DQPSK Serial PMD for 100GbE on 40-km SMF

IEEE 802.3 HSSG September 2007
Seoul, Korea

Noriyuki Takeda and Itsuro Morita
KDDI R&D Laboratories Inc.

Background

KDDI R&D LABS

- Considering 100GbE, a lot of presentation of “Parallel” PMD (Physical Medium Dependent) such as 4 x 25Gbps and 10 x 10Gbps have been made in HSSG meeting, on the other hand, very few about “Serial” PMD such as DQPSK (Differential Quadrature Phase Shift Keying) format.

- HSSG adopted 40-km reach as one of the objectives at HSSG April interim meeting in Ottawa.
  - Objectives :
    “Provide physical layer specifications which support 100 Gb/s operation over: at least 40km on SMF”

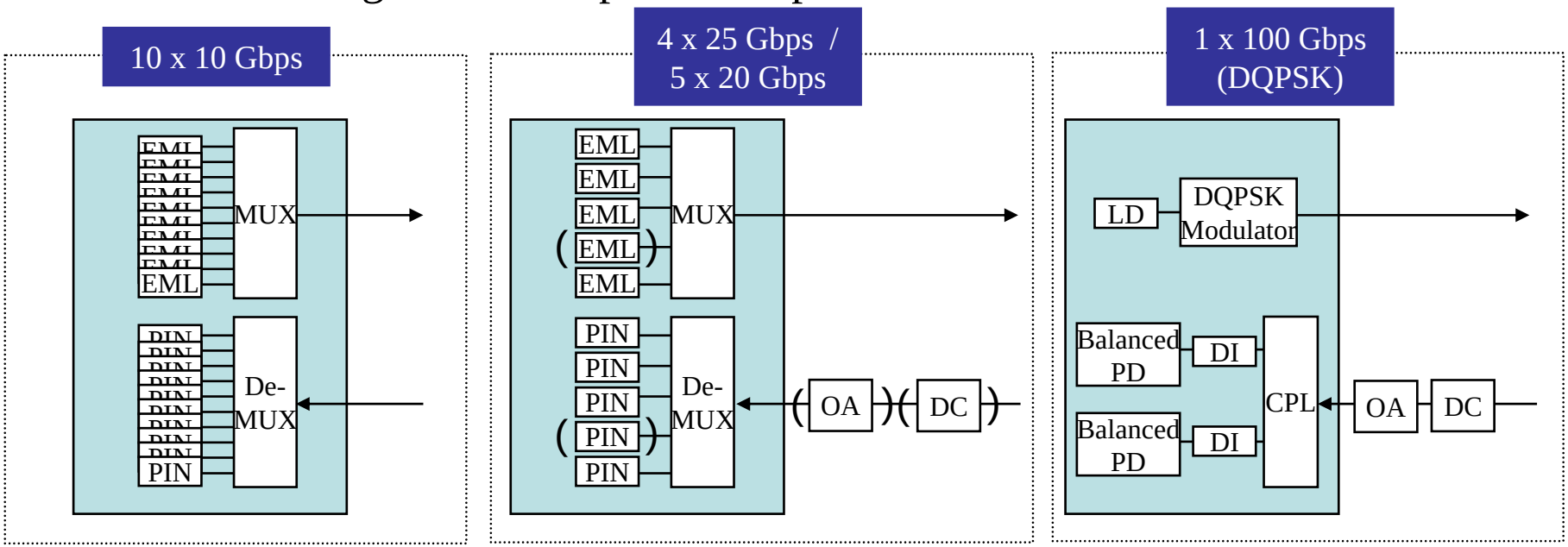
- Question :
  - Is DQPSK serial PMD applicable to 100GbE on 40-km SMF ?

Comparison : Serial PMD or WDM (1)

KDDI R&D LABS

- Comparison between Serial PMD and WDM from the standpoints of :
  - the number of optical components
  - with or without optical amplifier
  - with or without dispersion compensation

- Assumed configuration of optical components in transceiver



※EML : Electro-Absorption Modulated Laser, PIN : PIN Photo Diode, OA : Optical Amplifier, DC : Dispersion Compensator, DI : Delay Interferometer, PD : Photo Diode ,CPL : Coupler

Comparison : Serial PMD or WDM (2)

KDDI R&D LABS

10-km SMF at 1550nm

	# of optical components	OA	DC
10 x 10G	3.1 x	No	No
4 x 25G / 5 x 20G	1.4 x ~ 1.7 x	No	No
1 x 100G (DQPSK)	1 x	No	Yes

40-km SMF at 1550nm

	# of optical components	OA	DC
10 x 10G	2.4 x	Yes ?	No
4 x 25G / 5 x 20G	1.3 x ~ 1.6 x	Yes ?	Yes
1 x 100G (DQPSK)	1 x	Yes ?	Yes

