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
Taylor Madore
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Digitally signed by UNH-IOL
Date: 2014.06.11 17:48:03 -04'00'

Review Completed: 11-June-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 of 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.

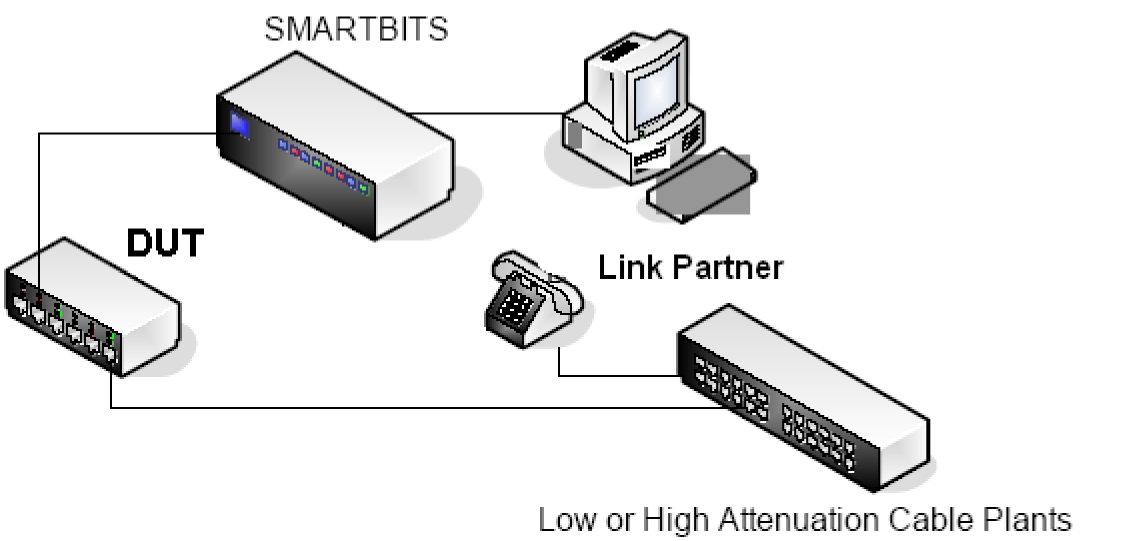
Revision History

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.

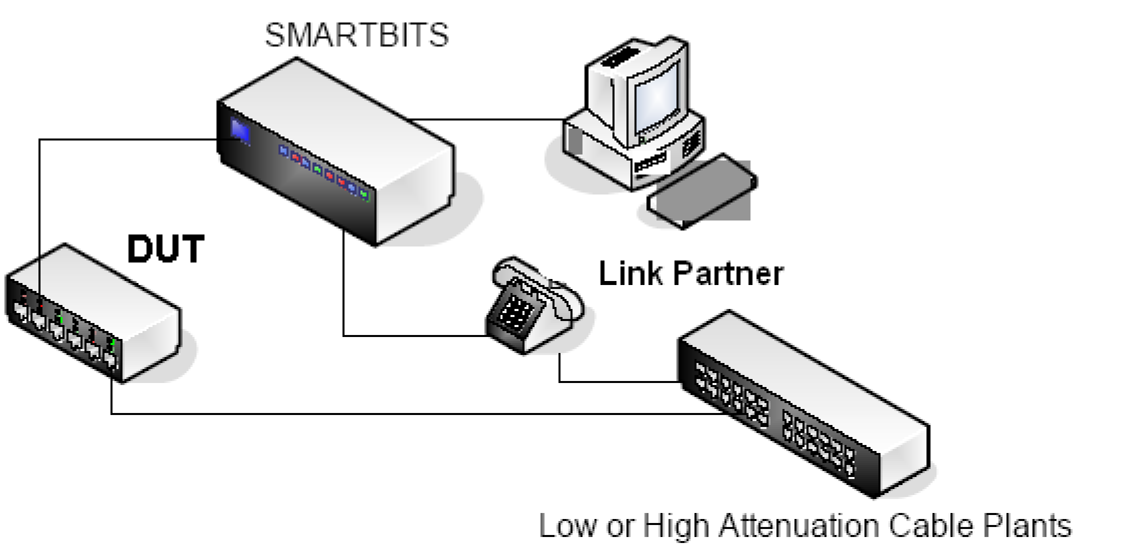
Test Setup

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 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.	

Test # 1.1.3 Packet Error Ratio Estimation	Result
High Attenuation Channel	**Not Applicable**
Low Attenuation Channel	**Not Applicable**
Comments on Test Results 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.	

Test # 1.1.7 Power Request and Application				
	High Attenuation Channel		Low Attenuation Channel	
PD Tested	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

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.

