Recommendation of lower minimum extinction ratio for 10GBASE-PR-U

Shinji Tsuji

Sumitomo Electric

Overview

- Current 10GBASE-PR-U minimum extinction ratio is 6dB. However 4.5dB is preferable.
  - Consistency with current standard.
  - Practical value with high yield and low cost.
  - Receiver impact of low ER is milder than high ER.
- Minimum extinction ratio has no impact to all other current transmit/ receive items.
- OLT(10GBASE-PR-D) adopts 6dB min. ER to expand the possibility for low cost transmitter. 4.5dB for ONU(10GBASE-PR-U) is reasonable.

Current ER Option

- Current min. ER is 6dB and there is a reduced launch power option (Comment #1465).
  - This option intends temporary EML solution.
    - Baseline adopts high power DML.
    - DFB has degraded frequency response at low power region.
- This is an another way from DML based solution.

High-Power ONU Transmitter

>+4 dBm upstream launch power is required
for 10GBASE-PR-U3 (10G ONU) transmitter

New developments are necessary for high-power DMLs
Technically feasible, but no requests existed before
Still requires money, time, and motivation of LD suppliers

EML transmitter option may relax launch power
Will NOT be a permanent option:
Cost and Temp. control are undesirable for ONU
But CAN be a temporary candidate:
>+1dBm EMLs are widely available today

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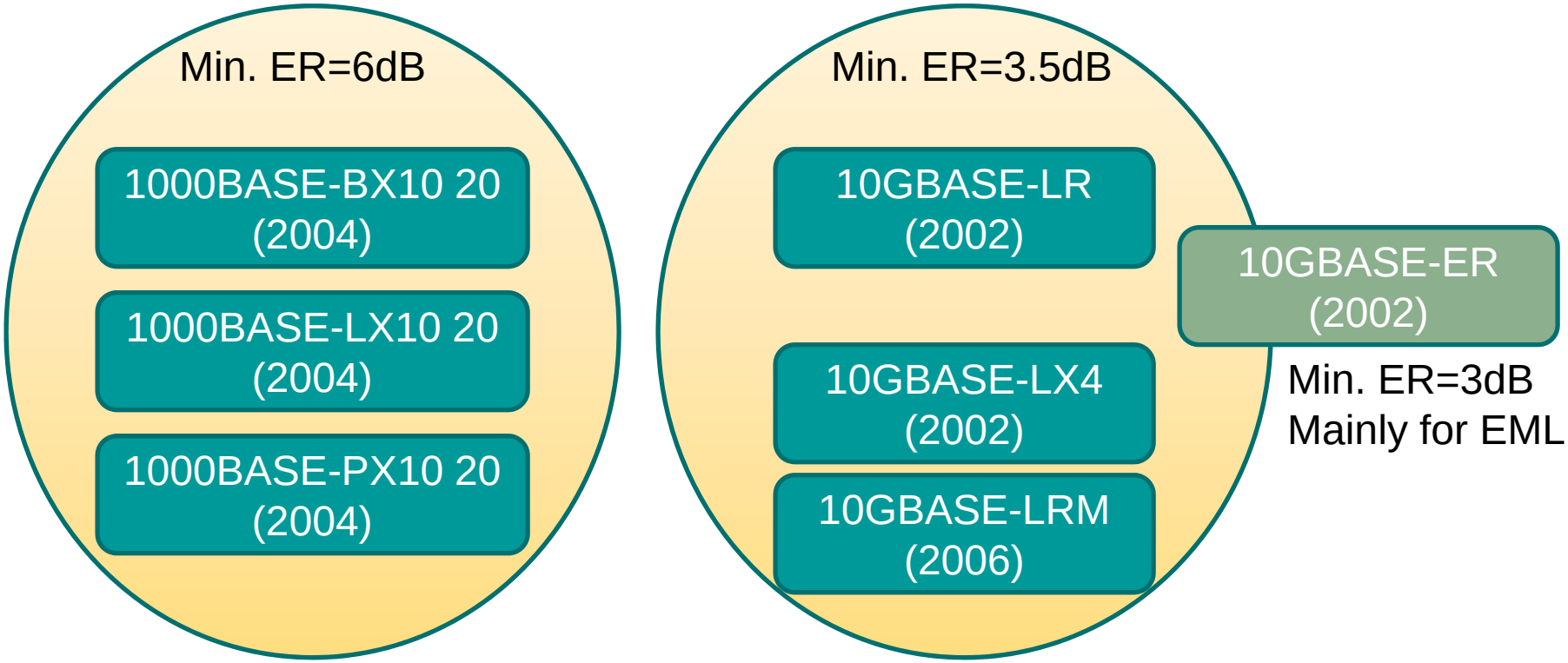
Current Standard ER specification



All standards define OMA-average power basis where lower extinction ratio is applicable.

