GT-14-59

Series 811

High Density Mighty Mouse

High Speed Characterization Report

For Differential Data Applications

811-005-07
PCB Mount Receptacle

811-001-06
Cable Mount Plug

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Revision: B

Revision History

Rev	Date	Approved	Description
A	7/14/14	G. Hunziker / C. Parsons	Initial Release
B	7/23/14	C. Parsons	Revised Impedance Summary

Table of Contents

Introduction

This testing was performed in order to evaluate the high-frequency electrical performance of our Series 811 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 pattern.

Connector Overview

Glenair Series 811 Mighty Mouse High Density (HD) connectors are already deployed in countless high reliability applications. In fact, the Mighty Mouse HD connector is now the new high-density connector standard for ruggedized environmental circular connectors in weight and size sensitive applications such as soldier gear, unmanned vehicles, and man-portable satellite uplink equipment. The Series 811 High Density (HD) utilizes the same ultra-miniature form factor connector shells as our standard 801 Mighty Mouse, but adds high performance micro TwistPin contacts set on .050 inch centers for optimal contact layout density..

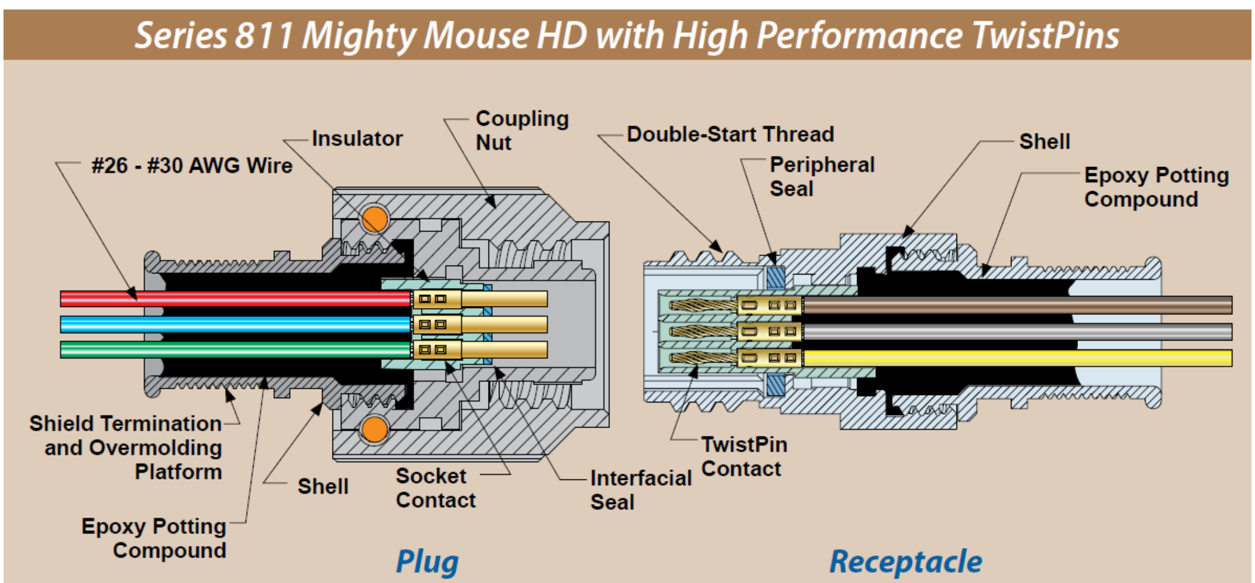

Figure 1: Series 811 Overview

Test Configuration

Several contact pair locations within the 6-12 insert layout were selected to provide a performance overview of the connector with a variety of position selections. Please contact the Glenair factory if you require performance characterization of any alternate configurations.

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. A detailed description of the test setup can be found on page 10. Insertion loss data has had losses due to the test fixture de-embedded and remaining attenuation is divided by two to show the performance of a single mated pair.

Performance Summary – Insertion Loss

Insertion and return loss data was acquired for several contact pairs however the performance difference was negligible. A differential pair made form positions 1 and 4 were used to represent the connector performance.

Layout	Parameter	Results
Differential Pair Positions 1-4	Insertion Loss (Crimp)	-3dB @ 2.74GHz
	Electrical Bandwidth*	6 Gbps 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.

Performance Summary – Crosstalk

Layout (Aggressor Victim Ground)	Parameter	Results
A1-2 V3-6	NEXT	< -13.4dB
A1-2 V4-5	NEXT (Worst Case)	< -12.6dB
A1-4 V11-12	NEXT	< -27.7dB
A1-4 V11-12 G8-9	NEXT (Best Case)	< -29.4dB
A2-9 V5-6	NEXT	< -19.3dB
A1-2 V3-6	FEXT	< -14.6dB
A1-2 V4-5	FEXT (Worst Case)	< -13.9dB
A1-4 V11-12	FEXT	< -24.1dB
A1-4 V11-12 G8-9	FEXT	< -24.7dB
A2-9 V5-6	FEXT (Best Case)	< -26.4dB

