

Joel Goergen – Force10 Networks

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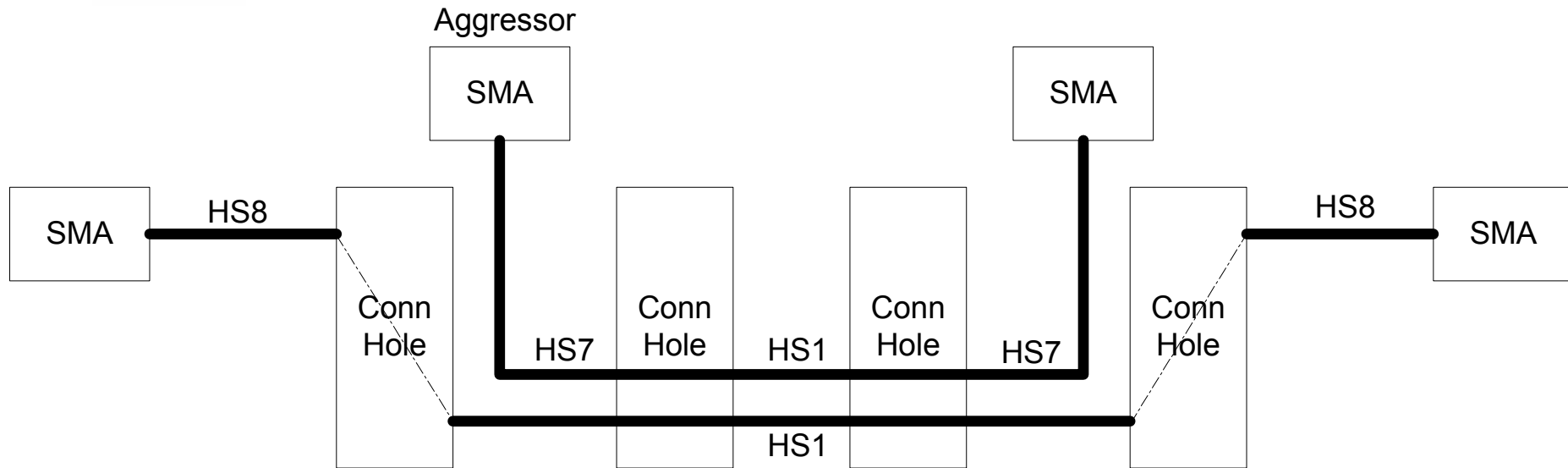
Subject : IEEE 802.3ap Backplane Ethernet

Abstract : This presentation documents a connector-less test card that will validate the informative channel mask discussed in the IEEE May04 meeting.

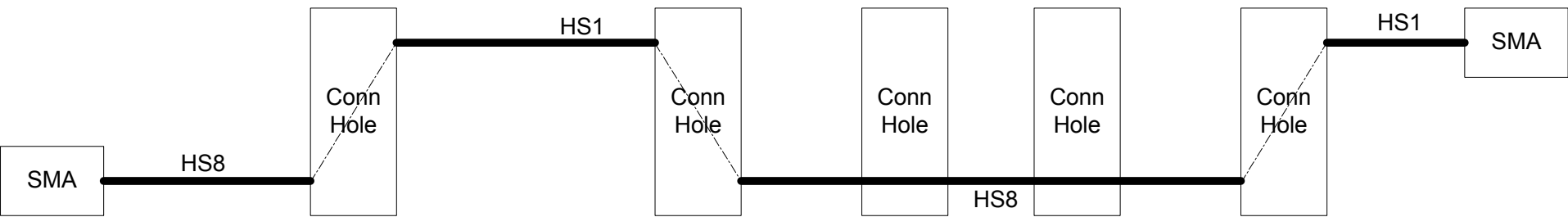
- Discuss Materials and Board Availability.
 - -13
 - IS620
- Test Card Block Diagram.
- Review Stack Details.
- Review Gerber Layers.
- Summary of Fabrication.
- Review SDD21, SDD11, SDD22.
- Review NEXT/FEXT.

- -13 Delivery Week of 13July04
- IS620 Delivery Week of 20July04
- Cards Available to others after IEEE meeting

Test Card Outline – 2 connectors



Test Card Outline – 3 connectors



Channel Lengths

#		LYR							
Conn		HS1		HS1		HS8		HS1	Total
2	CH1	4		3		4			11
2	CH2	7		3		7			17
2	CH3	10		3		10			23
3	CH4	3		3		3		7	16
3	CH5	5		5		3		10	23
2	CH6	4		10		4			18
2	CH7	7		10		7			24
2	CH8	10		10		10			30
3	CH9	3		3		10		7	23
3	CH10	5		5		10		10	30
2	CH11	4		15		4			23
2	CH12	7		15		7			29
2	CH13	10		15		10			35
3	CH14	3		3		15		7	28
3	CH15	5		5		15		10	35
2	CH16	4		20		4			28
2	CH17	7		20		7			34
2	CH18	10		20		10			40
3	CH19	3		3		20		7	33
3	CH20	5		5		20		10	40

- The original design called for 13.5mil drill VIA, but the aspect ratio forced this to a 16mil drill VIA.
- Registration is an issue for the first build because the glass construction is resin rich. Some clearances are 3mils to ground.
- SMA SMT pad was designed to be similar on nature to a BGA pad.
- SMA de-embedding for next release of the card.

-13 Stack Detail

Layers	Specified Thickness	Cross Section Diagram	Layer Name Definition	Layer Type	Resin Content	Material Type	Impedance	Geometry	Impedance	Geometry
L01	0.7	(((		Mask						
	2.0	|||	Foil & Plating	Plating						
	1.3	|||	Pads Only	Pads Only						
L02	6.0	|||||								
	1.3	|||||	GND	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
L03	1.3	|||||	HS1	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13	100ohm+3	6on14	51ohm+3	6on14
	1.3	|||||	GND	1 oz. Cu						
L04	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	HS2	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13	100ohm+3	6on14	51ohm+3	6on14
L05	1.3	|||||	GND	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	HS3	1 oz. Cu						
L06	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13	100ohm+3	6on14	51ohm+3	6on14
	1.3	|||||	GND	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
L07	1.3	|||||	HS4	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13	100ohm+3	6on14	51ohm+3	6on14
	1.3	|||||	GND	1 oz. Cu						
L08	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	HS4	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13	100ohm+3	6on14	51ohm+3	6on14
L09	1.3	|||||	GND	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	Plane	1 oz. Cu						
L10	10.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	Plane	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
L11	1.3	|||||	Plane	1 oz. Cu						
	10.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	Plane	1 oz. Cu						
L12	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
L13	1.3	|||||	HS5	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
L14	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	HS5	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
L15	1.3	|||||	GND	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	HS6	1 oz. Cu						
L16	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
L17	1.3	|||||	HS6	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
L18	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	HS7	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
L19	1.3	|||||	GND	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
	1.3	|||||	HS7	1 oz. Cu						
L20	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
	9.1	|||||		1x1080/2x106/1x1080	rc: 65%/75%/65%	N4000-13				
L21	1.3	|||||	HS8	1 oz. Cu						
	5.5	|||||		core 2x1080	rc: 58.4%	N4000-13				
	1.3	|||||	GND	1 oz. Cu						
L22	6.0	|||||		2x1080	rc: 65%	N4000-13				
	1.3	|||||	Pads Only	Pads Only						
	2.0	|||||	Foil & Plating	Plating						
L24	0.7	(((		Mask						

12 July 2004 2:14 PM

Total: 202.1 Est. Finish Thickness Over Plating & Mask

200.7 Est. Finish After Copper Plating

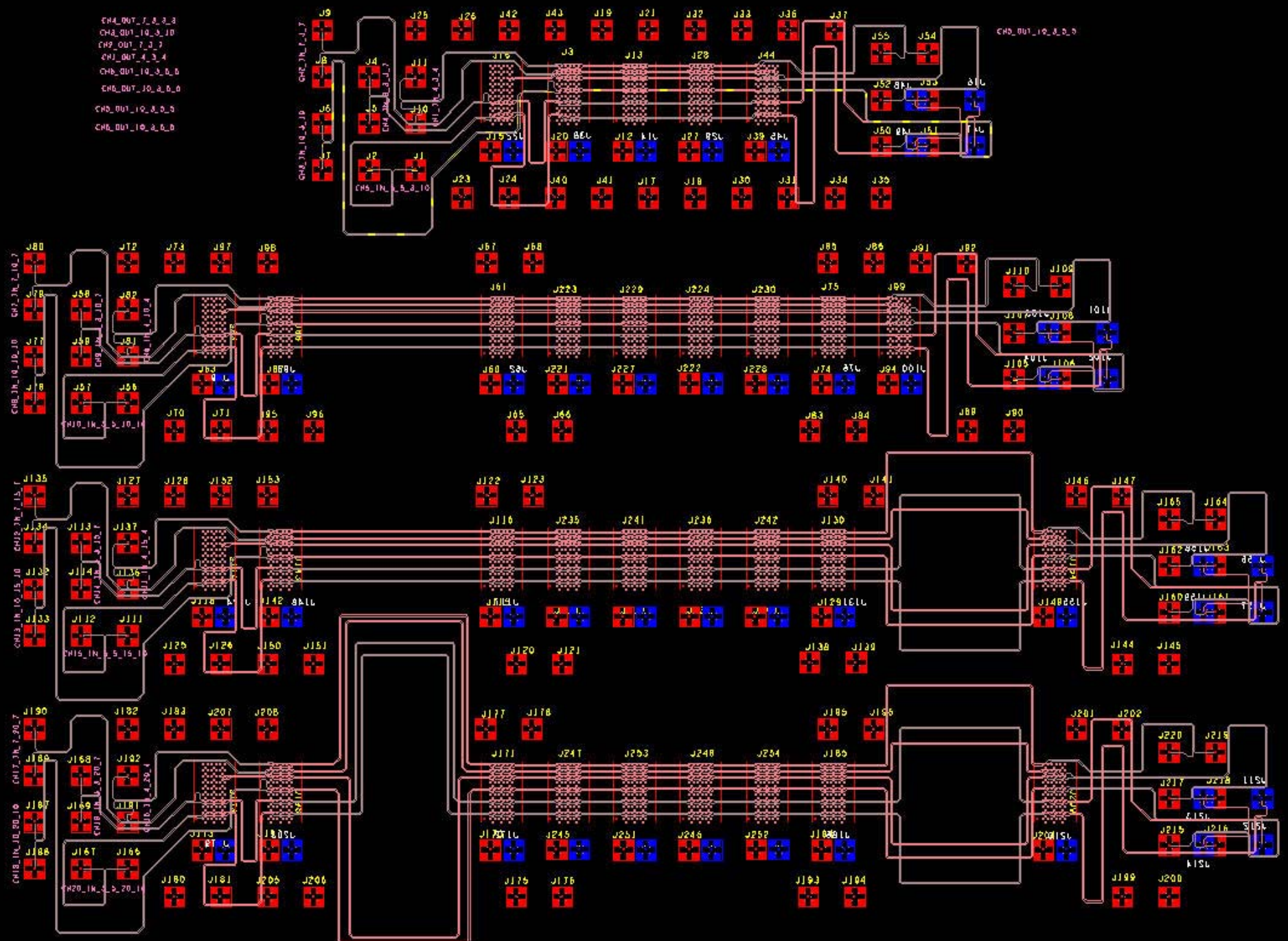
194.1 Est. Finish Thickness Dielectric

IS620 Stack Detail

Layers	Specified Thickness	Cross Section Diagram	Layer Name Definition	Layer Type	Resin Content	Material Type	Impedance	Geometry	Impedance	Geometry
L01	0.7	(((		Mask						
	2.0	(((	Foil & Plating	Plating						
	1.3	(((	Pads Only					Pads Only		
L02	6.3	|||||		2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu				98ohm+4	10on10	56ohm+5 10on10
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
L03	1.3	(((	HS1	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
L04	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	HS2	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
L05	1.3	(((	GND	1 oz. Cu						
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	HS3	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
L06	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
L07	1.3	(((	HS4	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
L08	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	HS4	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
L09	1.3	(((	GND	1 oz. Cu						
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	Plane	1 oz. Cu						
L10	10.5	|||||		1x1080H/2x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	Plane	1 oz. Cu						
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
L11	1.3	(((	Plane	1 oz. Cu						
	10.5	|||||		1x1080H/2x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	Plane	1 oz. Cu						
L12	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
L13	1.3	(((	HS5	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
L14	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	HS6	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
L15	1.3	(((	GND	1 oz. Cu						
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	HS7	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
L16	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
L17	1.3	(((	HS8	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
L18	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	HS7	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
L19	1.3	(((	GND	1 oz. Cu						
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
	1.3	(((	HS8	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
L20	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
	7.0	|||||		1x1080H/1x106H/1x1080H	rc: 63.4%/70.2%/63.4%	IS620				
L21	1.3	(((	HS8	1 oz. Cu				100ohm+3	6on14	51ohm+3 6on14
	6.0	|||||		core 2x1080H	rc: 63.4%	IS620				
	1.3	(((	GND	1 oz. Cu						
L22	6.3	|||||		2x1080H	rc: 63.4%	IS620				
	1.3	(((	Pads Only	1 oz. Cu				98ohm+4	10on10	56ohm+5 10on10
	2.0	(((	Foil & Plating	Plating						
L24	0.7	))))))		Mask						

CH4_OUT_7_8_2_3
CH4_OUT_10_3_10
CH2_OUT_7_3_7
CH1_OUT_4_3_4
CH6_OUT_10_3_5_5
CH6_OUT_10_2_8_5
CH3_OUT_10_3_5_3
CH6_OUT_10_2_5_5

