

PMD parameters of 40-km specification (BR40)

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Introduction

1. At the IEEE interim meeting in August, it was agreed that the loss budget classes for 10 km (BR10), 20 km (BR20) and 40 km (BR40) should be 6.3, 15 and 18 dB, respectively.
2. The PMD parameters were proposed for these specifications[1]. However, some parameters such as the launched power and receiver sensitivity were TBD.
3. For the discussion of such parameters, the 100G-lambda MSA specifications (100G-ER1-40) can be used as a reference [2].
4. This contribution discusses PMD parameters based on the 100G-lambda MSA specifications and proposes a level diagram and PMD parameters for BR40.

[1] Futurewei, https://www.ieee802.org/3/dk/public/2309/3dk_Effenberger_2309_1.pdf

[2] [100G-LR1-20, 100G-ER1-30 and 100G-ER1-40 Technical Specifications Rev 1.1](#)

Consideration of PMD parameters

PMD parameters that have been standardized in the MSA can be used as a reference. Launch power and receiver sensitivity should be discussed based on the MSA specifications, taking into account the BiDi configuration.

PMD parameters for 100G lambda MSA

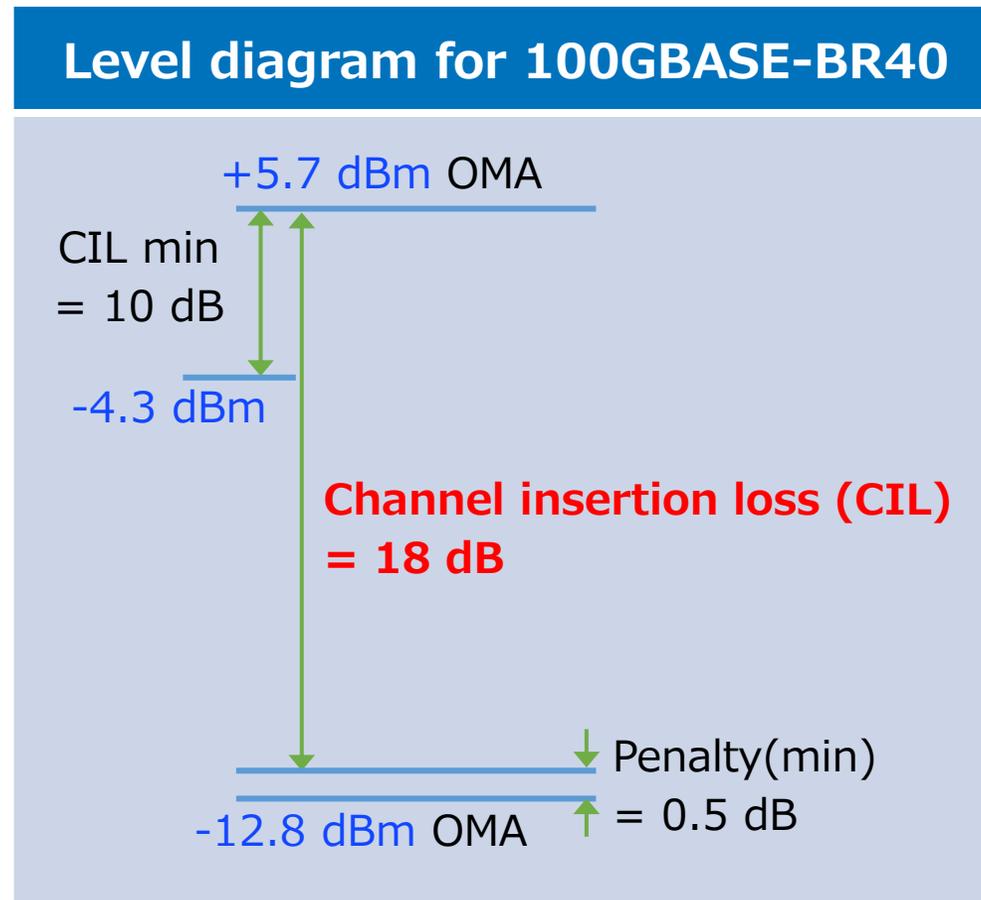
Items	Unit	100G-LR1-20	100G-ER1-40
Nominal modulation rate	Gbit/s	53.125	53.125
Wavelengths	nm	Tx: 1304.5- 1317.5 nm Rx: 1304.5- 1317.5 nm	Tx: 1308.09-1310.19 nm Rx: 1304.5- 1317.5 nm
Mean launch power max	dBm	+6.6	+7.1
Launch power in OMA _{outer} (min) For TDECQ < 1.4 dB For 1.4 dB < TDECQ < TDECQ (max)	dBm	2.8 1.4 + TDECQ	4.7 3.3 + TDECQ
Transmitter and dispersion eye closure for PAM4 (TDECQ) max	dB	3.6	3.9
Receiver sensitivity (OMA) For TECQ < 1.4 dB For 1.4 dB < TECQ < 3.6 dB For 1.4 dB < TECQ < 3.9 dB	dBm	-7.6 -9 + TECQ	-13.8 -15.2 + TECQ
Receiver OMA max	dBm	6.8	-2.6
Damage threshold MAX	dB	7.6	-2.4
TDECQ – TECQ (max)	dB	2.7	2.7
Extinction ratio MIN (Note 3)	dB	3.5	5.0
Bit error ratio		Less than 2.4×10^{-4}	Less than 2.4×10^{-4}

