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DG8SAQ VNWA 2.x Self Installer Manual

1. Introduction:

This document describes the DG8SAQ Installation process using the VNWA Self Installer. The VNWA Self installer is an executable file which contains the VNWA Driver, the VNWA Application and the VNWA helpfile and assists VNWA 2.x users with easy installation option.

The Self Installer installs VNWA Application 35.x upwards.

2. Important Information

Copyright notice

2.1 Caution - Safety Information:

1. VNWA 2.x is powered and controlled through the USB-cable supplied. The USB-cable should be connected to the USB port of a Personal Computer capable of supplying +5V DC at 500mA maximum.
2. The maximum safe input voltage into the TX-out and Rx-in ports is an RF Voltage of 0dBm (225mV RMS with a frequency between 1 kHz up to 1300 MHz). Exceeding this value may cause damage to the VNWA and may invalidate product warranty.
3. Always check the SDR-Kits Website for current Product information including Safety Information and latest Product Updates.
   http://www.sdr-kits.net/VNWA/VNWA_Documentation.html

2.2 Product Documentation:

The documentation of this product is supplied as a VNWA Application Helpfile, through the VNWA Installer or may be downloaded from the Internet from

http://sdr-kits.net/DG8SAQ/VNWA/VNWA_HELP.pdf

2.3 Requirements:

The Self Installer is available from VNWA Application 35.0 upwards. After VNWA Application 35.x is installed it is important that VNWA 2.x is firmware is **manually** upgraded to the latest firmware. The latest firmware can be found in the VNWA Application folder used by the Self Installer.
Note: Firmware version 4.14 comes after version 4.9 and 4.10!!

2.4 VNWA License code:

Make sure you have the VNWA License code which was supplied with the VNWA available prior to the installation. It will be required for the upgrade.

3. VNWA Self Installer: Driver - Software and Helpfile Installation

Caution: Although the installation package is provided for easy installation, it is recommended that the appropriate installation procedure for your Operating System is reviewed before starting the installer. The procedure below assumes that VNWA package has NOT been installed previously on the Computer in question.

3.1 Windows 7 & Vista 64 bit and 32 bit Installation

This section shows installation procedure for Windows 7 (64 or 32 bits)

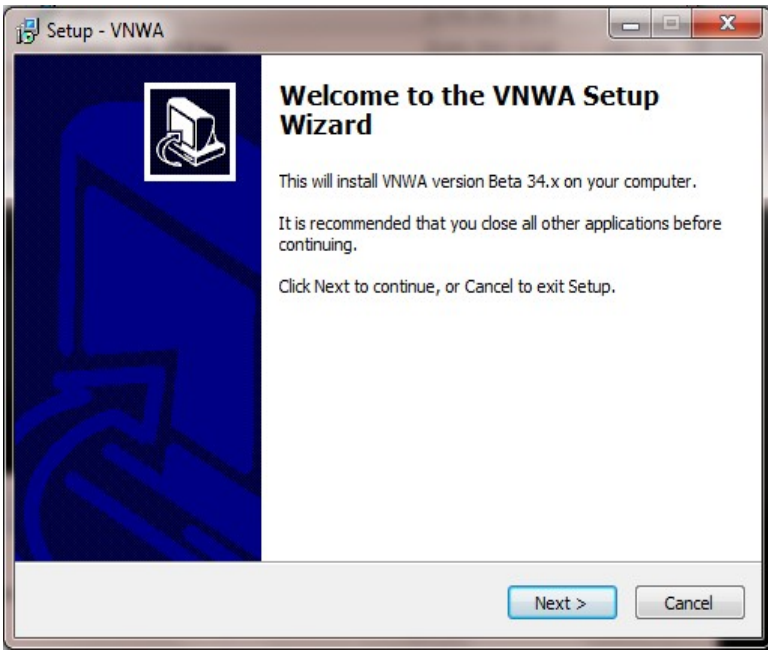
Note: For Installation on **Windows XP** refer to section 3.4

IMPORTANT: Information for Windows 7 and Vista users:
If you are installing the VNWA application for the **first time**, the VNWA Setup program will guide you to install an application Winhlp32.exe from the Microsoft website. The Winhlp32.exe program is required to display the VNWA help file. However Microsoft license conditions does not allow theWinhelp32.exe to be distributed as part of the VNWA setup program.
VNWA installation is easier and friendlier if Winhlp32.exe application is already installed beforehand. It is therefore recommend to install Winhlp32.exe from the link
http://support.microsoft.com/kb/917607 prior to starting the VNWA installation program in **step 3.1.1**. You can always check if **Winhlp32.exe** is already installed by inspecting the **file size** of this file in **C:\windows.** If file size of Winhlp32.exe is **290 KBytes** then the application is already installed. If this file is present but it is only **9Kbytes** in size then Winhlp32.exe should be installed first:

3.1.1 Download and save the Installation Package from the following location to your desktop
http://www.sdr-kits.net/DG8SAQ/VNWA-installer.exe

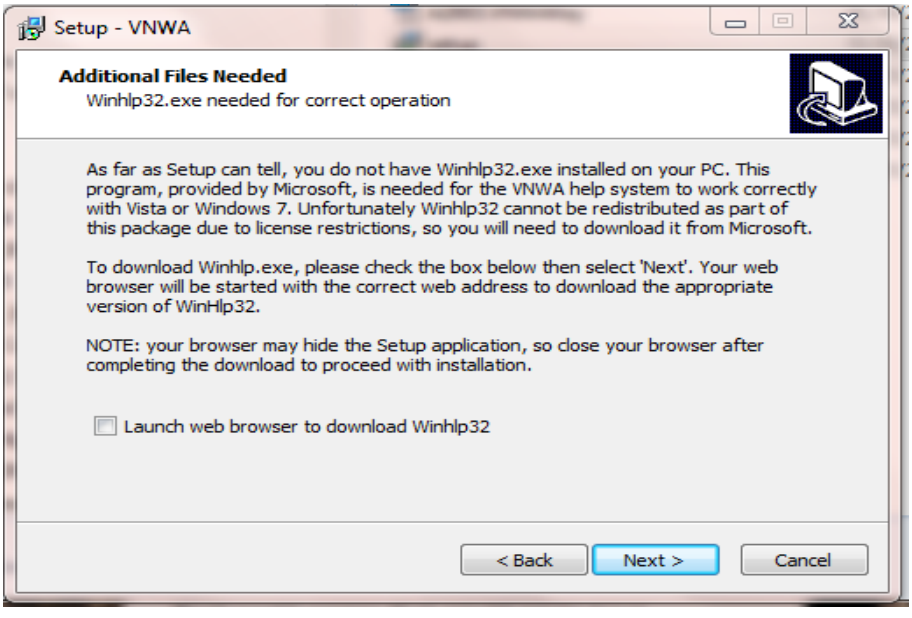
3.1.2 Make sure the VNWA is **NOT** connected to the PC
Double Click on the VNWA-installer Icon to start the VNWA installation process.

Confirm the VNWA-installer can make changes to your Computer, then screen below is shown. Press "Next"

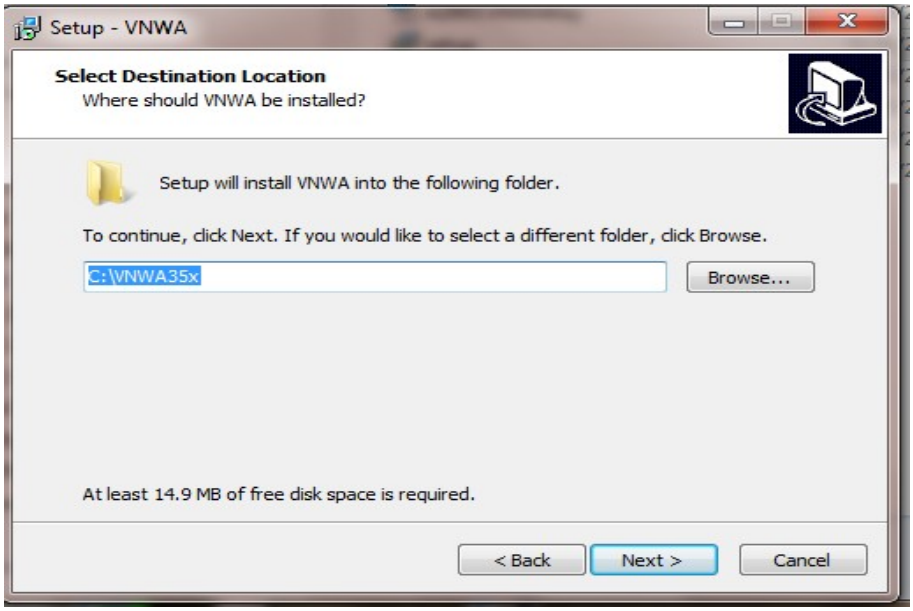


3.1.3 If the file Winhlp32.exe is **NOT** installed on the Computer than the screen below is shown. Winhlp32.exe file should be installed otherwise VNWA helpfile will not be displayed. If you click the box the Web browser will be launched. Follow the instructions on the Microsoft Website to download winhlp32.exe. **Note**: For 64 bit Operating Systems the filename ending in -x64.msu should be downloaded and -x86.msu for 32 bit Operating Systems.

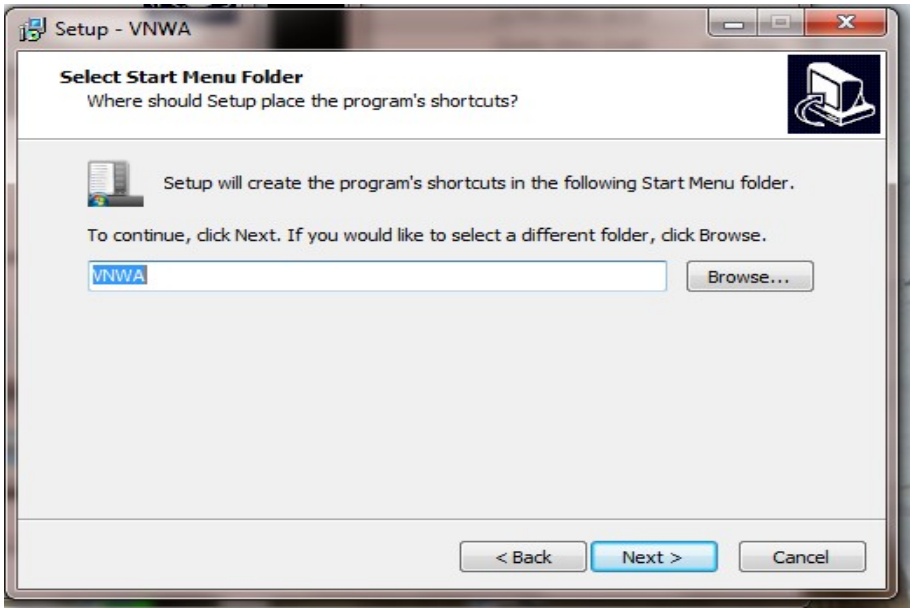
Note: The link to the microsoft winhlp32.exe support is: http://support.microsoft.com/kb/917607



3.1.4 Press "Next" – The default location where VNWA will be installed will be shown:
Note: Select a different Destination Location (ie C:\VNWA_2) if you s to install a second VNWA application on the same PC to prevent overwriting the setup files of your first VNWA application.

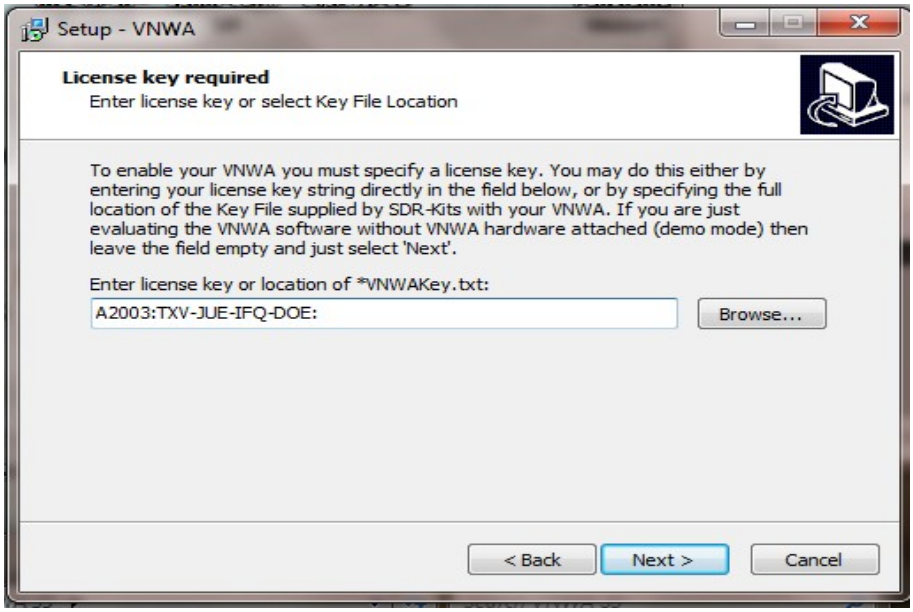


3.1.5 Press "Next" – Default where program shortcuts will be installed



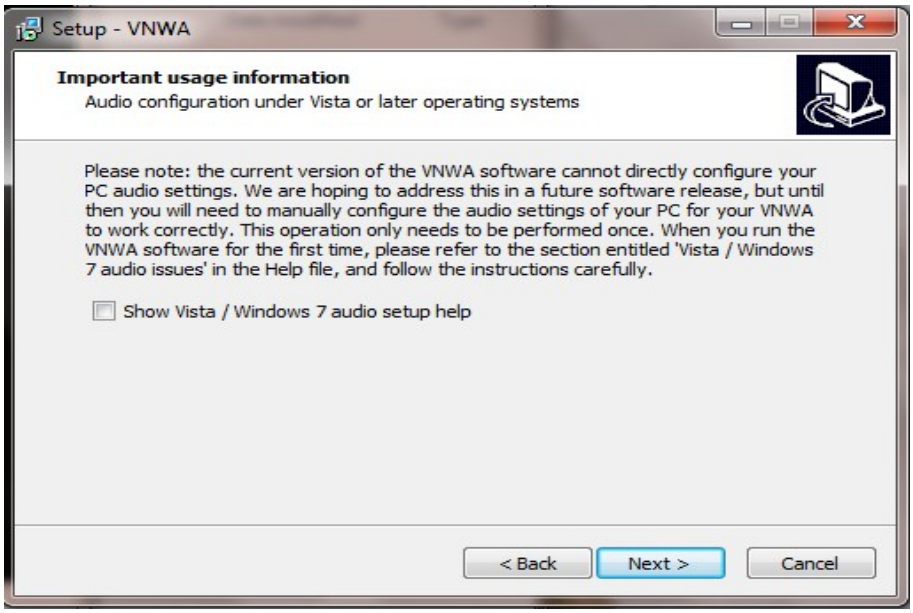
3.1.6 Press "Next" – Screen to enter VNWA license key is now displayed as shown below:
There are two options to enter the VNWA license key for your VNWA:

Directly enter the VNWA license code exactly as shown in the Manual supplied with the VNWA 2.x hardware. The VNWA license code is also specified in the VNWA shipping advice email
Note: the last colon is the last character and must also be entered.

