SUMITOMO ELECTRIC

Feasibility of 25G DML transmission

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May 24-25th, 2016
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Introduction

- Characteristics of EML devices are presented in previous meeting. http://www.ieee802.org/3/ca/public/meeting_archive/2016/03/umeda_3ca_1_0316.pdf
- 25G single channel is requested as the economical solution of 100G-EPON. Un-cooled DML is desirable to be a candidate of this solution.

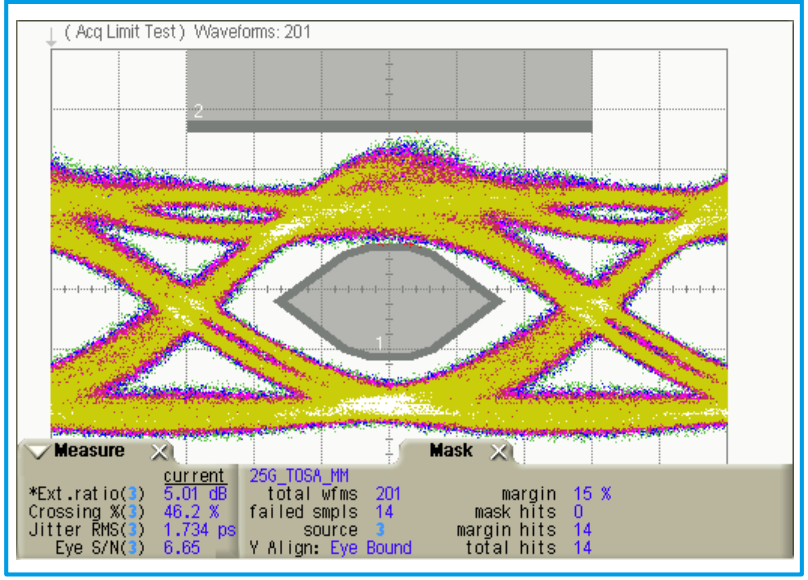
- 25.8G NRZ transmission performances of the uncooled DML device are shown.
  - Waveform quality of DML transmitter
  - Influence of 20km fiber transmission
  - Output power

- We reviewed 25.8G PMD performance with APD receiver.

25G DML for 25G Ethernet (1310nm)

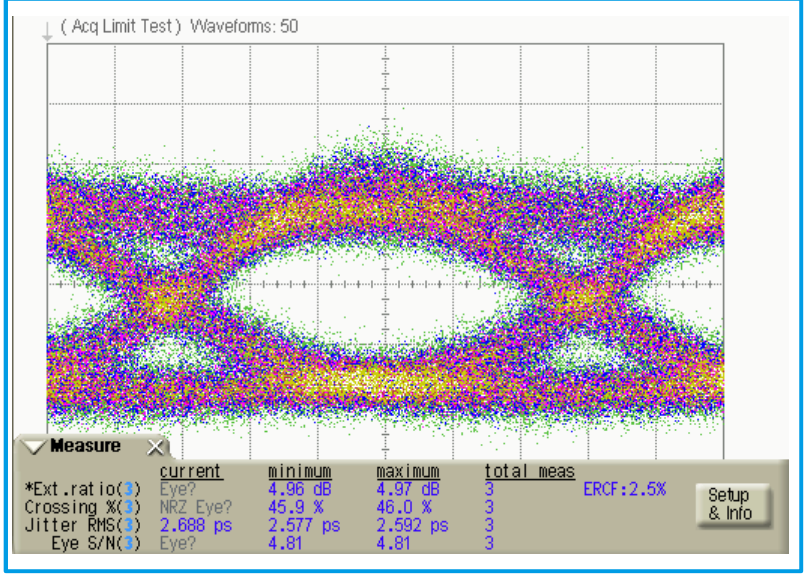
- Wavelength 1309.436nm (Tc ~35degC)
- Extinction Ratio 5.0dB
- 20km transmitted waveform isn't degraded so much.

