Abstract:

This paper describes the cable null feature on the Bravo and Echo series of network analyzers.

Introduction:

A coaxial cable connecting the network analyzer to a load under test (LUT) will alter the readings of that load. The coax rotates the readings about the center of the Smith Chart which may result in confusion. The cable null feature allows one to remove the effects of cables and/or fixtures from the network analyzer readings. Activating the cable null causes the analyzer to prompt you through a series of steps: “open”, “short”, “load”, (OS&L) and sometimes “thru”. For best results when operating at higher frequencies, you should always cable null, even if the cable is “zero length”.

Discussion:

As stated in the introduction, cable nulling removes confusion that results from rotated readings. For instance, without cable nulling, the resonant frequency of a load will be shifted, the impedance could be “way off” and alignment of an antenna or other load would become impractical. Sometimes people use a ½ wave length cable to counter this, because the ½ wavelength cable rotates the reading exactly 360 degrees. This approach limits you to a narrow sweep, and presents difficulties cutting the cable exactly on frequency. Cable nulling derotates the readings over an arbitrarily wide frequency sweep for whatever length of coax you have handy.

For S11 measurements, the cable is measured with three different loads, OS&L. For S21 measurements, the thru path is measured. Once these steps are taken, you may connect the LUT and get good readings.

The AEA network analyzers internally calibrate themselves when required by power up or frequency change. However, there is a short RF path that lies beyond this internal calibration path, so when frequencies get high enough, cable nulling should be done at the unit’s connector to get more accurate readings.

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Notes specific to the Bravo Analyzers:

1. Some Bravo units are single port, and do not require thru path calibration because S21 is not available. The 2 port models will ask for OS&L and/or thru, depending on the measurements selected for plotting. If you want to save both S11 and S21 data, select one S11 plot and one S21 plot for the display.
2. The Bravo, when possible, calibrates a sweep width that is twice as wide as the displayed width. This allows the Exam/Plot feature to shift the center frequency without truncating the plot.
3. To avoid excessive re-nulling, change the center frequency with the Exam/Plot cursor, do not enter frequency numerically. Never change the Sweep Width.
4. To force a new cable null, (re)enter the center frequency with the numeric keys. Changing sweep width always causes a recalibration, so when cable null is active, a renull occurs.
5. With later versions, it is possible to switch between CW and sweep without retriggering a cable null. Use “0”|Width to enter CW; use Width up to return to sweep.

Notes specific to the Echo Analyzers:

1. The Echo models will ask for OS&L and/or thru, depending on the measurements selected for plotting. If you want to save both S11 and S21 data, select one S11 plot and one S21 plot for the display.
2. To force a new cable null, (re)enter the center frequency with the numeric keys. Changing sweep width always causes a recalibration, so when cable null is active, a renull occurs.
3. By pressing the CW/SWP key, one cycles the display from sweep mode to CW (center frequency) to CW (marker 1) to CW (marker 2) back to sweep. Using this technique allows one to examine 3 frequencies in detail plus look at the swept plot without having to re-null.

Conclusion:

Using the cable null feature on AEA’s network analyzers will improve the accuracy and ease deciphering of the plotted data.

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