Power over Ethernet Consortium
Interoperability Test Report

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Texas Instruments, Inc.

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Report Rev. 1.0

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

Device Under Test (DUT):	Texas Instruments, Inc. TPS2388
UNH-IOL Device Identification Number:	18954
Port Tested:	1

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

The tables below contain summarized test results. For more details please see the detailed test results:

The Following Tests Exhibited Non-Conformant Behavior
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**	These tests require network traffic to be passed between the DUT and the Link Partner. Since the DUT was not observed to have a PHY, these tests were not performed.
1.1.4 – Endurance Stress Test	This test requires network traffic to be passed between the DUT and the Link Partner. Since the DUT was neither a midspan nor was it observed to have a PHY, this test was not performed.
1.1.7 – Power Request and Application	Part of the initialization of the DUT involves manual configuration after powering on the DUT. This step was performed after every power cycle during testing.

Testing Completed: 12/2/2014
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Result Key

The following table contains possible results and their meanings:

Result	Meaning	Interpretation
PASS	Pass	The Device Under Test (DUT) was observed to exhibit conformant behavior.
PWC	Pass With Comments	The Device Under Test (DUT) was observed to exhibit conformant behavior, however changes were made to the normal test procedure or the behavior observed requires additional comments.
FAIL	Fail	The Device Under Test (DUT) was observed to exhibit non-conformant behavior.
RTC	Refer to Comments	From the observations, a valid pass or fail was not determined. An additional explanation of the situation is included.
Info	Informative	Test is designed for informational purposes only. The results may help ensure the interoperability of the DUT, but are not standards requirements.
Warn	Warning	The DUT was observed to exhibit behavior that is not recommended.
N/A	Not Applicable	This test does not apply to the device type or is not applicable to the testing program selected.
N/S	Not Supported	The Device Under Test (DUT) was not observed to support the necessary functionality required to perform these tests or the requirement is optional and not supported by this device.
N/T	Not Tested	This test was not performed and therefore this is not a complete test report. Please see the comments for additional reasons.
UA	Unavailable	The test was not performed due to limitation of the test tool(s) or interoperable systems, or the test methodology is still under development.

Initialization Information

The following table contains the steps taken to initialize the DUT prior to testing:

Component	Description
Initialization	Initialization was performed by an onsite representative from Texas Instruments during testing.

Revision History

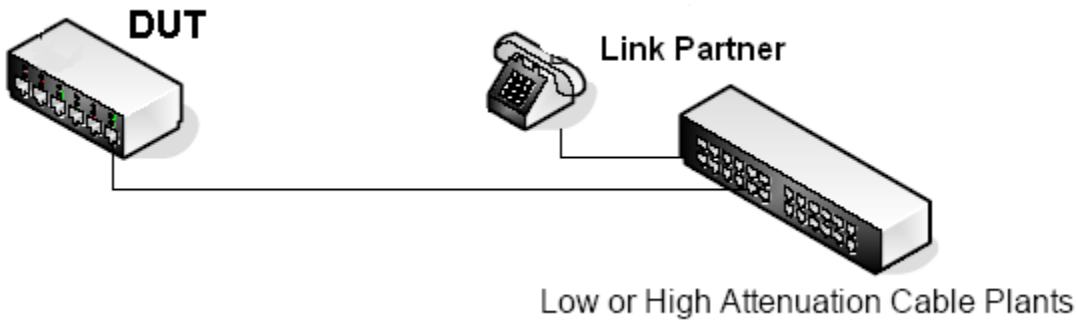
The following table contains a revision history for this report:

Revision	Explanation
1.0	Initial Version

Test Setup

Testing Equipment	
Spirent Smartbits 2000	Used to Source Packet Traffic

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:

PD Tested	Test # 1.1.1/7 Link Speed Detection/Power Request and Application				Test # 1.1.3		Test # 1.1.3	
	High Attenuation Channel		Low Attenuation Channel		High Attenuation Channel		Low Attenuation Channel	
	Case 1	Case 2	Case 1	Case 2	64 Byte	1518 Byte	64 Byte	1518 Byte
3Com Corp. NJ220	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
3Com Corp. NJ105	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
3Com Corp. 3C10248PE	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
3Com Corp. 3C10226PE	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 4610SW IP Phone	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 4620SW IP Phone	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 4625SW IP Phone	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 4630SW IP Phone	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 9620	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 9630	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Avaya, Inc. 9640	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Cisco Systems CP-7911G	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Cisco Systems D103994	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Cisco Systems D104176	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Nortel Networks IP PHONE 1110	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Nortel Networks IP PHONE 1120E	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Nortel Networks IP Phone 1210	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Nortel Networks IP Phone i2004	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Polycom, Inc. SoundPoint IP 330	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Polycom, Inc. SoundPoint IP 430	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Polycom, Inc. SoundPoint IP 550	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Polycom, Inc. Soundpoint IP 650 Rev A	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
HP T410 Thin Client	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Freescale Semiconductor MC34670	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Globtek GT-91080 Power/Data Splitter	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Linear Technology Corp. LTC4257IS8	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Linear Technology Corp. LTC4257CS8-1	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Linear Technology Corp. LTC4267	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
National Semiconductor LM5070	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S

Phihong USA POE14-120-R	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Texas Instruments, Inc. TPS2375 EVM	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Texas Instruments, Inc. TPS2376DDA-H EVM	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Texas Instruments, Inc. TPS23770	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Power Integrations POE101205A	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Silicon Laboratories, Inc. Si3400ISO-EVB	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S
Silicon Laboratories, Inc. Si3400-EVB	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	PWC[1, 2]	N/S	N/S	N/S	N/S

Note 1: Part of the initialization of the DUT involves manual configuration after powering on the DUT. This step was performed after every power cycle during testing.

Note 2: As the DUT was not observed to have a PHY, the Link Speed Detection portions of this test were not performed.

