GT-22-112

Glenair High-Speed Micro-D

High Speed Characterization Report for Ethernet Applications

Revision History

Rev	Date	Approved	Description
1	8/14/2024	L. Blackwell	Initial Release

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1. Introduction

This document contains results from testing that was performed to evaluate the high-frequency electrical performance of the Glenair High-Speed Micro-D (GHSM) with respect to Ethernet applications. This report outlines frequency domain performance metrics such as insertion loss (IL) and return loss (RL) as well as the time-domain performance metric of impedance.

2. Product Overview

High-speed datalink applications such as aircraft avionics and other high data rate and bandwidth equipment require both optimized data transmission performance as well as robust mechanical and EMC performance. Micro-D connector packaging with high-retention-force TwistPin contacts has a proven track record in standard signal and power applications. The Glenair High-Speed Micro-D (GHSM) brings high-speed datalink performance to these mission-critical platforms. The GHSM is a 1 Amp pre-wired cable and PCB solution with 10+ Gb/s. performance per differential pair. Auxiliary EMC ground springs on plug and integral contact separation architecture ensures data integrity and low attenuation performance.

3. Test Setup

This section details the test assemblies, test PCBs and equipment used to perform the high-speed characterization. All measurements were taken using a Tektronix DSA8300 Digital Serial Analyzer and a Keysight N5227B PNA network analyzer which were connected to coaxial-launch test fixture PCBs designed specifically for this testing.

3.1.Test Fixtures

3.1.1. Test Assemblies

Test fixture PCB sets utilizing surface-mount coax connectors were designed for the high-speed tests. Each set consisted of two GHSM to coax boards and a calibration board. One test set used straight PC tail GHSM-BSS series PCB-mount connectors, part numbers GHSM2R-15SBSSPU and GHSM2R-15PBSSLU. The other set used right-angle PC tail GHSM-HBR series PCB-mount connectors, part numbers GHSM2R-15PHBRLT-.110 and GHSM2R-15SHBRPT-.110. Photographs of the test boards are seen in the following two figures.

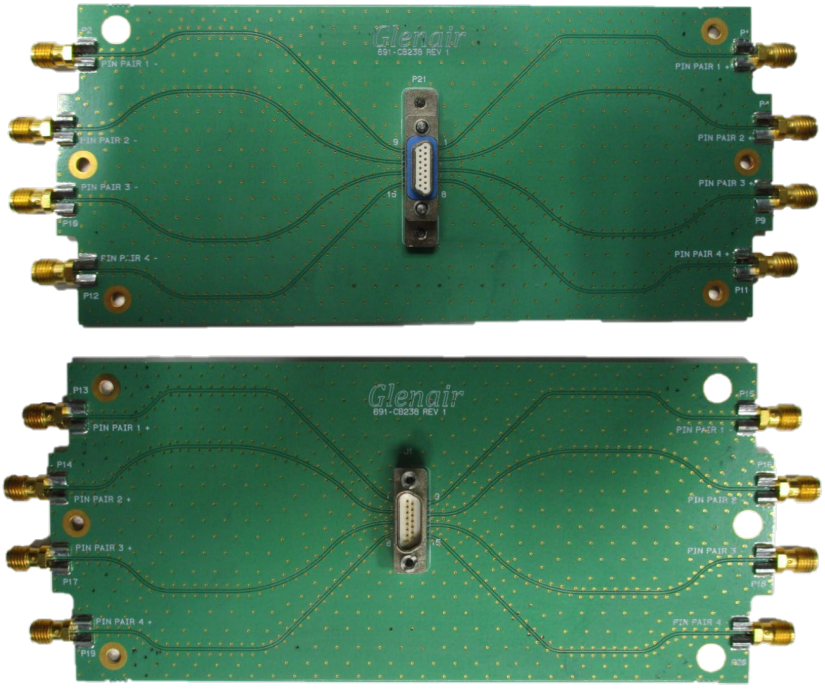

Figure 1. Straight PC Tail GHSM-BSS Pin and Socket Test PCB's

Figure 2. Right Angle PC Tail GHSM-HBR Pin and Socket Test PCB's

The board sets were manufactured as a single panel and separated into individual test boards to give consistent signal characteristics.

Cable assembly GHS7M-1005-6 was added between test PCBs to measure results including cable assembly. See Figure 3 below. Test results for this assembly are in Sections 6 and 7.

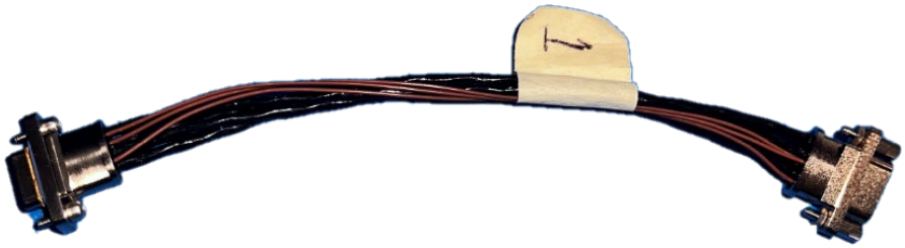

Figure 3. Cable assembly GHS7M-1005-6

The final test piece consisted of cable assemblies GHSM2R-15EP-A-6 and GHSM2R-15ES-A-6 along with test interface PCB's. The test interface PCB's and lead-in cables were de-embedded to provide mated connector results only. See Figure 4 below. Test results for this assembly are in Section 8.

Figure 4. Wired Connector GHSM (15E) Mated Pair

3.2.Test Pairs

Figure 5 shows the test pair arrangement.

