

Is an additional TDECQ related limit needed?

Pete Anslow, Ciena

IEEE P802.3cd Task Force, San Diego, CA, July 2018

Background

- Comment [r03-36](#) against P802.3cd D3.2 contained:

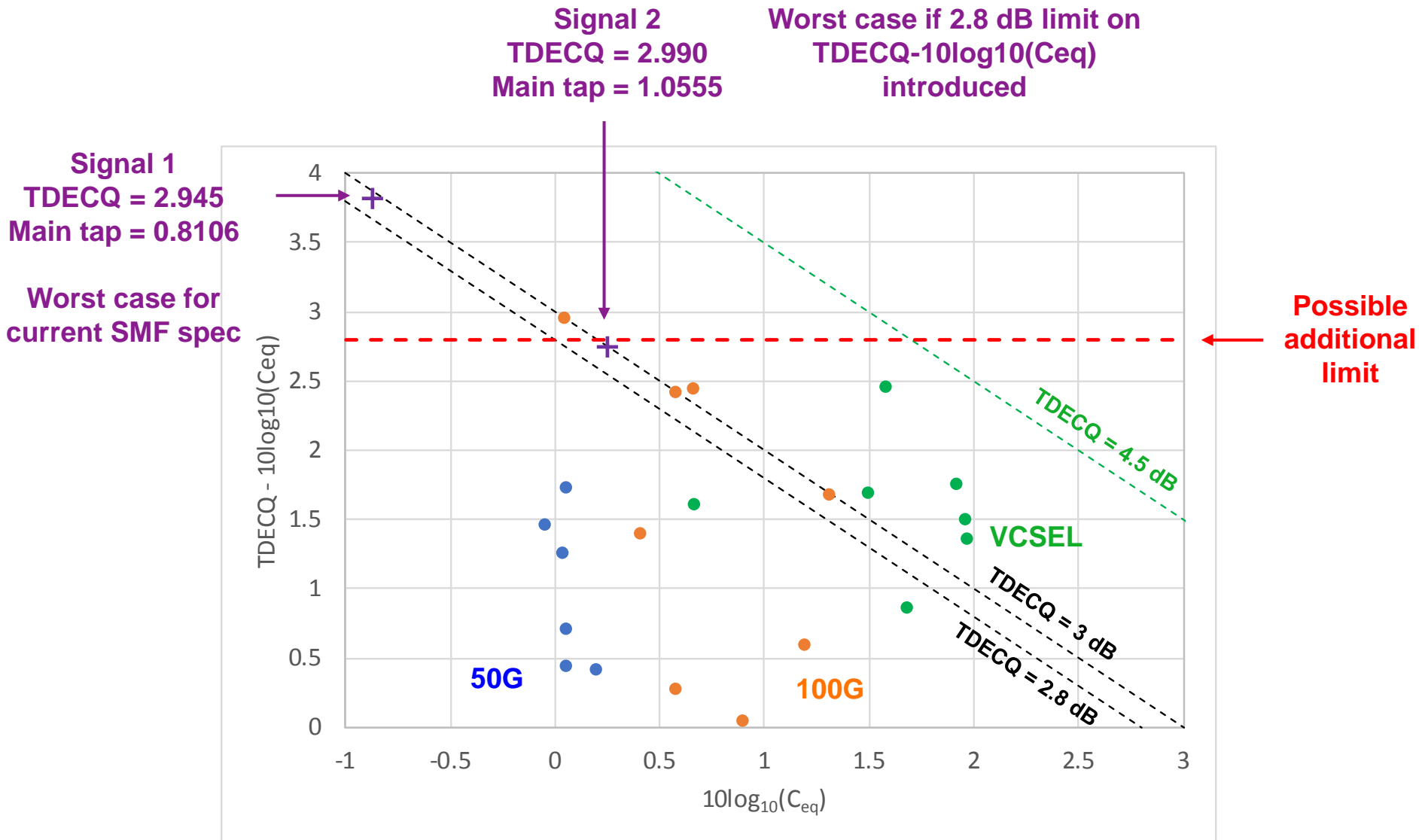
it is still possible to make a bad SMF transmitter with emphasis (e.g. with a distorted signal) that even an equalizer better than the reference equalizer won't be able to improve. Note the receiver is tested for a slow signal only, not for such signals. But notice that in the survey (e.g. [dawe_3cd_01b_0518](#) slide 8), the 50G SMF points are near neutral and below 1.8 dB, not near the upper left.

