

## Reference manual for mRS antenna analyser type miniVNA 0.1-180 MHz



The device is designed to measure antenna impedance and filters over the HF and VHF frequency range. The small hardware (9x5.5x3cm) uses an USB connection to a PC where the antenna parameters can be displayed, one full scan takes about 0.5 sec per 500 samples, the instrument will give a big help to tune and design antennas especially for radio amateurs.

The original software runs under Windows PC, by the way many hams worked on different version such as DOS, LINUX and PDA with Windows CE (Windows Mobile 2002-2003).

Several Hams have actively contributed to the development and supported the project in different ways, I would like to thanks in particular Juan Carlos([nominativo](#)), Stewart G3RXQ, Peter PA0PDW and all other hams very active in the discussion group at [http://groups.yahoo.com/group/analyzer\\_iw3hev](http://groups.yahoo.com/group/analyzer_iw3hev)

### System requirements

- PC with cpu 500Mhz or better, WIN98, WIN2000, XP or LINUX are supported
- The device work also with pocket PC, WIN CE are supported.

### Before you start

- Do not expose this device at strong rf fields (expecially with antenna connected), may be cause permanent damage of internal detector.
- In case of battery supply (not USB use) do not excede 5VDC.
- In antenna analisys this device generate about 1mW from 1 to 180 Mhz: it may cause interference and local QRM to others HAM radio station.

### Analyser Characteristics:

- \* Frequency coverage 0.1MHz to 180MHz
- \* DDS Generator with 0 dBm output
- \* 2 Ports allow Transmission Measurements e.g. filters, traps
- \* USB1.1 and USB2 compatibility
- \* RS232 optional socket for Pocket PC`s or Remote Displays
- \* Fast Scan (typical 0.6 sec for 500 points)
- \* Use of an internal Industrial Directional Coupler
- \* High Reflection Dynamic Range 40dB to 35dB (VSWR 1.06:1 or better)
- \* Wide Transmission Dynamic Range > 50-55dB
- \* Measures VSWR, RL, Rs, Z +/-jx, Phase, Cable length, R/L/C
- \* Finds Minimum VSWR automatically
- \* Transparent box with LED indicators for the operation status
- \* In-Circuit-Programming for future firmware CPU upgrades
- \* Operation from 3.6V Phone Batteries possible (current drawn <150mA)
- \* Software compatible with Windows and Linux operating systems.
- \* Save and Load of previous measurements
- \* Software for Pocket PC available

### Software Installation note (for Windows 2000/XP and WIN98):

1. Download the latest software version from <http://www.miniradiosolutions.com/miniVNA224.zip>
2. Download from FTDI web site the latest VCP (Virtual Com Port) for your OS (WIN2000/XP or WIN98), the chip is FTDI232BM, look at their web site <http://www.ftdichip.com/Drivers/VCP.htm> the latest right now for windows 2000/XP is <http://www.ftdichip.com/Drivers/CDM/Win2000/CDM%202.00.00.zip>
3. Unzip the minivna2xx.zip into C:/
4. Run the file setup.exe.
5. Follow the software installation program.
6. Plug the analyzer (a new USB connection will be detected) and follow the USB driver installation using the FTDI downloaded driver.
7. Edit the file analyz.ini file (c:\programs files\antenna network analyzer\analyz.ini) and change the "Port=?" parameter, port should correspond to the COM port occupy by the new USB driver just installed (look into windows control panel-peripherals-Com), Example my PC report COM=6, so my analyz.ini will have Port=6, see the below ini file.