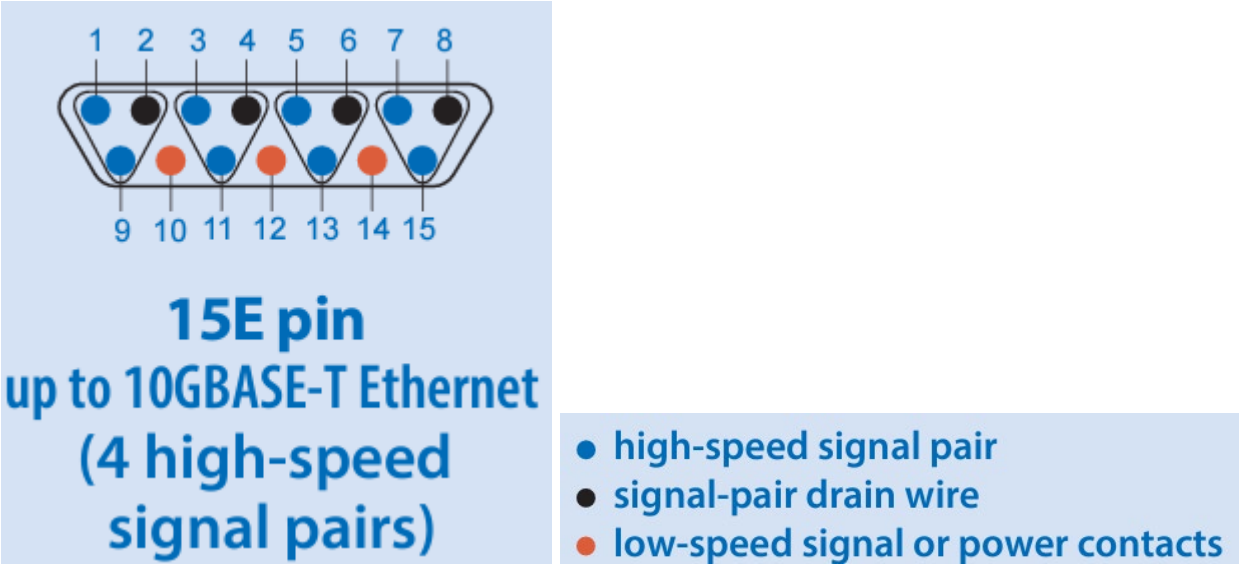

Figure 5. GHSM (15E) Pinout for Ethernet Signaling

4. Performance of Straight PC Tail GHSM-BSS Mated Pair

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

4.1.Frequency Domain Analysis

4.1.1. Insertion Loss – GHSM-BSS Mated Pair

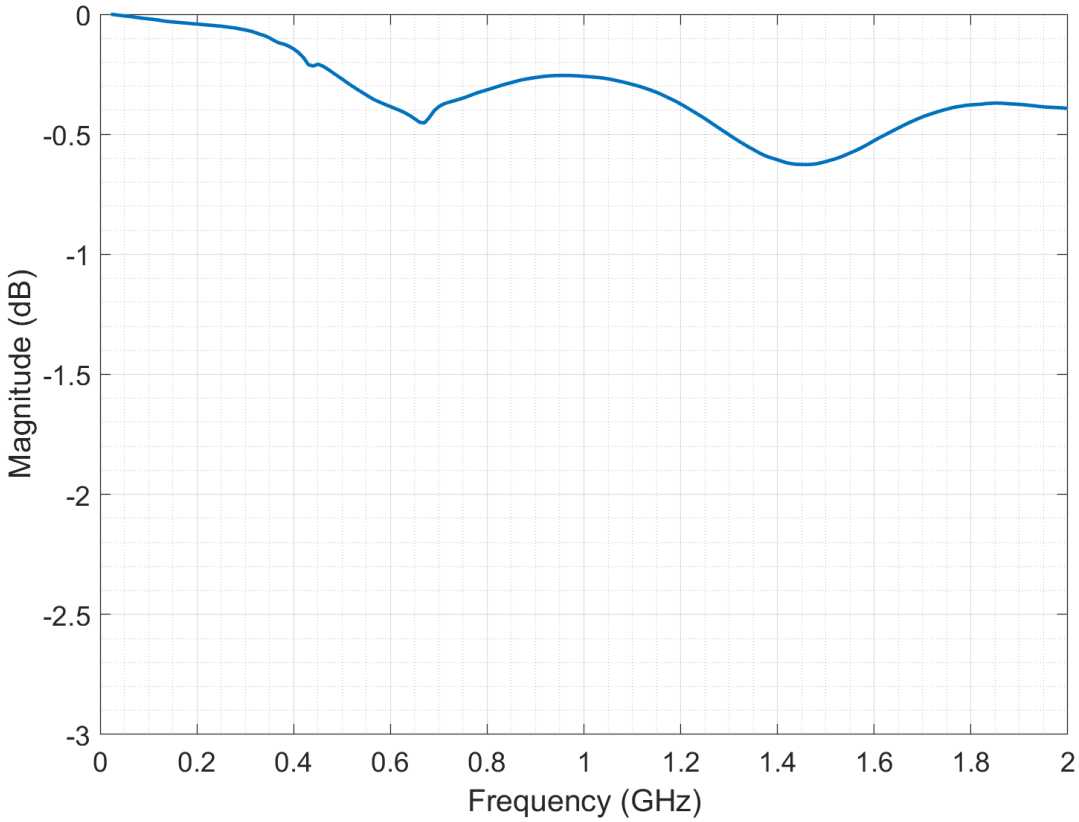

Figure 6. Insertion Loss – GHSM-BSS Mated Pair

4.1.2. Return Loss - GHSM-BSS Mated Pair

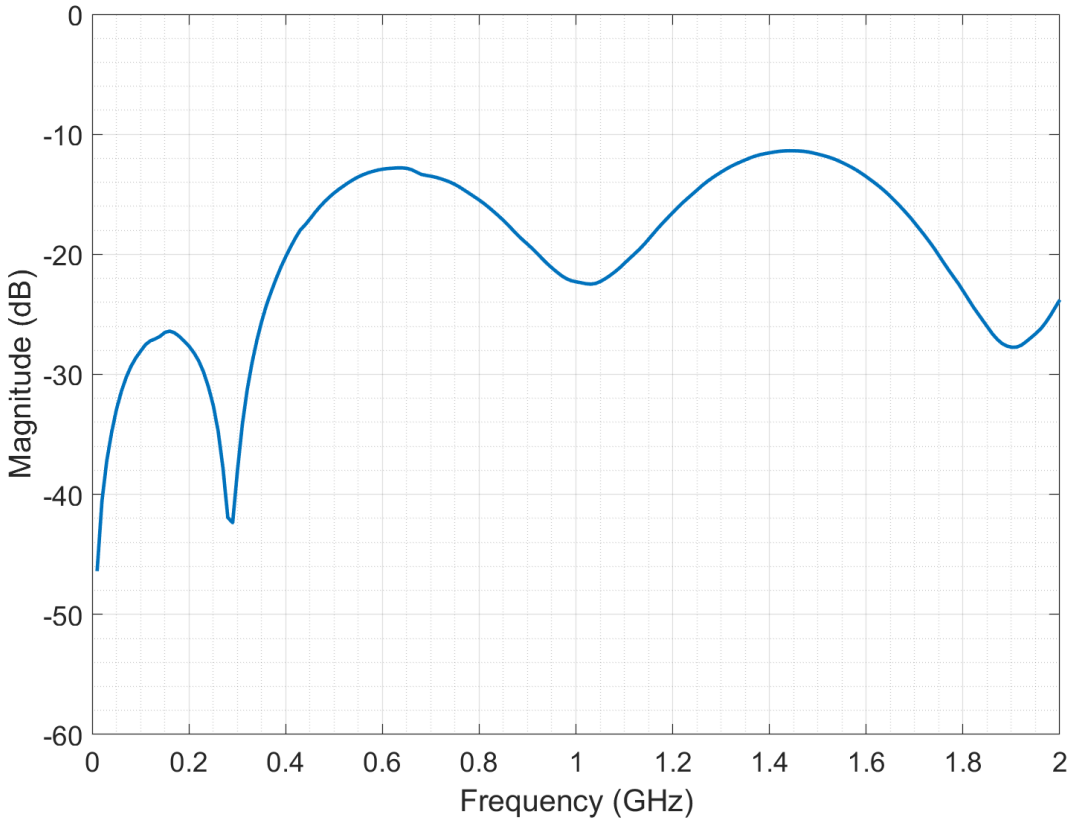

Figure 7. Return Loss – GHSM-BSS Mated Pair

4.1.3. NEXT - GHSM-BSS Mated Pair

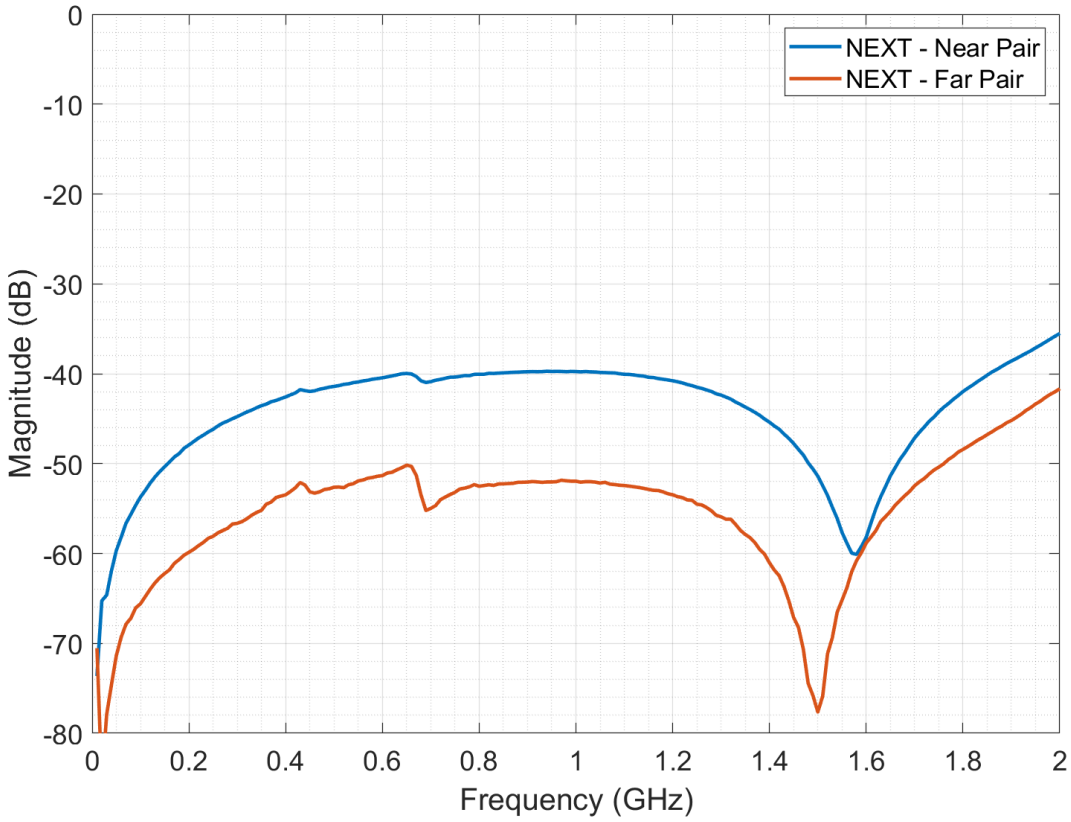

Figure 8. NEXT – GHSM-BSS Mated Pair

4.1.4. FEXT - GHSM-BSS Mated Pair

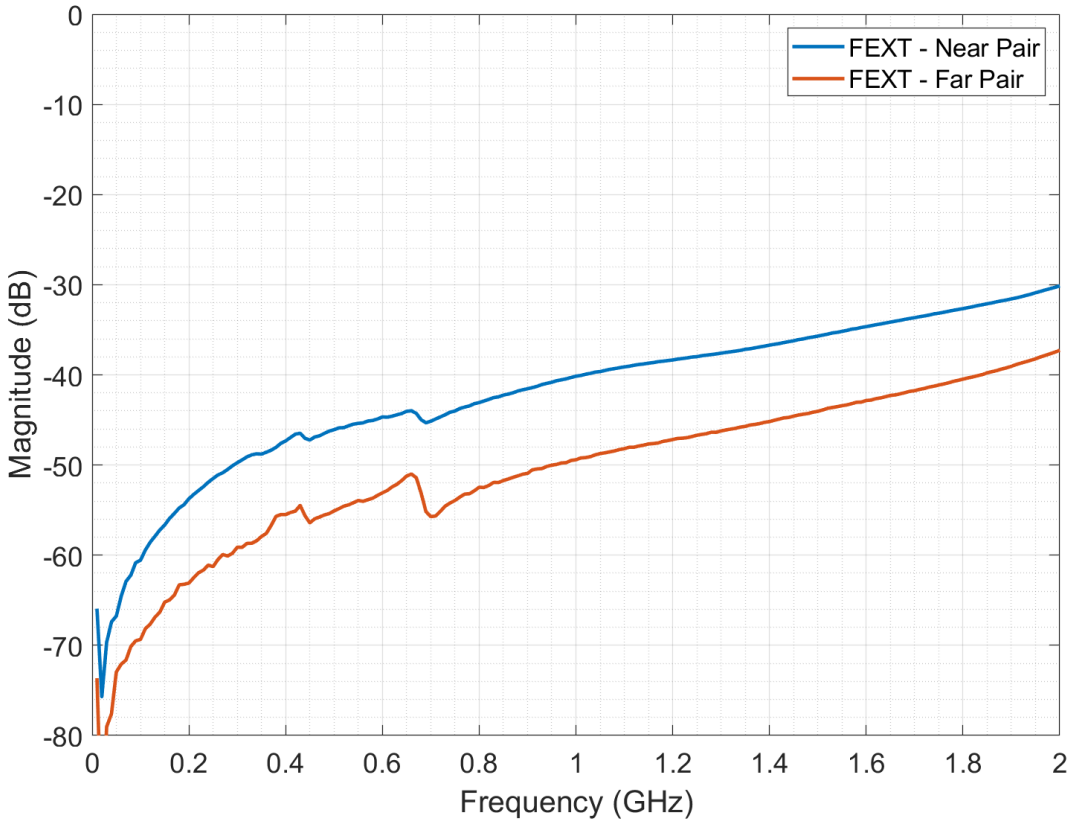

Figure 9. FEXT – GHSM-BSS Mated Pair

4.2.Time Domain Analysis - GHSM-BSS Mated Pair

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100ps, and 200ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r.