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	

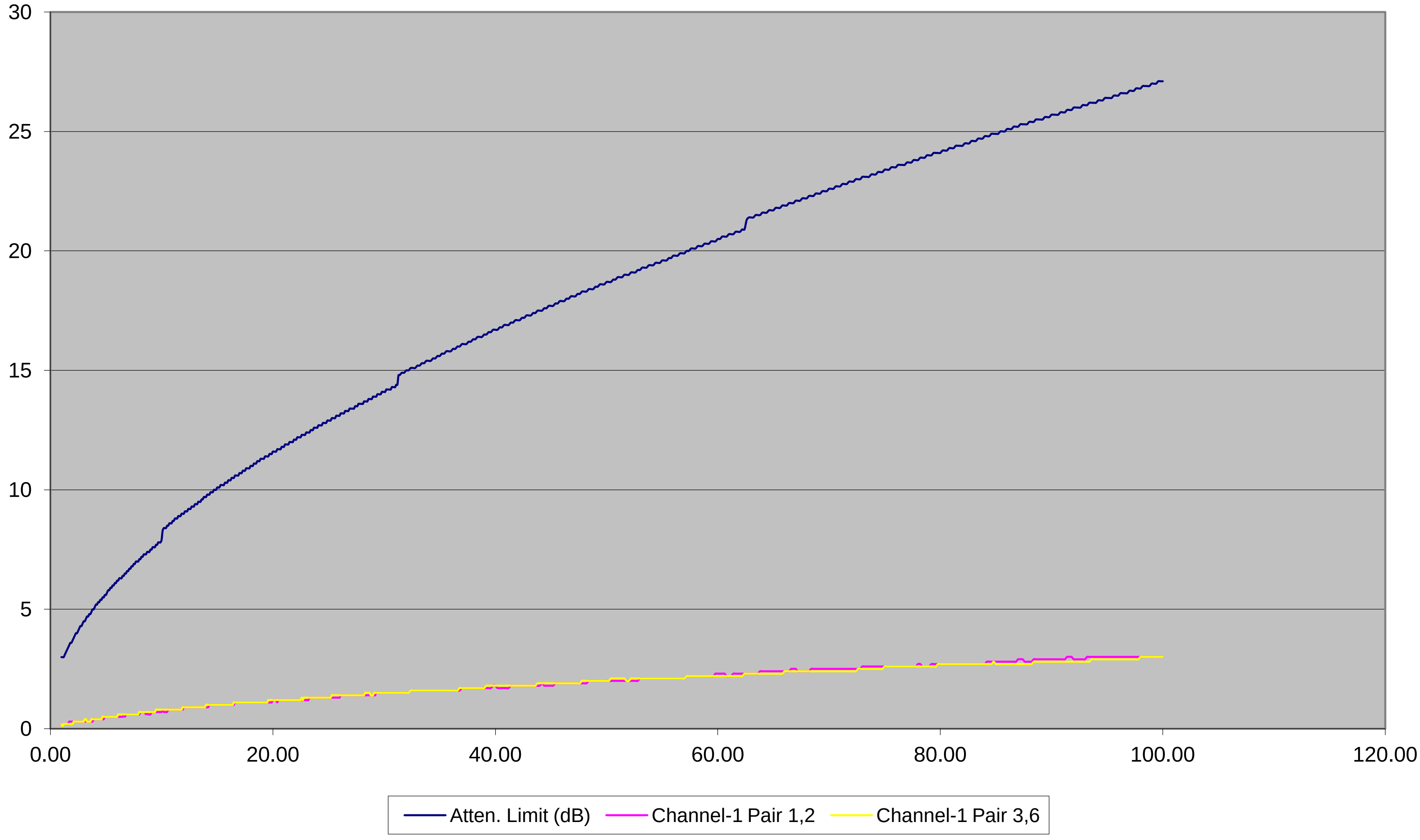
Parameter	Pair	Channel-1	Channel-2
Insertion Loss Margin (dB)	(1, 2)	2.80	
	(3, 6)	2.80	
	(4, 5)		
	(7, 8)		
Return Loss Margin (dB)	(1, 2)	8.55	
	(3, 6)	8.30	
	(4, 5)		
	(7, 8)		
Return Loss @ Remote Margin (dB)	(1, 2)	9.50	
	(3, 6)	7.41	
	(4, 5)		
	(7, 8)		
PSNEXT Margin (dB)	(1, 2)		
	(3, 6)		
	(4,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