CH5_OUT_10_3_5_5



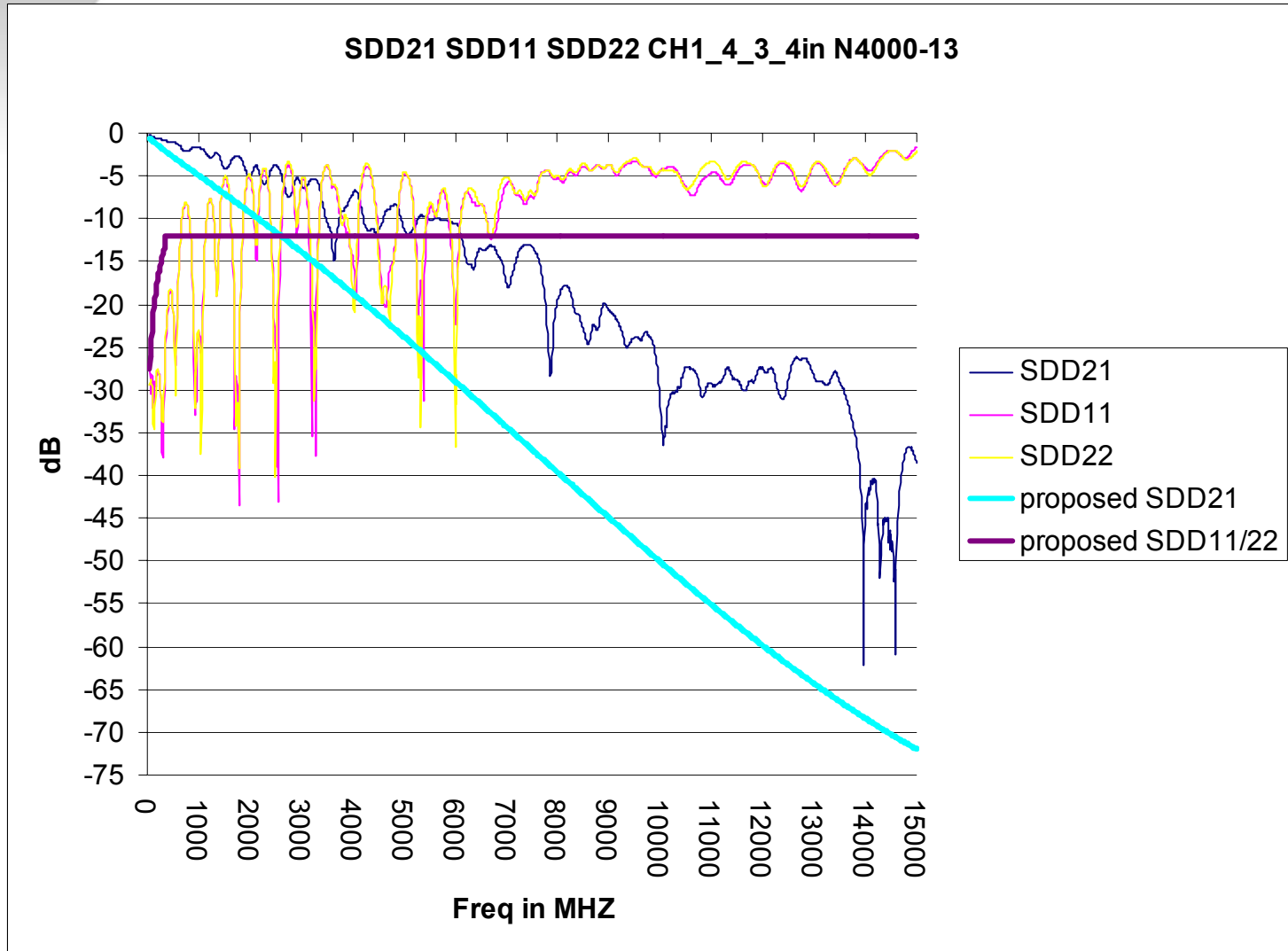
Company: Force10 Networks
Contact: Joel Goergen

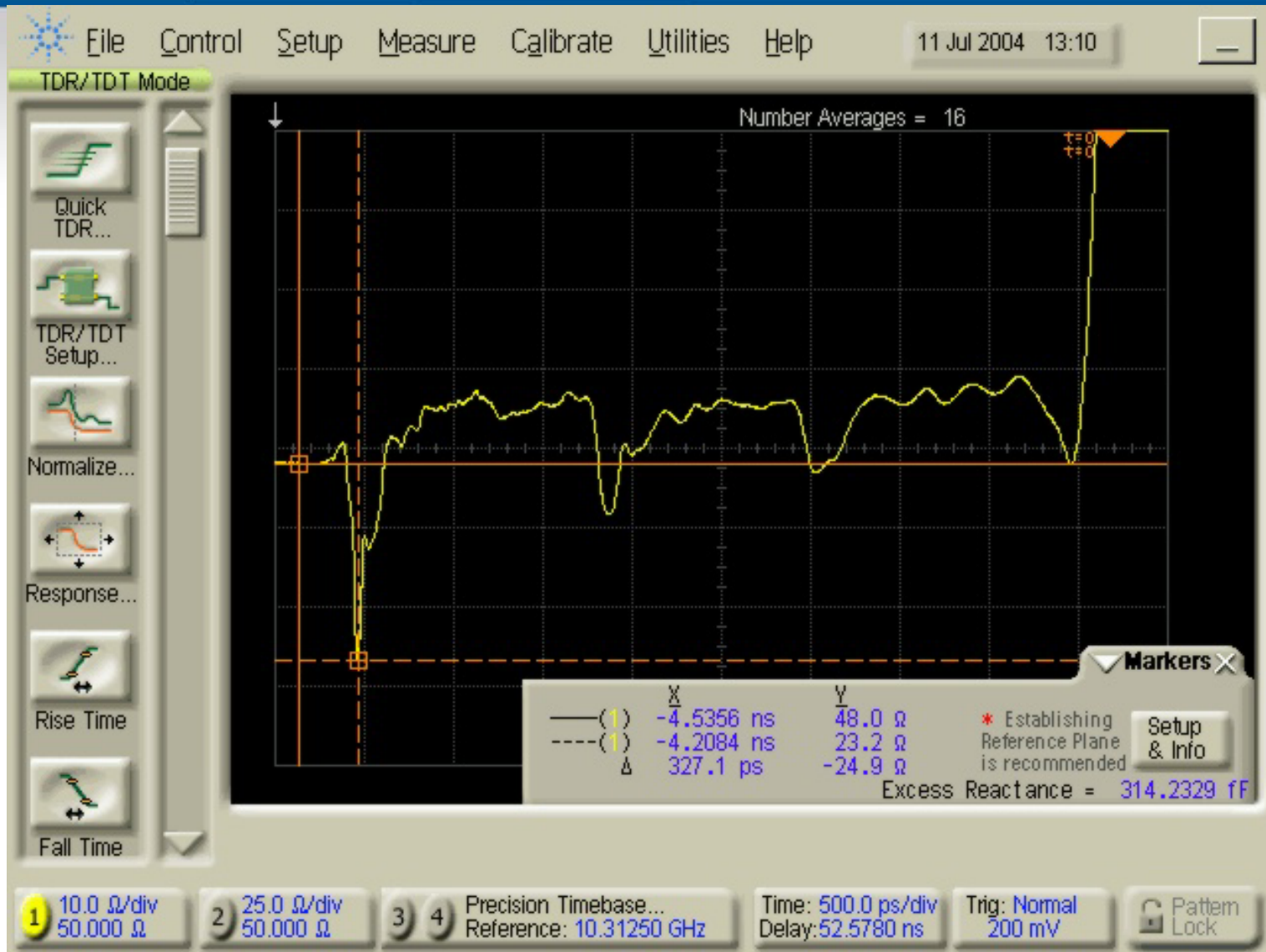
Board Name: Test Back Plane - Scorpion King
Detail by Joel Goergen

Grain Direction: in the 24inch

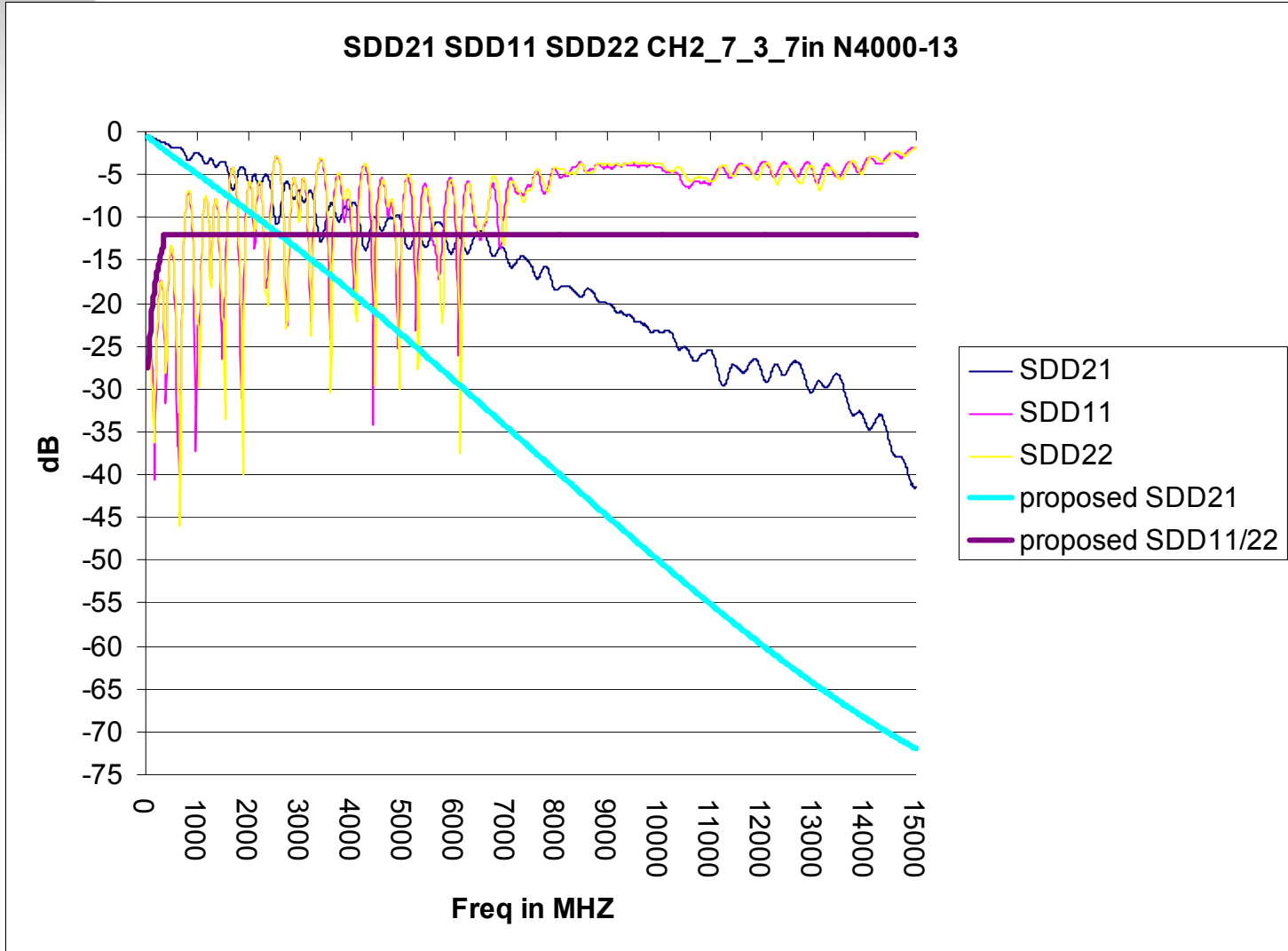
Layers	Specified Thickness	Cross Section Diagram	Layer Name Definition	Real Data	Hole Wall	Impedance	Geometry	Impedance	Geometry
	0.7	(((		Mask					
L01	2.0	(((	Foil & Plating	2.0					
	1.3	(((	Pads Only	1.2					
	6.0	|||||		6.0	1.44				
L02	1.3	(((	GND	1.2					
	5.5	|||||		5.2					
L03	1.3	(((	HS1	1.2		102 +/- 1.5ohms 6on14		53.4 +/- 2ohms 6on14	
	9.1	|||||		9.6					
L04	1.3	(((	GND	1.2					
	5.5	|||||		5.3					
L05	1.3	(((	HS2	1.2					
	9.1	|||||		8.8					
L06	1.3	(((	GND	1.2					
	5.5	|||||		5.3					
L07	1.3	(((	HS3	1.2					
	9.1	|||||		9.9					
L08	1.3	(((	GND	1.2					
	5.5	|||||		5.4					
L09	1.3	(((	HS4	1.2					
	9.1	|||||		9.0					
L10	1.3	(((	GND	1.2					
	5.5	|||||		5.4					
L11	1.3	(((	Plane	1.2					
	10.1	|||||		10.1					
L12	1.3	(((	Plane	1.2					
	5.5	|||||		5.4	1.37				
L13	1.3	(((	Plane	1.2					
	10.1	|||||		9.7					
L14	1.3	(((	Plane	1.2					
	5.5	|||||		5.3					
L15	1.3	(((	GND	1.2					
	9.1	|||||		8.8					
L16	1.3	(((	HS5	1.2					
	5.5	|||||		5.1					
L17	1.3	(((	GND	1.2					
	9.1	|||||		9.1					
L18	1.3	(((	HS6	1.2					
	5.5	|||||		5.2					
L19	1.3	(((	GND	1.2					
	9.1	|||||		8.7					
L20	1.3	(((	HS7	1.2		102 +/- 1.5ohms 6on14		53.4 +/- 2ohms 6on14	
	5.5	|||||		5.4					
L21	1.3	(((	GND	1.2					
	9.1	|||||		8.9					
L22	1.3	(((	HS8	1.2		102 +/- 1.5ohms 6on14		53.4 +/- 2ohms 6on14	
	5.5	|||||		5.3					
L23	1.3	(((	GND	1.2					
	6.0	|||||		6.0	1.44				
	1.3	(((	Pads Only	1.2					
L24	2.0	(((	Foil & Plating	2.0					
	0.7	(((((		Mask					

