GT-20-092

Signal Integrity Characterization Report

Ochito “Red” Contacts

P/N: 882-027 – Receptacle
P/N: 882-031 – Plug

Revision History

Rev	DCN #:	Date	Issued By:	Approved By:
1	N/A	1/10/2020	Ali Saberi	Guido Hunziker

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Table of Contents

1.0 Scope 3
2.0 Applications 3
3.0 Reference Industry Standards 3
4.0 Test Samples 3
4.1 Ochito “Red” Contact Pin Assignment 3
5.0 Test Equipment 4
6.0 Test Procedure 4
6.1 Test Equipment Setup and Calibration 4
6.1.1 PCB Test Fixture 4
6.1.2 ENA 4
6.1.3 TDR Scope 5
6.2 Ochito Mated Contacts 5
7.0 Test Results 6
7.1 Mated Contact – SI Test Results 6
8.0 Conclusion 10
Appendix A – Test Setup and SI Characteristics 11

Figure 1: Ochito "Red" Pin and Socket Pin-out Assignment 4
Figure 2: Test Configuration of Mated Ochito “Red” Pin and Socket 5
Figure 3: Mated Ochito Contact – Sampled Diff. TDR Profiles @50ps Test Signal Rise time 6
Figure 4: Mated Ochito Contact - De-embedded Insertion Loss (SDD21) 7
Figure 5: Mated Ochito Contact - Return Loss (SDD11/SDD22) 7
Figure 6: Mated Ochito Contact – Mode Conversion Loss (SCD21) 8
Figure 7: Mated Ochito Contact – Pair to Pair NEXT 8
Figure 8: Mated Ochito Contact – Pair to Pair FEXT 9
Figure 9: Mated Ochito Contact – SI Performance 9
Figure 10: ENA Test Setup 11
Figure 11: Ochito “Red” Test Boards and 2X Calibration Trace 11
Figure 12: 2X Calibration PCB Trace – SI Performance 12

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1.0 Scope

This document details the signal integrity (SI) performance and the test method of the Glenair 8-position Ochito “Red” contact, a product optimized for high-bandwidth transmission over 4 pairs of 100 Ohm differential signals.

2.0 Applications

The Glenair ruggedized Ochito “Red” contact is designed to transmit high-speed data protocols for high-definition video (HDMI, DisplayPort, DVI), storage devices (SATA), and any other application that requires 100-Ohm differential connectivity. The results presented in this report are valid for all Ochito “Red” contacts, regardless of the connector family they are installed into (D38999, Mighty-Mouse, Series 79 or SuperFly connectors).
For video protocol applications, all 4-pairs in a single Ochito contact assembly can be used for the high-speed data transmission. Protocols requiring only 2 differential pairs can be transmitted using two opposing differential pairs within the contacts. The latter configuration is recommended for applications requiring very high cross-talk rejection across the full frequency band (>40dB).

3.0 Reference Industry Standards

- SATA 3.0 – High-Speed Serialized AT Attachment, Revision 3.1. July 18, 2011
- HDMI 2.0 – High Definition Multimedia Interface, Revision 2. September 4, 2013
- DVI – Digital Visual Interface, Revision 2. April 2, 1999
- VESA Display Port, Version 1, Revision 2. January 5, 2010

4.0 Test Samples

For SI performance test of the mated contact, Ochito “Red” pin and socket contacts were constructed by mounting each on a PCB test board so that the mated contact can subsequently be tested with the ENA and the TDR scope.

- PCB test fixture assly. (P/N: 691-CB086 Rev8) with mounted Ochito PCB Plug (P/N: 882-031)
- PCB test fixture assly. (P/N: 691-CB086 Rev8) with mounted Ochito PCB Receptacle (P/N: 882-027)

4.1 Ochito “Red” Contact Pin Assignment

For each pin and socket sample contact, pin number assignment is defined in Figure 1.

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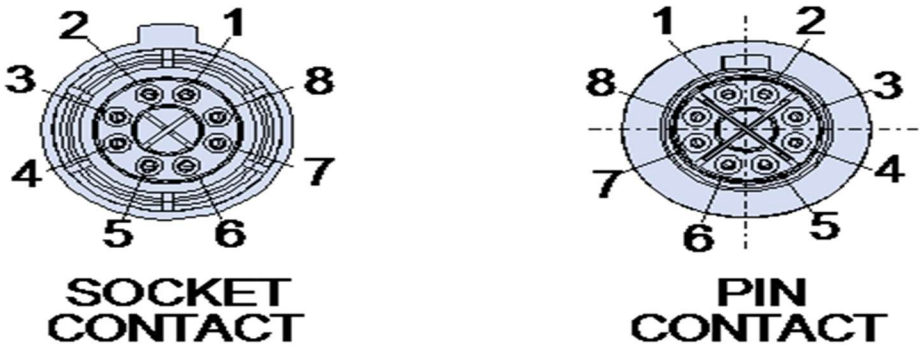