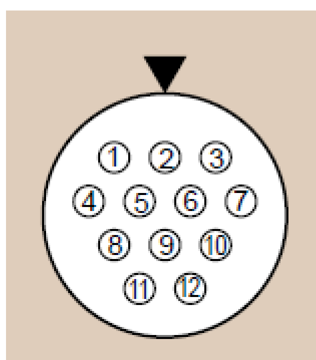

Figure 2: Contact layout for 12 position arrangement

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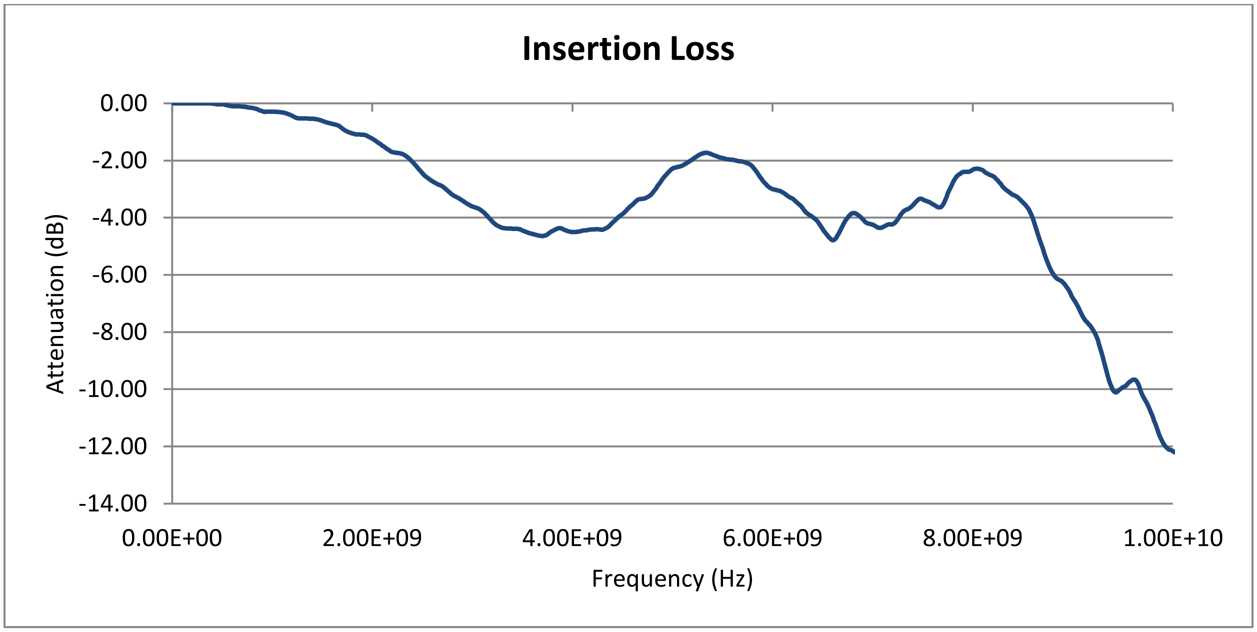
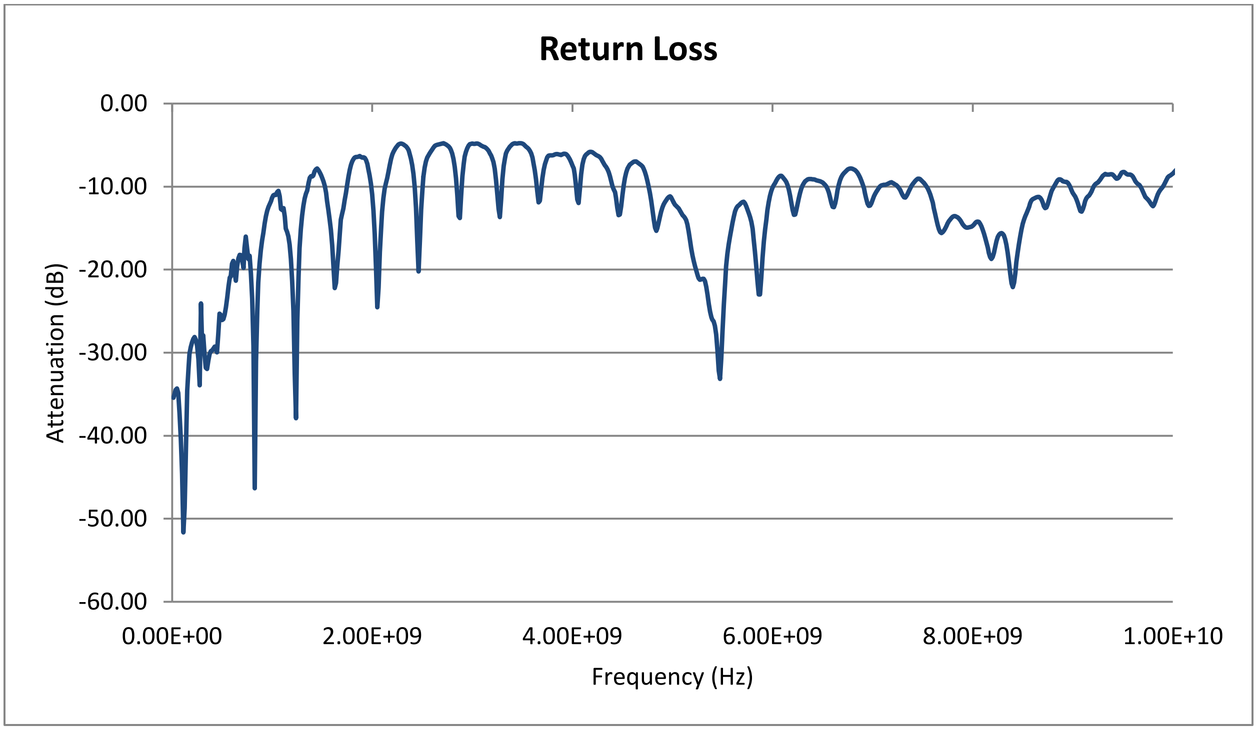
Frequency Domain Analysis





