

25G Receiver performance

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Introduction

- 25G APD receiver sensitivity are one of concerns to consider the power budget classes.
- OMA sensitivity degradation of APD receiver should be taken into account in case to use the low ER transmitter, for example the upstream DML transmitter.

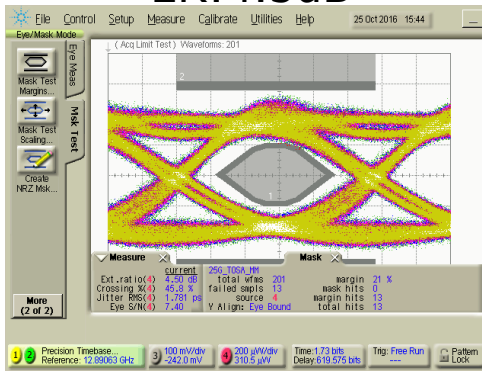
- 25G receiver sensitivities are evaluated.
 - Multiple devices of receivers and transmitters are tested.
 - Rx: PIN-PD ROSA and APD ROSAs provided by two vendors
 - Tx: DML and EML TOSA
 - Transmitter's ER is tuned as parameter
- 29dB Ch.I.L. is considered based on these evaluated data.

Trasmitter's waveforms

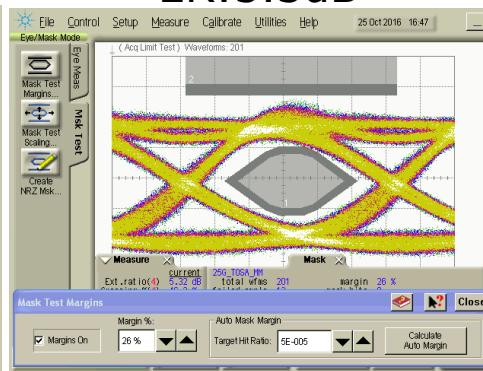
- Trasmitter's waveforms for receiver evaluation
 - Tx ER is tuned 4.5 – 6.1dB for DML and 4.9 – 9.9dB for EML.

