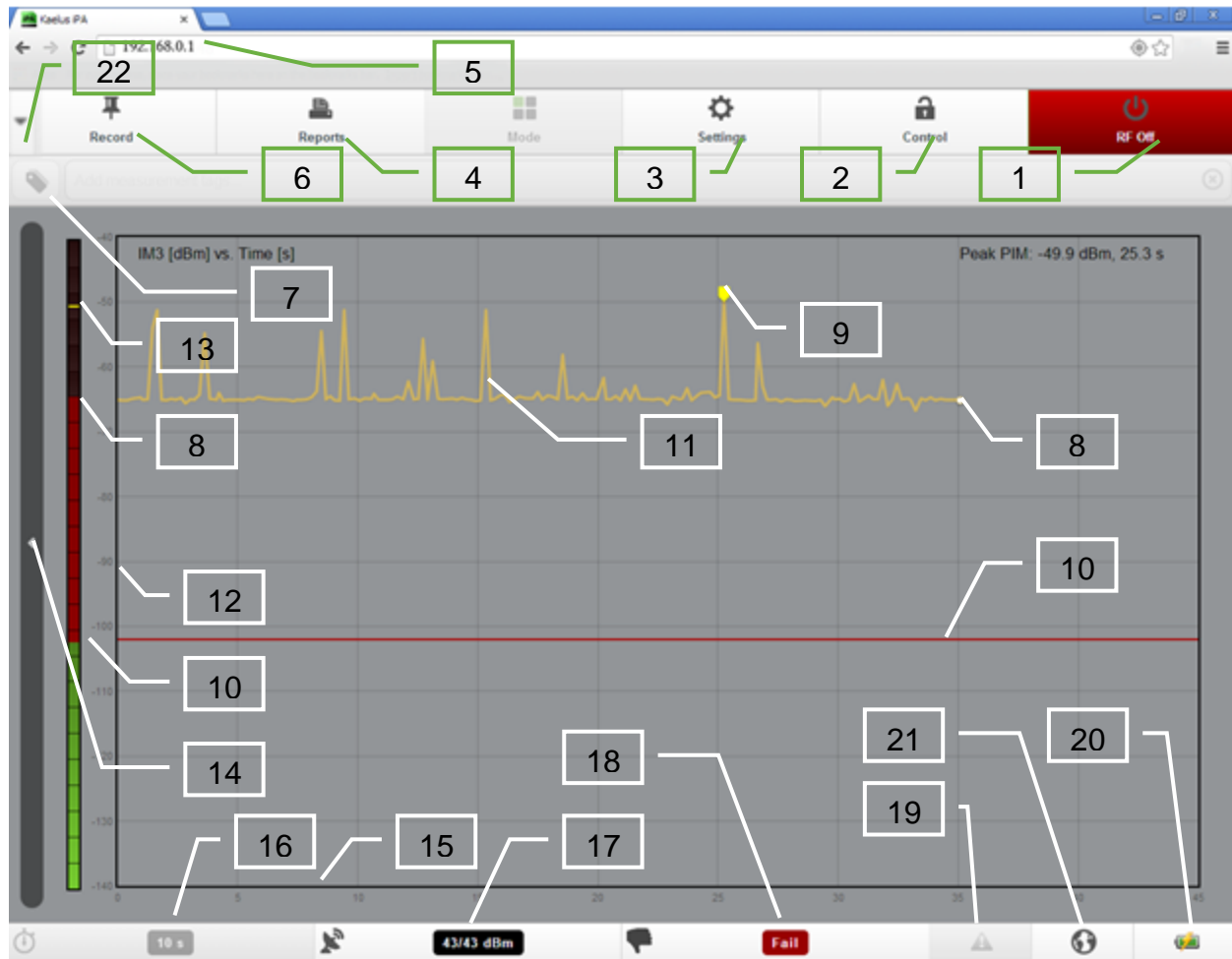


Figure 33 : Tablet PC PIM vs Time Window Mode (RF “on”)

Figure 30 shows a screen shot of the PIM vs Time measurement window. The shown trace is typical of a loose connector under dynamic testing (percussive tapping).

1. RF “On/Off” button – (Red: RF “On”, Green: RF “Off”)
2. iPA/Tablet PC Wi-Fi Remote Interface control (see table 1 for operation)
3. Settings Menu
4. Reports Menu
5. IP Address for iPA – (factory set to 192.168.0.1 in hotspot mode)\*
6. Record Data Point Button

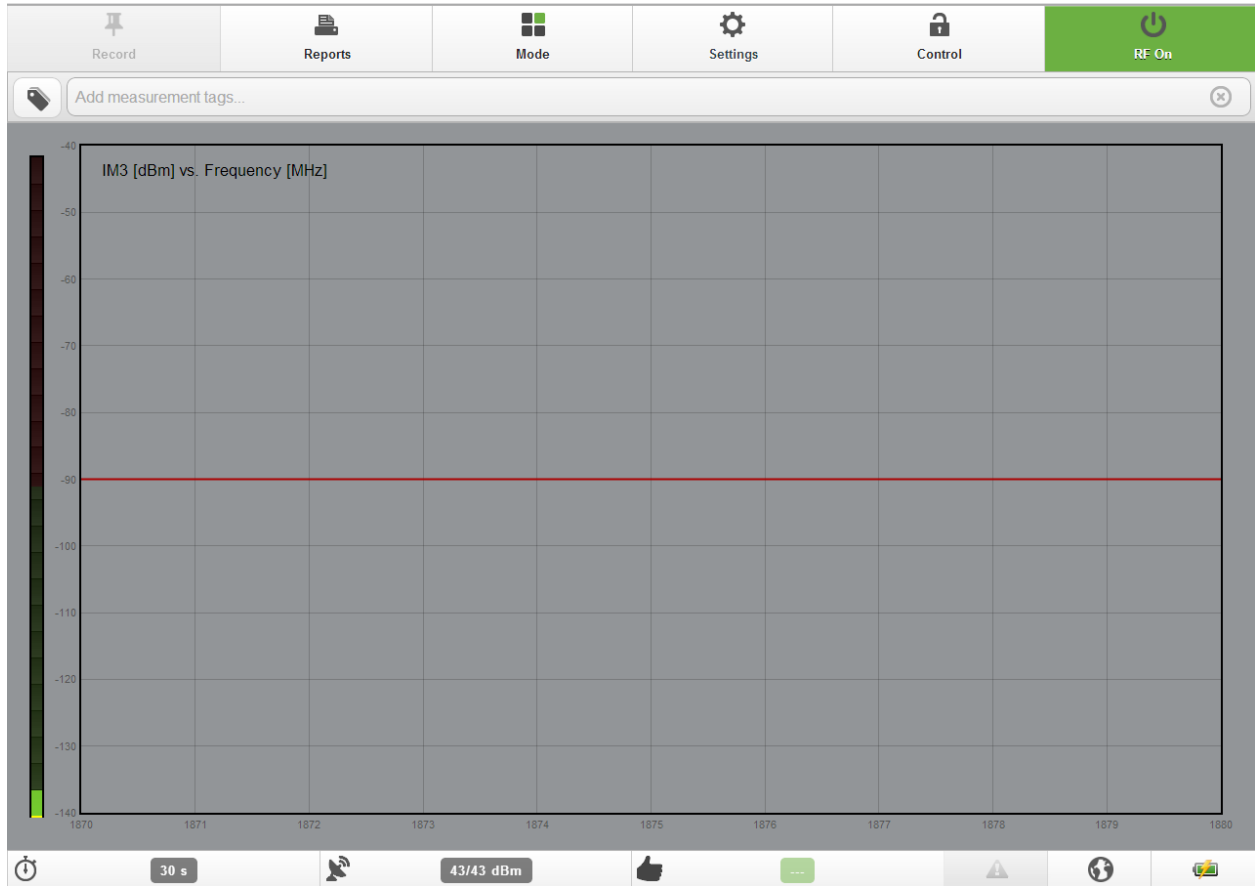
7. Measurement Tag Title
8. Instantaneous PIM measurement
9. Maximum recorded Peak PIM level - (Yellow Marker)
10. PIM fail limit - (Red line)
11. PIM Time Trace (Orange Trace)
12. PIM Measurement Axis (dBm)
13. Instantaneous PIM measurement (Bar level)
14. Scroll Bar Left (to change to Display Mode)
15. Time Measurement Axis (Seconds)
16. Timer Monitor and Settings Menu
17. TX tones Power Monitor and Settings Menu
18. IM Pass/Fail indicator and Settings Menu
19. Notifications icon
20. Battery Level Indicator
21. Geo Tag Indicator (Light grey, off), (Flashing, requires better location fix),(Dark Grey, Geo tag fix obtained)
22. Record drop down menu

\*In Client Mode the IP address is allocated by the Host network.

### 1.8.2 Frequency Sweep .

The Swept Tones mode is particularly useful for highlighting anomalies in IM performance within a specific receive band. The instrument measures the vector sum of all PIM sources present on an RF path. If two PIM sources of approximately equal magnitude are present on the RF path *and* are physically separated in such a way that the two signals arrive at the PIM test equipment exactly  $180^{\circ}$  out of phase, the two PIM signals will cancel and the PIM problem may not be evident. Changing the test frequencies will change the generated PIM frequency and the phase relationship between multiple PIM signals on the line, if they exist. “Sweeping” across multiple test frequency combinations provides a range of data points to accurately characterize the PIM performance of the system.

With this measurement mode, the high power tones are swept across the transmit band in such a way that their IM products fall within the receive band. To optimize speed and efficiency only those pairs of transmit frequencies which create IM products in the receive band are swept. A unique feature is the use of dual-tone sweeps: the high-frequency tone is first swept towards the stationary low-frequency tone (Sweep:1/2) and then the low-frequency tone is swept upwards toward the stationary high-frequency tone (Sweep:2/2). The progress on any dual-tone sweep is shown by the sweep number as tagged in the figure below.



**Figure 34: Swept Measurement Window**

Note: The instrument will complete as many dual-tone sweeps as possible within the preset time frame. After the timer expired the RF is switched off.

Note: The test equipment automatically changes the two test frequencies and displays the resulting IM frequency, when doing the frequency sweep.

The frequency step size is adjustable and directly impacts on the time it takes for a sweep to complete. Clicking on the frequency step label, will open a selection window with different frequency steps. The user can make a suitable selection based on the IM bandwidth in question.

