DG8SAQ Vector Network Analyzer[®] - VNWA 3E & 3 "Getting Started Manual" for Windows 10 – Windows 8.1 & Windows 7

For VNWA License Code see page 2

VNWA Hints see page 10



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1. Introduction:

Thank you for purchasing the DG8SAQ VNWA 3 or VNWA 3E Vector Network Analyzer from *SDR-Kits*[®]. This manual is a concise "Getting Started" guide for release VNWA 36.7.0 onwards, showing what steps are necessary to place the DG8SAQ VNWA in operation for the *Microsoft Windows 10, Vista, Windows 8, 8.1 or Windows 7 Operating Systems using VNWA Application 36.7.0 and later. For Windows XP refer to*: <u>https://sdr-kits.net/index.php?route=web/pages&page_id=30_30</u> The DG8SAQ VNWA has many advanced features and options, therefore VNWA Users are strongly urged to study the VNWA pdf helpfile: www.sdr-kits.net/documents/VNWA HELP.pdf

1.1 Shipment Damage:

You should receive the VNWA in good order, however in event of visible damage of the parcel, please notify in first instance your Carrier or the Postal Service who delivered the shipment to you.

2. Important Information Copyright and Registered Trademarks notice

The design of the VNWA 3.x is copyright by Thomas Baier DG8SAQ & SDR-Kits - All right reserved. *SDR-Kits*[®], the SDR-Kits Logo and DG8SAQ *Vector Network Analyzer*[®] are Registered Trademarks.

2.1 Caution - Safety Information:

- The VNWA 3 or 3E 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. Do NOT apply any DC Voltages to the RF Ports. 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.

https://sdr-kits.net/index.php?route=web/pages&page_id=30_30

2.2 Accuracy of Measurements

This product is designed for Educational, Amateur Radio and Hobbyist use. No warranties are made whatsoever as to the stability and suitability of the design in extended periods/continuous operation or operation outside components' specifications. No responsibility will be accepted for accuracy of measurements or performance either short term or long term. It is recommended that VNWA users check proper operation of VNWA at regular intervals by measuring parameters of known components after performing VNWA calibration.

2.3 VNWA 3 and VNWA 3E - Product Documentation:

The documentation of the VNWA 3 is supplied as a VNWA Application Helpfile, which is available when the VNWA Application is installed using the VNWA Installer. A PDF version of this help file may be downloaded from the Internet from <u>www.sdr-kits.net/documents/VNWA_HELP.pdf</u>

Note: The VNWA 3E is a VNWA 3 with the optional VNWA Expansion board containing a second Audio Codec fitted. This Booklet shows configuration of both VNWA 3E and VNWA 3. Note that a few steps in the VNWA Application setup procedure are only required for VNWA 3E.

2.4 VNWA License code:

The VNWA License code for your VNWA is shown below: The license code must be entered exactly as shown in step 3.2.6 (Win7 or Vista) or in step 3.4.6 (Windows 10 & Windows 8.1)

Axxxx:ABC-DE-FGH-IJK:

Note: Optionally the name of the VNWA user may be added after the VNWA license code within double quotes:

for example: A1999:kzl-blt-qua-lzt:"DG8SAQ"

The VNWA application will now display the VNWA serial number (A1999) and the VNWA User name as

Vector Network Analyzer Software - A1999 licensed to DG8SAQ

3. VNWA 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.

Prior to installing new Computer Software it is recommended to make suitable Backups of your Computer files. Also ensure you have at least 50 MByte space for installation.

Please email: <u>Support@SDR-Kits.net</u> to report any errors or improvements to this document.

3.1 Windows 7 & Vista 64 bit and 32 bit Installation

This section shows installation procedure for Windows 7 (64 or 32 bits) – Vista procedure is similar. Note: For Installation on **Windows 10, Windows 8 or 8.1** refer to Chapter 3.3

Windows 7 and Vista users:

- 3.1.1 Download and save the VNWA Installation Package from the following location to your desktop or to a download folder from: <u>http://www.sdr-kits.net/DG8SAQ/vnwaupdate.php?path=installer&source=Sdr-kits</u> Make sure the VNWA is **NOT** connected to the Computer
- 3.1.2 Double-click on the VNWA-installer Icon to start the VNWA installation process.
 Open File Security Warning will be displayed: Publisher: dg8saq type: Application Confirm that you want to run this software by pressing "RUN"

Name: C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe Publisher: dg8sag Type: Application From: C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe Run Cancel		want to run t	this file?
Publisher: dg8saq Type: Application From: C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe Run Cancel		Name:	C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe
Type: Application From: C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe Run Cancel		Publisher:	dg8saq
From: C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe Run Cancel Always ask before opening this file		Type:	Application
Run Cancel		From:	C:\Users\Jan\Downloads\VNWA-installer36.4.0.exe
Run Cancel			<u> </u>
Always ask before opening this file			Run Cancel
	V Alwa	ys ask before (opening this file
while lies from the internet can be useful, this file type can botentially		W/bile Ele e fu	

3.1.3 Next User Account Control Window is now shown for dg8saq setup Confirm the VNWA-installer can make changes to your Computer - Press "Yes" then screen below is shown. Next Press "Next >"



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3.1.4 Press "Next >" – the VNWA License Agreement will be shown: *Please read and tick the correct box.* Note: the VNWA Application is only licensed for VNWA hardware supplied by SDR-Kits and our authorized Resellers.

J	Setup - VNWA -	
L	icense Agreement Please read the following important information before continuing.	P7
	Please read the following License Agreement. You must accept the terms of this agreement before continuing with the installation.	
	DG8SAQ VNWA LICENSE AGREEMENT FOR END-USER	^
		6.
	IMPORTANT - READ CAREFULLY BEFORE INSTALLING FILES. BY INSTALLING THIS SOFTWARE AND FIRMWARE, YOU AGREE TO BE BOUND BY THE TERMS OF THE FOLLOWING AGREEMENT. IF YOU DO NOT AGREE TO THE TERMS OF THIS AGREEMENT, YOU MUST QUIT THIS SETUP PROGRAM IMMEDIATELY.	~
	• I accept the agreement	
	OI do not accept the agreement	

Press "Next >" The default location where VNWA will be installed will be shown: Note: Select a different Destination Location (ie C:\VNWA2) if you wish to install a second VNWA application on the same PC. This will prevent overwriting the setup files of your first VNWA application on the same PC.

a.
ollowing folder.
o select a different folder, click Browse.
Browse
uired.

3.1.5 Press "Next >" – This shows the default where program shortcuts will be installed. Press "Next>" to continue

Where should Setup p	ler ace the program's shortcuts	2	
			Ca
Setup will cre	ate the program's shortcuts	in the following Start N	1enu folder.
To continue, dick Nex	. If you would like to select a	a different folder, click	Browse.
VNWA			Browse

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3.1.6 The screen below is now displayed to select the required additional tasks options required.

story .	20/00/2021 22:02	D'D'TT THEO C
J Setup - VNWA	Jahrang Calcor Liby Ri	
Select Additional Tasks		
Which additional tasks should	be performed?	Č.
Select the additional tasks you then click Next.	i would like Setup to perform while i	nstalling VNWA,
Additional icons:		
Create a desktop icon		
For all users		
For the current user of	only	
	Real No.	
	< Back Nex	

3.1.7 Press "Next >" and Ready to Install screen is displayed

Ready to Install		
Setup is now ready to begin installing	g VNWA on your computer.	Ċ
Click Install to continue with the inst change any settings.	allation, or click Back if you w	ant to review or
Destination location: C:\VNWA34x		*
Start Menu folder:		
1000		
4		*

- 3.1.8 Press "Install" VNWA Application and helpfile are now installed
- **NOTE:** At this point the Installer will automatically install the Digital signed **Amateur Radio Root Certificate** (ARC). This Certificate is an essential requirement for Windows 10, Windows 8.1 & 8 and Windows 7 64 bits. Please see Section **3.6** for information on the Amateur Radio Certificate installation.

