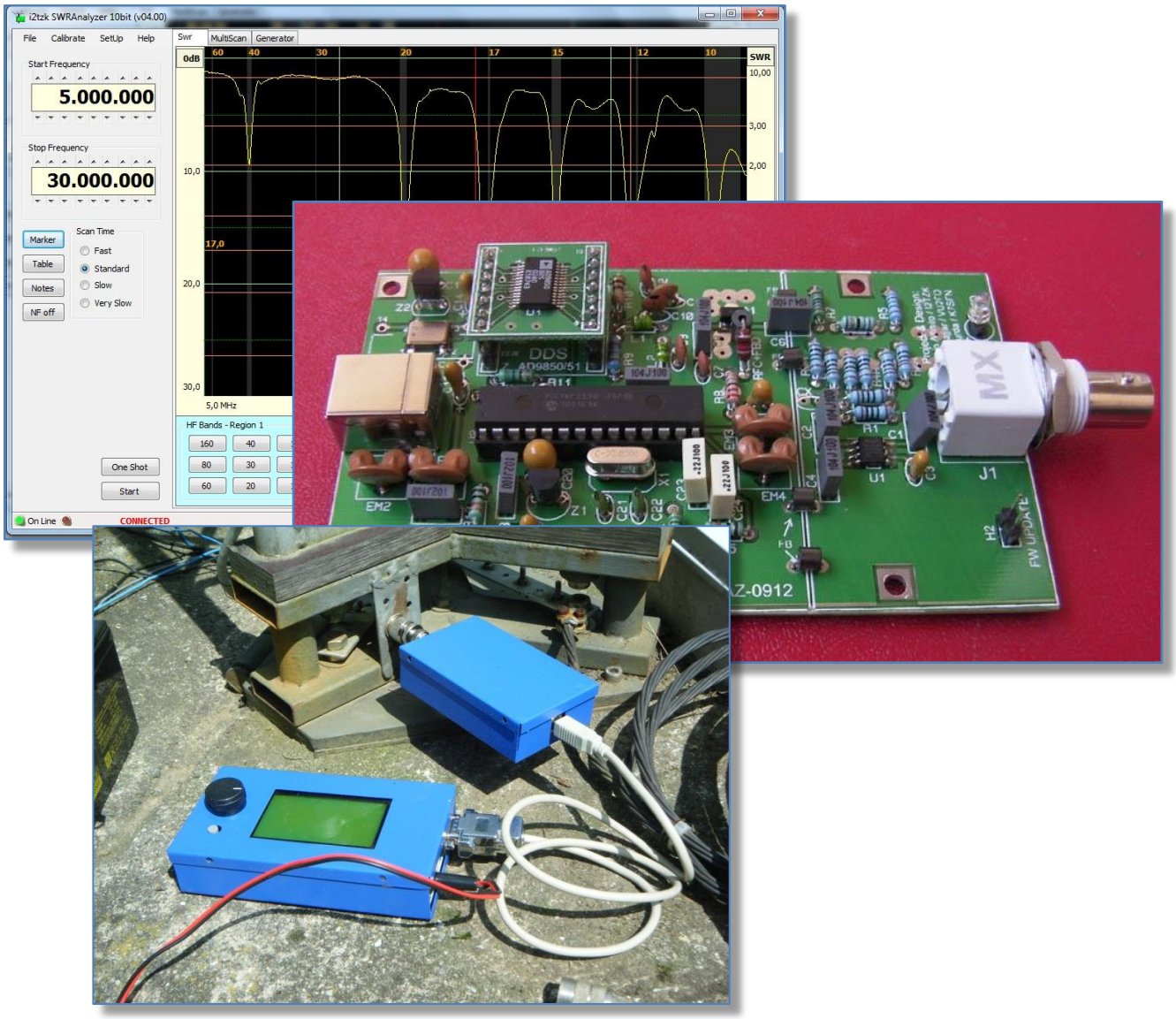
Fox Delta

Amateur Radio Projects & Kits

SWR ANALYZER

Measuring Without PC



June 2013

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1. Project description

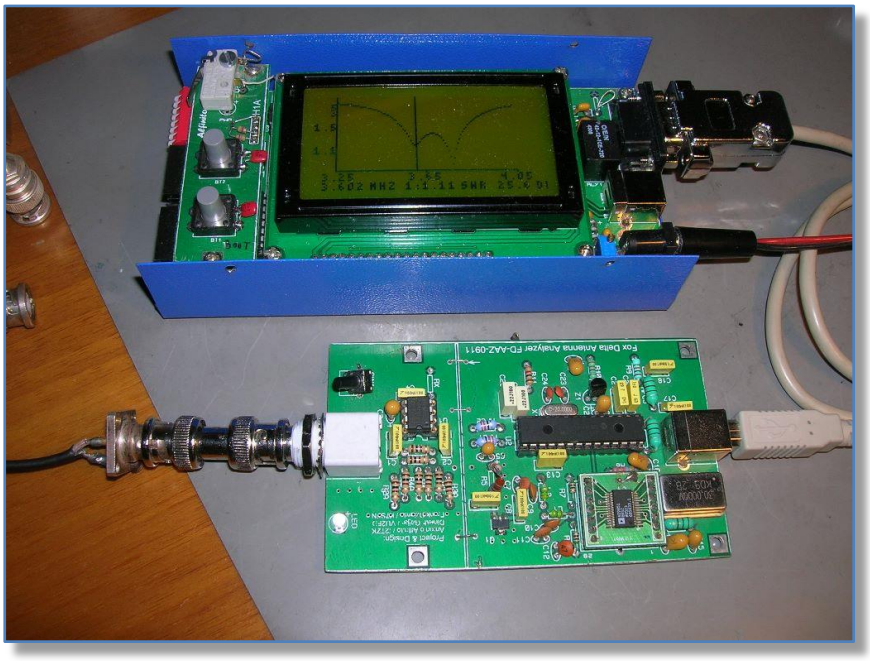
This document describes how the **Graphic LCD Controller (GLCDC)** operates with the **SWR Analyzer (SWR-A)** enabling antenna performance measurements to be made **without the PC and associated SWRA software.**