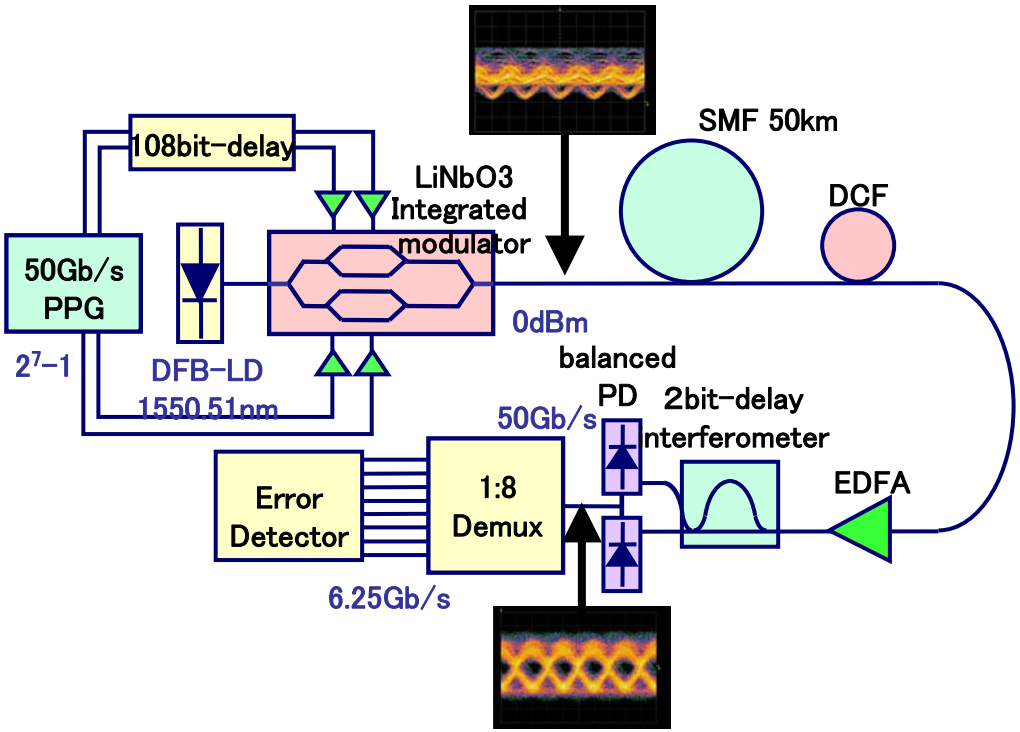
- There is a trade-off between the number of optical components and dispersion compensation.
- For 40-km reach, dispersion compensator is needed for 20-Gbps /25-Gbps WDM, same as serial PMD. So, serial PMD would be better than 20-Gbps /25-Gbps WDM from the standpoint of the number of optical components.

➡ For 40-km SMF, serial PMD (single wavelength) can be one candidate to realize 100GbE.

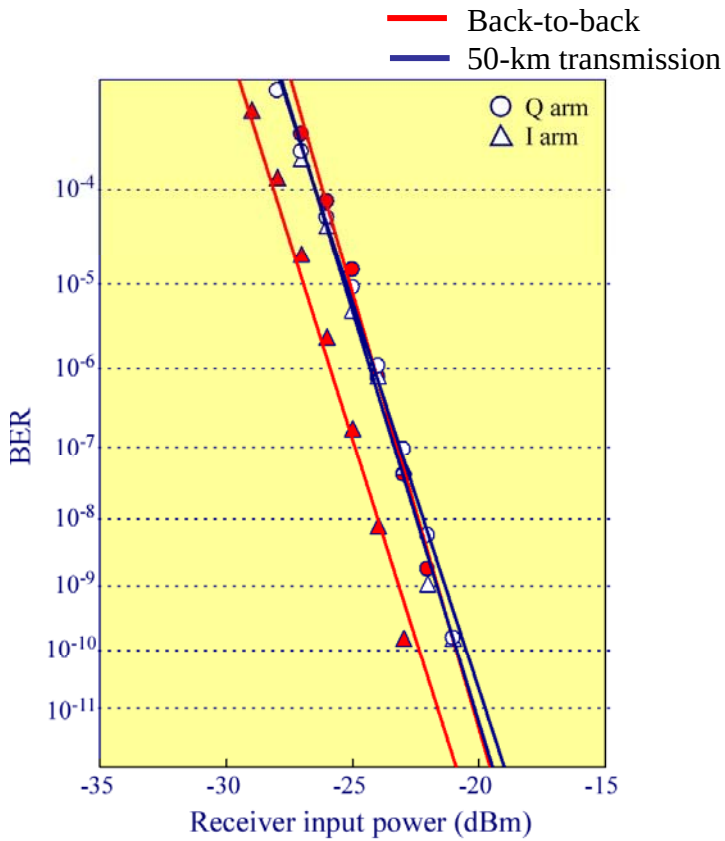
100-Gbps DQPSK serial PMD

KDDI R&D LABS

- DQPSK format is intensively investigated as a serial PMD
- Transmission experiment on 50-km SMF



Experimental Setup



Result

Feasibility of DQPSK serial PMD for 100Gbps over 40-km transmission on SMF has been already confirmed.

Issues

- The issues to realize 100-Gbps DQPSK serial PMD…

	Technical Feasibility	Reference
Components	Feasible	duelk_01_0107.pdf
Transmission	Feasible	duelk_01_1106.pdf takeda_01_0107.pdf
Precoder	Presented in this meeting	toyoda_01_0907.pdf

Summary

KDDI R&D LABS

- Serial PMD (single wavelength) can be used for 40-km transmission on SMF

- DQPSK format has been investigated for 100-Gbps transmission as a serial PMD

DQPSK serial PMD can be considered
as one of the candidates for 100GbE on 40-km SMF