KD9OWD nanoVNA

What Is a NanoVNA?

Electronic Test Instrument that Measures & Displays:

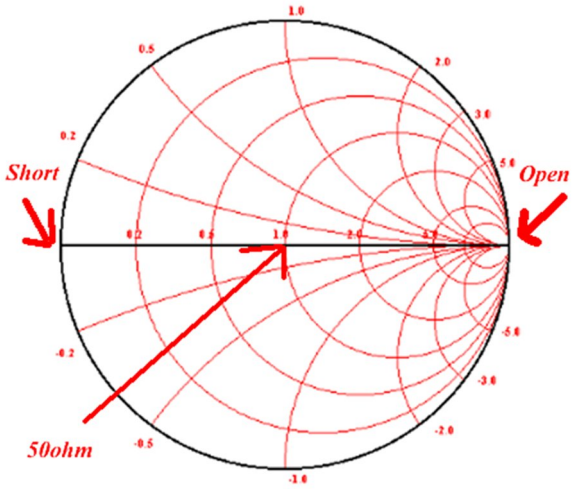
- Standing Wave Ratio (SWR)
- Performance of Common Mode Chokes (Loss vs. Freq)
- Coax Impedance
- Distance Along Coax to Significant Change (TDR)
- Capacitance & Inductance of Discrete Components
- Resistive and Reactive Portions of Impedance
- Smith Chart, Coax Loss and More…
- **Can plug directly into PC with nano saver**

Useful From 10KHz to 1500MHz Measurements (depending on model) Update About Every Second: Real-Time Open Source Hardware and Firmware (Updated Frequently)
Open Source PC Software (Updated Frequently)
Several On-Line Sources of Hardware, Firmware and SW

nanoVNA in the right hands is better than MFJ,RigExpert and Comet combined. I'm not saying that those analyzers don't have a place but I sold my MFJ after I learned about the nano. What was funny was that I sent back my first nano and bought the MFJ because the nano was so confusing. After watching videos on youtube I decide to give the nano a second go, and was very pleased. The nano is rechargeable, can save up to 4 calibrations and is very accurate. Checking the output frequency on my 200meg scope proved to be within +- .5hz The nano at 70 to 100 dollars is by far the better choice, except for those that feel the more you pay the better the item. 😉

Calibration

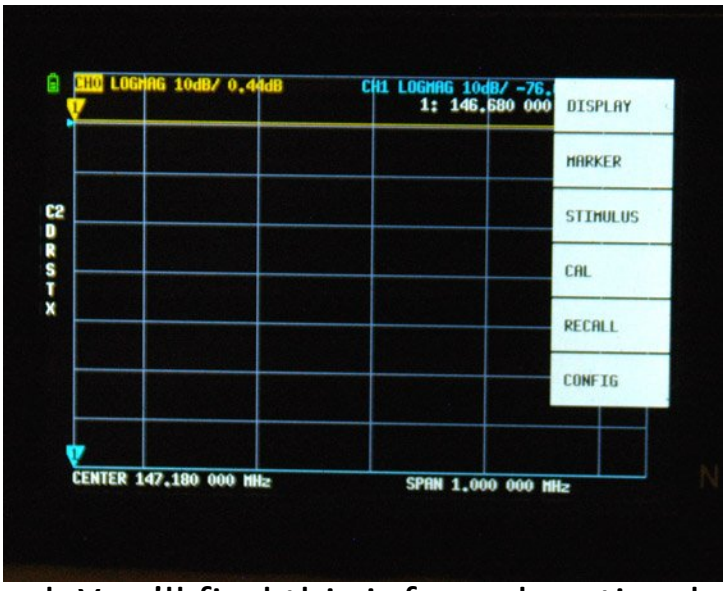
Calibration is a very important part of good readings. Some will say that you need to calibrate every time you want to use the vna but that isn't really true. The calibrations that you saved will be there on recall as long as your measure point hasn't changed. The measure point is where you will attach your DUT to so if you don't change, calibration is fine. You can also double check your cal by checking one of the points on your smith chart.



If you are out of calibration your point that you check will be off. Be careful though if you are checking an open because you must use the same method or your open will not be right. For example, if you used the open cal standard(preferred) then just check it with nothing attached it will NOT read the same.

Although calibration is boring we would be remiss if we didn't cover one here. We will do a calibration if you are only doing antenna and swr measurements. Calibration for TDR for measuring coax will need the additional isolation and thru calibration.