Test # 1.1.4 Endurance Stress Test	Result
	N/S

Comments on Test Results

These tests require network traffic to be passed between the DUT and the Link Partner. Since the DUT was not a midspan and was not observed to have a PHY, these tests were not performed.

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	

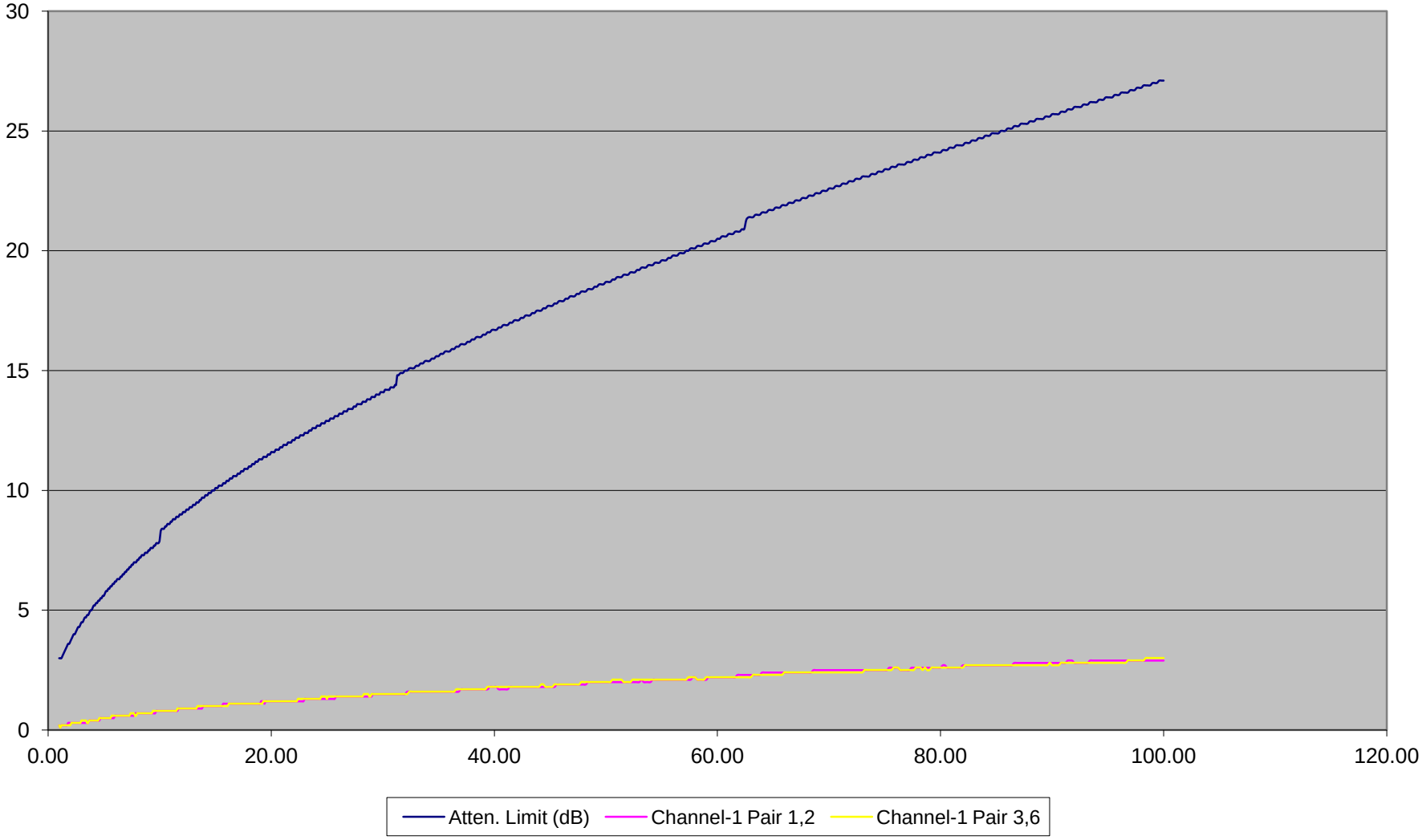
Parameter	Pair	Channel-1	Channel-2
Insertion Loss Margin (dB)	(1, 2)	2.80	
	(3, 6)	2.80	
	(4, 5)		
	(7, 8)		
Return Loss Margin (dB)	(1, 2)	7.70	
	(3, 6)	8.89	
	(4, 5)		
	(7, 8)		
Return Loss @ Remote Margin (dB)	(1, 2)	9.35	
	(3, 6)	6.71	
	(4, 5)		
	(7, 8)		
PSNEXT Margin (dB)	(1, 2)		
	(3, 6)		
	(4, 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)	14.70	
	(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)	14.70	
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(7, 8)		

