APPLICATION NOTE

AE-AN-TR-007-TR Multicoax Series Expected Results

Purpose:
This application note provides detailed information for observing the S-parameter performance of the TR Assembly using the Evaluation Kit.

Evaluation Kit:

The scattering parameter performance of the TR Assembly can be observed by an Evaluation Kit offered by Amphenol Ardent Concepts. The Evaluation Kit contains a TR Assembly, PCB mounting board with microstrip traces, and two movable end launch connectors (see figure 1 & 2).

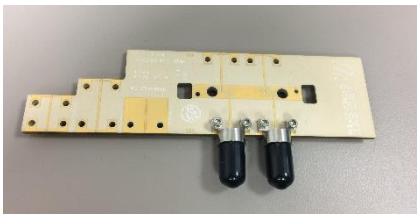


Figure 1: Evaluation Board

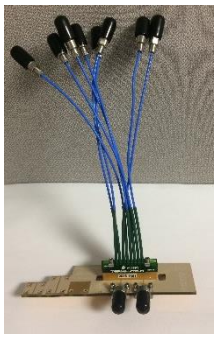


Figure 2: TR mounted on Evaluation Board

Evaluation Kit Board:

- Each metal layer is 1.7 mils thick with Electroless Nickel Immersion Gold (ENIG) plating.
- The board has two-line standards to de-embed board loss.
- The L2 / M line standard is 0.50” long and can also be used as an open to move the reference plane just before the narrow microstrip transition.
- The L1 / M line standard is 0.75” long.

- A load adapter may be connected to one end of the line standards.
- With the L2 / M line open standard, the reference plane extension determines a characterized attenuation with the end launch and microstrip. The loss characterization is determined by the PNA when measuring the open standard.

NOTE: The loss of the microstrip trace under the interface still remains and therefore further characterization would be implemented to completely remove the microstrip trace up to the signal landing pads.

NOTE: To ensure a correct de-embedded return loss measurement, ideally part of the microstrip trace would be included just before entering under the interface.

End Launch Connector:

For TR20 and TR40, two 2.92 mm female end launches are included and for TR70 two 1.85 mm units are included.

Vector Network Analyzer Calibration Parameter Settings:

The round-trip time for a TR Evaluation Kit with 6" cables is less than 2 ns.

Rise Time Period of Vector Network Analyzer = 1 / Frequency Span → 1 / 40 GHz = 25 ps.

The scattering parameter performance for an 8 channel TR 06KF Evaluation Kit was measured ideally with the following equipment settings:

- Vector network analyzer: Agilent E8361A PNA
- Sweep type: Step
- Number of points: 1601
- Intermediate frequency bandwidth: 100 Hz
- Rise time: ≈14 ps
- Stimulus time: 0 ns to 2 ns
- Stimulus: 0.041875 GHz to 67.041875 GHz

Determining Phase Length:

To determine the phase length of each cable, perform the following:

1. Remove the interface from the TR Assembly.

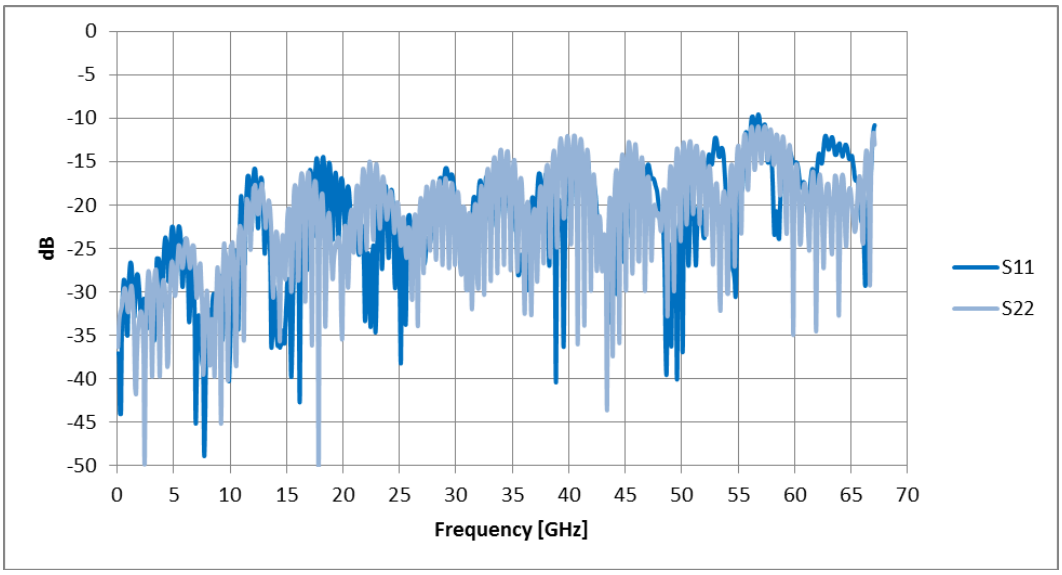
NOTE: Phase length measurements will not be accurate with the interface on the TR assembly because the contacts are not compressed.

