

Proposal of 8 x 50G NRZ specification for 400GbE 2km PMD

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Introduction

- 8 x 50Gb/s NRZ is the best option for 400GbE PMD because of the advantage in the link budget. It is suitable for high loss applications with large amount of connectors such as data center.
- This contribution provides loss budget considerations and baseline proposal of 8 x 50G/s NRZ for 2 km.

Assumptions

- Output power pre-Mux: <3.3dBm at $E_r = 6\text{dB}$ (shirao_3bs_01_0914)
- Link loss: 5.1dB for 2 km (kolesar_3bs_01_0514)
- MPI penalty: 0.3dB for NRZ (zhu_3bs_01a_0514)
- TDP: 1.8dB for 2km (cole_01a_1014_smf)
- 8:1 Mux/Demux insertion loss: 3dB each (cole_01a_1014_smf)
- Wavelength allocation: 8 wavelength with blue band extension of 100GBASE LR4 with 10 nm gap between L3 and L4
- Evaluated Rx sensitivity at $\text{BER} = 2\text{e-}4$ (wen_3bs_01_1114):

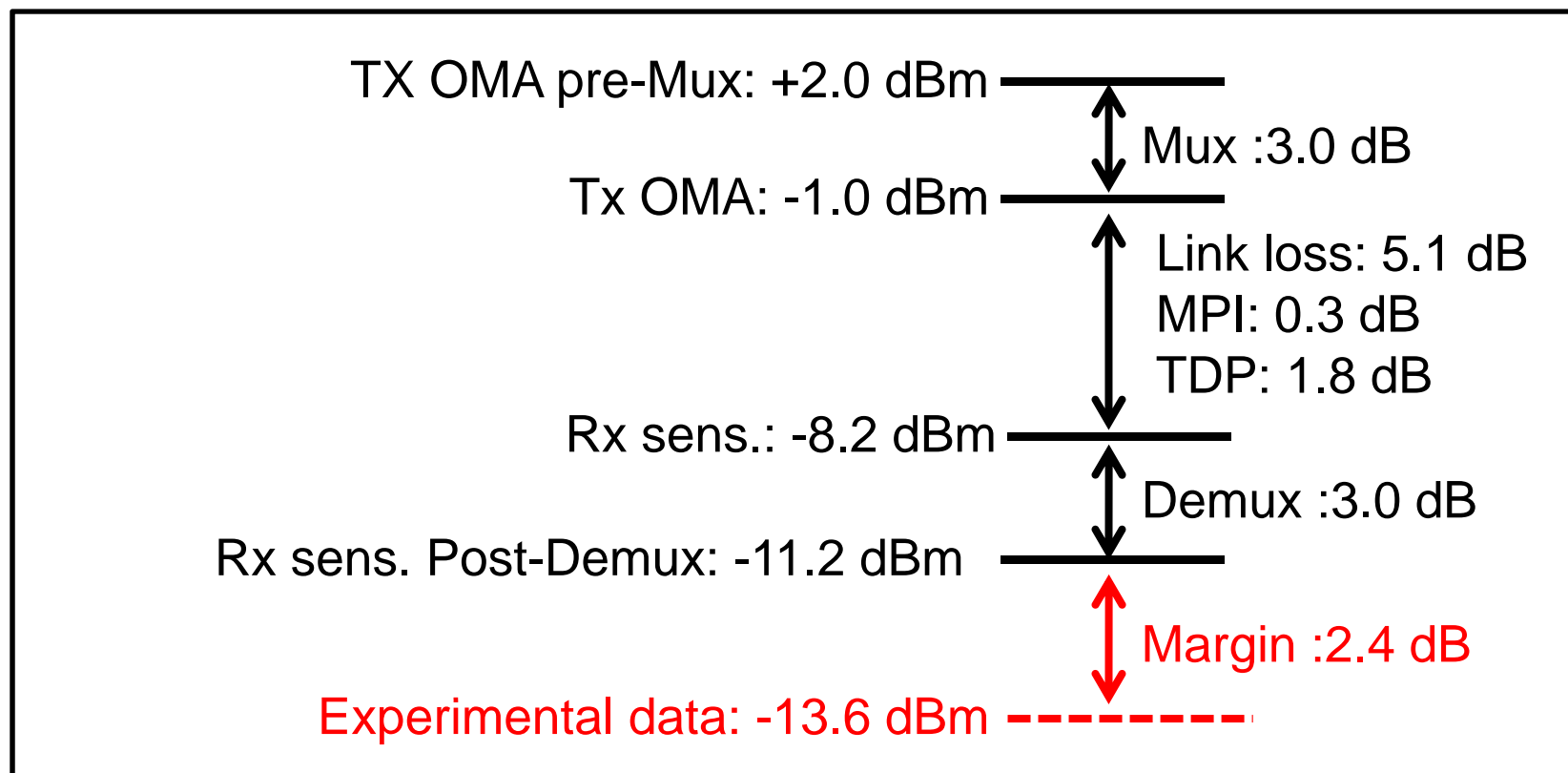
-15.7dBm in average power at $E_r = 9.6\text{dB}$



