

Technical Feasibility of 40GBASE-ER4 PMD

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Next Gen 100GbE Optical SG, Atlanta, November 2011

Introduction

- The proposals and data on pages that follow are work in progress that do not necessarily reflect a consensus position but are only illustrative to show that there is broad agreement on the technology approach and range of specification numbers. If IEEE 802.3 NG 100G SG adds 40GE 40km SMF PMD objective, exact numbers will be developed in Task Force.

40GBASE-ER4 PMD Technical Feasibility

- 10GBASE-ER in SFP+ form factor is available today from several suppliers. Optics typically employed are 1550nm EA-DFB and PIN-PD.
- Desirable to leverage 1300nm CWDM optics solutions developed for 40GBASE-LR4/C4S1-2D1 applications:
 - Available today from several suppliers;
 - Compatible for interoperability with 40GBASE-LR4 PMD;
 - Reduces ER4 cost by economies of scale.

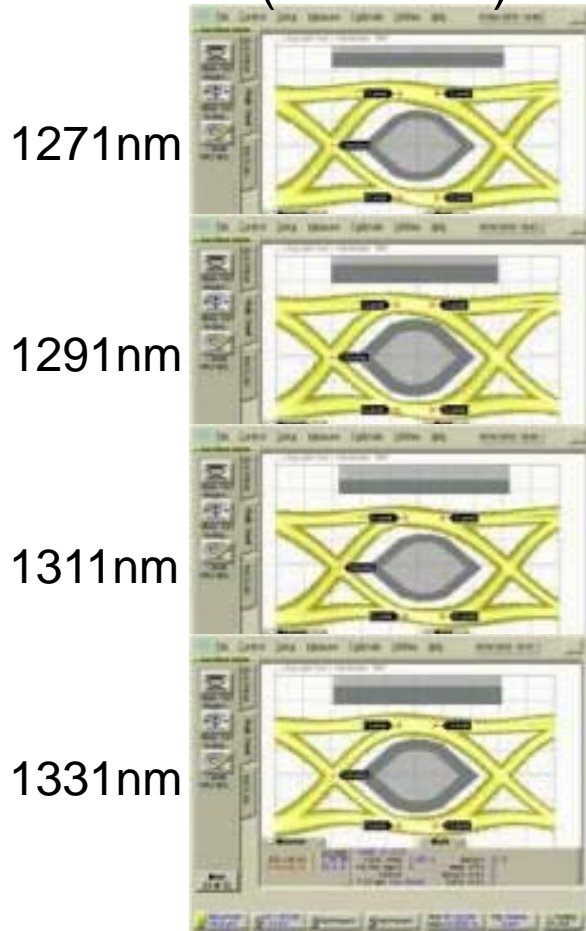
40GBASE-ER4 PMD Technical Feasibility Cont.

- For achieving 40km operating distance on SMF:
 - a. Cable optical fiber attenuation in 1300nm range is (0.47dB/km) 18.8dB plus a couple dB for connector and splice loss; may need to consider “engineered link” with improved insertion loss;
 - b. Transmitter dispersion penalty in 1300nm region is expected to be the same or similar to LR4;
 - c. Overall, channel IL is about 12dB greater than channel IL in LR4 link budget, which cannot be made up by only increased tx output power.
- Consider use of 10G APD:
 - a. Available today from several suppliers;
 - b. Rx sensitivity (OMA) typically -21dBm in 1550nm range;
 - c. Expect ~ 2dB responsivity degraded performance when operated in 1300nm range;
 - d. Overall, expect Rx sensitivity (OMA) to be in -18-19dBm range

4x10G 40km CFP Optical Transceiver

- Performance Example at Nominal Condition-

Optical waveform
(10.3Gb/s)