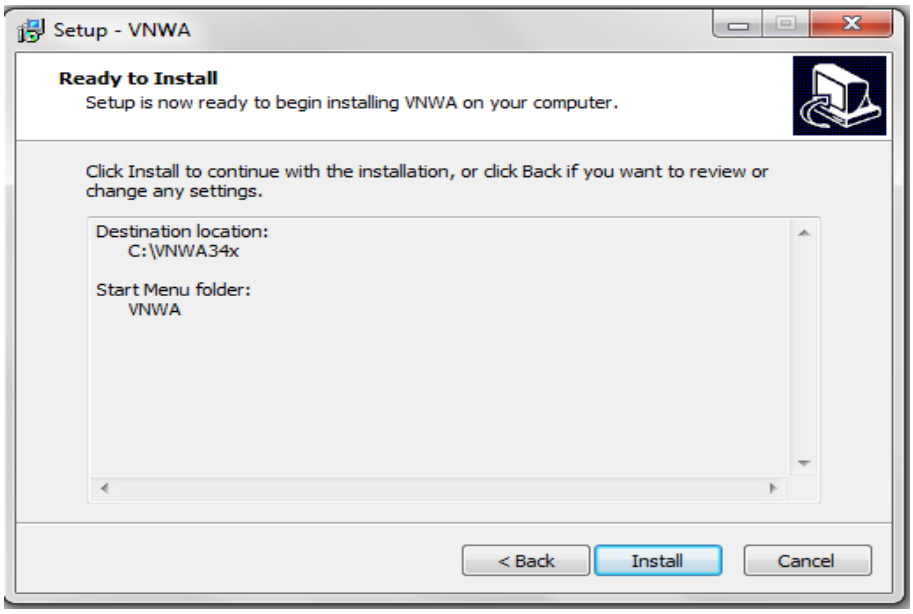


Note: A Screen (not shown in this manual) is now displayed with option to create a Desktop Icon for: A) All users or B) For Current User only. Make your selection and press "Next"

3.1.7 Press "Next" – Information on Audio Configuration is displayed

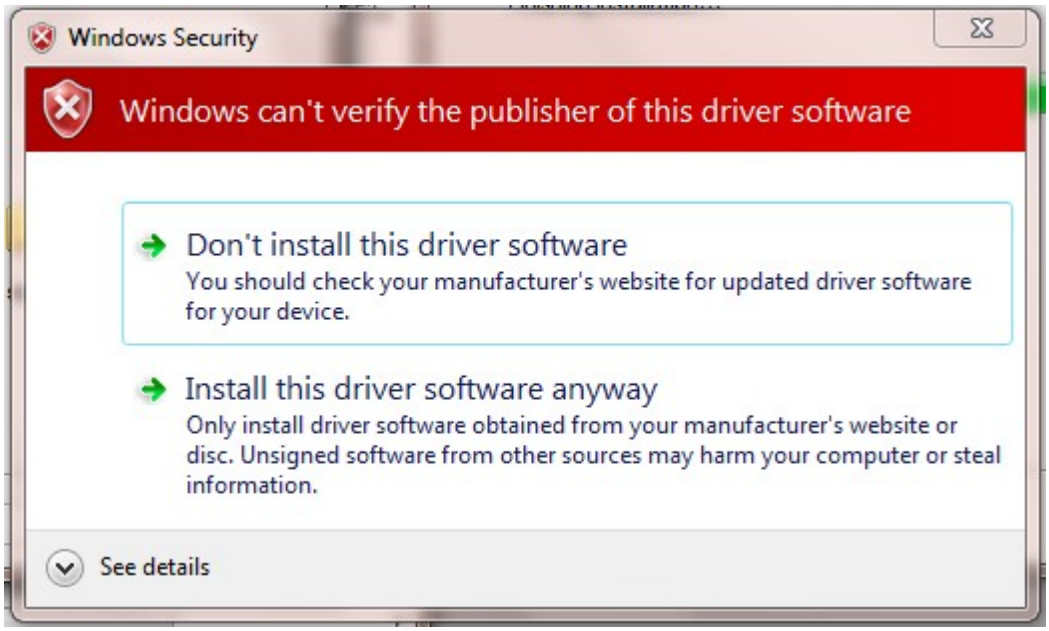


3.1.8 Press "Next" and Ready to Install screen is displayed

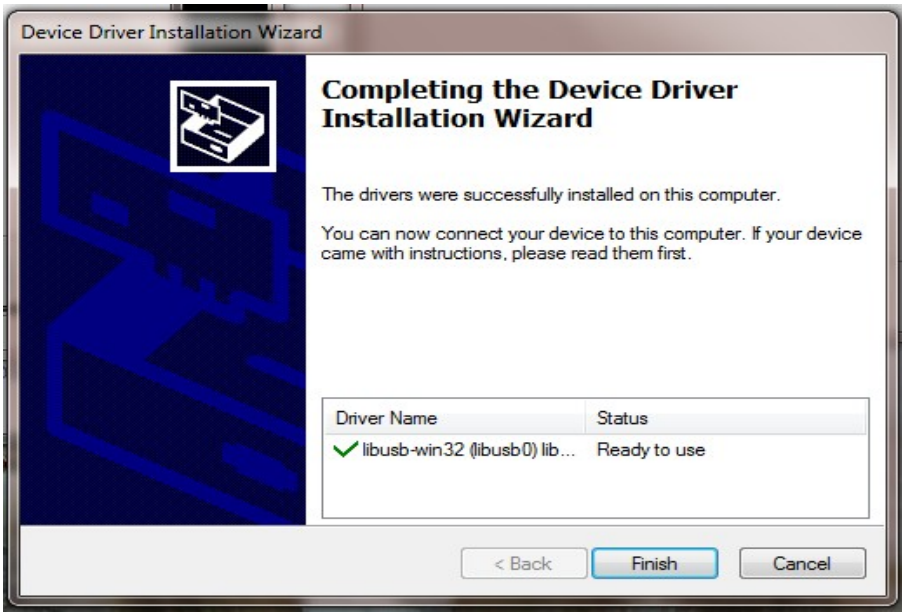


3.1.9 Press "Install" – VNWA Application and helpfile are now installed and Driver Installation window is displayed. **Note:** Do **NOT** plug-in VNWA at this time

3.1.10 Press "Next" – Following screen **may be displayed** – Select "**Install this driver software anyway"**



3.1.11 Press "Next" – Driver installation will take from 10-30 seconds



3.1.12 Press "Finish" -

3.1.13 If you have selected to view the “Show Vista/Windows 7 Audio setup help” in point 3.1.5 read the information and close the window prior to next step

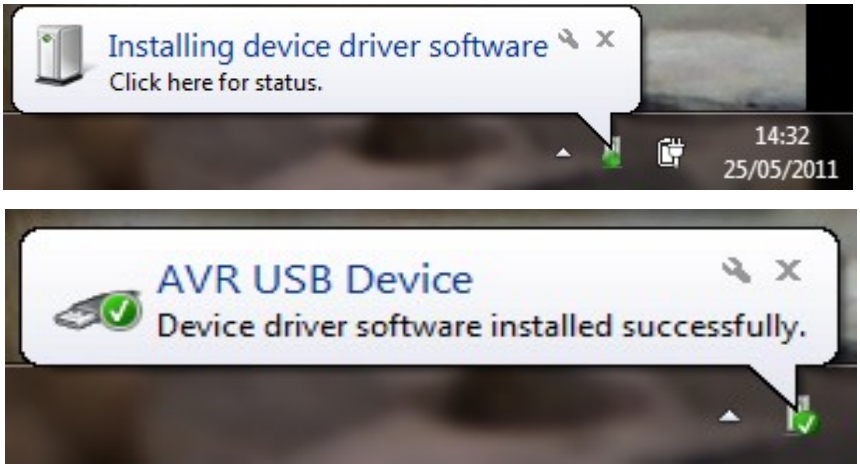
3.1.14 Press “Finish” to complete installation.

END OF VNWA Installation

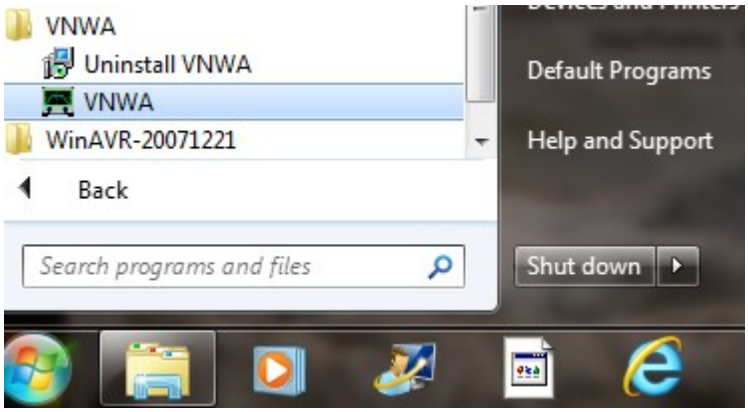
3.2 Windows 7 & Vista 64 bit and 32 bit Application Configuration:

3.2.1 Plug in the VNWA USB cable into USB Port of your Computer. Note: It is recommended to connect the VNWA same Computer USB Port next time you use the VNWA.

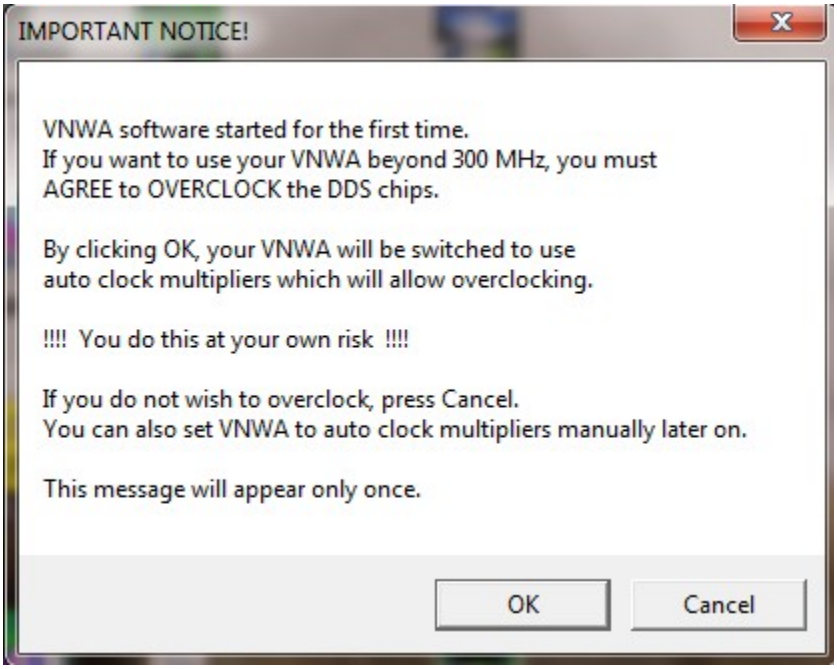
When connecting the VNWA for the **first time** after Driver installation, the VNWA will be recognized and device driver installation should complete automatically.