Comment [r03-36](#) proposed:

Limit TDECQ $-10 \cdot \log_{10}(C_{eq})$ to the lower of 3 dB or the max. TDECQ.

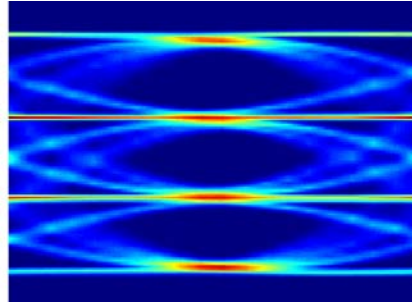
[dawe_062018_3cd_adhoc](#) follows on from this comment

Position on Piers' map



Generation of signals

- To investigate this, start with the Cisco “Golden eye” using SSPRQ:

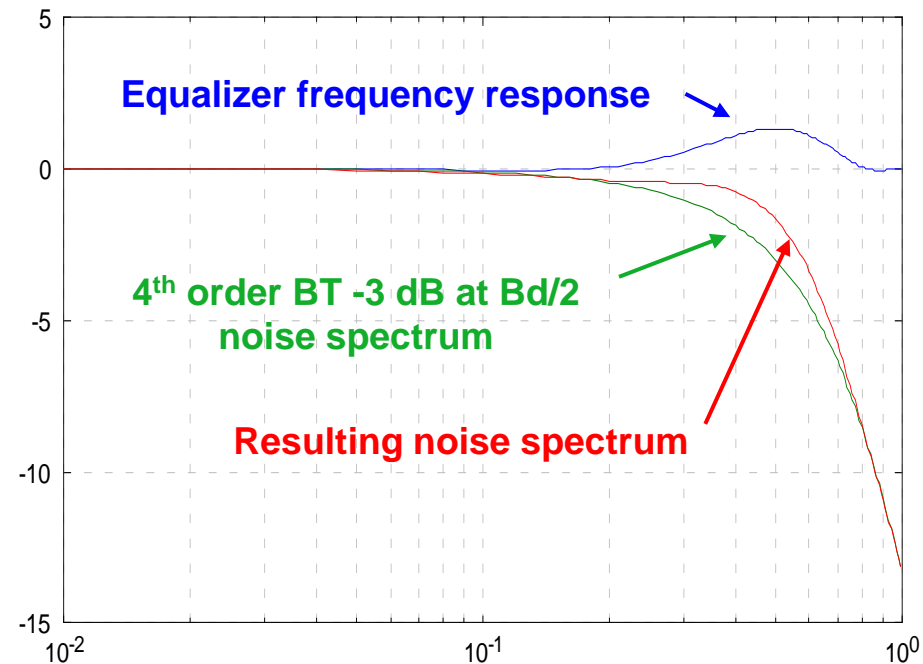
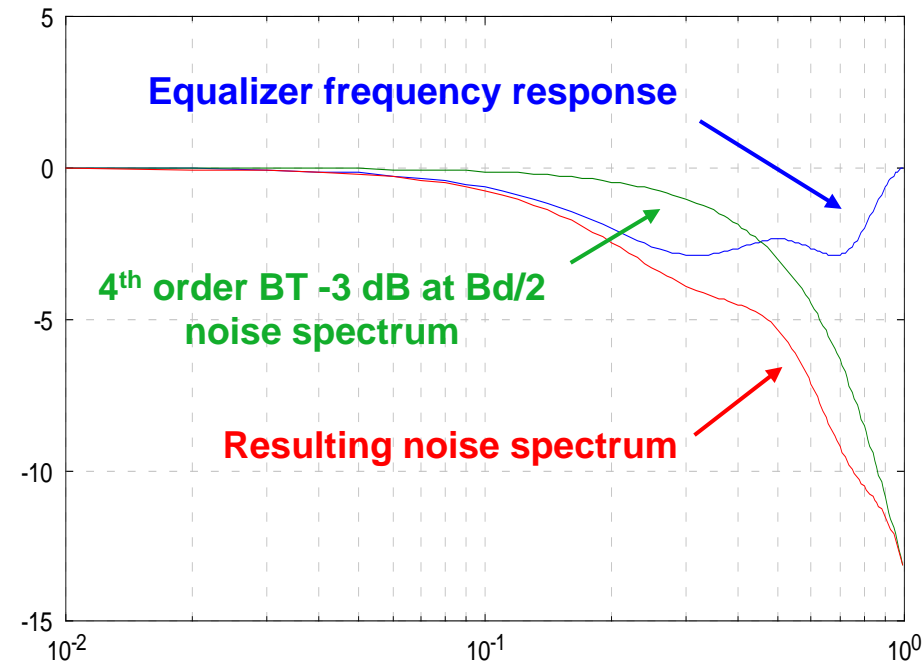