Device Driver Installation Wiza	rd
	Welcome to the Device Driver Installation Wizard! This wizard helps you install the software drivers that some computers devices need in order to work.
	To continue, click Next.
	< Back Next > Cancel

3.1.9 Press "Next >" – Following screen may be displayed – Select "Install this driver software anyway"



3.1.10 Press "Next >" – Driver installation will take from 10-30 seconds and screen below is displayed upon completion.



- 3.1.11 Press "Finish" to complete the Driver Installation.
- 3.1.12 VNWA Setup is now complete Press "Finish" to complete VNWA Installation.



END of VNWA Application and Driver Installation for Windows 7 & Vista

3.2 Windows 7 & Vista VNWA Application Configuration

3.2.1 This section shows first-time installation of a VNWA - or when VNWA application is started for the first time from a new Directory!Plug in the VNWA USB cable into a USB Port of your Computer.

Note: It is recommended to connect the VNWA into the same 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 Depending on the options specified during the installation, start the VNWA application from the directory specified during Installation, use the Shortcut created on the Desktop or use the "Start" and "VNWA" launch button.



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. (As on 15/1/2018 **no issues or damage** has been reported by overclocking the DDS chips during 8 years of use)

Note: VNWA performance over 500 MHz will be adversely affected if overclocking of the DDS is not permitted.



3.2.4 The VNWA "Hint File" is now displayed. Please review this information carefully!

VNWA	×
Hints for using the	/NWA software, read carefully!
The usage of this so as the main window Note, that neverthe	oftware might not seem obvious at first sight v only has very few button controls. less all important settings can be accessed very
conveniently from t (e.g. frequency labe - by right-clicking it - by double-clicking	he main window. Most features of the main window Is) can be changed by one of the following ways:
- by holding the mo - some labels and t	buse pointer over it and turning the mouse wheel he markers can freely be moved with the mouse
Note, that all these the main menu on t	functions can also be accessed the Windows way via he top.
Note, that there are	also keyboard shortcuts for convenience.
For details please of	onsult the online documentation by pressing "H" or
by selecting Help-H	lelp from the menu.
	ОК

3.2.5 Press "**OK**" to continue. This will start th*e* **VNWA** Application. Press "**OK**" again to enter VNWA auto-setup information.

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File Measure Setti	ngs Tools Options Help	
OdB/		<ref 0dB</ref
	WARNING Information missing in ini-Files. Check setup carefully!	
	OK Cancel	
Start = 1 MHz	Center = 30.5 MHz Span = 59 MHz ▼ S21 dB	Stop = 60 MHz
		Continuous

- 3.2.6 The tab "USB Setting" should now be displayed. If not, click on "Options" select "Settings" A new screen appears, now select the tab "USB-Setting" and the screen below is displayed. Check whether VNWA license code is shown. If this information is missing then enter the VNWA license code. Now press "Rescan USB Bus" and "Test USB Interface". Check bottom line for message "Test passed without errors".
- **Note:** The **VNWA License code** is shown on **page 2** of the "**Getting Started**" Manual shipped with your VNWA It is also shown in the **VNWA_Delivered** shipping email.

Rescan USB Bus Image: State of the st	Interface Type USB Setting	s Audio Settings Audio Level Instrument Settings M	Misc. Settings
License Code: A2003:TXV-JUE-IFQ-DDE:	Rescan USB Bus	bus/device idVendor/idProduct bus-0/\\\libusb0-00010x20a0-0x4118 0x20A0/0 - Manufacturer : www.sdr-kits.net - Product : DGBSAQ-VNWA 3.0 - Serial Number: None w1 otalLength: 18 bNumInterfaces: 1 bConfiguration/Value: 1 iConfiguration/Value: 1 iConfiguration/Value: 1 iConfiguration/Value: 1 iConfiguration/Value: 1 iConfiguration/Value: 1 bConfiguration/Value: 1 iConfiguration/Value: 1 bConfiguration/Value: 1 iConfiguration/Value: 1 iConfiguration/Value: 1 bConfiguration/Value: 1 iConfiguration/Value: 1 iC	bx4118
	License Code:	A2003:TXV-JUE-IFQ-DOE:	

3.2.7 Press the Tab "Audio Settings" to display the screen below.

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From Release 36.3.0 onwards, the VNWA application has a new functionality for Autodetection and Auto- setup of Audio devices.

The Auto-detection and Auto-setup procedure is executed when the VNWA application is started up for the first time – or whenever the VNWA Application (VNWA.exe) is run from an empty directory.

To start this procedure manually press the Button "Auto-Setup Audio Devices"

Audio Capture Device		_	Misc Audio Settings		
Line (2- USB AUDIO CODEC) Test Audio Max= Only VNWA3E has Auxiliary Audio Capture Device	ADC Resolution C 8 Bit I 16 Bit C 24 Bit 48000 Hz Min= this hox ticked e available	•	Audio Buffer Length in S Samples / IF Period # Presamples # Postsamples Calibrate Sample Sample Rate = UnCal. Reference = Left Chan	Samples	3000 => IF = 1200.00 Hz => Minimum Sampling Time = 0.96 ms ignore overload restart on no sync
Auxiliary Audio Capture Device			Auxiliary Audio Settings	3	
Line (2- USB AUDIO CODEC) Press this button to start Auto-Setup Audio Devices	ADC Resolution C 8 Bit 6 16 Bit C 24 Bit	•	Aux. Audio Channels Main Audio Channels n Sample Rate = UnCal.	s measure neasure RE	9 THRU EFLECT
			Auri Defense Diek	t Channal	

Note: The above screen shows the previous older setting for an IF Bandwidth setting of 1.2 kHz.

3.2.8 Make sure that nothing (no cables or connectors) are connected to VNWA RF Ports -Press "OK" to start the Audio Auto-detection -

Auto-detection and aut	o-setup of audio devices sta	arting.
Make sure that NOTHIN	IG is CONNECTED to the VN	WA RF ports!
This may take several se Observe progress in sta	econds. tus line at the bottom.	
	11.	

3.2.9 Auto-detection and Auto-set-up steps through from phase 1 to 8. The screen below is displayed once the process is completed. Press **"OK"** to calibrate the Audio device sampling rate.



3.2.10 Press **"OK"** to calibrate the Audio device sampling rate. Calibration of Sample rate takes approx 30 seconds.

Note: The screen below shows the later **default** settings for an **IF Bandwidth** of **12 kHz**

Audio Capture Device		Misc Audio Settings	
Line (4- USB AUDIO	ADC Resolution C 8 Bit C 16 Bit C 24 Bit	Audio Buffer Length in Samples Samples / IF Period Presamples 2	3000 ×4 => IF = 12000.00 Hz => Minimum Sampling Time =
Test Audio	48000 Hz	# Postsamples 2 Calibrate Sample Rate	0.17 ms
Max=	Min=	Sample Rate = uncal.	ignore overload
🗸 Auxiliary Audio Cap	oture Device available	Reference = Left Channel	restart on no sync
Auxiliary Audio Capture	Device	Auxiliary Audio Settings	
Line (3- USB AUDIO	CODEC)	 Aux. Audio Channels meas 	ure THRU
	ADC Resolution C 8 Bit (* 16 Bit C 24 Bit	Main Audio Channels measure f	REFLECT
din=	Max=	Aux. Reference = Right Chann	el _



3.2.11 Next the Audio Level Screen is displayed. Select "**Reflect**" (bottom RH softbutton) and two sine-waves should be displayed. Top = Left = Reference and Right = Reflect

From 36.7.2 VNWA application, triangular waves will be shown with the default 12 kHz IF BW setting as shown below. Changing the IF to 1.2 kHz will show sine-waves instead of triangular wave below.



3.2.12 Next connect the TX port to the RX Port with a short Coax cable. The wave on the Right = Tru/Reflect should now disappear (because the TX port is now terminated with a 50 Ohm load from the RX port).



- 3.2.13 This step is only for VNWA 3 (Expansion PCB not fitted) Select "Thru" (Softbutton in bottom RH corner) and Right = Thru/Reflect should now display a Triangular wave (RX port is receiving TX output via Thru coax cable).
- 3.2.14 This step is only for VNWA 3E with fitted expansion board:Select Tab "Aux Audio Level" and screen below should be displayed.(RX port is receiving TX output via Thru coax cable)



This completes setup of Auto-detection and Auto-set-up of Audio devices.

