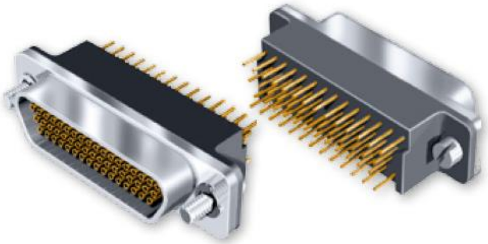
GT-14-19

Micro–D

High Speed Characterization Report

For Differential Data Applications

GMR7580-9S1BXX
PCB Mount



MWDM2L-9P-XXX-XX
Cable Mount

Glenair, Inc.
1211 Air Way
Glendale, CA 91201-2497 USA

WWW.GLENAIR.COM

Phone: 818-247-6000
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Revision: A

Revision History

Rev	Date	Approved	Description
A	4/10/2014	C. Parsons/D. Armani	Initial Release

Table of Contents

Introduction

This testing was performed in order to evaluate the high-frequency electrical performance of our Micro-D connectors in differential data applications. All measurements were taken using the Agilent E5071C network analyzer with TDR option connected to a SMA-launch test fixture PCB designed specifically for this testing. This report outlines frequency domain performance metrics such as Insertion Loss (IL), Return Loss (RL), Near End Crosstalk (NEXT), Far End Crosstalk (FEXT) as well as time domain performance metrics such as impedance and eye patterns.

Connector Overview

The Glenair family of TwistPin equipped Micro-D connectors offer outstanding mating performance, durability and minimal contact resistance. Micro-D Connectors feature High density micro TwistPin contacts set on .050 centers in arrangements from 9 to 130 contacts. They are available with insulated and un-insulated wire, PCB, solder cup and flex terminations and are supplied as QPL or commercial variations. This test report characterizes the differential high speed performance of PCB Micro-D mated to a cable Micro-D with both crimp and solder-cup contacts.

Test Configuration

Several contact pair locations were selected to provide a performance overview of the connector with a variety of position selections. It was observed that insertion loss improved as the number of grounded contacts increased.

Crosstalk performance was affected by aggressor and victim pair relative location along with the existence of grounded contacts between aggressor and victim pairs. Worst-case crosstalk performance resulted from parallel pairs and best case resulted from pair separated by grounded contacts. If separation by grounded contacts isn’t an option, placing aggressor and victim pairs perpendicular to one another also provides improved crosstalk performance.

All data besides insertion loss accounts for the entire device under test (DUT). This includes two mated connector pairs and twelve inches of high performance 100Ω cable. Insertion loss data was corrected for losses due to the test fixture and divided by two to show the performance of a single mated pair.

Performance Summary – Insertion Loss

Insertion and return loss data was acquired separately for crimp and solder cup contacts. All other frequency, and time domain, data was acquired from crimp contacts only but can be applied to solder cup contacts by similarity.

Layout	Parameter	Results
1/6 - signal 2,4,5 - ground	Insertion Loss (Crimp)	-3dB @ 3.23GHz
	Insertion Loss (Solder Cup)	-3dB @ 3.43GHz
	Electrical Bandwidth*	7Gbps Max Data Rate

* The connector system electrical bandwidth is based on the -3dB insertion loss point of a single mated pair, rounded up to the nearest 0.5Ghz to account for test system loss that could not be de-embedded from the results. The frequency is then doubled to determine an approximate data rate in gigbits per second (Gpbs). For example, a connector with a -3 dB point of 2.3Ghz would have a speed rating of 5.0Gbps.

Refer to the following image for micro-d contact locations:

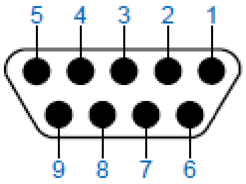


Figure 1: Micro D contact layout

Performance Summary - Crosstalk

Layout (Aggressor-Victim)	Parameter	Results
1/6-2/7	NEXT (Worst Case)	< -19.2dB
1/6-3/8	NEXT	< -26.5dB
1/6-4/9	NEXT (Best Case)	< -30.0dB
1/6-3/7	NEXT	< -21.9dB
1/6-8/9	NEXT	< -28.9dB
3/7-8/9	NEXT	< -29.5dB
1/2-4/5	NEXT	< -21.6dB
1/2-6/7	NEXT	< -27.5dB
1/2-8/9	NEXT	< -28.2dB
1/6-2/7	FEXT (Worst Case)	< -18.6dB
1/6-3/8	FEXT	< -23.2dB
1/6-4/9	FEXT	< -25.5dB
1/6-3/7	FEXT	< -24.0dB
1/6-8/9	FEXT	< -28.7dB
3/7-8/9	FEXT (Best Case)	< -33.1dB
1/2-4/5	FEXT	< -21.3dB
1/2-6/7	FEXT	< -27.5dB
1/2-8/9	FEXT	< -27.9dB