Figure 1: Ochito "Red" Pin and Socket Pin-out Assignment

5.0 Test Equipment

The following equipment were used for the SI test:

- Keysight E5071C 4-port Vector Network Analyzer with Optional TDR option (ENA)
- Keysight ECAL Module N4433A
- Tektronix DSA 8300 TDR Scope with 80E08 18ps Rise Time Test Modules
- PCB test fixture assly. (P/N: 691-CB086 Rev8) with mounted Ochito PCB Plug (P/N: 882-031)
- PCB test fixture assly. (P/N: 691-CB086 Rev8) with mounted Ochito PCB Receptacle (P/N: 882-027)

6.0 Test Procedure

6.1 Test Equipment Setup and Calibration

6.1.1 PCB Test Fixture

The PCB test fixture device in Figure 11 of the Appendix A was used for the SI characterization test of the Ochito “Red” contact and cable assembles. The fixture has the SMA connector interface for connecting to the ENA and/or the TDR scope for measurement. The test fixture was tested for 50-Ohm (+/- 3.5 Ohms) SE and 100-Ohm (+/-7 Ohms) differential using the ENA or the TDR scope.

The SDD21 test data of the 2X calibration trace on the test board was collected and saved in a touchstone (.s4p). This data was later used for de-embedding the insertion loss of mated Ochito contact and cable assembly test results.

6.1.2 ENA

The ENA was setup to characterize the differential s-parameters and impedance of the mated Ochito contact and cable assemblies. A typical setup inputs of the ENA are listed below:

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Frequency Sweep:	10 MHz – 20 GHz
IF Bandwidth:	500 Hz
Resolution:	2001 Points
Power Level:	-5.0dBm

A full 4-port calibration was performed using the ECAL module shown in Figure 10 before all tests could begin.

6.1.3 TDR Scope

The Tektronix DSA 8300 TDR Scope is a time-domain instrument to analyze and obtain the impedance characteristic of the PCB test fixture, contact, and cable assemblies.
The scope unit and its test modules were calibrated and compensated for the operating temperature per manufacturer’s recommendation before use for testing.
The differential impedance profile of mated contact and cable assembly interconnection points was measured and the data was saved in a .csv file for post processing.

6.2 Ochito Mated Contacts

The mated Ochito contact assembly under SI characterization test is defined to be from back-end of the socket contact to the back-end of the mated pin contact as shown as DUT in Figure 2. Any test fixture loss, which not part of the mated contact under test, will be de-embedded out using the 2X calibration file obtained in Section 6.1.1.
All un-active ports on the test boards that are not under test were terminated with the 50-Ohm loads.

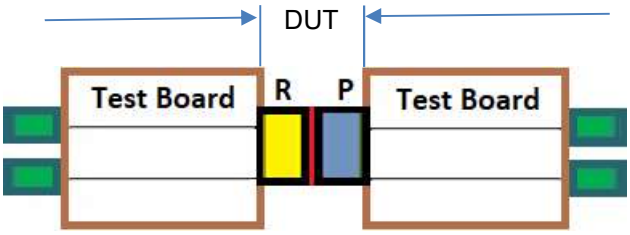

Figure 2: Test Configuration of Mated Ochito “Red” Plug and Receptacle

Using the ENA and/or TDR scope to collect the defined frequency-domain and time-domain test data below:

- Impedance profile @ 50ps signal rise time using the TDR scope
- SDD21 – Embedded diff. insertion loss
- SDD11/SDD22 – Diff. return loss
- SCD21 – Mode conversion loss
- Pair-to-pair near-end crosstalk (ppNEXT)

- Pair-to-pair far-end crosstalk (ppFEXT)

All test data were saved in a touchstone (.s4p) format for the s-parameters and in a .csv format for the impedance data for post processing.

7.0 Test Results

The following data represents a typical SI performance of the Ochito “Red” mated contact.

