GT-22-246

Glenair High-Speed Micro-D (GHSM)

High Speed Characterization Report for Differential Applications

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Revision History

Rev	Date	Approved	Description
1	8/28/2023	L. Blackwell	Preliminary Release
2	2/1/2024	L. Blackwell	Addition of Sav-Con and Feedthrough

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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.

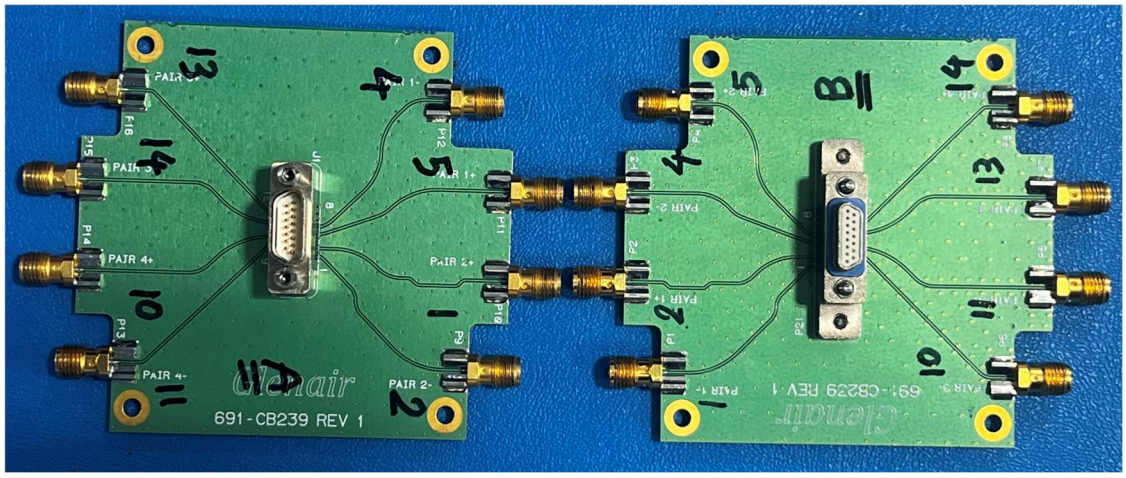

Figure 1. Straight GHSM (BSS) Test PCB Set

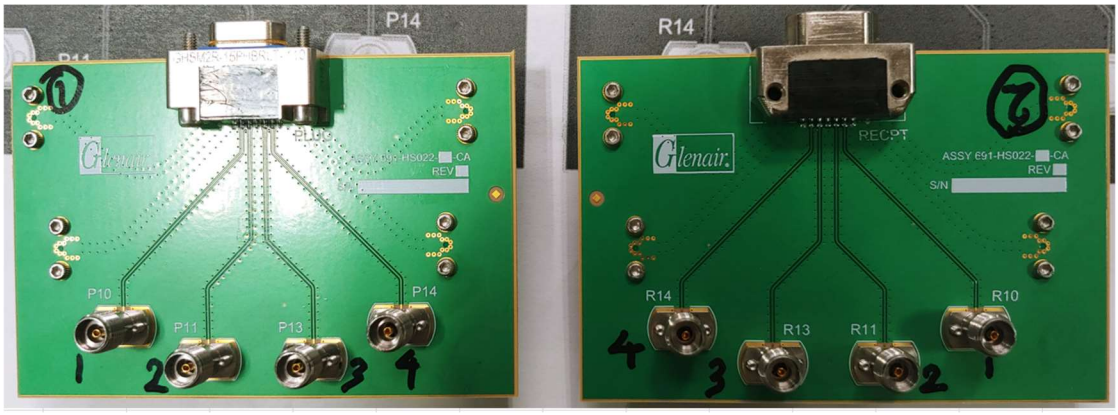

Figure 2. Right-Angle GHSM (HBR) Test PCB Set

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

Cable assembly testing was performed using a six-inch GHS7M-1011-1-6 test sample. This sample can be seen in the figure below. Both Straight and Right-Angle Test PCB sets were used to obtain data for this report.

Figure 3. Cable Assembly Test Sample

3.3.Bulkhead Feed-Thru and Sav-Con Connector Saver

GHSM Bulkhead Feed-Thru testing was performed using the GHSM-1011-2R15SN seen in Figure 4. Test data was obtained with the Straight Test PCB.

Figure 4. GHSM Bulkhead Feed-Thru Test Sample

GHSM Sav-Con testing was performed using the GHSM2R-15USP1 seen in Figure 5. As with the Bulkhead Feed-Thru, data was obtained with the Straight Test PCB set.

Figure 5. GHSM Sav-Con Connector Saver Test Sample

3.4.Test Pairs

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

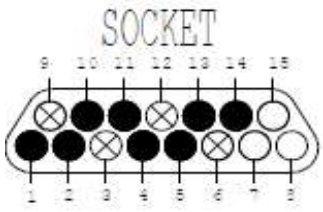

Figure 6. GHSM Test Pairs

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

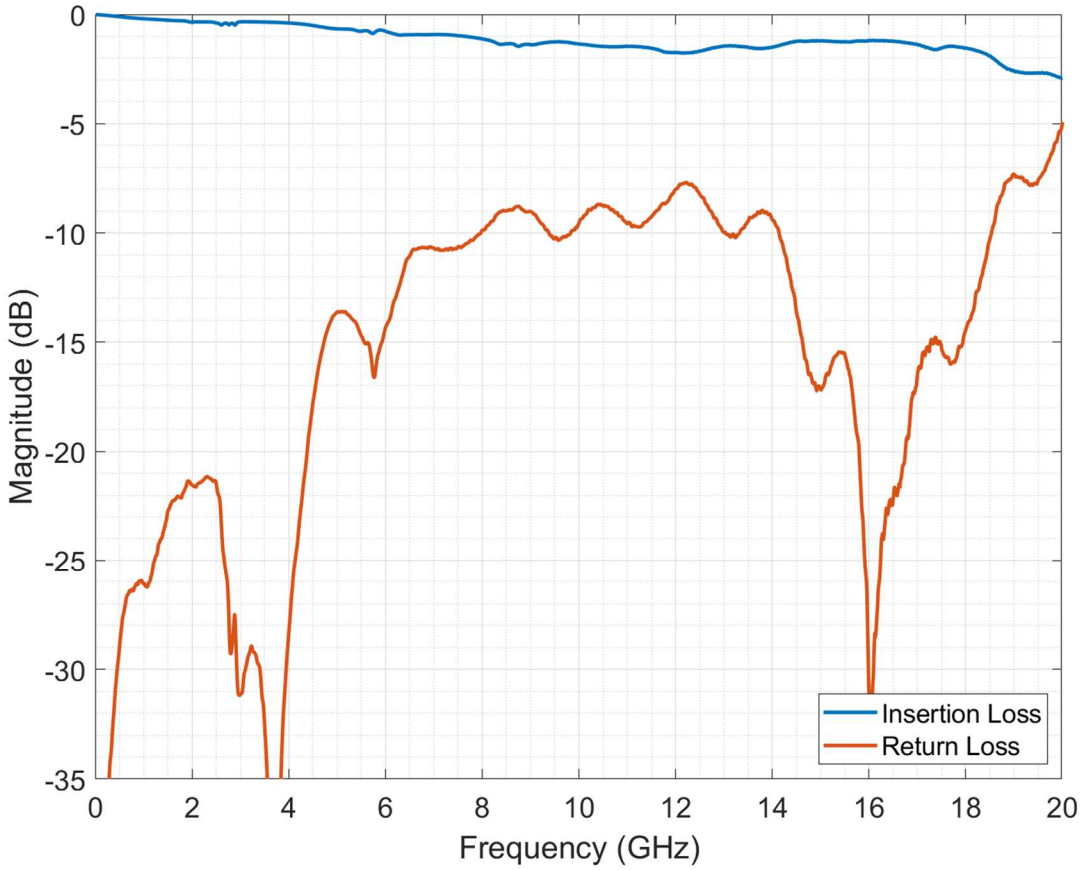

Figure 7. Straight GHSM (BSS) Response

4.1.2. Straight GHSM (BSS) Crosstalk

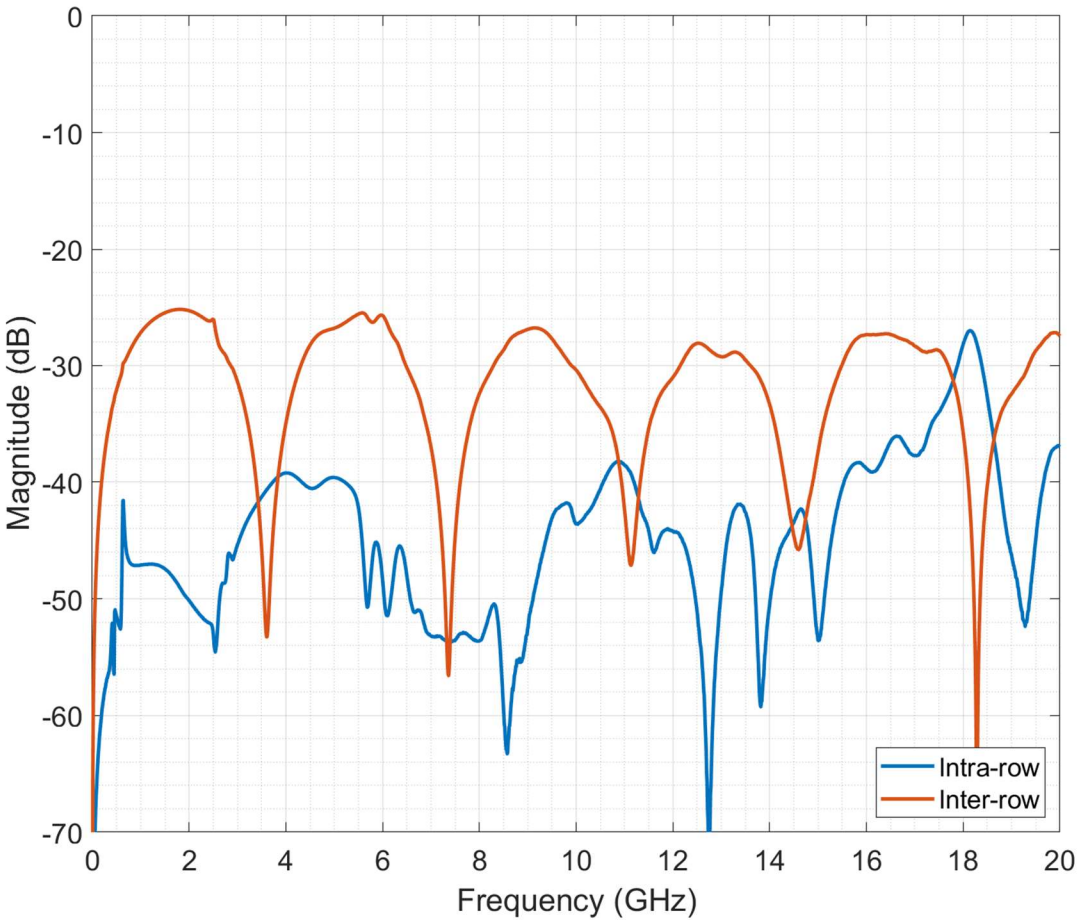

Figure 8. Straight GHSM (BSS) NEXT

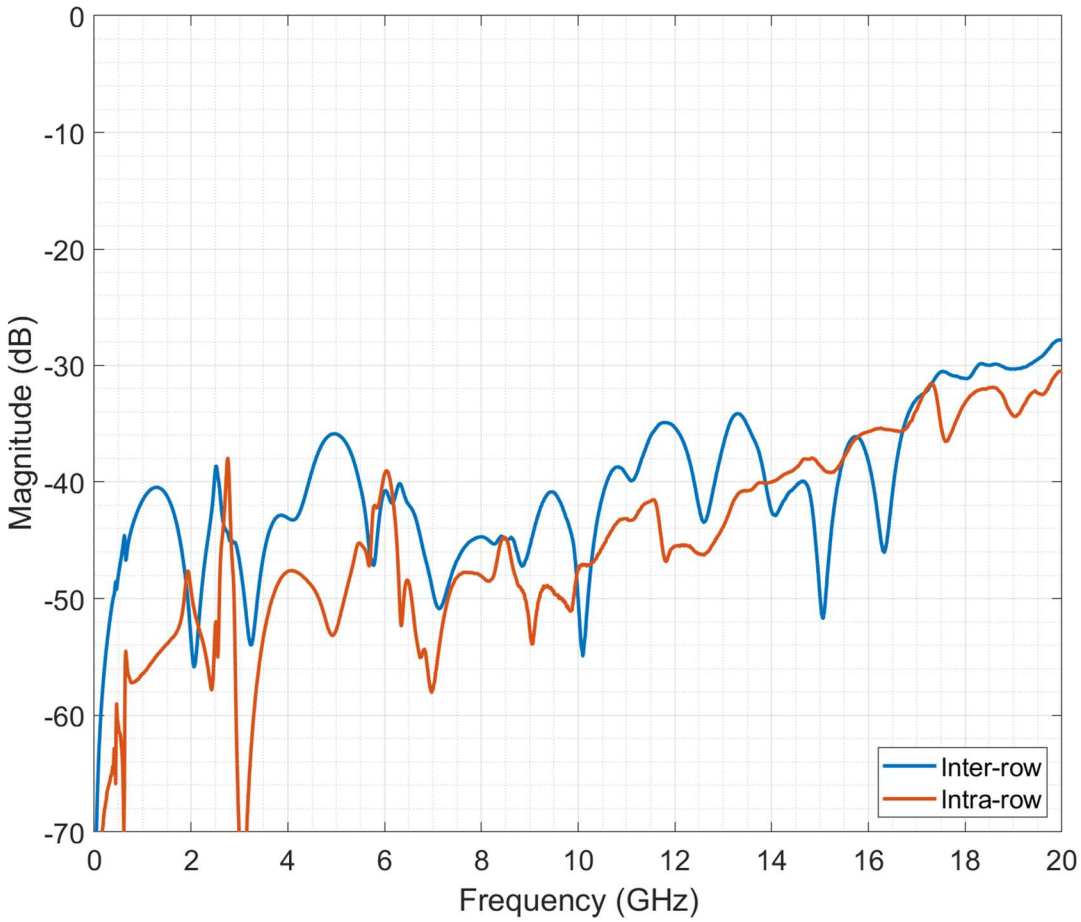

Figure 9. Straight GHSM (BSS) FEXT

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

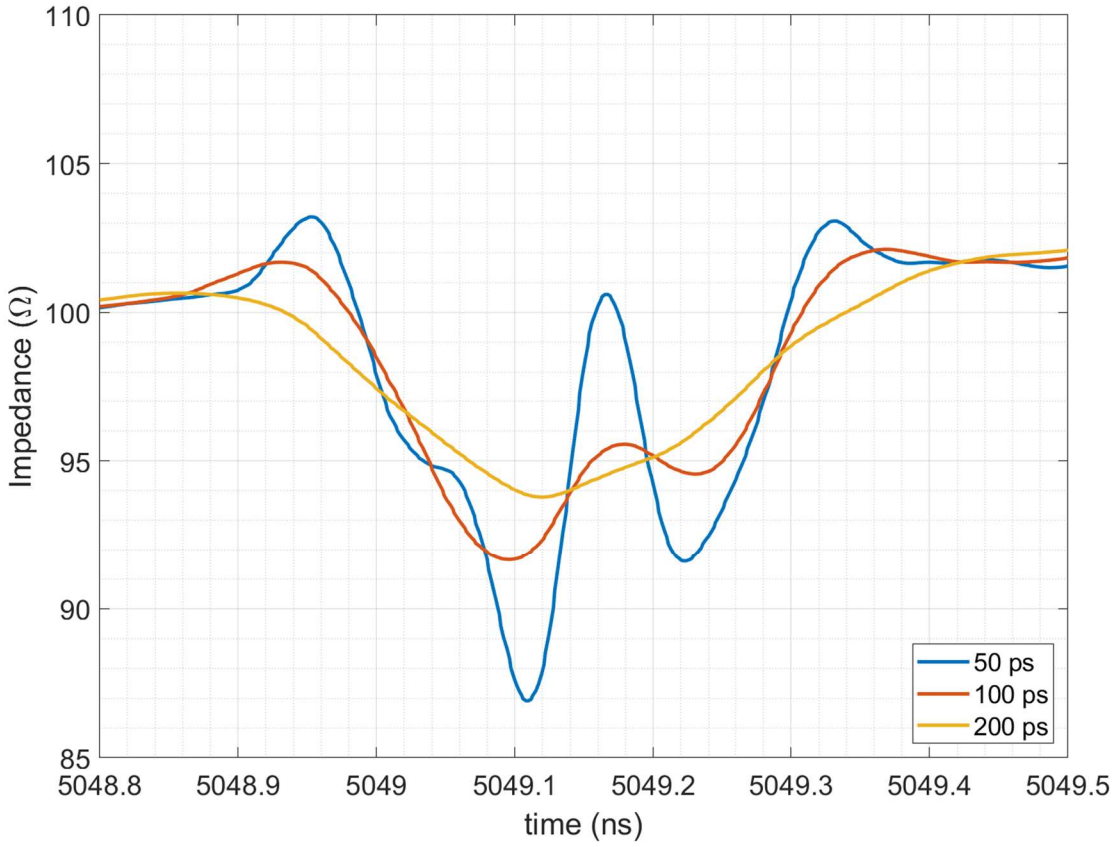

Figure 10. TDR – Straight GHSM (BSS)