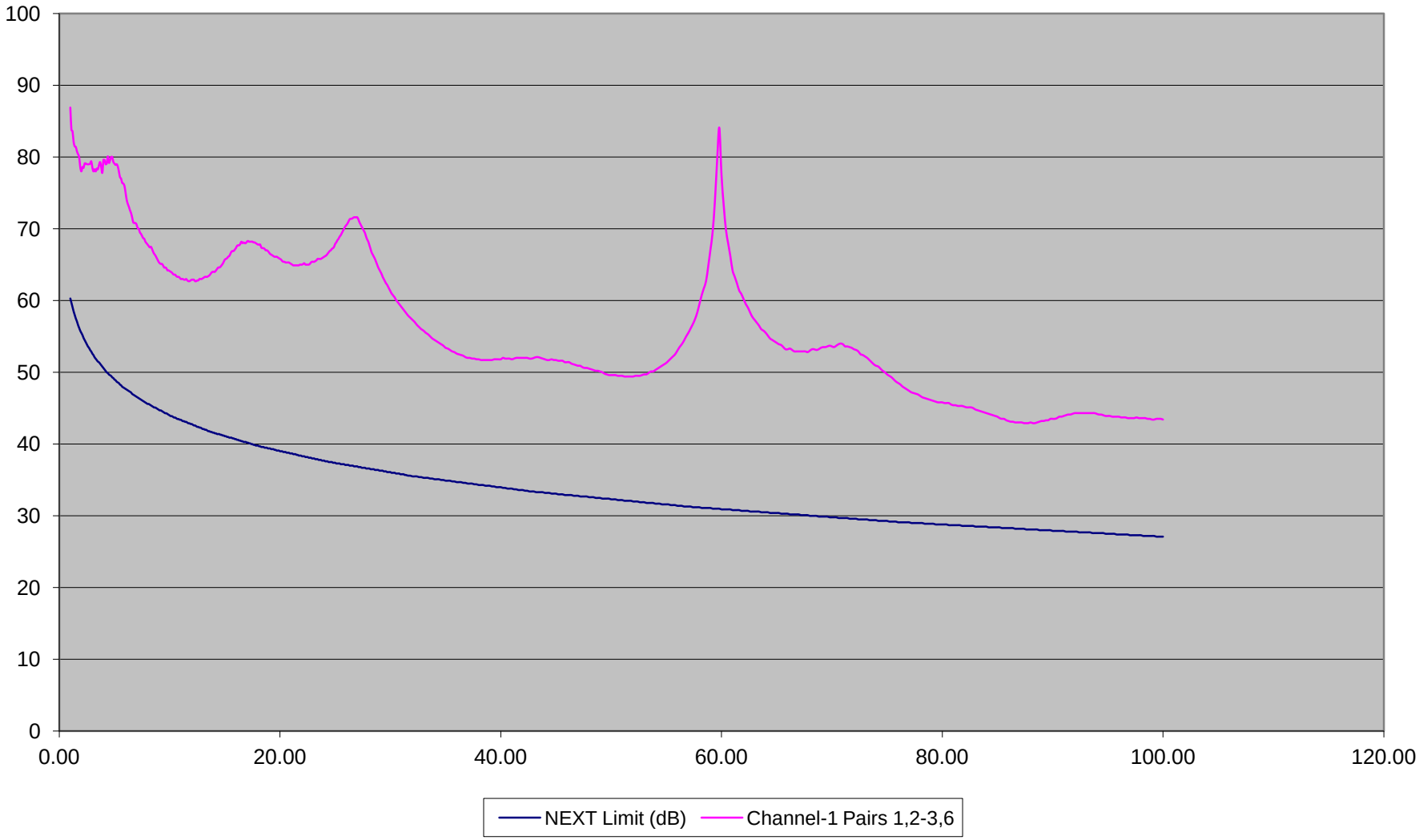
Parameter	Generator-Receptor	Channel-1	Channel-2
ELFEXT Margin (dB)	(1, 2)-(3, 6)		
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(1, 2)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(1, 2)		
	(4, 5)-(3, 6)		
	(4, 5)-(7, 8)		
	(7, 8)-(1, 2)		
	(7, 8)-(3, 6)		
	(7, 8)-(4, 5)		
ELFEXT @ Remote Margin (dB)	(1,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

Channel 1 Description: Crossover

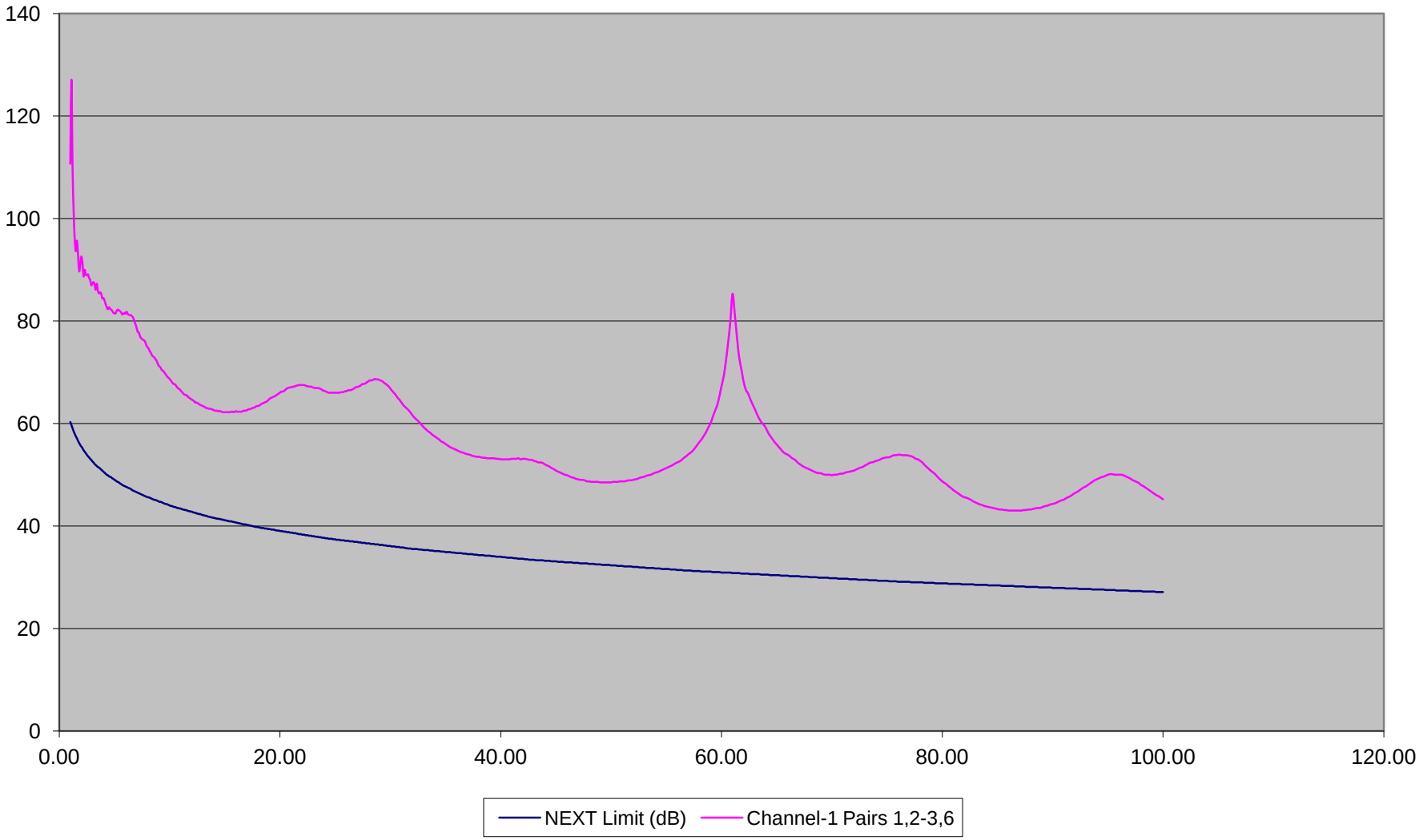
CAT 5 - TSB95 Spec @ Low Attenuation - Attenuation Plot
X-Axis Frequency (MHz), Y-Axis Attn (dB)



