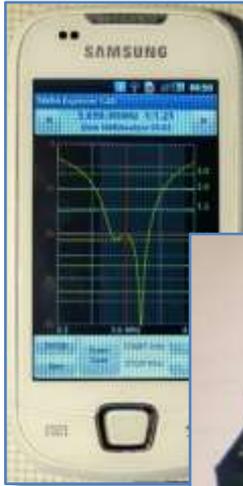




# Fox Delta

Amateur Radio  
Projects & Kits



GALAXY Mini I5800



SWRA & BT adapter

Samsung GT-3110  
Tablet 2 7"



January 2015

## Index

1	Project description	3
2	Getting started	5
2.1	SWRA Board AAZ-0914A	5
2.1.1	SWRA AAZ-0914A power supply	7
2.1.2	Testing the Bluetooth Add-on Module	8
2.2	SWRA Board before AAZ-0914A	10
2.2.1	Modify the SWRA Board	10
2.2.2	Bluetooth Adapter	12
2.2.3	Testing the BT Adapter	14
2.3	Installing SWRA Android application	15
3	SWRA for Android	17
3.1	Running the antenna analysis	20
3.1.1	Start and Stop Frequency	21
3.1.2	Direct keyboard entry	22
3.1.3	Thumb buttons entry	23
3.2	Measuring cursor	24
3.3	Scanning modes	25
3.4	Noise filter settings	26
3.5	Starting and Stopping a Scan	27
3.6	Saving the scan data	28
3.6.1	Export CSV file	29
3.6.2	Saving to SWRA pic's permanent memory	31
3.7	The Generator utility	32
3.8	Exiting the application	33
3.9	Parameters setting	34
4	Analyzing the scan results on PC	35
4.1	Import from SWRA board	35
4.2	Importing a CSV file	36

## 1 Project description

This document describes how the **SWR Analyzer (SWRA)** can work with an ANDROID device such as a **Smartphone or Tablet**, enabling antenna performance measurements to be made by **connecting the analyzer via a Bluetooth link to a portable Android terminal without the need for a PC. The BT add-on and SWRA require an auxiliary power supply for this mode of operation.**

Using SWRA with a portable terminal is very useful for tuning antennas quickly for mobile operations, portable field days, or even aloft at the top of the tower. Results can be obtained quickly and stored for future reference without the need for a cumbersome pc/laptop to drive the SWRA handle.

### H/W Requirements

#### **SWRA AAZ-0914A**

- SWRA unit with f/w **v6.02 or later.**
- Bluetooth add-on AAZ-0914A-BT2
- A 9-12V 500mA power supply
- A portable terminal (smartphone or tablet) running Android (v. Froyo or later)

#### **SWRA versions before AAZ-0914A**

- Modified SWRA unit as per paragraph 2, with f/w **v6.02 or later.**
- A Bluetooth (BT) adapter.
- A cable to connect SWRA to the Bluetooth adapter and 9-12V 500mA power supply.
- A portable terminal (smartphone or tablet) running Android (v. Froyo or later)

### S/W Requirement

- SWRA Analyzer.exe Windows software v 6.02 or later
- SWRA.apk application for Android devices v1.07 or later.

### **IMPORTANT NOTE**

***A Windows PC is still required to calibrate the SWRA board and optionally to make more detailed analysis on data collected by the portable device.***

During measurements SWRA Android version applies a simple **average offset** while PC uses the **linear regression** methodology, that is the offset applied to the measurement is computed by interpolating the values stored by a table "Frequency / 0dB".

Both table values (used by PC) and average 0dB offset (used by SWRA Android) are calculated during the PC calibration process. Currently the Android application cannot calibrate the SWRA. This is why the calibration must be done on the PC before the portable device can use the SWRA for scanning.

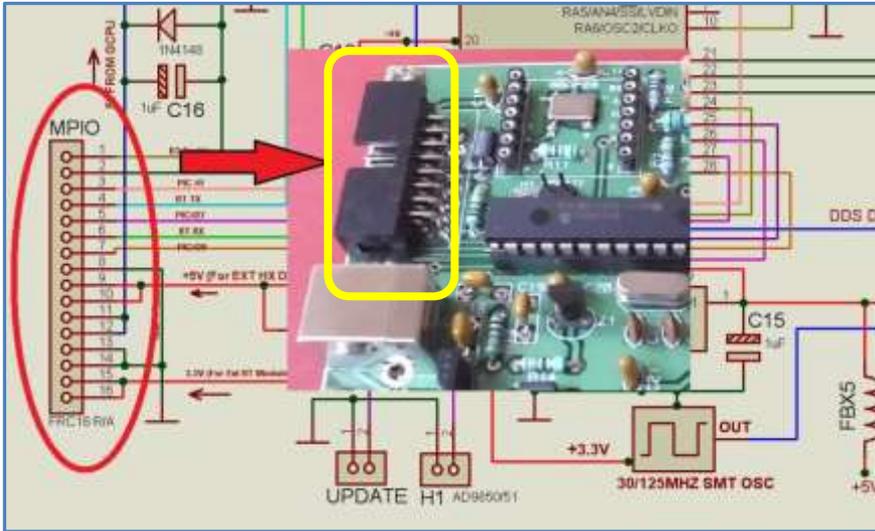
My special thanks go to Mario G8ODE, Tom WA4TA and Frank K7SFN for the time they dedicated helping me to test and improve this piece of software, as well as to Dinesh, VU2FD for the kit's design allowing our fellow radio hams to easily assemble this analyzer.

Tony, I2TZK

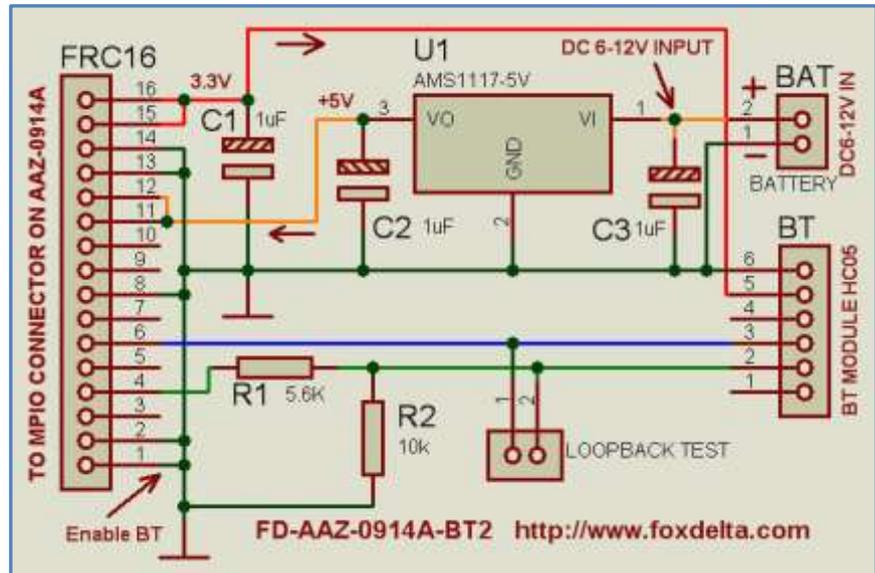
## 2 Getting started

### 2.1 SWRA Board AAZ-0914A

The AAZ-0914A SWR Analyzer hosts a FRC16 connector designed to expand the Analyzer's features.



The add-on board **AAZ-0914A-BT2** allows the SWRA to connect a portable Android terminal or a Windows Laptop via a Bluetooth link instead of the USB port.



Please insert in the FRC16 connector the optional module AAZ-0914-BT2 Bluetooth.



The Bluetooth Module can be powered from AAZ-0914A or from an external power supply and ***it is automatically recognized by the SWRA firmware v6.02 that disables the USB port and activates the Bluetooth*** communication channel.

### 2.1.1 SWRA AAZ-0914A power supply

While using Bluetooth function, it is assumed that the USB power is not available and external power will be required to power AAZ-0914A and BT module.