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

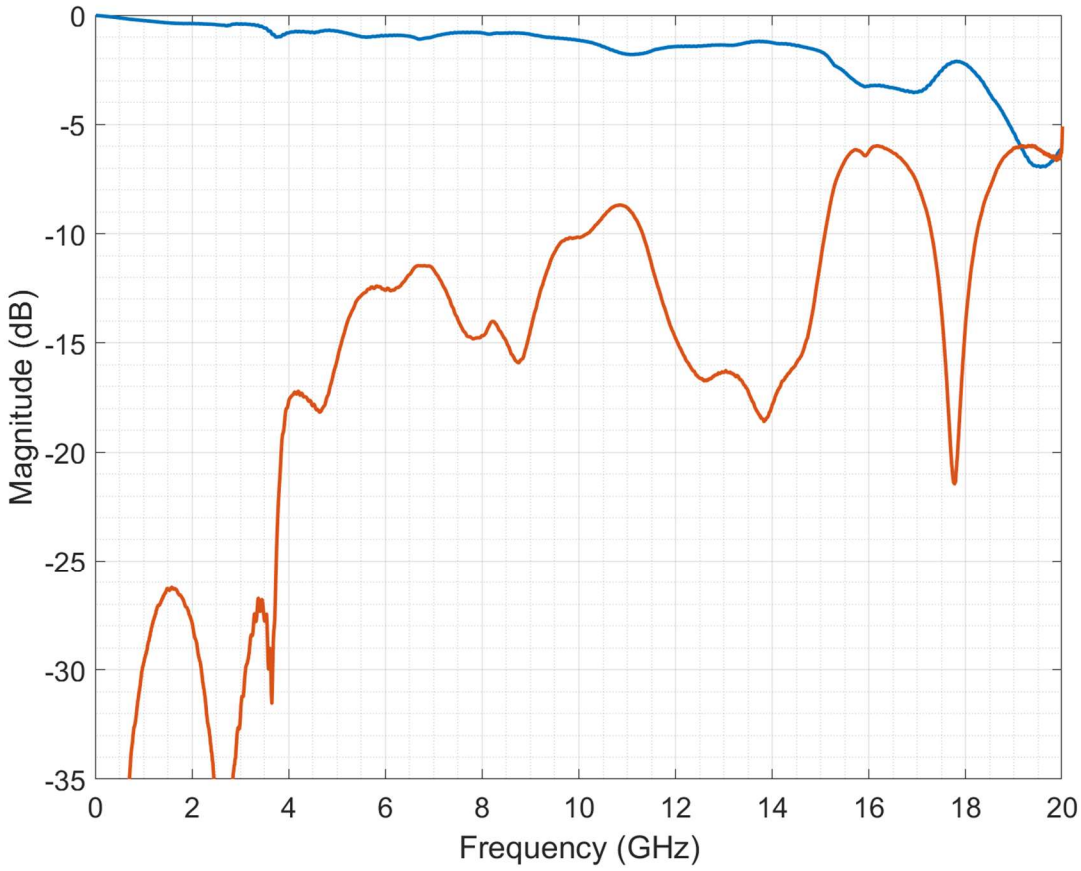

Figure 11. Right-Angle GHSM (HBR) PTH Response

Board-to-Board Results

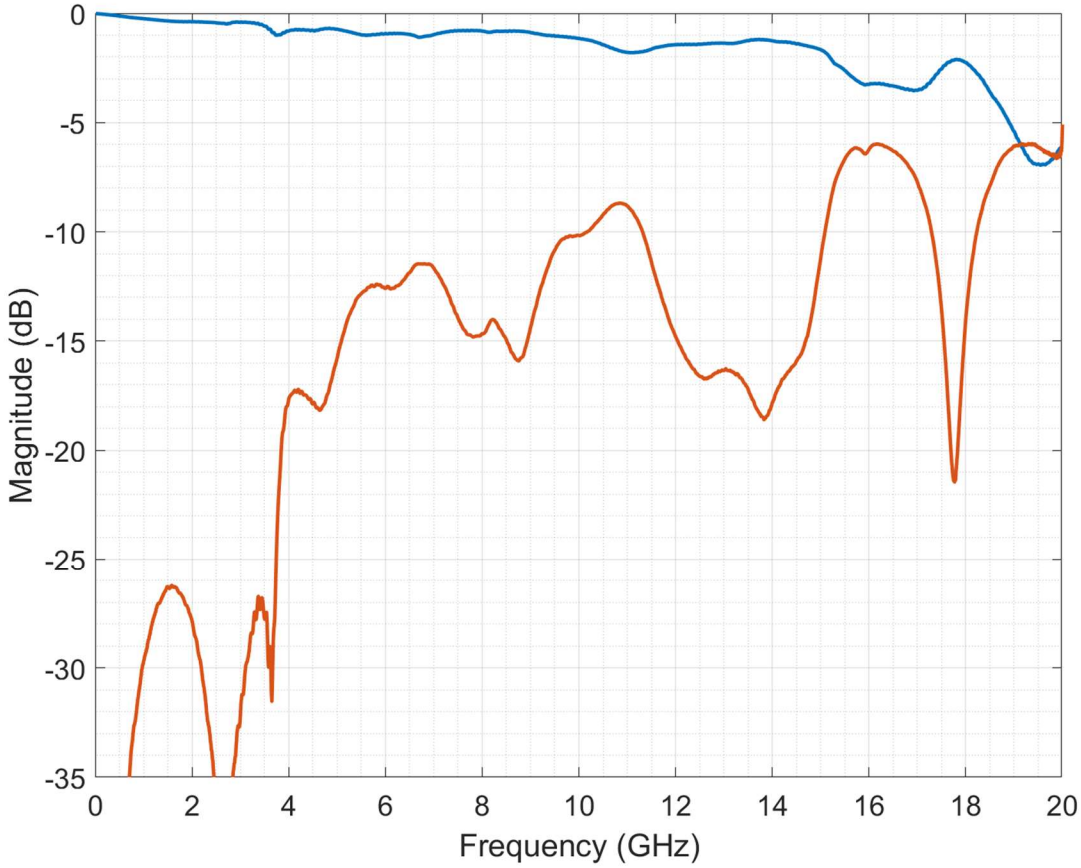

Figure 12. Right-Angle GHSM (HBR) SMT Response

4.2.2. Right-Angle (HBR) GHSM Crosstalk

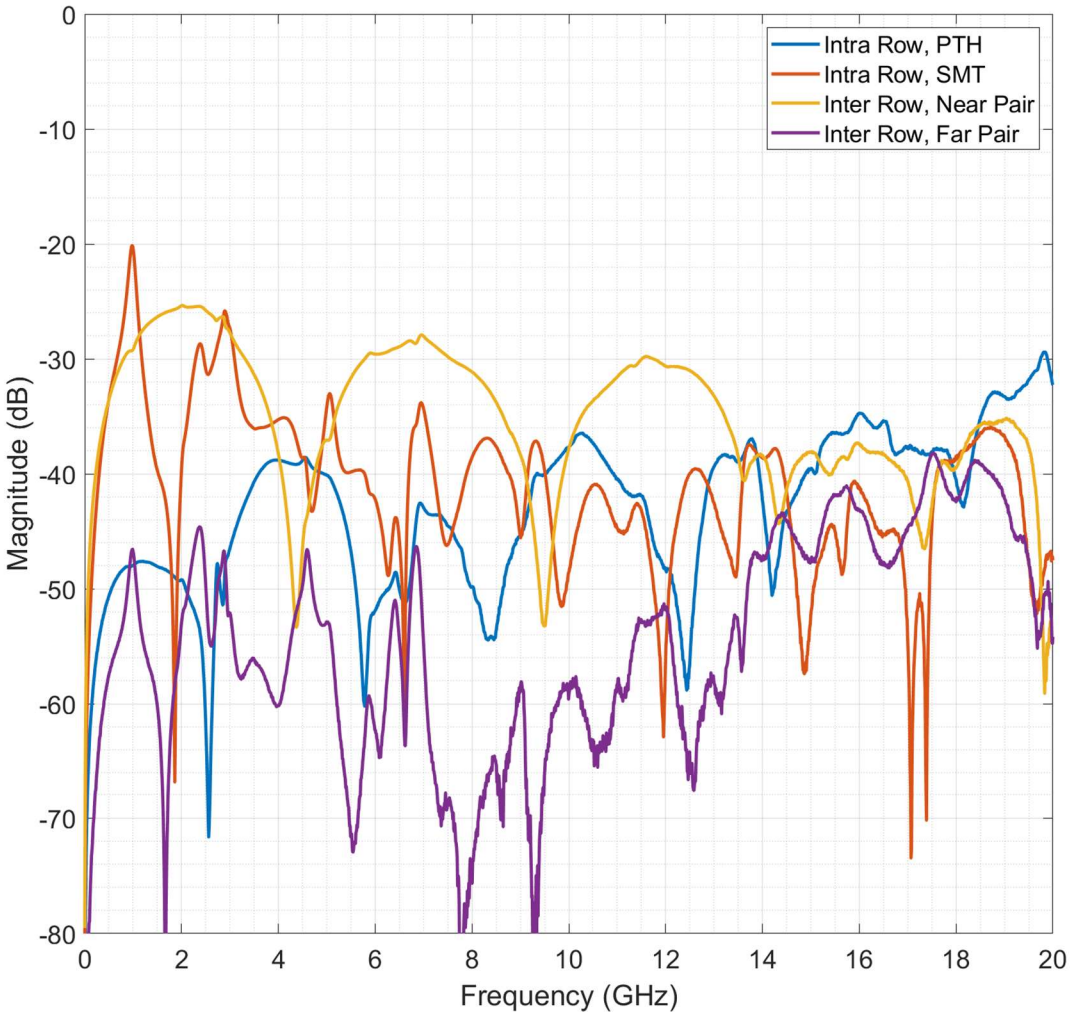

Figure 13. Right-Angle GHSM (HBR) NEXT

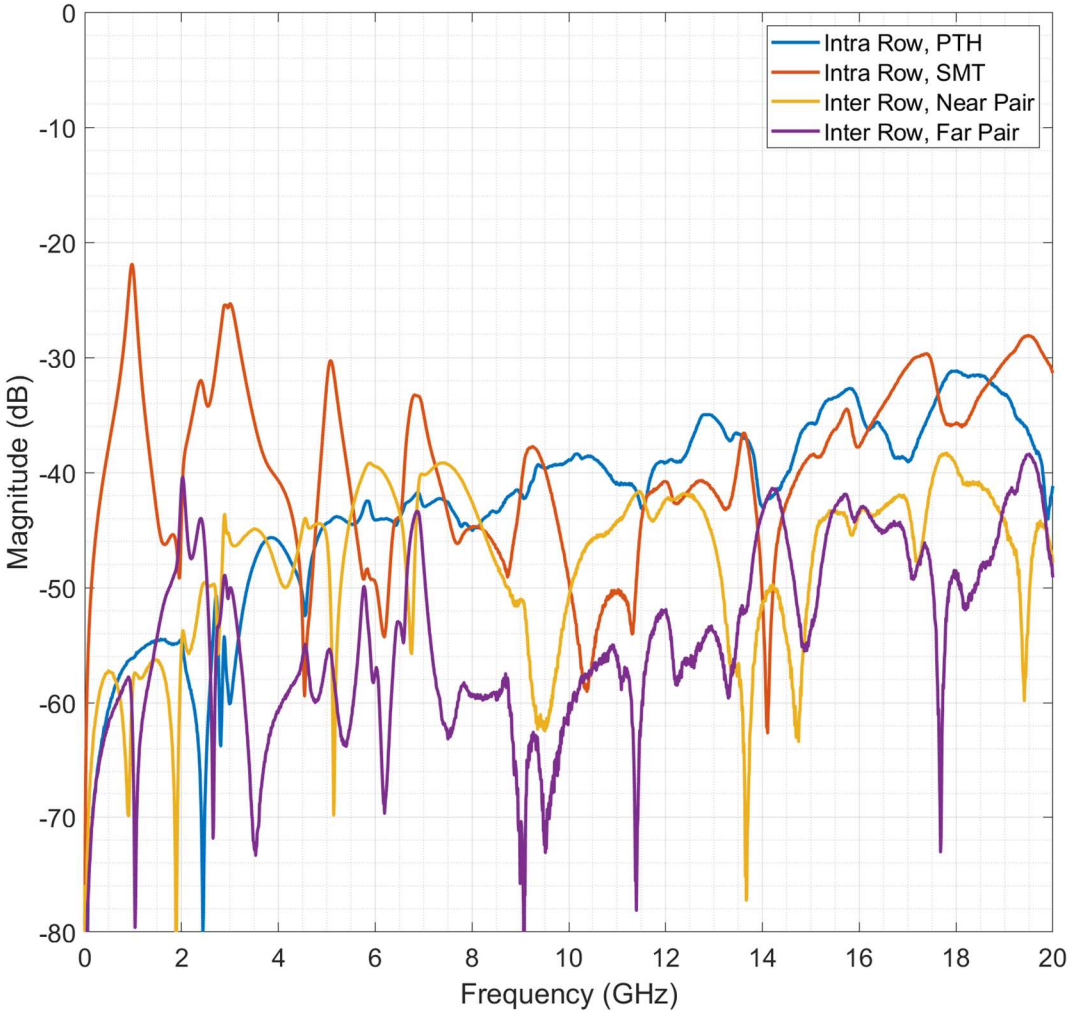

Figure 14. Right-Angle GHSM (HBR) FEXT

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

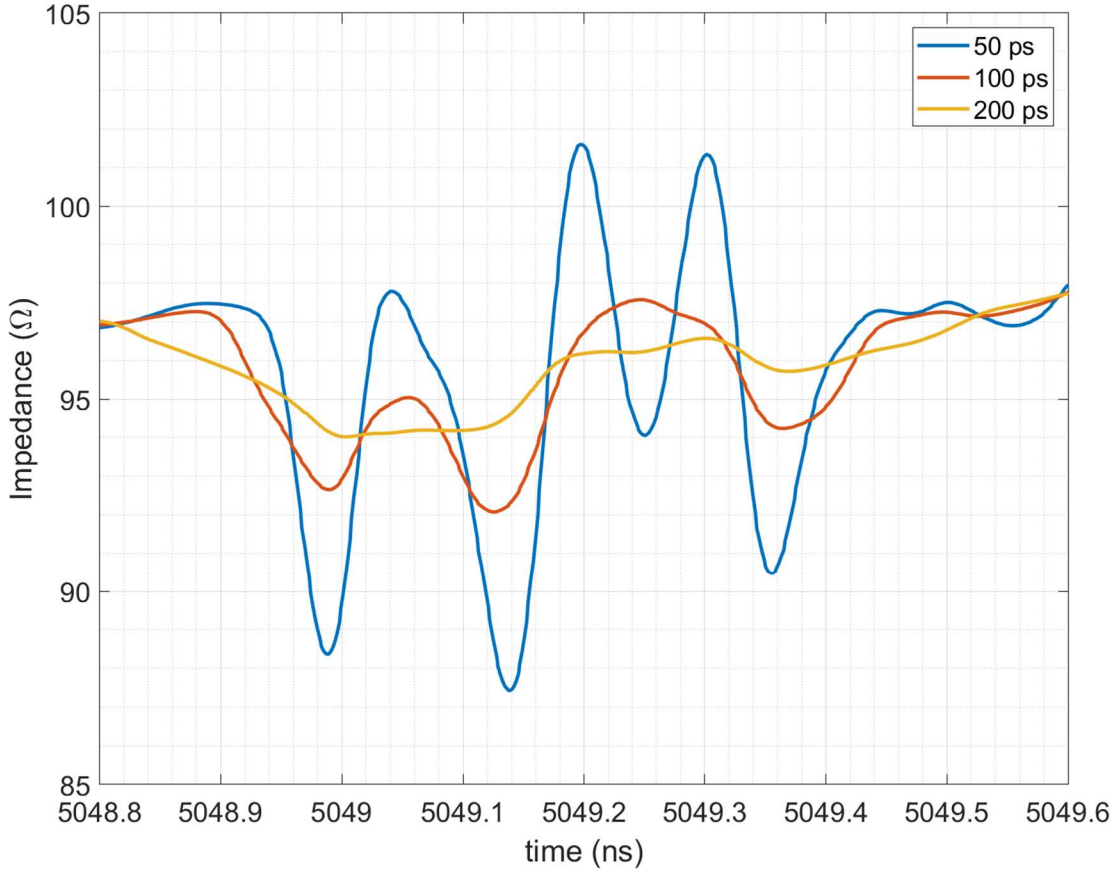

Figure 15. TDR – Right-Angle GHSM (HBR) PTH

Board-to-Board Results

