



Power over Ethernet Consortium Interoperability Test Report

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Matthew Murdock
Texas Instruments, Inc.

June 11, 2014
Report Rev. 1.1 – SLUA722

Enclosed are the results from the PSE interoperability testing performed on:

Device Under Test (DUT): Texas Instruments, Inc. TPS23861
IOL ID: 18202
Port Tested: 1
Firmware Version: FW5.2

The test suite that a portion of this testing is based on is available at the UNH-IOL website:

https://www.iol.unh.edu/sites/default/files/testsuites/ethernet/interop/Interop_Test_Suite_v2.4.pdf

No interoperability issues were discovered during the testing process.

| The Following Tests Were Either Not Performed Or Have Additional Comments | |
|---|--|
| 1.1.1 – Link Speed Detection 1.1.3 – Packet Error Ratio Estimation 1.1.4 – Endurance Stress Test | These tests require network traffic to be passed between the DUT and the Link Partner. As the DUT was neither a midspan nor did it appear to have a PHY, these tests were not performed. |

For specific details regarding issues please see the corresponding test result.

Testing Completed: 21-May-2014
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Result Key

The following table contains possible results and their meanings:

| Result | Interpretation |
|---------------------------|--|
| PASS | The Device Under Test (DUT) was observed to exhibit conformant behavior. |
| PASS with Comments | The DUT was observed to exhibit conformant behavior however an additional explanation of the situation is included, such as due to time limitations only a portion of the testing was performed. |
| FAIL | The DUT was observed to exhibit non-conformant behavior. |
| Warning | The DUT was observed to exhibit behavior that is not recommended. |
| Informative | Results are for informative purposes only and are not judged on a pass or fail basis. |
| Refer to Comments | From the observations, a valid pass or fail could not be determined. An additional explanation of the situation is included. |
| Not Applicable | The DUT was not observed to support the necessary functionality required to perform these tests. |
| Not Available | Due to testing station or time limitations, the tests could not be performed. |
| Borderline | The observed values of the specified parameters are valid at one extreme, and invalid at the other. |
| Not Tested | Not tested due to the time constraints of the test period. |

Revision History

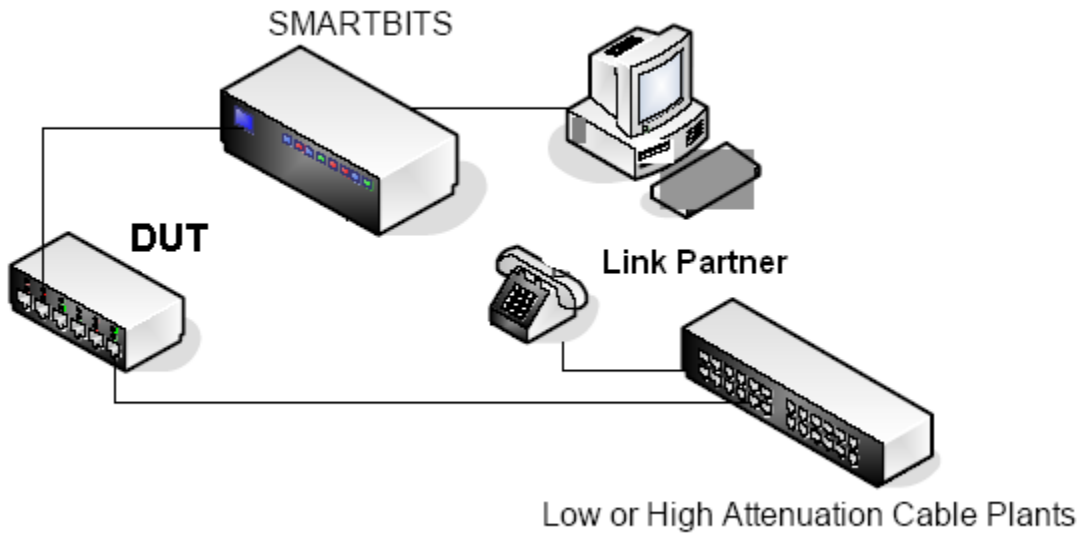
| Revision | Explanation |
|----------|---|
| 1.0 | Initial Version |
| 1.1 | The report was re-issued to include a TI reference number per request of TI. This was placed at the end of the Report Revision number. The headers, footers, and result key were also modified. |

Test Setup

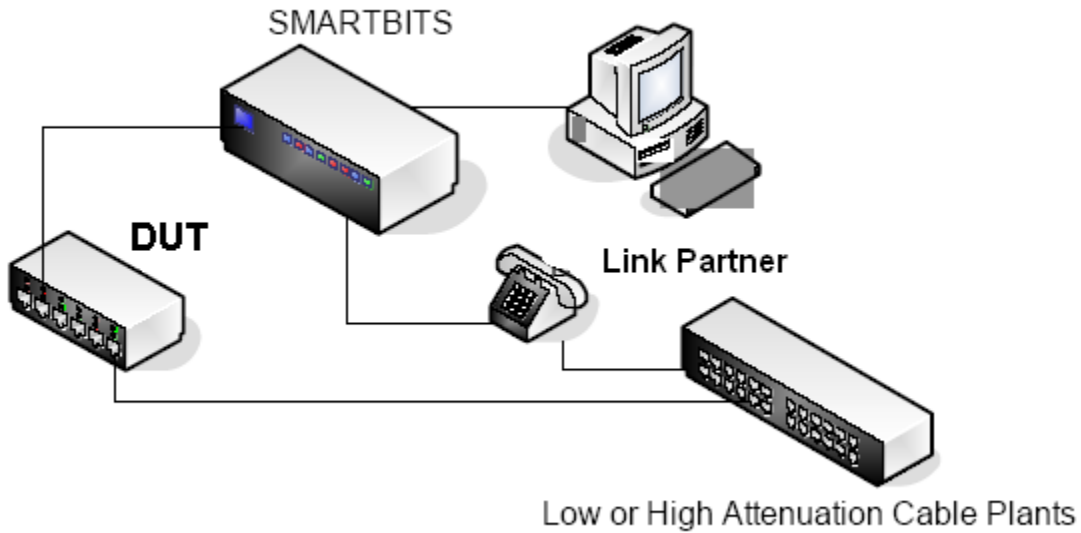
Testing Equipment

| | |
|------------------------|-------------------------------|
| Spirent Smartbits 2000 | Used to Source Packet Traffic |
|------------------------|-------------------------------|

Single Port Link Partner Testing Configuration:



Multiple Port Link Partner Testing Configuration:



Test #1.1.1 Link Speed Detection

These Cases differ from the referenced test suite.

Case 1: This test entails powering the DUT with the link partner disconnected until the DUT has fully booted. The link partner is connected via a high attenuation cable plant. Auto-negotiation, if supported, should result in a connection at common optimal values for both the PD and the PSE. The DUT and link partner should be able to send and receive packets. Please refer to the following pages for the results of this test.

Case 2: This test entails powering the DUT with the link partner connected via a high attenuation cable plant. Auto-negotiation, if supported, should result in a connection at common optimal values for both the PD and the PSE. The DUT and link partner should also be able to send and receive packets. Please refer to the following pages for the results of this test.

Test #1.1.3 Packet Error Ratio Estimation

High Attenuation Channel: The two devices are connected to each end of the channel with a 5-meter cable. The high attenuation channel is 125 meters long. A number of ICMP echo requests (Refer to the Ethernet Physical Layer Interoperability Test Suite: Appendix A Table A-1) are sent to verify that traffic can successfully be sent between the link partners. The number of packets lost is noted. Refer to the following tables for further information regarding the results of this test.

Low Attenuation Channel: The two devices are connected to each end of the channel with a short 5-meter cable. The low attenuation channel is 10 meters long. A number of ICMP echo requests (Refer to the Ethernet Physical Layer Interoperability Test Suite: Appendix A Table A-1) are sent to verify that traffic can successfully be sent between the link partners. The number of packets lost is noted. Refer to the following tables for further information regarding the test results.

Test #1.1.4 Endurance Stress Test

This test is designed to verify that no obvious buffer management problems occur when directing a large volume of traffic with minimum IPG at the DUT. This test is informative only and is designed to verify that the DUT has no obvious buffer management problems. The DUT is attached to a sourcing station that is capable of sending an appropriate number of 64-byte ICMP echo requests with a minimum IPG of 96BT (Refer to the Ethernet Physical Layer Interoperability Test Suite Table 1-6). The DUT does not have to respond to all of the requests but the test should not cause any system failures. Refer to the following tables for further information regarding the results of this test.

