Comments #52/53/54 on US Wavelength of Bidirectional 20/40km Optical PHY for 50GbE

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- Peter Stassar, Huawei
- Mark Kimber, Semtech
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In Support of Comment #52/53/54 Against D1.1 :

Cl **159** *SC* **159.10** *P* **70** *L* **5** # 52

Geng, Limin Huawei

Comment Type **TR** *Comment Status* **X**

The nominal wavelength of the upstream is 1288 in Table 159-15. With ±8nm spacing, the wavelength upper limit is only 1296nm, which does not fully cover the standard LWDM wavelength range from 1294.53 to 1296.59 defined in 802.3bs and cn. Meanwhile, the non-standard wavelength range would also impacts the yield and cost, and we will follow up with a presentation slide.

SuggestedRemedy

The Nominal wavelength in Table 159-15 needs to be changed from 1288 to 1289. The nominal wavelength of 1289 together with ±8nm spacing would fully cover the standard LWDM wavelength range defined in 802.3bs and cn.

Proposed Response *Response Status* **O**

Cl **160** *SC* **160.6.1** *P* **82** *L* **41** # 53

Geng, Limin Huawei

Comment Type **TR** *Comment Status* **X**

In Table 160-7, the wavelength range of 50GBASE-BR20-U/50GBASE-BR40-U/50GBASE-BR40+-U transmitter is 1280 to 1296nm. However, the wavelength upper limit is only 1296nm, which is not fully cover the standard LWDM wavelength upper limit of 1296.59nm defined in 802.3bs and cn. On the other hand, the non-standard wavelength range also impacts the yield and cost, and we will follow up with a presentation slide.

SuggestedRemedy

To fully cover the standard LWDM wavelength range defined in 802.3bs and cn, the Wavelength(range) of 50GBASE-BR20-U/50GBASE-BR40-U/50GBASE-BR40+-U transmitter in Table 160-7 needs to be changed to 1281-1297 nm.

If this comment is accepted, Table 159-15 and 160-9 would be affected.

Proposed Response *Response Status* **O**

Cl **160** *SC* **160.6.2** *P* **84** *L* **41** # 54

Geng, Limin Huawei

Comment Type **TR** *Comment Status* **X**

In Table 160-9, the wavelength range of 50GBASE-BR20-U/50GBASE-BR40-U/50GBASE-BR40+-U receiver is1280 to1296nm. However, the wavelength upper limit is only 1296nm, which is not fully cover the standard LWDM upper wavelength limit of 1296.59nm defined in 802.3bs and cn. On the other hand, the non-standard wavelength range also impacts the yield and cost, and we will follow up with a presentation slide.

SuggestedRemedy

To fully cover the standard LWDM wavelength range defined in 802.3bs and cn, the Wavelength(range) of 50GBASE-BR20-U/50GBASE-BR40-U/50GBASE-BR40+-U receiver in Table 160-9 needs to be changed to 1281-1297 nm.

If this comment is accepted, Table 159-15 and 160-7 would be affected.

Proposed Response *Response Status* **O**

Background

- At the Kona meeting, wavelength for bidirectional 20/40km Optical PHY for 50GbE is agreed and D1.1 document was generated.

Straw Poll #2 Wavelengths for 25G and 50G, distance 20km and 40km Option 2a: US 1288+/-8 DS 1314+/-8 Yes-16, No-2, Abs-0 - It was concluded that there was a consensus for option 2a. This was reflected in the comment resolution.

http://www.ieee802.org/3/cp/public/1911/P802.3cp_unapproved_minutes_1911_Kona.pdf

- After the Kona meeting, a concern is raised for the 1296nm, upper bound wavelength of US, as it is outside the 1296~1296.59nm window, which is a general wavelength range for most 50/200/400GbE standards and products, respectively.

Revisit Related Ratified IEEE 802.3 Standard

88.6 Wavelength-division-multiplexed lane assignments

The wavelength range for each lane of the 100GBASE-LR4 and 100GBASE-ER4 PMDs is defined in Table 88–5. The center frequencies are members of the frequency grid for 100 GHz spacing and above defined in ITU-T G.694.1 and are spaced at 800 GHz.