t_r (ps)	BW(GHz)
100	3.5
200	1.75

Table 1. Bandwidth to Rise Time Relationship

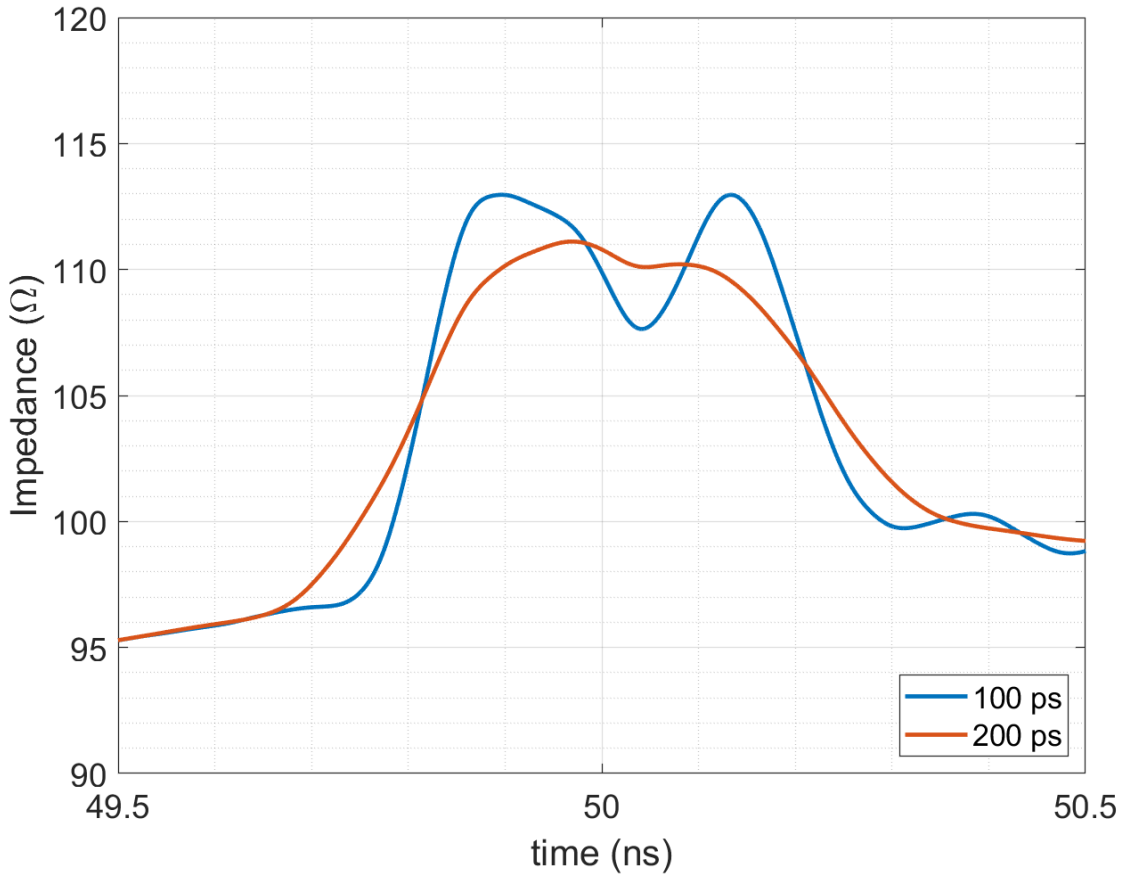

Figure 10. TDR – GHSM-BSS Mated Pair

5. Performance of Right-Angle PC Tail GHSM-HBR Mated Pair

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

5.1.Frequency Domain Analysis

5.1.1. Insertion Loss – GHSM-HBR Mated Pair

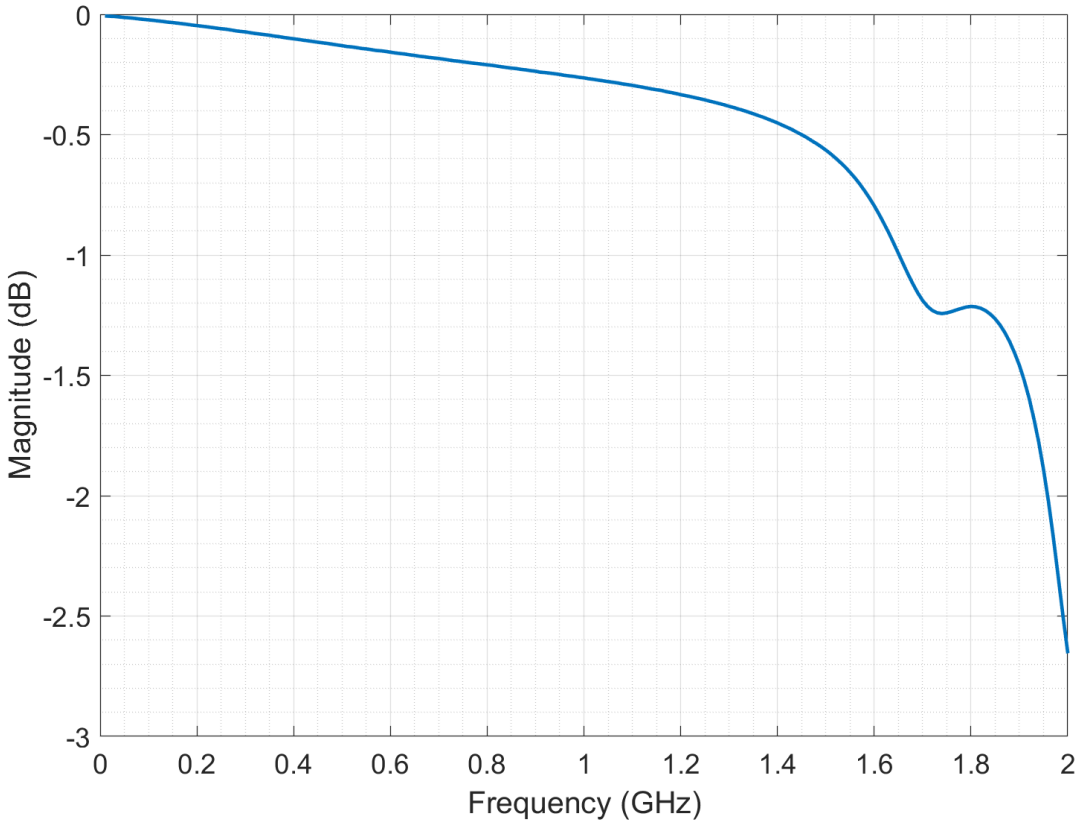

Figure 11. Insertion Loss – GHSM-HBR Mated Pair

5.1.2. Return Loss – GHSM-HBR Mated Pair

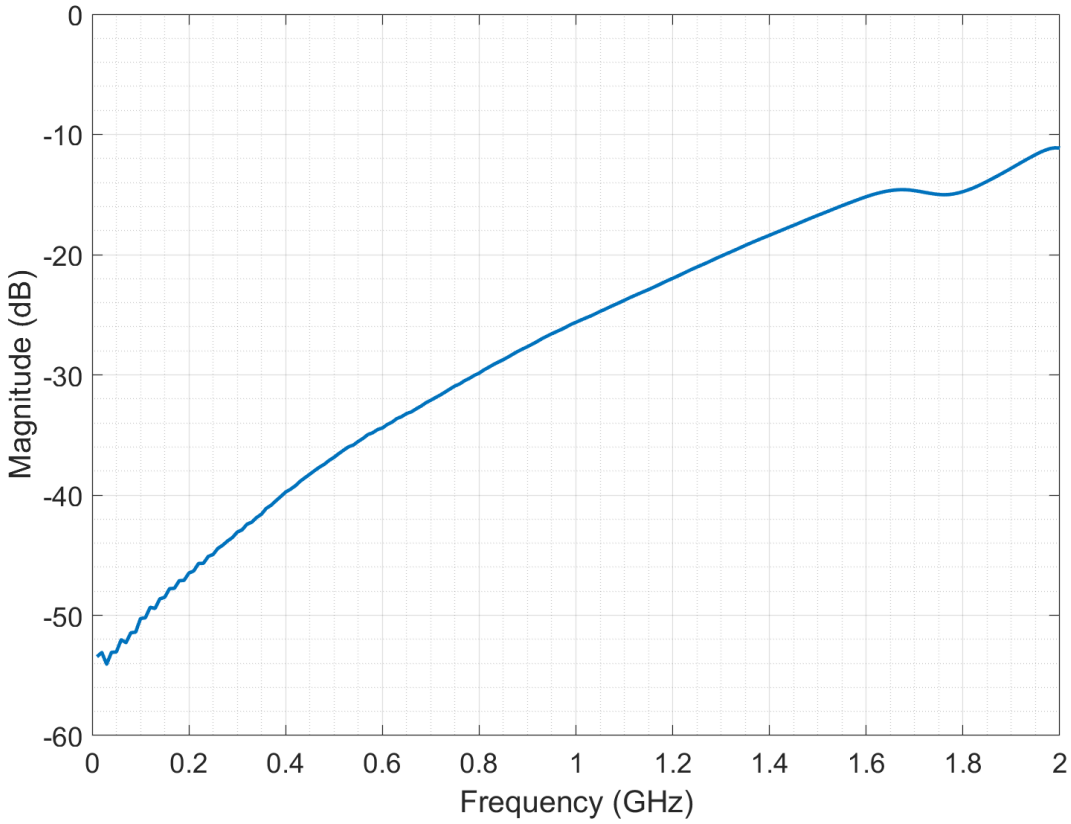

Figure 12. Return Loss – GHSM-HBR Mated Pair

5.1.3. NEXT- GHSM-HBR Mated Pair

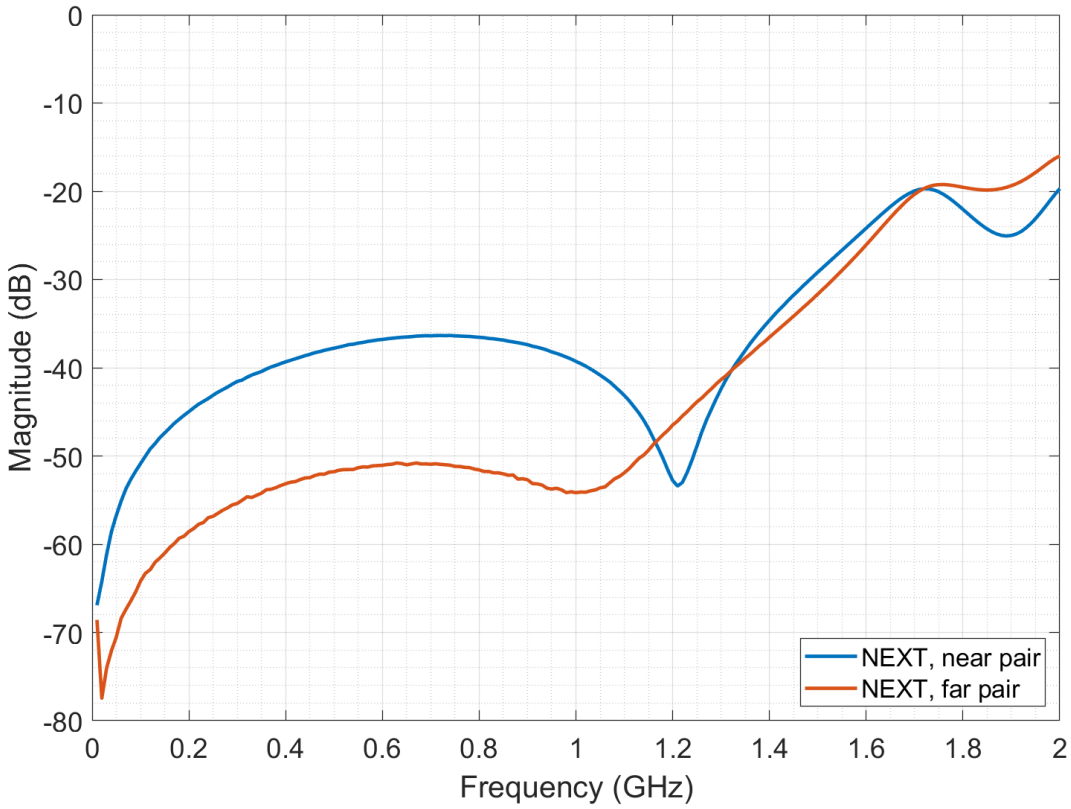

Figure 13. NEXT – GHSM-HBR Mated Pair

5.1.4. FEXT – GHSM-HBR Mated Pair

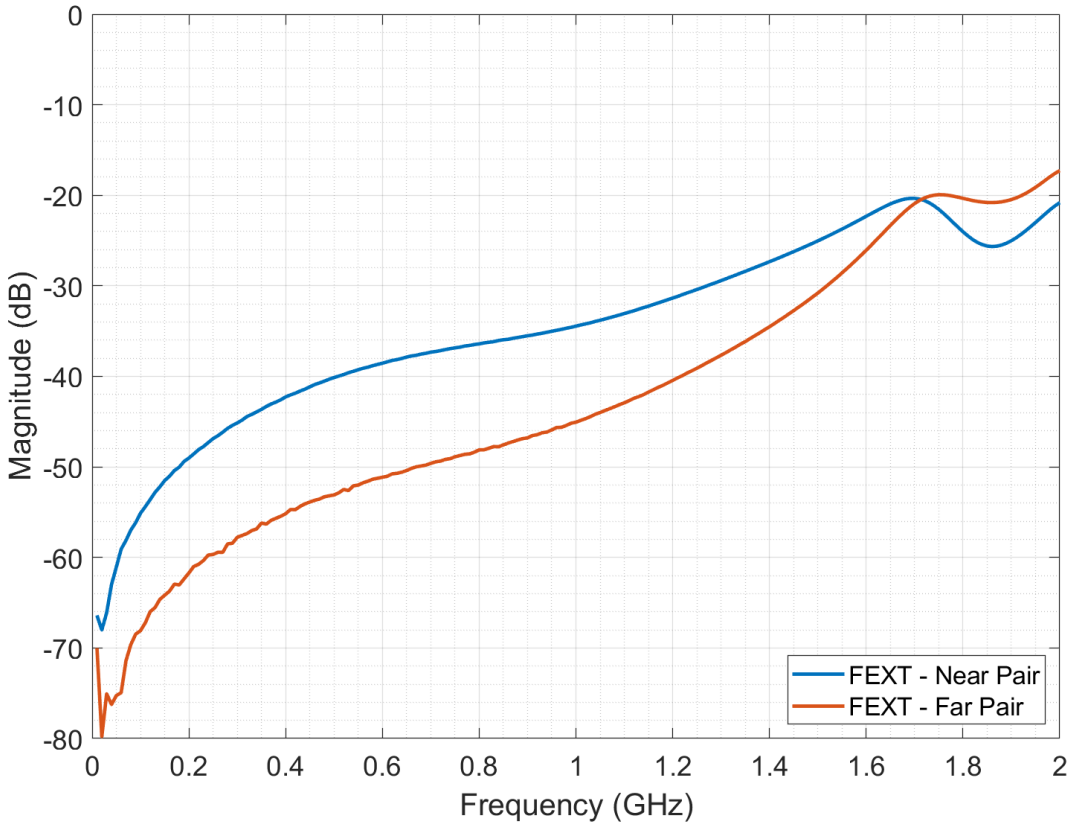

Figure 14. FEXT – GHSM-HBR Mated Pair

5.2.Time Domain Analysis – GHSM-HBR Mated Pair

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r.