Test #1.1.7 Power Request and Application

These Cases are designed specifically for devices that only support power. These tests are not contained in the referenced test suite.

Case 1: This test entails powering on the DUT separately and then connecting the link partner. The Power Sourcing Equipment should be able to provide power to the Powered Device. Refer to the following tables for further information regarding the results from this test.

Case 2: This test entails power cycling the Power Sourcing Equipment while the Powered Device is connected. The Power Sourcing Equipment should provide power to the Powered Device. Refer to the following tables for further information regarding the results from this test.

Channel Plots

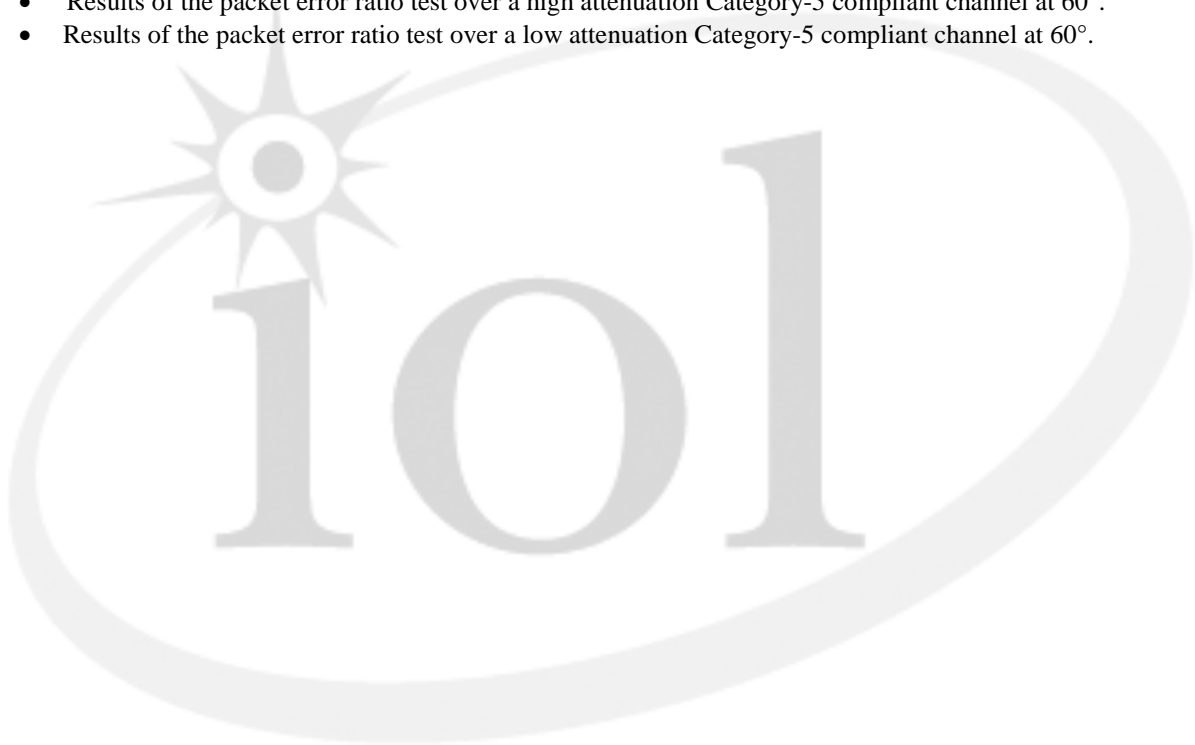
Included with this report is a series of plots that provide a characterization of the channels over which the testing was performed. The plots include the following items.

- Attenuation plots taken for each channel.
- Near end cross talk (NEXT) plots taken from both ends of each channel (Both the DUT and the testing station). The DUT end is labeled as “Near End Crosstalk” and the testing station end is labeled as “Near End Crosstalk @ Remote”.
- Return Loss plots taken for each channel, at the DUT and at the testing station. The DUT is labeled as “Return Loss” and the testing station end is labeled as “Return Loss @ Remote”.

Test Matrix

The matrices are divided into sections according to the type of device being tested against. The first matrix contains four columns:

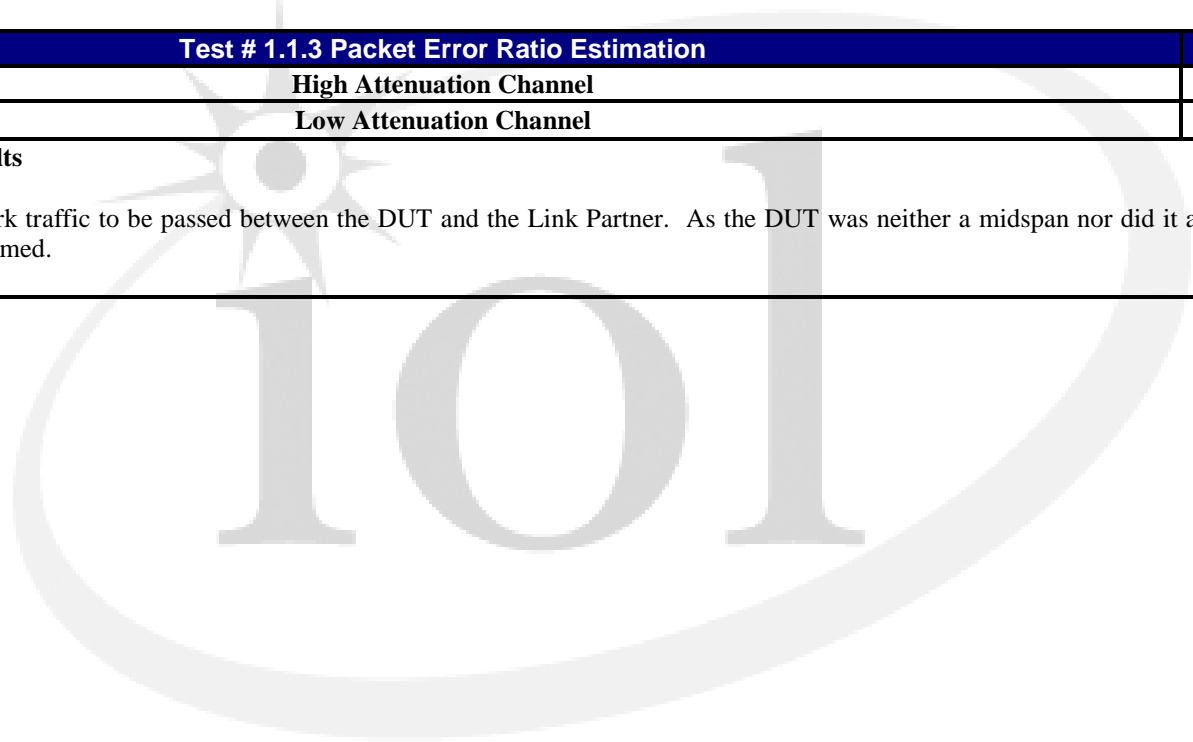
- The manufacturer and name of the device being tested against.
- Results of link speed detection testing.
- Results of the packet error ratio test over a high attenuation Category-5 compliant channel at 60°.
- Results of the packet error ratio test over a low attenuation Category-5 compliant channel at 60°.



