Cable measurement considerations For RTPGE cable balance testing

- Balance measurement floor
- Test setup

B. Moffitt, CommScope Labs

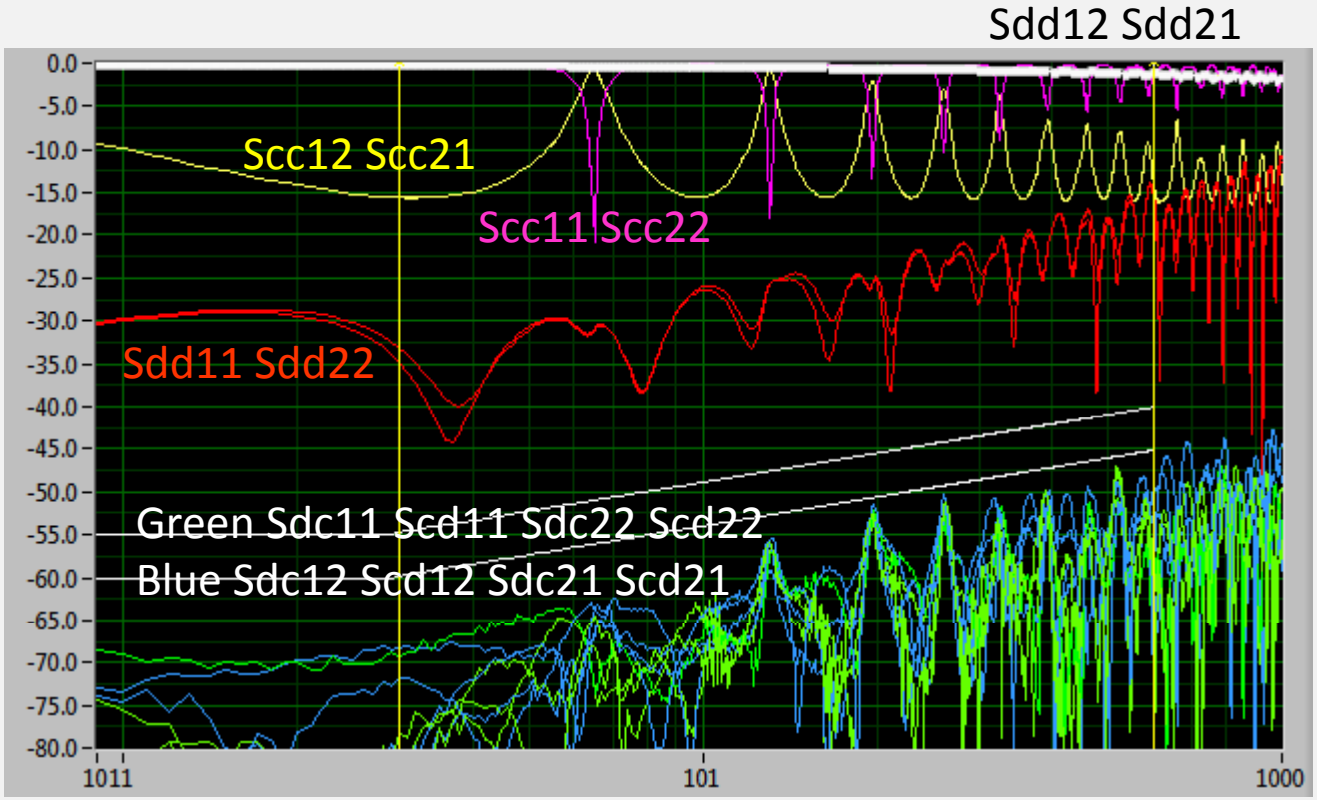
Calibration checks:

1. Matched thru connectors (Huber Suhner 34_SMA-50-0-1/111_NE) for checking “low loss measurement” balance floor
2. Thru connectors with matched loads (Fairview ST1822) for checking “high loss measurement” near end balance floor
3. Thru connectors open ended for checking the “high loss measurement” far-end reflected balance floor

- 0TD01D01036.0 Gore Phase-Flex Cables are used with a manual calibration
- Matching is done by mechanical gauging and then comparing results of measurements from a common port
- The balance of the calibration and artifacts can be verified by testing in swapped positions

