Baseline proposal of 25GBASE-BD PMD parameters

Hanhyub Lee and Hwan Seok Chung

IEEE 802.3cp 10Gb/s, 25Gb/s, and 50Gb/s Bidirectional Access Optical PHYs
Jan. 2019 Long Beach

ETRI
Electronics and Telecommunications Research Institute

Motivation

- In the Bangkok meeting, 40GBASE-LR4 and ER4 power budget were reviewed as good references because 40GBASE-LR4 and ER4 modules may potentially be used as BiDi modules in bidirectional links.
  - http://www.ieee802.org/3/NGBIDI/public/1811/181114_BidiBudgets_Effenberger.pdf
  - LR4 and ER4 optics include MUX or DeMUX and an insertion loss of MUX or DeMUX is similar with an insertion loss of 45 degree filter of bidirectional optical sub assembly (BOSA) module for BiDi modules .
- In this contribution, we propose
  - Channel insertion losses of 25GBASE-BD-LR and ER as single channel 25Gb/s bidirectional links
  - To use PMD parameter values of 100GBASE-ER4 as a baseline of PMD parameter values for 25GBASE-BD-ER

Channel insertion loss with 0.43dB/km of Fiber attenuation

Table 10-4 – Comparison of ITU-T G.655 and ITU-T G.652 fibre attenuation measurements

OTDR wavelength (nm)	ITU-T G.655 fibres				ITU-T G.652 fibres			
	Fitted attenuation (dB/km) Typical OH-model		Measured values (dB/km)		Fitted attenuation (dB/km) OH-model [b-Hopland]		Measured values (dB/km)	
	Average	Stdv	Average	Stdv	Average	Stdv	Average	Stdv
1241	0.443	0.007	0.439	0.007	0.423	0.009	0.42	0.011
1310	0.358	0.006	0.361	0.009	0.341	0.008	0.343	0.009
1383	0.412	0.042	0.413	0.043	0.51	0.227	0.508	0.224
1551	0.211	0.012	0.209	0.012	0.194	0.004	0.192	0.005
1621	0.227	0.016	0.23	0.017	0.207	0.006	0.209	0.006
1642	0.243	0.017	0.241	0.017	0.222	0.007	0.22	0.007

- The previous contribution used 0.47 dB/km of fielded fiber loss for calculating link power budget.
- IEEE 802.3 and ITU-T SG15 use 0.43 dB/km at 1290 nm of fiber attenuation and 0.42dB/km at 1241 nm of measured fiber attenuation.
- We proposed to use 0.43 dB/km at 1270 nm considering ITU-T SG15 G.652 fibers.

Channel insertion loss of 25GBASE-BD-LR and ER

	LR	ER		Unit
Distance	10	30	40	km
Fiber loss (0.43 dB/km)	4.3	12.9	17.2	dB
Connector loss (0.5dB x 6ea)	3	3	3	dB
Channel insertion loss	7.3	15.9	20.2	dB

Loss gap between 100GBASE and 25GBASE-BD

Table 88–9—100GBASE-LR4 and 100GBASE-ER4 illustrative link power budgets

Parameter	100GBASE-LR4	100GBASE-ER4		Unit
Power budget (for maximum TDP)	8.5	—		dB
Power budget	—	21.5		dB
Operating distance	10	30	40[a]	km
Channel insertion loss	6.3[b]	15	18	dB

