TDECQ and dispersion penalty for 400GBASE-LR4

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Introduction

A set of possible values for 400GBASE-LR4 was presented in lewis_optx_01a_0319. This presentation suggested that a CWDM wavelength grid and a maximum TDECQ of 3.9 dB might be suitable choices for the Task Force to make.

yu_optx_01a_0319 and lewis_cu_adhoc_041719 contained measurement results for 100G per lane PAM4 in the presence of chromatic dispersion.

stassar_cu_adhoc_041719 provided analysis of the dispersion values that would be required for various wavelength and fiber restriction choices. (see next slide)

This presentation brings all of this data together in the following charts. In addition, some data points have been added courtesy of an anonymous survey undertaken in the 100G Lambda MSA (from multiple suppliers).

Extract from stassar_cu_adhoc_041719

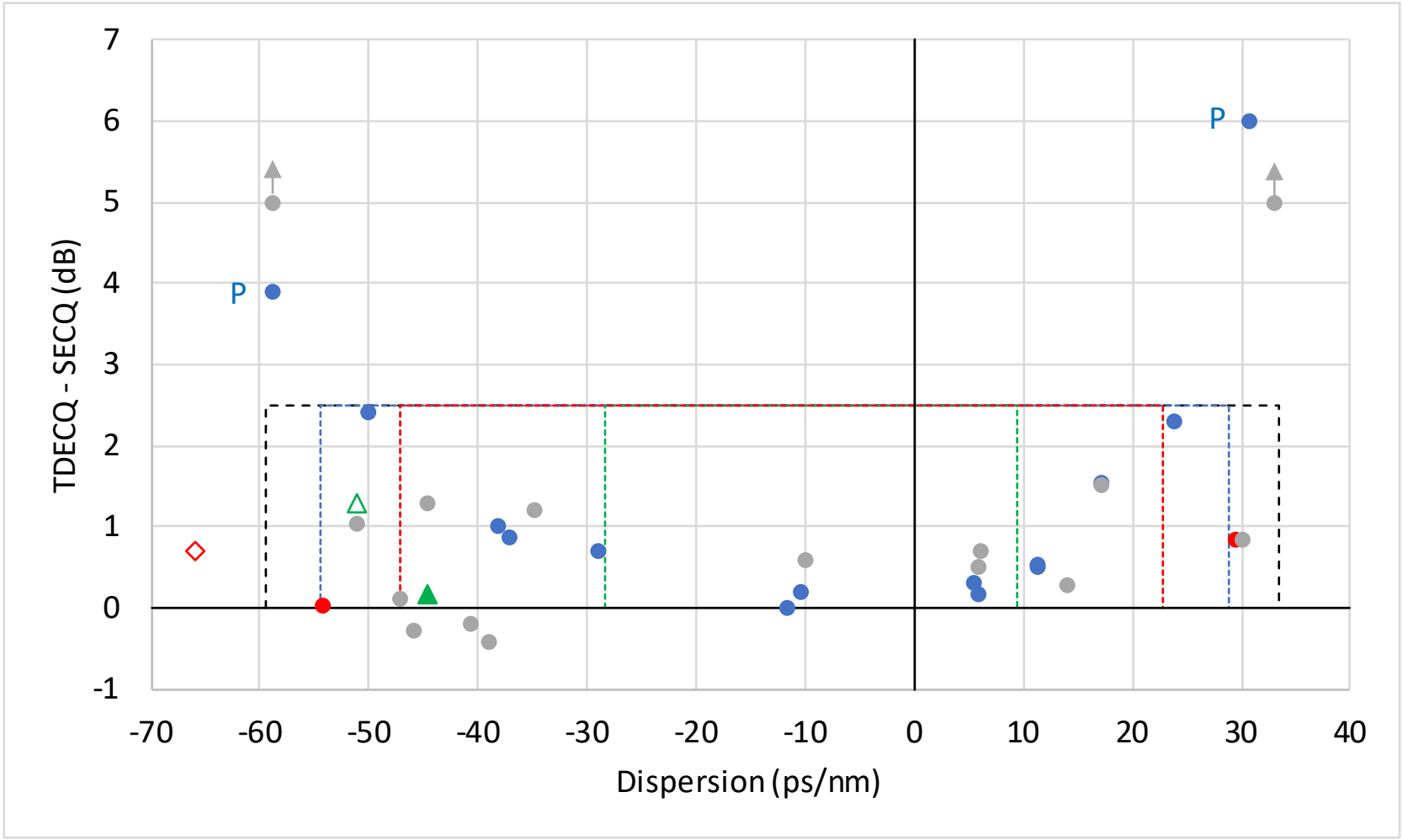
Dispersion value calculations for 802.3 and restricted fiber