Channel Data CH1

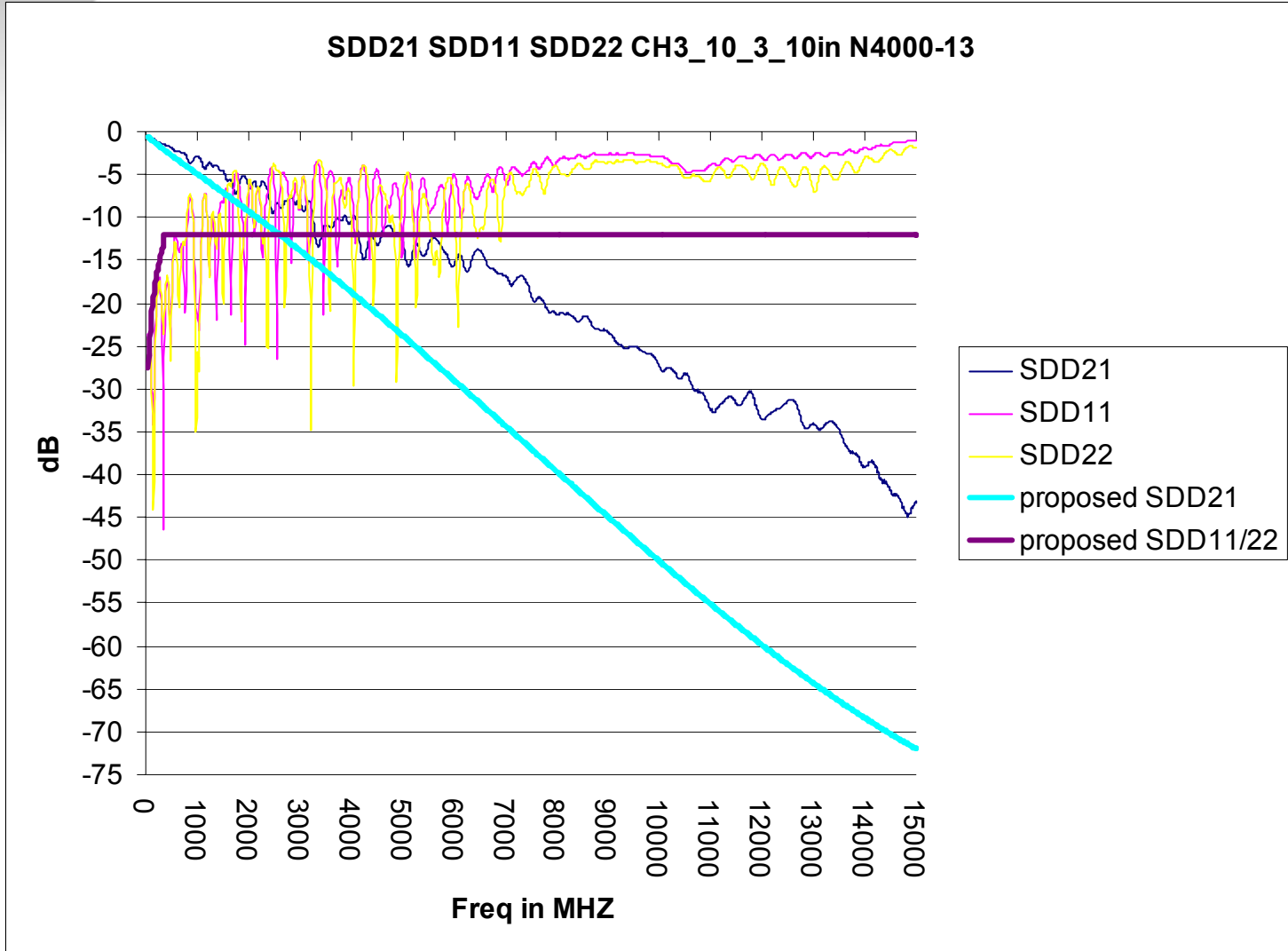




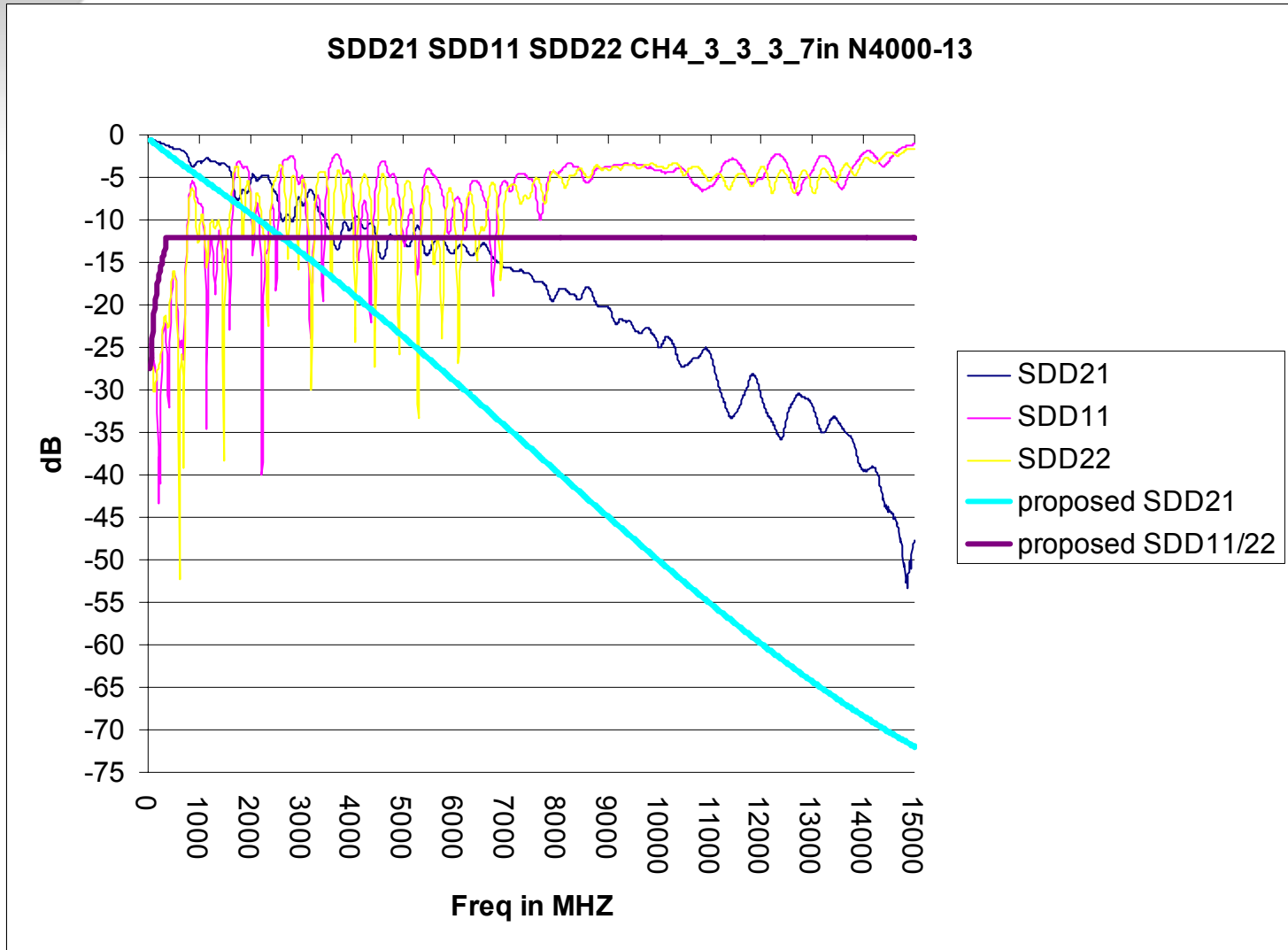
Channel Data CH2



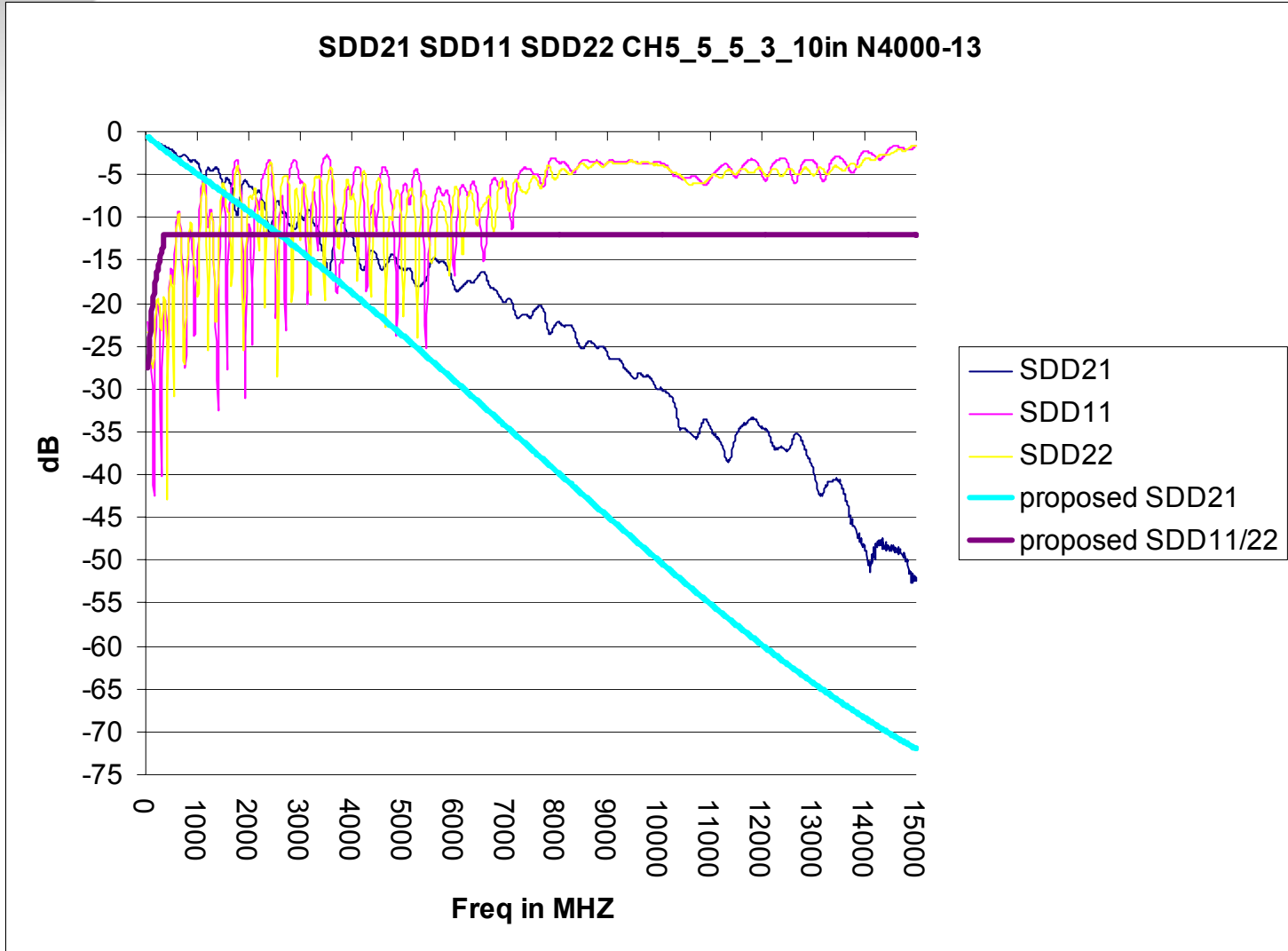
Channel Data CH3



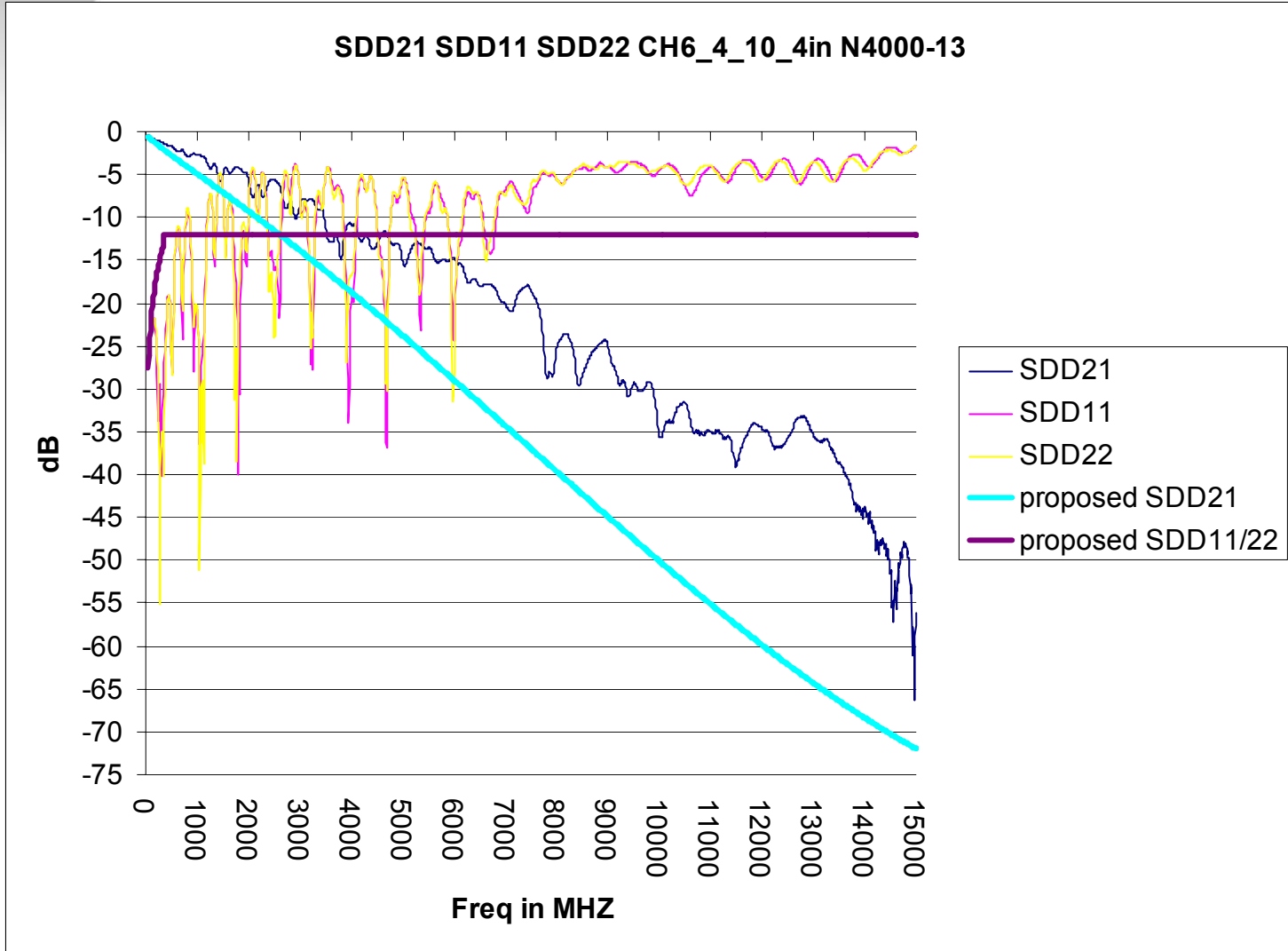
Channel Data CH4



