6dB Extinction Ratio for 10GBASE-PR-U

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Overview

In the IEEE Seoul interim meeting in Sep. 2007, current 10G-EPON power budget has been agreed in the TF.

- Allocation for penalty is still challenging, due to burst-mode, and moreover, dual-rate operation, especially for PR30 U/S tight budget requirement.

  - DML power relaxation is still the main concern in the TF.

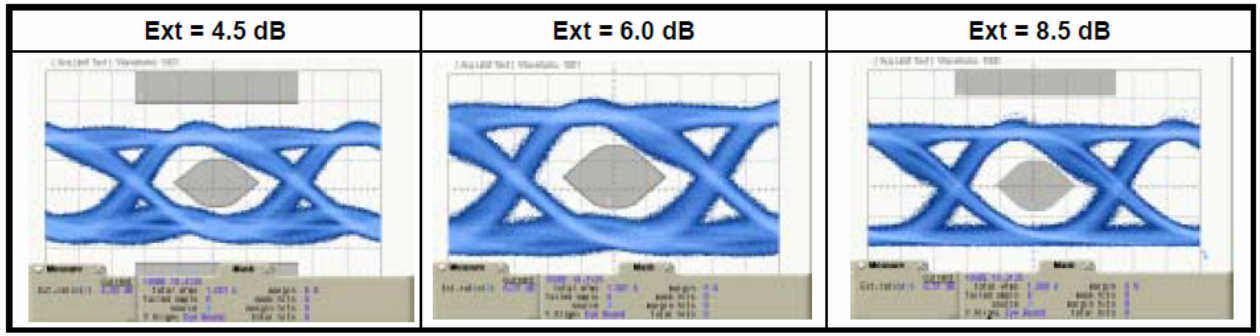
- ITU-T standard specifies 6dB-ER DML TXs for similar tight budgets.

  - Reasonable and practical reference, compared to IEEE specs. for rather moderate applications.

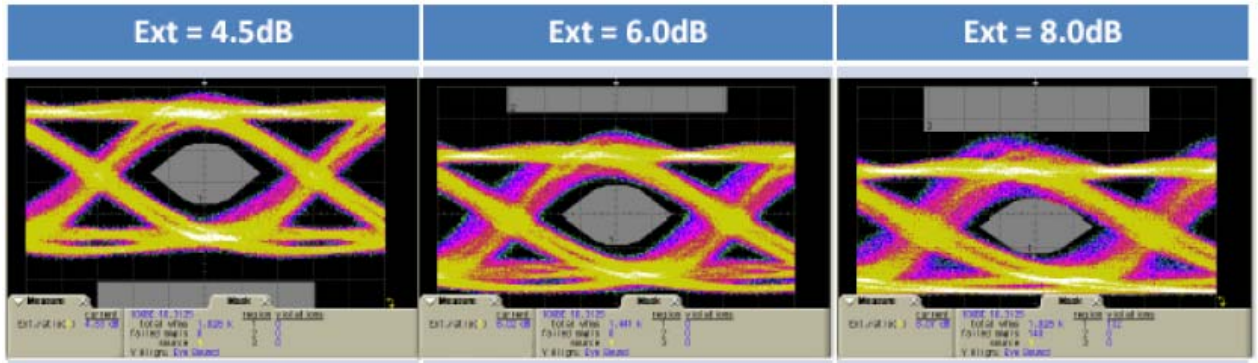
  - 6dB ER is achievable without difficulty, with current 10G DML technology.