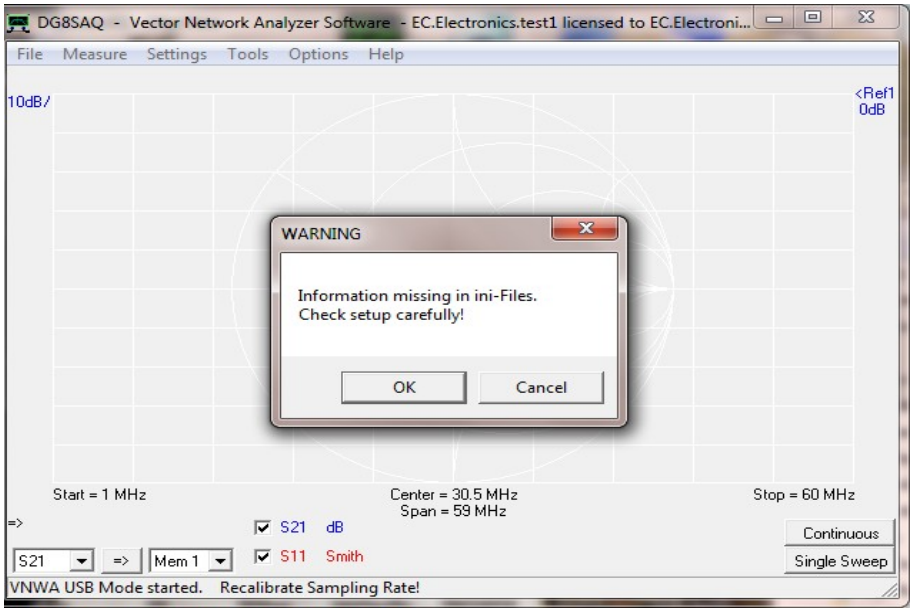
3.2.2 Click “Start” “All Programs” “VNWA” and VNWA Icon to start the application or use the Shortcut created on the Desktop.



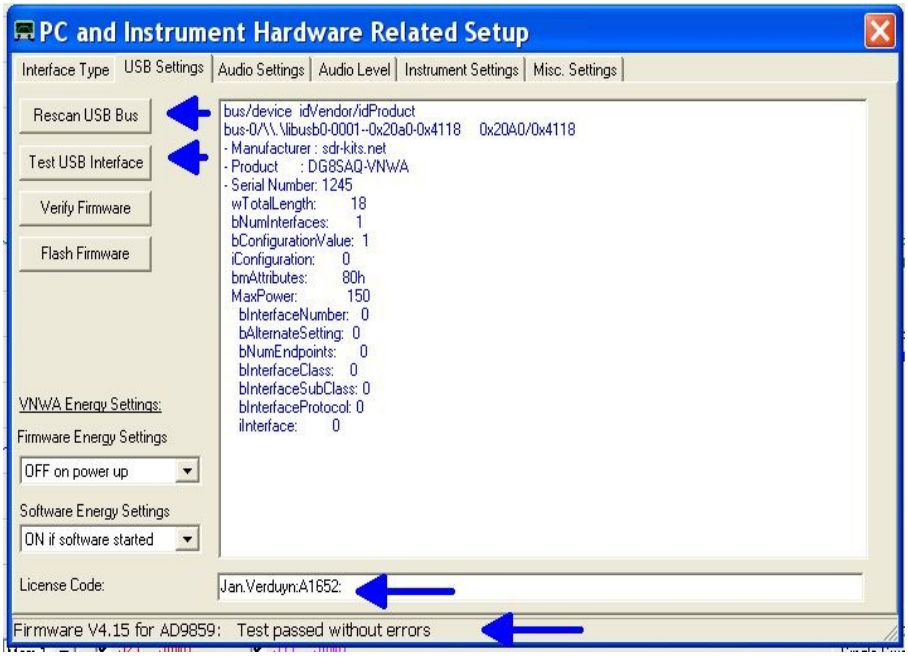
3.2.3 **Overclocking Warning may be displayed when you run VNWA Application software for the first time.** Select "ok" to allow overclocking of the DDS chips beyond 400 MHz. Note: VNWA performance over 500 MHz will be worse affected if overclocking of the DDS is not permitted.



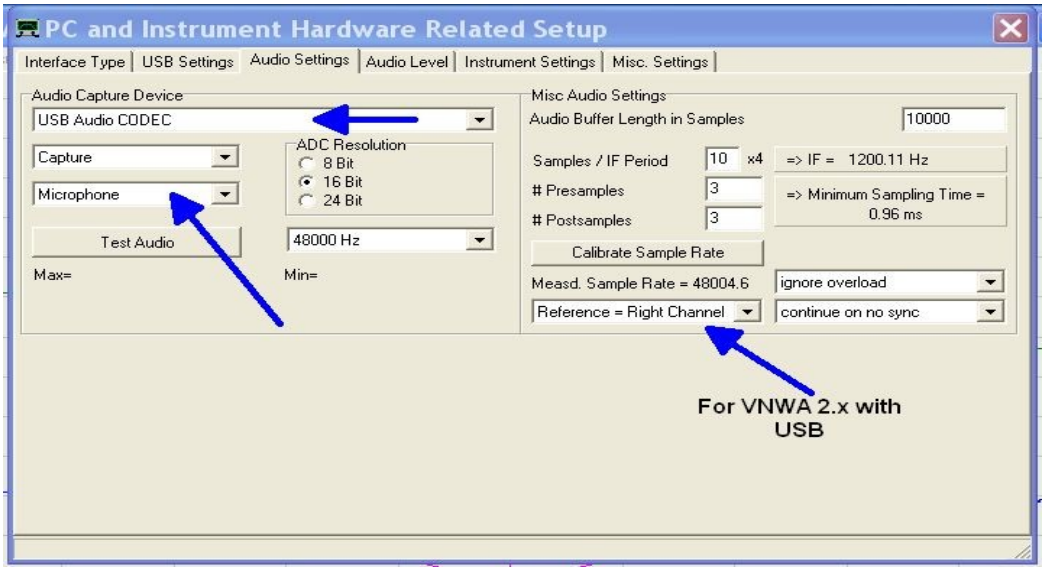
3.2.4 VNWA Application starts: Click “OK” to enter VNWA setup information



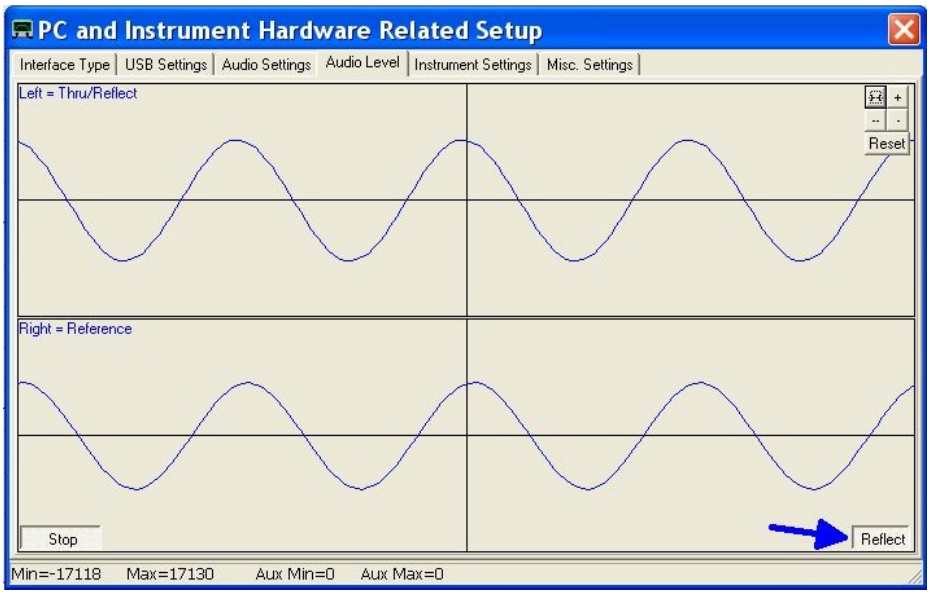
3.2.5 The tab "USB Setting" should now displayed. If not click on the USB-Setting Tab
Check whether VNWA license code is shown, In event this information is missing then enter the VNWA license code again. Now press “Rescan USB Bus” and “Test USB Interface”
Check bottom line for message “Test passed without errors”



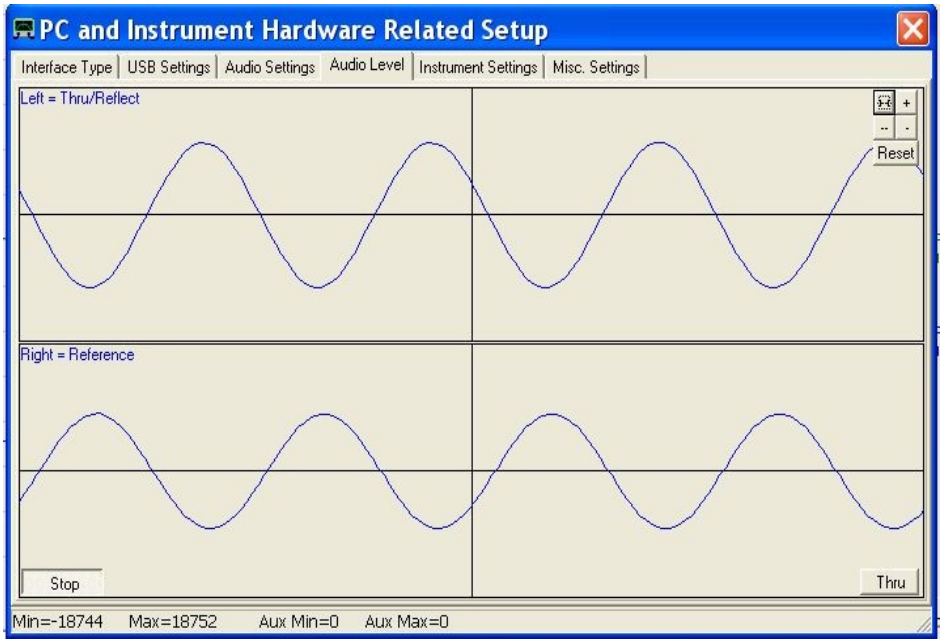
3.2.6 Select Tab “Audio Settings” and set “Audio Capture Device” to “USB Audio Codec”
Note: Variants of the USB Audio Codec” may be shown instead
For Factory VNWA2.x check Reference = Right Channel has been selected. (Note: some VNWA 2.x built from a Kit may use "Left Channel" depending on wiring of the 3.5mm audio connectors) Now press “Test Audio”



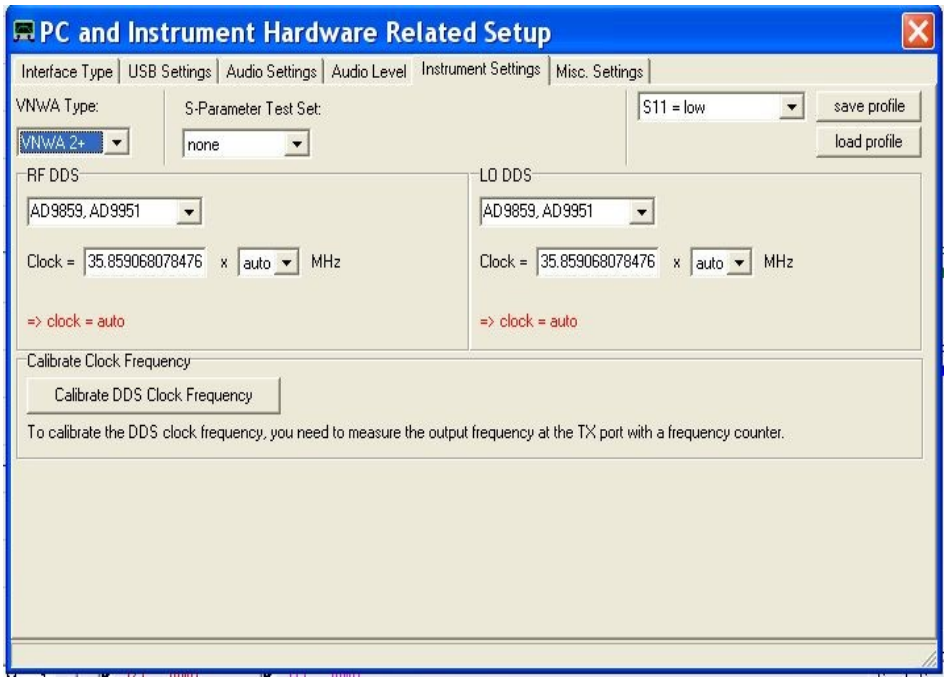
3.2.7 Click on Tab “Audio Level” and check whether two sine waves are present as show below in “Reflect” mode. (100% Reflection with TX Port unterminated)
If sine waves are distorted then USB Audio Codec needs to be configured as shown in section 3.3.
When the Audio level adjust is performed according to point 3.4 click on Tab "Calibrate Sample Rate"
***Note:** when the THRU Mode is active the Audio levels min and max are higher than when in REFL Mode*



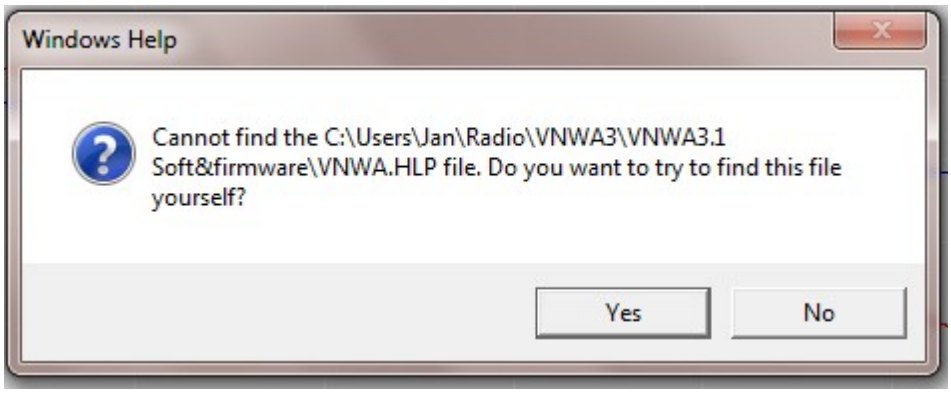
3.2.7 Connect the TX port and RX port with SMA cable and check that the Reflect (Left Channel) sine wave has now disappeared. (TX port now sees 50 Ohms and no reflection)
Next select “Thru” and check that the Left Channel "sine wave is displayed.