Test Results:

| Test # 1.1.1 Link Speed Detection | Result |
|--|----------------|
| | Not Applicable |
| Comments on Test Results <p>These tests require network traffic to be passed between the DUT and the Link Partner. As the DUT was neither a midspan nor did it appear to have a PHY, these tests were not performed.</p> | |

| Test # 1.1.3 Packet Error Ratio Estimation | Result |
|--|----------------|
| High Attenuation Channel | Not Applicable |
| Low Attenuation Channel | Not Applicable |
| Comments on Test Results <p>These tests require network traffic to be passed between the DUT and the Link Partner. As the DUT was neither a midspan nor did it appear to have a PHY, these tests were not performed.</p> | |



| Test # 1.1.7 Power Request and Application | | | | |
|---|---------------------------------|---------------|--------------------------------|---------------|
| PD Tested | High Attenuation Channel | | Low Attenuation Channel | |
| | Case 1 | Case 2 | Case 1 | Case 2 |
| 3Com Corp. NJ220 | PASS | PASS | PASS | PASS |
| 3Com Corp. NJ105 | PASS | PASS | PASS | PASS |
| 3Com Corp. 3C10248PE | PASS | PASS | PASS | PASS |
| 3Com Corp. 3C10226PE | PASS | PASS | PASS | PASS |
| Avaya, Inc. 4610SW IP Phone | PASS | PASS | PASS | PASS |
| Avaya, Inc. 4620SW IP Phone | PASS | PASS | PASS | PASS |
| Avaya, Inc. 4625SW IP Phone | PASS | PASS | PASS | PASS |
| Avaya, Inc. 4630SW IP Phone | PASS | PASS | PASS | PASS |
| Avaya, Inc. 9620 | PASS | PASS | PASS | PASS |
| Avaya, Inc. 9630 | PASS | PASS | PASS | PASS |
| Avaya, Inc. 9640 | PASS | PASS | PASS | PASS |
| Cisco Systems CP-7911G | PASS | PASS | PASS | PASS |
| Cisco Systems D103994 | PASS | PASS | PASS | PASS |
| Cisco Systems D104176 | PASS | PASS | PASS | PASS |
| Nortel Networks IP PHONE 1110 | PASS | PASS | PASS | PASS |
| Nortel Networks IP PHONE 1120E | PASS | PASS | PASS | PASS |
| Nortel Networks IP Phone 1210 | PASS | PASS | PASS | PASS |
| Nortel Networks IP Phone i2004 | PASS | PASS | PASS | PASS |
| Polycom, Inc. SoundPoint IP 330 | PASS | PASS | PASS | PASS |
| Polycom, Inc. SoundPoint IP 430 | PASS | PASS | PASS | PASS |
| Polycom, Inc. SoundPoint IP 550 | PASS | PASS | PASS | PASS |
| Polycom, Inc. Soundpoint IP 650 Rev A | PASS | PASS | PASS | PASS |
| HP T410 Thin Client | PASS | PASS | PASS | PASS |
| Globtek GT-91080 Power/Data Splitter | PASS | PASS | PASS | PASS |
| Linear Technology Corp. LTC4257IS8 | PASS | PASS | PASS | PASS |
| Linear Technology Corp. LTC4257CS8-1 | PASS | PASS | PASS | PASS |
| Linear Technology Corp. LTC4267 | PASS | PASS | PASS | PASS |
| National Semiconductor LM5070 | PASS | PASS | PASS | PASS |
| Phihong USA POE14-120-R | PASS | PASS | PASS | PASS |
| Texas Instruments, Inc. TPS2375 EVM | PASS | PASS | PASS | PASS |
| Texas Instruments, Inc. TPS2376DDA-H EVM | PASS | PASS | PASS | PASS |
| Texas Instruments, Inc. TPS23770 | PASS | PASS | PASS | PASS |
| Power Integrations POE101205A | PASS | PASS | PASS | PASS |
| Silicon Laboratories, Inc. Si3400ISO-EVB | PASS | PASS | PASS | PASS |
| Silicon Laboratories, Inc. Si3400-EVB | PASS | PASS | PASS | PASS |

| Test # 1.1.4 Endurance Stress Test | Result |
|--|--------|
| Not Applicable | |
| Comments on Test Results <p>These tests require network traffic to be passed between the DUT and the Link Partner. As the DUT was neither a midspan nor did it appear to have a PHY, these tests were not performed.</p> | |



APPENDIX A – Cable Plant Analysis

The following pages consist of a cable plant analysis performed using Fluke DSP-4300 Cable Analyzers. This data is offered to describe the environment in which the DUT was tested; this data is independent of the DUT. The propagation delay failure is intended, and it is related to the length of the cable, which is longer than the 100BASE-TX specified 100m of Category 5 cabling. This increase in cable distance is intended to increase the attenuation of the cable plant in an effort to approach the maximum allowed attenuation of the channel.



CAT 5 - TSB95 Spec - Low Attenuation

| Parameter | Pair | Channel-1 | Channel-2 |
|-----------------------------|--------|-----------|-----------|
| Propagation Delay (ns) | (1, 2) | 56.00 | |
| | (3, 6) | 56.00 | |
| | (4, 5) | 57.00 | |
| | (7, 8) | 56.00 | |
| Propagation Delay Skew (ns) | (1, 2) | 0.00 | |
| | (3, 6) | 0.00 | |
| | (4, 5) | 1.00 | |
| | (7, 8) | 0.00 | |

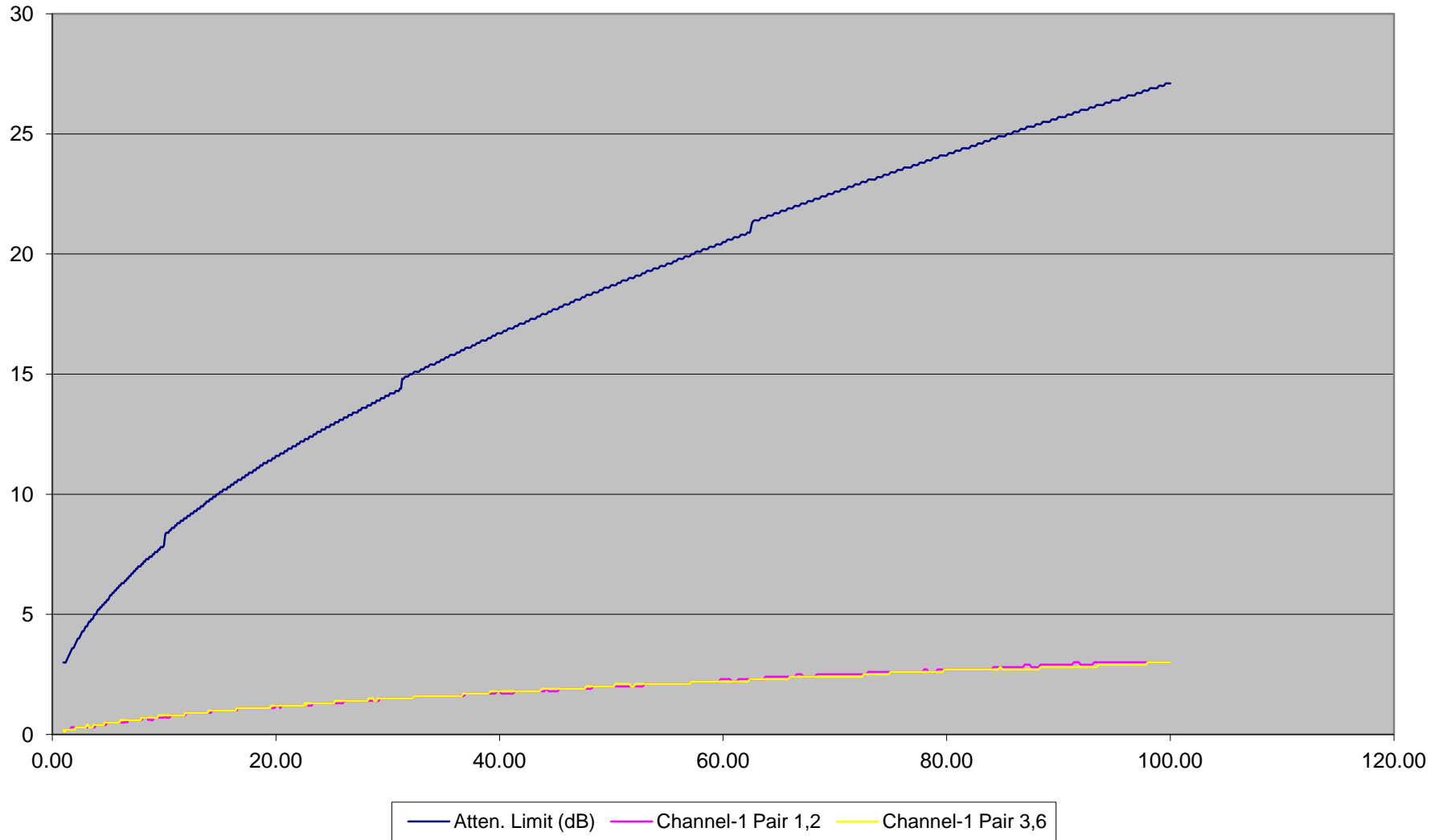
| Parameter | Pair | Channel-1 | Channel-2 |
|----------------------------------|--------|-----------|-----------|
| Insertion Loss Margin (dB) | (1, 2) | 2.80 | |
| | (3, 6) | 2.80 | |
| | (4, 5) | | |
| | (7, 8) | | |
| Return Loss Margin (dB) | (1, 2) | 8.55 | |
| | (3, 6) | 8.30 | |
| | (4, 5) | | |
| | (7, 8) | | |
| Return Loss @ Remote Margin (dB) | (1, 2) | 9.50 | |
| | (3, 6) | 7.41 | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSNEXT Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSNEXT @ Remote Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSELFEXT Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSELFEXT @ Remote Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |

