



Proposal for Changes to NEXT / FEXT Mask

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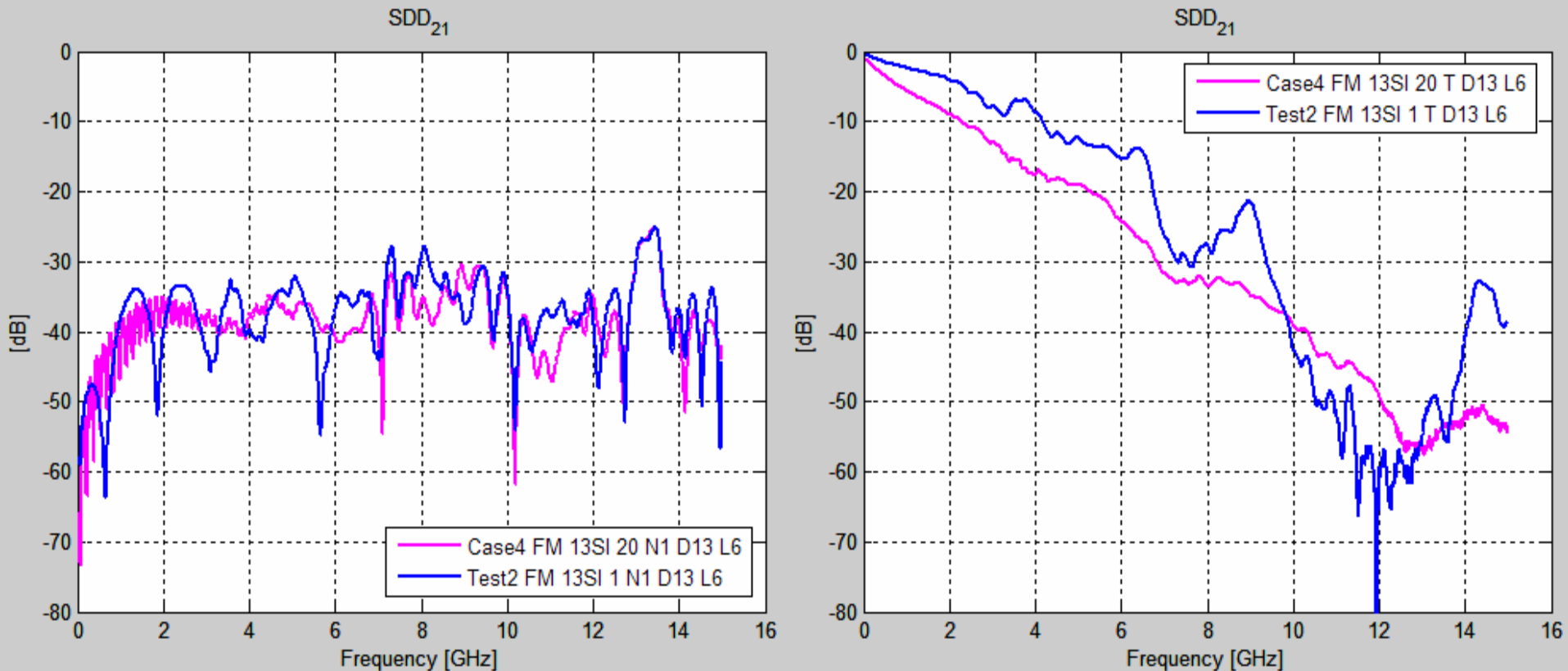
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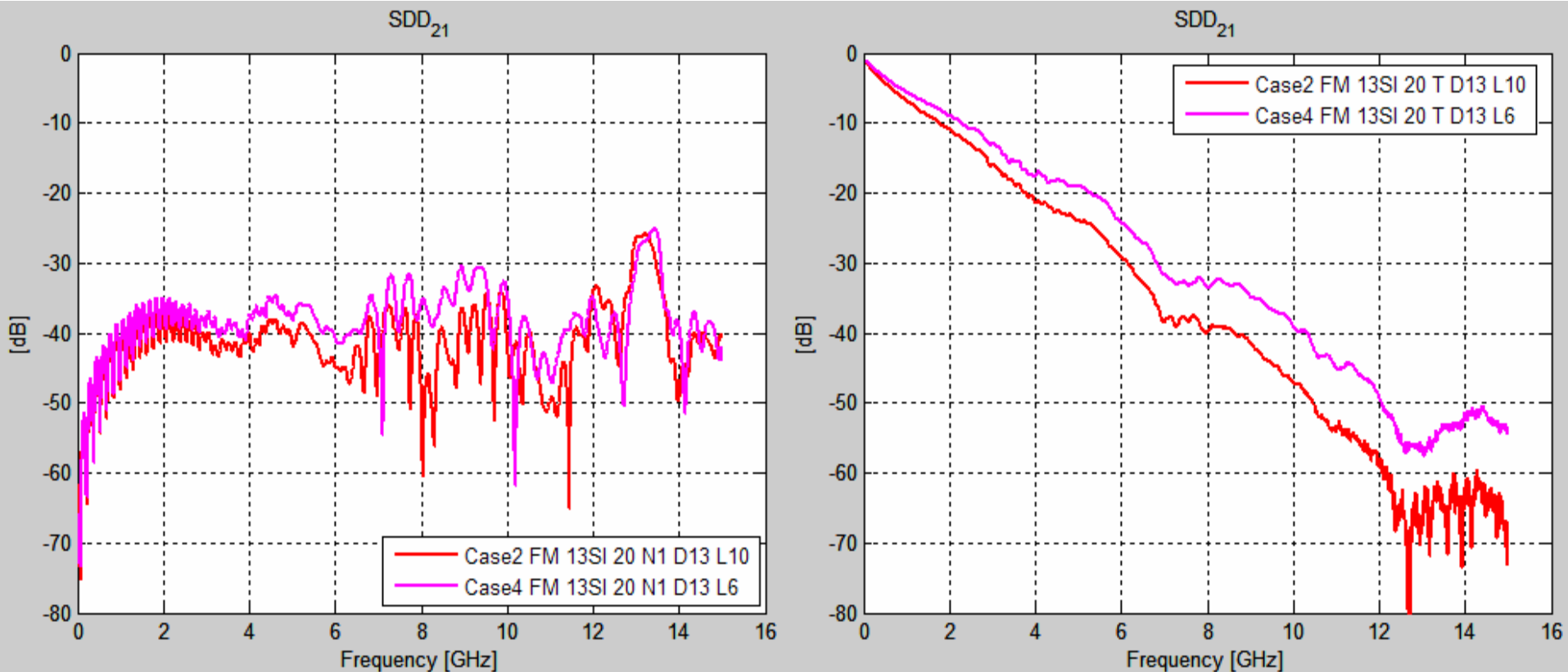
Crosstalk - Problem Statement