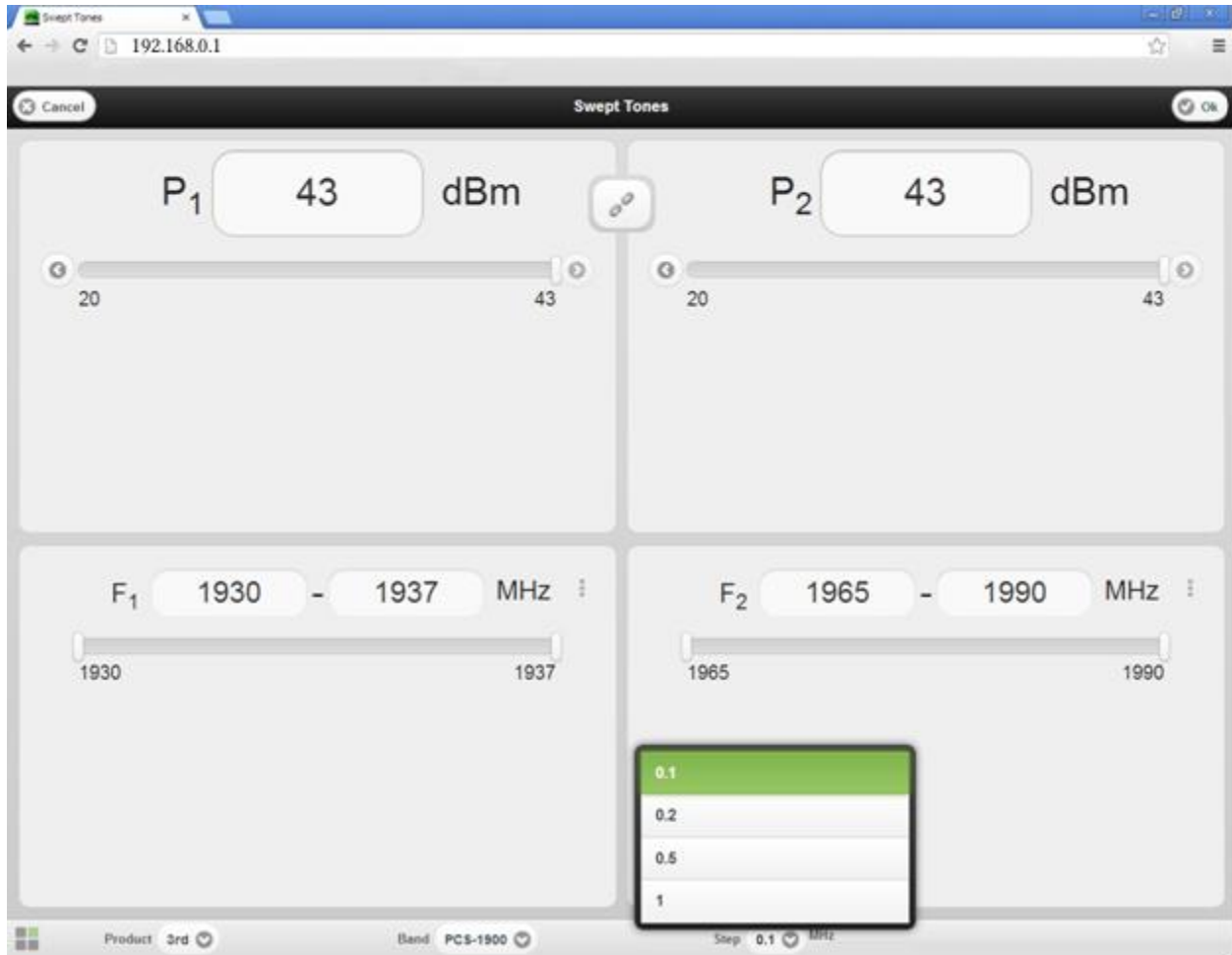
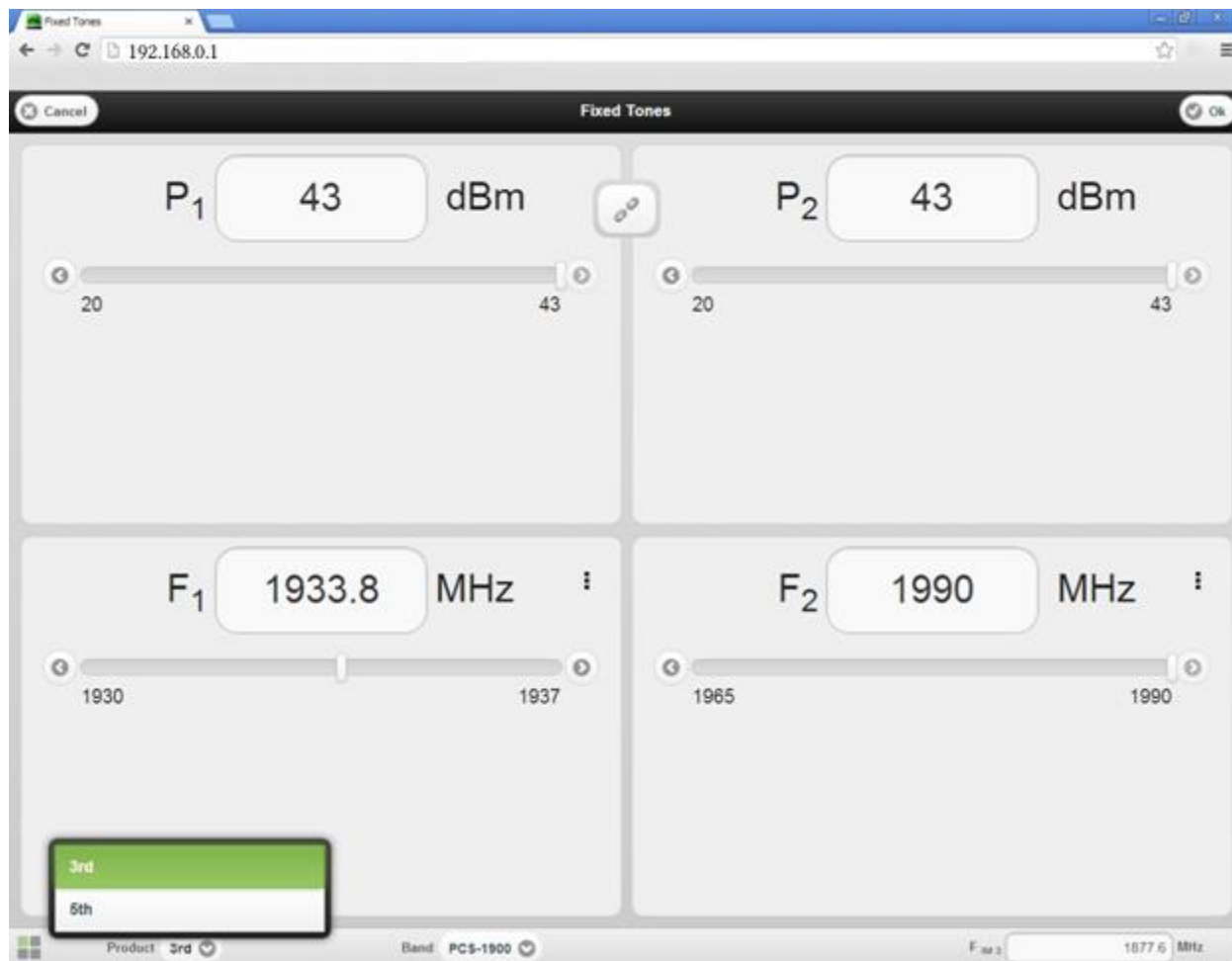


Figure 35: Frequency Step Selection Window

The figure below shows the IM order selection window. If a particular order IM band is present within the instruments receive band, it will be displayed.





**Figure 36: IM Order Selection Window**

The user is at liberty to record the peak IM level of a test point at any time during the active frequency sweep. Alternatively, if the set measurement interval is allowed to expire, the user will have the option to save the peak result to the test report.

### 1.8.3 Spectrum Monitor Mode

The Spectrum Analyzer mode offers an added analysis tool and is especially useful in detecting external interference introduced in the instrument's RX band. When the application starts up, a sweep is automatically initiated to detect interferers in the RX band of the instrument. In the default state, the two TX test tones will remain off, but the user also has the option for turning them "on". When "on" the operator will see all intermodulation products that fall within the receive band as well as wide band interference of whichever nature. A peak hold feature identifies the worst case value measured during each sweep.

The features offered by this mode are as follows:

- Adjustable sweep step size
- A peak level marker highlights the peak IM level and at what frequency this measurement was taken
- The option to have the RF on or off in this mode

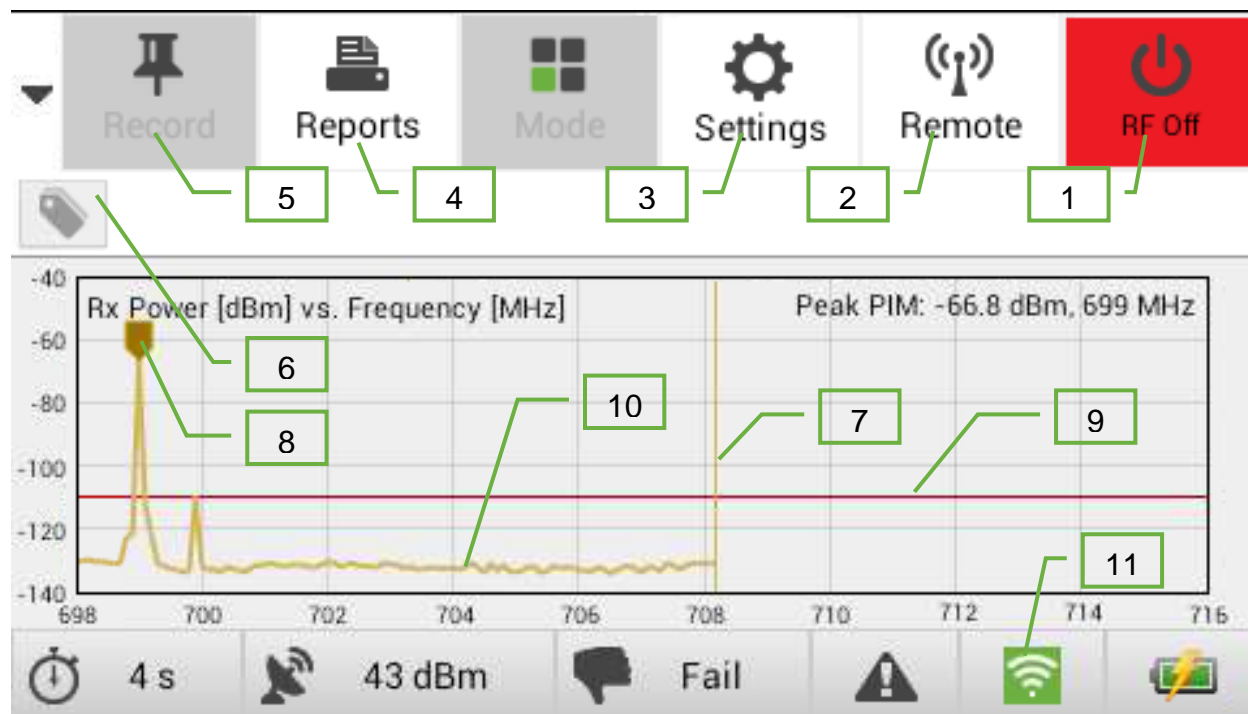


Figure 37: Spectrum Analyzer Measurement Window (Local Display)

An added feature in the spectrum monitor mode is the option to switch the RF on. In practical terms, this feature allows the user to see interference in the proximity of an IM signal. (Note: This feature is due to be released for the iPA at a future date).

1. RF “On/Off” button – (Red: RF “On”, Green: RF “Off”)
2. iPA/Tablet PC Wi-Fi Remote Interface control (see table 1 for operation)
3. Settings Menu
4. Reports Menu (Spectrum monitor mode is fault analysis tool, not intended for compliance testing)
5. Record Data Point Button (Not used in Spectrum Monitor mode)
6. Measurement Tag Title
7. Current trace Frequency (Vertical Orange line)
8. Maximum recorded Peak PIM level - (Yellow Marker)
9. PIM fail limit - (Red line)
10. PIM Time Trace
11. Network Settings (Local Display only)

### 1.8.4 Range To Fault Mode (Optional Module)

The Range to Fault mode offers an added analysis tool and is designed to determine the physical distance to the PIM fault from the iPA test set. Details on the operation of the RTF test set is given in the RTF operating manual:

R99-0068-RTF\_A-SERIES\_OPERATING\_MANUAL\_RevB.doc



Figure 38: Range to Fault (RTF) Measurement Window

### 1.8.5 Eco Mode

Eco Mode offers a battery saving feature. Eco mode will power down the iPA's instrument RF stages when not in use, helping to extend the battery life. Remote control and hotspot functions are still active, so the user can still access all the report functions and data while the iPA is in Eco Mode. This also allows remote users to return the instrument to the measurement mode of their choice whenever it is required. In addition to Eco Mode the local instrument display has a display dimming function that can be set to operate independently saving even more battery current. Eco Mode and the display dimming functions have their own timers that can be set in the Settings/Miscellaneous menu on the LOCAL console. The iPA can be set into Eco mode immediately via the mode menu both on the LOCAL console and remotely. Eco mode also frees up processor capacity. When generating large reports and uploading and downloading files, being in Eco mode can make these jobs finish quicker.