| Parameter | Generator-Receptor | Channel-1 | Channel-2 |
|---------------------------|--------------------|-----------|-----------|
| NEXT Margin (dB) | (1, 2)-(3, 6) | 12.10 | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(7, 8) | | |
| NEXT @ Remote Margin (dB) | (1, 2)-(3, 6) | 13.10 | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(7, 8) | | |

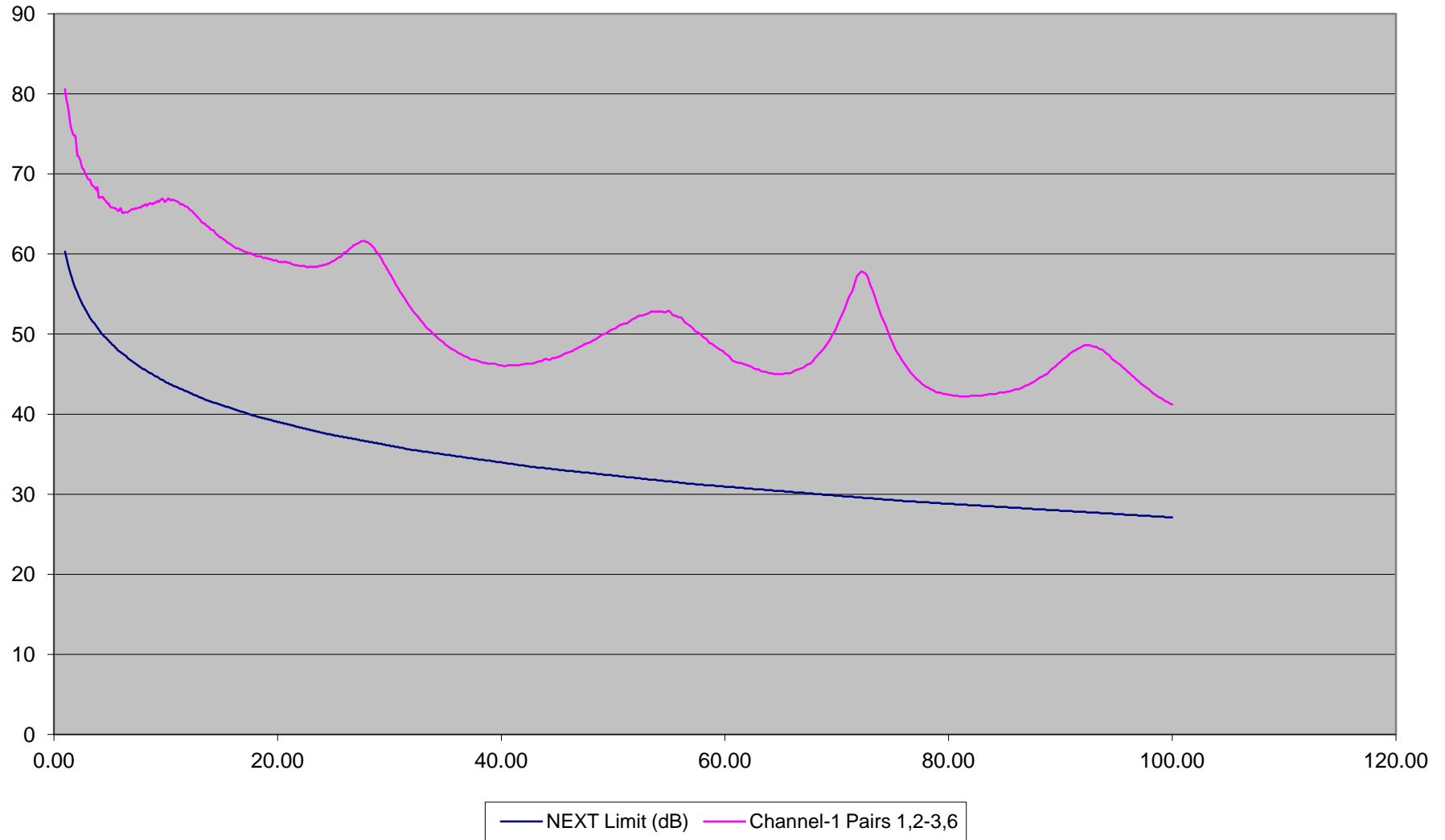
| Parameter | Generator-Receptor | Channel-1 | Channel-2 |
|-----------------------------|--------------------|-----------|-----------|
| ELFEXT Margin (dB) | (1, 2)-(3, 6) | | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(1, 2) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(1, 2) | | |
| | (4, 5)-(3, 6) | | |
| | (4, 5)-(7, 8) | | |
| | (7, 8)-(1, 2) | | |
| ELFEXT @ Remote Margin (dB) | (7, 8)-(3, 6) | | |
| | (7, 8)-(4, 5) | | |
| | (1, 2)-(3, 6) | | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(1, 2) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(1, 2) | | |
| | (4, 5)-(3, 6) | | |
| (4, 5)-(7, 8) | | | |
| (7, 8)-(1, 2) | | | |
| (7, 8)-(3, 6) | | | |
| (7, 8)-(4, 5) | | | |

Channel 1 Description: Pass Through

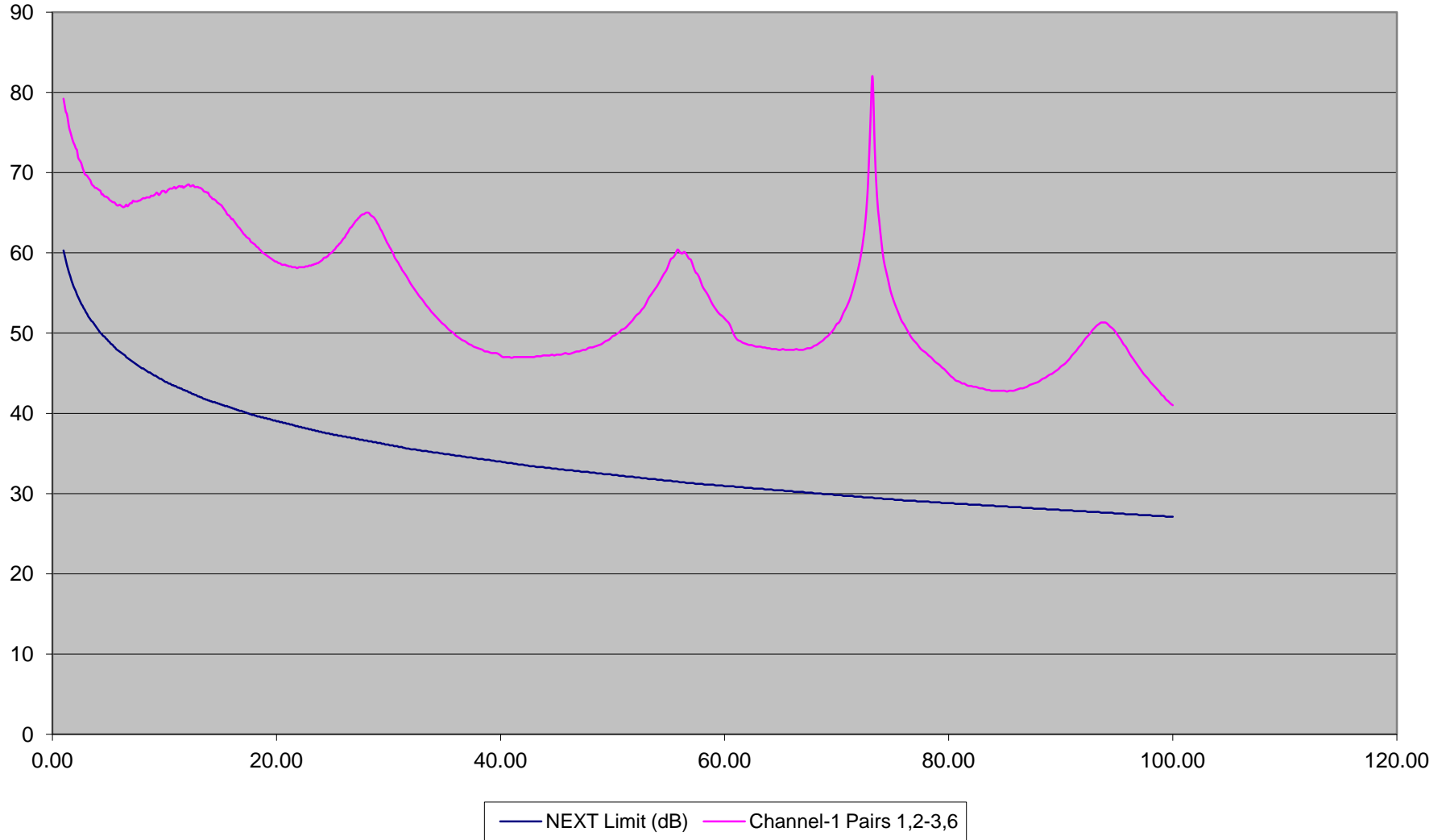
CAT 5 - TSB95 Spec @ Low Attenuation - Attenuation Plot
X-Axis Frequency (MHz), Y-Axis Attn (dB)