- Apply pre-emphasis via T-spaced filter
- Add a crosstalk signal (small copy of same data delayed by 8 symbols) to close the eye with non-equalizable ISI
- Filter using a 4th order BT response with -3dB at $B_d/2$
- Calculate TDECQ
- By adjusting pre-emphasis and crosstalk, generate two signals as shown on next page

Equalizer frequency response for the two cases

Signal 1
TDECQ = 2.945
Main tap = 0.8106

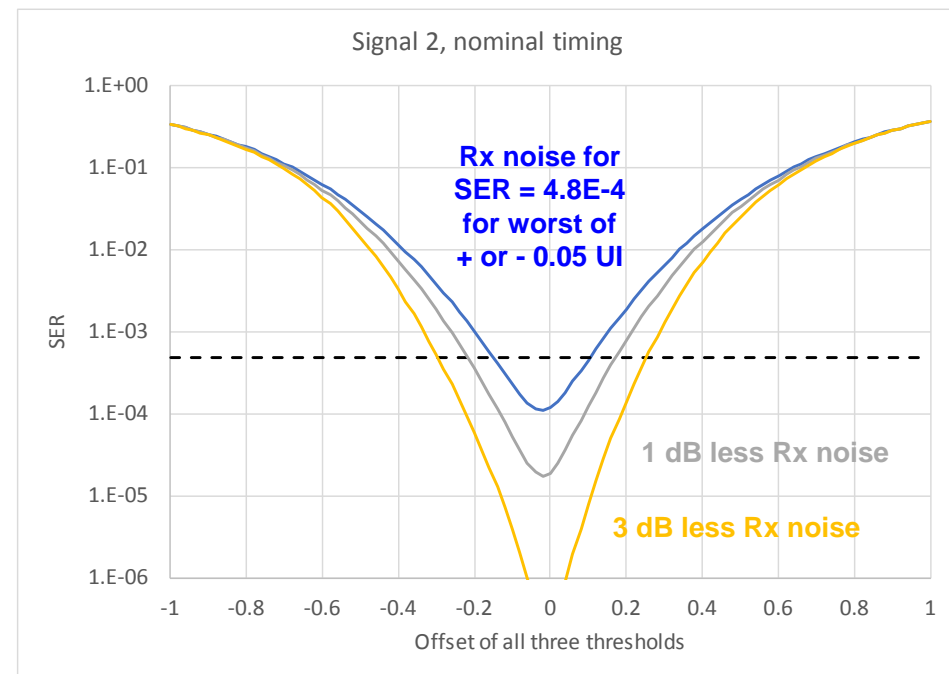
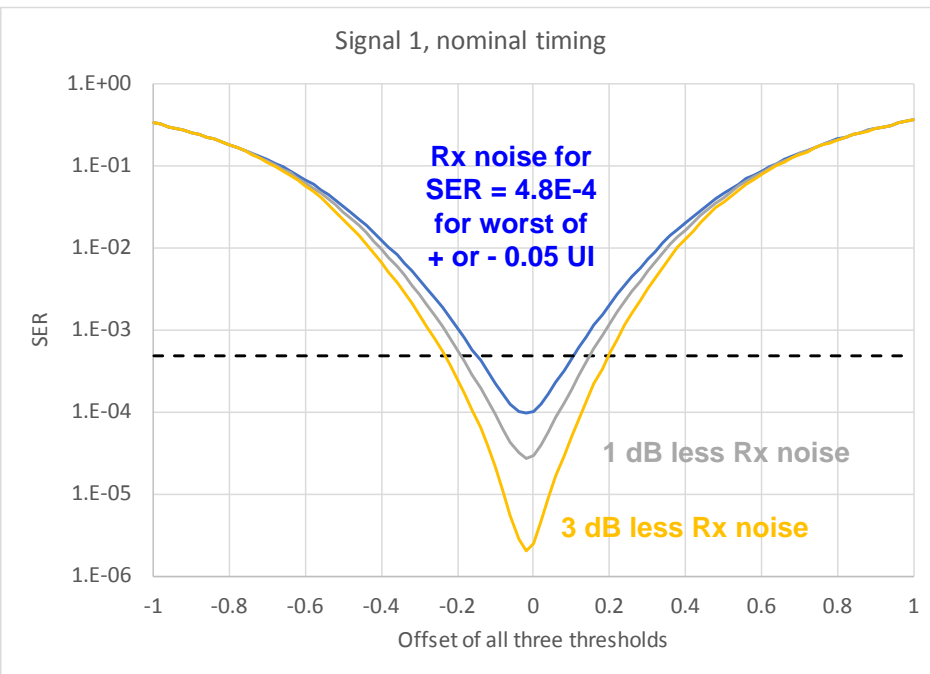
Signal 2
TDECQ = 2.990
Main tap = 1.0555



