

400Gb/s 2km & 10km duplex SMF NRZ PMD Nominal Specifications

400 Gb/s Ethernet Task Force
802.3 Plenary Session
San Antonio, TX
4 - 6 November 2014
Chris Cole



Finisar[®]

Background

- Nominal specifications based on:

http://www.ieee802.org/3/bs/public/adhoc/smf/14_10_14/cole_01a_1014_smf.pdf

- The NRZ channel insertion loss is reduced by ½ dB from above because of lower MPI penalty

	2km NRZ	2km PAM-4	10km NRZ	10km PAM-4
Channel Loss	4.0	4.0	6.0	6.0
MPI Penalty	0.5	1.0	0.5	1.0
Total Insertion Loss	4.5	5.0	6.5	7.0

(See Appendix 2 & 3 for updated summary tables)

- 10km spec. is w/ BCH FEC, but KP4 FEC is viable option
- These specifications are not a final proposal because of insufficient measurements

Transmit Characteristics (duplex SMF)

Description	2km NRZ	10km NRZ	Unit
Signaling Rate, each lane	53.2	55.9	GBd
Operating BER	2.0E-04	1.0E-03	
Total average launch power (max)	11.7	12.2	dBm
OMA, each lane (max)	2.5	3.0	dBm
OMA, each lane (min)	-2.8	-2.3	dBm
Launch Power in OMA – TDP, each lane (min)	-3.8	-3.3	dBm
Transmitter and dispersion penalty, (TDP) each lane (max)	1.8	2.3	dB
Extinction ratio (ER) (min)	4.5	4.5	dB
RIN OMA (max)	-130.0	-130.0	dB/Hz
Transmitter 3dB frequency (min)	21	21	GHz
Optical return loss tolerance (max)	20.0	20.0	dB

Receive Characteristics (duplex SMF)

Description	2km NRZ	10km NRZ	Unit
Signaling Rate, each lane	53.2	55.9	GBd
Operating BER	2.0E-04	1.0E-03	
Receiver reflectance (max)	-26.0	-26.0	dB
Receiver Sensitivity (OMA), each lane (max)	-8.3	-9.8	dBm
Receiver 3 dB electrical upper cutoff frequency, each lane (max)	42	42	GHz
Stressed receiver sensitivity (OMA), each lane (max)	TBD	TBD	dBm
Conditions of stressed receiver sensitivity test	TBD	TBD	

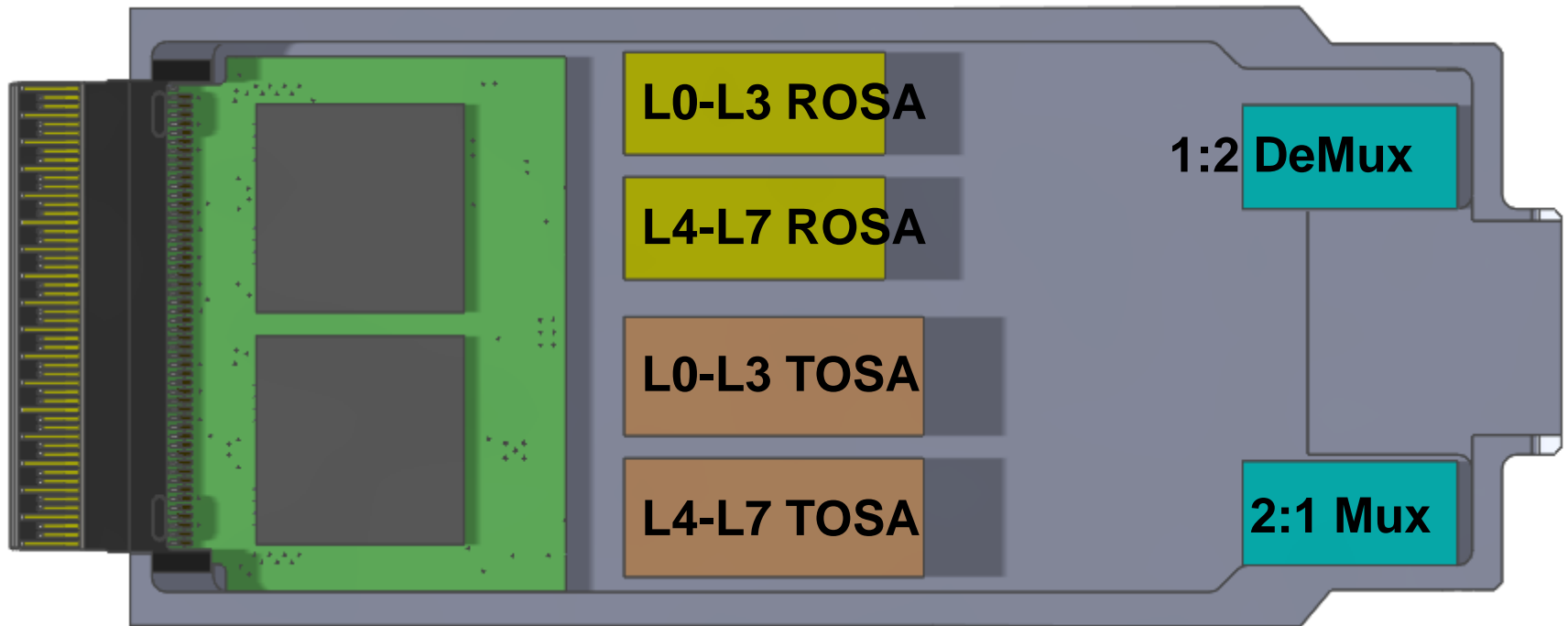
Illustrative Link Power Budgets (duplex SMF)

