Dispersion Spec Trade-offs for 80 km Objective

Ilya Lyubomirsky, Bo Zhang, Tomas Maj, Inphi Corp.

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Introduction

- The TF objectives include:

  Provide a physical layer specification supporting 100/400 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system

- This contribution attempts to clarify the trade-offs for choosing chromatic dispersion specs consistent with an 80 km reach objective, without overly burdening the receiver equalization complexity/power

Impact of Dispersion on Equalizer Complexity

- Chromatic dispersion causes a pulse to spread in time, with the spread Δt given by

$$\Delta t = D * L * \Delta\lambda$$

where L is the link distance in km, D is the dispersion coefficient with units ps/nm/km, and $\Delta\lambda$ is the signal spectral width in nm

- The required number of equalizer taps is approximately give by

$$N_{taps} \approx \frac{\Delta t}{T_s} = \frac{D * L * \Delta\lambda}{T_s}$$

where T_s is the sampling period of the equalizer

- **Required number of equalizer taps scales with the total dispersion D*L in units of ps/nm**

Dispersion Coefficient D for Standard Single Mode Fiber

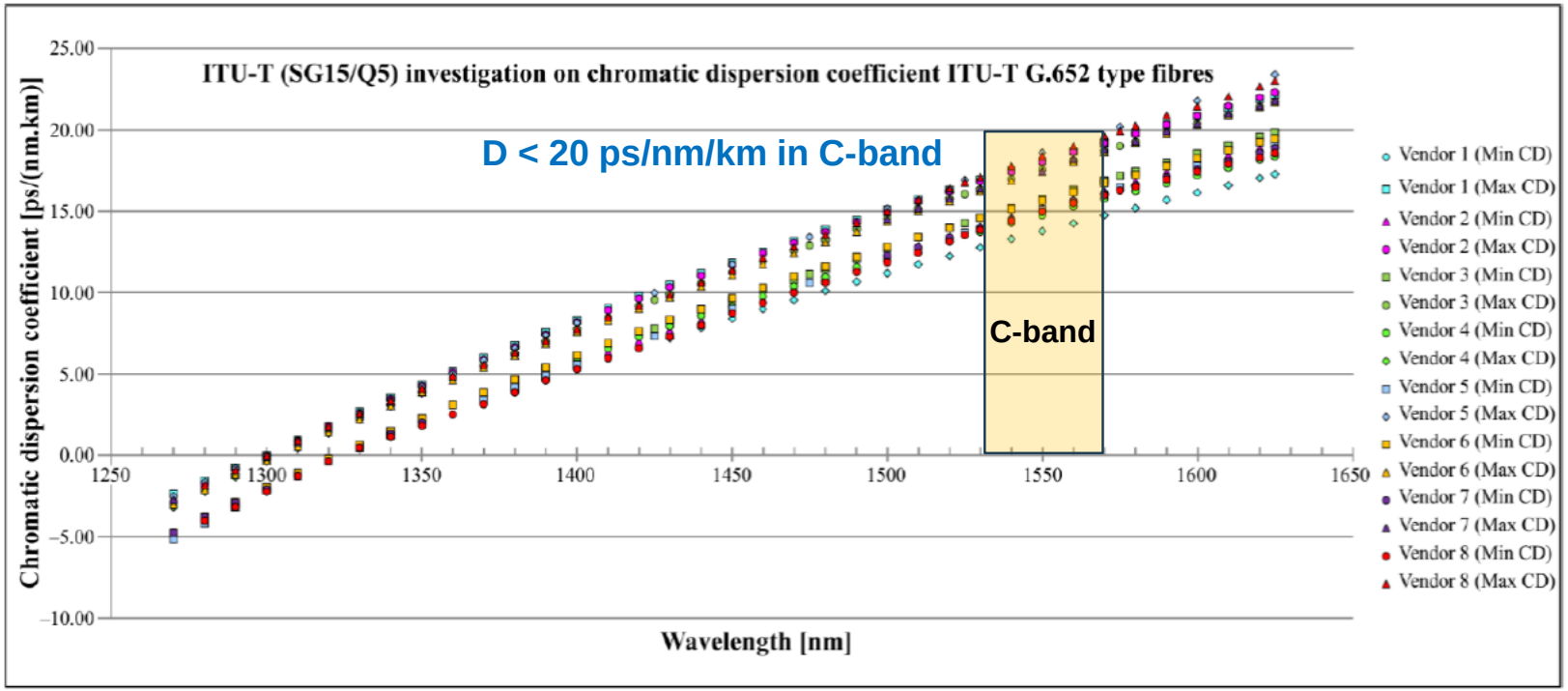

Figure II.1 – Investigation on maximum and minimum chromatic dispersion coefficient for G.652.D type fibres over the wavelength range 1270 nm to 1625 nm

Potential Maximum Dispersion Specs.

Distance (km)	Dispersion (ps/nm)	Relative EQ Complexity (%)
80	1600	baseline
90	1800	12.5
100	2000	25
120	2400	50

Dispersion Specs. for Black Link Characteristics

Proposal 1: Using max value of D for 80 km; no additional margin

Description	Value	Unit
Residual Chromatic dispersion (min)	0	ps/nm
Residual Chromatic dispersion (max)	1600	ps/nm

Proposal 2: Using max value of D for 80 km with additional margin of +/- 200 ps/nm

Description	Value	Unit
Residual Chromatic dispersion (min)	-200	ps/nm
Residual Chromatic dispersion (max)	1800	ps/nm

Conclusions

- Choosing the max. dispersion spec. value involves trade-off between equalizer complexity (power) versus how much additional dispersion is supported above an 80 km objective
- Proposal 1 is a “minimalist” approach to support a reach objective of 80 km and not any more
- Proposal 2 adds an additional margin of 200 ps/nm (10 km) on top of the reach objective of 80 km; provides margin without overly burdening the equalizer complexity
- Other proposals to spec. max. dispersion for 100 km or even 120 km may significantly increase equalizer complexity