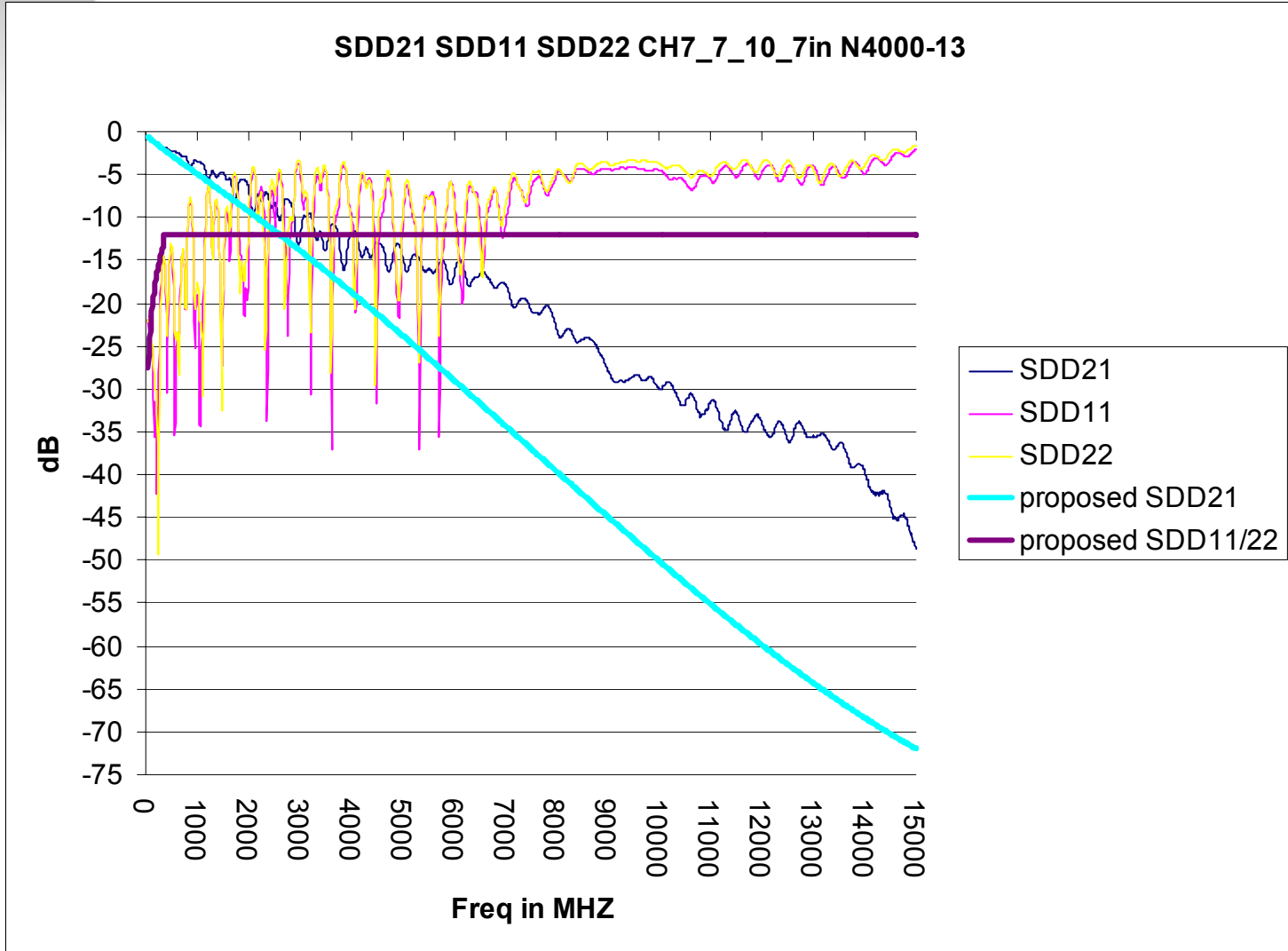
Channel Data CH5



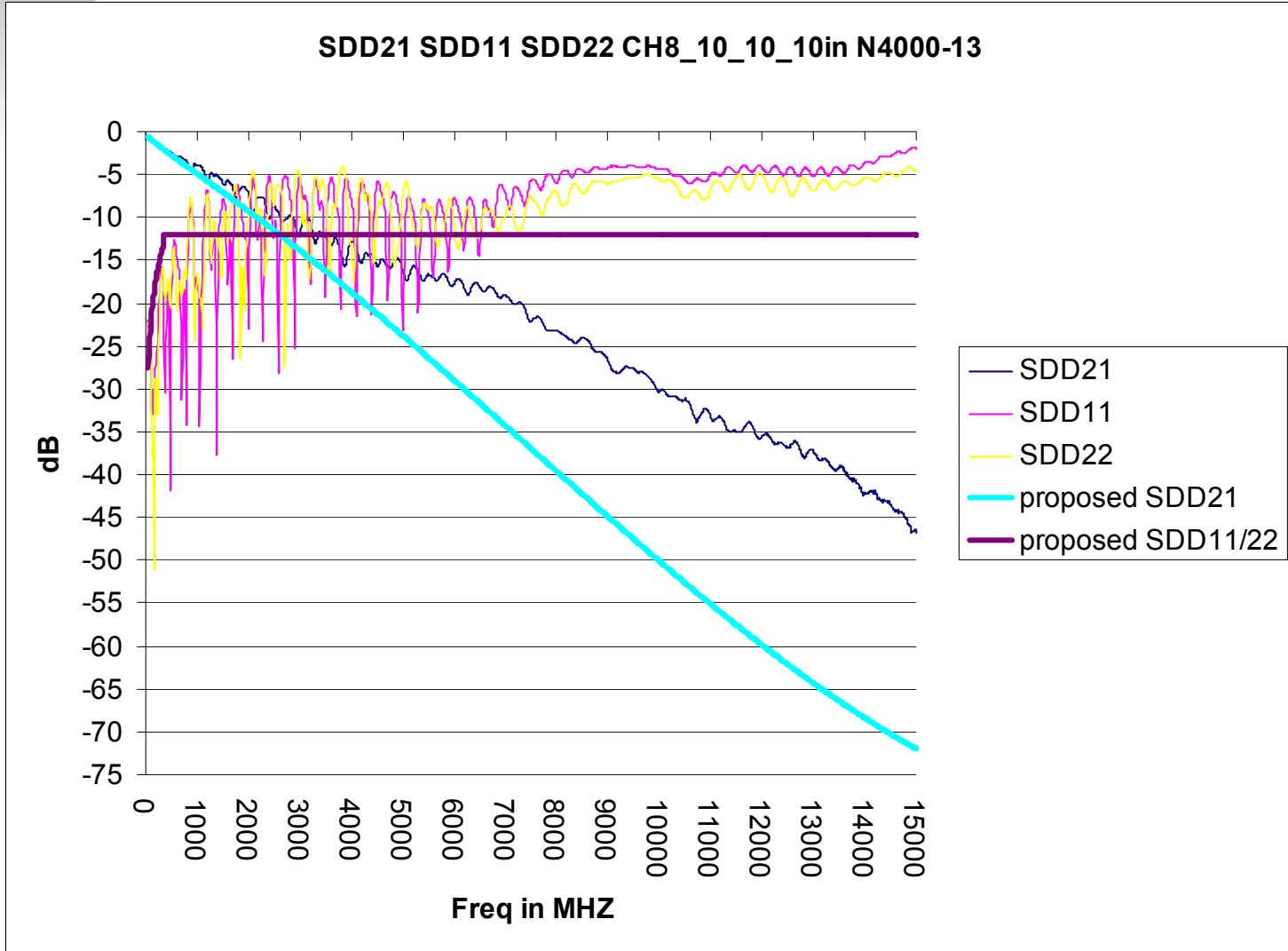
Channel Data CH6



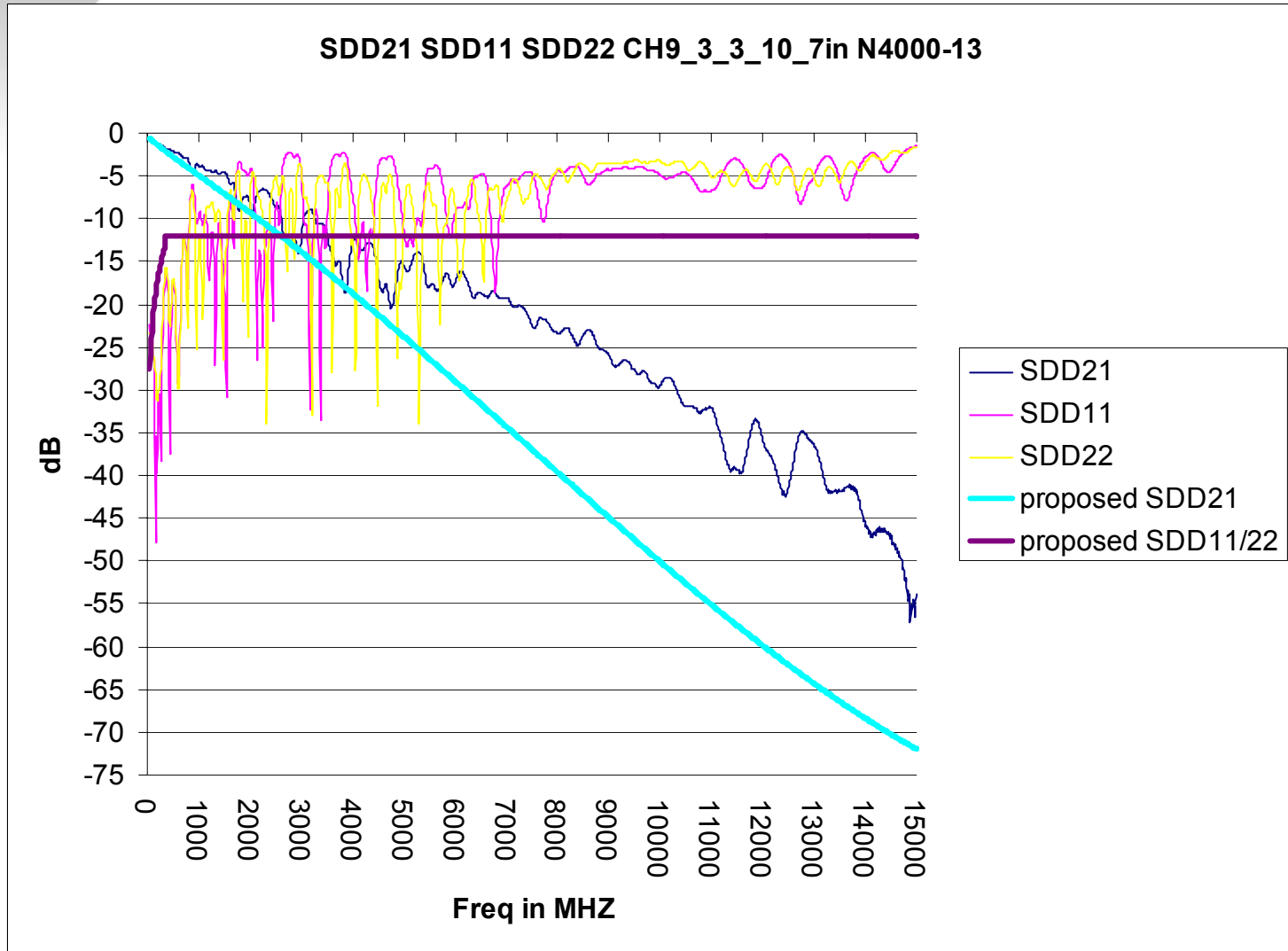
Channel Data CH7



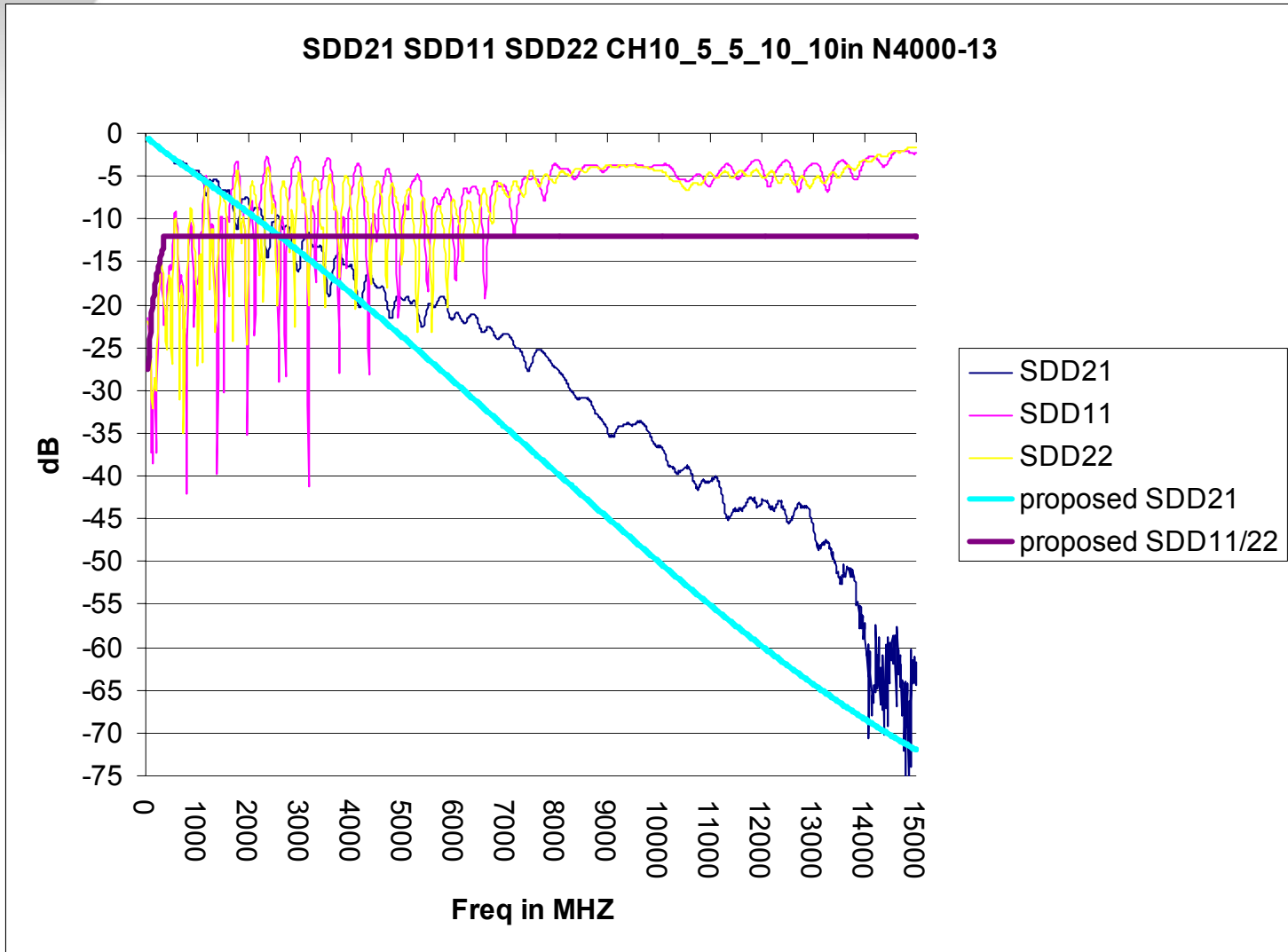
Channel Data CH8