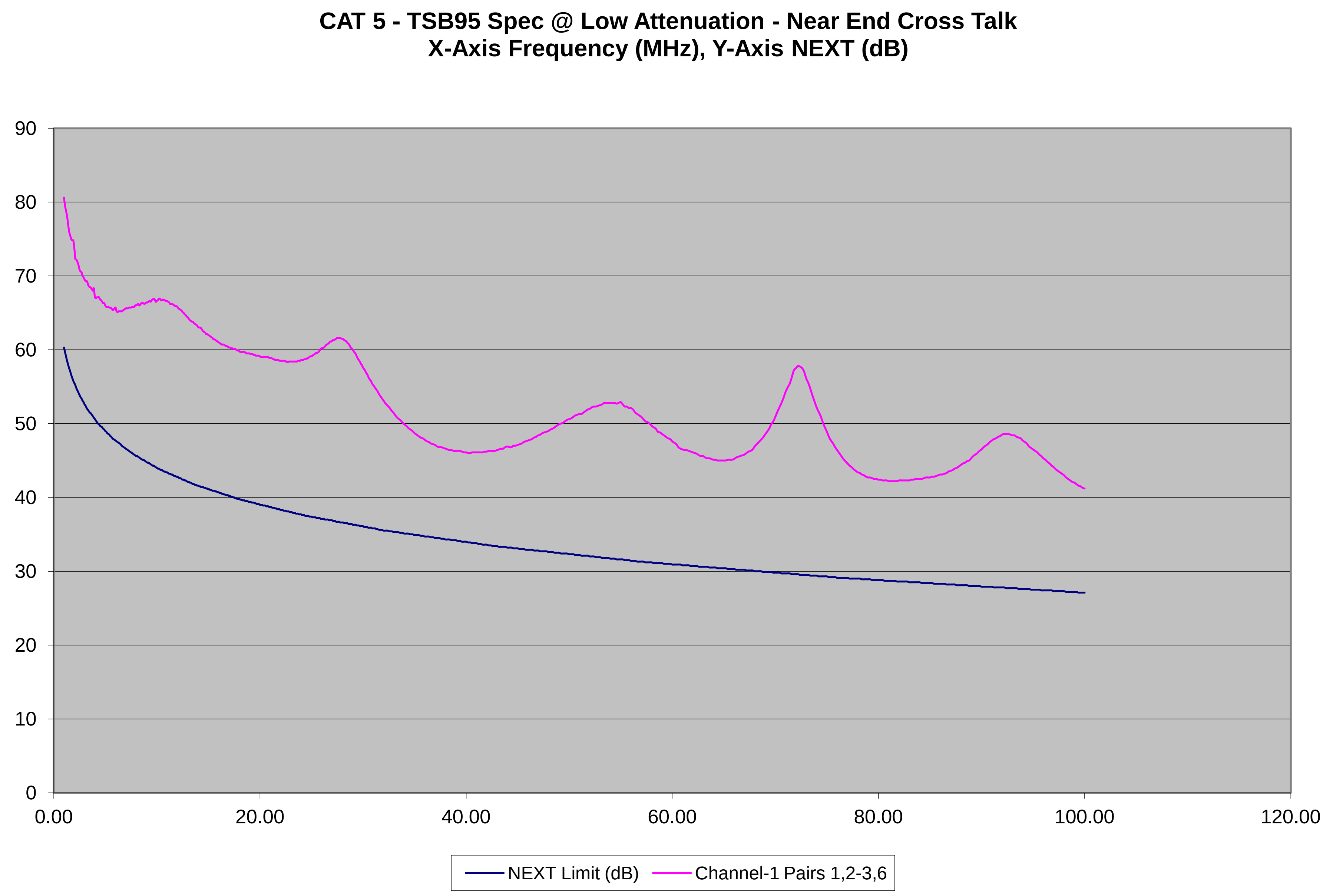
Parameter	Generator-Receptor	Channel-1	Channel-2
NEXT Margin (dB)	(1, 2)-(3, 6)	12.10	
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(7, 8)		
NEXT @ Remote Margin (dB)	(1, 2)-(3, 6)	13.10	
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(7, 8)		

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)		
	(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)		