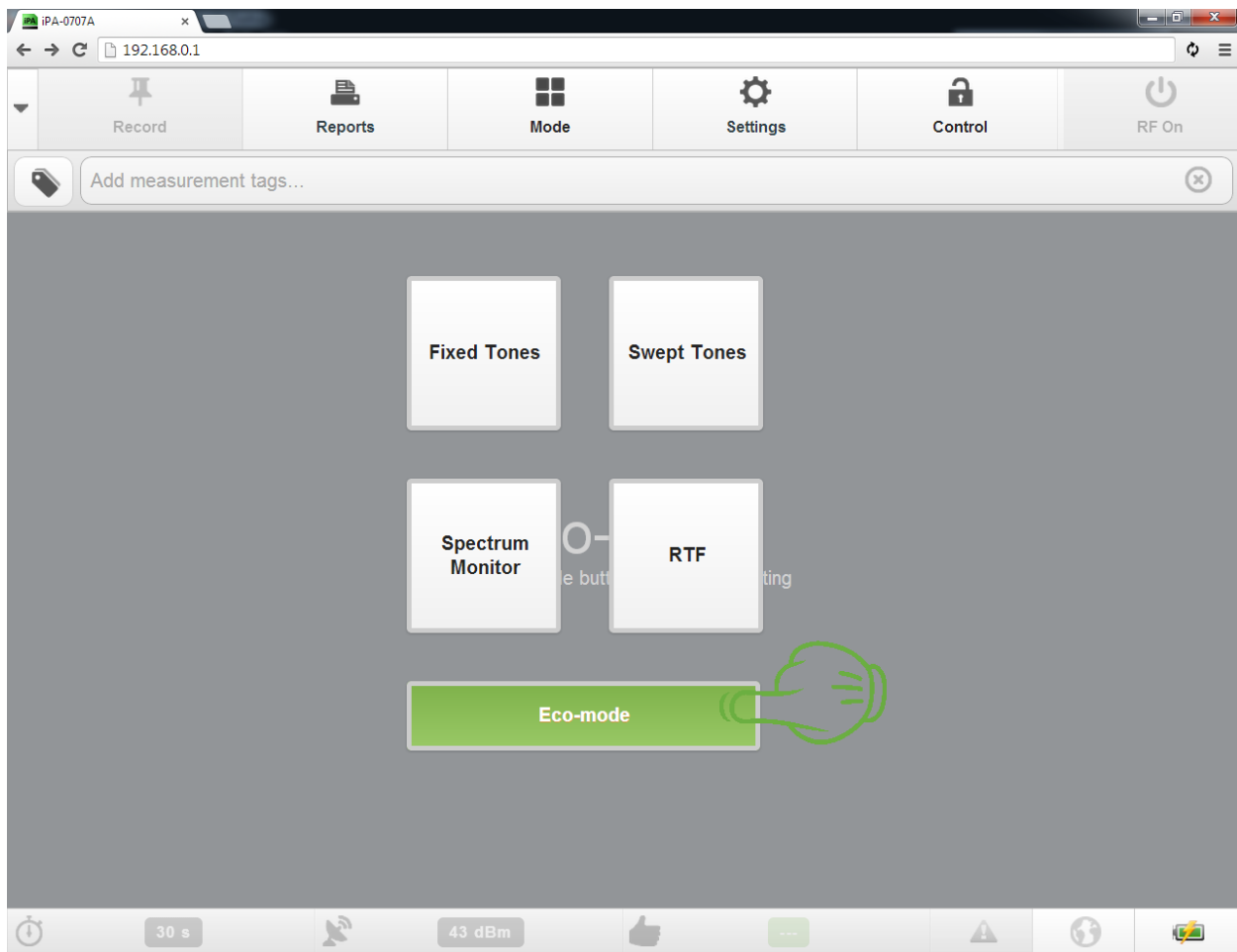
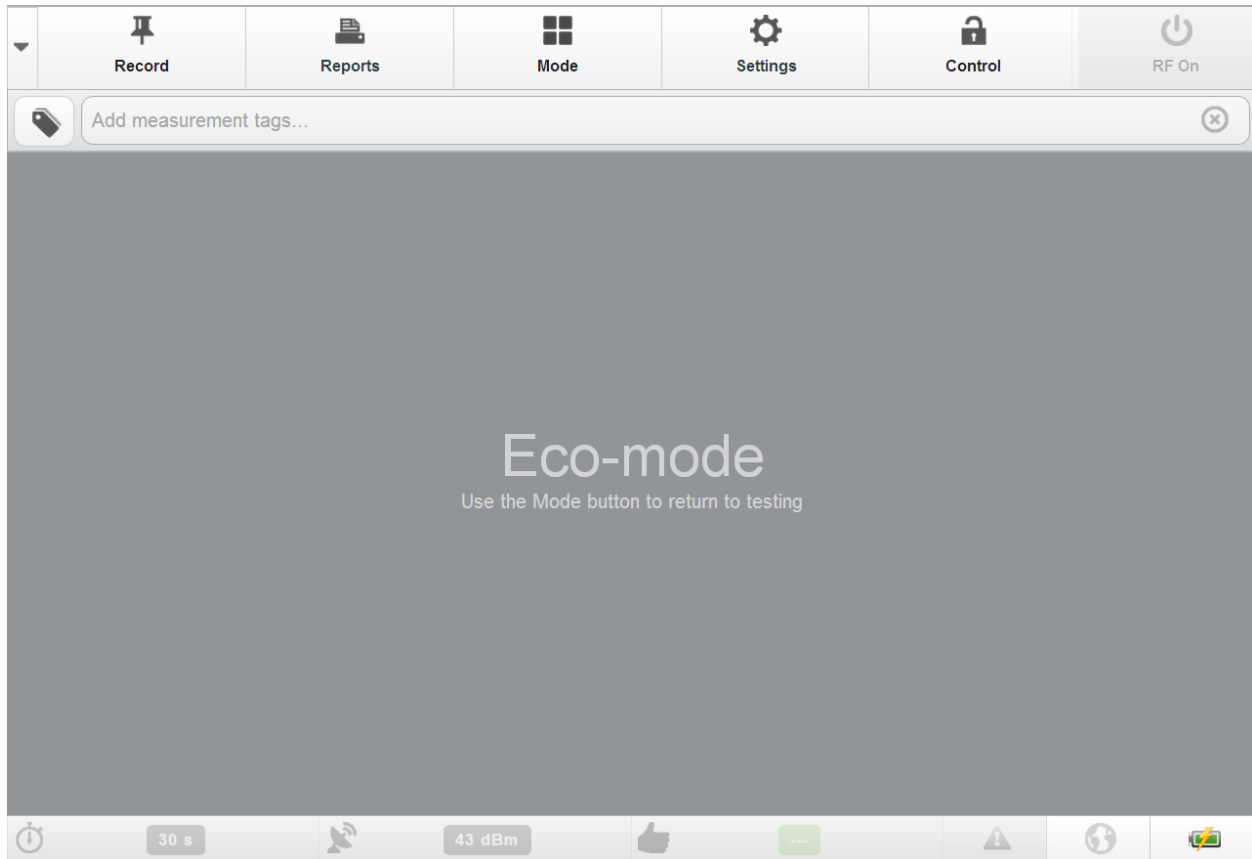


Figure 39 : Immediate switch to Eco mode (via mode menu)



**Figure 40 : Eco Mode Display**

To return to your measurement use the mode button and select the desired measurement mode again.

### 1.8.6 Eco mode and Dimmer timer setting

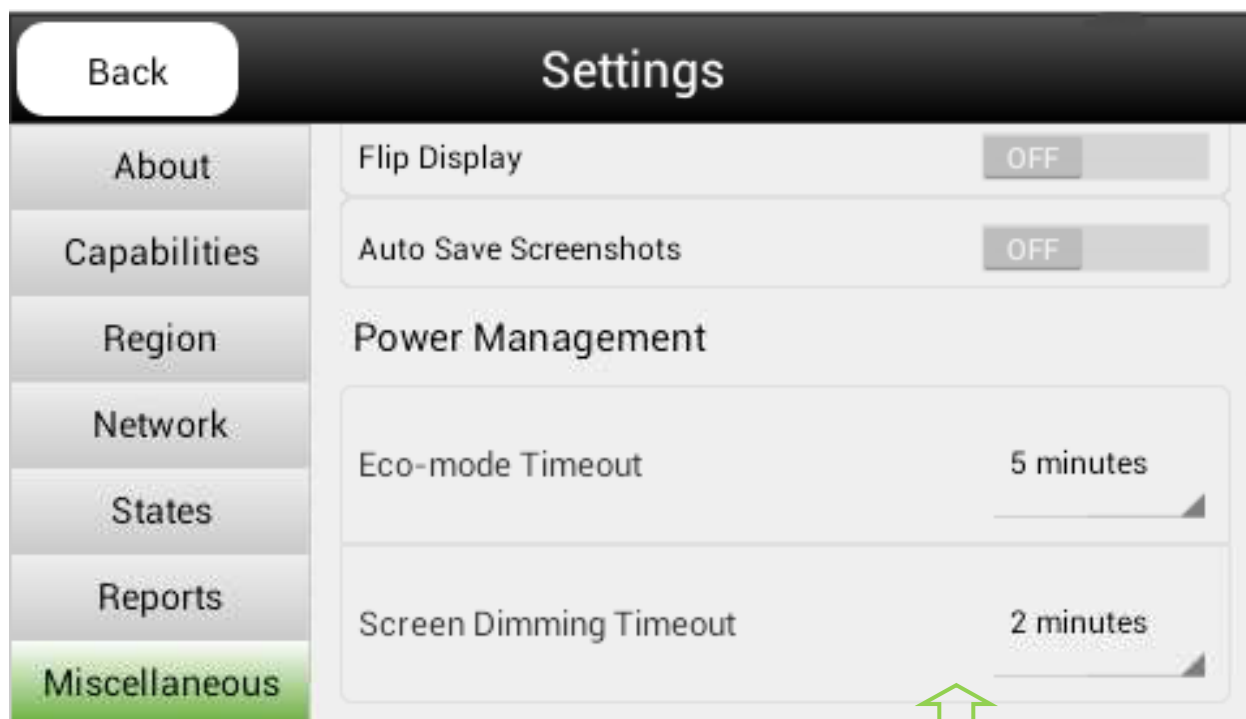
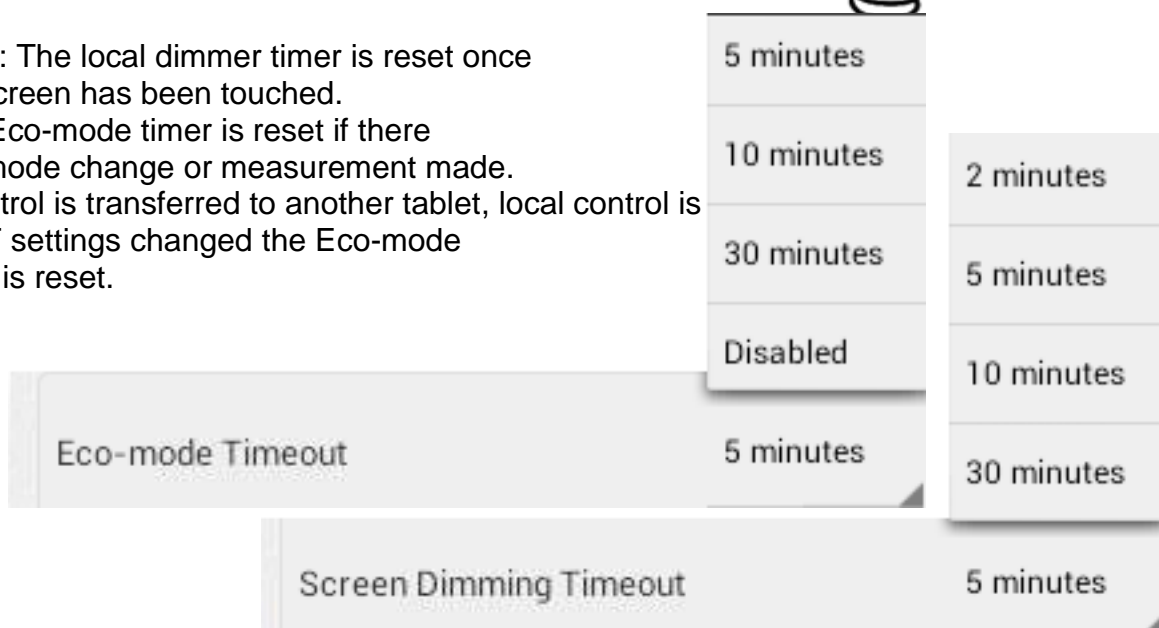


Figure 41 : Eco mode and Screen Dimming timer menu

Scroll down to find Screen and Eco-mode timeout settings.