7.1 Mated Contact – SI Test Results

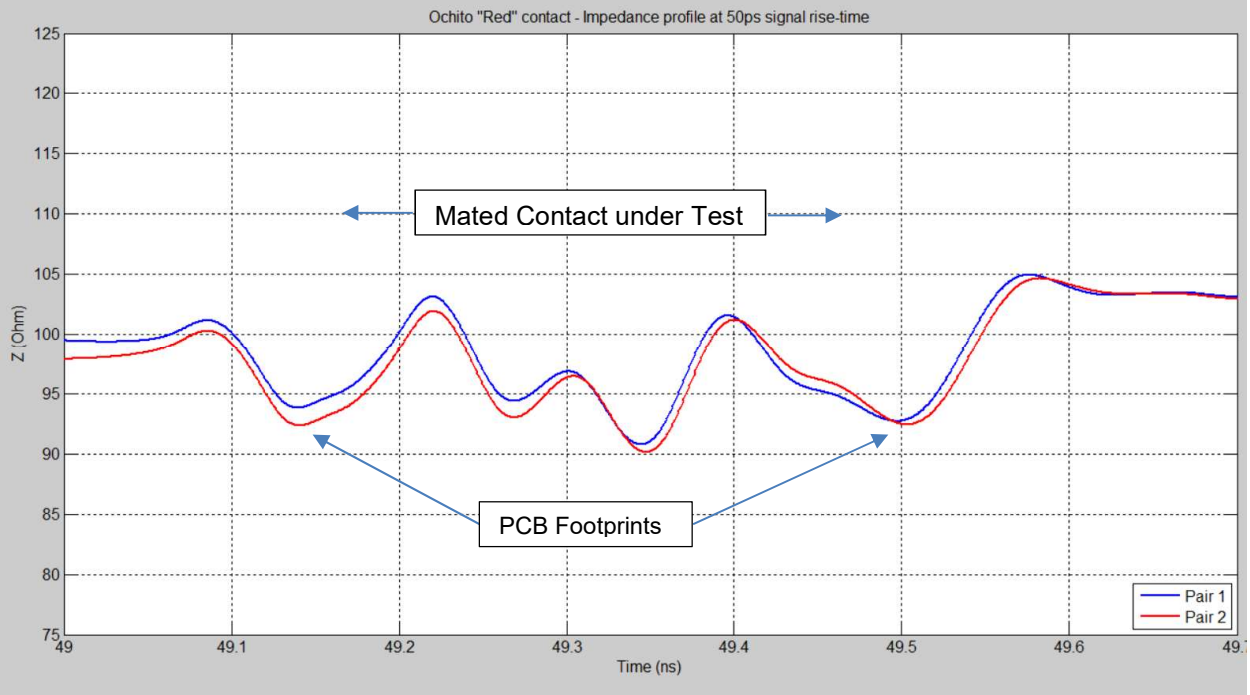

Figure 3: Mated Ochito Contact – Sampled Diff. TDR Profiles @50ps Test Signal Rise time

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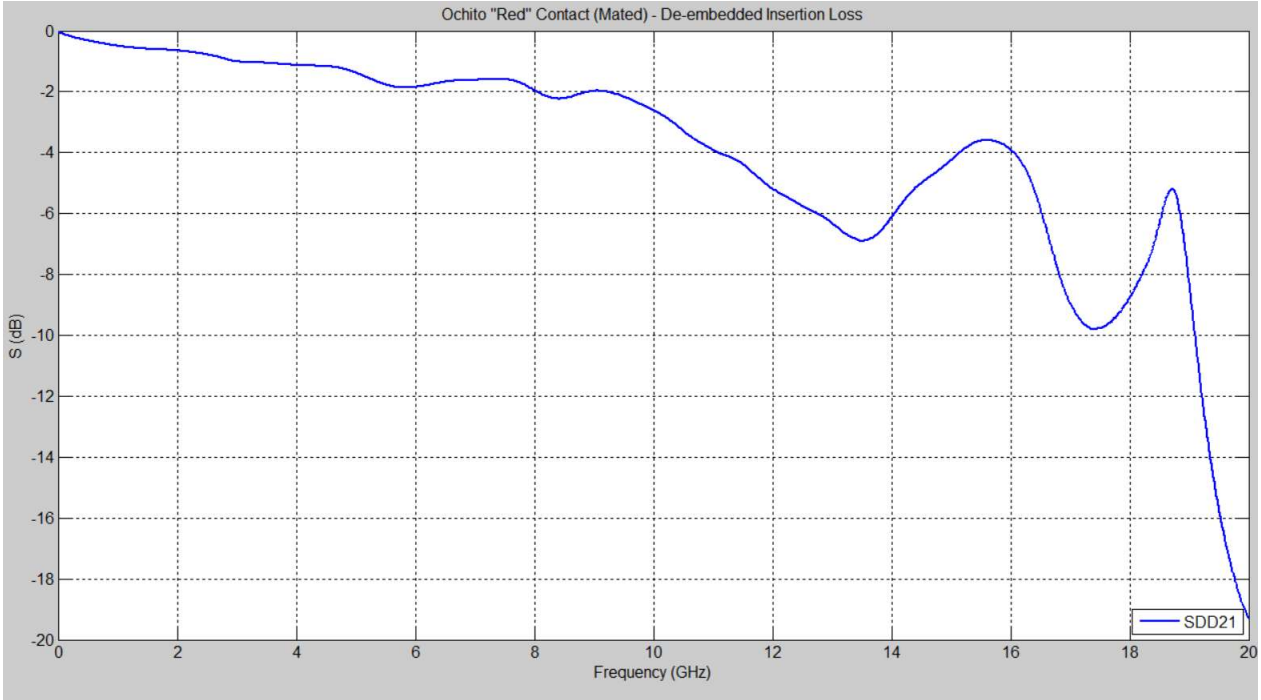