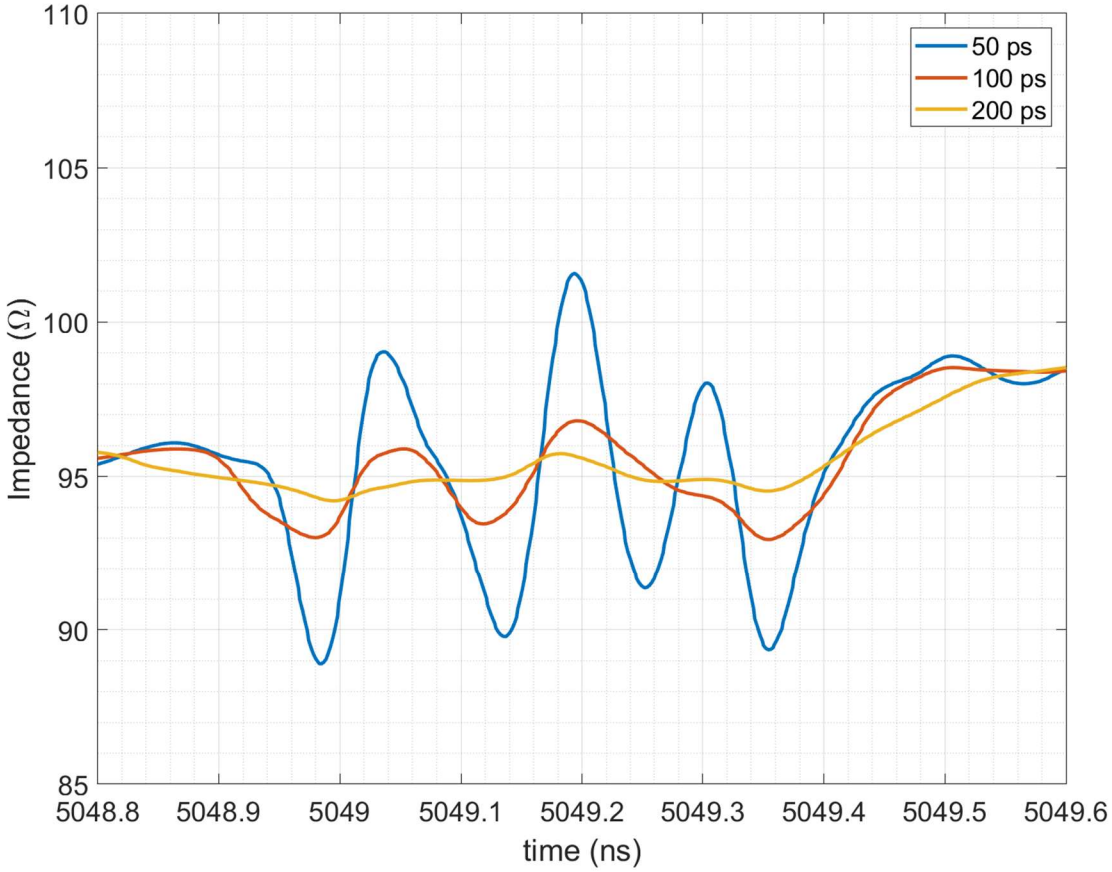

Figure 16. TDR – Right-Angle GHSM (HBR) SMT

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

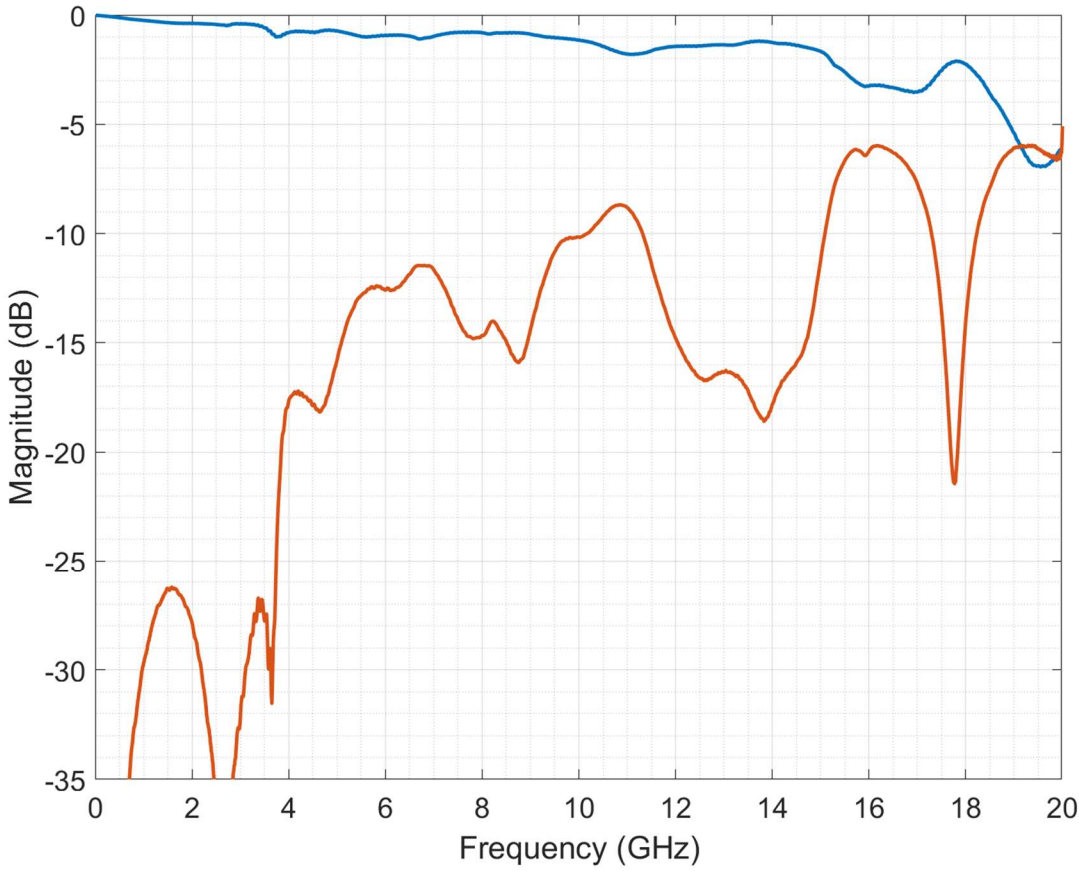

Figure 17. Straight to Right-Angle GHSM Response

4.3.2. Straight to Right-Angle GHSM Crosstalk

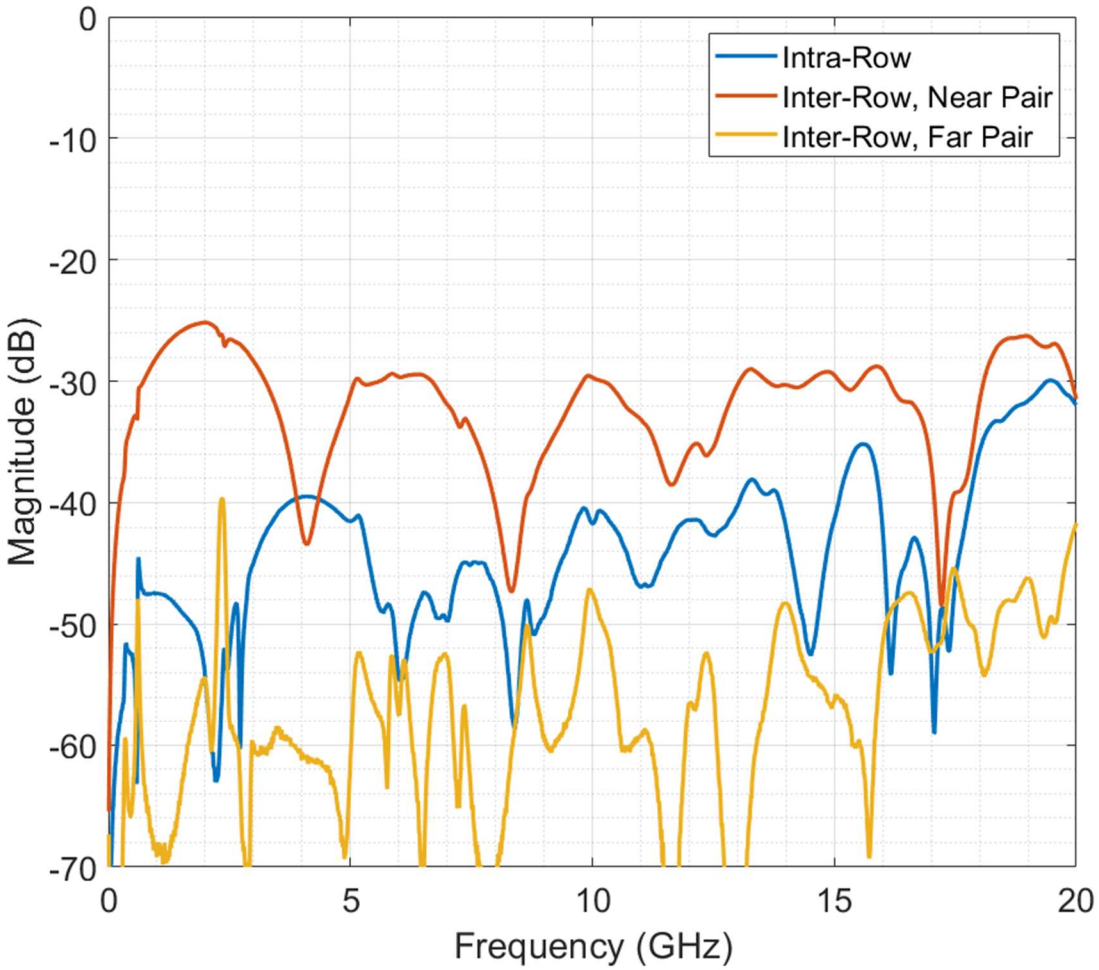

Figure 18. Straight to Right-Angle GHSM NEXT

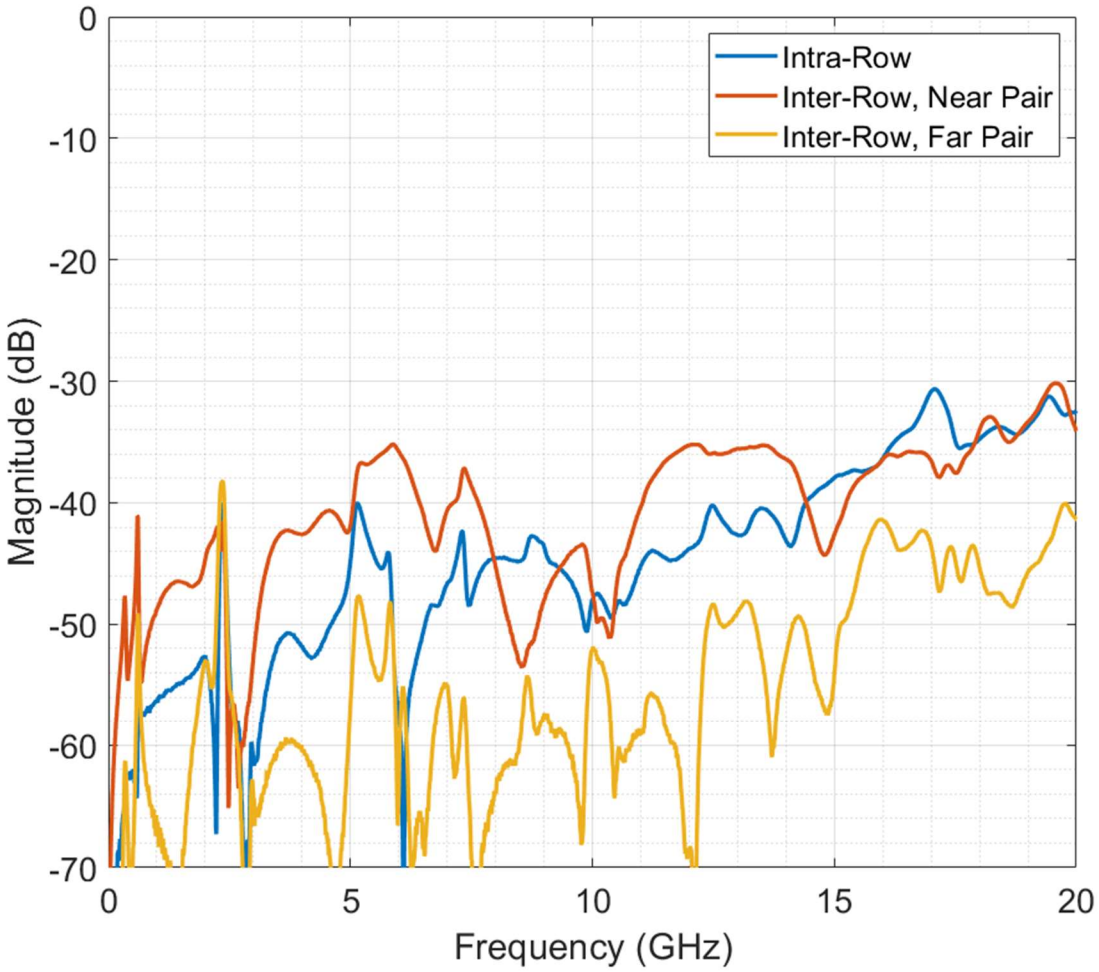

Figure 19. Straight to Right-Angle GHSM FEXT

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

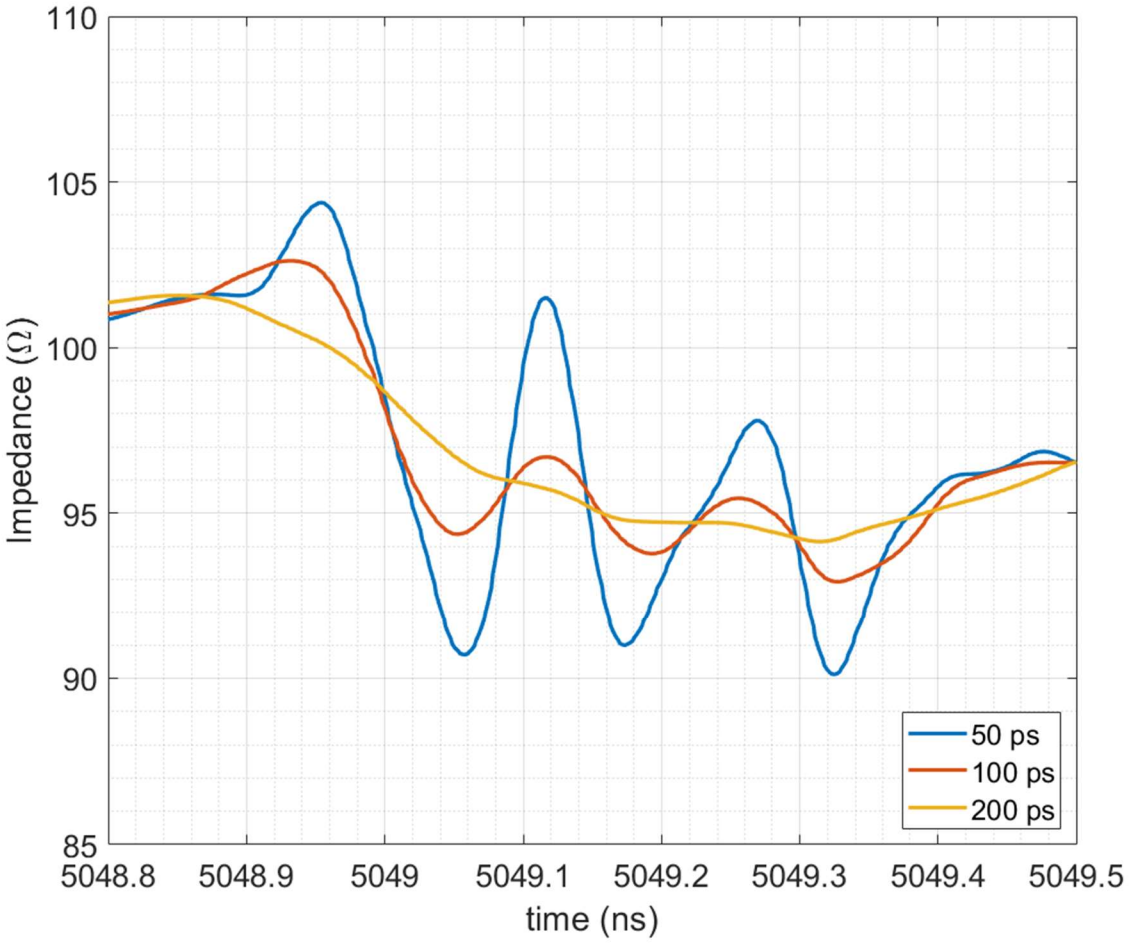

Figure 20. TDR – Straight to Right-Angle GHSM PTH