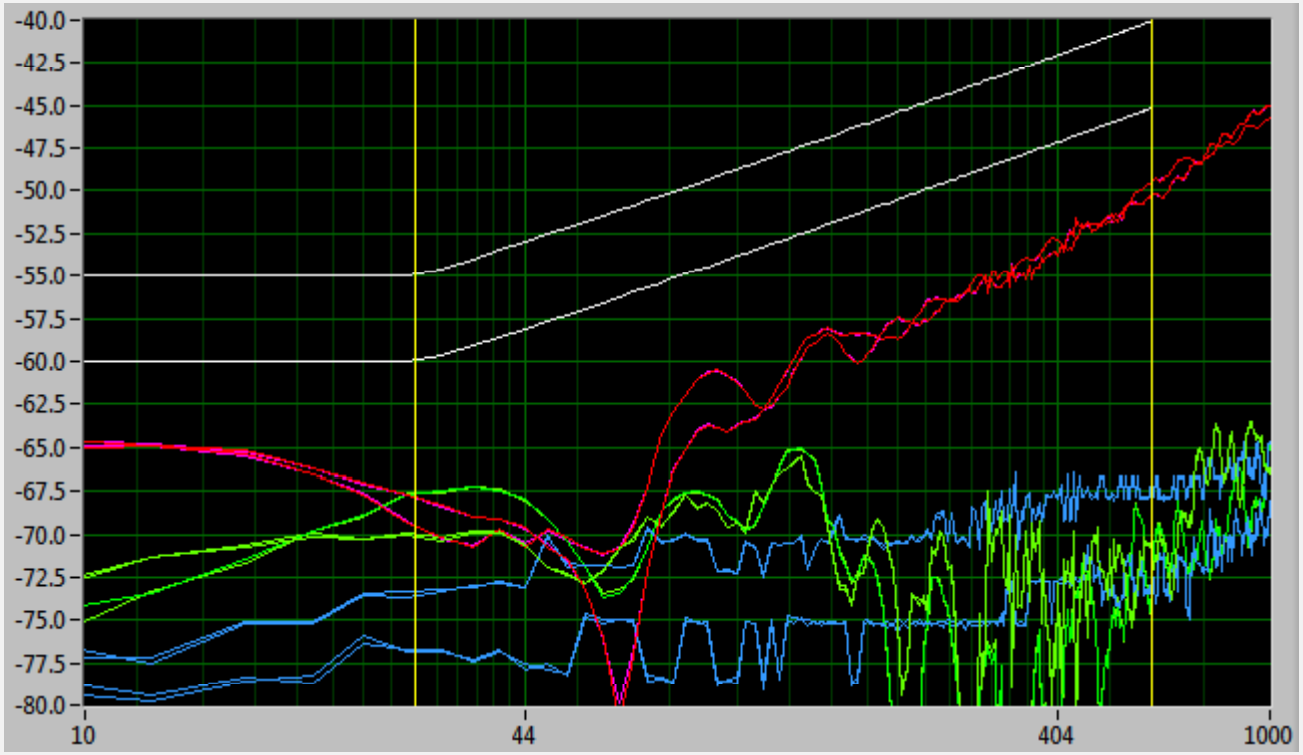
Assurance of proper measurement is not provided unless all parameters of a measurement set can be confirmed

The different types of 4 port S-parameters are color coded here for easy identification

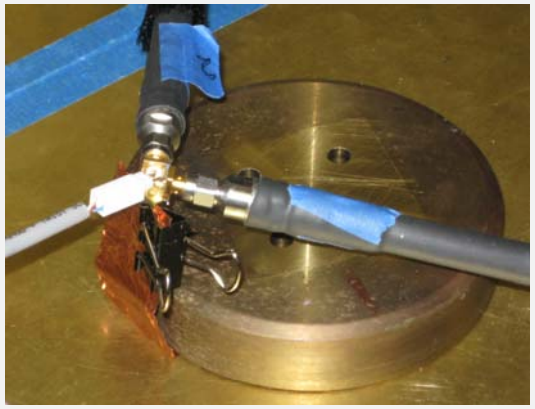


This is the first calibration check – a low loss thru measurement

At 30 MHz this has 7.5 dB balance margin to the proposed specification
(The differential and common mode insertion loss are close to 0 dB)