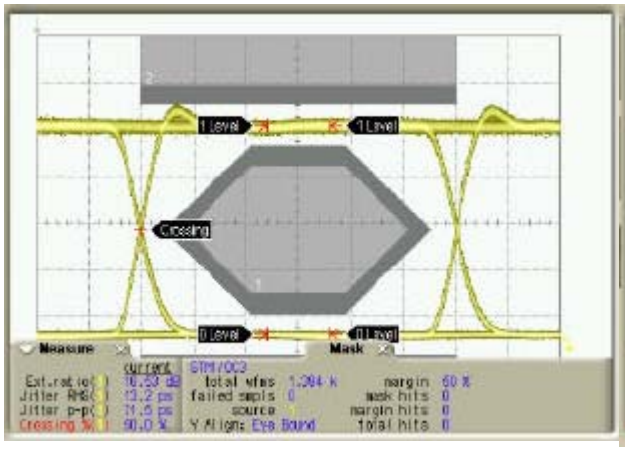
Direct modulation min. ER is 3.5dB for 10G. (6dB for 1.25G.)

Reason for recommending 4.5dB

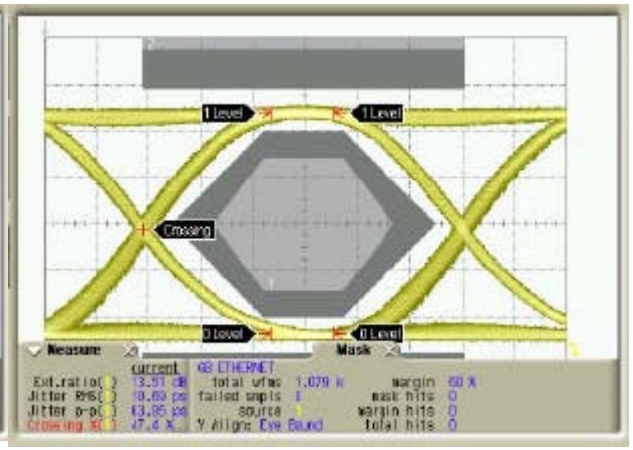
For PON ONU launch power range is as narrow as 5dB, there is little tuning space when setting 3.5dB ER.

10G difficulties

- Example of direct modulation laser optical eye and extinction ratio at several bit rates.

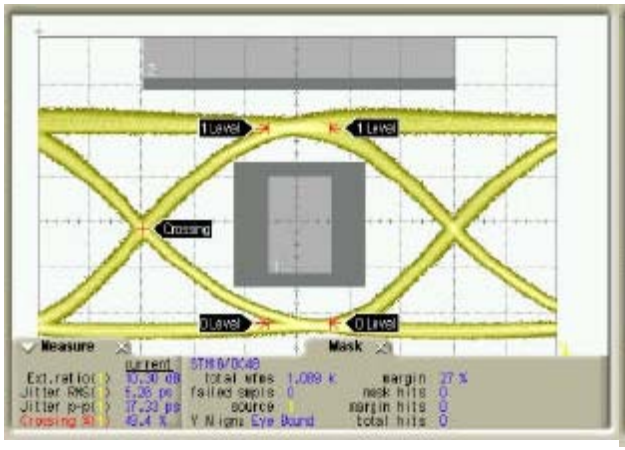


155M (16dB)

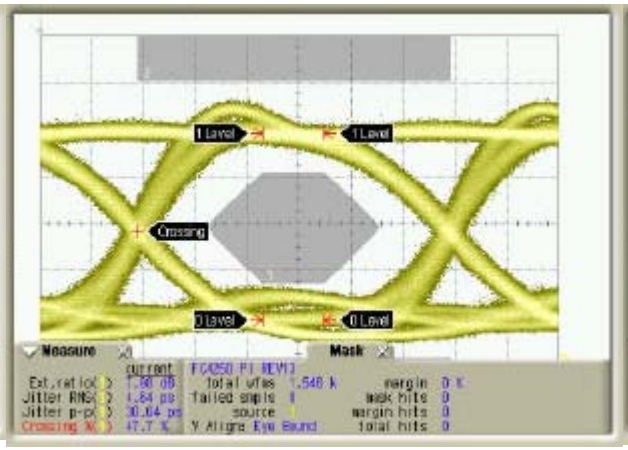


1.25G (13dB)

