# CHANNEL OPERATING MARGIN (COM) PROPOSAL FOR CDAUI-8 C2C


**Raj Hegde & Magesh Valliappan**

IEEE 802.3bs 400Gb/s Task Force – Electrical Ad-hoc

Nov. 30th, 2015

# OVERVIEW

- **Now that FEC & interleaving have been finalized, re-visit the BER target**
- **Re-visit TX and RX implementations budgets**
  - SNR-TX
  - COM target

# BER TARGET

With symbol interleave from 2 FEC code words and bit-muxing in the PMA (Option 8 from anslow_3bs_03_0915)

- For multi-part link with 0.1dB optical penalty, to achieve FLR = 6.2e-11, total BER target for the electrical segments:

| Case | DER0 | BER |
|---|---|---|
| Random | 1.6e-4 | 8.0e-5 |
| a=0.5 | 4.5e-5 | 4.5e-5 |

- With the same BER target, on an electrical only link, FLR < 6.2e-16 is achieved!

| Case | DER0 | BER |
|---|---|---|
| FLR | 6.2e-16 | |
| Random | 3.0e-4 | 1.5e-4 |
| a=0.5 | 5.3e-5 | 5.3e-5 |

- With the assumption that at most 2 segments could be operating at the worst case, **set the BER target per segment to 2e-5.**

# SNR-TX AND CHANNEL OPERATING MARGIN

- **SNR-TX:**
  - SNR-TX is derived from the TX SNDR specification.
  - PAM4 transmitters have a richer variety of transitions and more mechanisms to generate distortion compared to NRZ
  - Relaxed SNR-TX budget allows for ease of implementation leading to area and power savings.
  - Investigate a relaxed SNR-TX assumption

- **Channel Operating Margin:**
  - The current reference receiver is simplified and ideal in some ways (quantization of detector levels, ideal DFE, no RX circuit noise & non-linearity)
  - Consider a **COM margin of 3dB**.

# COM MARGIN

- Baseline: Start with final settings on the Addendum slide in healey_3bs_02_1115.pdf

| Test Case | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Insertion Loss (dB) | 19.2 | 14.34 | 7.22 | 18.93 | 17.24 | 11.14 | 9.24 | 18.75 |
| healey_3bs_02_1115 (final pass) | 2.55 | 3.3 | 3.33 | 2.35 | 1.83 | 3.23 | 3.14 | 4.19 |
| This implementation (first pass) | 2.09 | 3.21 | 3.3 | 2.24 | 1.61 | 3.06 | 3.0 | 4.33 |
| Rd = 55 Ohms | 1.85 | 2.92 | 2.73 | 2.0 | 1.35 | 2.73 | 2.57 | 3.97 |
| SNR-TX = 29dB | 1.17 | 2.1 | 1.94 | 1.32 | 0.73 | 1.93 | 1.8 | 2.96 |
| Set $DER_0$ = 2E-5 | 2.38 | 3.37 | 3.2 | 2.57 | 1.93 | 3.18 | 3.05 | 4.25 |

# CONCLUSIONS

- **The proposed modifications to the COM parameters provide better implementation targets with minimal compromise to end-to-end performance.**