10G DML Output Waveform

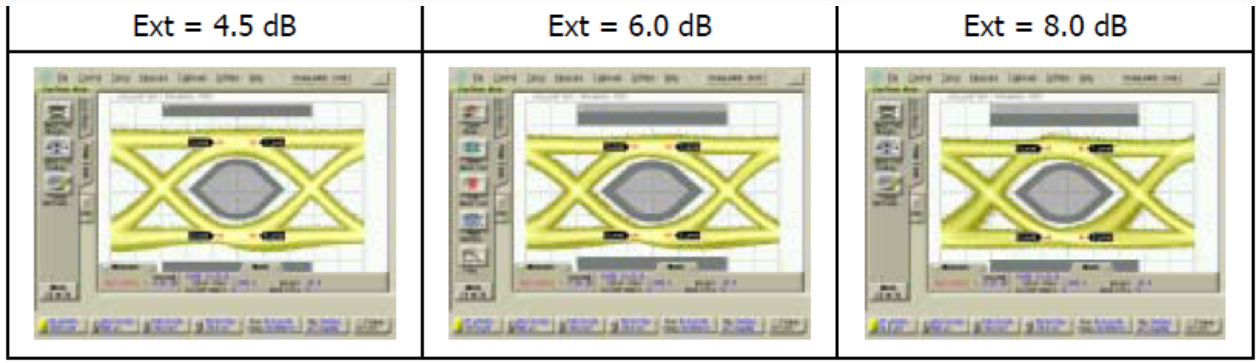
Vender A



Vender B



Vender C



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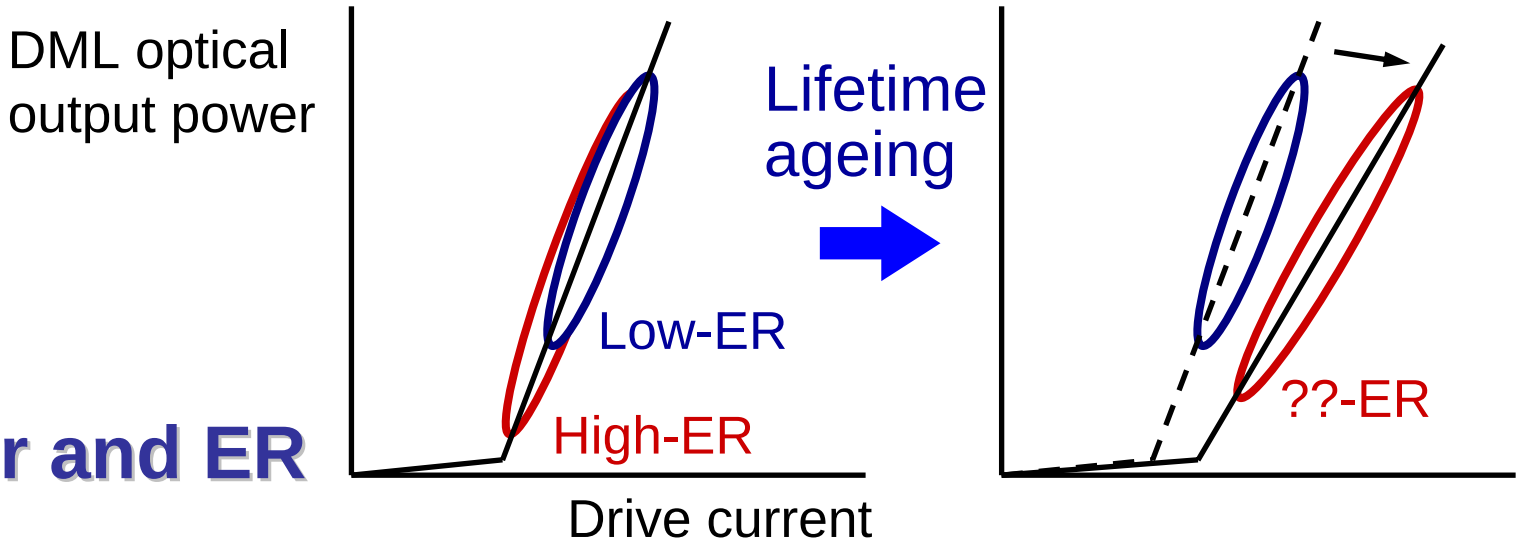
Some DML Speed Problem

- Significant ER dependency indicates its ON/OFF speed problem, and narrow ER tolerance window.

  Complicated ER control individually over temperature and deviation is necessary, and yet, lifetime waveform stability cannot be guaranteed for reliability and interoperability.