- System Issue
 - Crosstalk is topology dependent
 - Backplane length
 - Daughtercard length
 - Line card materials
 - Throughput is topology dependent
 - All of these configurations vary in different systems and must be accommodated
- In general crosstalk decreases as loss increases
- Key > Attenuation to Crosstalk Ratio (SNR)

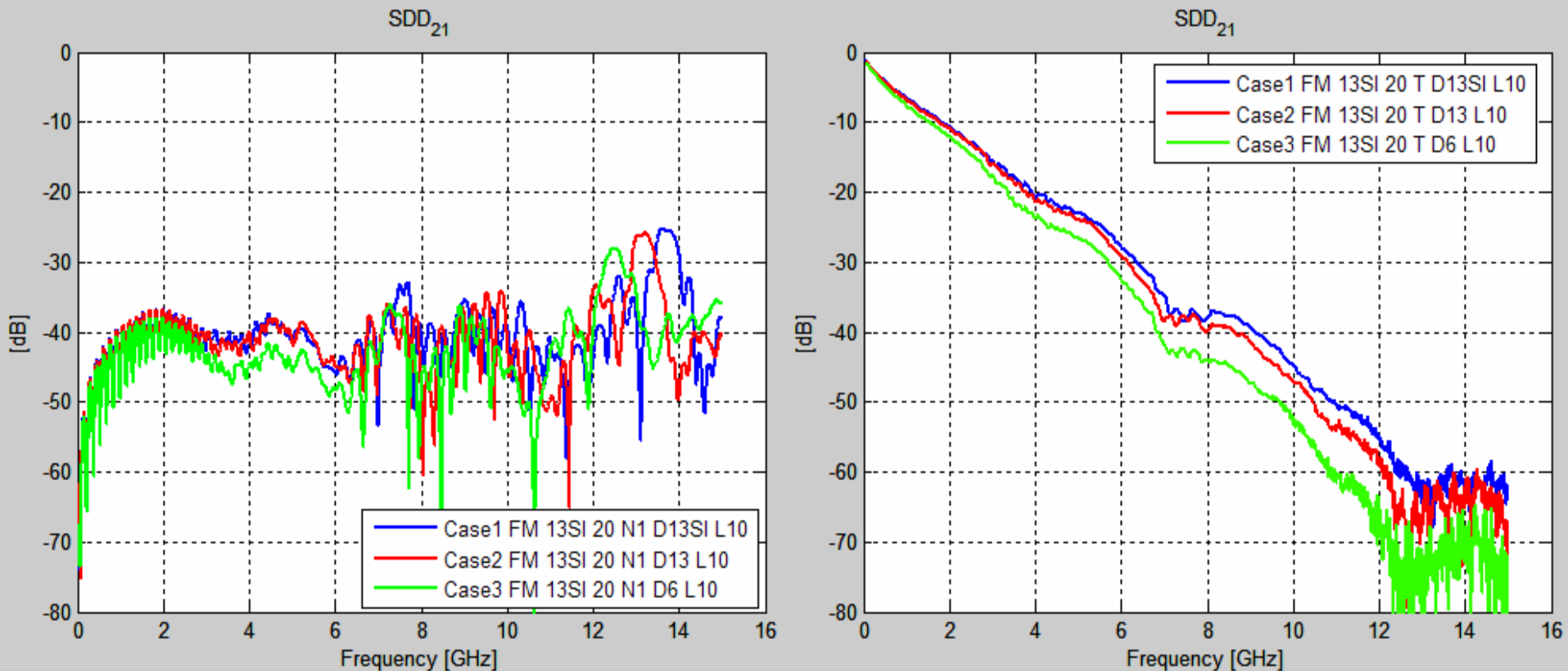
Different Backplane Lengths



Different Daughtercard Lengths



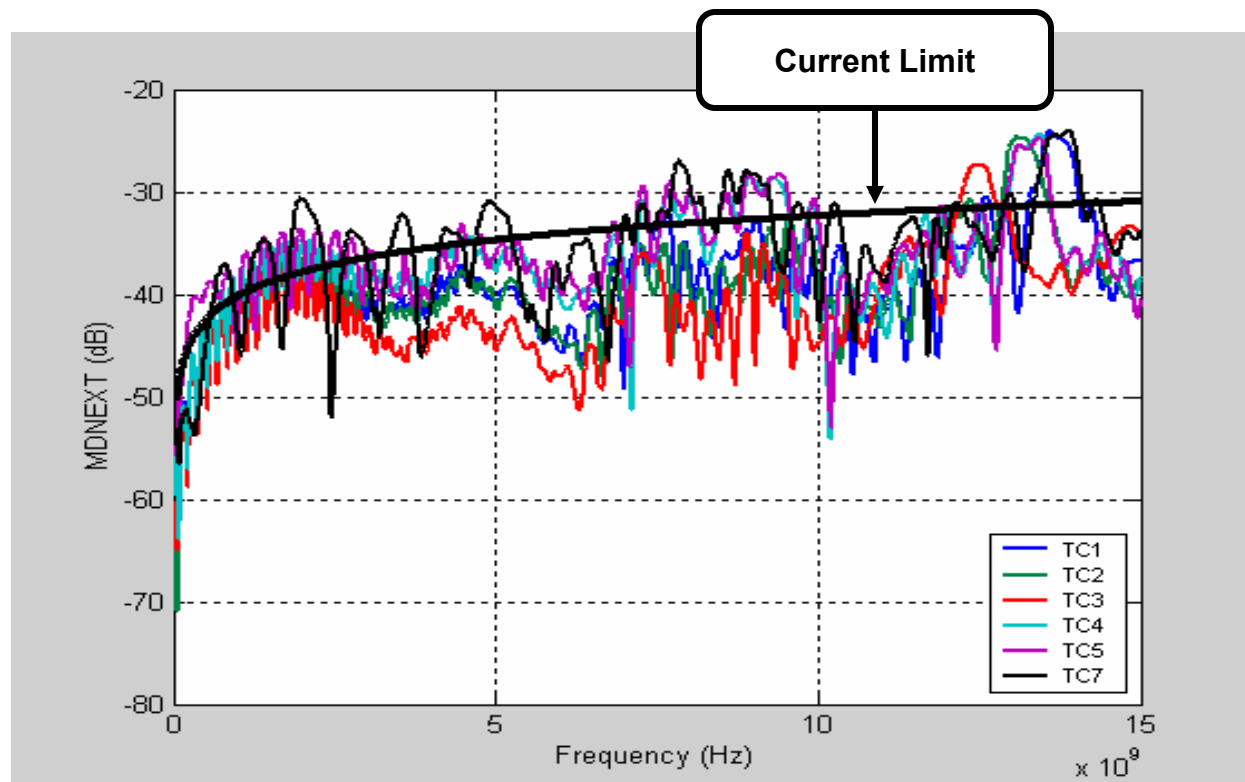
Different Daughtercard Materials



Test Case Summary

Test Case	Line Card		Backplane			Total Length	Comments
	Length	Material	Length	Material	Stub		
1	10" (254mm)	Nelco 4000 13SI	20" (508mm)	Nelco 4000 13SI	Bottom (or counter- boring)	40" (1016mm)	Channel Model
2	10" (254mm)	Nelco 4000 13	20" (508mm)	Nelco 4000 13SI	Bottom (or counter- boring)	40" (1016mm)	Margin Test Case
3	10" (254mm)	Nelco 4000 6	20" (508mm)	Nelco 4000 13SI	Bottom (or counter- boring)	40" (1016mm)	Margin Test Case
4	6" (152mm)	Nelco 4000 13	20" (508mm)	Nelco 4000 13SI	Bottom (or counter- boring)	32" (812mm)	ATCA Full Mesh
5	6" (152mm)	Nelco 4000 13	10" (254mm)	Nelco 4000 13	Bottom (or counter- boring)	22" (558mm)	ATCA Dual Star
6	6" (152mm)	Nelco 4000 13	10" (254mm)	Nelco 4000 13	Top Layer (with stub)	22" (558mm)	ATCA Dual Star
7	6" (152mm)	Nelco 4000 13SI	1" (25mm)	Nelco 4000 13SI	Near Top- Layer (with stub)	13" (330mm)	Adjacent Slot