Table 88–5—Wavelength-division-multiplexed lane assignments

Lane	Center frequency	Center wavelength	Wavelength range
L_0	231.4 THz	1295.56 nm	1294.53 to 1296.59 nm
L_1	230.6 THz	1300.05 nm	1299.02 to 1301.09 nm
L_2	229.8 THz	1304.58 nm	1303.54 to 1305.63 nm
L_3	229 THz	1309.14 nm	1308.09 to 1310.19 nm

122.6 Wavelength-division-multiplexed lane assignments

Change the second paragraph of 122.6 as follows:

The wavelength range for each lane of the 200GBASE-LR4 and 200GBASE-ER4 PMDs is defined in Table 122–6. The wavelength range for each lane of the 400GBASE-FR8, ~~and~~ 400GBASE-LR8, and 400GBASE-ER8 PMDs is defined in Table 122–7. The 200GBASE-LR4, 200GBASE-ER4, 400GBASE-FR8, ~~and~~ 400GBASE-LR8, and 400GBASE-ER8 center frequencies are members of the frequency grid for 100 GHz spacing and above defined in ITU-T G.694.1 and are spaced at multiples of 800 GHz.

Table 122–6—200GBASE-LR4 and 200GBASE-ER4 wavelength-division-multiplexed lane assignments

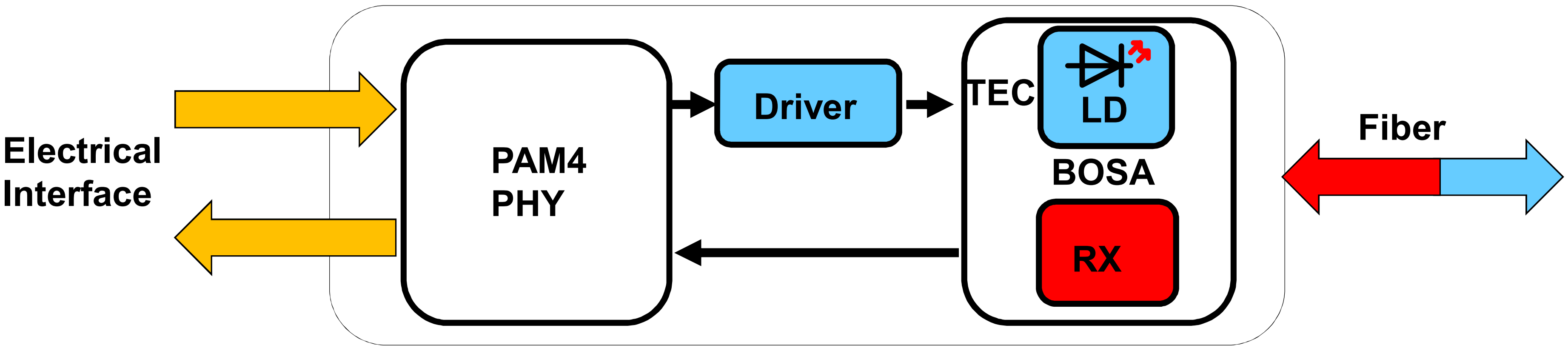
Lane	Center frequency	Center wavelength	Wavelength range
L_0	231.4 THz	1295.56 nm	1294.53 to 1296.59 nm
L_1	230.6 THz	1300.05 nm	1299.02 to 1301.09 nm
L_2	229.8 THz	1304.58 nm	1303.54 to 1305.63 nm
L_3	229 THz	1309.14 nm	1308.09 to 1310.19 nm

Table 122–7—400GBASE-FR8, ~~and~~ 400GBASE-LR8, and 400GBASE-ER8 wavelength-division-multiplexed lane assignments

Lane	Center frequency	Center wavelength	Wavelength range
L_0	235.4 THz	1273.54 nm	1272.55 to 1274.54 nm
L_1	234.6 THz	1277.89 nm	1276.89 to 1278.89 nm
L_2	233.8 THz	1282.26 nm	1281.25 to 1283.27 nm
L_3	233 THz	1286.66 nm	1285.65 to 1287.68 nm
L_4	231.4 THz	1295.56 nm	1294.53 to 1296.59 nm
L_5	230.6 THz	1300.05 nm	1299.02 to 1301.09 nm
L_6	229.8 THz	1304.58 nm	1303.54 to 1305.63 nm
L_7	229 THz	1309.14 nm	1308.09 to 1310.19 nm