t_r (ps)	BW(GHz)
100	3.5
200	1.75

Table 1. Bandwidth to Rise Time Relationship

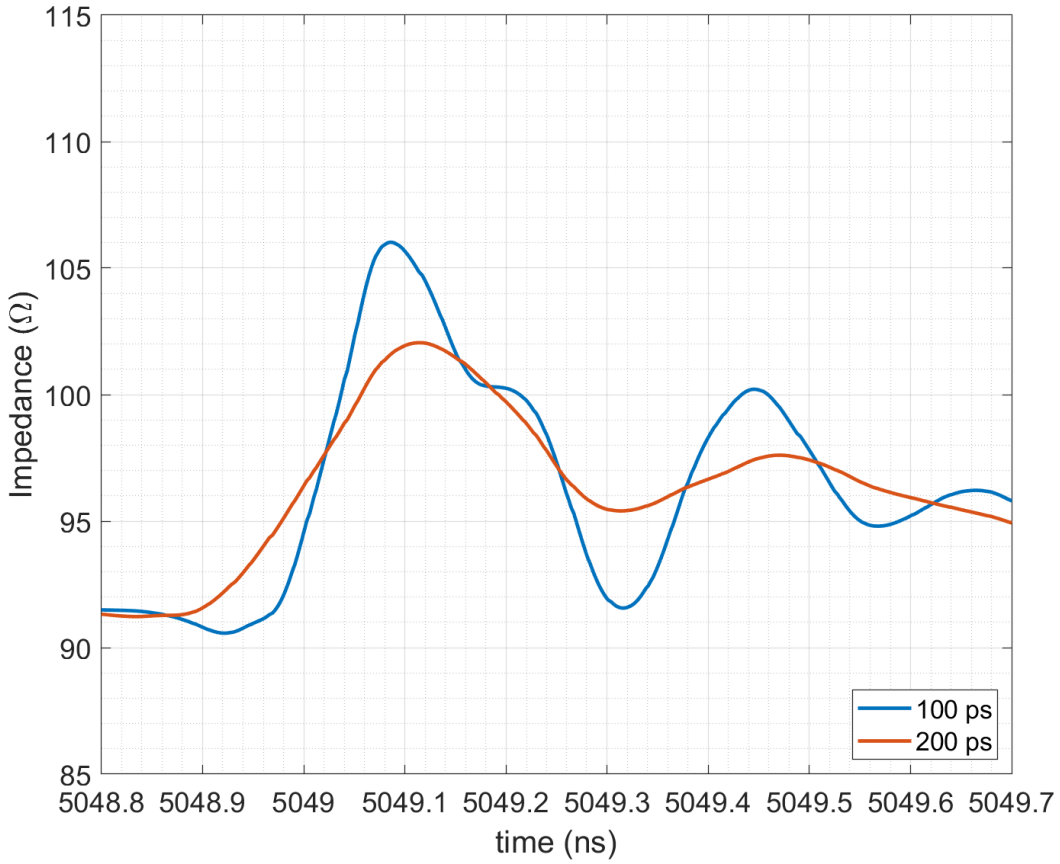

Figure 15. TDR – GHSM-HBR Mated Pair

6. Performance of Wired Connector GHS7M-1005-6 Mated With Straight PC Tail GHSM-BSS

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

6.1.Frequency Domain Analysis

6.1.1. Insertion Loss – GHS7M-1005-6 Mated With GHSM-BSS

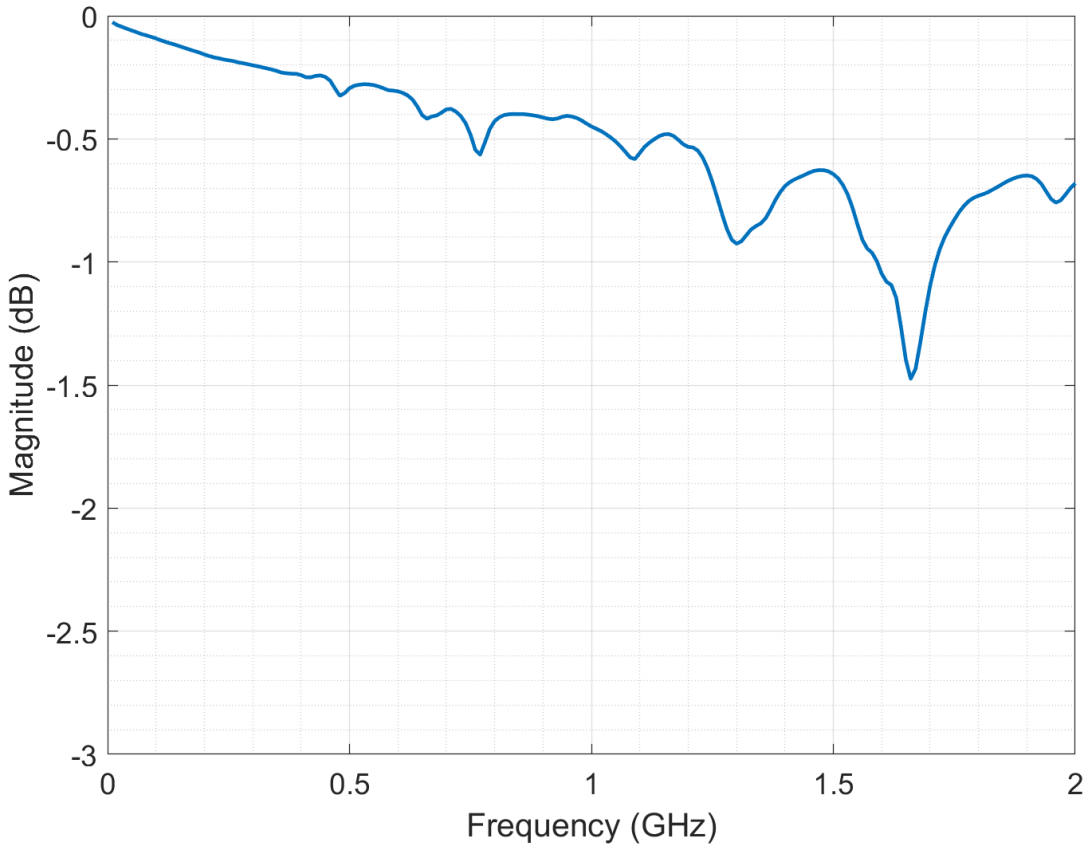

Figure 16. Insertion Loss – GHS7M-1005-6 Mated With GHSM-BSS

6.1.2. Return Loss - GHS7M-1005-6 Mated With GHSM-BSS

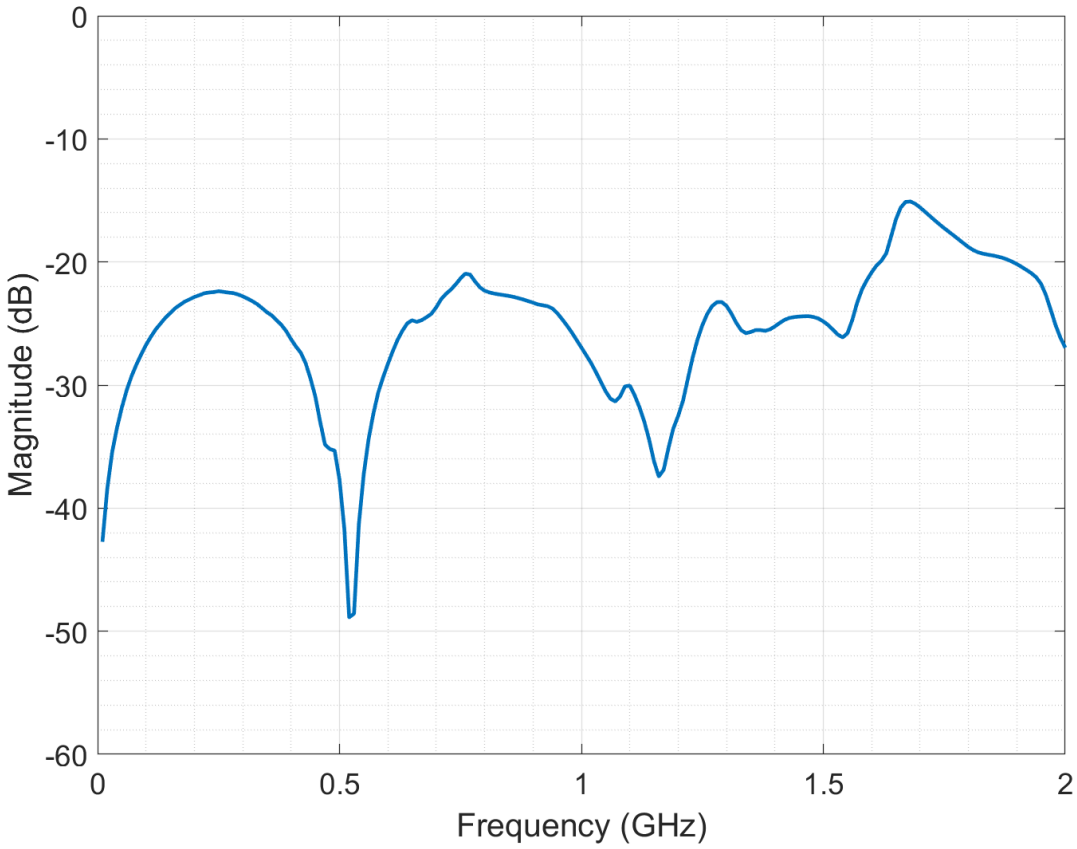

Figure 17. Return Loss – GHS7M-1005-6 Mated With GHSM-BSS

6.1.3. NEXT – GHS7M-1005-6 Mated With GHSM-BSS

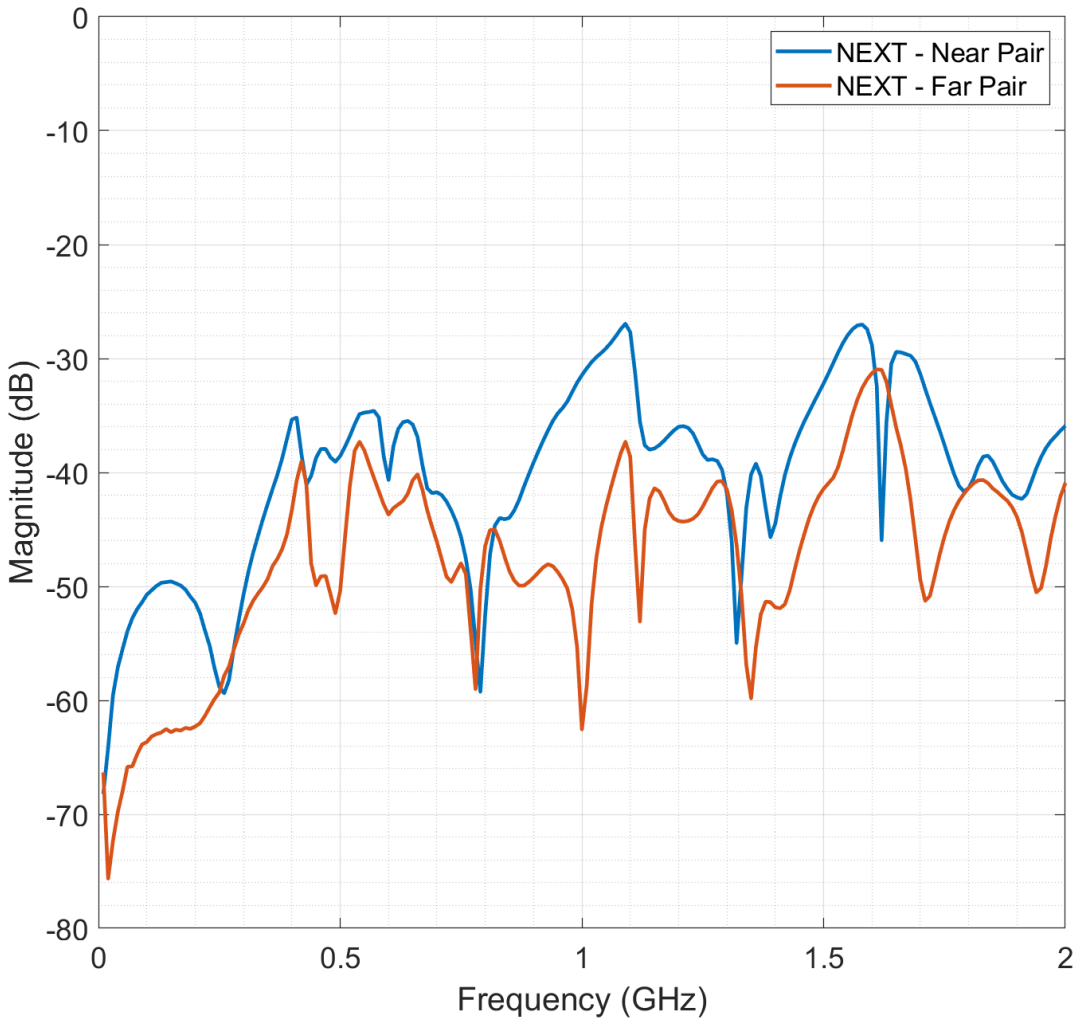

Figure 18. NEXT – GHS7M-1005-6 Mated With GHSM-BSS

6.1.4. FEXT – GHS7M-1005-6 Mated With GHSM-BSS

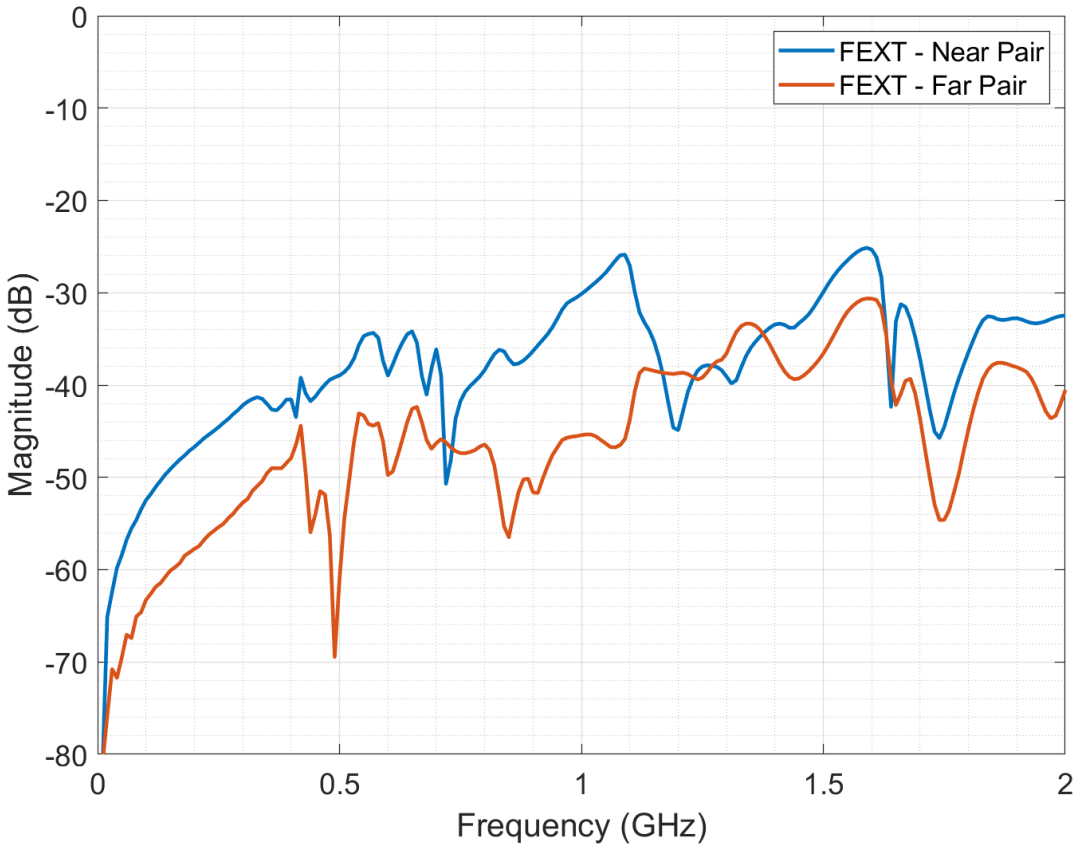

Figure 19. FEXT – GHS7M-1005-6 Mated With GHSM-BSS

6.2.Time Domain Analysis – GHS7M-1005-6 Mated With GHSM-BSS

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r.

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Table 1. Bandwidth to Rise Time Relationship

