Security Level:

Further test for beyond 10km transmission

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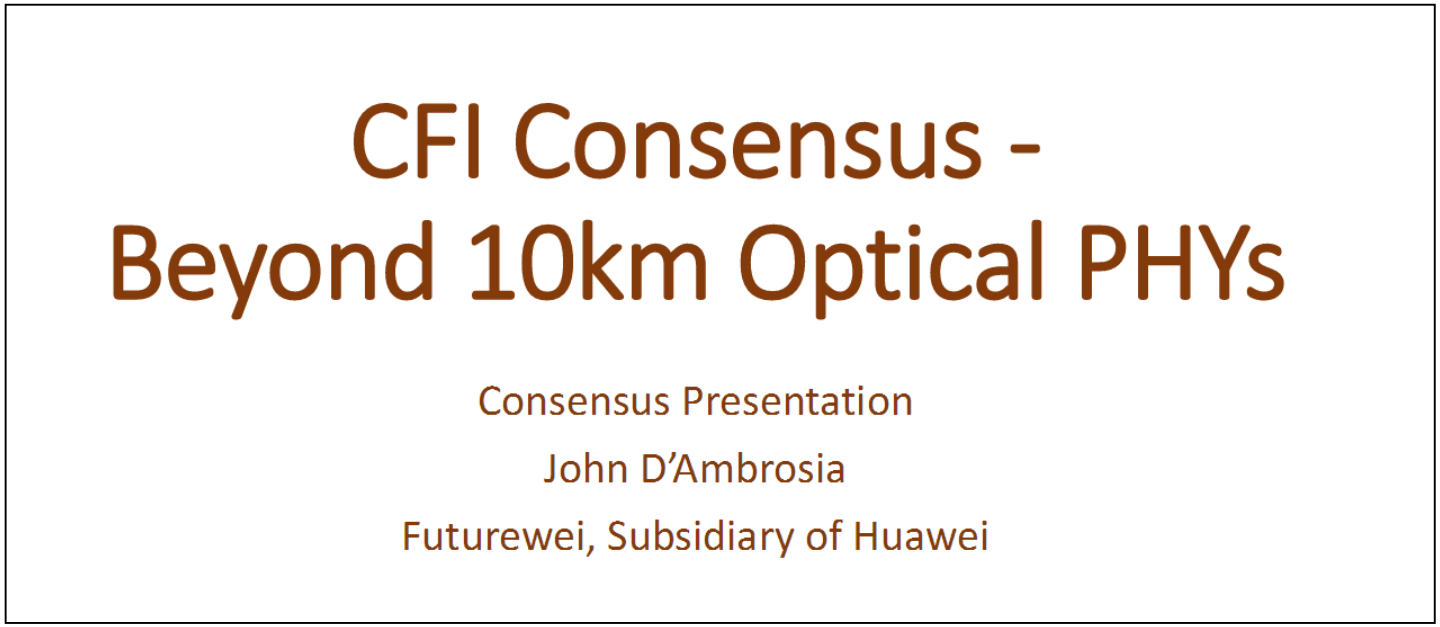
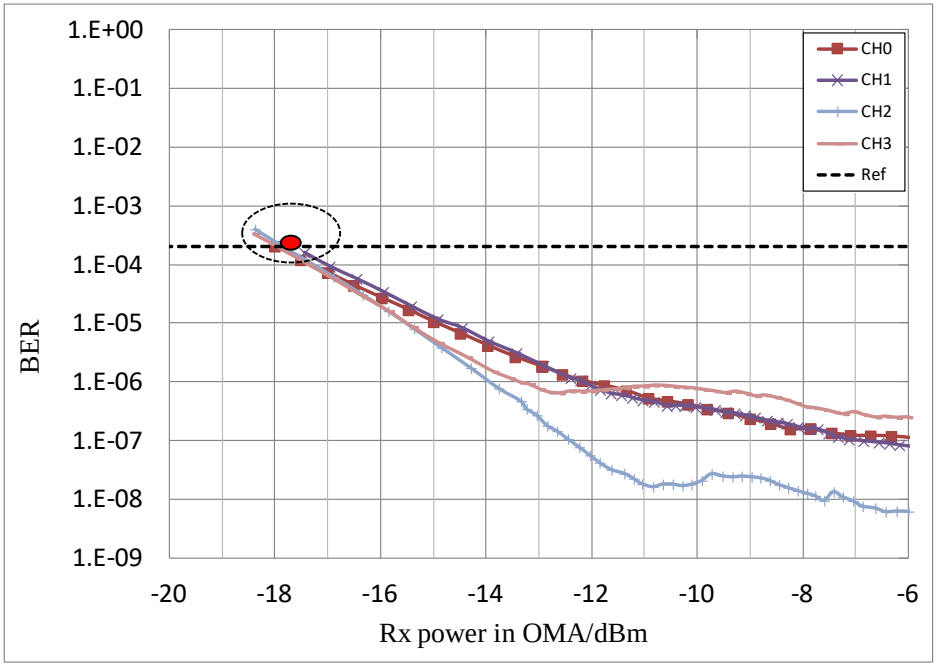
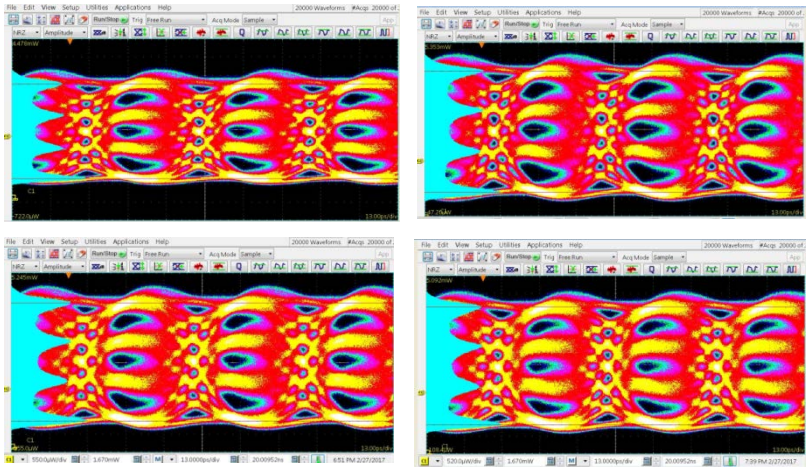
Background



