400G-PSM4: A Proposal for the 500m Objective using 100 Gbps per Lane Signaling

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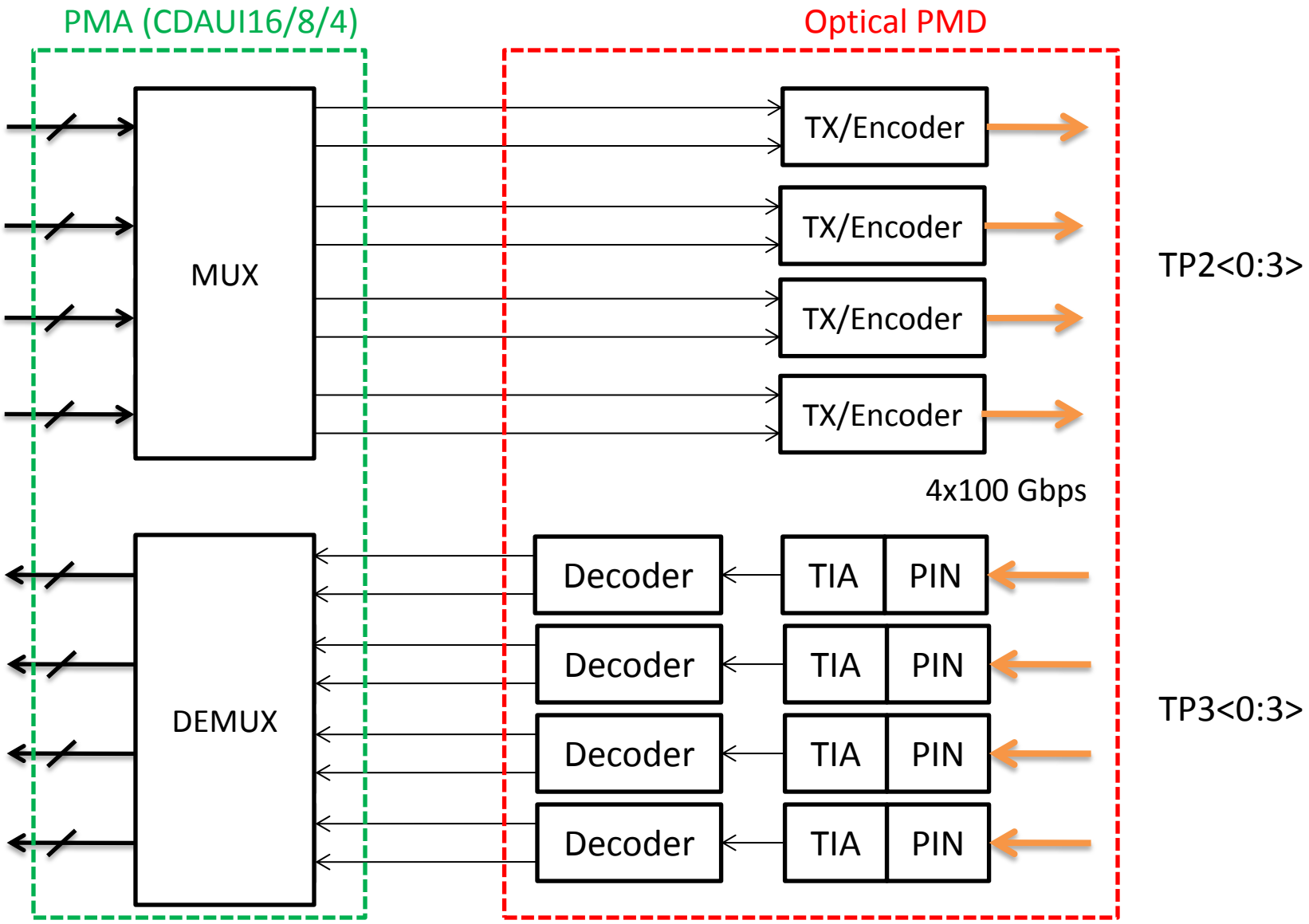
400G-PSM4