Impacted to Yield of Upper Bound Wavelength of US at 1296nm

- For current production which would satisfy the IEEE standards, one of the wavelengths would be 1294.53-1296.59nm, which would be perfectly satisfied and could be reused for 50GbE BiDi 20/40km application. If the upper bound wavelength range tights to 1296nm, the yield would be degraded ~20% without temperature control or ~10% with temperature control, based on module vendor’s feedback.
    - TEC current should be increased to shift the wavelength range from 1296.59nm to 1296nm.
- Under high temperature working environment, the case would be further worse which would lead to higher power consumption.



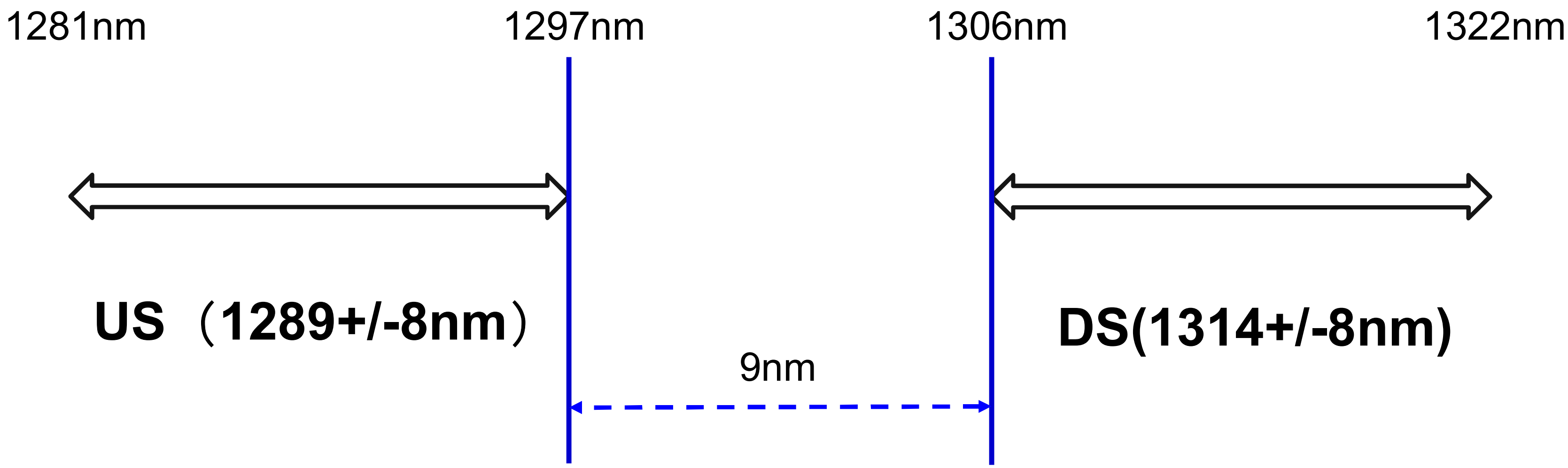
Proposal of Wavelengths of BiDi 20/40km Optical PHYs for 50GbE