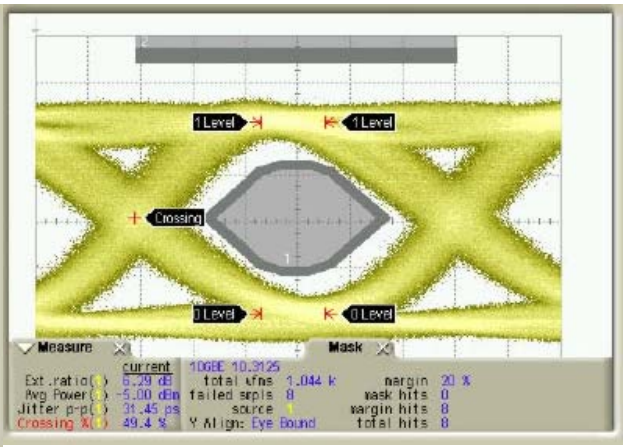
vendor A



2.5G (10dB)



4.25G (8dB)



10.3G (6dB)

ER for the PR Type ONU PMD 0804.pdf

Feasibility and Productivity

- High power DML for 10GBASE-PR30-U is feasible.
- Lower extinction ratio generates better waveform and higher mask/jitter margin. This means higher yield and lower cost.

Power : +6 dBm (LD drive current is reduced by -40 %)

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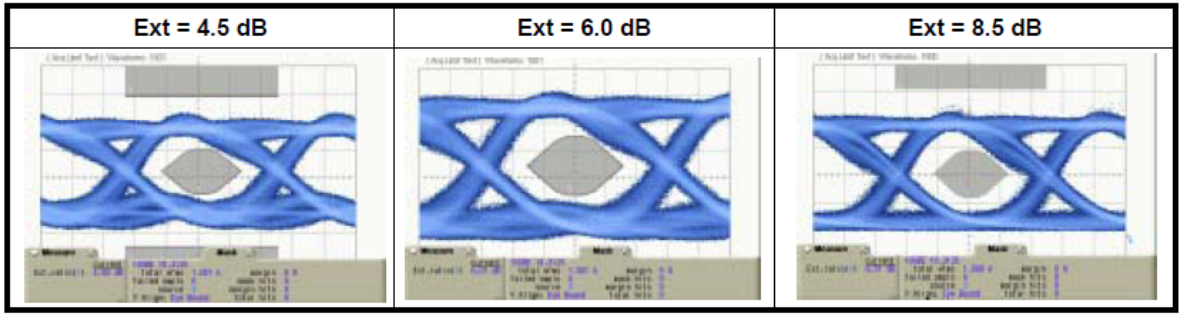
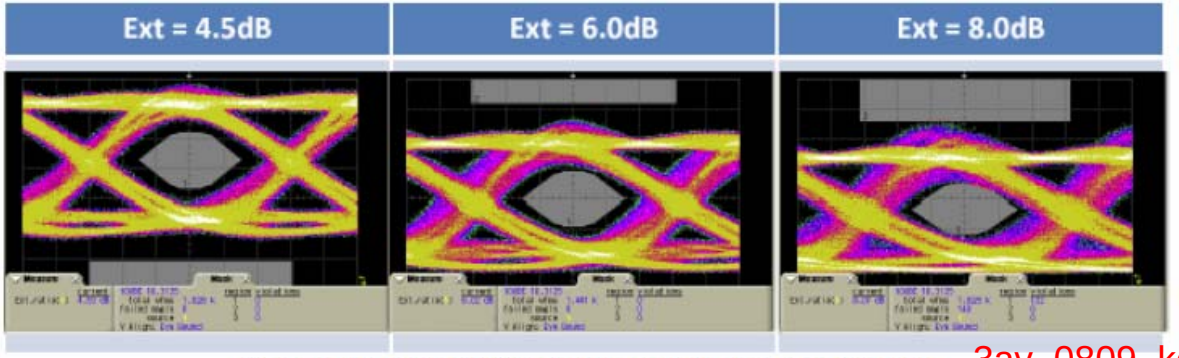
vendor B



vendor C



Measured result of Transmitter eye waveforms (worst)