This is achieved by providing Battery Connection on this board. DC 6 to 12V may be applied to power AAZ and BT module.



Do not forget to proper positioning the SWRA AAZ-0914A **"POWER" jumper** (refer to the "AAZ-0914A Tech info document" for details).



## 2.1.2 Testing the Bluetooth Add-on Module

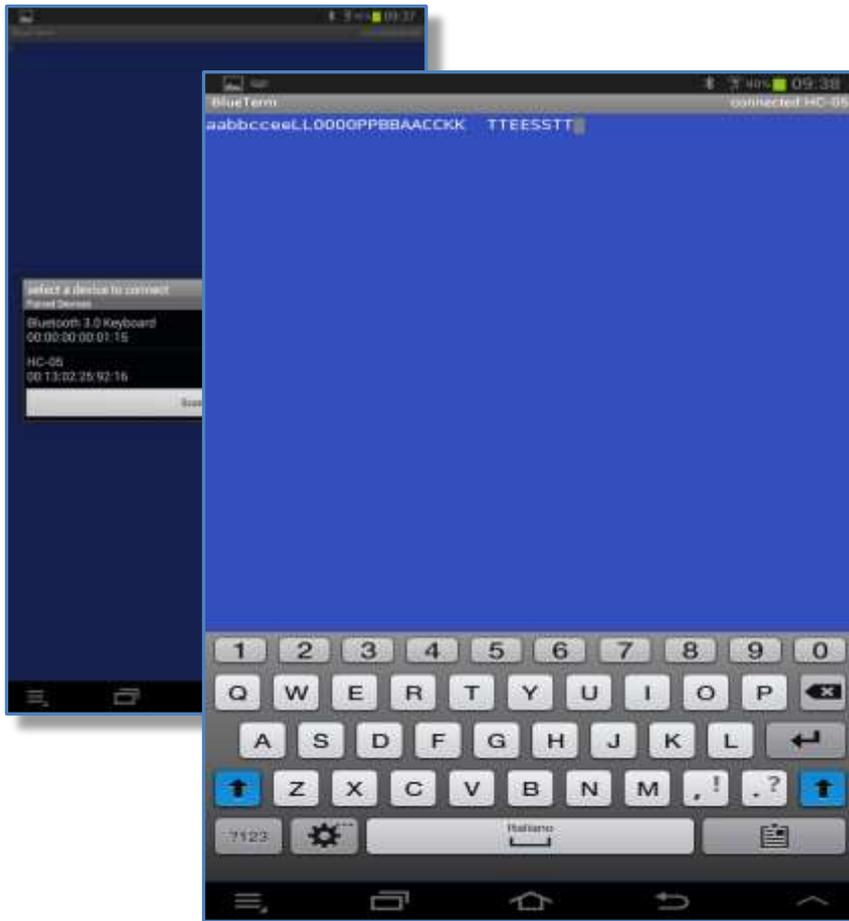
A “loop-back” test is used to verify that the Bluetooth module is correctly working.

This test connects the BT Adapter **transmit** pin to its **receive** pin, so that the terminal software sees an echo of every character that is sent. The test requires a laptop or a desktop with a BT port, or Smart phone or Tablet using terminal emulation software.

1. On the BT adapter AAZ-0914A-BT2 a header labeled “LB” is available for this test. Short the header.



2. Connect and *pair* the BT Adapter to your PC/Smartphone using the 4-digit code specific for the BT module version. The most common code is 1234 for pairing code and HC-05 or HC-06 for ID modules. However, refer to datasheet of the module that is used
3. Run any “Bluetooth terminal” application. Google Play, Amazon Store and similar websites offer many free “Terminal Emulator for Bluetooth” Apps.
4. A good choice is “Bluetooth Terminal” it’s simple and easy to install and use.
5. Connect and *pair* the BT module and verify that all the characters you enter from the terminal keyboard are transmitted and echoed back on the Android device’s screen.



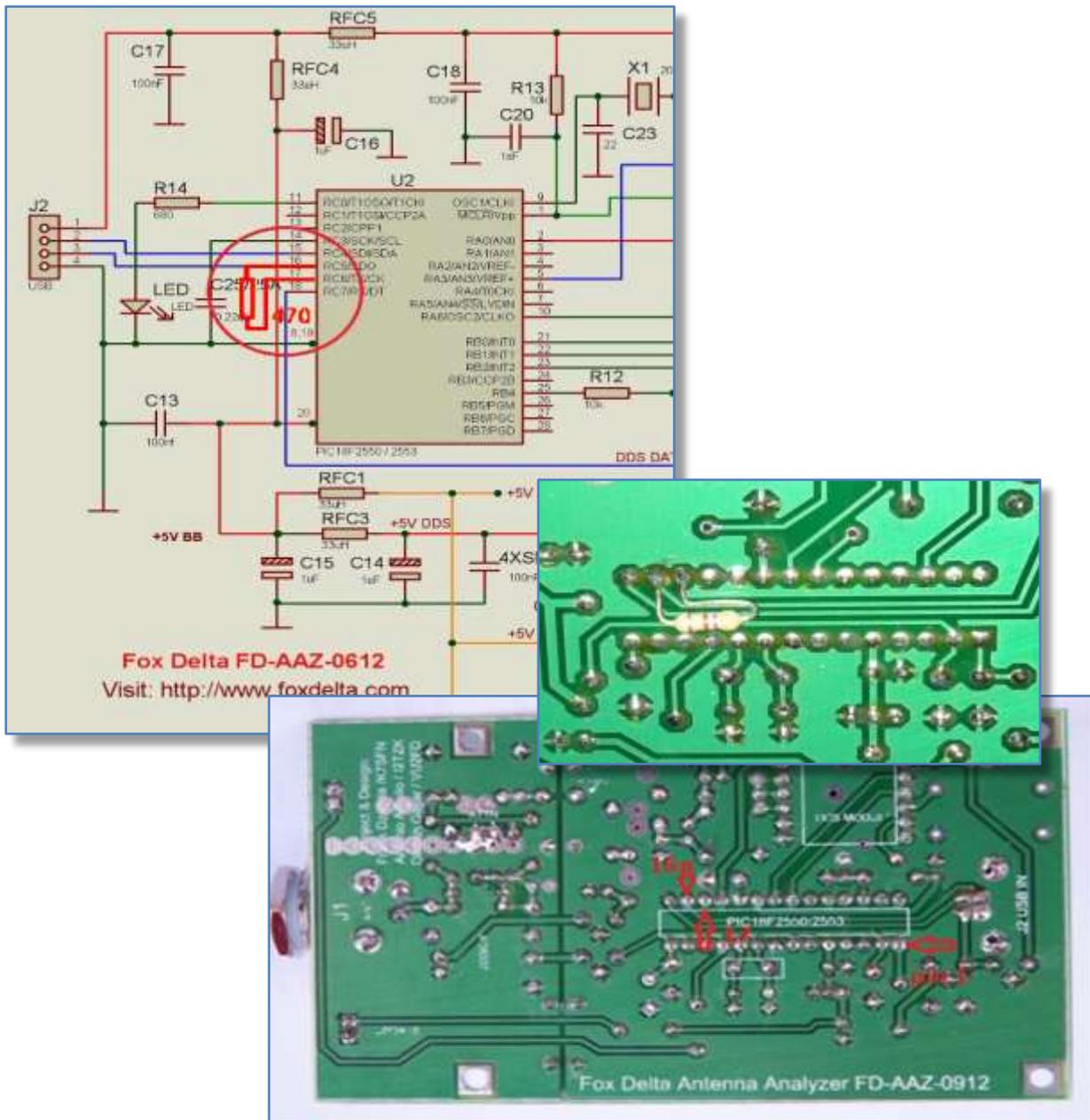
Notice that all characters are shown twice (echoed).

The first character is what is sent from the terminal keyboard and the second is the BT echoed character.

