



GT-22-246

Glenair High-Speed Micro-D (GHSM) High Speed Characterization Report for Differential Applications

Revision History

Rev	Date	Approved	Description
1	8/28/2023	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). 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 datarate 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 up to 15 Gbps 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 PCBs

A test fixture PCB set utilizing edge-launch SMA connectors was designed for the high-speed tests. Each set consisted of two GHSM to SMA boards and a calibration board. One test set used straight GHSM (BSS) PCB-mount connectors, part numbers GHSM2R-15SBSSPU and GHSM2R-15PBSSLU. The other set used right-angle GHSM (HBR) PCB-mount connectors, part numbers GHSM2R-15PHBRLT-.110 and GHSM2R-15SHBRPT-.080. Photographs of the test boards are seen in the following two figures.

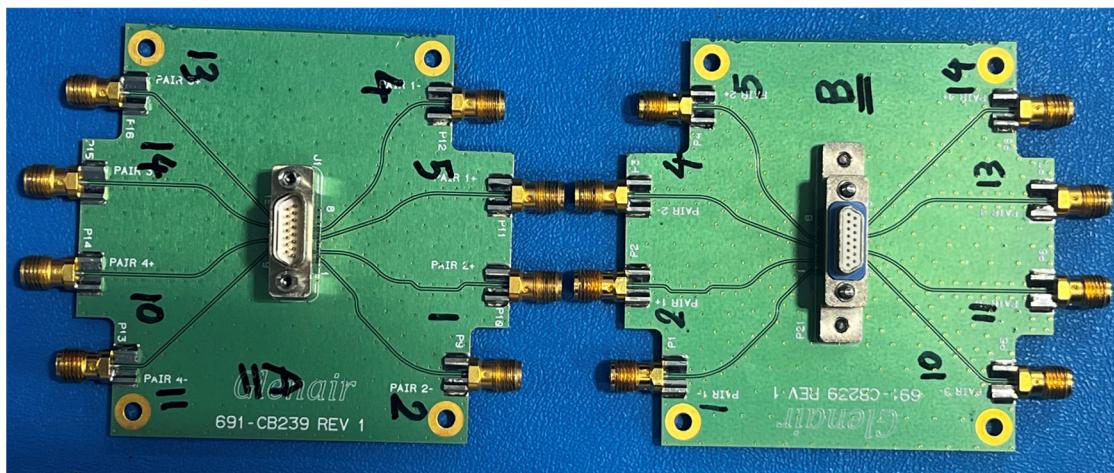


Figure 1. Straight GHSM (BSS) Test PCB Set



Figure 2. Right-Angle GHSM (HBR) Test PCB Set

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

3.2.Test Cable Assembly

In addition to board-to-board testing, cable assembly testing was performed using a GHS7M-1011-1-6 test sample. This sample can be seen in the figure below.



Figure 3. Cable Assembly Test Sample

3.3.Test Pairs

The darkened contacts shown in the figure below denotes differential test pairs. The crossed contacts denote the signal return contacts.

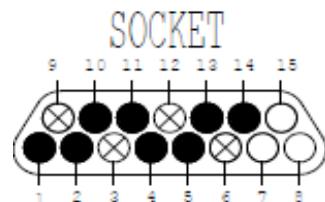


Figure 4. GHSM Test Pairs

Board-to-Board Results

4. Board to Board Testing

4.1.Straight GHSM (BSS) Performance

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.

4.1.1. Insertion Loss / Return Loss

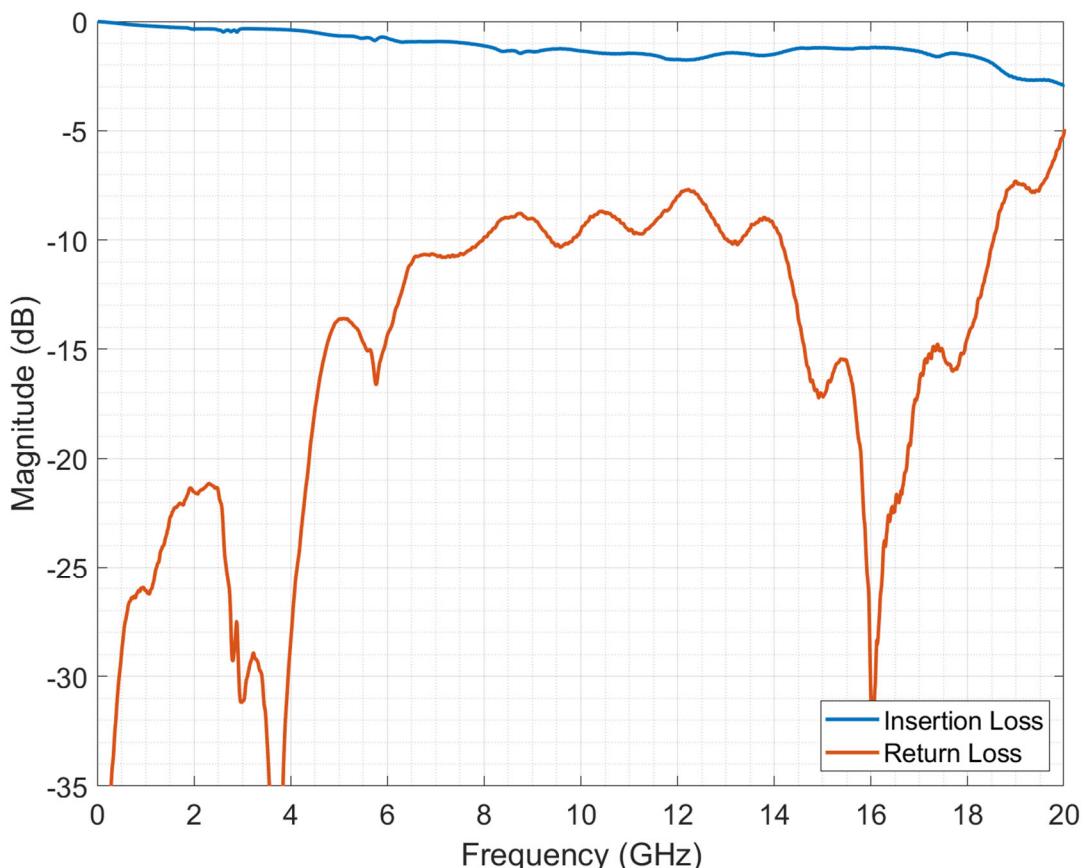


Figure 5. Straight GHSM (BSS) Response

Board-to-Board Results

4.1.2. Straight GHSM (BSS) Crosstalk

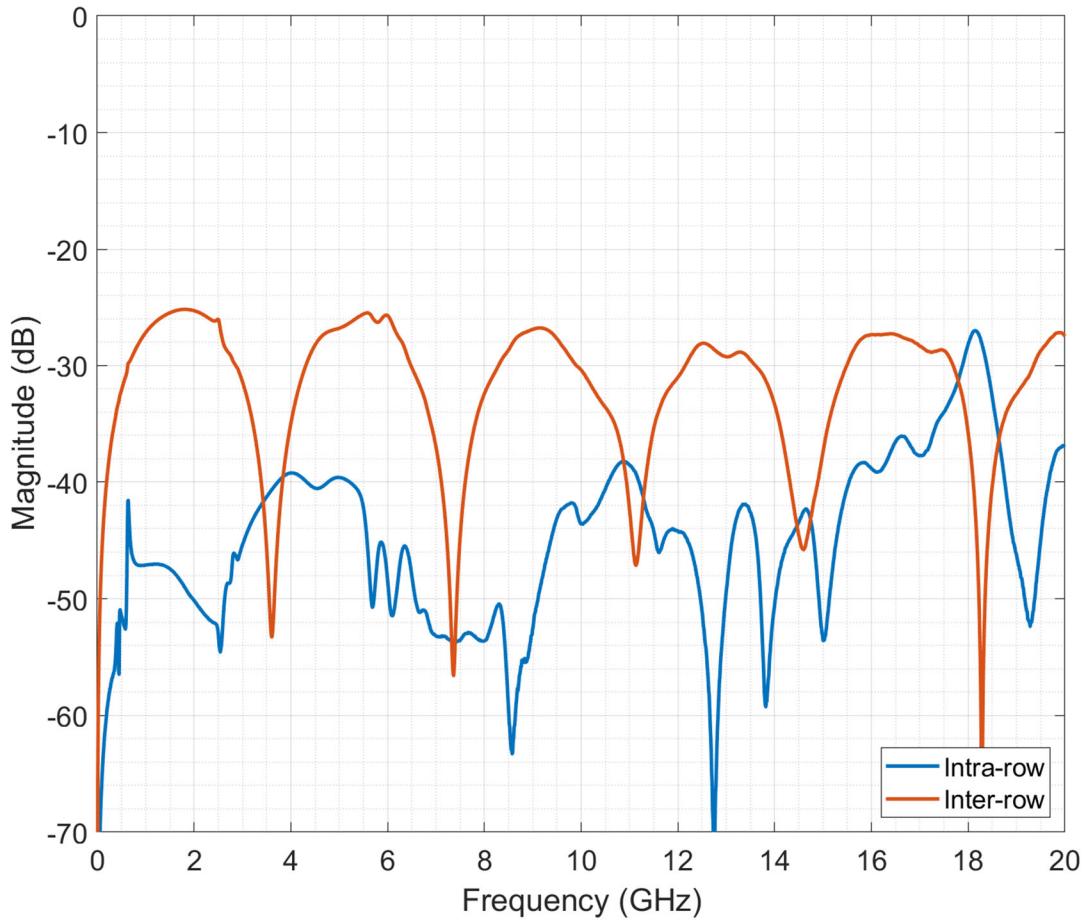


Figure 6. Straight GHSM (BSS) NEXT

Board-to-Board Results

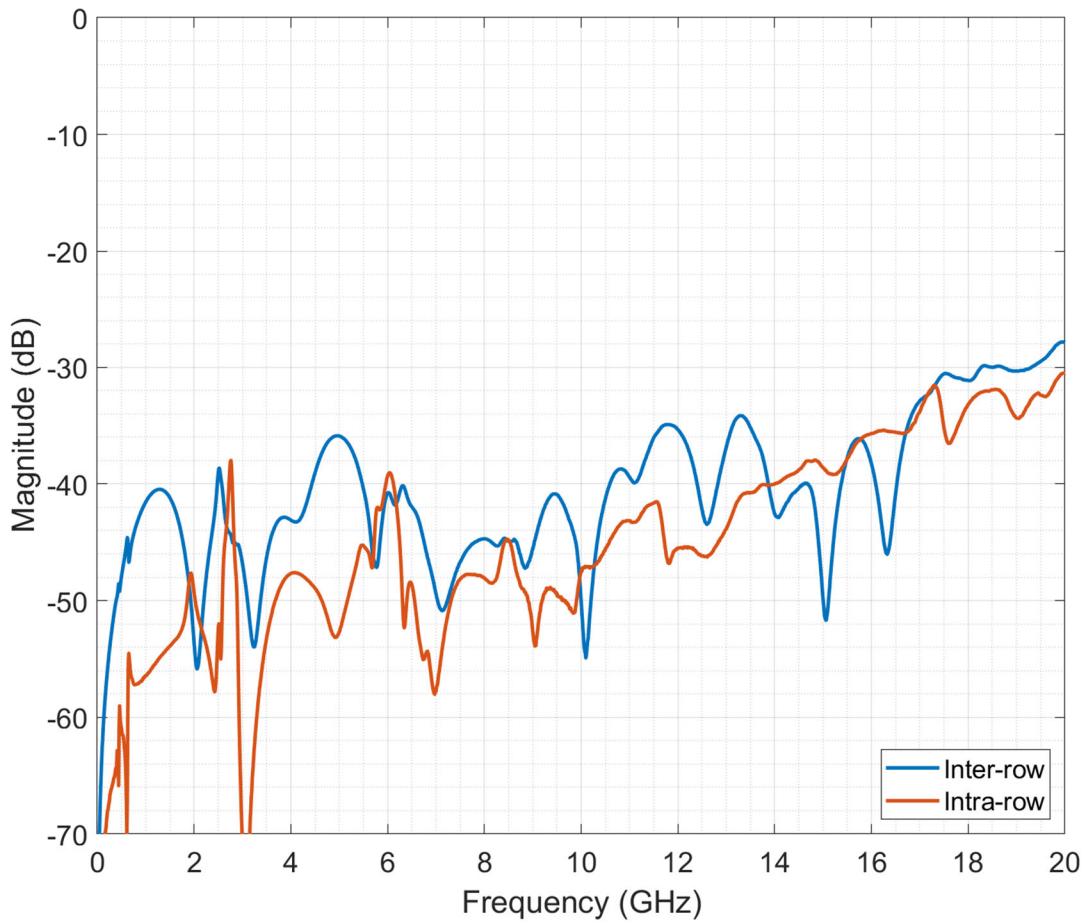


Figure 7. Straight GHSM (BSS) FEXT

Board-to-Board Results

4.1.3. Straight GHSM (BSS) TDR

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 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