Troubleshooting: Auto-detection and Auto-set-up of Audio devices

In case of audio set-up problems, please consult the VNWA helpfile - "Auto Set-up" Automatic Configuration of the Software for Usage with a DG8SAQ VNWA (Auto-Setup)

Notes: Audio Capture Devices may either be shown as **"Line"** or **"Microphone"** depending on type of USB-Codec chip fitted.

Troubleshooting: If "Auxiliary Audio Capture Device available" is **NOT** shown, then exit VNWA application and add the line *AuxAudio=1* to the file VNWA.ini with a text editor and restart the VNWA Application. See also VNWA helpfile for further information.

Windows 7 configures a VNWA USB Audio Capture Device by default either as a "**Microphone**" or as a "**Line**" depending on the type of USB Codec chip fitted. If the USB Codec is shown as "**Microphone**" Windows 7 will configure this as a **Mono** input with input levels set **too high** as shown below. This will prevent VNWA application from functioning.

Later VNWAs are fitted with PCM2900C chip which Windows configures as a "Stereo Line input" device but at the wrong sample rate – The correct sample rate is: 2 - channels Stereo 48000 Hz (DVD Quality) 3.2.15 Stop the Audio test by selecting Tab "Audio Level" (fig 3.2.13) and click on soft-button "Stop". Next click on Tab "Instrument Settings". The screen below shows usual settings for normal operation.

ienace Type Opp beanings Audio beanings Audio Lever Au	. Audio Level Instrument Settings Misc. Settings
IWA Type: S-Parameter Test Set.	S11 = low save profi
NWA 3 🔹 none 💌	load profi
FDDS	LODDS
AD9859, AD9951	AD9859, AD9951
Clock = 12 x auto 💌 MHz auto	Clock = 12 x auto MHz auto
> Clock = auto	=> Clock = auto
alibrate Clock Frequency	
Calibrate DDS Clock Frequency	
To calibrate the DDS clock frequency, you need to measure the	utput frequency at the TX port with a frequency counter.

3.2.16 Click on Tab "**Misc Settings**". The screen below shows usual settings for normal operation. You can close this the Setup file by clicking the top right-hand button.

nterface Type USB Settings Audio Settings Audio Level Au	x. Audio Level Instrument Settings Misc. Settings
Default Master Calibration File Name	
VNWA_Mastercal.cal	Browse and Load Master Cal.
Data Logging and User Postprocessing Options	
data logging OFF	Browse
postprocessing OFF User DLL	Browse
Special Settings	Debug Settings
🔲 don't autosave instrument state on entering setup	🔲 write audio data to file
update traces at end of sweep only (save CPU time)	do not normalize to reference channel
Extend or motivation paying by 0 approx (datault) =	
Extend synchronization period by To secs (detaul)	
show sweep statistics	deactivate LO DDS
	🔲 🔲 slow down LPT (LPT mode only!)
Signal Generator	Instrument Monitoring
RF Frequency Frequency Offset LO - RF	Instrument Temperature = 20.4 Deg. Celsius
+M +k +	Temperature offset correction value = 157 Deg Celsius
5 MHz 🕶 0.00120001 MHz 💌	
N I I	

- 3.2.17 **IMPORTANT:** To save the VNWA configuration (after any changes are made) *exit* the VNWA Application. This **updates** the VNWA configuration files for the next time the VNWA application is started.
- 3.2.18 VNWA Helpfile Configuration for Windows 7 and Windows Vista Refer to Chapter 3.5 for more information on enabling the VNWA Helpfile viewer.

End of VNWA Configuration for Windows 7 and Vista

3.3 Windows 10 & Windows 8.1 & 8 Installation

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

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. A minimum of **50 MByte** of **free diskspace** is required for installation. Please email: <u>Support@SDR-Kits.net</u> to report any errors or improvements to this document.

Windows 10, Windows 8.1 & 8 Installation

This section shows installation procedure for Windows 8.1 (Home – Professional or Enterprise) Windows 10 installation is essentially similar.

- 3.3.1 Download and save the VNWA Installation Package from the following location to your desktop or download folder: http://www.sdr-kits.net/DG8SAQ/vnwaupdate.php?path=installer&source=Sdr-kits
- 3.3.2 Make sure the VNWA is **NOT** connected to the PC Double Click on the **VNWA-installer Icon** to start the VNWA installation process.

If the VNWA installer is run for the first time the following warning is shown. Press **"More info"**

Windows protected your PC	
Windows SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk. More info	
ок	

3.3.3 Screen below with details may now be displayed, press "**Run anyway**" to proceed with the VNWA software installation



- 3.3.4 Windows User Account Control (UAC) Screen may be shown:
 Do you want to allow the following program to make changes to the Computer?
 Program name: VNWA Setup Verified Publisher: dg8saq Press "Yes" to continue
- 3.3.5 Welcome to VNWA Setup Wizard is now displayed. Press "Next>" to continue! Note: that the VNWA version number will be different from the one displayed because the VNWA.installer will always install the current General Release Software version!



- 3.3.6 Welcome to VNWA Setup Wizard (shown in 3.3.5) is shown. Press "Next>" to continue Note: that the VNWA version number will be different from the one displayed because the VNWA.installer will always install the current General Release Software version!
- 3.3.7 Press "Next >" the VNWA License Agreement will be shown: *Please read and tick the correct box.* Note: the VNWA Application is only licensed for VNWA hardware supplied by SDR-Kits and our authorized Resellers.



Press "Next >" The default location where VNWA will be installed will be shown:

Note: Select a different Destination Location (ie C:\VNWA2) if you wish to install a second VNWA application on the same PC. This will prevent overwriting the setup files of your first VNWA application:

19	Setup - VNWA	_ 🗆 💌
Select Destination Locatio Where should VNWA be in	n stalled?	
Setup will install V To continue, click Next. If y	NWA into the following folder. you would like to select a different	folder, click Browse.
c:\VNWA		Browse
At least 21.8 MB of free di	sk space is required.	
	< Back	Next > Cancel

3.3.8 Press "Next >" - This shows the default where program shortcuts will be installed A Screen is now displayed with option to create a Desktop Icon for:
a) For All users or b) For Current User only. Make your selection and press "Next >"

- 🗆 🗙
le installing VNWA, then
Next > Cancel

3.3.9 Press "Next >" and Ready to Install screen is displayed

	Setup	- VNWA	_ =	
Rea	ady to Install Setup is now ready to begin installing VM	IWA on your computer.		
(Click Install to continue with the installat change any settings.	ion, or click Back if you	want to review or	t.
	Destination location: c:\VNWA Start Menu folder: VNWA_M0PUB Additional tasks: Additional tasks: Create a desktop icon For all users			~
	<		>	×
		< Back	Install	Cancel

3.3.10 Press "Install" - VNWA Application and helpfile are now installed

15 ¹	Setup - VNWA	- 🗆 🗙
Installing Please wait while !	Setup installs VNWA on your computer.	
Extracting files C:\Users\Jan\VNV	/A2\ARCA.exe	
-		Cancel

3.3.11 Next Installer will automatically install the Digital signed **Amateur Radio Root Certificate** (ARC). This Certificate is an essential requirement for Windows 10 & 8.1 Operating Systems.

