Empowered by Innovation NEC

Re-suggestion of PRX30 upstream wavelength range

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About the Re-suggestion (1/3)

➢ Suggestion

Change of the PRX30 upstream wavelength range
「1260-1360nm」→「1260-1280nm」

Table 91-1—Power budgets defined in Clause 91

Description	Low Power Budget		Medium Power Budget		High Power Budget		Units
	PRX10	PR10	PRX20	PR20	PRX30	PR30	
Fiber type	B1.1, B1.3 SMF						–
Number of fibers	1						–
Nominal downstream line rate	10.3125						GBd
Nominal upstream line rate	1.25	10.3125	1.25	10.3125	1.25	10.3125	GBd
Nominal downstream wavelength	1590				1577		nm
Downstream wave-length band width	20				6		nm
Nominal upstream wavelength	1310	1270	1310	1270	1270	1270	nm
Upstream wavelength band width	100	20	100	20	20	20	nm
Maximum reach	≥10		≥20		≥20		km
Minimum reach	≤0.5						m
Maximum channel insertion loss	20		24		29		dB
Minimum channel insertion loss	5		10		15		dB

About the Re-suggestion (2/3)

Table 91–7—PRX type OLT PMD receive characteristics

Description	10/1GBASE –PRX–D1	10/1GBASE –PRX–D2	10/1GBASE –PRX–D3	Unit
Signaling speed (range)	same as 1000BASE-PX10-D receive parameters (see Table 60–5)	same as 1000BASE-PX20-D receive parameters (see Table 60–8)	1.25 ± 100 ppm	GBd
Wavelength (range)			1260 to 1280	nm
Bit error ratio (max)			10^{-12}	
Average receive power (max)			–9.38	dBm
Damage threshold (max)			TBD	dBm
Receiver sensitivity (max)			–29.78	dBm
Receiver sensitivity OMA (max)			–29.00 (1.26)	dBm (μW)
Signal detect threshold (min)			–45	dBm
Receiver reflectance (max)			–12	dB
Stressed receive sensitivity (max)[a]			–28.38	dBm
Stressed receive sensitivity OMA (max)			–27.60 (1.74)	dBm (μW)
Vertical eye–closure penalty[b]			TBD	dB
$T_{receiver\_settling}$ (max)[c]			TBD	ns
Stressed eye jitter			TBD	UI pk to pk
Jitter corner frequency for a sinusoidal jitter			637	kHz
Sinusoidal jitter limits for stressed receiver conformance test (min, max)			(0.05, 0.15)	UI

About the Re-suggestion (3/3)

Table 91–9—PRX type ONU PMD transmit characteristics

Description	10/1GBASE –PRX–U1	10/1GBASE –PRX–U2	10/1GBASE –PRX–U3	Unit
Signaling speed (range)	same as 10GBASE–PX10–U transmit parameters (see Table 60–3)	same as 10GBASE–PX20–U transmit parameters (see Table 60–6)	1.25 ± 100 ppm	GBd
Wavelength[a] (range)			1260 to 1280	nm
RMS spectral width (max)			see Table 91–10	nm
Average launch power (max)			5.62	dBm
Average launch power (min)[b]			0.62	dBm
Average launch power of OFF transmitter (max)			–45	dBm
Extinction ratio (min)			6	dB
RIN_xOMA (max)			TBD	dB/Hz
Launch OMA (min)[c]			1.40 (1.38)	dBm (mW)
Transmitter eye mask definition {X1, X2, Y1, Y2, Y3}			TBD	UI
Ton (max)			512	ns
Toff (max)			512	ns
Optical return loss tolerance (max)			15	dB
Transmitter reflectance (max)			–10	dB
Transmitter and dispersion penalty (max)			1.4	dB
Decision timing offset for transmitter and dispersion penalty			±0.125	UI

Change reason1 (1/3)

- ✓ In FP-LD, it is difficult to guarantee 20km transmission completely, and DFB-LD is most suitable.
- ✓ And 20nm is sufficient for the wavelength range of DFB-LD. (3av_0705_tanaka_1 [1].pdf)

Details are shown in the slide 6 and 7.
It explains using the example of PX20.

