

Update to Modern SMF Parameters for Calculating PMD (Physical Medium Dependent) Penalties

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Background

- ITU-T G.652 SMF codes, which underlie all 802.3 optical standards, specify ZDW (Zero Dispersion Wavelength) from 1300 to 1324nm
- 1300 – 1305 nm ZDW SMF is not found in modern applications
- Yet all 802.3 standards use the ITU-T ZDW limits
- This unnecessarily burdens design
- Significantly increases testing cost
 - To properly test, SMF with 1300nm and 1324 ZDW must be used
 - This requires special order SMF with custom doping and other costly steps
- As a result, in actual manufacturing environments, standard SMF is used
 - Modules are not verified for wavelengths near ZDW; ex. CWDM4 L2
 - This works out fine, because the specified ZDW range is not found in the field

Background, cont.

- Over the past decade, we have repeatedly tried to make the 802.3 SMF ZDW spec. realistic, for example:

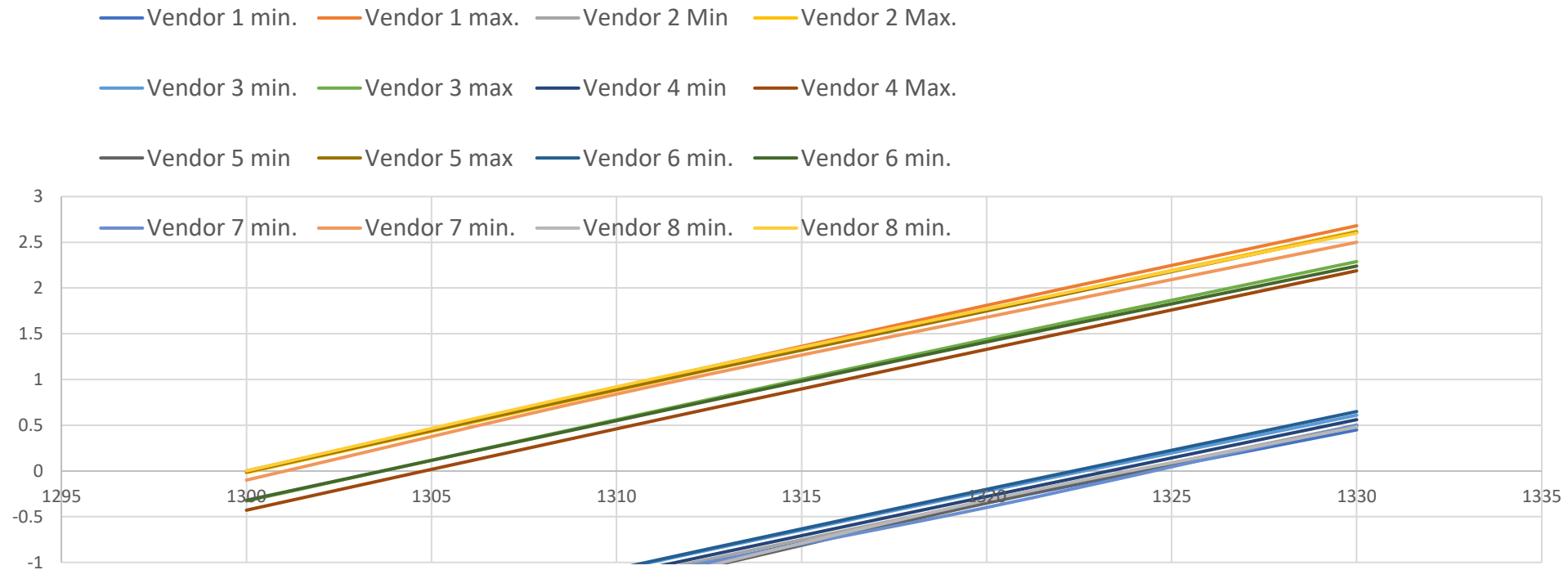
https://www.ieee802.org/3/cu/public/May19/cole_3cu_01a_0519.pdf [ieee802.org]

- In each case, we have been asked to go back to ITU-T to change the spec
- Because of a variety of reasons this has never been successful
- One reason is that DWDM applications, which are of primary interest in ITU-T, are in C-band where the exact value of ZDW doesn't much matter
- As Baud rate goes up, this spec. becomes more important
- IEEE 802.3 should base optical specifications on realistic fiber parameters