25.8G Optical Tx Eye (0km)



100GBASE_LR4 eye mask is applied

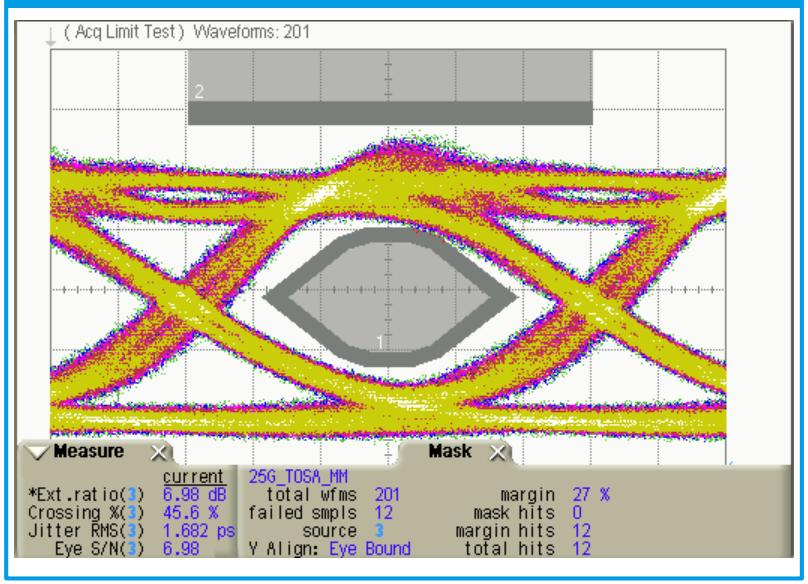
25.8G Optical Tx Eye (20km)



25G DML for 25G Ethernet (1310nm) cont.

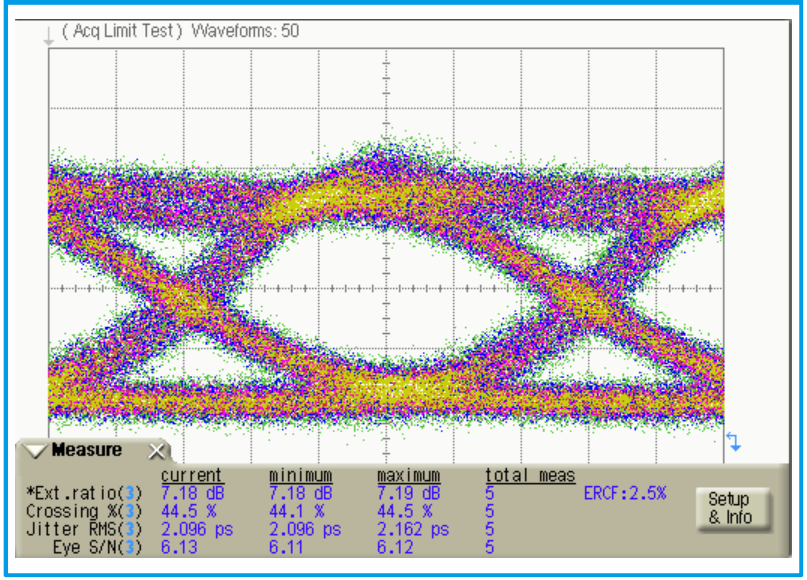
- Extinction Ratio is retuned to 7.0dB
- Wavelength 1309.768nm (Tc ~35degC)

25.8G Optical Tx Eye (0km)



100GBASE_LR4 eye mask is applied

25.8G Optical Tx Eye (20km)