Change reason1 (2/3)
PX20 Transmitter spectral limits

- ✓ 802.3ah PX20 (Fig.60-4) specifies the Tx spectral limits as follows.
- ✓ In this graph, e=0.115 is employed to calculate the relation between the maximum allowed RMS spectral width and the wavelength.
- ✓ e=0.115 is also used in ITU-T for estimating MPN (Mode Partition Noise) penalty for FP-LD, which assumed to be less than 1 dB.

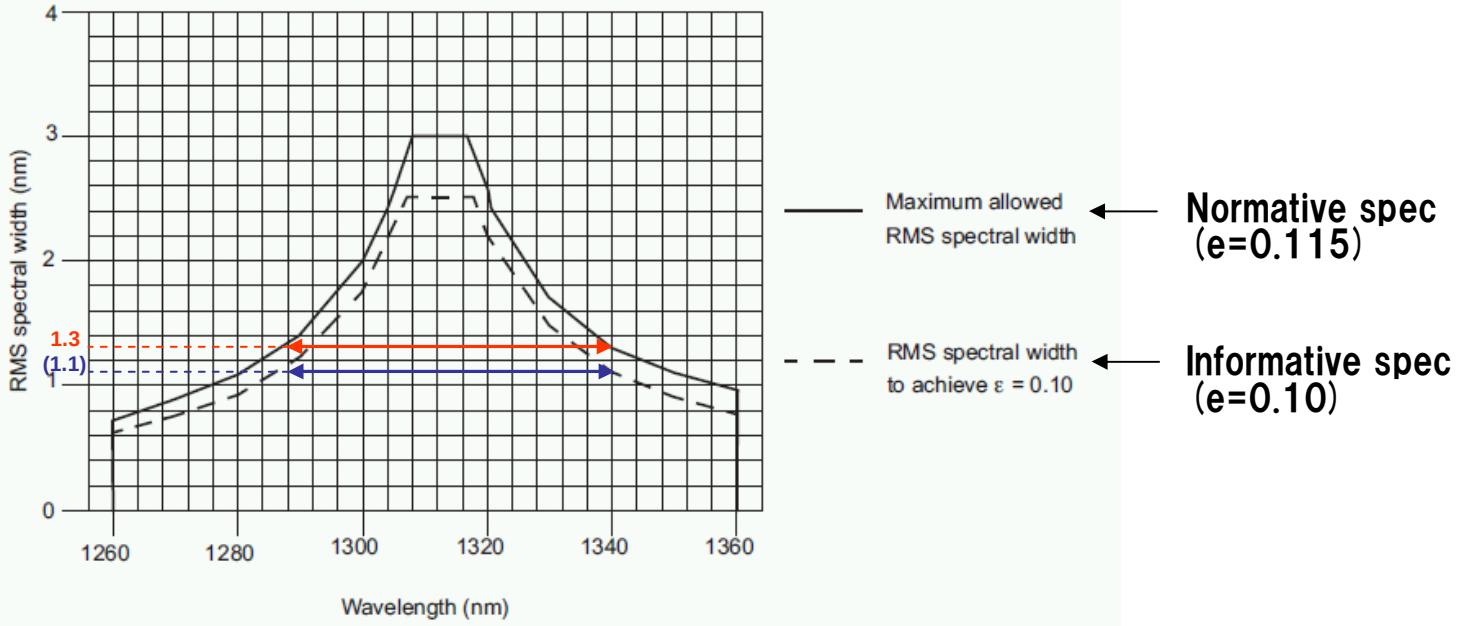

Figure 60–4—1000BASE-PX20-U transmitter spectral limits

Change reason1 (3/3)
Feasibility of 20km reach at 1G with FP-LD

- ✓ However, it is very difficult to meet the PX20 spectral limits with FP-LD, considering actual temperature range.
- ✓ Indoor ONU needs the RMS spectral width of < 1.3 nm.
  (Outdoor is much smaller number !!)
- ✓ Commercially available FP-LD is > 2.0 nm at the least.
- ✓ Therefore, DFB-LD is inevitably needed for PX20 deployment.