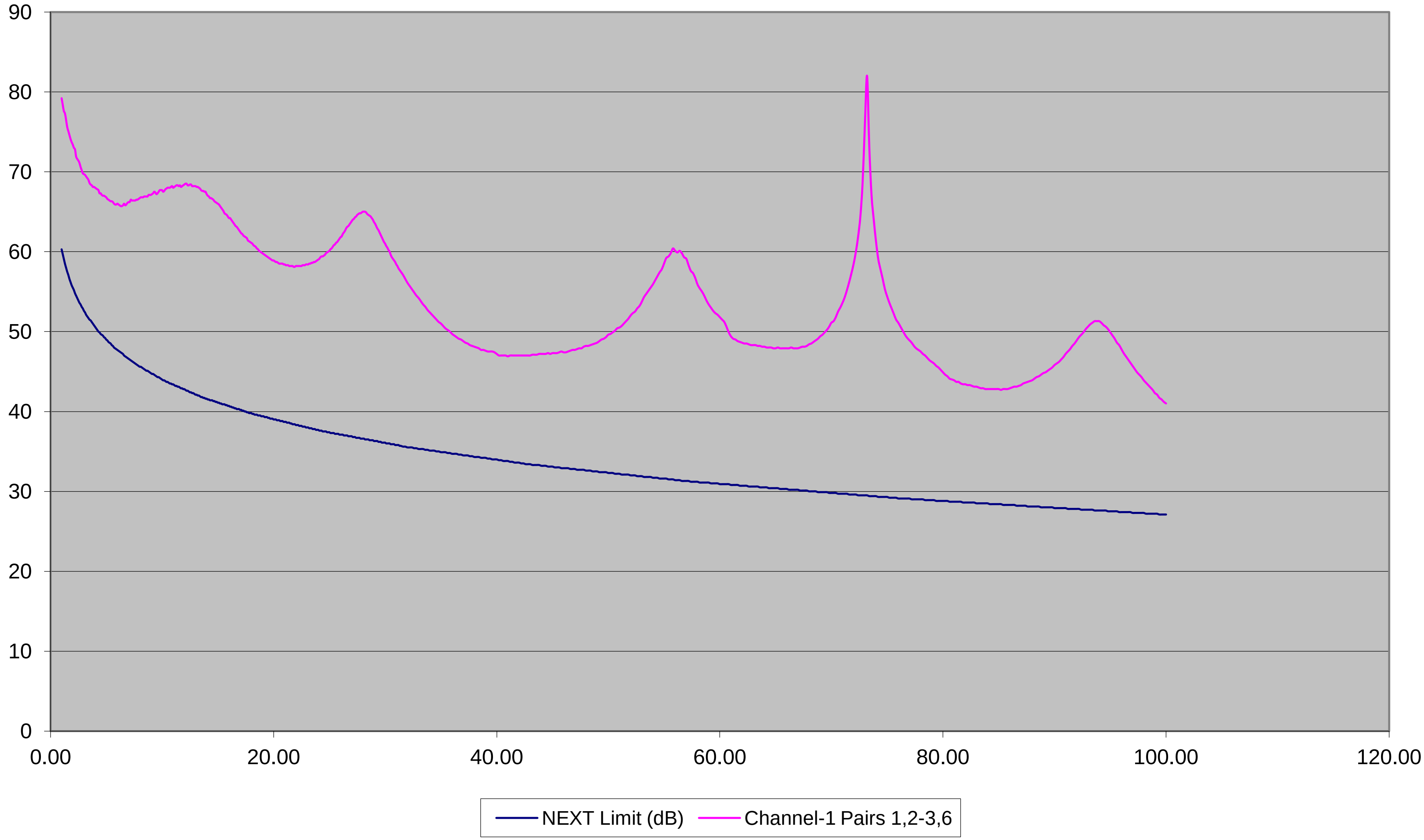
Channel 1 Description: Pass Through

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

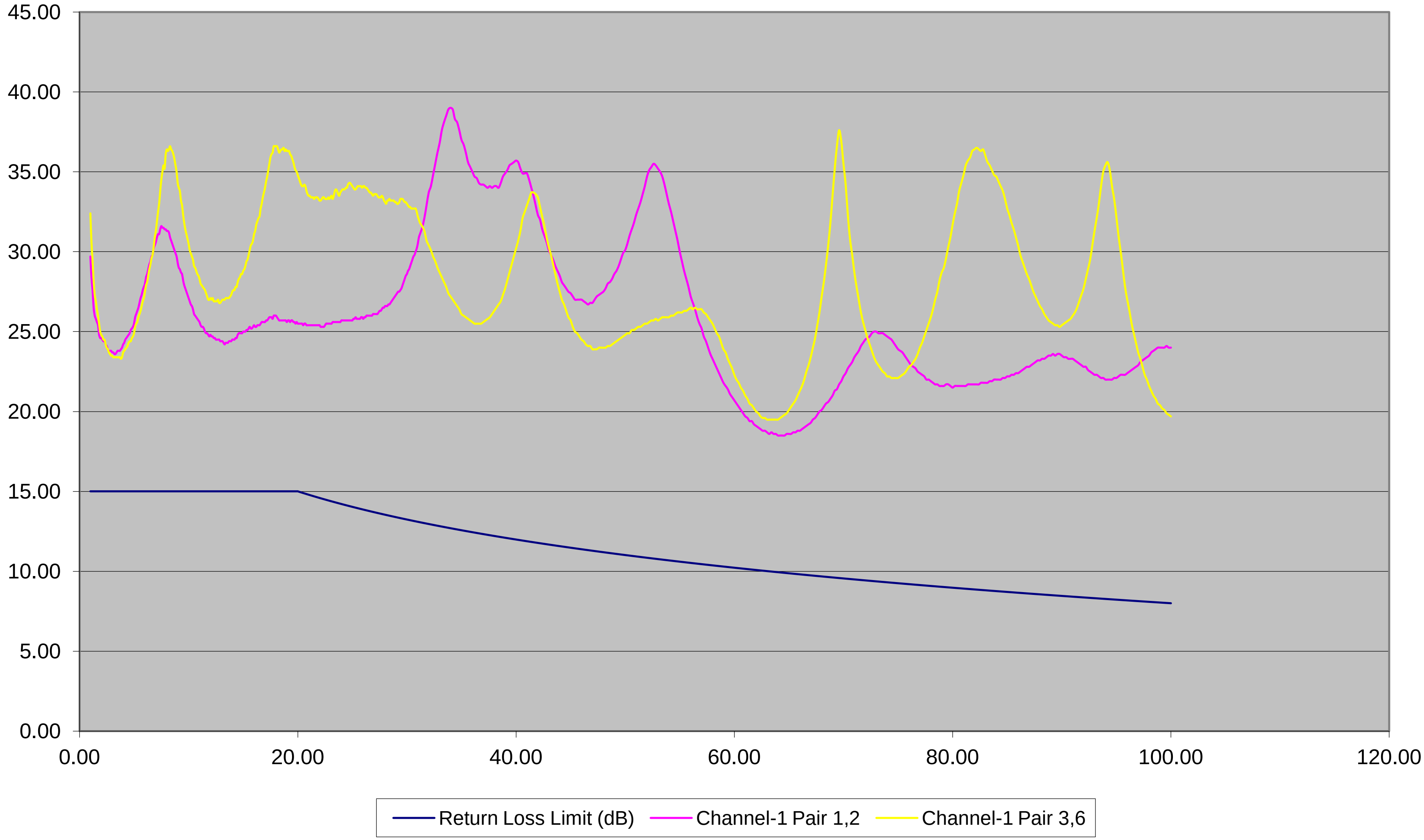


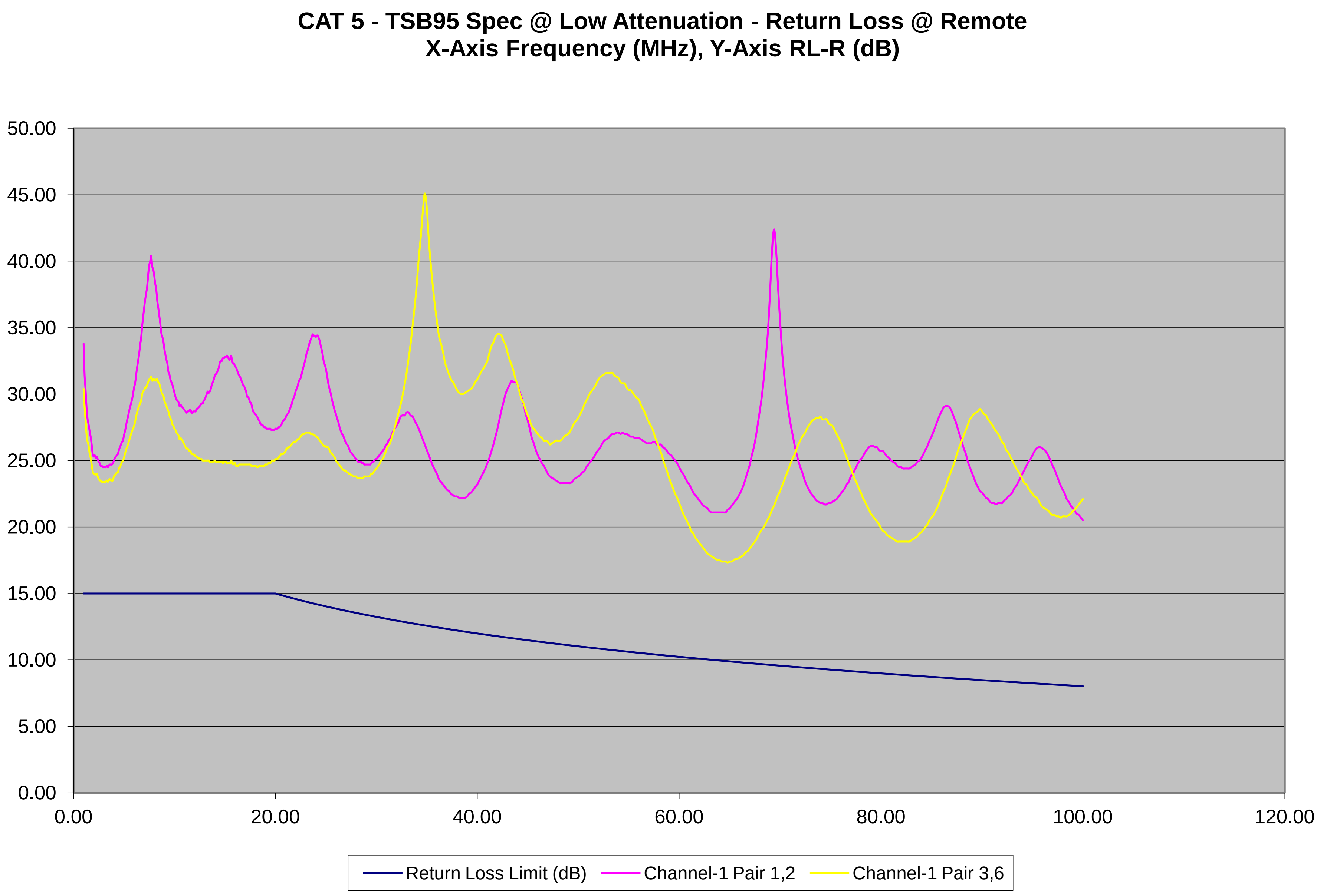

CAT 5 - TSB95 Spec @ Low Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)
90
80
70
60
50
40
30
20
10
0
0.00
20.00
40.00
60.00
80.00
100.00
120.00
NEXT Limit (dB)
Channel-1 Pairs 1,2-3,6

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)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Return Loss Limit (dB)
Channel-1 Pair 1,2
Channel-1 Pair 3,6