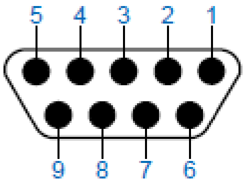
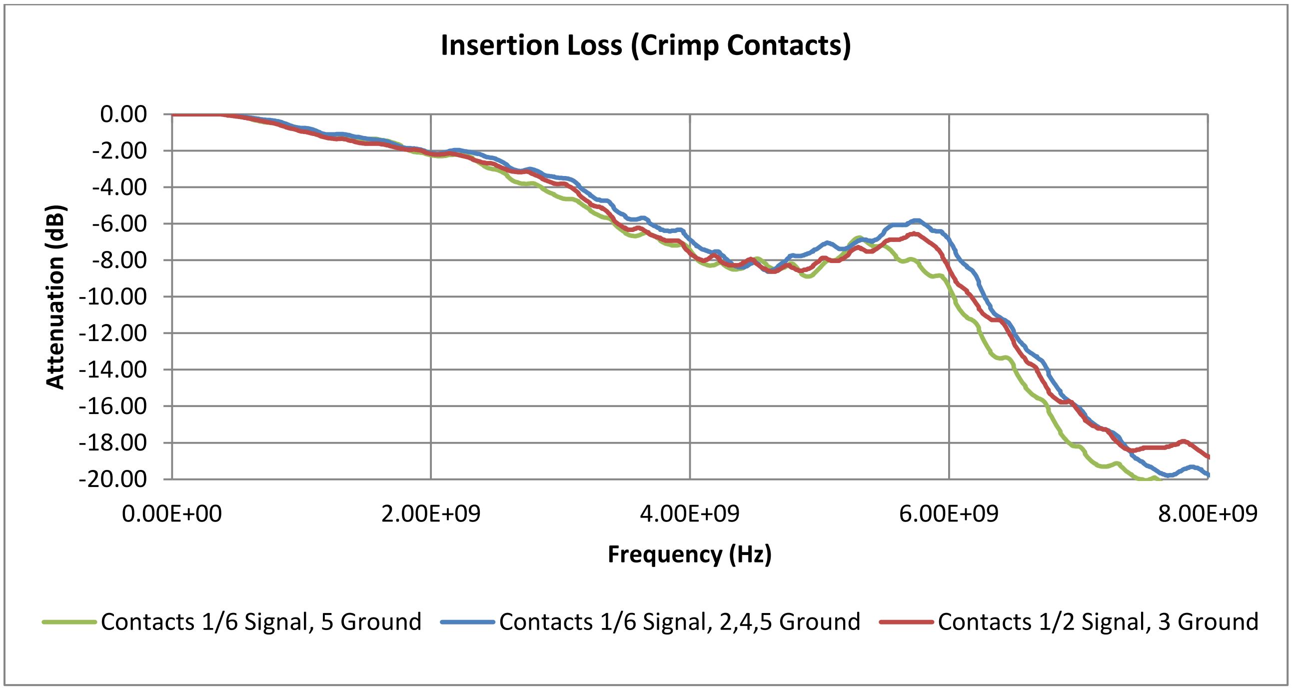
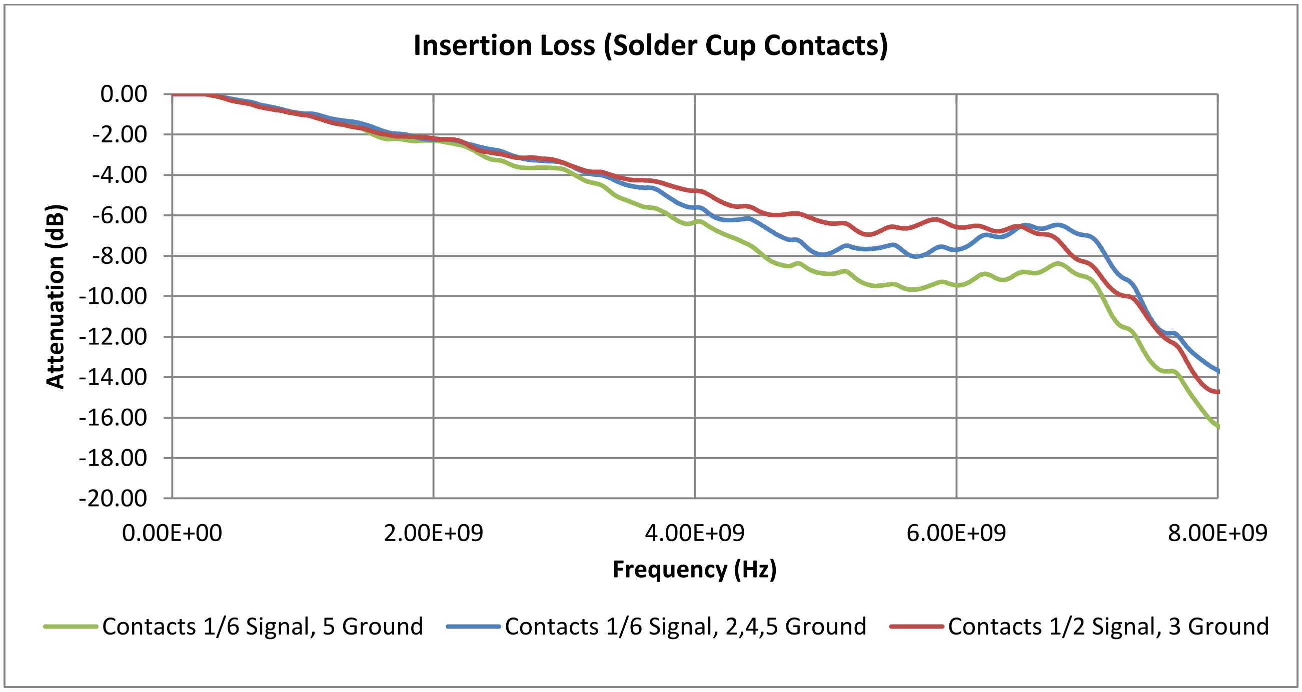
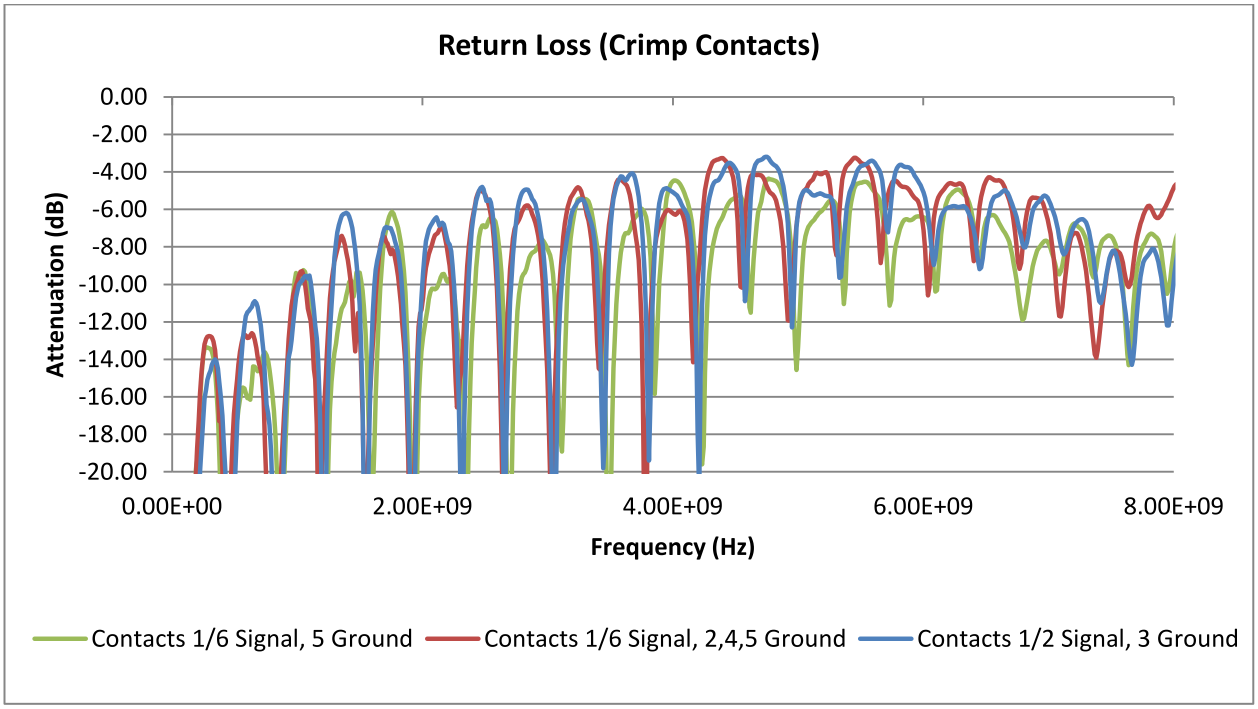


