Improvement to TDEC calculation for 100GBASE-SR4

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Introduction

- TDEC calculations were showing a higher penalty than predicted by link modelling
- Also, a bigger difference between good and bad transmitters than predicted by link modelling
- With a 1:1 trade, min. (OMA-TDP) = constant, this means that a good transmitter gets more credit than it deserves relative to a bad one; the budget doesn't close for the good transmitter
  - About 1/2 dB discrepancy
- The discrepancy is in the MPN calculation:
  - Link model assumes that MPN scales as deterministic inner eye height at eye centre, and with "DCD"-increased effective rate
    - The MPN penalty in dB goes as the square of MPN, and some Pcross follows
  - TDEC calculation assumes that MPN scales as OMA
- The proposed change to equations 95-3 and 95-4 on the next page provides a simple, implementable formula to close the budget gap
  - TDEC doesn't know the deterministic inner eye height at eye centre nor "DCD", so the formula is an approximation

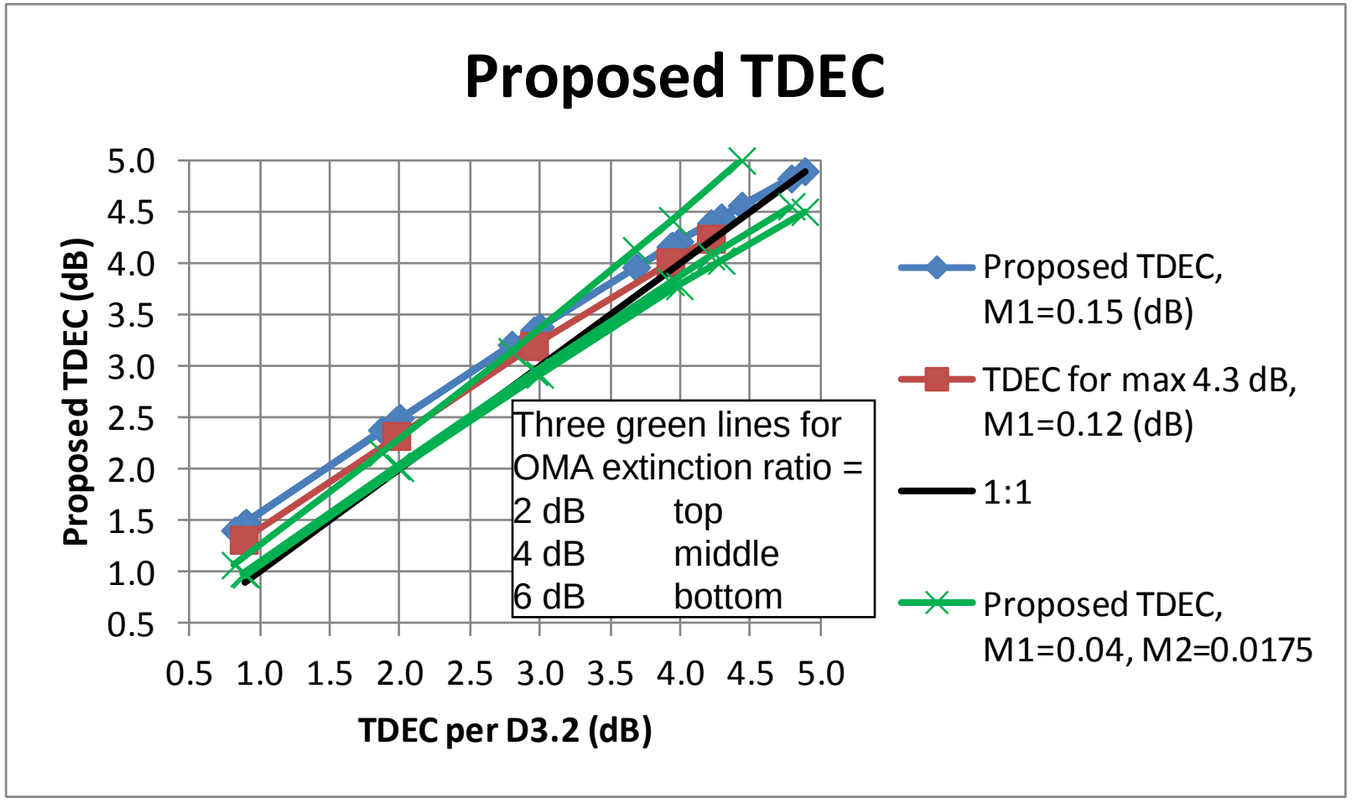
Equation changes

- The noise, R, that could be added by a receiver is given by:
- $R = \sqrt{(N^2 + S^2 - M^2)}$ (95-3)
- where
- M is a term to account for mode partition noise and modal noise that could be added by the optical channel, defined in Equation (95-4), and
- S is the standard deviation of the noise of the O/E and oscilloscope combination.
- $M = \sqrt{((0.0257 OMA^2 + (0.01 P_{ave})^2)}$ (95-4)
  - **----- changes to -----**
- The noise, R, that could be added by a receiver is given by:
- $R = $ (1-M1)$\sqrt{(N^2 + S^2 - M2^2)}$ (95-3)
- where M1 and M2, defined in Equation (95-4) and Equation (95-5), account for mode partition noise and modal noise that could be added by the optical channel,
- S is the standard deviation of the noise of the O/E and oscilloscope combination,
- $M1 = 0.04$ (95-4)
- $M2 = 0.0175 P_{ave}$ (95-5)

Note for presentation:

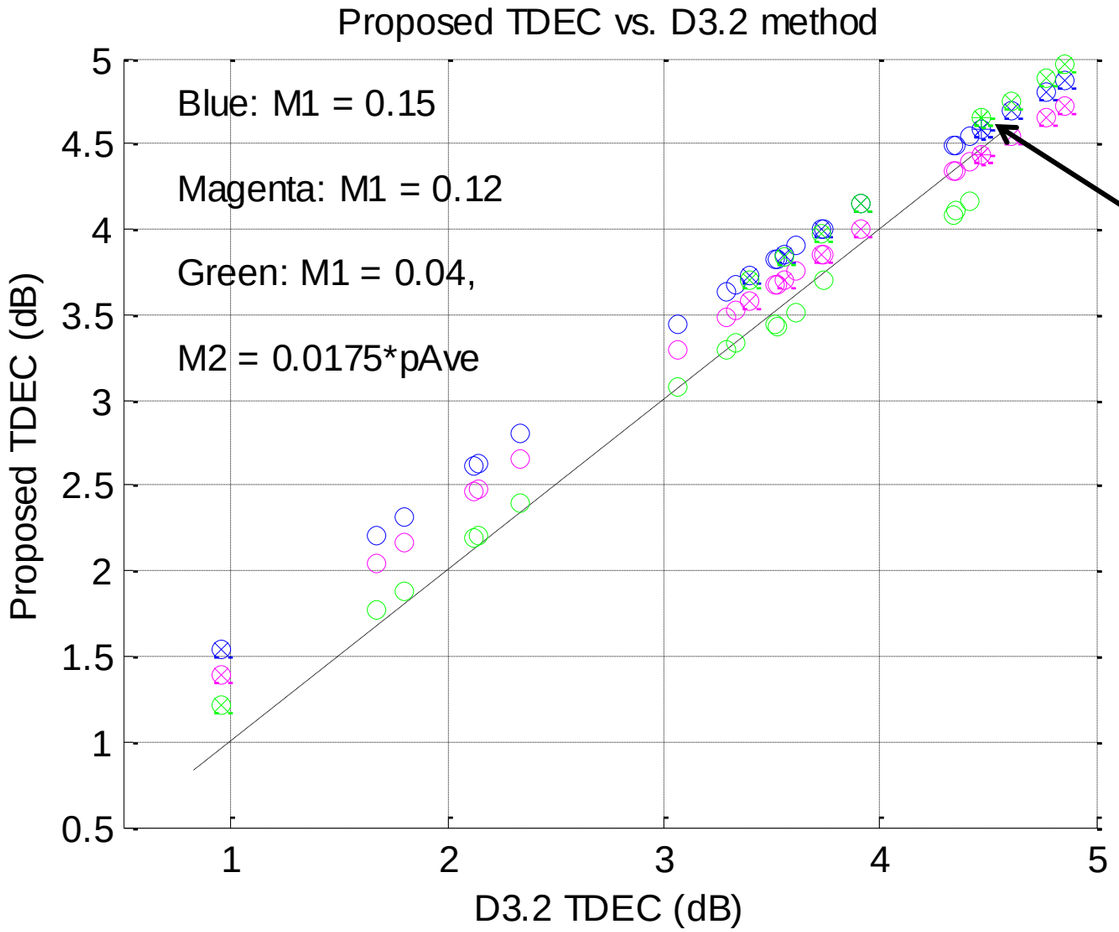
other changes will determine exact M1: see next slide