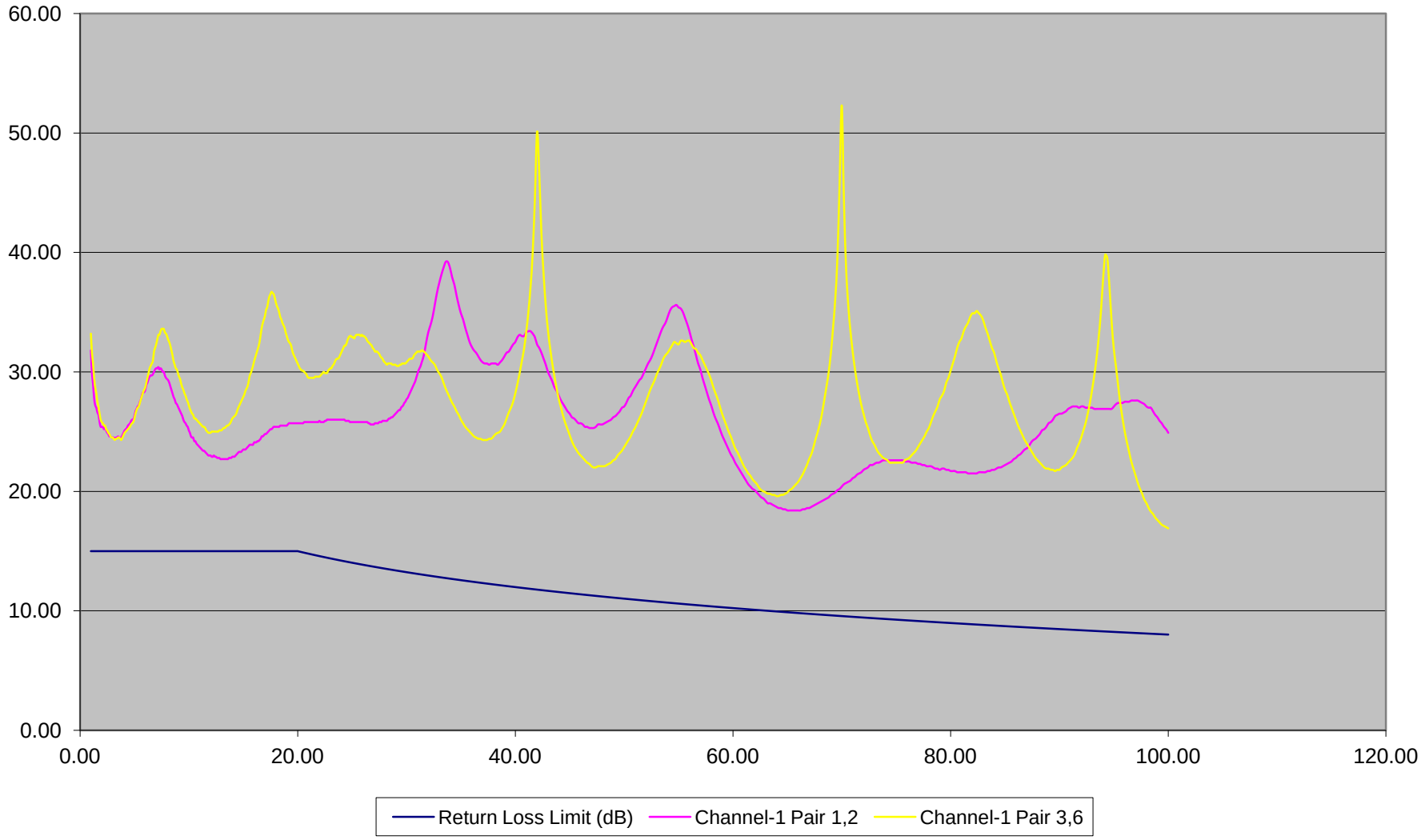
CAT 5 - TSB95 Spec @ Low Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)