The GLCD &-SWR-A set up enables the HF antenna:

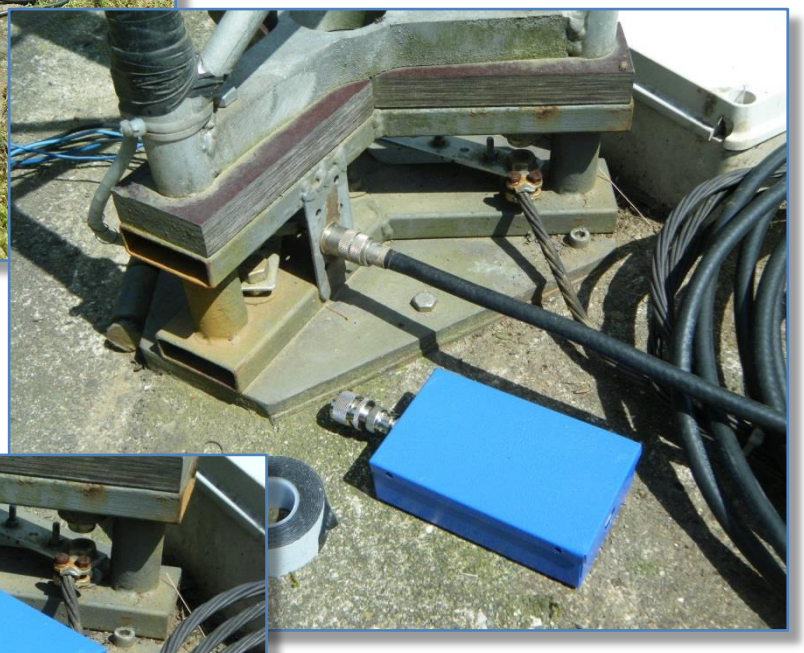
- To be explored/analyzed/tuned during field or mobile operations.
- Stores 500 measurements for in depth analysis on a Windows PC at a later date.

Requirements

- Modified SWR-A unit as per paragraph xx, with f/w v4.02.
- SWR-A Windows program v4.02
- A special cable to connect SWRA to GLCD Controller
- GLCDC this document provides details of the CPU01-SWRA f/w 1.00, FoxDelta kit, refer paragraph 2.3 if you want to design and implement your own unit.



Testing an 80m 1/4 wave vertical

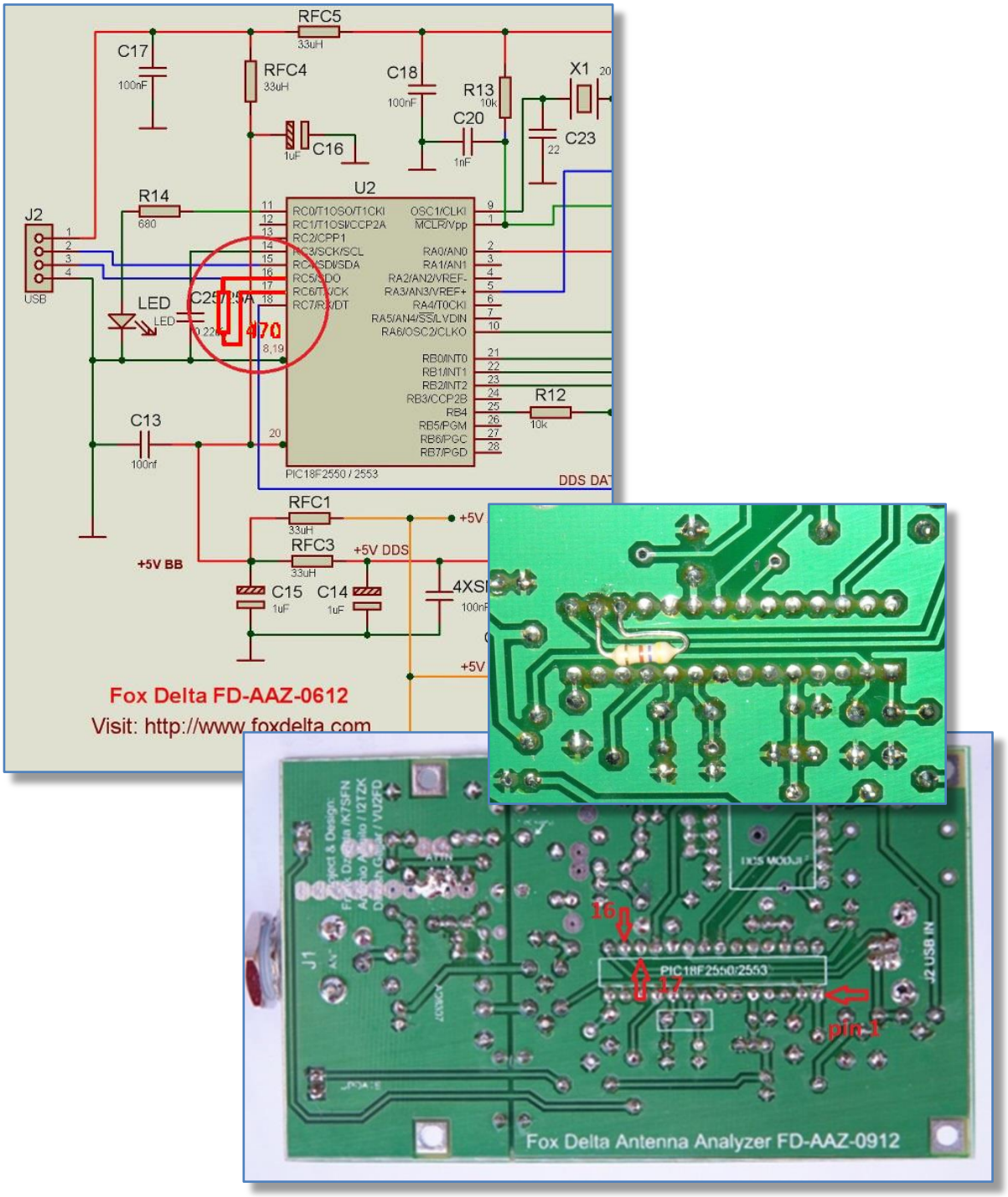


The SWR-A and GLCD Controller with red & black wires to the battery pack and special interunit (GLCD to SWR-A) cable.