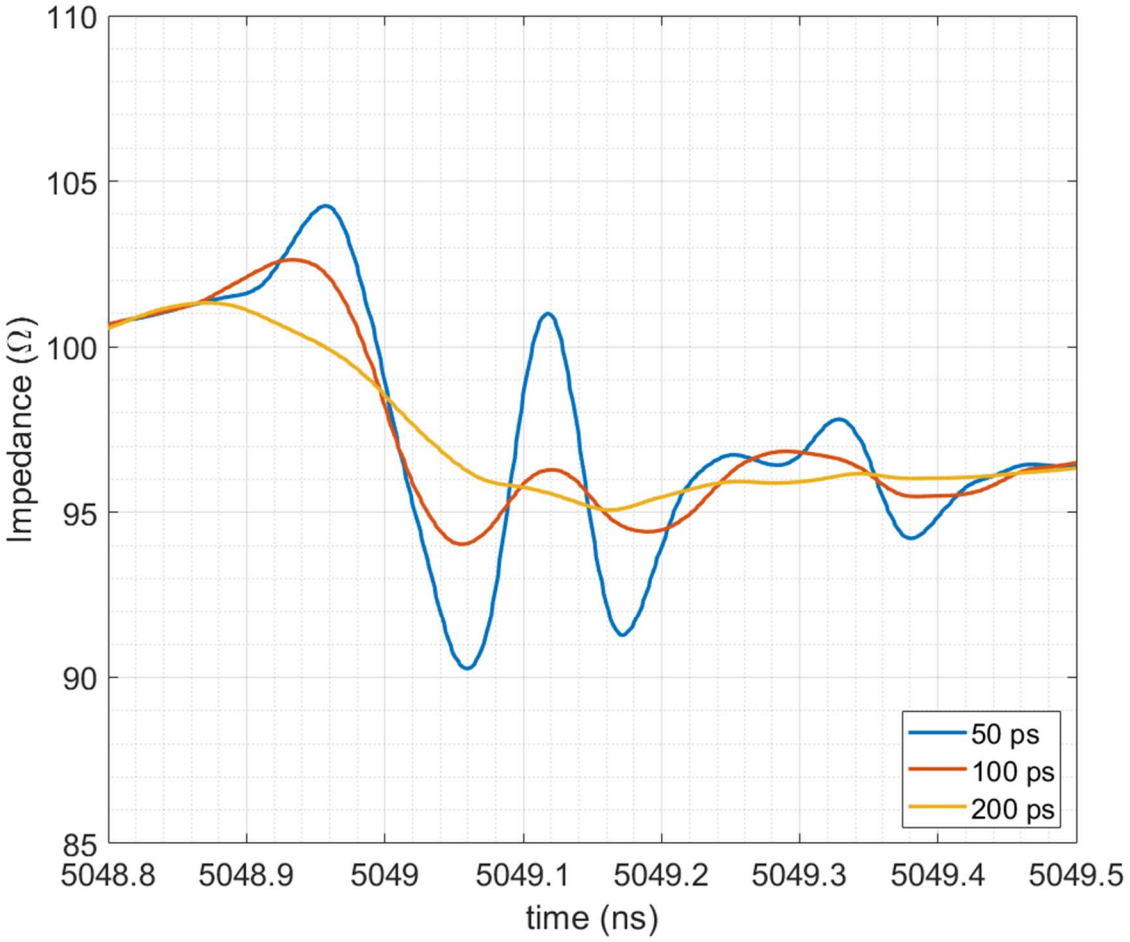

Figure 21. TDR – Straight to Right-Angle GHSM SMT

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

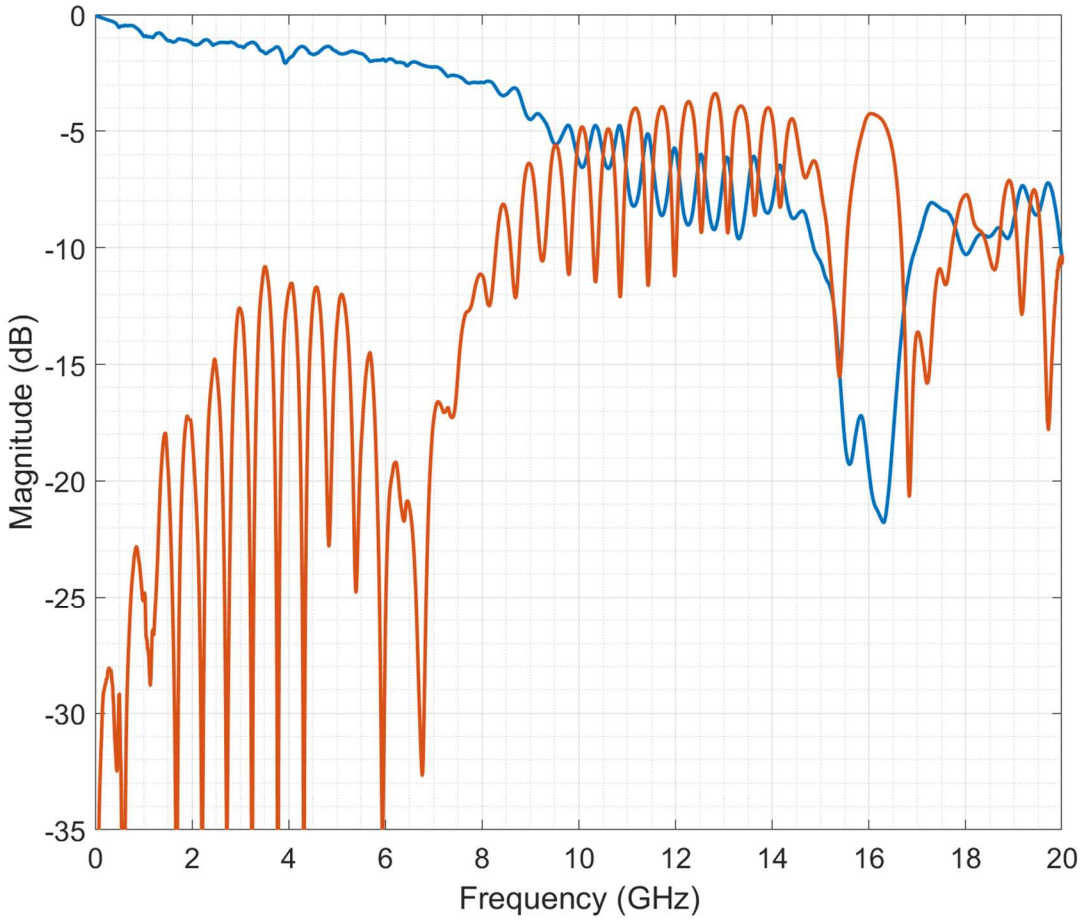

Figure 22. Straight to Straight GHSM (BSS) Response

5.1.2. Straight to Straight GHSM (BSS) Crosstalk

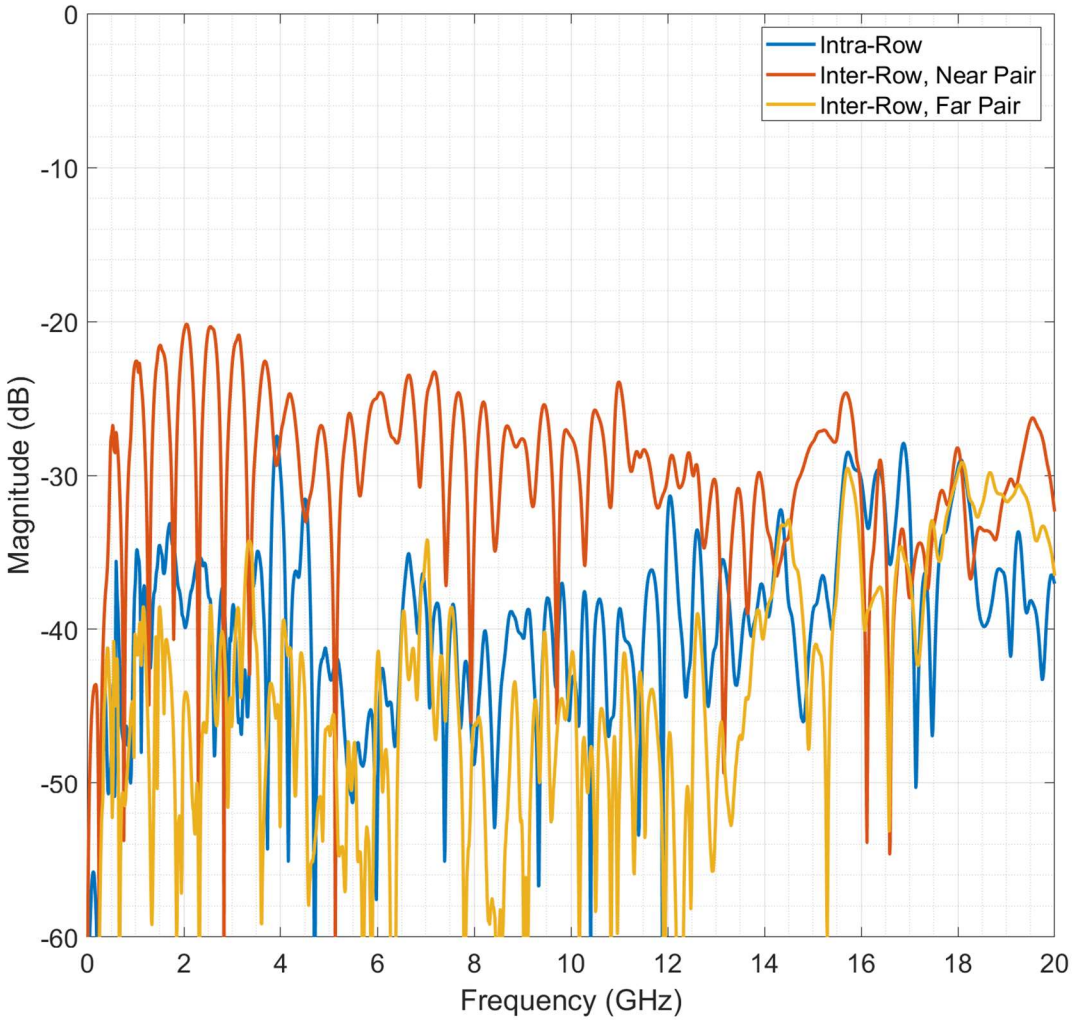

Figure 23. Straight to Straight GHSM (BSS) NEXT

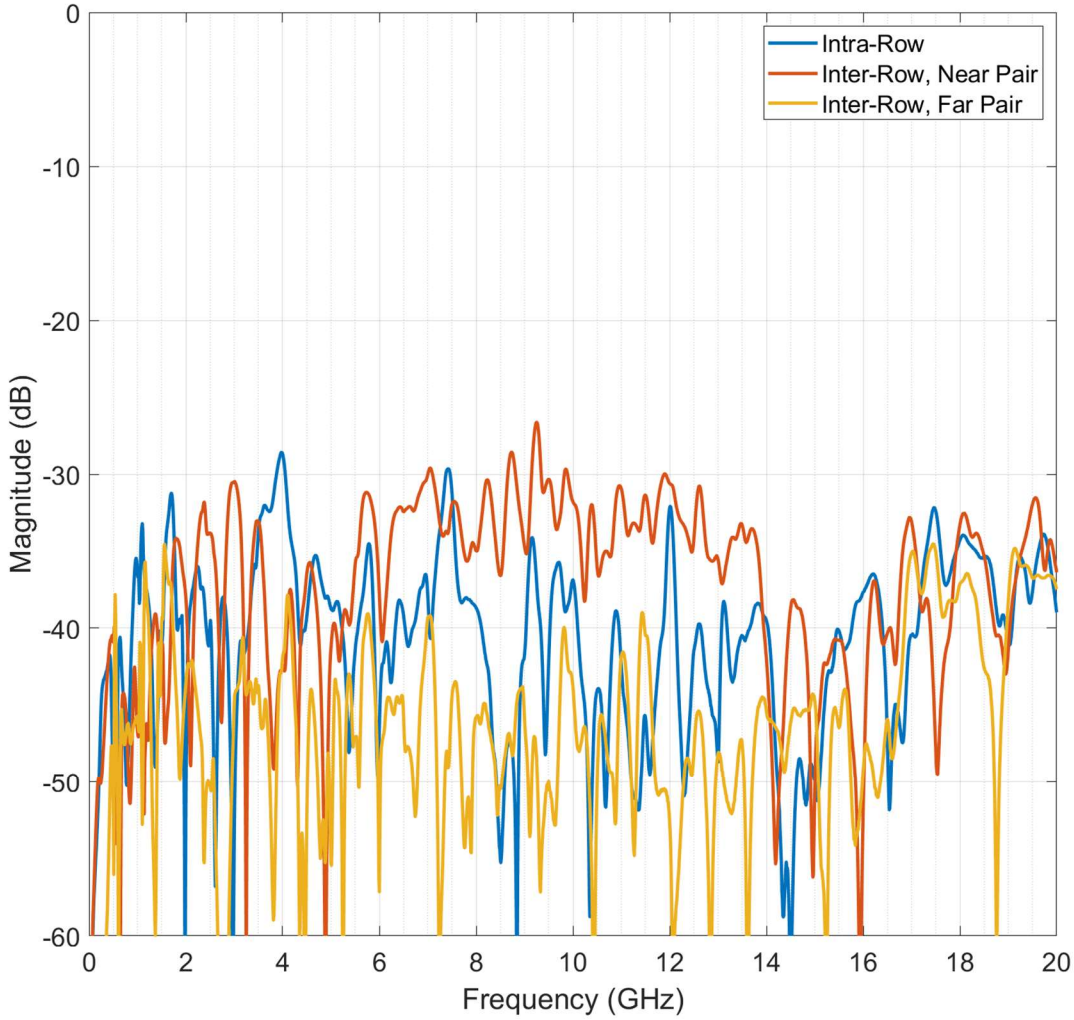

Figure 24. Straight to Straight GHSM (BSS) FEXT

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

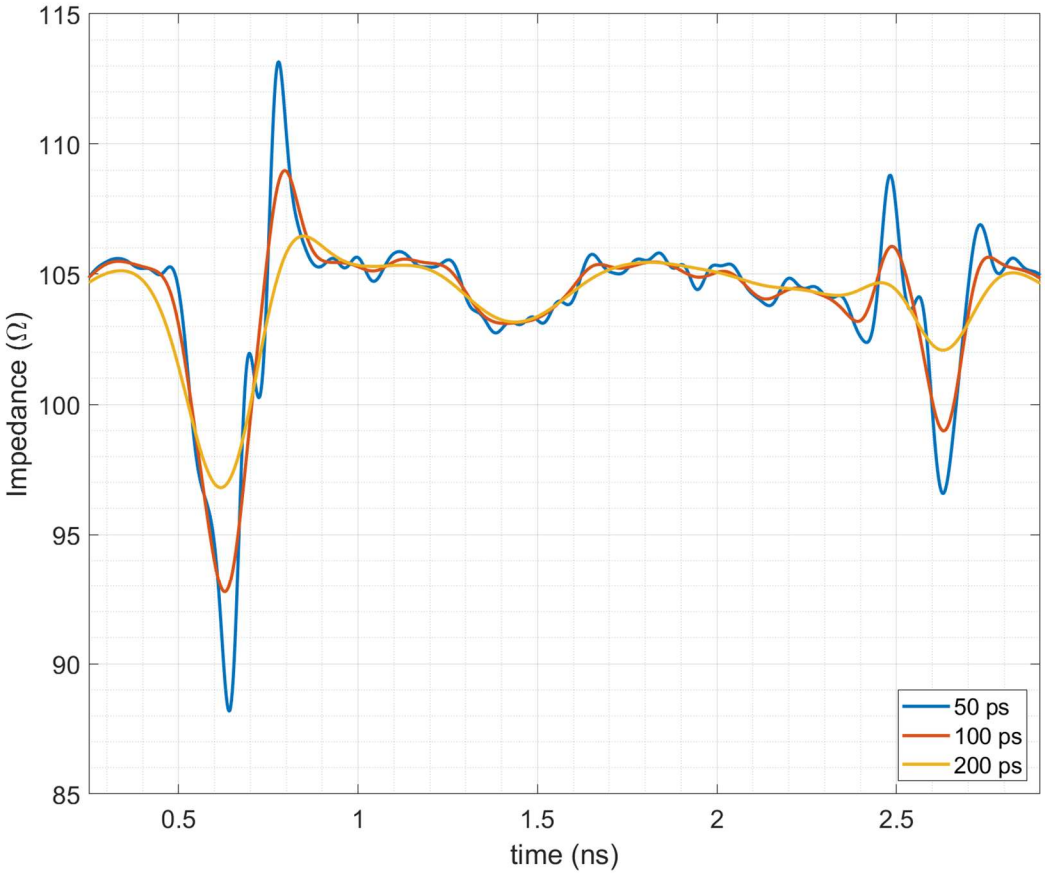

Figure 25. TDR – Straight to Straight GHSM (BSS)