Figure 4: Mated Ochito Contact - De-embedded Insertion Loss (SDD21)

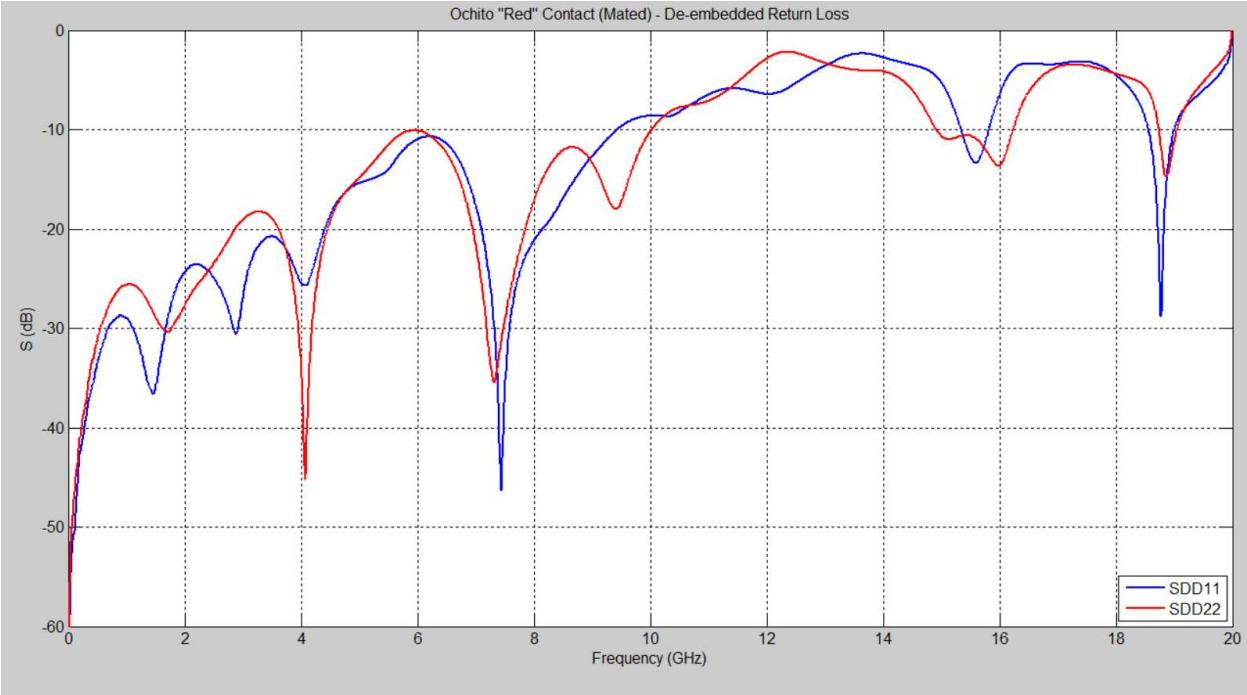

Figure 5: Mated Ochito Contact - Return Loss (SDD11/SDD22)