2. Getting started

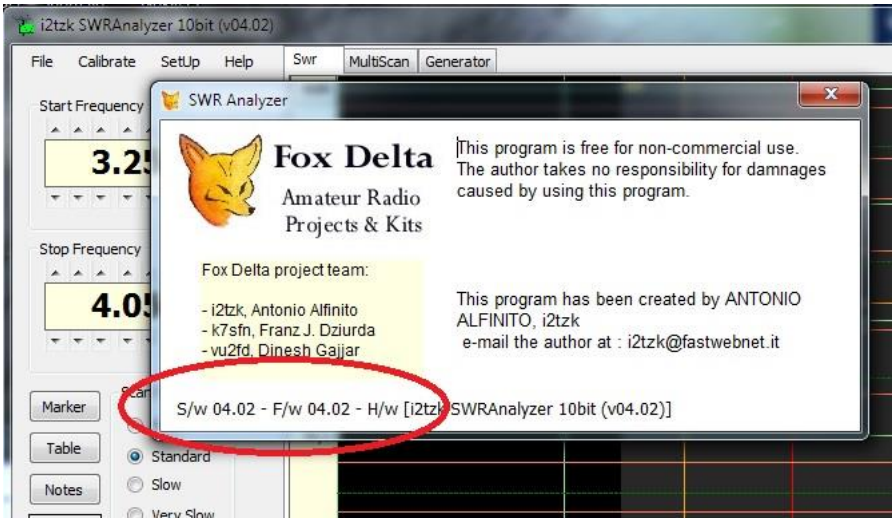
2.1 SWR Analyzer

- Modify the SWRA board by adding a 470 ohm resistor between pin 16 and pin 17 of the pic 18F2550
- Update the f/w to v4.02