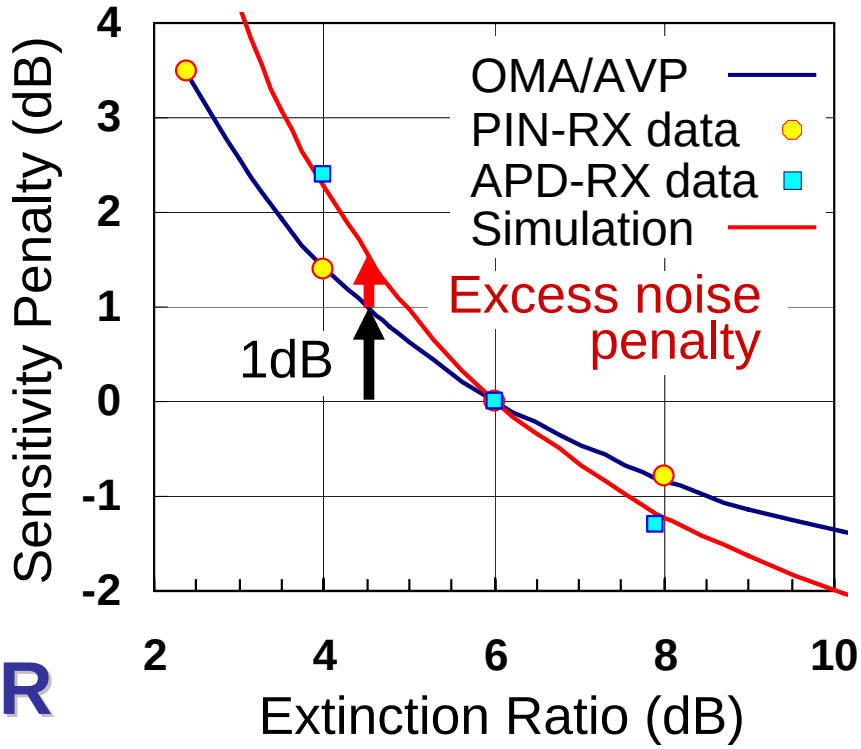
- ER relaxation should be introduced only for yield, not for salvaging wrecked components.

DML Power and ER



Sensitivity Degradation at Low-ER

- Due to APD-RX excess noise, sensitivity degradation increases significantly at low-ER signal inputs.
- All TX and RX power budget levels should be changed, and the power increase cannot be illustrated in a simple OMA/AVP model.
- DML output power range decrease, from 5dB to some 3.4dB at 4.5dB ER, causes a problem without introducing an expensive temperature control.



Sensitivity Penalty and ER

Co-ex RX implementation

Requirement for APD/TIA for US burst mode receiver

	PRX-30	PR-30	PR-30/PRX-30 Coex	
			Split in the optical domain	Split in the electrical domain
Sensitivity	-29.78dBm	-28.0dBm	-31dBm(*1)	-29.78Bm
Overload	-9.38dBm	-6dBm	-9dBm(*1)	-6dBm
treceiver_settling for TIA AGC	<<400ns	<<800ns	<<800ns	<<400ns(*2)
Dynamic Range	20.4dB	22.0dB	22.0dB	23.38dB

(*1)Using 1:2 splitter with 3.0 dB loss. Using optical amplifier is not practical because of 100nm (1260nm-1360nm) bandwidth.

(*2)treceiver_settling for PRX-30 is required for Dual Rate TIA.