Effect of changes



- Three proposals: blue, red and green
  - Green is most recent
- Proposed TDECs give up to 1/2 dB less credit to a good transmitter
  - Closing the budget gap of slide 2
- Blue line crosses black 1:1 line at 4.9 dB
  - Max TDEC in D3.2
  - M1 = 0.15
- Red line crosses black 1:1 line at 4.3 dB
  - Proposed max TDEC, comment 11
  - M1 = 0.12
- Green lines treat modal noise correctly, as *ModalNoiseIn100GBASE-SR4v3a_mmf*, and treat mode partition noise like the link model spreadsheet does

Effect of changes: simulations

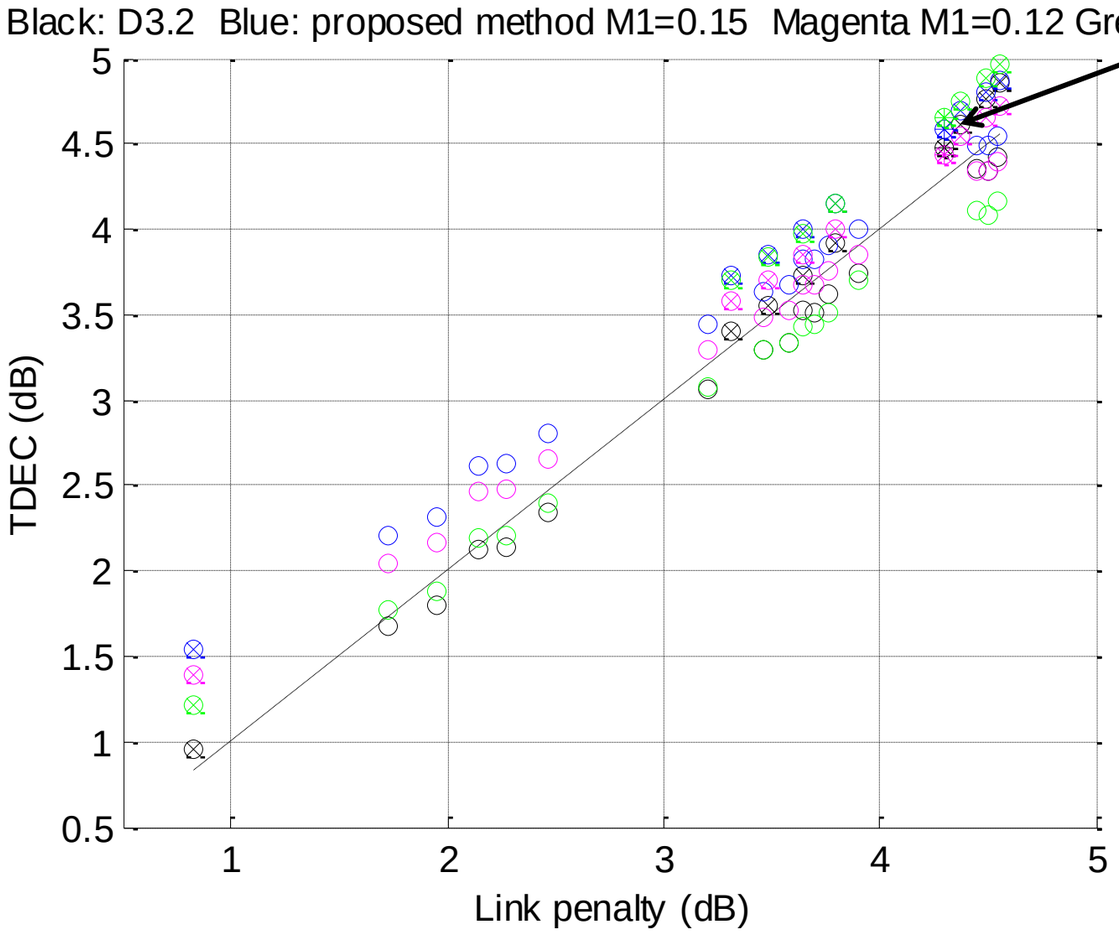


- M1 = 0.15 for max. TDEC = 4.9 dB,
- M1 = 0.12 dB for max. TDEC = 4.3 dB

- Reference worst case but at minimum extinction ratio

- Gaussian transmitters (shown with x) all have worst extinction ratio
- Other transmitters have various higher extinction ratios, so less modal noise penalty

TDEC against simulated link penalty



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Thank You