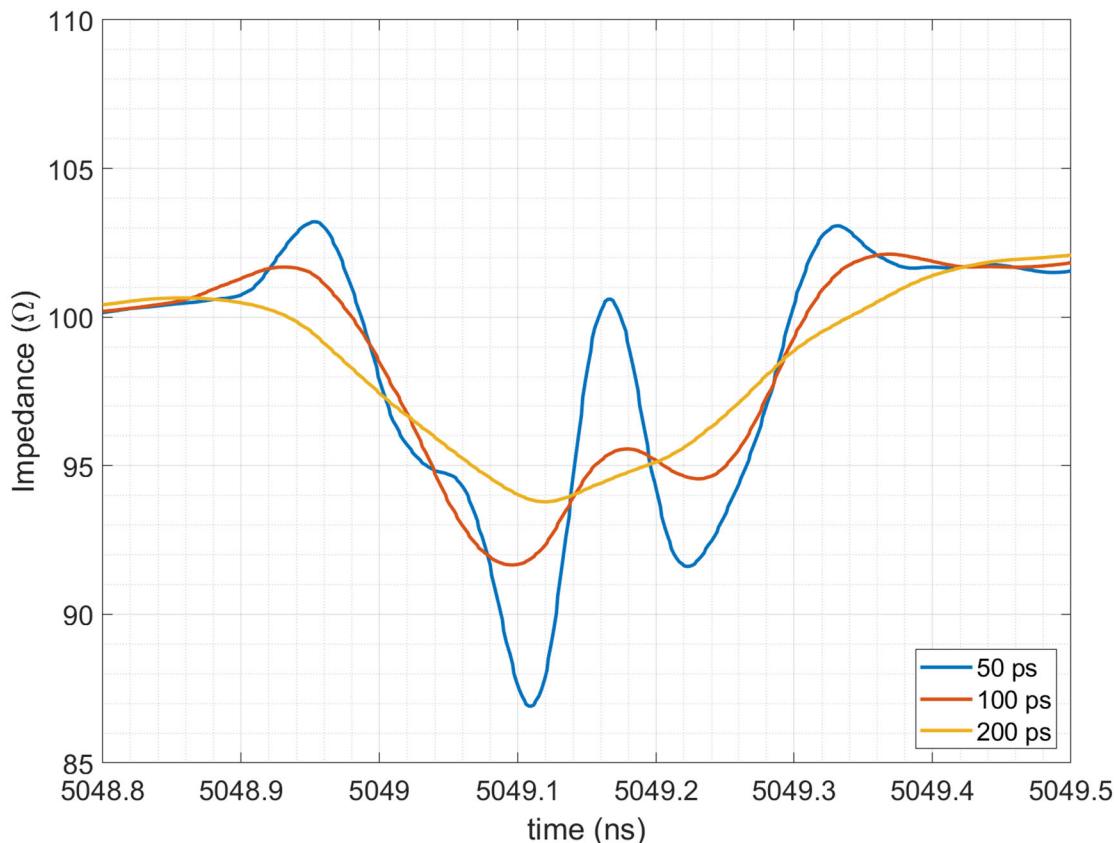


Figure 8. TDR – Straight GHSM (BSS)

Board-to-Board Results

4.2.Right-Angle GHSM (HBR) Performance Summary

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.