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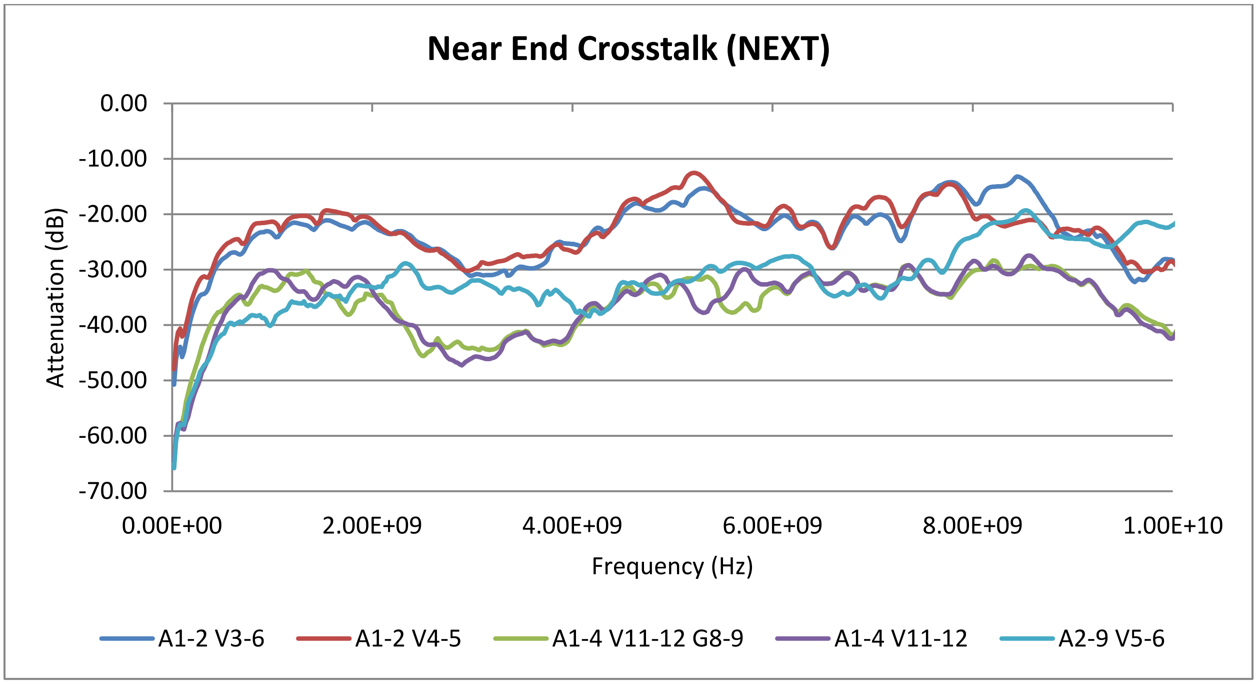
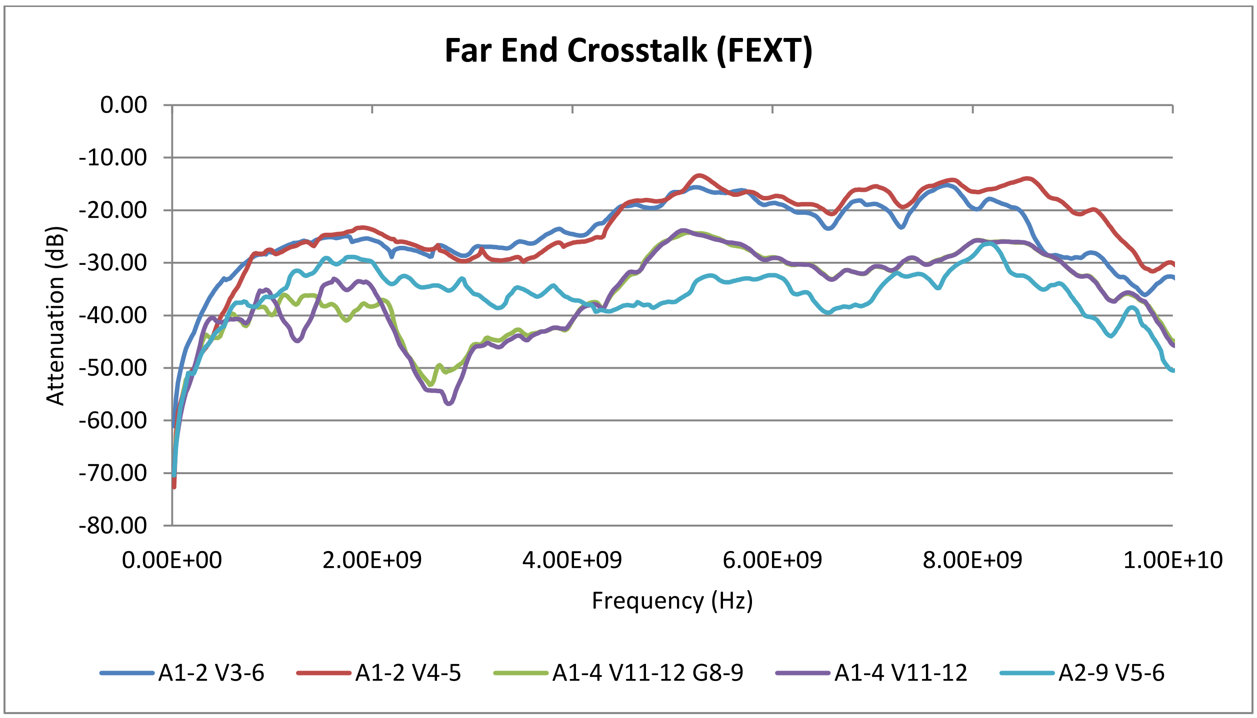
Crosstalk Analysis

