C2M spec consistency and tolerancing

Piers Dawe

Mellanox

400GAUI-8 C2M issues

- Channel losses for module input (10.5 dB) and module output (14.2 dB) are not consistent Comment 45
- Module output "far end" eye is specified before (without) any host IC package loss but complaint in healey_3bs_01a_0317 that the eye may be hard to receive after a host IC package loss 42
- C2M module output precursor ratio spec is more restrictive than a C2C driver could achieve 42
- In module stressed input test, high loss case, the combination of a channel that includes the host IC package loss plus unspecified actual package and interconnect loss in the pattern generator is too much 45
- The high loss case should exercise the top CTLE peaking setting 46
- Range of CTLE peaking appears inconsistent with range of channel losses in 120E.1 Overview
- Reference CTLE second pole is too low 12
- COM is moving to a neutral impedance basis; keeping the soft channel at 109.8 Ω seems strange – but does it matter?
- Should exclude pathological big bad C2M host signals that no host needs to make but this draft spec allows 40

Introduction 2

- C2M Spec Consistency and Tolerancing http://ieee802.org/3/bs/public/17_07/dawe_3bs_01_0717.pdf showed possible inconsistencies between the 5 criteria for module output setup
  - near-end eye height and width, far-end eye height and width, and far-end pre-cursor ISI ratio
- It was said that it should be possible to make a module output with a 2-tap (not 3-tap) FFE, but that it would not be feasible to meet the far-end pre-cursor ISI ratio spec without any FFE
- This presentation investigates these
- Also, eye metrics are changed from 1e-6 to 1e-5

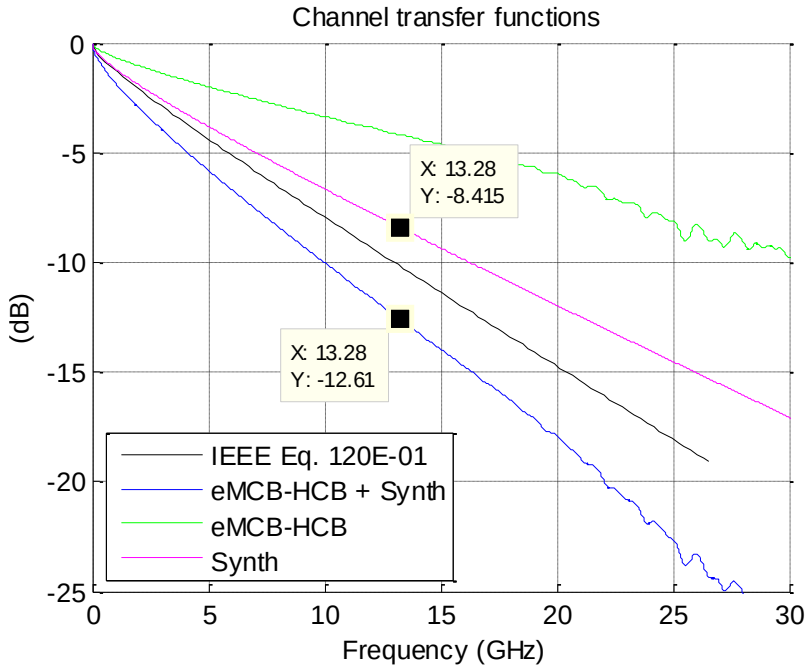
Introduction 3

- Concerns with stressed input tests in Annex 120E D3p2
  http://ieee802.org/3/cd/public/adhoc/archive/sekel_062817_3cd_adhoc.pdf
  and subsequent work said that it would be difficult to impossible to make a module stressed input signal without removing all or nearly all jitter and nonlinearity