ITU SG15/Q5 Dispersion Data for G.652.D SMF ZDW, Nov. 2016

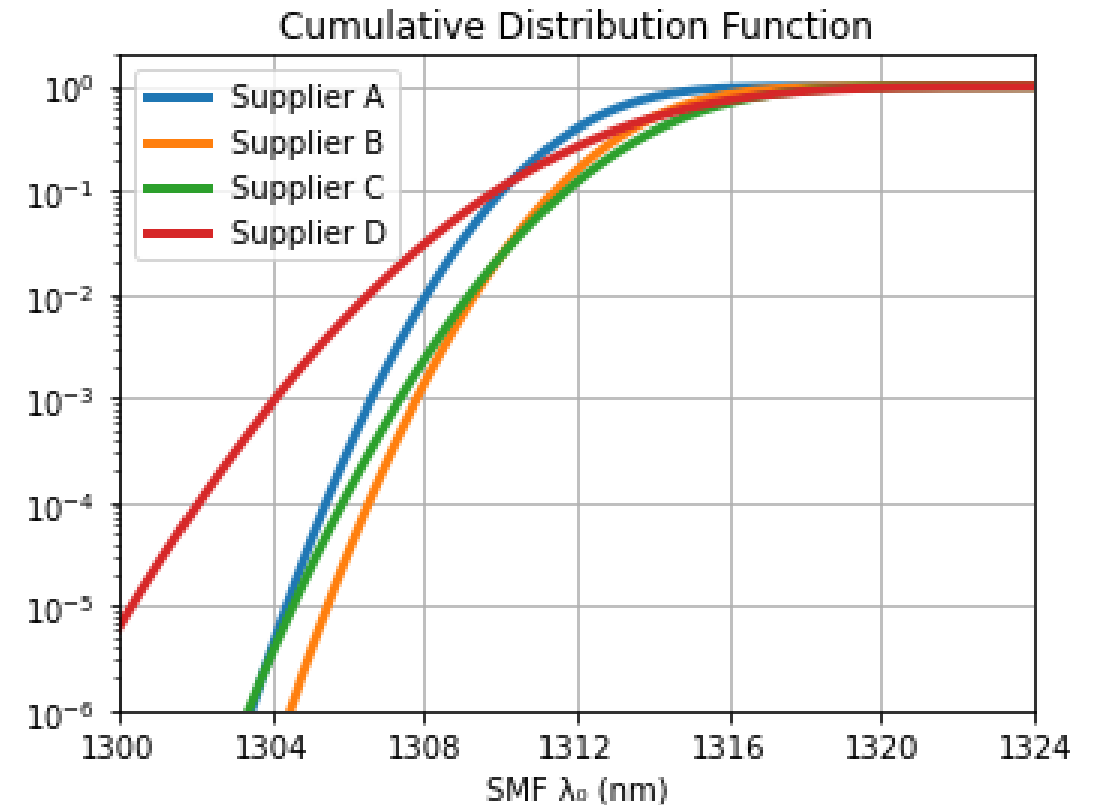
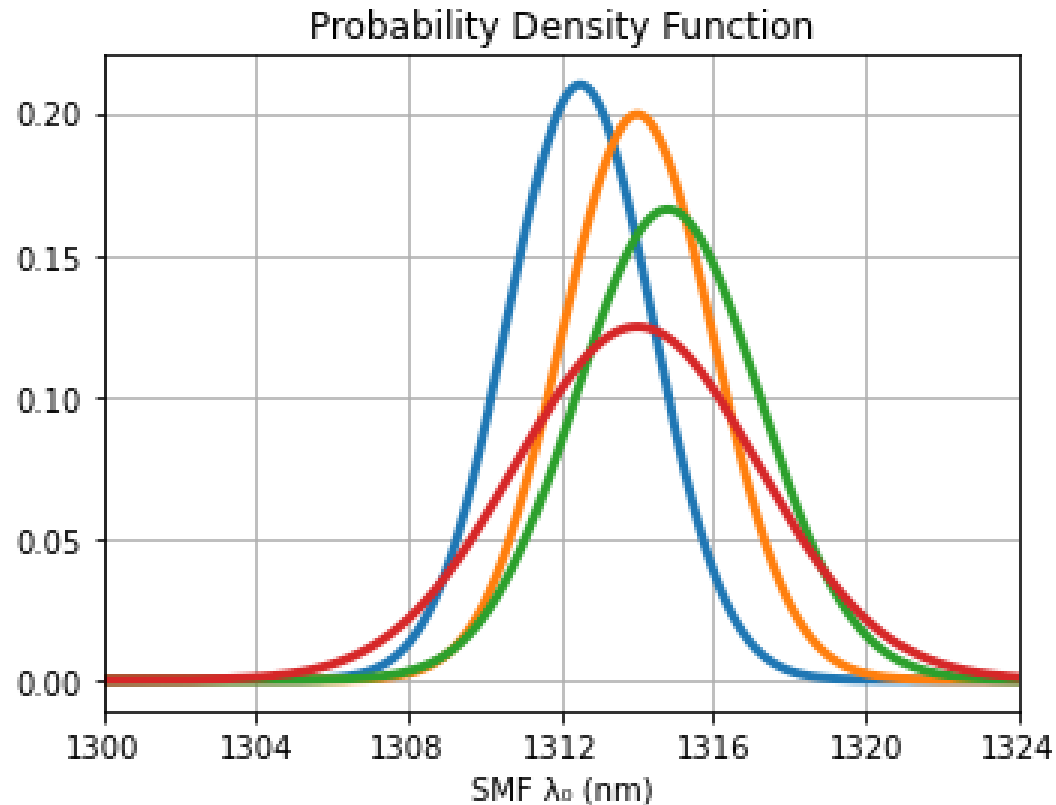
- 8 Suppliers
- Only Min. and Max.
- No market share data

https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-G.652-201611-I!!PDF-E&type=items [itu.int]



