Update to Adopted 100GE 40km SMF PMD Baseline

IEEE 802.3ba Task Force

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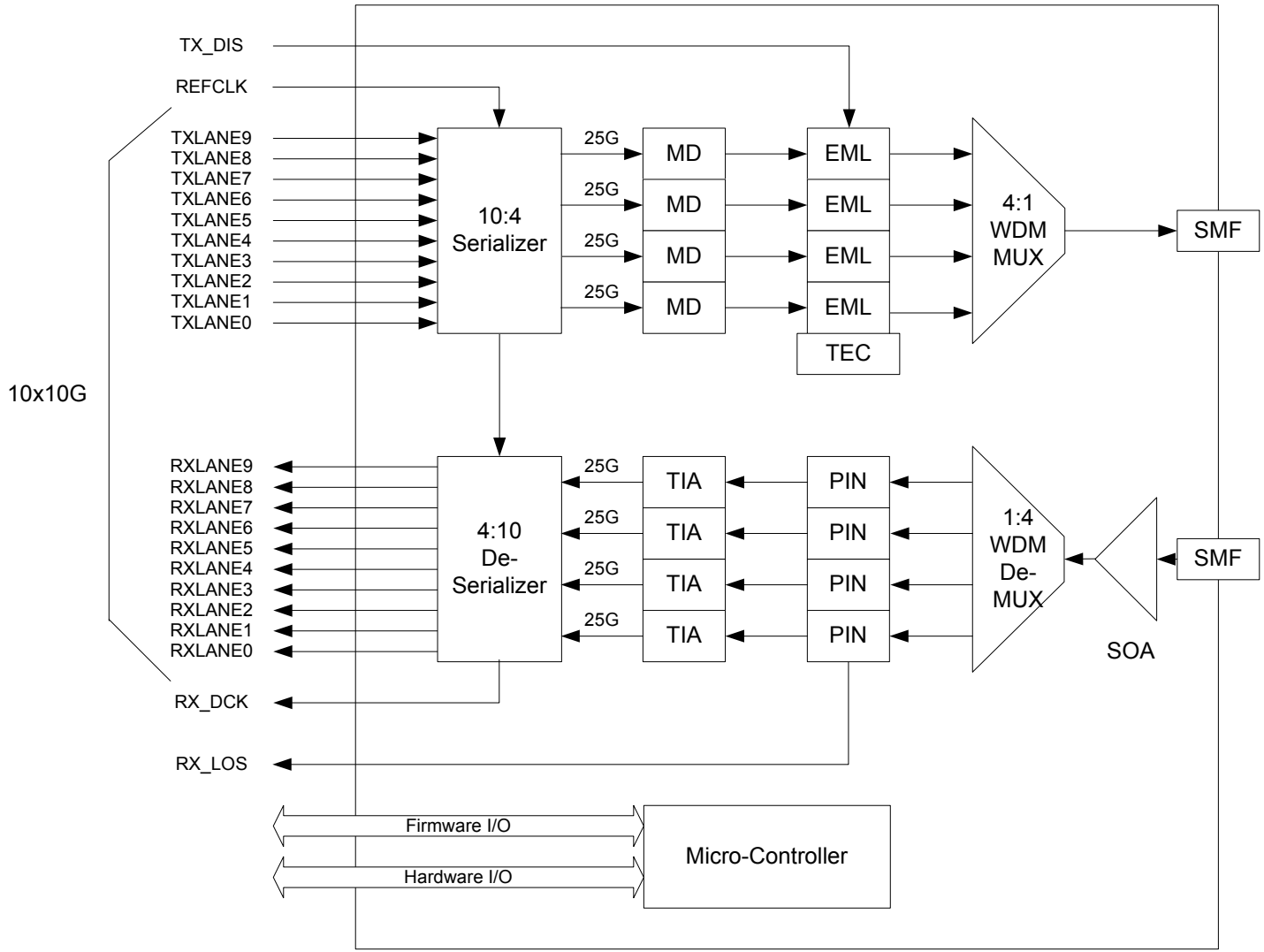
Introduction

- Baseline Proposal for 100GE 40km SMF PMD objective was adopted at the May 802.3ba meeting (http://www.ieee802.org/3/ba/public/may08/cole_02_0508.pdf.)
- This presentation proposes updates to the Baseline Proposal.
- It lists refinements and additions required for a complete 802.3ba specification.
- All numbers should be viewed as subject to change as a result of continued discussion by 802.3ba participants, through Task Force review.
- Proposed updates to the Baseline Proposal
  - Power Budget reformatted to 802.3ae format specification tables
  - Exact wavelength range set to 2.1nm (changed from tentative 2nm in May)
  - Link Power Budget decreased by 1dB to support 30km operating distance and 40km engineered link operating distance, as per 802.3ae 10GBASE-ER (40km) methodology and format
  - Max sensitivity values increased by 1dB to match the 1dB Budget decrease
  - Maximum transmitter and minimum receiver power values added
  - Eye mask, SMSR, ER, RIN, ORLT, TR, RL, 3dB BW limits added.

