From the Help Desk – November 2025

Note – this is the third of an ongoing series of related articles that will each take a look at some facet of radio selection, installation, or operation as suggested by actual questions received from Club members or other amateur operators.

Q: Can the impedance of a section of unknown coaxial cable be determined using a NanoVNA? If so, how is it done?

A: The short answer is *"YES"* – coax line impedance *can* be determined using a NanoVNA. For the second part of the question, some preparatory information becomes necessary. The information provided herein is specific to the NanoVNA H4 with firmware version 1.2.40, but it should be very similar for other NanoVNA models and firmware versions.

This process will take advantage of the fact that the impedance in a feedline inverts every quarter-wavelength ($\lambda/4$) along its length, called the $\lambda/4$ *inversion property*. In a feedline, the impedance looking into the end of the feedline divided by the line impedance is equal to the line impedance divided by the load impedance. There is a simple equation that describes this relationship, as follows:

$$\frac{Z_{IN}}{Z_{\emptyset}} = \frac{Z_{\emptyset}}{Z_{LOAD}}$$

which can be rearranged or simplified as ${Z_{\emptyset}}^2 = Z_{IN} \times Z_{LOAD}$ and then simplified again as $Z_{\emptyset} = \sqrt{Z_{IN} \times Z_{LOAD}}$. These equations show how the line impedance is mathematically derived. The NanoVNA will provide us with the Z_{IN} value for use in the equation. However, we must also do a little bit more very simple math before we are ready to go.

The math that we need to work now deals with the *STOP* frequency of the RF sweep that we will use to measure the cable. The intent is to determine a sweep *STOP* frequency that is greater than the $\lambda/4$ frequency of the cable under test. This can be determined easily by dividing estimated length of the cable under test into one-quarter of the speed of light. When done as explained below, this calculation will produce the *free space λ/4 frequency in megahertz,* which will always be somewhat greater than the actual cable $\lambda/4$ frequency. If estimating the cable length in feet, divide that length into 246, but if estimating the cable length in meters, divide that length into 75. You should by now understand the significance of these numbers. Once you have an estimated *STOP* frequency, use the procedure below to determine the cable impedance.

Procedure

1. Go to *MENU* > *DISPLAY* > *TRACE* and turn off all traces except *TRACE 0.*
2. Go to *MENU* > *DISPLAY* > *FORMAT S11 (REFL)* > and select *SMITH,* and then be sure that the *SMITH* form is set to $R + jX$.
3. Go to *MENU* > *DISPLAY* > *MARKER* and make sure that only *MARKER 1* is selected and active.
4. Go to *MENU* > *STIMULUS* > *START* and set the *START* frequency to 50kHz.
5. Go to *MENU* > *STIMULUS* > *STOP* and set the *STOP* frequency to the value determined using the simple equation discussed above.
6. Connect any adapters needed to connect the cable to be tested to the NanoVNA.
7. Perform a calibration of the NanoVNA at the connection plane established in the previous step.
8. Save the calibration to a suitable memory slot in the NanoVNA.
9. Attach a 50Ω load (terminator) to the cable to be tested.
10. Connect the cable to be tested to the NanoVNA at the connection plane established in Step 6 above.
11. Use the jog wheel to move *MARKER 1* along the displayed trace just until the first time that it crosses the prime axis.
12. Read the real (resistive) portion of the displayed complex impedance at the upper left corner of the display screen.
13. Use that resistance value in the impedance equation explained earlier, multiplying the resistance value by the load value of 50Ω, and then determine the square root of that product. This result will be the approximate line impedance of the cable under test.

Example

The complex impedance value displayed on the NanoVNA at the prime axis crossing point is $52.23\text{-}j29.5m\Omega$. If the real resistance value of 52.23Ω is then multiplied by the load impedance of 50Ω, we get a product of 2611.5. If we then determine the square root of that product, we find a line impedance value of 51.10Ω, which we can then assume indicates a 50-ohm cable.

I hope that this article will help to make your NanoVNA more useful to you as well as helping to improve your NanoVNA operational skills. The NanoVNA is an incredibly useful and powerful tool for the radio amateur to have in his/her tool arsenal. Knowing how to use it makes it just that much more valuable.