## 2.2 SWRA Board before AAZ-0914A

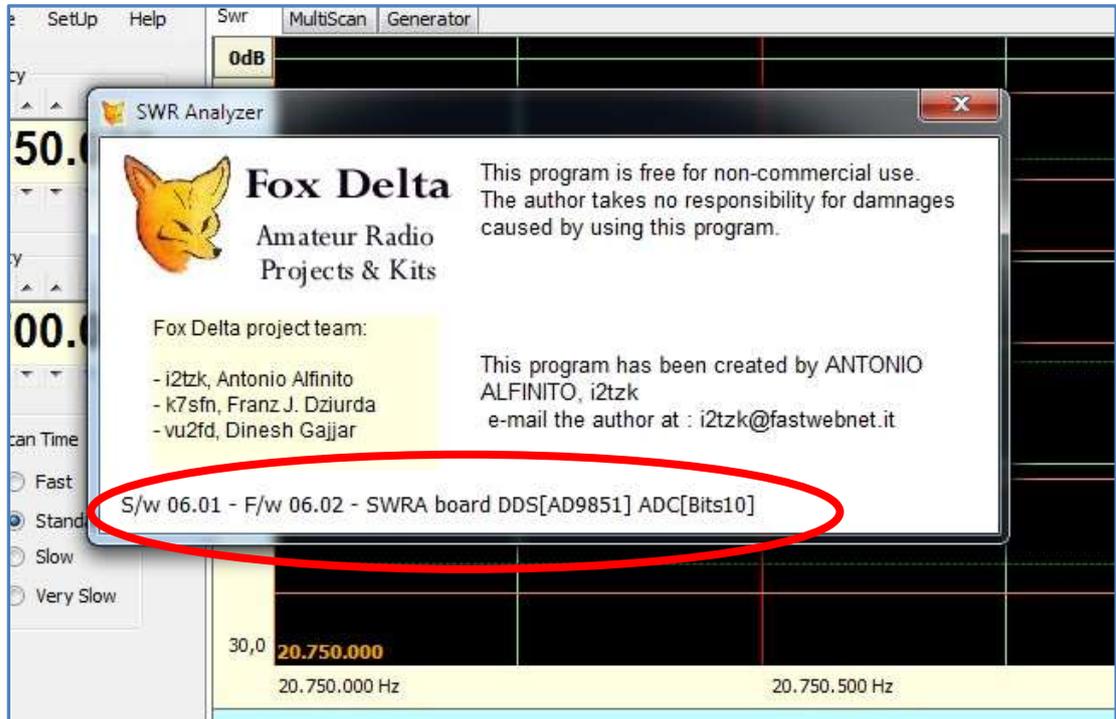
### 2.2.1 Modify the SWRA Board

- Modify the SWRA board by adding a 470 ohm 0.25W resistor between pins 16 & 17 of the Pic 18F2550. This mod is applies to all Fox Delta kits made before the version labeled **AAZ-0713**, this and following versions already include this modification.



- Update the 18F2550 pic f/w to v6.02 or later
- Update also the Windows program to v6.02 or later

Please refer to **“SWRA USB Update”** documentation for detailed instructions.

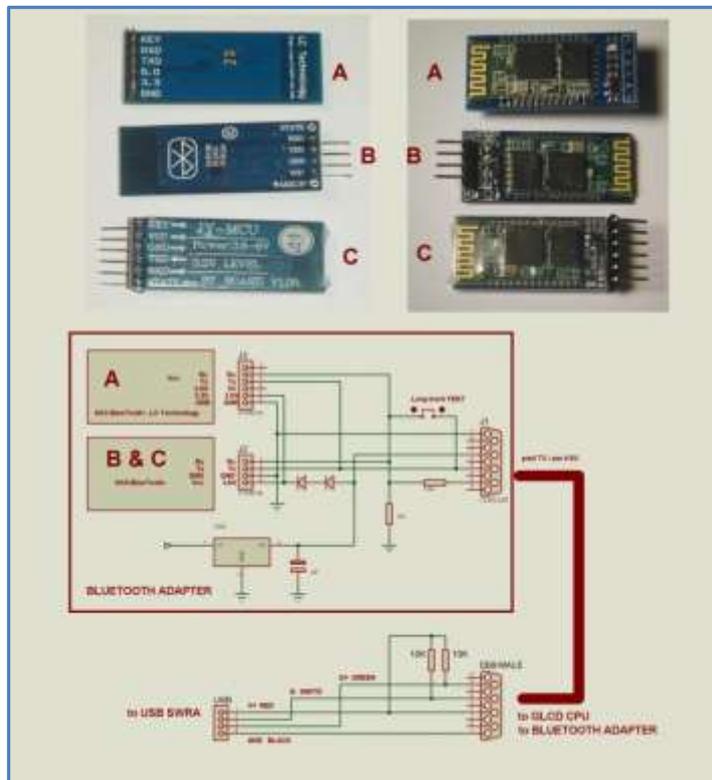


After updating the f/w, connect the SWRA board to the PC using a USB cable

- Verify that the correct f/w version is installed
- **CALIBRATE** the SWRA board by following the on-screen prompts.

## 2.2.2 Bluetooth Adapter

The BT Adapter uses an already assembled Bluetooth module. The photographs below show three of the several models commercially available.



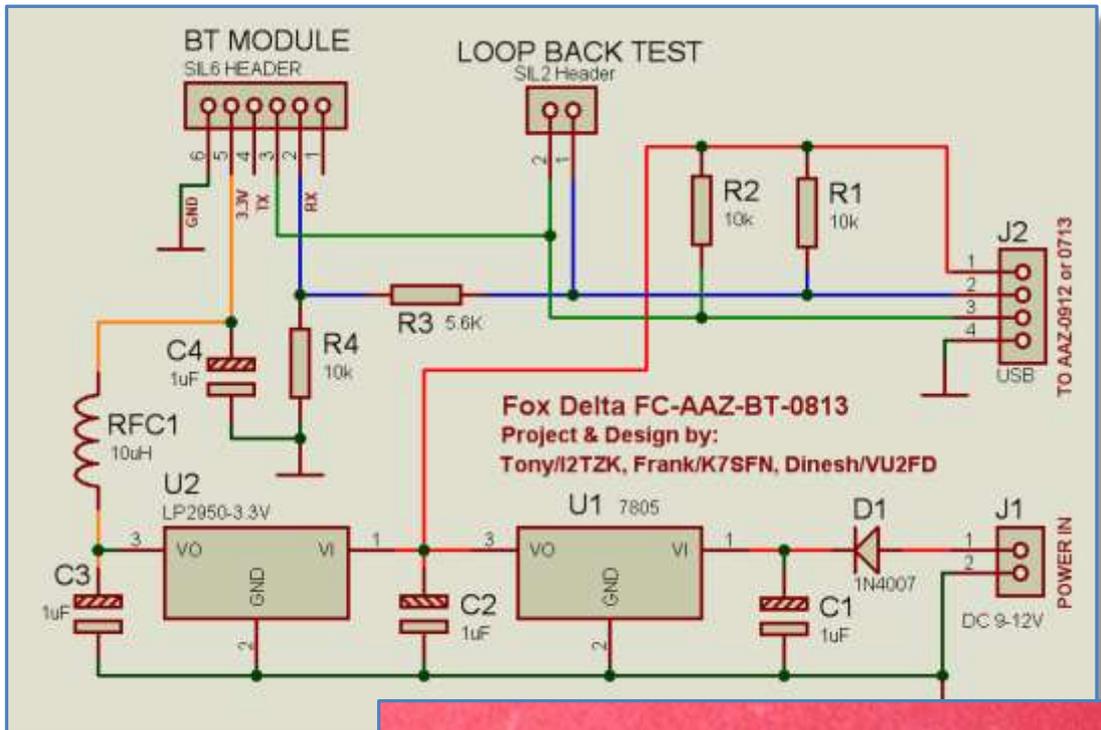
The schematic on the left caters for three different manufacturer's versions of the BT module.

The special purpose USB-DB9 cable designed for connecting the Graphic CPU (see FoxDelta web site) to the PC is used.

