

C2C SNDR and SNR_ISI

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Introduction

- 400GAUI-8 C2C SNR_ISI limit is so tight that even test equipment appears borderline: not practical
- Similar problem with SNDR
- Changes to COM reference RX can be made to introduce more practical TX specs
- Relates to comments 42,43

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

Test Equipment Measurement Results

Equipment	TXEQ Set	Vf	Pmax	pmax/ Vf	sigma_e	SNDR [dB] (Spec limit 31.5)	SNR_ISI [dB] (Spec limit 34.8)
Vendor A	[0,0,1,0]	0.591	0.578	0.976	0.0075	37.63	38.82
Vendor A	[0,0,0.75,-0.25]	0.301	0.437	1.453	0.008	34.68	39.01
Vendor A	[0,-0.15,0.85]	0.303	0.442	1.459	0.0079	34.84	38.87
Vendor A + 3dB PCB trace	[0,0,1,0]	0.6	0.507	0.845	0.0096	34.38	35.09
Vendor A + 3dB PCB trace	[0,0,0.75,-0.25]	0.273	0.374	1.37	0.0085	32.75	36.49
Vendor A + 3dB PCB trace	[0,-0.15,0.85]	0.418	0.429	1.028	0.0087	33.78	35.56
Vendor B	[0,0,1,0]	0.601	0.553	0.92	0.0116	33.57	32.57

- C2C spec allows c(-1) range of [-0.15,0] and c(1) range of [-0.25,0]. SNDR and SNR_ISI are 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

Mitigation

- Change SNDR min value from 31.5 dB to 28.5 dB
- Changes to COM RX
 - Increasing the DFE length from 10 to 14
- Changes to TX
 - Changing max $c(-1)$ value closer to 802.3cd: -0.2 instead of -0.15.
 - Addition of $c(-2)$ tap, aligning with 802.3cd
- COM Package model
 - Change C_d to 160 fF (P802.3cd D2.0 comments 164, 165)

Results

Tested on channels in mellitz_3bs_01_0714.pdf cases 1 (IL=19.63dB) and 4 (IL=19.49 dB).

Calculation steps (cumulative):

Step No.	Change
0	Original bs 3.2 COM
1	Change SNDR from 31.5 dB to 28.5 dB
2	Add c(-2) tap with range = [0:0.01:0.1]
3	Change Nb from 10 to 14
4	Change c(-1) range from [-0.15:0.05:0] to [-0.2:0.05:0]
5	Change Cd from 180 fF to 160 fF

Results

		Initial settings		Change SNDR from 31.5 dB to 28.5 dB		Add c(-2) tap		Change Nb from 10 to 14		Change c(-1) range to [-0.2:0.05:0]		Change Cd from 180 fF to 160 fF	
Channel	IL	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM	Case 1 COM	Case 2 COM
Mellitz 01	19.63	3.81	3.18	2.78	2.25	3.33	2.75	3.46	3.06	3.46	3.13	3.55	3.22
Mellitz 04	19.49	3.51	2.83	2.52	1.97	3.04	2.57	3.17	2.84	3.17	2.92	3.3	3.07

Conclusions

- Current 400GAUI-8 C2C SNDR (31.5 dB) and SNR_ISI (34.8 dB) limits are so tight that even test equipment appears borderline: not practical
- Proposed limits: SNDR = 28.5 dB; SNR_ISI = 32 (?) dB
- Spec changes to enable the proposed values:
 - Align the TX equalization towards 802.3cd:
 - Add a c(-2) tap with range of [0:0.01:0.1]
 - Increase the range of c(-1) to [-0.2:0.01:0]
 - Increase the reference RX DFE to 14 taps, also aligned with 802.3cd

Backup

Tested channels (from mellitz_3bs_01_0714.pdf)