Note : The local dimmer timer is reset once the screen has been touched.  
 The Eco-mode timer is reset if there is a mode change or measurement made.  
 If control is transferred to another tablet, local control is or RF settings changed the Eco-mode timer is reset.



## 1.9 Generating Reports

The iPA includes industry leading report generation functions to assist system installers designers and maintainers provide a clear picture of the state of the equipment under test. Saving time for everyone involved in the process.

### 1.9.1 Overview

Reports can include tags or a combination of tags to identify results against equipment and cable sections that can be saved and re-used .

Site, cable or equipment images can be uploaded directly into the report from the controlling smartphone, tablet or laptop and comments added.

The ability to add both contractor name and logo on the instrument and generate a PDF report directly helps to provide not just a professional looking report but helps to identify where the reports have come from and saves time, chasing a reports origin.

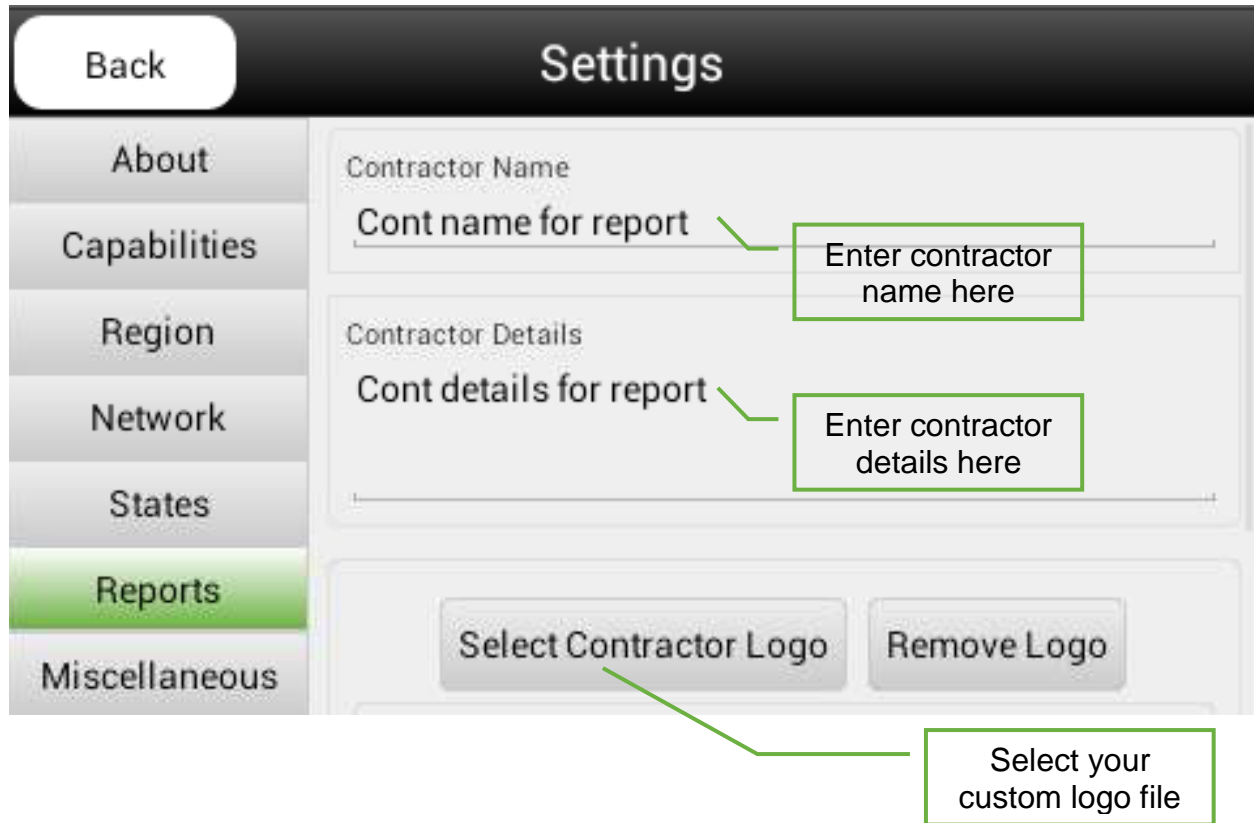
Measurement Plots and screens can be added to the PDF reports and commented, helping to convey the user's view of what they are seeing in the report.

Results can be recoded at various points showing IM product, power levels frequencies and spec applied.

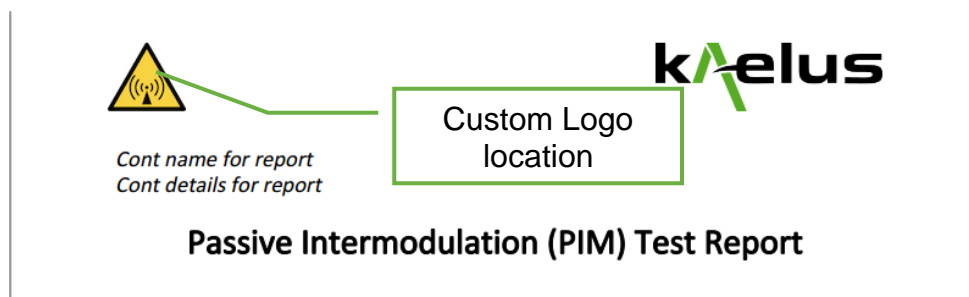
Reports can be retrieved from the instrument by either saving them on and removing the SD card or downloaded directly to a remote control device such as smartphone, tablet or laptop. Allowing the job to be finished and reported right there and then.

### 1.9.2 Customizing your report Contractor Name, Details and logo

Enter the Settings/Report Menu to see the following screen .



Note : Custom logo files can be added to the external SD card or uploaded to the iPA from a remote control tablet or PC Browser. This will be scaled down to fit in the corner of the report by the iPA . PNG, JPG filetypes are supported. Filesize limitations as per 1.3 FEATURES Note 1 . The custom logo is used in the PDF report header as shown. The iPA's PDF report generation allows for the Testers business details or custom heading and logo to be added.





### 1.9.3 Report file formats.

iPA Report files from software version 1.014.0000/1.14.0.0 onwards use the popular \*.zip file format , if you are upgrading software from an earlier version, the previous \*.rpt format report files can still be opened but will be saved in the \*.zip file format in future. The new \*.zip file includes all the convenient new report features in one file in an easily accessible zip file format, this zip file also includes csv (Comma Separated Values) of plots for importing to a spreadsheet program or database. All screenshots , photos and thumbnail images and comments are also included. Into one easily transportable file that also saves on disk space. To check your software version look in the Settings/About Menu.

### 1.9.4 Setting up the Site Test Report

The site test report should be set up before any measurements are made.

1. Press the **Report** button. The Report window will be displayed.



Figure 42: Report Window

2. Press the **Site** Field. A keypad will be displayed.

3. Input the Site name to be listed on the report, and press **Return/Done**.
4. Repeat the process for adding: Operator Name information
5. Press the **Back** button when the report setup is complete.

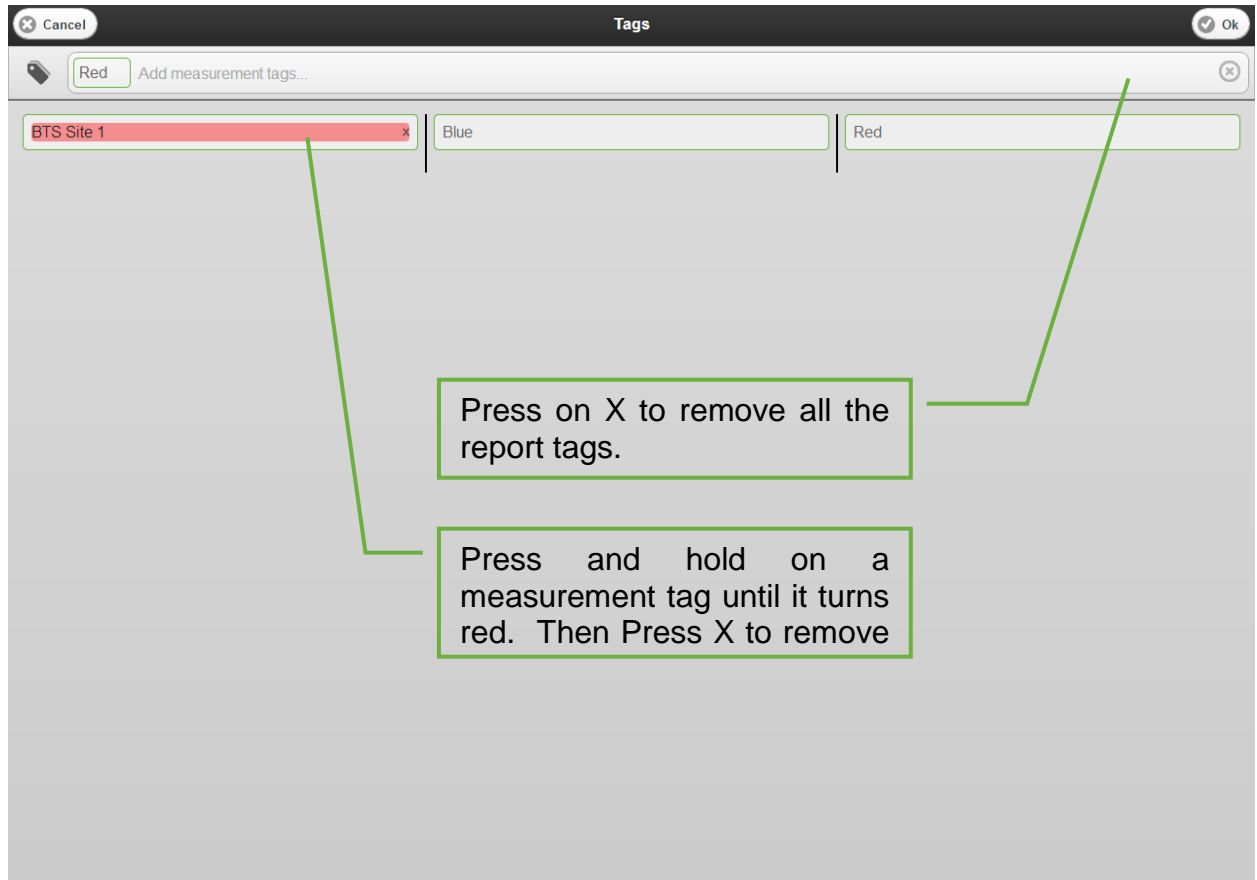
### 1.9.5 Taking an RF Measurement and Adding Measurement Tags

1. Before connecting the Device Under Test (DUT) to the Output Port, ensure that all mating surfaces are clean and free of physical defects. Ensure that the connection is adequately tightened.
2. Press the **Add Measurements Tag** field on the Main Display Window of the Tablet PC. The Test Point Label window will be displayed.