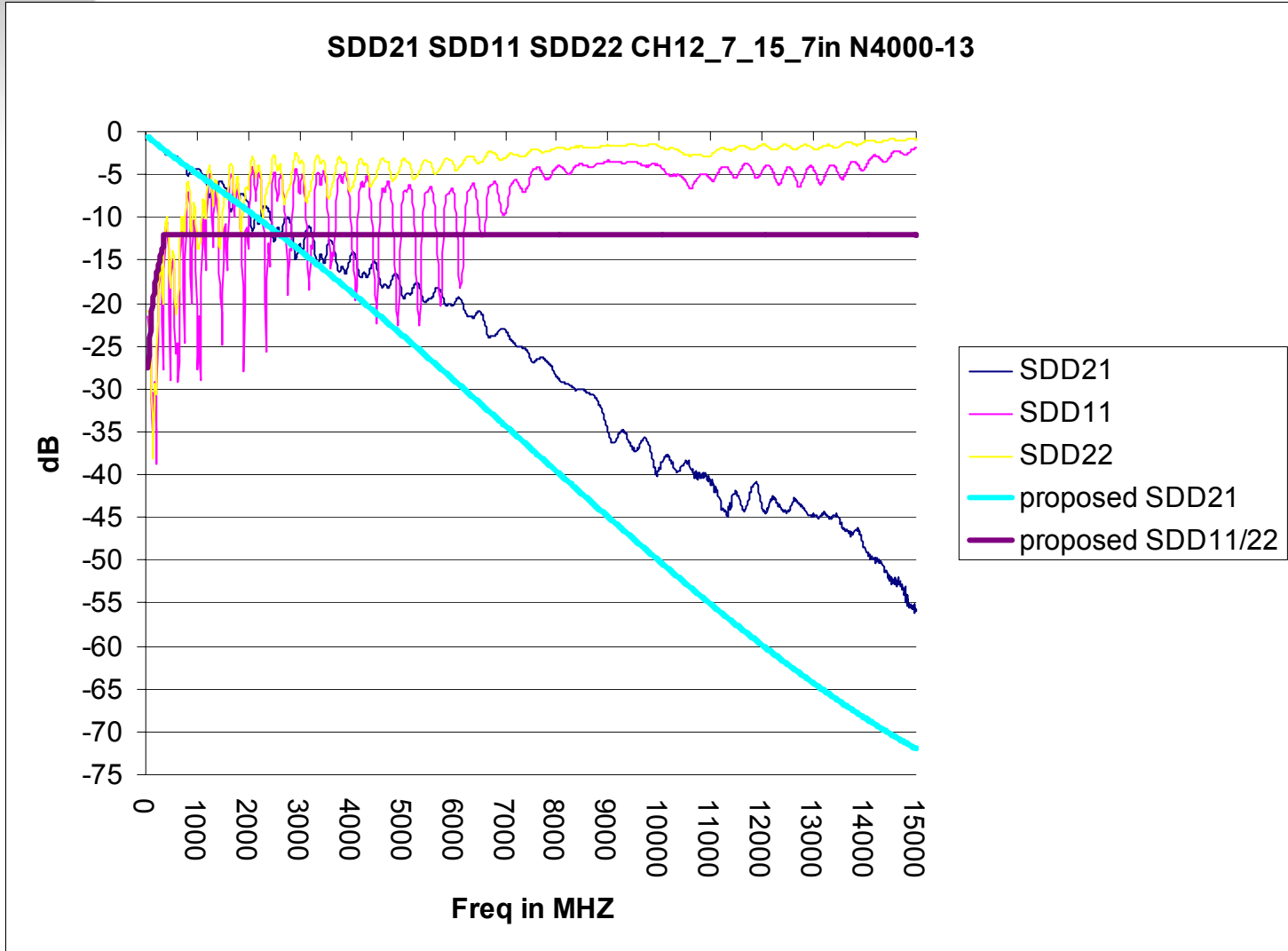
Channel Data CH9



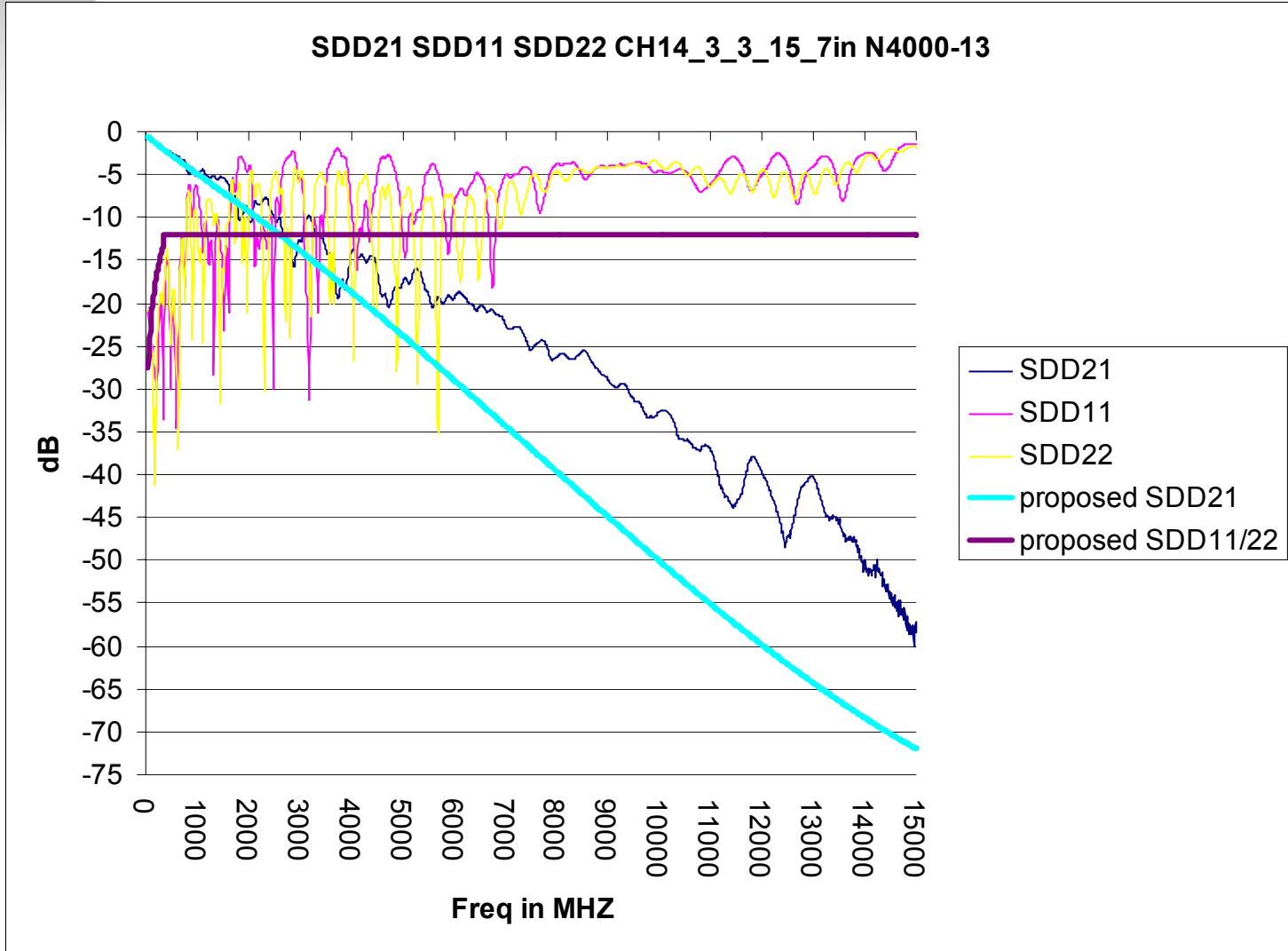
Channel Data CH10



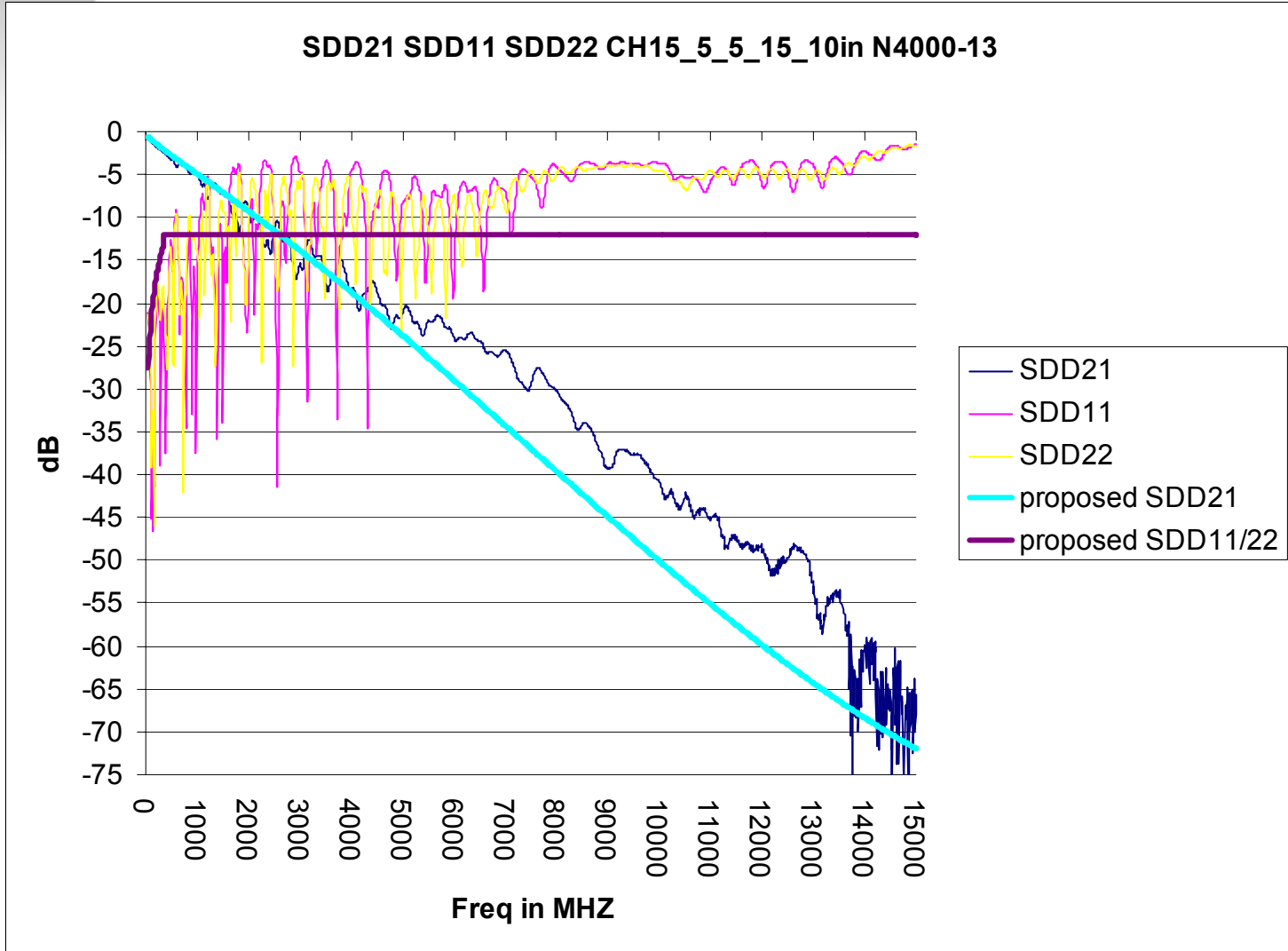
Channel Data CH12



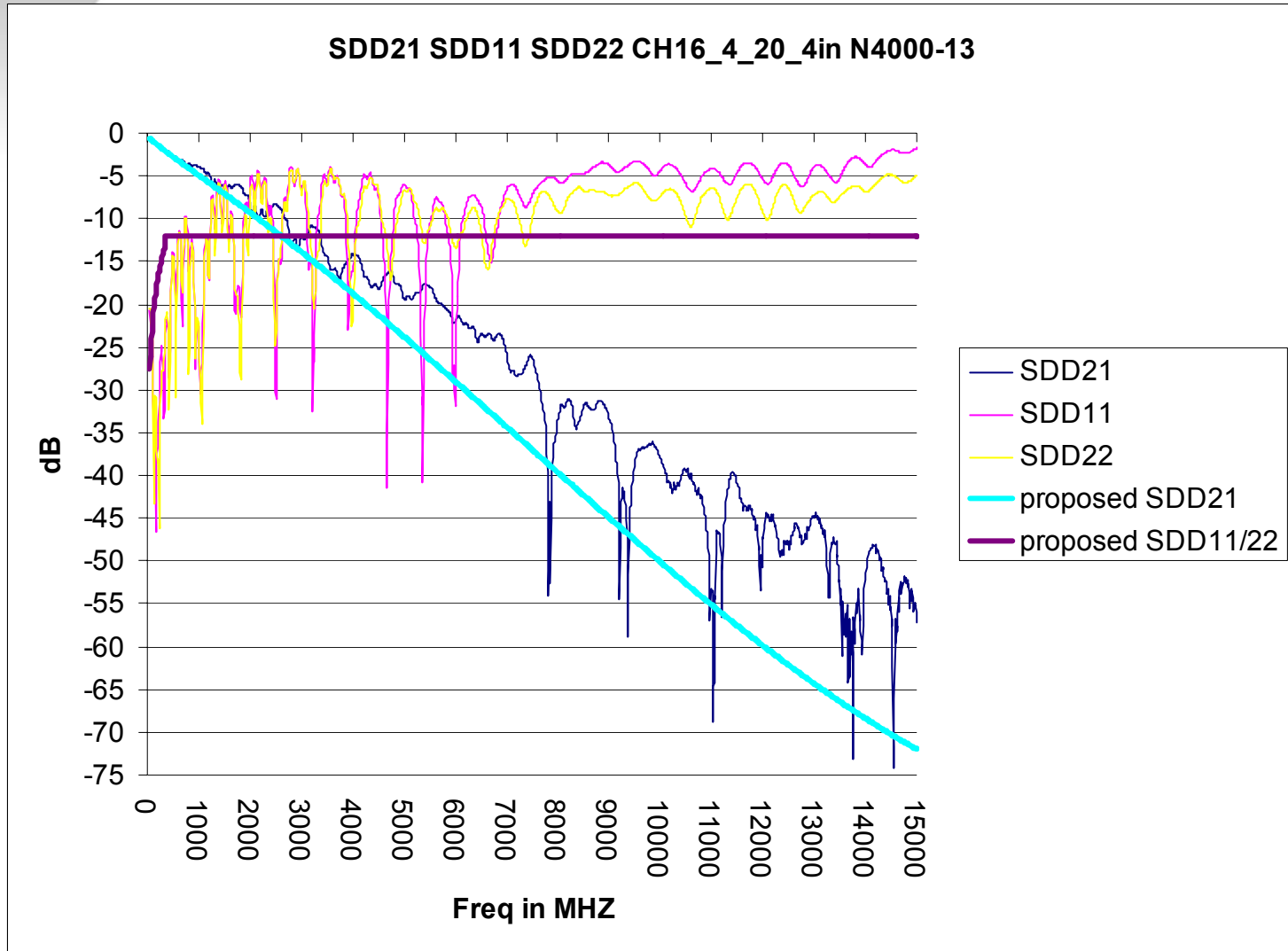
Channel Data CH14