2. In the time domain, select a step response in real format mode.
3. Connect a TR coax channel to the calibrated port.
4. Allow time for a steady state response.
5. Determine and mark the middle of the step response rise and record the time value.

NOTE: This chosen middle value will be used as a reference.

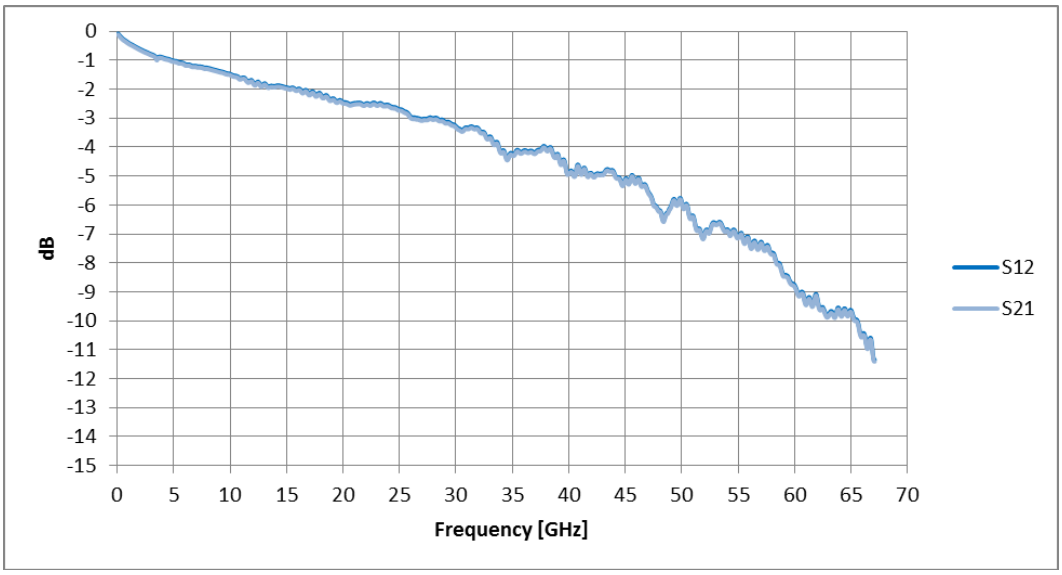
6. Average for what time the chosen middle rise value would fall on.
7. Disconnect the channel and connect a new channel.
8. Allow time for a steady state step response.
9. Determine and mark the middle of the step response rise and record the time value.
10. Average for what time the chosen middle rise value would fall on.
11. Repeat this process and when completed, the different time values for when the chosen middle value of the step response rise occurred can be compared.

