Rationale for dual-band Rx in 40GBASE-FR

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Introduction

- P802.3bg draft specifies dual 1310nm and 1550nm center wavelength bands for the 40GBASE-FR PMD optical receiver (P802.3bg™D2.1 Cl. 89.6.2/Table 89-7).
- WG Letter Ballot comments have been received questioning the need for a dual-band receiver specification and whether it adds unnecessary cost for the 40GBASE-FR transceiver.
- This contribution provides the rationale for the decision taken by the P802.3bg TF for requiring the dual-band receiver specification. Benefits and relative costs of the dual-band receiver are outlined.

Supporters

- Steve Trowbridge, Alcatel-Lucent
- Sam Sambasivan, AT&T
- Peter Anslow, Ciena
- Chris Cole, Finisar
- Jonathan King, Finisar
- H. Hamano, Fujitsu
- Zeng Li, Huawei
- Jeff Maki, Juniper Networks
- Osama Ishida, NTT
- H. Iwadate, Sumitomo
- John M. Carroll, Verizon

P802.3bg D2.1 Receiver Optical Specifications

Table 89–7—40GBASE–FR receive characteristics

Description	Value	Unit
Signaling rate (range)	41.25 ± 100 ppm	GBd
Center wavelength (range)	1290 to 1330 and 1530 to 1565	nm
Damage threshold[a] (min)	4	dBm
Average receive power (max)	3	dBm
Receiver reflectance (max)	–26	dB
Receiver sensitivity (average power)[b] (max)	–6	dBm
Receiver jitter tolerance (max)	1	dB
Receiver 3 dB electrical upper cutoff frequency (max)	49	GHz

Benefit

- Key objective of the P802.3bg project is to specify 40GE serial SMF PMD that is optically compatible with existing carrier 40Gb/s client interfaces.
- P802.3bg has adopted a 1550nm tx/rx optical PMD that is optically compatible with ITU-T G.693 1550nm/2km VSR2000-3R2 optical interface specifications.
- Carriers have expressed a need for and are requesting to deploy ITU-T G.959.1 40Gb/s serial 1310nm/10km (P1I1-3D1) client interfaces. G.693 also defines 40Gb/s serial 1310nm/2km VSR2000-3R1.
- Enabling the 40GE SMF PMD to be optically compatible with the 40Gb/s 1310nm interfaces is of benefit to carriers for providing 40Gb/s client interconnection flexibility and network operations cost savings.
- Specification of the dual-band rx in 40GBASE-FR PMD enables optical interconnection between 1550nm and 1310nm optical interfaces.

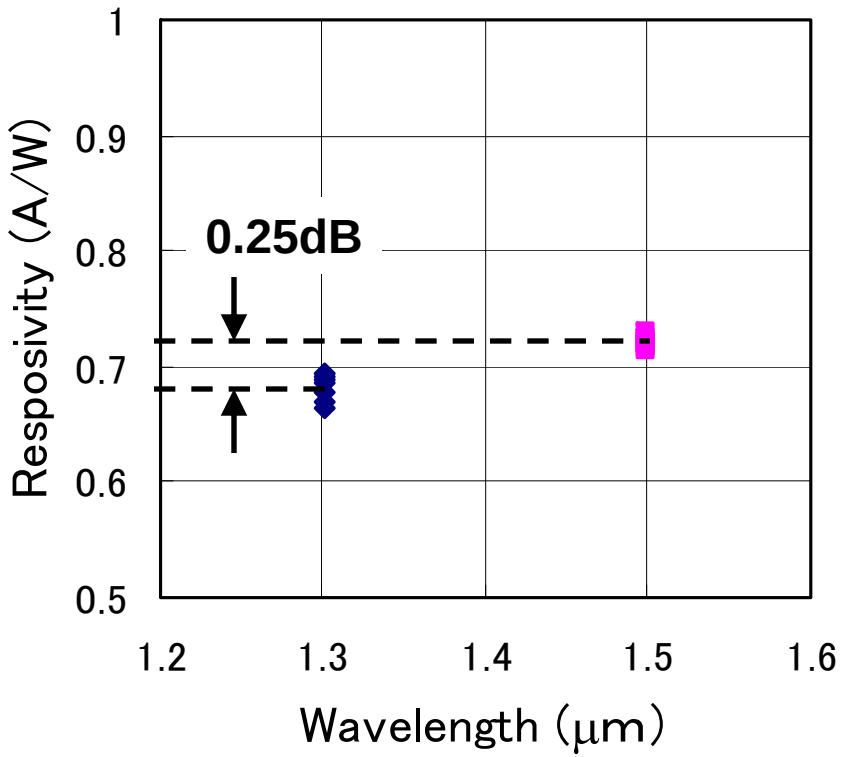
Relative Cost Impact

- Most high-speed PIN-PDs available today have wide spectral sensitivity to cover O-band (1310nm), C-band (1550nm) (and even L-band (1600nm)) with uniform responsivity and small temperature variation.
- A common ROSA (PIN-PD + TIA) is easily designed to meet optical receiver interface requirements for 1310nm tx *and* 1550nm tx sources.
- Relative cost difference between ROSA (1550nm only) and ROSA (1310/1550nm):
  - Materials & Assembly: 0
  - Testing: < 5%, 1310nm testing can be minimized following 1550nm testing
  - Yield loss: nearly zero (drop-outs mostly due to 1550nm components)
  - Test Infrastructure: Small to Moderate, as 1310nm requires new test equipment; also depends on expected production volume