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	

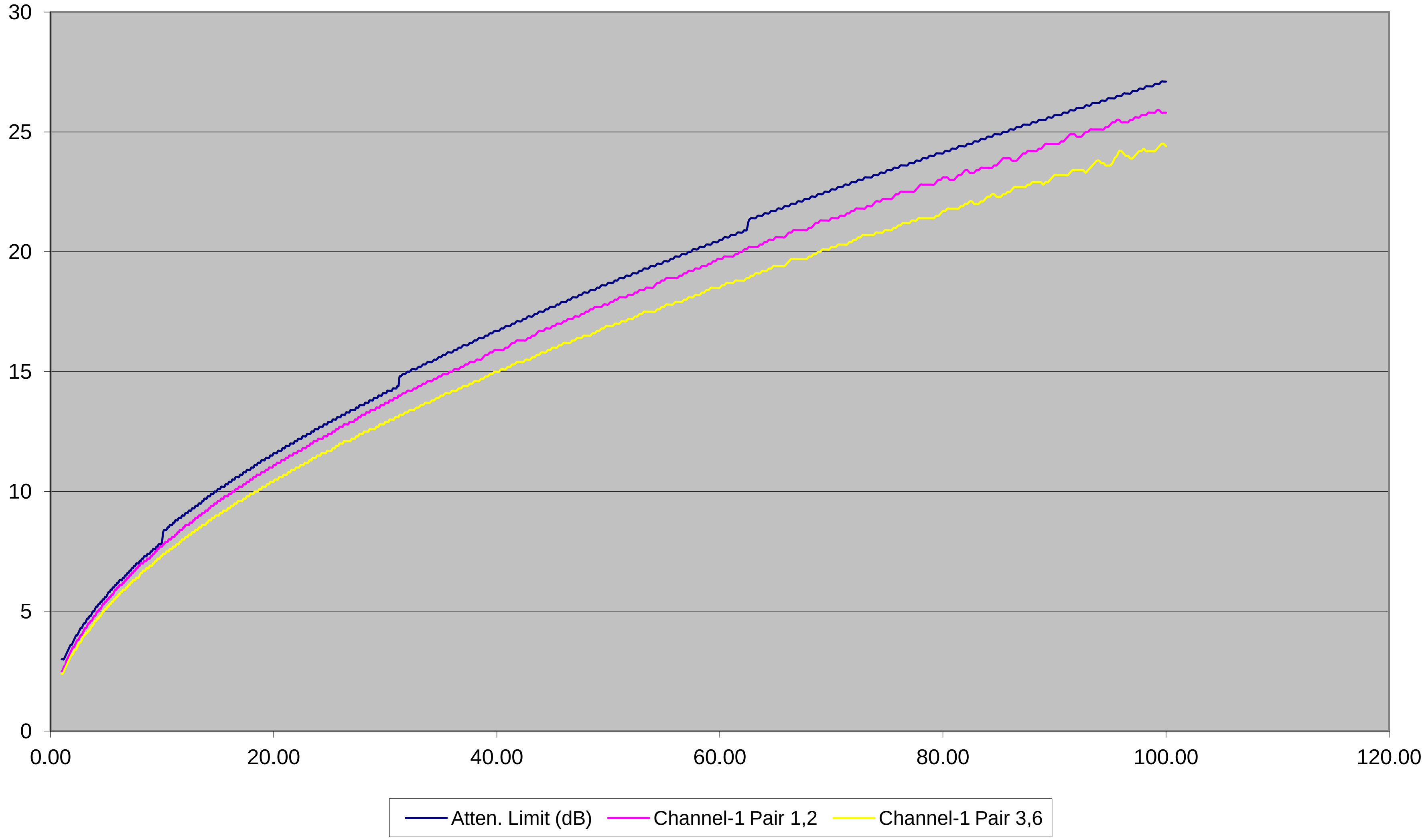
Parameter	Pair	Channel-1	Channel-2
Insertion Loss Margin (dB)	(1, 2)	0.10	
	(3, 6)	0.40	
	(4, 5)		
	(7, 8)		
Return Loss Margin (dB)	(1, 2)	9.20	
	(3, 6)	6.70	
	(4, 5)		
	(7, 8)		
Return Loss @ Remote Margin (dB)	(1, 2)	8.50	
	(3, 6)	9.00	
	(4, 5)		
	(7, 8)		
PSNEXT Margin (dB)	(1, 2)		
	(3, 6)		
	(4,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