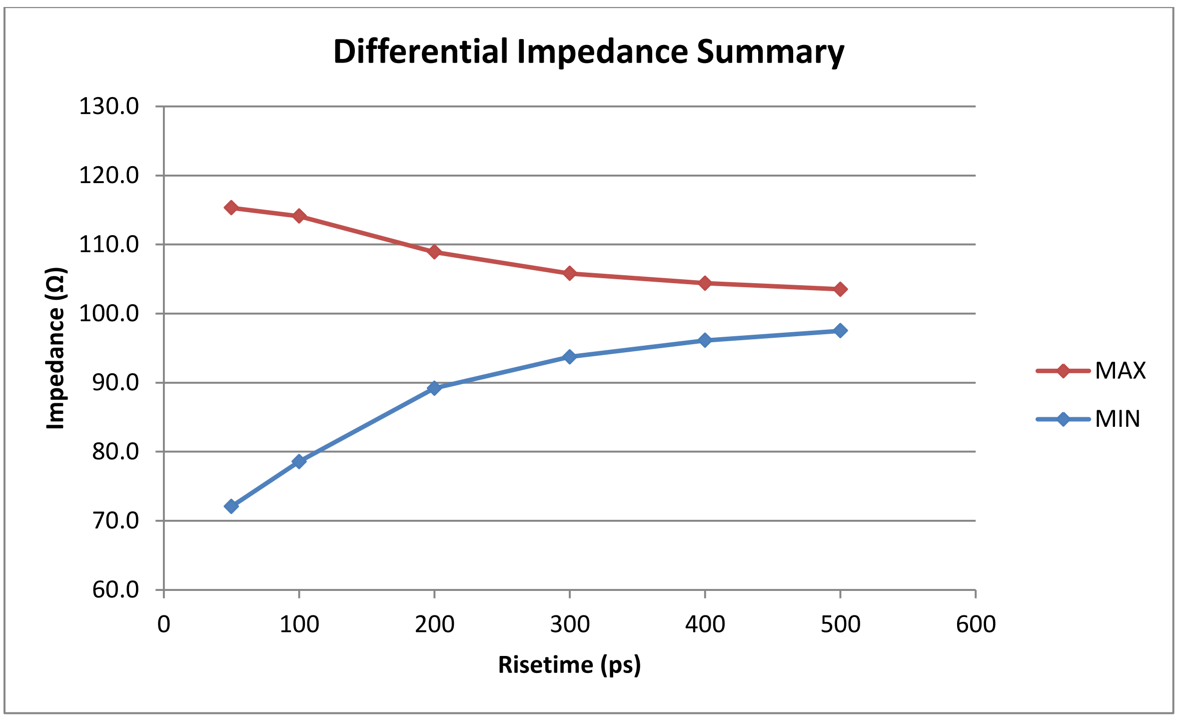




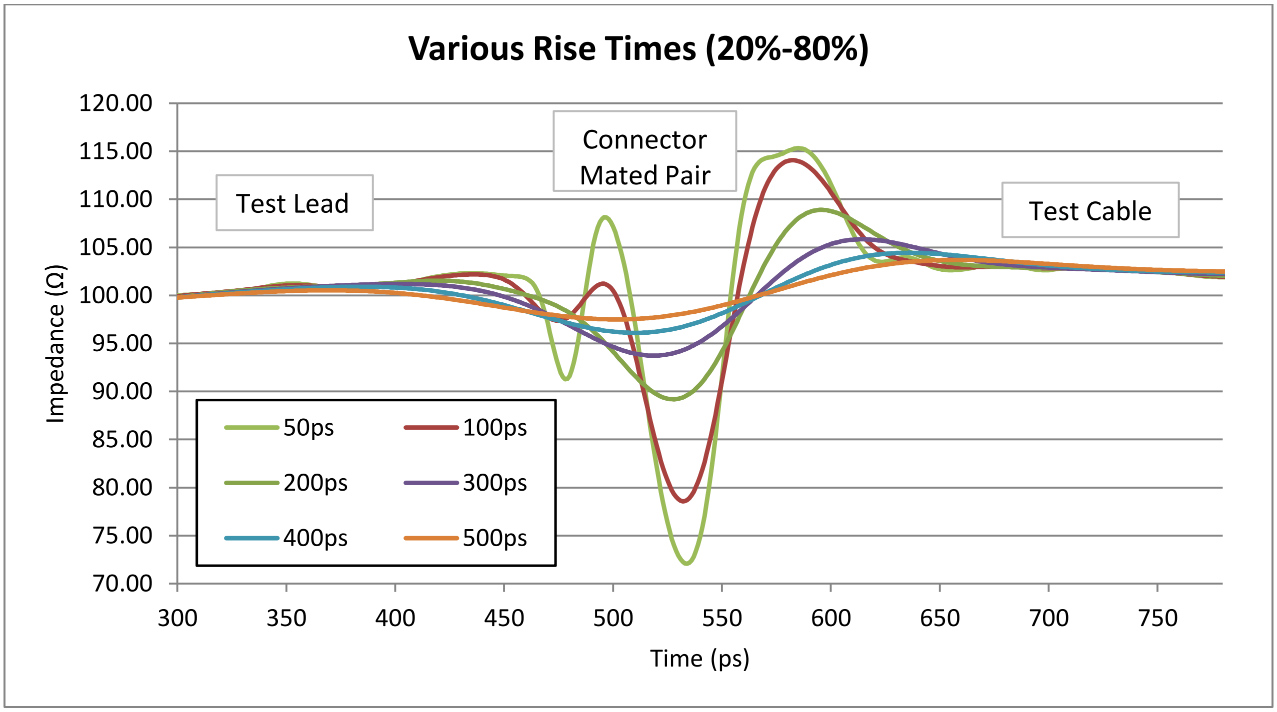
Time Domain Analysis

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 7.