**Figure 43: Add Measurement Tag Input Screen**

1. Direct tage entry
2. Tag list menu



**Figure 44: Removing Measurement Tags**

3. Choose the label for the point in the system at which you are doing the testing and press **Return**. The chosen Test Point label will be displayed at the top of the test screen, and in the report next to the associated measurements.
4. Press the green **RF ON/OFF** button. The button will turn RED, indicating that the RF is active. The level of the intermodulation product will be displayed on the IM level indicator and IM level bar indicator. The red RF ON LED Indicator situated immediately above the RF Output connector will flash showing RF is present. While the measurement is taking place, the instrument will take a peak measurement and indicate if the device under test has a Pass or Fail status. The 'Peak' result will, however, not be displayed until the output tone powers have been stabilized to within +/-0.5dB of the preset level.

The 'Record' Test Point button will be visible (and active) during and after the RF "on" period. The 'Record' Test Button may be pressed at any time to record the previous Peak IM value. The peak indication is held until the next RF power on event.



**Figure 45: Default Measurement Window**

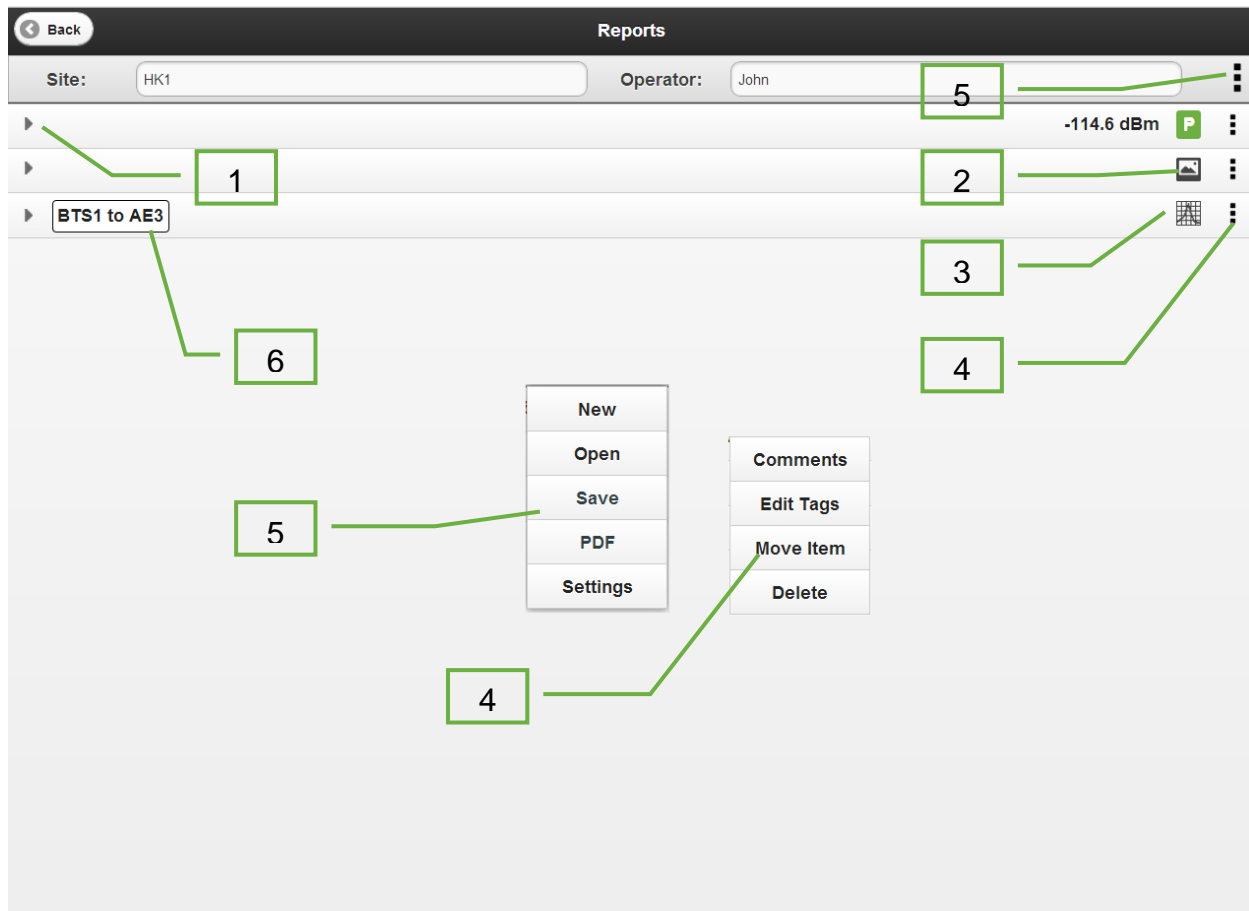
The RF power can be switched off by pressing the red **RF ON** button and it will return to green. If you want to record the peak measurement on the report before switching off the RF, press the **Record Test Point** button. The RF power will also turn off when the RF Timer reaches zero.

**Note:** All test reports are marked with a Pass or Fail Certification stamp. A Pass will only occur when the Peak PIM reading is equal to or below the test state setting for the Pass/Fail threshold.

### 1.9.6 Viewing a Test Report

Reports are can be saved to the iPA in a compressed \*.zip format.

1. From the user screen, press the **Report** button.
2. The report screen will be displayed.



**Figure 46: Report Browsing Window**

Navigation in the report directory screen is done as follows:

1. To Expand a Report result in a Measurement tag, click on '▶'
2. Indicates an included Photo.
3. Indicates an included Plot.
4. Each Item can edit or add comments and tags and move items via a pull down menu.
5. The report may be saved into the iPA or SD card in an \*.zip format or saved as a PDF. See Figure 46 . Note : (Settings)This allows access to Report Settings from remote browser as per Section 1.9.2. (New) This will clear the current report data and start from a new screen, ensure any wanted results are saved before commencing a new report or data will be lost.
6. Measurement tag.

⏪ Back
Reports

---

Site: 
Operator: 
⋮

-114.6 dBm
P
⋮

Time	3-Apr-2014 2:40:23 PM		PIM	-117.4 dBm
Band	700H		Peak PIM	-114.6 dBm
F <sub>1</sub> /F <sub>2</sub>	728.0 MHz	757.0 MHz	PIM Threshold	-100.0 dBm
F <sub>IM3</sub>	786.0 MHz		Result	Pass
P <sub>1</sub> /P <sub>2</sub>	43.0 dBm	43.0 dBm		

---

3-Apr-2014 3:06:34 PM
⋮

Time

Comments Comms room 1

---

BTS1 to AE3
⋮

Time

Time	3-Apr-2014 3:09:48 PM		Band	700H
F <sub>1</sub> /F <sub>2</sub>	728.0 MHz	757.0 MHz	F <sub>IM3</sub>	786.0 MHz
P <sub>1</sub> /P <sub>2</sub>	43.0 dBm	43.0 dBm	PIM Threshold	-95.0 dBm

Comments Pim trace with bumping

Figure 47: Report window items expanded

### 1.9.7 Saving Reports

Test reports can be saved internally in the iPA or to an SD card in a compressed .zip or PDF format.

1. Insert the SD card if required.
2. Type in a File Name to the test report.
3. Press the **Save** button to save the report in \*.zip or \*.pdf format internally on the Tablet PC or on an SD card.

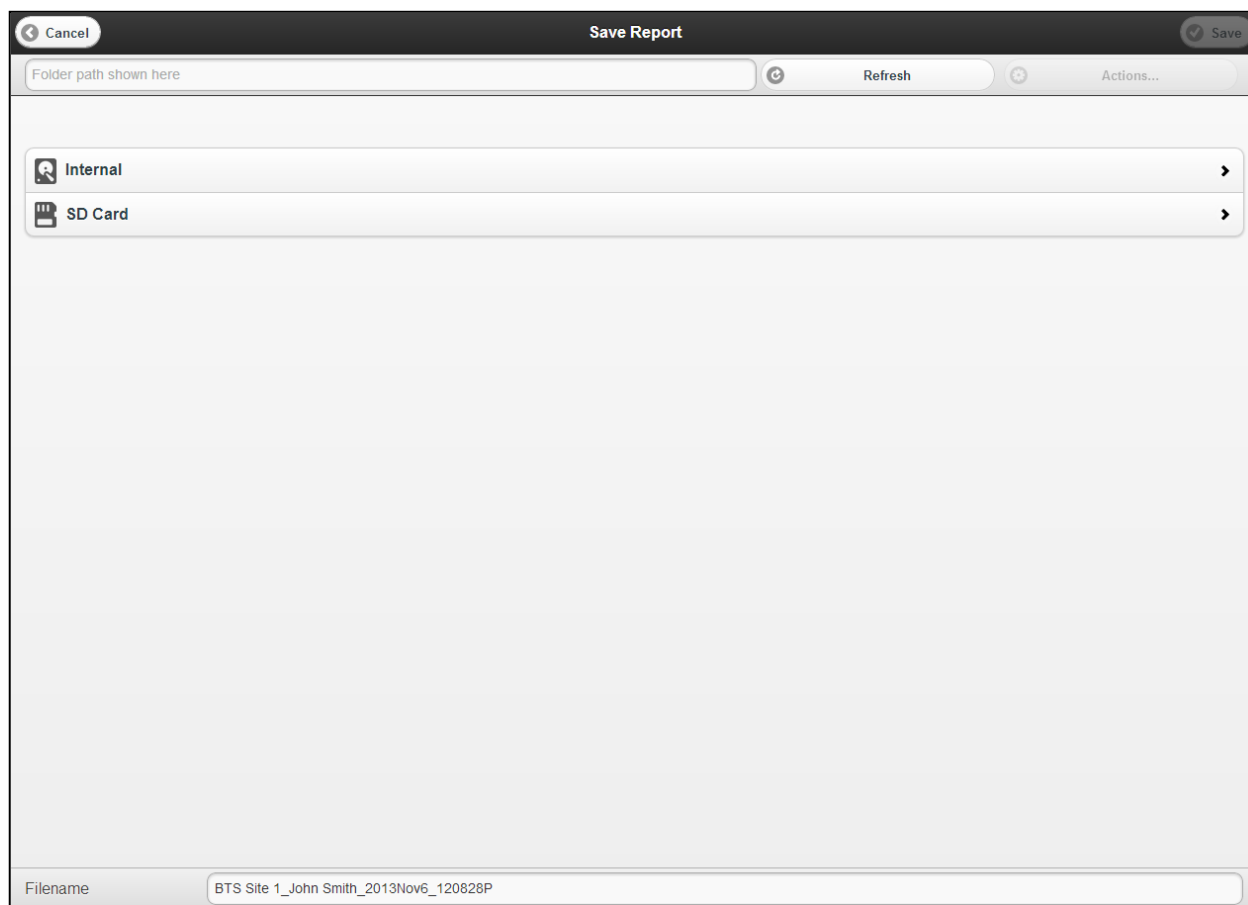


Figure 48: Report Save Window

### 1.9.8 Saving iPA screen shots for inclusion in reports

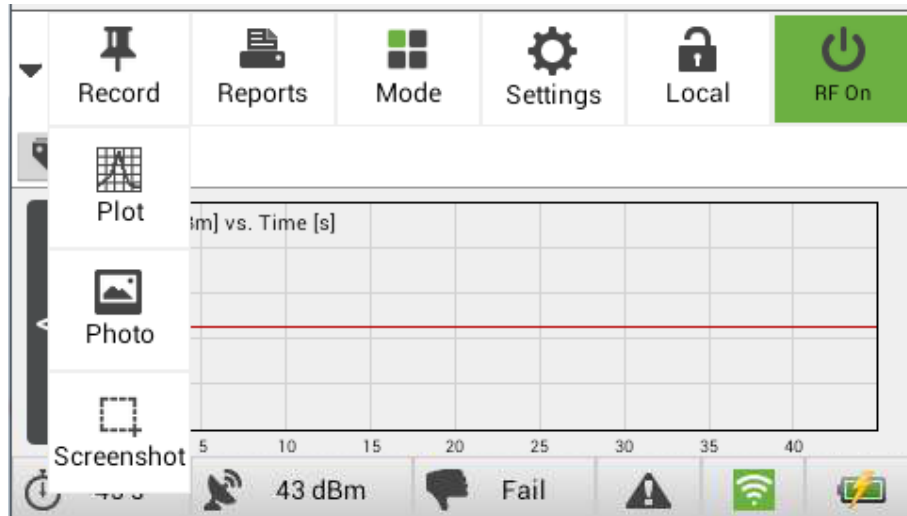


Figure 49 : Screen shots local display to be added to reports.