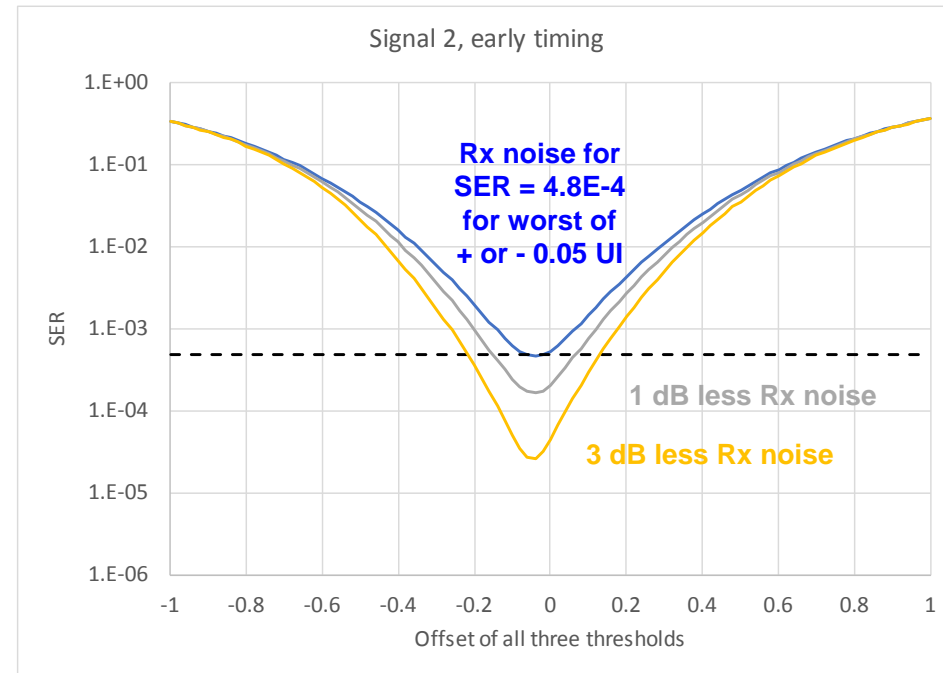
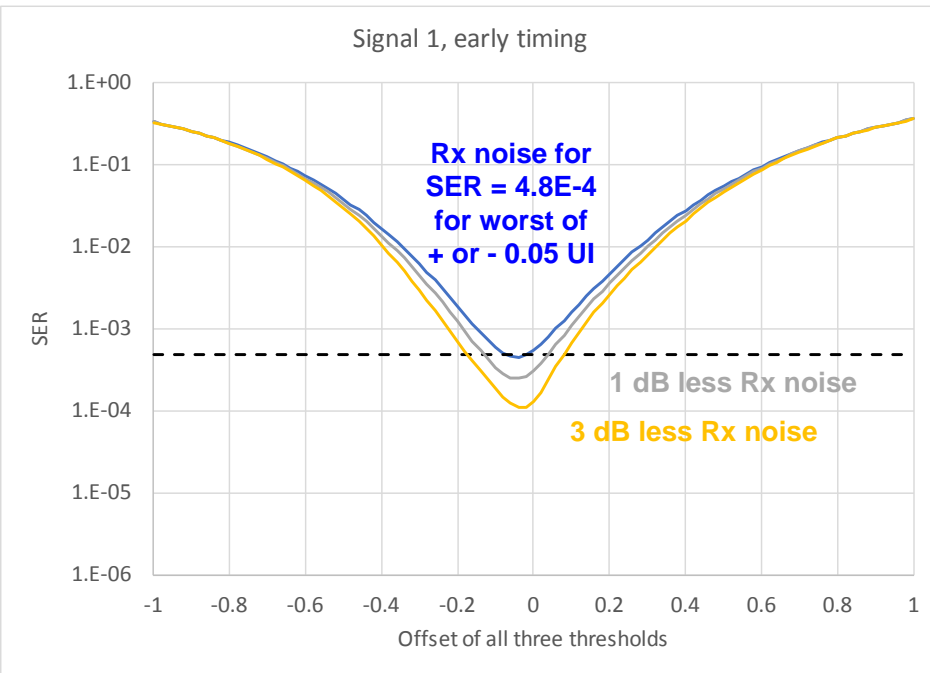
SER Vs offset