Photograph of Mario's, G8ODE BT prototype adapter used for very first tests.



Dinesh, VU2FD electric schematic below uses a standard USB –Printer cable (please refer to [www.foxdelta.com](http://www.foxdelta.com)) to connect the adapter to the SWRA board.



Photograph of the FoxDelta Kit AAZ-BT-0813 BT adapter



### 2.2.3 Testing the BT Adapter

A “loop-back” test is used to verify that the Bluetooth module is working correctly.

This test connects the BT Adapter **transmit** pin to its **receive** pin, so that the terminal software sees an echo of every character that is sent. The test requires a laptop or a desktop with a BT or using a USB BT adapter, or Smart phone or tablet using terminal emulation software.

Apply a shorting loop as shown in the photograph.

1. On the DB9 connector the RX is pin 9, and TX pin 8. Use a small paperclip that is cut done in size for this test.
2. On the FoxDelta BT adapter a jumper is used to do this.



3. Connect and **pair** the BT Adapter to your PC/Smartphone using the 4-digit code specific for the BT module version. The most common code is **1234** for pairing code and HC-05 or HC-06 for ID modules. However, refer to datasheet of the module that is used.
4. Run any “Bluetooth terminal” application. Google Play, Amazon Store and similar websites offer many free “Terminal Emulator for Bluetooth” Apps.
5. Connect the BT Adapter and verify that all the characters you enter from the terminal keyboard are transmitted and echoed back on the Android device’s screen.

## 2.3 Installing “SWRA Analyzer” Android application

Copy the file “SWRA.apk” to the SD Memory card of your portable terminal or download it from the FoxDelta server.



...\\Download\\i2tzk.SWRA  
and copy the application  
into the folder.

Navigate to the folder where the application has been copied and install it by clicking on the icon.

Android security settings may ask for permission to install a program from an unknown source. It may be necessary to temporarily change the settings in Smartphones Set-Up before the program installs. To protect your privacy & security, remember to reset the permissions to block programs from unknown sources again.

“SWRA.apk” asks for  
following permissions:



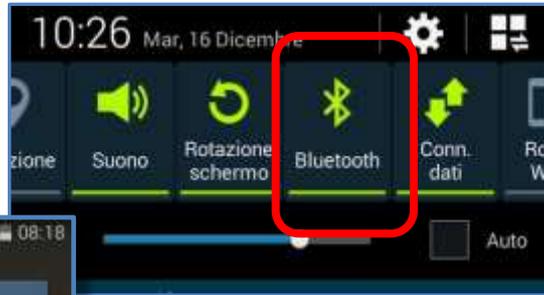
Installation successfully executed.



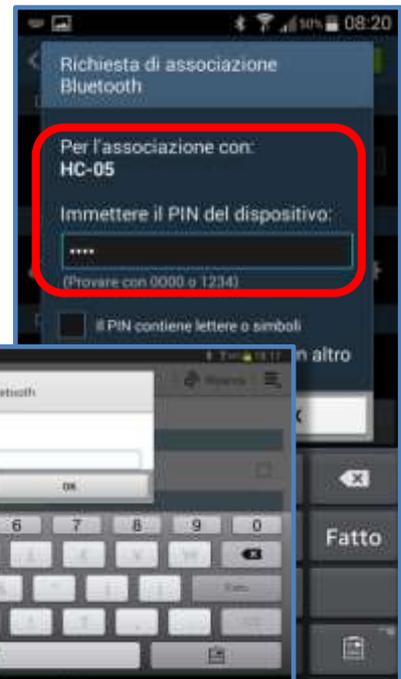
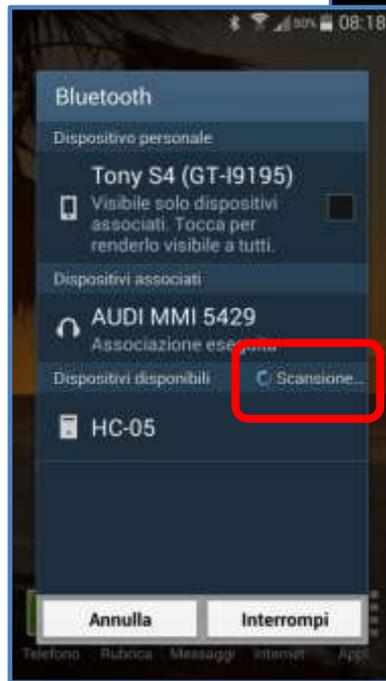
### 3 SWRA for Android

If this is the first time you're using SWRA, or it has been previously unpaired/removed, before to run "SWRA.apk", please run the Bluetooth discovery service from the Setting/Configuration menu of your terminal, identify your BT Adapter and enter the pairing code (PIN).

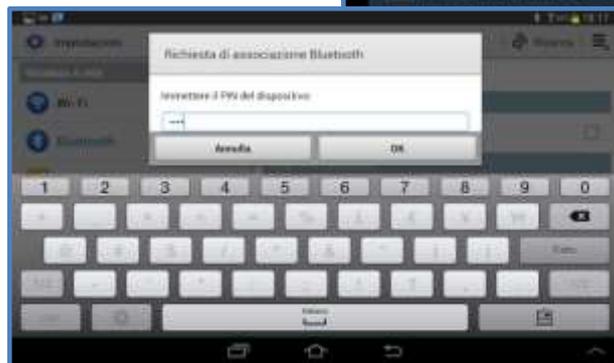
- enable the Bluetooth module



- Scan searching for SWRA BT (HC5 or HC6)



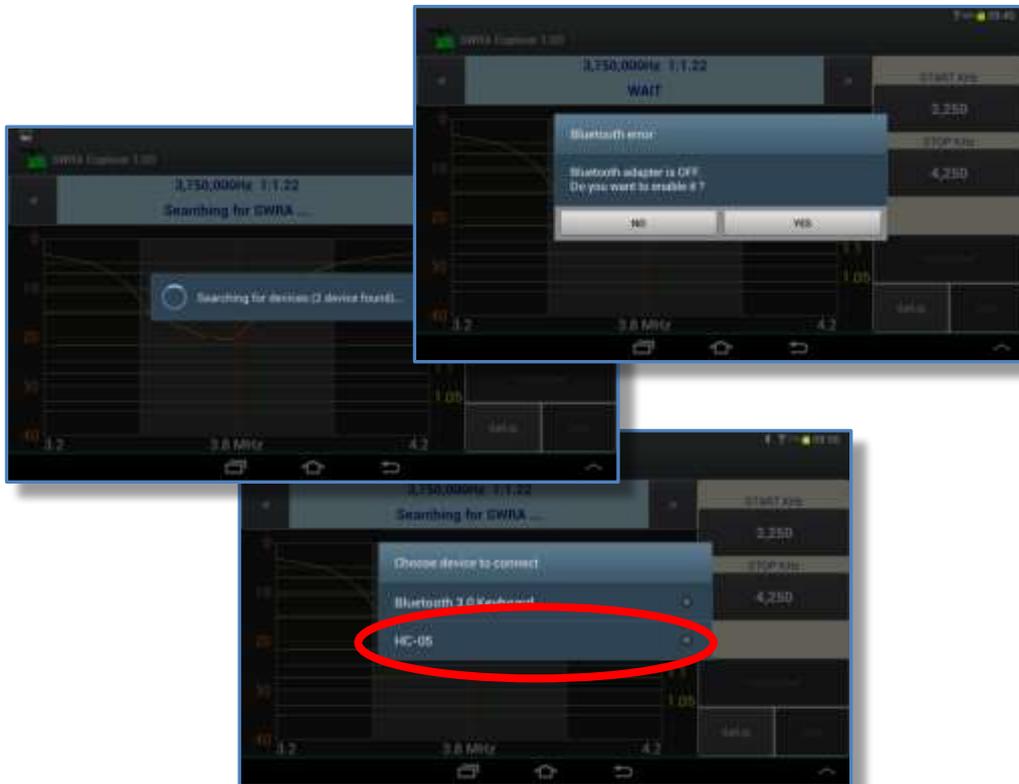
- pair SWRA BT module with your portable terminal.