Draft 1.1

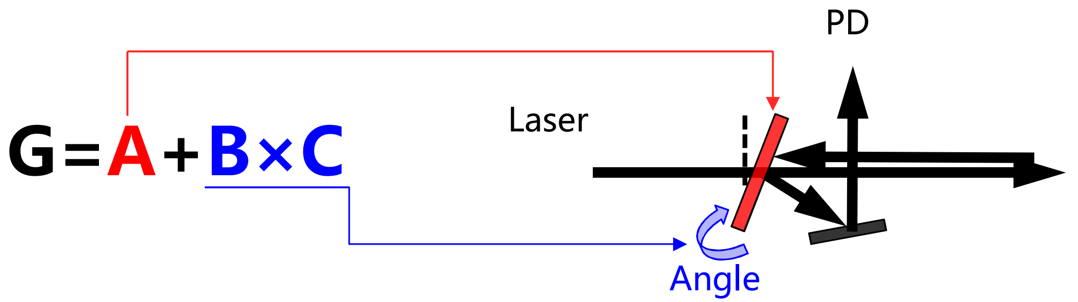
- US 1288+/-8nm
- DS 1314+/-8nm

Proposal

- US 1289+/-8nm
- DS 1314+/-8nm



Feasibility of Wavelength Gap of Bidirectional PHY



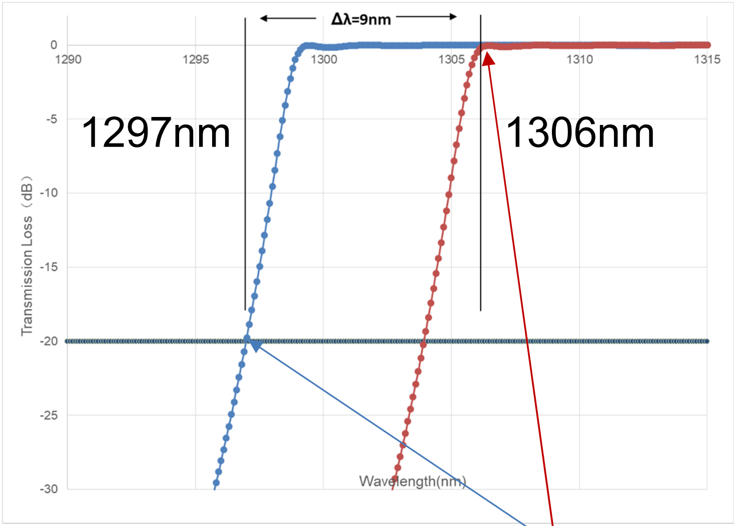
- According to the theoretical limits and practical implementations, the wavelength guard band G depends on the fabrication wavelength deviation of filter (A), angle-dependent wavelength variation of filter(B) and assemble angle deviation (C).

- In Geng_3cp_1a_1911, analysis on the gap between US and DS wavelength to supports ≥ 9nm

> ☐ From the classic Fresnel equation, Fabry–Pérot interference equation, and considering the optical film deposition vendor's capability, the wavelength gap need more than 9nm @13° incident angle.

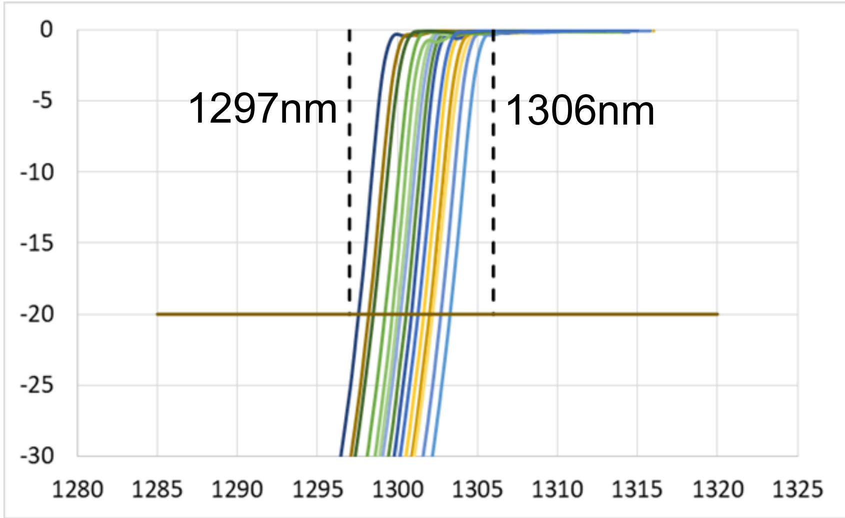
Feasibility of Wavelength Gap of Bidirectional PHY (Cont'd)

Simulation results



G = Wavelength (max-min)

Practical measurement results



- From theoretical simulation results, considering the minimum and maximum assemble angle deviations, ≥9nm guard band is sufficient;
- Practical results indicate roll-off edges locate between 1297 to 1306nm.