#### Extract from analyz.ini file

```
[PARAMETERS]
FMax=180000000          'max frequency input
FMin=1000000           'min frequency input
Champ=500              'samples per screen
Step=1                 'samples step
'-----
' Common Transmission Line Velocity Factors
' RG-58      ---- 0.66
' RG-174     ---- 0.66
' RG-213     ---- 0.66
' 600 ohm Open Wire ---- 0.92
' CATV Hardline ---- 0.81

InputVelFactor=0,66
'-----

[PORTSETTING]
Address1=888           'printer port address 1 byte
Port=6                 'virtual com port for USB
caloffsetrx=-5         'calibrate to near 0 db for open DUT
caloffsettx=115        'calibrate Transmission mode
caloffsetvalue=5       'calibrate for 50 Ohm load
```

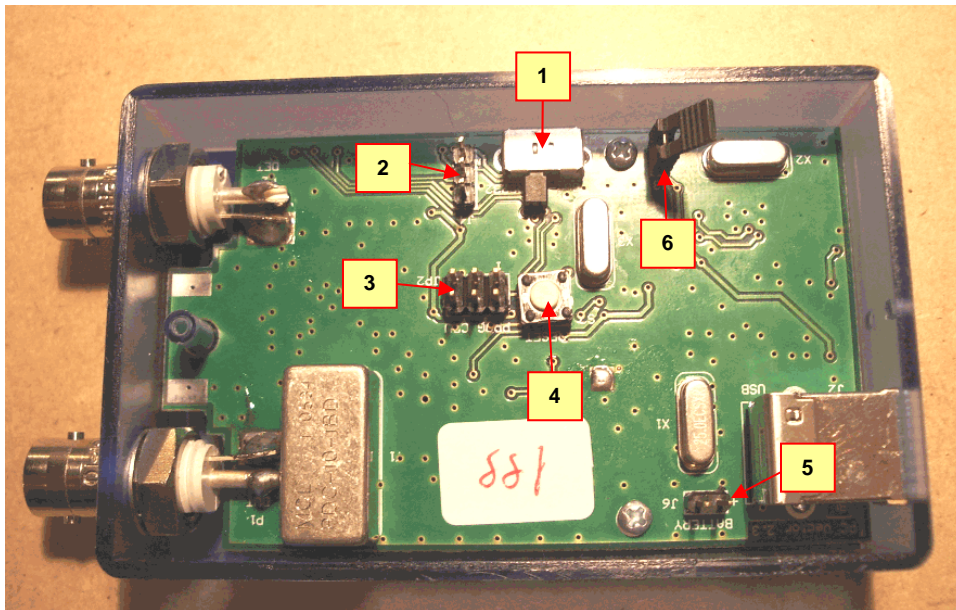
8. After adjusting the .ini file you can now run the analyzer program "c:\programs files\antenna network analyzer\minivna2xx.exe".

### Front view with functions & connections



1. BNC DUT: rf out / antenna. **WARNING! Do not connect to RF transmitter**
2. BNC DET: detector (transmission mode only). **WARNING! Do not connect to RF transmitter**
3. LED TX, RX: USB communication running (run mode).
4. LED POWER: *miniVNA* power on.
5. USB: USB connection (B type).