The most common pairing code is "1234" and is used by the "HC-05" (or "HC-06") modules. However, this may vary with different manufacturers. So please refer to their data sheet.

Touch the  icon to run SWR Analyzer,

The first time App runs it asks you to choose which device it has to connect to.



In the screenshot above this is the HC-05 device.

The following screenshots show the sequence to connect the SWRA board:



### 3.1 Running the antenna analysis

By default , launching “SWRA.apk” the last saved analysis is shown, if this is the first time you run the application or you have never saved an analysis, the default graph I2TZK 80m scan is displayed.

“SetUp” includes the option: “Restore last graphic”, this enables/disables this feature.

#### **IMPORTANT**

***Before to run any Antenna analysis, be sure the SWRA board has been previously calibrated.***

During measurements SWRA Android version applies a simple average offset while PC uses the linear regression methodology, that is the offset applied to the measurement is computed by interpolating the values stored by a table “Frequency / 0dB”.

Both table values (used by PC) and average 0dB offset (used by SWRA Android) are ***calculated during the PC calibration process***. Currently the Android application cannot calibrate the SWRA. This is why the calibration must be done on the PC before the portable device can use the SWRA for scanning.

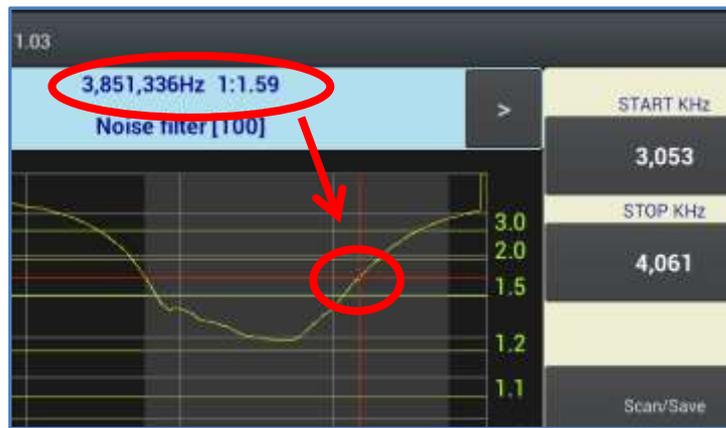
### 3.1.1 Start and Stop Frequency

Two modes are available to entry the frequency scan limit:

- Direct Keyboard Entry
- Thumb Buttons Frequency Entry

On both input mode, the **frequencies for the Start and Stop values must be entered in kHz**. However, the application operates with a 1 Hz frequency resolution enabling the measuring cursor to display the precise value of any point on the scan's trace.

Graphic banner displays the frequency at the cursor position, which is highlighted in the screenshot. This shows the frequency as **3,851,336 Hz** and the corresponding value for the SWR as 1:1.59 .

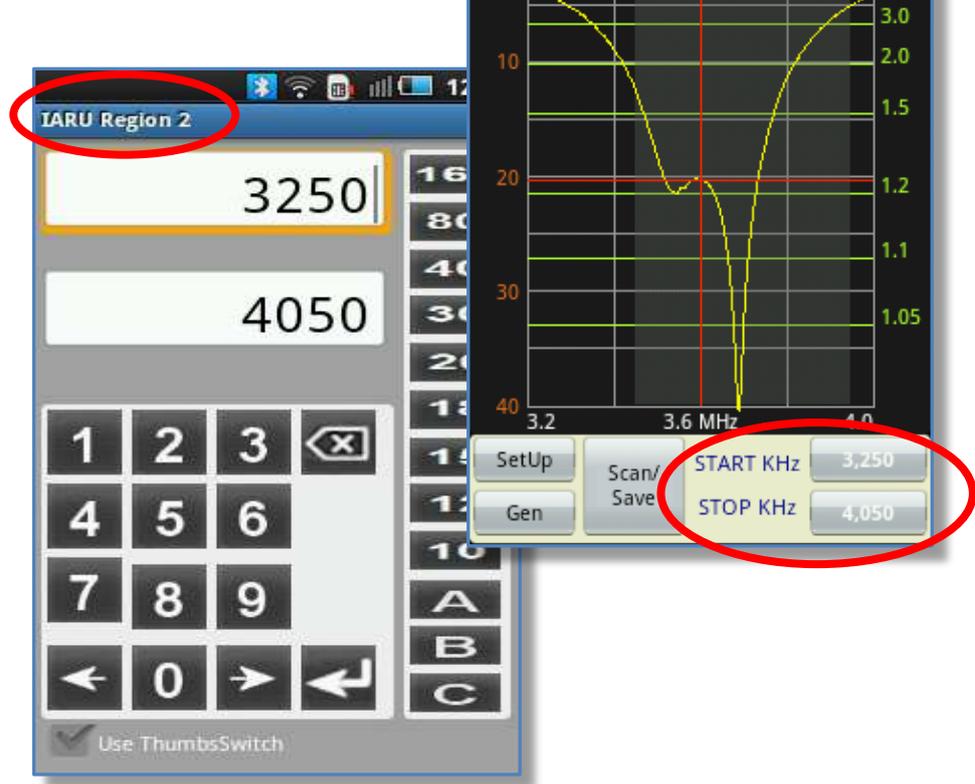


### 3.1.2 Direct keyboard entry

Touch "START kHz" or "STOP kHz" to enter the scan frequency limits.

Enter the "START" and "STOP" frequencies by first erasing the frequency using the "X" button, then touching the digits on the keyboard or by selecting the band button on the right of the screen.

**Frequencies must be entered in KHz.**



The App checks the Max and Min values entered, "Set Up" allows to change the frequency limits.

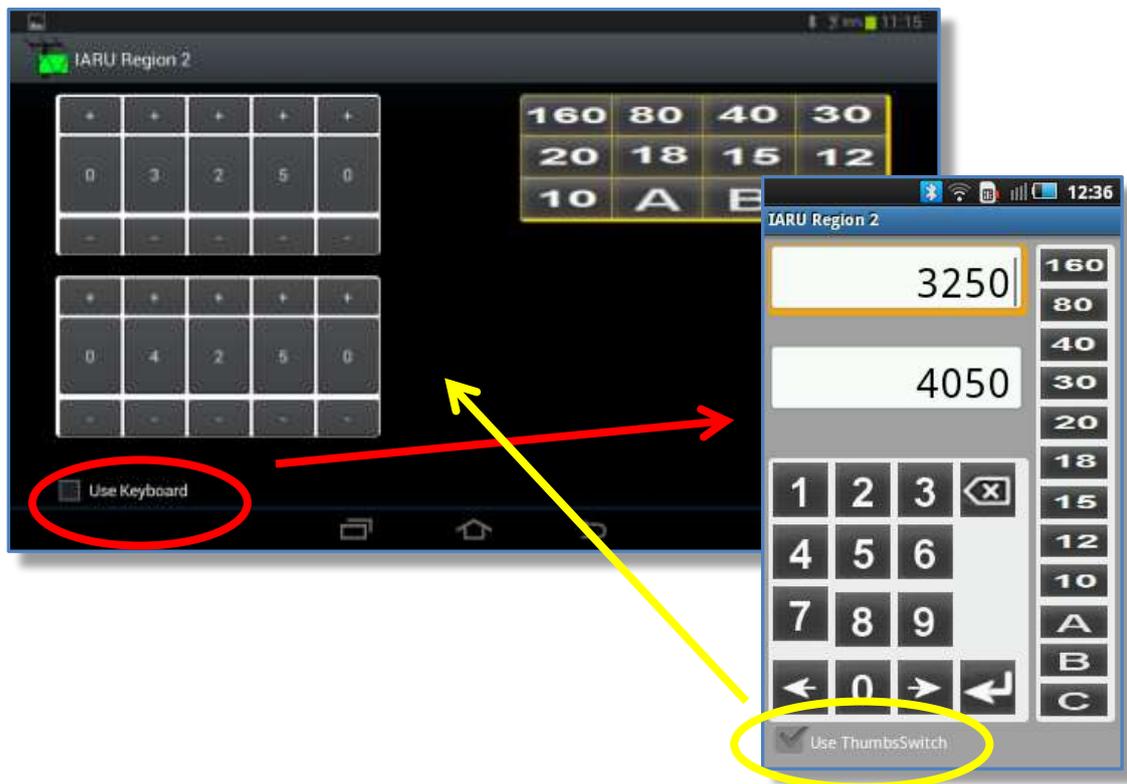
**NB. New Start and Stop values only take effect and appear on the graph after the scan is started.**

### 3.1.3 Thumb buttons entry

The Frequencies are changed using the “thumb buttons” above and below each digit.