3.2.8 Click “Stop“ cease the Audio test. Next click on Instrument Settings” and check whether clock is set to “auto" as shown below. **Note:** for VNWA 2, the clock is generally a little below 36 MHz, somewhere between 35.855 MHz and 36.000 MHz depending on Crystal fitted.
When performing Audio test press ++ / + or -- / - buttons until the sinewaves are almost stationary on the screen. If you have a frequency counter perform Calibrate DDS Clock calibration as described in the VNWA helpfile.



3.2.9 Press the top right button to close the VNWA Setup screen. Next we test whether the VNWA helpfile is available. Press “Help” and select “Help” again. The screen below may be shown. Press “Yes” and “Browse” to select the location where the Helpfile is located. If standard VNWA installation defaults were selected then the default path will be:
My Computer C:\VNWA\VNWA.hlp

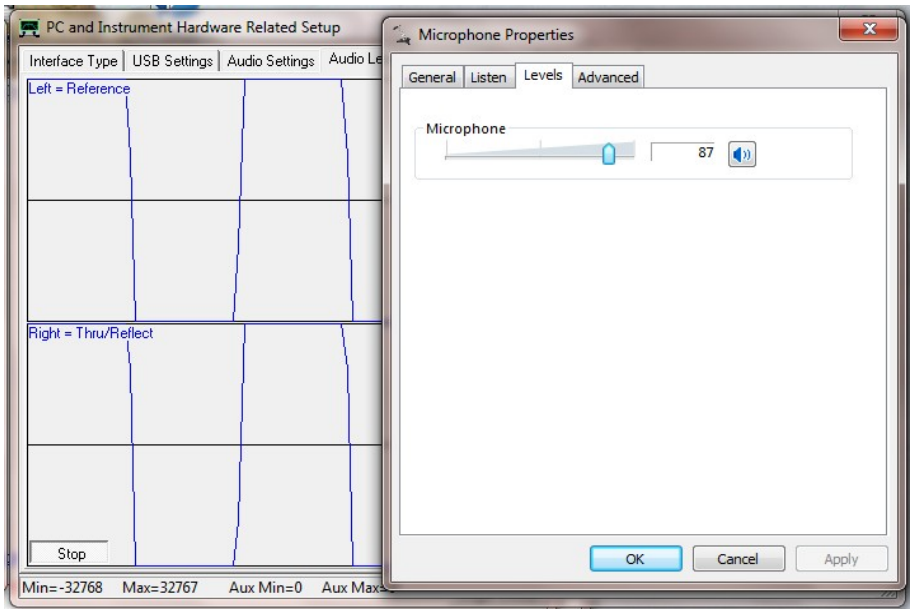


3.2.10 **IMPORTANT:** To save the VNWA configuration (after any changes are made) exit the Setup VNWA application. This saves the VNWA configuration files for the next time the VNWA application is started.

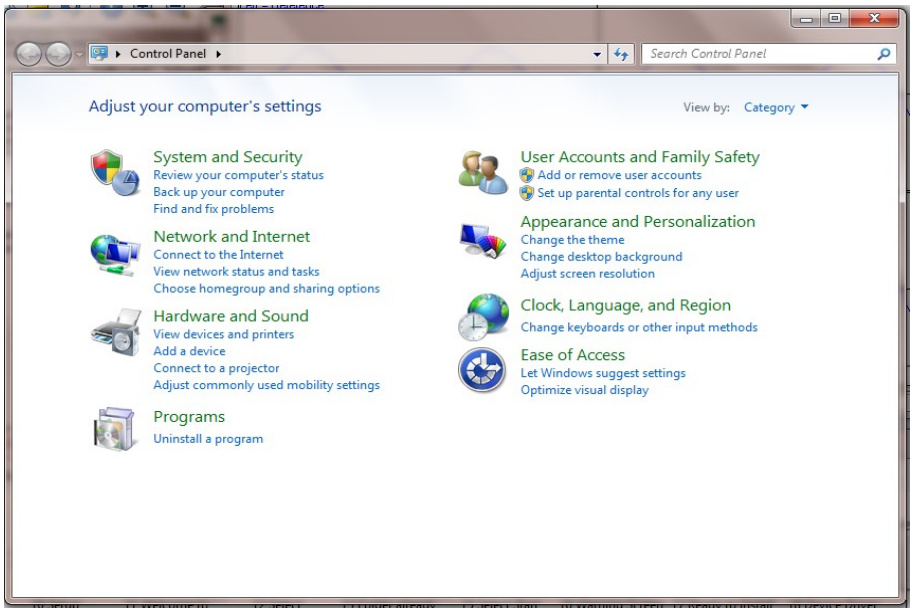
End of VNWA Configuration

3.3 Windows 7 - 64 bit and 32 bit Audio Codec Configuration

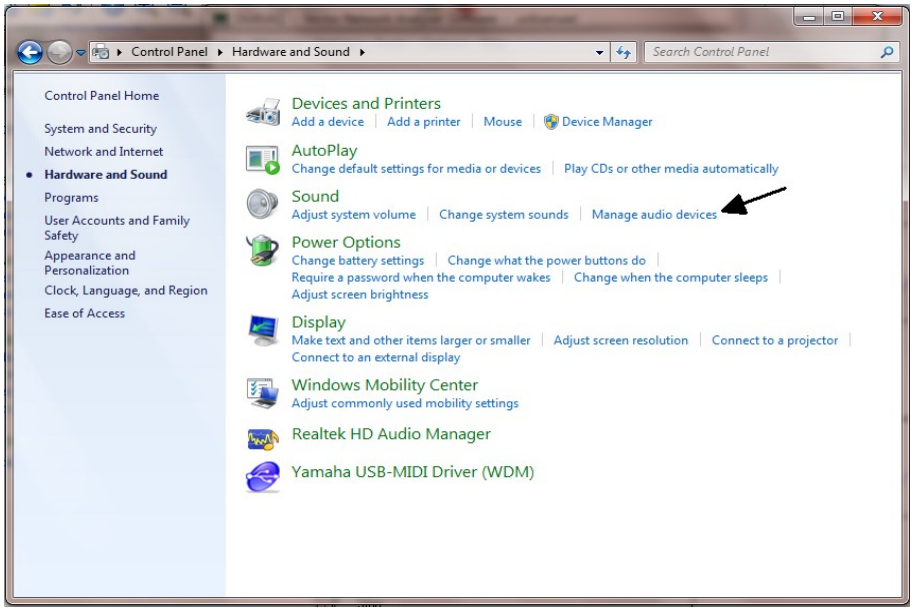
3.3.1 Windows 7 configures the USB Audio Codec as a mono application with levels set too high as shown below. This prevents VNWA application from functioning.



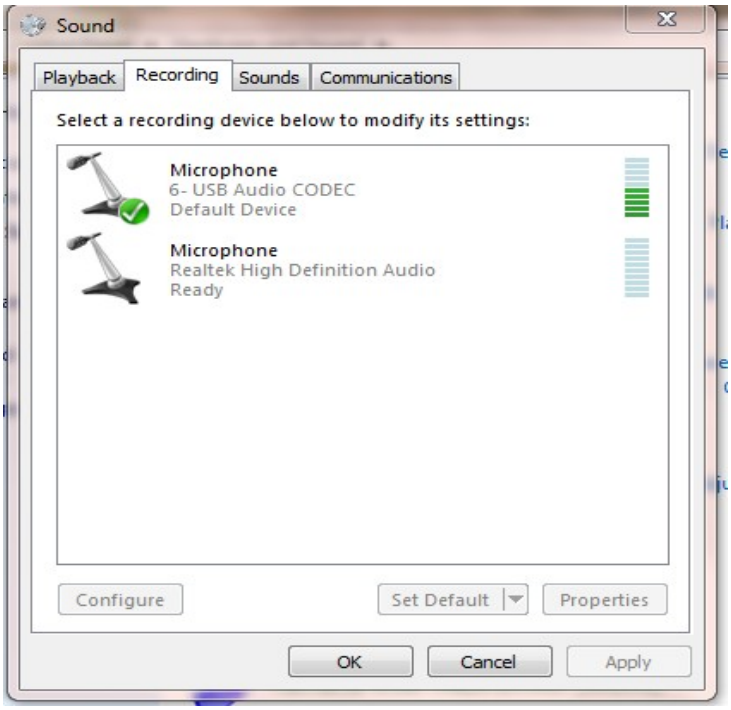
3.3.2 Start the VNWA Application and select Audio Test as shown in 3.2.7
Now to configure USB Codec properties select “Start”, “Control Panel”



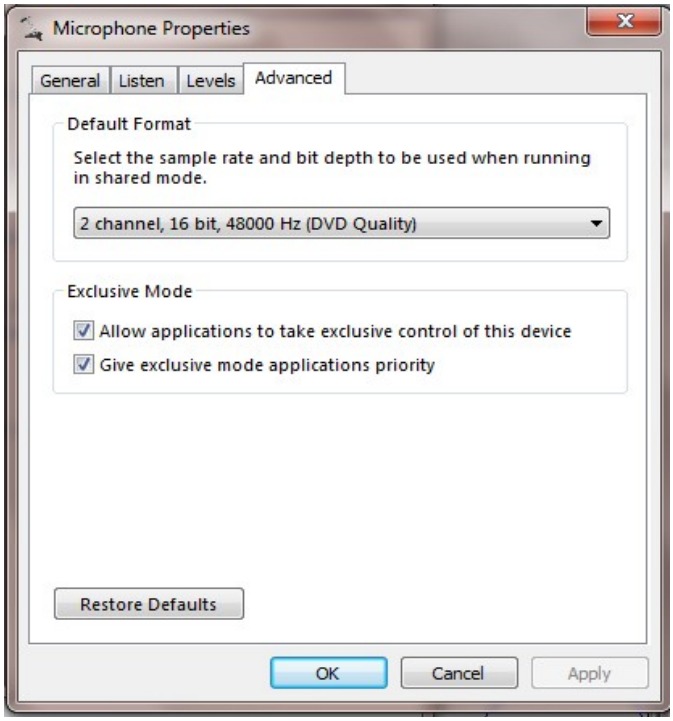
3.3.3 Select “Hardware and Sound” and click on "Manage Audio Devices"



3.3.4 and click on tab “Recording”

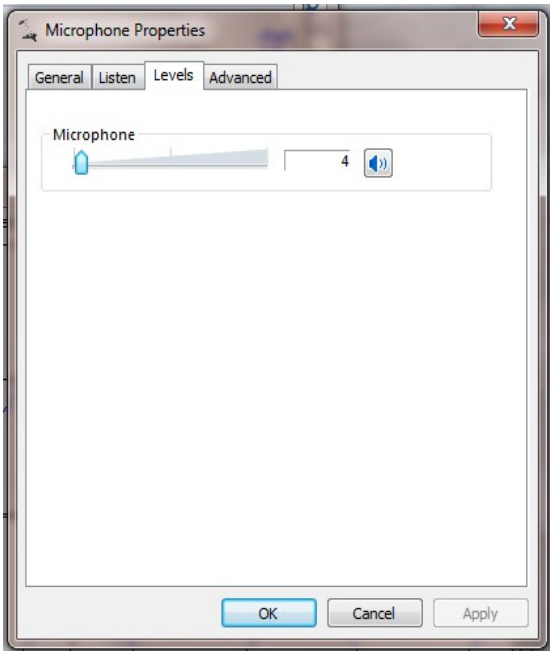


3.3.5 Click on “Microphone USB Audio Codec” and select “Advanced”
Ensure that Default Format is set to **“2 channel, 16 bit, 48000 Hz”**



3.3.6 Next select “Levels” and adjust Microphone level to value of between 3 and 5, (typically 4) and press OK

Note: If 4 is not selectable e.g. the displayed number jumps from 3 to 5 then use the left and right arrow keys and count you way. You will find whilst **only** 5 is shown both the setting for 4 and 5 is available.



3.3.7 Check on VNWA Setup Screen that sinewave covers approx 50% to 60% as shown in step 3.3.6 and 3.3.7. If necessary adjust Microphone level until this is achieved.