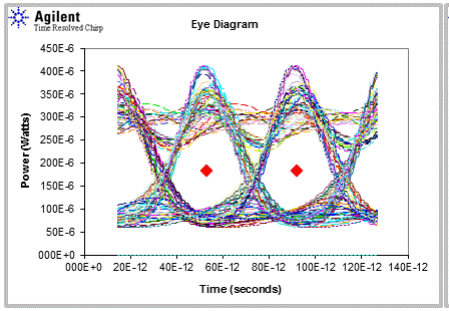
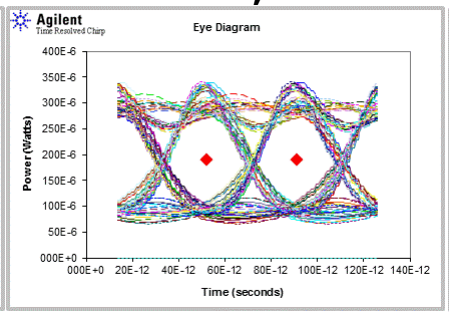
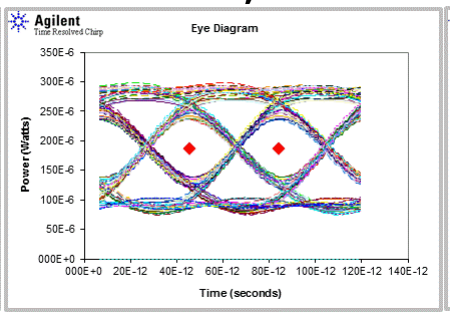
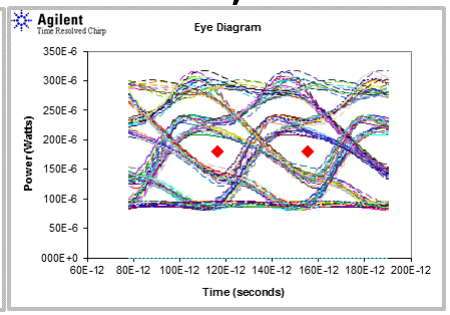
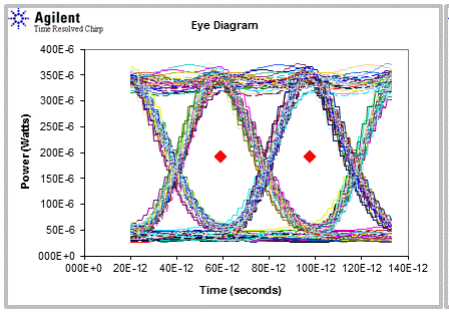
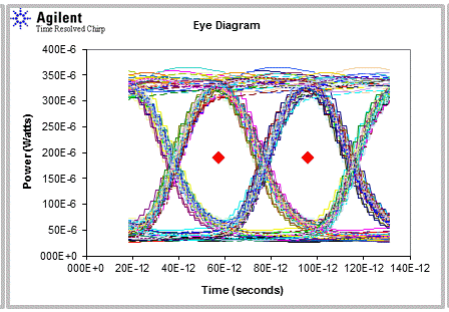
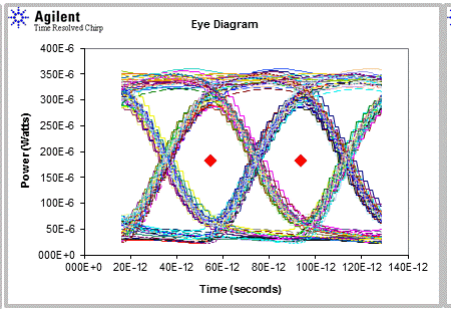
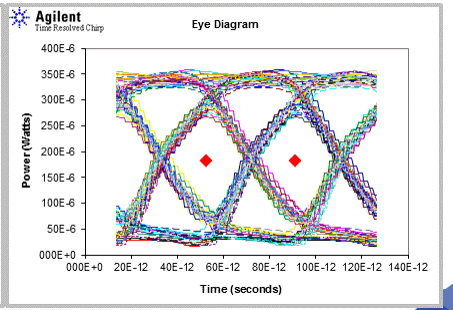
Influence of long transmission (TRC)

- DML is influenced by chromatic dispersion more than EML.
  - DML Eyes are distorted especially on 1360nm
- DML is adoptable under 1330nm.
- Additional dispersion compensation technics are needed on 1360nm.