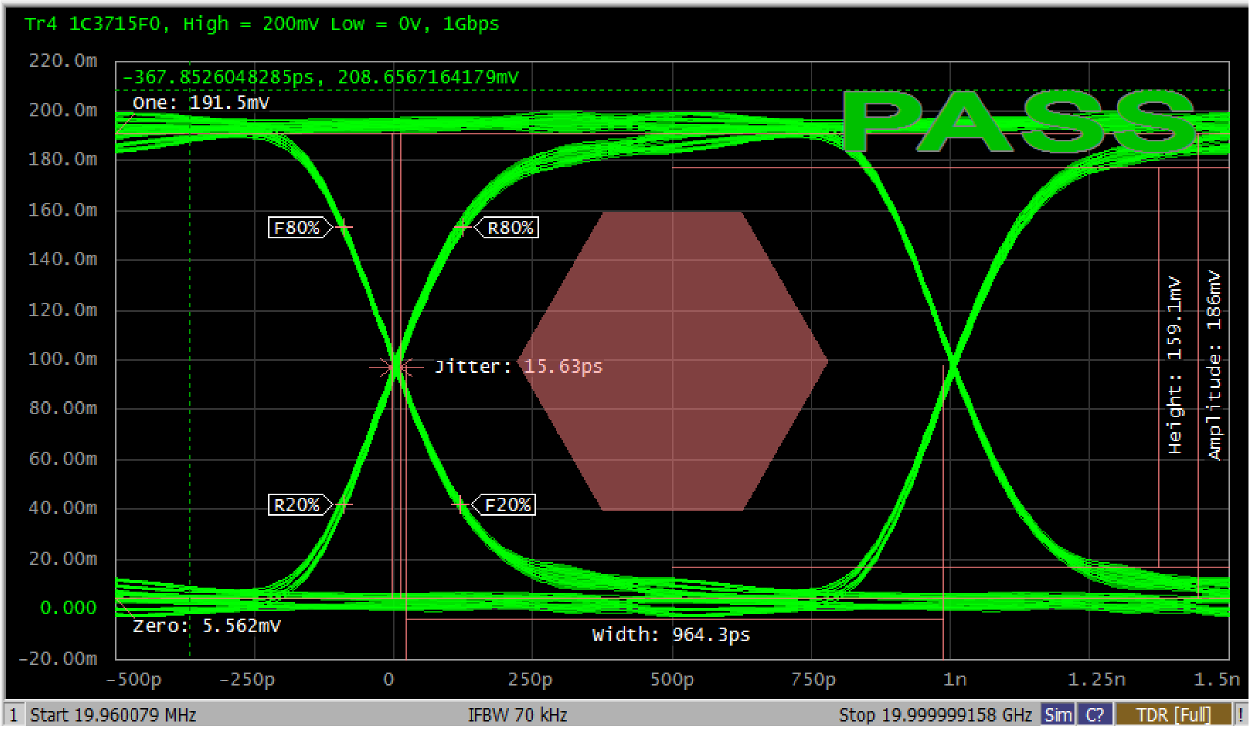
Table 2 – Impedance vs. Risetime						
Input Risetime	**50ps** (13GHz)	**100ps** (6.6GHz)	**200ps** (3.3GHz)	**300ps** (2.2GHz)	**400ps** (1.7GHz)	**500ps** (1.3GHz)
Maximum Impedance	115.3Ω	114.1Ω	108.9Ω	105.8Ω	104.4Ω	103.5Ω
Minimum Impedance	72.1Ω	78.6Ω	89.2Ω	93.7Ω	96.1Ω	97.5Ω