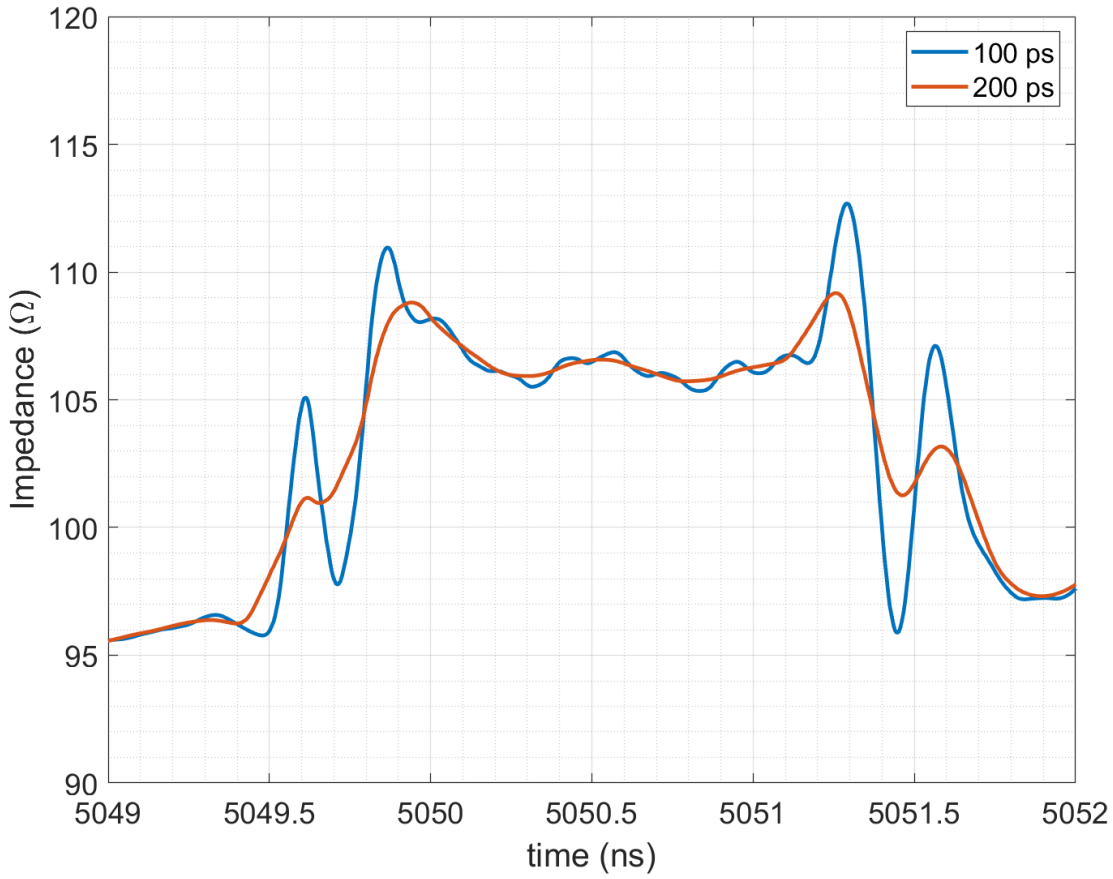

Figure 20. TDR – GHS7M-1005-6 Mated With GHSM-BSS

7. Performance of Wired Connector GHS7M-1005-6 Mated With Right Angle PC Tail GHSM-HBR

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

7.1.Frequency Domain Analysis

7.1.1. Insertion Loss – GHS7M-1005-6 Mated With GHSM-HBR

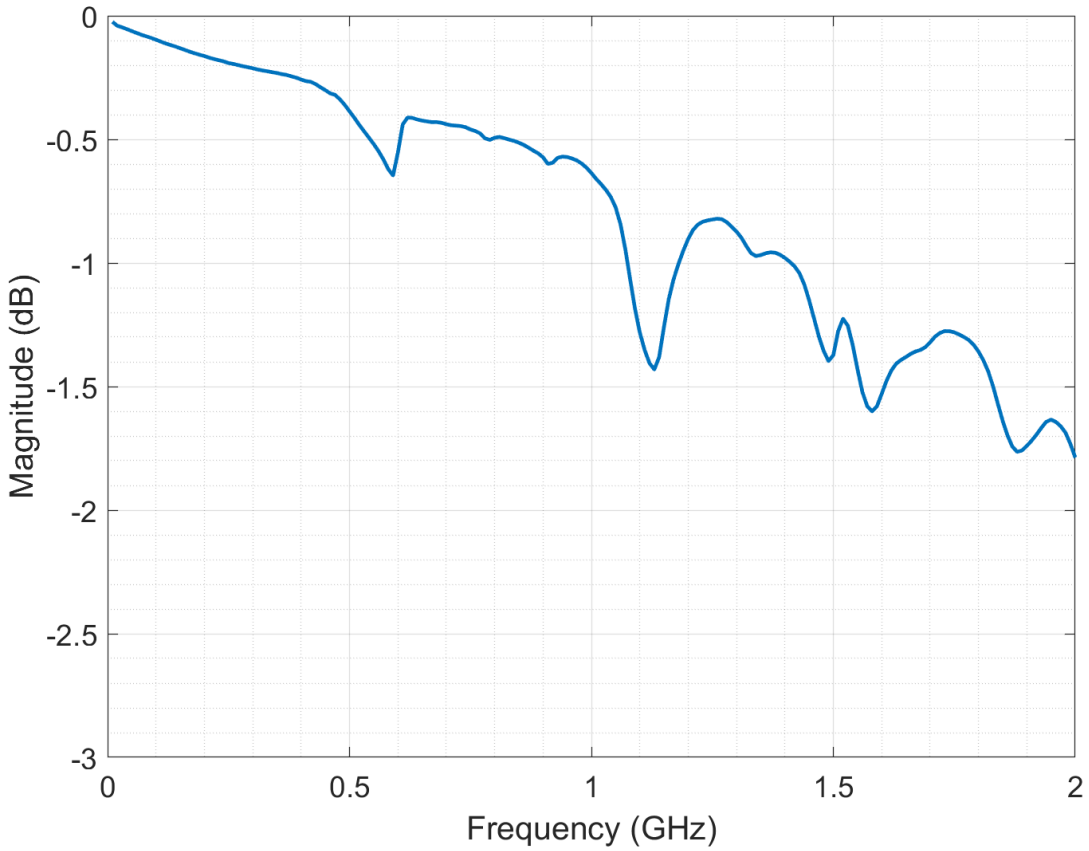

Figure 21. Insertion Loss – GHS7M-1005-6 Mated With GHSM-HBR

7.1.2. Return Loss – GHS7M-1005-6 Mated With GHSM-HBR

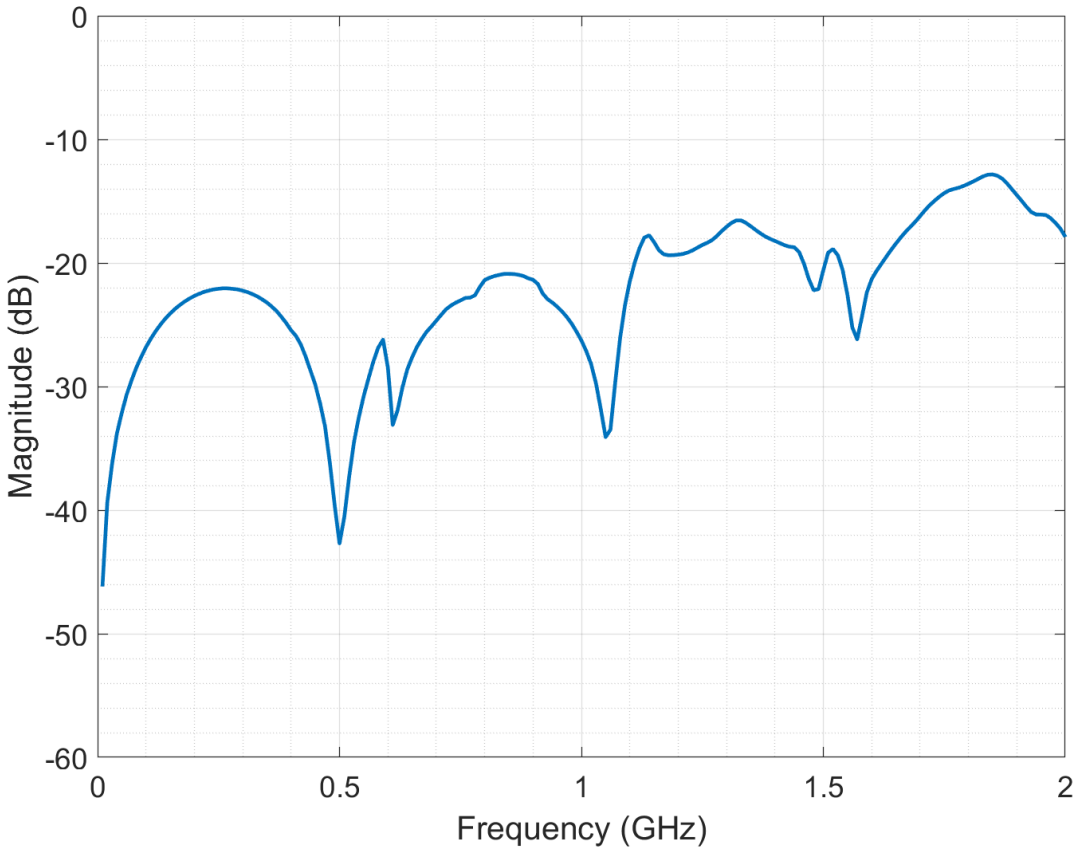

Figure 22. Return Loss– GHS7M-1005-6 Mated With GHSM-HBR

7.1.3. NEXT – GHS7M-1005-6 Mated With GHSM-HBR

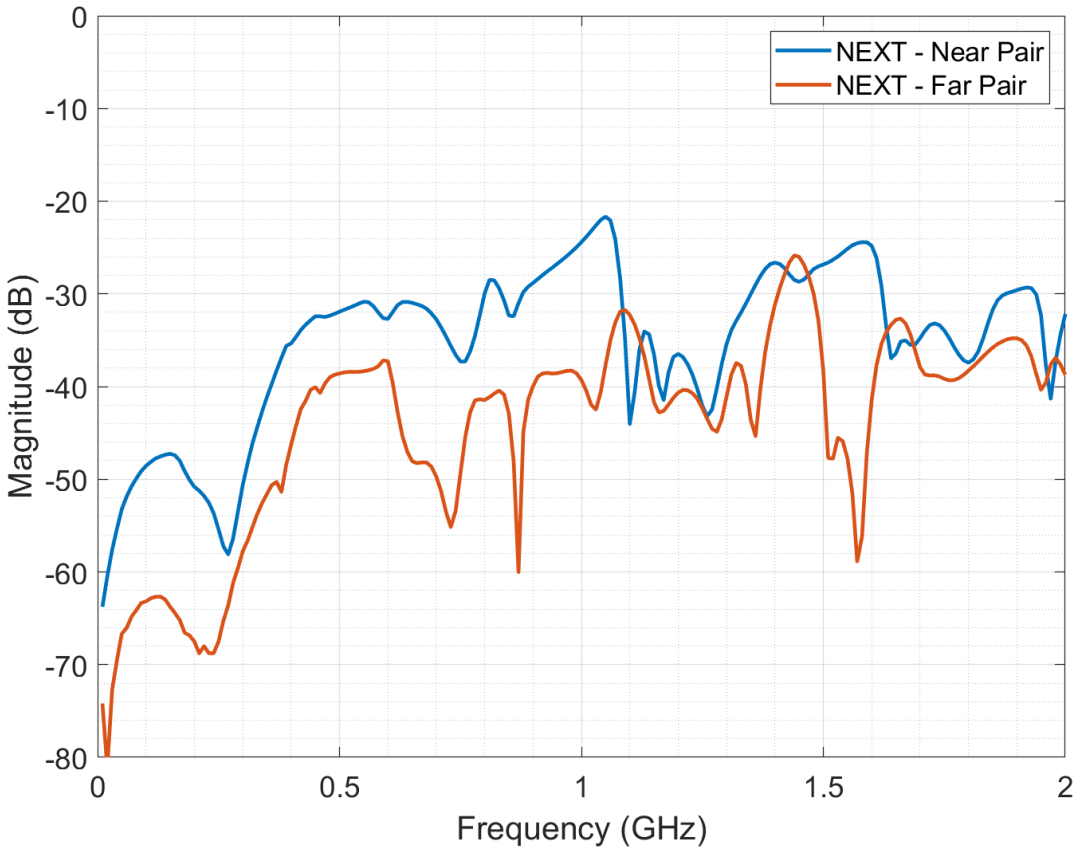