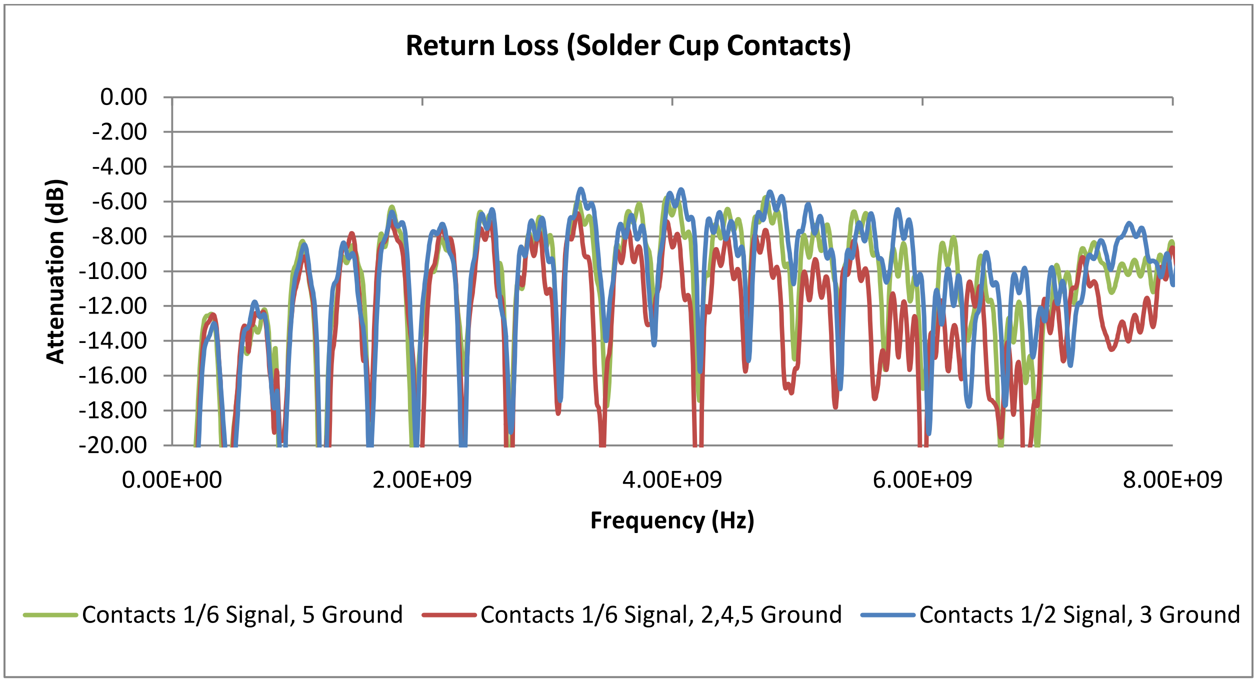
Figure 1: Micro D contact layout

Frequency Domain Analysis

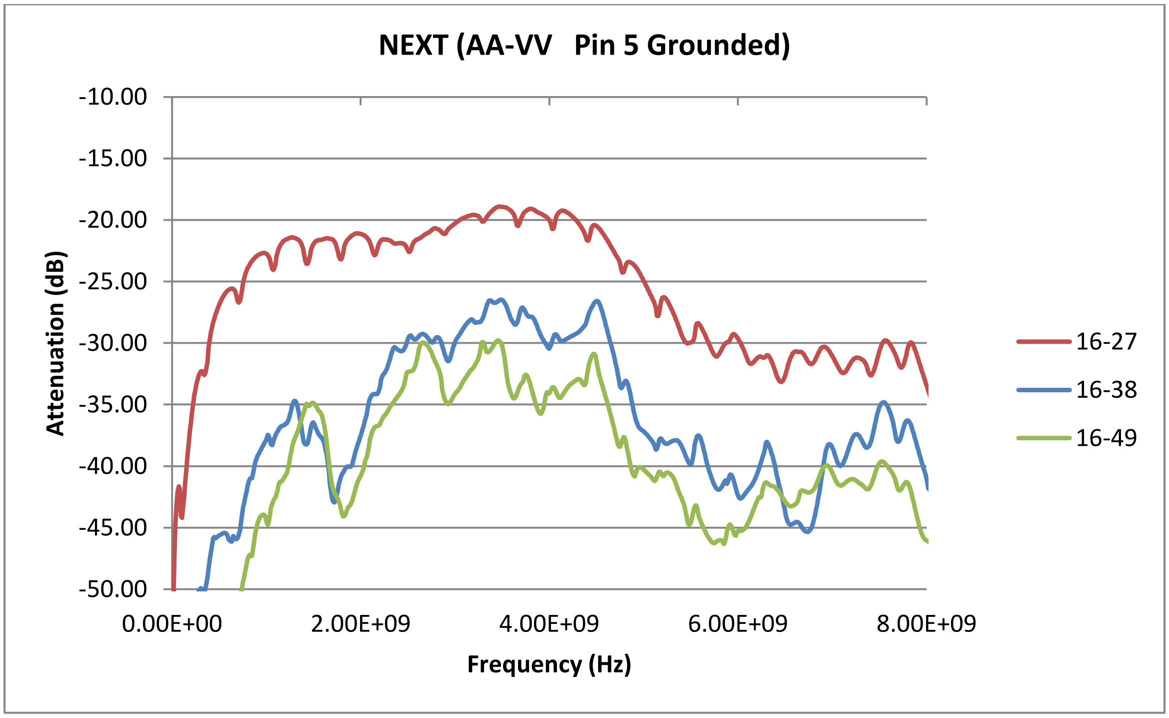


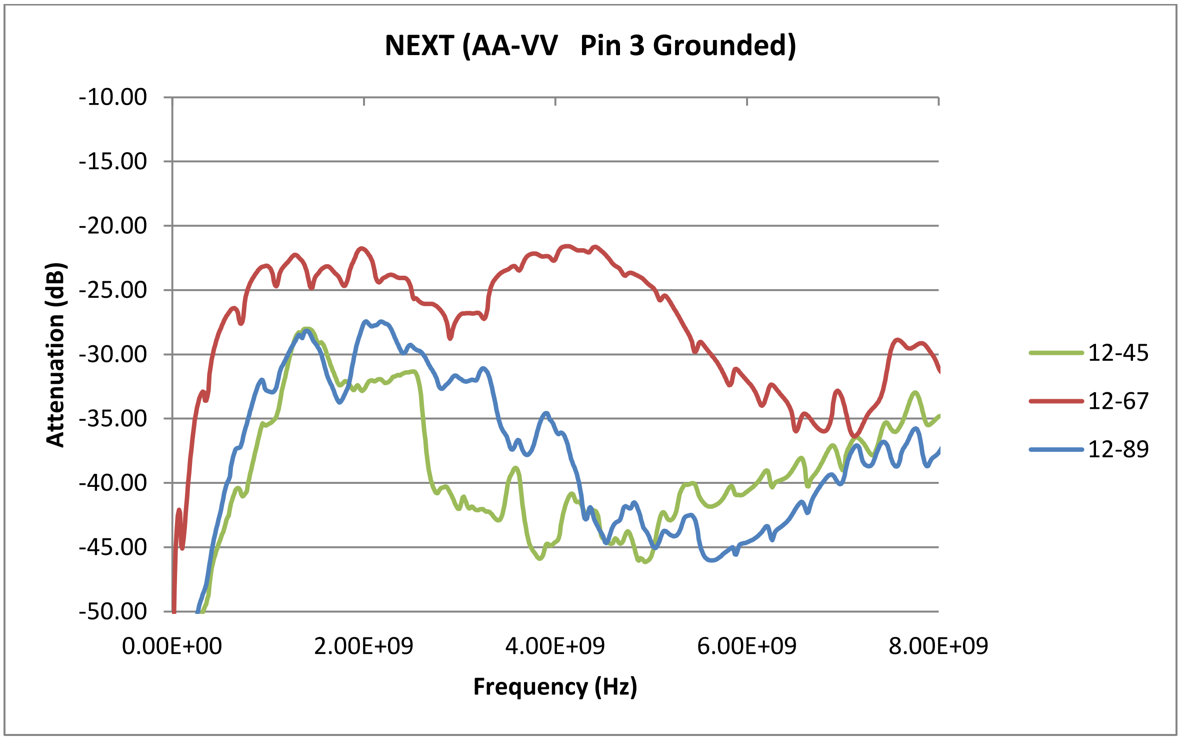


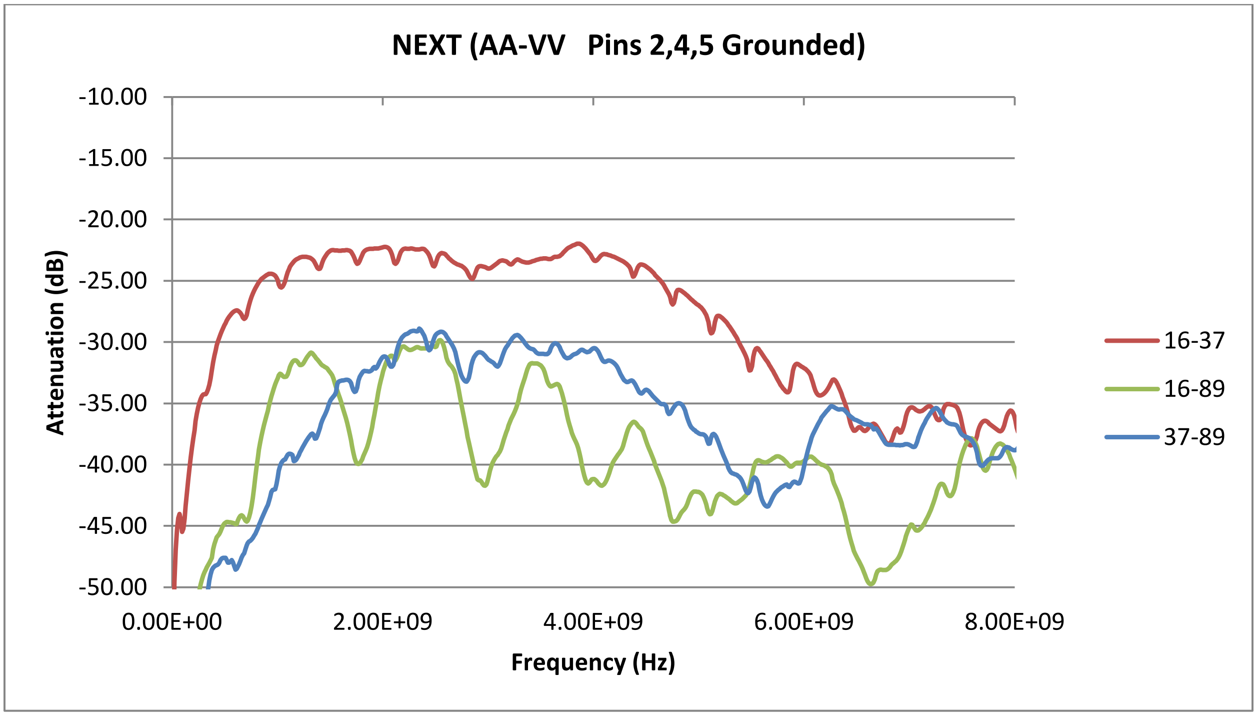

Return Loss (Crimp Contacts)
Attenuation (dB)
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
-18.00
-20.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