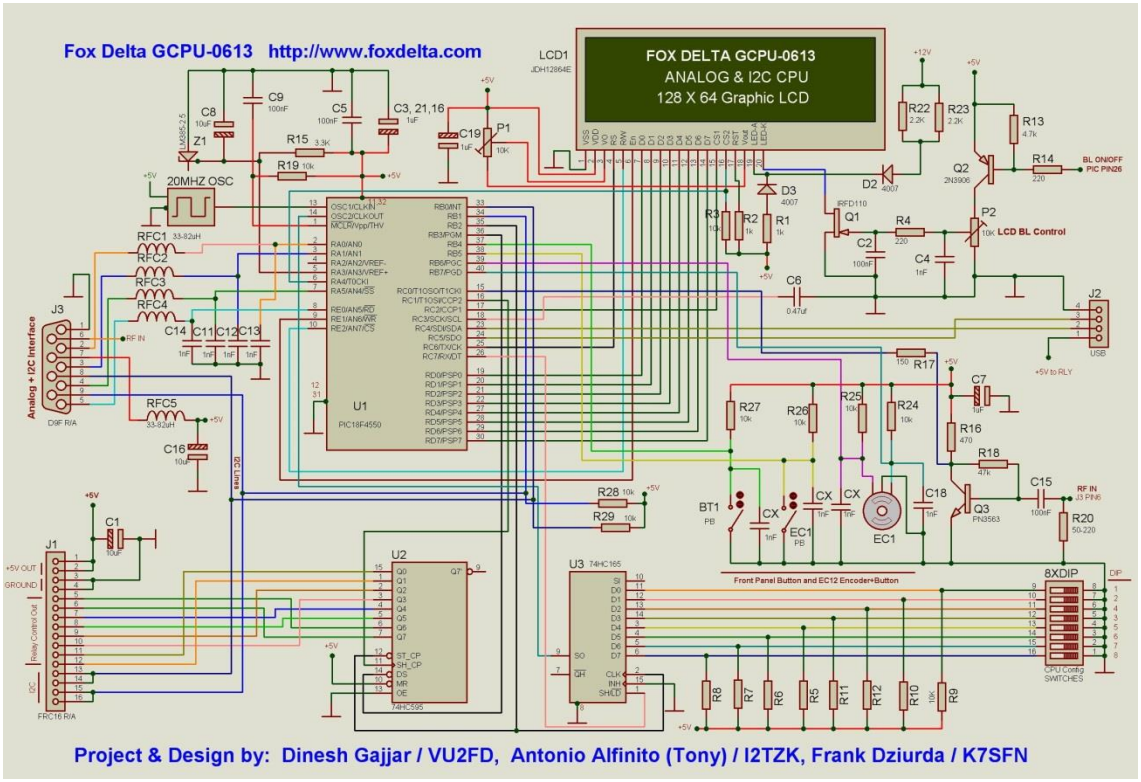
2.2 SWR Analyzer Windows program

- Update the program to v4.02

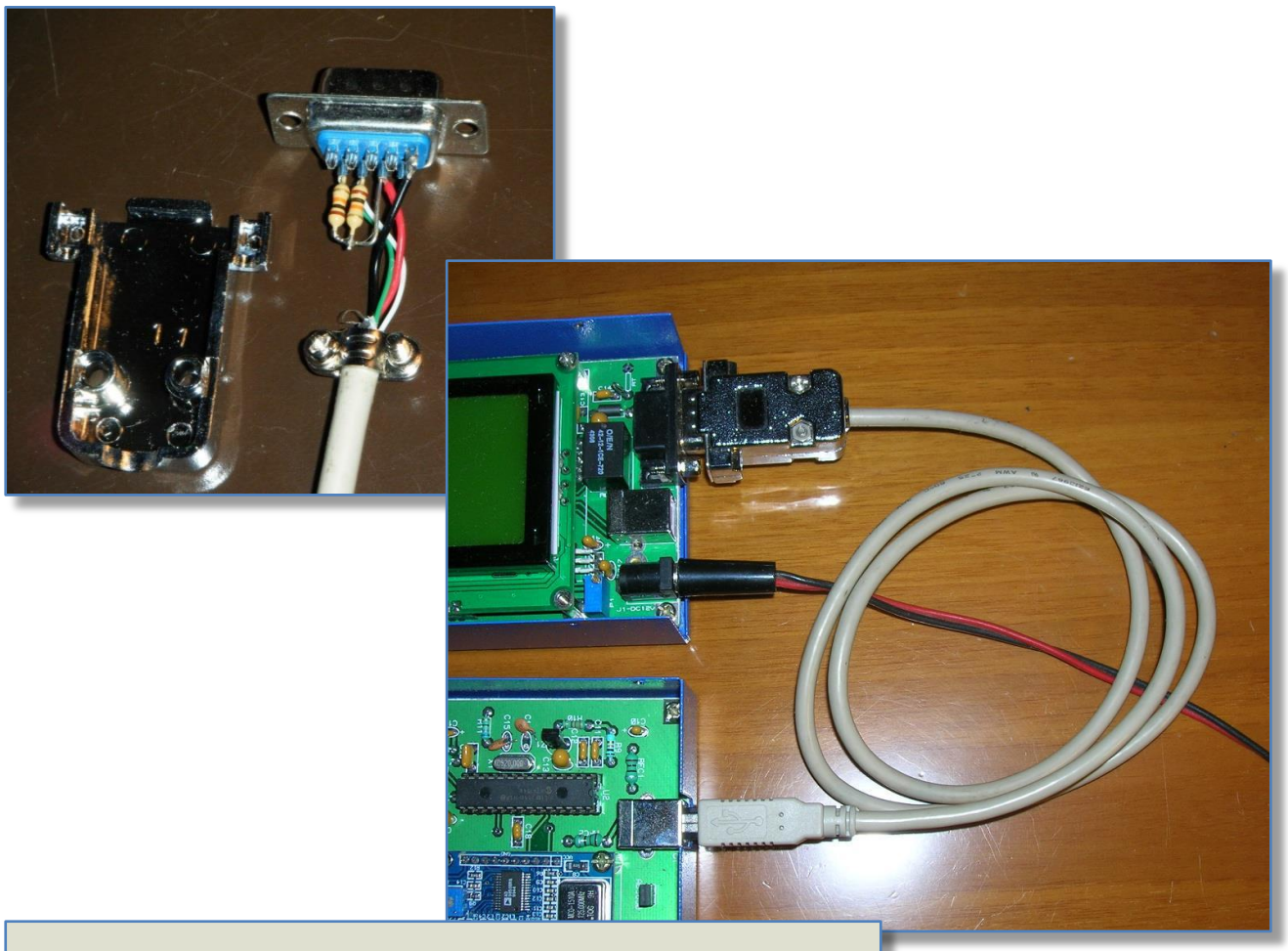


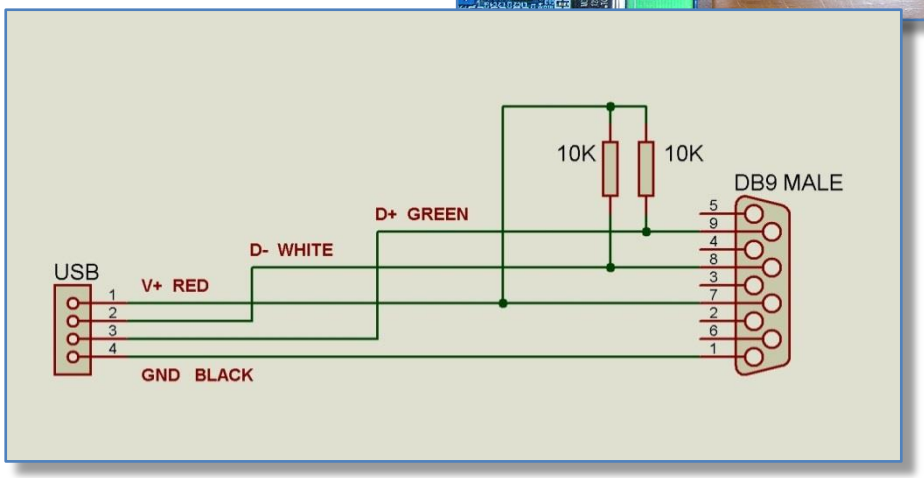
- Connect the SWRA Board and ***calibrate*** the SWR-A by following the on screen prompts.