Figure 23. NEXT– GHS7M-1005-6 Mated With GHSM-HBR

7.1.4. FEXT – GHS7M-1005-6 Mated With GHSM-HBR

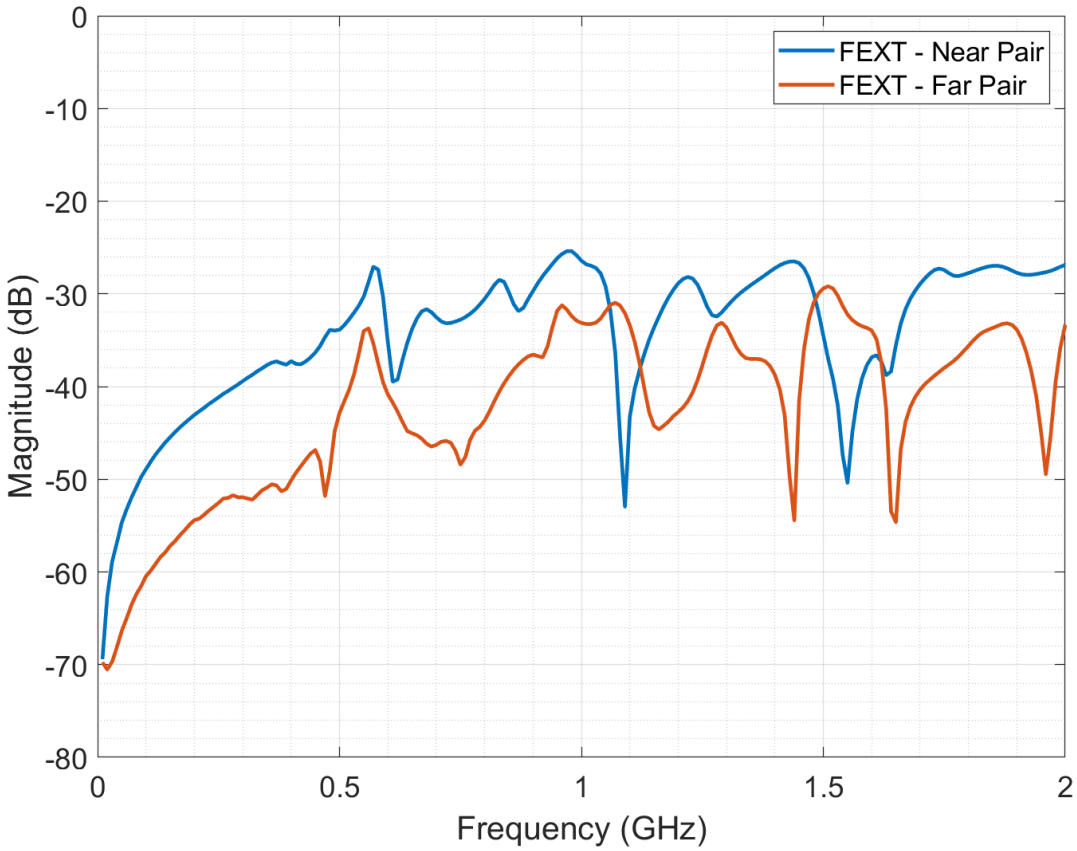

Figure 24. FEXT– GHS7M-1005-6 Mated With GHSM-HBR

7.2.Time Domain Analysis – GHS7M-1005-6 Mated With GHSM-HBR

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100 ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r.

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Table 1. Bandwidth to Rise Time Relationship

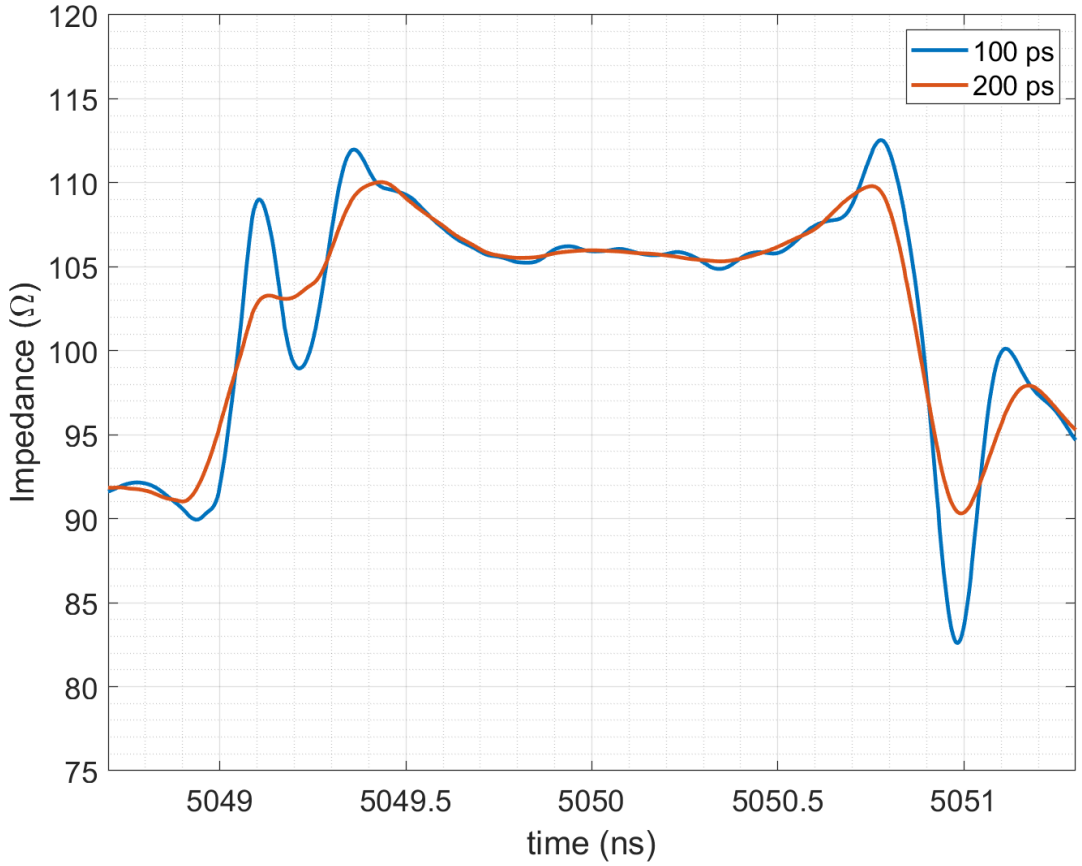

Figure 25. TDR– GHS7M-1005-6 Mated With GHSM-HBR

8. Performance – Wired Connector GHSM (15E) Mated Pair

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the assembly only.