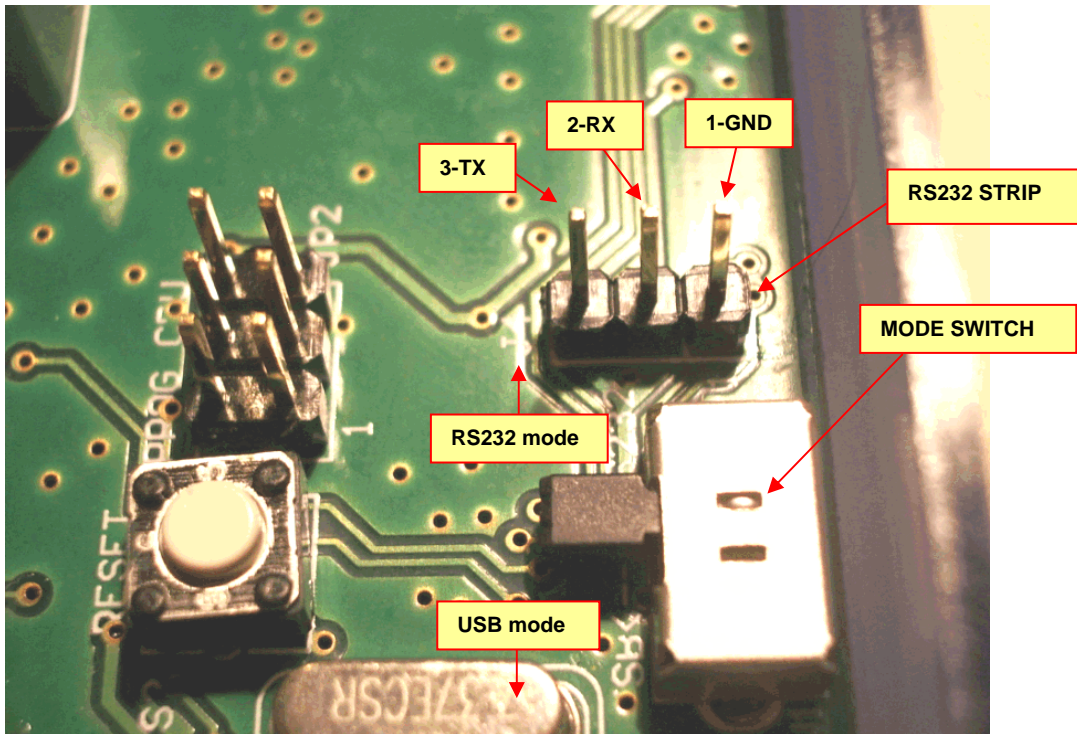
#### Inside view



1. SW1 SWITCH MODE: select mode between USB and RS232.
2. J4 RS232 STRIP: to connect the *miniVNA* to RS232 port (see Application Notes).
3. JP2 PRG CONNECTION: to program cpu in-circuit.
4. S2 RESET BUTTON: to reset the *miniVNA*.
5. J6 BATTERY STRIP: to connect to external battery (see Application Notes ).**WARNING! Do not place jumper on it!**
6. J3 JUMPER : enable supply to USB driver (present in normal USB operation, see Applications Notes for RS232 use).

#### Hardware connection

The analyzer has USB 1.0/2.0 connection to the PC via standard USB cable. The necessary 5 Vdc power will be taken from the PC without the need of an external power supplier. An optional RS232 port is available in case of PDA connection, see the fig. for connection pads (to use RS232 the user has to add 3 wires plus DB9 cannon).