•DML

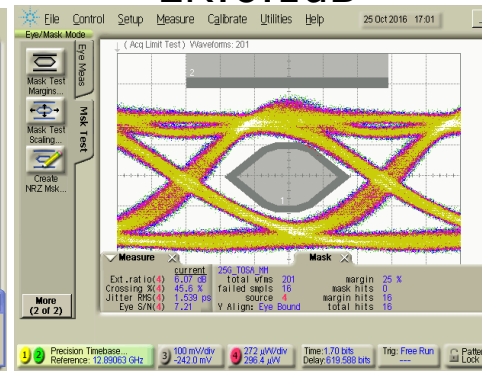
ER:4.5dB



ER:5.3dB

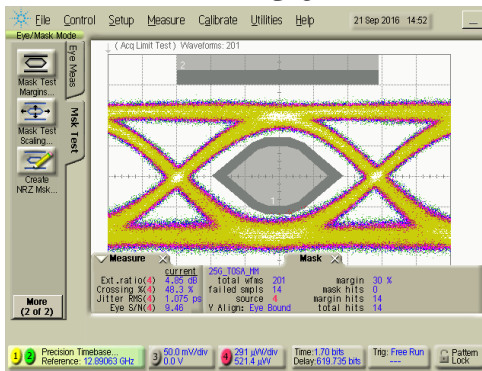


ER:6.1dB

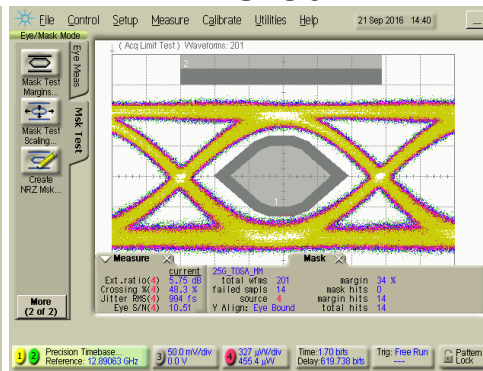


•EML

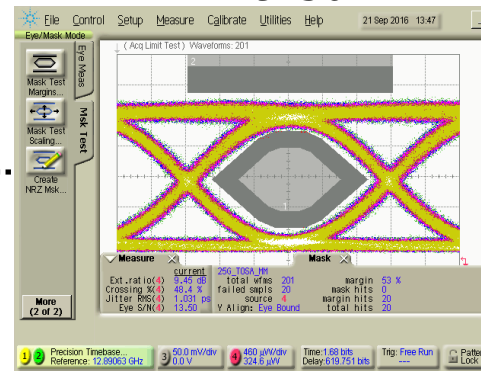
ER:4.9dB



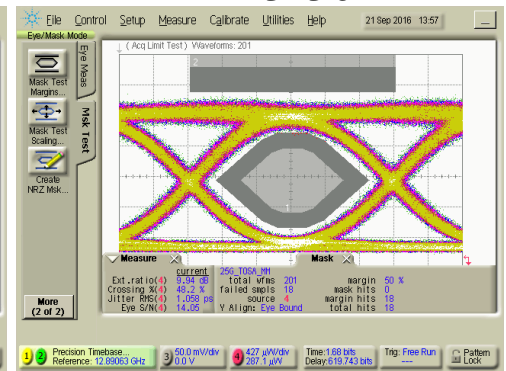
ER:5.8dB



ER:9.5dB



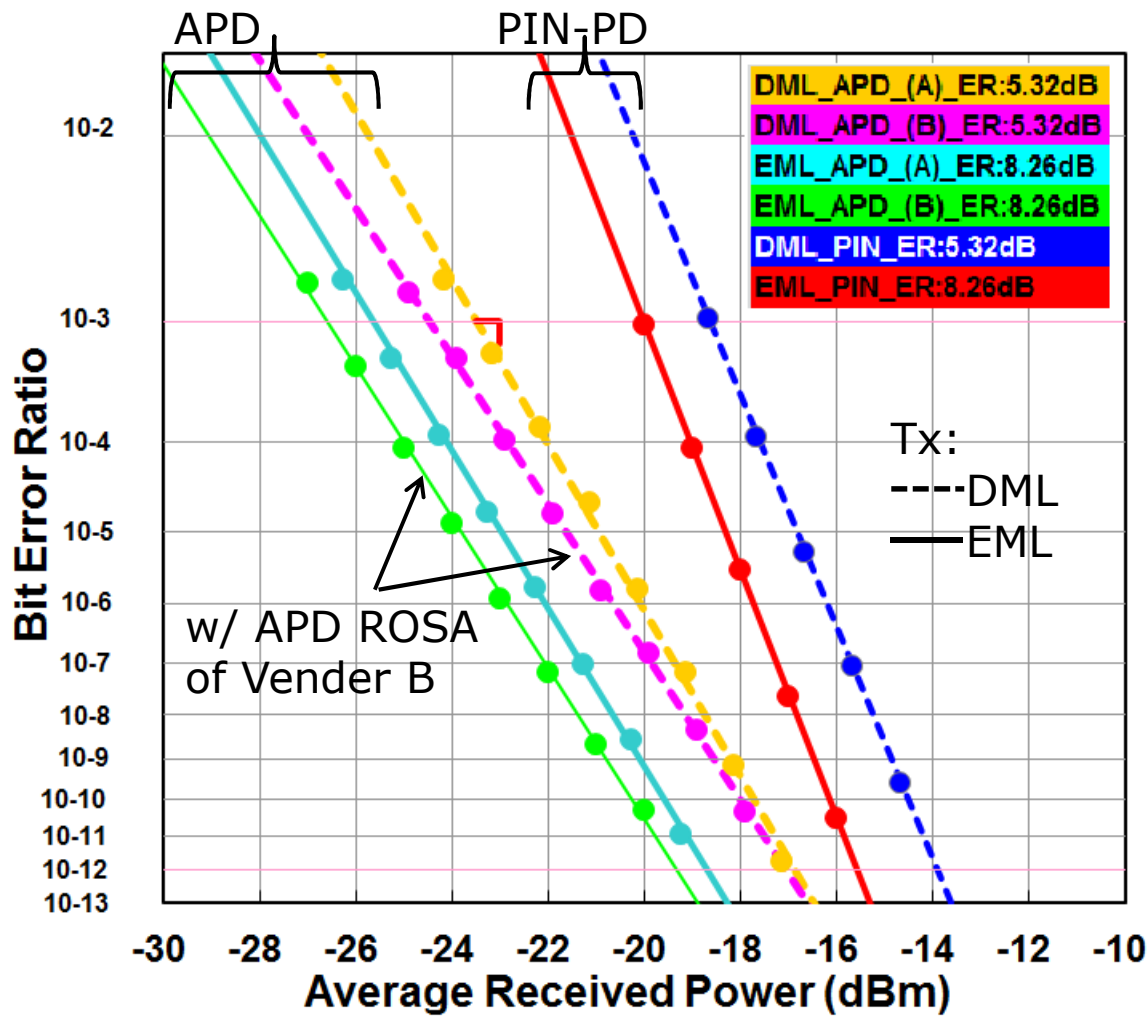
ER:9.9dB



•0 level of low ER is noisy a little.

BER results

- Simple BER results with the fixed ER for respective Tx device.
- Conditions: 1309.3nm, PRBS2^31-1, Ta25degC



