

Upstream wavelength- dependent power budgets

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Supporters

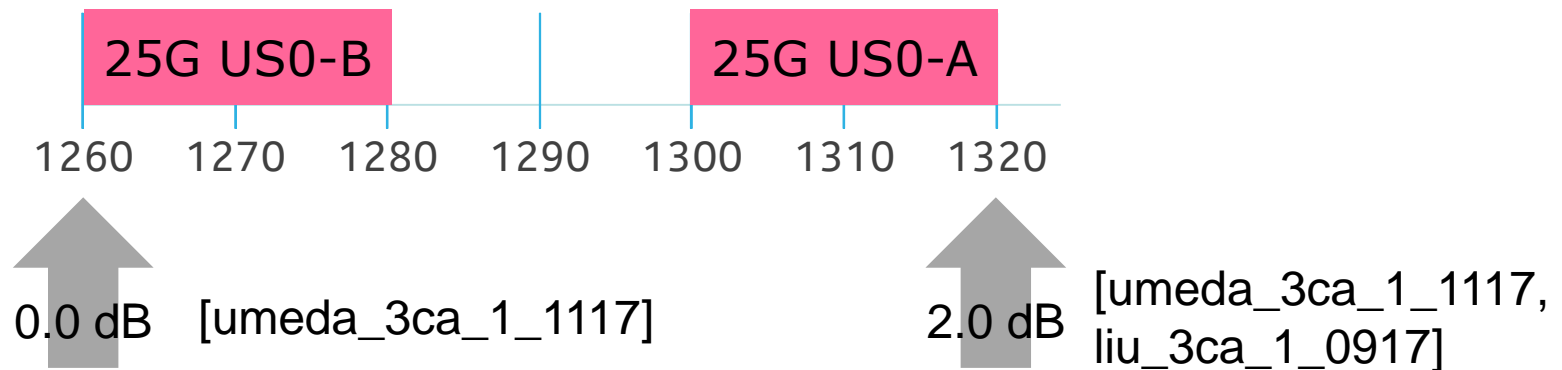
100G-EPON

- ❑ Yong Guo, ZTE
- ❑ John Johnson, Broadcom
- ❑ Dekun Liu, Huawei
- ❑ Naoki Suzuki, Mitsubishi Electric

Dispersion penalty: wavelength dependence

- ❑ For a DML, there is a strong dependence of dispersion penalty (DP) on wavelength.

Worst dispersion penalty at 25G for DML



- ❑ It would be a mistake to burden the 1270 nm option with the 2.0 dB larger DP of the 1310 nm option.
- ❑ Therefore, we propose to specify different DPs (and therefore different TDP or OMA-TDP) for the two options.

ONU launch power: wavelength dependence

- ❑ OLT receivers must support both 1270 and 1310 nm upstream transmissions, therefore we should specify the same OLT receiver sensitivity for both wavelengths.
- ❑ Therefore, the difference in DPs will lead to different required launch powers of the two different kinds of ONUs.
 - The launch power specification of the 1310 nm ONU will be 2.0 dB higher compared to the 1270 nm ONU.
- ❑ Assuming PR30 loss budget, DPs from above, and TP = 2.0 dB for an uncooled DML [umeda_3ca_1_1117]:

Minimum ONU launch powers, 25G

Wavelength range	OLT receiver sensitivity -24 dBm	OLT receiver sensitivity -25 dBm
1270 +/- 10 nm	7.0 dBm	6.0 dBm
1310 +/- 10 nm	9.0 dBm	8.0 dBm

- ❑ Note: It appears unlikely that a 25G uncooled DML will ever meet the required launch power in the 1310 nm window. If true, we can take advantage of the 0.5 dB lower TP for cooled lasers [umeda_3ca_1_1117].

Recommendation #1

For the two 25G upstream wavelengths, nominally at 1270 and 1310 nm,

- the 25G OLT receiver sensitivity specification should be the same,
- any difference in DP should be cancelled out with higher ONU launch power requirement at 1310 nm

US0-A wavelength tolerance options

- ❑ 20 nm, the plan of record



- ❑ 5 nm (say) for cooled lasers only, since uncooled lasers are unlikely to meet the PR30 power budget for 25G PON upstream at 1310 nm.

