RMS Spectral Width

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Introduction

- RMS spectral width is specified as maximum 0.6 nm for both 844 – 863 nm and 900 – 918 nm channels in Table 150 – 7 of Draft 1.1.

- Fiber chromatic dispersion is 22% lower at 900 nm compared to 844 nm.

  A maximum of 0.65 nm was suggested in king_3cm_01a_0718 for the 900 – 918 nm channel based on the lower fiber chromatic dispersion at the longer wavelength channel.

- A change from 0.60 to 0.65 nm for the maximum RMS spectral width on the 900 – 918 nm channel will promote supply assurance and reduce the manufacturing/test cost of 900 – 918 nm VCSEL arrays.

RMS Spectral Width

Impact of changing max RMS spectral width 0.60 ➡ 0.65 nm for the 900 – 918 nm channel:

- Mode partition noise penalty
  Penalty at 844 nm is higher (even with Uw 0.65 nm at 900 nm).

- TDECQ filter reference response
  Calculated at 918 nm.

MPN

- The product of the fiber chromatic dispersion D and RMS spectral width U_W is a figure of merit for the mode partition noise penalty.

  Product $D \cdot U_W$ is lower for the 900 – 918 nm channel with a max U_W of 0.65 nm when compared to the 844 – 863 nm channel with max U_W of 0.60 nm.

λ (nm)	D (ps/(nm·km)) [1]	Max U_W (nm)	Product $D \cdot U_W$ (ps/km)
900	-89.8	0.60	-53.9
		0.65	-58.4
844	-115.7	0.60	-69.4

Lower at 900 nm

- Using other fitted values to the fiber chromatic dispersion model leads to the same conclusion as above:

	U_0 = 1320 nm	S_0 = 0.11 ps/(nm^2·km)
	U_0 = 1316 nm	S_0 = 0.10275 ps/(nm^2·km)
OM5	U_0 = 1328 nm	S_0 = 0.093477 ps/(nm^2·km)

- The maximum RMS spectral width of 0.60 nm for the 850 nm channel is compatible with other Standards (e.g. P802.3cm SR8; 802.3cd SR4).

1. Fiber chromatic dispersion calculated using 10 GbE spreadsheet methodology with zero dispersion wavelength U_0 of 1320 nm and zero dispersion slope S_0 of 0.11 ps/(nm^2·km).

TDECQ Filter Bandwidth

- The TDECQ filter replaces the MMF and receiver with an effective 4th order Bessel-Thompson filter.

Element	Unit	Minimum Bandwidth[1] at 918 nm		
		OM3 70m	OM4 100m	OM5 150m
Modal Dispersion	MHz·km	1208	1846	2885
Chromatic Dispersion 0.60 ➡ 0.65 nm	MHz·km	3770 ➡ 3480	3770 ➡ 3480	4299 ➡ 3968
Modal Dispersion	–3dBo GHz	17.3	18.5	19.2
Chromatic Dispersion 0.60 ➡ 0.65 nm	–3dBo GHz	53.9 ➡ 49.7	37.7 ➡ 34.8	28.7 ➡ 26.5
Receiver	–3dBe GHz	13.28125	13.28125	13.28125

- TDECQ reference filter bandwidth decreases by a negligible amount when the maximum RMS spectral width is changed from 0.60 to 0.65 nm for the 900 – 918 nm channel. The reference filter bandwidth of 9 GHz noted in Section 150.8.5 of Draft 1.1 can be used without any change.

λ (nm)	Max U_W (nm)	TDECQ Filter –3dBe BW (GHz)		
		OM3 70m	OM4 100m	OM5 150m
918	**0.60**	9.05	9.08	9.01
918	**0.65**	9.04	9.05	8.96

Calculations by Jonathan Ingham.[2]

1. Fiber chromatic dispersion model with U_0 = 1320 nm and S_0 = 0.11 ps/(nm^2·km) for OM3 and OM4, and U_0 = 1328 nm and S_0 = 0.093477 ps/(nm^2·km) for OM5. Minimum EMB guidance from IEC, see kolesar_3cm_01_1118.pdf.
2. Model described in ingham_3cm_02_0918.pdf.

Summary

[Comment on Draft 1.1]

- Propose maximum RMS spectral width of 0.65 nm for the 900 – 918 nm channel.