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

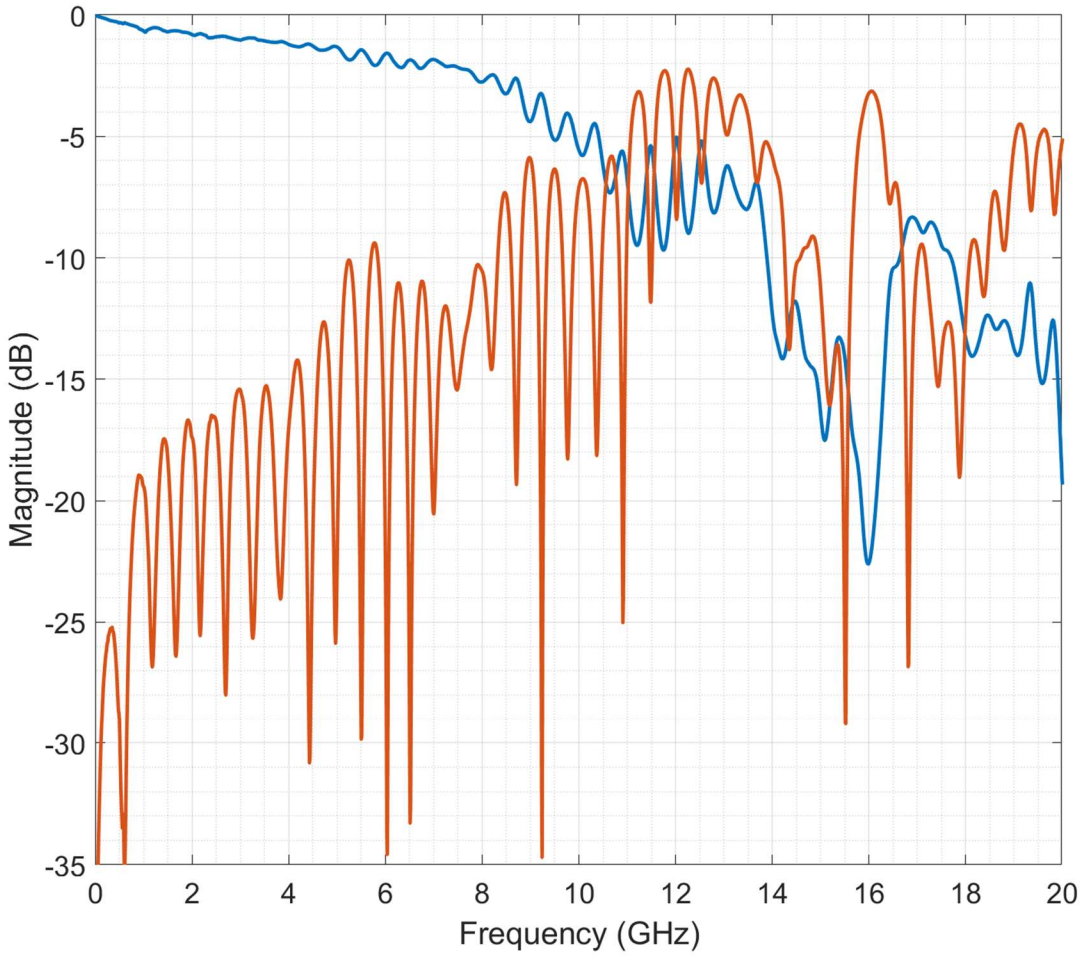

Figure 26. Right-Angle to Right-Angle GHSM (HBR) PTH Response

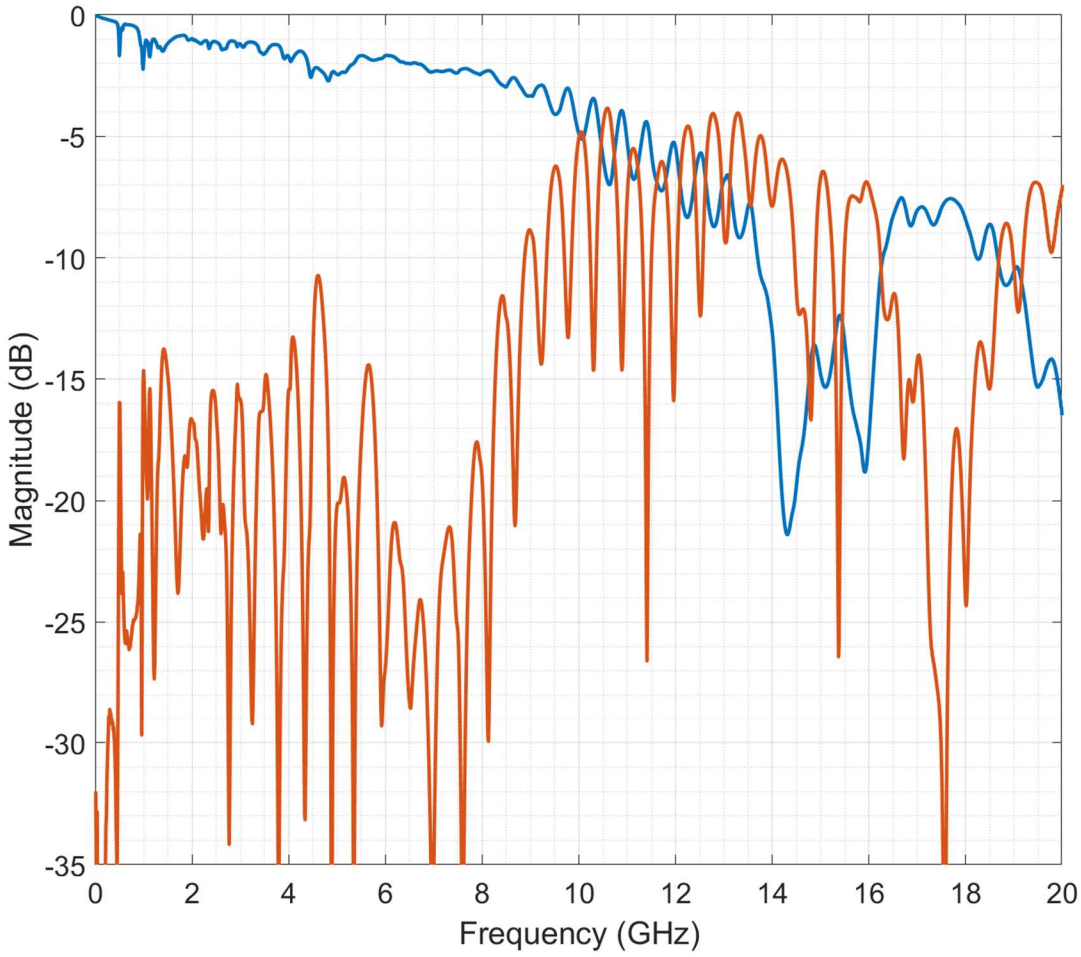

Figure 27. Right-Angle to Right-Angle GHSM (HBR) SMT Response

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

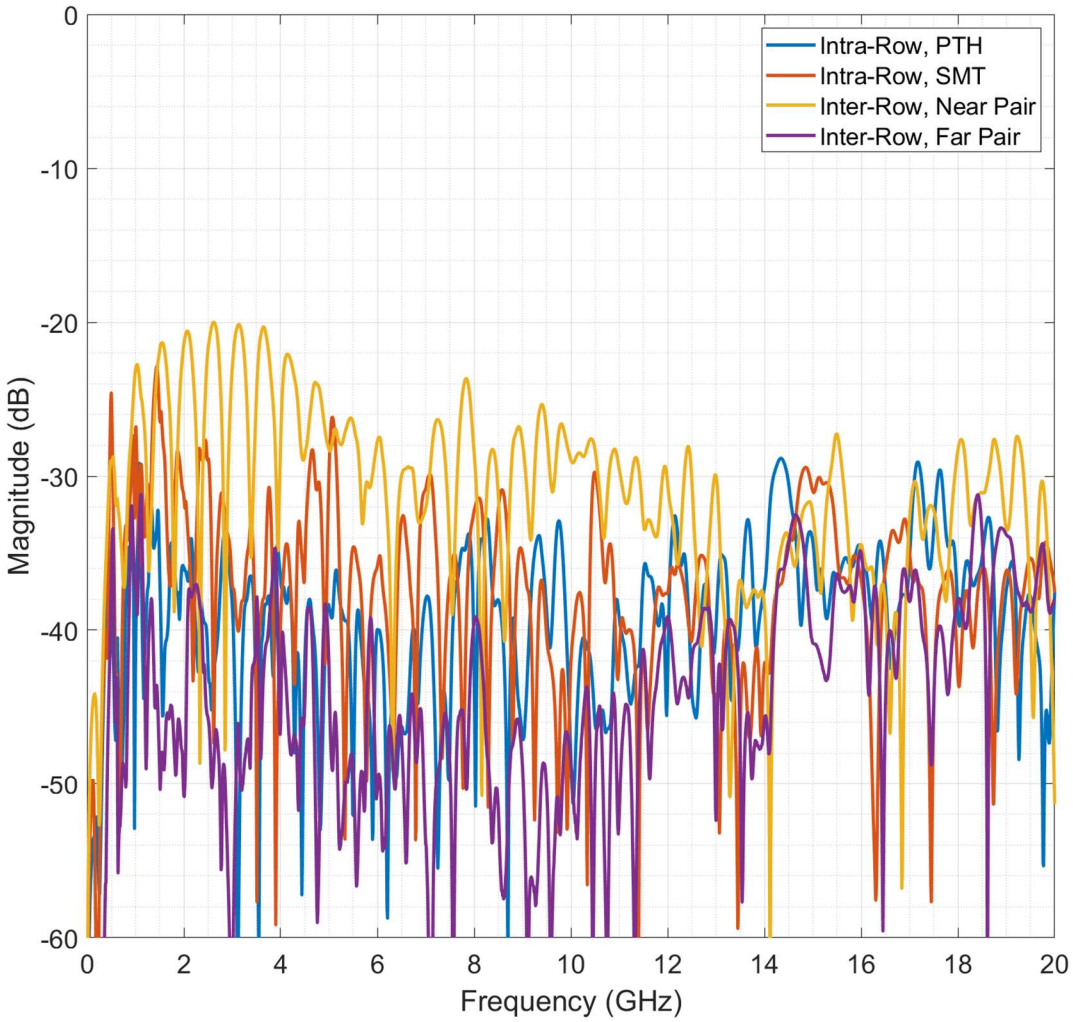

Figure 28. Right-Angle to Right-Angle GHSM (HBR) NEXT

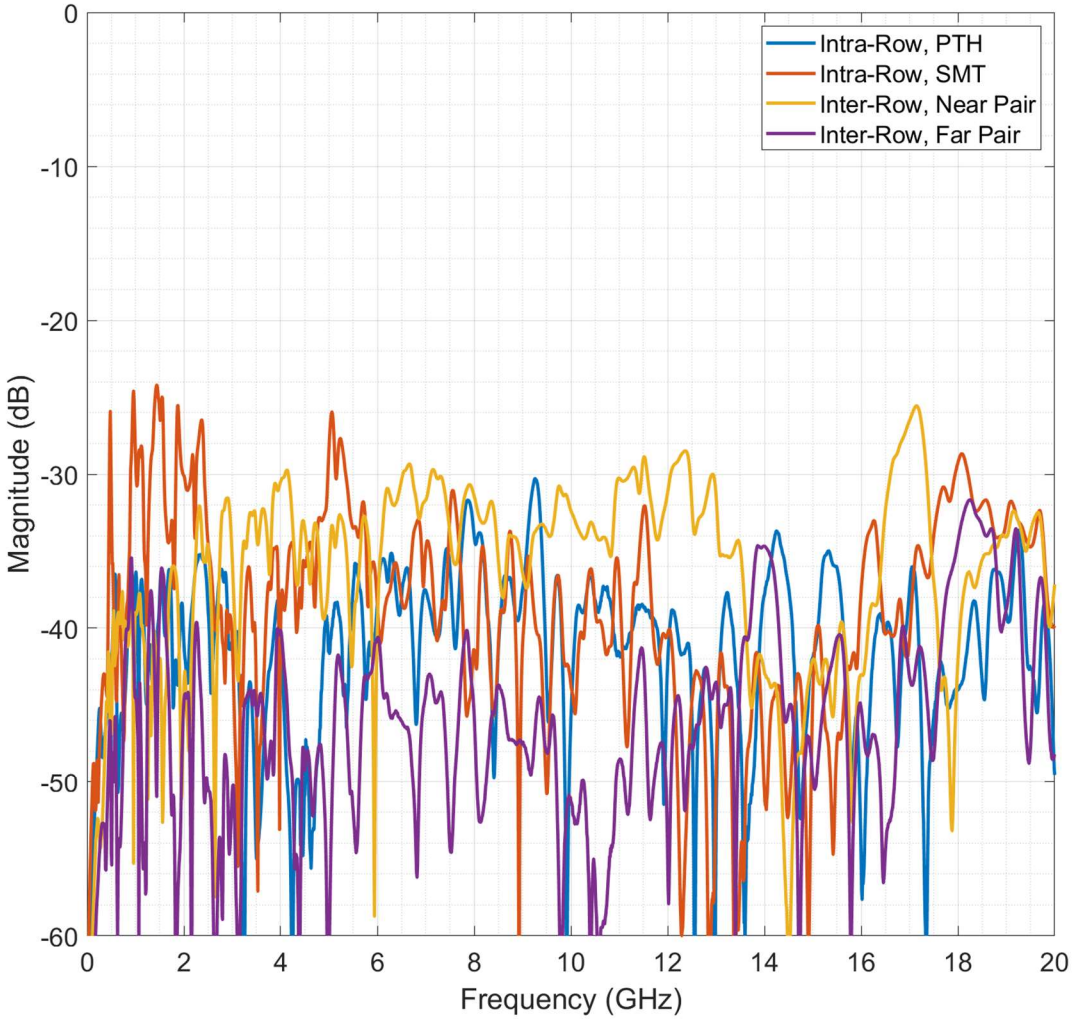

Figure 29. Right-Angle to Right-Angle GHSM (HBR) FEXT

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

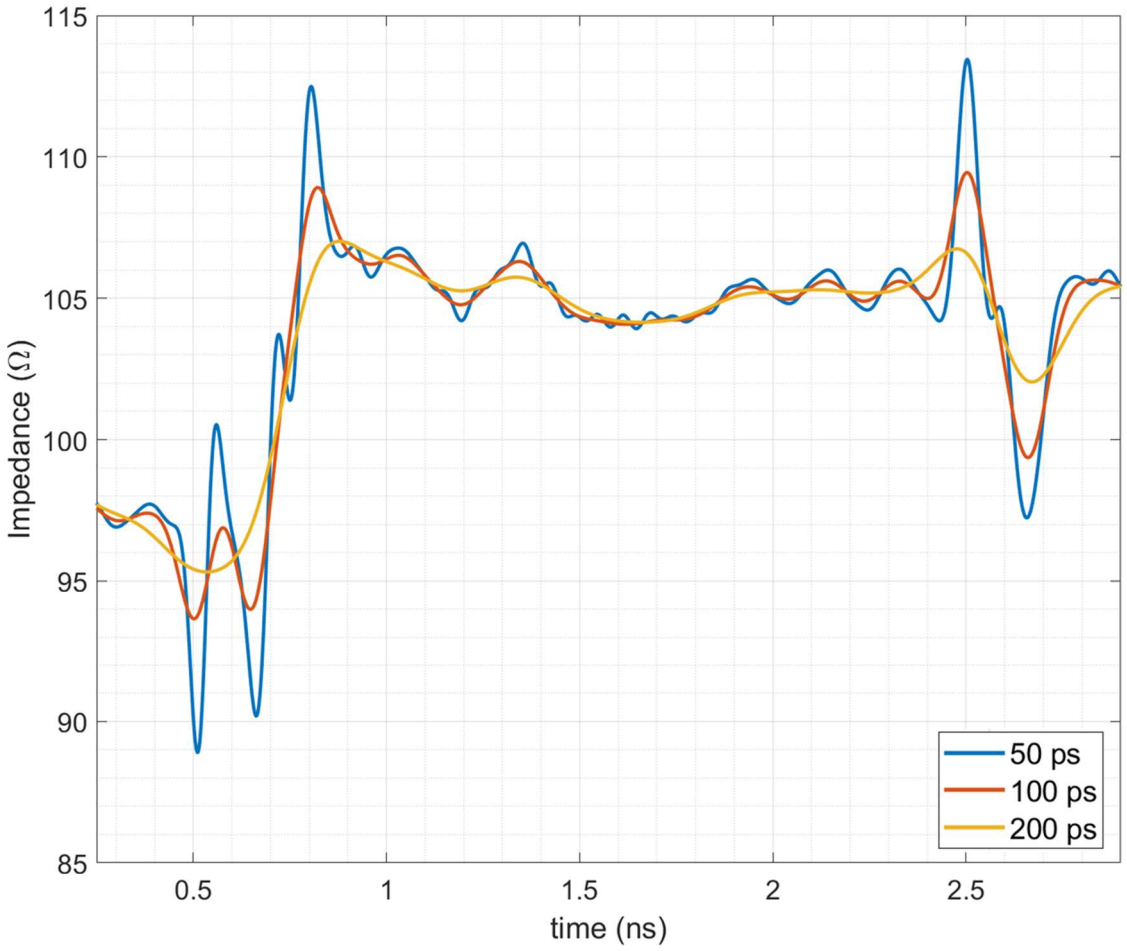