**Software description:**




Hardware connected



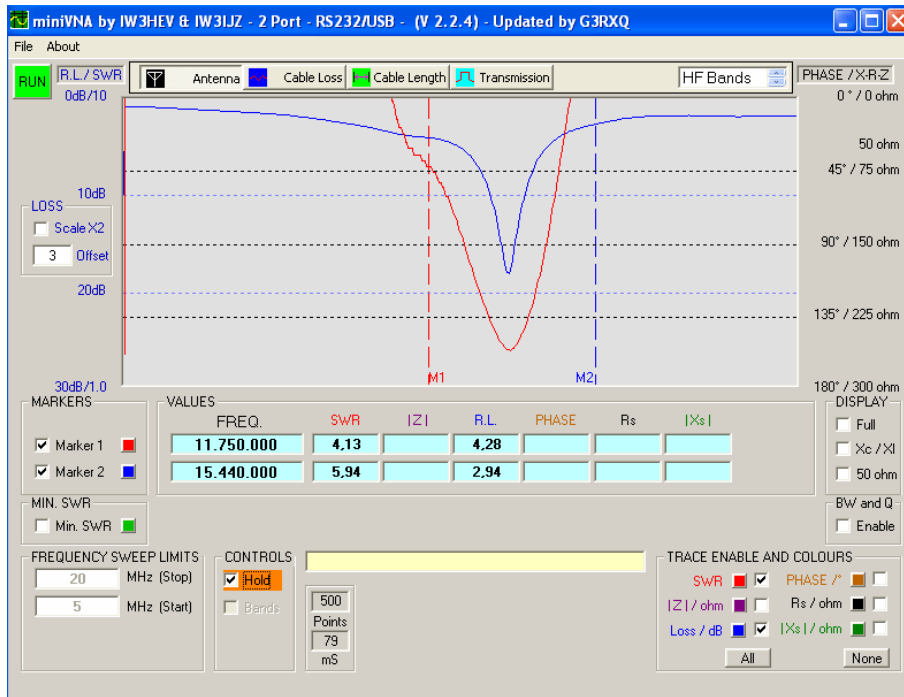
Hardware not connected

You can evaluate files previously saved without having the analyzer connected (Off-line/RUN button is in read colour), from "FILE" click open and search for file with extension VEC. This is the format used by the analyzer to read and store internal binary files. You can export reading/file in CSV format. There are basically two mode of operation one is reflection and the other is transmission, the reflection mode use only the connector "DUT".

### 1. The reflection mode

To enable reflection mode click on the icon “Antenna” 

This mode is used for antenna measurement. In this mode you can read most of the information like return loss, X, R, Z, reflection coefficient and phase, see below an example of 20 meters loop antenna response.

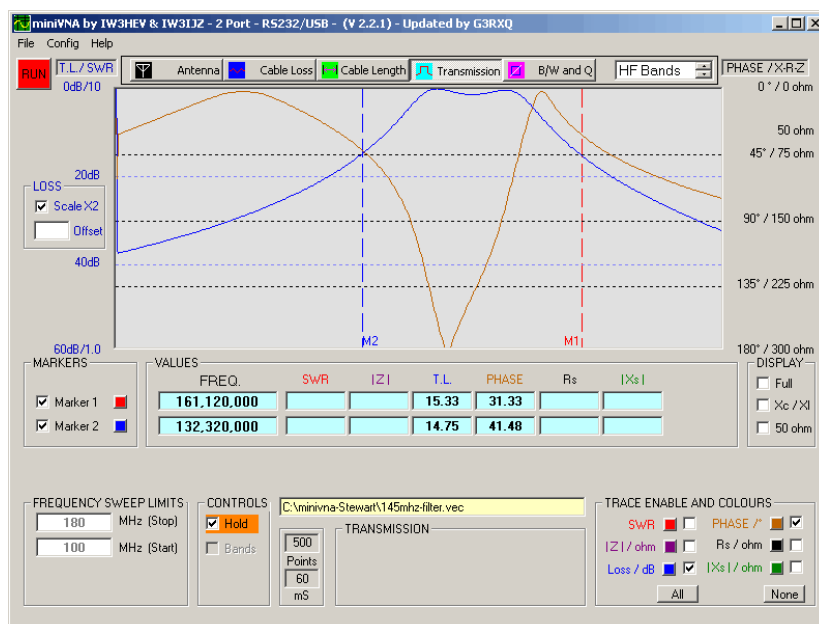


### 2. The transmission mode

To enable transmission mode click on the icon “Transmission” 

It is used to check filters, crystals, attenuator, etc., it requires both connectors, the DUT port is the RF output and DET port is the input detecting the response of the filter. The dynamic range is about 50 dB, X2 scale will double the scale range from 30 to 60 dB. A part from the Loss and phase the other information (SWR, Rs, Xs) has no meaning.

Below the picture shows a 144 Mhz band pass filter.