- The project of 50G/200G/400G beyond 10km transmission had been started after the July Berlin meeting.
- Data from the market shows the requirement of 40km transmission application.
- We once presented our test report on 50G/200G 40km transmission based on the solution of 50G PAM4. See http://www.ieee802.org/3/ad_hoc/ngrates/public/calls/17_0502/yu_nea_01_170502.pdf
- After that ad hoc, we received several feedbacks asking for further test data.

BER test of 200G PAM4 solution





Tx characteristics

Room temperature

PRBS Length: one line test (equal to 2^31-1)

Launch power in OMA each lane: ~ +5dBm

Signaling rate each lane: 26.5625Gbaud

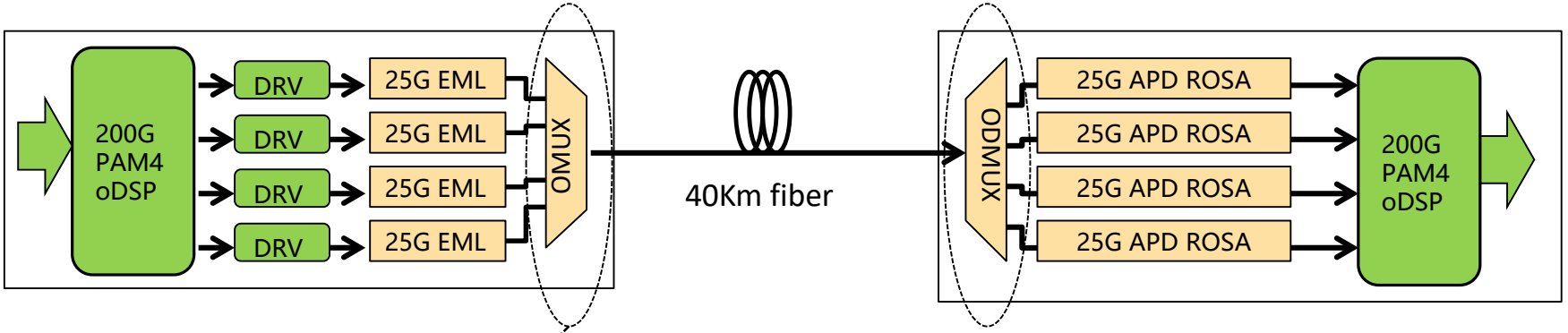
Modulation format: PAM4

Test method

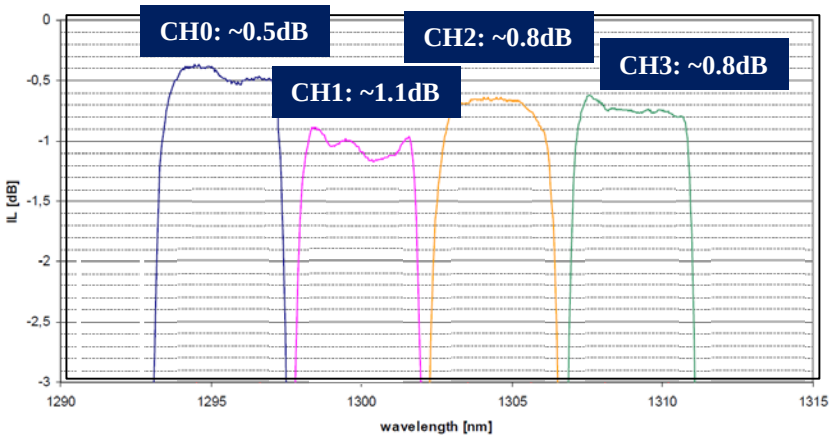
- Online test;
- The optical devices in the module are all commercially available;
- The environment temperature is adjustable to evaluate TDL(Temperature Dependence Loss) see page 5;

- Typical sensitivity at 2E-4 is about -17.9dBm (B2B scenario, Room temperature).

1:4 oMux/oDemux test



ODMUX has almost the same characteristics with OMUX



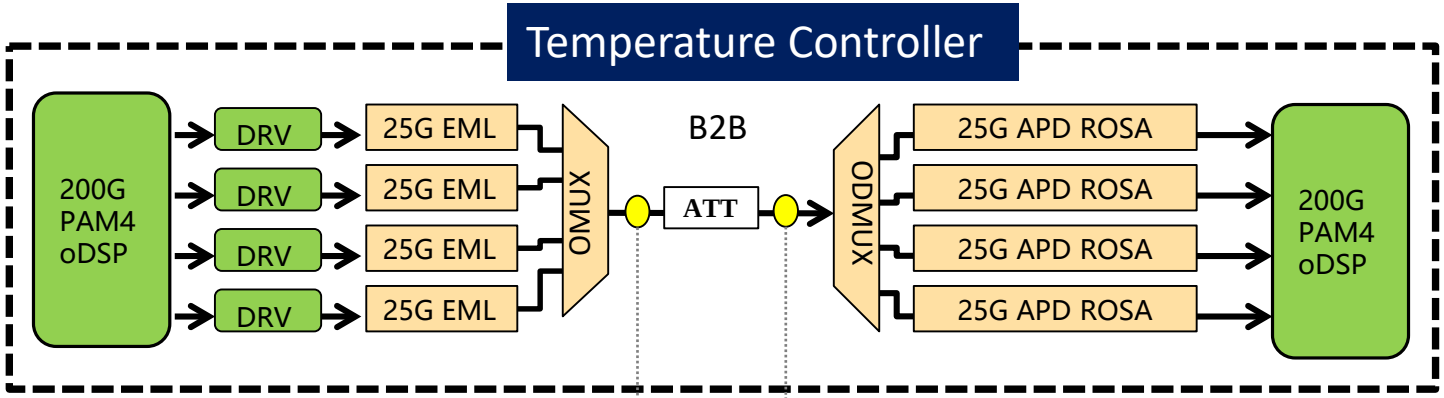
Insertion loss of OMUX(Typical, Experimental results)