Contacts 1/6 Signal, 5 Ground
Contacts 1/6 Signal, 2,4,5 Ground
Contacts 1/2 Signal, 3 Ground

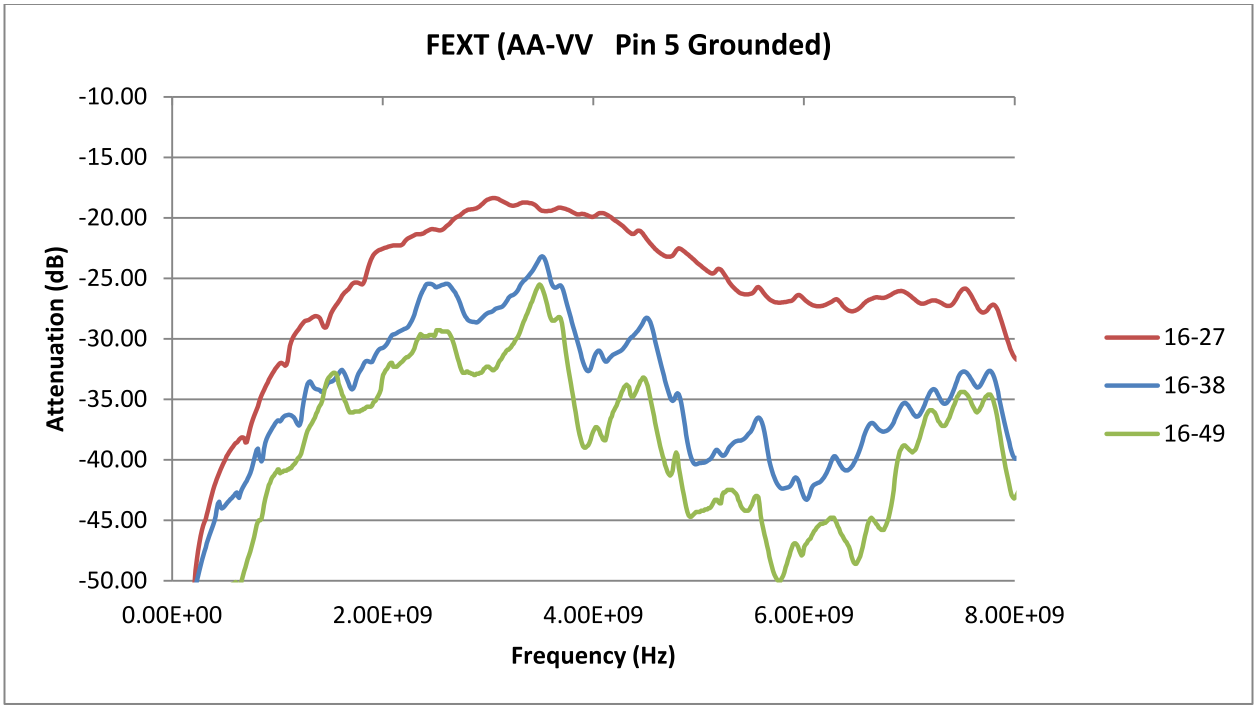

Return Loss (Solder Cup Contacts)
Attenuation (dB)
0.00
-2.00
-4.00
-6.00
-8.00
-10.00
-12.00
-14.00
-16.00
-18.00
-20.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
Contacts 1/6 Signal, 5 Ground
Contacts 1/6 Signal, 2,4,5 Ground
Contacts 1/2 Signal, 3 Ground

