



## **GT-19-159**

# **Signal Integrity Characterization Report**

## **For Glenair High-Speed Micro-D**

### **Series GHSM**



## Revision History

Rev	DCN #:	Date	Issued By:	Approved By:
1	N/A	06/11/2019	Ali Saberi	Guido Hunziker



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## Introduction

This testing was performed in order to evaluate the high-frequency electrical performance of the High-Speed Micro-D contacts. All measurements were taken with a Tektronix DSA8300 Digital Serial Analyzer & an Agilent E5071C network analyzer with option TDR; both connected to an SMA-launch PCB test fixture which is specifically designed for this testing. This report outlines frequency domain performance such as Insertion Loss (IL), Return Loss (RL), Near-End Crosstalk (NEXT), Far-End Crosstalk (FEXT), as well as time-domain performance including Impedance.

## Product Overview

Glenair High-Speed Micro-D connectors offer outstanding signal integrity results, mating performance, durability and minimal contact resistance.

## Test Samples and Test Fixtures

- 1) Two (2) board mount right angle Micro-D connectors (PN GHSM2L-9SBRHPT-.110) installed on PCB test fixtures (PN 691-CB120 REV 5)
- 2) SMA PCB 2x CAL test fixture (P/N: 691-CB120 REV 5)

**Note\*** Test fixtures are shown in Figure 1.

Four (4) test cable assemblies were constructed in lengths of 9.84" (.25 m), 19.68" (.5 m), 39.37" (1 m), 118.11" (3 m) that as described below:

### Cable PN:

963-121-28, 100-Ohm impedance matched twinax twisted pair

### Cable Assembly PN (a sample picture of the cable assembly is shown in Figure 2)

- 1) GHSM2L-9PP-A8K1-10 (9.84"  $\approx$  0.25 m)
- 2) GHSM2L-9PP-A8K1-20 (19.68"  $\approx$  0.50 m)
- 3) GHSM2L-9PP-A8K1-40 (39.37"  $\approx$  1.00 m)
- 4) GHSM2L-9PP-A8K1-118 (118.11"  $\approx$  3.00 m)



Figure 1: High-Speed Micro-D test fixtures and 2X CAL PCB



Figure 2: Sample photo of the High-Speed Micro-D cable assembly

## Test Equipment:

- Keysight ENA E5071C 4-port Vector Network Analyzer with option TDR
- Keysight ECAL Module N4433A
- Tektronix 8300 TDR Scope with 80E08 Test Modules

## Test Setup and Calibration

The ENA was set up to characterize the differential s-parameters and impedance of the mated High-Speed Micro-D connector cable assemblies. The setup inputs for the ENA are specified as below:

Frequency Sweep:	300 KHz – 20 GHz
IF Bandwidth:	500 Hz
Resolution:	2001 Points
Power Level:	-5.0dBm

A full 4-port calibration was performed using the ECAL module as illustrated in Figure 3 before commencing test of the mated cable assemblies.

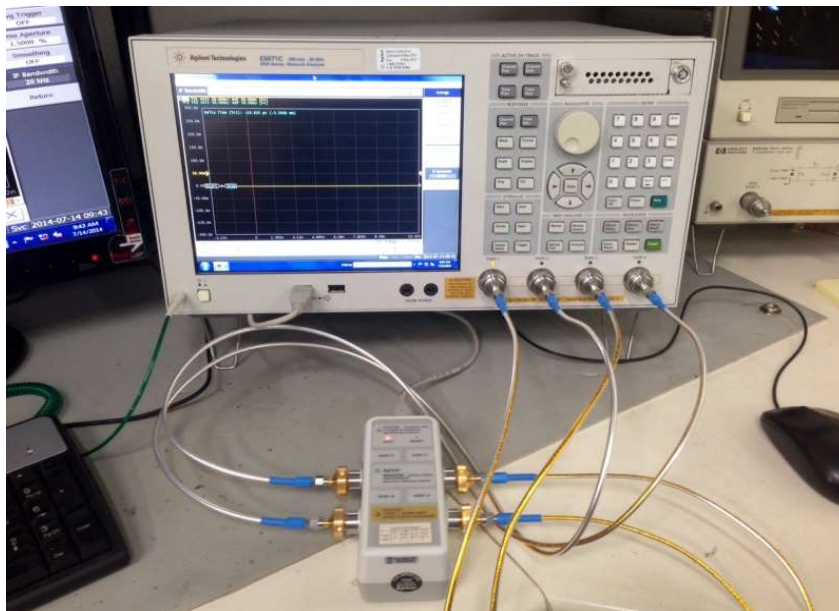


Figure 1: ENA Test Setup and Calibration

## Test Procedure

### 1. PCB Test Fixture

The PCB test fixture for the High-Speed Micro-D qualification test for SI compliance is shown in Figure 1. The test fixture was first characterized for the impedance performance using the TDR scope to ensure a good impedance match.

The ENA and TDR scope would be used to collect the respective frequency domain and time domain test parameters for the bulk cable and mated connectors:

- Impedance @ 50ps signal rise time using the TDR scope
- Insertion Loss
- Return Loss
- Near-end crosstalk or NEXT
- Far-end crosstalk or FEXT

For the Insertion Loss, the PCB test fixture artifact that is not part of the mated connectors would be de-embedded from the results using the 2x CAL PCB test fixture.

The High-Speed Micro-D cable assembly under test is considered from the first mated pin/socket to the last mated pin/socket as shown in Figures 2 and 4.

For the SI performance test, Four (4) cable assembly configurations and lengths would be evaluated.

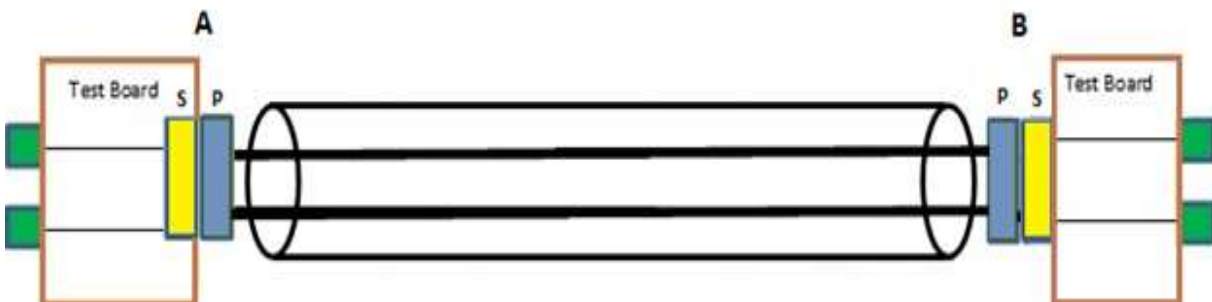


Figure 4: Test Configuration for each 0.25m, 0.5m, 1.0m and 3.0m length cable assembly test

The test data would be saved in a touchstone (.s4p) format for the s-parameters and in a .csv format for the impedance data. All parts of the PCB test fixture artifact that are not part of the cable assemblies would be de-embedded from the results using the Atatec software and the s-parameter data of the PCB test fixture.

## Test Results

The following data represents typical signal integrity performance of mated High-Speed Micro-D cable assemblies:

The Impedance of a mated High-Speed Micro-D cable assembly is shown in Figure 5. All cable assemblies have similar impedance results despite the cable length differences:

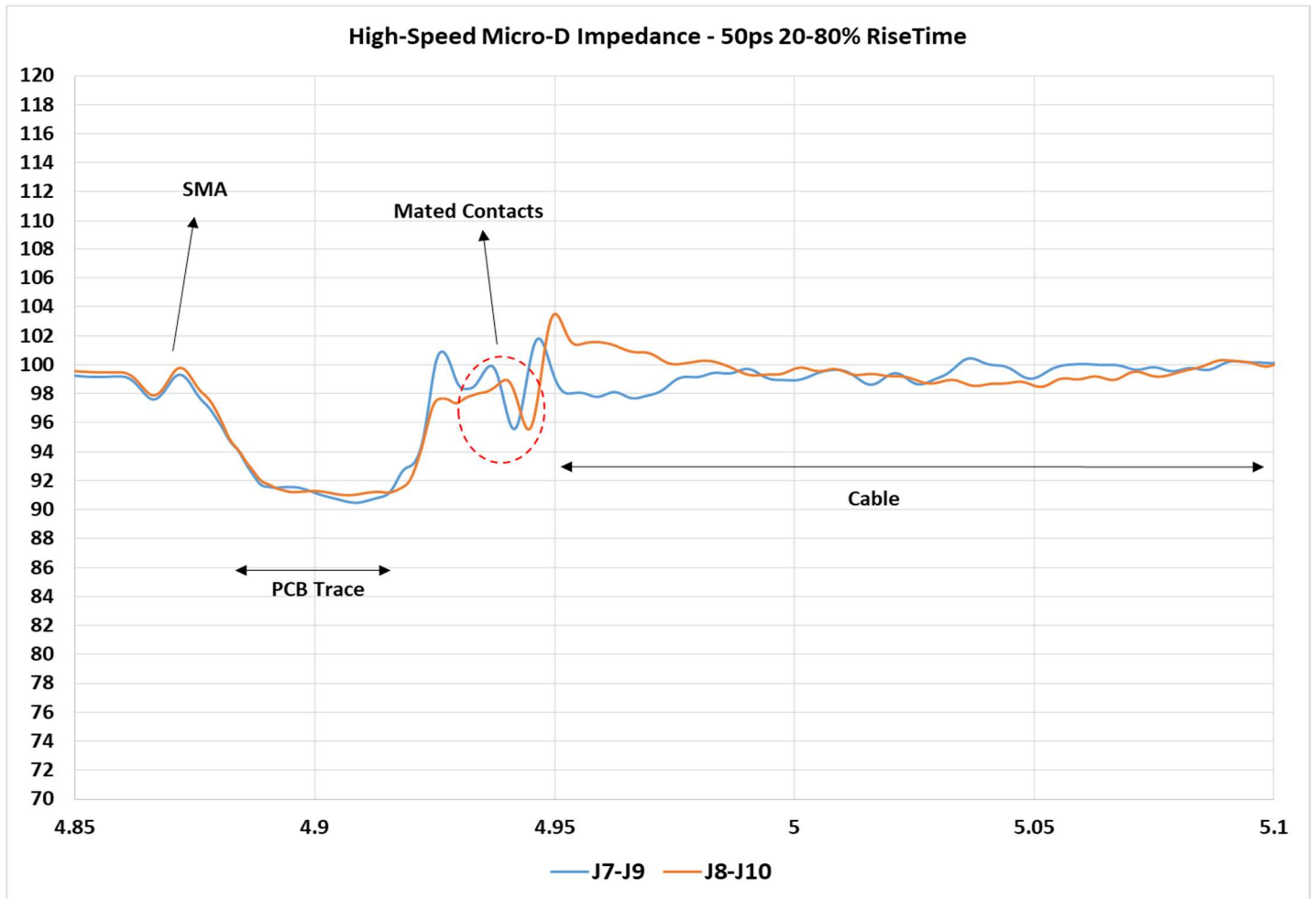


Figure 5: Impedance of the 1m cable assembly (all cable assemblies have similar impedance results)



1) 0.25m Cable Assembly:

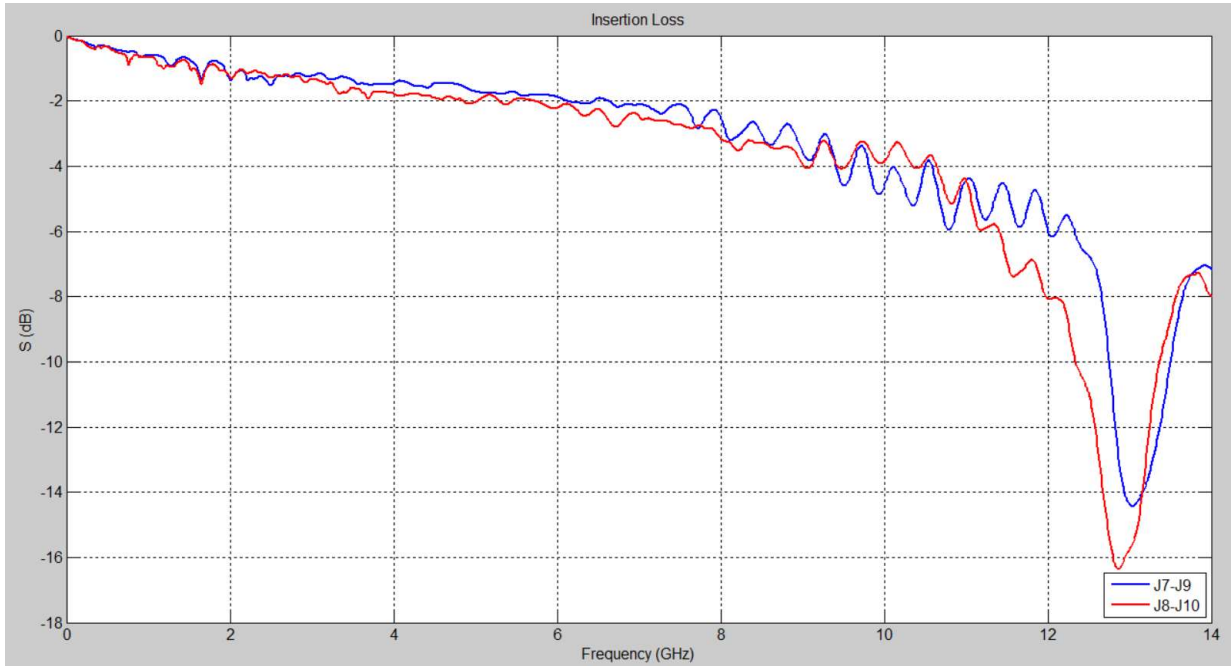


Figure 6: Insertion Loss - Pair 1 and Pair 2

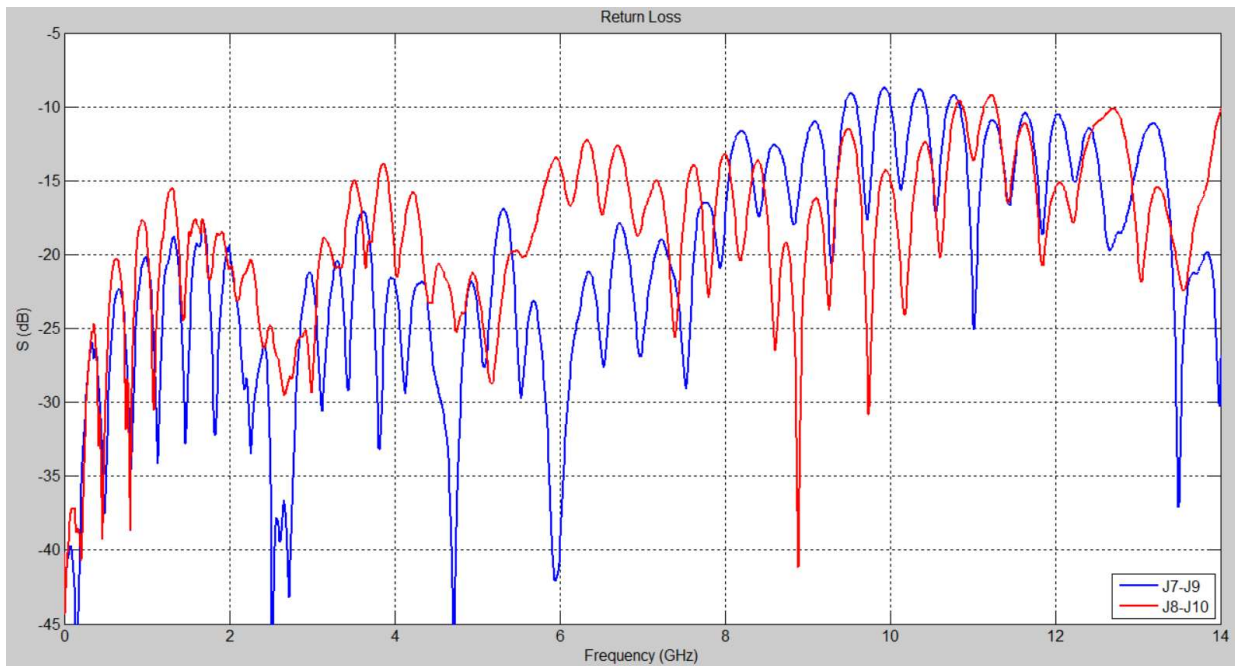


Figure 7: Return Loss - Pair 1 and Pair 2

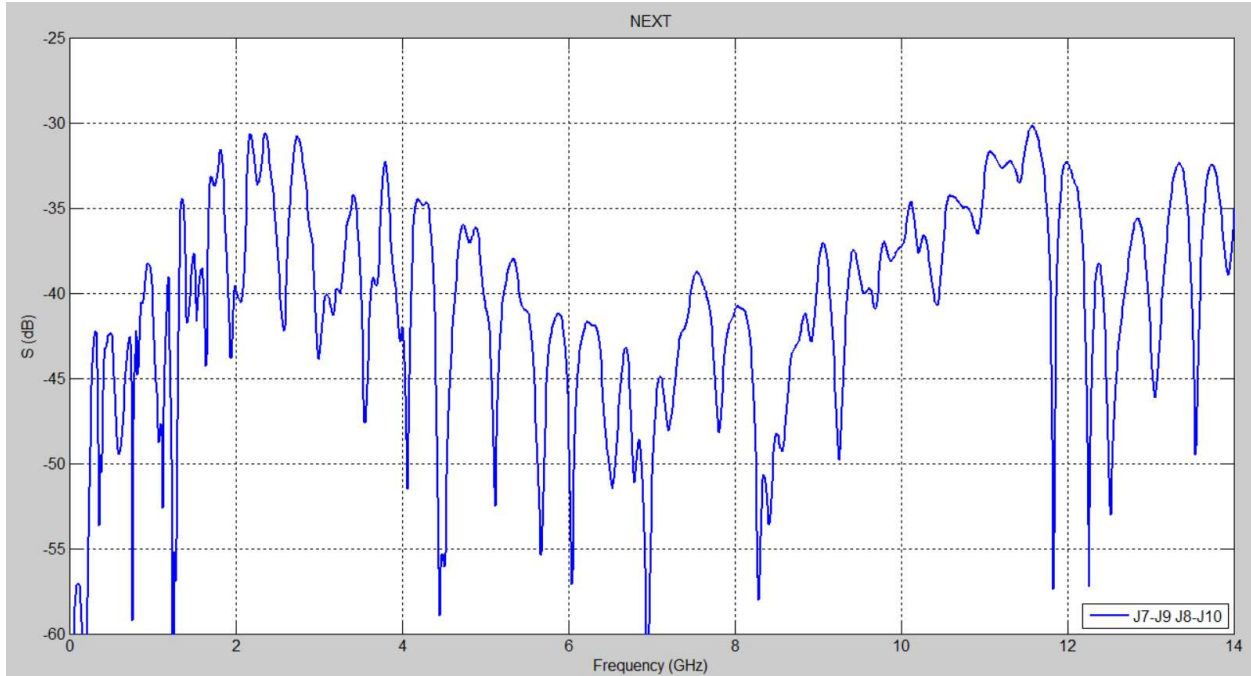


Figure 8: Near-End Crosstalk (NEXT)