- Proposal: A 4x100 Gbps parallel SMF interconnect to satisfy the 500m objective.
- Lane Speed: 100 Gbps per lane using 50 Gbaud-PAM4 optical signaling
- Uncorrected BER = 2.1e-5
  - Corrected BER < 1e-15
- Single wavelength solution

Proposal Objectives

- Enable minimum reach of 500m using a PSM4 fiber plant
- Enable cost/power competitiveness (per Gbps) with 100G solutions
- Enable backward compatibility with 100G-PSM4 solutions
  - At 100Gbps rate
- Enable breakout potential

400G-PSM4 Block Diagram



Spec evolution from 100G-PSM4

- Similar to 100G-PSM4
  - http://www.psm4.org/100G-PSM4-Specification-2.0.pdf
- PSM DL Fiber Plant
  - 3 dB passive loss budget
    - Kolesar_3bs_01_0514.pdf
  - Reduced from 3.25 dB for 100G-PSM4
- Approximately 2.2 dB of RX sensitivity relaxation
  - BW expansion penalty ~ 1.5
  - Linearity/AGC penalty ~ 0.5
  - BER reduction penalty ~ 0.2
  - At wavelength extremes
  - 1.5 dB mid band relaxation
- PAM4 TX penalties
  - 4.77 dB modulation penalty
  - 0.3 dB MPI penalty
  - 0.25 dB Rin penalty
- 1dB excess margin at min TDP
- Total Margin (min) from $OMA_{11\text{-}00}$ = 9.3 dB

400G-PSM4 : Link Parameters

	400G-PSM4
Reach (m)	> 500
Nominal Signaling Rate (each Lane) †	51.5625 GBd-PAM4
Wavelength(s)	1297 to 1323
Uncorrected BER†	< 2.1e-5
Corrected BER†	< 1e-15
802.3bs Objective BER	< 1e-13
Loss Budget, max (dB)	3
Allocation for Penalties, at max TDP (dB)	5.05
Connector Reflectance, Max (dB)	-35

† Assumes Clause91 type FEC. Additional relaxations may be realized with different FEC types.

400G-PSM4: Transmitter Specifications (TP2)

	400G-PSM4
Nominal Signaling Rate (each Lane)	51.5625 GBd-PAM4
Wavelength(s)	1297 to 1323
$OMA_{11\text{-}00}$, each lane, min (dBm)	$MAX(-1.9+(\lambda-1310)^2/70,-1.4)+MAX(TDP,0.8)$
$OMA_{01\text{-}00/10\text{-}01/11\text{-}10}$, each lane, min (dBm)	$MAX(-6.67+(\lambda-1310)^2/70,-6.17)+MAX(TDP,0.8)$
Intra-Eye OMA $Variability_{01\text{-}00/10\text{-}01/11\text{-}10}$, each lane, max (dB)	TBD
$ER_{11\text{-}00}$, each lane, min (dB)	5
Average launch power, each lane max (dBm)	3.5
Total average launch power per fiber max (dBm)	3.5
Average launch power, each lane min (dBm)‡	-2.7
TDP, each lane, max (dB)	3.5
Transmitter RIN_{ave}, max (dB/Hz)	-142
Transmitter Reflectance, max (dB)	-20