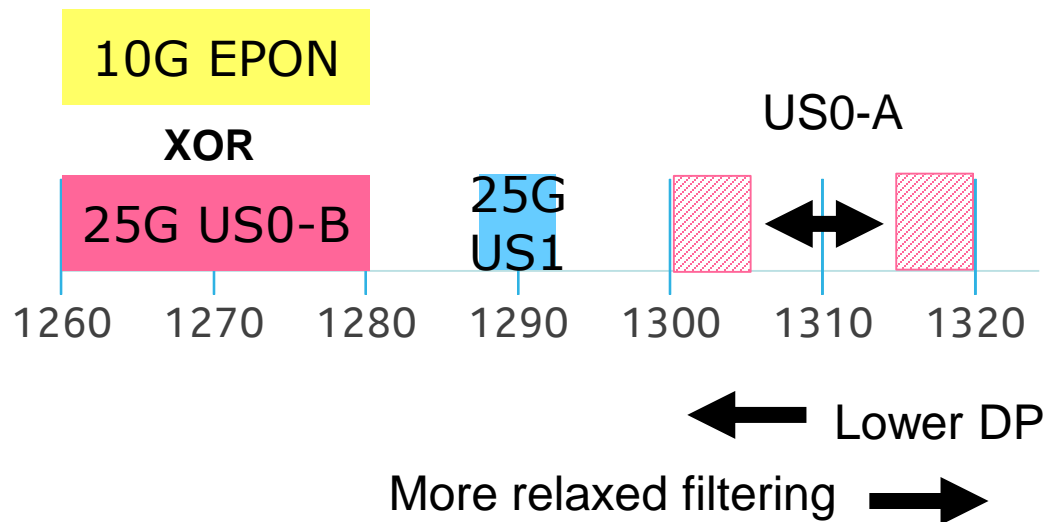


- ❑ 13 nm, allowing for uncooled lasers for 25/10 ONUs and for 25G PR20 ONUs, in indoor environments [adhoc_3ca_1_0717_R04a]



Lower DP vs. relaxed filter requirements

The 5 and 13 nm options have a knob to trade off dispersion penalty vs. relaxing filter requirements to support 25G US1, if required.



Note: the Task Force is currently evaluating 2x25G vs. 1x50G. If 2x25G is not selected, then DP can be optimized without consideration for US1 filtering.

Comparison table

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US0-A 1310 nm wavelength tolerance options

US0-A wavelength tolerance	Uncooled DML?			DP [1]	Spectrum for US1*
	25/25 ONU, PR30	25/25 ONU, PR20	25/10 ONU PR20 or PR30		
20 nm	unlikely	yes	yes	2.0 dB	20 nm
13 nm	no	indoor only	indoor only	1.3 – 2.0 dB	20-27 nm
5 nm	no	no	no	0.5 – 2.0 dB	20-35 nm

[1] umeda_3ca_1_1117, liu_3ca_1_0917

*1280 nm to short edge of US0-A

Trade-off DP vs. US1 filtering for 5 and 13 nm, if US1 required

Trade-off examples 1 and 2

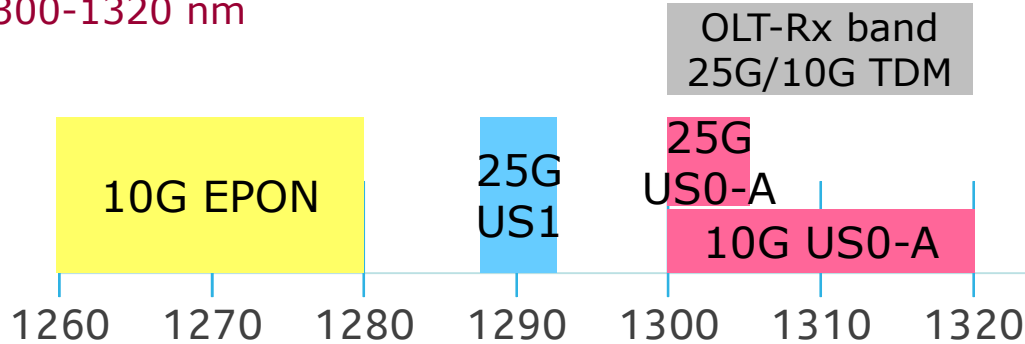
[Example 1] 25G US0-A/US1 5 nm band, 7.5 nm gap