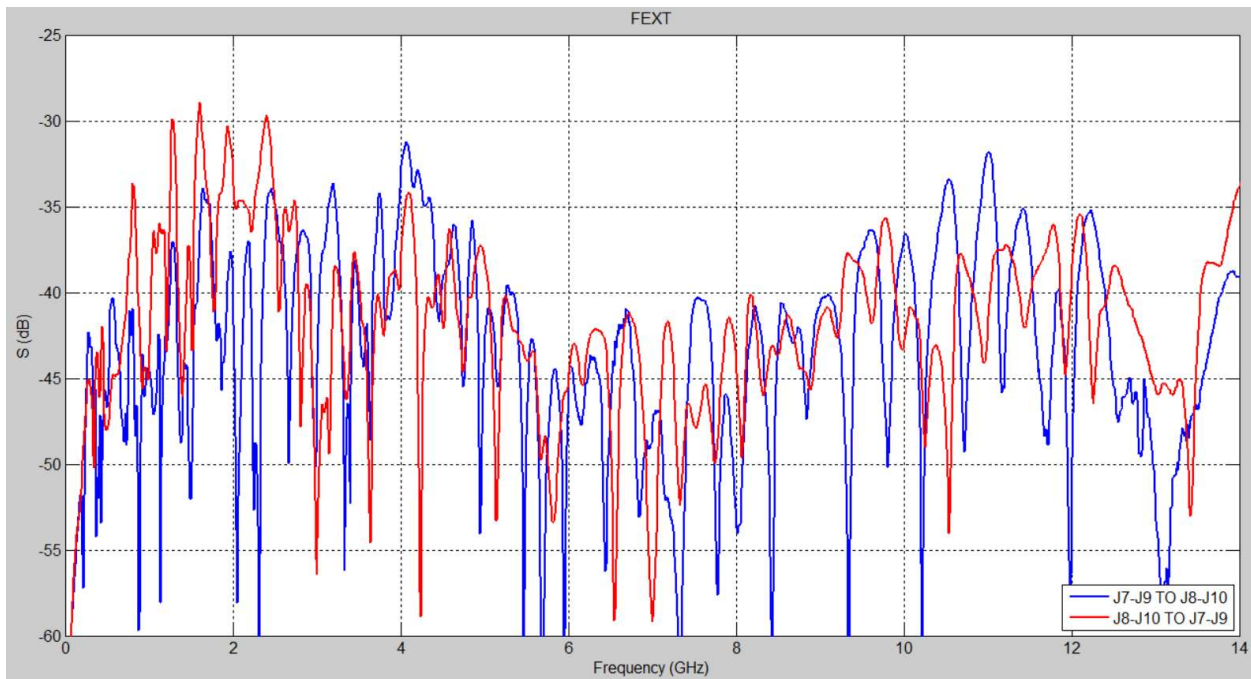


Figure 9: Far-End Crosstalk (FEXT) – Pair 1 and Pair 2

2) 0.5m Cable Assembly:

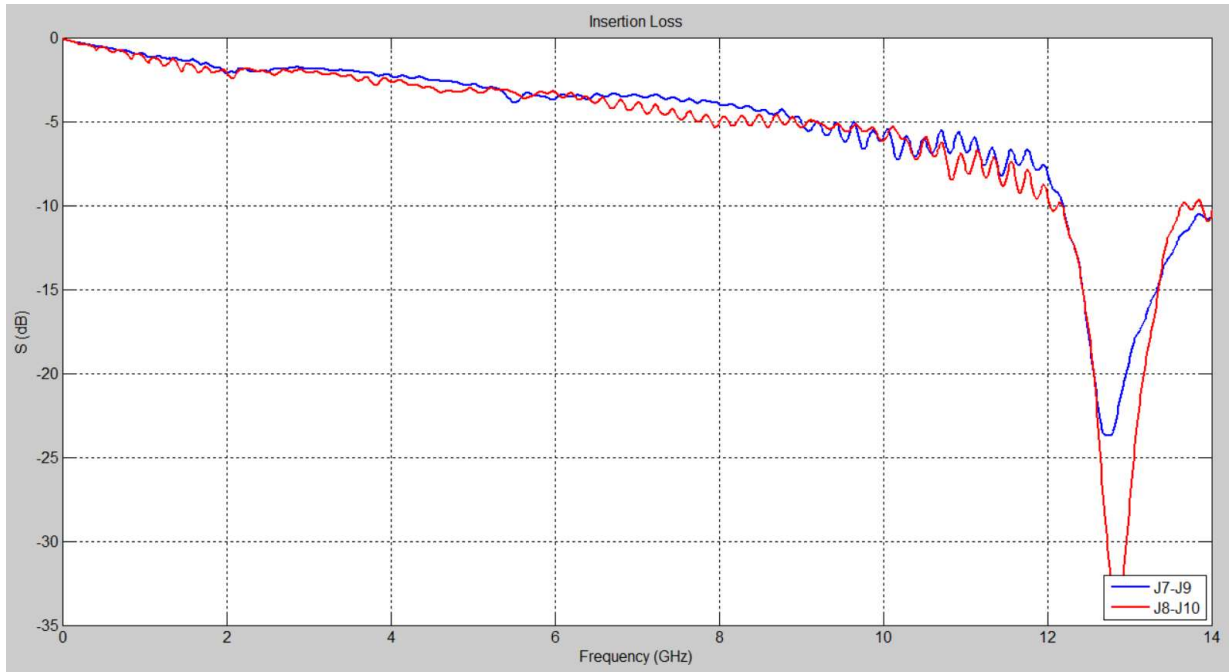


Figure 10: Insertion Loss - Pair 1 and Pair 2

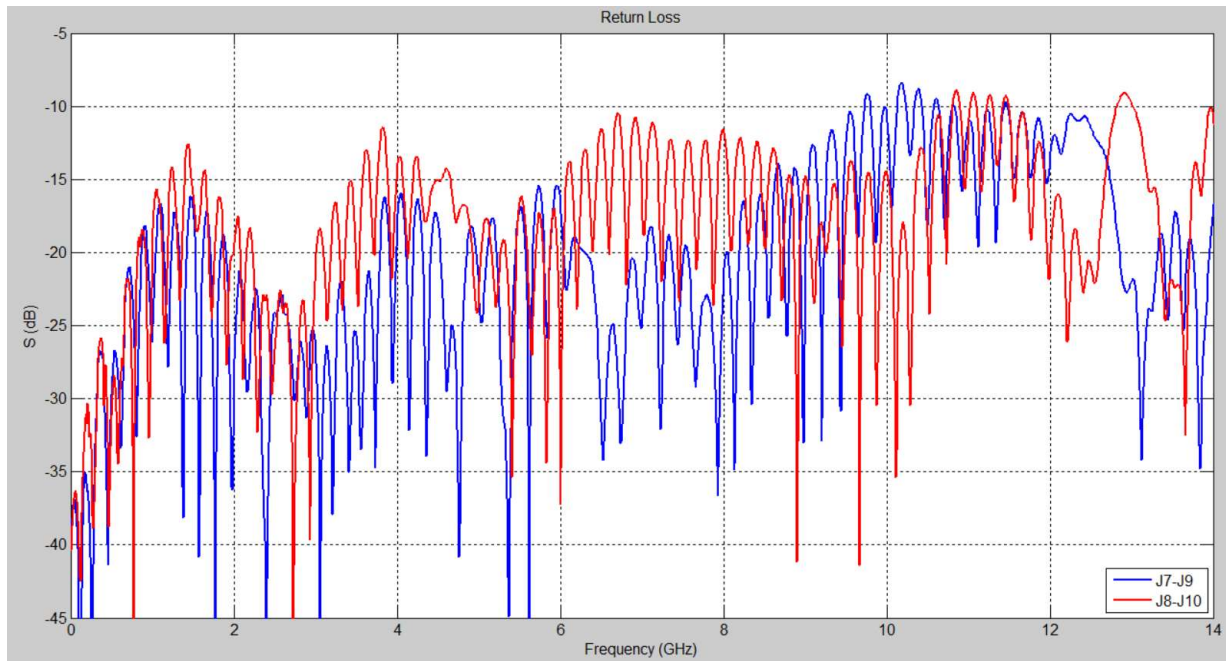


Figure 11: Return Loss - Pair 1 and Pair 2

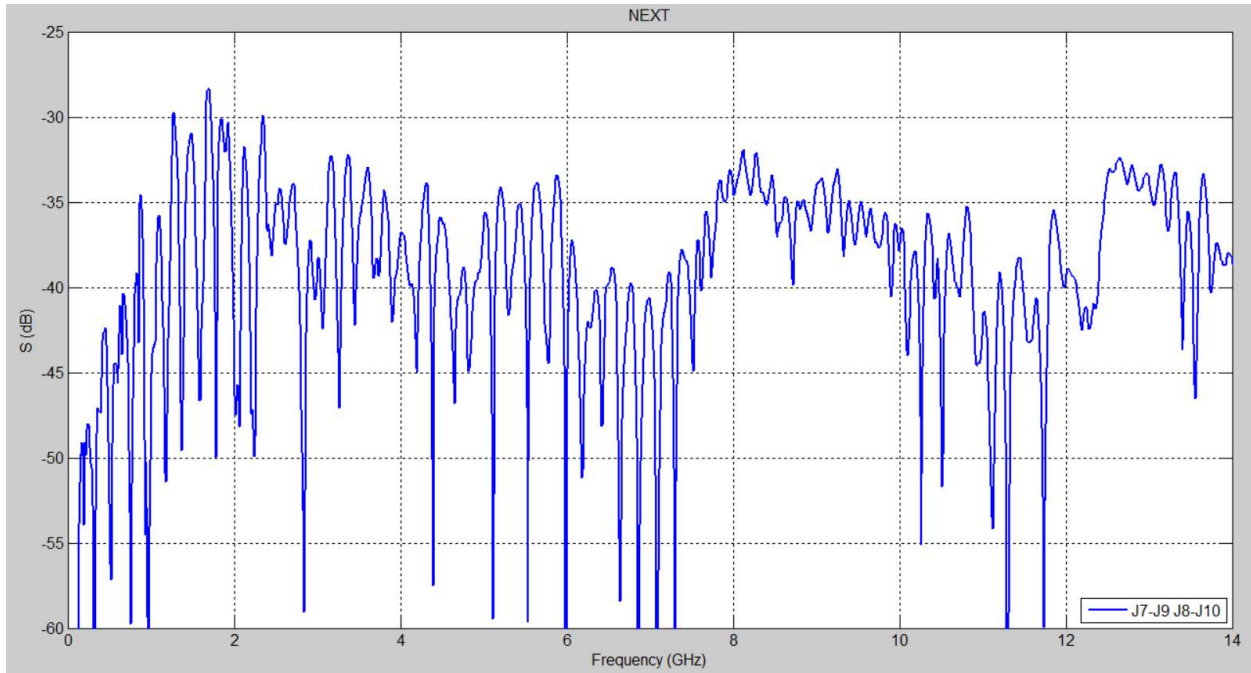


Figure 12: Near-End Crosstalk (NEXT)

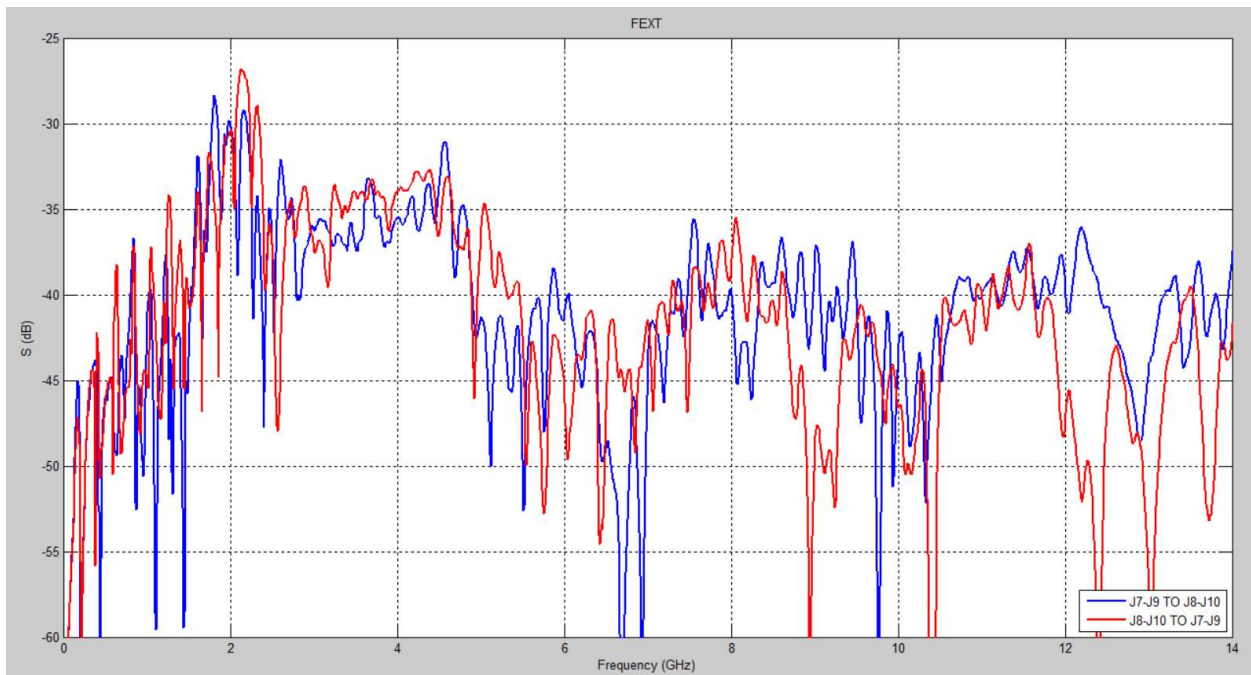


Figure 13: Far-End Crosstalk (FEXT) – Pair 1 and Pair 2

3) 1.0m Cable Assembly:

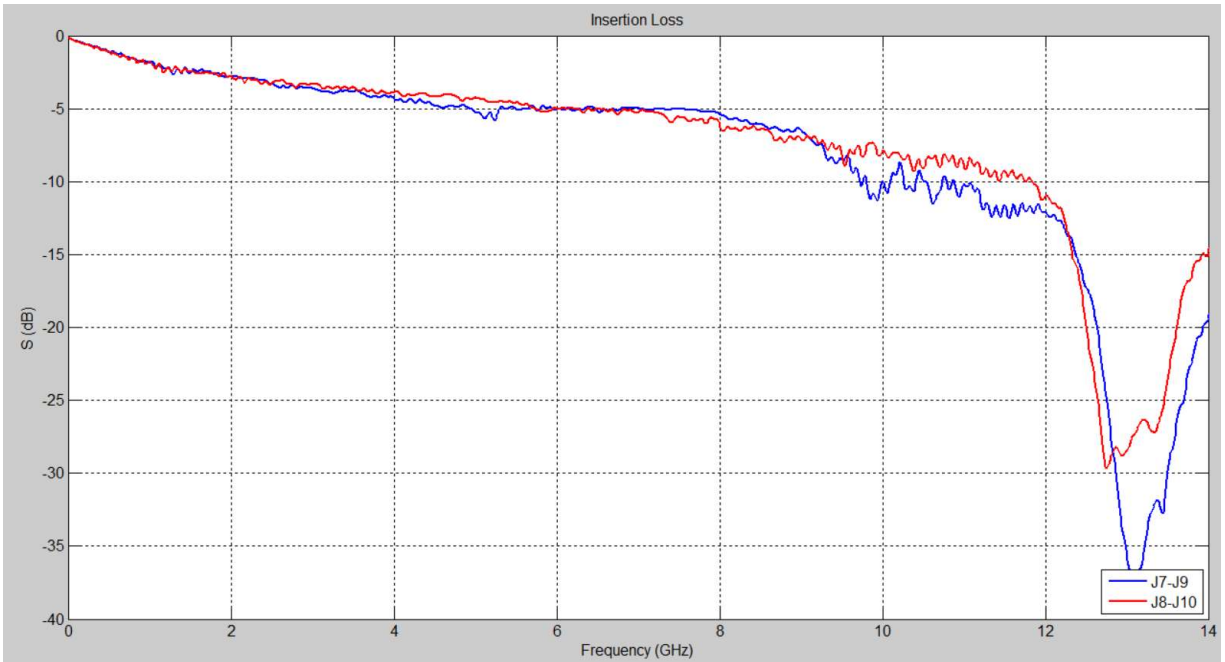


Figure 14: Insertion Loss - Pair 1 and Pair 2

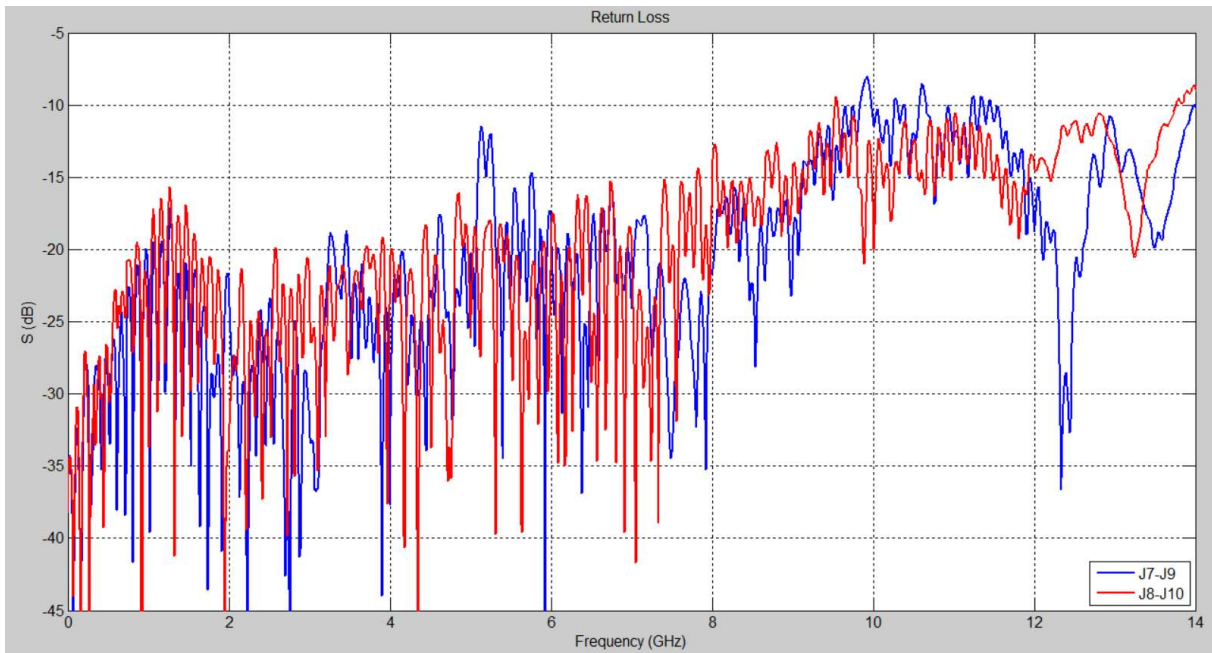


Figure 15: Return Loss - Pair 1 and Pair 2

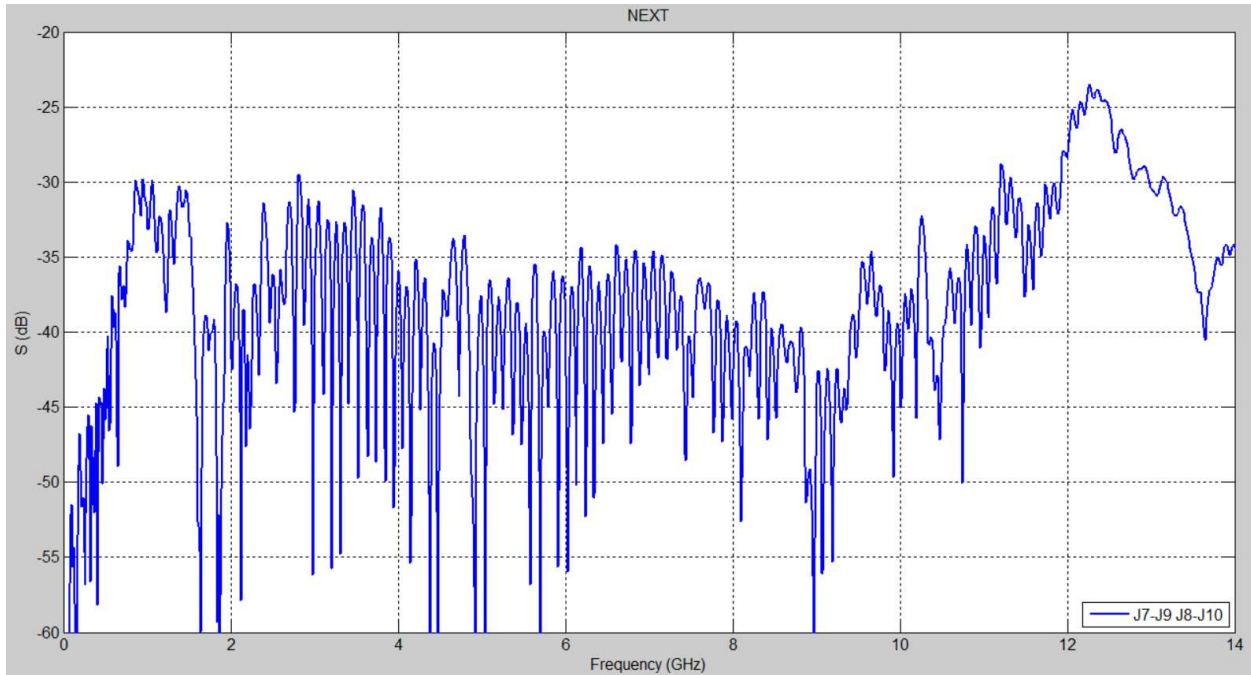


Figure 16: Near-End Crosstalk (NEXT)