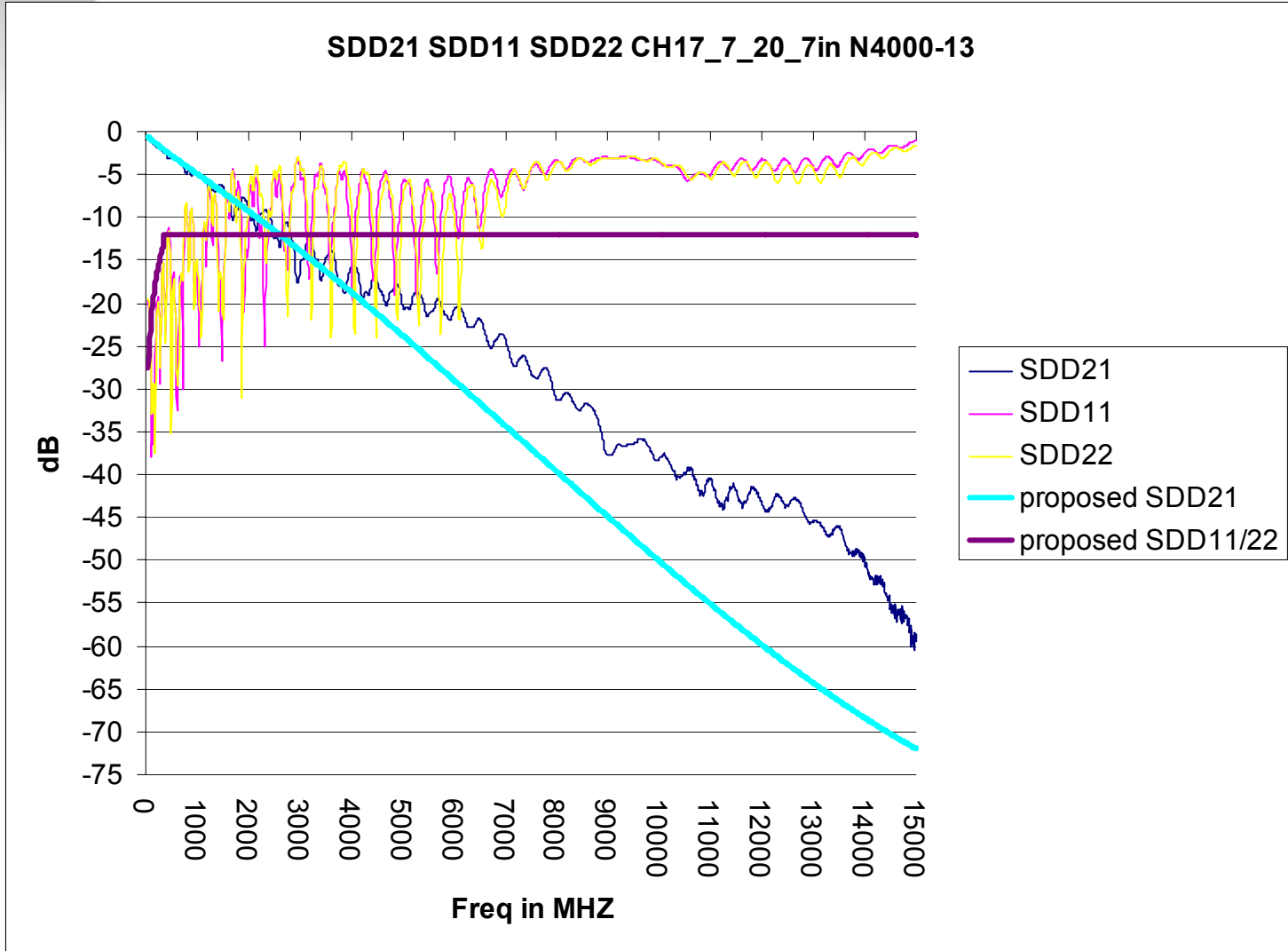
Channel Data CH15



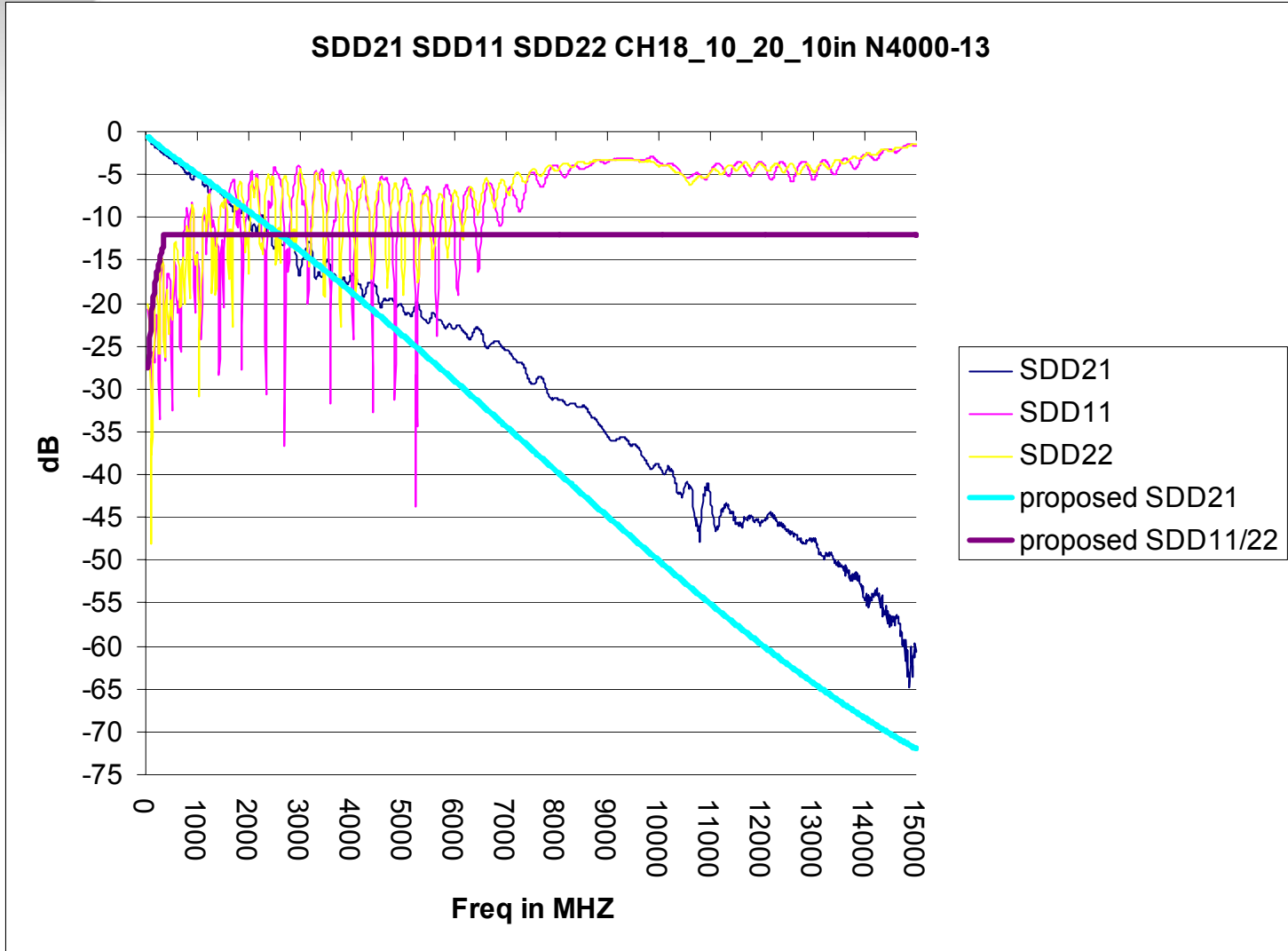
Channel Data CH16



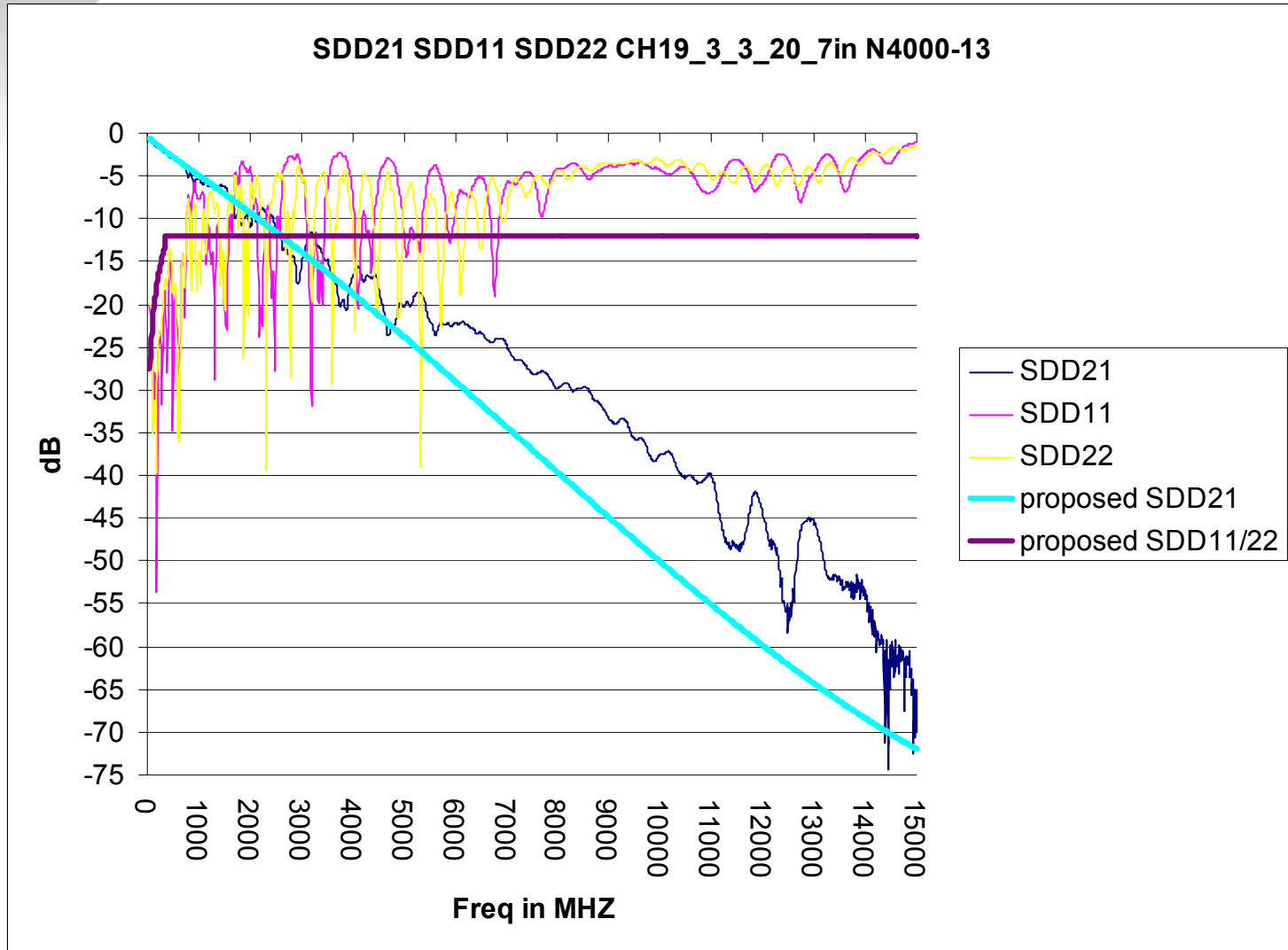
Channel Data CH17



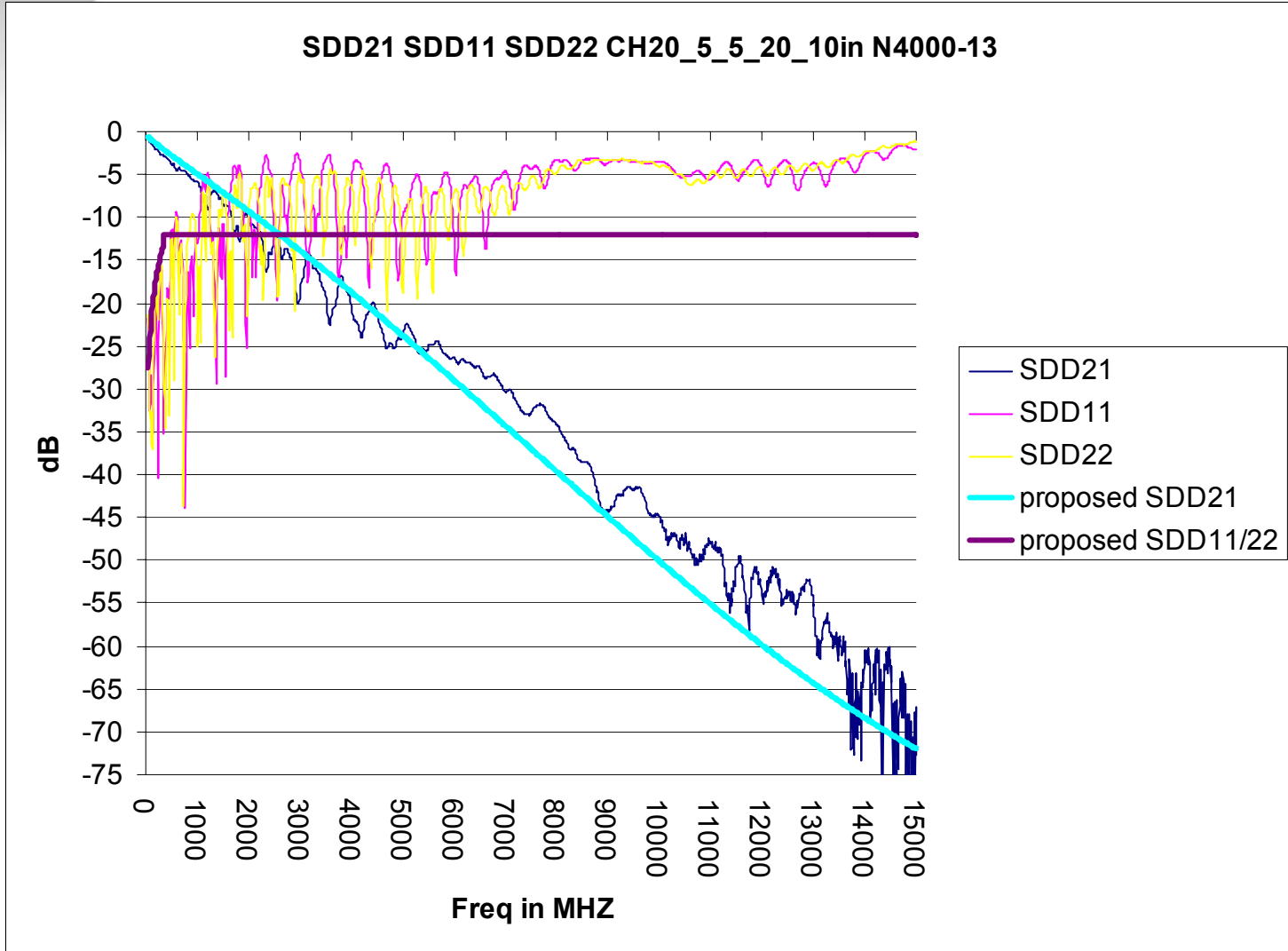
Channel Data CH18



Channel Data CH19