End of Audio Codec Configuration

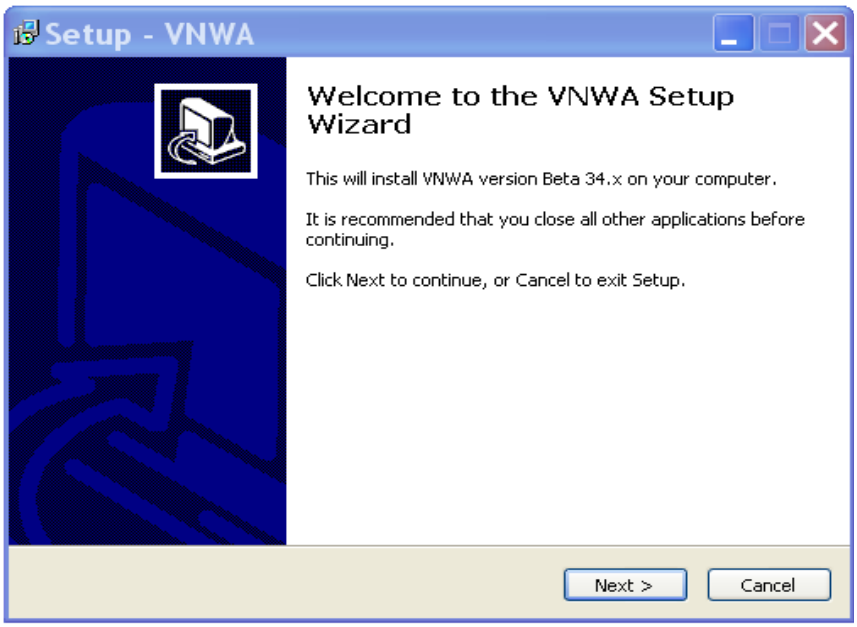
3.4 Windows XP Installation

Note: For Installation on **Windows 7 and Vista** refer to section 3.1

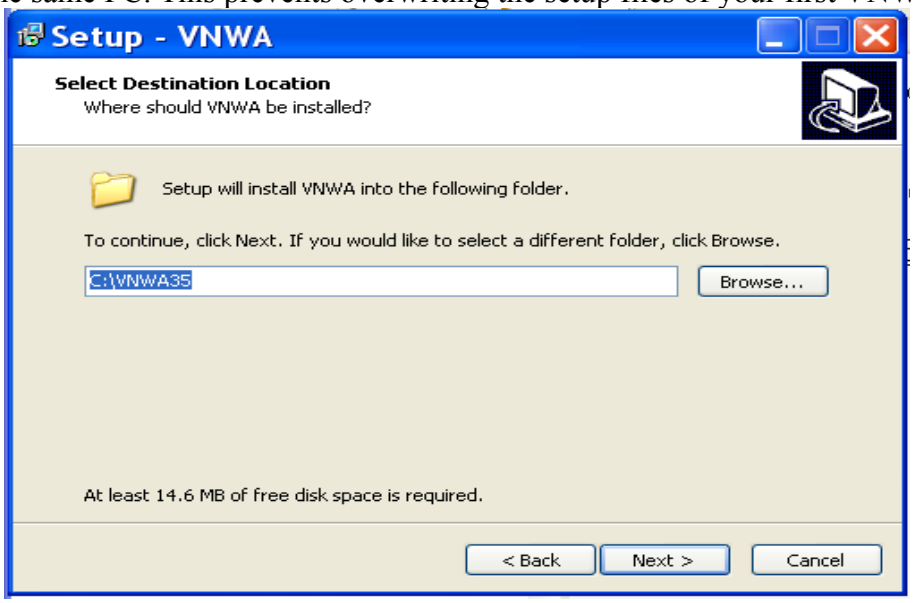
This section shows installation procedure for Windows XP Operating System.

3.4.1 Download and save the Installation Package from the following location to your desktop
http://www.sdr-kits.net/DG8SAQ/VNWA-installer.exe

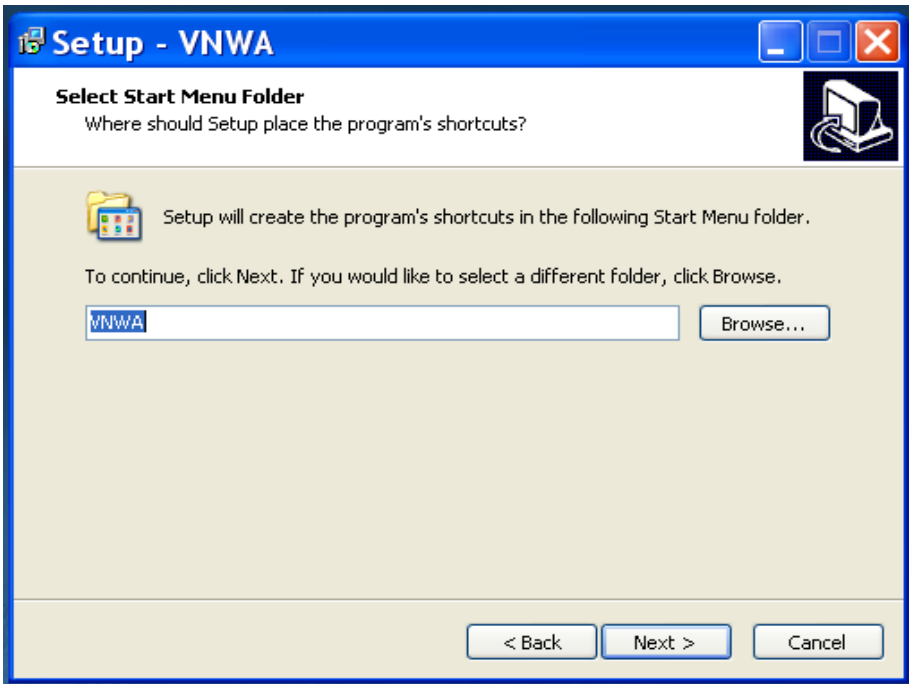
3.4.2 Make sure the VNWA is **NOT** connected to the PC
Double Click on the VNWA-installer Icon to start the VNWA installation process.
Confirm that the VNWA-installer can make changes to your Computer



3.4.3 Press Next – The default location where VNWA will be installed will be shown:
Note: Select a different Destination Location (ie C:\VNWA_2) if you want to install a second VNWA application on the same PC. This prevents overwriting the setup files of your first VNWA application

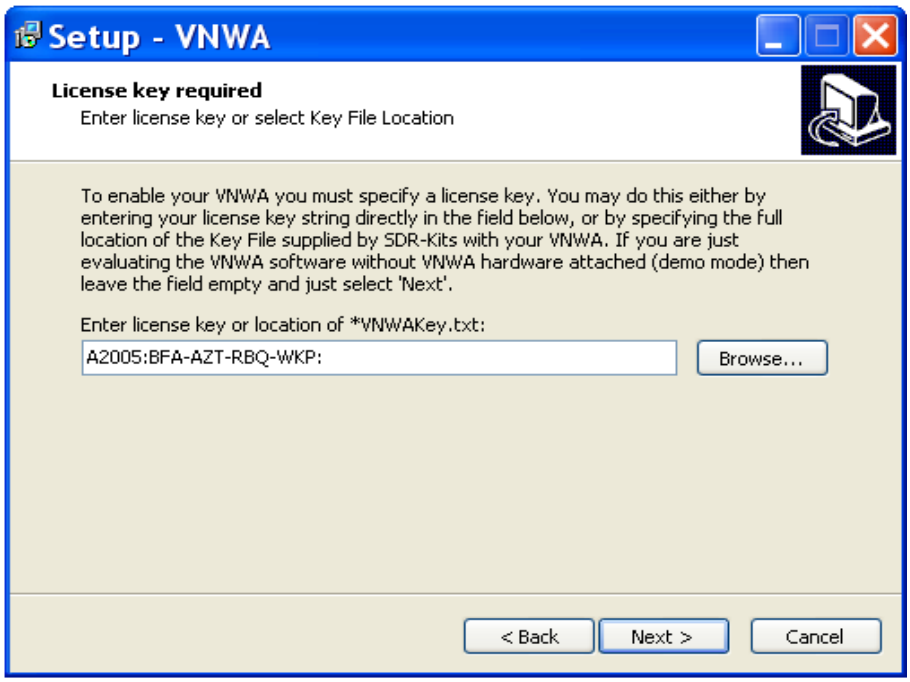


3.4.4 Press Next – Default Location where VNWA program shortcuts will be installed



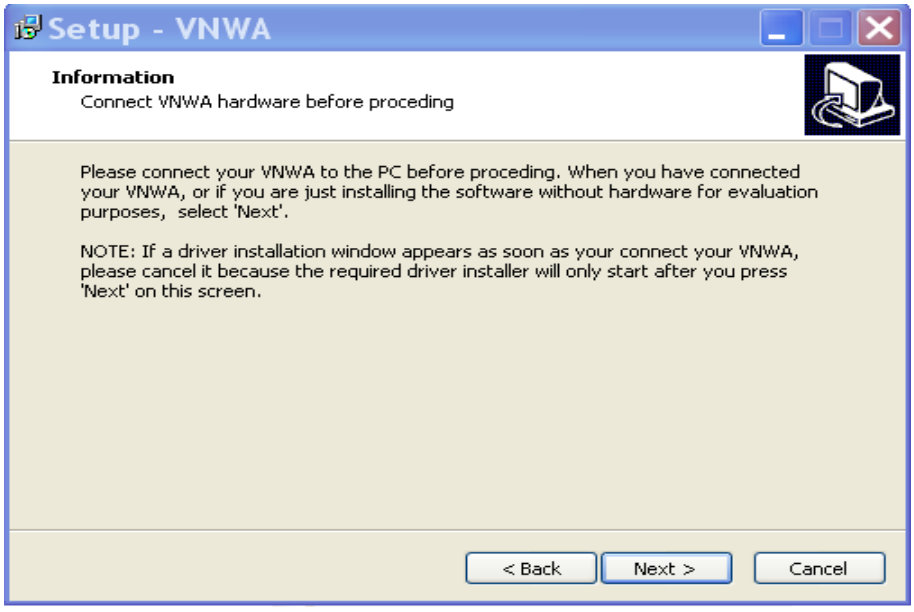
3.4.5 Press Next – Screen to enter VNWA license key is now displayed as shown below:
There are two options to enter the VNWA license key for your VNWA:

Directly enter the VNWA license code exactly as shown in the Manual supplied with the VNWA 2.x hardware
The VNWA license code is also specified in the VNWA shipping advice email
Note: the last colon is the last character and must also be entered.



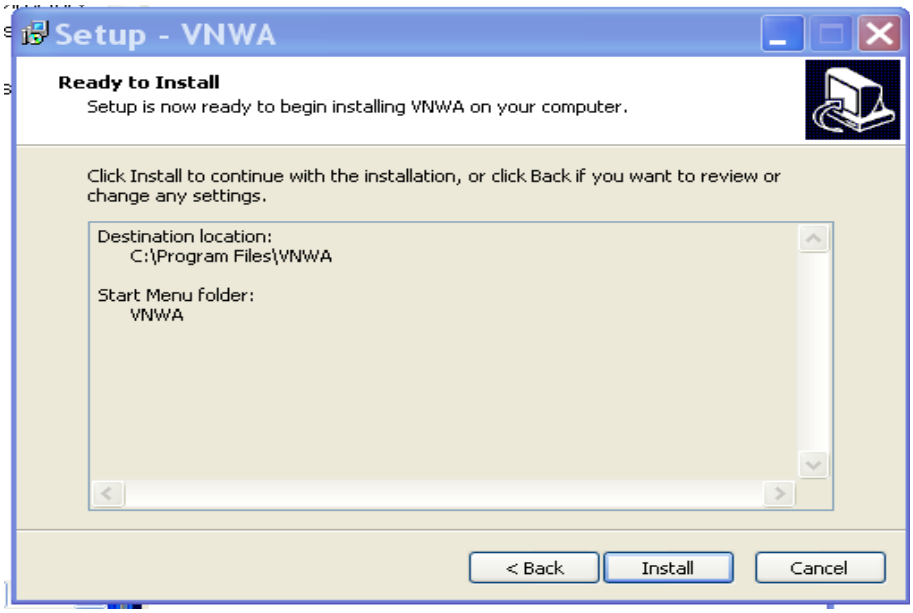
Note: A Screen (not shown in this manual) is now displayed with option to create a Desktop Icon for: A) All users or B) For Current User only. Make your selection and press "Next"

3.4.6 Press "Next" - Read and execute the instructions displayed on the screen below:
Note: The VNWA hardware must be connected in this step otherwise driver installation may fail.