Figure 30. TDR – Right-Angle to Right-Angle GHSM (HBR) PTH

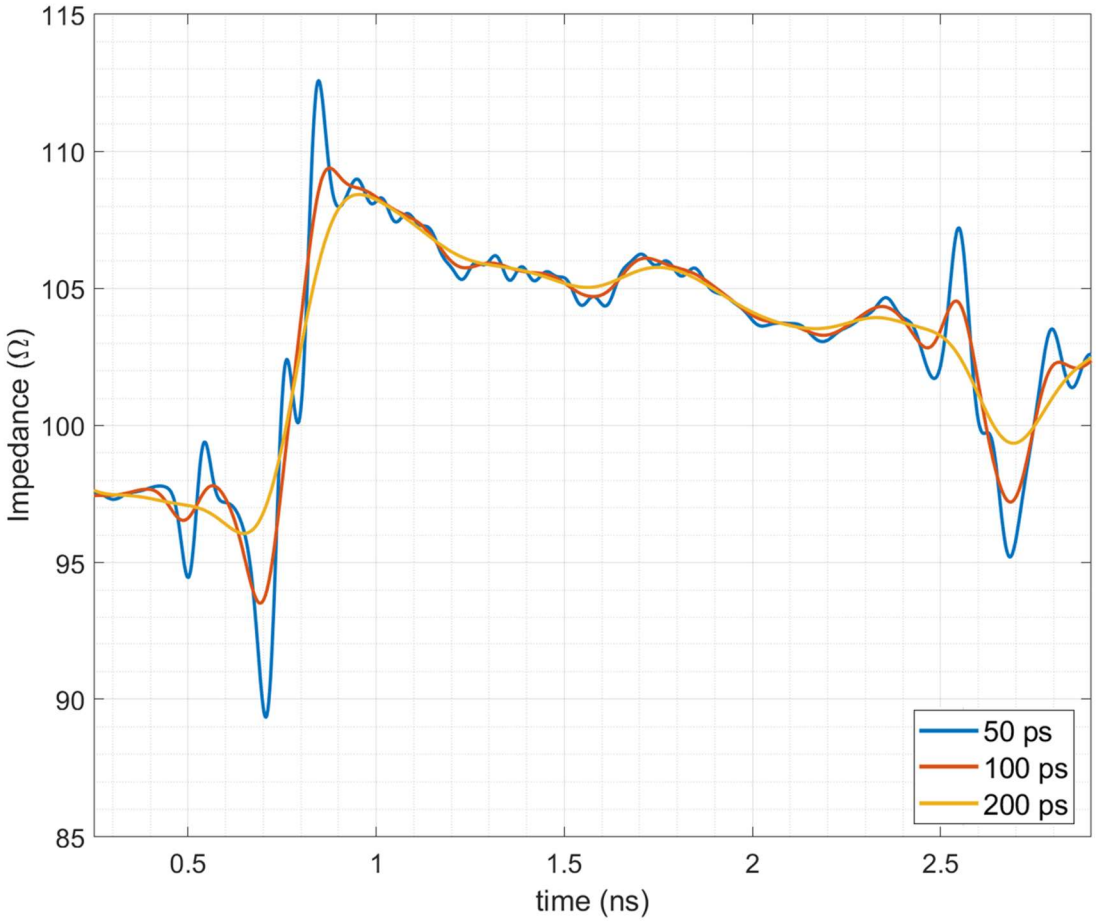

Figure 31. TDR – Right-Angle to Right-Angle GHSM (HBR) SMT

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

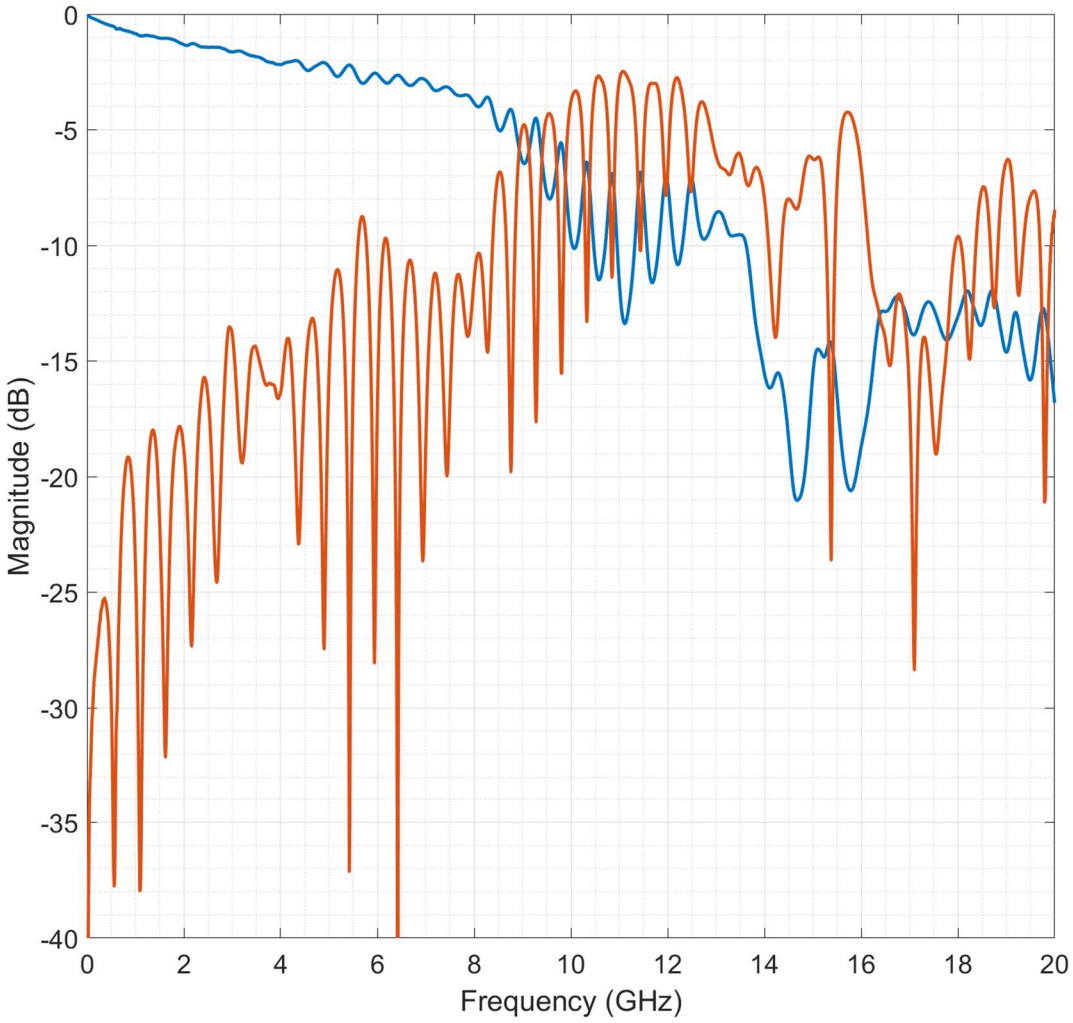

Figure 32. Straight to Right-Angle GHSM Response

5.3.2. Straight to Right-Angle GHSM Crosstalk

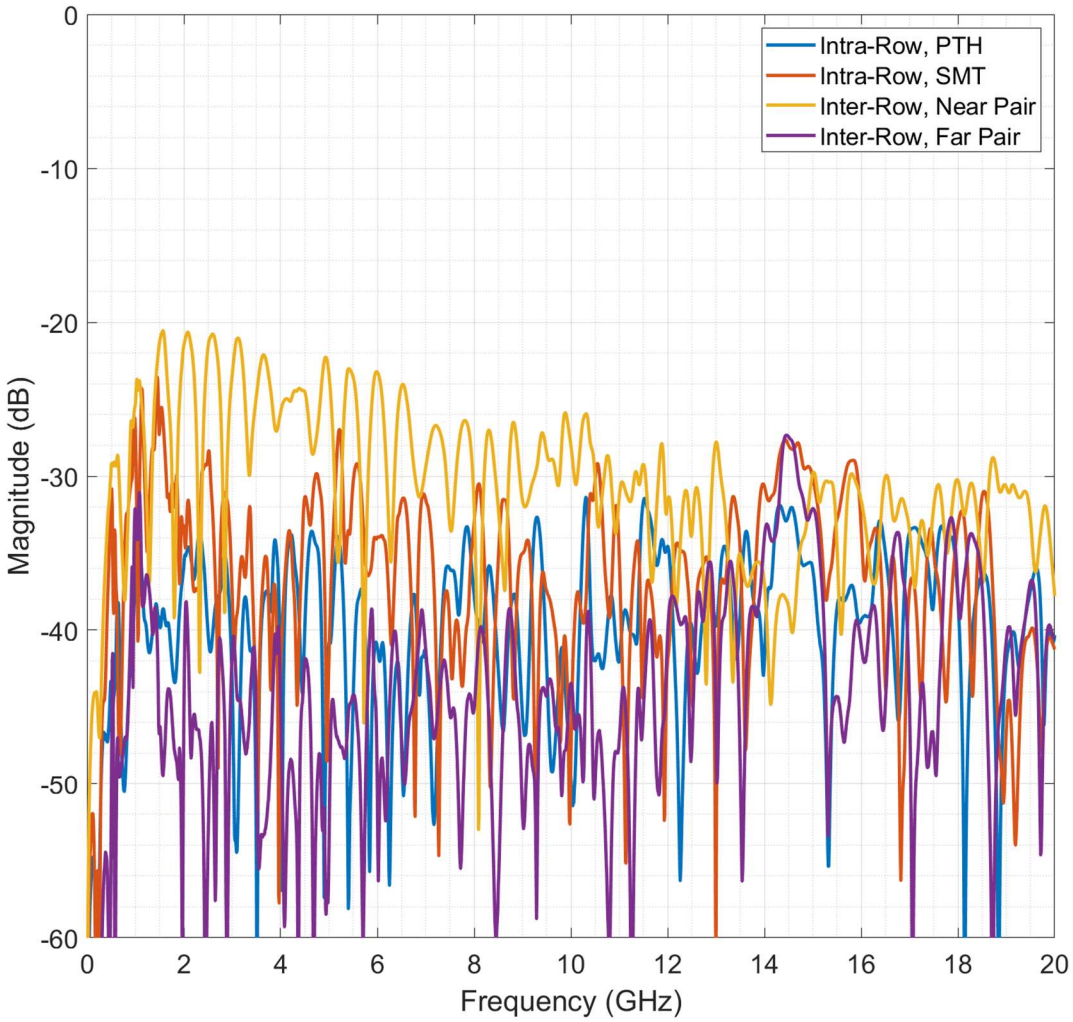

Figure 33. Straight to Right-Angle GHSM NEXT

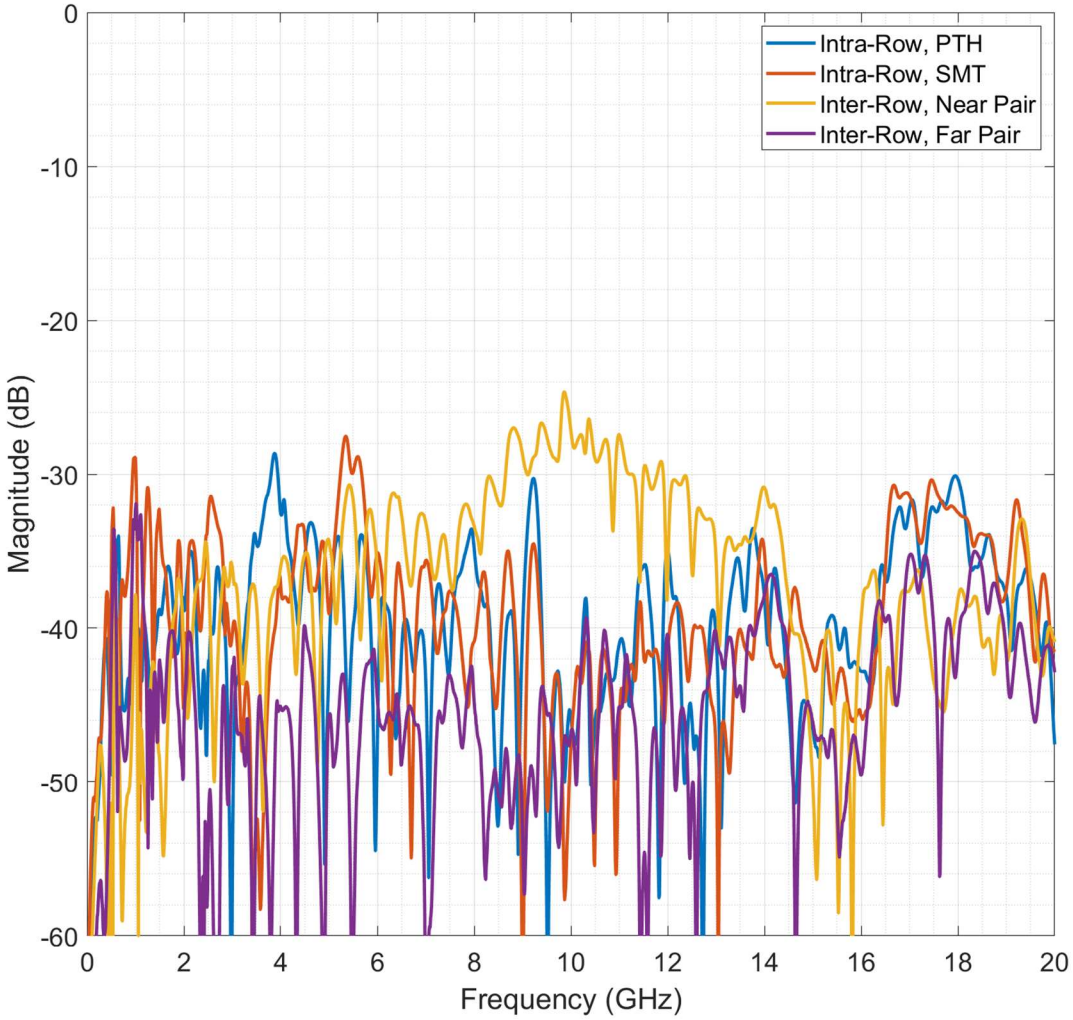

Figure 34. Straight to Right-Angle GHSM FEXT

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.

