Information on TDECQ & CD penalty for 100G PAM4 from 802.3cu project

Peter Stassar, Huawei
P802.3dk meetings, 802.3 interim meeting January 2023

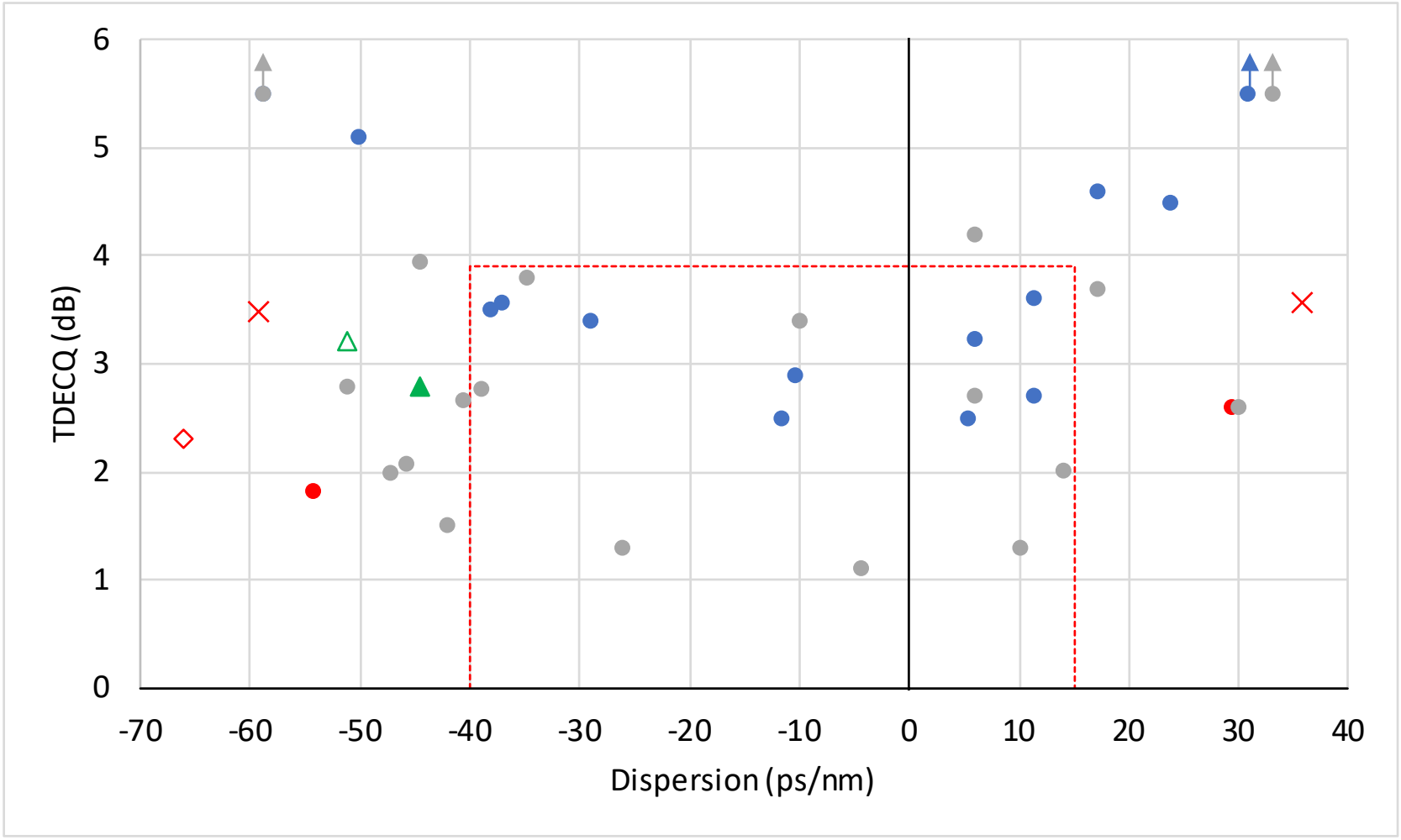
Introduction

During the 802.3cu project a lot of experimental data on TDECQ and CD penalty for 100G PAM4 was made available from a variety of sources.

Most of this information is contained in the presentation stassar_3cu_01_0919 to the IEEE P802.3cu Task Force meeting in Indianapolis, 9 September 2019, by Peter Stassar and Pete Anslow.