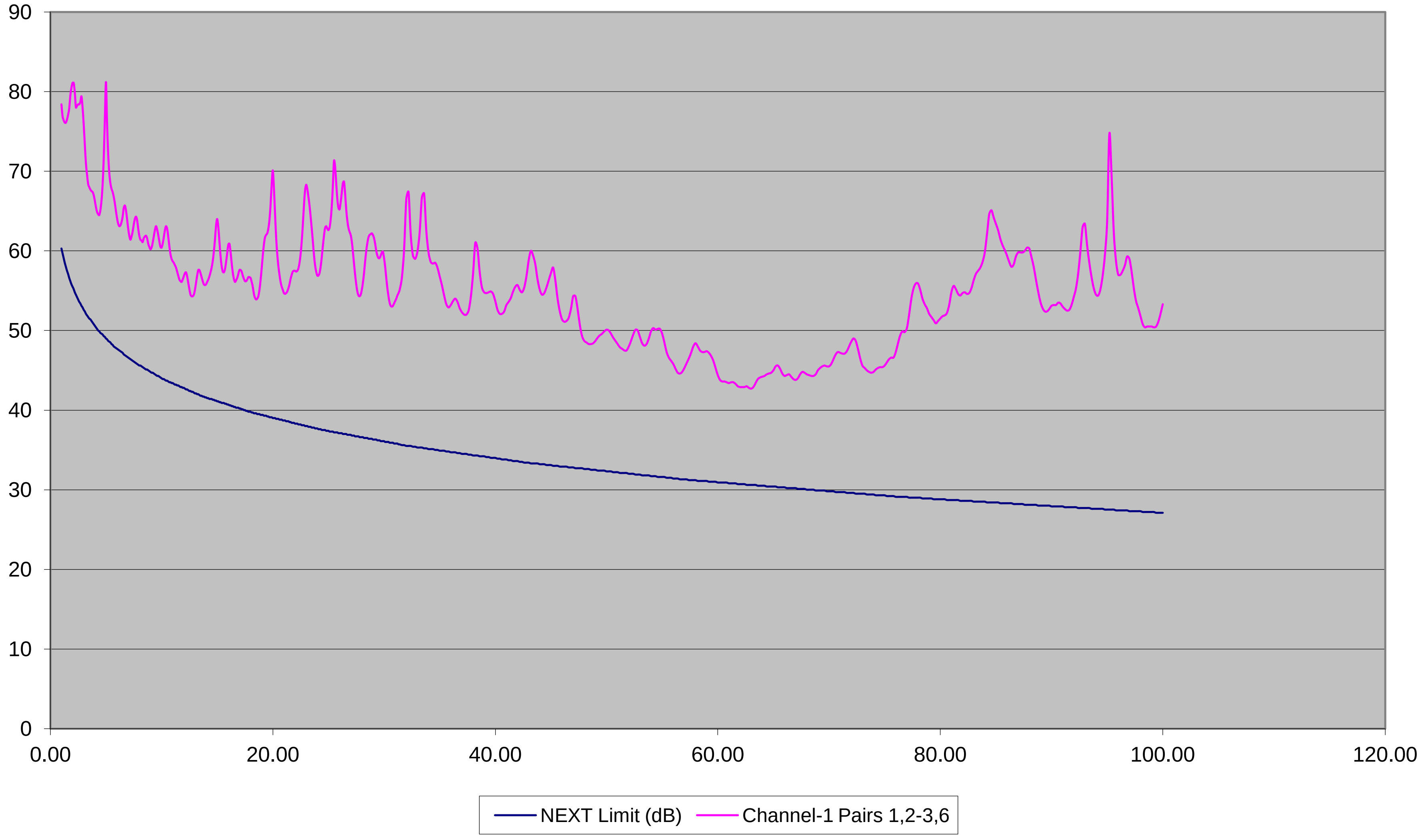
Parameter	Generator-Receptor	Channel-1	Channel-2
ELFEXT Margin (dB)	(1, 2)-(3, 6)		
	(1, 2)-(4, 5)		
	(1, 2)-(7, 8)		
	(3, 6)-(1, 2)		
	(3, 6)-(4, 5)		
	(3, 6)-(7, 8)		
	(4, 5)-(1, 2)		
	(4, 5)-(3, 6)		
	(4, 5)-(7, 8)		
	(7, 8)-(1, 2)		
	(7, 8)-(3, 6)		
	(7, 8)-(4, 5)		
ELFEXT @ Remote Margin (dB)	(1,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

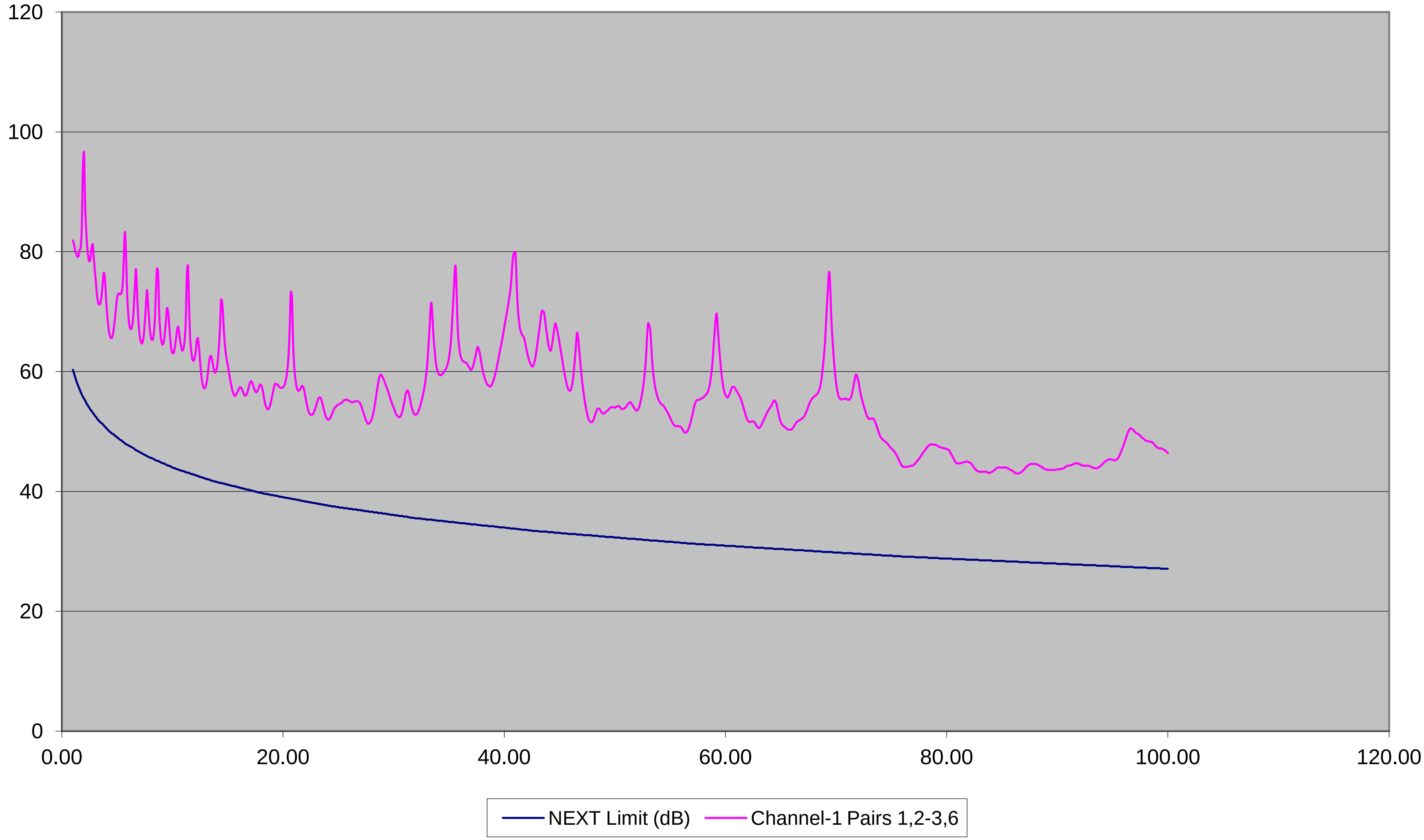
CAT 5 - TSB95 Spec @ Maximum Attenuation - Attenuation Plot
X-Axis Frequency (MHz), Y-Axis Attn (dB)