ONU Environment	Ambient Temp. of optics	Wavelength shift over temp *1)	Total wavelength range *2)	Required RMS spectral width *3)
Indoor	0~70°C	32nm	52nm	<1.3nm (1.1nm)
Outdoor	-40~85°C	56nm	76nm	<1.0nm (0.9nm)

*1) FP-LD wavelength-temp coefficient of 0.45nm/°C is assumed.
*2) Center wavelength unevenness of 20nm is assumed.
*3) Value in parentheses is informative value with e = 0.10

Reference

If Mr. Suzuki's material (3av_0805_suzuki_1 [1].pdf) is used, it'll be the severer value.

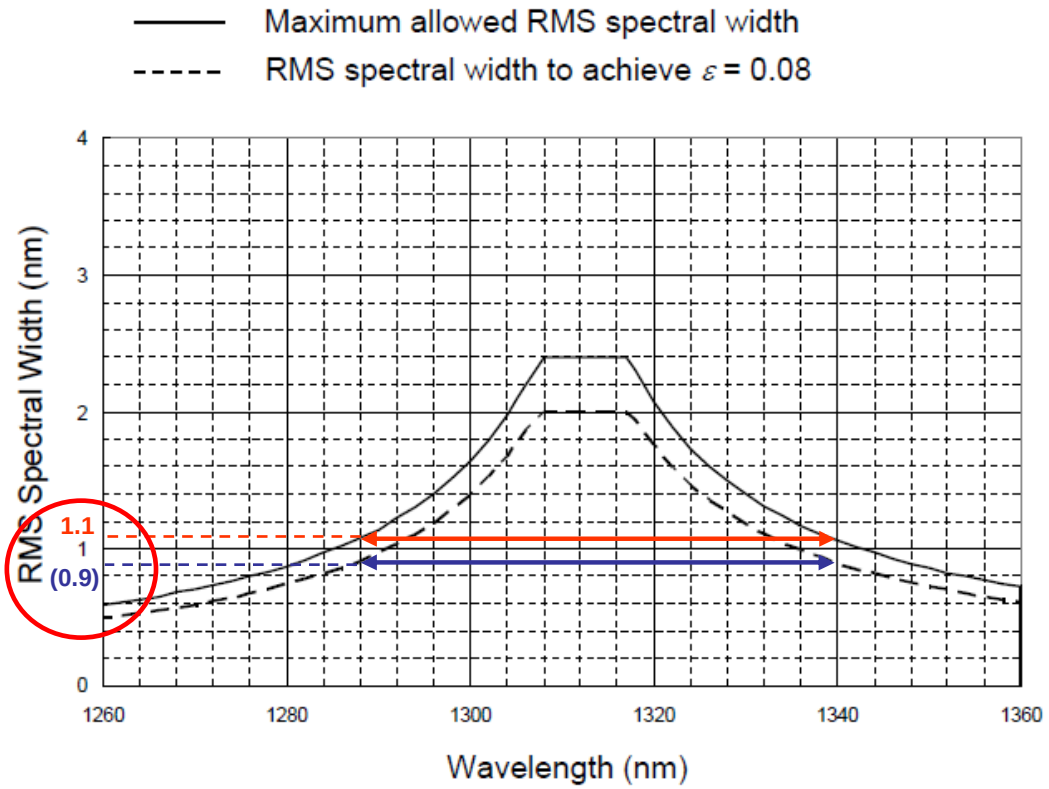

Figure 91-6-10/1GBASE-PRX-U3 transmitter spectral limits

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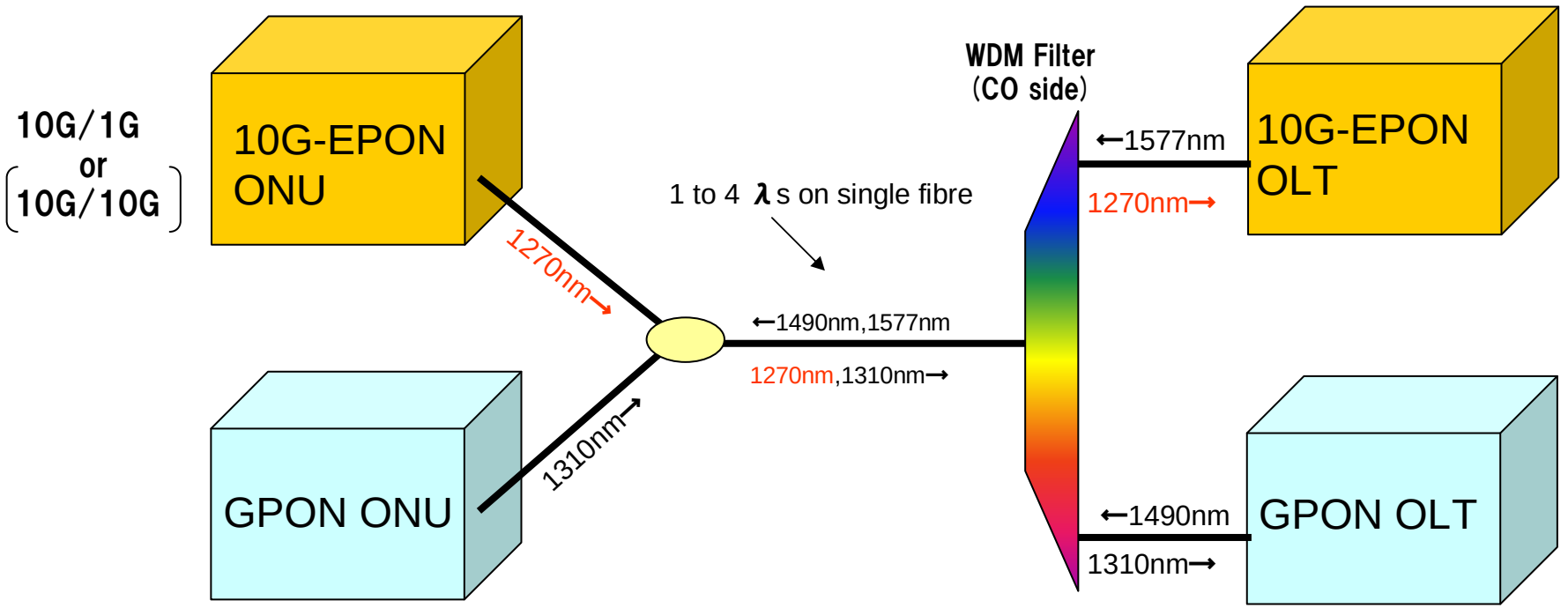
3av_0805_suzuki_1 [1].pdf