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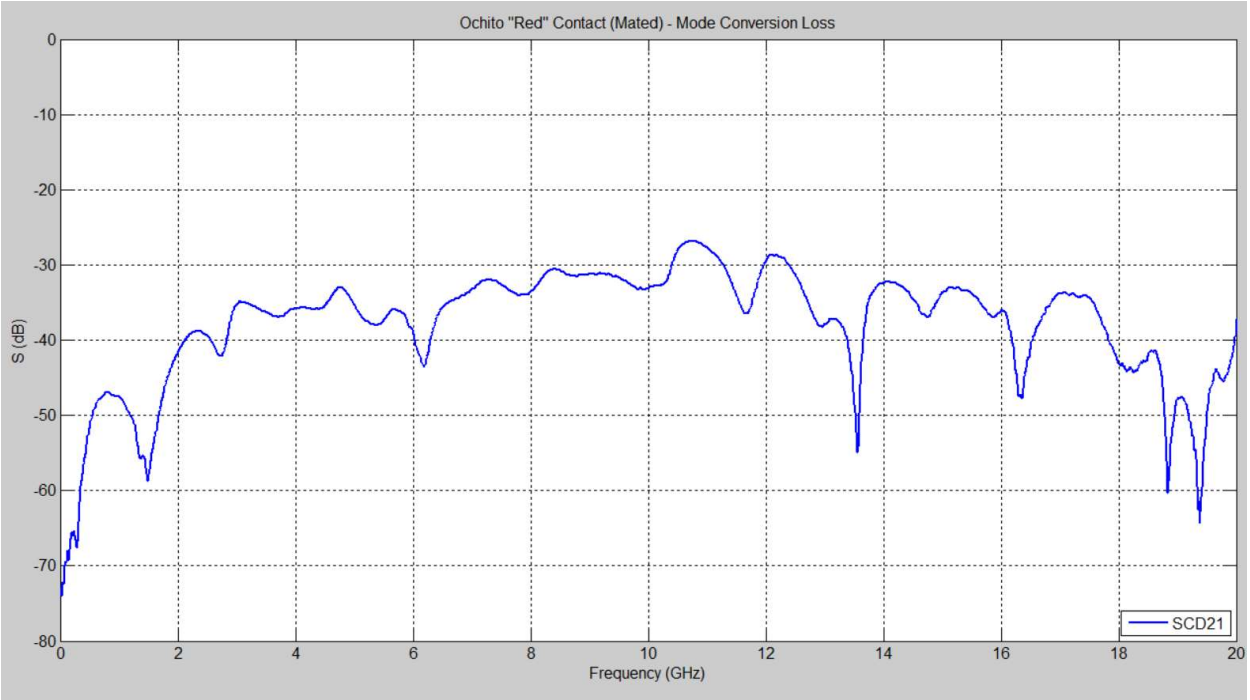

Figure 6: Mated Ochito Contact – Mode Conversion Loss (SCD21)