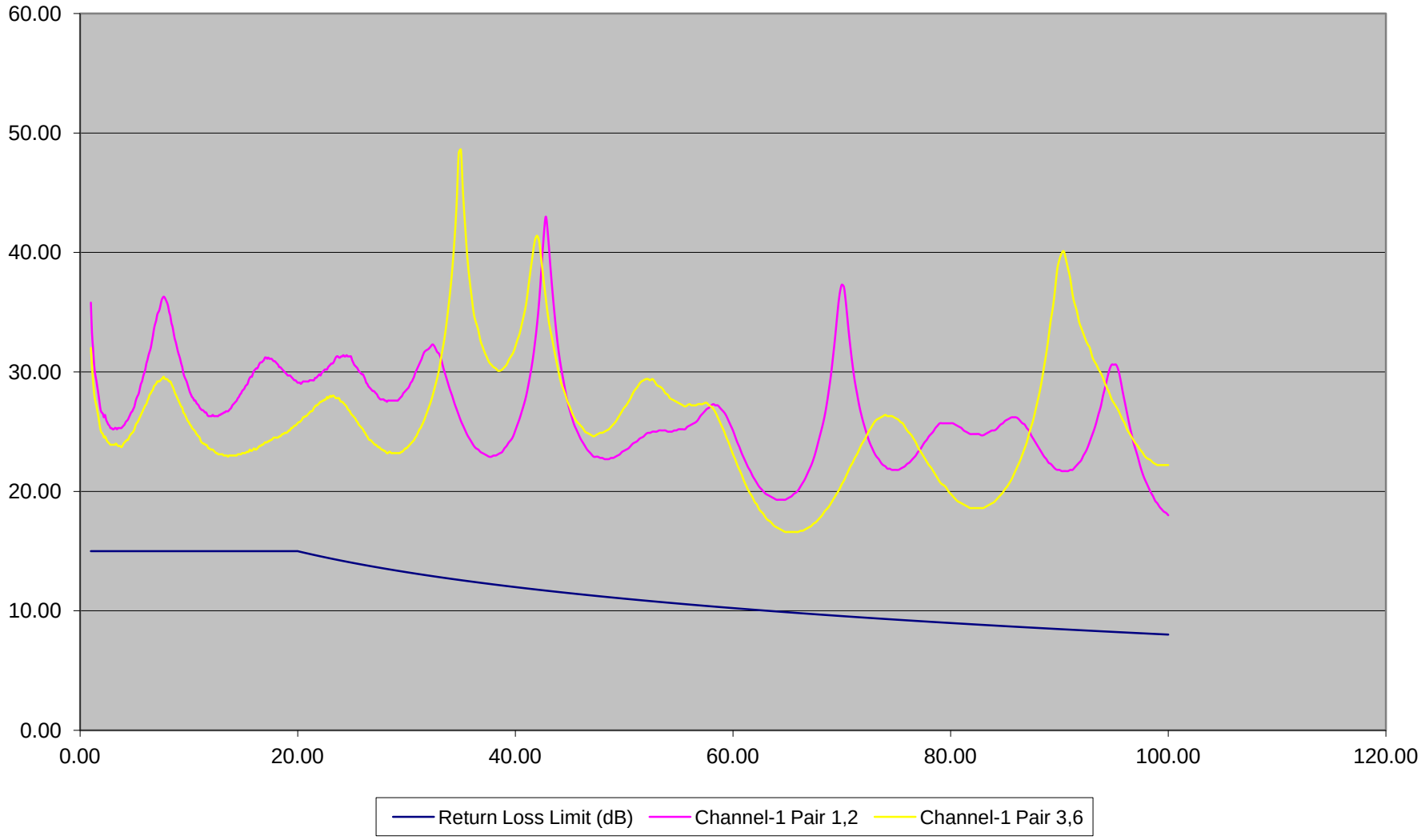
CAT 5 - TSB95 Spec @ Low Attenuation - Near End Cross Talk @ Remote
X-Axis Frequency (MHz), Y-Axis NEXT-R (dB)



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	

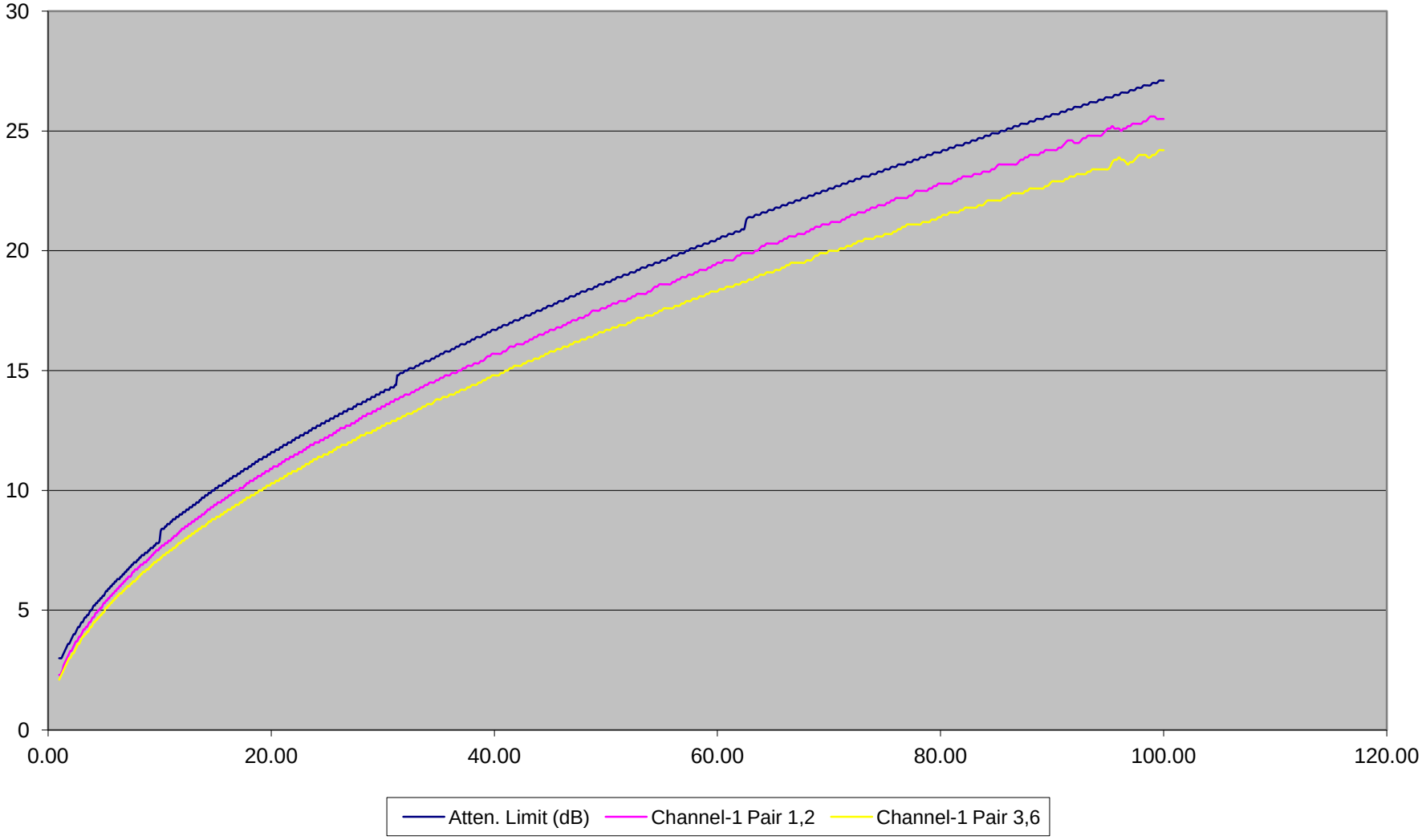
Parameter	Pair	Channel-1	Channel-2
Insertion Loss Margin (dB)	(1, 2)	0.30	
	(3, 6)	0.60	
	(4, 5)		
	(7, 8)		
Return Loss Margin (dB)	(1, 2)	8.90	
	(3, 6)	7.00	
	(4, 5)		
	(7, 8)		
Return Loss @ Remote Margin (dB)	(1, 2)	7.70	
	(3, 6)	8.30	
	(4, 5)		
	(7, 8)		
PSNEXT Margin (dB)	(1, 2)		
	(3, 6)		
	(4, 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)	14.10	
	(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)	14.50	
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(7, 8)		

