

10GEPON Feasibility at 29dB Loss Budget

Mitsunobu Kimura

mitsunobu.kimura.be@hitachi.com

Hitachi Communication Technologies, Ltd.

Subject: IEEE 802.3 10Gb/s PHY for EPON Study Group

Abstract: This presentation mentions about feasibility of 10G EPON system applying current 1G EPON technologies particularly to secure 29dB loss budget.

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■ Use existing fibers: 29 dB Loss Budget

- (1) Fibers built already = SMF with normal dispersion
- (2) Optical Span Loss > 25 dB (28 dB desirable)
+ Optical Penalty 1 dB (Example)
= Optical Loss Budget: 26-29 dB
- (3) 20 km transmission required

■ Keep existing services

Analog Video Service: WDM (@1550-1560nm) required

■ Economic requirements for parts

- (1) ONT Transmission: DFB-LD direct modulation
Receiving: PIN-PD
- (2) OLT Trans.: DFB-LD direct modulation; Receiving: APD
- (3) Margin for mass production (Launched power range: > 5 dB;
Minimum Receiver Sensitivity margin: > 3 dB)

■ Downstream 10 Gbit/s: Feasible

- In the case of Direct modulation, the critical transmission distance is 10 km due to dispersion characteristic of existing fibers.
- In the case of External modulation: Feasible
- To secure power budget, consider changing devices.

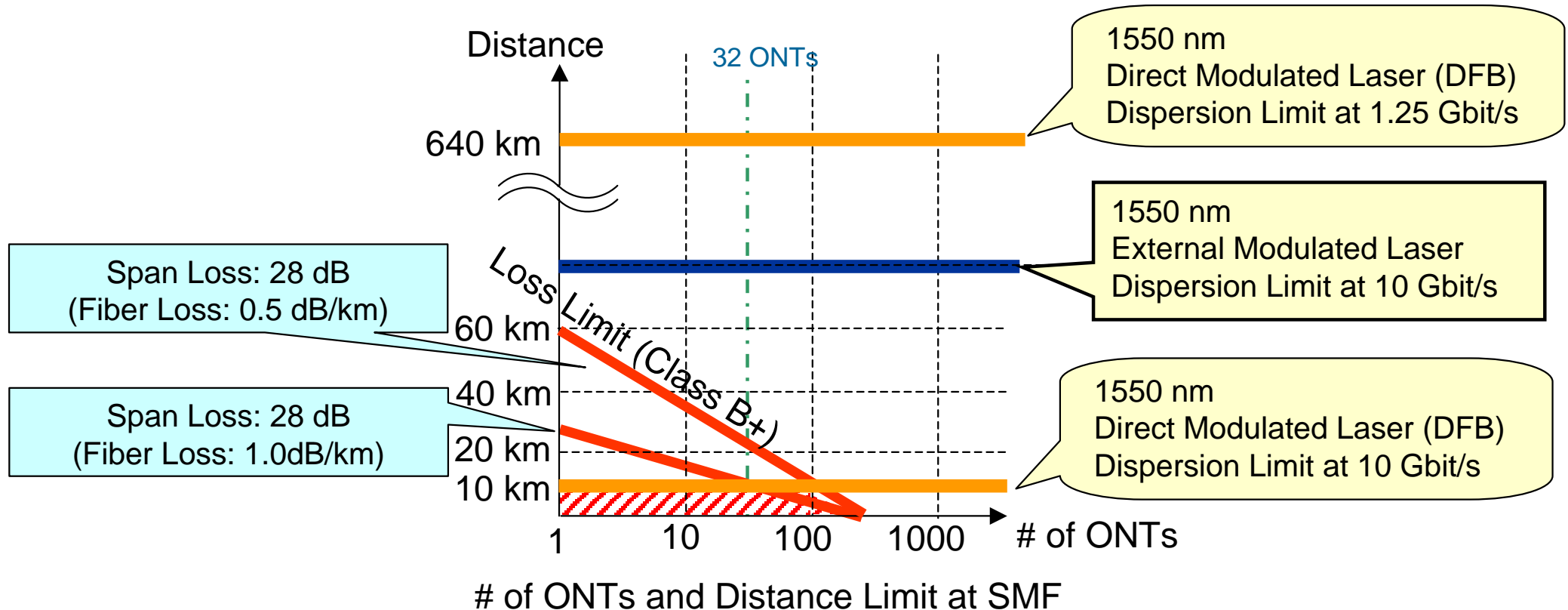
■ Upstream 10 Gbit/s: Technical Challenge

- Burst Receiving: Quick level detection of bursty packets.
- Receiver Sensitivity.

Downstream Issue 1 - Influence of Dispersion Characteristic

Dispersion of Fiber reduces Maximum Transmission Distance by 1/64 of 1G EPON's (The Max. Trans. Distance is approximately in inverse proportion to the 2nd power of bit rate when power penalty of dispersion remains intact)

-> *Using external modulation expands the distance limit.*



Downstream Issue 2

- Receiver Sensitivity (Example)

Minimum Optical Receiving Power Sensitivity				
Down-stream	Case1: PD		Case 2: APD	
	Average	Best	Average	Best
1.25G	-24.0 dBm(*1)	-27.0 dBm	-30.0 dBm	-33.0 dBm
2.5G	-21.0 dBm(*2)	-24.0 dBm	-27.0 dBm(*3)	-30.0 dBm
10G	-15.0 dBm	-18.0 dBm	-21.0 dBm	-24.0 dBm

*1: IEEE 802.3ah PX20
 *2: ITU-T G.984.2 class B
 *3: ITU-T G.984.2 class B+

(1) To secure Loss Budget 29 dB,
Transmission power: +14 dBm

↓ SOA is needed

Economical issue of OLT

Moreover, higher transmission power may cause Stimulated Raman Scattering to the analog video wavelength (1550-1560 nm).

(2) To secure Loss Budget 29 dB,
Transmission power: +8 dBm

↓

Economical issue of ONT

- Receiver: APD for lower DFB-LD output
 - Cost of APD can be shared by ONTs
- Burst Receiving: Quick level detection of bursty packets
 - Need consideration of longer preamble length for level detection and sampling clock.
- Transmitter: Max Bit rate is 2.5 Gbit/s, because LD output of ONT should be 0 to +1 dBm
 - Considering economical and reliability issues.
 - The bit rate can be at most 2.5 Gbit/s.

(APD can receive -27 dBm at less than 2.5Gbit/s.)

- Downstream: Feasible by extending current 1G EPON technologies
 - External modulation to secure 20 km transmission with existing fibers.
 - APD for ONT, or SOA for OLT.
 - Economical issues.

- Upstream: Technical challenge
 - There hasn't been any practical study of upstream 10G.

- Totally
 - Need continuous studies of feasibility.