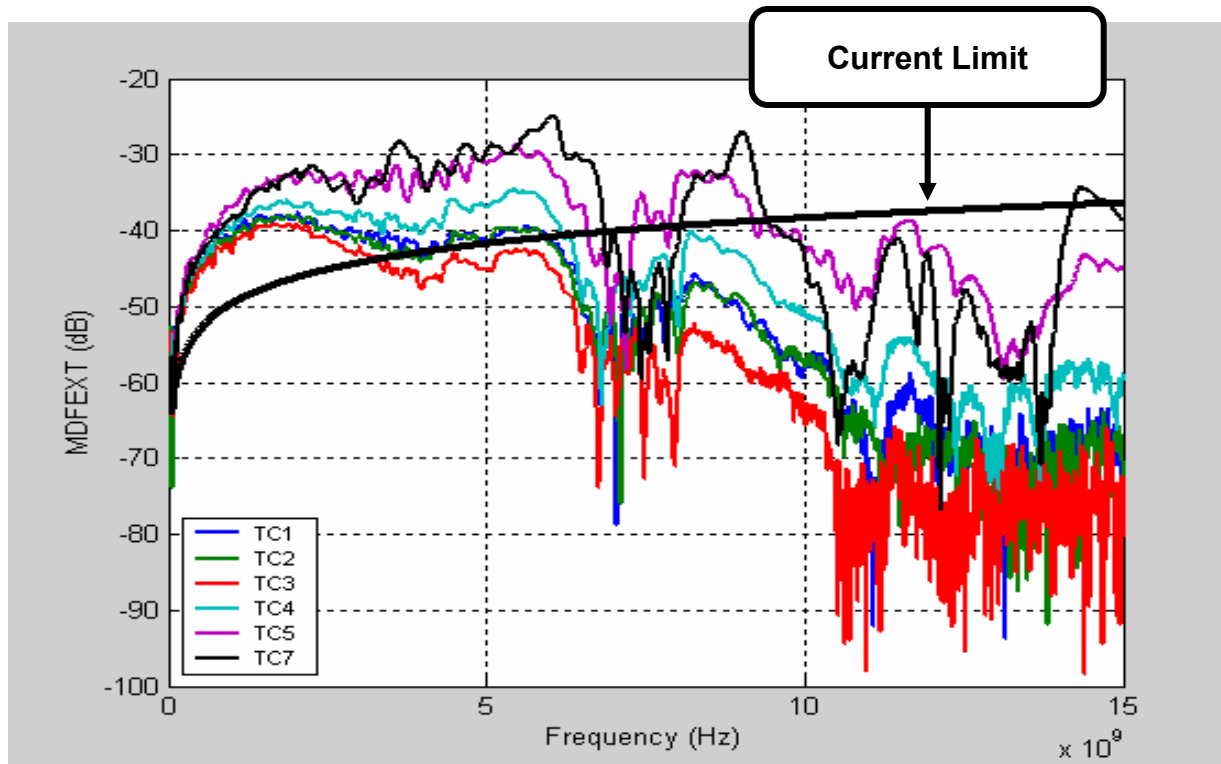
MDNEXT Definition



AB	CD	EF	GH
N1	RX	N2	

$$MDNEXT(f) = 10 \log_{10} \left(\sum_{n=1}^N NEXT_n(f) \times NEXT_n^*(f) \right)$$

