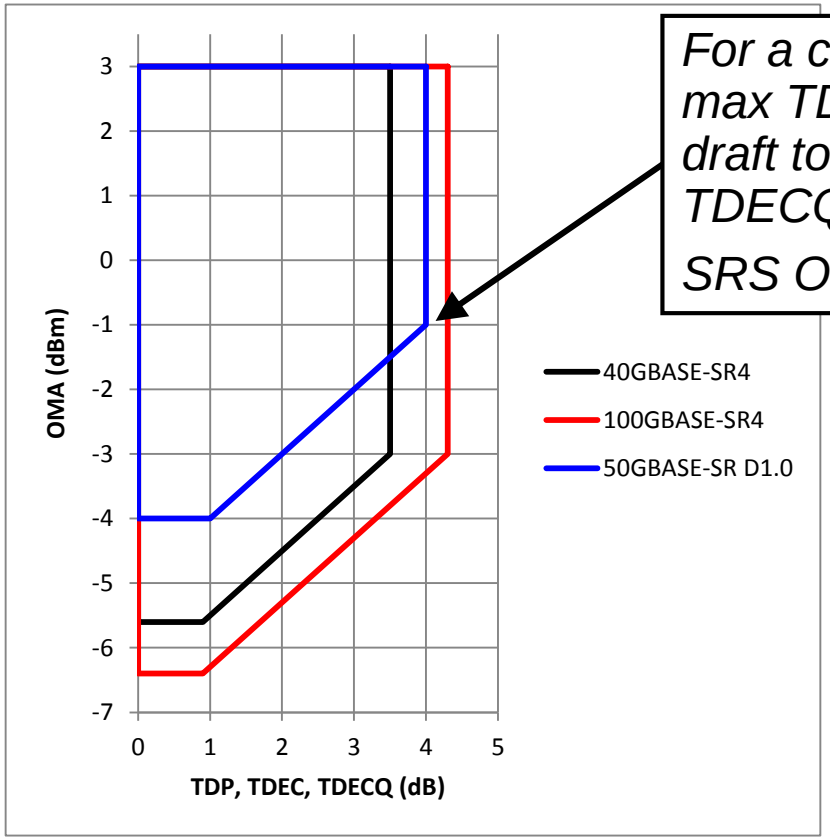
# Restoring the optical power levels for the 50GBASE-SR family