Adoptable

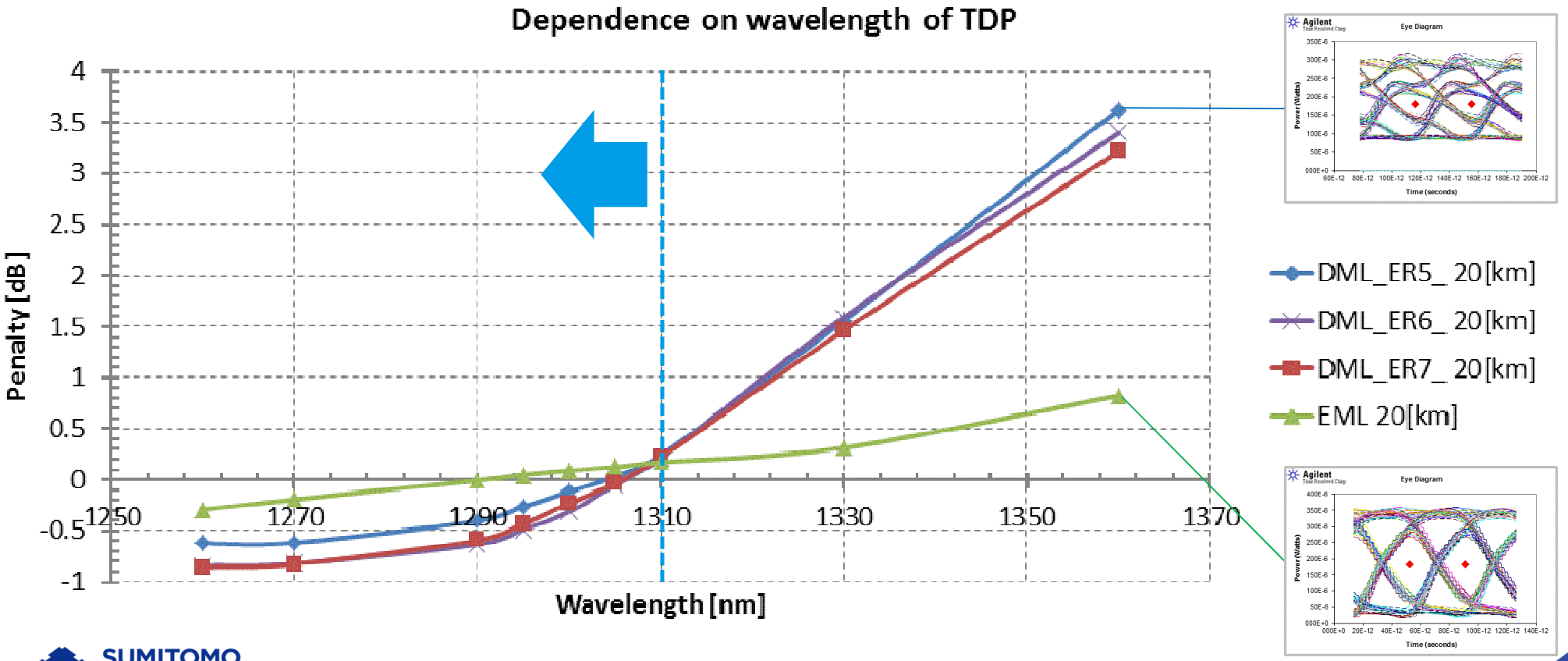
DML: Difficult to adopt

Transmitted Eye (TRC sim.)

	1260nm,20km	1290nm,20km	1330nm,20km	1360nm,20km
25G DML (ER 5dB)				
25G EML (reference)				