Touch “+” to increment or “-” to decrement each digit value.

For ease of operation, touch any single digit to clear it to zero.



Each frequency entry screen has a check box to revert to the other frequency input screen.

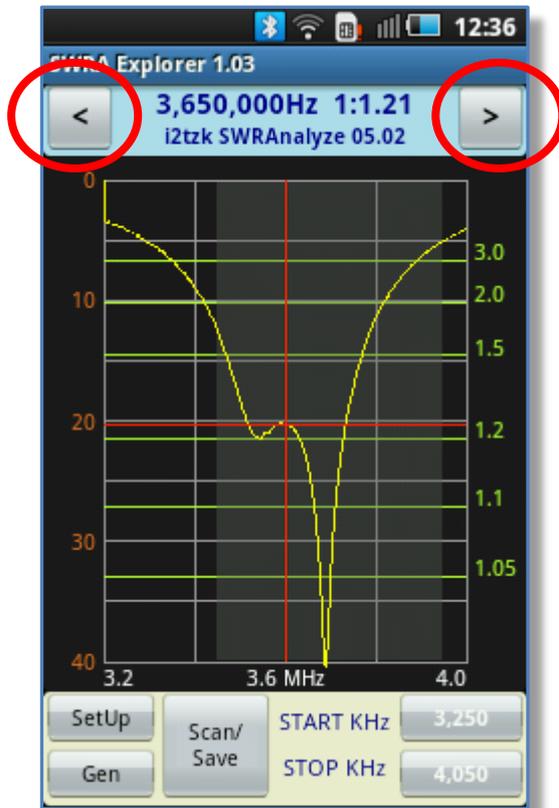
On both input screen's, the frequencies for the ***Start and Stop values must be entered in kHz.*** However, the application operates with a 1 Hz frequency resolution enabling the measuring cursor to display the precise value of any point on the scan's trace.

The App checks the Max and Min values entered, “Set Up” allows to change the frequency limits.

***NB. New Start and Stop values only take effect and appear on the graph after the scan is started.***

### 3.2 Measuring cursor

Move the measuring cursors (red vertical and horizontal lines) by **touching the screen** to where you want to read the scan trace value.

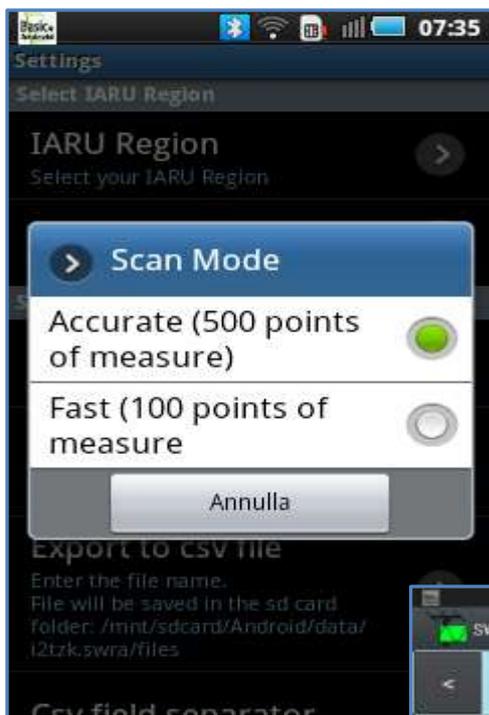


For ***fine precise movements*** of the cursors, use the two chevrons (< and >) either side of the banner.

This moves the cursors by 1 scan step enabling you want to determine the precise value of a particular point on the trace

### 3.3 Scanning modes

Two scanning modes are available in the “SetUp” menu:



**ACCURATE** scanning: the scan cycle measures the SWR of 500 points

**FAST**: the scanning cycle is limited to 100points of measure.



After changing the “Scan Mode” the **application must restart to take effect.**

### **3.4 Noise filter settings**

“SetUp” is where the Noise Filter characteristic is defined.

The default standard value is 100 (Std), the highest filter setting is 255 (Max) and it is disabled with a minimum value of 5 (min) if you want to disable it.

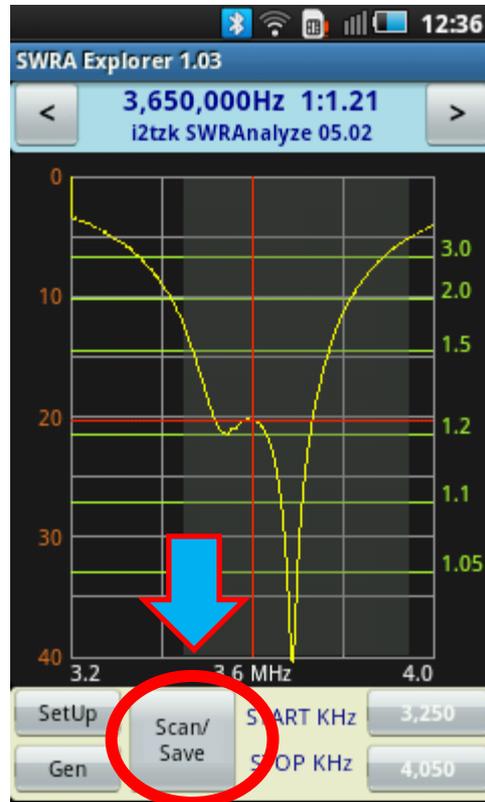
The Noise Filter works by averaging consecutive scans, so this action will slow down the scanning process. Use it only if you are experiencing local noise pickup or receiving strong broadcasts.

### 3.5 Starting and Stopping a Scan

Activate the scan by touching the “Scan/Save” button *momentarily*.

Once the scan starts, the frequency scale is update to any new values if this is the first scan after changing the Start Stop Frequencies of band selection.

The “Stop” appears once a scan starts.  
Touch this button to stop it



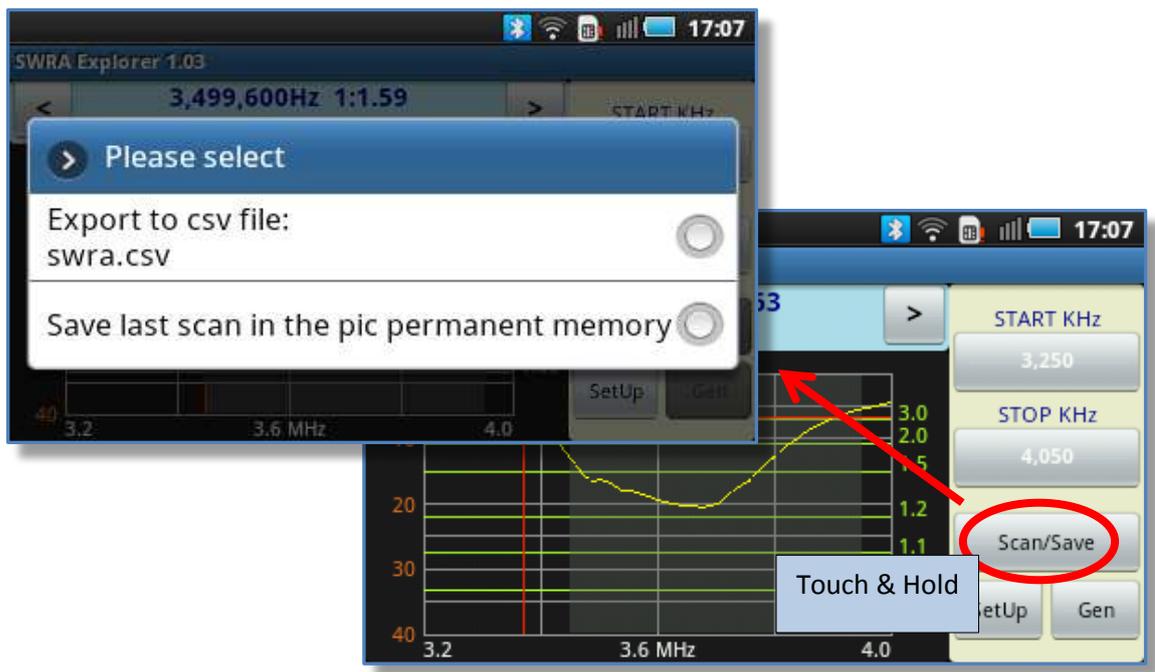
**NB.** Scan/Save button is a **dual purpose** button, **touching and holding** the “save data” mode is selected.