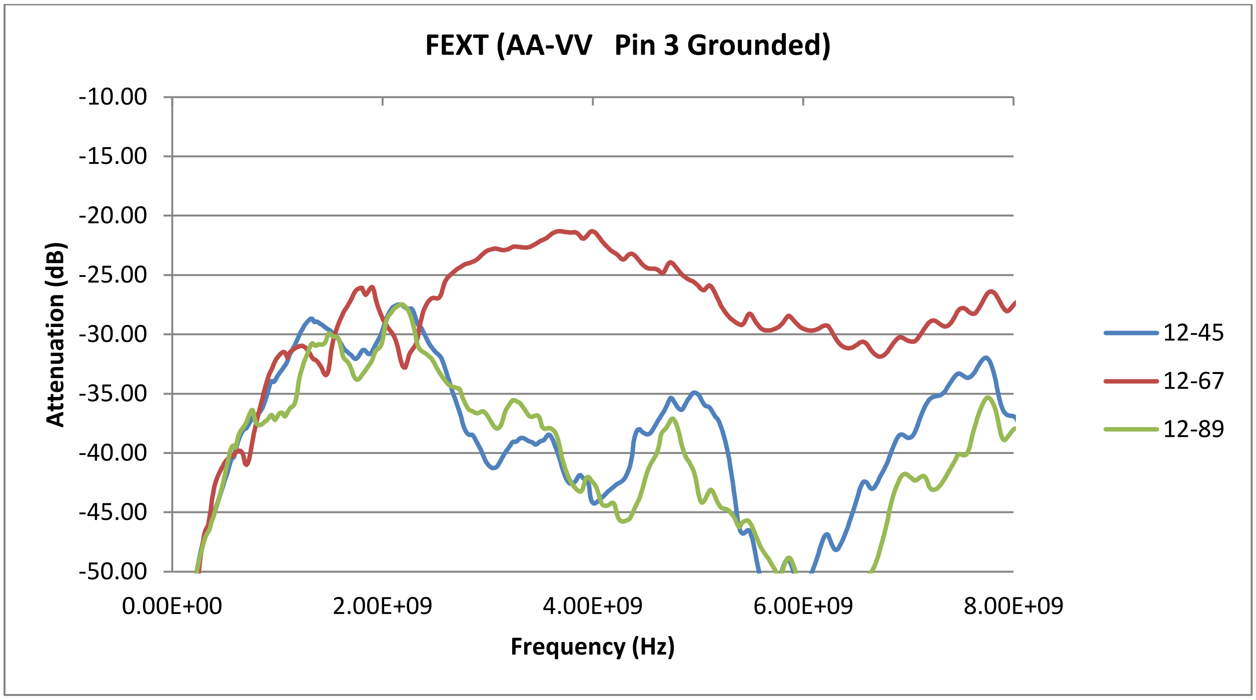
Crosstalk Analysis

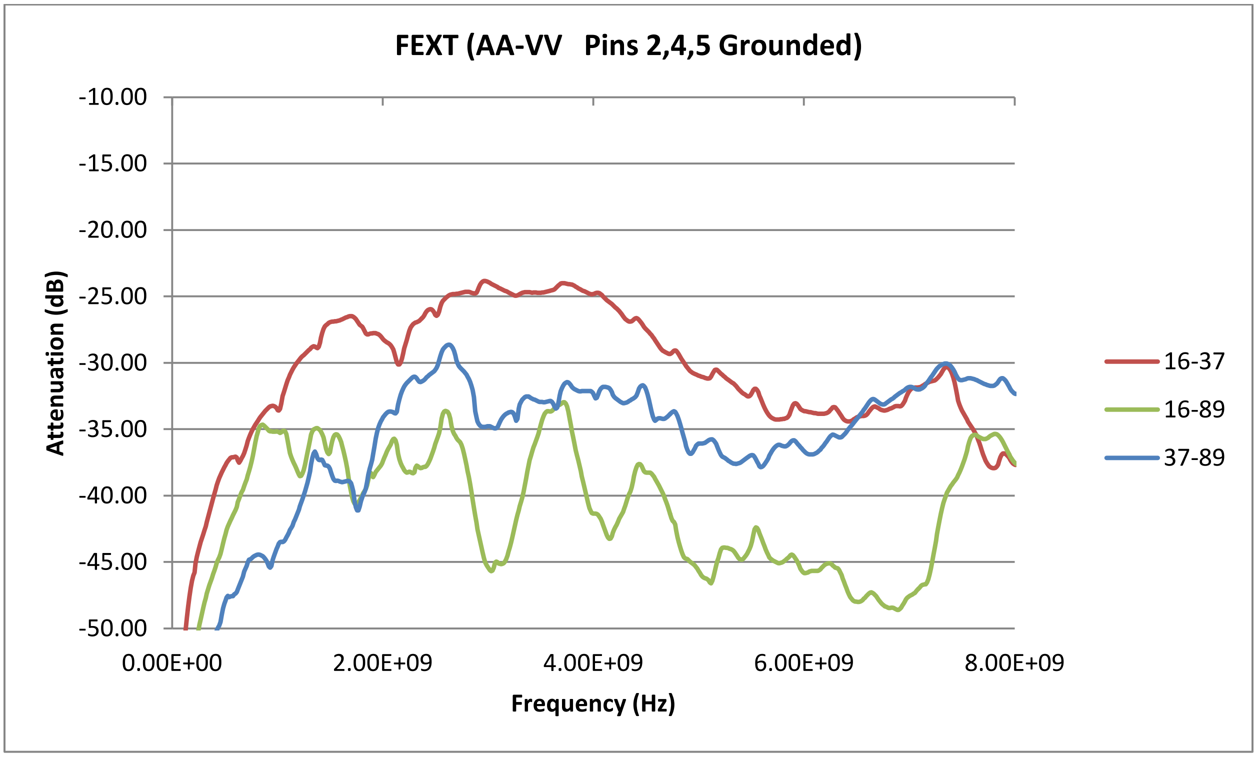





NEXT (AA-VV Pins 2,4,5 Grounded)
Attenuation (dB)
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
16-37
16-89
37-89


FEXT (AA-VV Pin 5 Grounded)
Attenuation (dB)
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
16-27
16-38
16-49


FEXT (AA-VV Pin 3 Grounded)
Attenuation (dB)
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
12-45
12-67
12-89

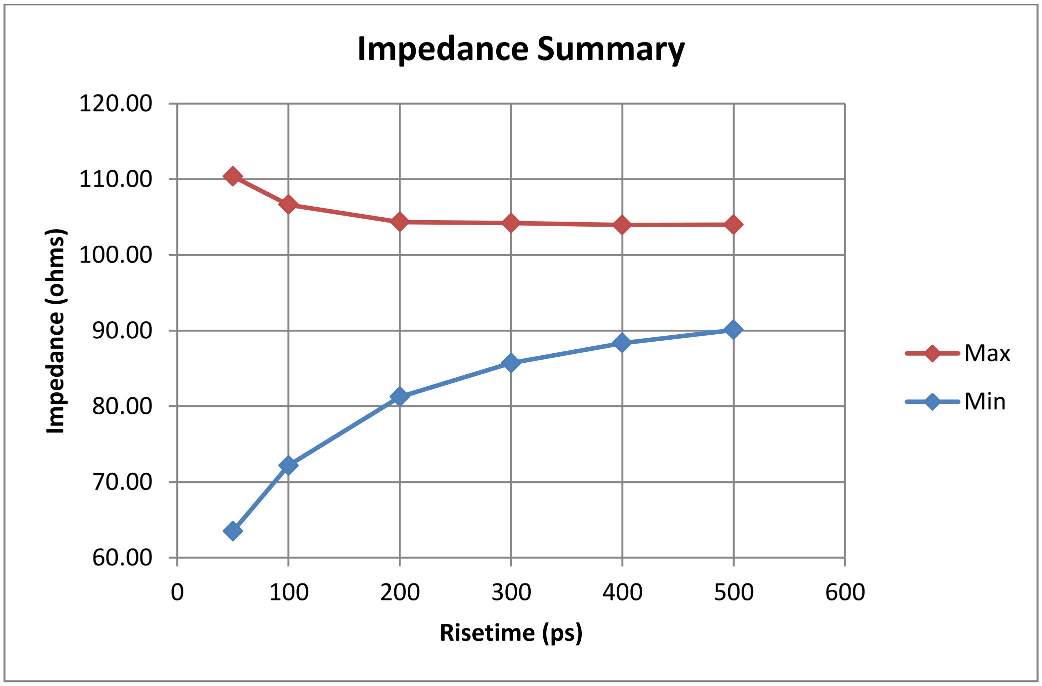

FEXT (AA-VV Pins 2,4,5 Grounded)
Attenuation (dB)
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
-50.00
0.00E+00
2.00E+09
4.00E+09
6.00E+09
8.00E+09
Frequency (Hz)
16-37
16-89
37-89

Time Domain Analysis

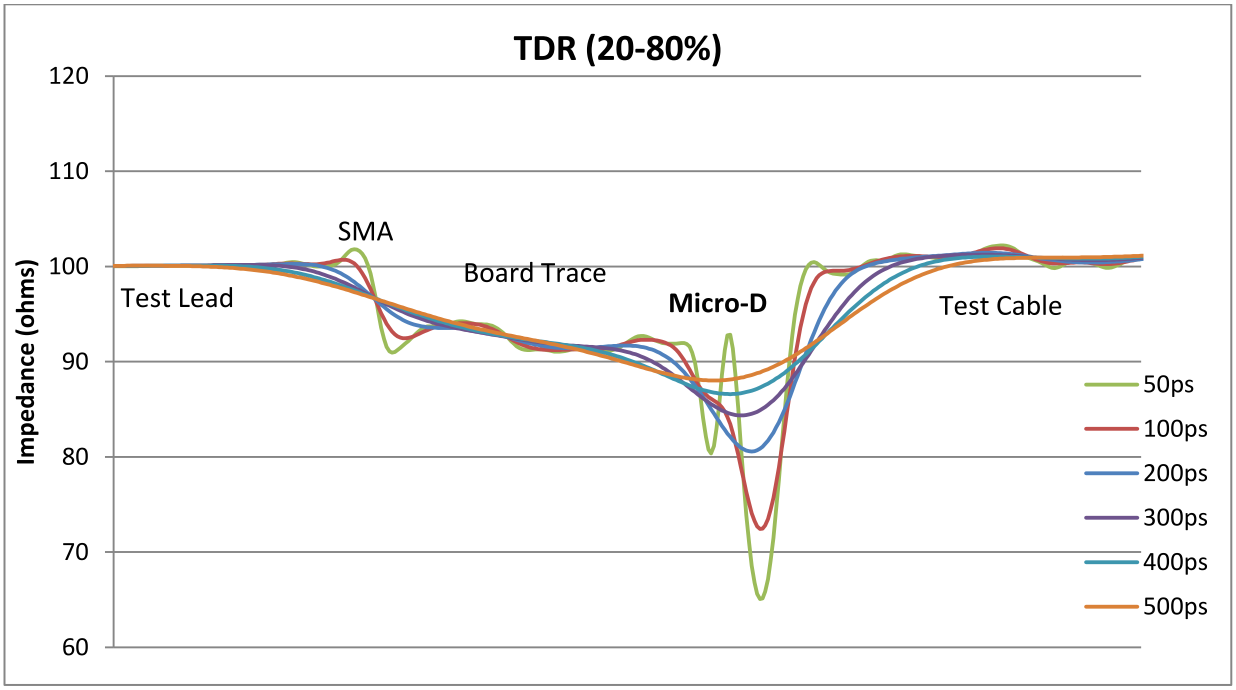
Time domain data was internally calculated by the Agilent Option TDR software package within the 5071C ENA network analyzer. Minimum and maximum differential impedance is shown below with reference to rise time and approximate transmission speed. A graphical comparison of TDR behavior at various rise times is shown on page 10.