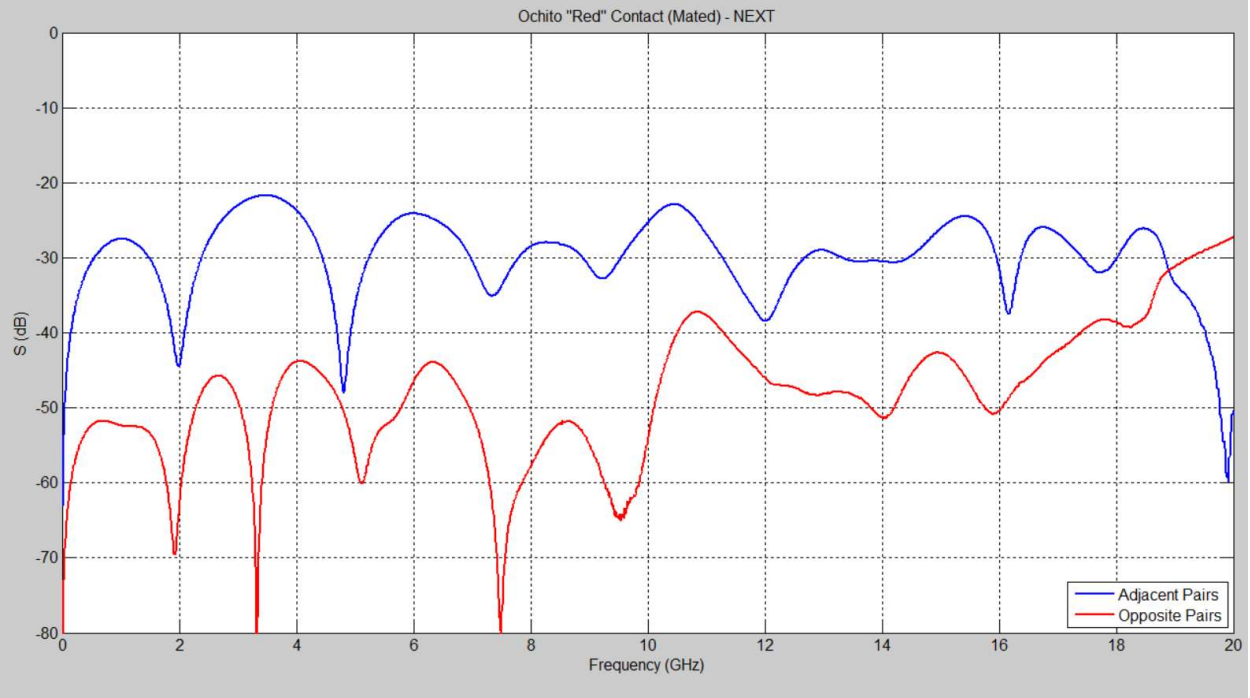

Figure 7: Mated Ochito Contact – Pair to Pair NEXT

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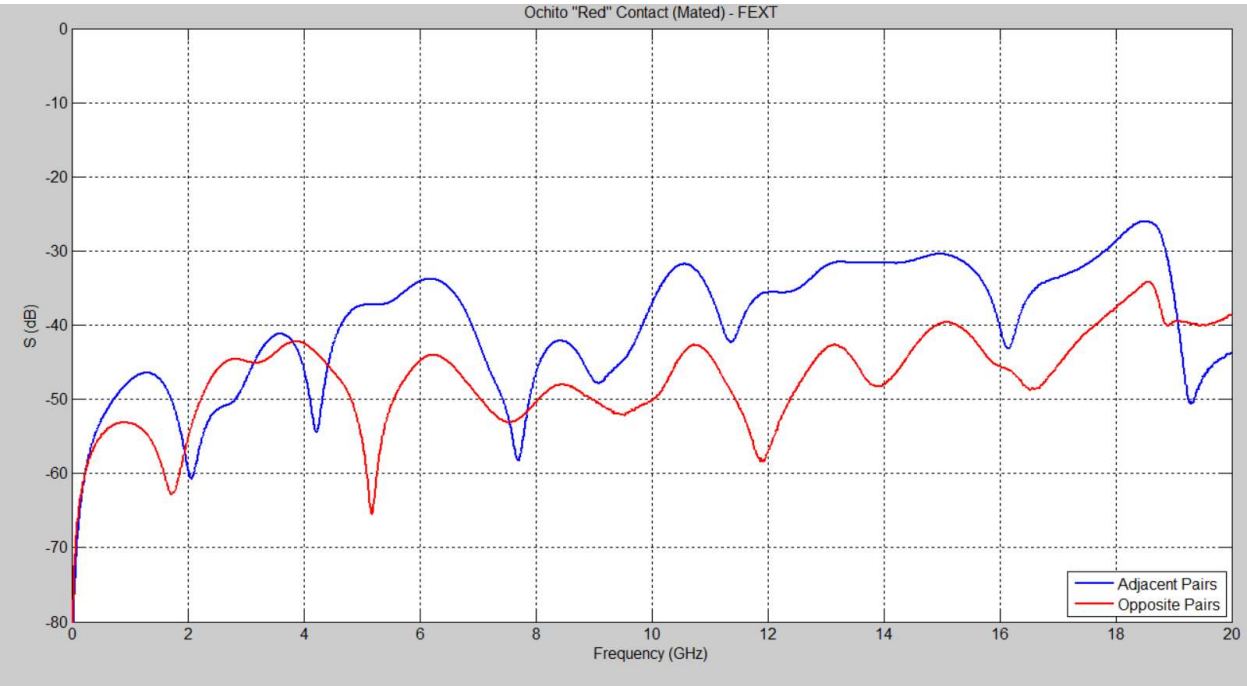