Piers Dawe

Mellanox

# 50 Gb/s per lane MMF baseline and earlier specs

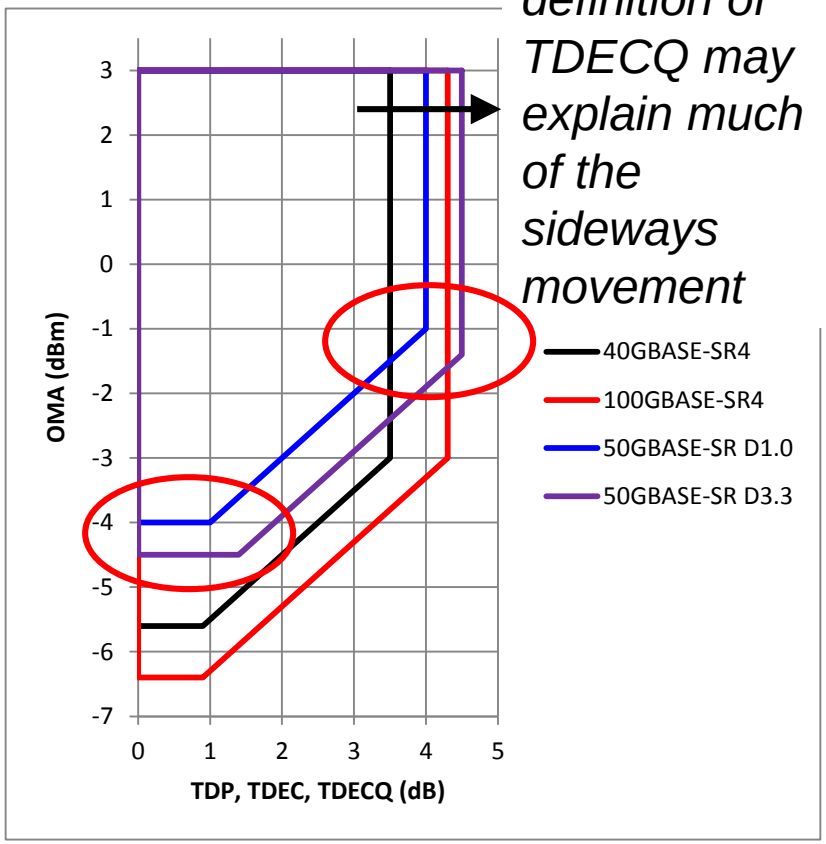



*For a consistent worst signal, the OMA at max TDECQ should stay constant from draft to draft even as the definition of TDECQ changes*

*SRS OMA follows this (1.9 dB lower)*

- Black: 10G/lane, PAM2
- Red: 25G/lane, PAM2, with FEC
- Blue: 50G/lane, PAM4, with FEC
- From adopted baseline king_3cd_01a_0516 and D1.0 Cl. 138 50GBASE-SR, 100GBASE-SR2, 200GBASE-SR4 (contained some TBCs)