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Table 1. Bandwidth to Rise Time Relationship

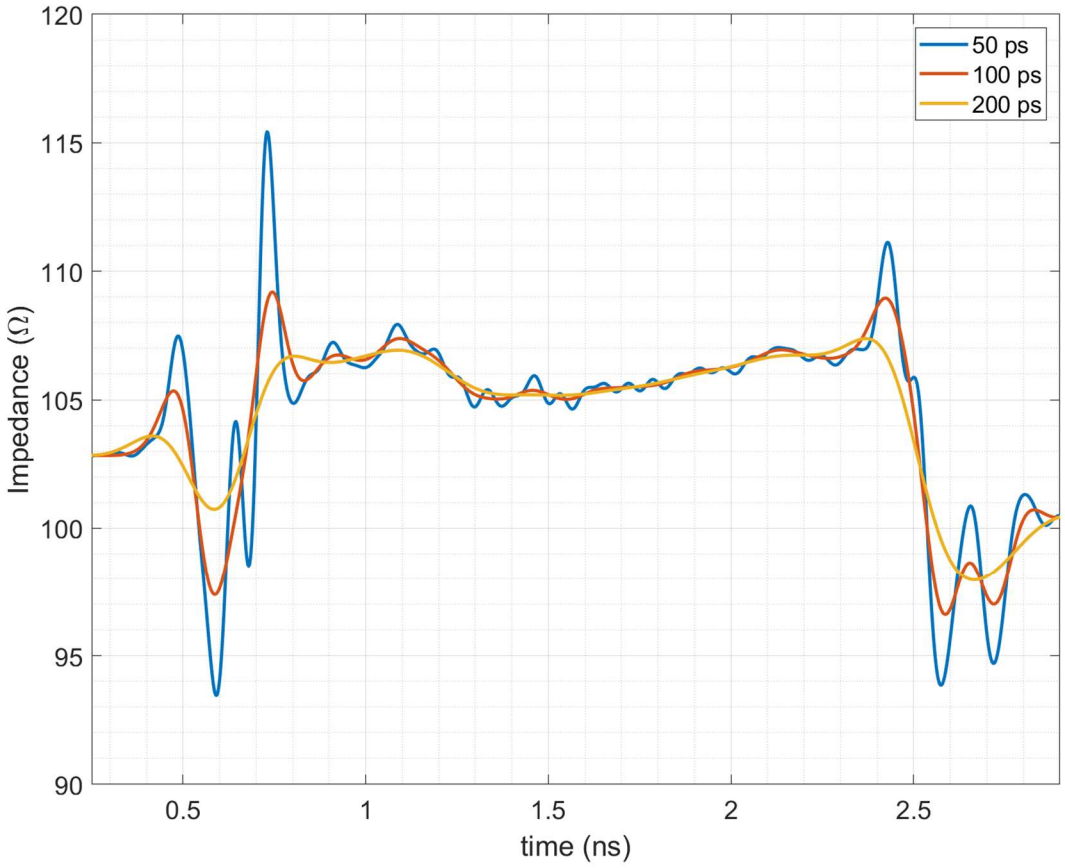

Figure 35. TDR – Straight to Right-Angle GHSM

6. Feed-Thru and Sav-Con Results

6.1.Feed-Thru Performance

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the Feed-Thru and mating PCB board connectors.

6.1.1. Insertion Loss / Return Loss

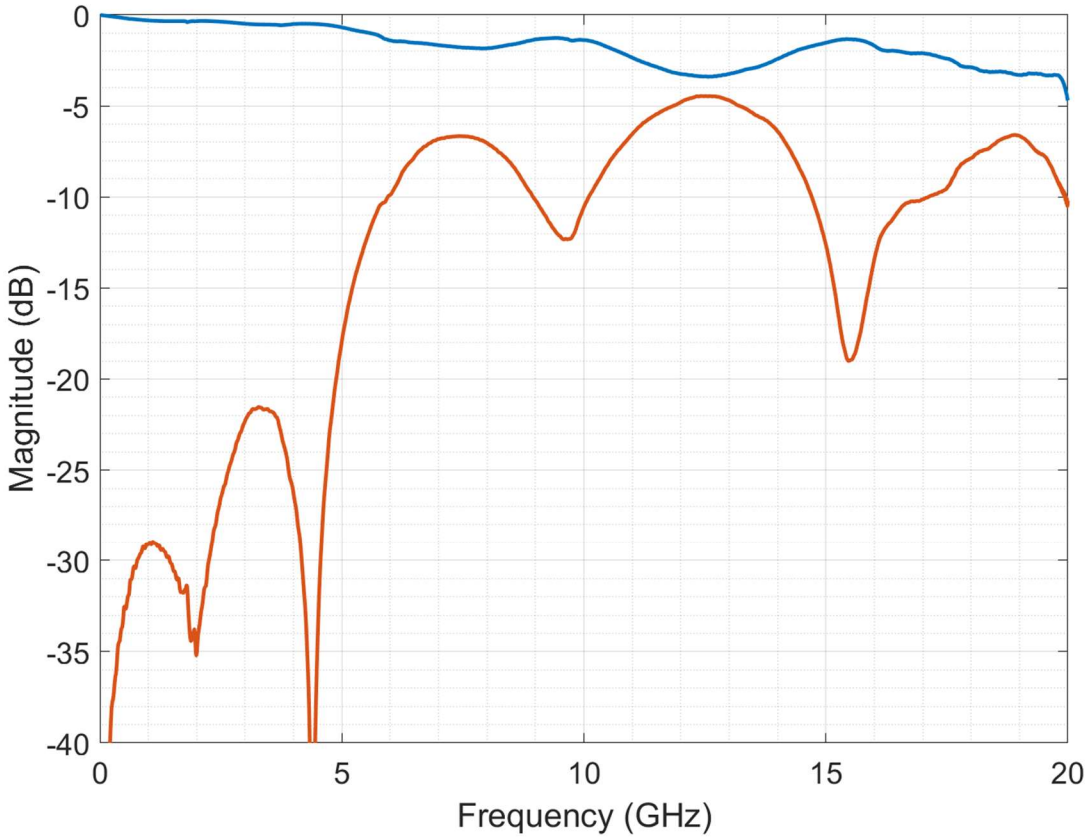

Figure 36. GHSM Feed-Thru Response

6.1.2. Crosstalk

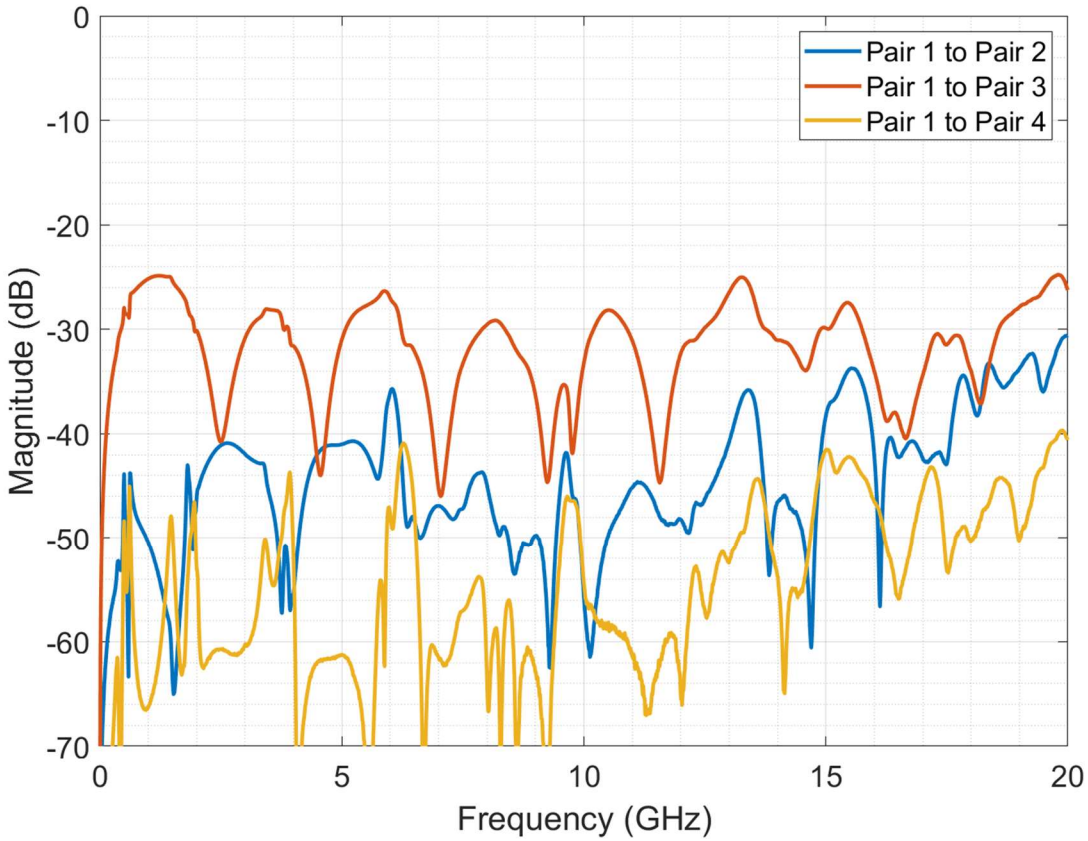

Figure 37. GHSM Feed-Thru NEXT

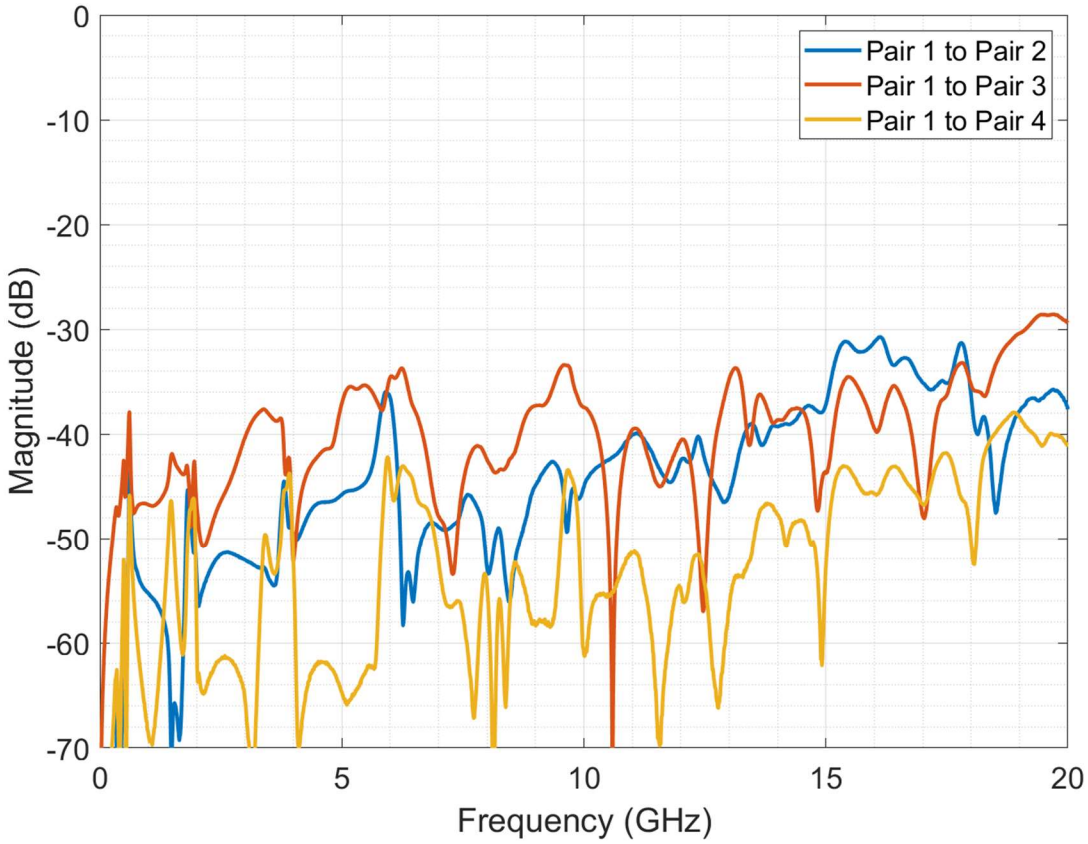

Figure 38. GHSM Feed-Thru FEXT

6.1.3. 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.

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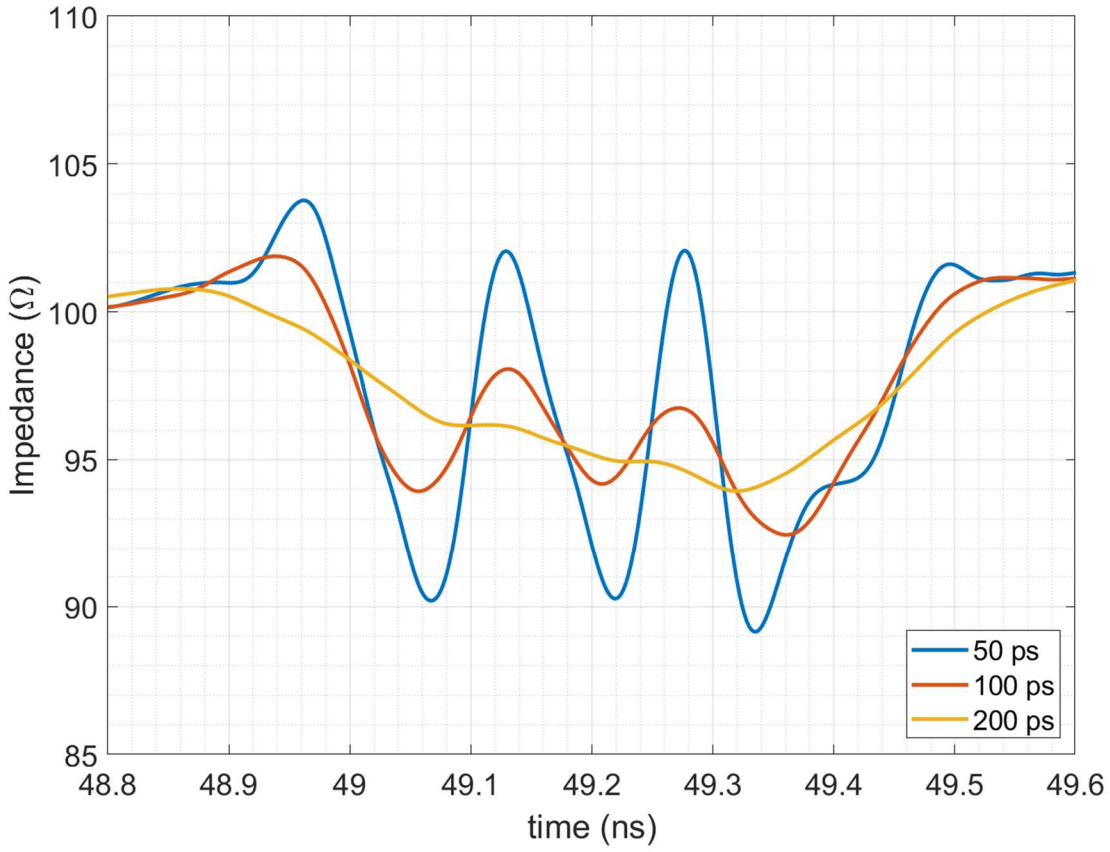

Figure 39. TDR – GHSM Feed-Thru

6.2.Sav-Con Results

This section includes both frequency and time domain results. Test fixture PCB loss has been de-embedded to show the performance of the Sav-Con and mating PCB board connectors.