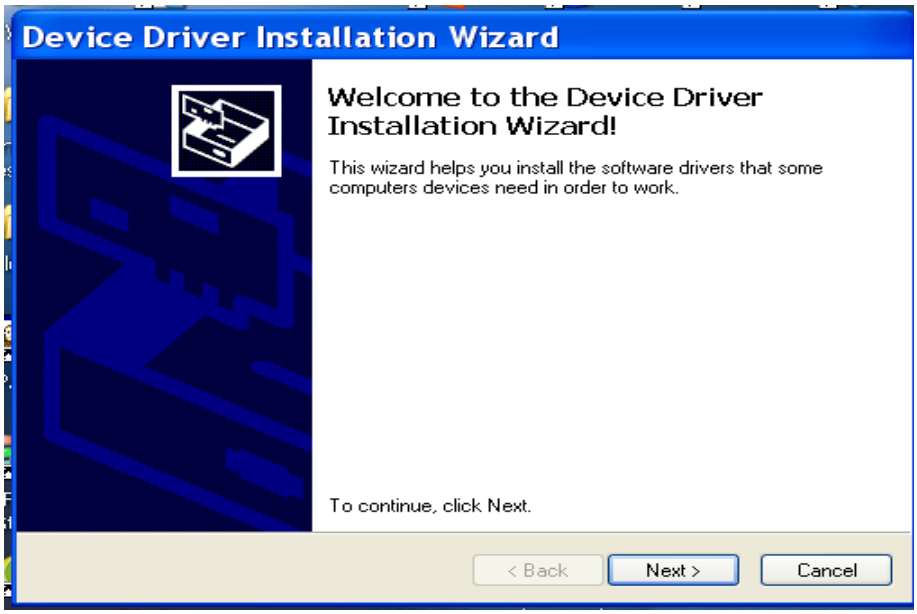


3.4.7 If the screen below is displayed after plugging in VNWA then press "Cancel button on this screen

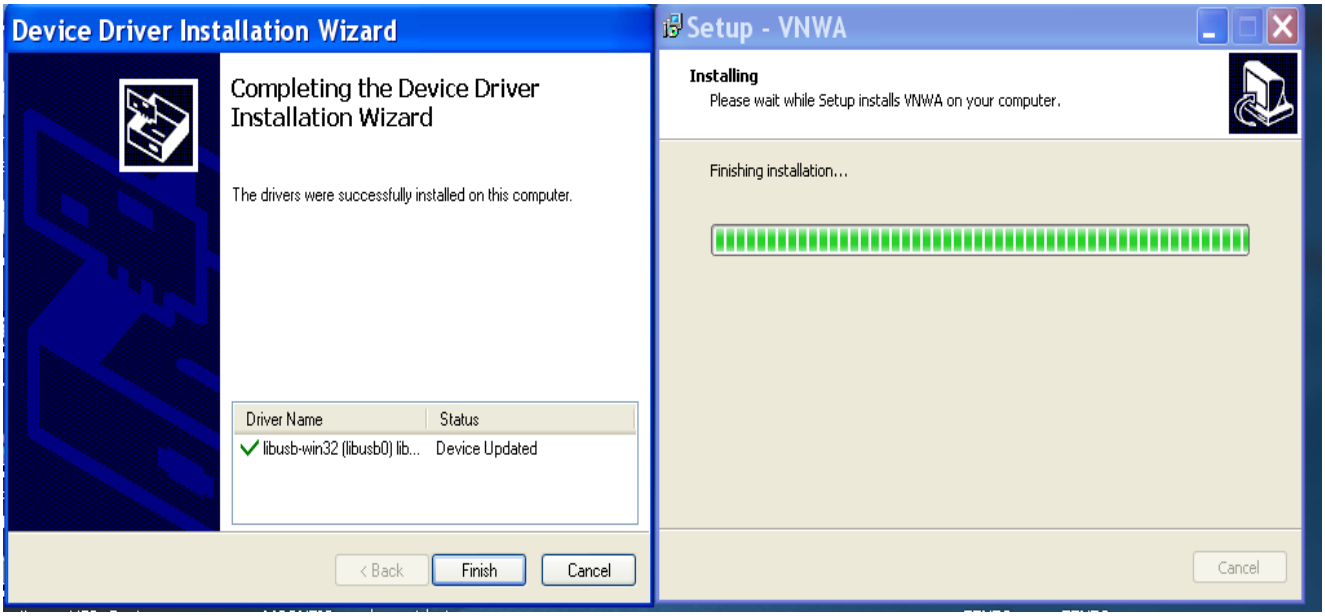
3.4.8 Press "Install" on Screen below. The Installation of VNWA Application and Driver should now start and screen below is shown.



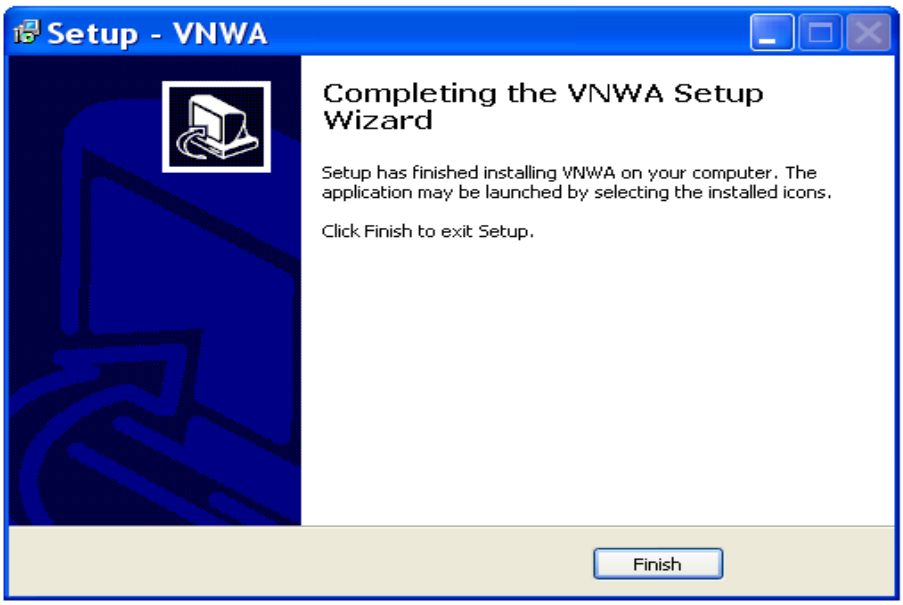
3.4.9 The Installation of VNWA Application and Driver now start and screen below is displayed. press "Next"



3.4.10 Driver installation now completes - Press "Finish"



3.4.11 Press "Finish" - to exit the VNWA installation routine.



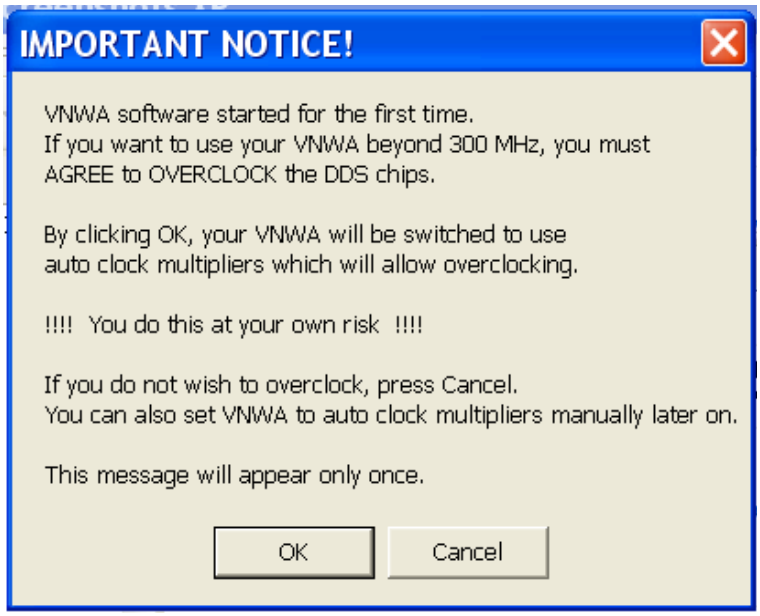
END of Windows XP Installation

3.5 Windows XP VNWA Application Configuration

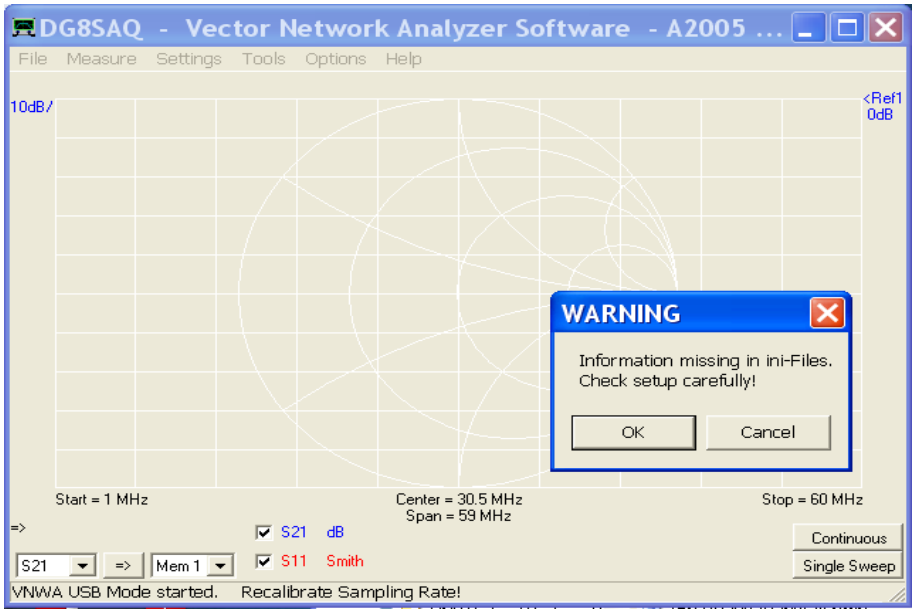
3.5.1 Ensure the VNWA USB cable into USB Port of your Computer.

3.5.2. Click “Start” “All Programs” “VNWA” and "VNWA" to start the VNWA application or use the Shortcut created on the Desktop.

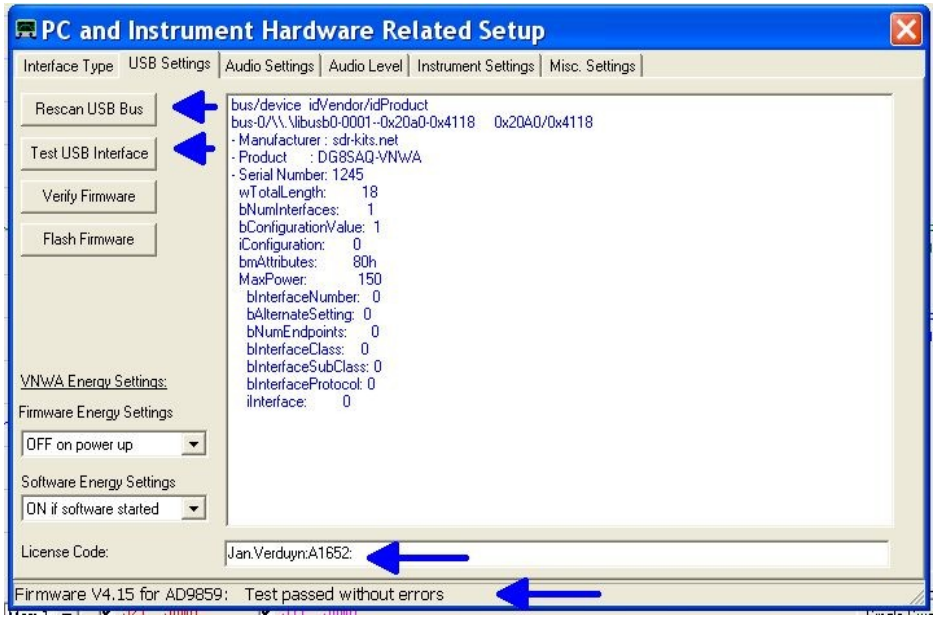
3.5.3 VNWA Application is started. The following Notice is displayed when VNWA application is started for the first time:
Note: To allow for VNWA operation above 500 MHz auto clock multipliers must be selected**.**



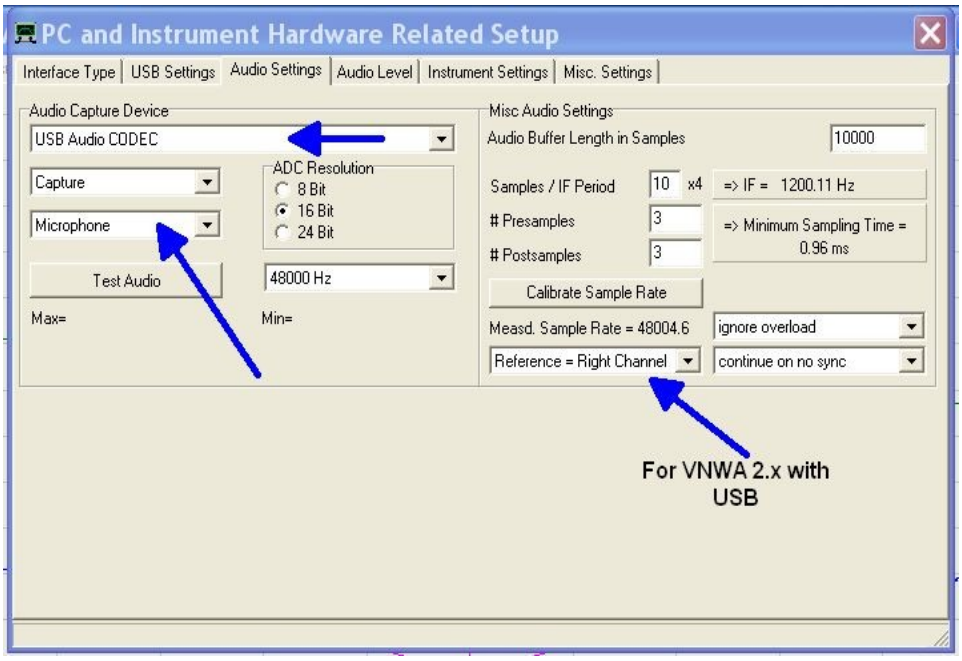
3.5.4 VNWA Application starts: Click “OK” to acknowledge that VNWA setup information needs to be entered.