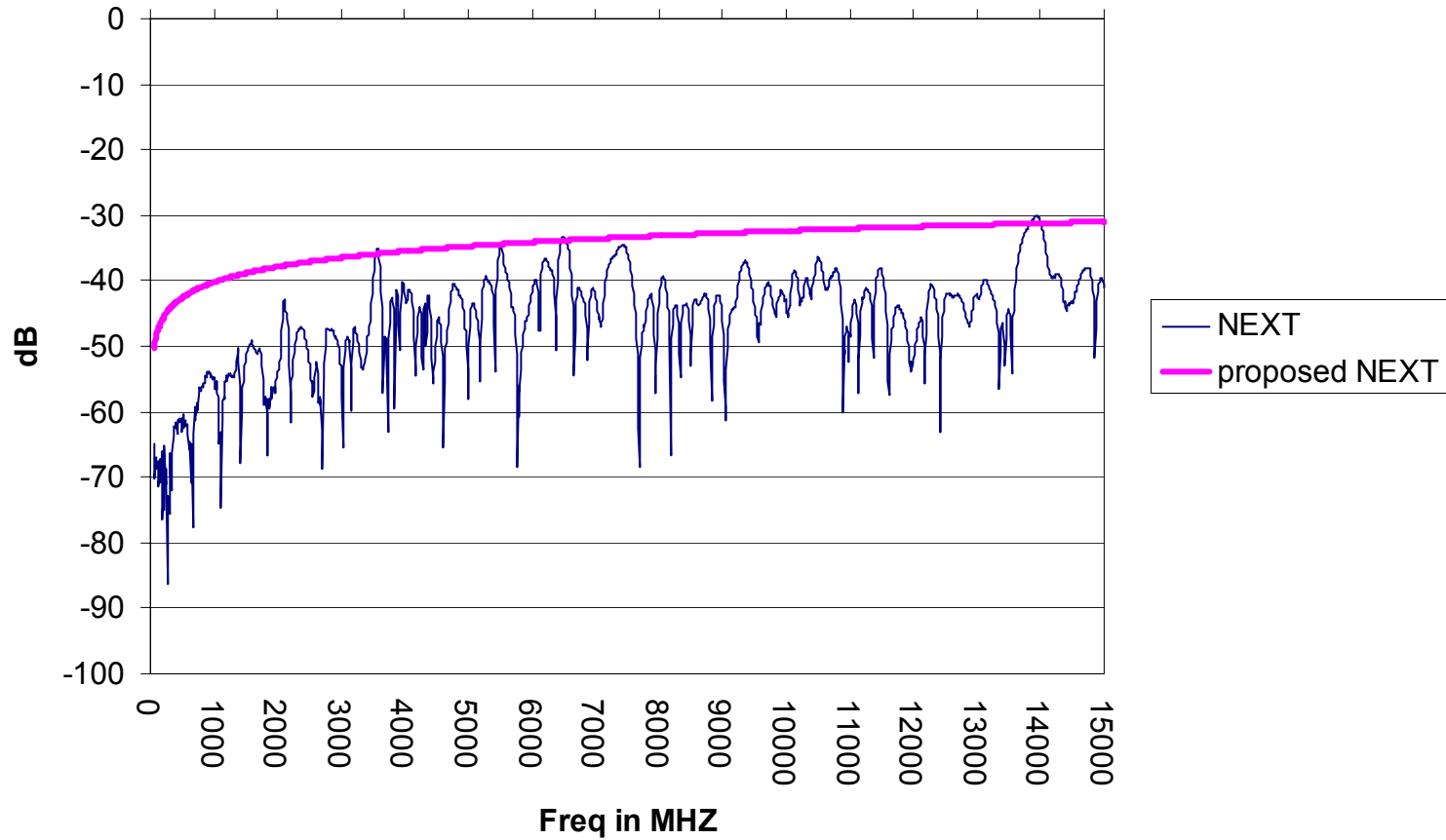


Channel Data CH20

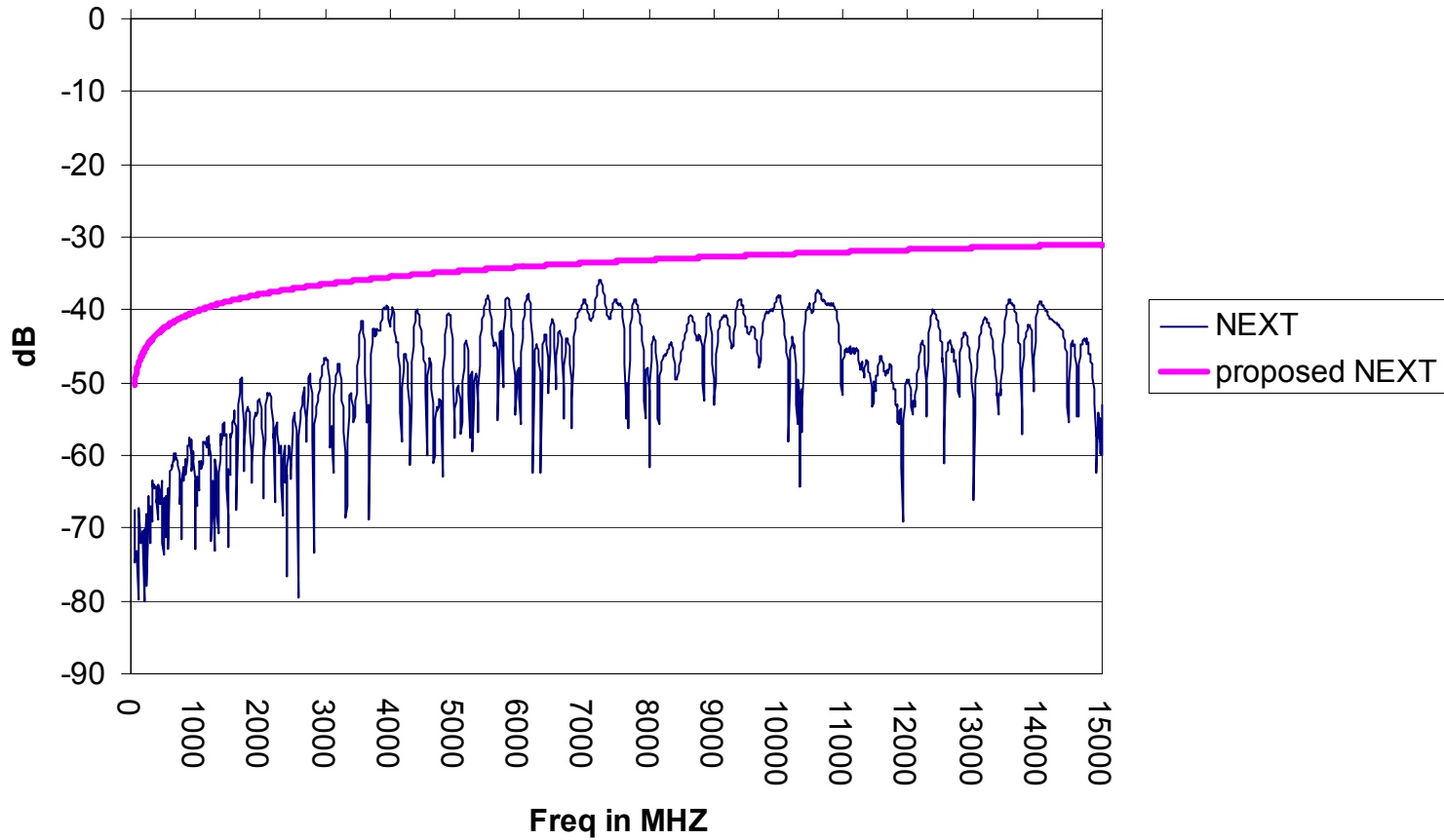


- The limit lines are multi-aggressor.
- Data shown is single aggressor for the backplane length only, including the connector field.