Table 2 – Impedance vs. Risetime

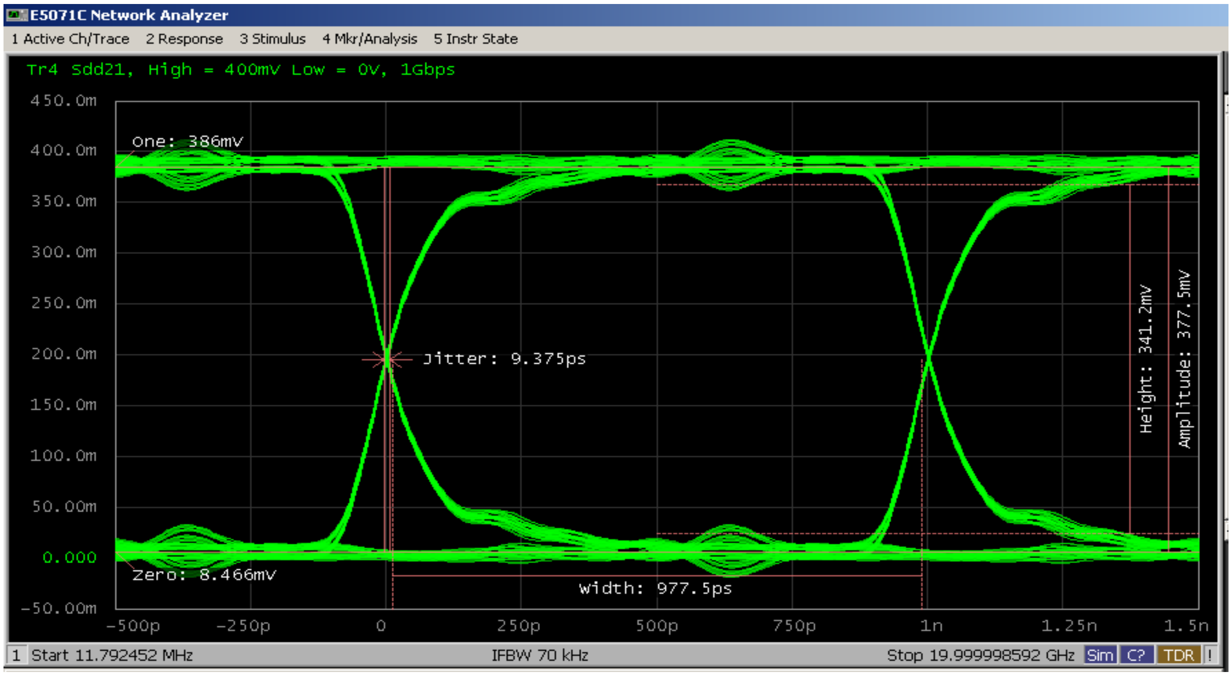
Input Risetime	**50ps** (13GHz)	**100ps** (6.6GHz)	**200ps** (3.3GHz)	**300ps** (2.2GHz)	**400ps** (1.7GHz)	**500ps** (1.3GHz)
Maximum Impedance	110.4Ω	106.6Ω	104.4Ω	104.2Ω	104.0Ω	104.0Ω
Minimum Impedance	63.5Ω	72.2Ω	81.3Ω	85.7Ω	88.4Ω	90.1Ω