	Wavelength [nm]	Dispersion [ps/nm] for 10 km	
Grid	Lowest and highest wavelengths out of 4	*Standard SMF in IEEE 802.3 with λ_0 = 1300 to 1324 nm and S_0 = 0.093 ps/nm^2.km*	*Restricted SMF with λ_0 = 1305 to 1320 nm and S_0 = 0.092 ps/nm^2.km*
CWDM	1264.5 to 1277.5	**-59.4** to -45.7	**-54.5** to -41.1
CWDM	1324.5 to 1337.5	22.2 to **33.4**	17.5 to **28.8**
CWDM restricted	1271.5 to 1277.5	**-51.9** to -45.7	**-47.2** to -41.1
CWDM restricted	1324.5 to 1330.5	22.2 to **27.4**	17.5 to **22.8**
800 GHz	1294.53 to 1296.59	**-28.4** to -26.3	**-24.1** to -22.1
800 GHz	1308.09 to 1310.19	7.5 to **9.4**	2.8 to **4.7**

Notes:

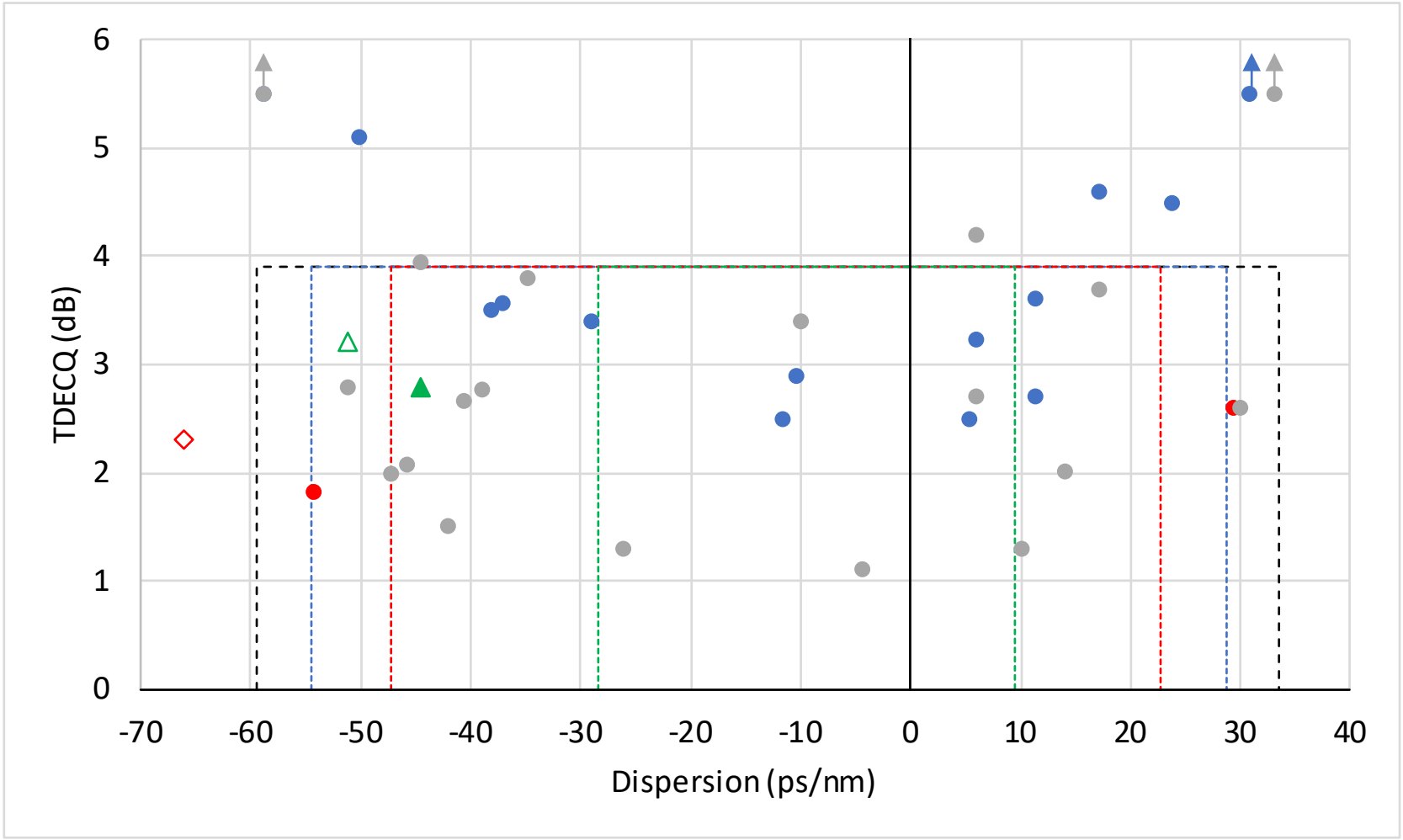
- For CWDM restricting the fiber specification provides a reduction in CD of 8.2% at 1264.5 nm and 13.7% at 1337.5 nm. To obtain the same positive dispersion reduction with standard SMF requires reducing the max length from 10 km to 8.6 km. If the CWDM wavelength range is reduced from ±6.5 nm to ±3 nm CD further reduces. To obtain the same positive dispersion reduction with standard SMF requires reducing the max length from 10 km to 8.3 km.
- For comparison for 800 GHz grid restricting the fiber specification provides a reduction in CD of 14.4% at 1294.53 nm and 49% at 1310.19 nm