Receiver sensitivities @BER:1e-3
 Upper :as Average optical power(AOP)
 (Lower):as Optical modulation amplitude(OMA)

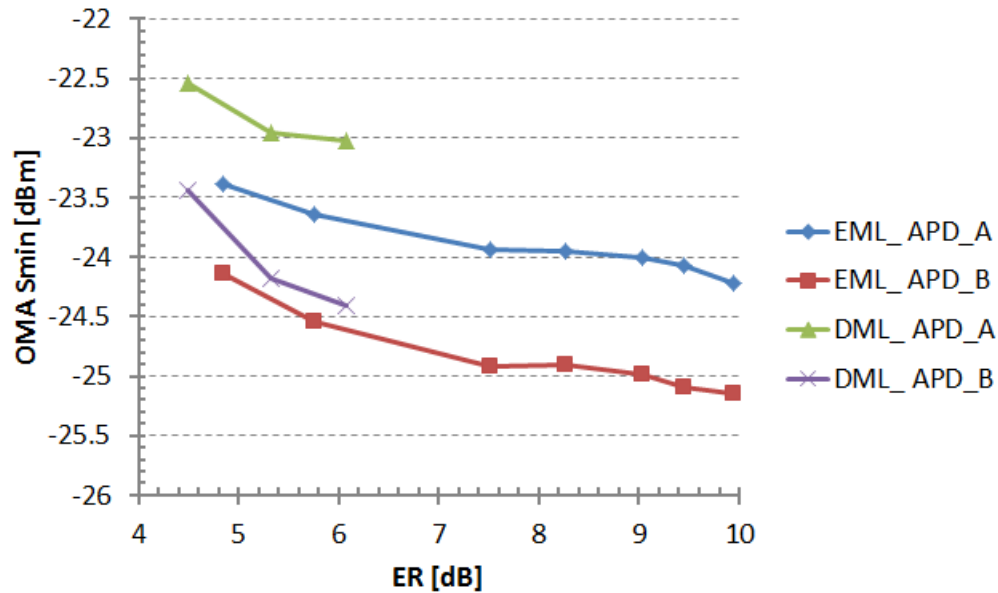
	ROSA	APD A	APD B	PIN-PD
TOSA				
DML (ER:5.3dB)		-23.49 (-23.11)	-24.47 (-24.09)	-18.44 (-18.06)
EML (ER:8.3dB)		-25.65 (-23.95)	-26.62 (-24.91)	-20.03 (-18.32)

- 0.8dB differences of OMA sensitivities with both APD ROSAs b/w DML and EML
- 5~6dB differences b/w PIN and APD (1dB differences of sensitivities between two venders)