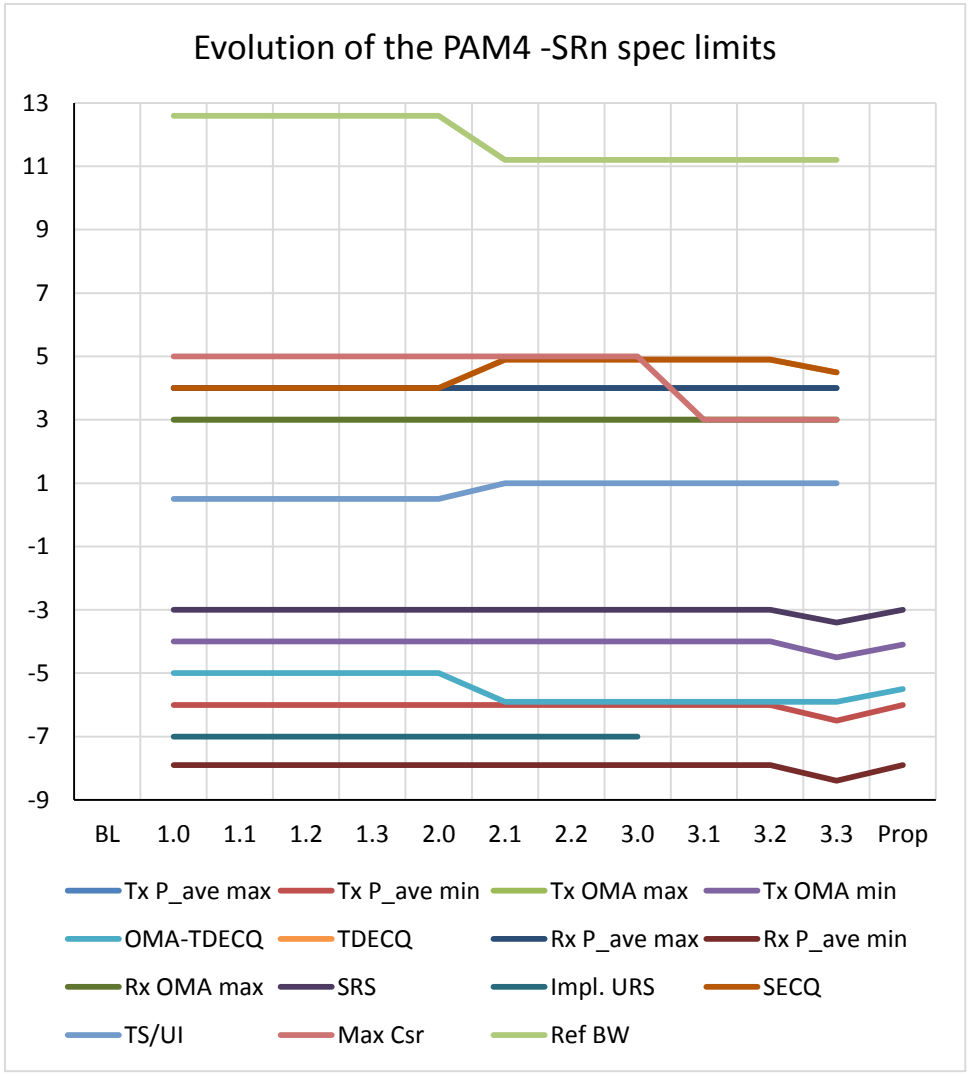
# Somehow, the spec has drifted




*Changing definition of TDECQ may explain much of the sideways movement*

- In D3.3, the min. OMA at max TDECQ, and the SRS OMA, were moved down by 0.4 dB
- This should not have happened
  - Our idea of a worst signal hasn't changed, but the TDECQ score it gets, has changed
  - king_3cd_01_0518 had proposed different changes to the ones adopted for D3.3
  - In D3.3 we aimed to correct a discrepancy introduced by the floating thresholds, but created a new error in the process

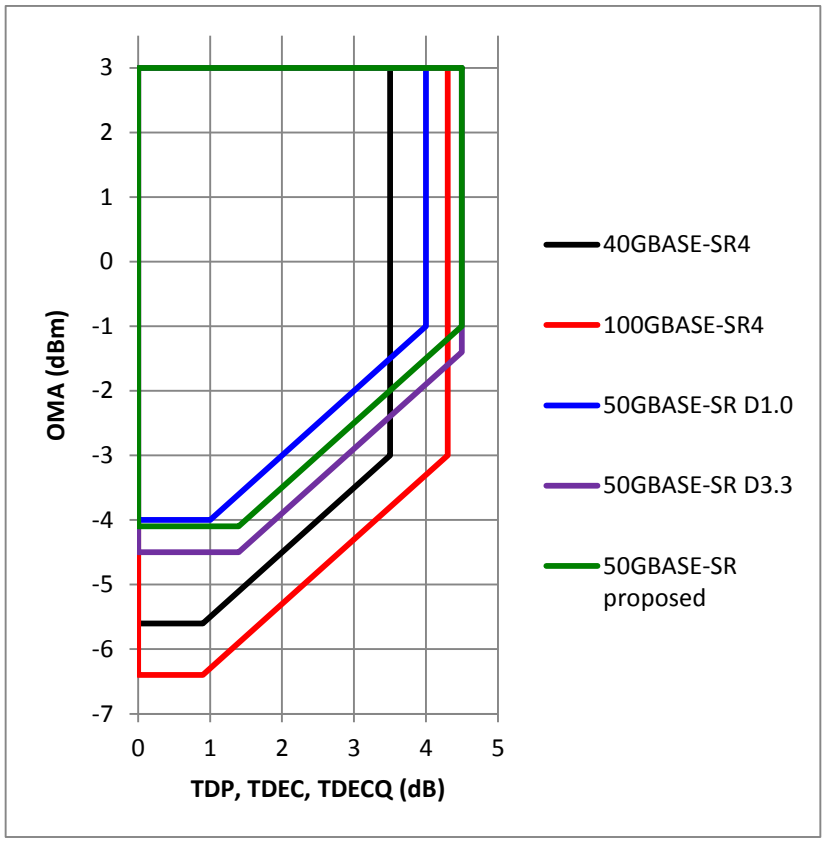
# Evolution of the PAM4 -SRn spec limits

