

Wavelength Plan for PR-20

2007.11.

Bong Kyu Kim and Bin Young Yoon

Introduction

- ❑ For system consistency with PR-10, PR-30 and 1G EPON, PR-20 should support SFP or XFP
 - PR-10 and PR-20 can be implemented with a small form package such as XFP or SFP
- ❑ EDFA and SOA are a possible candidate for the optical amplifier of PR-20. Currently, SOA is only a solution to downsize the package to SFP or XFP
- ❑ Low power consumption of SOA is required for stable operation inside the small form package
- ❑ 1590nm consumes more power than 1550nm with the following reasons
 - More power penalty by transmission loss and bending loss
 - Characteristics of SOA (longer wavelength, more power consumption)

Fiber Loss(1/2)

- ❑ Fiber Loss
 - Transmission Loss + Bending Loss

λ (nm)	Total loss	Transmission Loss ¹		Bending Loss ² (r=10 mm)	
		coefficient	20km-SMF	coefficient	2-turns
1550	7 dB	0.30 dB/km	6 dB	8 dB/m	1.2 dB
1590	9~10 dB	0.35* dB/km	7 dB*	15 dB/m	2.4 dB
1625	12~13 dB	0.40 dB/km	8 dB	37dB/m	4.6 dB

1: transmission loss: SMF Class B, IEC60793-2-50

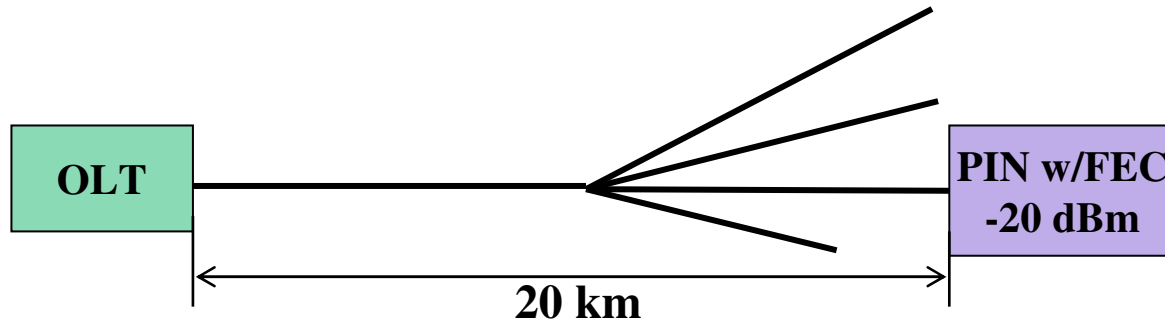
2: Q. Wang, et.al., Optics Express, p4476 (2005), & S. Bhaumik, Presentation in 15th Convergence India (2007. 03)

*: estimated value

- ❑ It is necessary to need **Power Budget more than 2~3 dB** compared to 1550 nm wavelength for 20 km transmission.

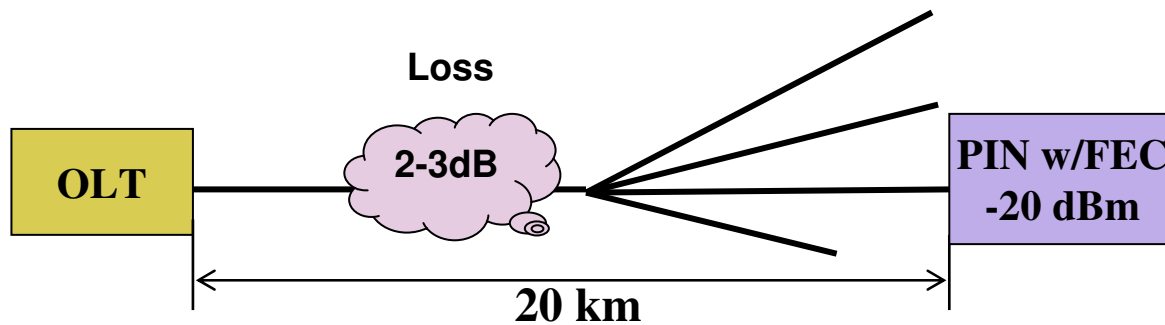
Fiber Loss(2/2)