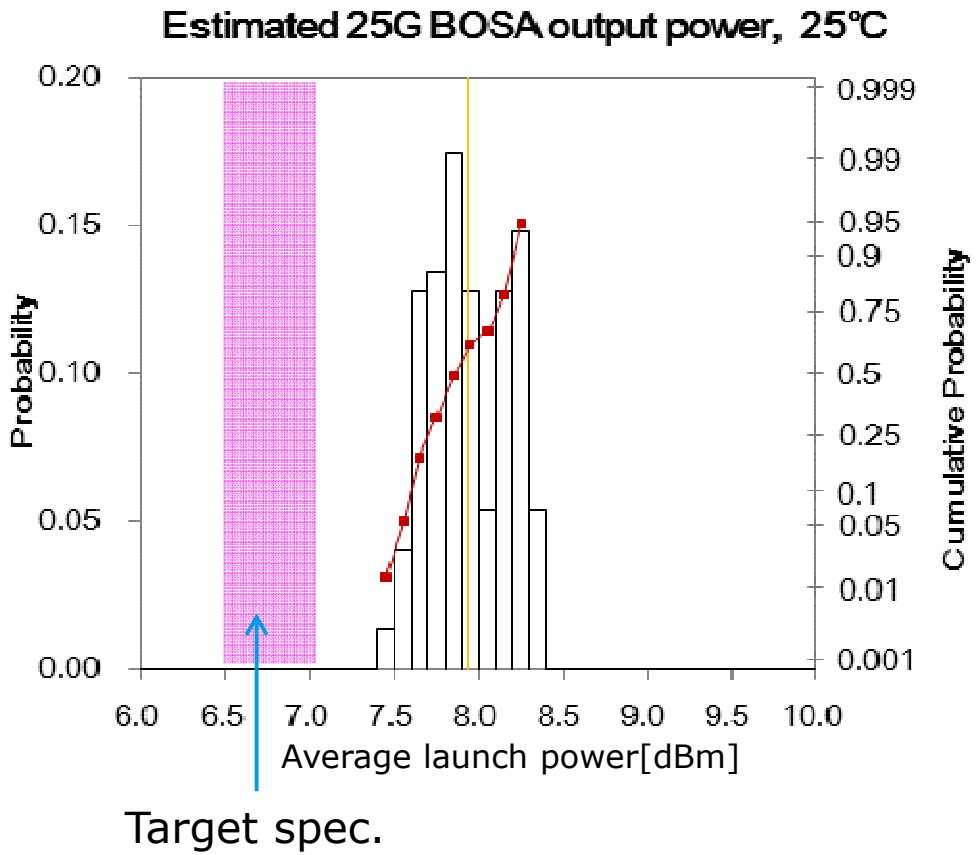
Simulated TDP with 25G NRZ

- Simulated TDP at 20km based on measured chirp data.
- TDP of DML increases extremely above 1.5dB over 1330nm.
- Shorter side of O-Band is appropriate to select for DML. Lowest TDPs are expected in 1270~1290nm. (+2dB TDP isn't unfeasible.)



Expected launch power

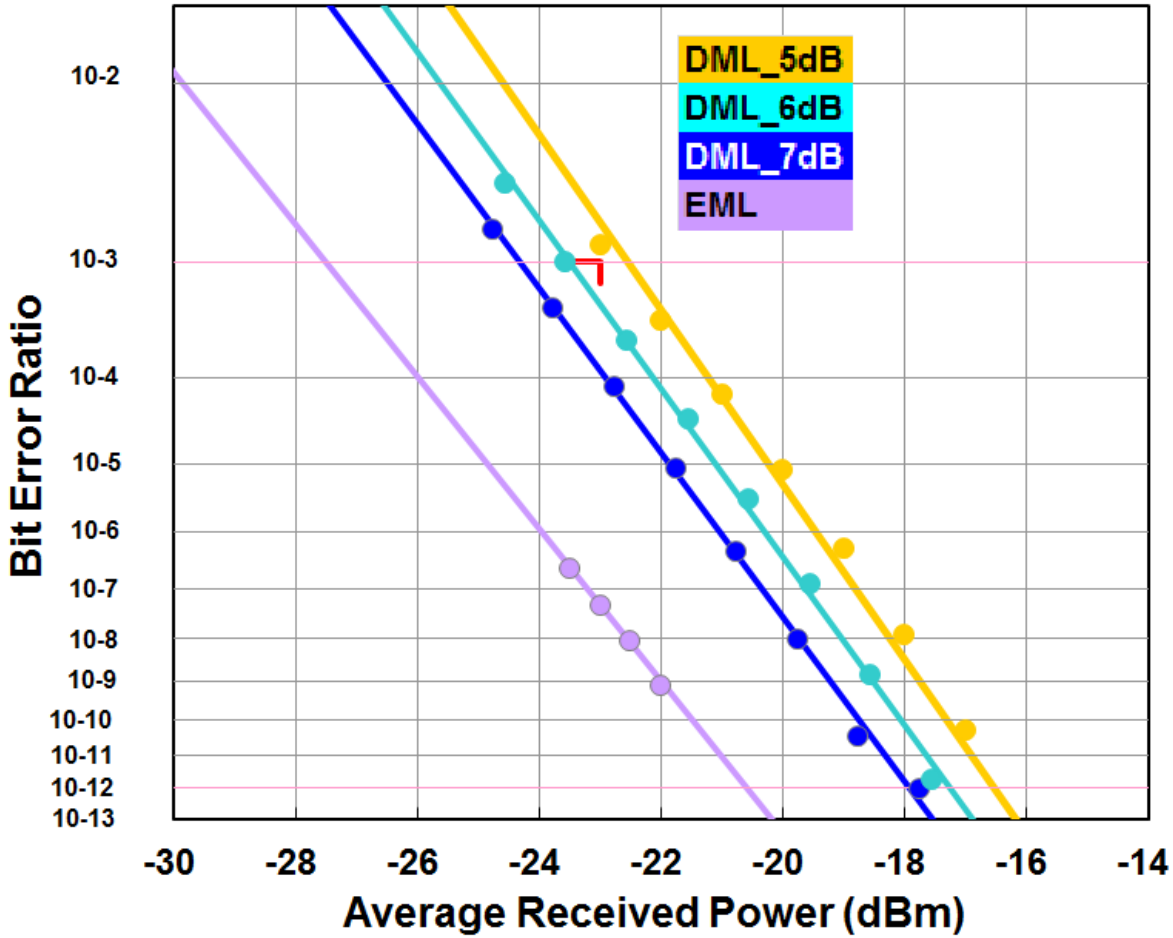
- Considering average launch power of 25G BOSA with
  - LD output power distribution of the typical production lot
  - high light coupling efficiency from LD to BOSA (50% or higher)
- Min. +6.5dBm is achievable to be specified. +7dBm is challenging.