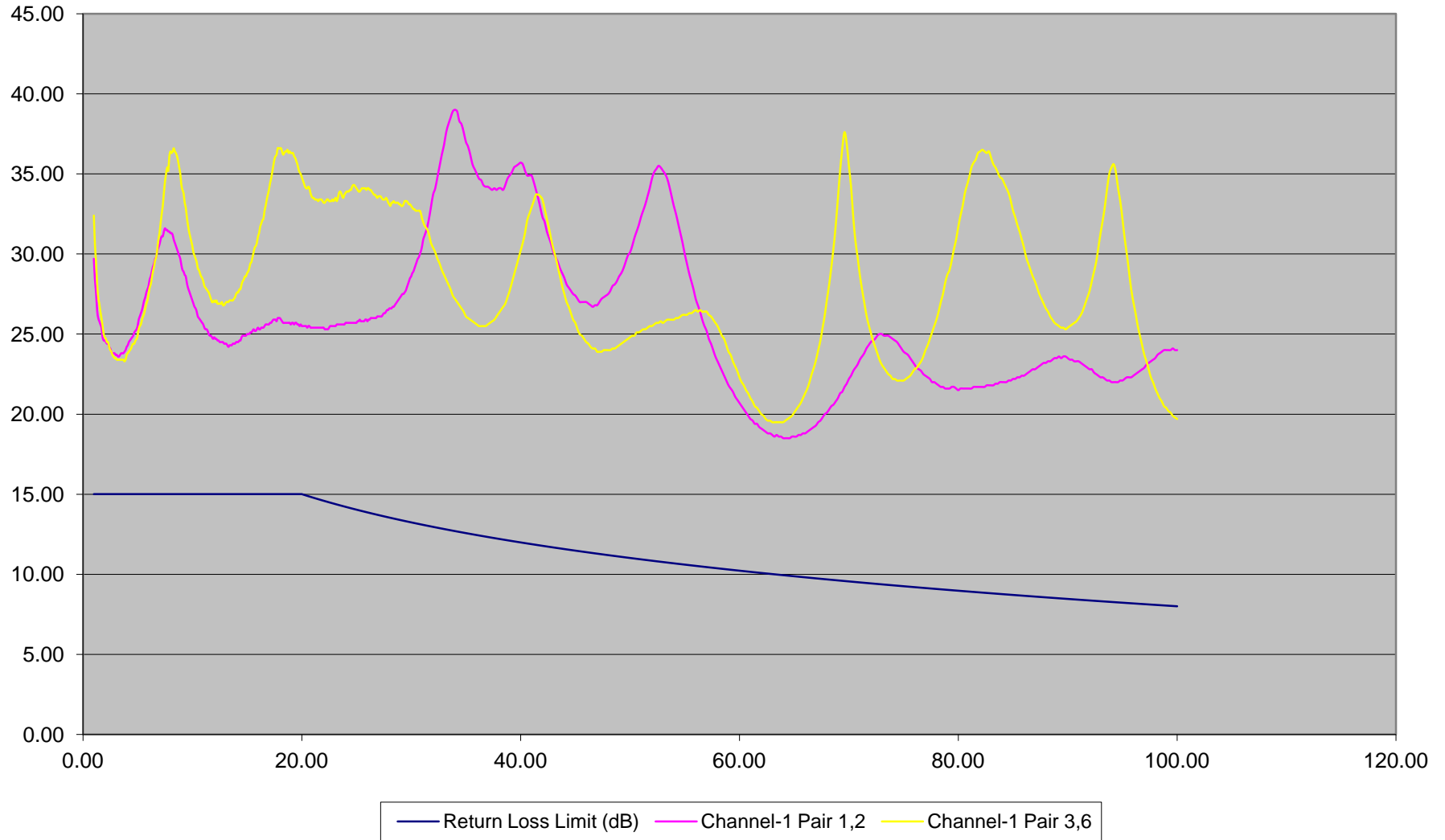
CAT 5 - TSB95 Spec @ Low Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)



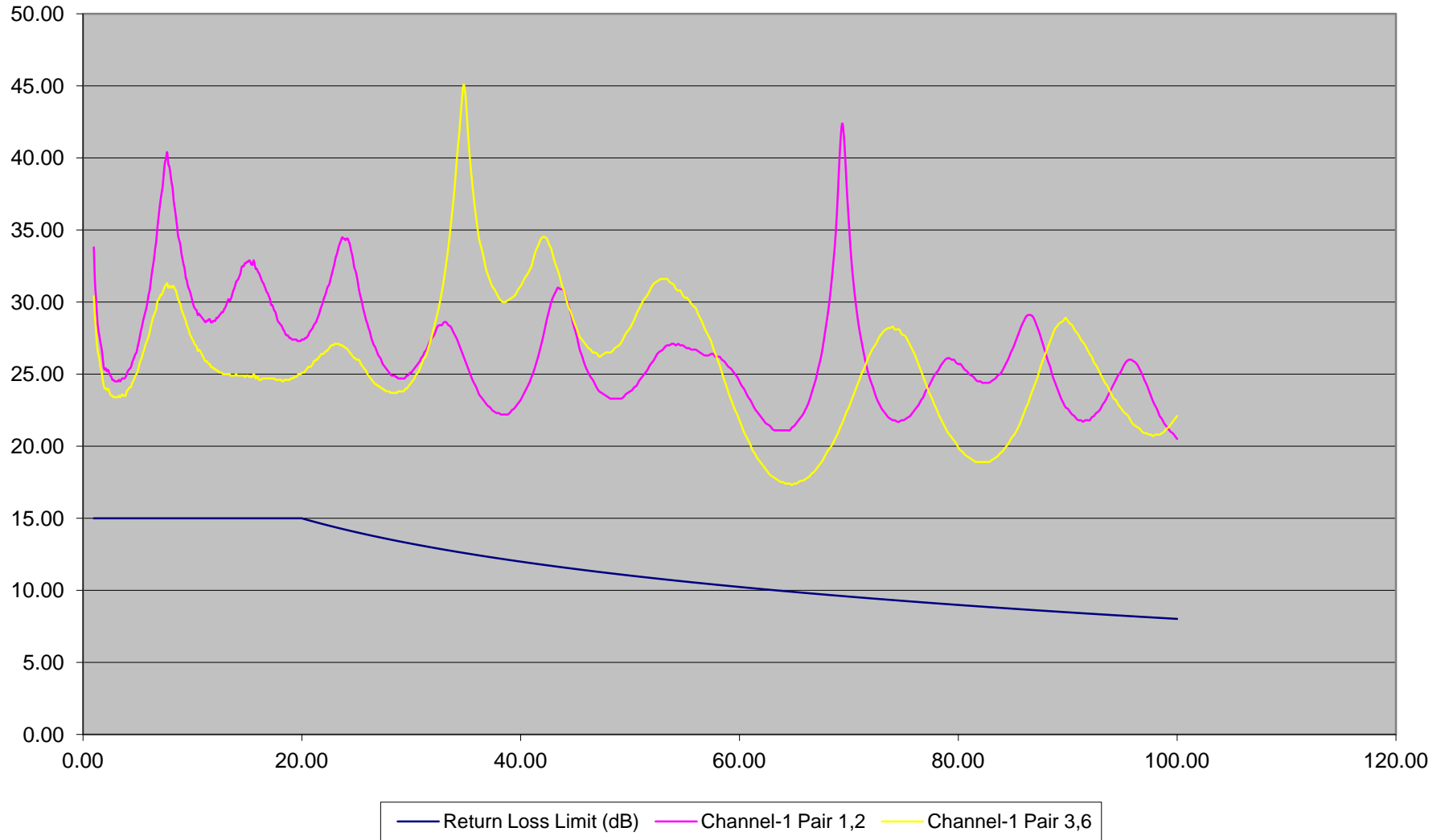
CAT 5 - TSB95 Spec @ Low Attenuation - Near End Cross Talk @ Remote
X-Axis Frequency (MHz), Y-Axis NEXT-R (dB)