-13.6dBm in OMA

Loss budget consideration (2km)

- Margin of 2.4dB between this proposal and experimental data.
- 8 x 50G NRZ is a strong candidate for high loss applications with large amount of connectors such as data center thanks to its high sensitivity and high tolerability for MPI.



Wavelength assignment

- 8 wavelength with blue band extension of LAN-WDM allocation. A 10 nm gap between L3 and L4 enables use of dual 4-lane TOSA/ROSA with external optical Mux/Demux for early adopters.

Lane	Center frequency	Center wavelength	Wavelength range
L ₀	235.6 THz	1272.46 nm	1271.41 to 1273.51 nm
L ₁	234.8 THz	1276.80 nm	1275.75 to 1277.85 nm
L ₂	234 THz	1281.16 nm	1280.11 to 1282.21 nm
L ₃	233.2 THz	1285.56 nm	1284.51 to 1286.61 nm
L ₄	231.4 THz	1295.56 nm	1294.51 to 1296.61 nm
L ₅	230.6 THz	1300.05 nm	1299.00 to 1301.10 nm
L ₆	229.8 THz	1304.58 nm	1303.53 to 1305.63 nm
L ₇	229 THz	1309.14 nm	1308.09 to 1310.19 nm

 10nm gap

Link power budget

Parameter	400GbE 2km	Unit
Power budget (for maximum TDP)	7.2	dB
Operation distance	2	km
Channel insertion loss	5.1	dB
MPI penalty	0.3	dB
Maximum discrete reflectance	-26	dB
Allocation for penalties (for maximum TDP)	1.8	dB

Transmit characteristics

Description	400GbE 2km	Unit
Signaling rate, each lane	53.125 (KP4 FEC)	GBd
Lane wavelengths	1271.41 to 1273.51 1275.75 to 1277.85 1280.11 to 1282.21 1284.51 to 1286.61 1294.51 to 1296.61 1299.00 to 1301.10 1303.53 to 1305.63 1308.09 to 1310.19	nm
Side-mode suppression ratio (SMSR), min	30	dB
Optical Modulation Amplitude (OMA), each lane (min)	-1.0	dBm
Launch power in OMA minus TDP, each lane (min)	-2.8	dBm
TDP, each lane (max)	1.8	dB
Extinction ratio (min)	6	dB
RIN20 OMA	TBD	dB/Hz
Optical return loss tolerance (max)	20	dB
Transmitter reflectance (max)	-12	dB

Receive characteristics

Description	400GbE 2km	Unit
Signaling rate, each lane	53.125 (KP4 FEC)	GBd
Operation BER	2E-4	
Lane wavelengths	1271.41 to 1273.51 1275.75 to 1277.85 1280.11 to 1282.21 1284.51 to 1286.61 1294.51 to 1296.61 1299.00 to 1301.10 1303.53 to 1305.63 1308.09 to 1310.19	nm
Receiver reflectance (max)	-26	dB
Receiver sensitivity (OMA), each lane (max)	-8.2	dB

Thank you