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Baseline Proposal for 500m using 8x50G NRZ

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IEEE802.3bs 400GbE Task Force, Interim, May 2015

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- Features
  - Use of low cost un-cooled DFB
  - Use of low cost OSA structure using BiDi scheme
  - Easy for backward compatibility with 100G PSM4 MSA (need further specification discussion)

Transmit Characteristics (Modification)

- The same as cole_3bs_01a_1114 except below
  - Extinction Ratio: TBD (to consider uncooled DFB)
  - Transmitter 3dB frequency: Not specified

Transmit Characteristics ~~(duplex SMF)~~ Remove

Description	500m NRZ		Unit
Signaling Rate, each lane	53.2		GBd
Operating BER	2.0E-04		
Total average launch power (max)	11.2		dBm
OMA, each lane (max)	2.0		dBm
OMA, each lane (min)	-3.3		dBm
Launch Power in OMA – TDP, each lane (min)	-4.3		dBm
Transmitter and dispersion penalty, (TDP) each lane (max)	~~1.8~~	2.8	dB
Extinction ratio (ER) (min)	~~4.5~~	TBD	dB
RIN OMA (max)	-130.0		dB/Hz
~~Transmitter 3dB frequency (min)~~	~~21~~		~~GHz~~ Remove
Optical return loss tolerance (max)	20.0		dB

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Receive characteristics (Modification)

- The same as cole_3bs_01a_1114

Receive Characteristics ~~(PSM4)~~ Remove

Description	500m NRZ		Unit
Signaling Rate, each lane	53.2		GBd
Operating BER	2.0E-04		
Receiver reflectance (max)	-26.0		dB
Receiver Sensitivity (OMA), each lane (max)	~~-8.8~~	-9.8	dBm
Receiver 3 dB electrical upper cutoff frequency, each lane (max)	42.0		GHz
Stressed receiver sensitivity (OMA), each lane (max)	TBD		dBm
Conditions of stressed receiver sensitivity test	TBD		

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Link Power Budget (Modification)

- The same as cole_3bs_01a_1114

Illustrative Link Power Budgets ~~(PSM4)~~ Remove

Parameter	500m NRZ		Unit
Power Budget (for maximum TDP)	~~6.3~~	7.3	dB
Operating Distance	~~2.0~~	0.5	km
Channel Insertion Loss	~~4.5~~	4.0	dB
Maximum Discrete Reflectance	-26.0		dB
Allocation for Penalties (for maximum TDP)	~~1.8~~	3.3	dB
Allocation for Modulation Penalties	0.0		dB

Wavelengths (Modification)

- Modify as below
  - Agreement with both end-channel wavelengths in 40GbE_LR4
  - These wavelengths may change with another 40GbE_LR4 wavelengths

WDM Lane Assignments

Lane	Center Frequency THz	Center Wavelength nm	Wavelength Range nm
L0	~~233.8~~	~~1282.26~~	~~1277.89 to 1286.66~~
L1	~~229.8~~	~~1304.58~~	~~1300.05 to 1309.14~~

Below

	Center Wavelength	Wavelength Range
L0	1270nm	1264.5 to 1277.5 nm
L1	1330nm	1324.5 to 1337.5 nm

Dispersion for wavelength

- Fiber dispersion were calculated as below.
- 2.5km can be achievable based on commercial available 25Gbit/s CWDM DFB's that is capable for 10km, assuming the same α-parameter