CAT 5 - TSB95 Spec @ Low Attenuation - Return Loss
X-Axis Frequency (MHz), Y-Axis RL (dB)



CAT 5 - TSB95 Spec @ Low Attenuation - Return Loss @ Remote
X-Axis Frequency (MHz), Y-Axis RL-R (dB)



CAT 5 - TSB95 Spec - Maximum Attenuation

| Parameter | Pair | Channel-1 | Channel-2 |
|-----------------------------|--------|-----------|-----------|
| Propagation Delay (ns) | (1, 2) | 577.00 | |
| | (3, 6) | 566.00 | |
| | (4, 5) | 562.00 | |
| | (7, 8) | 571.00 | |
| Propagation Delay Skew (ns) | (1, 2) | 15.00 | |
| | (3, 6) | 4.00 | |
| | (4, 5) | 0.00 | |
| | (7, 8) | 9.00 | |

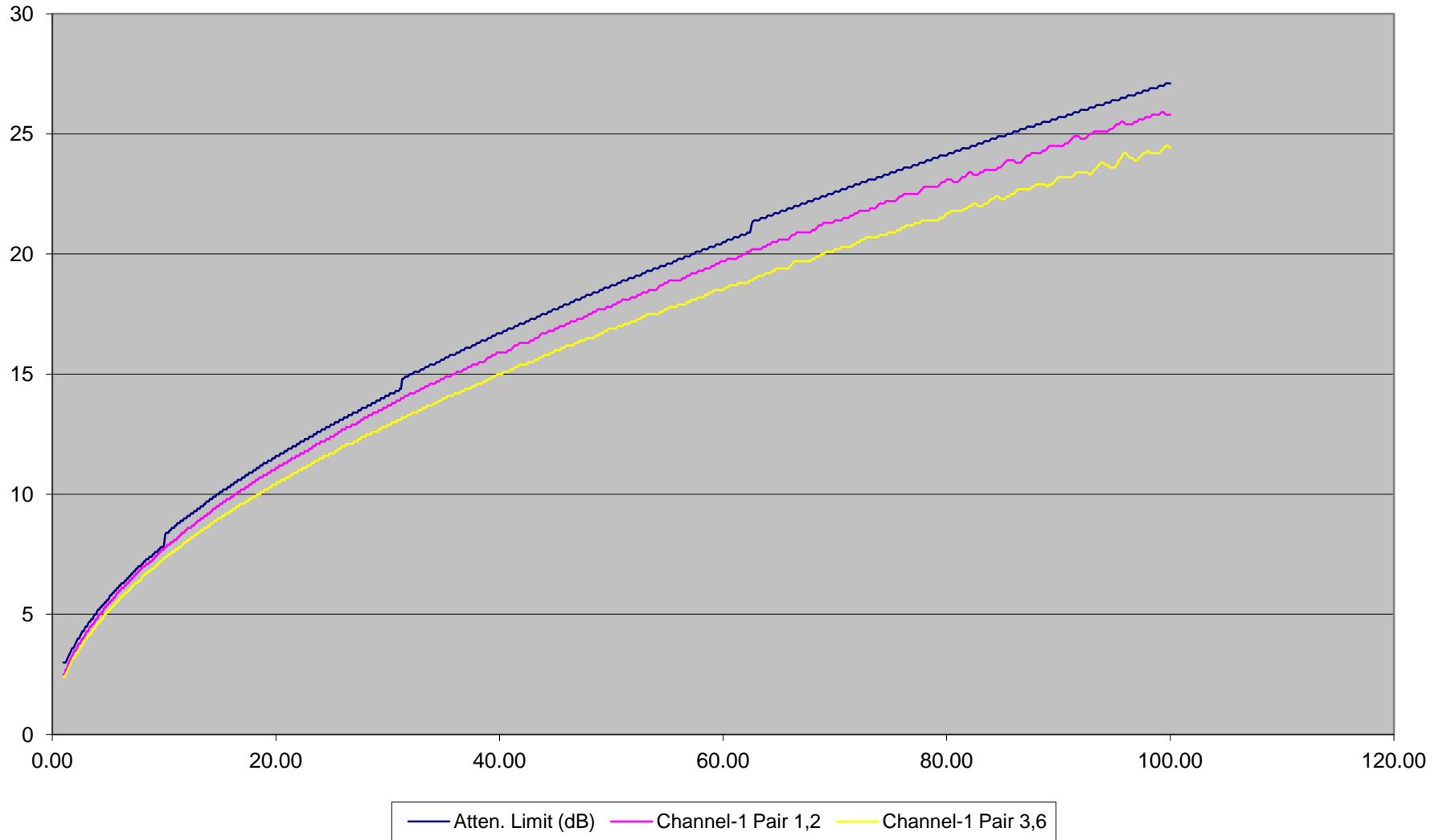
| Parameter | Pair | Channel-1 | Channel-2 |
|----------------------------------|--------|-----------|-----------|
| Insertion Loss Margin (dB) | (1, 2) | 0.10 | |
| | (3, 6) | 0.40 | |
| | (4, 5) | | |
| | (7, 8) | | |
| Return Loss Margin (dB) | (1, 2) | 9.20 | |
| | (3, 6) | 6.70 | |
| | (4, 5) | | |
| | (7, 8) | | |
| Return Loss @ Remote Margin (dB) | (1, 2) | 8.50 | |
| | (3, 6) | 9.00 | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSNEXT Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSNEXT @ Remote Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSELFEXT Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |
| PSELFEXT @ Remote Margin (dB) | (1, 2) | | |
| | (3, 6) | | |
| | (4, 5) | | |
| | (7, 8) | | |

| Parameter | Generator-Receptor | Channel-1 | Channel-2 |
|---------------------------|--------------------|-----------|-----------|
| NEXT Margin (dB) | (1, 2)-(3, 6) | 12.00 | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| NEXT @ Remote Margin (dB) | (4, 5)-(7, 8) | | |
| | (1, 2)-(3, 6) | 14.20 | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(7, 8) | | |

