Excerpt from the nanoVNA Workshop from Field Day 2022

What is a VNA?

Vector Network Analyzer, VNA, is an instrument that measures network parameters of electrical networks, such as antenna or antenna system, filters, individual components, etc. The VNA sends a known signal (an electromagnetic wave of known magnitude and frequency) into a device under test (DUT), and measures how much of that wave reflects from the device (reflection) and how much transmits through the device (transmission).

What can I use it for in the context of amateur radio?

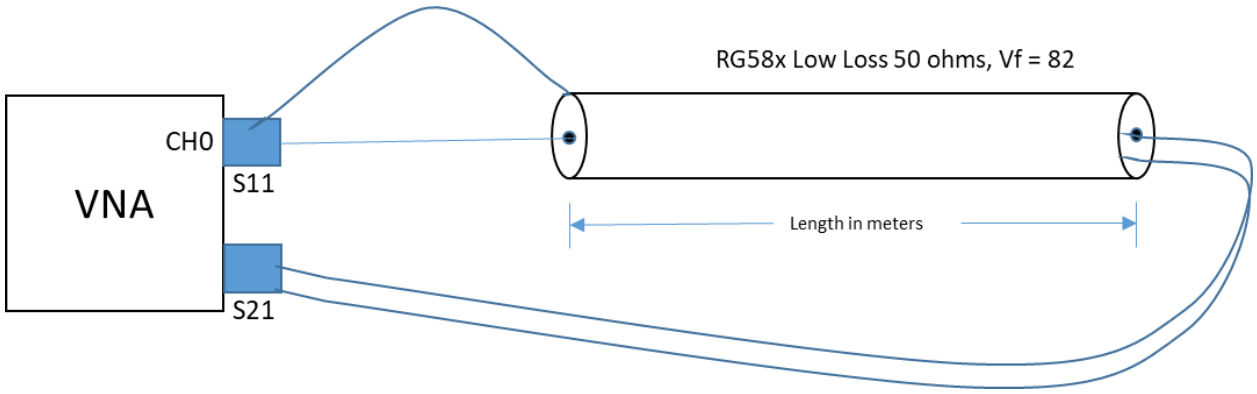
- Measure VSWR (aka SWR) for an antenna and transmission lines
- Measure the characteristic impedance (Z_0) of coaxial cable
  - Measure the distance along a coax until it sees a significant change in impedance. (use to check the length or look for a defect)
  - Measure response of a filter (low pass, high pass, bandpass) (needs 2 ports)
  - Advanced uses include Smith Chart and R+jX impedance measurements

Part 2: COAX LOSSES

Guiding equation is $Z_0 = \sqrt{\frac{L}{C}}$ Where Z_0= Impedance, $\sqrt{\frac{L}{C}}$ *is cable loss*

There are some good YouTube videos that show this measurement.

It requires the two port VNA configuration shown below.



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If we measure this RG8x coax for use for VHF and UHF, what do you think we will find?

Our specs are :

- DX Engineering Low Loss DXE-8XDB050 with BNC connectors – 50 ohms Characteristic Impedance
- Gas injected foam dielectric cable, 16 AWG center, 19 stands 29 AWG shield
- Loss for 100ft is 1.4dB @ 30Mhz
- Velocity Factor is 82%

For our experiment we will be using the nanoVNA Saver application on the PC

1. We set the sweep for 1 MHz to 30 MHz – basically the HF band.
2. Verify that the losses are minimal at - dB.
3. Change the sweep to be 100MHz to 150 Mhz range.
4. See that the losses may be acceptable for 50' of RG8x of about -2.2dB, but unacceptable for 100' which would be about -4.4dB.
5. Change the sweep for 300MHz to 450MHz.
6. See that RG8x is unacceptable at all frequencies, but at 445MHz it is -5dB

For using the stan-alone nanoVNA follow these steps instead.

1) Connect the coax like the figure with it making a loop between the S11 and S21 ports. The VNA transmits a signal of known magnitude and frequency from its Port 1 into the coax, and measures the magnitude and phase of the signal passed through the coax to the VNA other port, Port 2.
2) Use Trace 1 set to Log/Mag for Channel 1. This must be channel 1 because this is the through port S21. In VNA Saver set to display the S21 Gain plot and S11 Return Loss
3) Set Start Frequency to 120 MHz (ie below the 2m band), set Stop Frequency to 500 MHz
4) Losses will be shown in dB at the range of frequencies we set.
5) What is the loss at 144MHz ? _____
6) What is the loss at 443 MHz? _____ How much power is lost?

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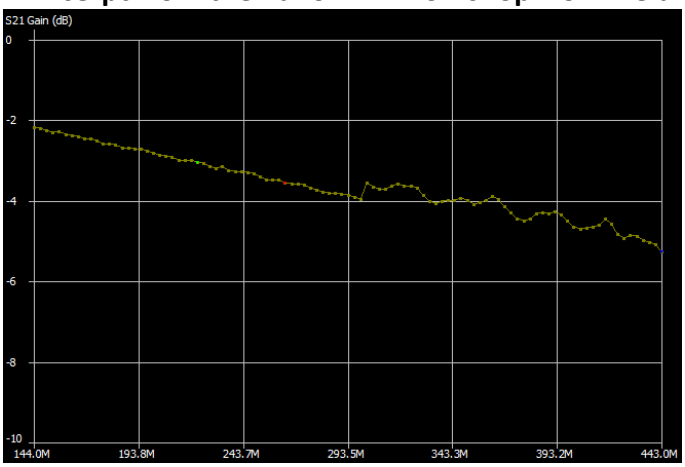
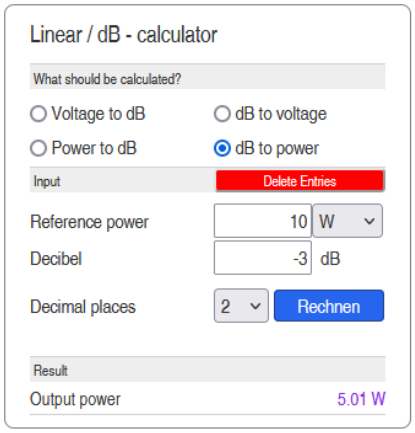
7) 

8) Change the Stop Frequency to 40 MHz and read the loss at 30MHz. How does that compare to the datasheet? _____
9) Would you use this coax for a UHF station? _____

dB Calculator Software

https://www.redcrab-software.com/en/Calculator/Electrics/Decibel-Voltage-Power



nanoVNA Saver software can be found at :

https://nanovna.com/