4.2.1. Insertion Loss/Return Loss

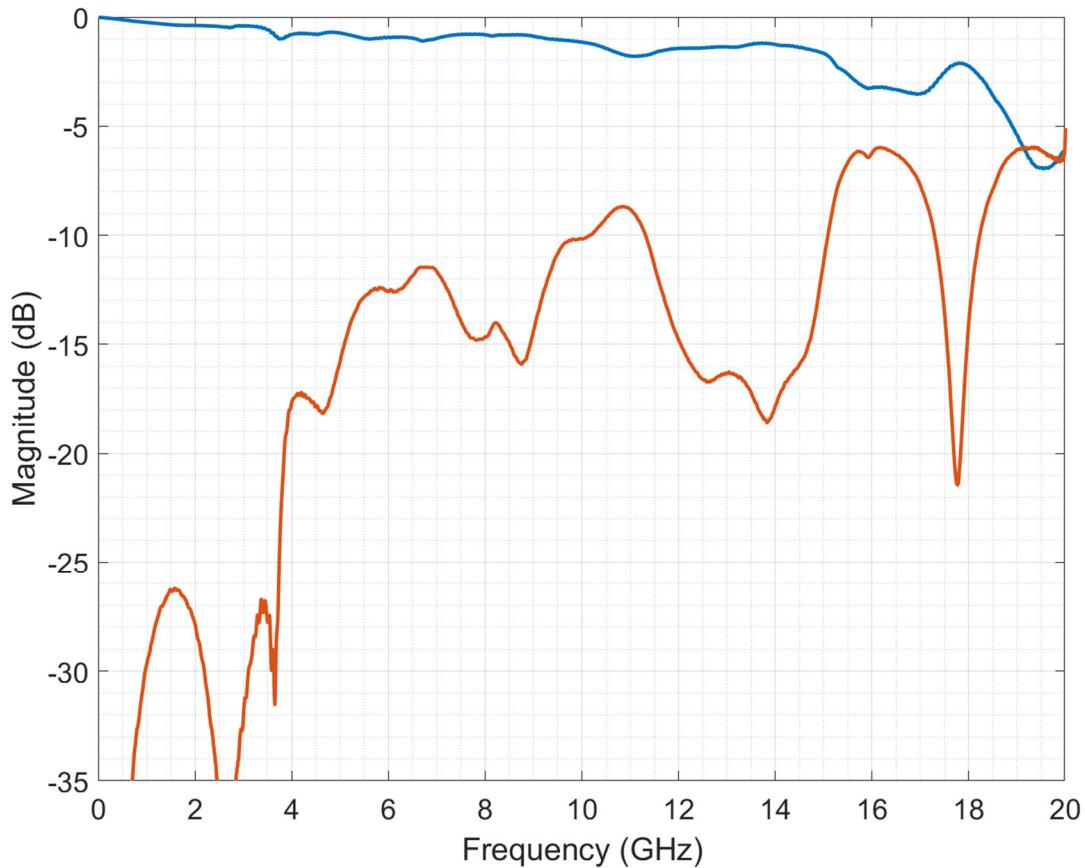


Figure 9. Right-Angle GHSM (HBR) PTH Response

Board-to-Board Results

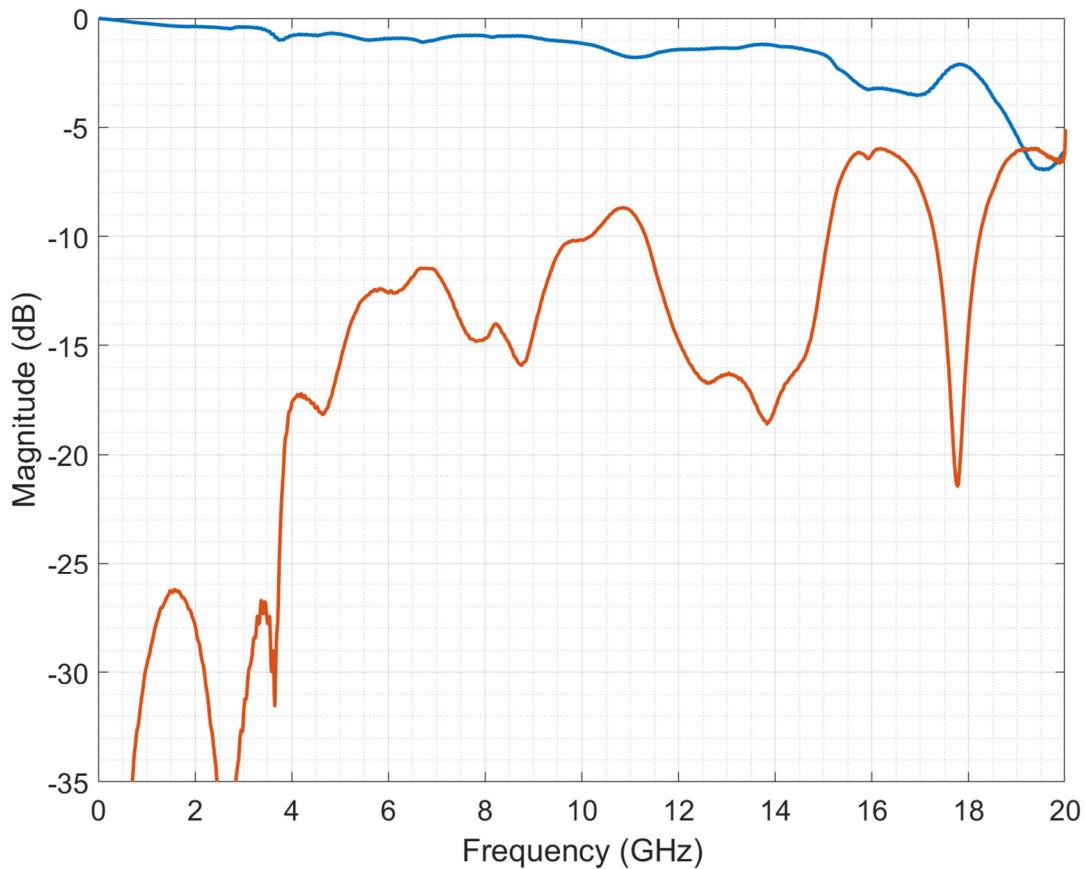


Figure 10. Right-Angle GHSM (HBR) SMT Response

Board-to-Board Results

4.2.2. Right-Angle (HBR) GHSM Crosstalk

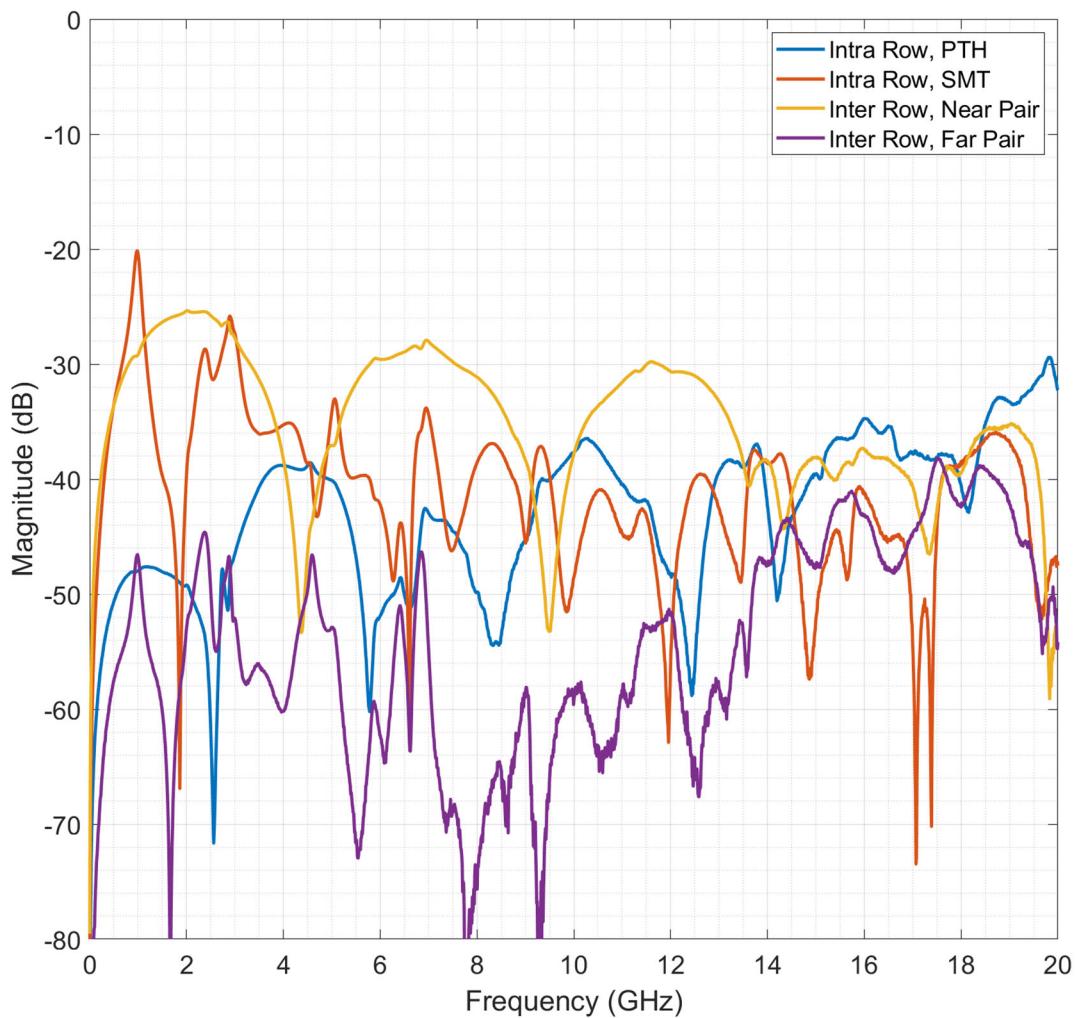


Figure 11. Right-Angle GHSM (HBR) NEXT

Board-to-Board Results

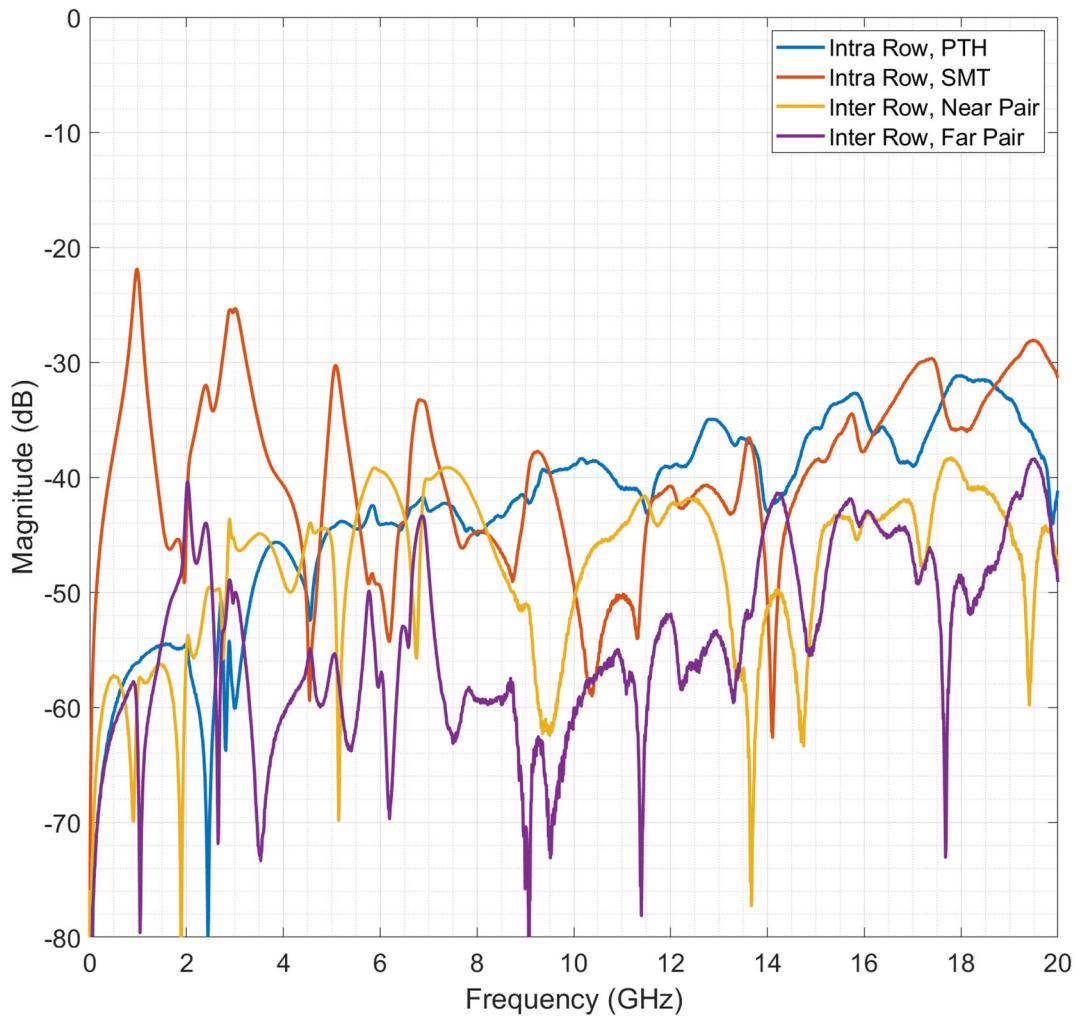


Figure 12. Right-Angle GHSM (HBR) FEXT

Board-to-Board Results

4.2.3. Right-Angle GHSM (HBR) TDR

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 20% to 80% of the signal's rising edge. Rise times of 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

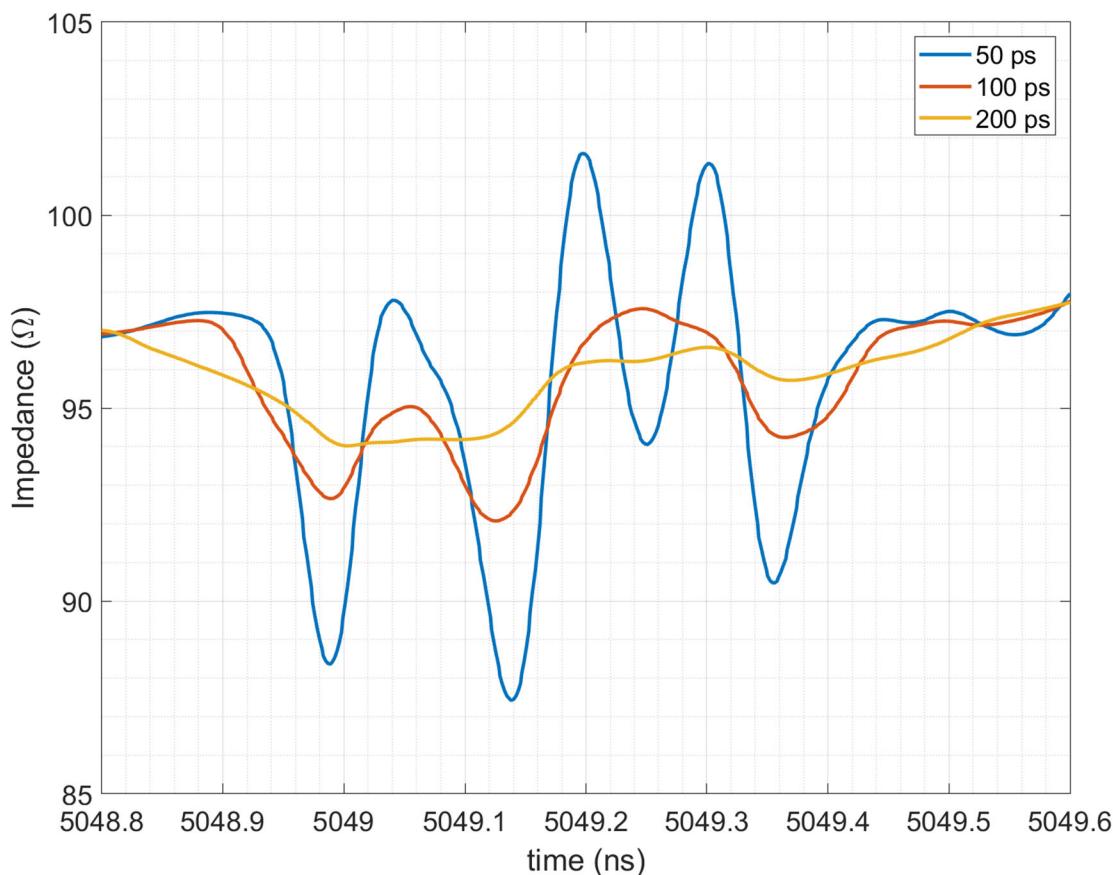


Figure 13. TDR – Right-Angle GHSM (HBR) PTH

Board-to-Board Results

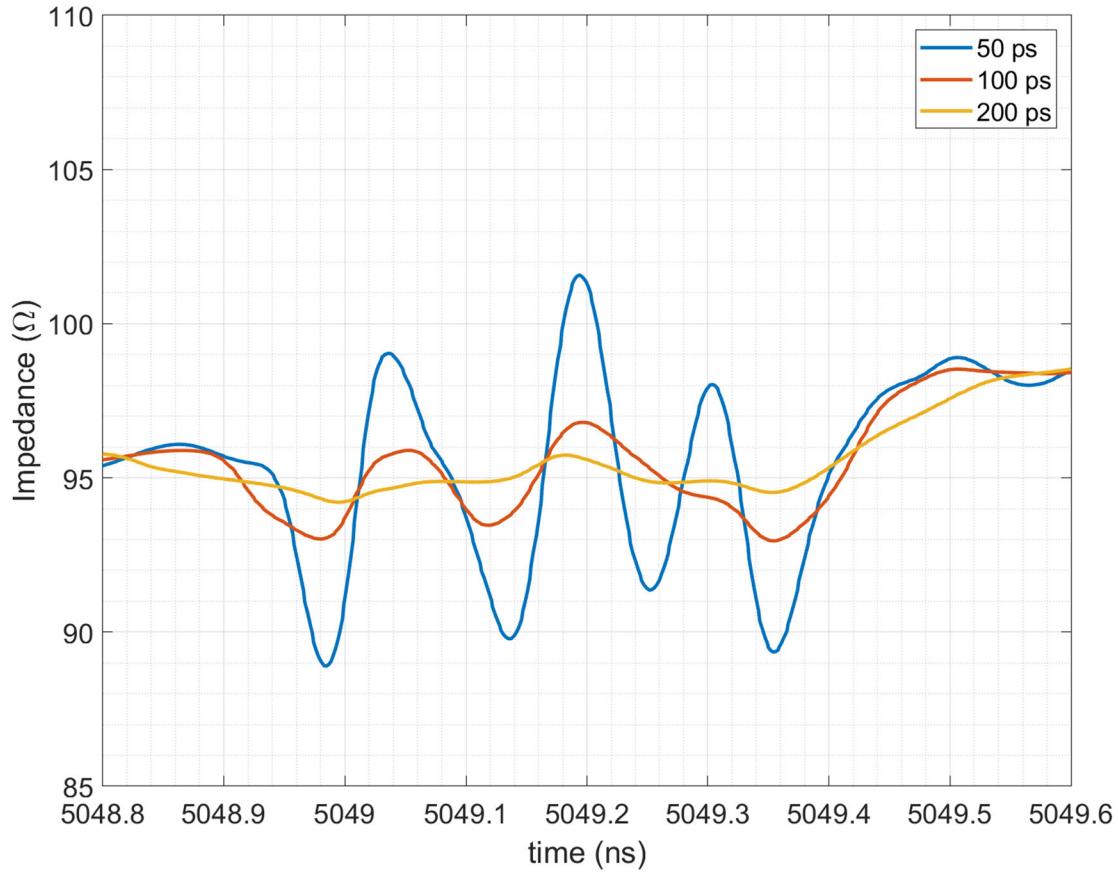


Figure 14. TDR – Right-Angle GHSM (HBR) SMT

Board-to-Board Results

4.3.Straight to Right-Angle GHSM Performance Summary

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.