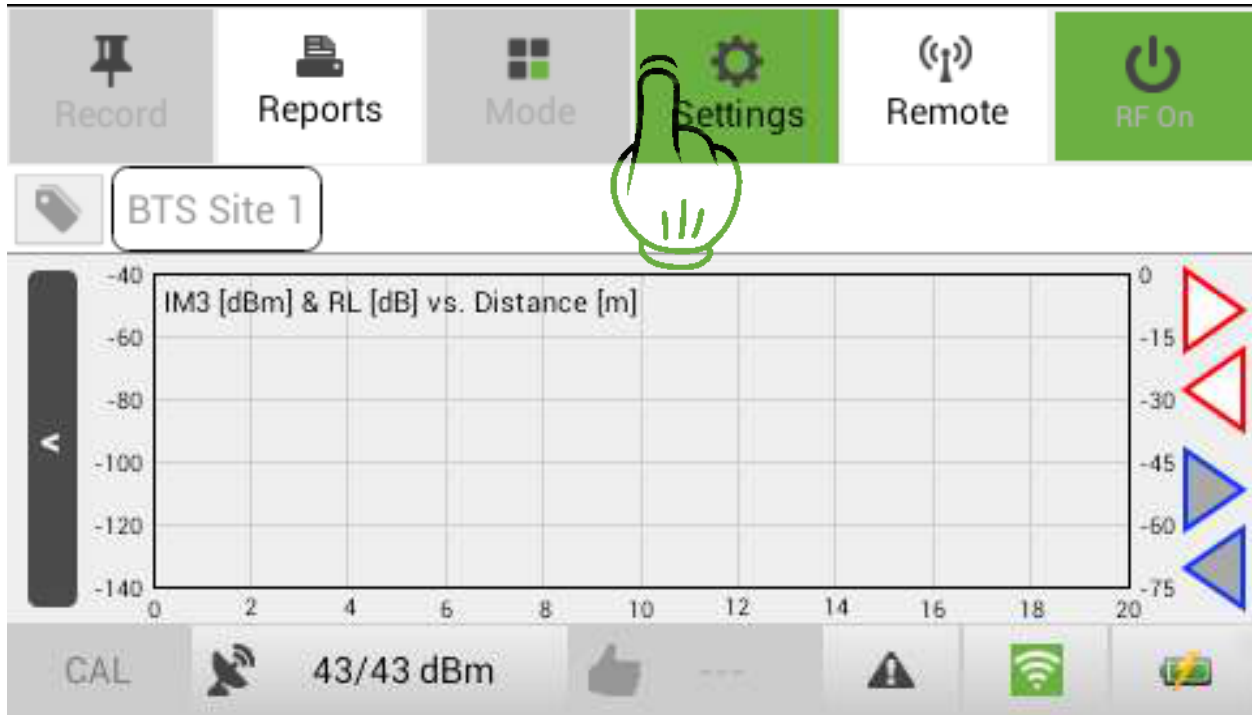
1.9.9

### Saving iPA screen shots (Not included directly in reports)

If you are already using your iPA via remote control , each of your remote control devices will have a different way to do a local screen capture, Print Screen for PC based devices, Android tables often use a combination of home , and Power buttons to do a screen shot as do iPADS , some use power and Volume up, refer to you control devices user manual. The iPA's local control console can also create and save screenshots of your local display in 2 different modes (Standard mode , or Autosave mode).

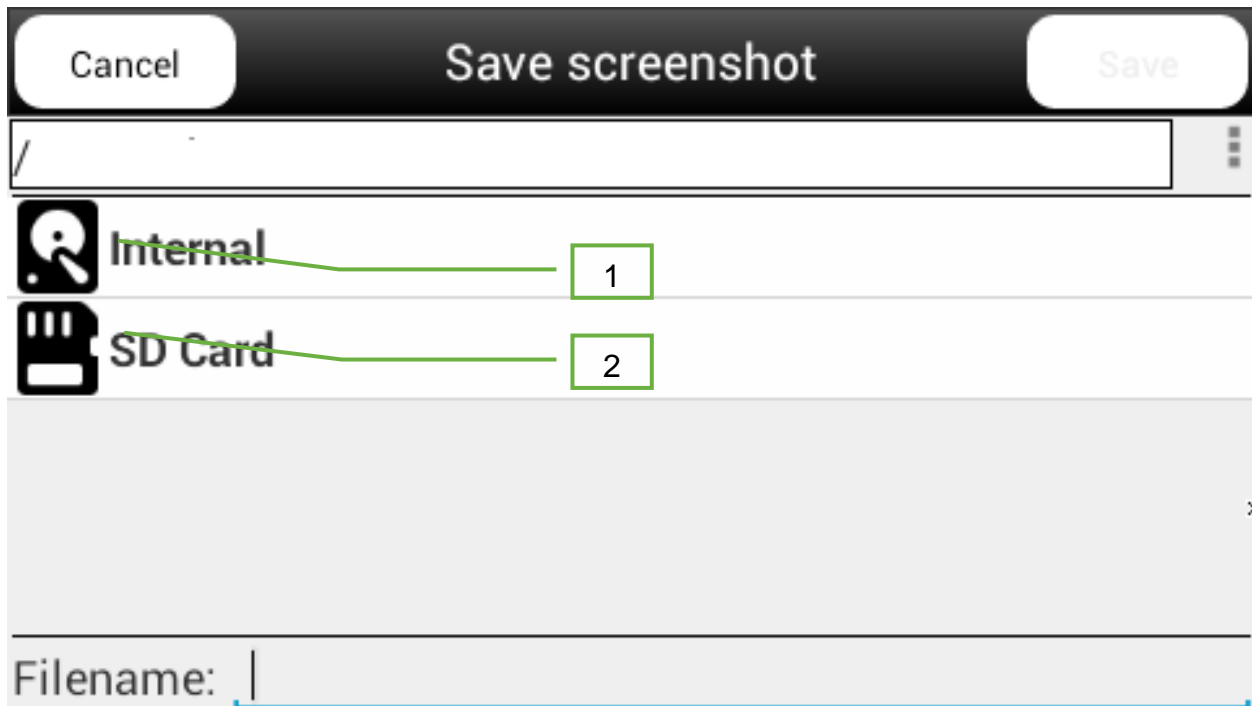
Touch and hold the Settings control for around 3 secs and release. The save screenshot menu will appear where you can select to save your screenshot on the SD card or internal memory. Once you have typed a filename the save control is then made available . The image will be save in \*.png image format for you, saving on the SD card will allow you to remove the card and share your image with other devices equipped with an SD card reader or download via a remote control device.





**Figure 50: Local Screenshot touch point (Not for inclusion in report)**

Touch and hold the settings button for 3 secs and release to enter the screenshot menu.. For standard mode (Autosave off) the following menu will appear.



1. Touch on to select internal Storage
2. Touch on to select external SD card.

If Autosave mode is selected the iPA will create a filename starting screenshot followed by a date stamp . If an SD card is fitted the screenshots will be saved in the screenshots directory on the SD card . If the SD card is not fitted the screenshot will autosave to the screenshot directory on the internal storage. To recover files from internal storage you will need to switch the iPA into USB mode and recover them with your PC connected via the mini USB port as shown in Figure 3 item 15 .

### 1.9.10 Moving items around in a report

See Figure 46: Report Browsing Window. To locate the move control beside the item you want to shift. Select Move , then press in the new location for the item.

## 1.10 Uploading and downloading reports, files and Photos

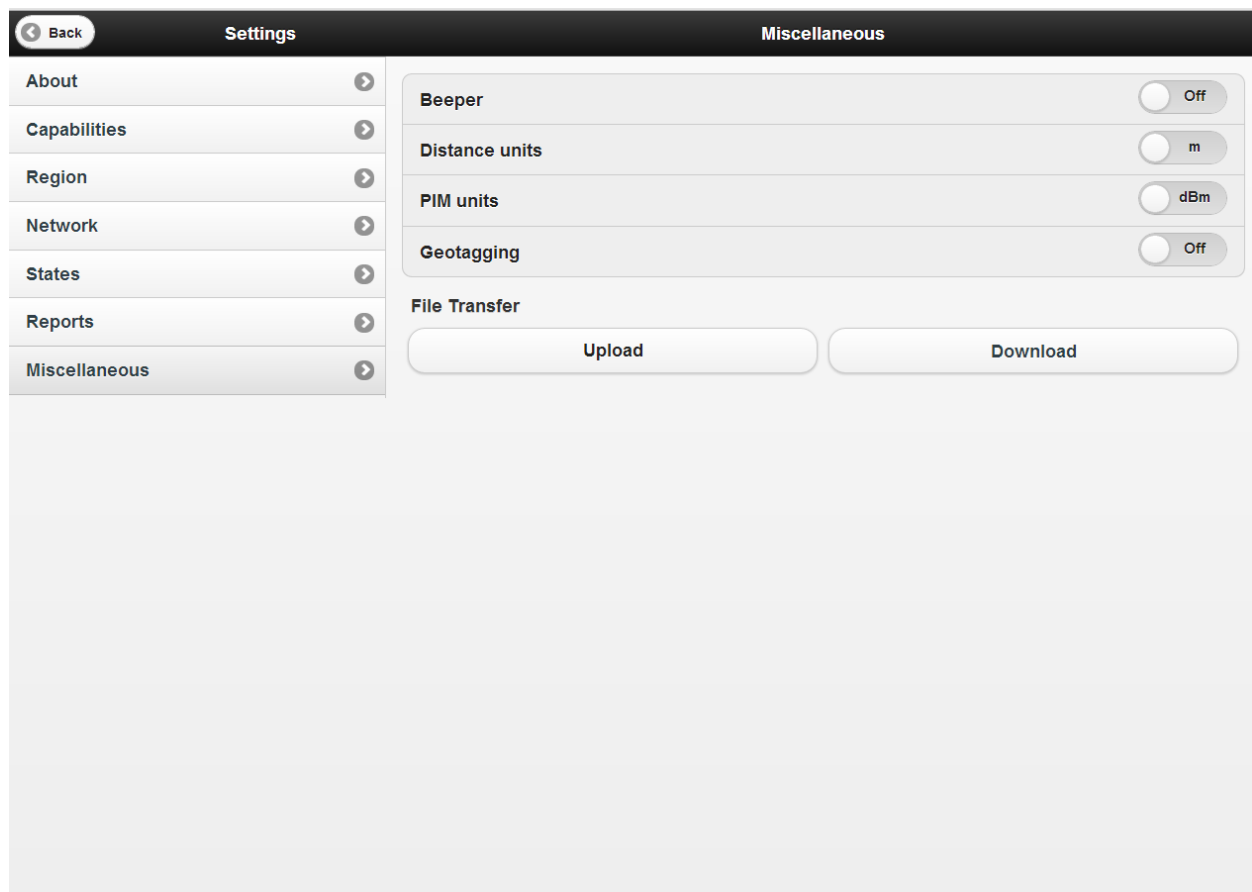
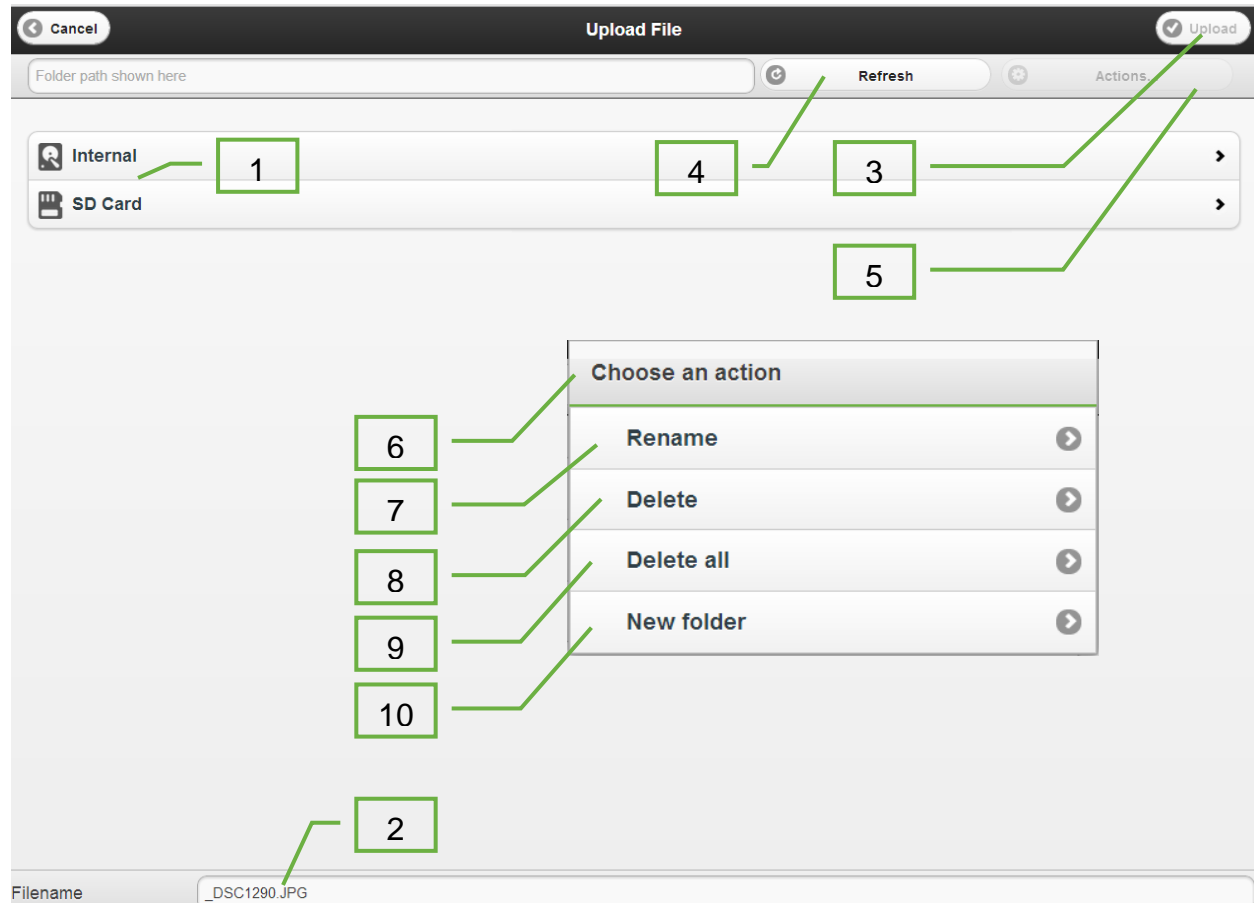