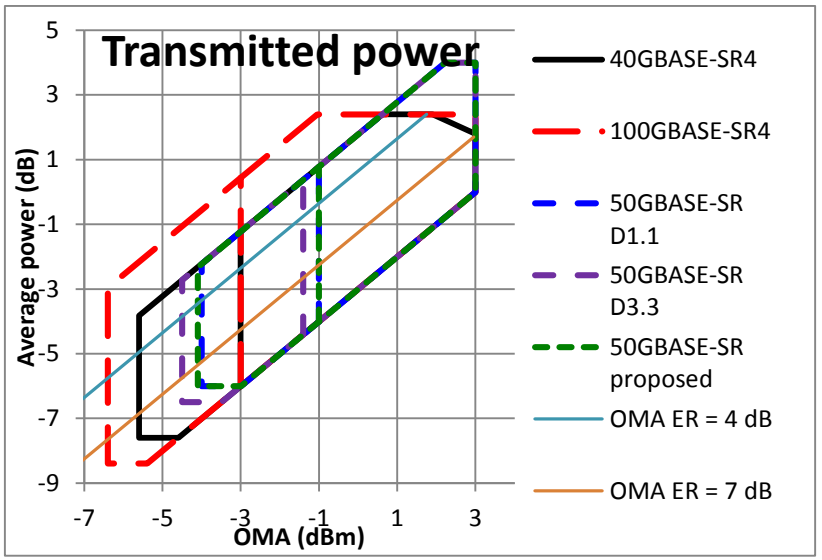


# Does this matter?

- In D3.3, the implied unstressed sensitivity for 50GBASE-SR (100 m) is about -7.3 dBm
- After converting optical power to photocurrent (subtract 1.9 dB for 1310 nm equivalent), this is equivalent to 50GBASE-LR (10 km) and 1.5 dB harder for the receiver than 50GBASE-FR (2 km)
- As well as much higher stress levels (higher TDECQ and residual penalty
- This is the wrong way round! The very short reach PMD should be easier and lower power

# Restoring the optical power levels




The changes on the left (green) restore the status quo within 0.1 dB, assuming today's TDECQ reads about 0.5 dB higher than the baseline's (4.5 vs. 4 dB)

- *See next slide for the same in bigger type*
- OMA-TDECQ from -5.9 to -5.5 dBm
- SRS OMA from -3.4 back to -3 dBm (as in the baseline and D3.2)
- Other receiver sensitivity, equation 138-1, from max(-6.5, SECQ - 7.9) to max(-6.1, SECQ - 7.5).
- Tx min OMA from -4.5 in D3.3 to -4.1 (nearly the -4 from the baseline);
- Min average power at Tx from -6.5 in D3.3 to -6 (back to the baseline);
- Min average power at Rx from -8.4 in D3.3 to -7.9 (back to the baseline)

# Restoring the optical power levels

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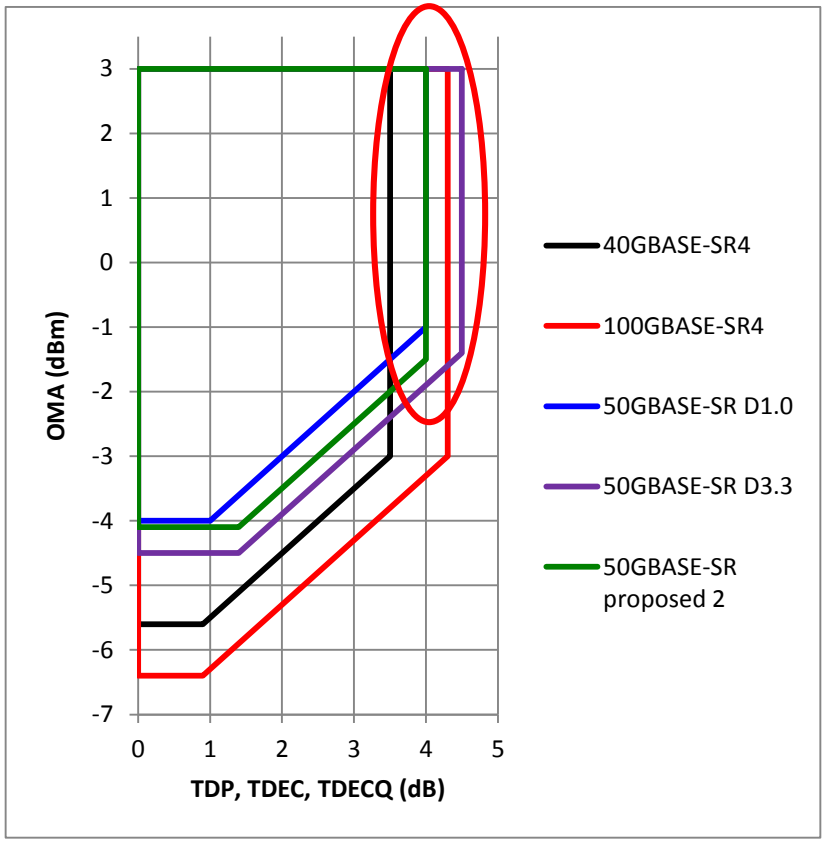
- *Most of this is in comment 25*