2.3 GLCD Controller Circuit diagram



2.4 GLCD Controller to SWRA interface cable details

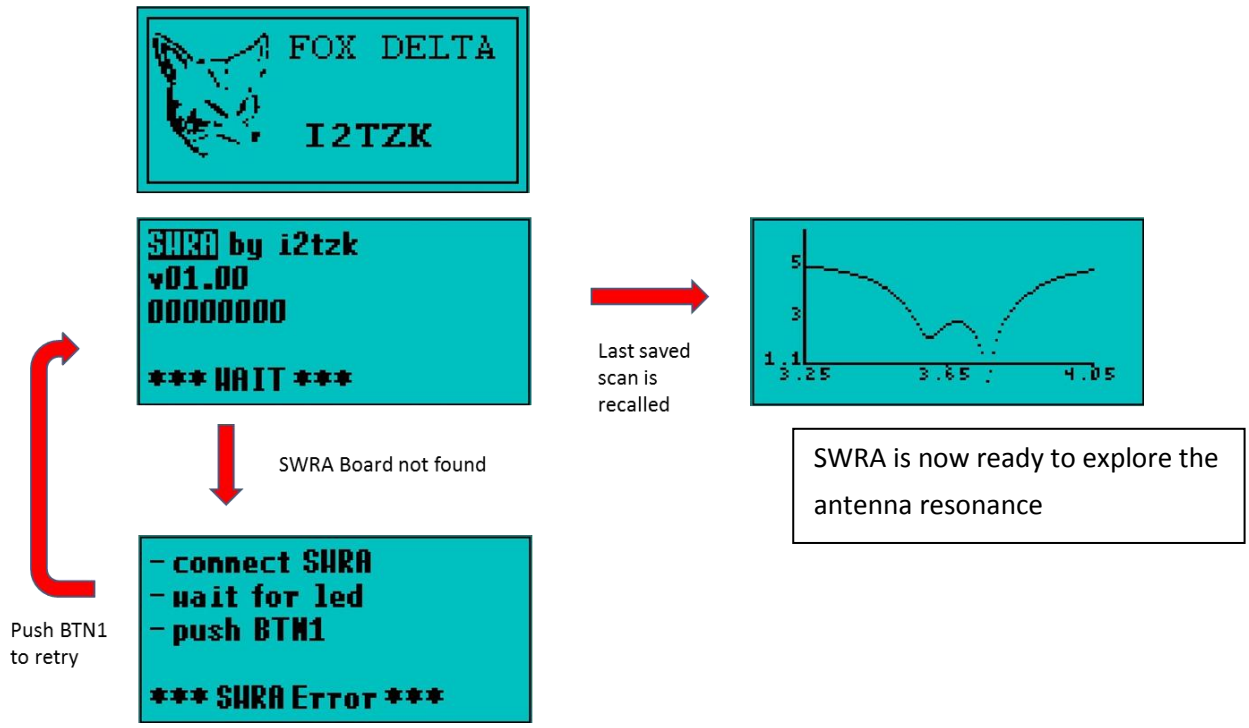




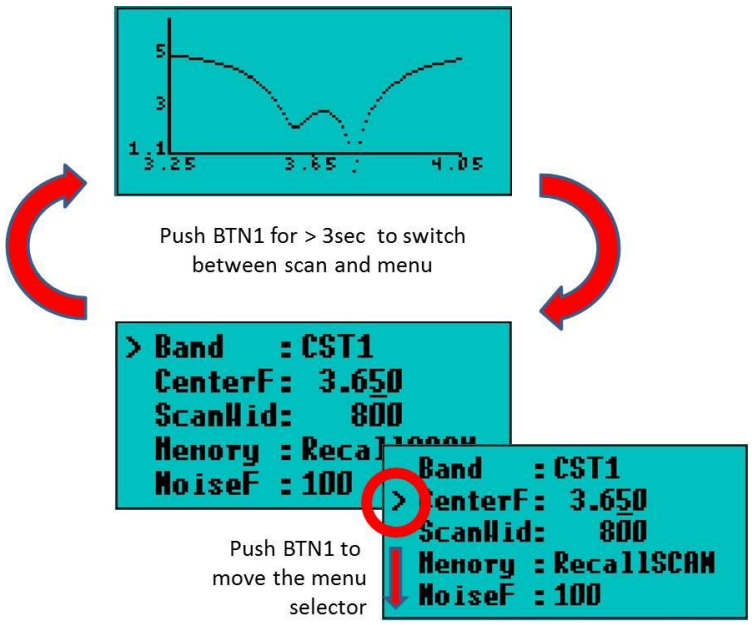
The 2 x 10K ohms pull-up resistors are 0.5 watt.

3. GLCD Controller functions

Power ON sequence



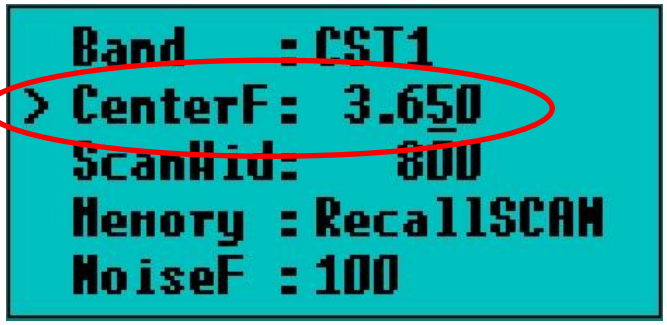
Switch between Scan Graphic and Parameter's Menu by pushing BTN1 for more than 3 Sec.



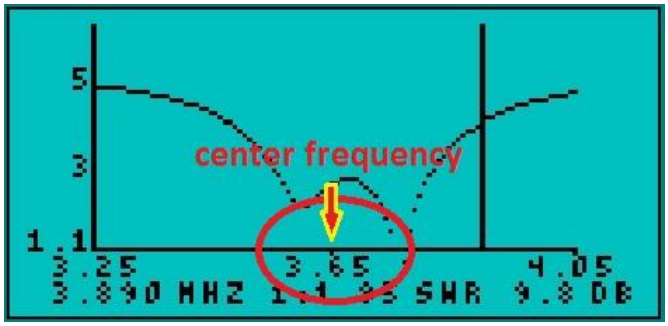
4. Exploring the antenna resonance

4.1 Select scanning parameters

- Select the Parameter's menu by pushing BTN1 for more than 3 Sec.
- Enter the ***Center Frequency*** ***[CenterF]*** by rotating the control knob.

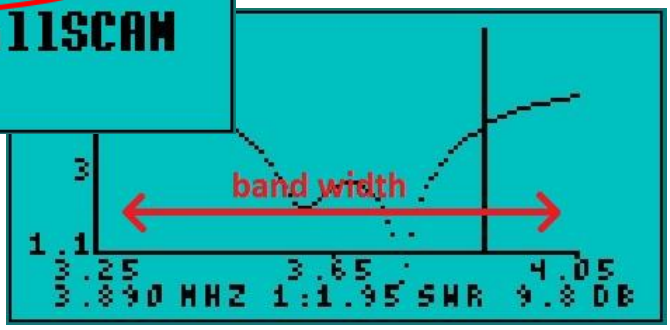


Frequency increment/decrement step can be changed by pushing down on the control knob, the cursor underneath the digit will move to the next digit.



- Change the **Scan Width** **[ScanWid]** by rotating the control knob.