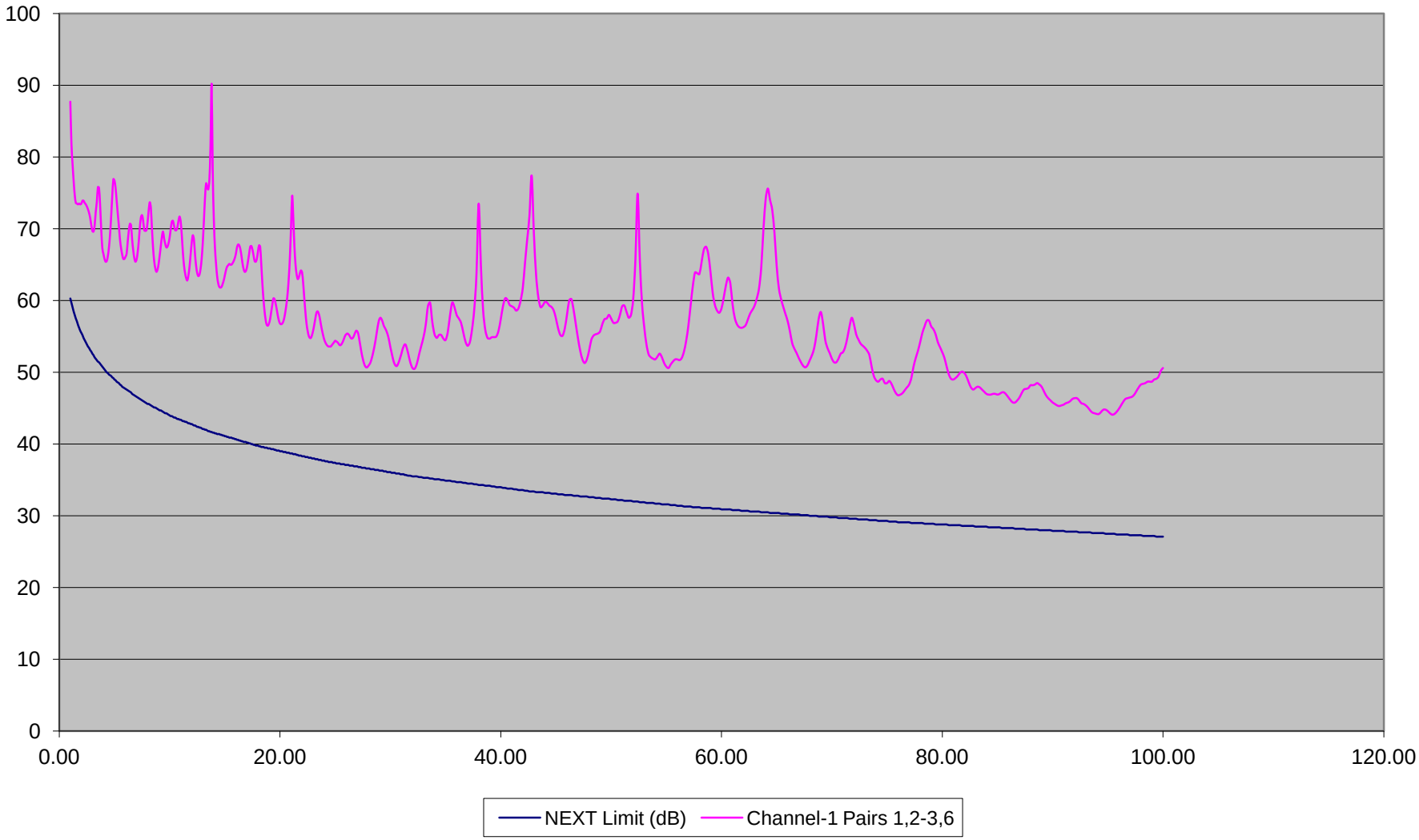
Parameter	Generator-Receptor	Channel-1	Channel-2
ELFEXT Margin (dB)	(1, 2)-(3, 6)		
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(1, 2)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(1, 2)		
	(4, 5)-(3, 6)		
	(4, 5)-(7, 8)		
	(7, 8)-(1, 2)		
	(7, 8)-(3, 6)		
	(7, 8)-(4, 5)		
ELFEXT @ Remote Margin (dB)	(1,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