4.3.1. Insertion Loss/Return Loss

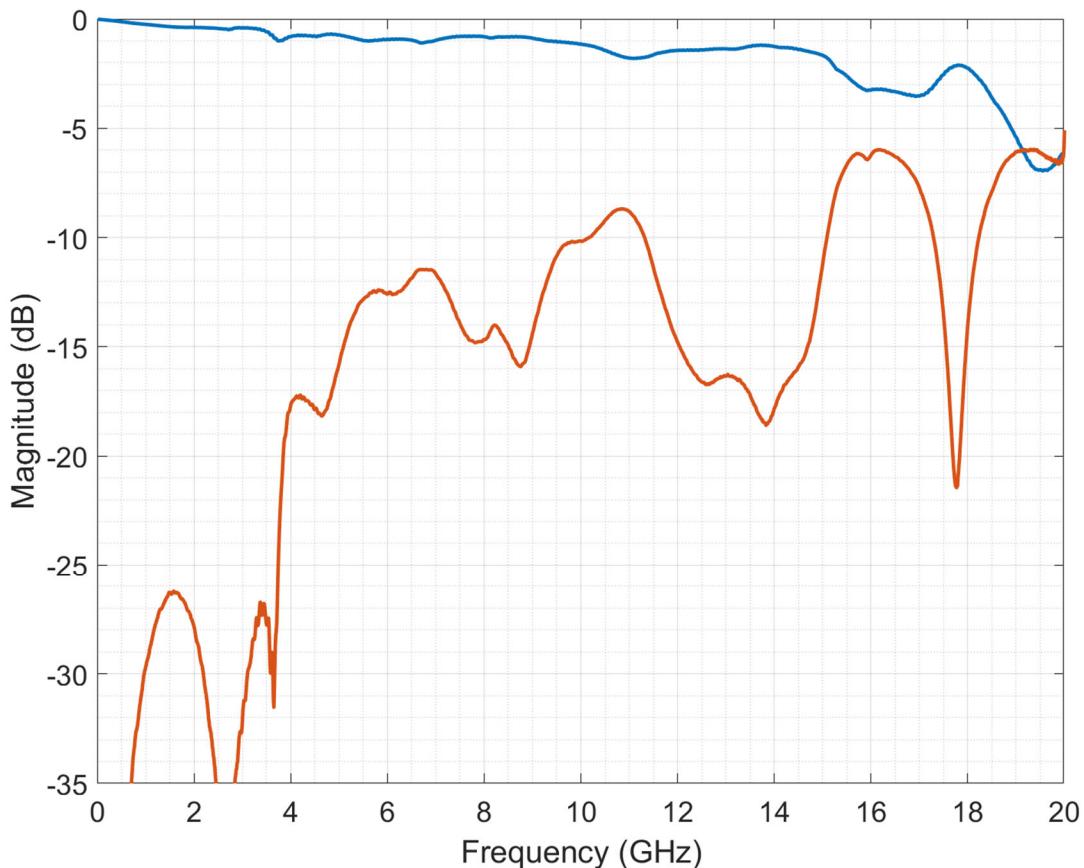


Figure 15. Straight to Right-Angle GHSM Response

Board-to-Board Results

4.3.2. Straight to Right-Angle GHSM Crosstalk

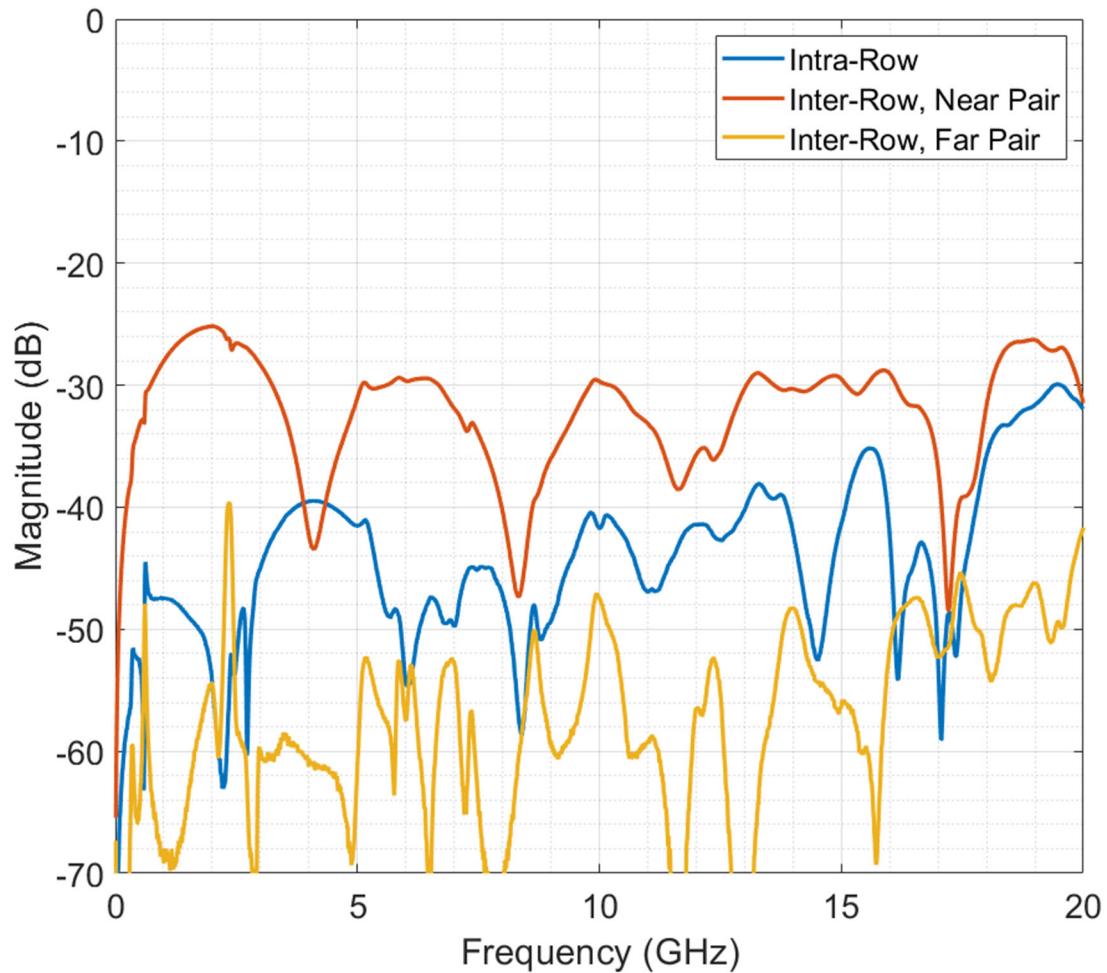


Figure 16. Straight to Right-Angle GHSM NEXT

Board-to-Board Results

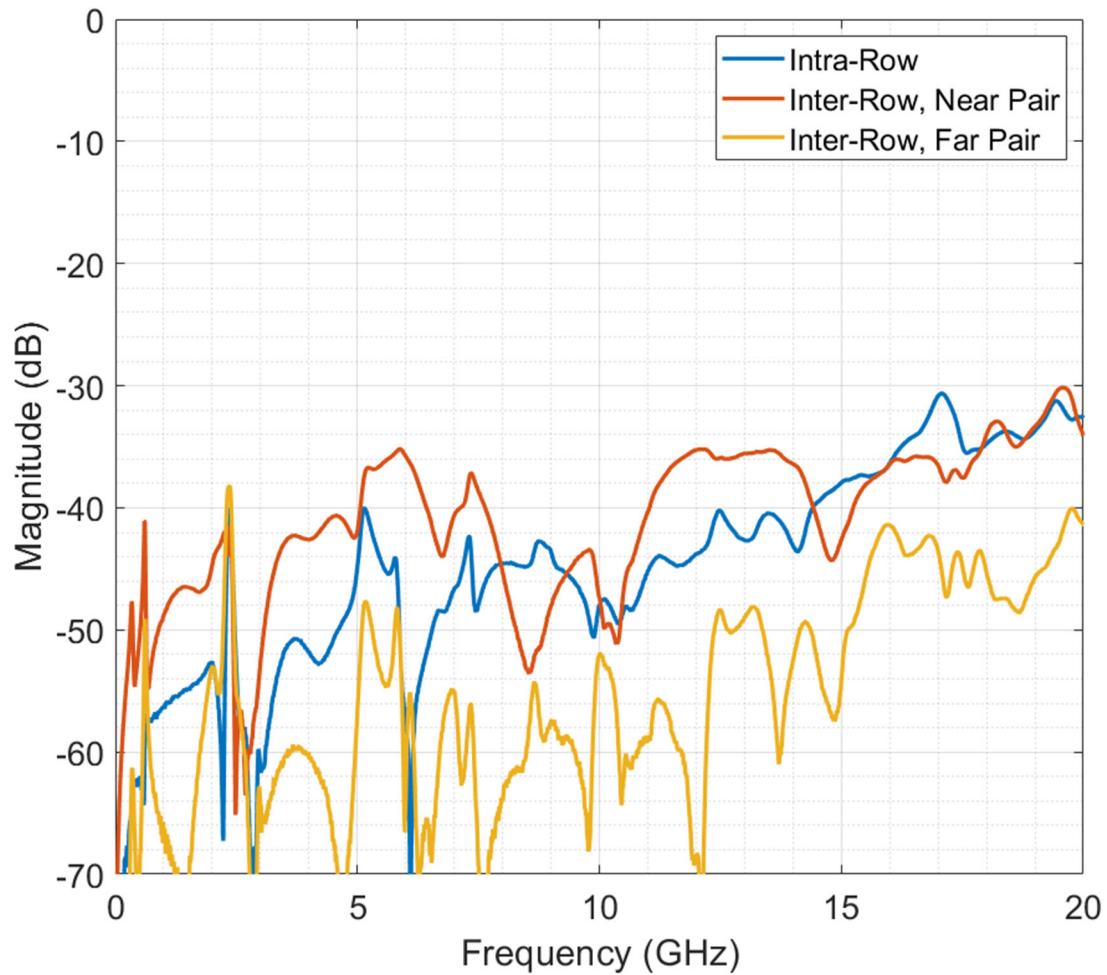


Figure 17. Straight to Right-Angle GHSM FEXT

Board-to-Board Results

4.3.3. Straight to Right-Angle GHSM TDR

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 20% to 80% of the signal's rising edge. Rise times of 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

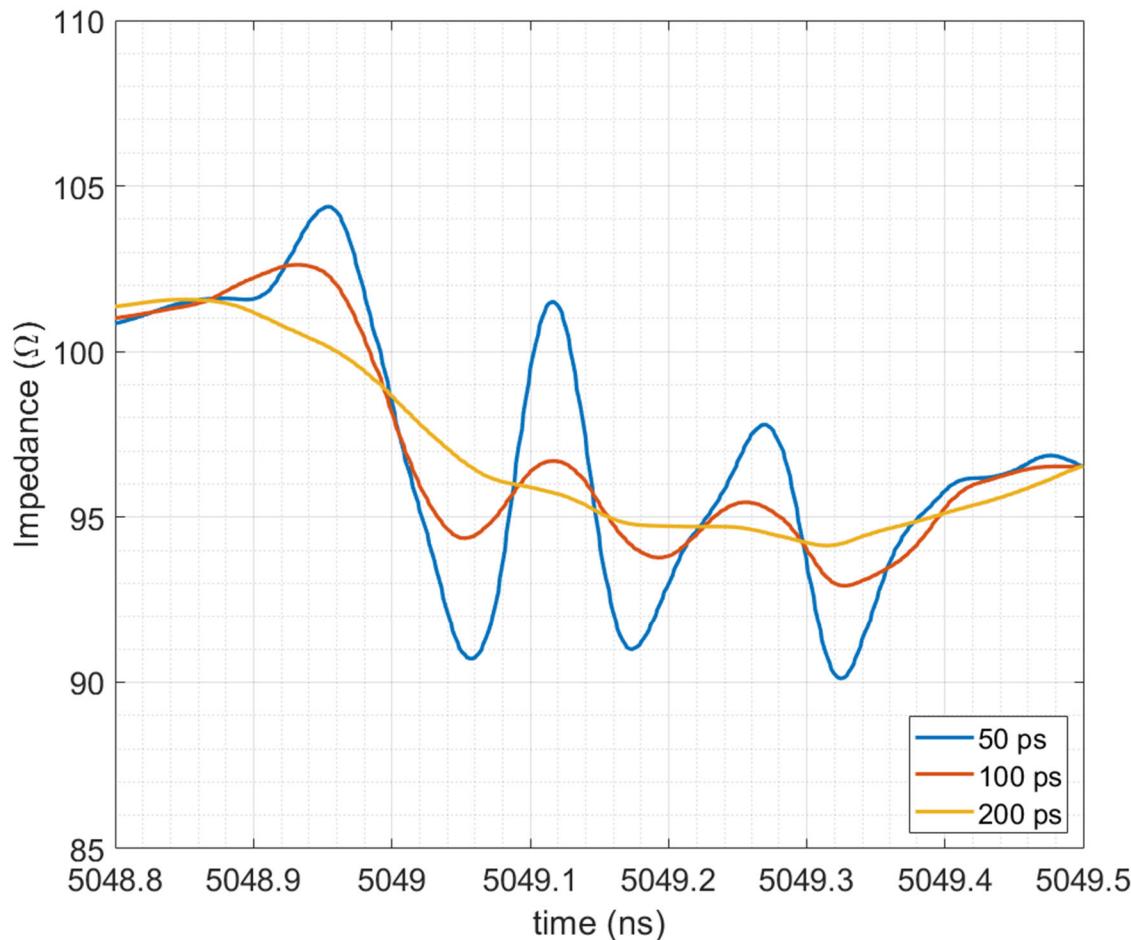


Figure 18. TDR – Straight to Right-Angle GHSM PTH

Board-to-Board Results

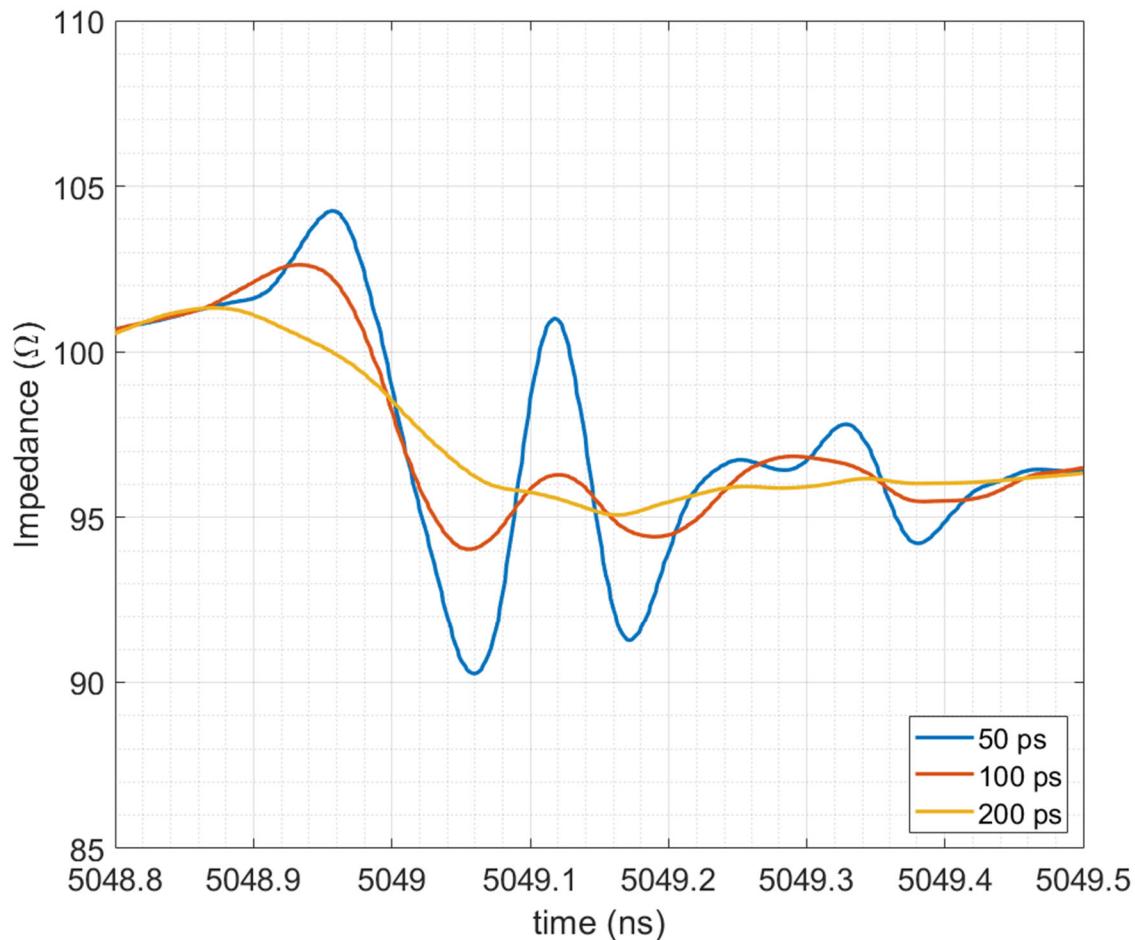


Figure 19. TDR – Straight to Right-Angle GHSM SMT

Cable Assembly Results

5. Cable Assembly

5.1.Straight to Straight GHSM (BSS) Performance

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.