8.1.Frequency Domain Analysis

8.1.1. Insertion Loss – Wired Connector GHSM (15E) Mated Pair

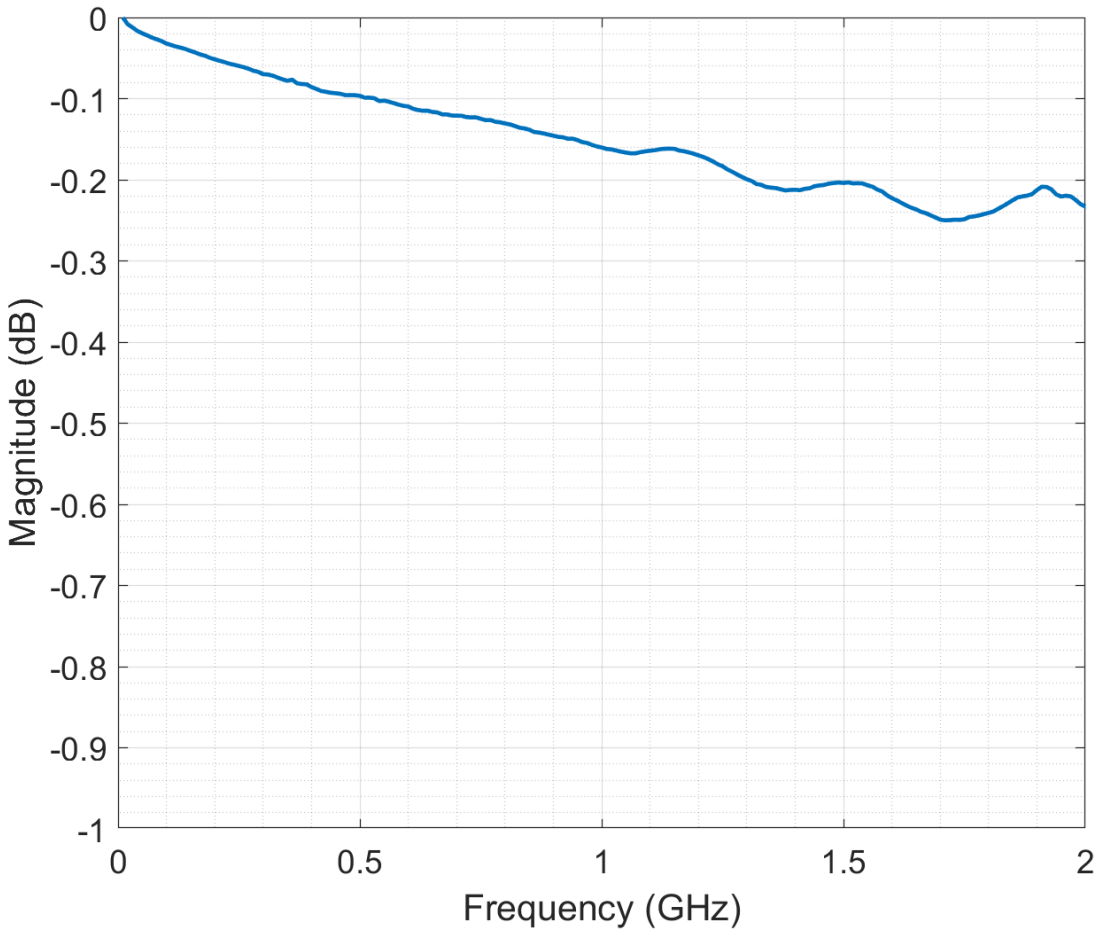

Figure 26. Insertion Loss – Wired Connector GHSM (15E) Mated Pair

8.1.2. Return Loss – Wired Connector GHSM (15E) Mated Pair

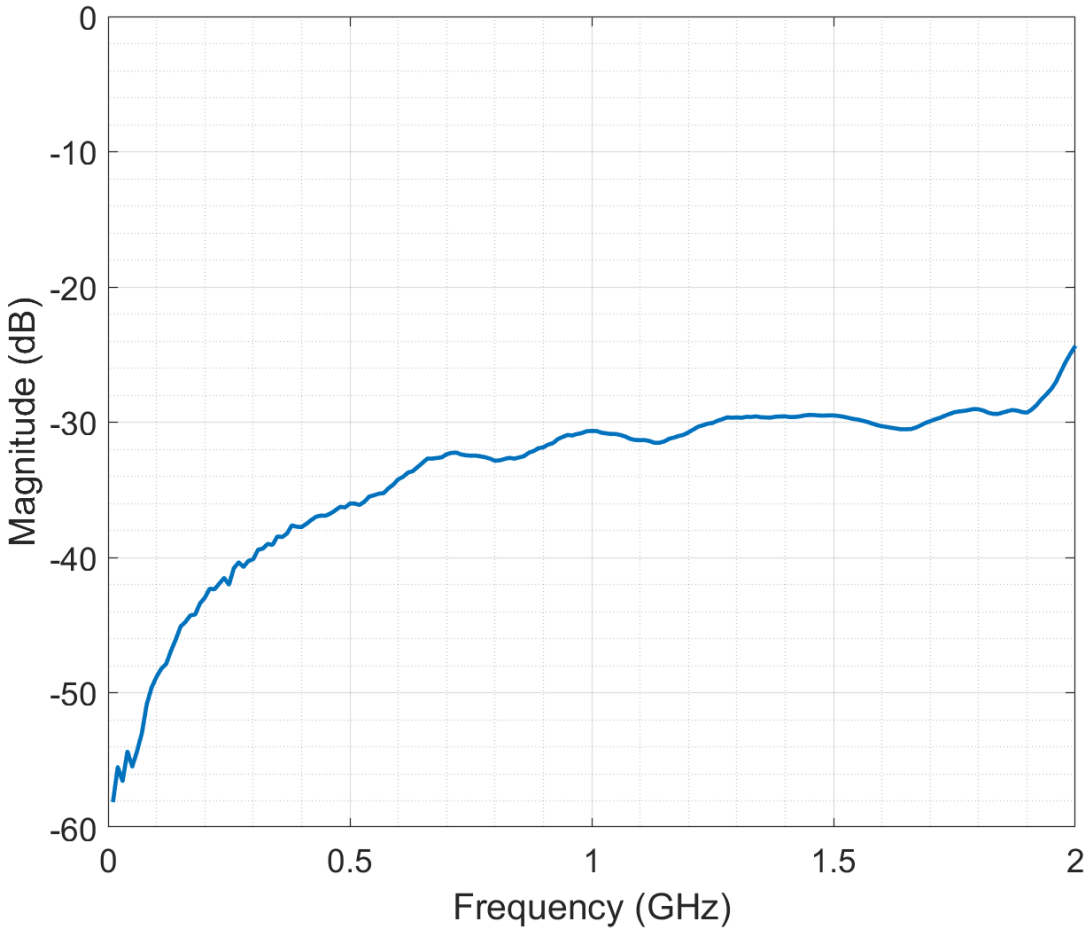

Figure 27. Return Loss – Wired Connector GHSM (15E) Mated Pair

8.1.3. NEXT – Wired Connector GHSM (15E) Mated Pair

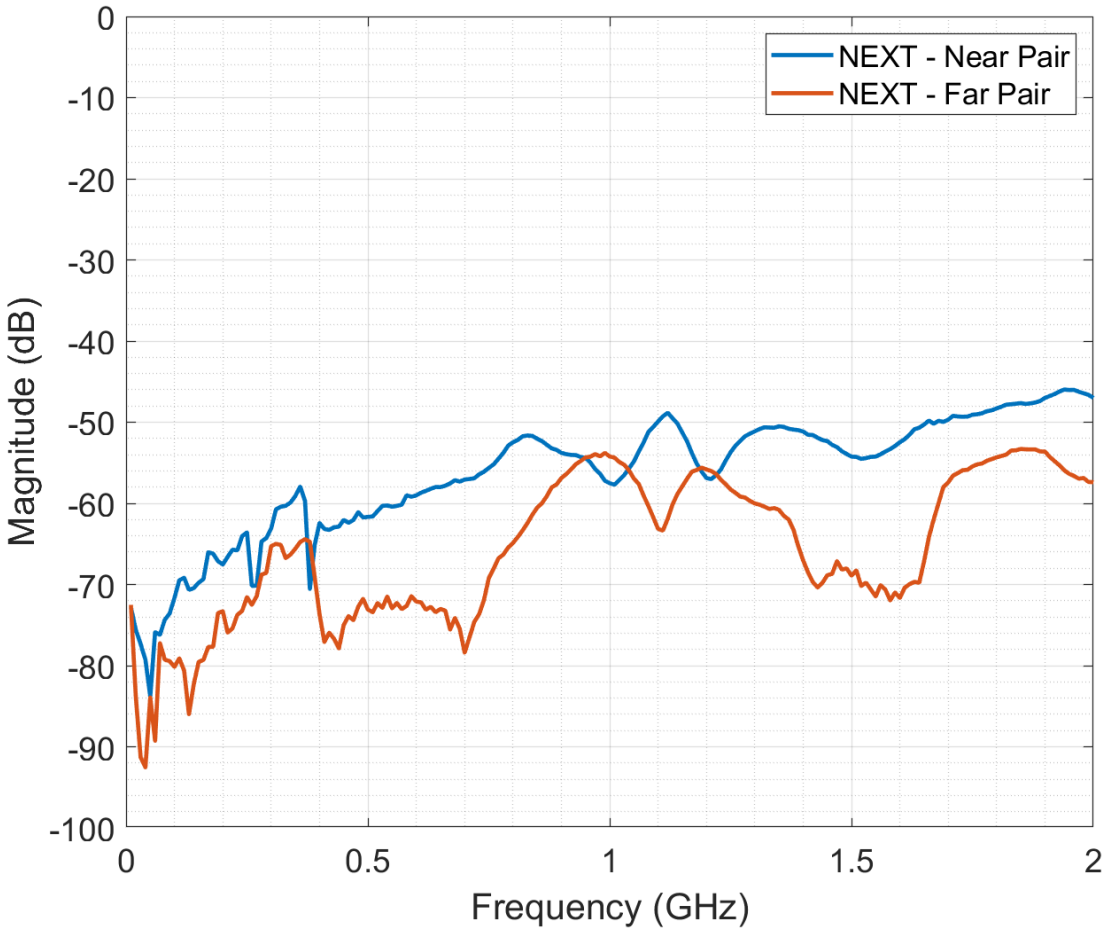

Figure 28. NEXT – Wired Connector GHSM (15E) Mated Pair

8.1.4. FEXT – Wired Connector GHSM (15E) Mated Pair

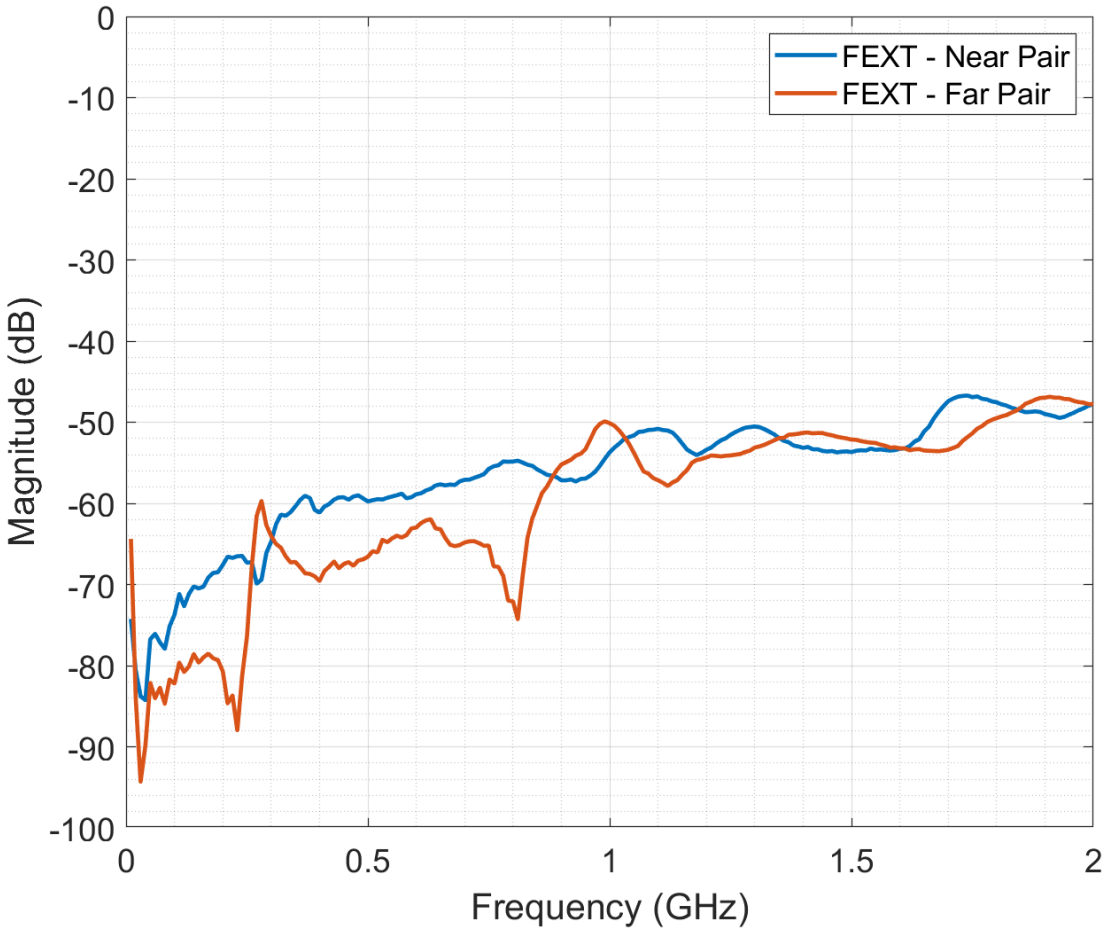

Figure 29. FEXT – Wired Connector GHSM (15E) Mated Pair

8.2.Time Domain Analysis – Wired Connector GHSM (15E) Mated Pair

Time domain data was generated in real time using a Tektronix DSA8300 Digital Serial Analyzer. Graphs for each test cable and pair configuration are shown below for various rise times. Rise time is defined at 10% to 90% of the signal's rising edge. Rise times of 100ps and 200 ps were used. The following table shows the relative bandwidth, BW, for a given TDR test step rise time, t_r.