1550 nm



split ratio	OLT Tx (dBm)
16	4.0
32	7.5
64	11.0
128	14.5

1590 nm

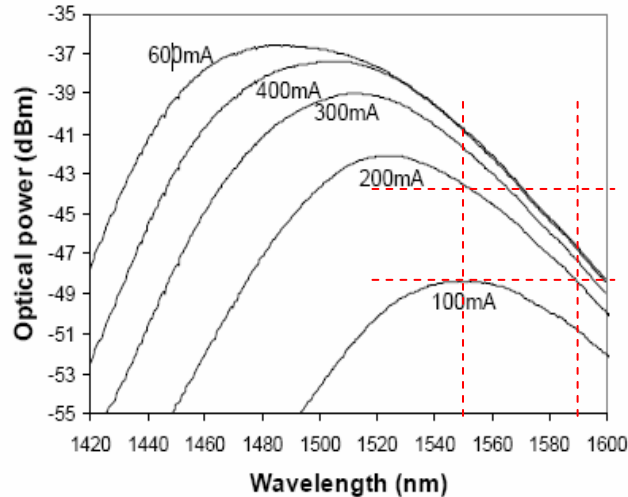


split ratio	OLT Tx (dBm)
16	6~7
32	9.5~10.5
64	13~14
128	16.5~17.5



SOA characteristics

- SOA spectrum characteristics



* www.ciphotonics.com, SOA application notes

- Typical saturation output power of commercial SOA products

Vendor	C-band	L-band
A	13dBm	12dBm
B*	13.7dBm	11dBm
C**	13dBm	10dBm

- Peak wavelength is less than 1590 nm. As the wavelength increases, the optical power gain is decreased

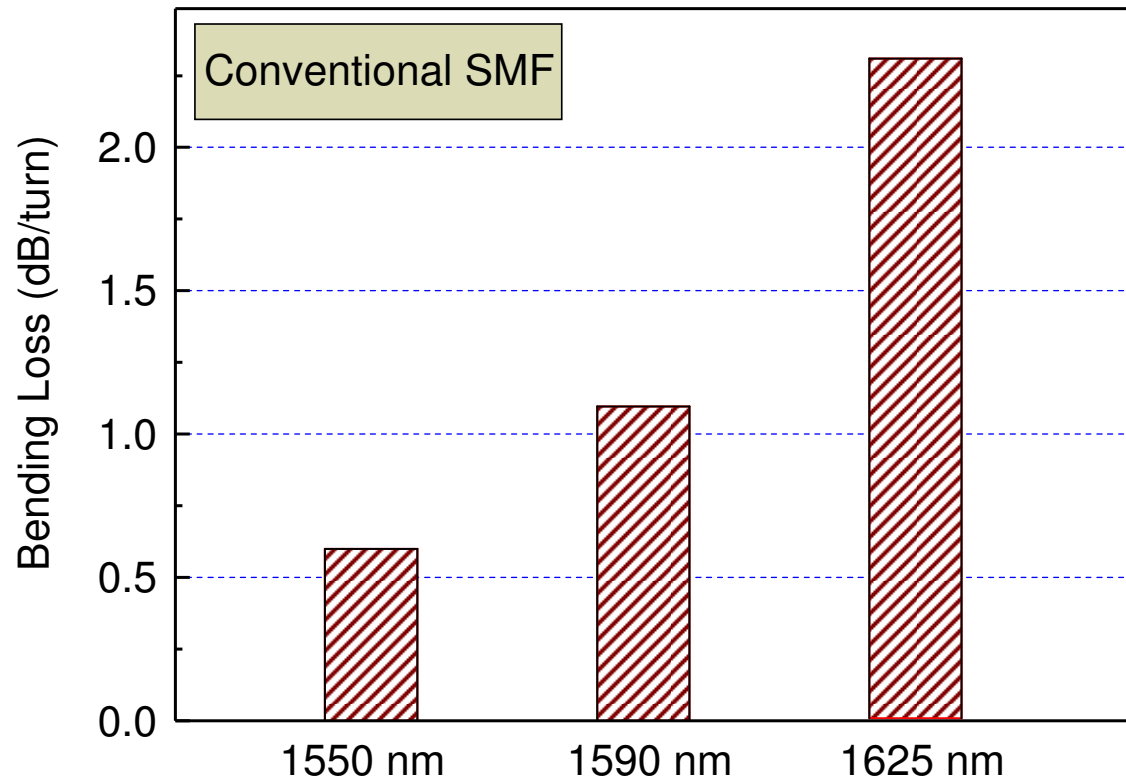
- M. J. Connelly, *Semiconductor Optical amplifiers*, Kluwer Academic Publishers, Boston (2002)
- G. P. Agrawal & N. K. Dutta, *Semiconductor Lasers 2nd Ed*, Van Nostrand Reinhold, NY (1993)

- SOA providing better performance for 1550nm than 1590nm

Conclusions

- ❑ Video overlay is very important so that we have already reserved the seat in the **First Class** for PR-30
- ❑ We need to consider putting a seat in the **Economic class** for PR-20 with LD, SOA and PIN based on 1550nm, widely available and proven
- ❑ Technically, 1550nm is better than 1590nm when specially supporting the practical split ratio (more than 32 split ratio/20Km) with the amplifier and PIN
 - By transmission and bending loss, 1590nm requiring more power budget of 2dB~3dB compared to 1550 nm wavelength for 20 km transmission
 - SOA, only a solution for the small form packages, providing better performance for 1550nm than 1590nm
 - Increasing optical power budget, more power consumption, can make it harder to implement the small form package with SOA

Appendix: Fiber Bending Loss ($r=10$ mm)



[1] Q. Wang, et.al., *Optics Express*, p4476 (2005),