### 3.6 Saving the scan data

Touch and hold the dual purpose “Scan/Save” button to select mode and save data.

The data can be saved in two ways

- Saving the last scan’s data into the SWRA board’s PIC permanent memory
- Exporting the scan data CSV (comma separated values) file into the SD memory card of your portable terminal



The PC program **SWR Analyzer.exe v6.02** provides two functions that enable the scan data to be imported in the scan table for a further analysis:

- Import from the SWRA Board permanent PIC memory
- Import a CSV file

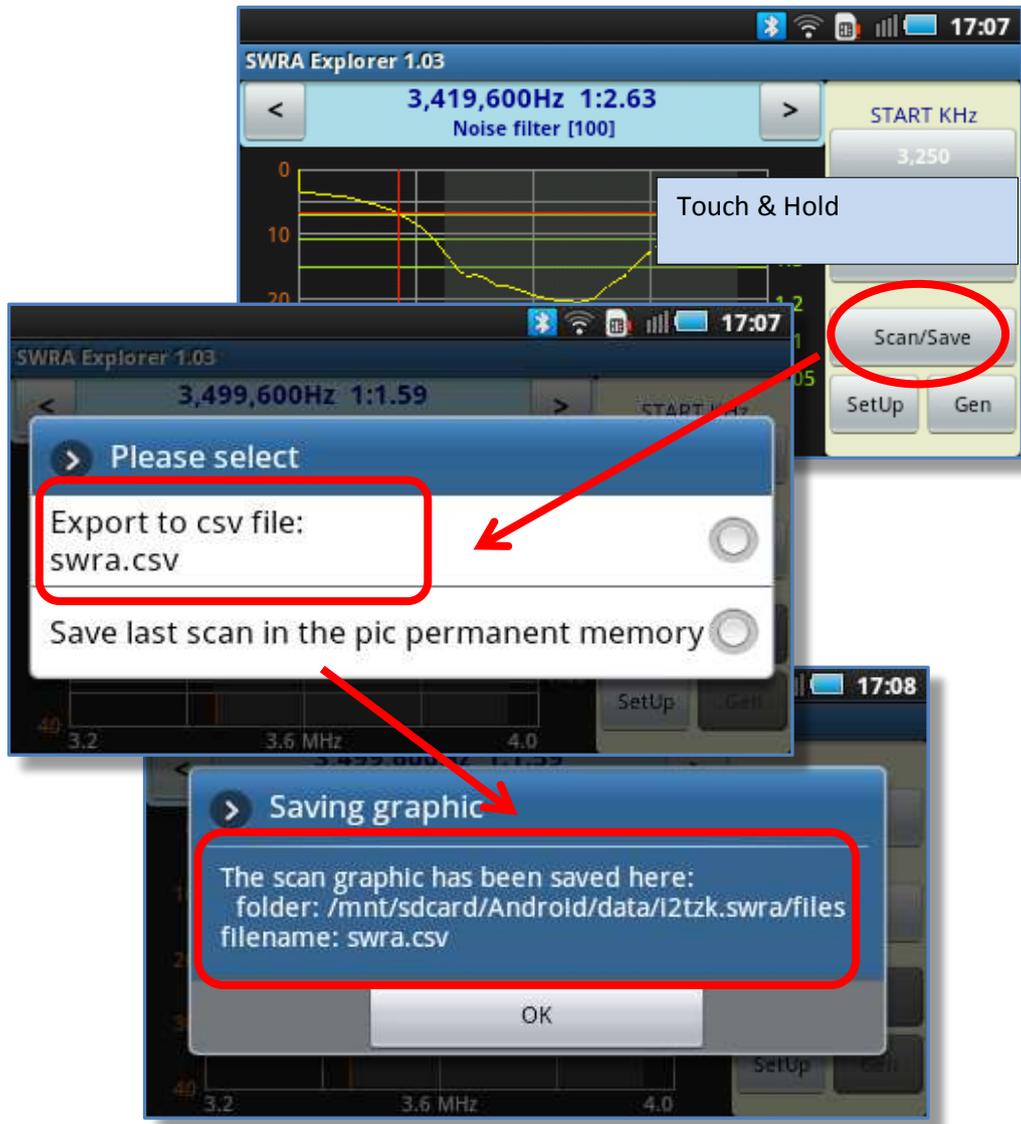
The Android application at start up *automatically imports the last saved CSV file if the option “ACCURATE” scan is selected.* “SetUp” has a check box to disable this feature.

Currently for compatibility with the Windows PC program “SWR Analyzer.exe”, the Android application allows to export/import only graphic saved in “ACCURATE” mode.

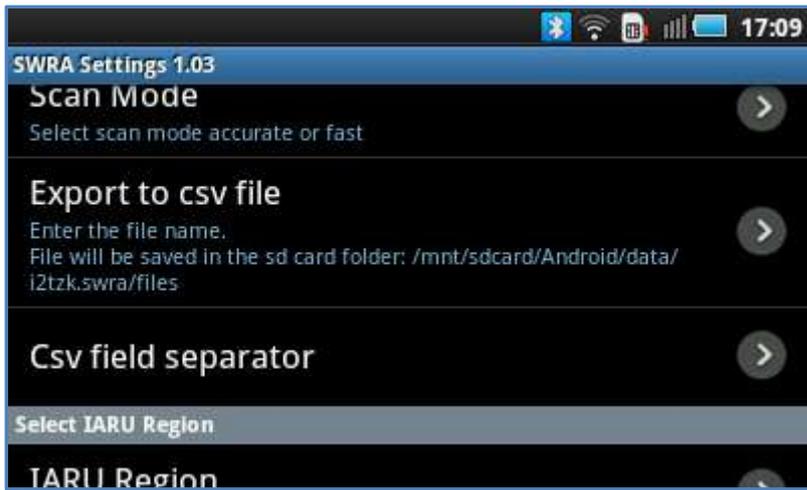
### 3.6.1 Export CSV file

First execute an “**ACCURATE**” scan cycle, **touch and hold the dual purpose** “Scan/Save” button to activate the save/export function, select: “Export to CSV file”.

Filename and the CSV file fields separator can be edited from the “SetUp” function.