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Table 1. Bandwidth to Rise Time Relationship

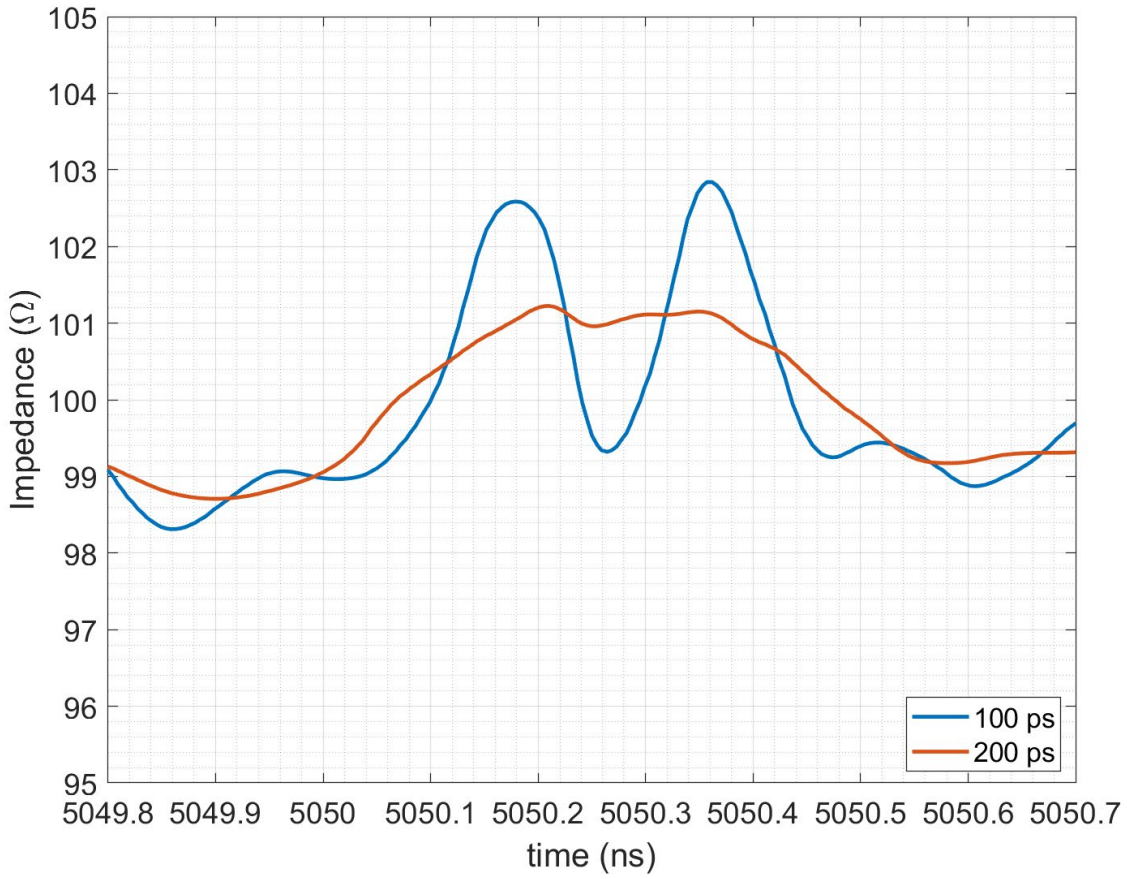

Figure 30. TDR – Wired Connector GHSM (15E) Mated Pair

9. 2x-Thru Fixture Performance

This section includes both frequency and time domain results of the 2x-thru PCBs used to extract the GHSM electrical characteristics from the overall measured DUT/fixturing data.

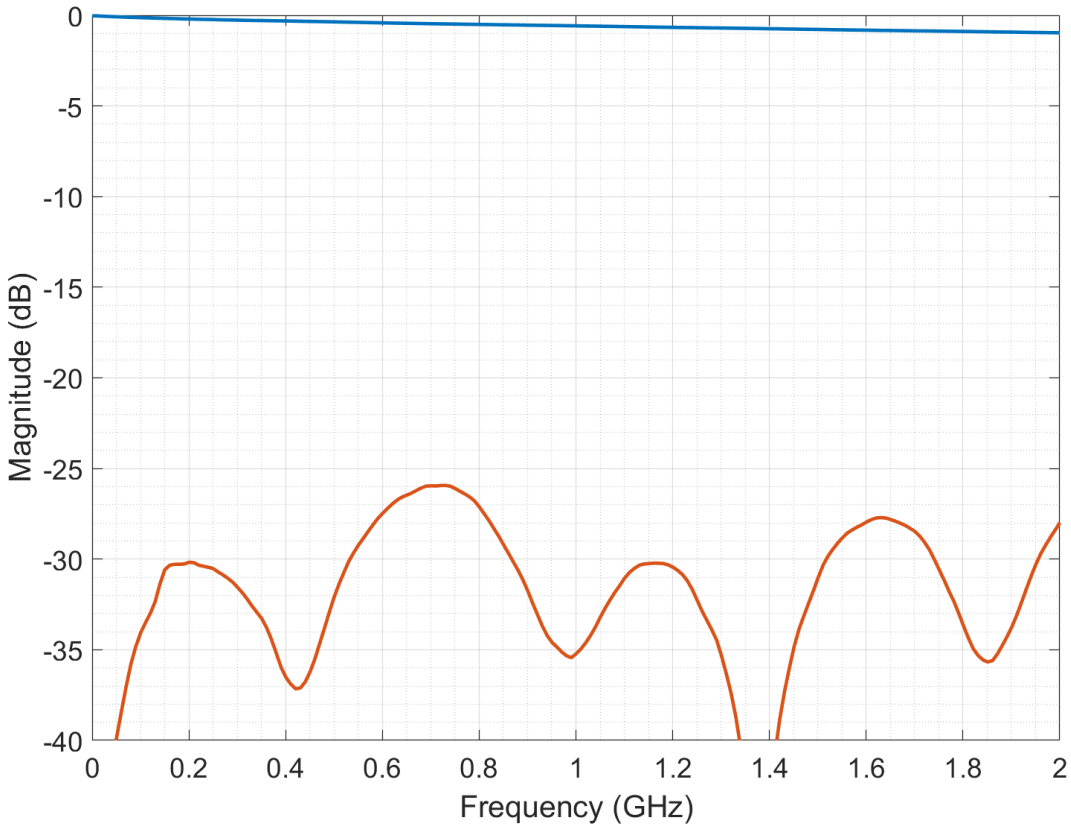

Figure 31. 2x-Thru PCB Response – GHSM-BSS Mated Pair

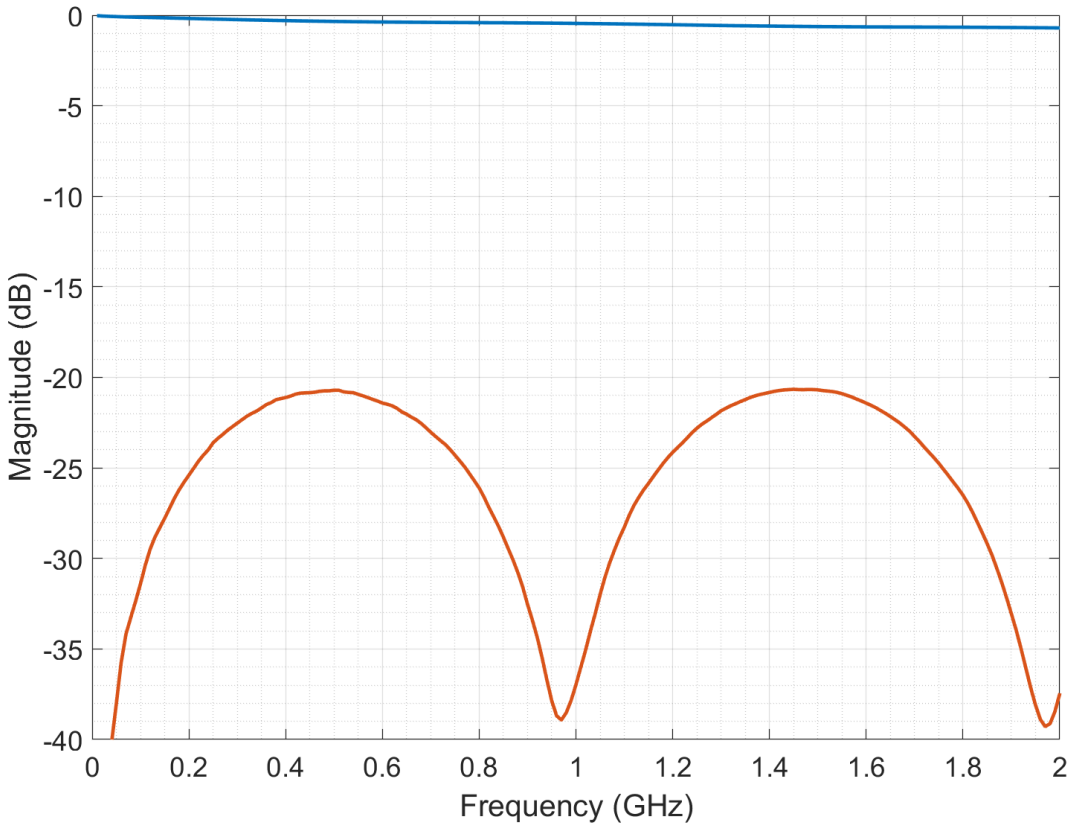

Figure 32. 2x-Thru PCB Response – GHSM-HBR Mated Pair

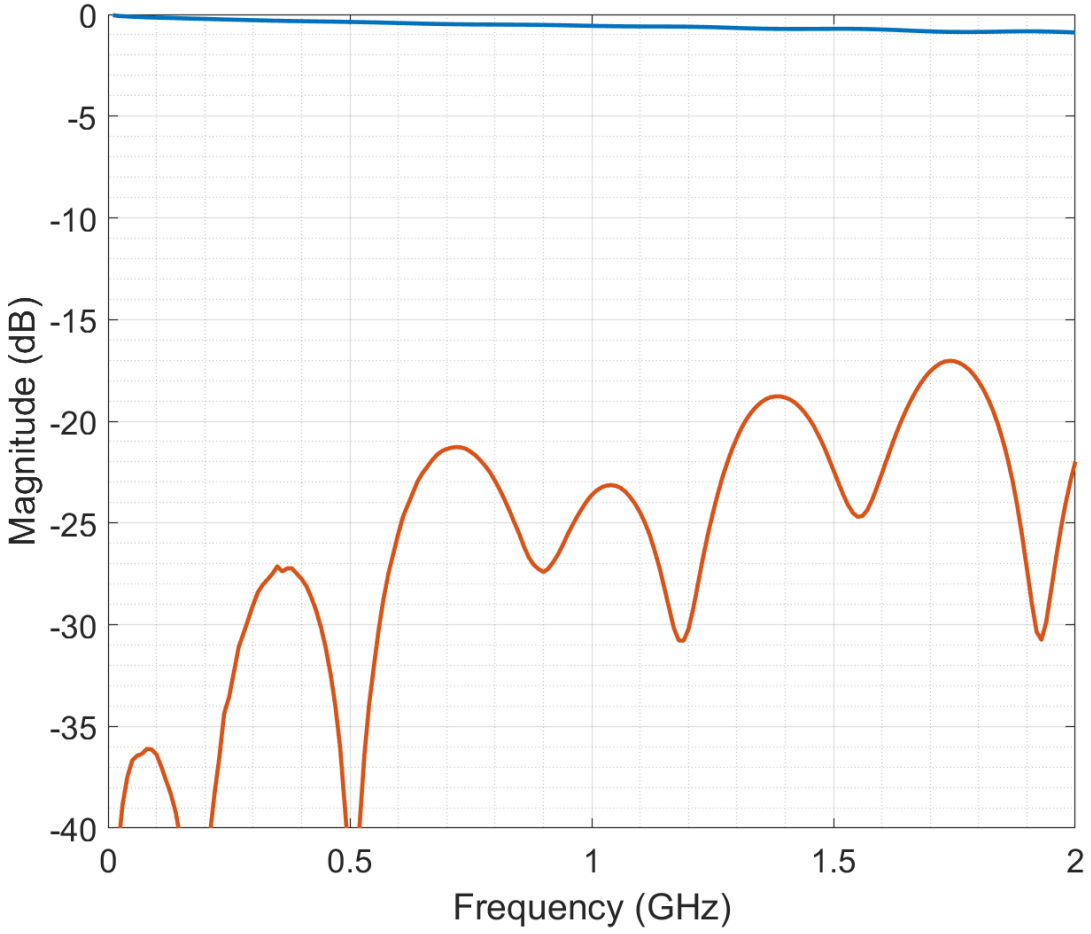

Figure 33. 2x-Thru Response – GHSM (15E) Mated Pair