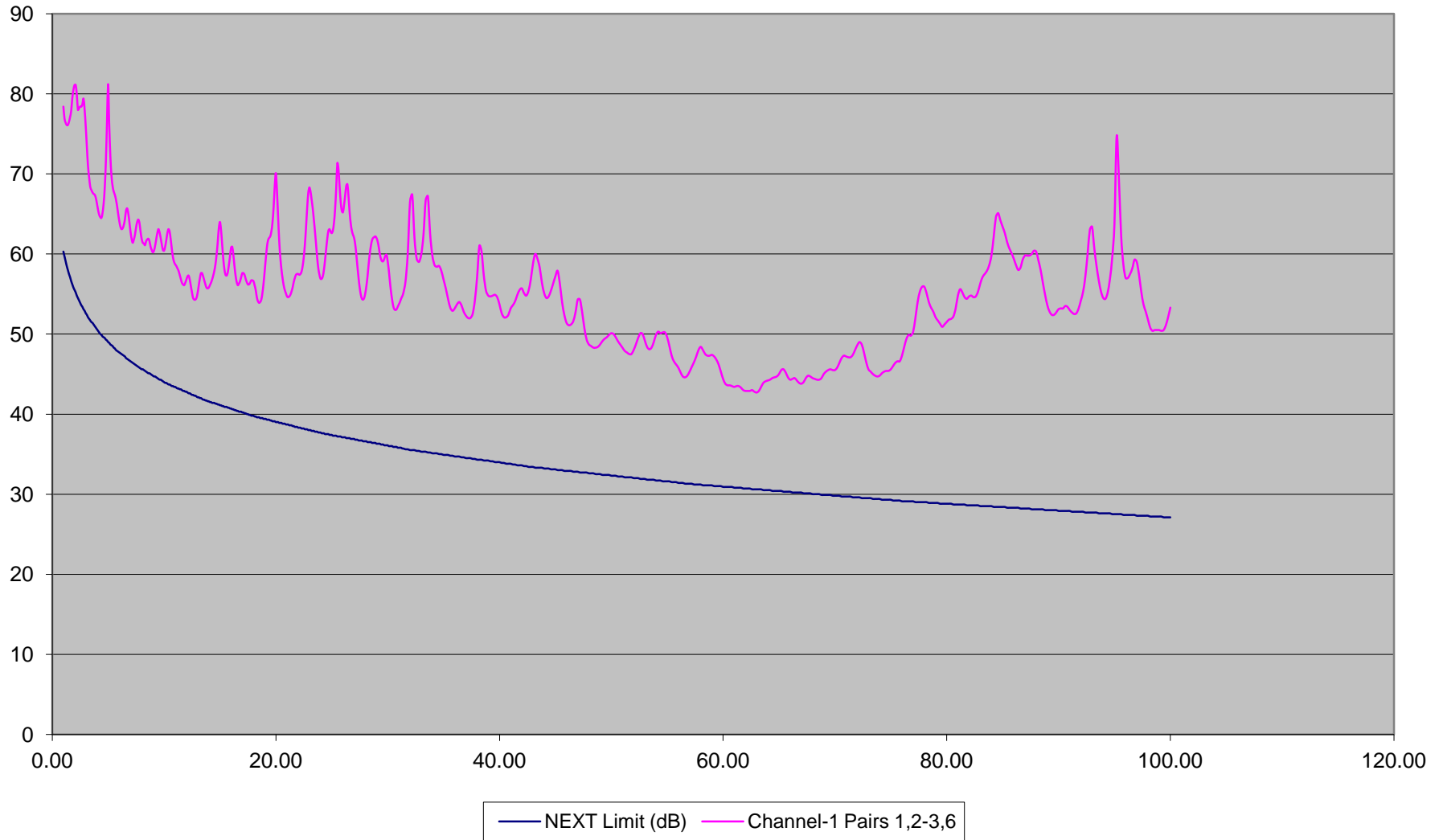
| Parameter | Generator-Receptor | Channel-1 | Channel-2 |
|-----------------------------|--------------------|-----------|-----------|
| ELFEXT Margin (dB) | (1, 2)-(3, 6) | | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(1, 2) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(1, 2) | | |
| | (4, 5)-(3, 6) | | |
| | (4, 5)-(7, 8) | | |
| | (7, 8)-(1, 2) | | |
| ELFEXT @ Remote Margin (dB) | (7, 8)-(3, 6) | | |
| | (7, 8)-(4, 5) | | |
| | (1, 2)-(3, 6) | | |
| | (1, 2)-(4, 5) | | |
| | (1, 2)-(7, 8) | | |
| | (3, 6)-(1, 2) | | |
| | (3, 6)-(4, 5) | | |
| | (3, 6)-(7, 8) | | |
| | (4, 5)-(1, 2) | | |
| | (4, 5)-(3, 6) | | |
| | (4, 5)-(7, 8) | | |
| | (7, 8)-(1, 2) | | |
| | (7, 8)-(3, 6) | | |
| | (7, 8)-(4, 5) | | |

Channel 1 Description: Pass Through

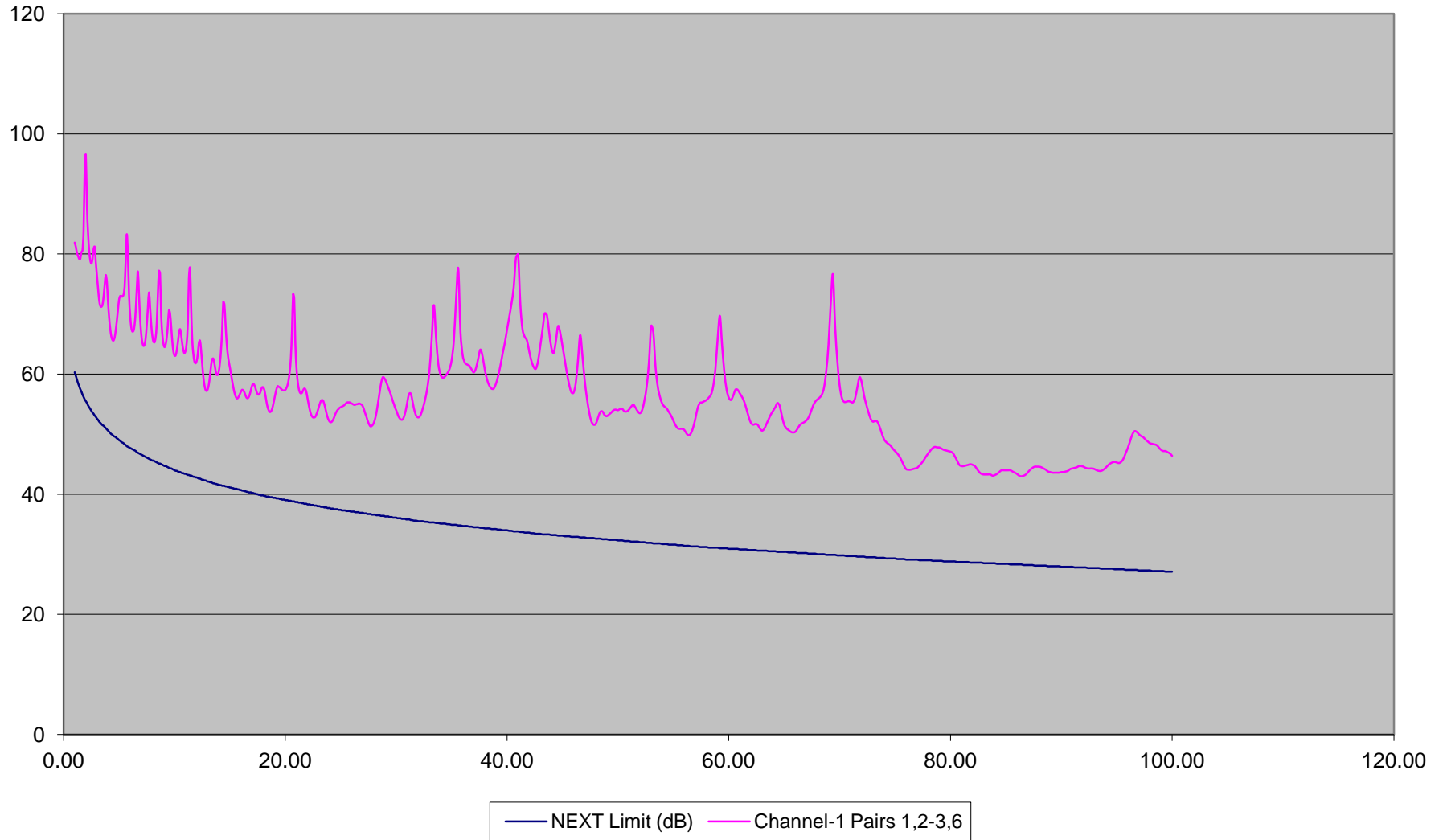
CAT 5 - TSB95 Spec @ Maximum Attenuation - Attenuation Plot
X-Axis Frequency (MHz), Y-Axis Attn (dB)