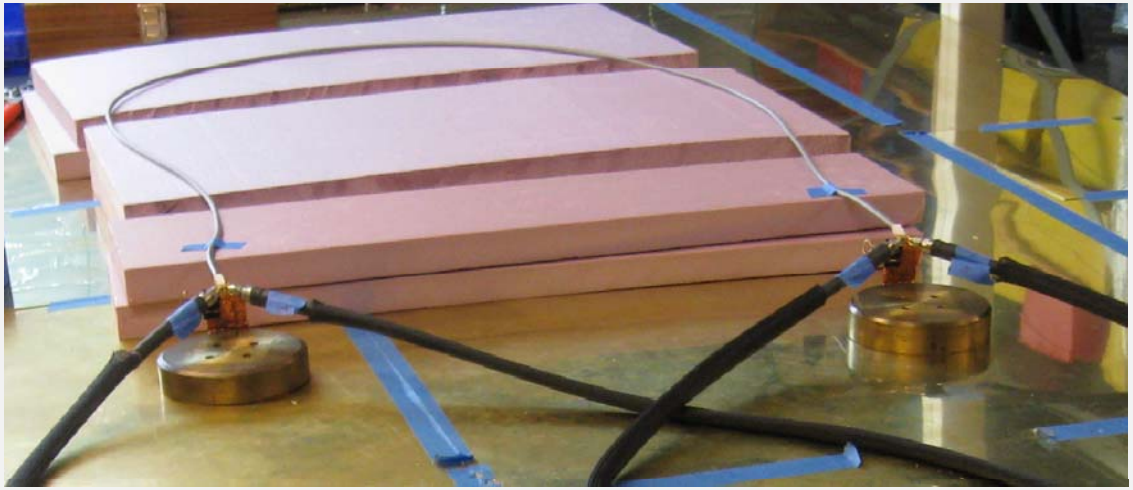
The second two calibration checks result in high insertion loss and high loss for the transmitted balance terms (Blue)



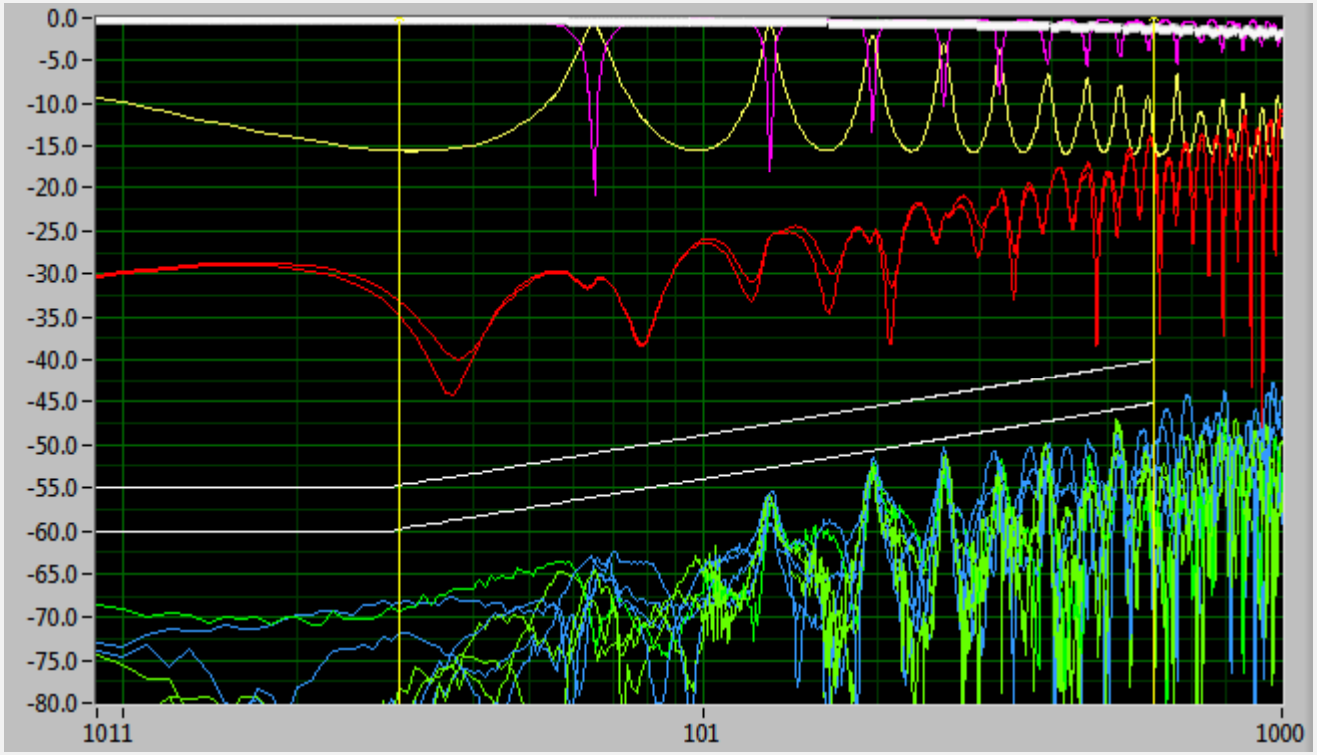
Test heads here are grounded to the plane with a wide foil strip with the end weighted down with an old heavy stand to contact the ground plane