Am	nateur Radio CA - In	stall the Root certifica	te 📗
This tool will inst	all the X509 Amateur Radio	ROOT Certificate on your sy:	stem!
The Certificate of his system. Driv systems.	an be used to validate driv er validation by this Certifi	vers (and software) that can b icate is mandatory on Window	e installed on s8 x64
The certificate w	ill be installed on the LOCA	AL_MACHINE/Root and the	
OCAL_MACHIN (or program) sig his system! If y Websit	ned with a client certificate ou do not want this, don't te Amateur Radio Certificat	e from the root certificate can press "Install Cert". te Authority - http://pe0fko.nl	l/ca Goto
OCAL_MACHIN (or program) sig his system! If y Websit BEGIN C MIIE4jCCA8qg BAMTH0F&YXR1 YXR1dXIgUmFk MTIwMz11M1oX	E/TrustedPublisher store. ned with a client certificate ou do not want this, don't te Amateur Radio Certificat ERTIFICATE AwIBAGIJAIKKiwgmsY+gMU dXIgUmFkaW8gUm9vdCBDZ2 aW8gUEUwRktFMRMwEQYDV DTIwMDYyODIwMsI1M1owX	After installing the root certific from the root certificate can b press "Install Cert". te Authority - http://pe0fko.nl AOGC3qG3Ib3DQEBBAUAMF4xK XJ0_WZpY2F0Z34xHTAbBqNVB QQLEwp0ZXRoZXJ=YW5kMB4XD jEoMCYGA1UEAxMfQW1hdGV1c	Late, a driver be installed or //ca Goto DAmBgNV AoTFEFt TEwMDew iBSYWRp V
OCAL_MACHIN (or program) sig his system! If y Websit BEGIN C MIIE4jCCA8qg BAMTHOF&YXR1 YXR1dXIgUmFk MTIwMzI1M1oX	E/TrustedPublisher store, ned with a client certificate ou do not want this, don't te Amateur Radio Certificat ERTIFICATE AwIBAGIJAIKKiwgmsY+gMU dXIgUmFkaW8gUm9vdCBDZ2 aW8gUEUwRktFMRMwEQYDV DTIwMDYyODIwMsI1M1owX	After installing the root certific from the root certificate can press "Install Cert". te Authority - http://pe0fko.nl AOGC3qGSIb3DQEBBAUAMF4xK XJ0=W2pY2F0Z54xHTAbBqNVB QQLEwp0ZXRoZXJ=YW5kMB4XD jEoMCYGA1UEAxMfQW1hdGV1c	Late, a driver be installed or //ca Goto DAmBgNV AoTFEFt TEWMDcw iBSYWRp V

3.3.12 Press "Install Cert" and the following Screen will be displayed



3.3.13 Press "**Yes**" and ARC installation should complete with screen below Press "**OK**", and "**Exit**" to continue



3.3.14 "Welcome To Device Driver Installation Wizard" is now shown.



3.3.15 Press "Next >" – Driver installation will take from 10-30 seconds and the screen below is shown. Once Status "Ready to use" is shown press "Finish" to complete Driver installation.

De	vice Driver Installation W Completing the De Installation Wizard	izard vice Driver 1
	The drivers were successfully installed on this computer. You can now connect your device to this computer. If your device came with instructions, please read them first.	
	Driver Name	Status
	✓ libusb-win32 (libusb0) lib	Ready to use

3.3.16 VNWA installation is now complete, Return to the **Setup VNWA** screen and Press "**Finish**" to exit the Setup.



END of Windows 10 or Windows 8 or 8.1 VNWA Application & Driver Installation

3.4 Windows 10 & Windows 8, 8.1 VNWA Application Configuration

3.4.1 Plug in the VNWA USB cable into a USB Port of your Computer.

Note: It is recommended to connect the VNWA same 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.



3.4.2 Depending on the options specified during the installation, start the VNWA application in the Windows 10 or 8 "**Apps**", or click on the VNWA Shortcut Icon created on the Desktop.

Apps		
Sport	Irfan	VNWA
Store	Ab t IrfanView	Pelp
Travel	Available Languages	Help Change History
Video	Available PlugIns	Uninstall VNWA
Weather	Command line Options	VNWA

3.4.3 **Overclocking Warning will** be displayed when you run VNWA Application software for the first time.

Select "**OK**" to allow overclocking of the DDS chips beyond 400 MHz. (As on 15/1/2018 no issues or damage has been reported by overclocking the DDS chips in more than 8 years of use)

Note: VNWA performance over 500 MHz will be **adversely** affected if overclocking of the DDS is **not permitted.**

IMPORTANT NOTICE!
VNWA software started for the first time. If you want to use your VNWA beyond 300 MHz, you must AGREE to OVERCLOCK the DDS chips.
By clicking OK, your VNWA will be switched to use auto clock multipliers which will allow overclocking.
IIII You do this at your own risk IIII
If you do not wish to overclock, press Cancel. You can also set VNWA to auto clock multipliers manually later on.
This message will appear only once.
OK Cancel

3.4.4 The VNWA "**Hint File**" is now displayed. Please review this information carefully! Whilst the look of the VNWA screen is "uncluttered" note however that all functions are available from the screen!. Time spent reading the Hint screen pays **BIG DIVIDENDS** later



3.4.5 Press "**OK**" to continue and start the VNWA Application. Press "**OK**" again to enter VNWA setup information.

Here Settings Tools Options Help MdB/ WARNING Information missing in ini-Files. Check setup carefully! Check setup carefully! Start = 1 MHz Center = 30.5 MHz Stop = 60 MHz Start = 1 MHz Stop = 50 MHz Stop = 60 MHz		GasaQ - vector Networ	k Analyzer Software	- EC.Electronics.test1 licensed to EC.	Electroni
dB/ WARNING Information missing in ini-Files. Check setup carefully! OK Cancel Start = 1 MHz Center = 30.5 MHz Span = 59 MHz Span = 59 MHz Span = 59 MHz Span = 59 MHz Sinde Sur	ile	Measure Settings To	ools Options Hel	p	
WARNING Information missing in ini-Files. Check setup carefully! OK Cancel Start = 1 MHz Center = 30.5 MHz Start = 1 MHz Center = 30.5 MHz Start = 1 MHz Center = 30.5 MHz Start = 1 MHz Continuou Start = 1 MHz Start = 1 MHz V S21 Center = 30.5 MHz Span = 59 MHz Start = 1 MHz	dB7				<re 0dB</re
Start = 1 MHz Center = 30.5 MHz Stop = 60 MHz V S21 dB Continuor 21 w m1 w V S11 Smith Sinde Sur			WARNING	×)	
OK Cancel Start = 1 MHz Center = 30.5 MHz Span = 59 MHz Stop = 60 MHz Span = 59 MHz Continuo Sinde Swith Sinde Swith			Information of Check setup	missing in ini-Files. carefully!	
Start = 1 MHz Center = 30.5 MHz Stop = 60 MHz Span = 59 MHz Continuo Sinde Surt				DK Cancel	
21 - March 1 - V S11 Smith Single Sur		Start = 1 MHz	C 001 00	Center = 30.5 MHz Span = 59 MHz	Stop = 60 MHz
21 → → Mars 1 → 🗹 S11 Smith Single Sur			I¥ 521 dB		Continuous
	21	▼ => Mem 1 ▼	S11 Smith		Single Sweep

3.4.6 The tab "USB Setting" should now displayed. If not click on the tab "USB-Setting" If this is the first VNWA setupthe following screen is shown. Press "Ok" and enter the VMWA License code. (The VNWA License code is found on Page 2 of the "Getting Started Manual" shipped with the VNWA, or in the VNWA_Dispatched email with shipping information)

	Wrong or missing license code!
/NWA Energy Settings: îrmware Energy Settings	After pressing OK, enter License Code and press "Return"-key or rescan button"
ON on power up 💽	OK Cancel
ON if software started 💽	

3.4.7 Check whether correct VNWA license code is shown, If this information is missing or incorrect then enter the VNWA license code. Now press "Rescan USB Bus" and "Test USB Interface" Check bottom line for message "Test passed without errors"

Interface Type USB Settings	Audio Settings Audio Level Aux. Audio	Level Instrument Settings Misc. Settings	
Rescan USB Bus	1 bus/device idVendor/idProduct bus-0/\\\libusb0-0001-0x20a0-0x4118 • Manufacturer : www.sdr-kits.net	0x20A0/0x4118	
Verify Firmware	 Product : DI3SAU-VNWA 3.0 Serial Number: None wTotalLength: 18 bNumInterfaces: 1 		
Flash Firmware	bConfigurationValue: 1 iConfiguration: 0 bmAttributes: 80h MaxPower: 150 bInterfaceNumber: 0 bAlternateSetting: 0 bNumEndpoints: 0 bInterfaceClass: 0 bInterfaceSubClass: 0 bInterfaceProtocol: 0		
Firmware Energy Settings OFF on power up Software Energy Settings ON if software started	linterface: U		
License Code:	A9299:XCZ-TOA-BQY-LZK:	VNWA License code	
		Change VNV	VA USB Identifier
Firmware V5.16 for AD9859:	Test passed without errors	Test result	

3.4.8 From Release 36.3.0 onwards, the VNWA application performs an Auto-detection and Auto-

setup of Audio devices instead of the Manual setup which was previously required. The Auto-detection and Auto-setup procedure is executed when the VNWA application is started up for the first time – or whenever the VNWA Application (VNWA.exe) is run from an empty directory.