Change reason2 (1/2)
About Overlay with GPON

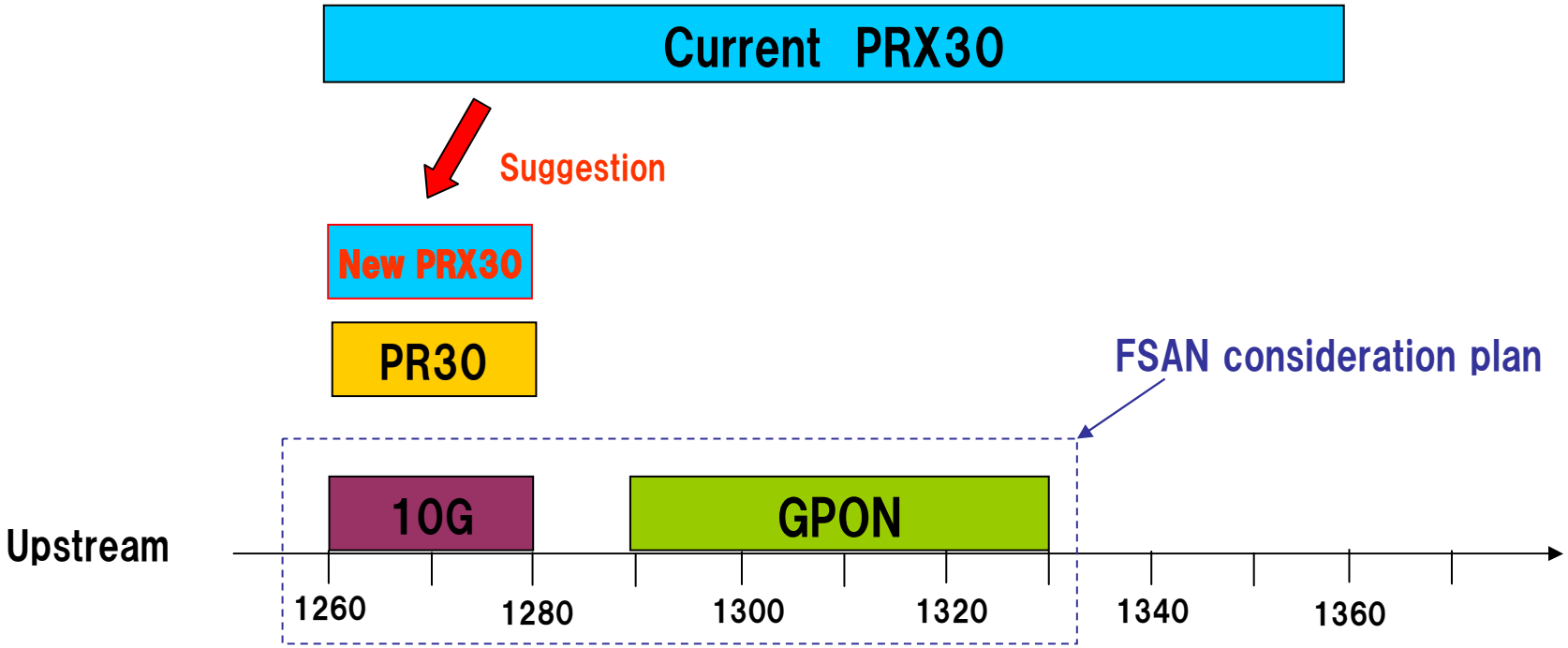
✓But, the cost impact of DFB-LD is greater.
⇒So, the cost must be suppressed by the mass production effect.

✓If it can coexist with GPON, market development would spread.



Change reason2 (2/2)
Wavelength Plans

- ✓ If it is the same "1260-1289 nm" as PR30, it has good compatibility with FSAN/ITU-T. And It will be able to migration (i.e., asymmetry 10G to symmetry 10G) that smoothly.
- ✓ When this value is used, overlay with GPON becomes possible by WDM.



Wavelength Plans

Conclusion

- ✓ The 20km guarantee is difficult in FP-LD.
  ⇒Therefore, DFB-LD is inevitably needed.
- ✓ But, the cost impact of DFB-LD is greater.
  ⇒So if it can coexist with GPON, the cost will be suppressed by the mass production effect.
- ✓ Therefore, PRX30 is made same wavelength range as PR30 and the migration from asymmetry 10G to symmetry 10G is smoothly done.

Straw Poll

- PRX30 upstream wavelength range should be

a. 1260-1280nm

b. 1260-1360nm

c. Others

d. No Opinion