- Having established the two signals, the following pages contain plots of symbol error ratio (SER) vs offset of the decision thresholds
- All three decision thresholds are offset by the same amount with respect to their nominal positions
- An offset of 1 moves the thresholds to the nominal symbol levels
- Page 7 shows SER vs offset for nominal timing
- Page 8 shows SER vs offset for 0.05 UI early timing
- Page 9 shows SER vs offset for 0.05 UI late timing

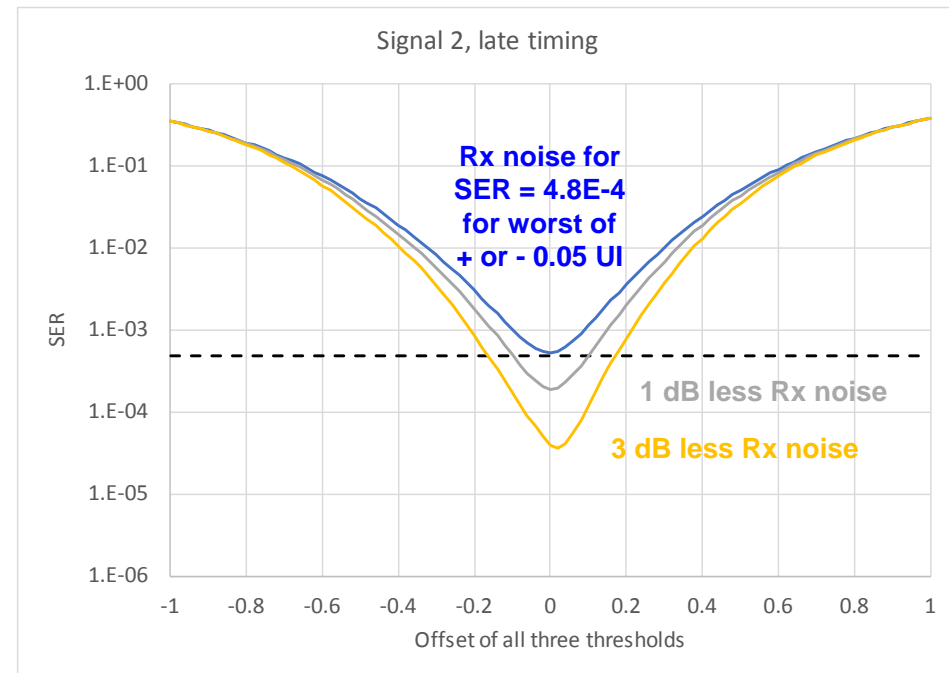
Results, nominal timing



Results, 0.05 UI early timing



Results, 0.05 UI late timing



Conclusion

- For signal 1, the equalizer filters out some of the receiver noise, whereas for signal 2, the equalizer increases the noise.
- Because of this, reducing the receiver noise improves the SER more in the case of signal 2 than it does in the case of signal 1.
- However, introducing a limit on $TDECQ - 10 \cdot \log_{10}(C_{eq})$ of even 2.8 dB for SMF PMDs does not appear to make a sufficiently large difference that removing these transmitters is compelling.

Thanks!