➢ Insignificant overall relative cost impact in adding 1310nm band to receiver requirements, especially at transceiver level.

40Gb/s PIN ROSA Responsivity

- Responsivity of 40G PIN-PD ROSA is shown in the figure demonstrating almost flat responsivity over wavelength.

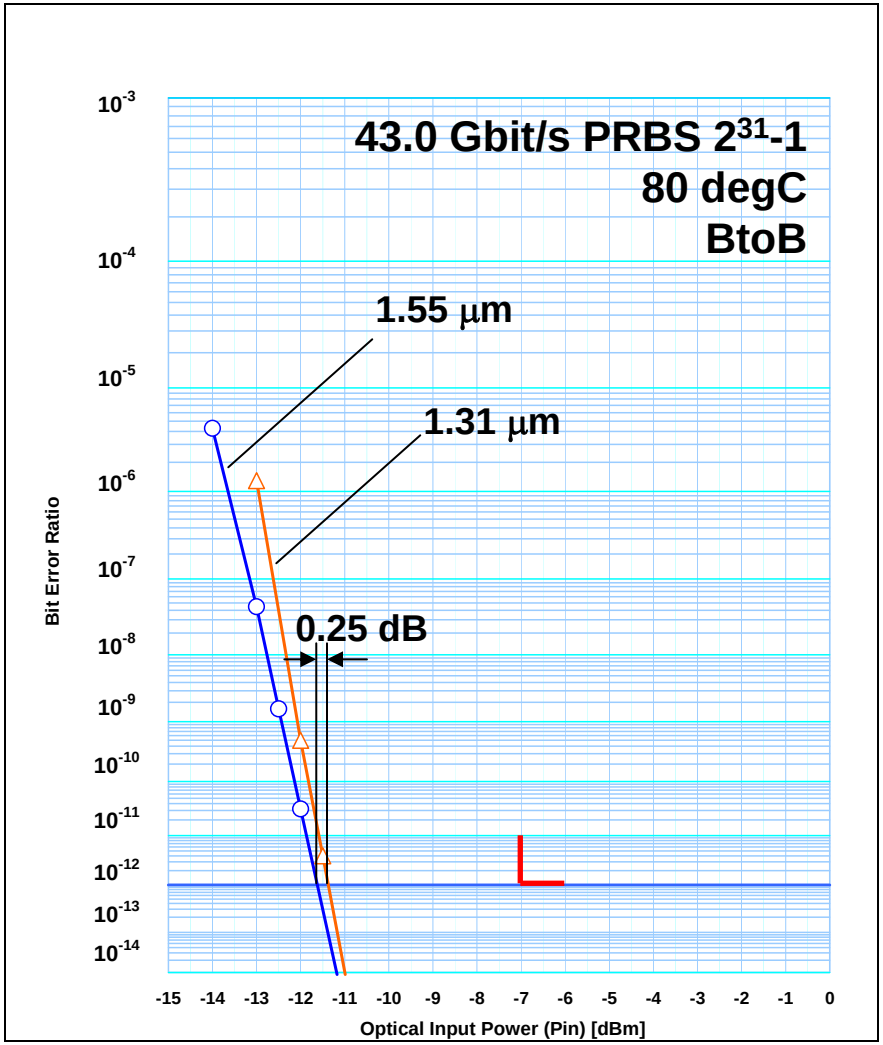


Source: Opnext

40Gb/s PIN ROSA Sensitivity

- Owing to the same responsivity, minimum receiver sensitivity at 1.31 μm and 1.55 μm are almost the same with a good margin against the spec.

Source: Opnext



Conclusion

- The dual-band optical receiver specification in P802.3bg “40GBASE-FR PMD” draft provides a key benefit for carriers by enabling interconnection flexibility between 40GBASE-FR 1550nm optical interfaces and 40Gb/s serial 1310nm optical interfaces.

- This benefit is gained at small cost; overall relative cost difference between 1550nm-only band and 1310/1550nm dual-band receivers across 39-43 Gb/s data range is insignificant.

- It is recommended the dual-band receiver specification be retained in P802.3bg 40GBASE-FR PMD.

End of Contribution