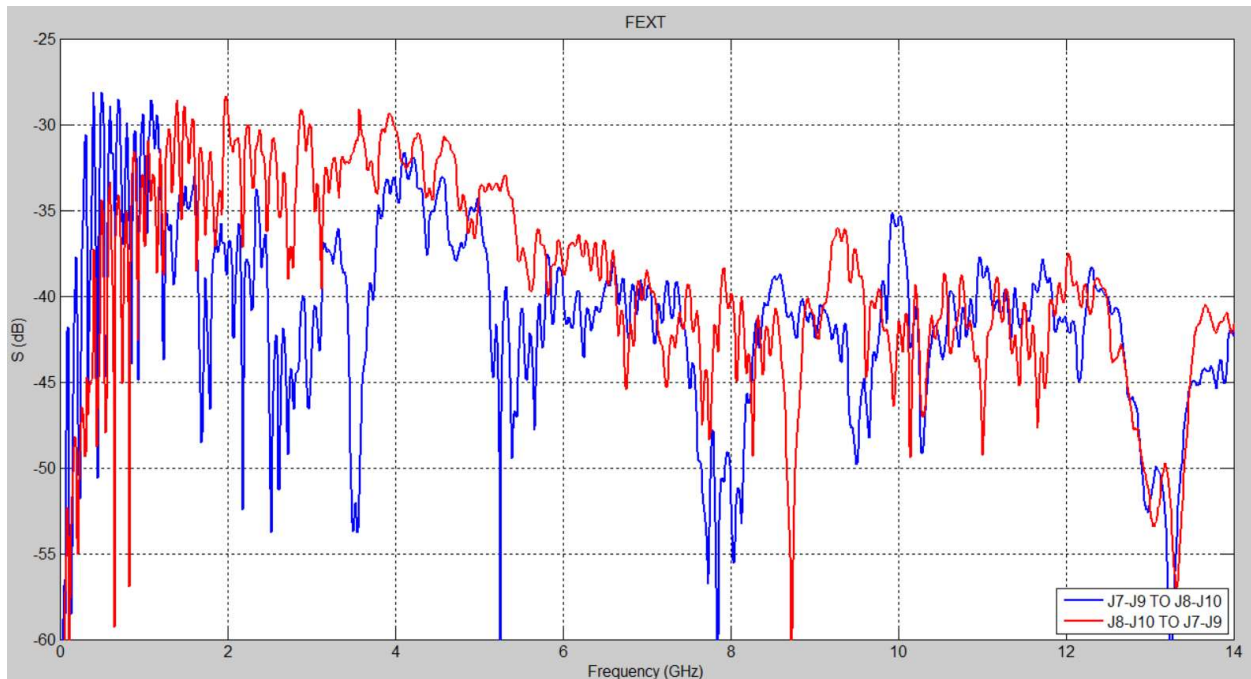


Figure 17: Far-End Crosstalk (FEXT) – Pair 1 and Pair 2

4) **3.0m Cable Assembly:**

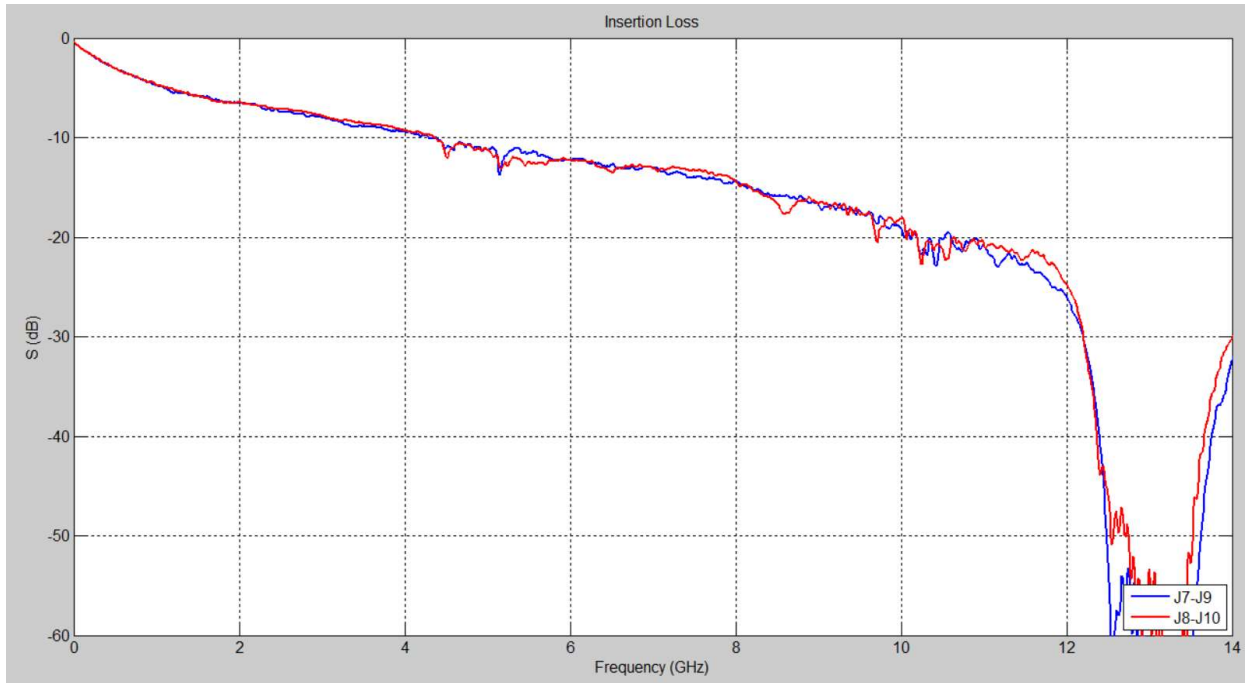


Figure 18: Insertion Loss - Pair 1 and Pair 2

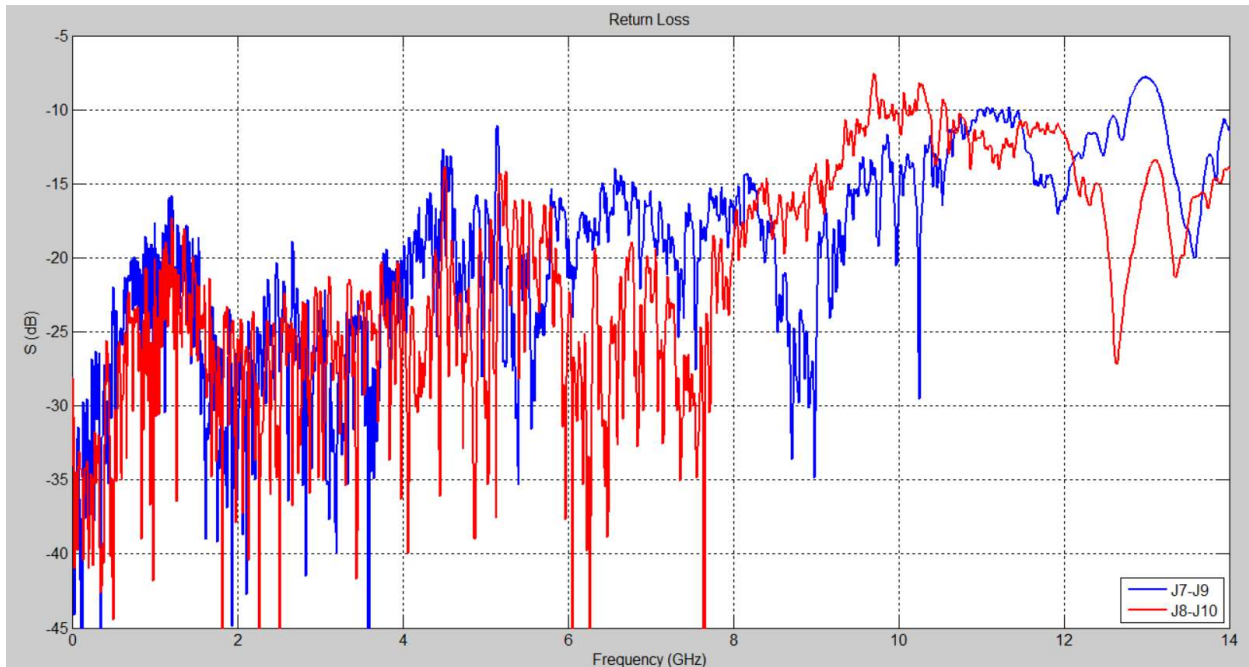


Figure 19: Return Loss - Pair 1 and Pair 2

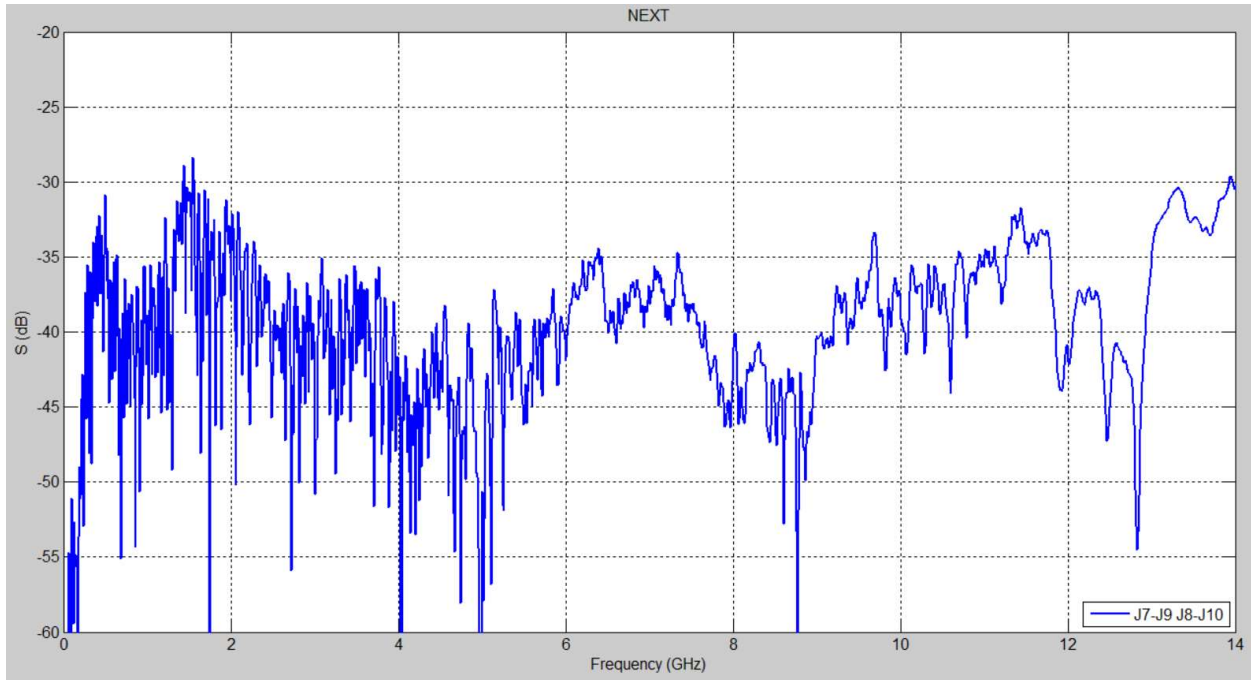


Figure 20: Near-End Crosstalk (NEXT)