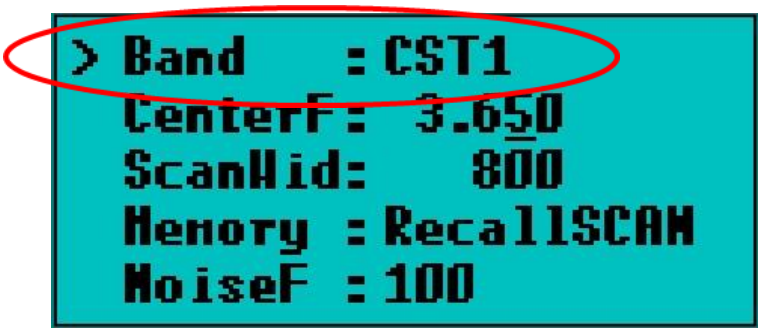
The available ***Scan Width*** selections are: 100 KHz, 200 KHz, 500 KHz, 800 KHz, 1 MHz, 2 MHz, 10 MHz.



The ***Frequency Center*** and ***Scan Width*** will be used on the next scan. Until a new scan is executed the previous values are still shown on the graph display.

Custom values for ***Center Frequency*** and ***Scan Width*** can be predefined for any ***Band*** ***[Band]*** and recalled by using the Control knob.

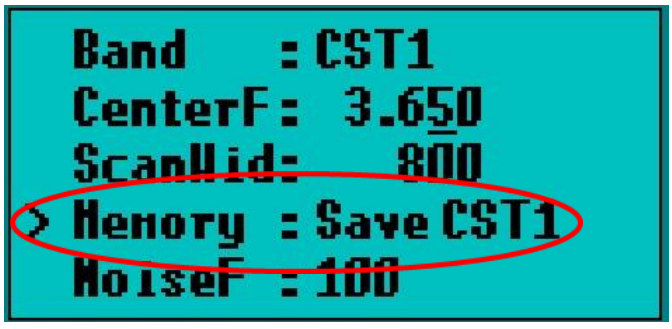
Rotate the knob to go through the available band values.



Band	Center Frequency	Band Width
10	28 MHz	2 MHz
12	24.940 MHz	200 KHz
15	21.225 MHz	500 KHz
17	18.120 MHz	200 KHz
20	14.175 MHz	500 KHz
30	10.125 MHz	100 KHz
40	7.150 MHz	500 KHz
80	3.750 MHz	800 KHz
160	1.9 MHz	200 KHz
CUSTOM 1	User Defined	User Defined
CUSTOM 2	User Defined	User Defined
CUSTOM 3	User Defined	User Defined

Select the Band, by pushing down on the control knob.
The values for the **"Center Frequency" and "Band Width"** (see table opposite) will be copied to the corresponding fields.

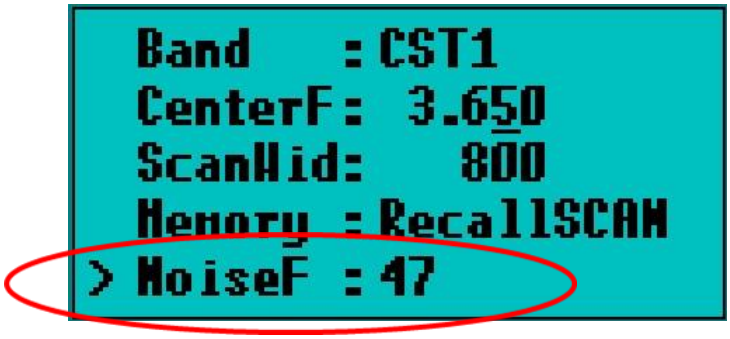
To set a new CUSTOM entry:



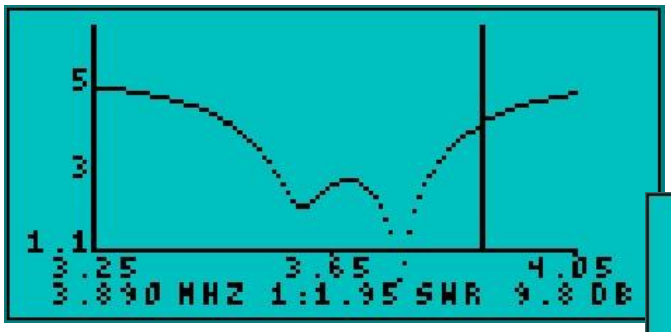
- Select a new Center Frequency
- Select a new Scan Width
- Select a **[Memory]** action [SaveCSTx]
- Push down on the knob
- Label ***"SaveCSTx"*** will blink confirming that the new parameters are accepted and stored in the microprocessor memory.

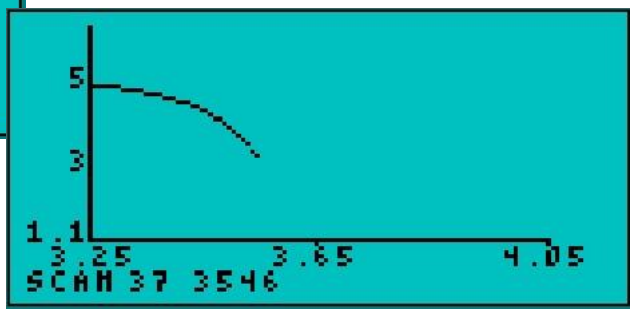
- To disable the ***Noise Filter [NoiseF]*** simply **select the value 1.**

  Any value > 1 activates the filter (default value is 5).
- N.B. the Noise Filter slows down the scanning process, use it only when necessary.