Figure 51: Upload and Download menu

### 1.10.1 Uploading files to the iPA

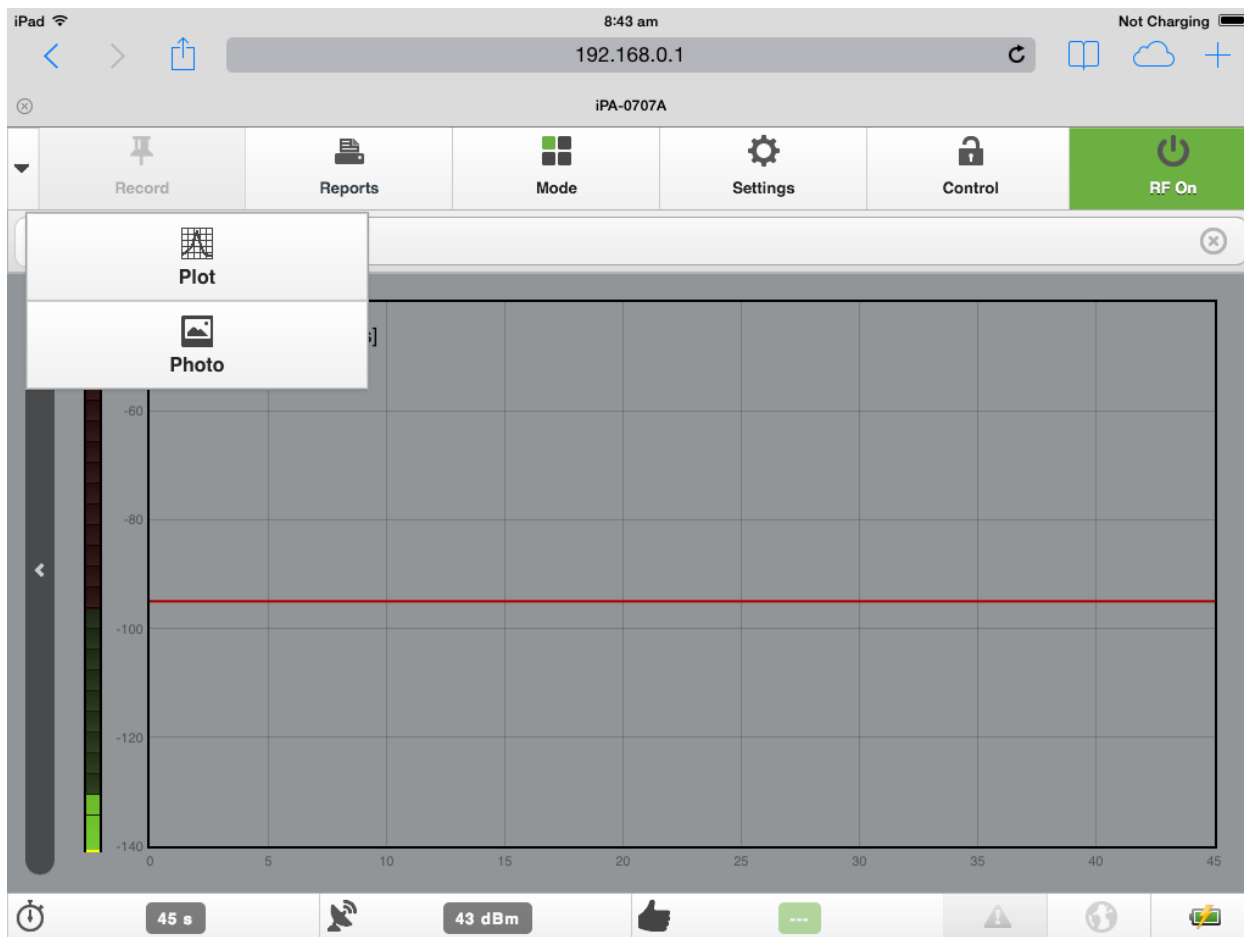
First your remote device needs to be in control, see 1.6.6. Select the upload key refer Figure 51 above, a file dialogue will appear on the remote control device a filename can then be selected, this will be as per the local operating system, Apple, Windows, Android. Then a file dialogue will open for where the file will be saved on the iPA



**Figure 52: Upload file dialogue**

1. Storage location selection
2. Filename (Can be changed at this point if required)
3. Upload Key (Currently Grey as storage device not selected yet)
4. Refresh (Refreshes the view of the current directory for any recently changed or uploaded files)
5. Actions menu selection (Causes pulldown menu to be shown) Items 7-10
6. Actions Pulldown menu.
7. Rename, the currently highlighted file can be renamed.
8. Delete, the currently highlighted file can be deleted.
9. Delete all, All files in the current selected directory are deleted. (Take care you really want to delete them all, this might include \*.sta state files)
10. New Folder. Create a new folder under the currently selected directory

### 1.10.2 Uploading photos into reports



**Figure 53: Uploading photos into reports**

Depending on your tablet or smartphone operating system the screens will look slightly different when the photo option is selected, the operating system will give you the option to upload an existing photo file from the device or to take the photo directly from the tablet or smartphone. This allows you to take photos of the state of the equipment under test for your reports. As per 1.9.6

### 1.10.3 Downloading files

Files can be downloaded to the controlling device. Select download as shown in Figure 51. The available files can be browsed either on the SD card or internal storage and downloaded. Filetypes of interest include .

- \*.sta files (Instrument State files) for instrument settings .
- \*.zip files include images, results plots and the display thumbnails.
- \*.PDF reports generated in PDF format and saved on the iPA.
- \*.png files, graphics such as screenshots generated by the iPA

### 1.10.4 How Language functions and settings effect report generation

PDF Reports are generated based on the language, units and settings of the controlling device. Reports can still be browsed by other connected devices even when not in control. If controlling device A is set to Mandarin Chinese and dBc units, then if a PDF report is saved, the Report will be saved in that language and those units, if another device B takes control with English settings in ft and dBm then the PDF report will be generated in that form. However the \*.zip file generation is common, opening a saved \*.zip file will allow report units and language to be changed to what is desired by the user.

### 1.11 PDF report layout

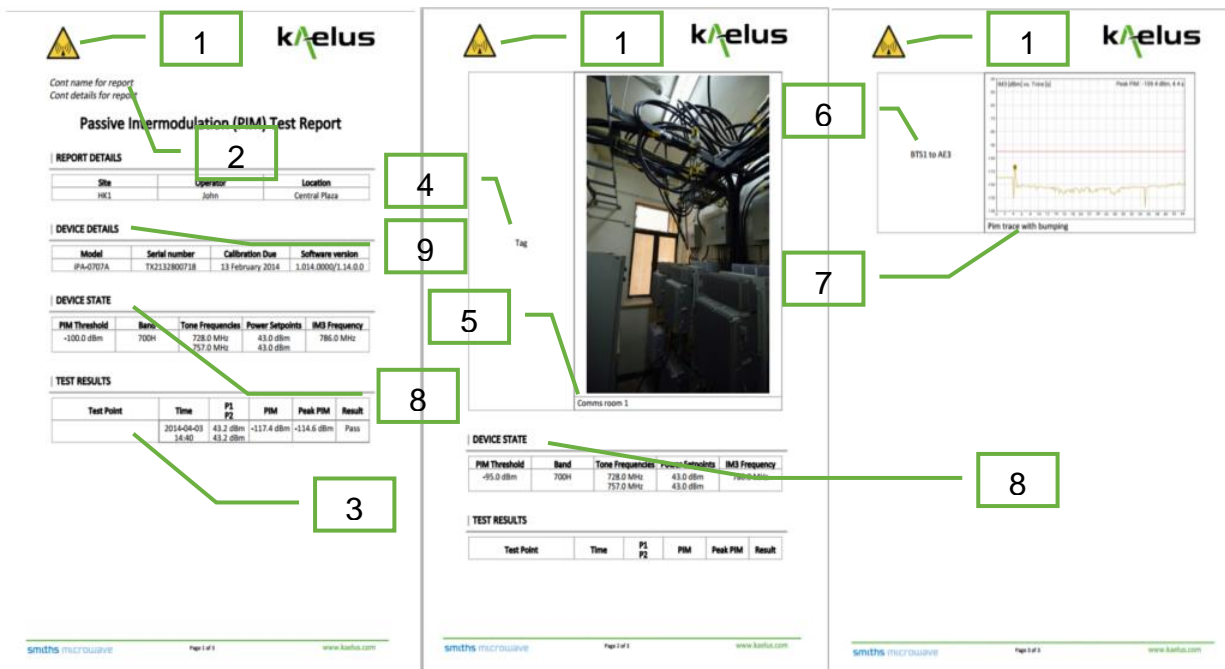


Figure 54: PDF Report layout

1. Contractor Logo
2. Contractor name and details
3. Recorded test result
4. Photo tag/s
5. Photo comment
6. Plot tag/s
7. Plot comment
8. Device state report header
9. Testing device details

## 2. CONNECTION OPTIONS



**Figure 55: Wi-Fi Connection Options (iPA hotspot)**

1. This is a nice and easy configuration with the iPA in hotspot mode connecting to the Serial number as a network 192.168.0.1 in your browser and kaelusap as a default Wi-Fi password.
2. Easy to remember the same IP address and password every time just the serial number required to connect to the correct iPA.