The foil provides a vertical 5 cm low inductance ground path

This references the measurement ports to the ground plane and should be done regardless of the test height

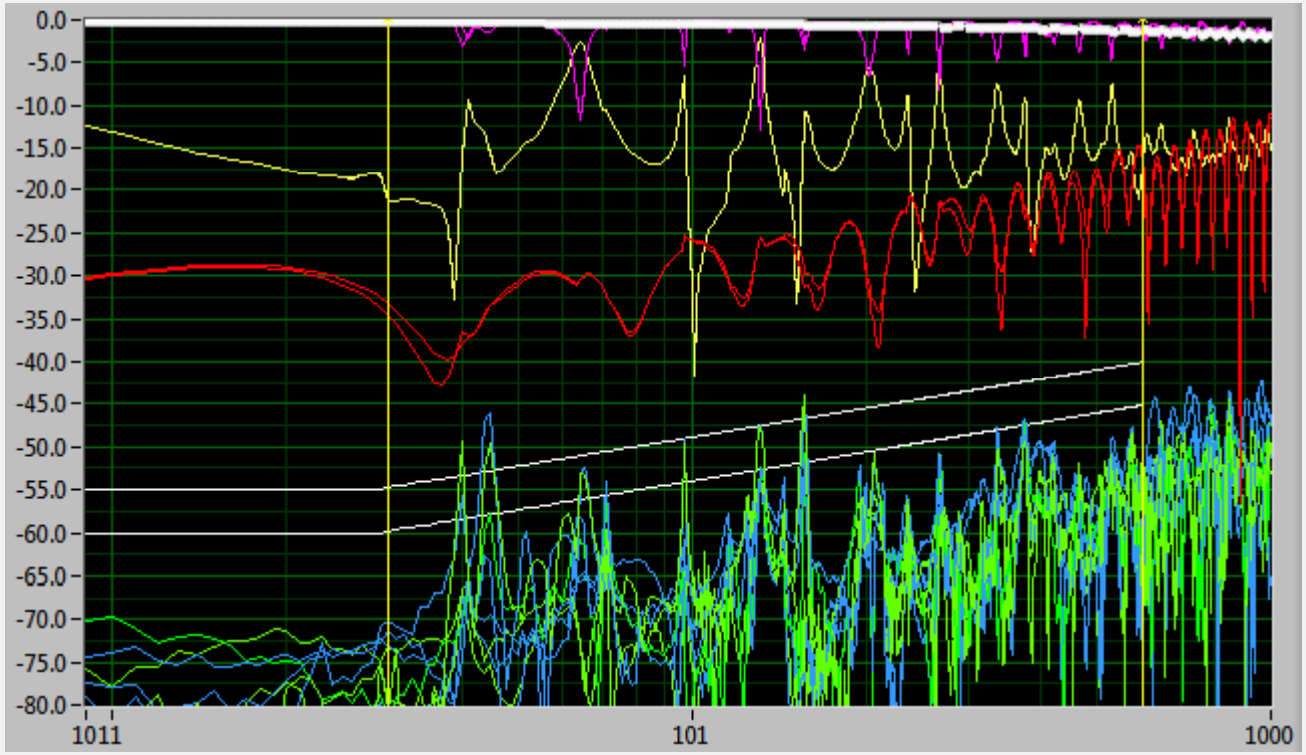


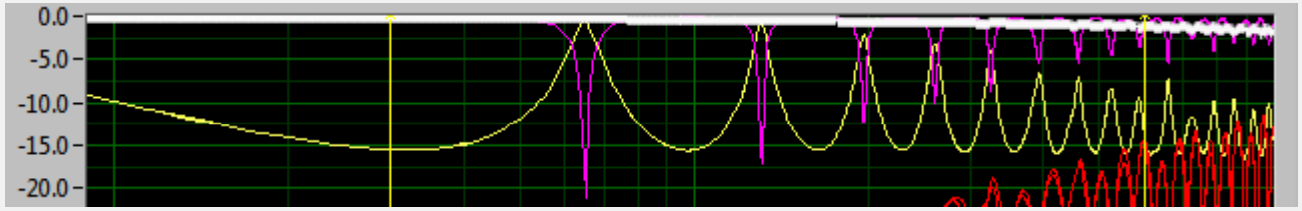
A preliminary 2 meter sample measurement



This is the same sample measurement with the test heads floating (Not low inductance grounded to the ground plane).