Channel 1 Description: Crossover

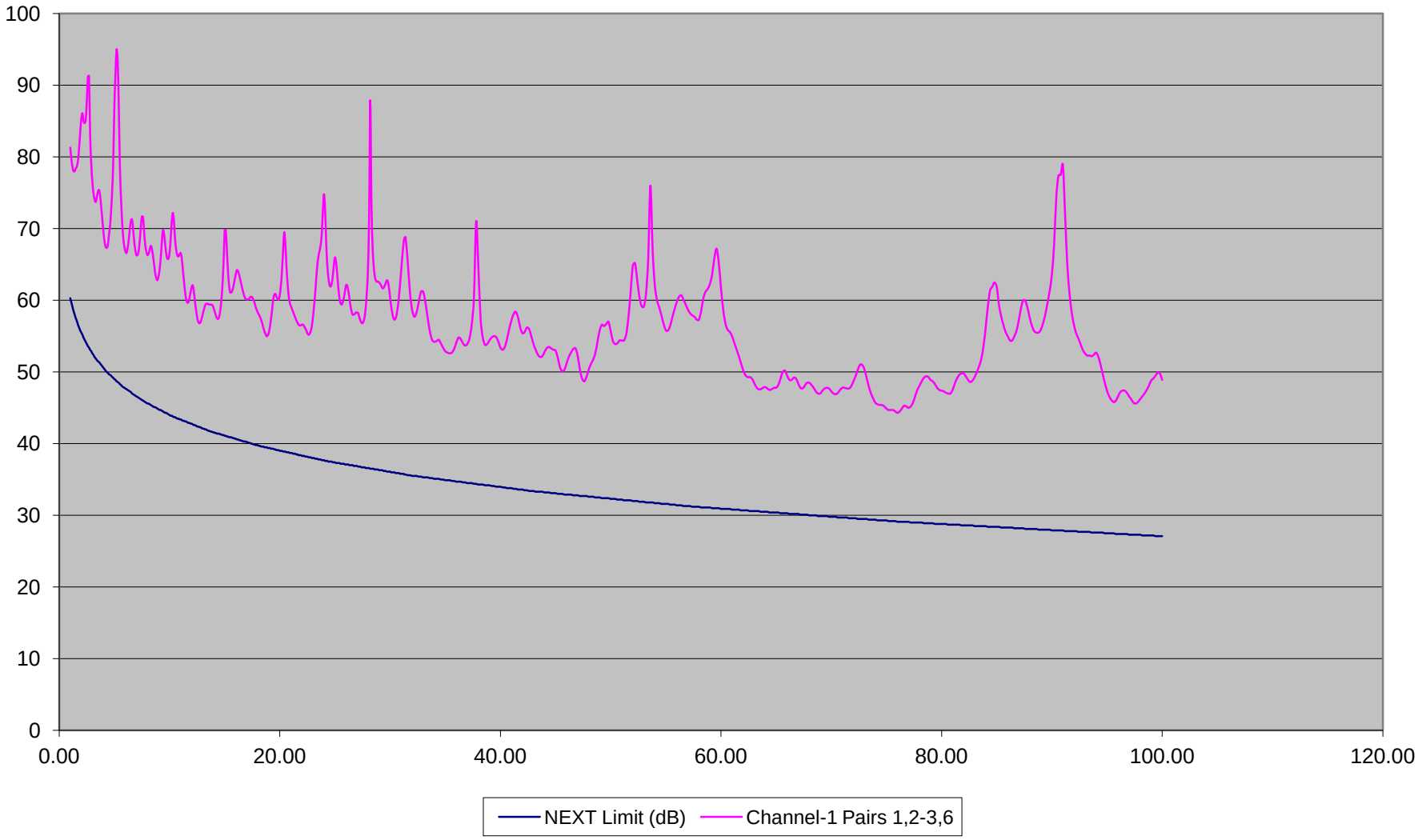
CAT 5 - TSB95 Spec @ Maximum Attenuation - Attenuation Plot
X-Axis Frequency (MHz), Y-Axis Attn (dB)



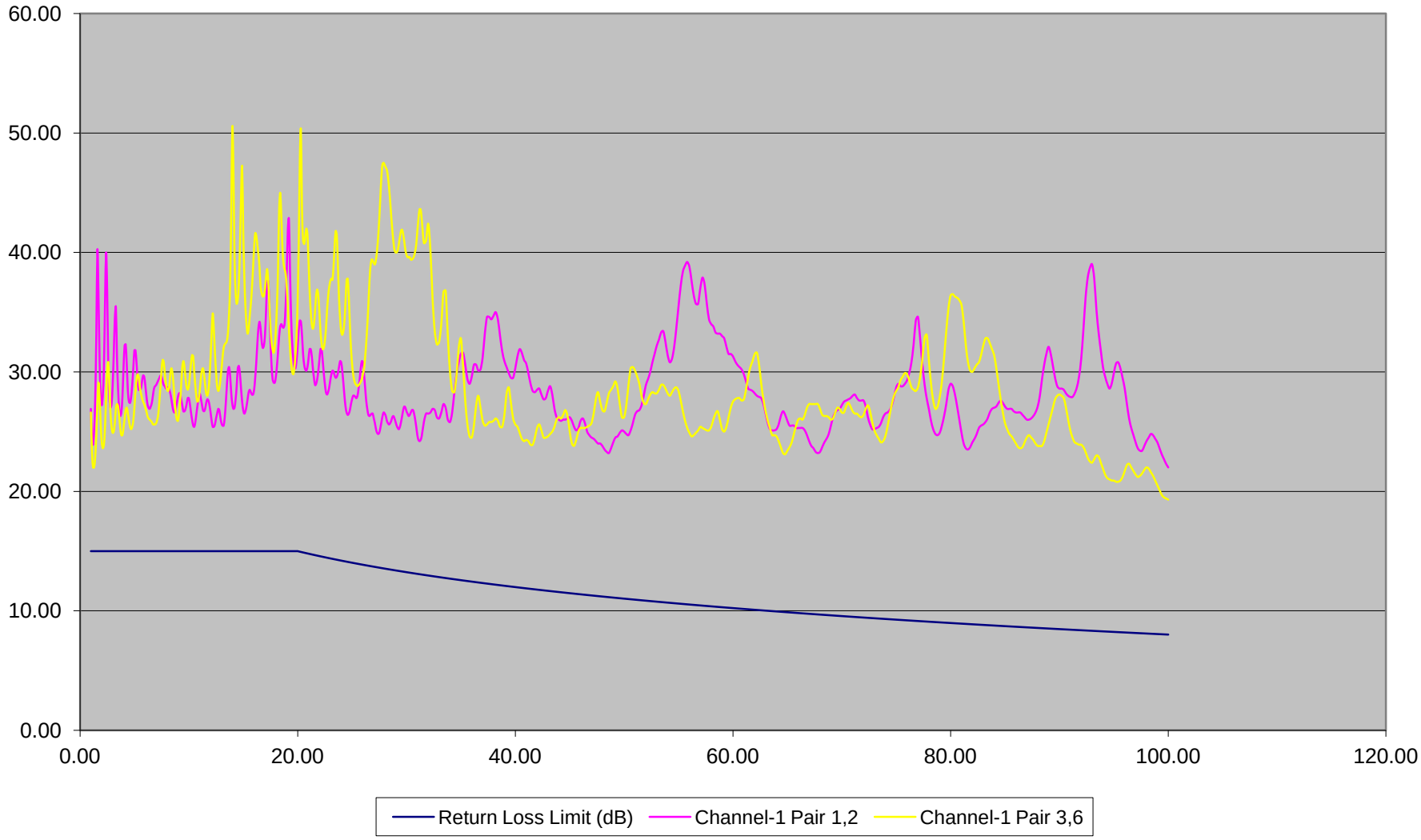
CAT 5 - TSB95 Spec @ Maximum Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)