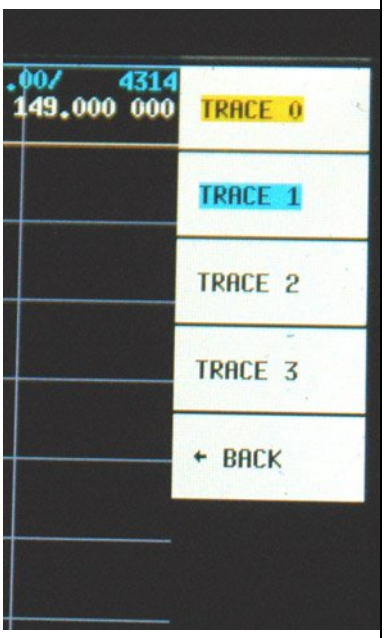
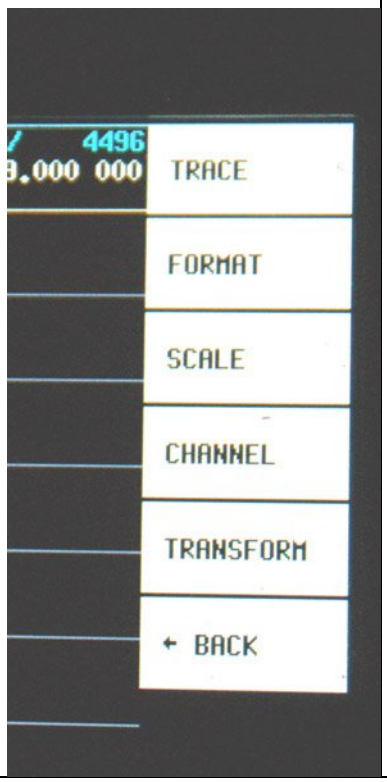
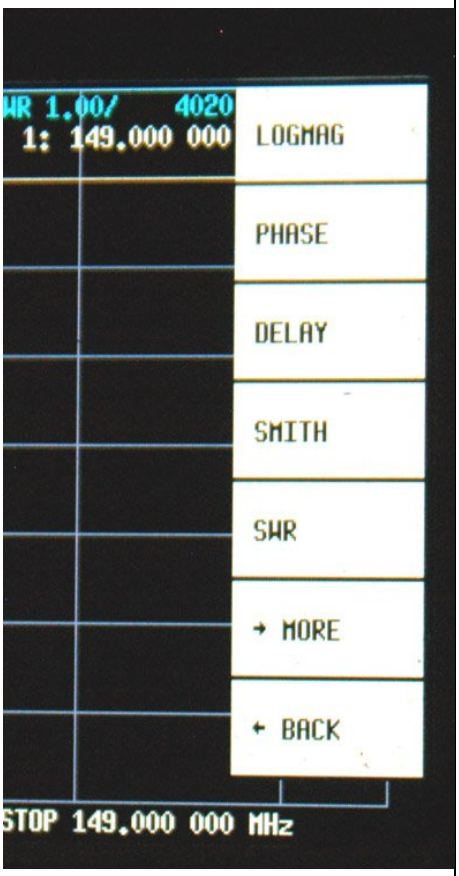
1. Set the start and stop frequency that you want to measure. Depending on the antenna, pick the span that will cover what it is to be tuned to. For example a dual band antenna I would choose 130mhz to start and 500



mhz to end. You'll find this info under stimulus on the main menu.
2. Under stimulus you'll find start and stop items.

3. Now lets turn off the traces we don't want and since we are going to measure just resonance and swr lets turn off the pink and green trace. From the main menu select display | trace and turn off green and pink by double

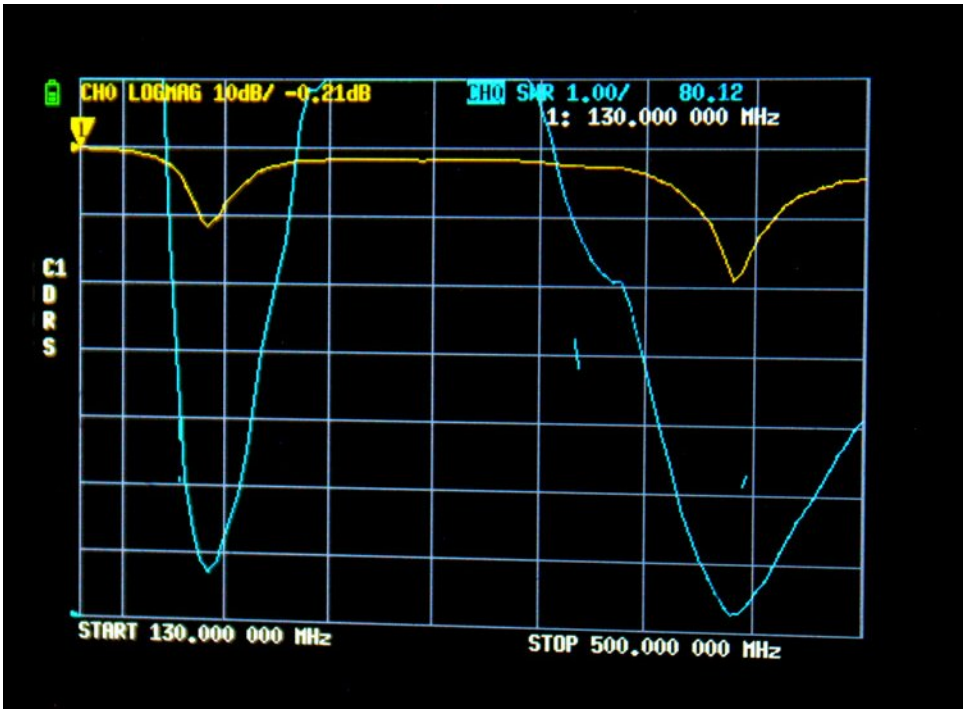
clicking them.