Channel losses

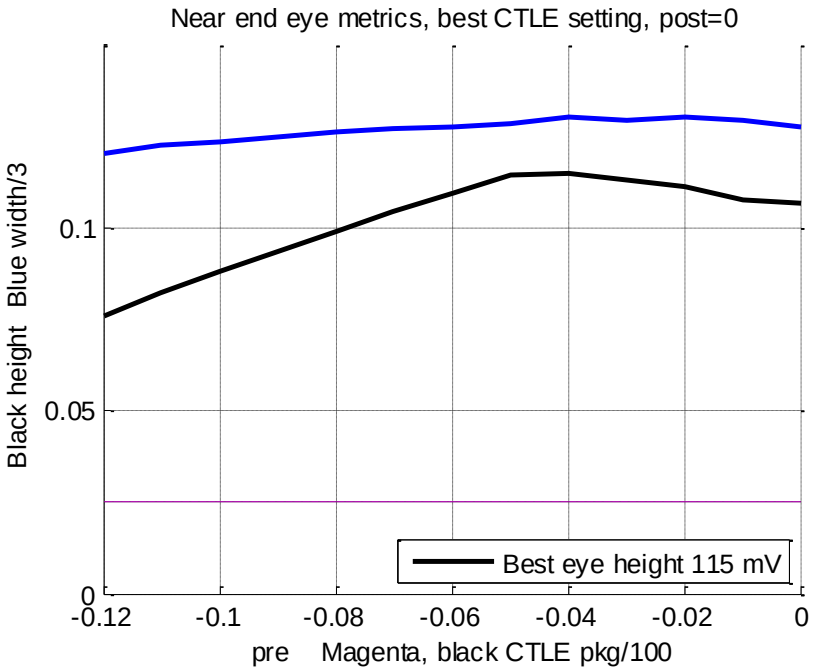
- Module output far-end eye
  - Intention is constancy with 7.5 + 1.2 (+ 1.5) dB, presumably at 13.28125 GHz (Figure 120E–2—200GAUI-4 chip-to-module insertion loss budget at 13.28 GHz)
  - Achieved by internal loss of module + MCB + "soft" 6.4 dB
  - Mated compliance boards loss is 3.59 dB at 12.890625, at least for 25GBASE-CR, 25GBASE-CR-S, and 25GAUI C2M
    - $IL_{MatedTF}(f) = 0.471\sqrt{f} + 0.1194f + 0.002f^2$ (dB) (136A–2)
  - 92.11.2 Cable assembly test fixture
    - $IL_{catf}(f) = -0.00125 + 0.12\sqrt{f} + 0.0575f$ (dB) (92–35)
  - Loss of MCB connector is probably <1.2 dB. Actual internal loss of module if not 1.5 dB is to module's benefit or disadvantage
- Module stressed input signal, high loss case
  - 13.28 GHz from the output of the pattern generator to TP1a is 14.2 dB. The 14.2 dB loss represents 10.5 dB channel loss with an additional allowance for host transmitter package loss
  - Plus unspecified losses and filtering inside the pattern generator

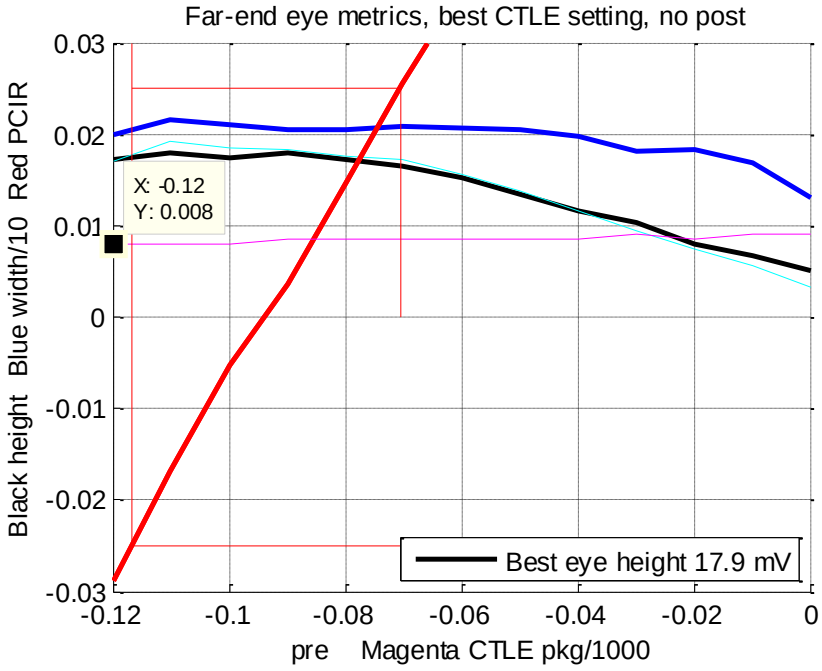
2 dB more loss



- As compared with dawe_3bs_01_0717, the "soft" channel has been extended by 2 dB, representing the host IC package loss
- This is still 1.6 dB less than the 14.2 dB loss of the module stressed input test
- Tx risetime is 10 ps: real pattern generator ~13.5 ps

Near and far end eyes, 2-tap FFE





- With 2 dB extra "soft" channel loss. CTLE selected for best EH*EW: 8 or 8.5 dB in the range between the red lines
- Eye heights and widths could be higher or lower than these
- Range of FFE precursor settings that satisfies far-end ISI pre-cursor ISI ratio rule is only 0.0463. This is less than the 0.05 step size for the C2C Tx emphasis control, without allowing anything for tolerancing
- The far-end ISI pre-cursor ISI ratio rule (+/-2.5%) is too tight