40km 1310nm EML 4x25G PMD



LAN WDM Baseline (-10nm) Grid

- ITU G.694.1 specification
- 800GHz spacing (193.1THz base)
- 4 wavelengths shifted by -10nm from minimum dispersion Grid
- Exact wavelengths: 1295.56 1300.05 1304.58 1309.14 nm
- Shorthand wavelengths: 1295, 1300, 1305, 1310 nm
- TX and RX wavelength range: 2.1 nm (2 nm shorthand)
- G.652 A&B 40km SMF worst dispersion and fiber loss
  - Max positive dispersion (1310nm) = 38ps/nm
  - Max negative dispersion (1295nm) = -114ps/nm
  - Max Loss (1310nm) = 16.8dB
  - Max Loss (1295nm) = 17.3dB

100GBASE-ER4 lane assignments

Lane	Center frequencies	Center wavelengths	Wavelength ranges [a]
L_0	231.4 THz	1295.56 nm	1294.53 – 1296.59 nm
L_1	230.6 THz	1300.05 nm	1299.02 – 1301.09 nm
L_2	229.8 THz	1304.58 nm	1303.54 – 1305.63 nm
L_3	229.0 THz	1309.14 nm	1308.09 – 1310.19 nm

[a] Wavelength ranges calculated for center frequencies $\pm$ 23% of 800GHz spacing

100GBASE-ER4 transmit characteristics

Description	100GBASE-ER4	Unit
Signaling speed per lane	25.78125 ±100 ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}[a]	TBD	
Side Mode Suppression Ratio (SMSR), (min)	30	dB
Total average launch power (max)	8.4	dBm
Difference in launch power between any two lanes (max)	3.0	dB
Average launch power per lane (max)[b]	2.4	dBm
Average launch power per lane (min)[b]	-2.9	dBm
Optical Modulation Amplitude (OMA), per lane (max)	4.0	dBm
Optical Modulation Amplitude (OMA), per lane (min)	0.1	dBm
Extinction Ratio (min)	8.0	dB
Average launch power of OFF transmitter, per lane (max)	-30	dBm
$RIN_{12}OMA$ (max)[c]	-132	dB/Hz
Optical Return Loss Tolerance (max)	12	dB
Transmitter Reflectance (max)[d]	-12	dB

[a] Tx eye mask spec to be specified as per eye mask methodology discussions

[b] Informative

[c] RIN is scaled by 10*log(10/4) to maintain SNR out of transmitter

[d] -12dB transmitter reflectance helps relax RX reflection spec

100GBASE-ER4 receive characteristics

Description	100GBASE-ER4	Unit
Signaling speed per lane	25.78125 ±100 ppm	GBd
Lane wavelengths (range)	1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19	nm
Difference in receive power between any two lanes (max)	4.0	dB
Receive power, per lane (OMA) (max)	4.0	dBm
Average receive power, per lane (max)[a]	4.0	dBm
Average receive power, per lane (min)[b]	-20.9	dBm
Return loss (min)[c]	-26	dB
Receive sensitivity (OMA), per lane (max)	-21.4	dBm
Stressed receive sensitivity (OMA), per lane	-17.9	dBm
Vertical eye closure penalty, per lane	3.5	dB
Receive electrical 3 dB upper cutoff frequency, per lane (max)	31	GHz

[a] The receiver shall tolerate, without damage, the Average Receive Power (max) plus 1 dB

[b] Informative, equals min Tx OMA with infinite ER and max channel insertion loss

[c] Prevents excess coherent interference due to Tx Rx reflectance

100GBASE-ER4 link power budget

Description	100GBASE-ER4		Unit
Power budget	21.5		dB
Operating distance	30	40[c]	km
Channel insertion loss [a]	15	18	dB
Maximum Discrete Reflectance (max)	-26	-26	dB
Allocation for penalties [b]	3.5[d]	3.5	dB
Additional insertion loss allowed	3.0	0.0	dB

[a] Channel insertion loss includes fiber and connector losses for worst case wavelength lane

[b] Dispersion and other penalties for worst case wavelength lane, DGD_{max} = T.B.D.

[c] Links longer then 30km are considered engineered links. Attenuation for such links needs to be less then that guaranteed by 802.ba reference SMF.

[d] Assumes 1.5dB CD Penalty, 1.0dB PMD Penalty, 1.0dB Other Penalties.