Make sure that Nothing is connected to VNWA RF Ports – and Windows sound manager is closed

Press "OK" to start the Audio Auto-detection -

	Notification	
Auto-detection and auto-setu	p of audio devices starting.	
Make sure that NOTHING is C	ONNECTED to the VNWA RF ports!	
Windows 8 detected!		
Make sure the Windows Sound the sound devices may be lock	I Manager IS CLOSED before proce ced!	eding, otherwise
This may take several seconds		
Observe progress in status line	at the bottom.	
	OK	Cancel

Note: Click on tab "**Audio Settings**" if Audio detection is not started automatically. Press button Auto "**Auto-Setup Audio Devices**" to start auto detection.

SD Seanys Addie Beam	gs Audio Level Aux. Audio Level Instru	iment Settings Misc. Settings	
Audio Capture Device		Misc Audio Settings	
Line (2-USB Audio Devic	e) 💌	Audio Buffer Length in Samples	3000
Test Audio Max=	ADC Resolution ADC Resolution 8 Bit 16 Bit 24 Bit 48000 Hz Min= Device available	Samples / IF Period 10 x4 # Presamples 3 # Postsamples 3 Calibrate Sample Rate Sample Rate = UnCal. Reference = Left Channel	=> IF = 1200.00 Hz => Minimum Sampling Time = 0.96 ms ignore overload
Auxiliary Audio Capture De	evice	Auxiliary Audio Settings	
Line (USB Audio Device)	ADC Resolution C 8 Bit C 16 Bit C 24 Bit	Aux. Audio Channels measure Main Audio Channels measure RE Sample Rate = UnCal.	FLECT
	Mav=	Aux. Reference = Right Channel	

Note: The above screen shows the previous older setting for an IF Bandwidth setting of 1.2 kHz.

3.4.9 Auto-detection and Auto-set-up steps through from phase 1 to 8. A Wrong Sound Device settings screen may be displayed with information how to correct the settings

Wrong sound device settings	×
Some VNWA sound devices are running in wrong mode:	
Line (2- USB AUDIO CODEC): 44100 Hz / stereo Line (USB AUDIO CODEC): 44100 Hz / stereo	
Required settings: 48000 Hz / stereo	
These settings have to be corrected in Windows. On OK, the Windows recording device manager will open automatically Double-click above shown sound devices there, go to the "Advanced" tab and change accordingly	
OK Cancel	1

- 3.4.10 To correct Sound Device Configuration, click on the USB Audio Codec and Properties will be displayed. Select the Advanced Tab and set the sample and bit rate to
 2 channel 16 bit 48000 Hz (DVD Quality). Press "Apply" and "Ok".
- 3.4.11 This step is only required for VNWA 3E (VNWA with expansion board): Select the second USB Audio Codec (shown below) and configure also to 2 channel 16 Bit 48000 Hz

9		Sound	×	J Line Properties	×
Playback	Recording Sour	nds Communications		General Listen Levels Advanced	
Select a	Line 2- USB AUDI Default Devi	o codec		Default Format Select the sample rate and bit depth to be used when in shared mode.	nrunning
	Microphone High Definit Ready Microphone High Definit Ready Line USB AUDIO Ready	ion Audio Device Ion Audio Device CODEC		2 channel, 16 bit, 44100 Hz (CD Quality) 1 channel, 16 bit, 11025 Hz (Dictation Quality) 1 channel, 16 bit, 16000 Hz (Tape Recorder Quality) 1 channel, 16 bit, 22050 Hz (AM Radio Quality) 1 channel, 16 bit, 32000 Hz (FM Radio Quality) 1 channel, 16 bit, 44100 Hz (CD Quality) 2 channel, 16 bit, 48000 Hz (DVD Quality) 2 channel, 16 bit, 11025 Hz (Dictation Quality) 2 channel, 16 bit, 22050 Hz (AM Radio Quality) 2 channel, 16 bit, 32000 Hz (Tape Recorder Quality) 2 channel, 16 bit, 32000 Hz (FM Radio Quality) 2 channel, 16 bit, 32000 Hz (FM Radio Quality) 2 channel, 16 bit, 44100 Hz (CD Quality) 2 channel, 16 bit, 44000 Hz (DVD Quality)	
Config	gure	Set Default	Properties	Restore Defaults	
		OK Cancel	Apply	OK Cancel	Apply

3.4.12 Press button Auto "Auto-Setup Audio Devices" (fig 3.4.8) to start auto detection again. Now the screen below is displayed once the process is completed successfully. Press "OK" to proceed to calibrate the Audio device sampling rate.



3.4.13 Calibration of Sample rate takes approx 30 seconds. An confirmation window appears to confirm that Automatic Setup and calibration is finished. Press "**Ok**" to proceed.

Note: If calibration fails, then exit and restart the **VNWA Application** and perform step 3.4.11 again. **Note:** The screen below shows the new default settings for an **IF Bandwidth** of **12 kHz**

Audio Capture Device		Misc Audio Settings	
Line (4- USB AUDIO Test Audio Max=	CODEC)	Audio Buffer Length in Samples Samples / IF Period 1 ×4 # Presamples 2 # Postsamples 2 Calibrate Sample Rate Sample Rate = uncal.	3000 => IF = 12000.00 Hz => Minimum Sampling Time = 0.17 ms
🔽 Auxiliary Audio Cap	oture Device available	Reference = Left Channel	restart on no sync
Auxiliary Audio Capture Line (3- USB AUDIO	CODEC)	Auxiliary Audio Settings Aux. Audio Channels measur	e THRU
	ADC Resolution C 8 Bit (* 16 Bit C 24 Bit	Main Audio Channels measure RE Sample Rate = uncal.	FLECT
Min=	Max=	Aux. Reference = Right Channel	

- 3.4.14 Next the Audio Level Screen is displayed. Select "Reflect" (bottom RH softbutton) and two waves should be displayed. Top = Left = Reference and Bottom = Right = Thru/Reflect
- **Note:** If **Audio Level** screen is not shown press **Tab "Audio Level"** to manually select this screen and press "**Test Audio**" to start Audio Test.

From 36.7.2 VNWA application triangular waves will be shown with the default 12 kHz IF BW setting as shown below. Changing the IF to 1.2 kHz will show sine-waves instead of triangular wave below



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3.4.15 Now connect the TX port to the RX Port with a short Coax cable. The sine-wave on the Right = **Tru/Reflect** should now disappear (because the TX port is now terminated with a 50 Ohm load from the RX port).



- 3.4.16 This step is only for VNWA 3 (Expansion PCB not fitted) –
 Select "Thru" (by pressing Reflect Softbutton in bottom RH corner in fig 3.4.10) and
 Right = Thru/Reflect should now display a waveform (RX port is receiving TX output via Thru coax cable).
- 3.4.17 This step is **only for VNWA 3E** (with fitted expansion board:) Select Tab **"Aux Audio Level"** and screen below should be displayed. (RX port is receiving TX output via Thru coax cable)



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This completes Auto-detection and Auto-set-up of Audio devices.

Note: In case of audio set-up problems, please consult the **VNWA helpfile - "Auto Set-up"** *Automatic Configuration of the Software for Usage with a DG8SAQ VNWA (Auto-Setup)*

Audio Capture Devices may either be shown as "Line" or "Microphone" depending on type of USB-Codec chip fitted.

3.4.18 Stop the Audio test by selecting Tab "Audio Level" and click on softbutton "Stop". Next click on Tab "Instrument Settings". The screen below shows usual settings for normal operation.

nterface Type US	B Settings Audio Settings Audio Level	Aux. Audio Level Instrument Setting	3s Misc. Settings	
/NWA Type:	S-Parameter Test Set		S11 = low 💌	save profile
VNWA 3 💌	none			load profile
RFDDS		LODDS		
AD9859, AD9951	•	AD9859, AD9951	•	
Clock = 12	× auto • MHz auto	Clock = 12	× auto 💌 MHz	auto
=> Clock = auto		=> Clock = auto		
Calibrate Clock Fre	quency			
Calibrate DDS	Clock Frequency			
To calibrate the DI	 DS clock frequency, you need to measure	the output frequency at the TX port wit	h a frequency counter.	