There are numerous mode conversion spikes and the common mode Insertion loss (yellow) shows a complex reflection pattern indicating more than just a single cable path.

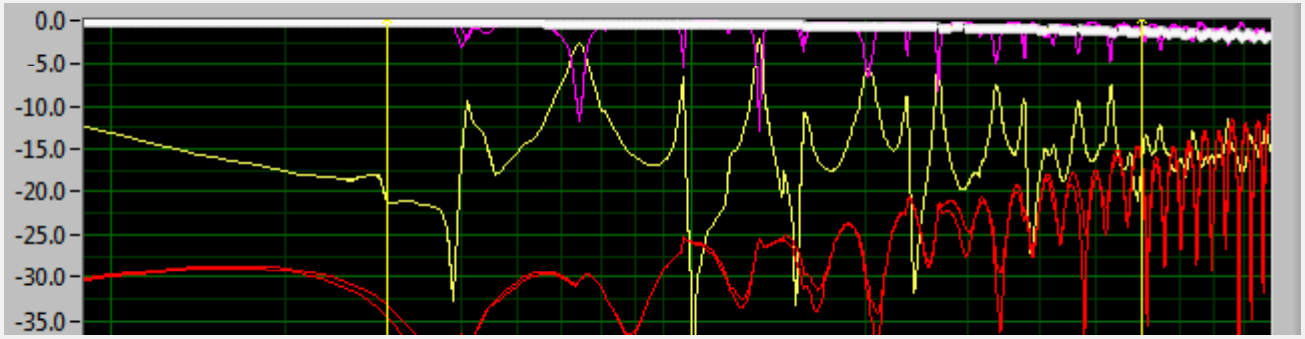




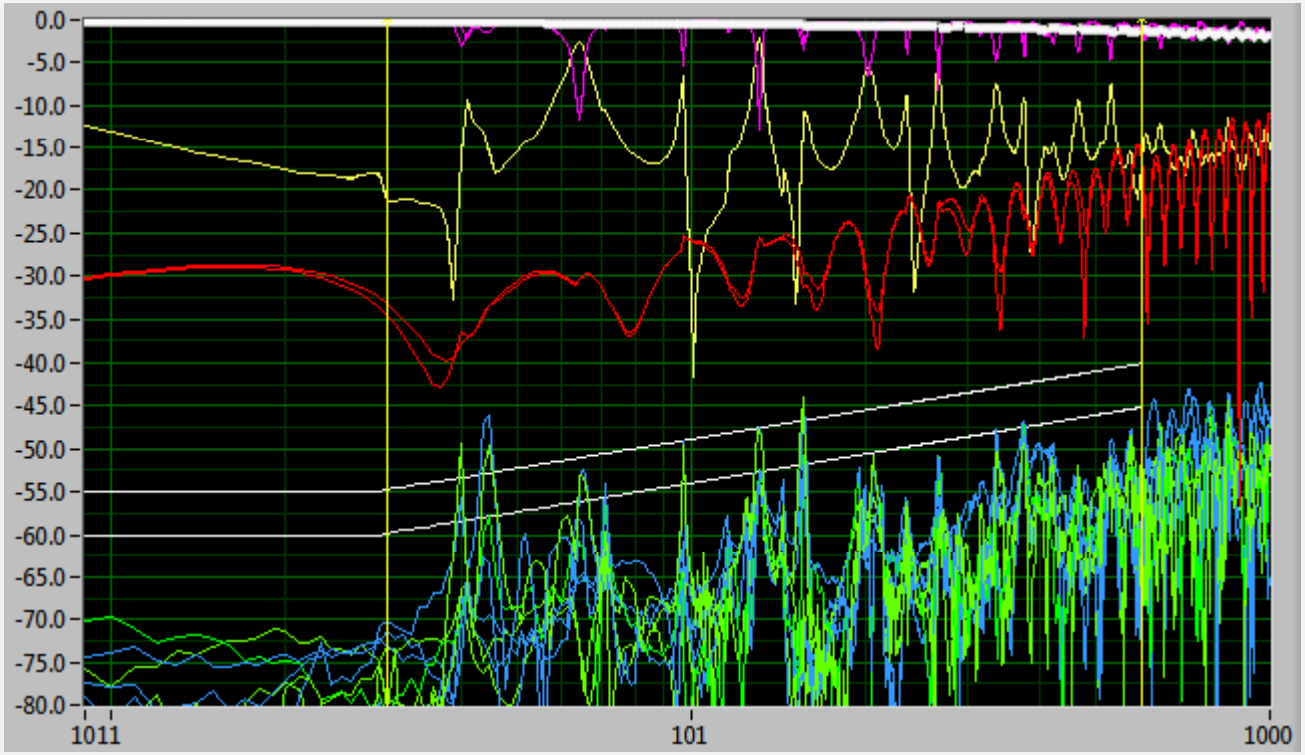
With the heads properly grounded to the ground plane the CM Insertion loss (yellow) shows the expected lobed pattern of a 2 meter line driven through 25 Ω reference ports. This is an accurate measurement of the line.

