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CWDM Wavelength Spacing

Proposal for clarification of the 200GBASE-FR4 wavelength spacing budget

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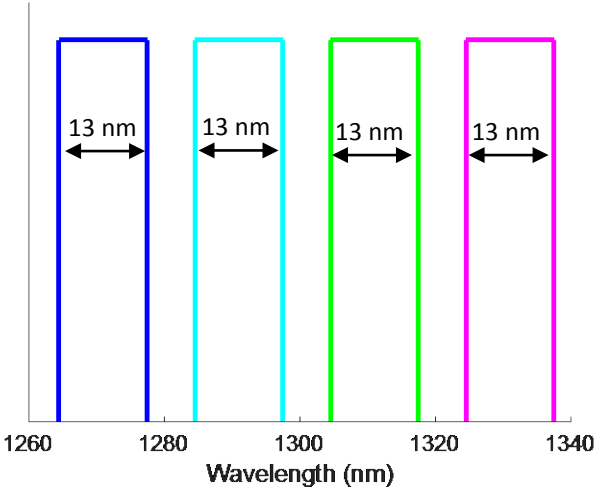
200GBase-FR4 Wavelengths

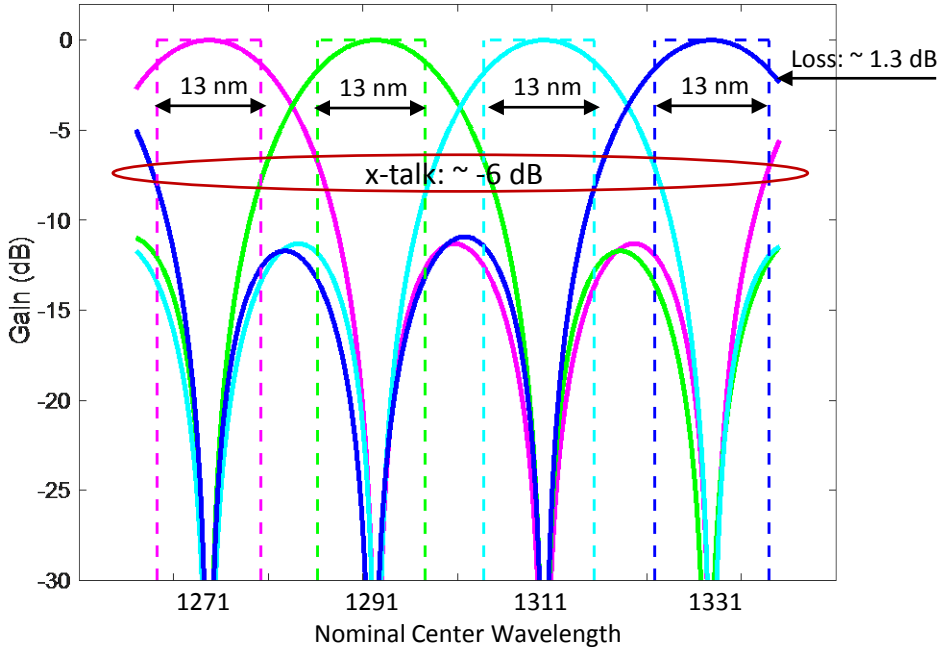
- IEEE 802.3bs in Table 122-5 follows the CWDM wavelength grid defined in ITU-T G.694.2 and allows 13 nm wavelength variation within each channel. Nothing is said in 802.3bs about the characteristics of this variation, leading the reader to assume that all of 13 nm is random variation.
- As mentioned in ITU-T G.694.2 wavelength variations have two main components:
  1. Laser variations around a nominal wavelength due to manufacture tolerances
  2. Uncooled laser wavelength shift as a result of temperature changes
- G.694.2 further states “Specific values and allocations of this variation will be defined in individual applications.” However 802.3bs does not currently define this.
- In all likelihood the lasers of the four channels are co-located on the module. Therefore, any temperature changes will cause a wavelength shift in same direction and by roughly the same amount for all four channels. This type of variation is less challenging to design for, compared to the random.
- Therefore, it would be useful to specify what portion of the 13 nm is due to manufacturing variation of the laser wavelength and what portion the variation can be expected to be similar for all of the four lasers.