TDECQ – SECQ 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)
- 100G Lambda MSA
- 100G Lambda MSA excessive
- CWDM grid
- CWDM restricted fiber
- Restricted CWDM, restricted fiber
- 800 GHz grid

TDECQ vs dispersion



- johnson_optx_01_0319 un-optimised
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- yu_optx_01a_0319
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- 100G Lambda MSA excessive
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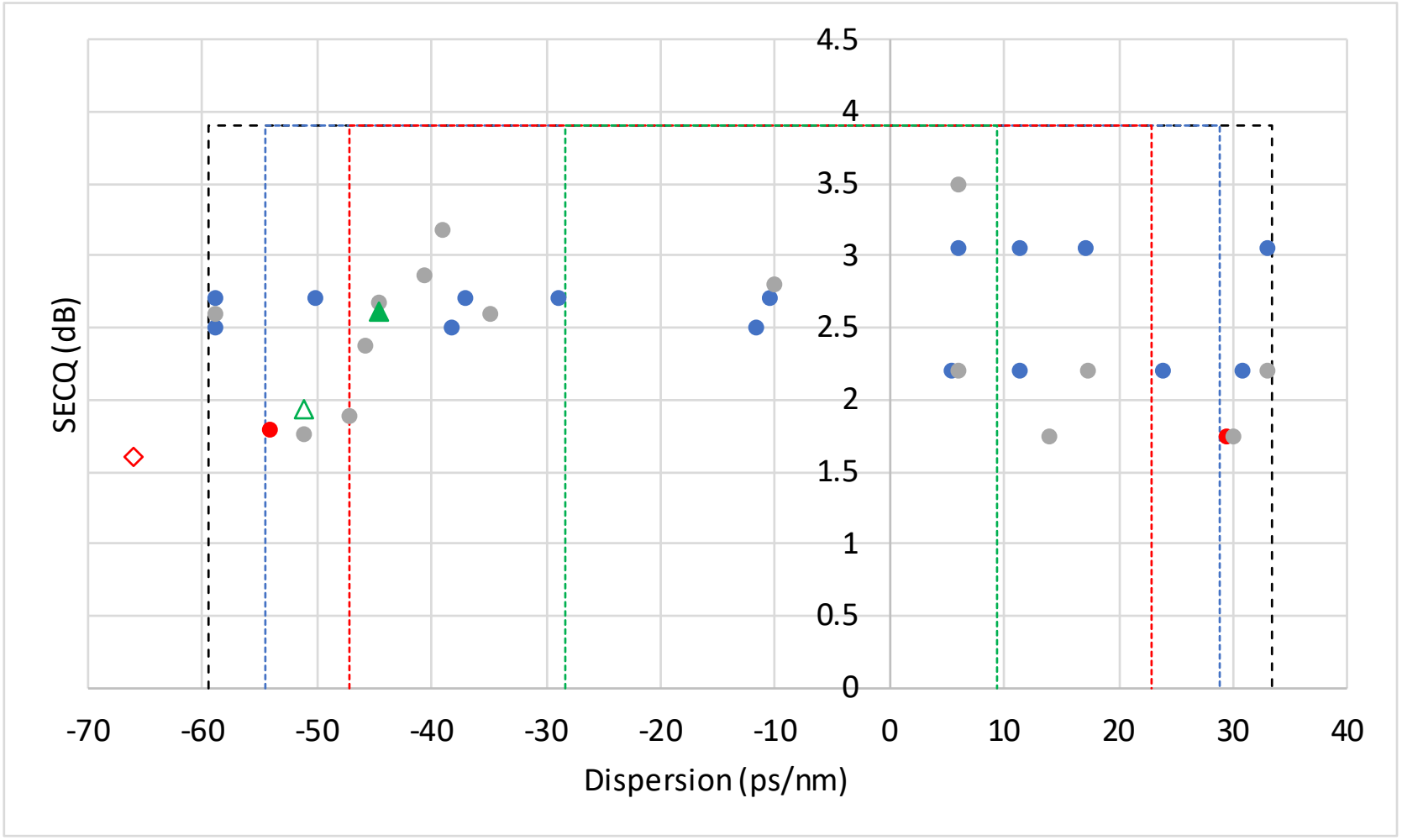
SECQ vs dispersion



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- schube_3cu_01_0519 Si Ph
- 100G Lambda MSA
- CWDM grid
- CWDM restricted fiber
- Restricted CWDM, restricted fiber
- 800 GHz grid

Observations

- The curve for TDECQ – SECQ versus dispersion shows the expected shape with a modest amount of scatter.
- The curve for TDECQ versus dispersion shows significantly more scatter.
- One provisional conclusion may be that a limit for TDECQ – SECQ would be a good idea.
- The major contributor to TDECQ is SECQ, which is between 1.6 and 3.1 dB, with only one exception.
- The SECQ versus dispersion plot does not show much evidence that the devices have been tuned for best TDECQ at the expense of SECQ.
- We need to see more data for devices optimized for 10 km transmission, before being able to draw conclusions on maximum TDECQ, maximum TDECQ minus SECQ and maximum tolerable chromatic dispersion values (impacting the choice of transmitter wavelengths).

Thanks!