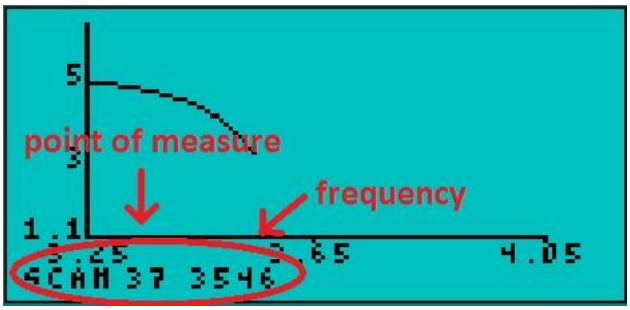


4.2 Run a Scanning cycle



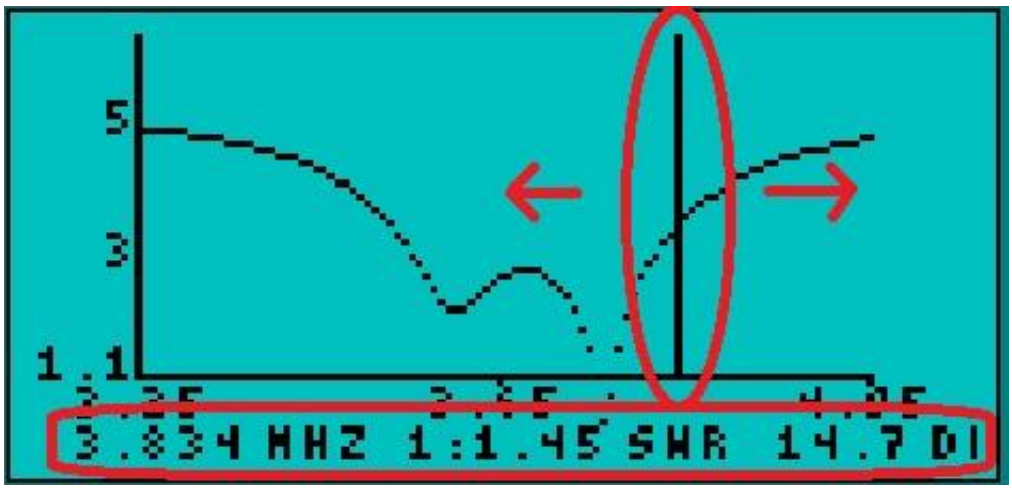


Start scan cycle by **pushing down on the control knob**, stop the scan at any time pushing down knob again.



During the scan phase the SWR value and corresponding frequency are shown for each point as it is displayed, the SWR-A led blinks.

Because of Graphic LCD's low pixel resolution and limited resources of the PIC processor, only a 100 measurements are stored in the processor working area, i.e. the X-Axis can only show 100 different frequencies and their associated Return Loss and SWR values.

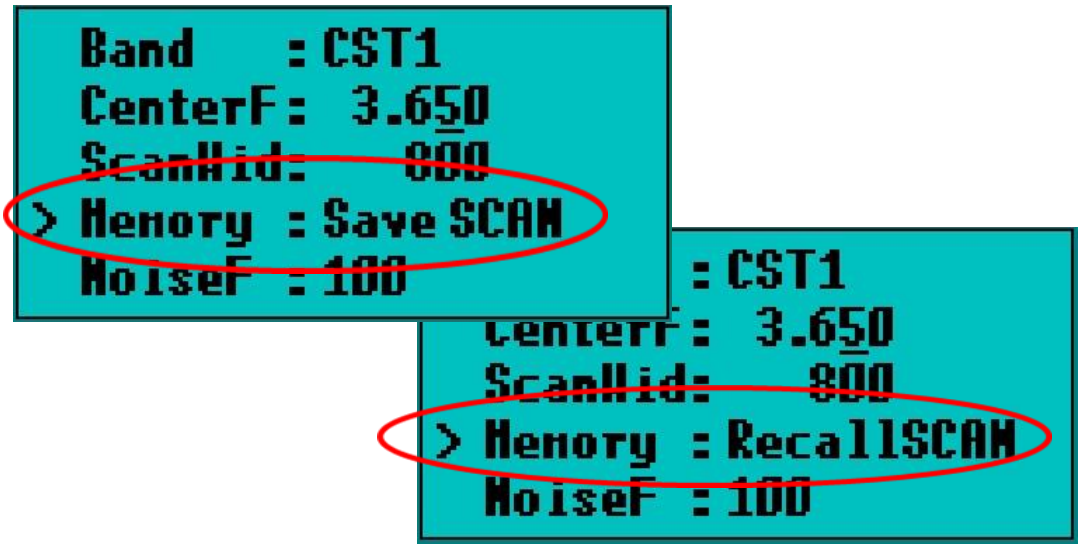


Rotate the knob to move the cursor (vertical line) left or right to read values of each point on the graph i.e.

- Frequency in MHz
- SWR
- Return Loss in dB

These values are displayed on the bottom line of the LCD .

Current scan can be **saved in the SWRA Board permanent memory** and recalled later.



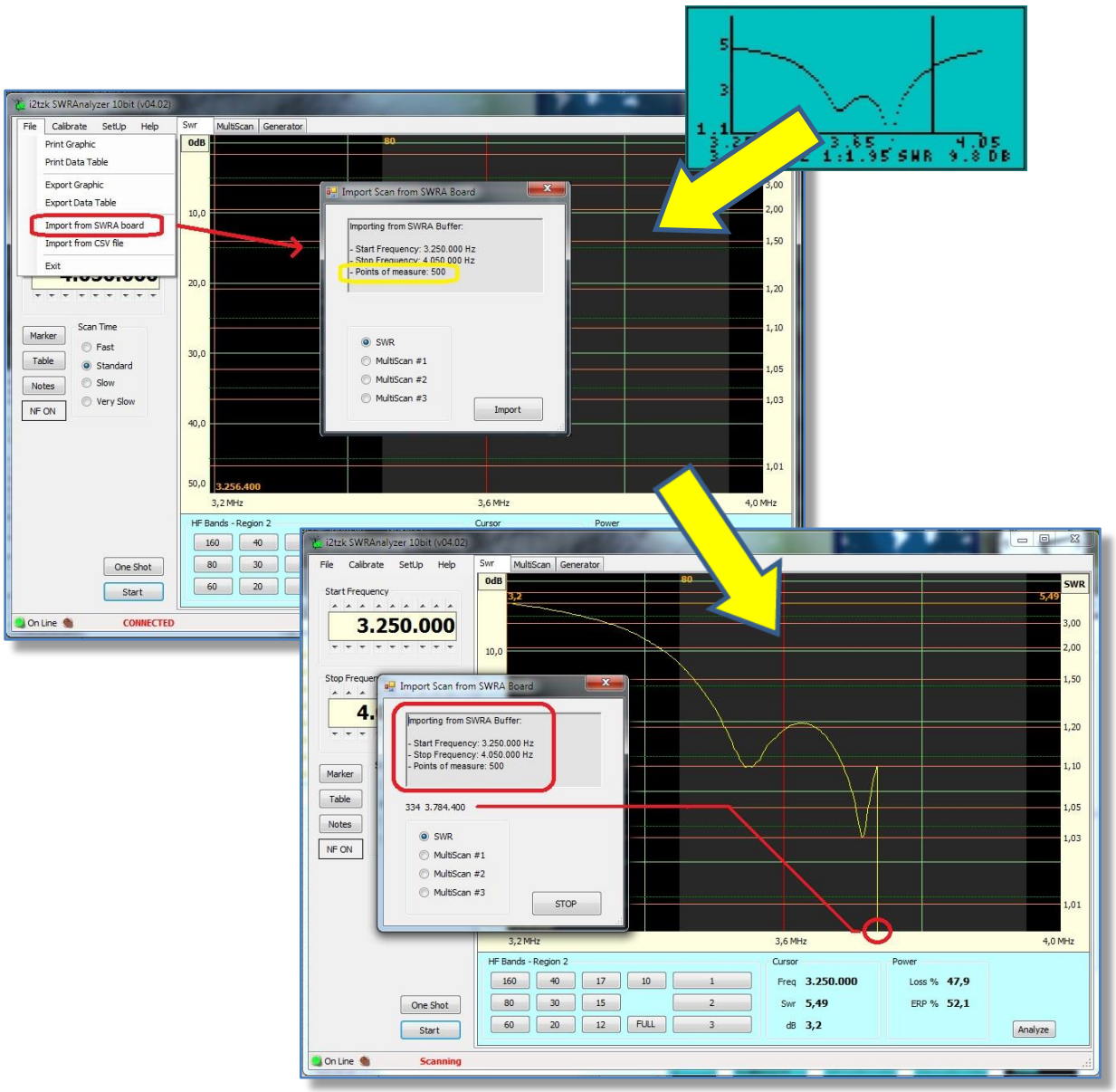
The scan's individual measurements are **stored in the SWR-A Board and not in the Graphic LCD controller**. This enables the PC program to import the data when the SWR-A is connected to the PC.