Parameter	2km NRZ	10km NRZ	Unit
Power Budget (for maximum TDP)	6.3	8.8	dB
Operating Distance	2.0	10.0	km
Channel Insertion Loss	4.5	6.5	dB
Maximum Discrete Reflectance	-26.0	-26.0	dB
Allocation for Penalties (for maximum TDP)	1.8	2.3	dB
Allocation for Modulation Penalties	0.0	0.0	dB

WDM Lane Assignments

Lane	Center Frequency THz	Center Wavelength nm	Wavelength Range nm
L0	231.4	1295.56	1294.53 to 1296.59
L1	230.6	1300.05	1299.02 to 1301.09
L2	229.8	1304.58	1303.54 to 1305.63
L3	229.0	1309.14	1308.09 to 1310.19
L4	235.4	1273.55	1272.55 to 1274.54
L5	234.6	1277.89	1276.89 to 1278.89
L6	233.8	1282.26	1281.25 to 1283.28
L7	233.0	1286.66	1285.65 to 1287.69

Appendix1: Example Gen1 400G CFP2 Layout



Appendix 2: 2km Duplex SMF PMDs Specs

Specifications	NRZ 4x25G LR4 No FEC MOD / DML	8x50G NRZ KP4 FEC MOD	8x50G PAM4 KP4 FEC MOD / DML	4x100G BCH FEC PAM4 MOD	4x100G DMT BCH FEC 25G DML
Symbol (or Sample) Rate Gbaud (or GS)	25.8	53.2	26.6	55.9	55.9
Operating BER	1.0E-12	2.0E-04	2.0E-04	1.0E-03	1.0E-03
ER Full Scale (min) dB	4.0	4.5	4.5	7.0	4.5
TX OMA (min) @TDP (max) dBm	-0.1	-2.0	-0.5	1.0	2.5
Modulation Penalty (MP) dB	0.0	0.0	5.0	5.0	9.0
TDP (max) dB	2.2	1.8	1.0	2.0	2.5
TX OMA - MP -TDP each lane (min) dBm	-2.3	-3.8	-6.5	-6.0	-9.0
Channel Insertion Loss & MPI penalty dB	6.3	4.5	5.0	5.0	5.0
RX Sens. OMA pre-FEC each lane (max) dBm	-8.6	-8.3	-11.5	-11.0	-14.0

Appendix 3: 10km Duplex SMF PMDs Specs

Specifications	NRZ 4x25G LR4 No FEC MOD / DML	8x50G NRZ BCH FEC MOD	8x50G PAM4 BCH FEC MOD / DML	4x100G BCH FEC PAM4 MOD	4x100G DMT BCH FEC 25G DML
Symbol (or Sample) Rate Gbaud (or GS)	25.8	55.9	28.0	55.9	55.9
Operating BER	1.0E-12	1.0E-03	1.0E-03	1.0E-03	1.0E-03
ER Full Scale (min) dB	4.0	4.5	4.5	7.0	4.5
TX OMA (min) @TDP (max) dBm	-0.1	-1.0	0.0	1.0	2.5
Modulation Penalty (MP) dB	0.0	0.0	5.0	5.0	9.0
TDP (max) dB	2.2	2.3	1.5	2.5	3.0
TX OMA - MP -TDP each lane (min) dBm	-2.3	-3.3	-6.5	-6.5	-9.5
Channel Insertion Loss & MPI penalty dB	6.3	6.5	7.0	7.0	7.0
RX Sens. OMA pre-FEC each lane (max) dBm	-8.6	-9.8	-13.5	-13.5	-16.5

2km & 10km NRZ PMD Nominal Specs

Thank you