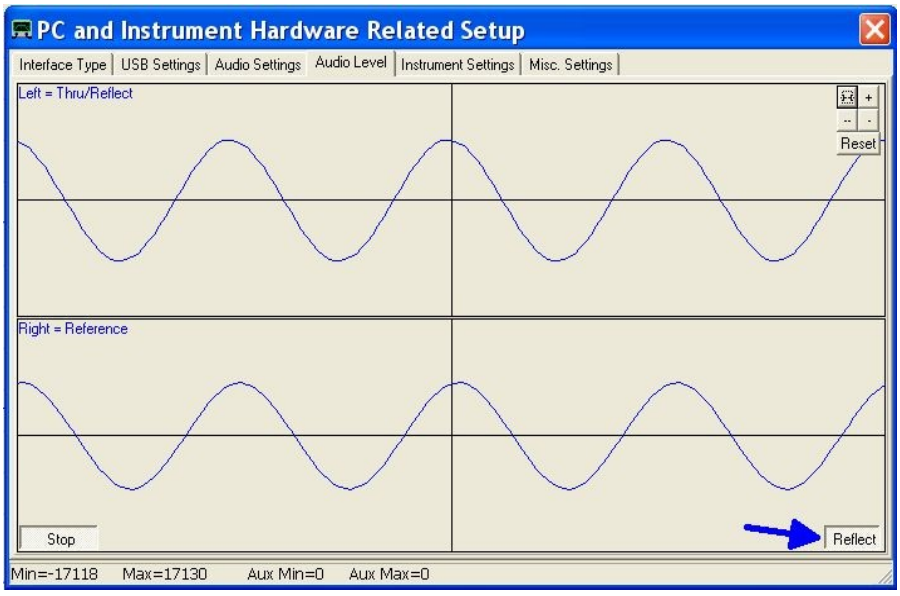
3.5.5 Now click on Tab "USB Setting"
Check whether VNWA license code is shown, In event this information is missing then enter the VNWA license code shown on page 2, 2.4 again. Now press “Rescan USB Bus” and “Test USB Interface” Check bottom line for message “Test passed without errors”



3.5.6 Select “Audio Settings” and set “Audio Capture Device” to “USB Audio Codec”
Set Recording Mode to "Capture" and Recoding Device to "Microphone"
For Factory assembled VNWA 2.x check Reference = Right Channel has been selected.
(**Note**: Older VNWA 2.x built from a Kit may use "Left Channel" depending on wiring of the 3.5mm audio connectors) Now press “Test Audio”

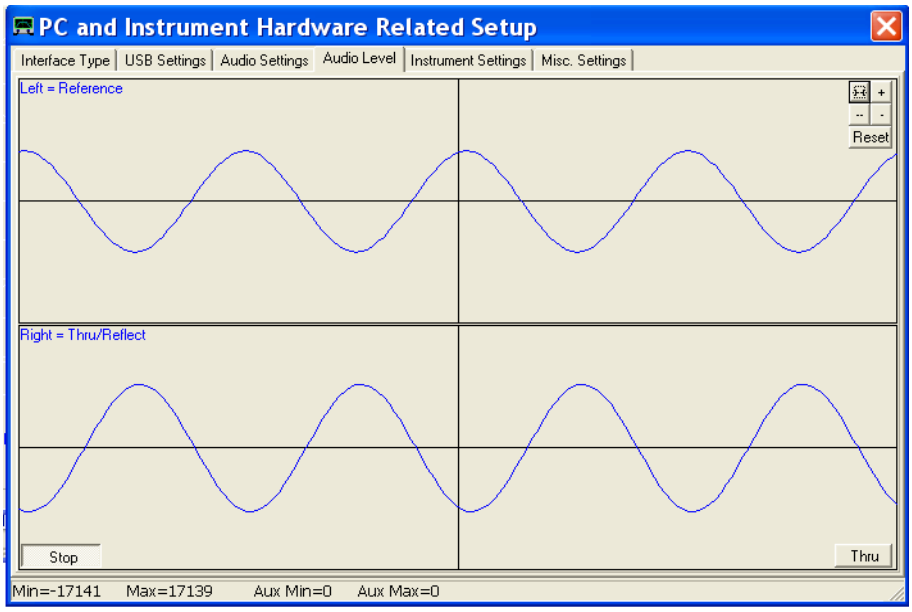


3.5.7 Select “Audio Level” and ensure whether Reflect Mode is selected. The sinewave levels should be as displayed below (100% Reflection as TX port is not terminated)
Note: If screen display is different from shown below (for instance when Volume Sliders are shown) then return to previous step 2.6.5 and change Recording Mode and Recording Device.

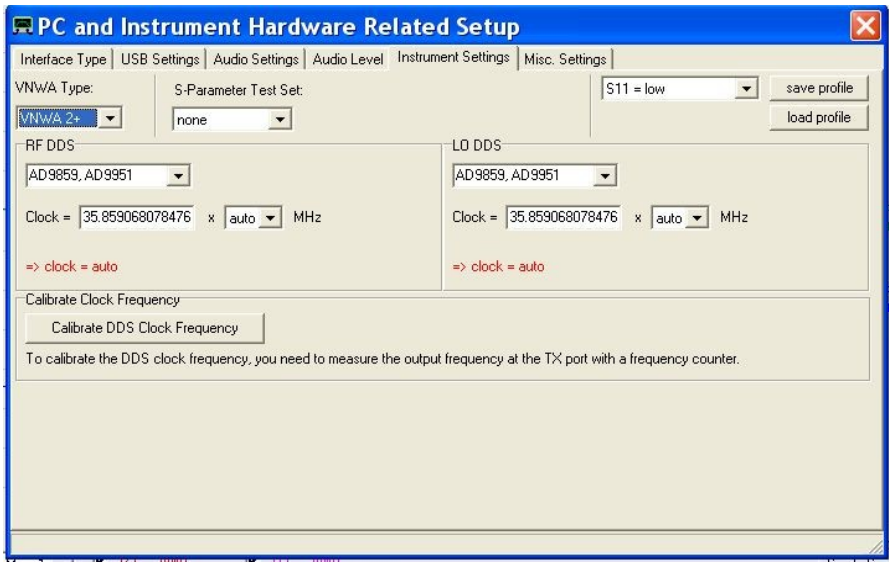


3.5.8 Connect the TX port and RX port with an SMA cable and check that Left Channel sinewave has disappeared (No signal reflected) . Now select “Thru” (by pressing on softbutton "Reflect" and check that the Left Channel sinewave is displayed as shown in screenshot below.

Note: when the THRU Mode is active the Audio levels min and max are a little higher than when in REFL Mode



3.5.9 Click “Stop“ cease the Audio test. Next click on "Instrument Settings” and check whether clock is set to “auto”. Note that for VNWA 2, the clock is generally a little below 36 MHz, somewhere between 35.855 MHz and 36.000 MHz depending on Crystal fitted.
When performing Audio test press ++ / + or -- / - buttons until the sinewaves are almost stationary on the screen. If you have a frequency counter perform Calibrate DDS Clock calibration as described in the VNWA helpfile



3.5.10 Press the top right button to close the VNWA Setup screen. Next we test whether the VNWA helpfile is available. Press “Help” and select “Help” again. The screen below may be shown. Press “Yes” and “Browse” to select the location where the Helpfile is located. If standard VNWA installation defaults were selected then the default path will be:

My Computer C:\VNWA\VNWA.hlp

3.5.11 **IMPORTANT:** To save the VNWA configuration (after any changes are made) exit the VNWA Application. This saves the VNWA setup for the next time the VNWA application is started.

End of VNWA Configuration for Windows XP

4. VNWA Master Calibration

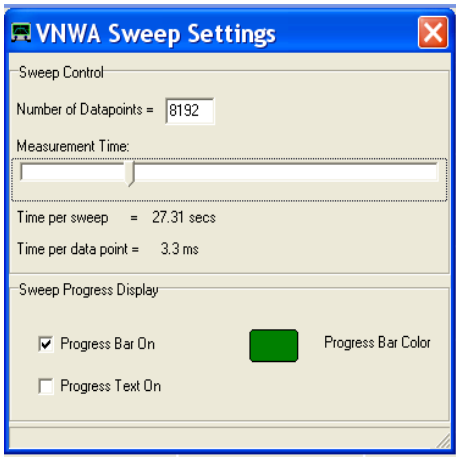
Prior to taking VNWA measurements the VNWA needs to be calibrated - Calibration uses SOLT - Short - Open - Load and Through Method. Ideal Calibration standards are used by default. For High precision measurements in VHF and UHF range you need to specify more precise model of the calibration standards used - please consult the VNWA helpfile

To calibrate the TX port (One Port) you need an SMA Short connector and and a SMA 50 Ohm Termination. For RX port (Two Port) calibration a short SMA to SMA cable is also required.

4.1 Master Calibration procedure

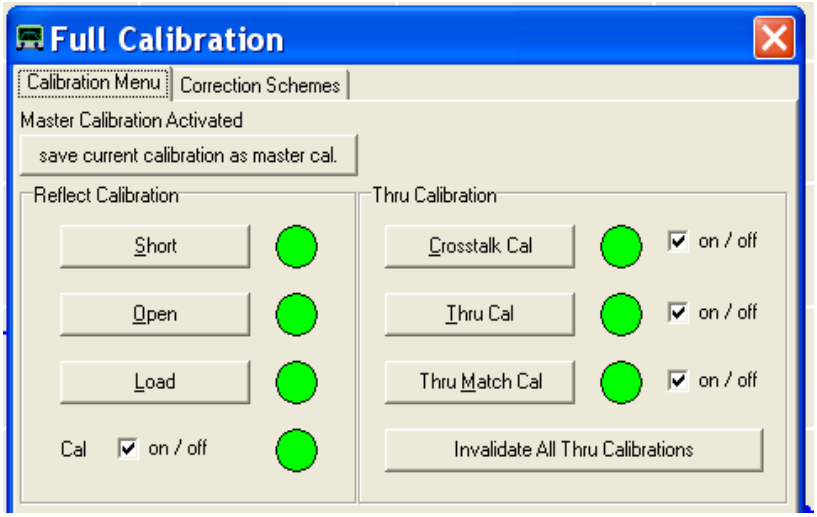
1. Set frequency range for Master Calibration (for instance 0 MHz - 500 MHz). Click on "Center=" and "Span=" and specify Start and Stop frequency of the Master Calibration

2. From VNWA top menu select "Setting" and select "Sweep"
   Specify: 8192 points
   time per sample: 3.3 mS



3. From VNWA top menu select "Measure" and "Calibrate" and select Short - Open - Load for TX calibration and follow the instructions shown on screen. For 2 Port Thru calibration "Crosstalk Cal - Thru Cal - Thru Match Cal" steps also need to be done using a short cable.

4. Once Calibration has been done, save the results in a Master Cal file: for instance with filename: ***Master Cal 0-500Mhz***. Note: you may save any number of cal files.



4.2 Reloading saved Master Calibration File

To load a previously save Master Calibration File:

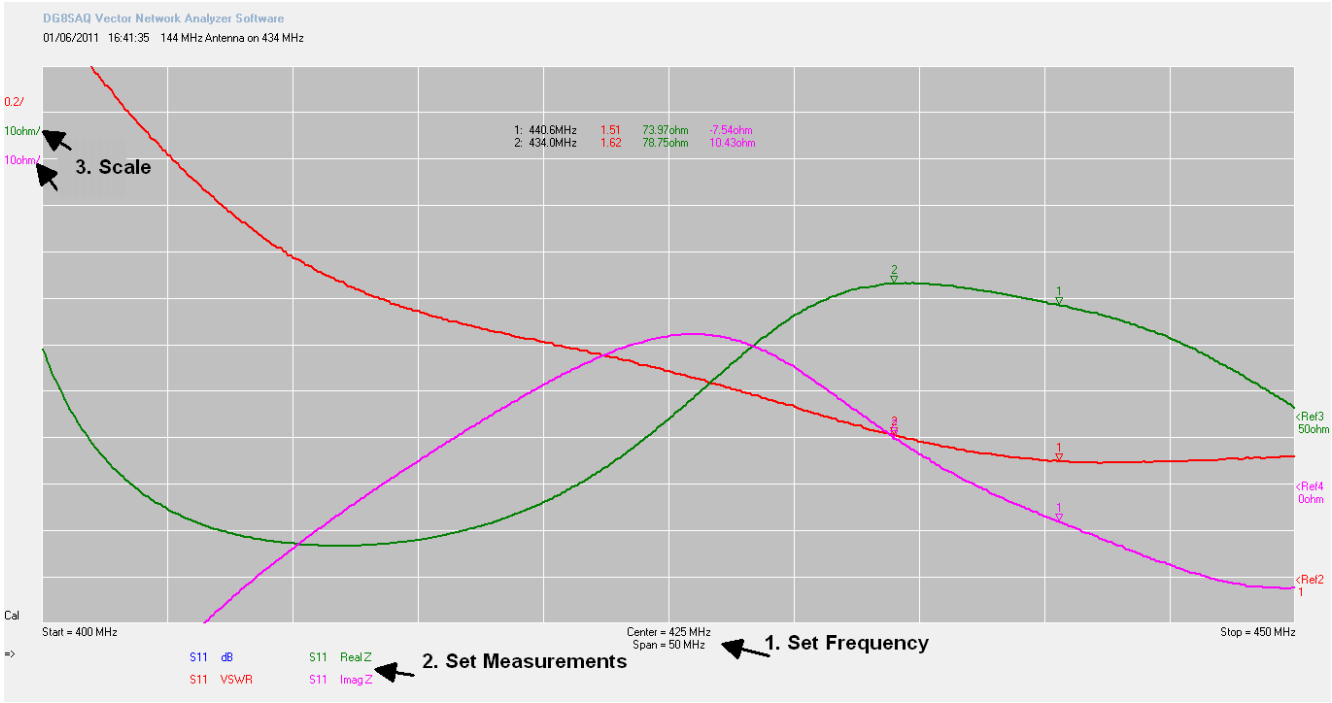
1. From Top Menu select "Options" and "Setup" and "Misc. Settings"
2. Now select the required Calibration file for loading