5.1.1. Insertion Loss / Return Loss

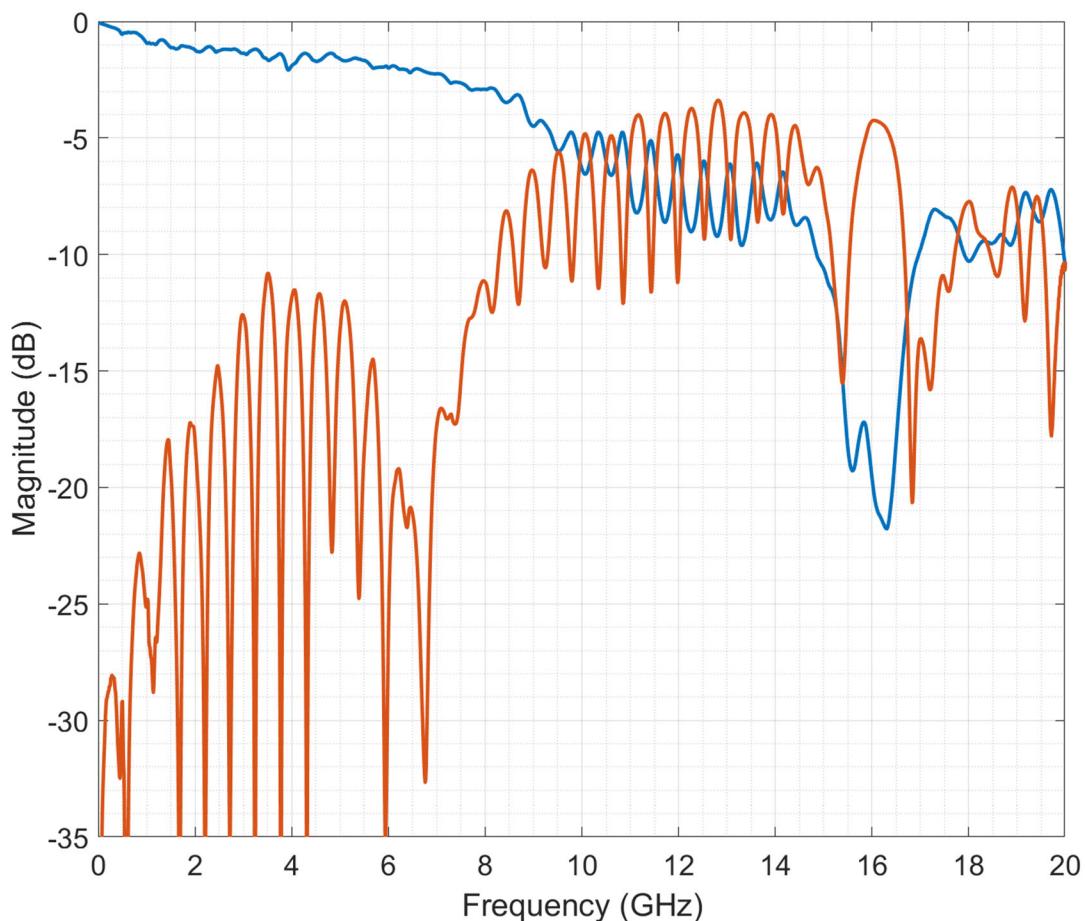


Figure 20. Straight to Straight GHSM (BSS) Response

Cable Assembly Results

5.1.2. Straight to Straight GHSM (BSS) Crosstalk

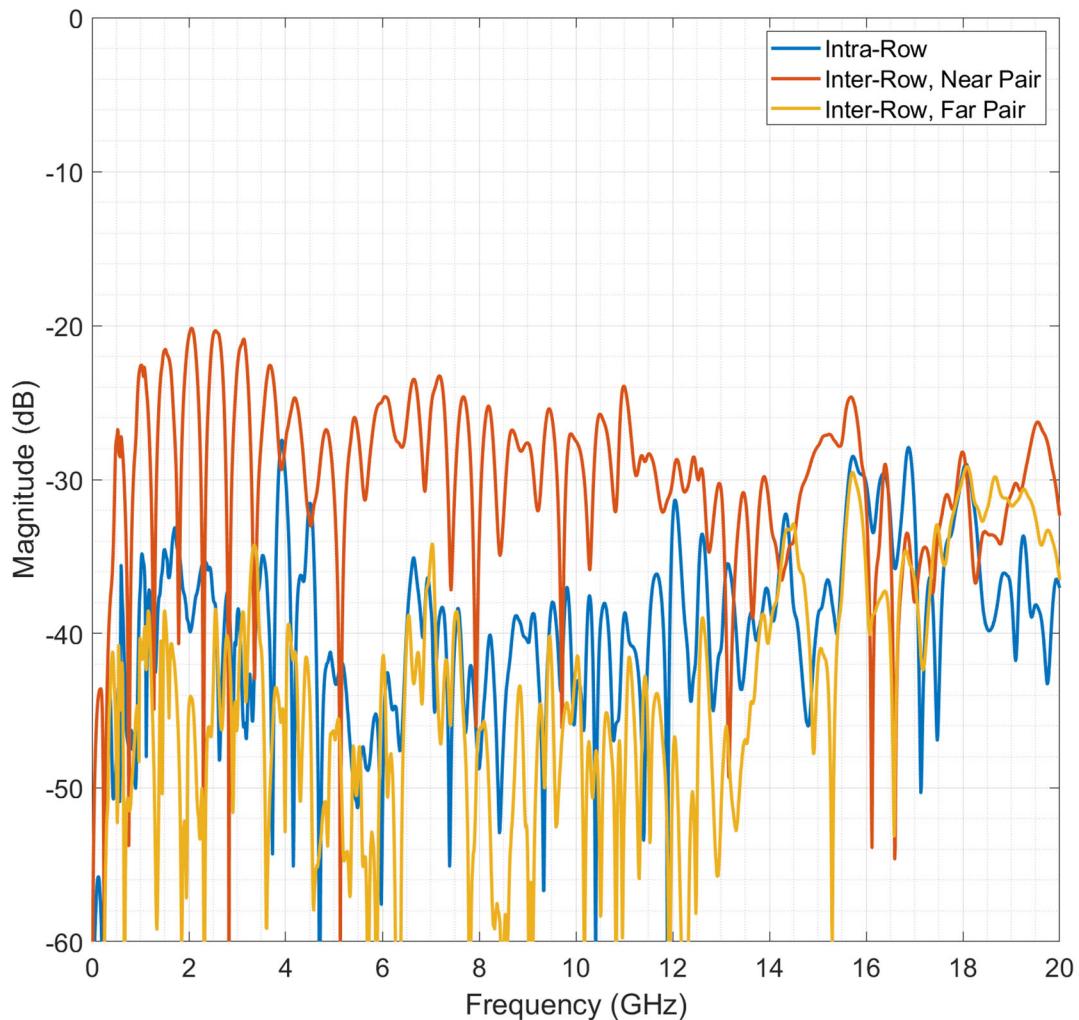


Figure 21. Straight to Straight GHSM (BSS) NEXT

Cable Assembly Results

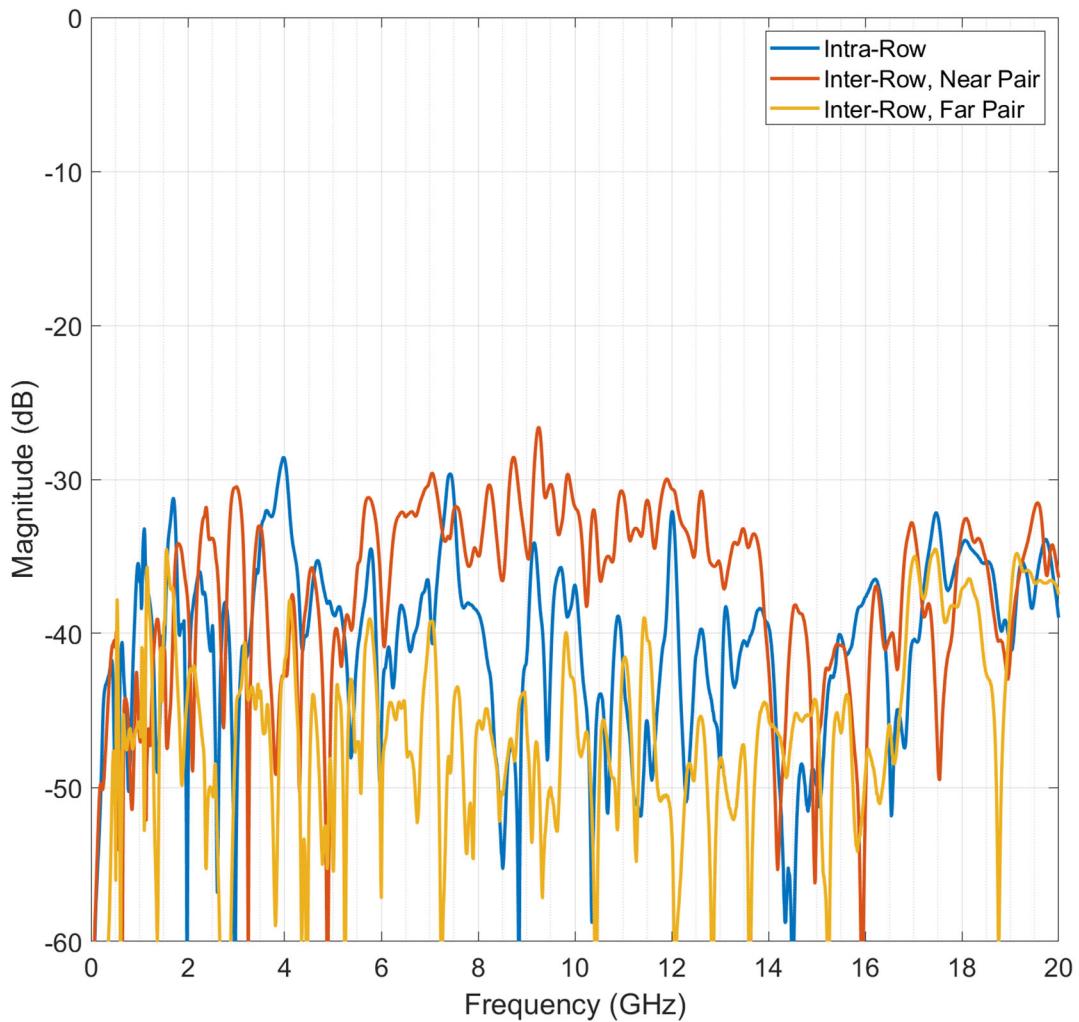


Figure 22. Straight to Straight GHSM (BSS) FEXT

Cable Assembly Results

5.1.3. Straight to Straight GHSM (BSS) TDR

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 times of 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

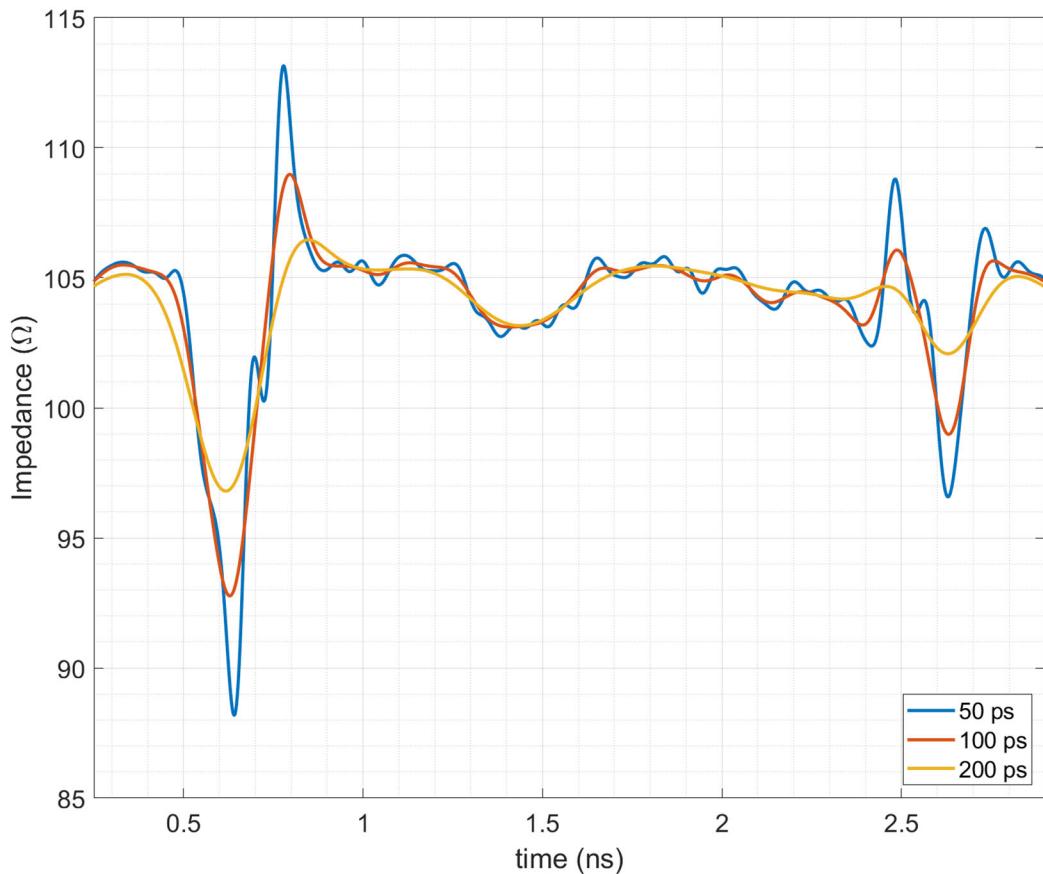


Figure 23. TDR – Straight to Straight GHSM (BSS)

Cable Assembly Results

5.2.Right-Angle to Right-Angle GHSM (HBR) Performance Summary

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.