**Figure 56: Wi-Fi Connection Options (Smartphone hotspot)**

1. This is a nice way to use geolocation services, particularly if your phone also has a GPS (Global Positioning System) receiver built in. Remember to setup your phone to share it's location.
2. You should check that your smartphone is able to establish it's own location first, the iPA will then be able to share that location in it's reports if geolocation is enabled.
3. Note : the geotag switch is only visible on devices that browse the iPA .



**Figure 57: Wi-Fi Connection Options (external access point)**

When using this configuration the IP address of the iPA will be the one allocated to it from the access point. This can be checked by scrolling down in the network menu of the local machines screen

1. This configuration has a number of advantages when connecting many devices, the access point can now take some of the Wi-Fi traffic load improving response times.
2. The access point features can be used for additional functionality such as allocating fixed addresses. Allowing shortcuts or bookmarks to connect to each iPA.
3. Sharing internet connectivity can assist with Geolocation services.



4. When using this configuration the IP address of the iPA will be the one allocated to it from the access point. This can be checked by scrolling down in the network menu of the local machines screen.
5. The other browsing clients will need to use those allocated IP addresses to connect to the required iPA.
6. If you want to browse the iPA from either the internet or intranet the access point will need to offer an appropriate network address or port translation to connect to the desired iPA.

### 3. GENERAL DETAIL

#### 3.1 GETTING THE BEST FROM THE TEST EQUIPMENT

There are a number of practices that will allow the best to be gained from the IM test system, especially for taking PIM measurements.

##### Connector & Cable Care

- Good quality connectors and test cables are essential for making PIM and return loss measurements
- Take good care of the RF connectors on the test port and the test cable. Do avoid damaging the connectors in transit
- Remove O-rings from all test equipment adapters and test leads. This will reduce the torque required to achieve a tight, low PIM connection during test and extend the life of the connectors. (Do not remove O-rings from the site jumper cables)
- Care should be taken when mating a cable to the test port on the test set. Ensure the mating surfaces line-up correctly, and the coupling nut does not cross thread. Tighten the locking nut by hand initially, and then only do a final torque using a spanner. If a torque spanner is used, torque the 7-16 connector to a maximum of 25 Nm; otherwise ensure that the connector is firmly fastened. DO NOT allow the body of the connector to rotate. DO NOT over-torque these as this can cause permanent damage to the connector.
- Ensure that the relevant connectors are cleaned regularly as lack of cleanliness can cause PIM problems
- A cleaning kit is supplied within the accessories kit for this purpose. Clean connector mating surfaces using a cotton bud and an isopropyl wipe to remove dirt, dust & small metal filings
- The connection of the cable screen to the connector is a major cause of PIM problems, so observe connector assembly instructions closely if constructing your own
- Do not allow the body of the connector to rotate while tightening
- Keep protective caps installed on RF connectors whenever they are not in use
- RF connectors have a finite life and are typically rated for 500 mate / de-mate cycles by connector manufacturers. Longer life is achievable with proper Care

## Making PIM Measurements

- PIM measurements made by the test set are affected by all items attached to the test port. This includes the test cable, the device under test and any terminations.
- Be aware that high power resistive loads are known to have poor PIM in the region of -60 to -80 dBm for two +43 dBm tones. Choice of RF load type is important and cable loads are preferred for good PIM performance.
- Not all test cables are suitable for taking good quality PIM measurements.
- All isolators and circulators are known to be a source of poor PIM performance in the region of -50 dBm for two +43 dBm tones.
- If constructing your own cables, the major sources of PIM are in the connectors, the connection of the Outer Conductor of the coax to the connector and the Outer conductor itself. Observe connector assembly instructions closely.
- PIM measurement must be taken under conditions that simulate the physical stresses that apply in the installation environment, and the recorded results can only be regarded as relevant if this stress is applied during the test sequence. International standard IEC37065 provides guidance on this matter.

## General Tips and Caution

- Correctly terminate components to measure best return loss
- When not carrying out measurements, switch the RF Output Power OFF, for safety reasons
- When connecting or disconnecting from the measurement port, switch the RF Output Power OFF

## 3.2 SAFETY FEATURES

There are several features to enhance the tester's safety and prevent damage to the instrument. It is important that the operator is aware of these built-in features.

### 1. Auto-Power Off

The RF power is on a 'Power Timer' which is set up in the Timer menu. The maximum time the power can be on at any time is 90 Seconds. This is an added feature to prevent power being left on for an indefinite time.

### 2. Fuses

The iPA has a 4 Amp fuse on the internal DC bus to protect the internal circuitry. This fuse is not User Accessible.

### 3. Battery Over-temperature shutdown

The battery has inbuilt hardware over temperature protection. When the battery reports more than 50 Deg C, the iPA software suspends charging until the temperature drops.

### 4. Local Exclusive Control

On the local control panel the instrument can be set to Local exclusive control. This prevents any connected remote control from operating the RF on Control, while changing cables and configurations.

## 3.3 ACCESSORIES KITS

Accessory kits are provided with iPAs and include the basic tools, cables, connectors, and adapters etc. to do PIM testing in the field. Users are encouraged to contact iPA service centers to discuss the specific requirements and configurations of these accessory kits.

## 3.4 HANDLING AND TRANSPORT

- The equipment is designed for rugged handling, but it remains a precision test instrument and should be handled with care
- Do ship the equipment in a padded external box where possible
- Use a lock or external straps to secure both IM tester and accessories kit
- Airfreight is allowed as there are no dangerous items contained within the iPA (but battery packs should be transported in accordance with Airline Company regulations).
- Transport via road freight is preferred to air freight due to care of handling

## 3.5 CLEANING THE EQUIPMENT

Before commencing any cleaning, switch off the equipment. We recommend that the exterior surface of the equipment case is cleaned using a soft cloth moistened in water. Do not use aerosol or liquid solvent cleaners.

To prevent damage to the internal panel, care should be taken not to scratch the surface during use and also when cleaning. To prevent the access of moisture and lint into the device, we recommend that the internal panels and instruction sheets should be cleaned by wiping with a slightly damp, lint-free cloth gently over the surface.

### 3.6 EXTERNAL CHARGER

External Charger is sold separately with Various accessory kits and has specific details for it's use in user manual R99-0092-BATTERY\_CRADLE\_OPERATING\_MANUAL



Figure 58: External Battery charger (Optional)

### 3.7 RTF ( Range To Fault ) Unit

RTF unit is sold separately with Various accessory kits and has specific details for it's use in user manual R99-0068-RTF\_A-SERIES\_OPERATING\_MANUAL



Figure 59: RTF Range to Fault Unit (Optional)

## 3.8 TROUBLESHOOTING GUIDE

If the remedies indicated in the chart below do not solve the problem, consult the manufacturer for further instructions.

### Power

---

#### No Power upon pressing power switch

- Insert a fully charged battery.
- If the above action does not fix the problem the test set should be returned to a Kaelus/Summitek approved service facility.
- Note : Battery charging occurs when connected to the charger and the iPA is switched ON.

### Operation

---

#### PIM measurements are worse than expected.

- Tester may be defective. Perform RF verification using PIM standard from accessories kit. Check PIM of an external cable load
- Confirm all test rig components are in good condition by separately testing the device or system under test
- Device under test may have poor PIM. Test a device with known PIM performance.
- RF cable may be defective. Try another RF cable or attach an external cable load directly to test port to confirm
- Benchmark against another IM tester

Carrier frequencies are not suitable for antenna feeders using Tower Mounted Amplifiers (TMAs).

- Bypass TMA using cable tail with known PIM. Retest PIM
- Consult manufacturer. Other frequencies can be supplied

#### Carrier frequencies cause interference or regulatory problems.

- Consult manufacturer. Other frequencies can be supplied

#### Buttons Greyed out and not working with remote Tablet PC

- Another remote client may have control. Check the control icon to see you have control. Note : Network settings cannot be changed remotely.
- Some buttons are inhibited during certain functions, changing settings while a test is underway for example.

### Unable to take control with remote Tablet PC

---

- Another Client or the local control screen may have exclusive control. Releasing remote control on the local control screen will take priority over any remote control sessions. This should allow you to take control again.

### Geotag

---

- Geotag data may not be available inside a screened room or where high RF fields are present. Secure your location on your smartphone or Tablet PC before connecting wirelessly to the iPA or entering the screened environment.
- Geotag data is only as good as the information provided by the location service on your Smartphone or Tablet PC. You must allow the application to access your location when prompted.
- Geotag service providers can gather geo data from several sources. Having more data sources turned on, on your smartphone/Tablet PC being shared with your geotag service provider can improve your chances of an adequate fix. These include GPS (Global Positioning System) switched on and set to share your location (if fitted), Wi-Fi access points that can be received nearby, Cellular Phone tower signals being received nearby for smartphones or phone enabled tablets, and an internet data connection can all assist to get a geotag fix.
- If your smartphone/Tablet PC Wi-Fi is your only Geotag data collection source, get your geotag fix first then use the Wi-Fi to connect to the iPA Hotspot after your location is resolved.

### 3.9 CE Declaration of Conformity

Hereby, **Kaelus Pty Ltd**  
**34 Corporate Drive**  
**Cannon Hill, QLD, 4170**  
**AUSTRALIA**

declares that the following products are in compliance with the essential requirements of Directive 2004/108/EC (EMC Directive) and Directive 2006/95/EC (LVD Directive) if installed and operated in accordance with manufacturer's instructions.

Part Number:	Model Number	Description
IP0707V01B-01N, V01C-01N	iPA0707A	Passive Intermodulation Test Set
IP0850V01A-01N, V01B-01N, V01C-01N	iPA0850A	Passive Intermodulation Test Set
IP0900V01A-01N, V01B-01N	iPA0900A	Passive Intermodulation Test Set
IP0901V01B-01N	iPA0901A	Passive Intermodulation Test Set
IP1800V01A-01N, V01B-01N, V01C-01N	iPA1800A	Passive Intermodulation Test Set
IP1900V01A-01N, V01B-01N	iPA1900A	Passive Intermodulation Test Set
IP1921V01B-01N	iPA1921A	Passive Intermodulation Test Set

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

Referenced EMC Standard:	
EN 61326-1:2006	EN 61000-4-4
EN 61326-2-1:2006	EN 61000-4-5
EN 55022:2010 "Class A"	EN 61000-4-6
EN 61000-4-2	EN 61000-4-11
EN 61000-4-3	
Referenced Safety Standard:	
EN 61010-1:2010	EN 61010-030:2010



The design, development and manufacturing of Kaelus Pty Ltd products are controlled by an ISO 9001:2008 certified Quality Management System.  
Authorised representation within the EU is

Kaelus, 1 Aquarius Court, Viking Way, Rosyth, Scotland, KY11 2DW

Signed by the manufacturer at 34 Corporate Drive, Cannon Hill, QLD, Australia 4170 (the location of the technical file),

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**Christine Blair**  
**Engineering Director**  
**Kaelus Pty Ltd**  
**2<sup>nd</sup> March 2014**  
**ID: EUTA2036A1**



### 3.10 END OF LIFE STATEMENT

Equipment marked with the symbol below (Crossed Out Wheelie Bin) complies with the European Parliament and Council Directive 2002/96/EC (the “WEEE Directive”) in the European Union.



Please contact your local Kaelus representative (see next section) at the end of the product’s useful life to arrange its disposal in accordance with your local regulations.

### 3.11 CONTACTS

Kaelus has service center locations globally. Please visit <http://www.kaelus.com/Contact-Us/Locations/> to find the service center nearest you.

When ringing, ask for IM tester support (technical or otherwise) & quote the relevant part numbers.

Send feedback to: [info@Kaelus.com](mailto:info@Kaelus.com)