End of VNWA Master Calibration

5. Some Practical VNWA Measurements

5.1 Antenna VSWR and Impedance (S11 - 1 Port Device)

Antenna VSWR or Impedance measurements are typical examples of VNWA "One Port Measurements" The example below illustrates how VSWR measurement is obtained of an (144 MHz) Antenna from 400MHz to 450MHz (2 Meter Antenna used on 70 cm Band)



Method: (assume VNWA has been calibrated before)
Connect Device Under Test (DUT) ie Antenna to the VNWA TX Socket

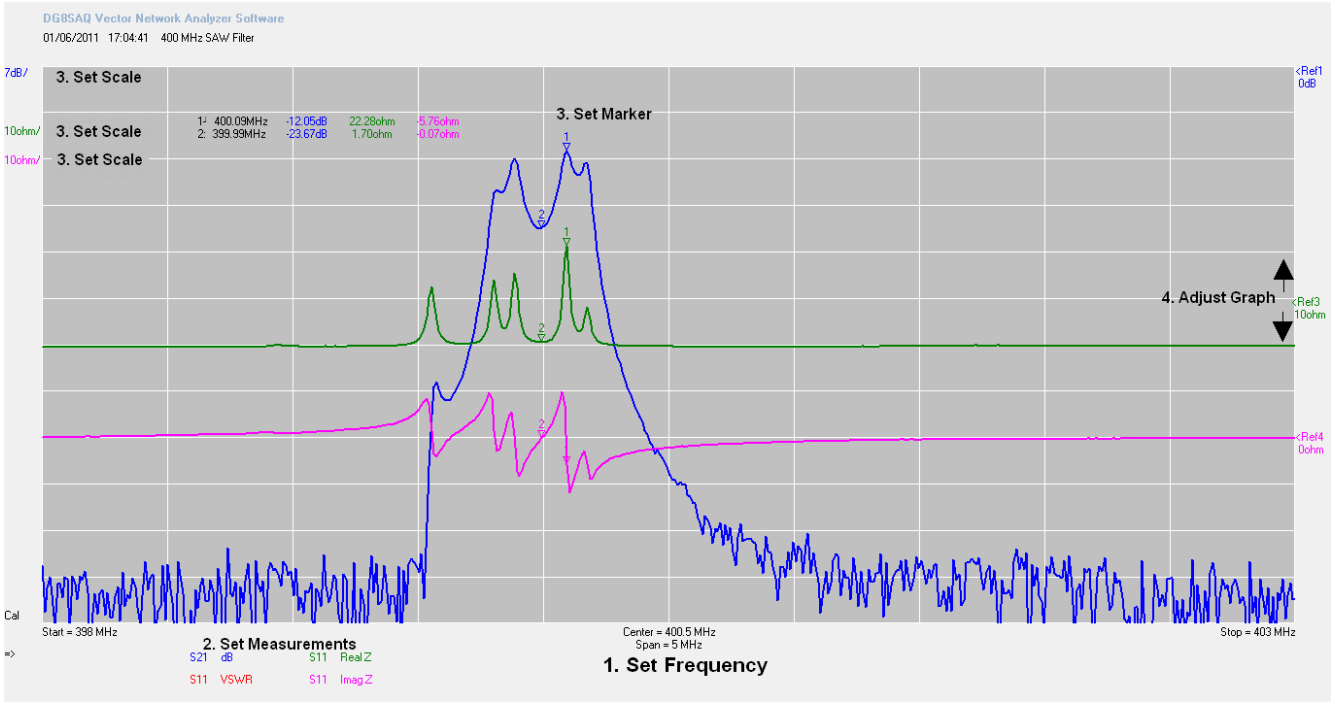
1. Set Frequency Start and Stop frequency
2. Set Measurements - select measurements to be displayed
   (S11, dB), (S11, Real Z), (S11, Imag Z)
   Press "Single Sweep" results are now displayed
3. Adjust the measurement scale if required to improve the graph appearance
   Add Marker (Right Mouse Click and select "Normal Marker") and place on point of interest

In the example the Marker displays: Frequency = 434 MHz, VSWR = 1.61 Real Z = 78.75 Ohm and Imag Z = 10.43 Ohm (Inductive)

5.2 VNWA Transmission Line Measurements (2 Port Measurement)

Filter Attenuation measurement is an example of VNWA "Two Port Measurements"

The measurements of attenuation (S21 dB) and input impedance (S11 Z) of a 400 MHz Surface Acoustic Wave (SAW filter)



Method: (assume VNWA has been calibrated before)

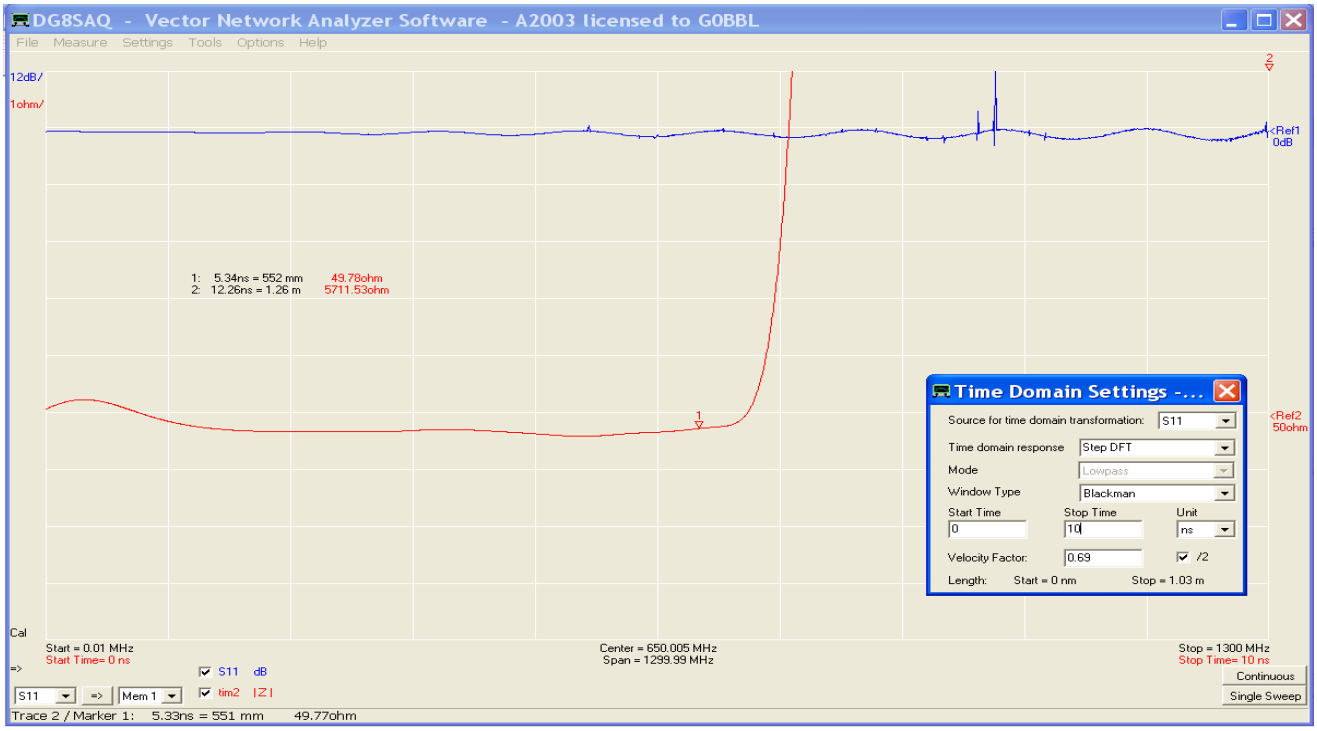
Connect Device Under Test (DUT) input to VNWA TX port and Device output to VNWA RX port

1. Set Start and Stop frequency
2. Select measurements to be displayed (S21, dB), (S11, Real Z), (S11, ImagZ) Press "Single Sweep" Results should be displayed
3. You can change the measurement scale if required to improve graph appearance
4. Add Marker (Right Mouse Click and select "Normal Marker") and place on point of interest
5. Graph position may be adjusted by placing curser here and dragging graph up or down.

In the example Marker 1 displays: Frequency = 400.09 MHz Attenuation = -12.05dB Input RealZ = 22.28 Ohm and Input imagZ = -5.76 Ohm (capacitive). Note: SAW filter is not matched to 50 Ohm impedance of VNWA TX and RX port.

5.3 Time Domain Reflectometry Measurement (T D R)

Below is an example of using the TDR capability of the VNWA to determine the characteristic impedance (and length) of a coaxial cable.



Method:

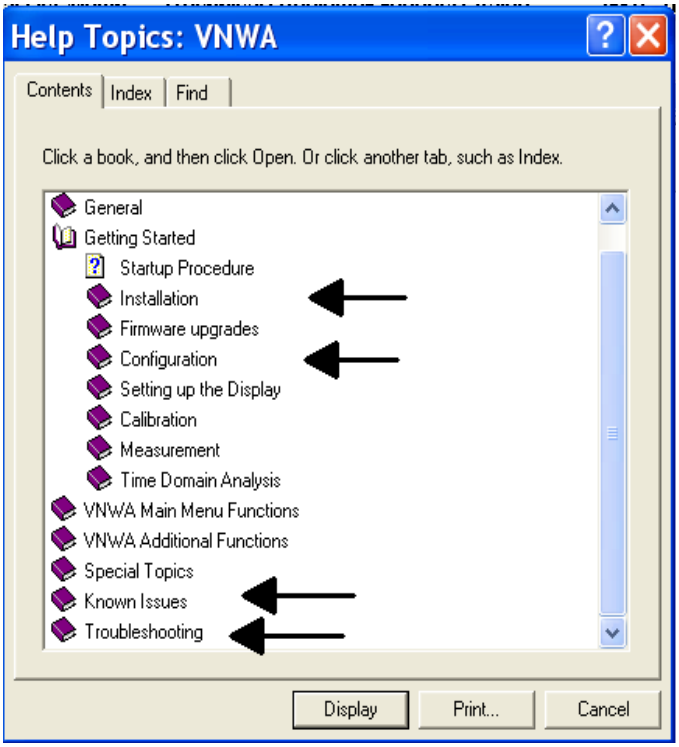
1. Calibrate VNWA between 0 kHz and 1300 MHz with sweep of 2000 points and 4mS
2. Connect the Coax cable to VNWA TX port. Other end of Coax is left unconnected.
3. Perform S11 dB measurement as (shown as Trace 1)
4. Add Trace 2 as |Z| and Time - (Use right hand mouse click and select "Trace Options")
5. Move curser over Trace 2 (shown as S11 |Z|), Next do right hand mouse click and select "Other" and "Time Domain. Time domain Setting window now appears as in picture.
6. Change the settings as shown in the example, - Select "Stop Time" to be a little longer than the length of your coax cable. (10ns shown - for measuring cable length up to 1m)

In the example Marker 1 displays: the characteristic impedance as 49.78 Ohm (each division is 1 Ohm!). The total length of the coax cable is actually 0.63m. Accuracy of this measurements depends on correct Velocity Factor of the cable type to be entered

6. VNWA Help file

Check you can open and read the VNWA HELPFILE. Open the VNWA Helpfile and take out time to familiarize yourself with the VNWA application: particularly with sections such as:

- Installation & Configuration
- Calibration
- Known Issues
- Verification of Proper Operation (Troubleshooting section)



Note: a PDF version of the latest helpfile may be downloaded from:
http://sdr-kits.net/DG8SAQ/VNWA/VNWA_HELP.pdf

7. VNWA User Support

7.1 VNWA User group

It is recommended you become a member of the DG8SAQ VNWA Forum on Yahoo where VNWA announcements and VNWA user experiences are shared. You will have the benefit of useful information including advice when new software and helpfile updates are available for download.
http://groups.yahoo.com/group/VNWA/

Please use the DG8SAQ VNWA Forum to check for important announcements, documentation updates and to share your experiences building and using the DG8SAQ Vector Network Analyser.

7.2 Acknowledgements

Acknowledgements and thanks to all the VNWA 2.x owners who tested 34.x and 35.x releases and patiently reported issues via the VNWA reflector. A special thanks for Kurt Poulsen OZ7OU for his diligent review of the this manual and for his sterling work on the VNWA Calibration Standards supplied by SDR-Kits.

Tom Baier and I acknowledge the contribution of Alan Rowe M0PUB for his expertise and efforts in providing the Installer package.

15th June 2011

Jan Verduyn
Proprietor SDR-Kits

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