5.2.1. Insertion Loss/Return Loss

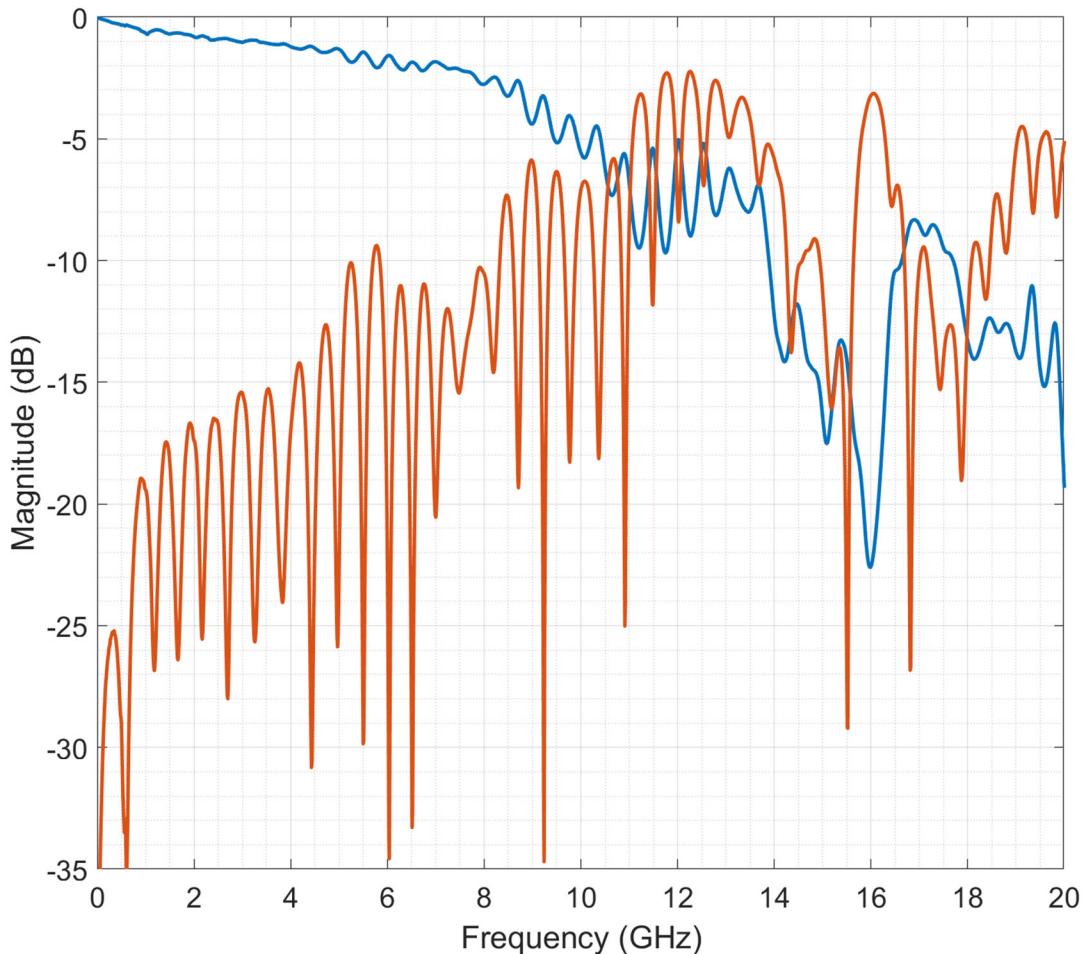


Figure 24. Right-Angle to Right-Angle GHSM (HBR) PTH Response

Cable Assembly Results

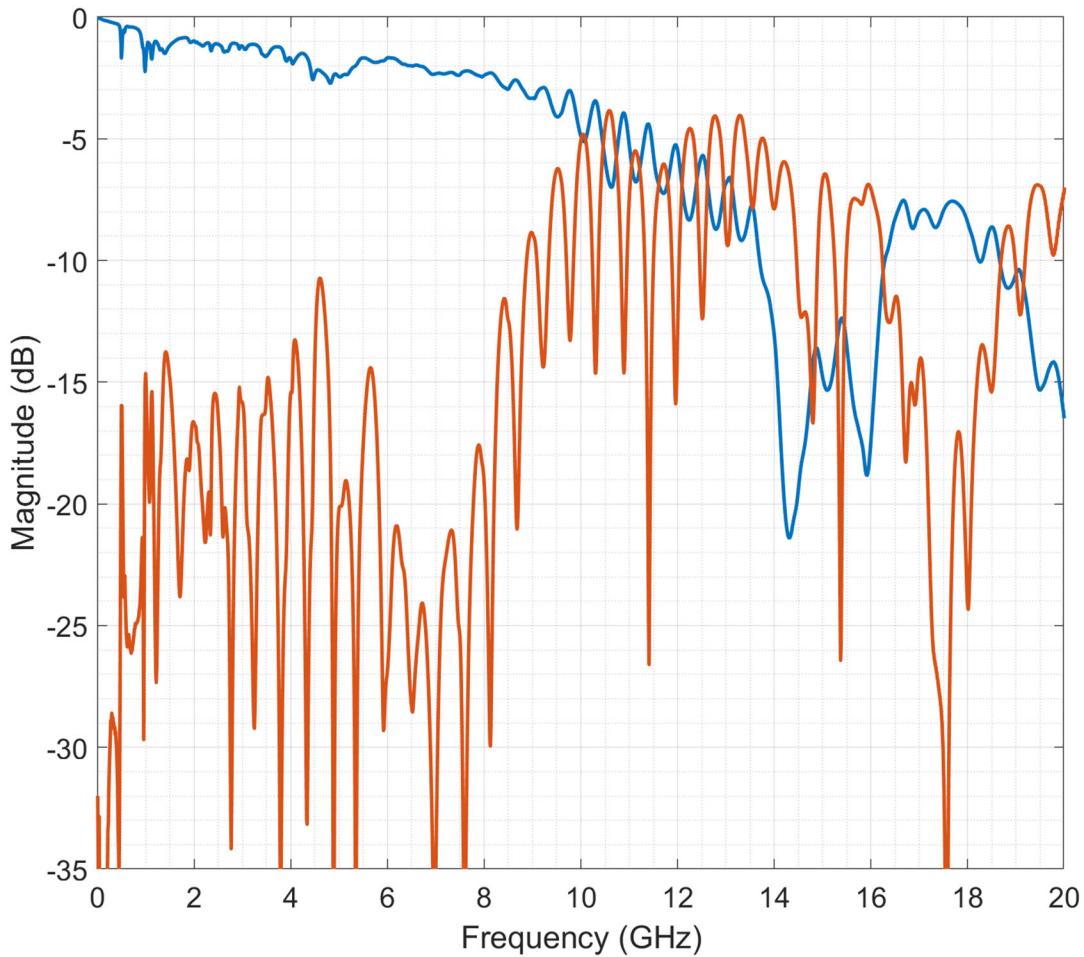


Figure 25. Right-Angle to Right-Angle GHSM (HBR) SMT Response

Cable Assembly Results

5.2.2. Right-Angle to Right-Angle (HBR) GHSM Crosstalk

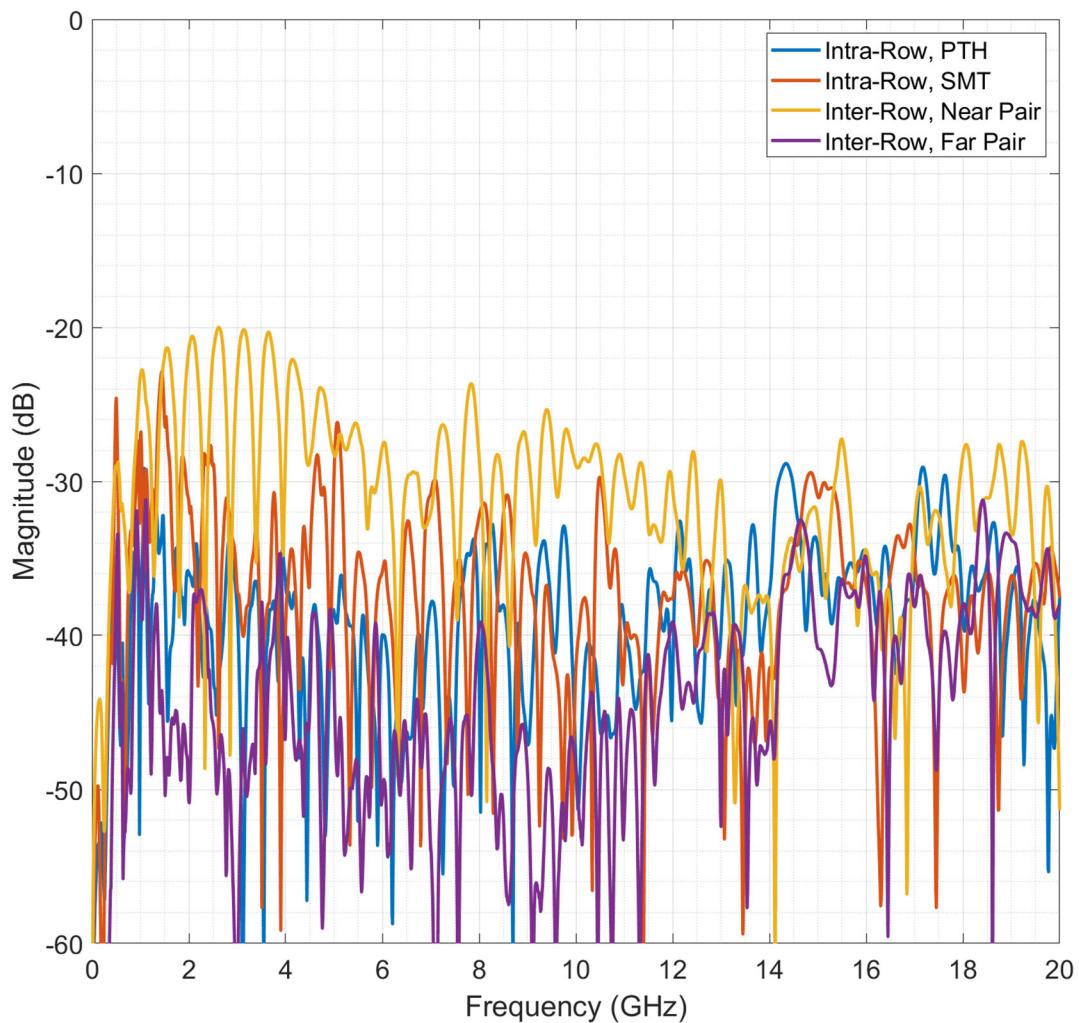


Figure 26. Right-Angle to Right-Angle GHSM (HBR) NEXT

Cable Assembly Results

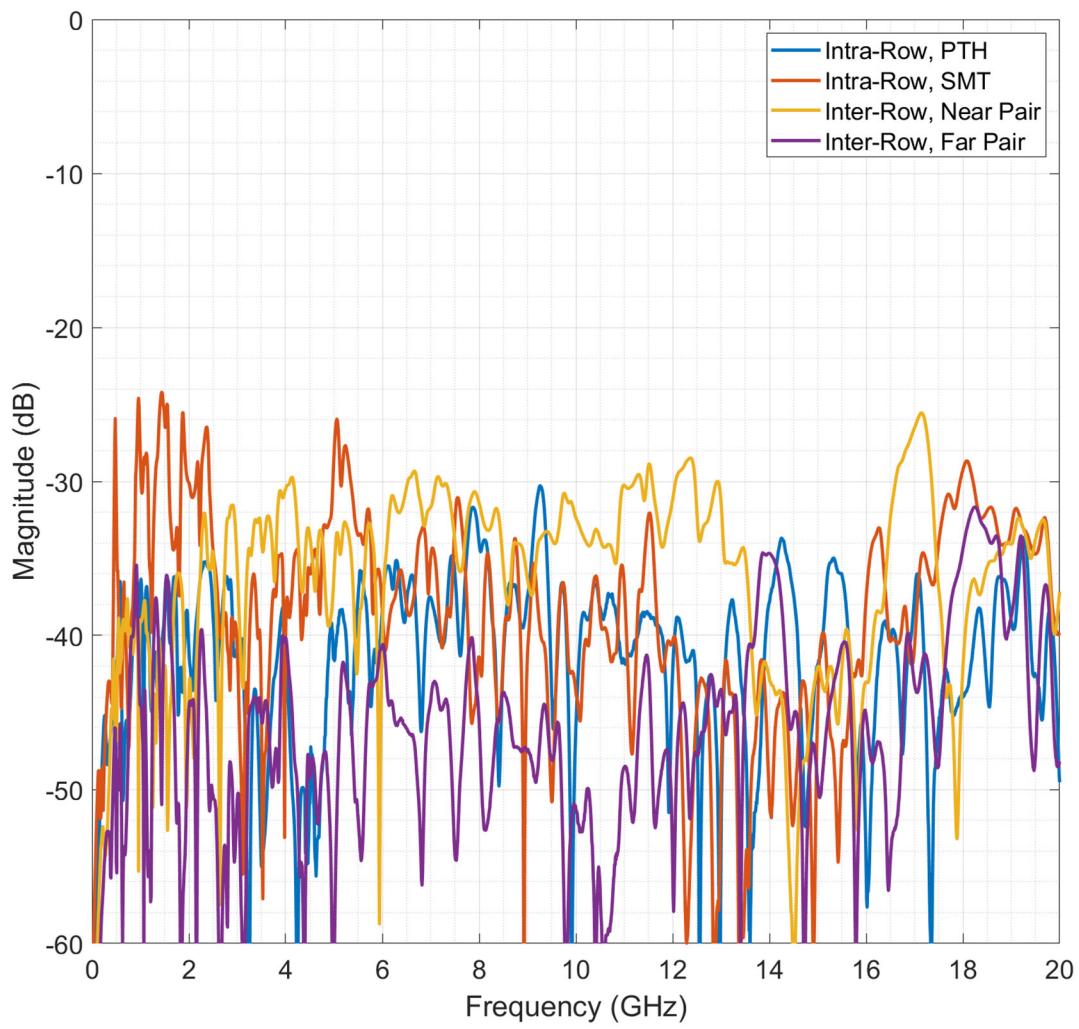


Figure 27. Right-Angle to Right-Angle GHSM (HBR) FEXT

Cable Assembly Results

5.2.3. Right-Angle to Right-Angle GHSM (HBR) TDR

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 times of 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