These values for Duplex configuration

The chromatic dispersion is assumed to be in the range of -73.4 to 37.1 ps/nm in 100G-lambda MSA.

Proposal: Level diagram for BR40

The level diagram for the 40 km specification, BR40, was investigated based on the 100G-lambda MSA. The receiver sensitivity is -12.8 dBm, corresponding to the BiDi filter loss of 1 dB at -13.8 dBm in the MSA specification.



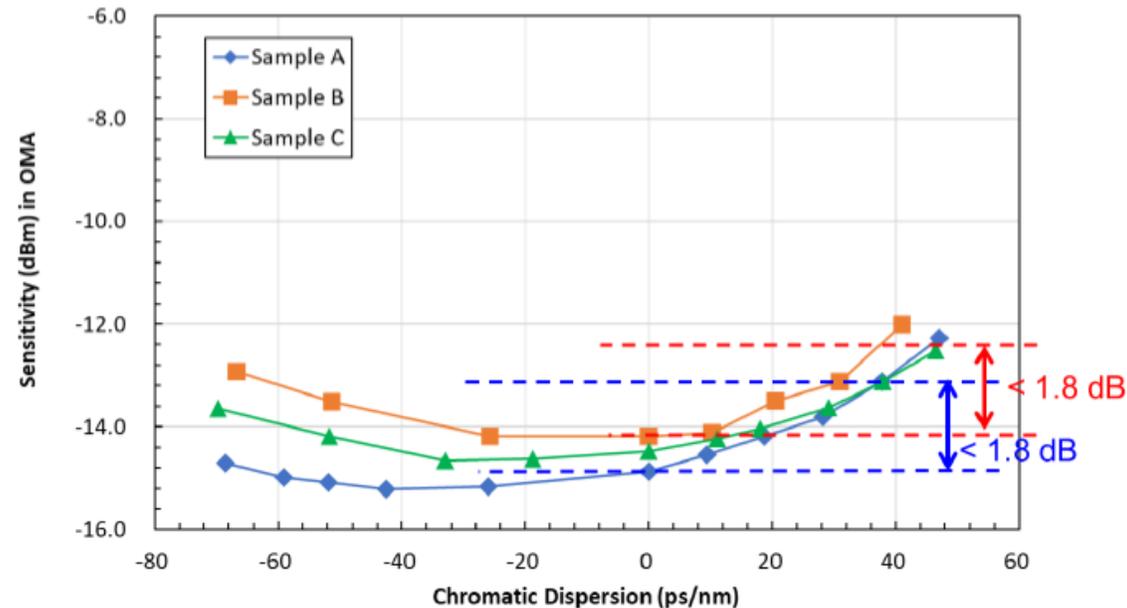
100 Gbps/ λ transmission experiment [3]

[3]Joint, https://www.ieee802.org/3/dk/public/2307/3dk_jackson_2307_1r1.pdf

The receiver sensitivity of -12.8 dBm is considered reasonable when taking into account the experimental results reported at the July meeting.