Channels	4
Operating Channels L0 - L3	(According to cole_01_0708 IEEE 802.3ba) 1295.56 / 1300.05 / 1304.58 / 1309.14
Optical Bandwidth L0 L1 L2 L3	(According to cole_01_0708 IEEE 802.3ba) 1294.53 - 1296.59 nm 1299.02 - 1301.09 nm 1303.54 - 1305.63 nm 1308.09 - 1310.19 nm
Insertion Loss *	< 1.5 dB

* For all ports: max. insertion loss over channel bandwidth, within operating temperature range and all states of polarization and including optical connectors (receptacle & ferrules).

- We have tested insertion loss of OMUX/oDMUX used in 4*50G PAM4 technologies
- The insertion loss of 1:4 OMUX is less than 1.5d which is the same with 1:4 oDMUX

Tx launch power & Sensitivity of APD-based ROSA

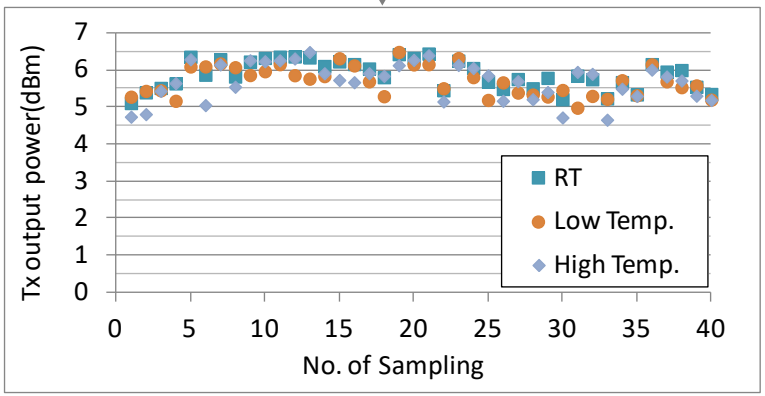


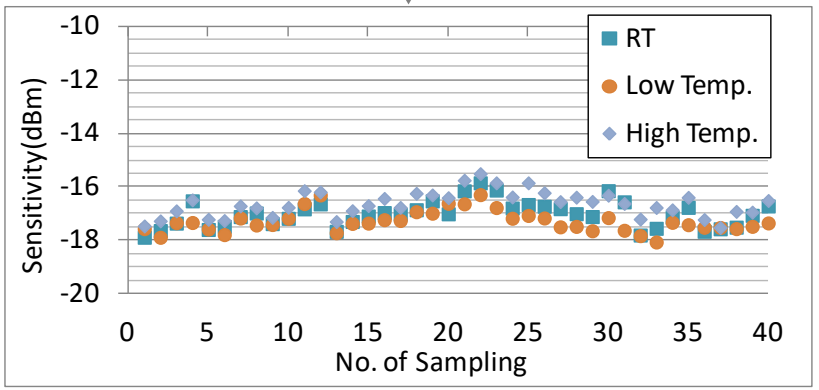
Temperature control:

High Temp.: 70degreeC

Low Temp.: 0 degreeC

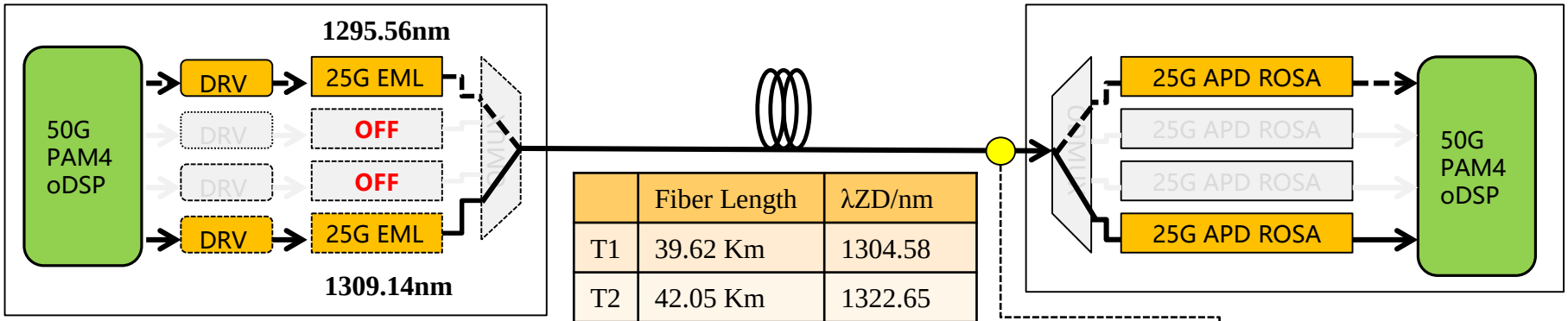
RT Temp.: 25 degreeC





- We have mass-tested Tx launch power and Rx sensitivity of APD-based ROSA
- Three different temperatures are used to simulate real environment

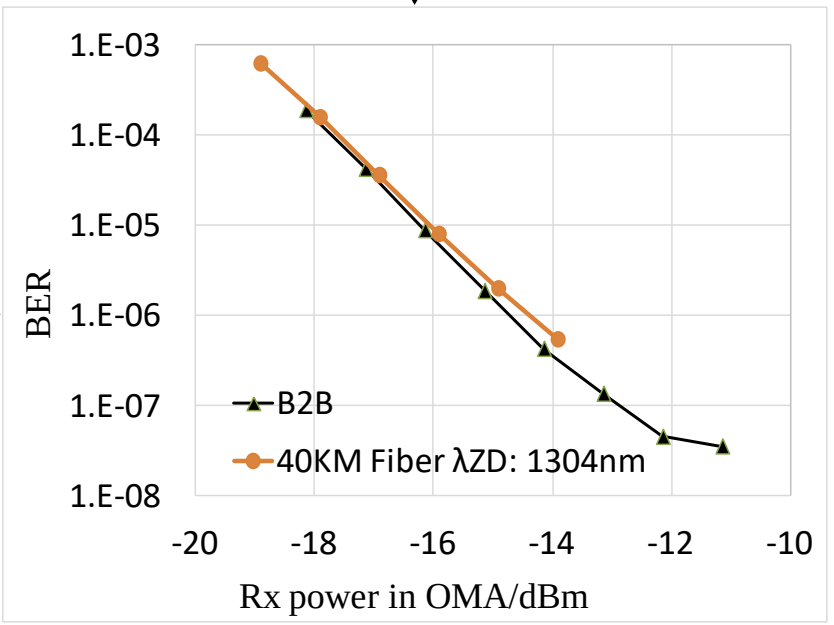
Fiber Dispersion



	Fiber Length	λZD/nm
T1	39.62 Km	1304.58
T2	42.05 Km	1322.65

Tx characteristics
Room temperature
PRBS Length: 2^31-1
Launch power in OMA: 5.0 dBm
Signaling Rate: 26.5625Gbaud
Tx wavelength: 1309.14nm

Positive dispersion



- **Fiber dispersion penalty**
  - Because of lab limitation, we only have the fiber with zero-dispersion point @1322.65nm and 1304.58nm
  - Negative dispersion: we can not find any dispersion penalty when turn on CH0(1295.56) and use fiber with lambda ZD 1322.65nm
  - Positive dispersion: as shown in the figure, the dispersion penalty is not obvious (we turn on CH3(1309.14) and use fiber with lambda ZD 1304.58nm)

Summary

- According to our test, from technical point of view, 4*50G PAM4 can be one of the candidate solution for 40km transmission.
- For 400G 8*50G PAM4 beyond 10km transmission, higher power EML will be the first step for future study.
- We could further analyze other solutions and compare with n*50G PAM4 to support the project choose the best one.
- Based on our study, beyond 10km reach objective could be suggested to be 40km, or to be 30 km and engineered link up to 40 km like 100GBASE-ER4 in 802.3ba.

Thank you

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