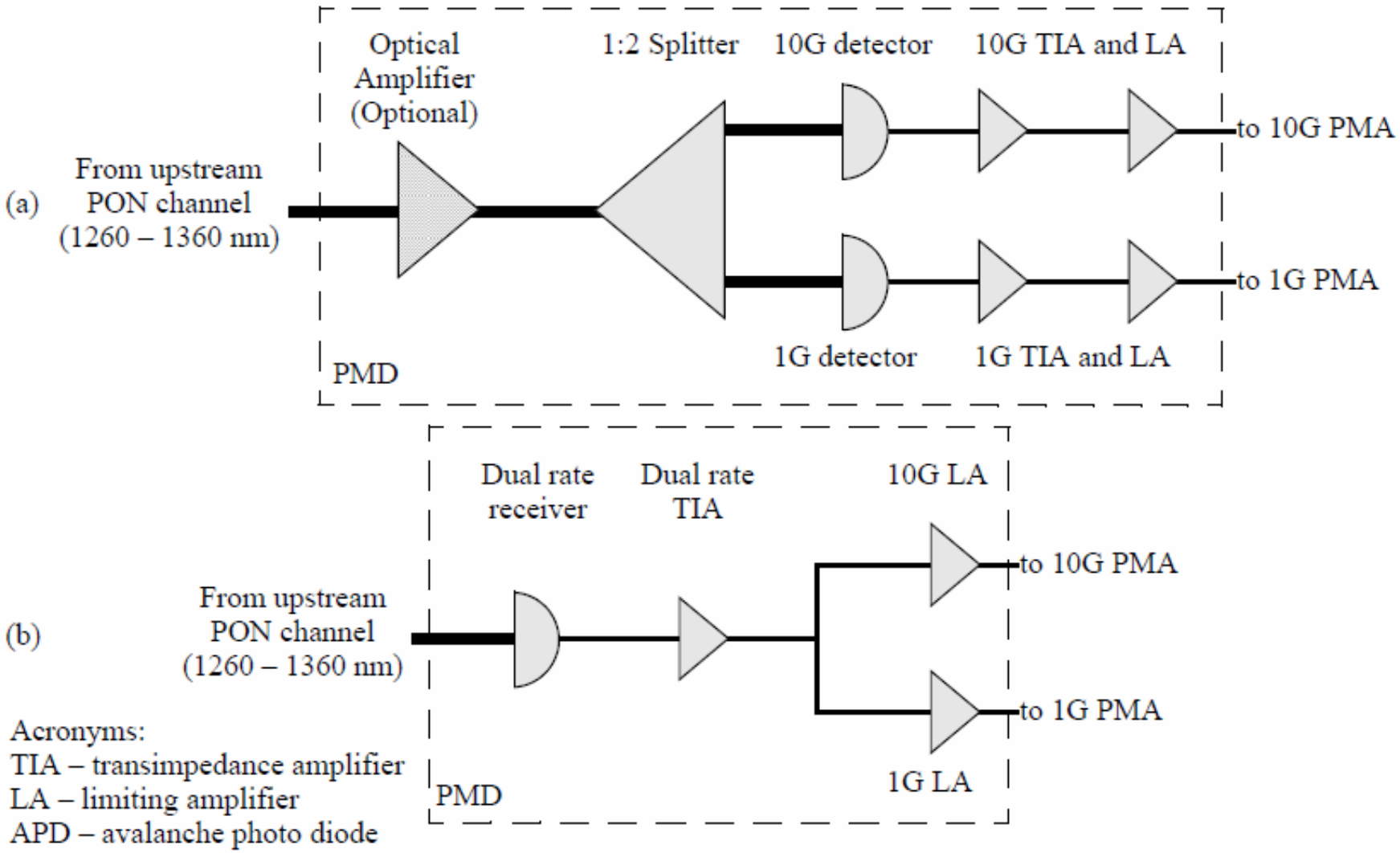


Figure 75A–1—Dual–rate PMD topologies with the split in the (a) optical domain, (b) electrical domain

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Co-ex RX Difficulties with Low-ER

- PMD spec. should be determined with considering sensitivity, dynamic range and timing in Dual-rate operation in detail, although it is not mandatory.
- Dual-rate PMD topology with the split in the optical domain is not practical in receiver sensitivity.
  The split in the electrical domain is the only solution.
- Tighter timing and larger dynamic range are required for Dual-rate APD/TIA than that for 10G single-rate APD/TIA.

  The ER must large enough to allow a wide variety of TIA AGC architecture for faster response and larger dynamic range of 802.3ah, G-EPON.
- 6dB ER, same as 802.3ah, is a reasonable choice for dual-rate operation.

Conclusion

ER relaxation may have an impact to yield and cost, but…

- Some DML speed problem is a different argument, which should not be discussed here as a relaxation.
- No big room remains for practical ER relaxation for PR30.
  - APD-RX sensitivity degradation due to excess noise increases significantly at low-ER.
  - 1G-similar or higher 10G ER is significant for practical Dual-rate RX to achieve co-existence.

At this time and stage of the standardization, current power budget and ER 6dB should be determined.

- Current technology already shows it is feasible.
- Good development target for component suppliers.
- Further production data will show how it can be in future.