Time Domain Reflectometry Results



Eye Diagram



Tr4 Sdd21, High = 400mV Low = 0V, 1Gbps

one: 386mV

Jitter: 9.375ps

zero: 8.466mV

width: 977.5ps

Height: 341.2mV

Amplitude: 377.5mV

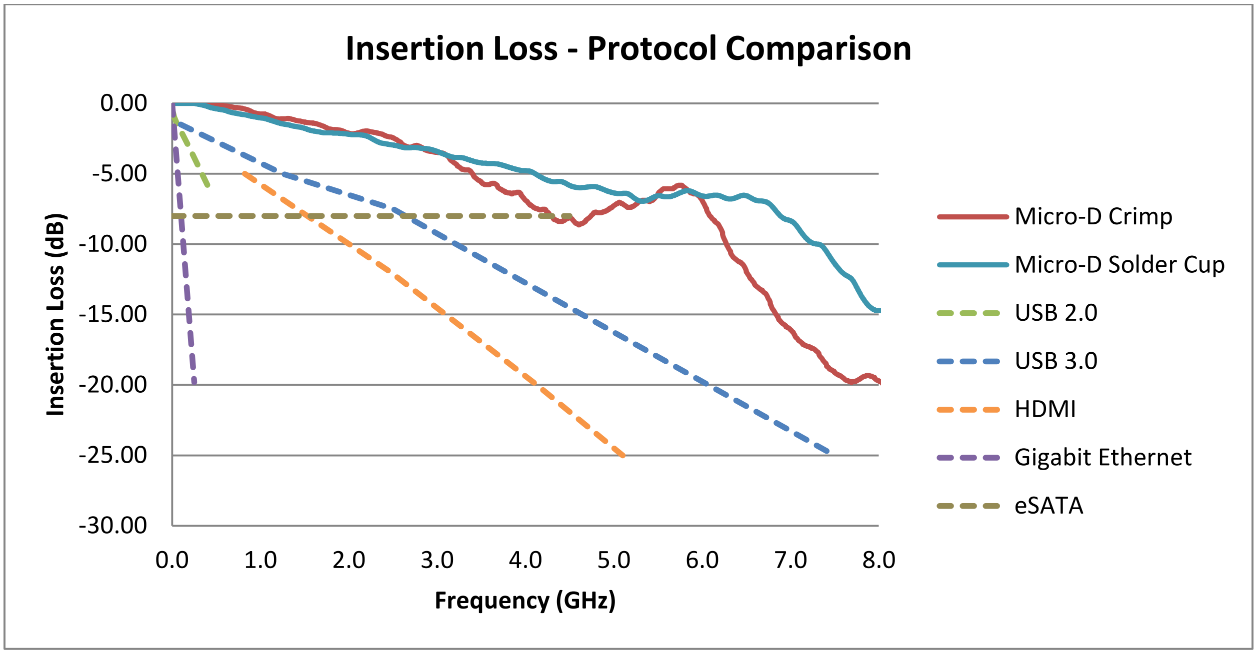
1 Start 11.792452 MHz

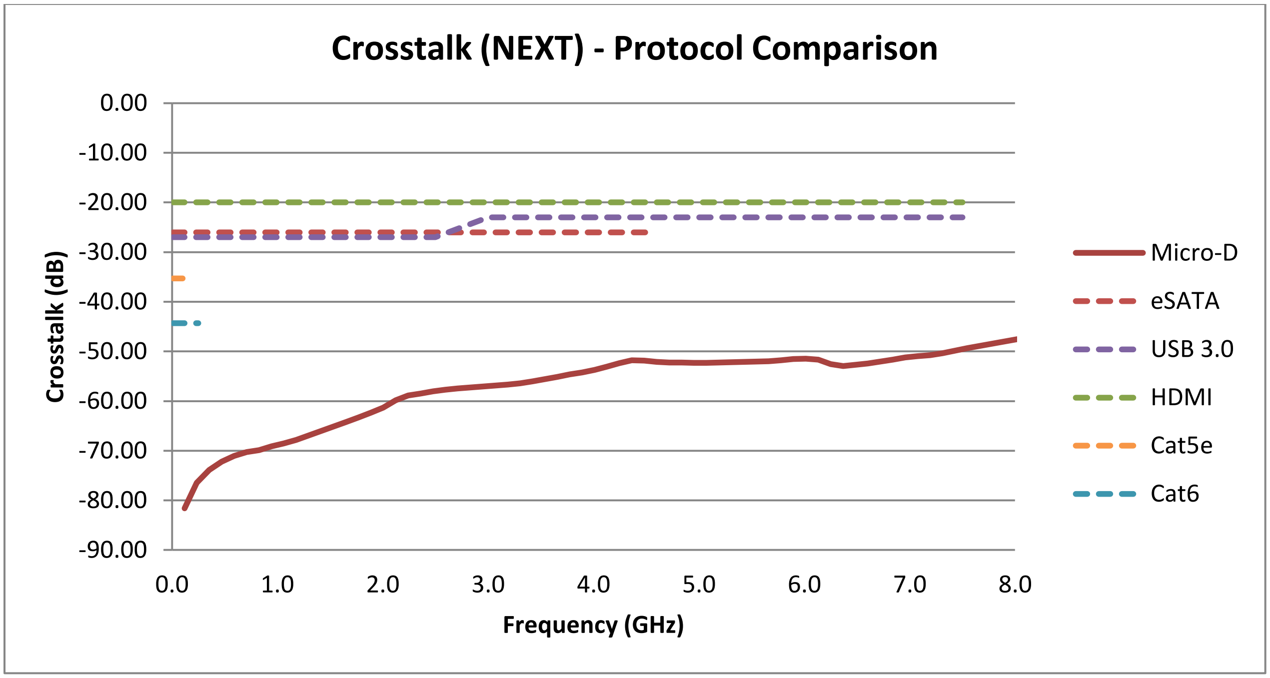
IFBW 70 kHz

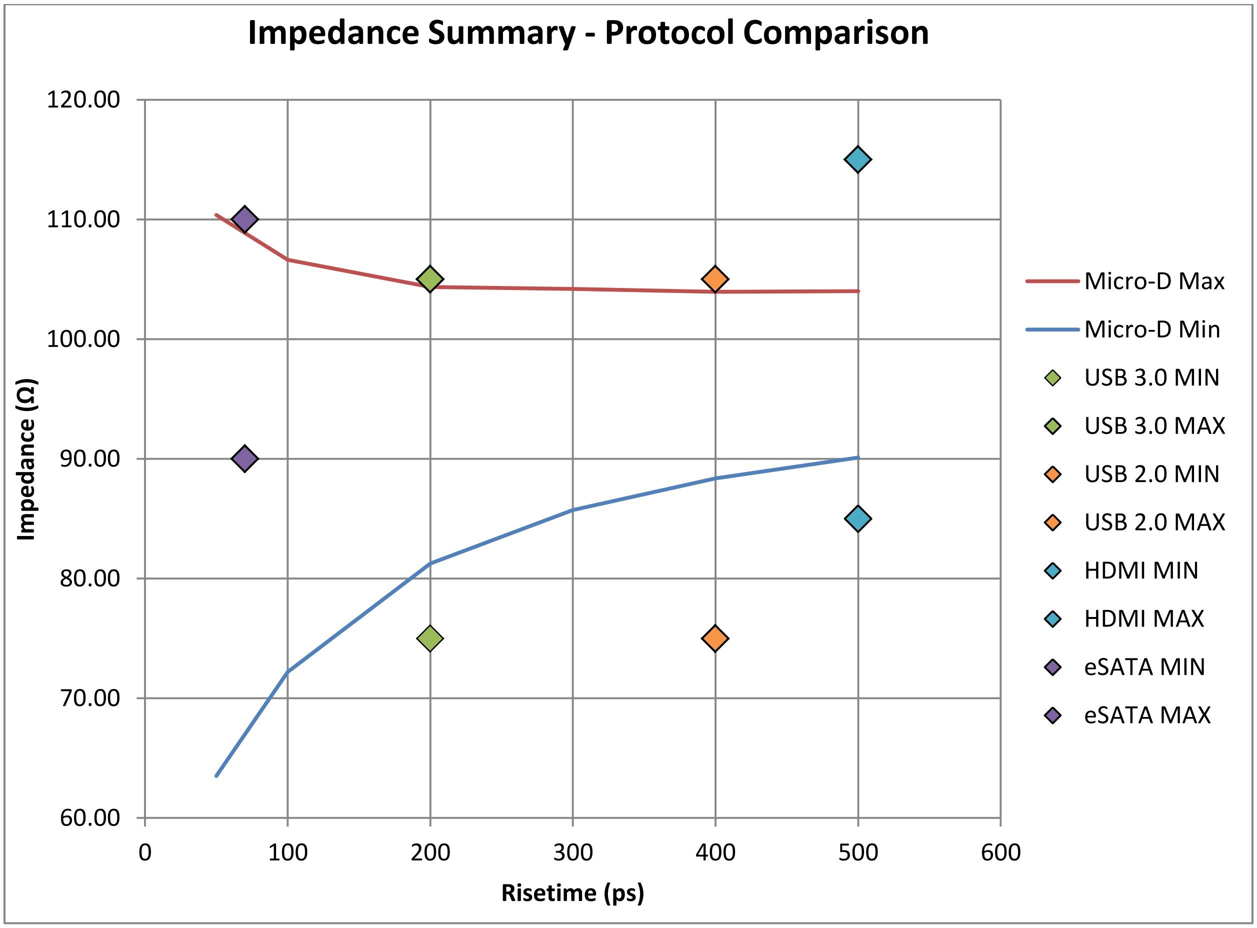
Stop 19.999998592 GHz

APPENDIX A – Protocol Compatibility

The following figures show micro-d frequency and time-domain performance in relation to the requirements of popular high speed protocols.







Please contact the Glenair factory for additional information about protocol compatibility.

APPENDIX B – Test System

Test System Description

All tests were performed using the Agilent E5071C ENA network analyzer with option TDR. Insertion loss and crosstalk responses have 2% smoothing filter applied within the network analyzer. Device under test (DUT) includes two mated connector pairs (GMR7580-9S1BXX and MWDM2L-9P-XXX-XX) with 12” of low-loss 100±10Ω cable (Glenair P/N 963-001). Insertion loss data is divided by two to show response due to a single mated pair.