Receiver sensitivity for chromatic

- Experimental results demonstrated the feasibility of 100G/ λ 40-km transmission.



- Receiver sensitivity of -14.2 dBm was achieved for BtoB.
- Chromatic dispersion penalty for -77 to 37 ps/nm was less than 1.8 dB.

PMD parameters for BR40

Items	Unit	100G-LR1-20	100G-ER1-40	IEEE802.3dk BR40
Nominal modulation rate	Gbit/s	53.125	53.125	53.125
Wavelengths	nm	Tx: 1304.5- 1317.5 nm Rx: 1304.5- 1317.5 nm	Tx: 1308.09-1310.19 nm Rx: 1304.5- 1317.5 nm	1304.6 ± 1 nm / 1309.1 ± 1 nm
Mean launch power max	dBm	+6.6	+7.1	TBD
Launch power in OMA _{outer} (min) For TDECQ < 1.4 dB For 1.4 dB < TDECQ < TDECQ (max)	dBm	2.8 1.4 + TDECQ	4.7 3.3 + TDECQ	5.7 4.3 + TDECQ
Transmitter and dispersion eye closure for PAM4 (TDECQ) max	dB	3.6	3.9	3.9
Receiver sensitivity (OMA) For TECQ < 1.4 dB For 1.4 dB < TECQ < 3.6 dB For 1.4 dB < TECQ < 3.9 dB	dBm	-7.6 -9 + TECQ	-13.8 -15.2 + TECQ	-12.8 -14.2 + TECQ
Receiver OMA max	dBm	6.8	-2.6	-1.6
Damage threshold MAX	dB	7.6	-2.4	-1.4
TDECQ – TECQ (max)	dB	2.7	2.7	2.7
Extinction ratio MIN (Note 3)	dB	3.5	5.0	5.0
Bit error ratio		Less than 2.4 x 10 ⁻⁴	Less than 2.4 x 10 ⁻⁴	Less than 2.4 x 10 ⁻⁴

Summary

- The level diagram and PMD parameters, investigated based on the 100G-lambda MSA, were proposed for the 100G-BiDi 40-km specifications in IEEE802.3dk.
 - Tx launch power: +5.7 dBm
 - Rx receiver sensitivity: -12.8 dBm
- The proposed receiver sensitivity is achievable, taking into account the results of the 100 Gbps/ λ transmission experiments reported at the July meeting.

Thank you

PMD parameters of 40 km specification in ITU-T G.9806

Items	Unit	Class B _L Specification
Modulation format	-	PAM4
Nominal modulation rate	Gbit/s	53.125
Wavelengths	nm	1304.6 ±1 nm / 1309.1 ±1 nm
Mean launch power max	dBm	+9.4
Launch power in OMA _{outer} (min) For TDECQ < 1.6 dB For 1.6 dB < TDECQ < 3.7 dB	dBm	+7.0 +5.4 + TDECQ
Transmitter and dispersion eye closure for PAM4 (TDECQ) max	dB	3.7
Receiver sensitivity (OMA) For TECQ < 1.6 dB For 1.6 dB < TECQ < 3.7 dB	dBm	-13.5 -15.1 + TECQ
Receiver OMA max	dBm	0.0
Damage threshold MAX	dB	1.0
TDECQ – TECQ (max)	dB	2.5
Optical path penalty MAX (Informative)	dB	2.5
Extinction ratio MIN	dB	5.0
Bit error ratio		Less than 2.4 x 10 ⁻⁴