6.2.1. Insertion Loss / Return Loss

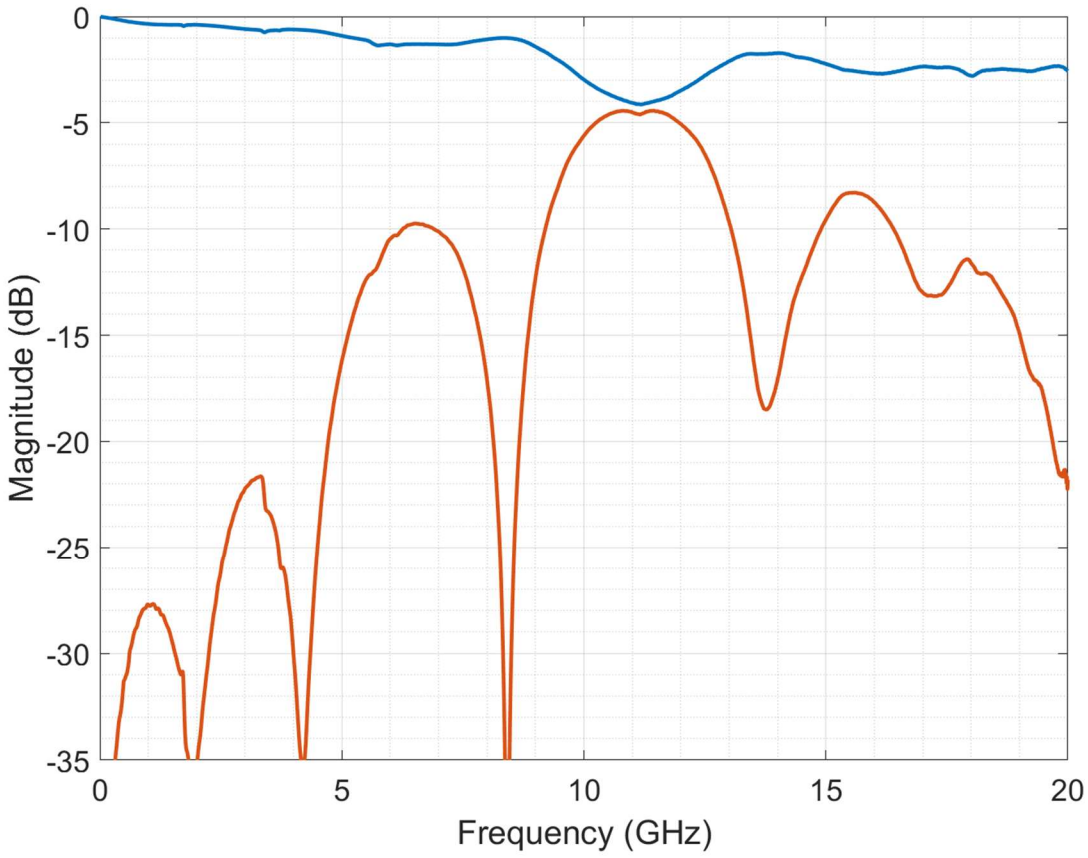

Figure 40. GHSM Sav-Con Response

6.2.2. Crosstalk

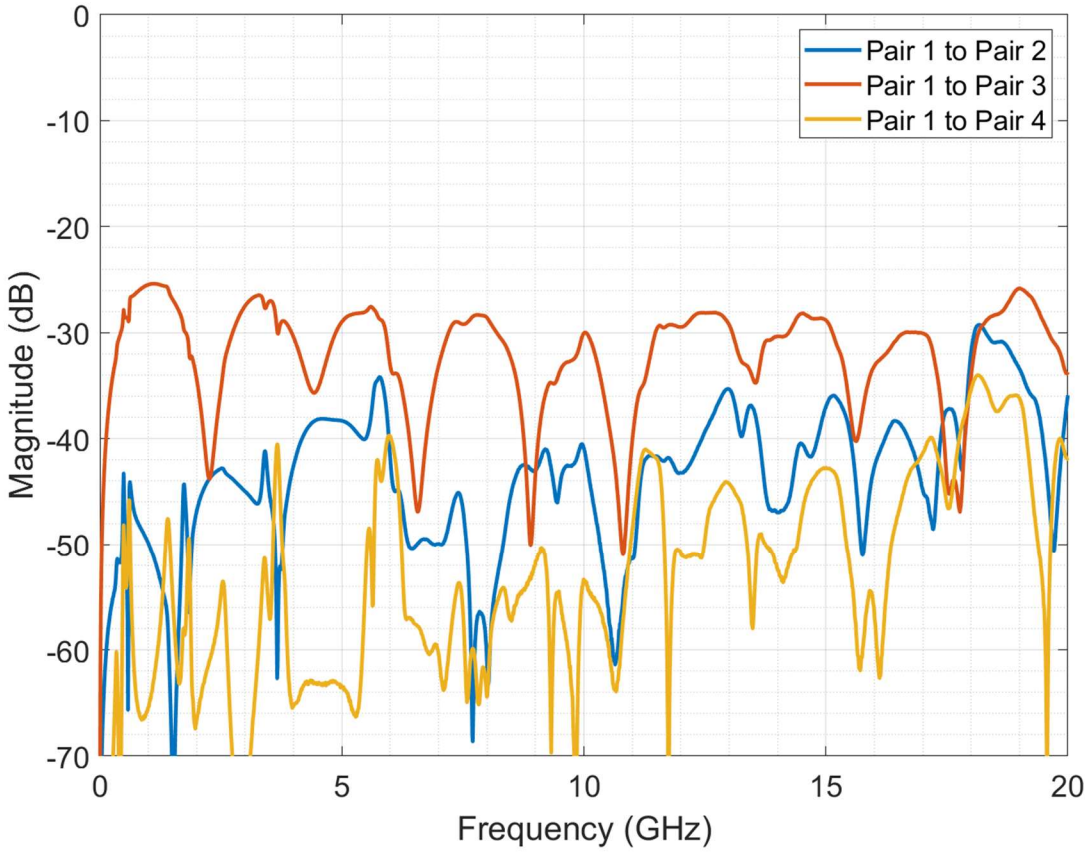

Figure 41. GHSM Sav-Con NEXT

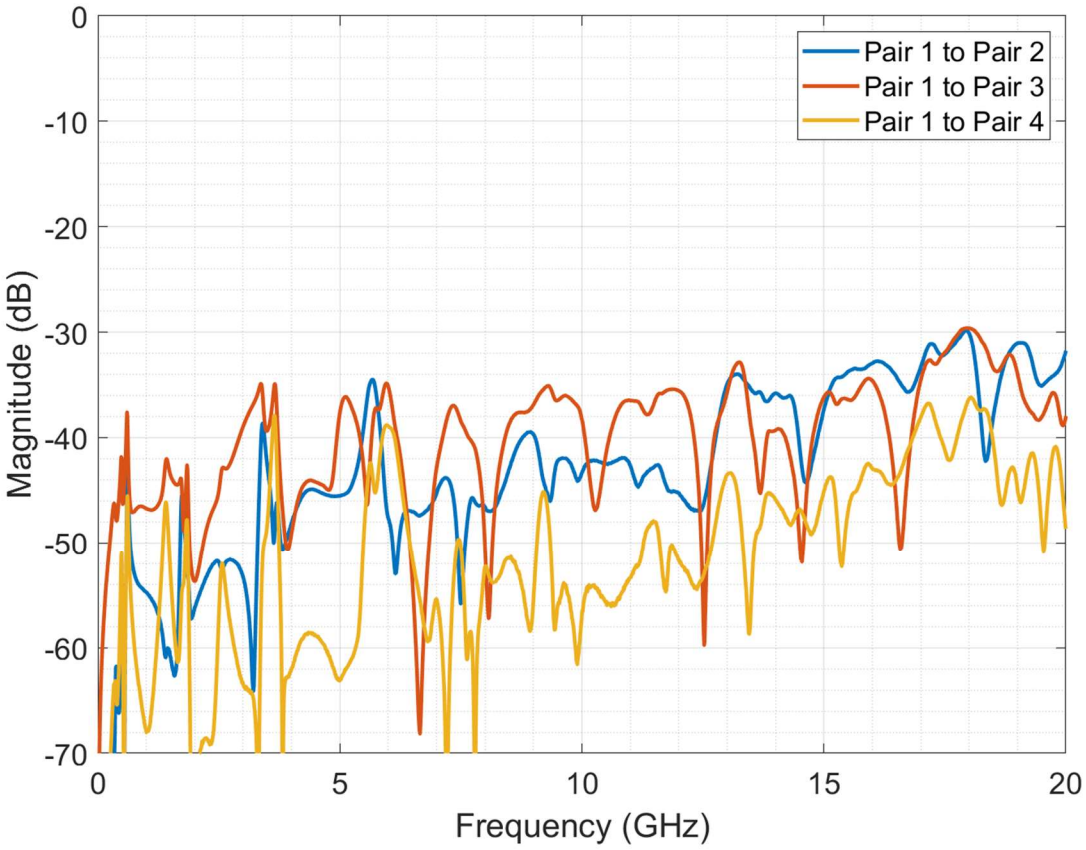

Figure 42. GHSM Sav-Con FEXT

6.2.3. 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

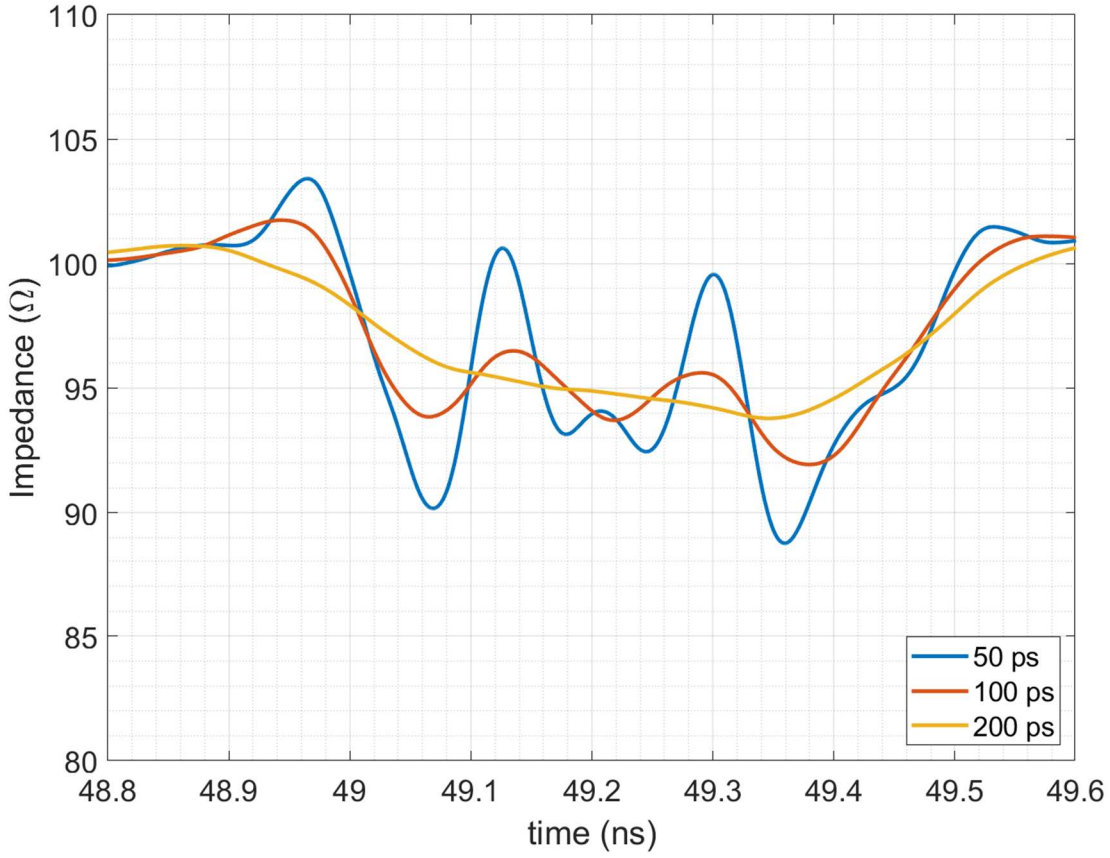

Figure 43. TDR – GHSM Sav-Con

7. 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.

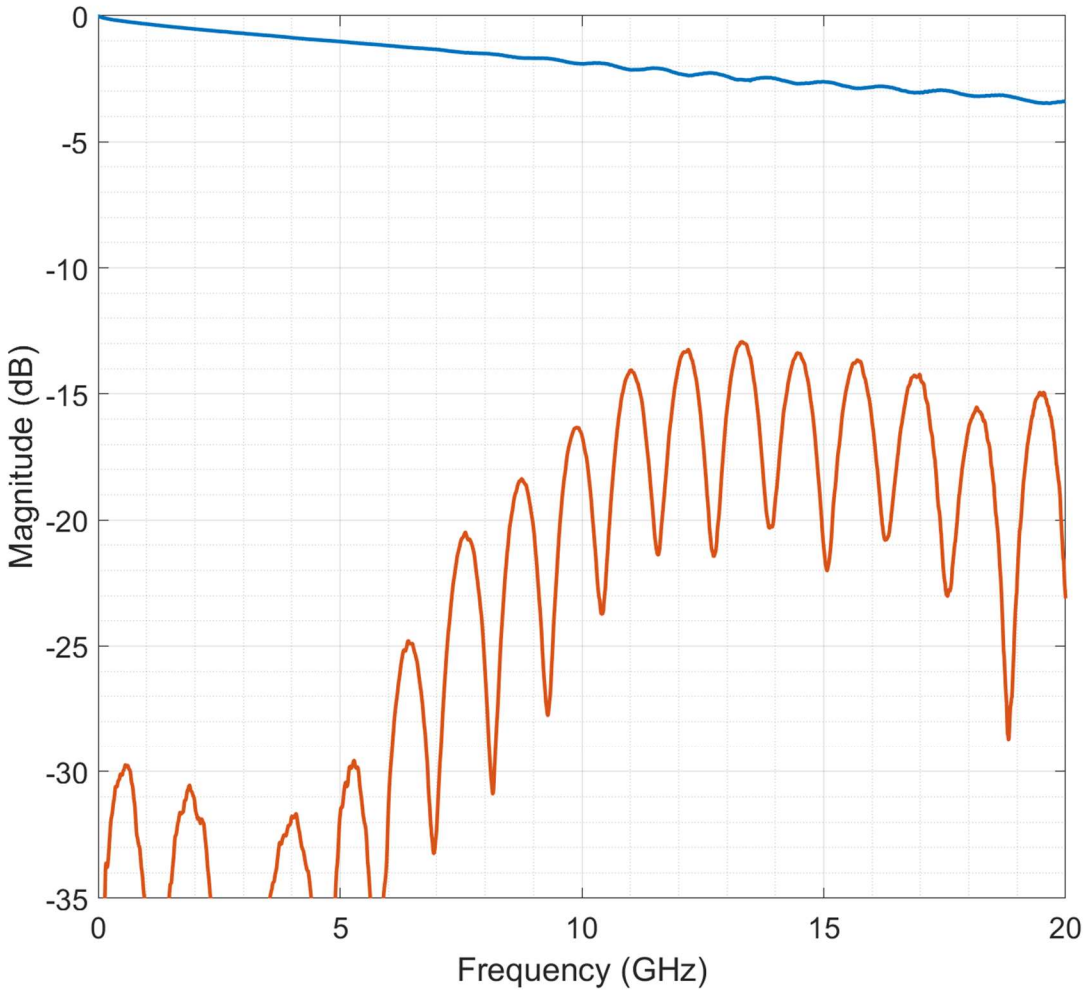

Figure 44. Straight GHSM 2x-Thru PCB Response

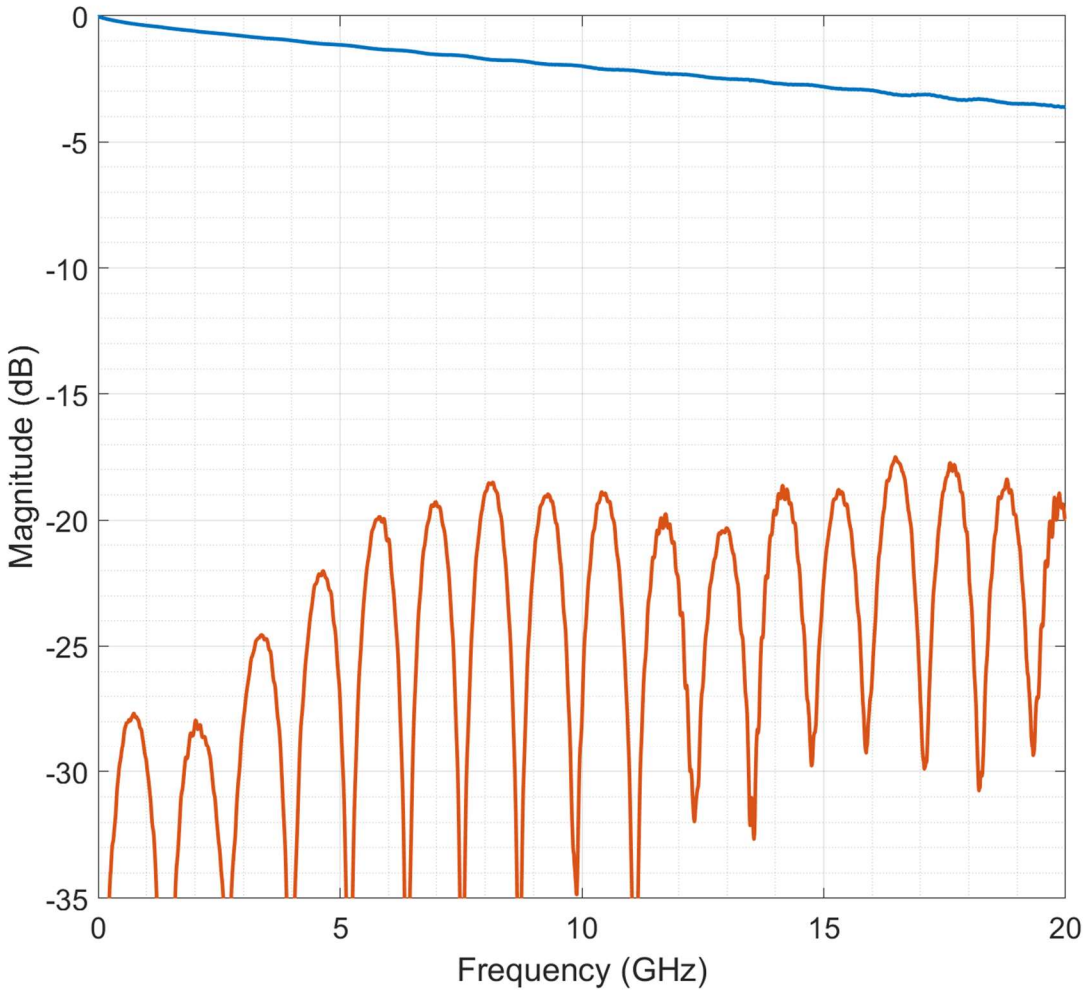

Figure 45. Right Angle GHSM 2x-Thru PCB Response