Test fixture and test cables were connected to the Agilent E5071C ENA Network Analyzer via high-performance 50-ohm coaxial cables and SMA connectors. The system configuration is shown in the block diagram below:

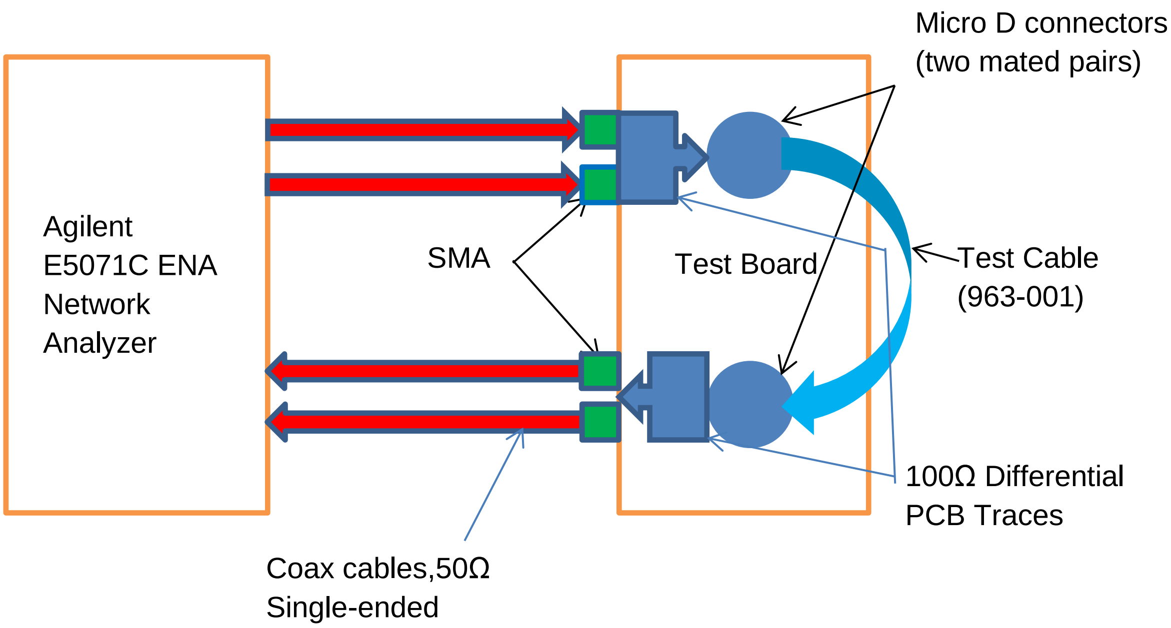


Figure 2: Test System Block Diagram

Test Fixture

A test fixture printed circuit board was designed specifically for this analysis. This PCB includes straight through single-ended 50Ω and differential 100Ω traces to acquire text fixture insertion loss data which can be de-embedded from the connector insertion loss data. All traces to Micro-D connectors were designed to nominal 100Ω ± 5% differential impedance.

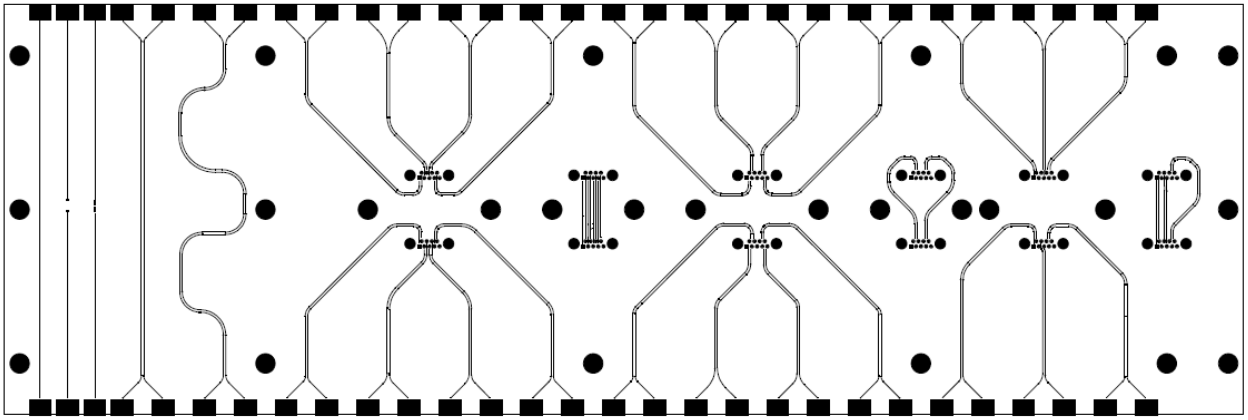


Figure 3: Test fixture PCB trace layout

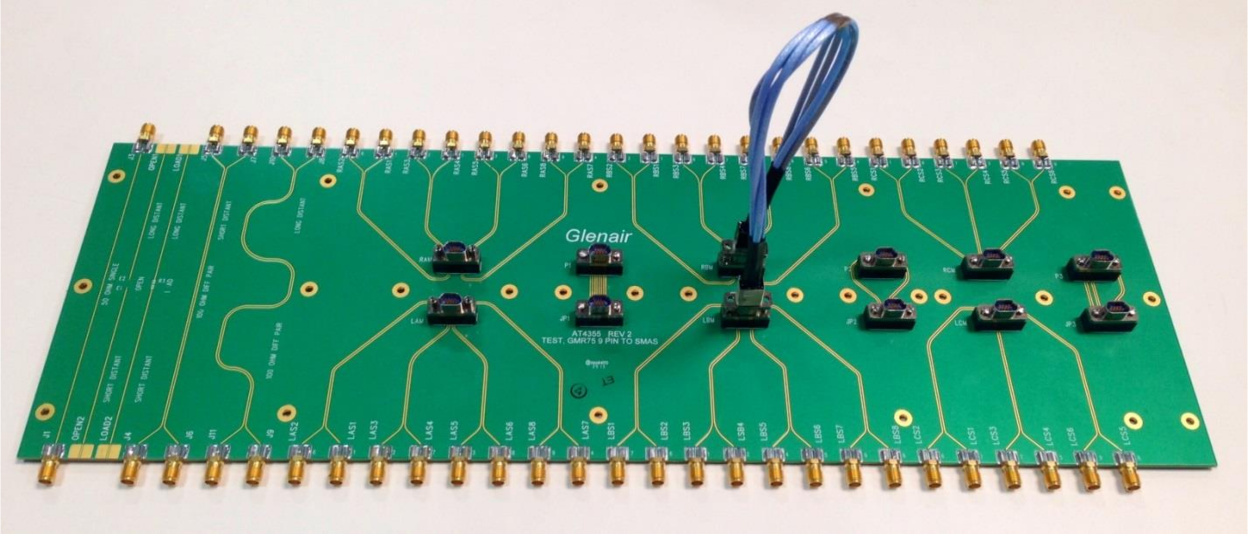


Figure 4: Test fixture with test cable

Appendix C – Frequency and Time Domain Measurements

Frequency (S-Parameter) Doman Procedures

To ensure precise and repeatable data acquisition, extreme care was taken in the test fixture design and test procedure. Deskew and loss calibration was performed prior to testing with the Agilent 85052D SOLT calibration kit. A post-calibration state file was then saved to allow for this calibration to be recalled at any time.

After calibration, test leads were connected to the test fixture. Applicable data was observed and saved into a .csv file and the test leads were then moved to different contact pairs. Once all testing was complete the acquired data was loaded into a spreadsheet for analysis and figure generation.

Time Domain Procedures

Historically, dedicated TDR equipment was necessary to analyze time-domain response of RF systems. The Agilent 5017C used for this testing contains software package “option TDR” which mathematically derives time-domain information from acquired frequency domain data (S-parameters). Even with bandwidth-limited data and a finite number of sample points, option TDR offers a very accurate TDR representation. This also allows for generation of simulated eye patterns to determine jitter and skew performance in relation to high speed data transmission. In this report, the relationship between risetime and bandwidth was determined by using Time X Bandwidth = 0.446, an equation provided by Agilent for use with the 5071C.

Appendix D - Glossary of Terms

DUT – Device Under Test
FD – Frequency Domain
FEXT – Far-end Crosstalk
NEXT – Near-end Crosstalk
PCB – Printed Circuit Board
RF – Radio Frequency
SE – Single-ended transmission
SI – Signal Integrity
SUT – System Under Test
TD – Time Domain
TDA – Time Domain Analysis
TDR – Time Domain Reflectometry
TDT – Time Domain Transmission
Z – Impedance (Ω)