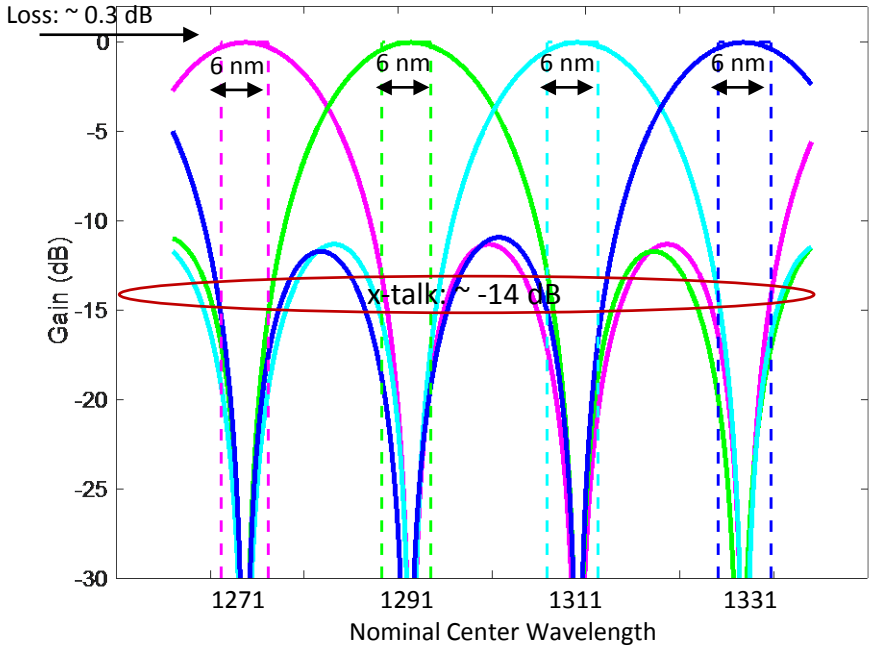
Demux Improvement – Cross Talk and Insertion Loss (e.g., MZI-Based Demux)

WL Variation	x-talk (dB)	Loss (dB)
13 nm	-6	1.3
6 nm	-14	0.3

13 nm random wavelength variation



6 nm random wavelength variation



Conclusion

- Allocation of variation in the CWDM wavelength spacing between laser variation and wavelength shift due to temperature is desirable to allow improvements in demux design.
  - Typical wavelength tolerance of CWDM laser is < +/- 3 nm
  - Typical temperature drift of uncooled CWDM lasers is 0.1 nm/ºC or 7 nm from 0-70ºC
- This could lower cost and improve yields by using newer non-traditional methods.
  - e.g., MZI-based demux vs. thin-film filters or PLC AWG's
- It is proposed that any operating condition the laser are to have nominal pitch of 20nm and each can deviate from this pitch by ±3 nm. This means:
  - The wavelength pitch (spacing between any 2 adjacent wavelengths) is 20 nm ± 6 nm
  - The wavelength pitch between any two non-adjacent channels with one channel in between is 40 nm ± 6 nm
  - The wavelength pitch between any two non-adjacent channels with two channels in between is 60 nm ± 6 nm
- This results in the same (total) wavelength range as show in Table 122-5
  - No change in the wavelength grid or (overall) tolerance from ITU G.694.2
  - ITU already specifies that this allocation will be defined in individual applications

Proposal

- This could be handled with a footnote to Tables 122-9 and 122-11:
  - “While the wavelength range for 200GBASE-FR4 can vary across temperature as specified in the table it is expected that the channel-to-channel wavelength spacing due to manufacturing variation between any two channels is given by 20*(n+1) ± 6nm, where n is the number of channels between the two channels” (or whatever language the editor deems appropriate)
- Alternatively, an addition line could be added to Tables 122-9 and 122-11 for 200GBASE-FR4:
  - Wavelength pitch 20 nm ± 6 nm for adjacent channels
  - Wavelength pitch 40 nm ± 6 nm for non-adjacent channels with one channel between
  - Wavelength pitch 60 nm ± 6 nm for non-adjacent channels with two channels between

THANK YOU

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