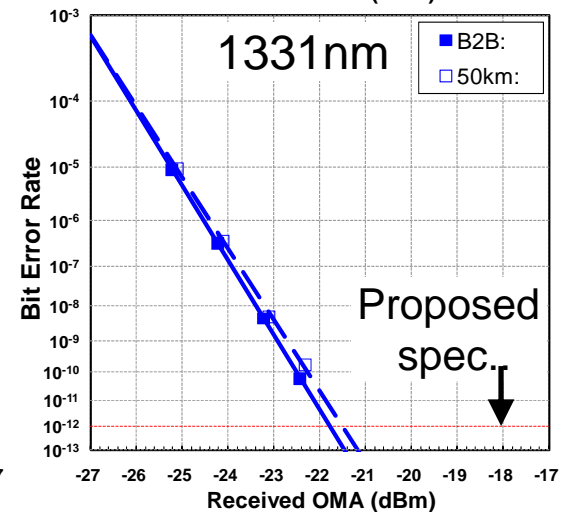
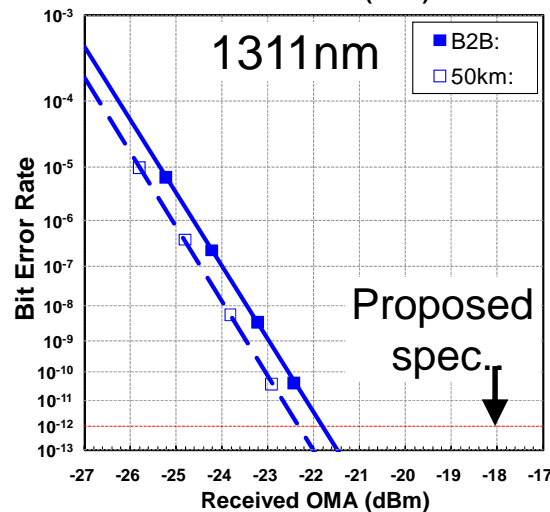
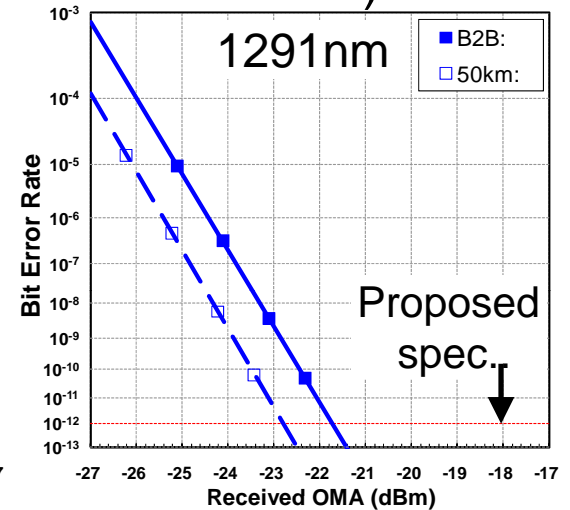
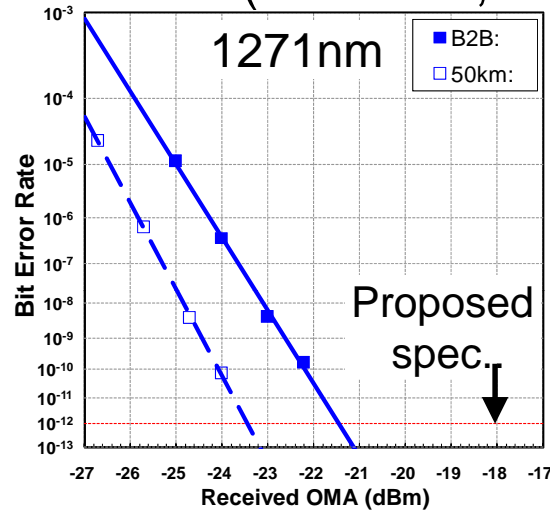


~7dB extinction ratio

Source: Sumitomo Electric

1 Nov 2011

BER curve
(10.3Gb/s, B-to-B/50kmSMF)



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4x10G 40km CFP Optical Transceiver - Receiver Sensitivity Deviation -

Normalized CFP receiver sensitivity (Temperature dependency)

	Tc=0°C	Tc=35°C	Tc=70°C
Normalized receiver sensitivity (OMA, B-to-B) (dBm)	-0.5	0 (nominal)	+1.0

Normalized CFP receiver sensitivity (Extinction ratio dependency)

	ER 5dB	ER 6dB	ER 7dB
Normalized receiver sensitivity (OMA, B-to-B) (dBm)	+0.5	0 (nominal)	-0.5

Normalized CFP receiver sensitivity (Data rate dependency)

	10.3Gb/s	10.75Gb/s	11.15Gb/s
Normalized receiver sensitivity (OMA, B-to-B) (dBm)	0 (nominal)	0.5	0.8

Source: Sumitomo Electric

Illustrative Link Budgets for 40GBASE-ER4

	40GBASE-LR4	Sumitomo 40GBASE-ER4		Opnext 40GBASE-ER4	Finisar 40GBASE-ER4	
Power budget (for max TDP)	9.3	20.6		22.3		
Operating distance	10	30	40	40	30	40
Maximum fiber loss per km	0.47	0.47	0.4		0.47	0.4
Optical connector loss	2	2	2			2
Channel insertion loss max	6.7	16	18	18.8		18
Channel insertion loss min	0	5.1		0	8.5	
Maximum discrete reflectance	-26	-26	-26	-26	-26	
Allocation for penalties (for max TDP)	2.6	2.6	2.6	3.5		
Additional insertion loss allowed	0	2	0			0

Note: Link budget and optical transmitter/receiver specifications are under study.

Note a: The channel insertion loss is calculated using the maximum distance specified in Table 87–6 and cabled optical fiber attenuation of 0.47 dB/km at 1264.5 nm plus an allocation for connection and splice loss given in 87.11.2.1.

Note b: Link penalties are based on experimental results.

Note c: The channel insertion loss is calculated using the maximum distance specified in Table xx–x and cabled optical fiber attenuation of 0.47 dB/km at 1264.5 nm plus an allocation for connection and splice loss given in 87.11.2.1.

Note d: The channel insertion loss is calculated using the maximum distance specified in Table xx–x and cabled optical fiber attenuation of 0.4 dB/km which is used in Table 52-14 plus an allocation for connection and splice loss given in 87.11.2.1.

Appendix: Additional Illustrative Link Budgets proposed for 40GBASE-ER4

Illustrative link power budget

	40GBASE-LR4	Inolight 40GBASE-ER4	Egtran 40GBASE-ER4		Unit
Power budget (for max TDP)	9.3	24	22.5		dB
Operating distance	10	40	30	40	km
Maximum fiber loss per km	0.47	0.47	0.47	0.47	dB/km
Optical connector loss	2	2	2	2	dB
Channel insertion loss max	6.7	20.8	15	20	dB
Channel insertion loss min	0				
Maximum discrete reflectance	-26	-26	-26	-26	dB
Allocation for penalties (for max TDP)	2.6	3.2	2	2.5	dB
Additional insertion loss allowed	0	0	3		dB

End of Contribution

Thanks!