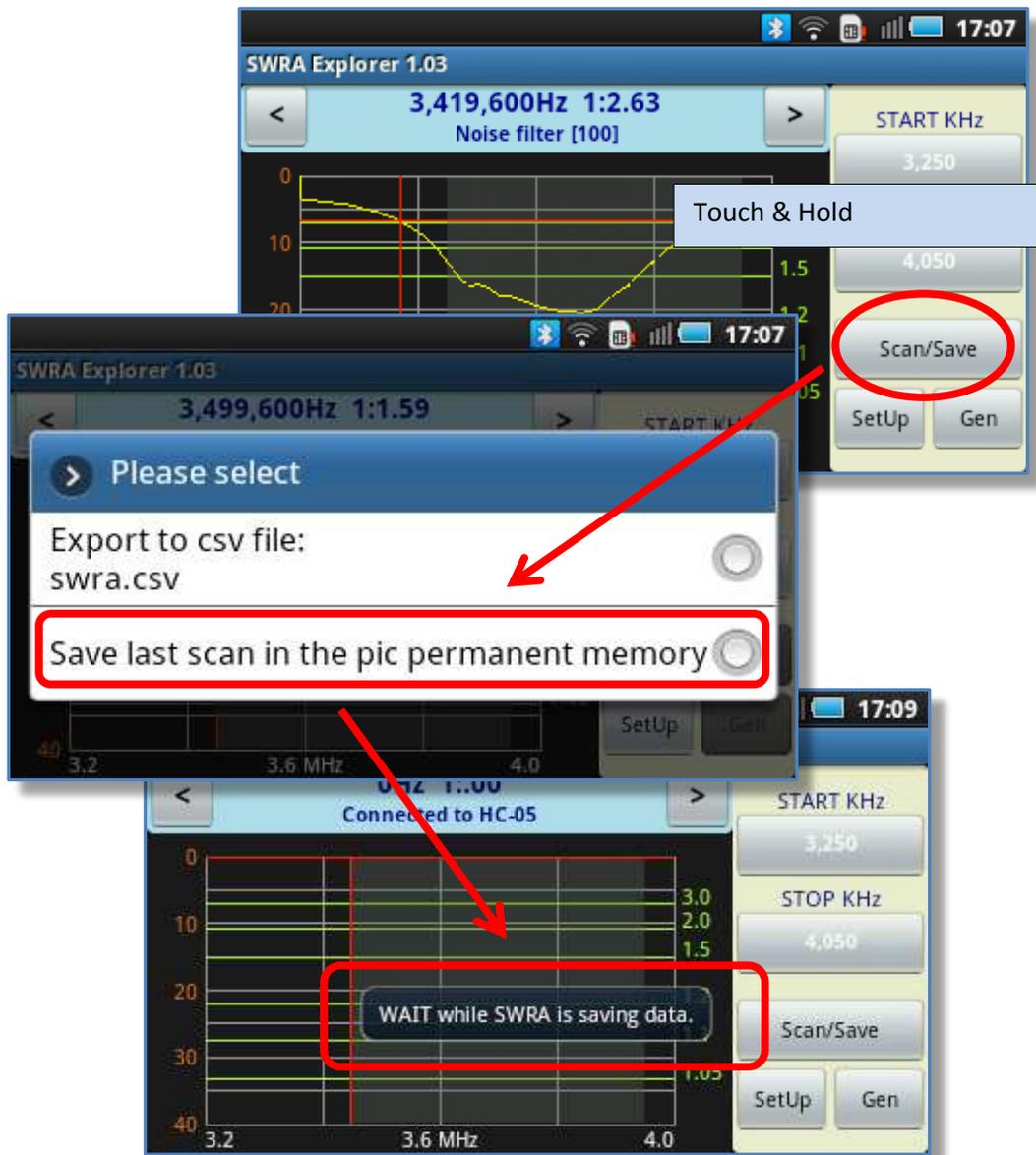
**NB.** For compatibility with the Windows PC program “SWR Analyzer.exe”, only “**ACCURATE**” scan’s data can be saved as a CSV file.



This SetUp option allows you to change file name and CSV field's separator

The PC SWR Analyzer program and Android Application save the CSV files in the same format, i.e. the records for each step are in the same order.

### 3.6.2 Saving to SWRA pic's permanent memory



The scan's data is saved into the permanent block of the pic memory.

It is thus safe to power off the SWRA board remove the Bluetooth adapter and to connect the board to the USB port of your PC.

### 3.7 The Generator utility



Use the thumb button switches above each digit to select the output frequency  
Touch "+" to increase, "-" to decrease, touch a single digit to clear it.

The small band panel to the right is used to set the generator frequency to mid-band of the selected band button or user defined button A, B or C.

### 3.8 Exiting the application

When touching the Android terminal “BACK” or “HOME” buttons, SWRA Explorer pauses, goes on background and still remains active.

The notification  icon will appear on the notification system tray.



To Exit SWRA Explorer, run the app again, long touch “Gen” or “SetUp” button and confirm you want to exit.



### 3.9 Parameters setting



If the **“Scan Mode”** is changed, the new mode takes effect the next time the application is run.  
**“Restore default”** reset all values to their default the next time the application is run.

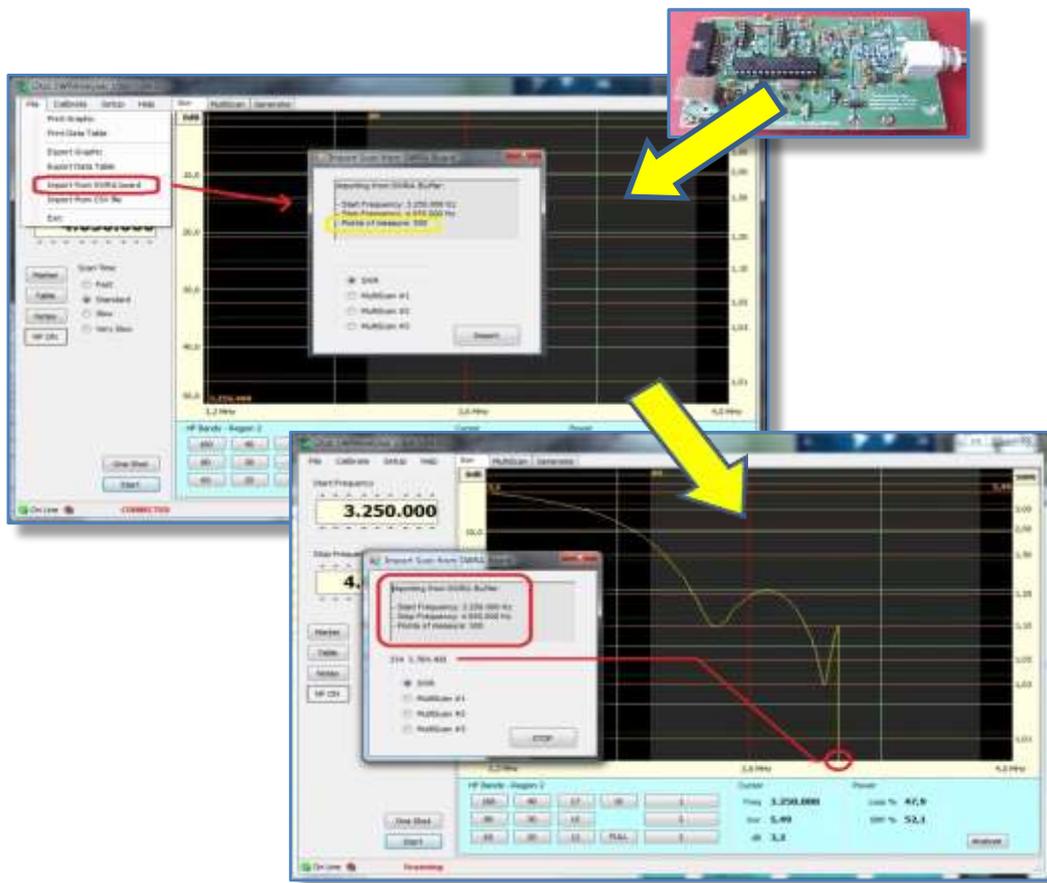
## 4 Analyzing the scan results on PC

The PC program *SWR Analyzer.exe v6.02* provides two functions that enable the scan data to be imported by the program for a detailed analysis:

- Import from the SWRA Board
- Import a CSV file

### 4.1 Import from SWRA board

Please refer to “SWR Analyzer User Guide v6.02” paragraph “Import Data from SWRA board” for more details.



## 4.2 Importing a CSV file

Please refer to “SWR Analyzer User Guide v6.02” paragraph “Import Data from a CSV file” for more details.

