SNDR and SNR_ISI

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Introduction

- 50GBASE CR and KR SNR_ISI limit is so tight that even test equipment appears borderline: not practical
- Similar problem with SNDR
- Relates to comments 139 and 140

Summary of spec values

Spec	TX SNDR	COM SNR_TX	SNR_ISI
802.3bj CR4	26	27	
802.3bj KR4	27	27	
802.3bm C2C	27	27	
802.3by CR	26	CA-N: 28.4 CA-S: 27 CA-L: 27	
802.3by KR	27	27	
802.3cd CR	33.3	32.5	36.8
802.3cd KR	32.5	32.5	43
802.3bs C2C	31.5	31	34.8

The bs and cd limits are much higher than before

Test Equipment Measurement Results

Equipment	TXEQ preset	Vf	Pmax	pmax/ Vf	sigma_e	SNDR [dB]	SNR_ISI [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75		CR: 33.3 KR: 32.5	CR: 36.8 KR: 43
Vendor A	1	0.591	0.578	0.976	0.0075	37.63	38.82
Vendor A	2	0.301	0.437	1.453	0.008	34.68	39.01
Vendor A	3	0.303	0.442	1.459	0.0079	34.84	38.87
Vendor A + 3dB PCB trace	1	0.6	0.507	0.845	0.0096	34.38	35.09
Vendor A + 3dB PCB trace	2	0.273	0.374	1.37	0.0085	32.75	36.49
Vendor A + 3dB PCB trace	3	0.2632	0.3549	1.028291	0.0086	32.25	35.82
Vendor B	1	0.601	0.553	0.92	0.0116	33.57	32.57

- Spec allows c(-1) range of [-0.25,0] (Preset 3) and c(1) range of [-0.25,0] (Preset 2). Is SNDR to be met for all equalization settings?
- SNDR limit very close to test equipment results, especially for equalized TX
- SNR_ISI limit still close to or above test equipment results
- Results after mated compliance boards will be worse than these

Possible Solutions

- Change SNDR min value from 32.5 dB in KR and 33.3 in CR to 29 (28.5) dB
- Changes to COM RX
  - Increase the DFE length from 10 to 16
  - Increase the max DFE tap weights – b_max[1] from 0.7 to 0.9; b_max[2...N] from 0.2 to 0.4
- COM Package model
  - Change Cd to 160 fF (D2.0 comments 164, 165)
- Or...
- Reduce the COM limit for the channel from 3 dB to 2.5 dB
- Or accept that the channels have to be better
- What else?

Results (For KRn)

Tested on channels in zambell_110216_3cd_adhoc-v2.pdf Link 6 and Cavium 30 dB backplane channels (http://ieee802.org/3/cd/public/channel/Cavium_Backplane_Channels.pdf) . Channels description in backup slides.

Calculation steps (cumulative):

Step No.	Change
0	Original cd 2.0 KR COM
1	Change SNR_TX from 32.5 dB to 29 dB
2	• Change Nb from 10 to 14 • Change b_max[1] from 0.7 to 0.9 • Change b_max[2...N] from 0.2 to 0.4 • Change Cd from 180 fF to 160 fF

Results

		Initial settings		Step 1: Change SNR_TX from 32.5 dB to 29 dB		Step 2: • Change Nb from 10 to 14 • Change b_max[1] from 0.7 to 0.9 • Change b_max[2...N] from 0.2 to 0.4 • Change Cd from 180 fF to 160 fF	
Channel	IL [dB]	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM
Amphenol Link 6	30.1	3.401	2.987	2.592	2.236	2.757	2.372
Cavium HighZ	30.8	4.041	3.185	3.123	2.418	3.248	2.569
Cavium HighZ_Nom_HighZ	30.8	4.11	3.198	3.185	2.43	3.324	2.522

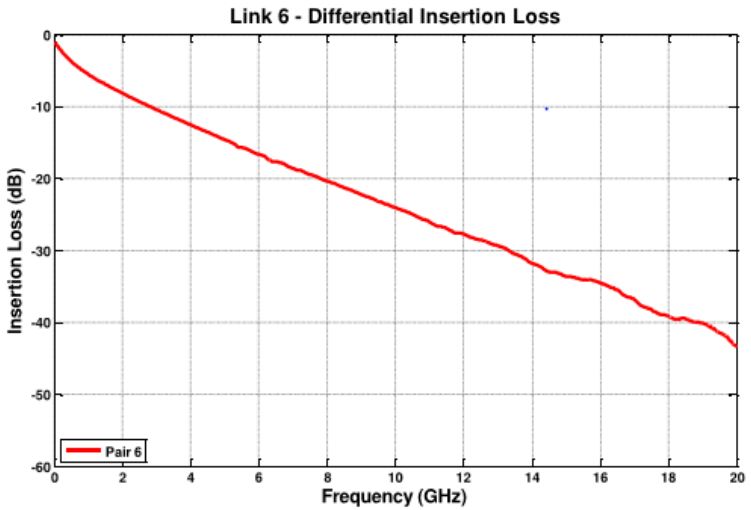
Reducing the COM limit for the channel from 3 dB to 2.5 dB seems be more effective than step 2, and simpler

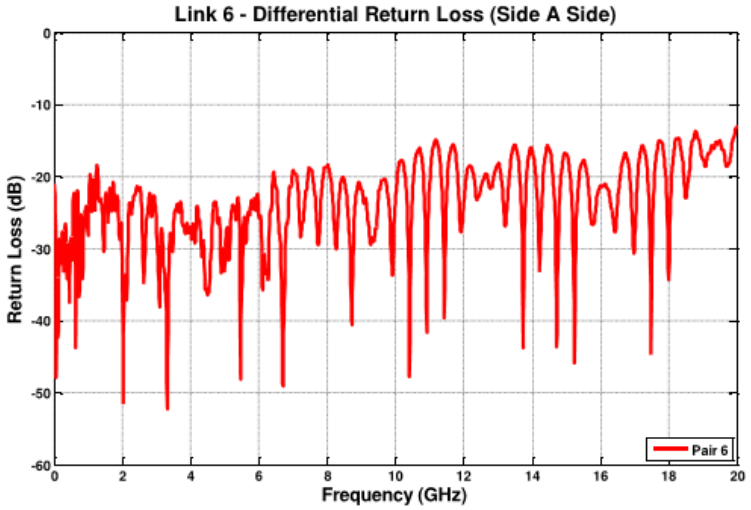
Conclusions

- 50GBASE CR and KR SNDR (32.5 dB for KR, 33.3 for CR) and SNR_ISI (43 dB for KR, 36.8 for CR) limits are so tight that even test equipment appears borderline: not practical
- Proposed limits: SNDR = 29 (28.5) dB; SNR_ISI = 32 (?) dB
- Minor changes to the COM reference RX and package (Cd) are not sufficient to enable the proposed practical values.
- More work has to be done.

Backup

Tested channels (Amphenol)





Tested channels (Cavium)