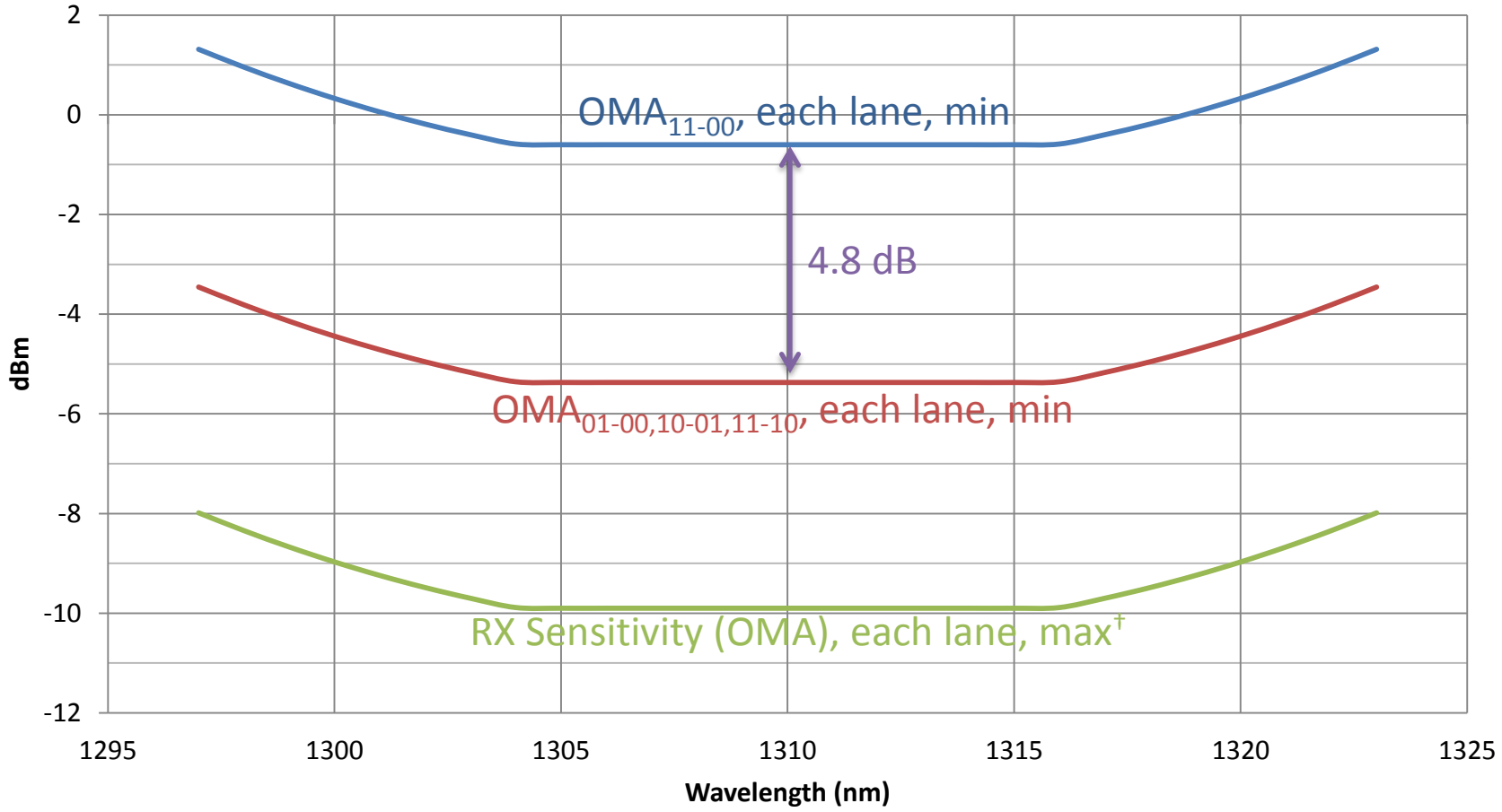
‡ Mid band assuming 10 dB extinction ratio

400G-PSM4: Receiver Specifications (TP3)

	400G-PSM4
Nominal Signaling Rate (each Lane)	51.5625 GBd-PAM4
Wavelength(s)	1297 to 1323
Receiver Sensitivity (OMA), each lane max (dBm)†	MAX(-10.4+(λ-1310)^2/70,-9.9)
Average received power, each lane max (dBm)	3.5
Average received power, each lane min (dBm)	-5.7
Damage Threshold (dBm)	4.5
Receiver Reflectance, max (dB)	-26

† Received sensitivity reported in 'NRZ mode' and uncorrected BER, equivalent to sensitivity for any sub-eye 01-00,10-01,11-01

400G-PSM4



† Received sensitivity reported in 'NRZ mode' and uncorrected BER, equivalent to sensitivity for any sub-eye 01-00,10-01,11-01

Thank You