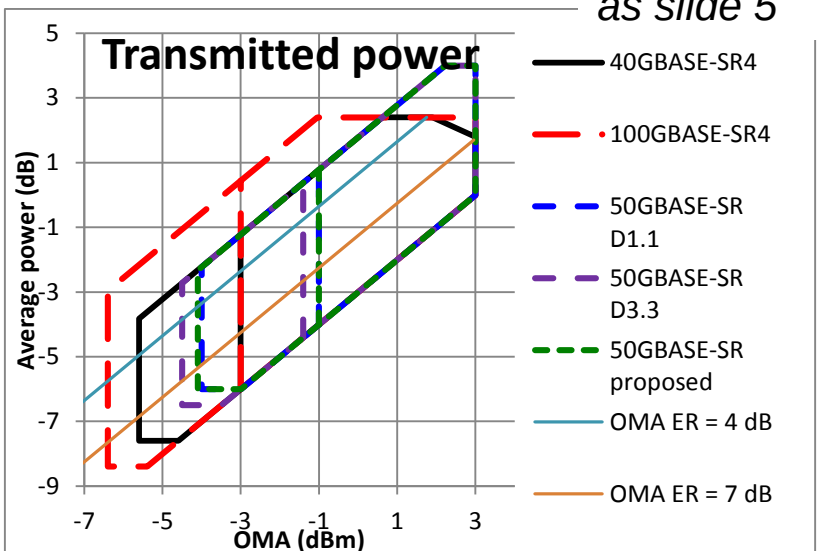
# When we are back on solid ground…

- Max TDECQ and max residual penalty, TDECQ-10log10(Ceq), are much higher for MMF than for SMF
- Although the receiver circuitry could be similar, and lower power for lower distance would be desirable

# Restoring the optical power levels and reducing max TDECQ

*RH chart same as slide 5*




The changes on the left (green) restore the status quo within 0.1 dB then reduce max TDECQ from 4.5 to 4 dB

- *See next slide for the same in bigger type*
- OMA-TDECQ from -5.9 to -5.5 dBm
- Max TDECQ from 4.5 to 4 dB
- SRS SECQ from 4.5 to 4 dB
- SRS OMA from -3.4 to -3.5 dBm (new value)
- Other receiver sensitivity, equation 138-1, from max(-6.5, SECQ - 7.9) to max(-6.1, SECQ - 7.5).
- Tx min OMA from -4.5 in D3.3 to -4.1 (nearly the -4 from the baseline);
- Min average power at Tx from -6.5 in D3.3 to -6 (back to the baseline);
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# Restoring the optical power levels and reducing max TDECQ

- OMA-TDECQ from -5.9 to -5.5 dBm
- Max TDECQ from 4.5 to 4 dB
- SRS SECQ from 4.5 to 4 dB
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- Tx min OMA from -4.5 in D3.3 to -4.1 (nearly the -4 from the baseline);
- Min average power at Tx from -6.5 in D3.3 to -6 (back to the baseline);
- Min average power at Rx from -8.4 in D3.3 to -7.9 (back to the baseline)
- Table 138-10, power budget (for max TDECQ) from 6.5 to 6 dB, and allocation for penalties (for max TDECQ) from 4.6 to 4.1 dB

# Limiting the residual penalty, 10log10(*K*) = *TDECQ* - 10log10(*Ceq*)

- Residual meaning after the reference equalizer
- Comment 30 proposes "Limit TDECQ -10*log10(Ceq) to 0.5 dB less than the max. TDECQ. E.g. for a MMF TDECQ limit of 4 dB, limit TDECQ -10*log10(Ceq) to 3.5 dB."
- This limit protects the equalizer and decision circuit or A to D from very bad waveforms, while OMA-TDECQ protects the receiver front end from excessive sensitivity demands
- Doing this does not affect any of the other Tx or Rx spec numbers
- See dawe_3cd_01_0718