50G based wavelength plan for BR40

Han Hyub Lee and Hwan Seok Chung

Electronics and Telecommunications Research Institute

IEEE P802.3dk Greater than 50 Gb/s Bidirectional Optical Access PHYs Task Force

Introduction

- Currently, there are discussions regarding wavelength plans for 100GBASE BR40:

  - 2 x 50G and 1 x 100G wavelength plans

- To standardize 1x100G wavelength plan, two wavelengths are required for bidirectional transmission. There is concern about CD penalty and power budget when transmitting 100 Gb/s signals over 40 km SMF.
- On the other hand, to standardize 2x50G wavelength plan, four wavelengths are needed. It has been proven that there is sufficient margin when transmitting 50 Gb/s signals over 40 km SMF and flexibility for wavelength plan.
- This contribution discusses advantages of 2 x 50G wavelength plan for BR40.

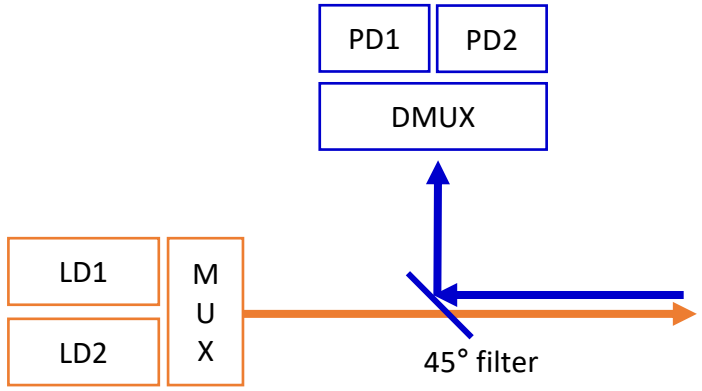
Advantages of 2x50G wavelength plan

- **Wide CD-limited wavelength range in O-band**
  - No critical issues for 50 Gb/s signal over 40 km transmission, even with already deployed SMF
  - Provides flexibility in the wavelength plan
  - Various BOSA implementation method is possible
- **High power budget**
  - The 25Gbaud PAM4 receiver sensitivity is approximately 4 ~ 5 dB lower than that of the 50Gbaud PAM4 receiver sensitivity.
  - 22 dB of power budget can be supported using 25G EML instead of high-power SOA integrated EML.
- **Low-cost optics**
  - 25G optics are widely utilized in Ethernet applications, contributing to cost-effectiveness.

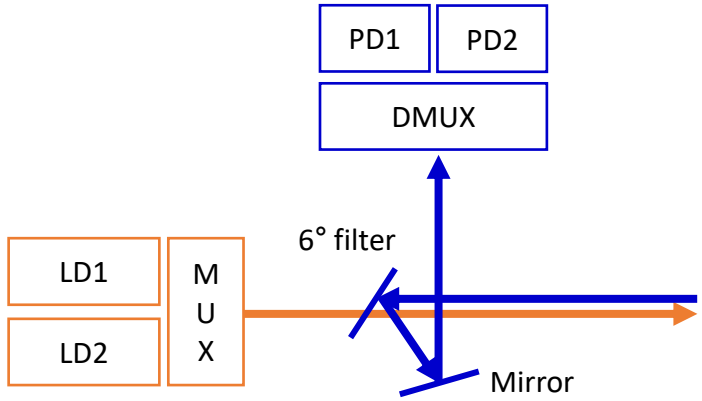
	10 km SMF	20 km SMF	40 km SMF
50GBASE-	LR BR10-D/U	BR20-D/U	ER BR40-D/U
200GBASE-	LR4 (4x50G)		ER4 (4x50G)
400GBASE-	LR8 (8x50G)		ER8 (8x50G)

100GBASE BR40 BOSA configuration

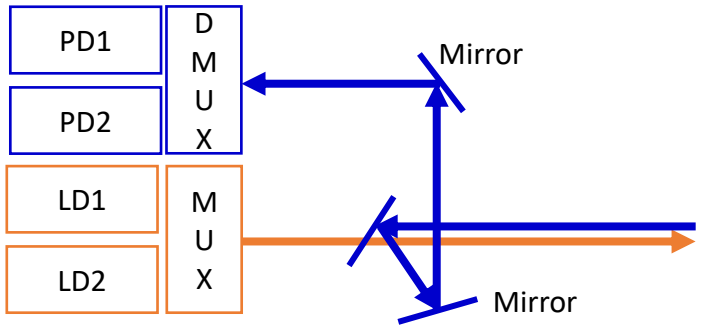
Example 1 – Using 45 degree filter



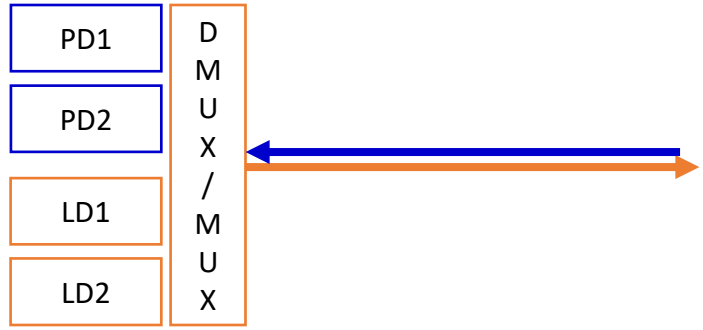
Example 2 : Using 6 degree filter [1)]



