

SNDR and SNR_{TX}

(Clauses 136 and 137)

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Introduction

- 50GBASE CR and KR SNDR limit is so tight that even test equipment appears borderline: not practical
- Currently the SNDR Specs are aligned with the COM SNR_{TX}
- With that, the COM SNR_{TX} is defined at the TX driver output (before the package), while the SNDR is measured after a package and a test fixture

Summary of spec values

Spec	TX SNDR	COM SNR_TX
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
802.3cd KR	32.5	32.5
802.3bs C2C	31.5	31

The bs and cd limits are much higher than before

Test Equipment Measurement Results

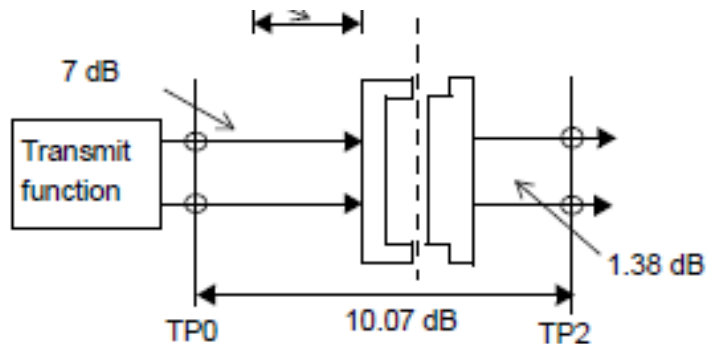
Equipment	TXEQ preset	Vf	Pmax	pmax/ Vf	sigma_e	SNDR [dB]
802.3cd spec limit	Presets 1-3	0.34-0.6		CR: 0.49 KR: 0.75		CR: 33.3 KR: 32.5
Vendor A	1	0.591	0.578	0.976	0.0075	37.63
Vendor A	2	0.301	0.437	1.453	0.008	34.68
Vendor A	3	0.303	0.442	1.459	0.0079	34.84
Vendor A + 3dB PCB trace	1	0.6	0.507	0.845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

- 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
- Results after mated compliance boards will be worse than these

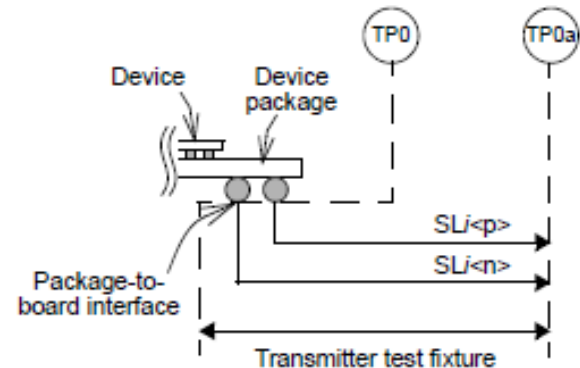
*Signal timing and linearity were optimized for the measurement

Correction for Test Fixtures

CR TX Test Setup

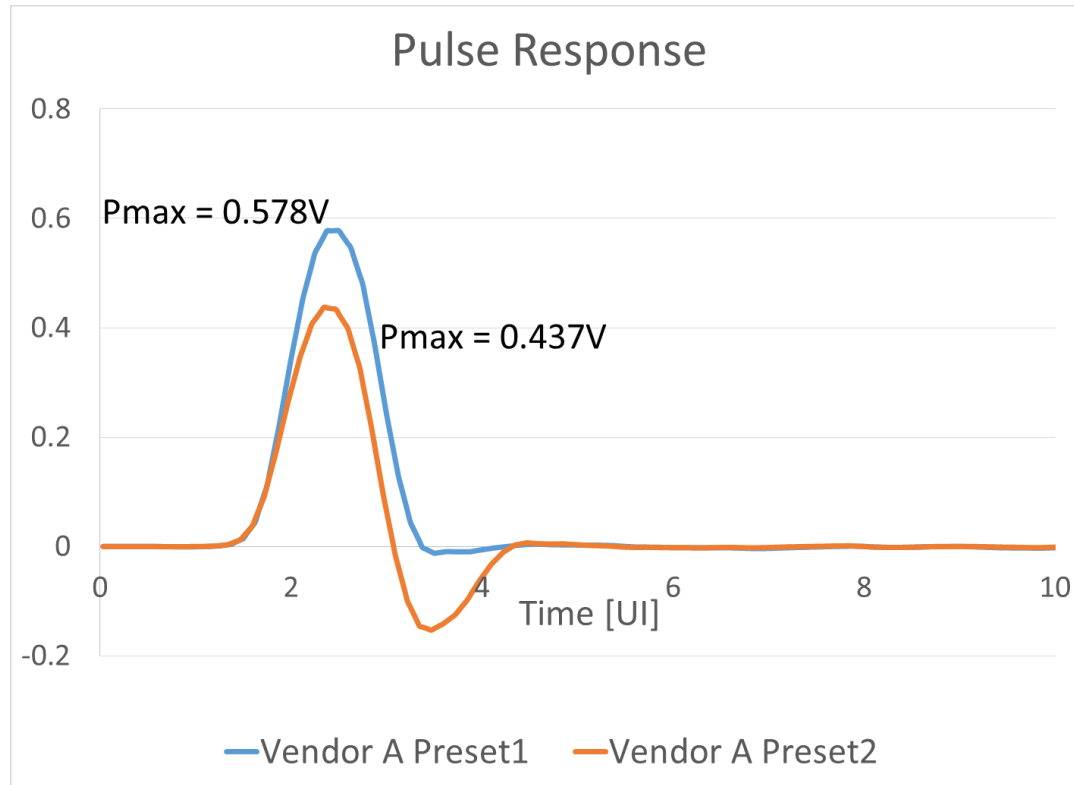


KR TX Test Setup



- COM SNR_{TX} is defined at the driver output (before TP0). SNDR is measured at TP2 for CR and at TP0a for KR
- Simulations show up to 4.3 dB degradation in SNDR between TP2 and TP0 and up to 3.5 dB degradation between TP0a and TP0
- Proposed mitigation: Reduce the SNDR specs in Clauses 136 and 137 to 30 dB, while keeping the COM SNR_{TX} at their respective original values

TX Equalization



- Spec is to be met for all equalization settings
- Pmax scales with equalization, noise and distortion don't scale as much
- Measuring SNDR only for preset1 should be considered

Conclusions

- 50GBASE CR and KR SNDR (32.5 dB for KR, 33.3 for CR) limits are so tight that even test equipment appears borderline: not practical.
- Currently the SNDR spec is aligned to the SNR_{TX} value in COM. With that, differences between the test points are not considered.
- Pmax scales with equalization, noise and distortion don't scale as much.
- Proposed changes:
 1. Change the SNDR spec in clauses 136 and 137 to 30 dB.
 2. Consider requiring SNDR measurement only for Preset1.