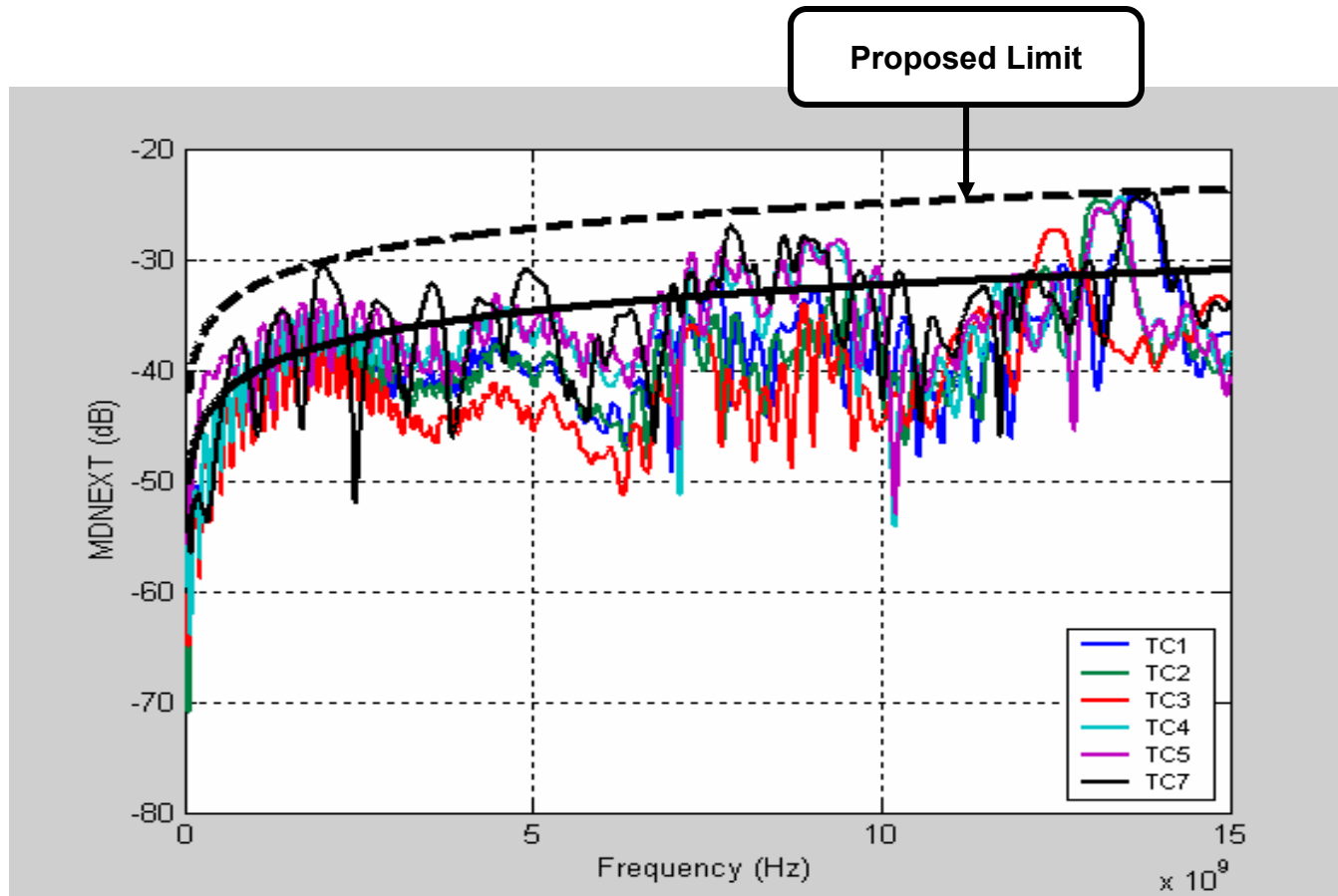
MDFEXT Definition



AB	CD	EF	GH
	F		
	RX		
	F		