Figure 8: Mated Ochito Contact – Pair to Pair FEXT

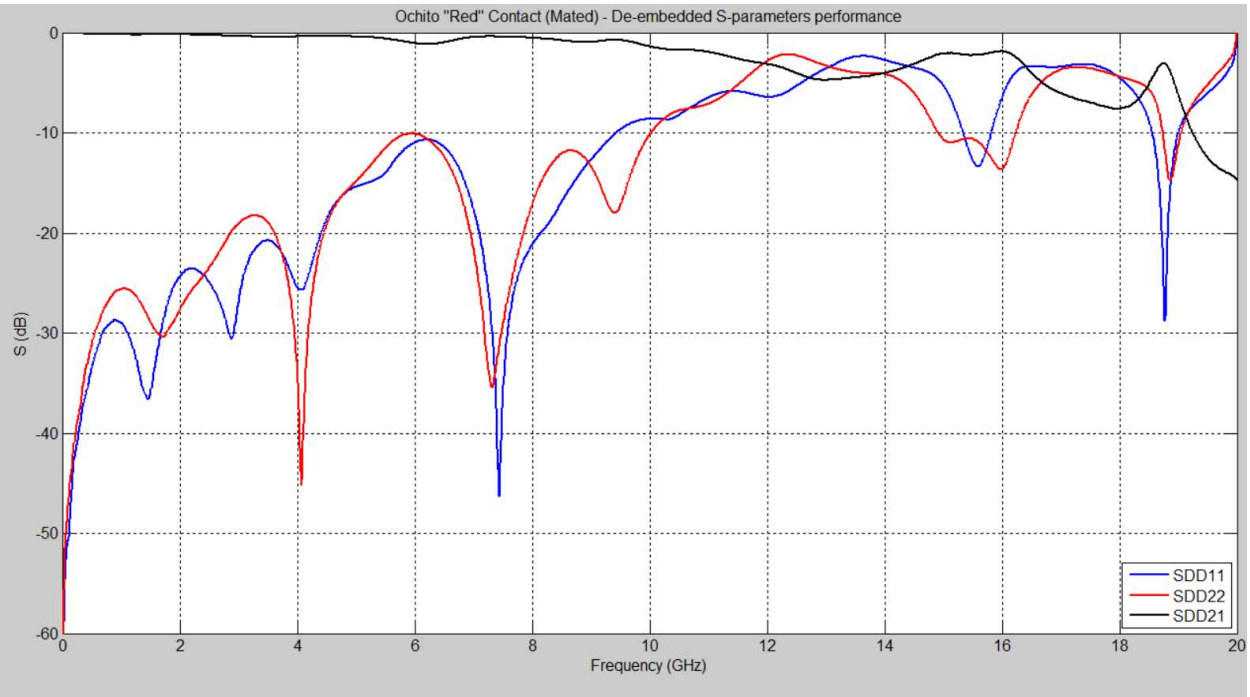

Figure 9: Mated Ochito Contact – SI performance

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8.0 Conclusion

The Ochito “Red” contact is designed to meet a 100 +/- 10 Ohm impedance requirement. The impedance test of the main contact with a fast test signal rise time of 50 picoseconds, which equates to a 3dB bandwidth of 7GHz, passes the Glenair internal design requirement. Based on the SI characterization test results the contact has demonstrated that it can provide a transmission bandwidth of 7GHz or greater. This bandwidth can comfortably support a data rate transmission of at least 10Gb/s NRZ per lane or pair.

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Appendix A – Test Setup and SI Characteristics