Measured BER with APD Rx

- Min. sensitivity -23.5dBm @1e-3 BER with DML (ER is tuned to 5.9dB)
- Min. sensitivity -27.5dBm @1e-3 BER with EML (ER is 10.0dB)

Notes; Sensitivity would be improved 1.5dB from this result by ROSA assembly optimization or simple equalization.



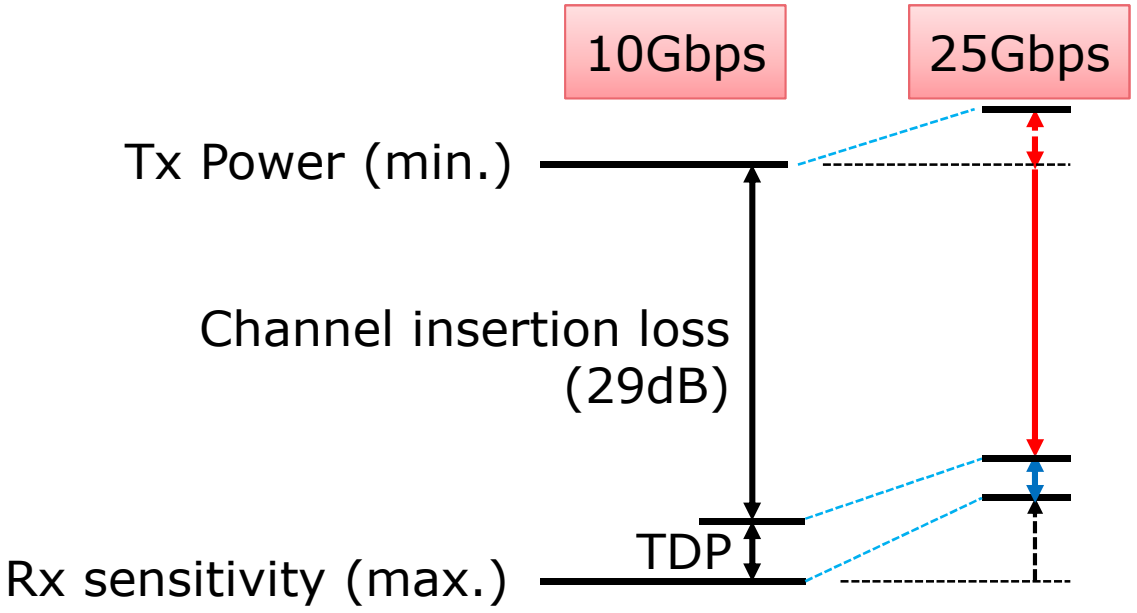
Measured at room temperature

5dB worse than 10G w/DML

29dB Ch.I.L. with DML Tx+ APD Rx

- Possibility of 29dB channel insertion loss same as 10GBASE-PR30,

Parameter	10G	25G			Notes
		Un-cooled		Cooled	
(1) Tx output power min. [dBm]	4	6.5	7	7.5	ER>6dB
(2) Rx sensitivity max. at BER=10^{-3} [dBm]	-28	-23	-23	-23	ER>6dB
(3) Transmitter and Dispersion Penalty [dB]	3	2	2	1.5	1280-1310nm
Channel insertion loss [dB]	29	27.5	28	29	(1)-(2)-(3)



Changes from 10G to 25G:

Tx Power: 2.5dB increase may possible
3dB increase is challenging

Required improvement
FEC, Tx Power or Rx Sensitivity

TDP: 1dB better spec is possible

Rx sensitivity: 5dB Loss

Summary

- Experimental results and manufacturing data as example are shown to consider the feasibility of 25G DML transmission.
- DML is adoptable in 1260 - 1330nm to suppress TDP. Relaxing TDP specification is possible around 1290nm.
- Min. specification of its launch power is expected to be +6.5dBm. +7dBm is still challenging.
- Possibility of 29dB channel insertion loss is considered using this DML and APD.
- Further investigation is needed to get higher DML power and certain characteristics at high temperature.

Thank you