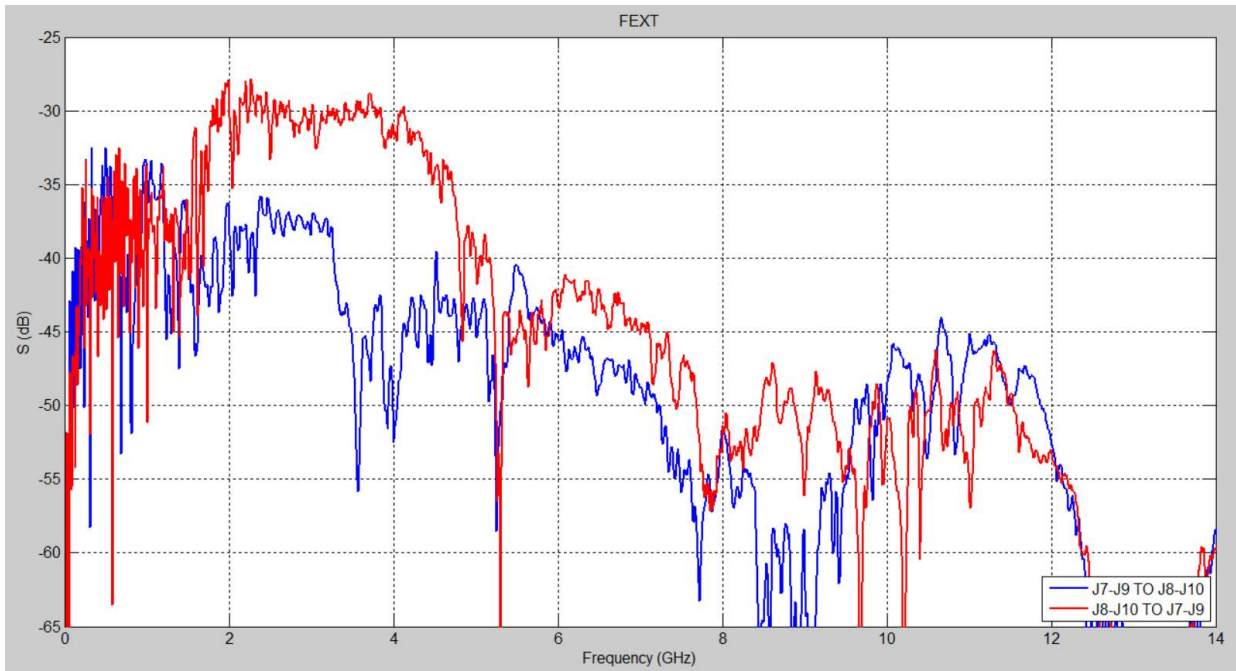


Figure 21: Far-End Crosstalk (FEXT) – Pair 1 and Pair 2



**Appendix A:**  
Calibration board (2x CAL):

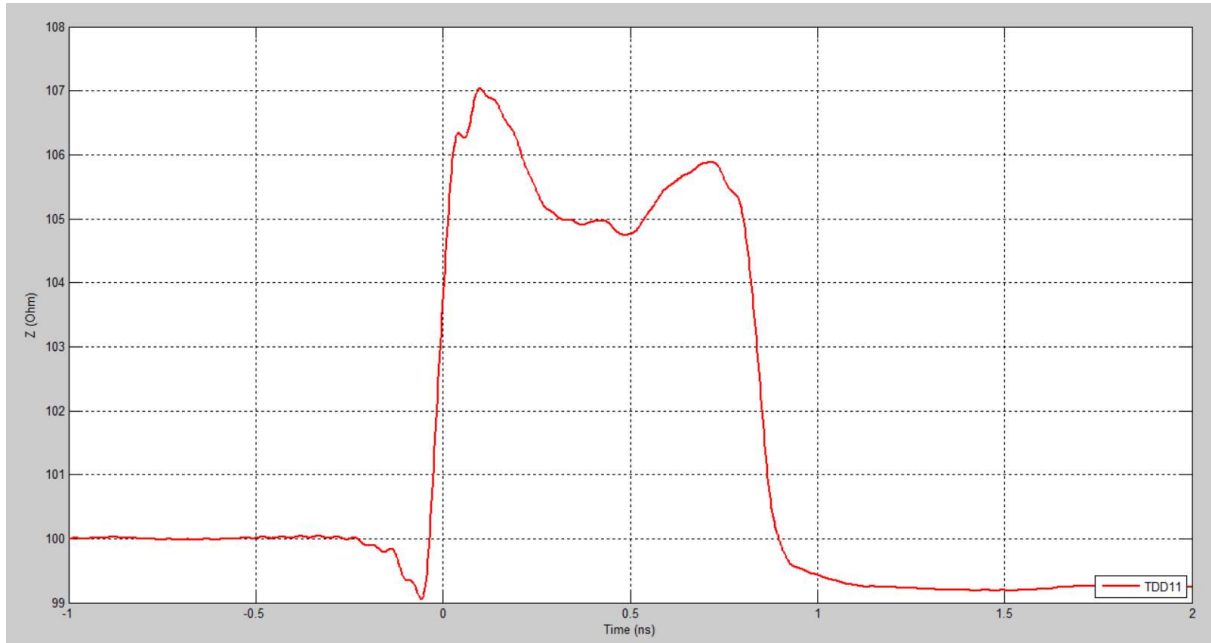


Figure 22: 2X-CAL Impedance 50ps 20-80% RiseTime

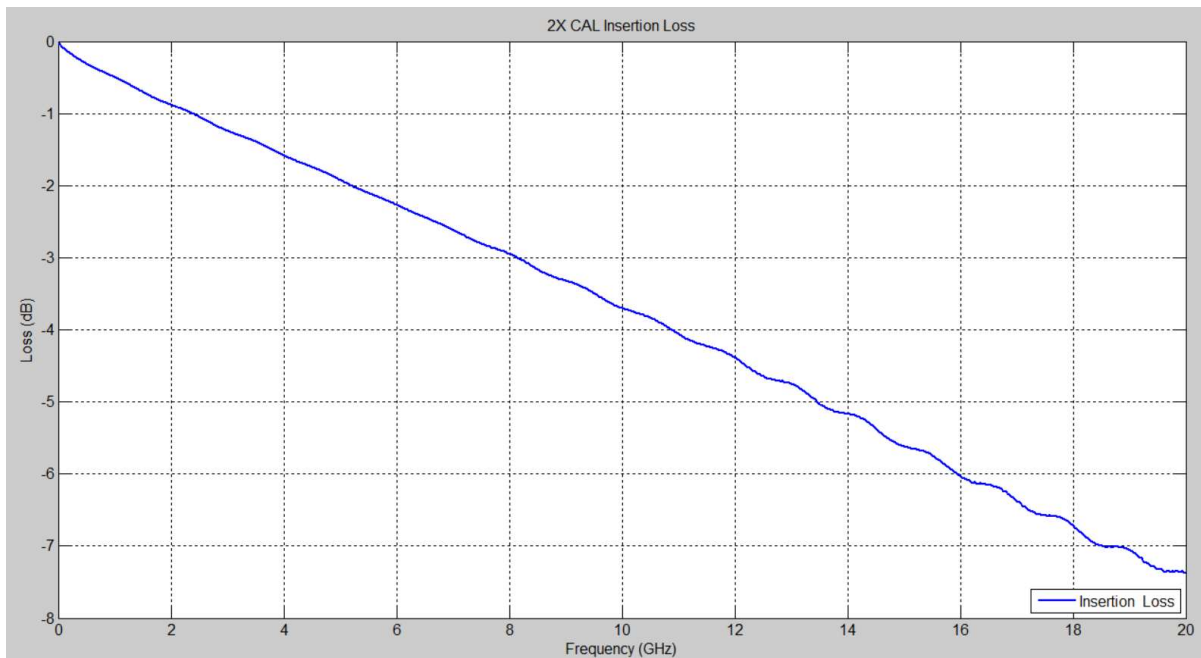


Figure 23: 2X-CAL Insertion Loss

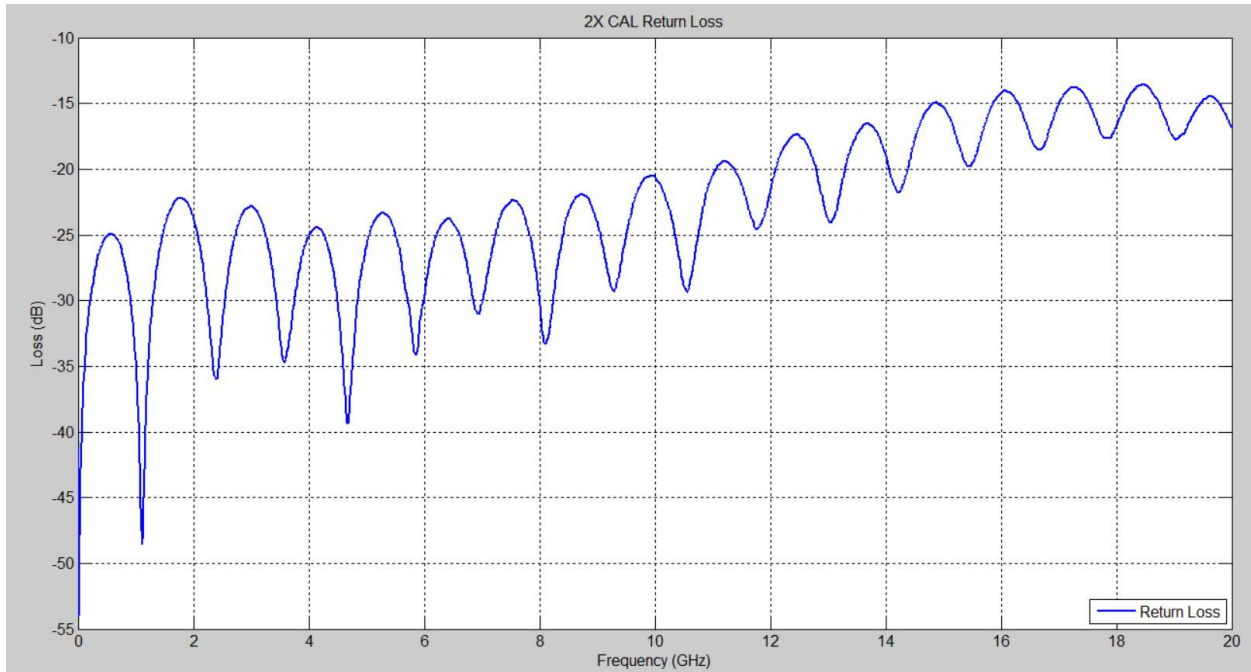
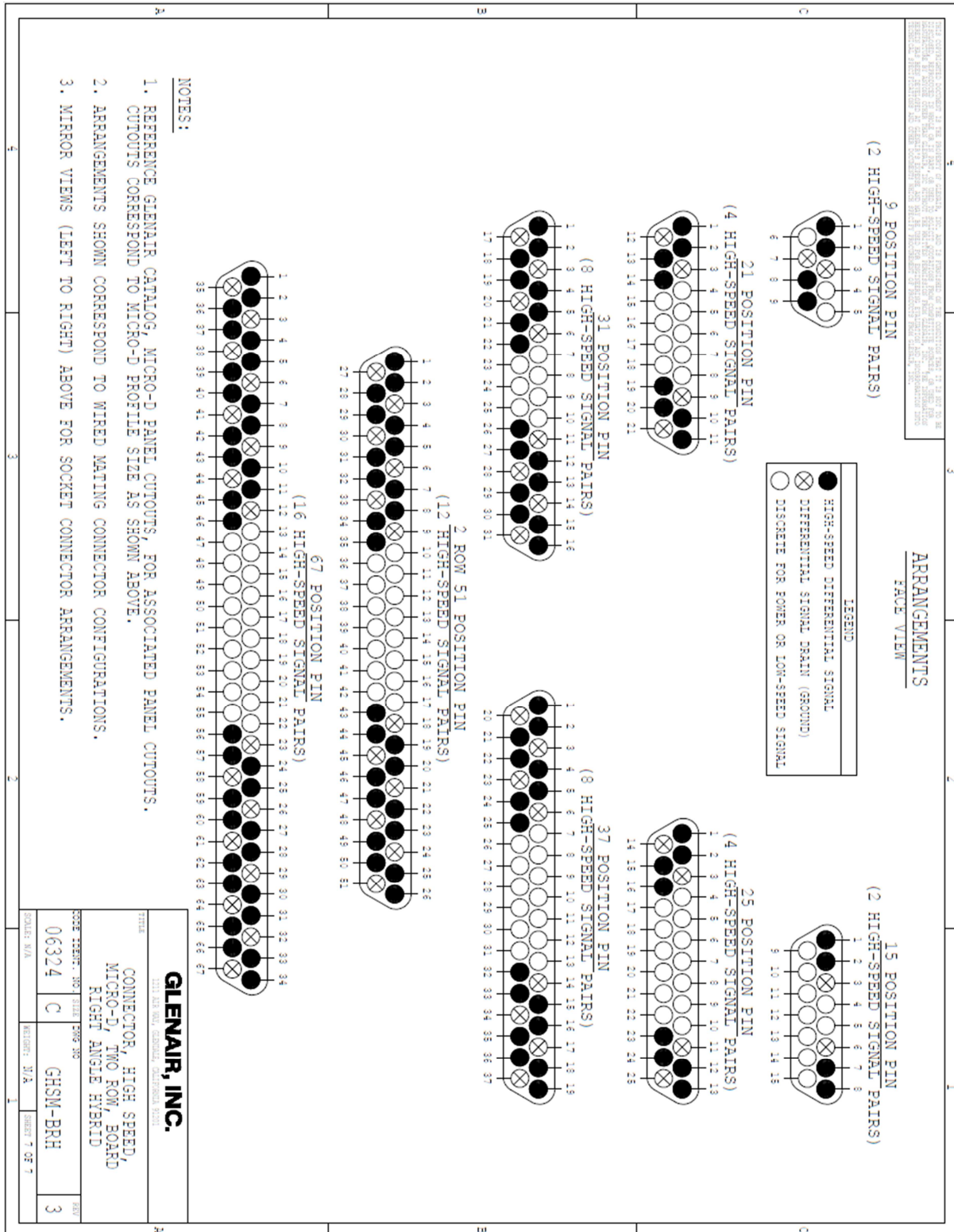