3.4.19 Click on Tab "**Misc Settings**". The screen below shows usual settings for normal operation.

Interface Type USB Settings Audio Settings Audio Level Au	x. Audio Level Instrument Settings Misc. Settings
Default Master Calibration File Name	
VNWA_Mastercal.cal	Browse and Load Master Cal.
Data Logging and User Postprocessing Options	
data logging OFF	Browse
postprocessing OFF Vser DLL	Browse
Special Settings	Debug Settings
on't autosave instrument state on entering setup	write audio data to file
update traces at end of sweep only (save CPU time)	do not normalize to reference channel
Extend synchronization period by 0 secs (default)	deactivate RF DDS
	C deactivate LO DDS
snow sweep statistics	Slow down I PT (I PT mode only)
Signal Concretor	- Instrument Monitoring
RF Frequency Frequency Offset LO - RF	Instrument Temperature = 20.4 Deg. Celsius
5 MHz V 0.00120001 MHz V	Temperature offset correction value = 15.7 Deg. Celsius

- 3.4.20 **IMPORTANT:** To save the VNWA configuration (after any changes are made) *Exit the VNWA Application.* This updates the VNWA configuration files with the setup information for the next time the VNWA application is started.
- 3.4.21 **VNWA Helpfile Configuration** for Windows 10 and Windows 8.1 & 8 Refer to Chapter 3.5 for more information on enabling the VNWA Helpfile viewer.

End of VNWA Configuration for Windows 10 & Windows 8.1

3.5 VNWA Help File Installation – Windows 10, Windows 8, 8.1 & Windows 7

Introduction As Microsoft does not provide viewers to view help files in *.hlp format for new Windows versions like Windows 10 and Windows 8.1.

You may choose to use a different viewer or use the pdf help file instead if you are unable to install the Microsoft winhlp32 viewer for the particularly operating system on your Computer

A possible alternative viewer is **viewhlp** kindly provided as freeware by Alan Rowe – M0PUB under GPL. **Viewhlp** is similar to **winhlp32**, but lacks some of its features.

3.5.1 To test whether the VNWA helpfile is available. Select the Help tab and select "Help H" again.



3.5.2 Select Configure Help – and the screen below is displayed and informs if the Microsoft winhlp32 viewer is installed. More information about winhlp32 is shown in 3.5.5
 "Download from Microsoft" shows that winhlp32 is NOT currently installed on your PC.

王	Configure Help Document Viewer
Microsoft winhlp32	Download from Microsoft
C Alternative Viewer	browse for viewer Download viewhlp.exe
C PDF Help	browse for PDF Download latest PDF
Downloading the >20MB Note, that VNWA cannot but you may close this win downloading.	PDF may take several minutes. be terminated while downloading, idow and continue to work while

3.5.3 The viewhlp viewer is installed by ticking Alternative Viewer and "Download viewhlp.exe". Save this file into the same directory as where you installed the VNWA application. Once viewhlp is actually installed, the blue "browse for viewer" label will indicate "viewhlp.exe" instead. Clicking on this label will launch a *.exe file open dialog. Here, you can select the executable of any help file viewer you like to use. Typing "H" or pressing Help will now display the the VNWA helpfile is by the viewhlp viewer.

围			Open		×
Look in	: 🚺 VNWA36.4	4.0		- 🗈 💣 📰	•
Recent places Desktop	DG8SAQ-U firmwares tmp dunins000.e viewhlp.ex	JSB-Driver xe e			
This PC	File name: Files of type:	viewhlp.exe		×	Open Cancel

3.5.4 Clicking on the blue "**browse for PDF**" label (Fig 3.5.3) will launch a *.pdf file open dialog. Select the pdf file, that is to be opened later when you click the Help menu. After a pdf file has been selected, the label will show its name.

Clicking the "Download latest PFD" will launch the download of the latest PDF help file From t he SDR-Kits website as a background process.

Note, that the download cannot be interrupted and may take several minutes.

The VNWA helpfile comprises >500 pages and covers numerous topics, a selection is displayed here



3.5.5 Winhlp32 Installation:

In order to view the VNWA helpfile on the Windows 7, 8, 8.1 you need to download and install the appropriate Winhlp32.exe for your operating system from Microsoft. This is because Microsoft no longer includes this file in Windows 7, 8, 8.1 and Windows 10 Operating Systems.

Note: Winhlp32 can run on Win10 but Microsoft actively blocks its installation, however a simple fix was published in the German Funkamateur magazine in issue 10/2016. It is possible to install the Win7 winhlp32 version, provided you make the installer to believe that your Win10 is a Win7 system. The folks of Funkamateur have done this. They provide the necessary files here: http://www.funkamateur.de/tl_files/downloads/hefte/2016/WinHelpWin10.zip

All you have to do is unzip into a folder and right-click the installer script Install.cmd and select run as administrator. This will install the win7 version of winhlp32 on your win10 system and it does work inside any software using the *.hlp format.

Note: No warranties are made as this method may not work in future.

3.6 Amateur Radio Root Certificate Installation (ARC)

Introduction: The libusb0.sys driver is required to enumerate the Atmel ATMega Microprocessor used in the VNWA. On Windows 10 & W8.1 & Window-7 64bit system, kernel-mode drivers can only be installed if the Driver is signed by a certificate from Microsoft (or a derivative certificate). From VNWA installer v36.2.3 available after 20th November 2012 or later, the Amateur Radio Root Certificate is automatically installed, thanks to Fred Krom PE0FKO for making this certificate available. ARC installation is a simple procedure as follows:

Note: Installation of the root certificate only happens once. Subsequent installer runs won't show it any more when the certificate is already found installed.

3.6.1 After installing the VNWA Application and Helpfile but prior to installing the Libusb0 driver, the following screen will be displayed on VNWA selfinstaller V 36.2.3 or later. Press "Install Cert" to continue.

🖉 Amate	ur Radio	CA - Inst	all the Ro	oot cert 🔀
This tool will in	stall the X509 Ar	mateur Radio RO	OT Certificate on	your system!
The Certificate this system. D systems.	; can be used to river validation b) validate drivers by this Certificate	(and software) th is mandatory on	iat can be installed on Windows8 x64
The certificate LOCAL_MACH (or program) s this system! If Web	will be installed (NE/TrustedPubl igned with a clie you do not war site Amateur Ra	on the LOCAL_M lisher store. After int certificate from t this, don't pres adio Certificate Ar	ACHINE/Root and r installing the roo n the root certific s "Install Cert". uthority - http://p	f the it certificate, a driver ate can be installed on e0fko.nl/ca Goto
BEGIN MIIE4jCCA8 BAMTHOFEYXI YXRI dX IgUmJ	CERT IF ICATE - IgAw IBAg IJAIKI 1 dX IgUmFkaW8; %aW8gUEUwRktI	Kiwams Y+ gMAOGC gUm9vdCBDZXJO PMRMwEQYDVQQLE	5q651b3DQEBBAU WZpV2F0254xHT# wp02XRoZXJ=YW5	IMF4xKD 2mB gNU 2bB gNUB AoT FE Ft 3kHB 4XDTEwHD cw
Show Cert	Delete Ce	rt	Install Ce	ert Exit

3.6.2 Next the Installation Confirmation screen is displayed – press - "**Continue**" and "**YES**" The Amateur Radio Certificate installation should now complete and the following screen displayed.



3.6.3 Press "**OK**" and Press "**Exit**" button in step 3.5.1 and the VNWA Installer will proceed to install the Driver.

For Windows 7 & Vista refer to para 3.1.9 onward to finish the installation. For Windows XP refer to step 3.3.9 onwards to finish the installation.

End of Amateur Radio Certificate Installation

4. VNWA Calibration

IMPORTANT - VNWA Calibration is the single most important factor in obtaining accurate VNWA measurements. Please do read the Chapter "Calibration" in the VNWA helpfile to ensure you have an appreciation of the many factors affecting VNWA Calibration.

Prior to taking VNWA measurements the **VNWA needs to be calibrated** - Calibration uses SOLT - <u>Short - Open - Load and Through Method</u>.