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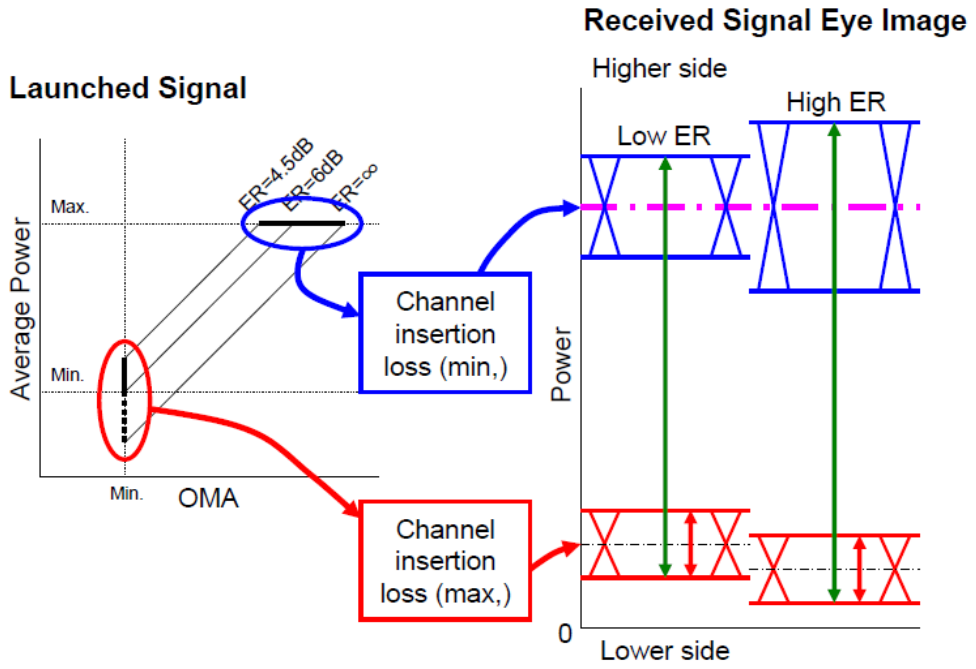
Receiver Impact

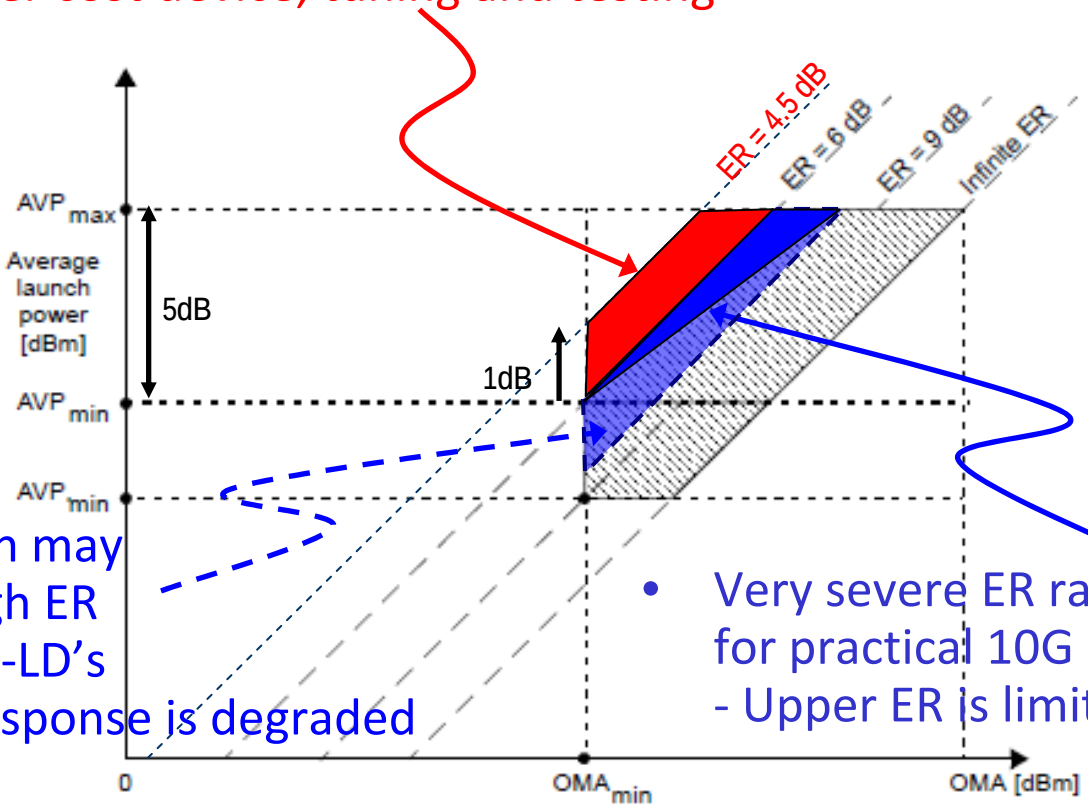
- Receiver impact at low ER is milder than high ER.
  - Lower peak level
  - Higher ‘0’ level to dark current margin
  - Prevent from overshoot without severe ER control.



Summary

- 4.5dB min. ER is a practical selection with considering high volume/ low cost solution.

- Expanding ER operating range of more than 4.5 dB :
  Allowing lower cost device, tuning and testing



- Low Pf region may not allow high ER because DFB-LD's frequency response is degraded

- Very severe ER range (e.g. 2.5 dB) for practical 10G DM-DFB use
  - Upper ER is limited by 8 - 9 dB