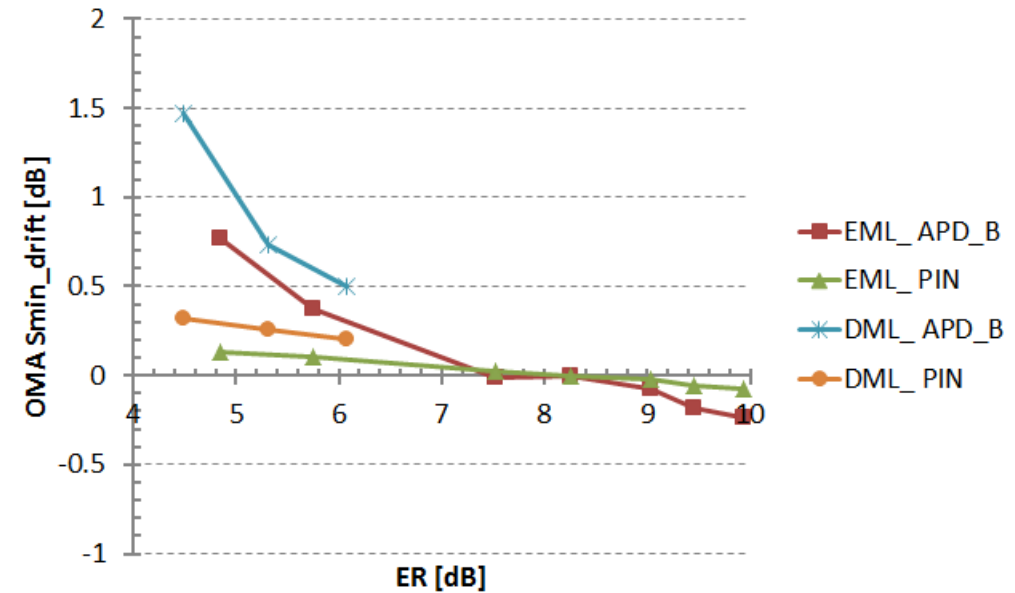
ER dependency of OMA sensitivity

- ER dependencies of OMA sensitivity and influences of DML Tx.

OMA Smin vs ER (BER:1e-3, APD Rx)



ER dependency of OMA Smin (BER:1e-3, APD B & PIN)



- OMA sensitivities are degraded w/ low ER Tx.
- They are degraded w/ DML Tx more than EML Tx. (Both APD ROSAs have same tendencies.)
- Normalized to results w/ 8dB EML Tx.
- PIN-PD ROSA has no ER dependencies and 0.1~0.2dB difference b/w DML Tx and EML Tx. (This difference of PIN-PD ROSA's results is TP)

29dB Ch.I.L. of 25G with APD Rx

- Possibility of 29dB channel insertion loss for 25G 1st channel,

Parameter	10G US	25G cooled DML (Upstream)		25G cooled EML (Downstream)		25G Proposal	
	PR30	Case A	Case B	Case A	Case B	US	DS
(1) Tx output power min. [dBm]	4	7	7	5.5	5.5	(7.51)	(5.32)
Launch OMA min. [dBm]	4.78	7.49	7.49	7.12	7.12	8.0	7.0
(2) Transmitter and Dispersion Penalty [dB]	3	2	2	1.5	1.5	2	1.5
OMA-TDP [dBm]	1.78	5.49	5.49	5.62	5.62	6.0	5.5
(3) Rx sensitivity max. at BER=10 ⁻³ [dBm]	-28	-22.5	-23.5	-24.7	-25.6	(-23.5)	(-25.18)
Rx sensitivity OMA max.[dBm]	-27.22	-22.01	-23.01	-23.08	-23.98	-23.0	-23.5
Channel insertion loss [dB]	29	27.5	28.5	28.7	29.6	29.0	29.0

- 10G US: ER 6.0dB, 25G: DML ER 5.5dB, EML ER 8.0dB
- Case A: Vender A's APD ROSA is applied, Case B: Vender B's one is applied
- Rx sensitivities of 25G has **1dB** margin to the evaluated results.
- TDP of DML is assumed with use of negative dispersion wavelength in O-Band
- Channel Insertion Loss = (1)-(2)-(3)