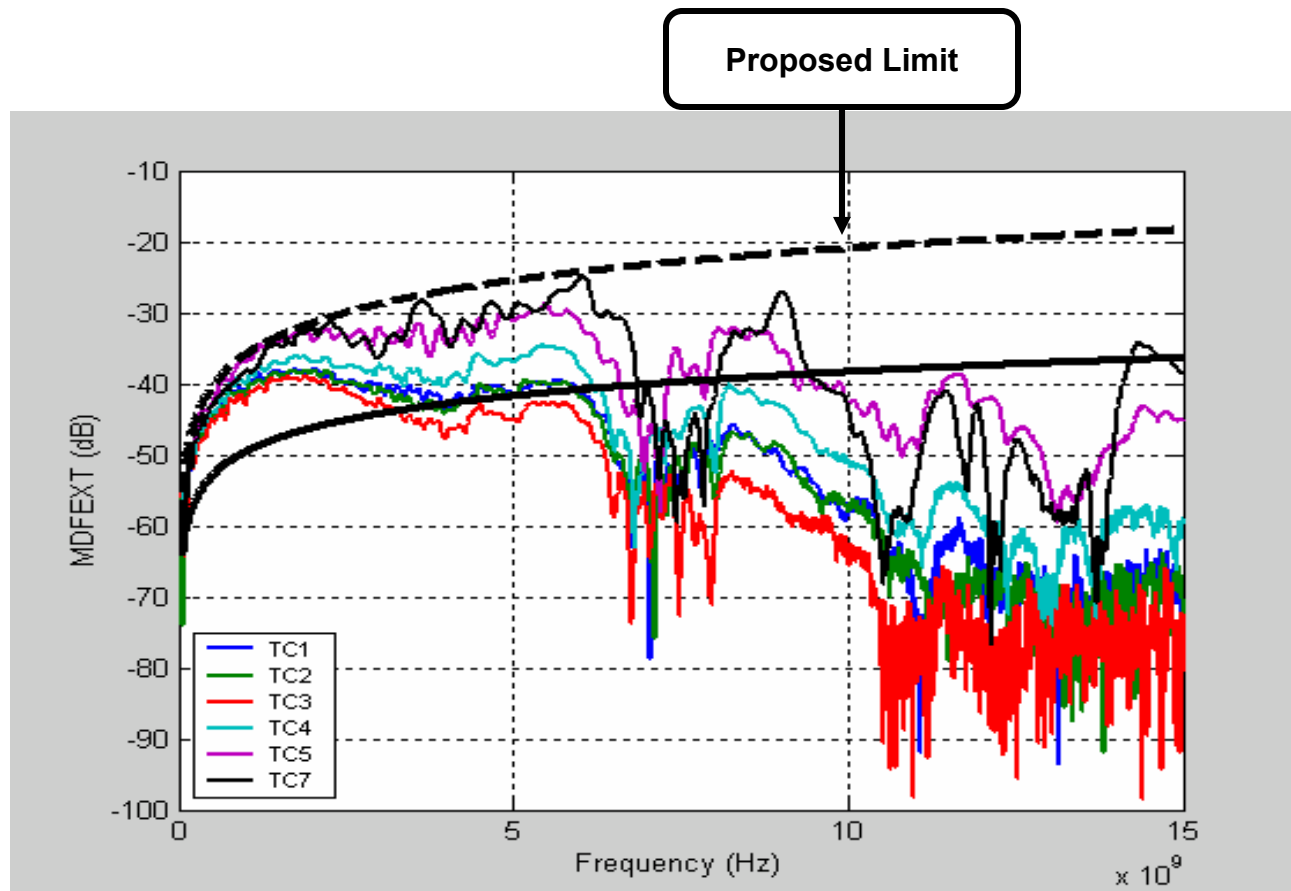
$$MDFEXT(f) = 10 \log_{10} \left(\sum_{n=1}^N FEXT_n(f) \times FEXT_n^*(f) \right)$$