(300 Ω @ 5 cm)

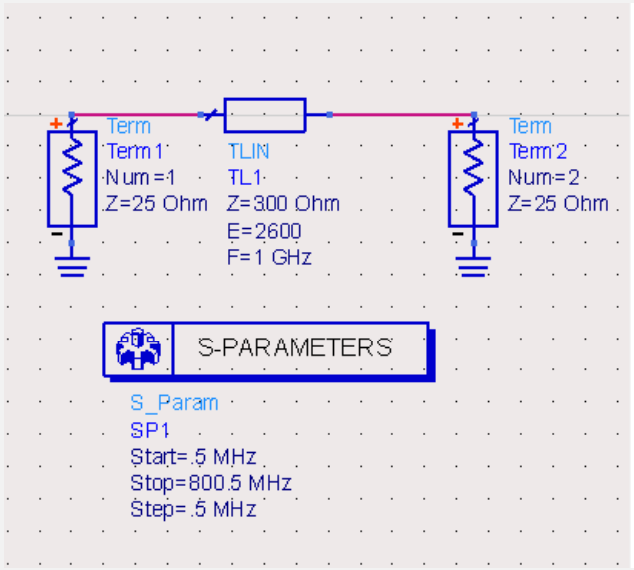
With the heads floating from the ground plane the CM Insertion loss shows a random spiked pattern that indicates CM signal reflections from multiple paths and not just a single 2 meter 300 Ω line. CM signal is leaking and reflecting along the coax shields from the grounding at the analyzer. This measurement includes the cable and the test fixturing and will not necessarily be repeatable from one lab to another.