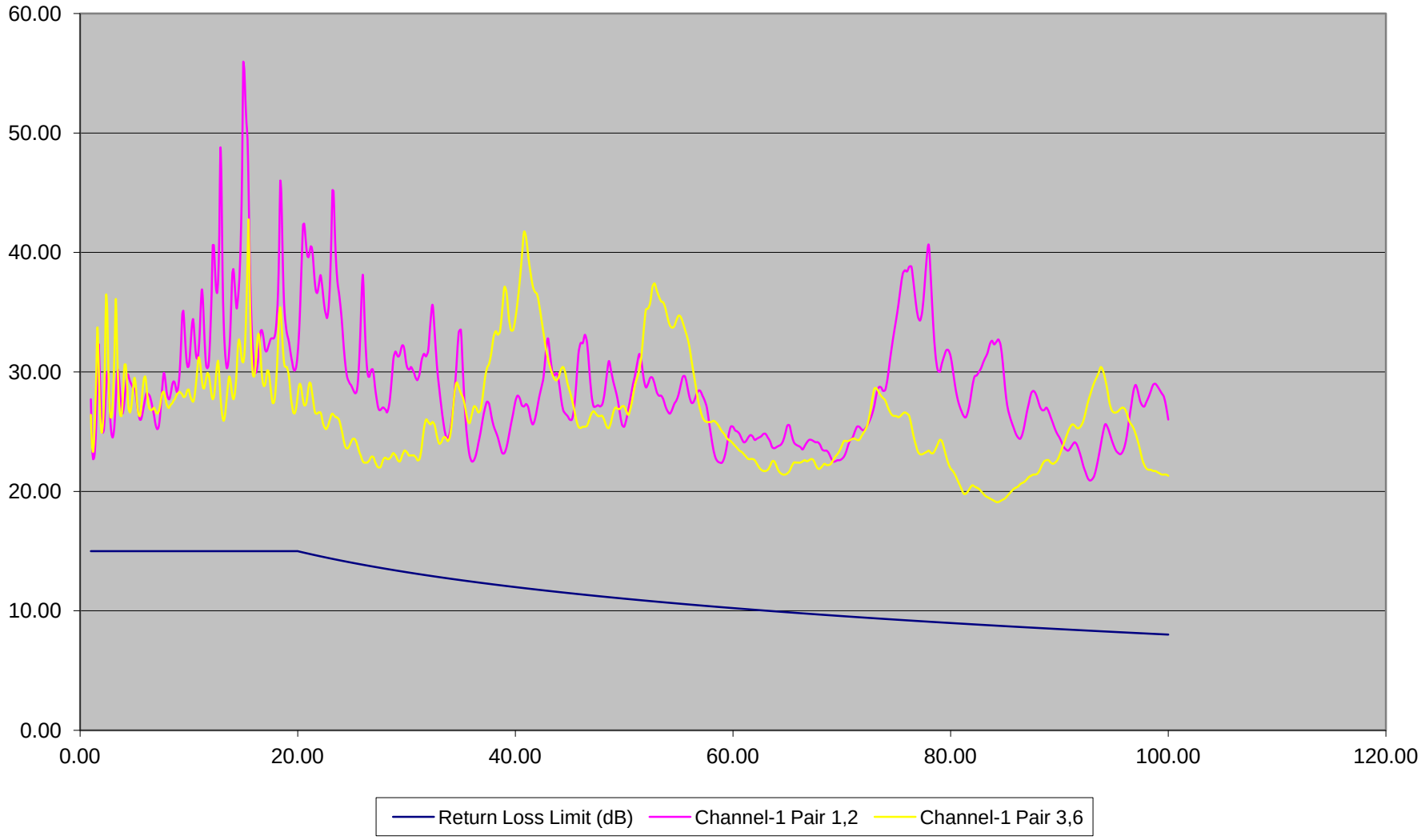
CAT 5 - TSB95 Spec @ Maximum Attenuation - Near End Cross Talk @ Remote
X-Axis Frequency (MHz), Y-Axis NEXT-R (dB)



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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