Example 3 - Using 6 degree filter



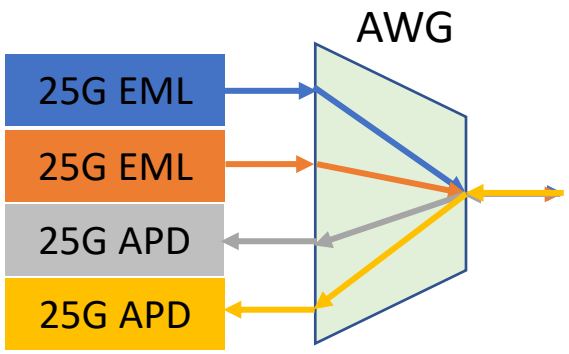
Example 4 –Using optical block



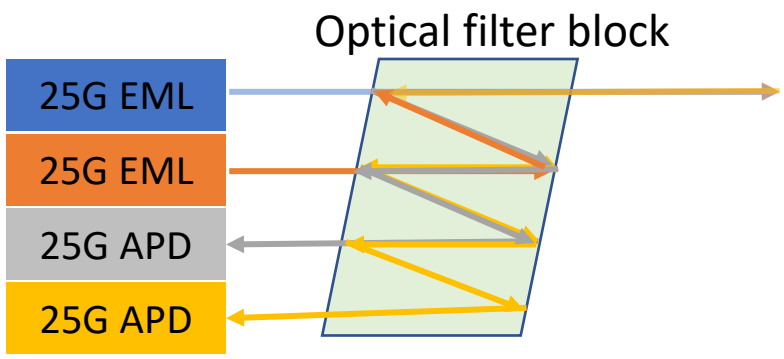
1) https://www.ieee802.org/3/dk/public/2309/3dk_Geng_2309_1.pdf

MUX/DMUX for 2x50G BOSA

- Two-channel Tx and Rx parts in 2x50G BOSA can be achieved using multiplexing and demultiplexing technology similar to ER4 Ethernet transceivers.
- 4 wavelengths MUX, DMUX are used for LAN-WDM TOSA or ROSA.
- The figure suggests implementing MUX/DMUX for two channels with a single optic, utilizing compact solutions like AWG or optical filter block.



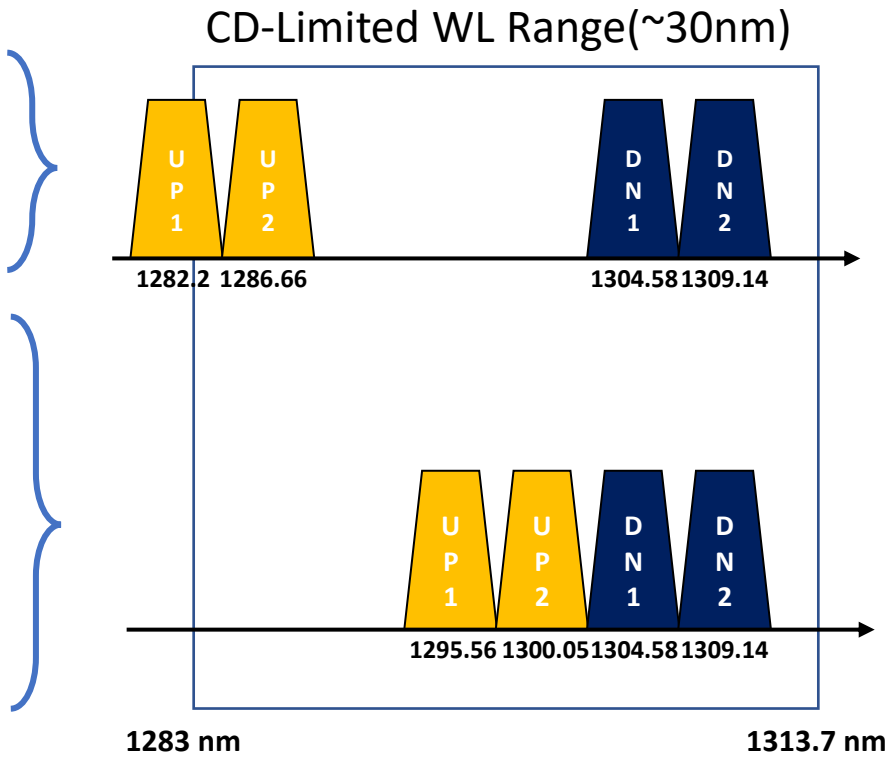
Insertion loss: ~ > 3dB



Ma. Insertion loss: ~ < 0.5 dB

Wavelength plan example

BOSA	Downstream	Upstream	Gap
Example1	1282.26 nm 1286.66 nm	1304.58 nm 1309.14 nm	18 nm[1)]
Example2 Example3	1295.56 nm 1300.05 nm	1304.58 nm 1309.14 nm	2.5 nm[1)]
Example4	1295.56 nm 1300.05 nm	1304.58 nm 1309.14 nm	800GHz



This wavelength plan example takes into account the LWMD wavelength and allows for flexible adjustments within the CD-limited WL range.

1) https://www.ieee802.org/3/dk/public/2309/3dk_Geng_2309_1.pdf

Summary

- Utilizing 50 Gb/s lane rate provides the advantage of a broad available wavelength range, with no issues in supporting BR40 power budget.
- The implementation of BOSA introduces complexity due to the necessity of using MUX/DMUX. However, leveraging existing integration technology should make the implementation relatively straightforward.
- On the other hand, multi channels BOSA technology will apply for 200GBASE-BR transceiver because 200GBASE-BR specification inherently requires multi-wavelength plan such as 4 λ x 50G or 2λ x 100G.