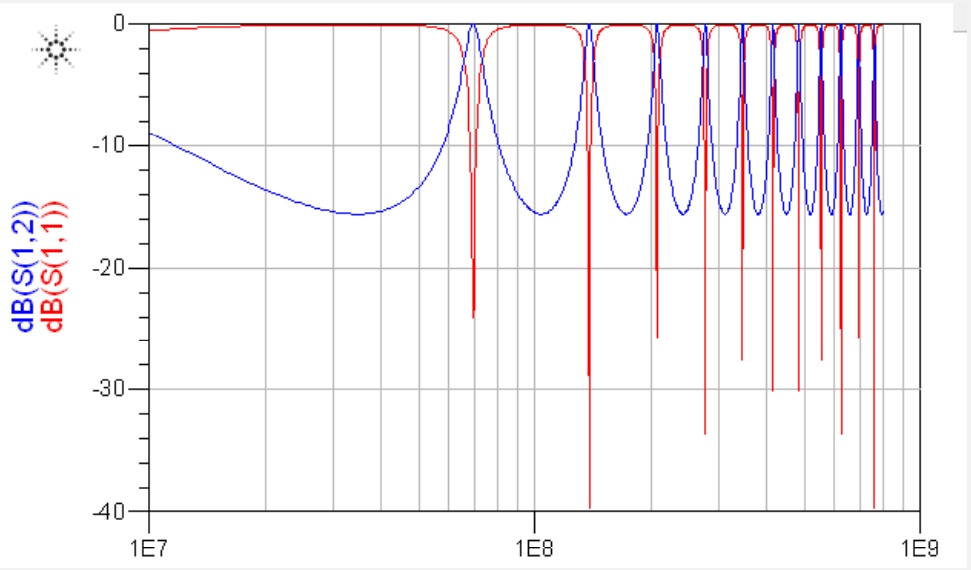


Another problem with floating heads is more susceptibility to external pickup because any energy that makes its way onto the analyzer ground or test lead shields can show up in the measurement as random spikes in the mode conversion terms (green and blue)

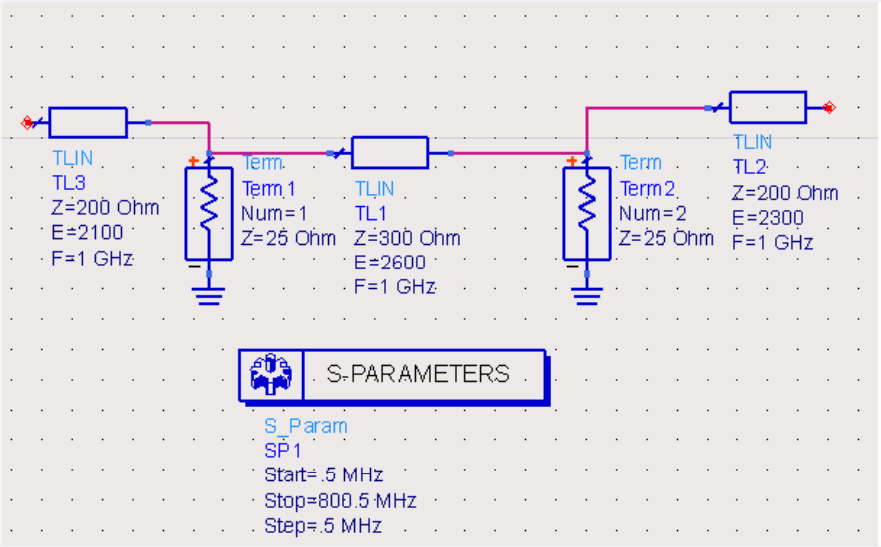


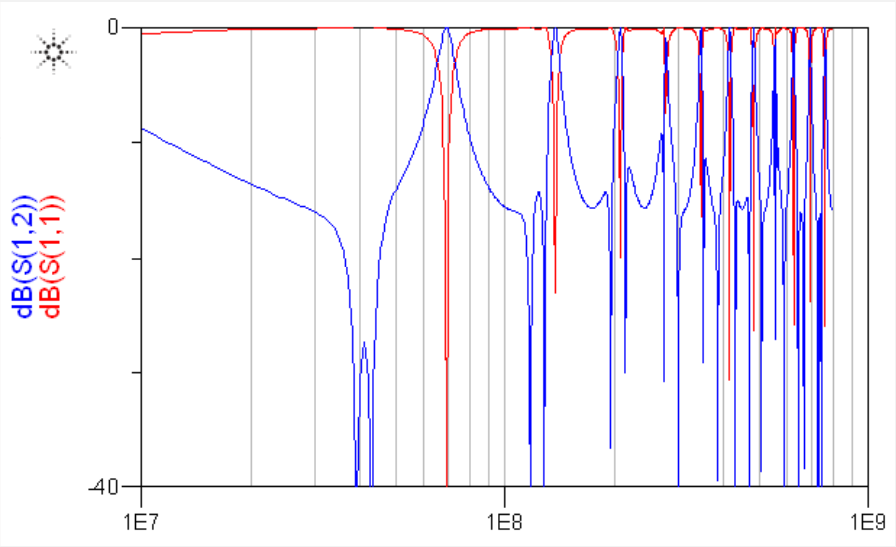
This is an ADS simulation of a 300 Ω line driven through 25 Ω ports





Here is the line with one possible arrangement of extra loading





Loading like this from inadequate grounding can take on many forms and is not generally possible to analyze because of the multiple parallel transmission leakage paths