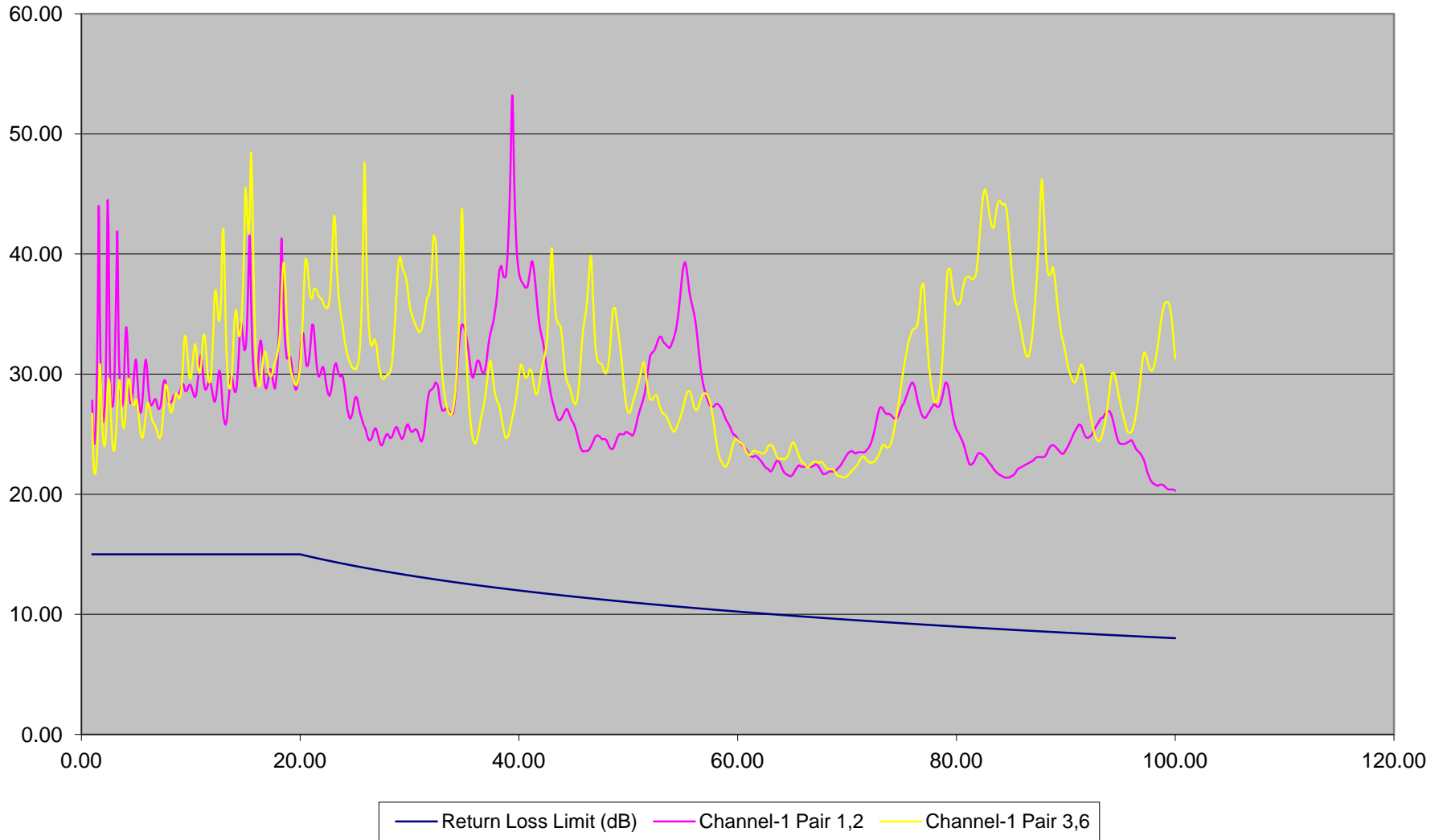
CAT 5 - TSB95 Spec @ Maximum Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)



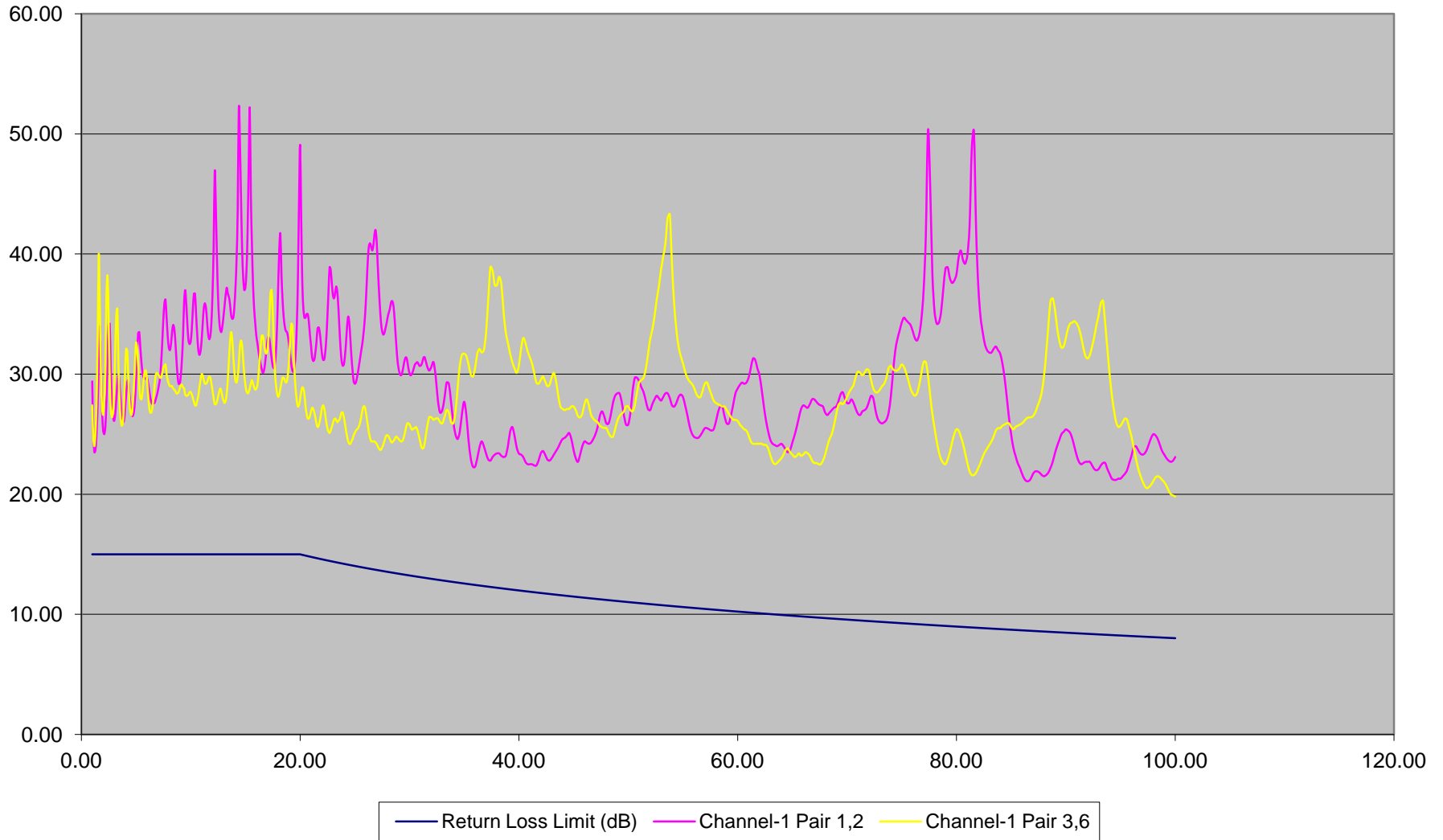
CAT 5 - TSB95 Spec @ Maximum Attenuation - Near End Cross Talk @ Remote
X-Axis Frequency (MHz), Y-Axis NEXT-R (dB)



CAT 5 - TSB95 Spec @ Maximum Attenuation - Return Loss
X-Axis Frequency (MHz), Y-Axis RL (dB)



CAT 5 - TSB95 Spec @ Maximum Attenuation - Return Loss @ Remote
X-Axis Frequency (MHz), Y-Axis RL-R (dB)



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No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

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