Summary

- Accept the comments #XX with the following wavelength for BiDi 20/40km Optical PHYs for 50GbE
  - US 1289+/-8nm
  - DS 1314+/-8nm

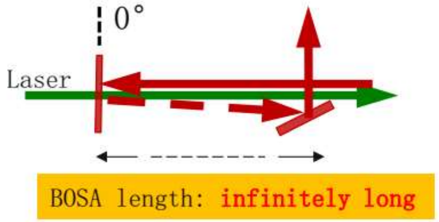
thank you
danke
謝謝
ngiyabonga
teşekkür ederim
рахмат
Баярлалаа
спасибо
taafetai lava
mersi
tack
spas
welalin
dank je
misaotra
malondo
paldies
mahalo
tapadh leat
gracias
хвала
asante
manana
vinaka
blagodaram
kiitos
dankie
bedankt
hvala
mauruuru
enkosi
dziękuję
mochchakkeram
go raibh maith agat
chnorakaloutioun
gracies
sulpay
obrigado
sobodi
dekuji
sagolun
sukriya
kop khun krap
taiku
arigatō
takk
dakujem
trugarez
ありがとう
mesi
najis tuke
tanemirt
grazie
rahmet
terima kasih
diolch
dhanyavadagalu
shukriya
мерси
kam sah hamnida
감사합니다
xiexie
ευχαριστώ
merci

Backup:

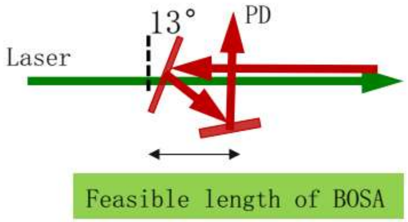
- In [Geng_3cp_1a_1911](), analysis on the gap between US and DS wavelength to support 9nm gap.

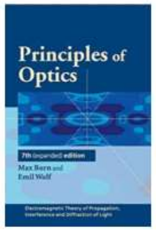
The achievable wavelength gap

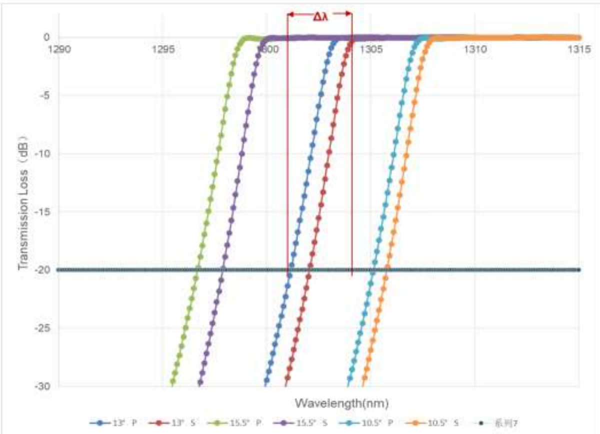
Ideal condition:
0° incident angle

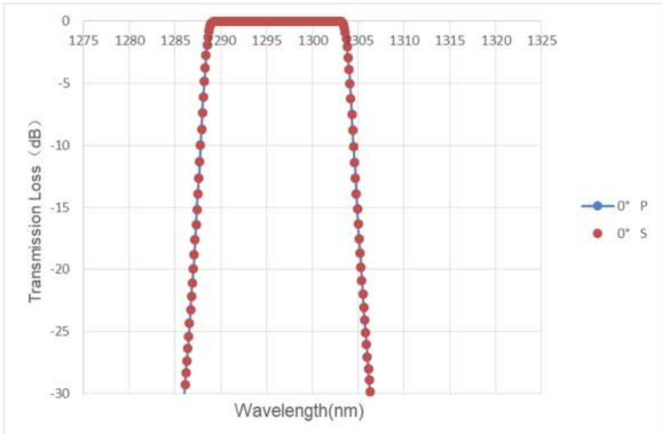


feasible condition:
13° incident









- Considering the feasible length of BOSA, 13° is the minimal incident angle.
- From the classic Fresnel equation, Fabry–Pérot interference equation, and considering the optical film deposition vendor's capability, the wavelength gap need more than 9nm @13° incident angle.