Quite often, cables are used to interconnect a test fixture to the test port of a VNA. Physical layout of a system puts constrain on the length and shape of the interconnect cable. Compromises must be made between cable length, physical stress, power loss, system stability and measurement accuracy.
Length and Physical Stress

Tight coaxial cable bends cause physical stress and impedance changes. These stress points are also the most susceptible to temperature changes and cause behavior instability. A longer cable with a more gentle bend may provide better stability.

Length and Power Loss

Cable loss is proportional to length. If power level is not an issue, cable loss can actually improve the raw source and load match of a test port. The loss is calibrated out. It should have no impact on residual directivity, residual source match, residual reflection tracking and residual load match. Residual transmission tracking should improve slightly due to better raw source and load match. This is illustrated by Figures 1 thru 5.

Length and System Stability

People always assume that short length is better than long length. It is true that phase change with respect to temperature change is proportional to length. However, this is only one of the factors. If the cable needs to be moved or bend to make connections, short cables are more sensitive to such movements. The stress level on the cable’s internal structure is inversely proportional to the bend radius. This is illustrated in Figure 6.

Figure 1. Comparison of residual directivity
Figure 2. Residual source match compared

Figure 3. Residual reflection tracking compared

Figure 4. Residual load match compared
Figure 5. Residual transmission tracking compared

Figure 6. Vector magnitude change caused by a 1-inch movement at end of cable

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