Ideal Calibration standards are used by default. High precision measurements in VHF and UHF range you need to specify a more precise model of the calibration standards used

From software version 36.7 on, the VNWA installer also installs a set of default calibration kit model files prepared by Kurt Poulsen OZ7OU corresponding to the calibration kits supplied by SDR-Kits with your VNWA. Consult the VNWA helpfile for more details

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

Sweep Control Number of Datapoints = 8132 Measurement Time:	
Time per sweep = 27.31 secs Time per data point = 3.3 ms	
Sweep Progress Display	
🔽 Progress Bar On	Progress Bar Color
F Progress Text On	

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

Note: It is generally recommended to skip the crosstalk cal. It has benefits only in very special circumstances.

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Calibration Menu Correction Schemes		
Aaster Calibration Activated	2	
save current calibration as master cal.		
Reflect Calibration	Thru Calibration	
<u>Short</u>	Crosstalk Cal	🔽 on / off
Open	Ihru Cal	🔽 on / off
Load 🔵	Thru <u>M</u> atch Cal	🔽 on / off
Cal 🔽 on / off	Invalidate All Thru Cal	ibrations

4.2 Reloading saved Master Calibration File To load a previously saved Master Calibration File:

- 1. From Top Menu select "File" "Retrieve" and select "Mastercalibration"
- 2. Now select the required Calibration file for loading

End of VNWA Master Calibration

5. Some Practical VNWA Measurements

Introduction:

The DG8SAQ VNWA is a very capable instrument offering many options which may overwhelm first time users who may not be familiar with basic VNWA measurements.

A good introduction is to start with some simple measurements as shown below. For more information including VNWA Tutorials - see section 6.2 - Other Links

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 andImag Z = 10.43 Ohm (Inductive)

5.2 VNWA Transmission 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 cursor 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. The other end of Coax is left unconnected.
- 3. Perform **S11 dB measurement** and display in **Trace 1**. (blue trace near 0dB)
- 4. Add a second trace type "**Time**" and open the "**Time Domain settings**" via "**Settings**-**Display**" menu or by the appropriate popup menu on right-clicking the display label.
- 5. Open the time domain setting window by activating the "**Settings-Time Domain**" menu or by double-clicking one of the time labels.
- 6. Select source S11, select "Impulse DFT", "Lowpass" and "Rectangular" for maximum time resolution and edit start and stop times as shown.

In the example Marker 1 and 2 display: the characteristic impedance as 49.78 Ohm (each division is 10 Ohm!). The total length of the coax cable is actually 1.08m. Accuracy of this measurements depends on correct Velocity Factor of the cable type to be entered.

Please consult the VNWA Helpfile for further information on T D R

6. The VNWA Help file

Check you can open and read the VNWA HELPFILE.

See Section 3.5 if there is a problem opening this file: It is recommended to 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)

lp Topics: VNWA	2
ntents Index Find	
lick a book, and then click Open. Or click another t	ab, such as Index.
🔶 General	~
🔟 Getting Started	
? Startup Procedure	
🔷 Installation 🛛 🚽 🚽	
🔖 Firmware upgrades	
📚 Configuration 🛛 🚽 🛶	
📚 Setting up the Display	
📚 Calibration	
🔷 Measurement	
🔹 📚 Time Domain Analysis	
📚 VNWA Main Menu Functions	
Sectional Functions	
Special Topics	
📚 Known Issues	
📚 Troubleshooting 🛛 🚽 🔤	~
3	

Note: a PDF version of the latest helpfile may be downloaded from:

www.SDR-Kits.net/documents/VNWA_HELP.pdf

6.1 Further Reading in the VNWA Helpfile

By the time you read this, you should have a fully functioning VNWA and start to explore some of the capabilities and measurements. However, do try to explore some of the more advanced capabilities mentioned in the **VNWA helpfile** such as:

- **Built-in Matching tool** allows to simulate the 2 port DUT transfer characteristics under a chosen impedance termination conditions and to calculate matching networks for optimum power transfer.
- **Touchstone Files** VNWA can import and export certain S-parameter files in **Touchstone** format (s1p, s2p, s3p)
- **Custom Back ground Options -** The custom background options allow to load an image to appear as background on the VNWA main window. Scalable vector graphics files (.svg) and Pixel Graphics (jpeg, png) pare supported.
- **Crystal analyzer tool** allows to extract equivalent circuit model parameters direct from the measured reflection coefficient of a crystal resonator or similar resonator (SAW, ceramic Resonator)

6.2 VNWA Tutorial Videos and other Support Links

To support the VNWA software, three Videos have been produced by Kurt Poulsen OZ7OU. Viewing of these videos is particularly recommended for new VNWA users, however also existing VNWA users may benefit from viewing these videos. Thanks to Kurt for producing these Videos!

First time Installations VNWA software – duration 7min 4 sec	https://youtu.be/TOMj4jaUSKs
First time start VNWA Software – duration 11 min 38 sec	https://youtu.be/cuLjsJYpODc
First time VNWA calibration - duration 15 min 34 sec	https://youtu.be/gATrqw4lKT8

• VNA Tuturials - by Fred Schneider PA4TIM a beginners Guide in 8 Chapters! - thanks Fred!!

http://www.pa4tim.nl/?p=1594

- VNWA One Port Measurements
 TX Port only Step by Step Example of Antenna Tutorial by Tom Baier <u>http://www.sdr-kits.net/DG8SAQ/VNWA/_Example_A_simple_one_port_measurement.pdf</u>
- VNWA Two Port Measurements TX and RX ports - Step by Step Example of Filter Tutorial by Tom Baier -<u>http://www.sdr-kits.net/DG8SAQ/VNWA/_Example_2_Port_Measurement.pdf</u>
- Introduction to S-Parameters A good Introduction to S-Parameters is the following Application Note published by Hewlett Packard: <u>http://sss-mag.com/pdf/an-95-1.pdf</u>
- **Zplots** Dan, AC6LA, has written Zplots <u>http://ac6la.com/zplots.html</u>, a wonderful Excel application that uses the power of the Excel charting engine to neatly plot and analyze S-parameters like the ones generated during a VNWA measurement. See also the VNWA helpfile **how to use Zplots in the VNWA Application**.

7.0 VNWA 3 - 3E Hardware Description

The VNWA3 3E combines the VNWA and the USB interface functionality on a single 100x60mm² board. The VNWA3 only requires a single USB cable to connect to a PC. Nevertheless, it offers many hardware interfacing options: Please refer to the VNWA Helpfile for a block diagram and details of external connections.



7.1 VNWA 3E - Fitted Expansion Printed circuit board

The VNWA 3E is fitted with VNWA 3 Expansion Board which provides additional functionality as follows: **Note:** VNWA 3E was formerly named VNWA 3+ but these are the same products

- 2nd Audio Codec allowing S11 and S21 measurements to be performed in a single sweep instead of 2 sweeps.
- USB power consumption reduced to from 0.41 Amp without Expansion board to 0.33 Amp despite additional power consumption of 2nd Audio Codec on the Expansion board.
- RJ12 connector making the VNWA3 control signals and power accessible to the outside world
- Optional SMA connector to obtain the multiplied 12 MHz internal TCXO clock or to feed in an external 36 MHz clock source.



7.1.1 VNWA 3 E - Expansion Board - External Connections

RJ12 pin	Signal Description	Cable colour	Remarks: (see also VNWA helpfile for info on options)
Pin 1:	Rotor start/stop control signal Output 0V or 3.3V DC - 680 Ohm Series Resistor	white	Output signal, normally +0V. When VNWA sweep is active Output signal is +3.3V DC – This signal can be used to start and stop Rotor Engine.
Pin 2:	Not Connected	black	
Pin 3:	S-Parameter Test set Control Signal (output)	red	0 or 3.3V Logic DC Signal from AVR via 680 Ohm series resistor. See Helpfile for configuration details
Pin 4:	Not Connected	green	
Pin 5:	Internal 5V DC Power out or External 5V Power In (See Note 1)	yellow	A maximum of about 100mA may be drawn from internal power provided PC USB Hub can supply 500mA. See Note 1; when using external power
Pin 6	Ground	blue	VNWA Ground Connection

Note 1: For operating the VNWA3 from an external 5V DC power supply, a zero Ohm resistor must be removed as detailed in VNWA Helpfile section "General", page "VNWA3E"

Note 2: Cable colour refers to the colours of the optional RJ12 cable available from SDR-Kits

7.1.2 VNWA 3E Optional External Clock input/Output

An Optional SMA connector may be fitted for connecting an External 36 MHz Clock output or to tap the internal multiplied System clock. After the VNWA 3 Expansion Board is fitted, the SMA connector is fitted in the 8mm round hole provided only in VNWA3 with s/n 2201 and higher as shown in fig 1.