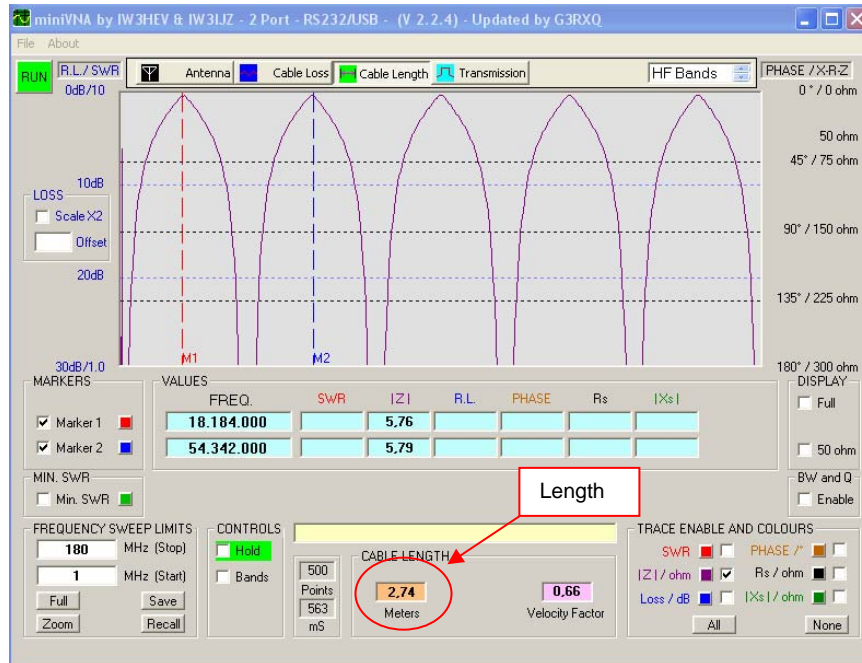
### How to measure cable length.

To enable cable measurement click on the icon "Cable Length" 

Set Marker1 by left click of the mouse on the graph

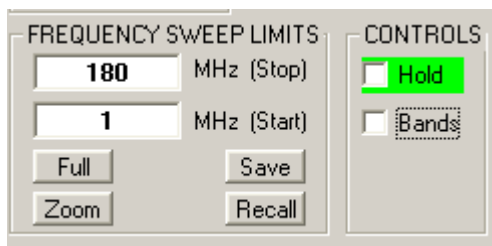
Set Marker2 by right click of the mouse on the graph

To measure cable length place both markers on two consecutive Z peaks as per the picture below.

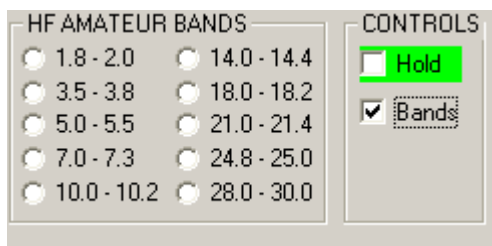


### How to select the frequency sweep

There are basically two method, one by input the **start** and **stop** frequency box.



The second method is by the band check box



## How the analyser works

The hardware is based on a DDS (AD9951-14 bits) which acts as a sweep generator feeding a directional coupler; the two coupled outputs are compared in phase and amplitude. In reflection mode the Return Loss and the Phase of the reflection coefficient is used to calculate the antenna impedance, while in transmission mode the coupler is used as a power splitter which sends power to the load and creates a reference for the first port of the AD8302.

The hardware contains a CPU (Atmega8L) which acts as an interface between the DDS and the USB converter, first the CPU will receive via USB/RS232 the command to carry out a sweep, then the CPU will send back the results of the two internal analogue to digital converters (magnitude and phase) values for each generated frequency sample.

Here below the command given via RS232 to generate a single sweep (for example using Windows HyperTerminal set the communication parameter to "115200 8 N 1", no HW flow control):

```
MSComm1.Output = Str(Control) & Chr(13)
Sleep (1)
MSComm1.Output = Str(Fout) & Chr(13)
Sleep (1)
MSComm1.Output = Str(Lchamp) & Chr(13)
Sleep (1)
passo1 = passo * 10.737
MSComm1.Output = Str(Passo1) & Chr(13)
```

As you can see there are 4 data transmitted from the PC, the "Control" data can be 0 or 1 selecting the reflection or transmission mode, the "Fout" data is the starting frequency scan, the data "lChamp" is the number of frequency points (samples), the data "passo1" is the frequency step between two samples and it is represented as DDS word (i.e. 1 KHz=10737 DDS increments).