Summary

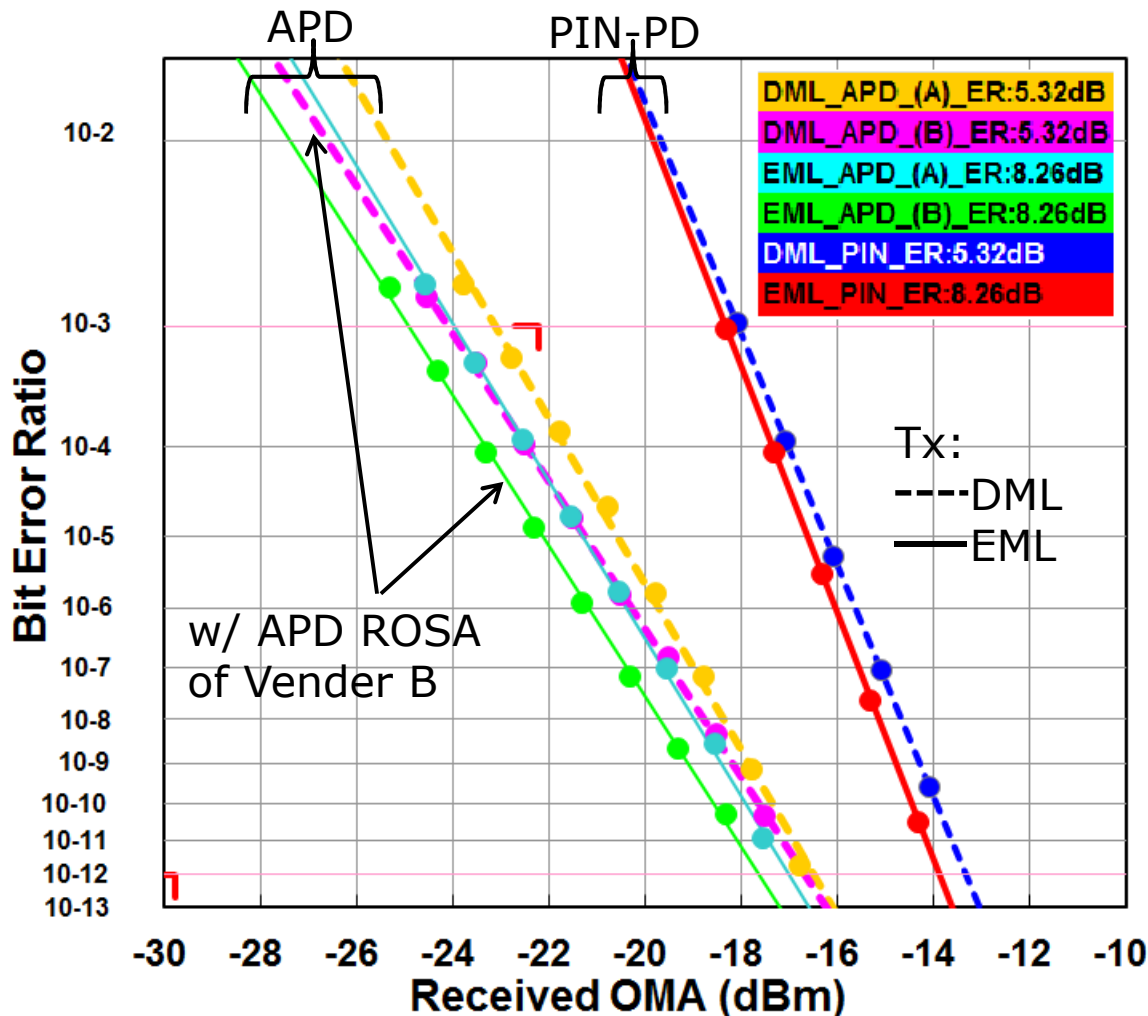
- APD receiver sensitivities are shown to consider the specification of power budget classes.
- ER dependencies of OMA sensitivities are investigated.
 - 0.5~0.7dB worse w/ low ER EML Tx than w/ 8dB ER.
 - Difference of sensitivities b/w DML Tx and EML is depend on APD ROSA's characteristics including the evaluation board.
- Feasible specifications for 25G 1st channel to satisfy 29dB channel insertion loss are proposed with the sufficient margin to APD receiver sensitivity.

Thank you

Back Up

BER results (OMA)

- Simple BER results with the fixed ER for respective Tx device.
- Conditions: 1309.3nm, PRBS2^31-1, Ta25degC



Receiver sensitivities @BER:1e-3
(Upper):AOP
Lower :OMA

ROSA	APD A	APD B	PIN-PD
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