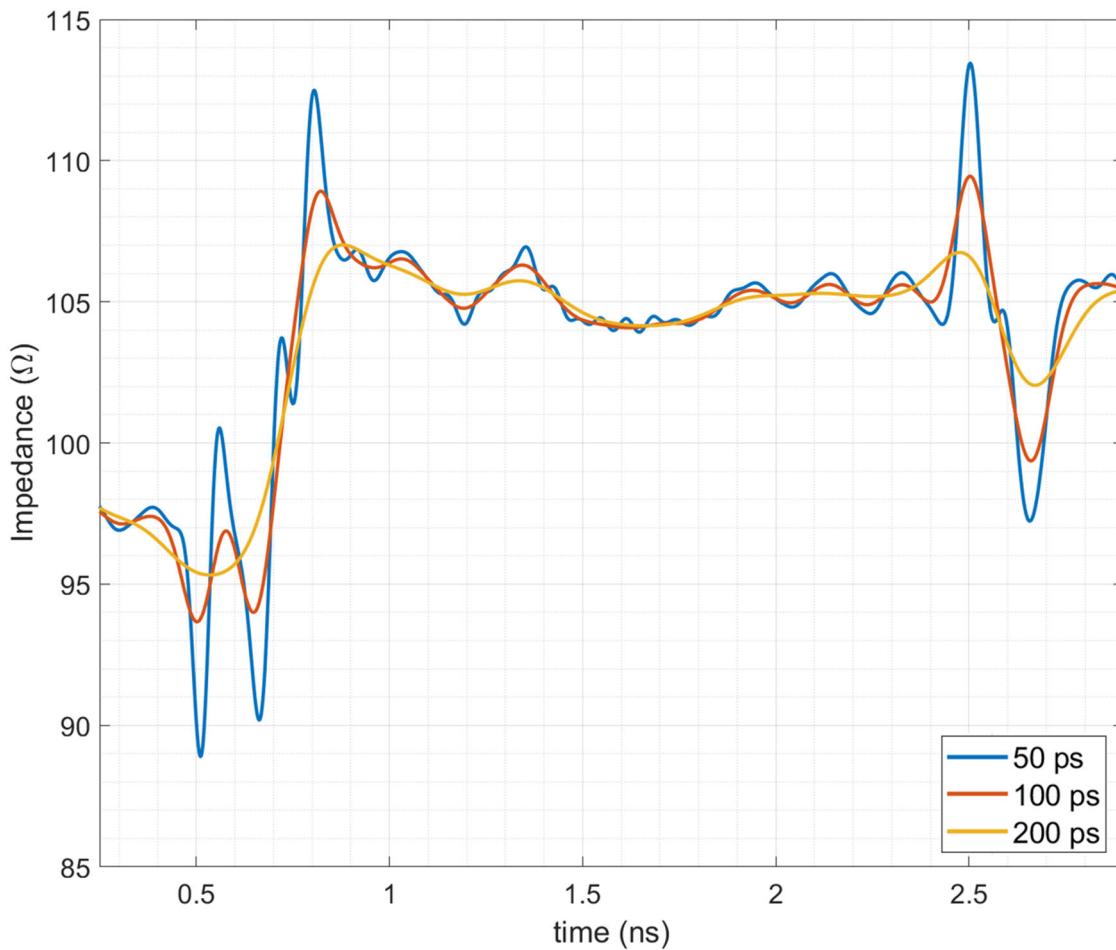


Figure 28. TDR – Right-Angle to Right-Angle GHSM (HBR) PTH

Cable Assembly Results

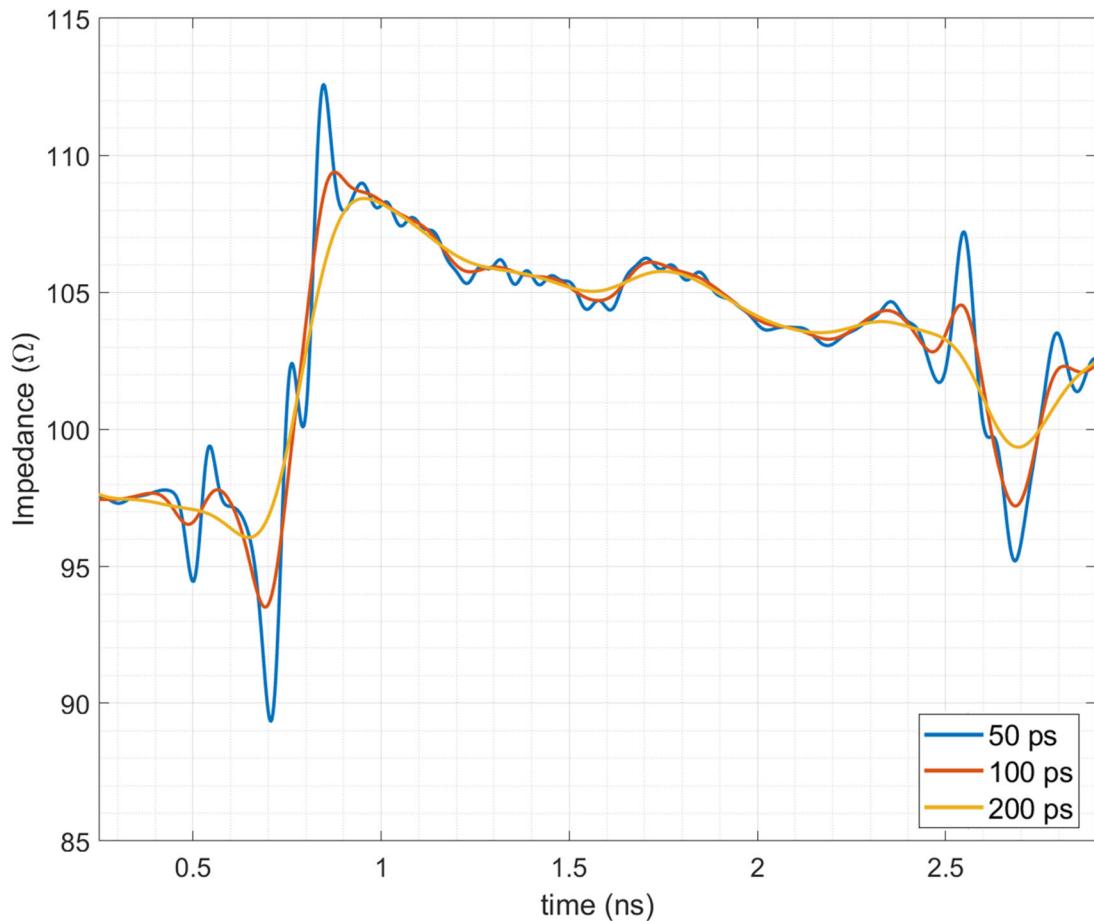


Figure 29. TDR – Right-Angle to Right-Angle GHSM (HBR) SMT

Cable Assembly Results

5.3.Straight to Right-Angle GHSM Performance Summary

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.