Time Domain Reflectometry



1Gbps Eye Diagram



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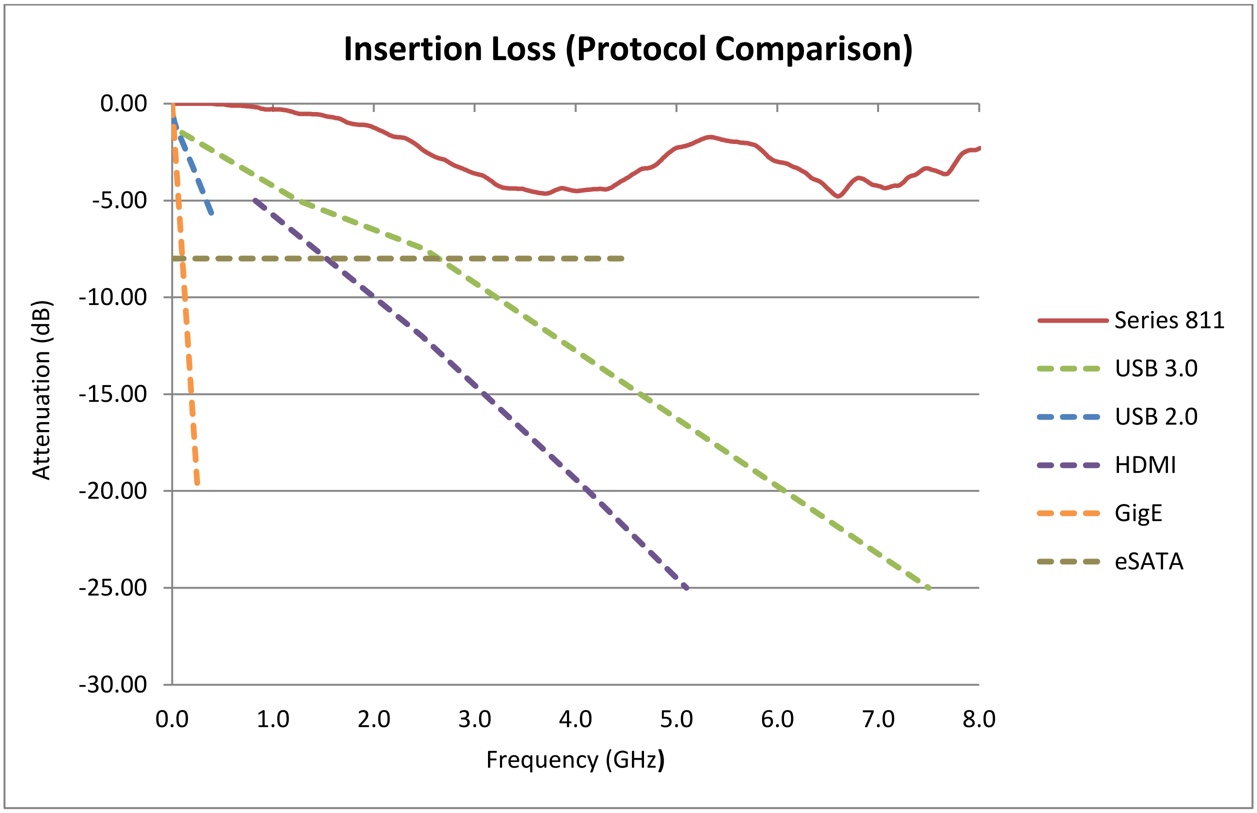
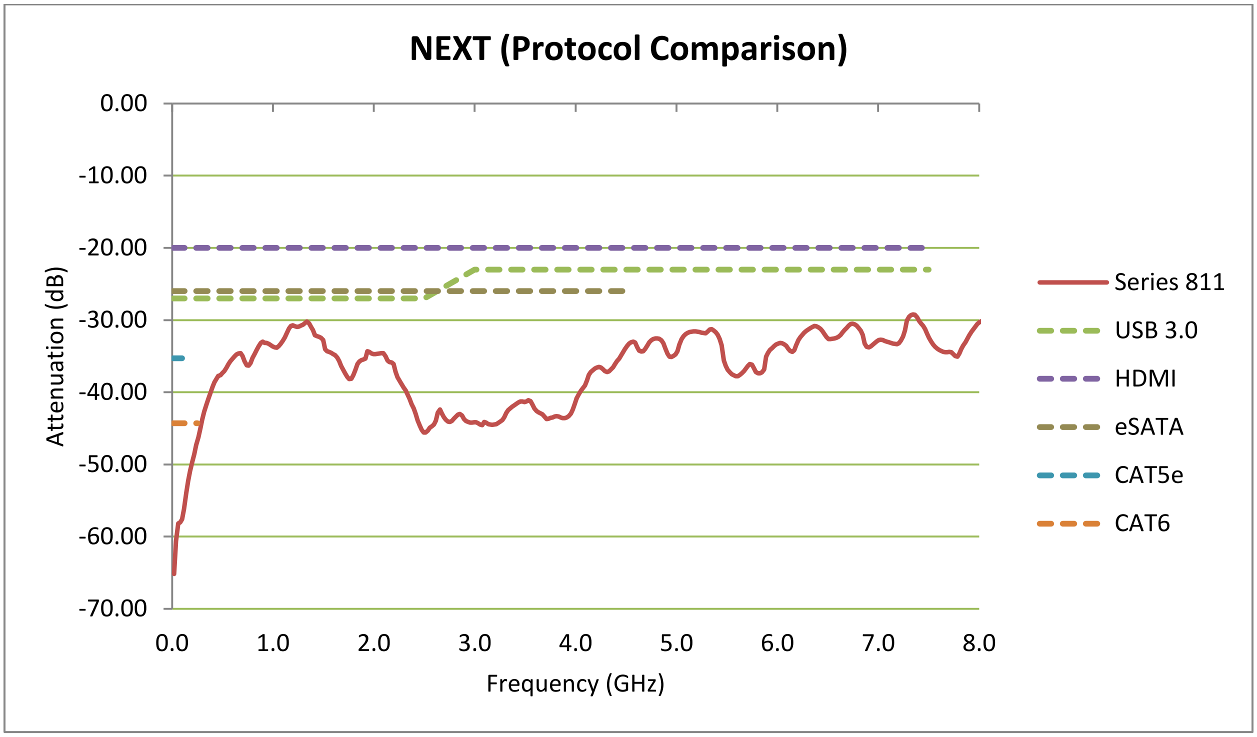
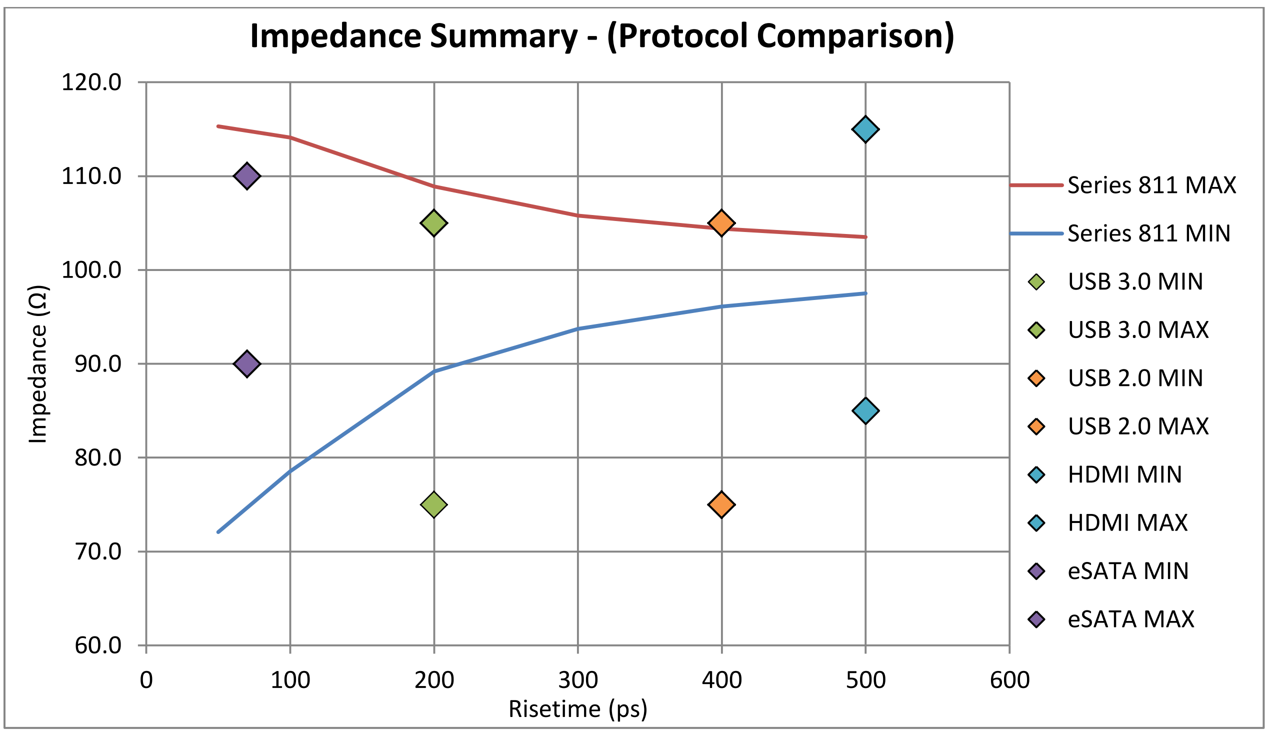
APPENDIX A – Protocol Compatibility