Return Loss:



Interpolation 1: Return Loss for a 06KF Evaluation Kit

Insertion Loss:



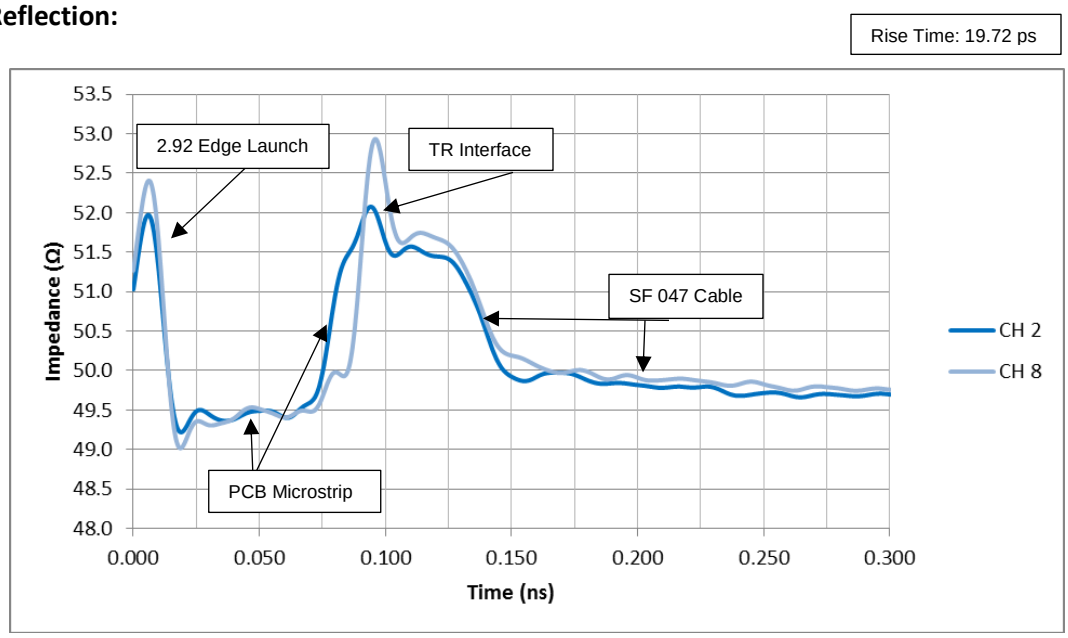
Interpolation 2: Insertion Loss for a 06KF Evaluation Kit

NOTE: The 2.92 mm End Launch connector and 0.5" microstrip (Rogers 3003 10 mil thick ENIG substrate laminated onto FR4) is included in loss.
NOTE: The attenuation of the 06K assembly and interface is -2.5 dB at 40 GHz.

NOTE: The attenuation of the 06V assembly and interface is -1.9 dB at 40 GHz.

TR 12" Cable Assembly Insertion Loss	TR 6" Cable Assembly Insertion Loss
≤ 22 GHz: -2.39 dB	≤ 22 GHz: -1.30 dB
≤ 40 GHz: -3.46 dB	≤ 40 GHz: -1.92 dB
Loss Due to Cable 22 GHz: -2.18 dB	Loss Due to Cable 22 GHz: -1.09 dB
Loss Due to Cable 40 GHz: -3.08 dB	Loss Due to Cable 40 GHz: -1.54 dB
Loss Due to Interface 40 GHz: -0.38 dB	Loss Due to Interface 40 GHz: -0.38 dB

Time Domain Reflection:



Interpolation 3: Time Domain Reflection for a 06KF Evaluation Kit

NOTE: The measurement includes a 2.92 mm End Launch connector and 0.5" microstrip (Rogers 3003 10 mil thick ENIG substrate laminated onto FR4).

NOTE: The interface reactance is controlled.

Application Note Summary:

- The Evaluation Kit contains a TR Assembly, PCB mounting board with microstrip traces, and two movable end launch connectors.
- The round-trip time for a TR Evaluation Kit with 6" cables is less than 2 ns.
- Attenuation values @ 40 GHz for V & K are -2.5 dB and -1.9 dB at 40 GHz.

Who Is Amphenol Ardent Concepts?

Amphenol Ardent Concepts is a leading designer and manufacturer of high performance multicoax and coaxial assemblies, connectors, and sockets used in the development of next generation semiconductors and electronics systems. Our core technology is the smallest, fastest, most electrically efficient compression mount connector technology worldwide. As data rate requirements increase and devices and systems shrink, Ardent's products deliver superior signal integrity in a dense footprint that can be reusable across programs to maximize cost savings.