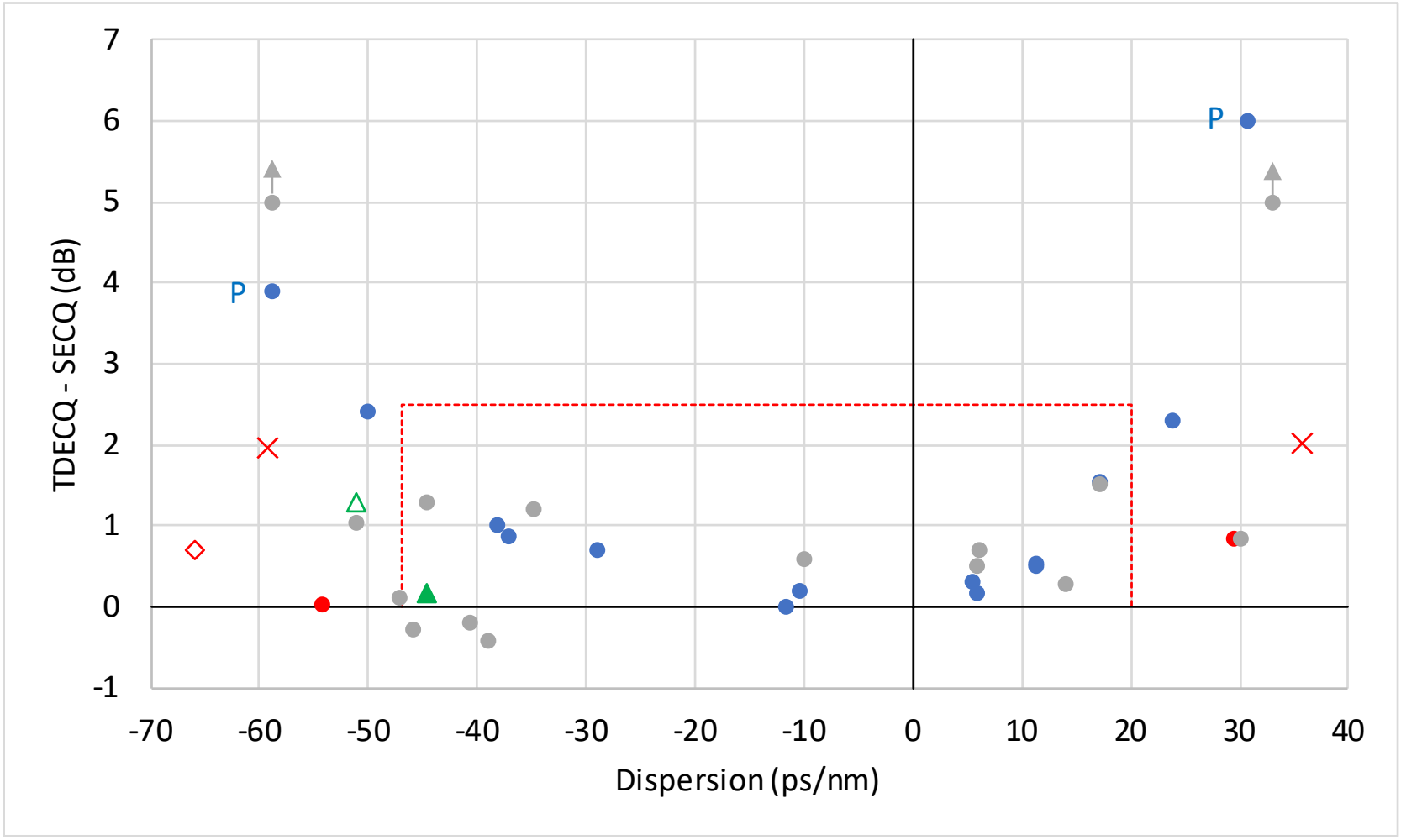
In this presentation to the P802.3dk TF the fundamental information from stassar_3cu_01_0919 has been reproduced in a form reformatted to fit the in-force specifications from clauses 140 and 151 (cu project).

TDECQ vs dispersion



- johnson_optx_01_0319 un-optimised
- johnson_optx_01_0319 optimised
- yu_optx_01a_0319
- P yu_optx_01a_0319 predicted
- lewis_cu_adhoc_041719
- schube_3cu_01_0519 Si Ph (CD pen)
- mazzini_3cu_adhoc_082119 Si Ph
- 100G Lambda MSA
- 100G Lambda MSA excessive
- –40 to 15 ps/nm with 3.9 dB penalty

TDECQ – TECQ vs dispersion (shown as TDECQ – SECQ)



- johnson_optx_01_0319 un-optimised
- johnson_optx_01_0319 optimised
- yu_optx_01a_0319
- P yu_optx_01a_0319 predicted
- lewis_cu_adhoc_041719
- schube_3cu_01_0519 Si Ph (CD pen)
- mazzini_3cu_adhoc_082119 Si Ph
- 100G Lambda MSA
- 100G Lambda MSA excessive
- –47 to 20 ps/nm with 2.5 dB penalty

NOTE: 802.3cu introduced TECQ parameter

Observations and decisions by 802.3cu

- The results for TDCEQ versus chromatic dispersion are quite scattered
- The results for TDECQ – TECQ are much better correlated and are quite consistent
- The philosophy behind TDECQ for PAM4 based transmitters (as TDP for NRZ based transmitters) was to allow trade-off between transmitter distortion and penalties due to chromatic dispersion.
- Since the consideration of TDECQ values in the range of 3.9 dB (higher than current in-force values of up to 3.4 dB), transmitters causing TDECQ – TECQ penalties in excess of 2.5 dB, became likely, which should be avoided (for values the penalty could significantly increase for small increases of chromatic dispersion).
- As a result 802.3cu decided to introduce 2 new parameters and associated values:
  - TECQ “Transmitter eye closure for PAM4” with a limit of 3.4 dB.
  - |TDECQ – TECQ|, effectively being the CD penalty, with a limit of 2.5 dB.

Recommendations

The presented experimental data from the 802.3cu project can be used by the P802.3dk project to develop appropriate dispersion limits and associated wavelengths for the PMDs under development.

Thanks!