MDNEXT Proposed Limit



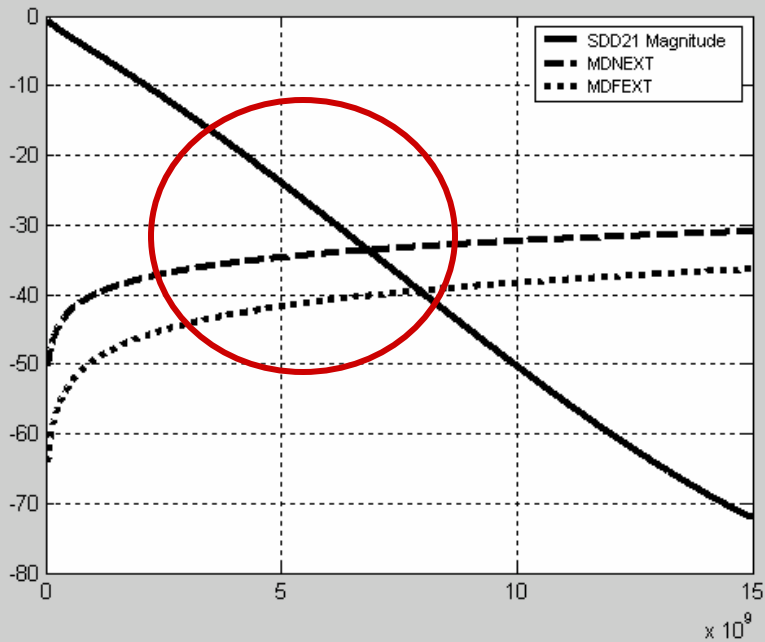
$$MDNEXT(dB) \leq -25 + 7.5 \log_{10} \left(\frac{f}{10GHz} \right), f = 0.1 \dots 15GHz$$

MDFEXT Proposed Limit

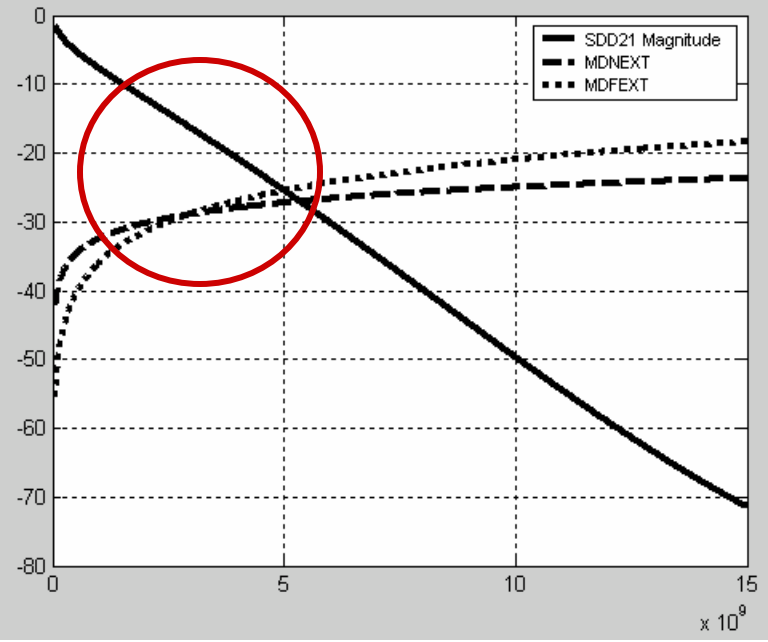


$$MDFEXT(dB) \leq -21 + 15 \log_{10} \left(\frac{f}{10GHz} \right), f = 0.1 \dots 15GHz$$

Unintentional SNR Squeeze



Original "Stake in the Ground"



Subsequent Modifications
(proposed)