The following figures show Series 811 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.




NEXT (Protocol Comparison)
Attenuation (dB)
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Frequency (GHz)
Series 811
USB 3.0
HDMI
eSATA
CAT5e
CAT6


Impedance Summary - (Protocol Comparison)
Impedance (Ω)
120.0
110.0
100.0
90.0
80.0
70.0
60.0
0
100
200
300
400
500
600
Risetime (ps)
Series 811 MAX
Series 811 MIN
USB 3.0 MIN
USB 3.0 MAX
USB 2.0 MIN
USB 2.0 MAX
HDMI MIN
HDMI MAX
eSATA MIN
eSATA MAX

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 (811-005-07 and 881-001-06) with 12" of low-loss 100±10Ω cable (Glenair P/N 963-001). Insertion loss data has the test fixture loss de-embedded and is divided by two to show response of 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:

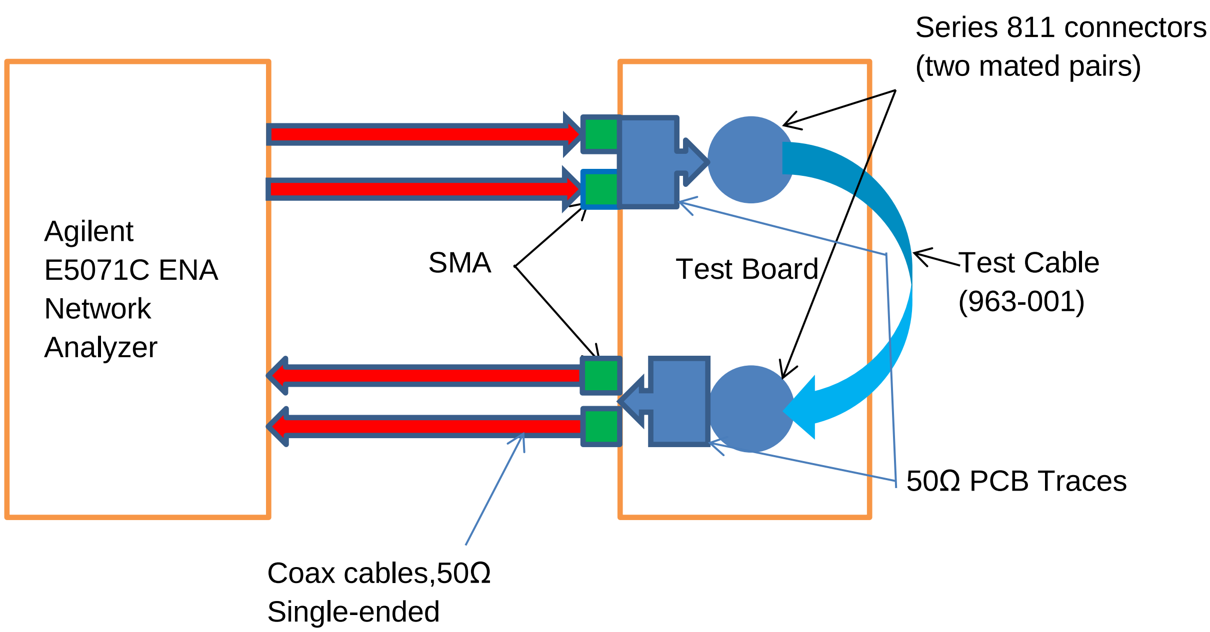


Figure 3: Test System Block Diagram

Test Fixture

A test fixture printed circuit board was designed specifically for this analysis. This PCB includes straight-through traces to acquire text fixture insertion loss data to be de-embedded from the connector insertion loss data. All traces to Series 811 connectors were designed to a nominal 50Ω ± 2% single-ended impedance but used in differential 100Ω pairs.