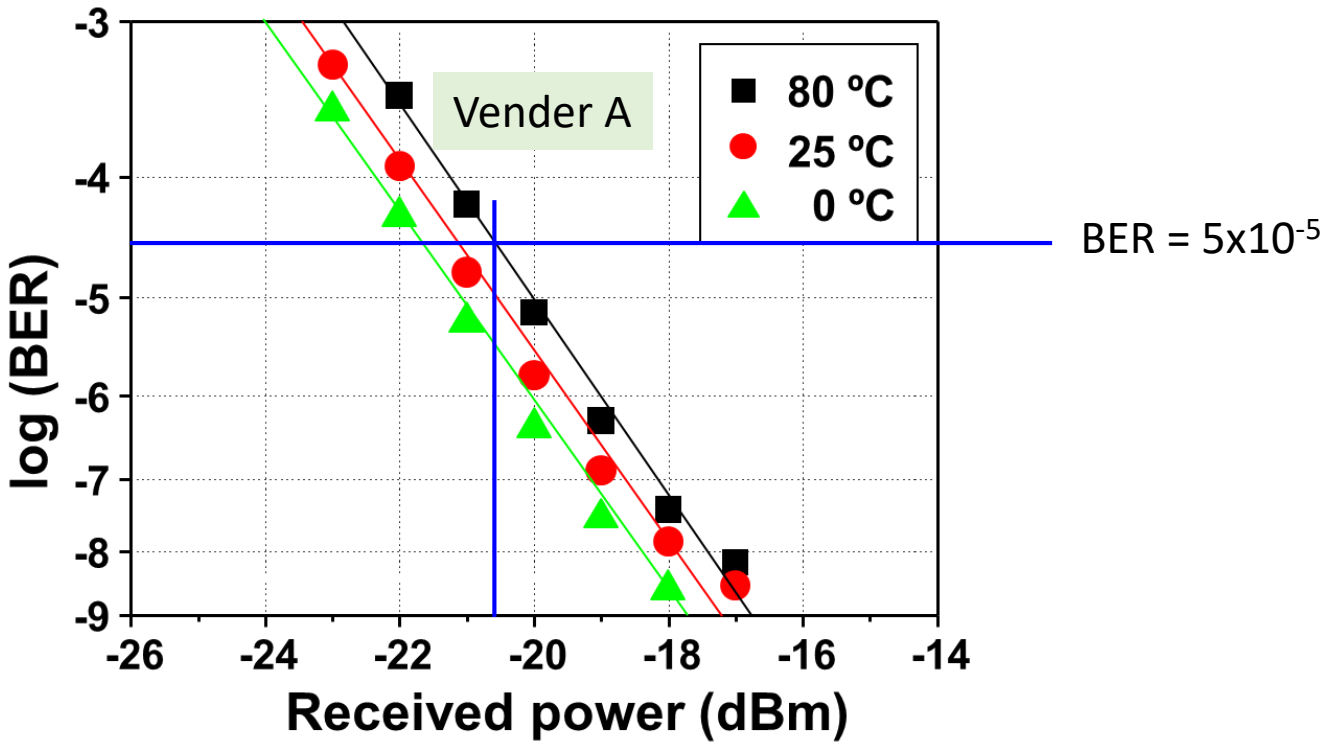
Link	LR (10 km)	ER (30 km)	ER (40 km)
100GBASE	6.3 dB	15 dB	18 dB
25GBASE-BiDi	7.3 dB	15.9 dB	20.2 dB
Gap	+1 dB	+0.9 dB	+2.2 dB

How to overcome the gap

Method	100GBASE-ER4	Gap	Target Value	Possible values
1. Increasing average launch power (Max)	2.9 dBm	2.2 dB	5.1 dBm	7.8 dBm (IEEE 802.3ca)
2. Reducing transmitter and dispersion penalty (TDP)	2.5 dB (EML) (1295nm~1310nm)	2.2 dB	0.3 dB	1.5 dB (EML) (1345nm ~ 1357nm) (IEEE 802.3ca)
3. Decreasing average receive power Rx sensitivity (min) (ER: 8dB)	-20.9 dBm	2.2 dB	-23.1 dBm	-20.9 dBm

- By Increasing an average launch power from 2.9 dBm to 5.1dBm, 2.2 dB of gap can be overcame, easily.
- The average launch power can be 4.1 dBm if TDP is 1.5 dB.
- Improving Rx sensitivity would be difficulty due to limited performance of current 25G APD ROSA and BOSA.

25G APD based BOSA (prototype) Rx sensitivity



- 25G BOSA sensitivity: -20.7 dBm@BER=$5x10^{-5}$ at high temperature.
  - ➢ ER of input signal: 8 dB
- 0.2 dB difference can be overcame by optimizing BOSA design.

Summary

- We propose the channel insertion losses of 25GBASE-BD-LR and 25GBASE-BD-ER.
- We propose to consider PMD parameter values of 100GBASE-ER4 as baseline PMD parameter values of 25GBASE-BD-ER.