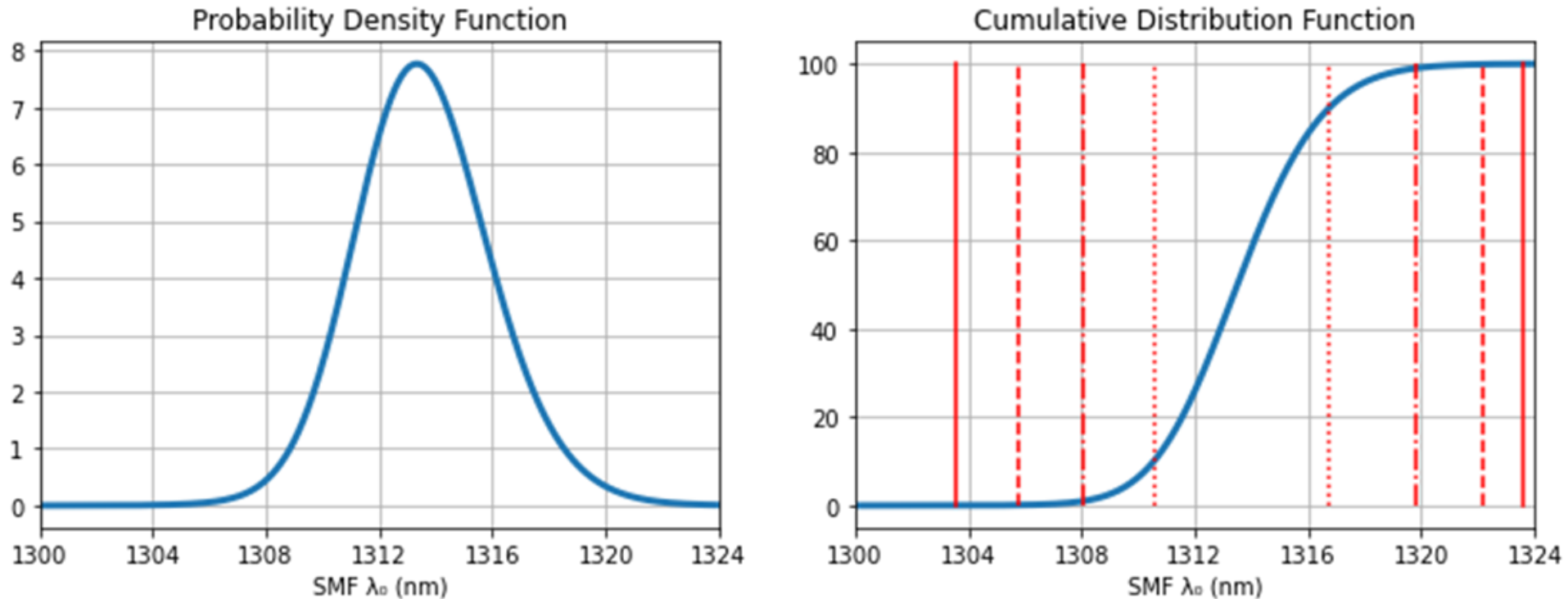
Global Optical Fiber and Cable Market Share: <http://www.networktelecom.cn/dianxin/2021/baogao/cn/index.html>

Data from Four SMF Suppliers Representing ~50% Market Share



- Suppliers from China, Japan and United States
- Each PDF is normalized (same final CDF value)

Data from Four SMF Suppliers Combined by Market Share



ZDW Range	
—	0.01% - 99.99%: 1303.6nm - 1323.6nm
- - -	0.10% - 99.90%: 1305.8nm - 1322.1nm
- · - ·	1.00% - 99.00%: 1308.1nm - 1319.8nm
· · · ·	10.00% - 90.00%: 1310.6nm - 1316.7nm

Recommendation

- IEEE 802.3df and 802.3dj explore adoption of the following example ZDW (Zero Dispersion Wavelength) limits for use in calculating penalties for all SMF PMDs (Physical Medium Dependents):

$$\text{ZDW}_{\min} = 1306\text{nm}$$

$$\text{ZDW}_{\max} = 1322\text{nm}$$

- Consider adding a footnote to spec. tables noting that modern SMF is assumed
- Explore use of ZDW distribution in statistical link performance analysis, for example:
https://www.ieee802.org/3/df/public/22_10/22_1012/rodes_3df_01b_221012.pdf#page=8
- Future IEEE 802.3 Task Forces can use the adopted limits as their reference points

Update to Modern SMF Parameters

Thank you