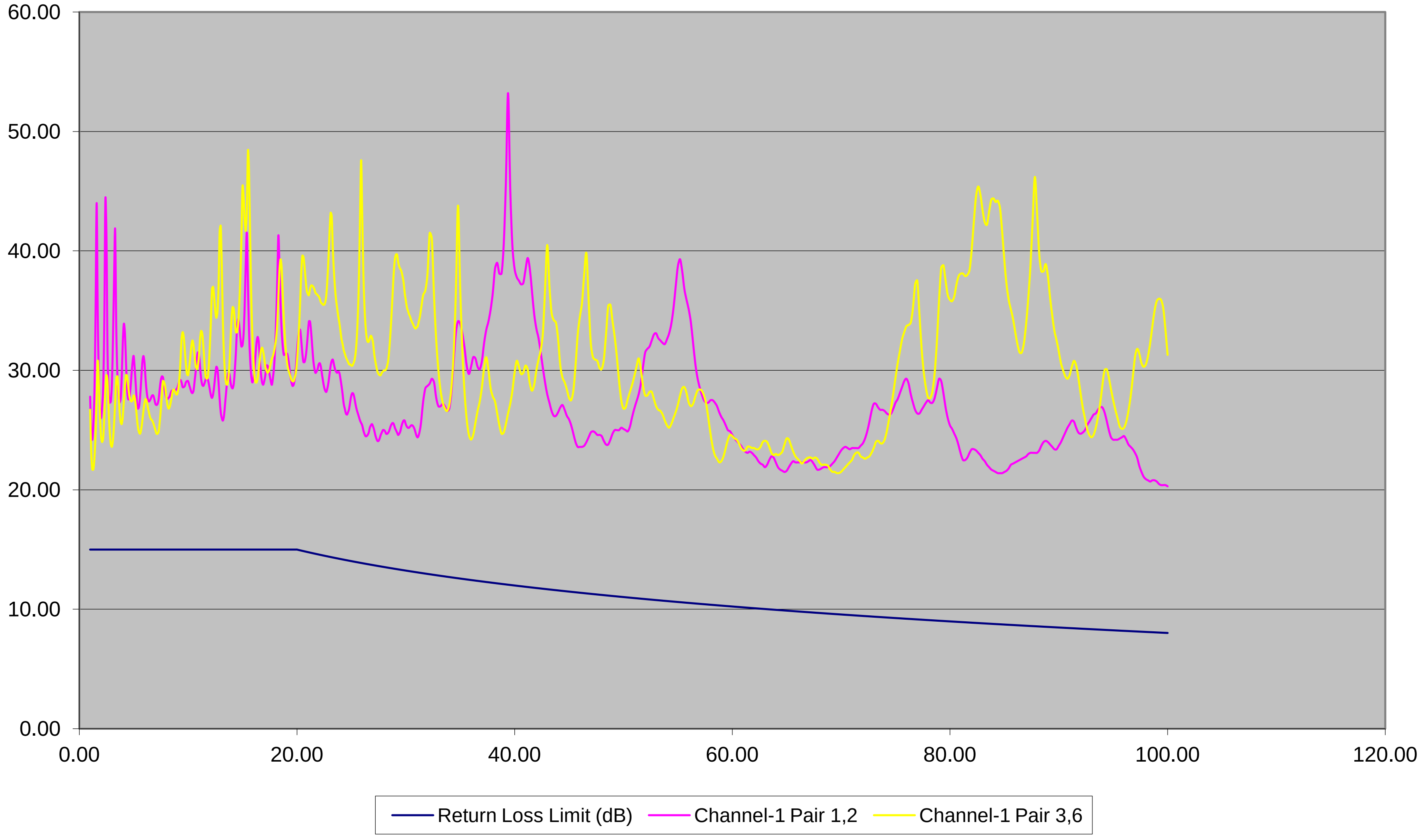
CAT 5 - TSB95 Spec @ Maximum Attenuation - Near End Cross Talk
X-Axis Frequency (MHz), Y-Axis NEXT (dB)



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)