After turning off traces it should look like this,	Staying on that screen or going back to it SINGLE click trace 1 to select it.	Then select swr.
		

Now hit back and select channel and select channel 0 . Now your yellow and blue trace are on the same channel and are almost ready to go. NOW and only NOW is when we are ready to calibrate. This seems like a lot but it goes real fast and once we do this we can save it to one of the save spots and recall it anytime we want to measure a dual band antenna.

On the main menu select CAL then RESET then CALIBRATE Using the calibration devices that came with your unit connect the open one to your vna OR extension cable that you are going to connect to your antenna then click OPEN and it will be reversed and the next item will be highlighted. Now put the

short device on your vna and click short, then it will move to load so connect the load device to your vna and click load. At this time you can stop by clicking done and then selecting a save spot. It will now be saved and in the future if you want to measure a dual band antenna again just recall this saved spot and your ready to go.
Now lets hook an antenna up.



As we move the cursor to the right and to the bottom of the dip we will see that the first resonant frequency of this antenna is out of out band we were hoping for.

The resonant frequency is 192.900Mhz and the swr is 1.74

Now the next dip is in the 400 Mhz area and here is what that looks like. It is at 440.800 Mhz and an swr of 1.25.

Of course this might seem like a bad antenna BUT it isn't. The antenna is a HT portable antenna and doesn't play well with vna, rigexpert commet or MFJ. Portable antennas use your hand and body as it ground plane. To get around that problem is simple just put your antenna on a mag mount and either place it on your vehicle or make a ground plane to mount the antenna to. I use the vehicle mount and the antenna was almost perfect for a dual band. I was in the 140 rand and 440 range on my readings.

The other area we should cover is using the vna to measure coax length and coax loss. I will give you the setup and the only difference on calibration is you need to do the isolin and the thru before doing done and save.

Coax Loss

The simplest one is coax loss so we will do the setup for that. Select the start and stop frequencies of that you will use the cable on. Let's say we want to use it on 2meter and 70cm. Set the frequency start at 100Mhz and stop at 500Mhz. Now kill all the traces except for the blue one. Now format the blue trace for logmag and make it channel1. Now do your calibration including isolin and thru. Hit done and save it to a slot of your choice. You'll notice that the blue line is up top and goes across on a straight line. When you disconnect the thru cable you will

see the line drop to the bottom of the display because it is open and at max loss.

Now connect one end of your cable to each port of the nano. Now you will notice that the blue line will slope downward. Move your cursor along the line to the frequency you want to measure and read the loss in db.

Length of coax or fault

We will setup the yellow channel 0 for this test. As far as frequency goes the higher the frequency the shorter the distance measured. Lower frequency sweep would be longer distance measured. The start frequency is the lowest your nano will do. Mine is 10k. There is a formula for the max frequency.

StopFreq=5850/max distance in meters X the velocity factor. I use a vf of .80 as an all around standard. Example about 75ft of cable=23meters.= 203Mhz

I set my nano to a stop frequency of 200Mhz. You can adjust that frequency up and down for a better display if you have to.

Now turn off all traces except yellow. Select it and set format | More | Linear. Now set transform to LoPass and Velocity Factor to 80 (no decimal just 80) Then turn transform ON.

Now hook you cable up to channel 0 and move your marker to the peak. Then you can read your length in meters.

Before hooking up your coax you can move the cursor to the far right to see how many meters is your max. Remember you can always adjust that upper stop frequency to measure a longer length.

Enjoy your nano and I hope this has helped with its usage.

This information is available as a pdf download at:

https://kd9owd.com/nano.pdf

preamble thanks to AA3S