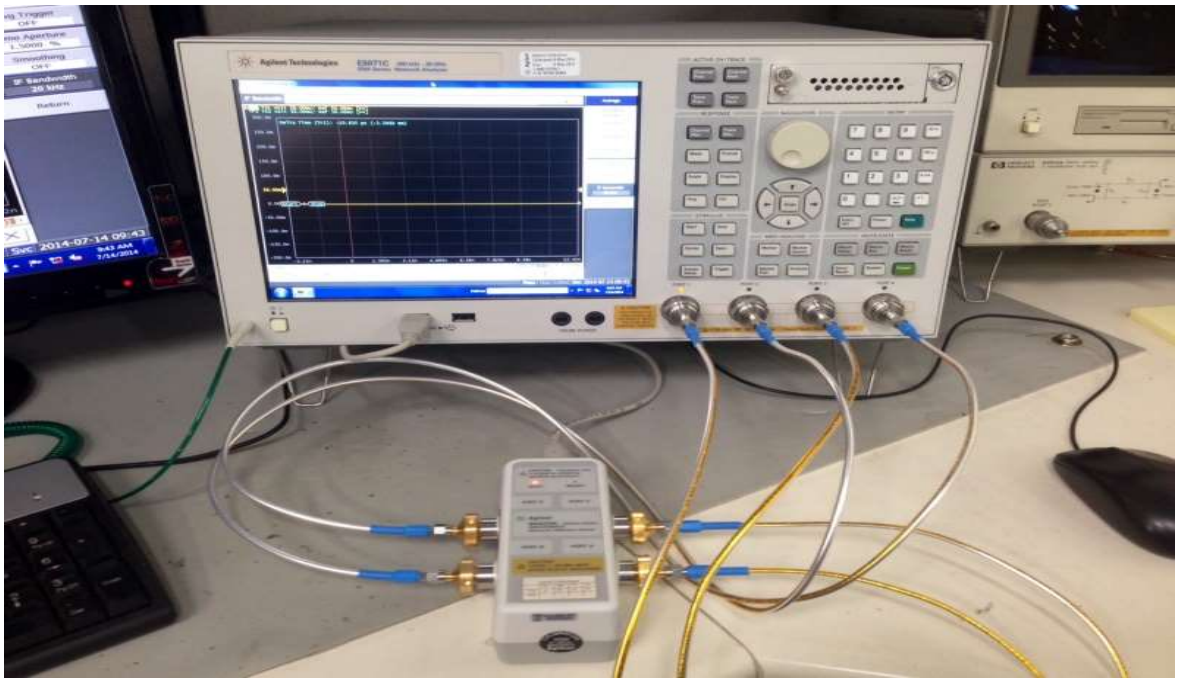

Figure 10: ENA Test Setup

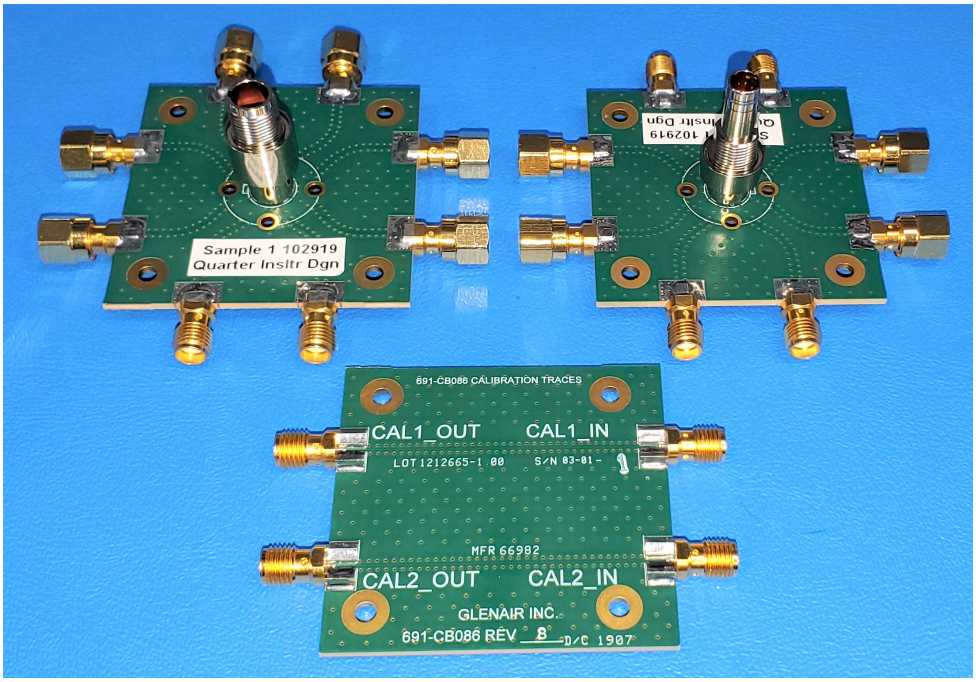

Figure 9: Ochito “Red” Test Boards and 2X Calibration Trace

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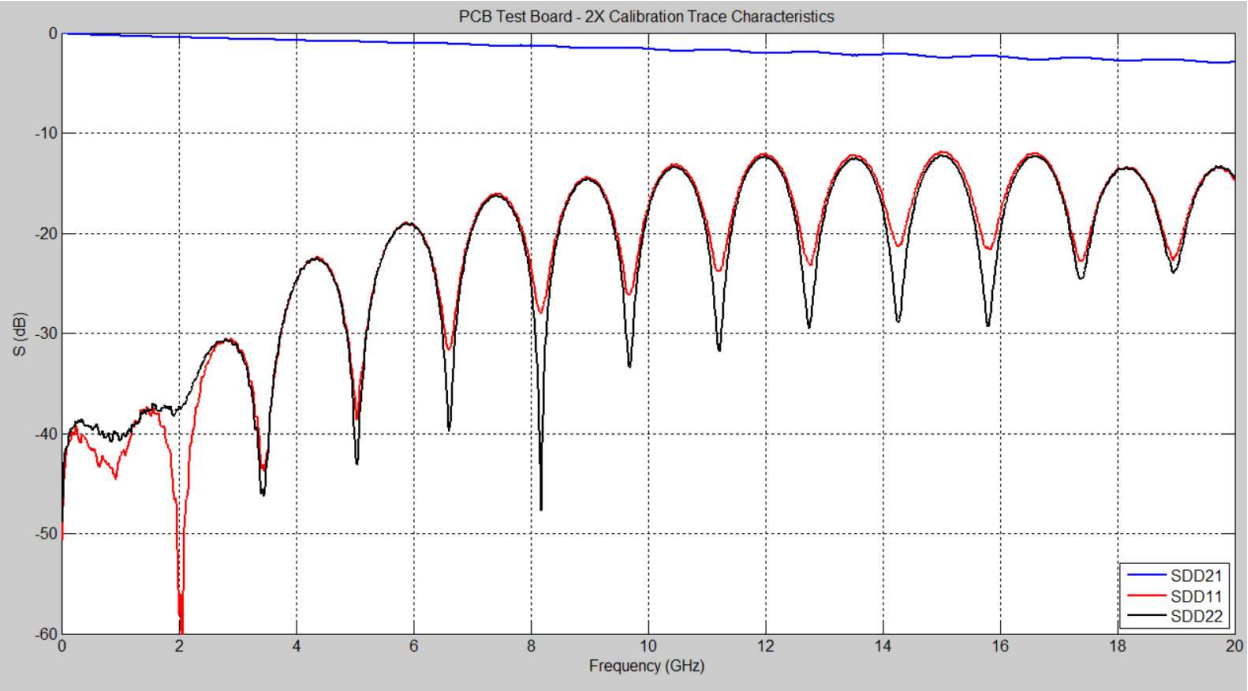

Figure 10: 2X Calibration PCB Trace - SI Performance

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