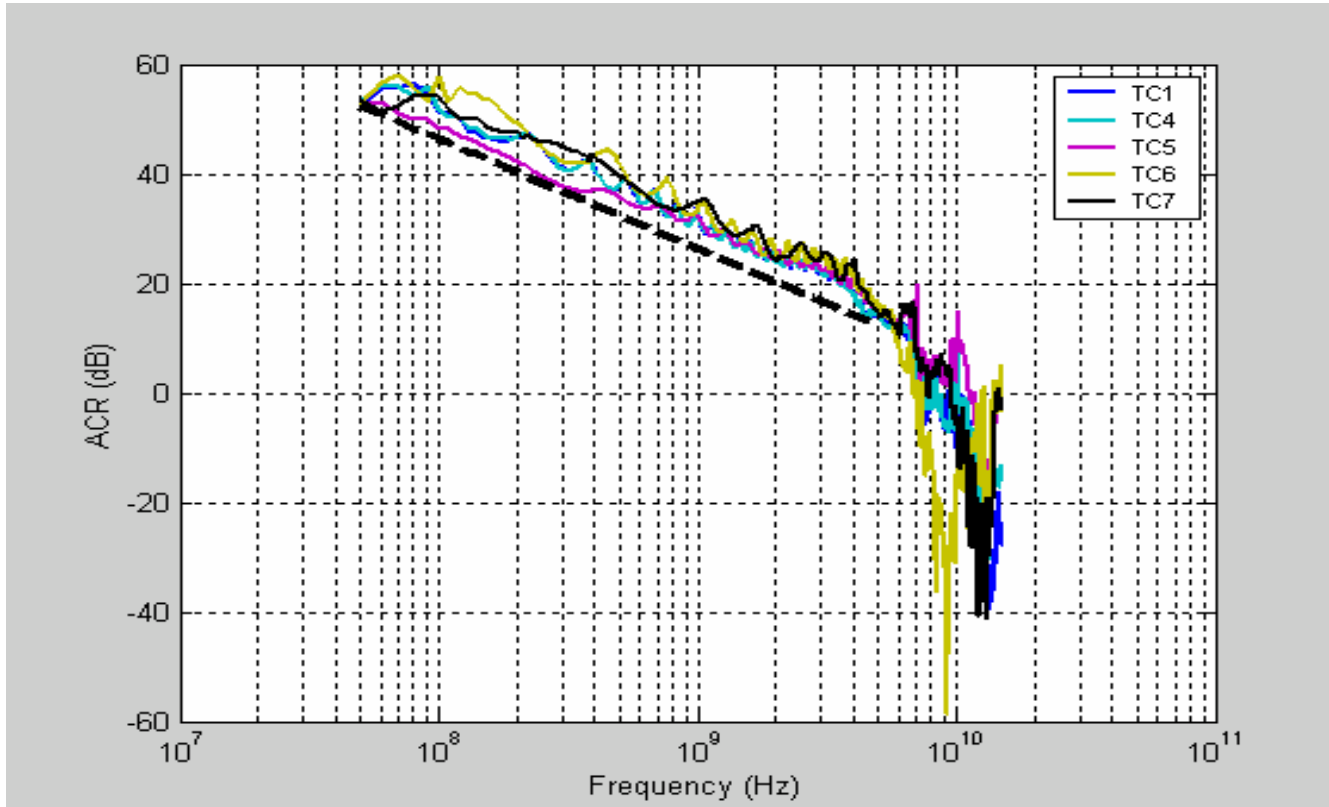
No Heart Attacks Please!

- Address Problem with New Parameter
 - SNR “squeezed” if worst-case attenuation and crosstalk occur simultaneously.
 - Test cases indicate that as attenuation increases, crosstalk decreases, and vice versa.
 - As a result, the Attenuation to Crosstalk Ratio (ACR) is quite consistent (see following slide).
 - To maintain reasonable SNR for the line codes of interest, define a minimum ACR that the channel must satisfy.

ACR Proposal

$$Total_Crosstalk(dB) = 10 \log_{10} \left(10^{(MDNEXT(dB)/10)} + 10^{(MDFEXT(dB)/10)} \right)$$

$$ACR(dB) = SDD21(dB) - Total_Crosstalk(dB)$$



$$ACR(dB) \geq 12.5 - 20 \log_{10} \left(\frac{f}{5GHz} \right), f = 0.1 \dots 5GHz$$



Conclusion

- ATCA applications exceed current MDNEXT and MDFEXT limits.

$$MDNEXT(dB) \leq -25 + 7.5 \log_{10} \left(\frac{f}{10GHz} \right), f = 0.1...15GHz$$

$$MDFEXT(dB) \leq -21 + 15 \log_{10} \left(\frac{f}{10GHz} \right), f = 0.1...15GHz$$

- Symbiotic relationship - related to throughput
- Introduction of new specification (ACR) necessary

$$ACR(dB) \geq 12.5 - 20 \log_{10} \left(\frac{f}{5GHz} \right), f = 0.1...5GHz$$

- Enforces 12.5 dB ACR @ 5 GHz



Recommendations

- Current MDNEXT and MDFEXT limits must be modified to support ATCA applications.
- Addition of Attenuation-to-Crosstalk Ratio (ACR) specification enforces reasonable SNR while addressing ATCA applications.
- Further comparisons to measured data required to validate the proposed limits.