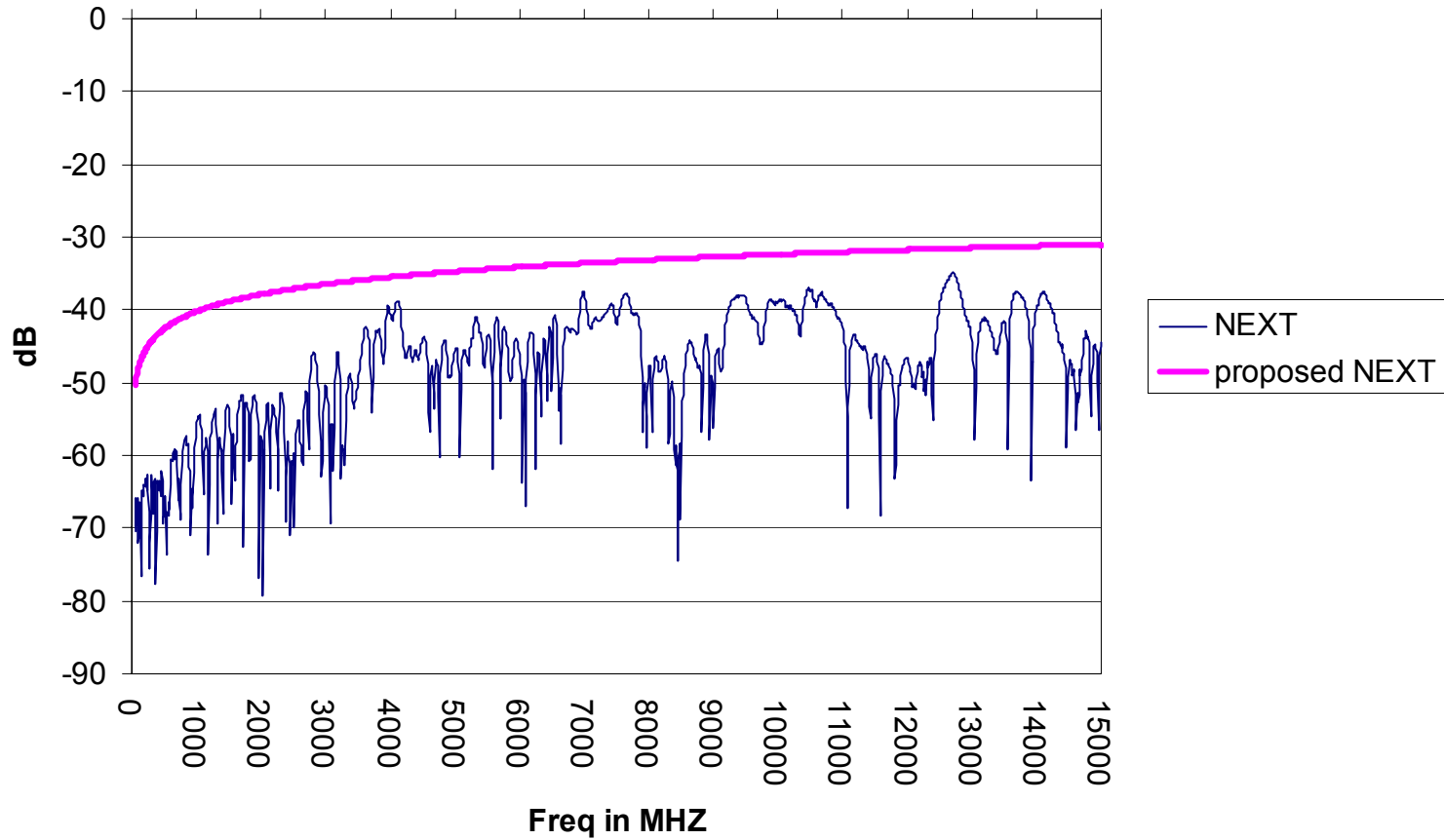
CH2 NEXT



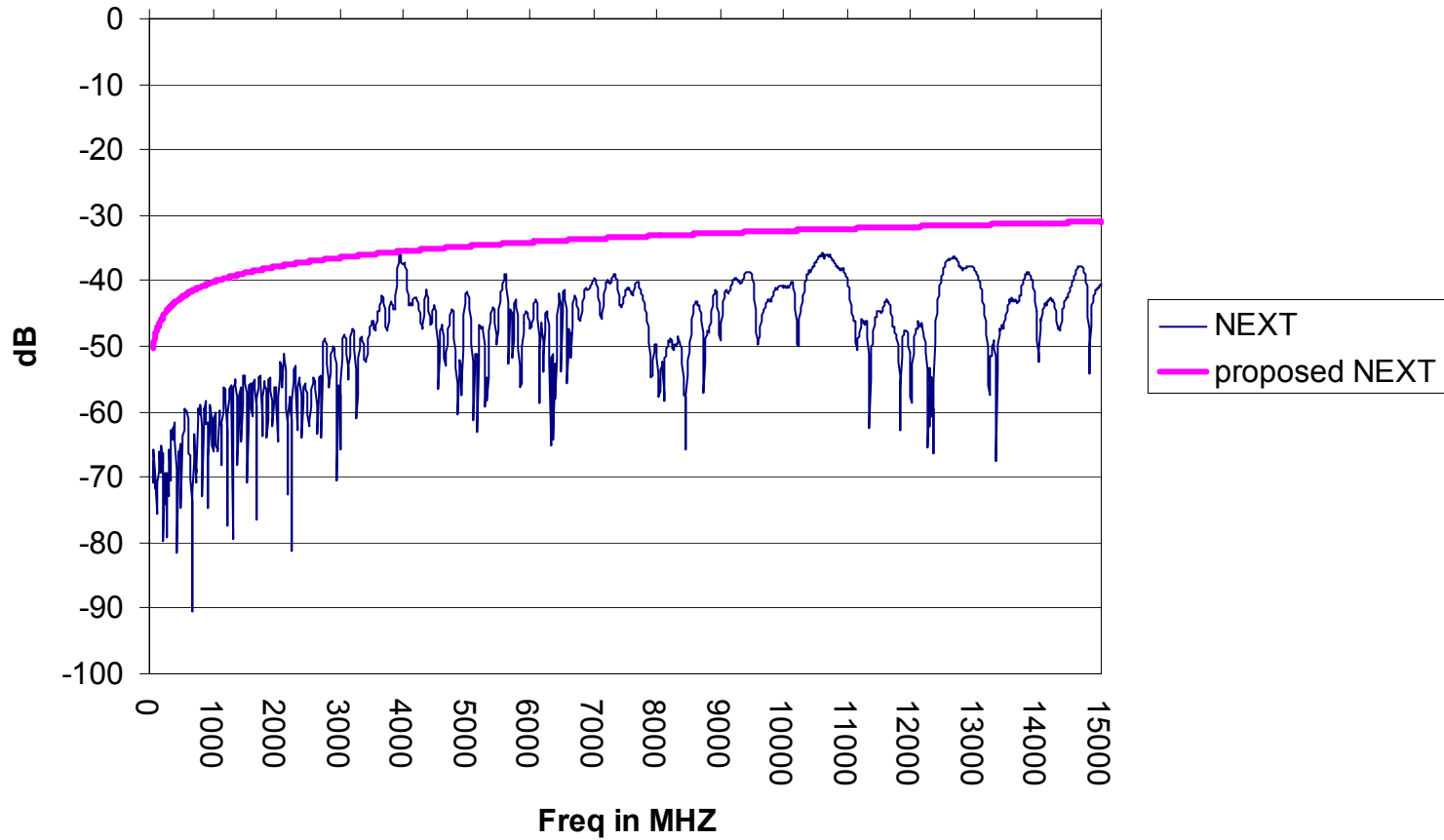
CH7 NEXT



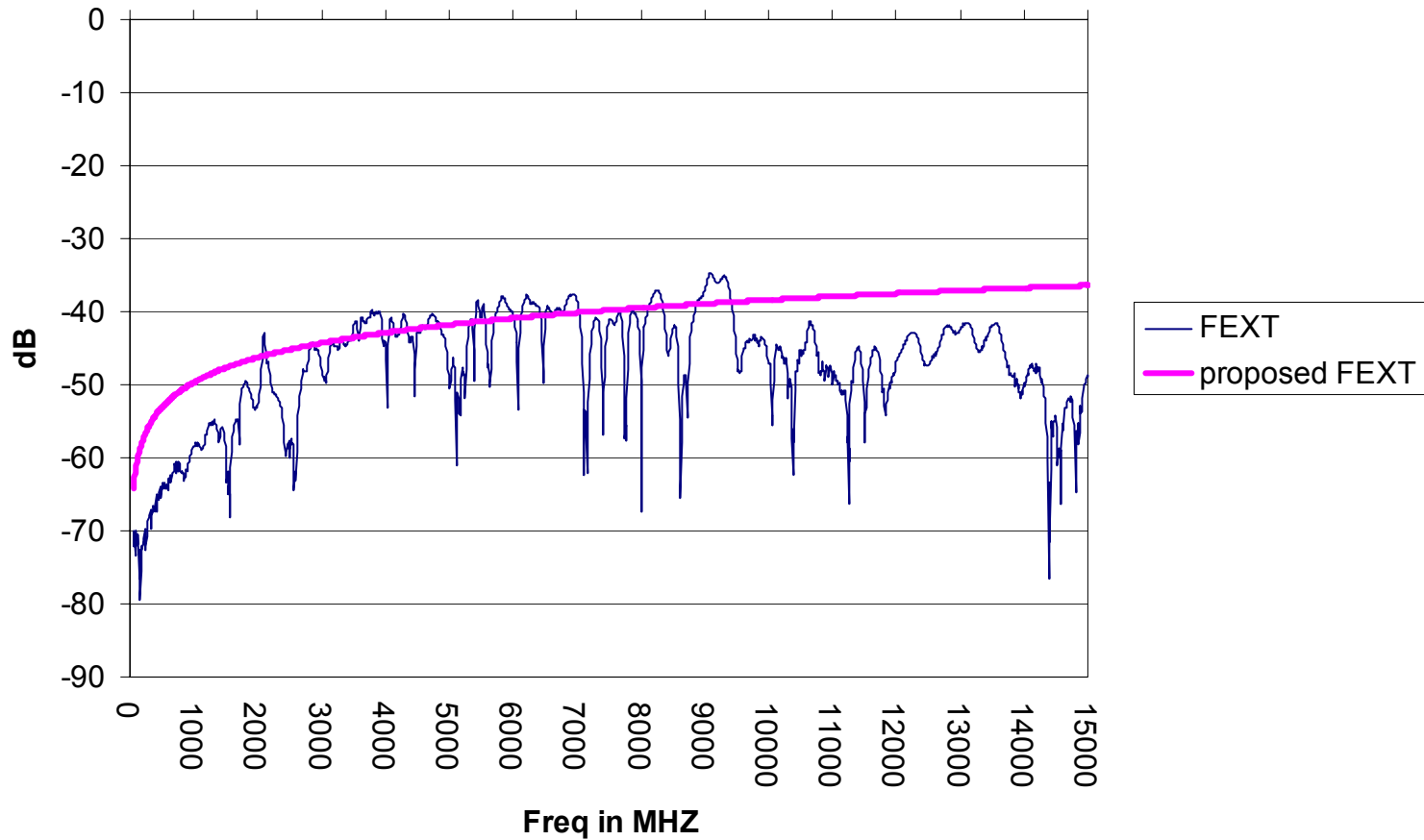
CH12 NEXT



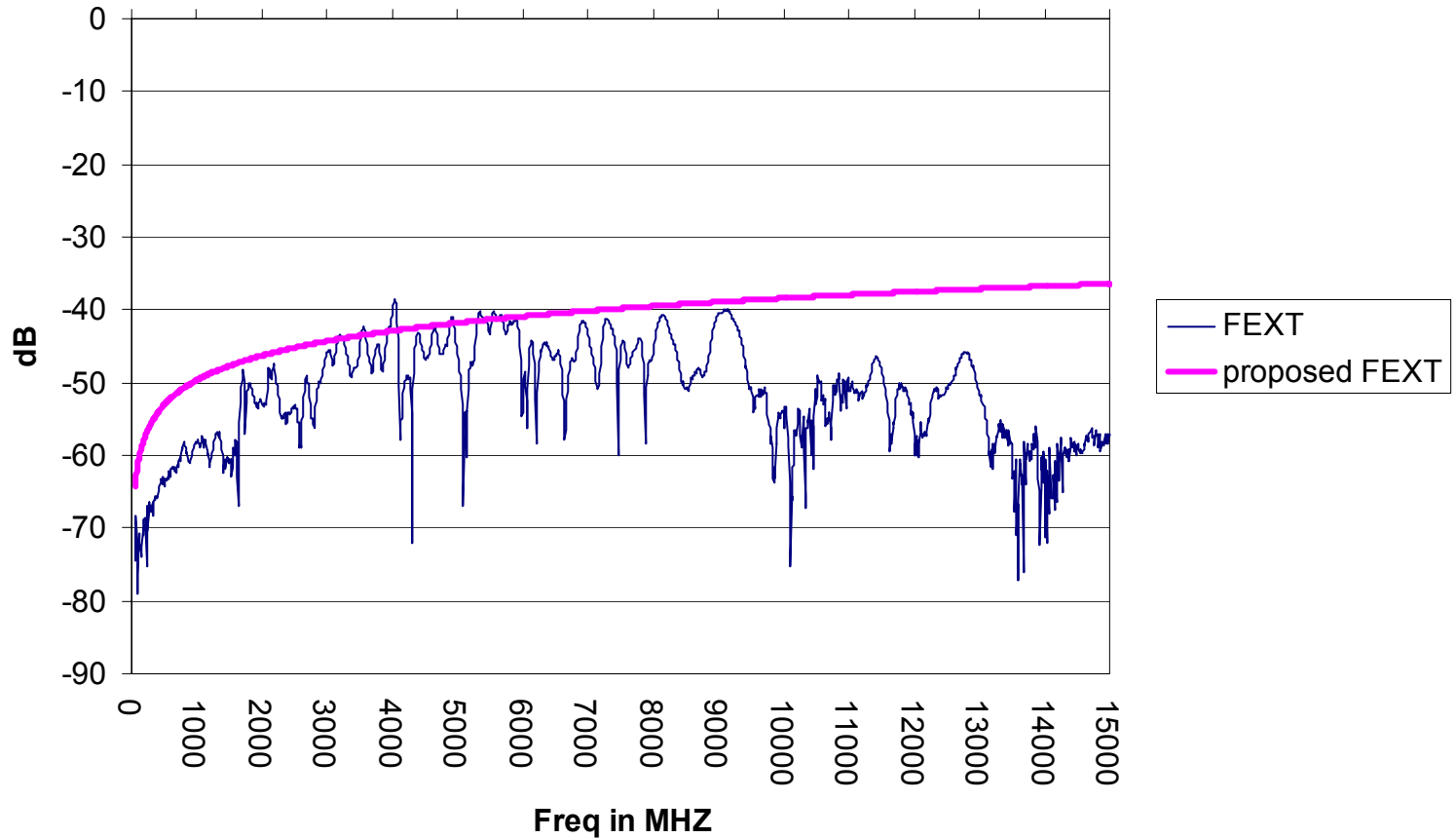
CH17 NEXT



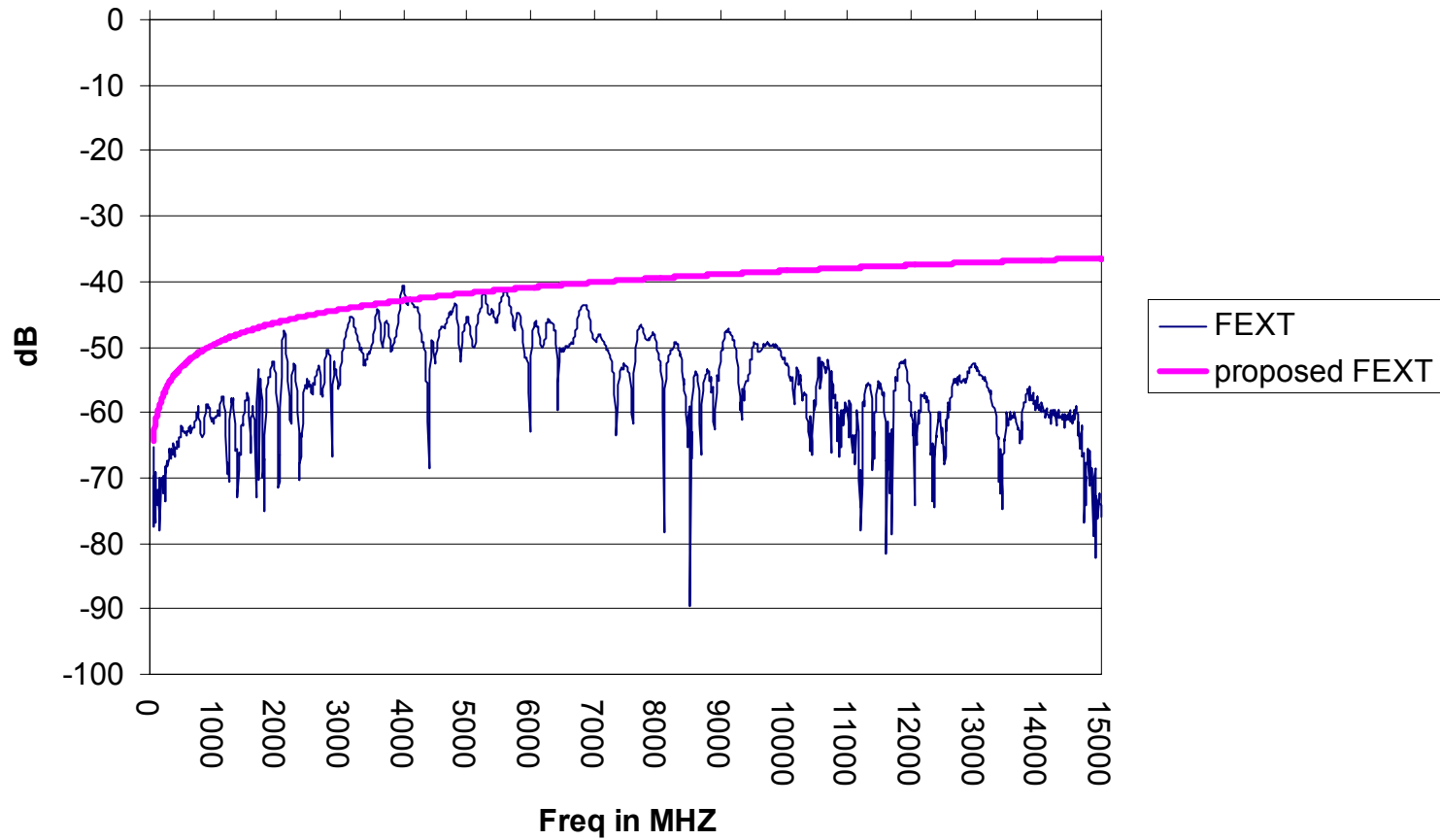
CH2 FEXT



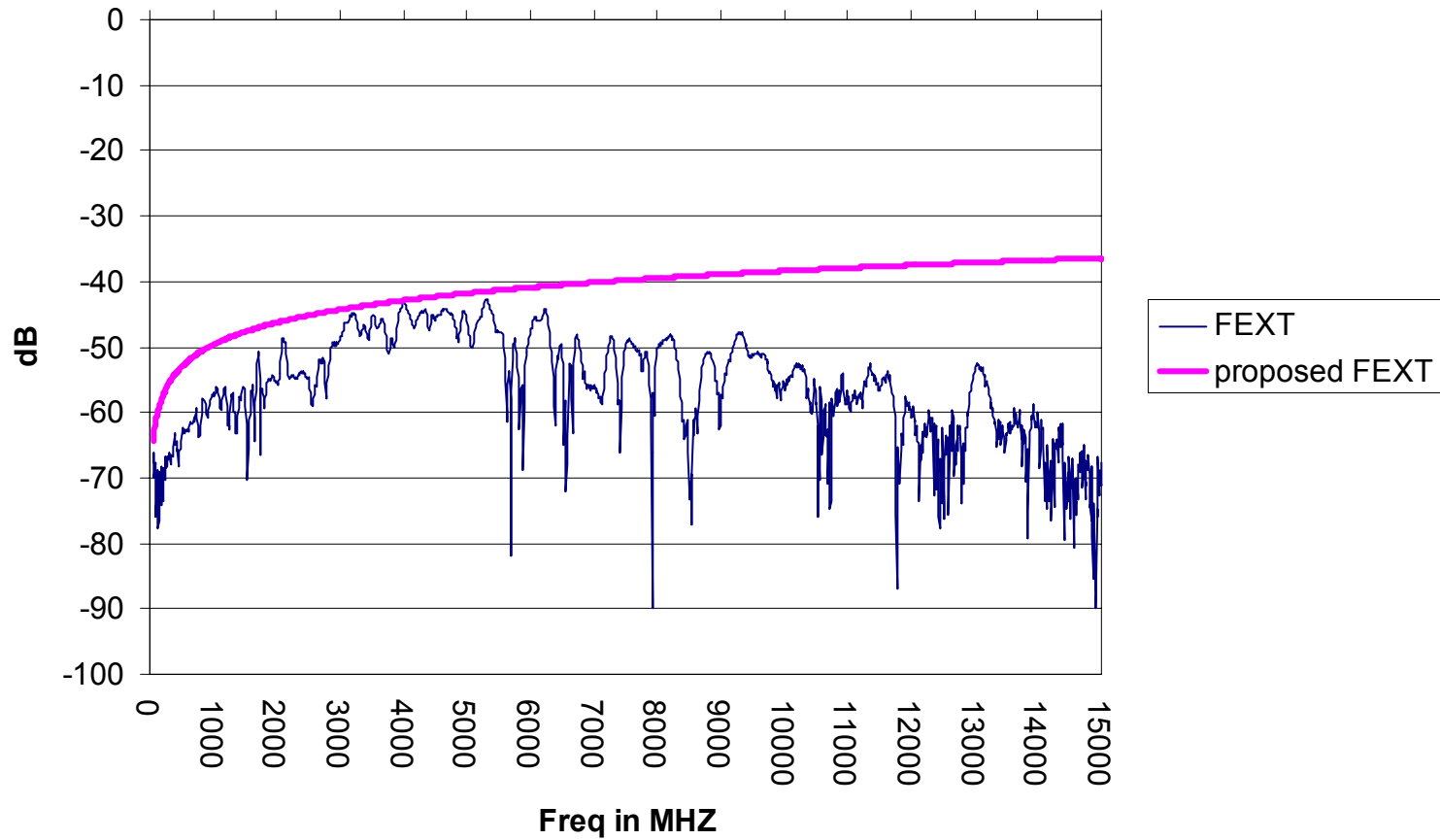
CH7 FEXT



CH12 FEXT



CH17 FEXT



- Approve Goergen_01_0704 page6 as the definition of improved fr-4.
- Approve SDD21.
- Approve NEXT and FEXT.
- The Channel Ad-hoc continue to validate and adjust SDD11, SDD22, and Group Delay Variation.