US0-A : 1300-1320 nm

25G Tx : 1300-1305 nm (5 nm band), DP@1305 nm ~ 0.5 dB

10G Tx : 1300-1320 nm (20 nm band)

25G/10G Rx : 1300-1320 nm



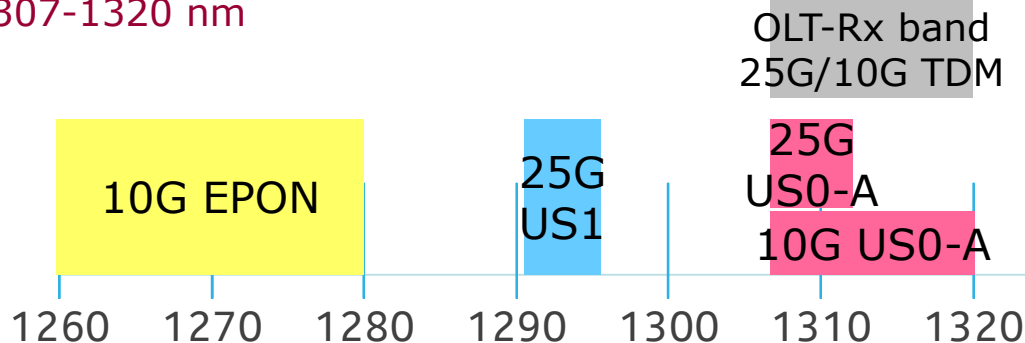
[Example 2] 25G US0-A/US1 5 nm band, 11 nm gap

US0-A : 1307-1320 nm

25G Tx : 1307-1312 nm (5 nm band), DP@1312 nm ~ 1.2 dB

10G Tx : 1307-1320 nm (13 nm band)

25G/10G Rx : 1307-1320 nm



For 1x50G,
there is no
US1 and you
don't need
this tradeoff

Tradeoff example 3

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Suggested by Dekun Liu

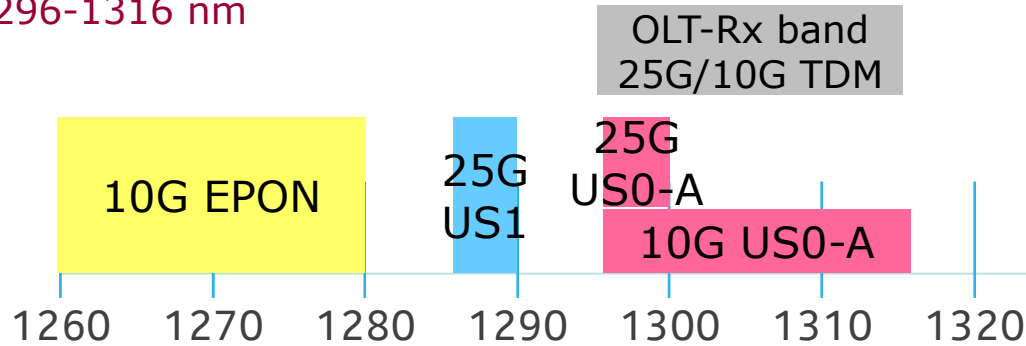
[Example 3] Shifting US0-A by -4 nm. 25G US0-A/US1 4 nm band, 6 nm gap

US0-A : 1296-1316 nm

25G Tx : 1296-1300 nm (4 nm band), DP ~ 0 dB

10G Tx : 1296-1316 nm (20 nm band)

25G/10G Rx : 1296-1316 nm



For 1x50G,
there is no
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Note: In this example, both US0-A and US0-B have DP = ~ 0 dB, which means they may have the same launch power requirements.

Recommendation #2

The trade-offs between the 3 wavelength tolerances for the US0-A wavelength (nominally 1310 nm) and their location should be weighed.