- 1. With a scalpel cut a round hole in the rear panel label and fit the SMA connector.
- 2. solder a short wire between the SMA center connector to the PCB track. Soldering of ground connections is not required.

If the SMA connector is not used then it is recommended to fit an SMA Screening cap to prevent radiation from and damage to the SMA connector.

7.1.3 Specification of the VNWA Reference Clock output or External Clock input:

- Internal Clock Output: TCXO 12 MHz*x (x=2....8) 2ppm Out 1kOhm impedance, 150mVpp output
- External Reference Clock: ideally 36 MHz with level of between -6dBm...+3dBm / 50 Ohms, however Clock frequencies from 10 MHz upward to 40 MHz may be used.

SDR-Kits offersa programmable Low Jitter GPS Controlled Precision Reference Oscillator offering a stability of +/-1 ppb is recommended for use with the VNWA.

8. DG8SAQ VNWA 3 & 3E Specification

- Supported Operating Systems: Microsoft Windows 10, Windows 8.1 & 8.0, Windows 7, Vista, (64 and 32 bits) and Windows XP.
- Coverage from 1 kHz to 500 MHz with dynamic range of over 90dB Useful performance of of up to 1.3 GHz with reduced dynamic range (>50dB) and accuracy.
- S-Parameter S11, S12, S21 & S22, VSWR
- Component Measurements Resistance, Admittance Capacitance, Inductance & Quality Factor (Q)
- Time domain & Gating in Time domain Distance to Fault (DTF) measurement.
- Import and Export of Touchstone files (S1P S2P S3P)
- Logarithmic and Listed sweep: up to 8192 points with sampling time adjustable from 0.2mS to 100mS
- Matching Tool, Complex Calculator & Crystal Parameter tool
- User defined S-parameter calculator Zplot & Excel application Support
- Basic Spectrum Analyzer useful up to 100 MHz
- Basic Signal Generator TX-Out max RF Output as signal generator -17dBm no harmonic filtering
- Power requirement USB 1.1 or USB 2 Interface 5V DC max 400mA
- 12 MHz TCXO Master Clock stability of +/- 0.5 ppm
- Microprocessor: Atmel ATMega 328P with 16K Flash memory clocked at 12 MHz
- Connectors: SMA x 2, Mini USB-B
- Power requirement USB 1.1 or USB 2 Interface 5V DC max 400mA
- Dimensions: Width 10.4 cm, Depth 8.0 cm, Height 4.6 cm, Weight 0.35 Kg
- RoHS Compliant
- VNWA 3 E is factory fitted with Expansion Printed Circuit Board offering S11 and S12 measurements in a single sweep instead of 2 sequential sweeps.

8.1 DG8SAQ VNWA 3E – VNWA 3 Deliverables (without presentation case)

- VNWA 3E or VNWA 3 as ordered
- Mini-USB lead
- VNWA 3 "Getting Started" Manual (this manual)
- 3 pcs Calibration kit and 1 pcs RG223 cable

8.2 DG8SAQ VNWQ 3E – 3 in Presention case or Optional Items

- Presentation case for storing VNWA and all accessories
- Rosenberger or Amphenol SDR-Kits 4 pcs Calibration Kit (SMA Short SMA 50 Ohm Load etc) and 1 pcs RG223 thru Calibration cable.
- Low Jitter GPS Controlled Precision Reference Oscillator.

9. VNWA User Support

9.1 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. <u>http://groups.yahoo.com/group/VNWA/</u>

Please use the DG8SAQ VNWA Forum to check for important announcements, documentation updates and to share your experiences building and using the DG8SAQ VNWA 3 Vector Network Analyser.

9.2 Warranty information

A 24 **month return to base Warranty** from date of Shipment date is applicable to the VNWA 3.x on condition the product is unmodified, not misused or damaged and the maximum permissable ratings have not been exceeded. Warranty claims should be made by contacting SDR-Kits by email in first instance with a description of the issue. Customer is responsible for return of the VNWA to SDR-Kits by tracked shipment. SDR-Kits will pay for outbound shipping cost of the repaired unit or for the supply of a replacement VNWA in similar condition as the VNWA received.

9.3 Hardware Servicing information

If an hardware issue is suspected then refer to the VNWA Helpfile section "Verifying Proper Operation" and report which step your VNWA is failing and contact SDR-Kits

(email Support@SDR-Kits.net) for advice and service assistance. Service documentation of the VNWA 3 or 3E is **not** available - there are **no user serviceable parts** used in the design.

9.4 WEEE, Disposal of Waste Electrical Equipment



This symbol on the product indicates that this product should not be treated as household waste. Instead it should be handed over to a suitable collection point for the recycling of electrical and electronic equipment.

VNWA users of this product in the European Community should contact SDR-Kits (<u>Support@SDR-Kits.net</u>) to make specific arrangements (Take back service by Manufacturer) for disposal and recycling of this product in accordance with the relevant UK or EEC Directives.

9.5 CE Certification,

This product is CE certified according to the provisions of 2004/108/EC and 1995/5/EC relating to the Radio and Telecommunications Terminal Equipment (R&TTE) is in compliance with the essential requirements of these directives.

9.6 FCC & IC Statement

This product complies to FCC Part 15 for Class B devices. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

Note: The manufacturer is not responsible for ANY interference, for example RADIO or TV interference, caused by unauthorized modifications to this equipment.

Such modifications could void the user's authority to operate the equipment.

9.7 Notices and Acknowledgements

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Acknowledgements and thanks are due to all the Beta Testers who tested VNWA 35.x and VNWA 36.x series of VNWA releases and who patiently reported issues either direct or via the VNWA reflector. A special thanks goes to **Kurt Poulsen OZ7OU**, **Dr Eric Hecker** and **Alan Rowe M0PUB** for their sterling work in supporting the VNWA product.

Prof. Dr. Thomas Baier DGSAQ, the VNWA designer and I hereby acknowledge the contributions of of **Fred Krom PE0FKO** for his kind assistance in providing the **Amateur Radio Root Certificate**.

Updated 15 January 2018

Jan Verduyn G5BBL SDR-Kits

SDR KITS LIMITED UK Company no 08668127 trading as SDR-Kits Trademark: SDR-Kits®

9.8 Contact address

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Technical support email:	Support@SDR-Kits.net			
Email Backup	sdrkits@gmail.com			
Website	www.SDR-Kits.net			

9.9 *SDR-Kits*[®] – Ordering Terms and Conditions

SDR KITS LIMITED, trading as SDR-Kits[®], UK Company Reg. 086681127

Office 11, Hampton Park West, Melksham, Wilts, SN12 6LH, United Kingdom, email: orders@SDR-Kits.net

Ordering Terms and Conditions

- 1. All products supplied by SDR-Kits are subject to these Ordering Terms and Conditions as from 15th January 2016.
- 2. Customers should ascertain whether a product meets their specific requirements, prior to placing an order. Customers should determine whether they have the appropriate knowledge and skills to assemble or operate a product supplied by SDR-Kits. Documentation of products supplied by SDR-Kits are provided only in the English language unless otherwise stated otherwise.
- 3. Orders are made by opening an account on the SDR-kits Webshop, and placing the required goods into the Web basket. Payment should be made at the time of ordering via Paypal or by requesting a Pro Forma invoice.
- 4. When requesting a Pro Forma invoice, SDR-Kits will email an invoice within 3 working days, showing the total price in GBP or EUROs and relevant Bank details (IBAN and BIC) to where payment should be made. Goods are only shipped once Payment is received in full. Paypal accepts most payment methods (Credit Cards) from Customers and opening of a Paypal account is not required to make a payment.
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- 7. SDR-Kits accepts no responsibility for kit assembly errors by kit buyers, for repairs due to non-operation, misuse, inadequate kit-building skills, unauthorised product modification or lack of performance.
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