Example for 1 KHz generator

```
0{enter} 10737.41824{enter} 1{enter} 0{enter}
```

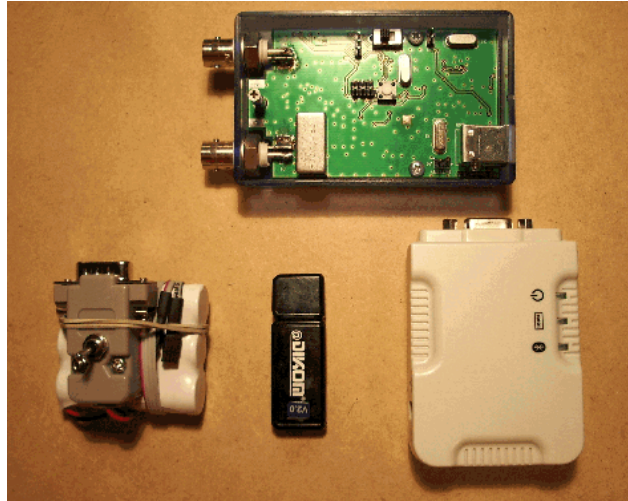
The analyzer is supplied with USB and for the RS232 communication there is a slide switch to change from USB to RS232, the three signals for the RS232 (RX-TX-GND) are available on the PCB already converted at the right level to rs232 specs, user has to solder 3 wires with DB9 cannon connector.

## Applicatio Notes

### Analysers with wireless connection

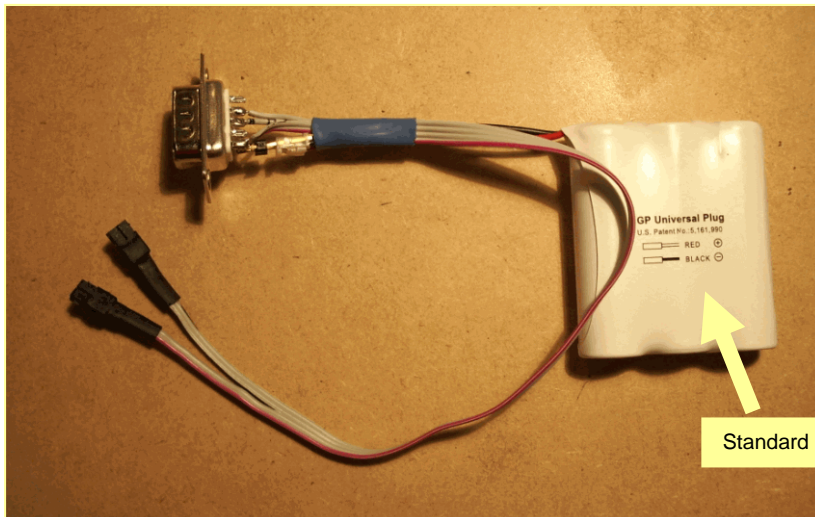
In case you need to place the analyzer under the antenna you can receive the data via a wireless adapter. You will have to power both analyzer and adapter with external 3.6-5.0 VDC source and use the RS232 interface connection.

The communication was succesfully done using the followig adapter, the RS232 adapter for about 50 EUR is available from [www.eikonsite.com](http://www.eikonsite.com)



Here available some tecnical information <http://www.blue2bfree.com/site/datasheet/rs232cl1e05.pdf>

### Setup with wireless adapter (homemade)



DB9 Bluetooth	miniVNA
2 (TX)	3 J4(RX)
3 (RX)	2 J4(TX)
5 (GND)	J6 (GND)
9 (+ BATT)	J6 (+ BATT)

Standard cordless battery 1,2V x 3 NiCd

### NOTE

- Before connecting RS232 and battery, remove jumper from J3.
- Move SW1 to RS232 position.
- Apply power from battery to J6 max 5VDC.