5.3.1. Insertion Loss/Return Loss

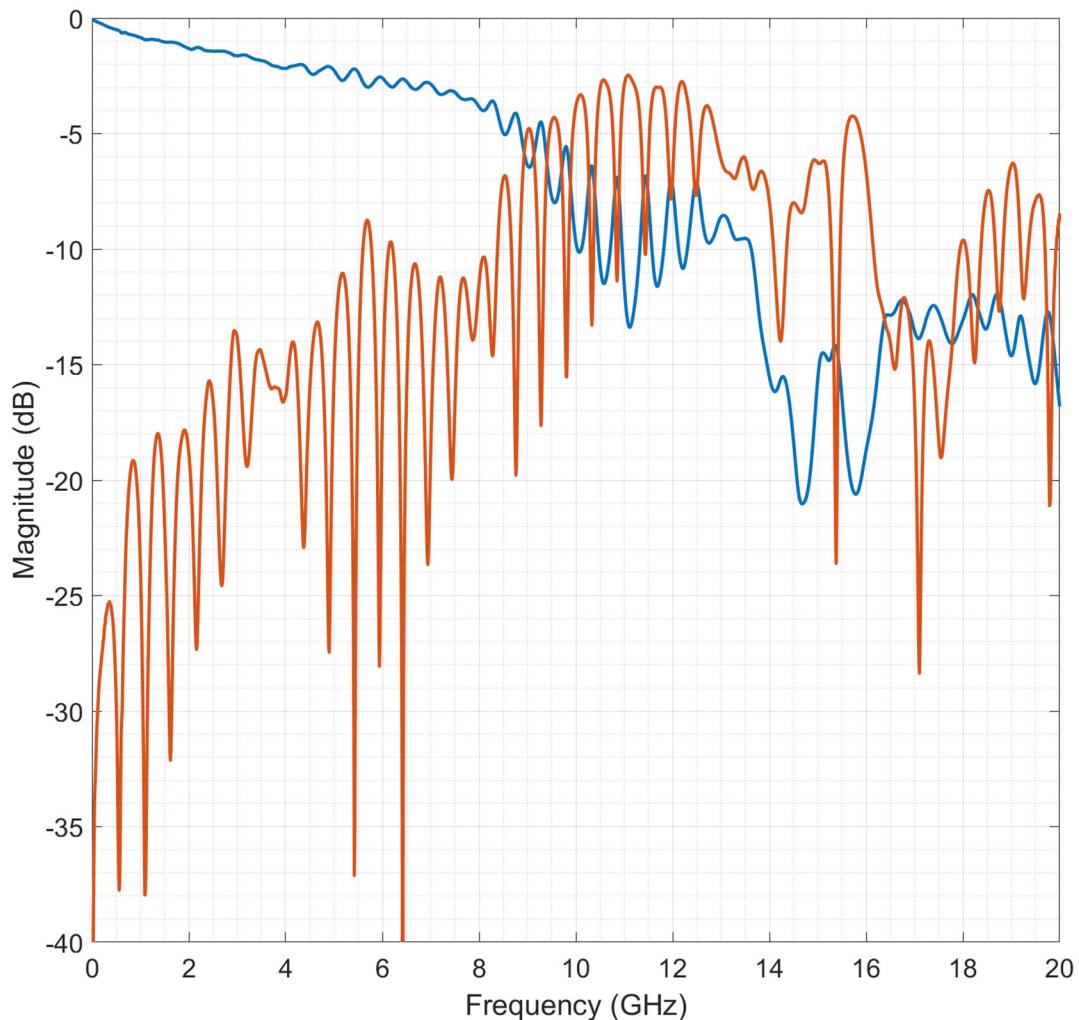


Figure 30. Straight to Right-Angle GHSM Response

Cable Assembly Results

5.3.2. Straight to Right-Angle GHSM Crosstalk

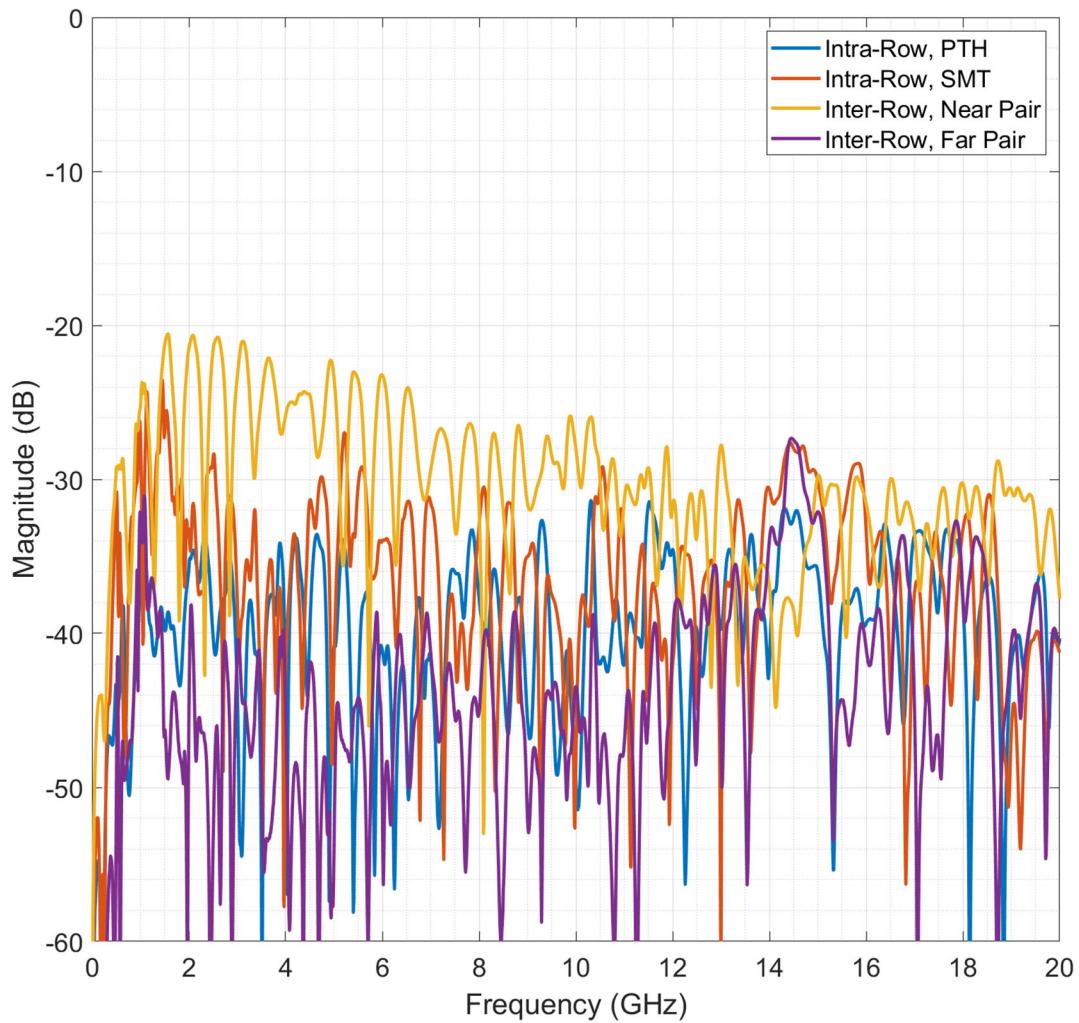


Figure 31. Straight to Right-Angle GHSM NEXT

Cable Assembly Results

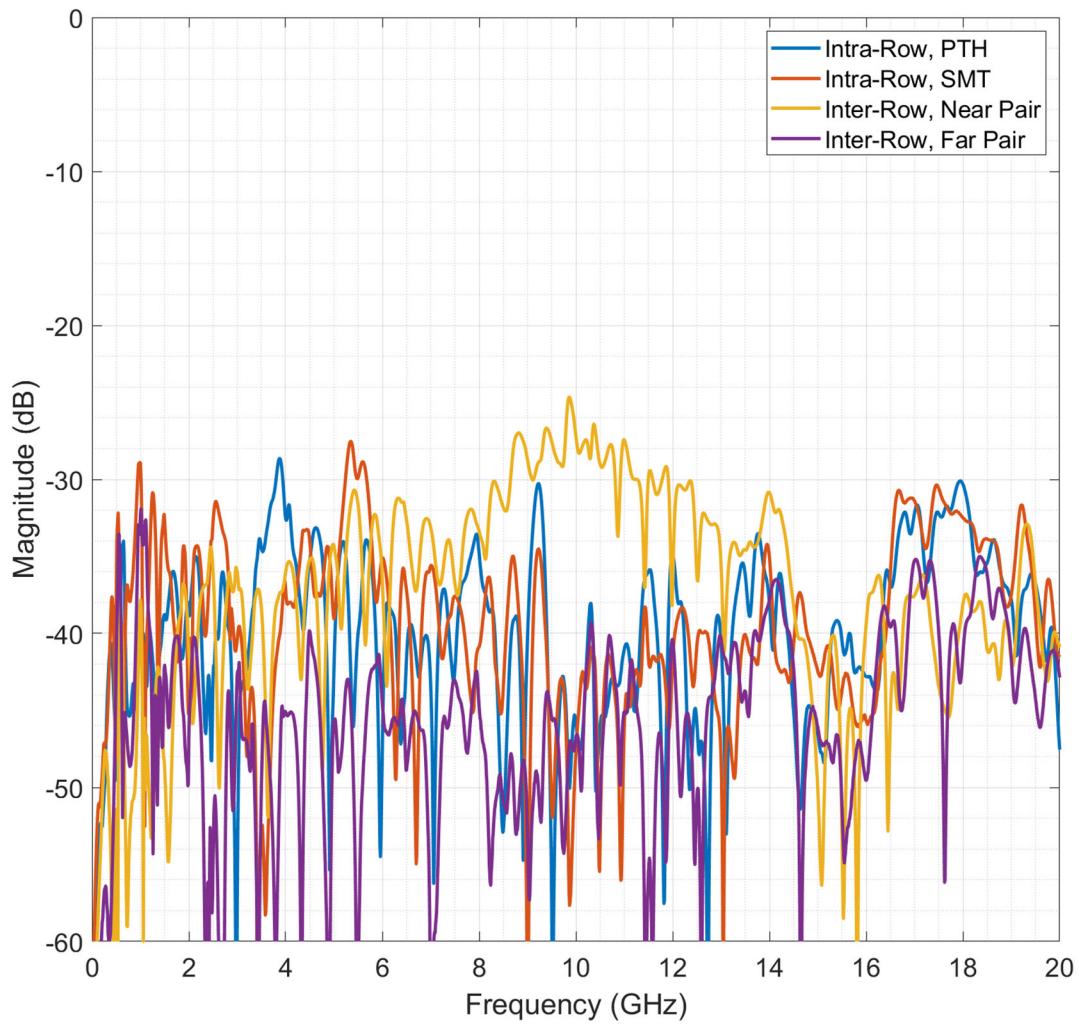


Figure 32. Straight to Right-Angle GHSM FEXT

Cable Assembly Results

5.3.3. Straight to Right-Angle GHSM TDR

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 times of 50ps, 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)
50	7.00
100	3.50
200	1.75

Table 1. Bandwidth to Rise Time Relationship

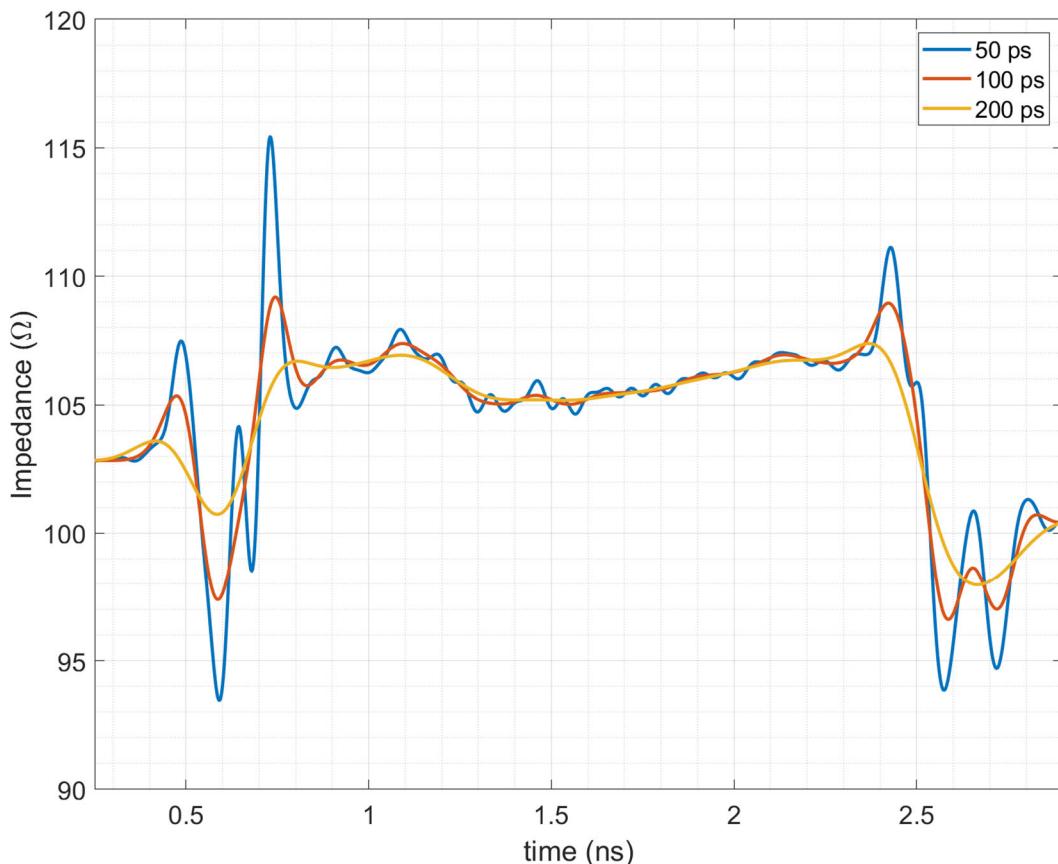


Figure 33. TDR – Straight to Right-Angle GHSM

6. Appendix A - 2x-Thru Fixture Performance

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

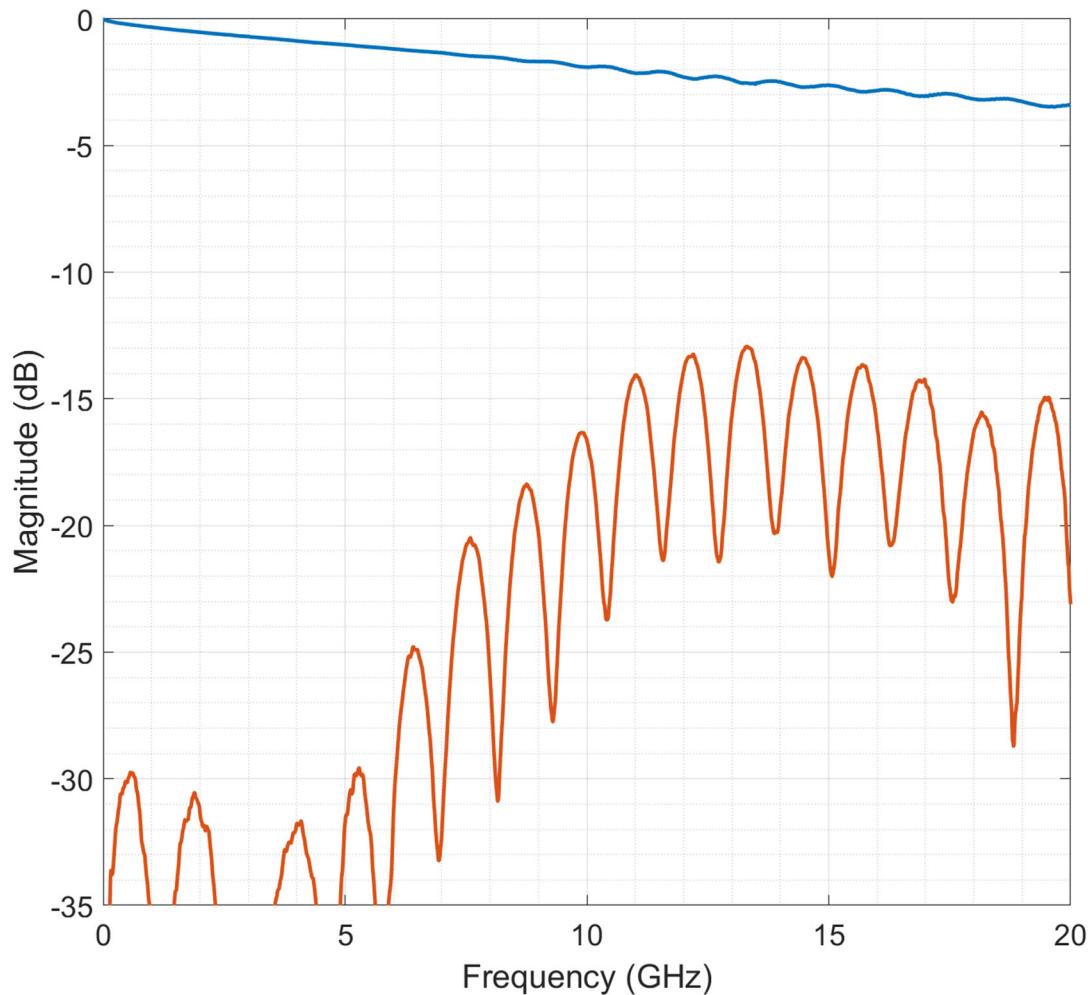


Figure 34. Straight GHSM 2x-Thru PCB Response

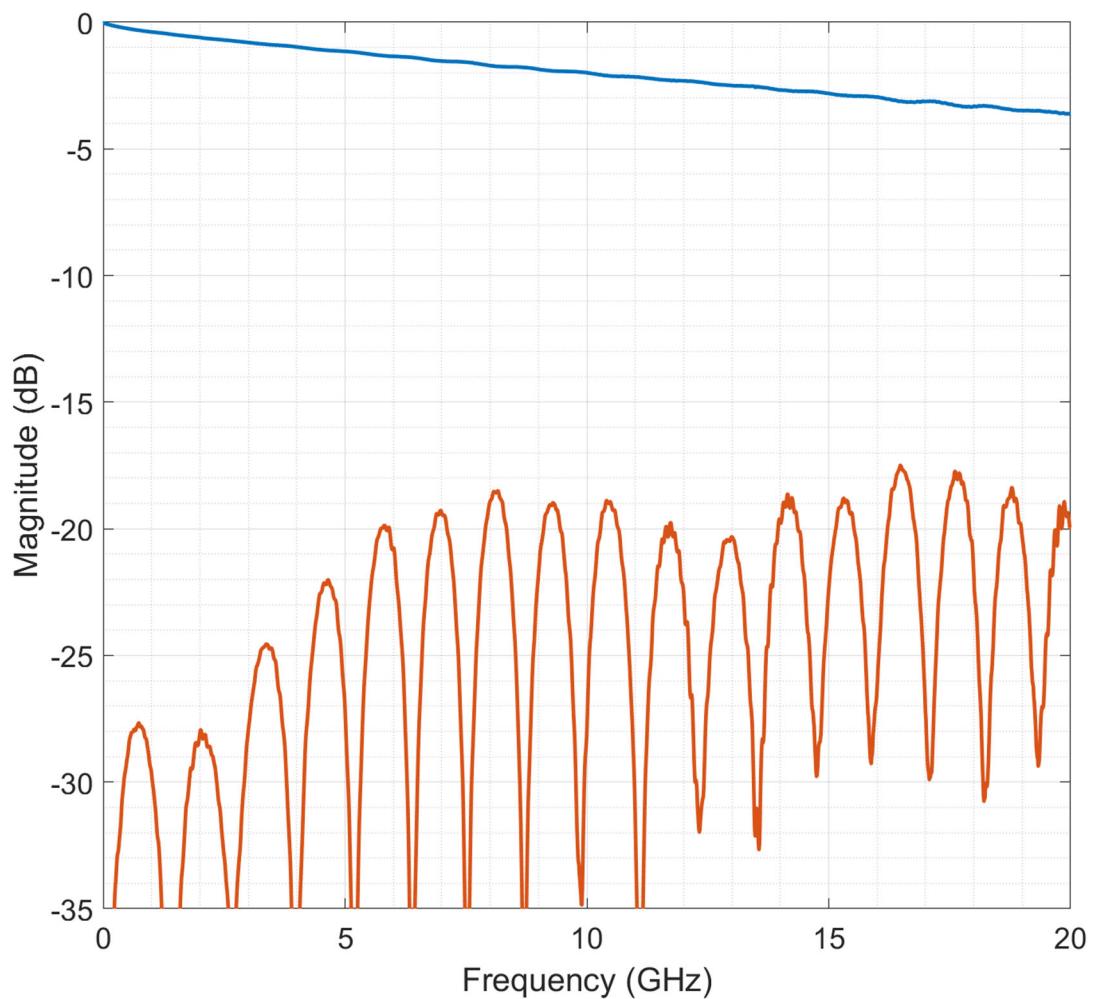


Figure 35. Right Angle GHSM 2x-Thru PCB Response