Figure 24: 2X-CAL Return Loss



2) High-Speed Micro-D Connector, Selection and Pinout

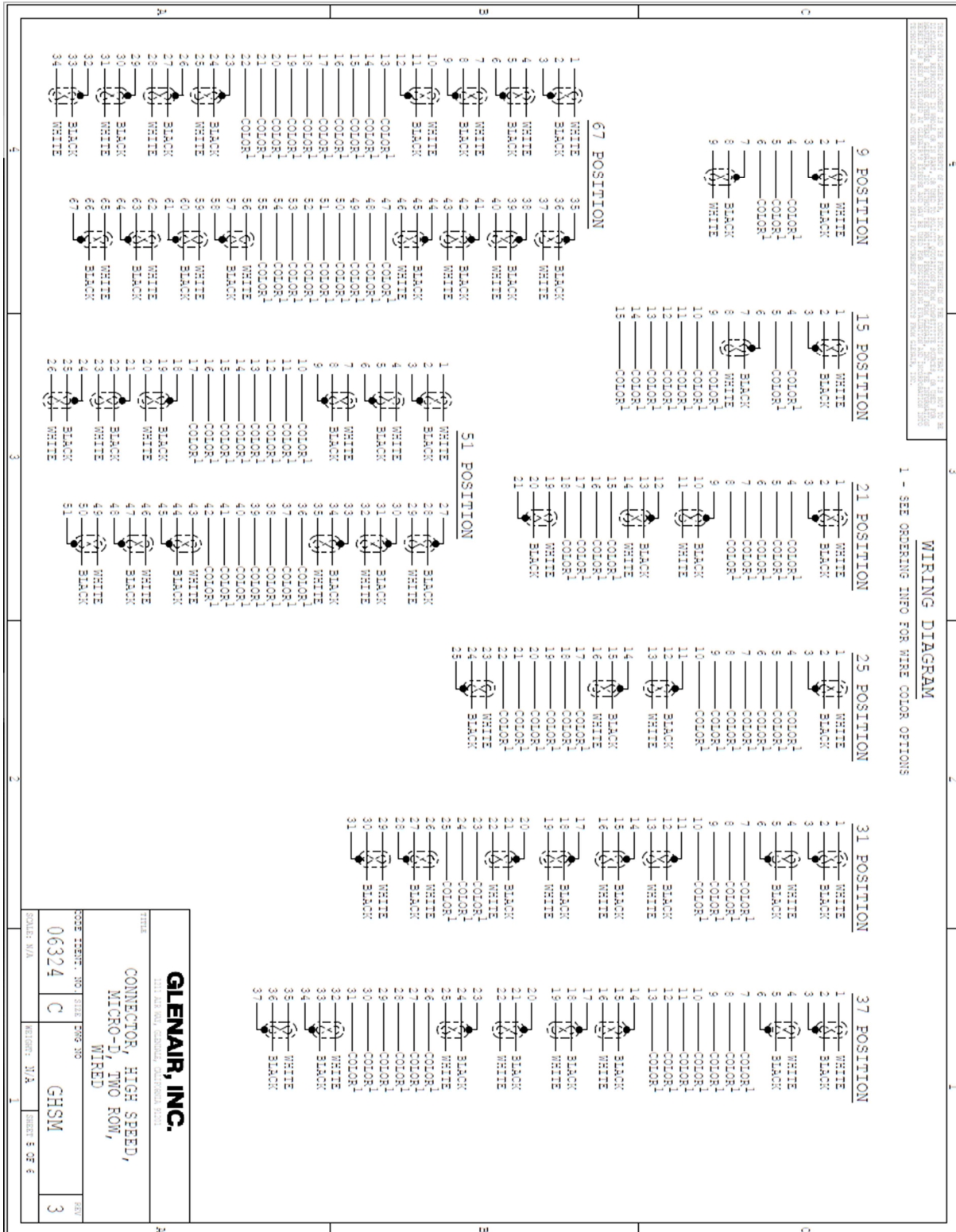


### 3) High-Speed Micro-D Wired Connector

<p><b>MATERIALS AND FINISHES:</b>          CONNECTOR SHELL - ALUMINUM ALLOY 6061          (SEE ORDERING INFO FOR PLATING OPTIONS)          INSULATOR - POLYETHYLENE SULFIDE (PPS)          PIN CONTACT - COPPER ALLOY, GOLD OVER NICKEL PLATING          SOCKET CONTACT - COPPER ALLOY, GOLD OVER NICKEL PLATING          GROUND SPRING - STAINLESS STEEL, GOLD PLATING          HARDWARE - 300 SERIES STAINLESS STEEL, PASSIVATED          ENCAPSULANT - EPOXY RESIN HYSOL EE4215</p>	<p><b>PERFORMANCE SPECIFICATIONS:</b>          CURRENT RATING - 1 AMP          - 600 VAC SEA LEVEL          - 5000 MEGOHMS MINIMUM (500 VDC)          - 71 MILLIOHMS MAXIMUM (#30 AWG WIRE)          - -55°C TO 150°C          - (7 OUNCES) X (# OF CONTACTS)          - 500 MATING CYCLES</p>	<p><b>HOW TO ORDER DETAILS</b></p>
<p>PERIPHERAL FLANGE SEAL          BLUE FLUOROSILICONE RUBBER          MOD CODE 1089 (PLUG ONLY)          EX. GHSMDL-31P-A80J1-181M-1089</p>	<p>GROUND SPRING (PLUG AND RPM PLUG ONLY)</p>	
<p>NON-CONDUCTIVE O-RING          (NITRILE)</p>	<p>PERIPHERAL FLANGE SEAL          BLUE FLUOROSILICONE RUBBER          (RPM PLUG ONLY)          EX. GHSMDL-31RF-A80J1-18R3M</p>	
<p><b>NOTES: UNLESS OTHERWISE SPECIFIED...</b></p> <ol style="list-style-type: none"> <li>ASSEMBLY TO BE IDENTIFIED WITH GLENAIR NAME, P/N, DATE CODE, AND POSITION #1 IDENTIFICATIONS.</li> <li>INTERFACE DIMENSIONS              IAW MLL-DTL-83513,              *** CONTAINS REDUCED SIZED CONTACTS ***              *** WILL NOT MATE WITH STANDARD MICRO-D ***</li> <li>ELECTRICAL PERFORMANCE IAW GLENAIR SPECIFICATION T.B.D.</li> <li>REFERENCE APPLICATION NOTES AN# T.B.D. FOR OPTIMAL PERFORMANCE.</li> </ol>		
<p><b>GLENAIR, INC.</b></p> <p>CONNECTOR, HIGH SPEED,          MICRO-D, TWO ROW,          WIRED</p>		
<p>06324</p>	<p>C</p>	<p>GHSM</p>
<p>SCALE: N/A</p>	<p>REVISION: N/A</p>	<p>SHEET 2 OF 6</p>



4) High-Speed Micro-D Connector, wire diagram



5) 100-Ohm Impedance matched Twinax Twisted Pair Cable

PART NUMBER		AWG	INSULATOR COLOR	STRAND	DC RESISTANCE (OHMS/1000' MAX)	"A" NOM OVER TAPE	"B" NOM INSULATION DIA	NOM COND-COND CAPACITANCE (PF/FT)	NOM ATTENUATION (dB/100')	
963-121-28		28	WHITE/BLACK	19/40	86.40	.096" ±.008	.040" ±.002	15.2	500 MHz	1 GHz
									33	47

**TABLE I**

**CONSTRUCTION DETAILS**

CONDUCTOR/DRAIN: SILVER PLATED HIGH STRENGTH COPPER ALLOY  
 INSULATION: FEA  
 SHIELD: .0015" ALUMINUM/POLYESTER TAPE, 50% TAP, FOIL IN  
 JACKET: FEP, BLACK  
 PAIR: TWISTED

**PROPERTIES**

IMPEDANCE: 100±10 OHMS  
 CAPACITANCE: SEE TABLE I  
 V.O.F.: 70%  
 ATTENUATION: SEE TABLE I

TEMPERATURE RATING: 105°C

**NOTES:**

1. CABLE IS AVAILABLE IN 1 FOOT INCREMENTS. SPECIFY LENGTH ON PURCHASE ORDER.

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10/29/18	MODIFY DESIGN	MRH	

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES

FRACTIONS: 1/16  
 DECIMALS: .005  
 ANGLES: ± 1°

DO NOT SCALE THIS DRAWING

SCALE: N/A

WEIGHT: N/A

SHEET: 1 OF 1

Labels: FEP JACKET, ALUMINUM/POLYESTER TAPE, DRAIN 30 AWG (19/42), CONDUCTOR, FEA INSULATOR, Ø B, A

**GLENAIR, INC.**      Est. 1961  
 1211 AIR WAY • GLENDALE, CALIF. 91201

100-OHM IMPEDANCE  
 MATCHED TWINAX  
 TWISTED PAIR CABLE

DATE: 08/21/18  
 BY: MRH  
 APPROVED: *B. Brown*

SCALE: N/A

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SHEET: 1 OF 1

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