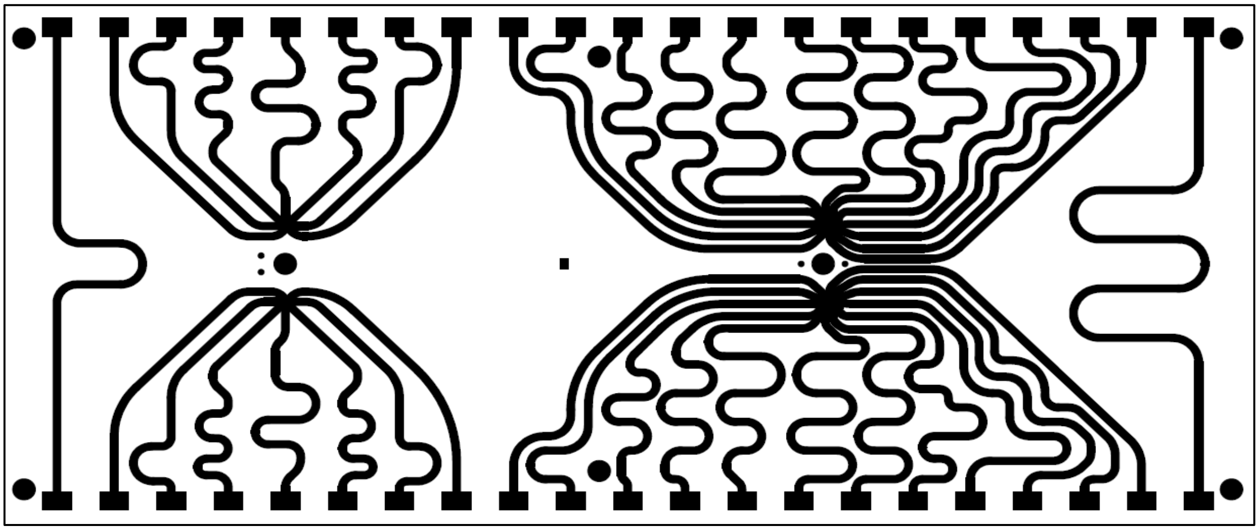


Figure 4: Test fixture PCB trace layout

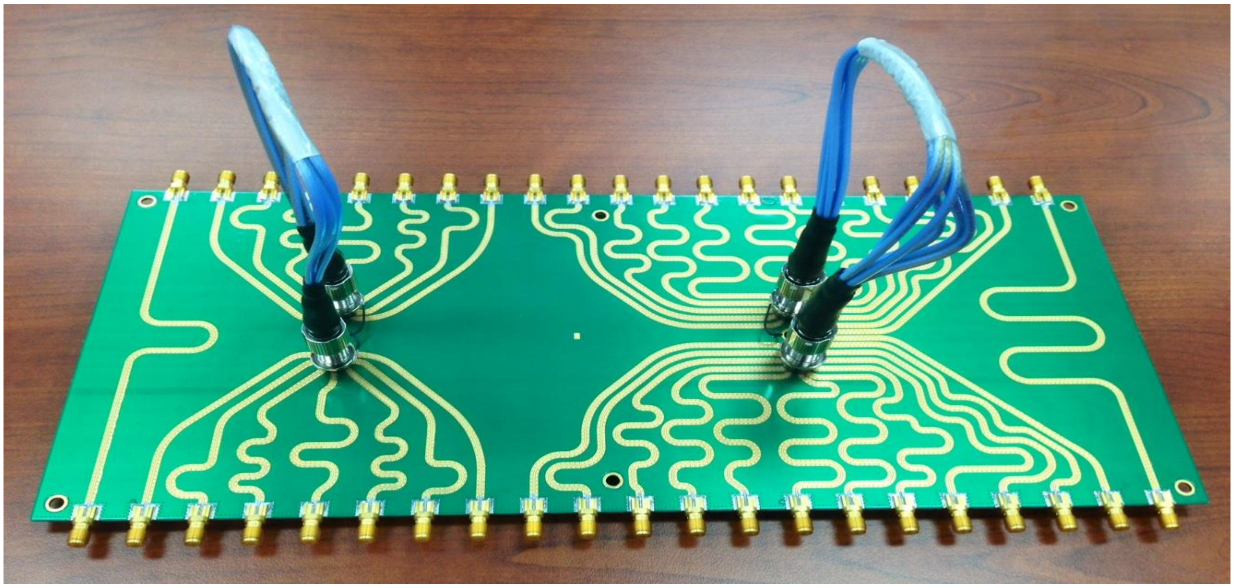


Figure 5: Test fixture with test cables

APPENDIX C – Frequency and Time Domain Measurements

Frequency Domain (S-Parameter) Procedures

To ensure precise and repeatable data acquisition, extreme care was taken in the test fixture design along with the calibration and testing procedure. A full calibration from 300kHz to 20GHz was preformed prior to testing using the Agilent N4433A eCal module.

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.

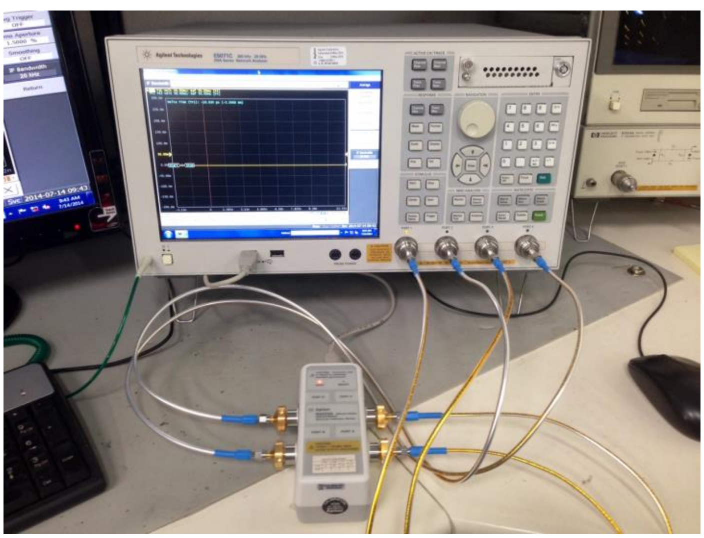


Figure 6: Vector network analyzer with eCal module

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)