Since a PC offers a faster CPU and better memory resources than the PIC, during the scan 500 measurements are taken and stored for later analysis by the PC software.

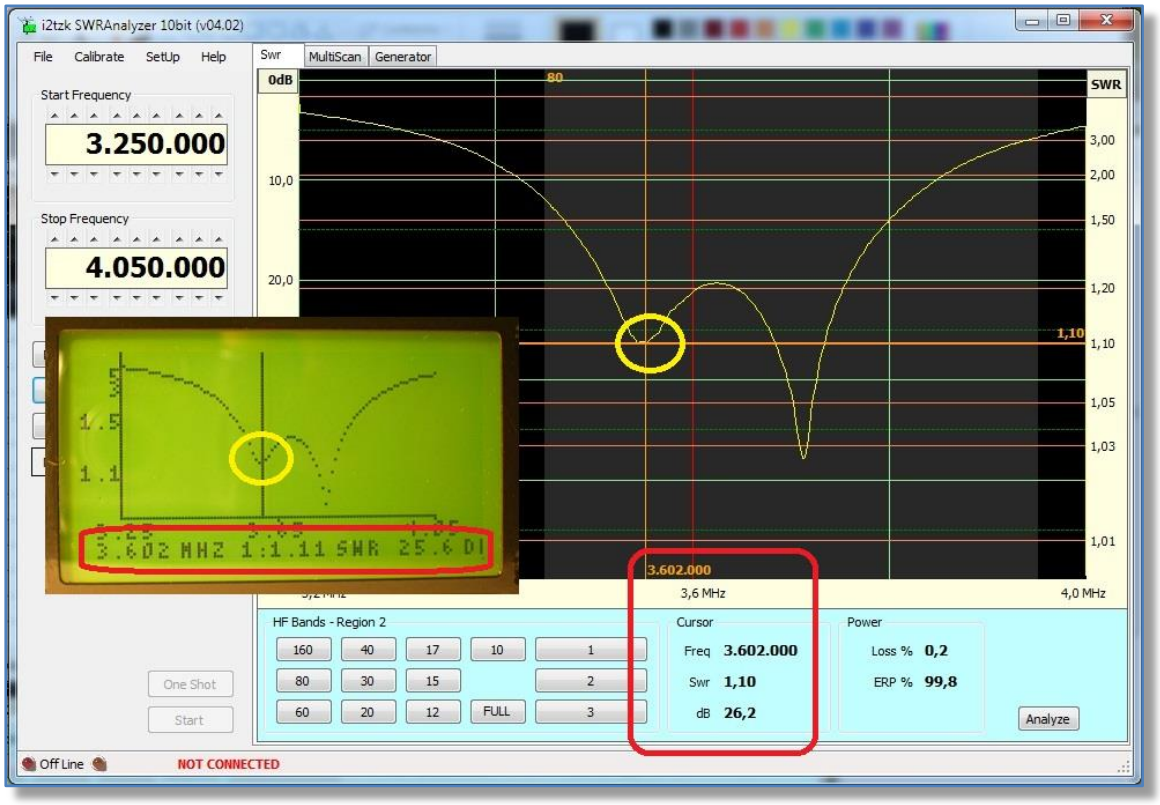
To summarize, only 1 in 5 measurements (100) are displayed on the LCD panel, but all 500 are available to the PC with its superior graphical resolution.

4.3 Analyze the full scan results on PC

The program ***SWR Analyzer.exe v4.02*** provides a new function that enables the scan data to be imported into the SWRA Board permanent PIC memory.



There may be slight differences between the displayed values of the GLCD and the PC screen for the same frequency.



Differences are usually less than 1dB and are can be attributed to:

- ***The Measure resolution***: 100 points for GLCD compared to 500 points for PC
- ***The calibration process,*** 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", the GLCD Controller applies a simple average offset i.e. the same for any frequency.

  Both, table values (used by PC) and average 0dB offset (used by GLCD) are calculated during the calibration process, for this reason the calibration must be done at least once before to start the first measuring session.
- ***The mathematic packages*** on PC and PIC microprocessor (rounding and algorithm bit resolution)