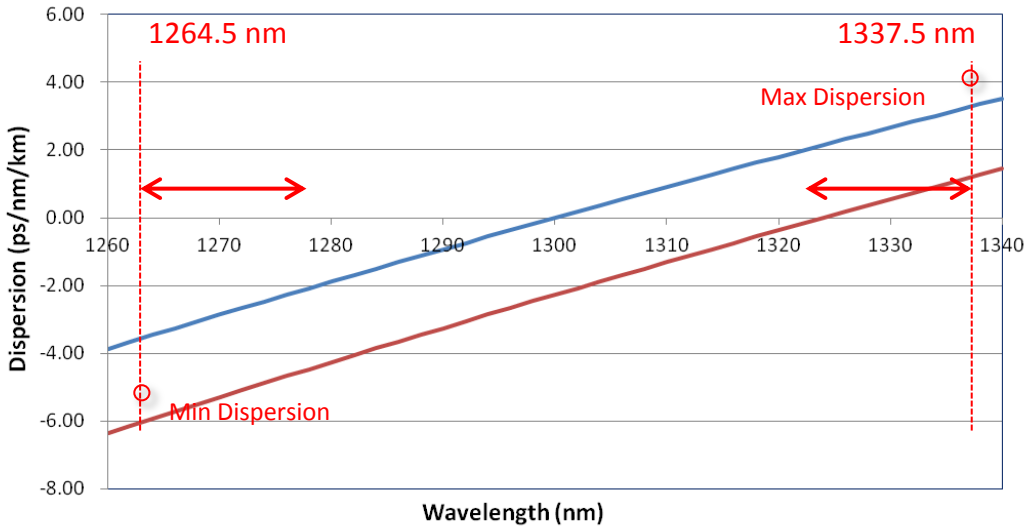
$$L \propto \frac{1}{B^2} \quad \text{where L : Transmission distance, B : Bit rate}$$

	Dispersion	500m
1264.5 nm	-5.87 ps/nm/km	-2.94 ps/nm
1337.5 nm	3.31 ps/nm/km	1.65 ps/nm

ITU-T G.652

$$\frac{\lambda S_{0\max}}{4}\left[1-\left(\frac{\lambda_{0\max}}{\lambda}\right)^4\right] \le D(\lambda) \le \frac{\lambda S_{0\max}}{4}\left[1-\left(\frac{\lambda_{0\min}}{\lambda}\right)^4\right]$$

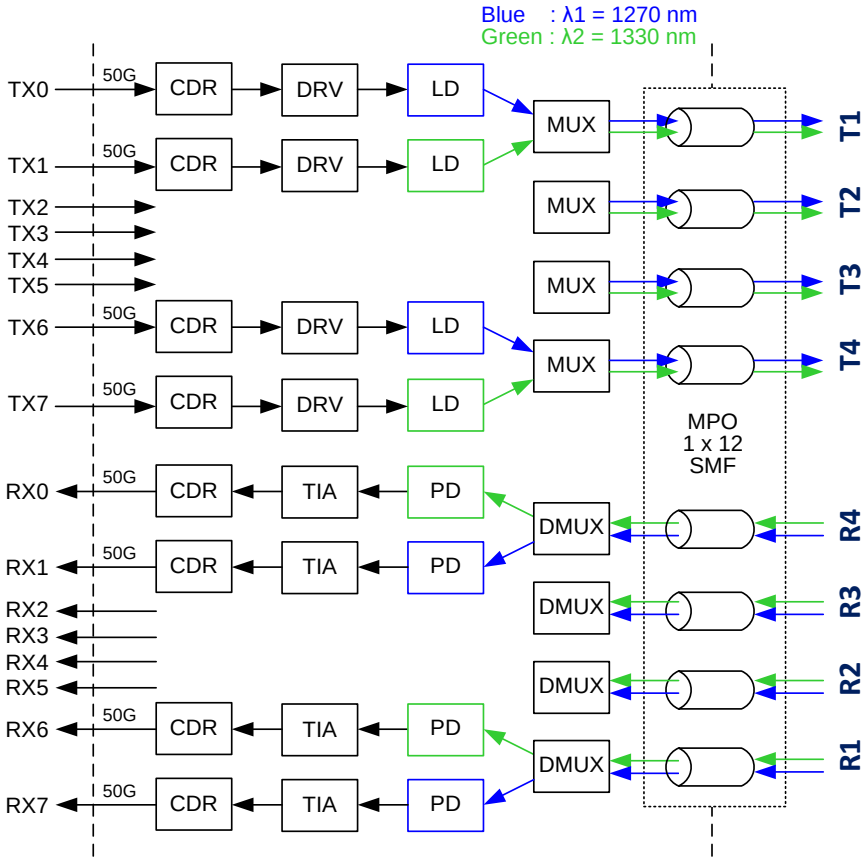
Chromatic dispersion coefficient	$\lambda_{0\min}$	1300 nm
	$\lambda_{0\max}$	1324 nm
	$S_{0\max}$	0.092 ps/nm^2 × km

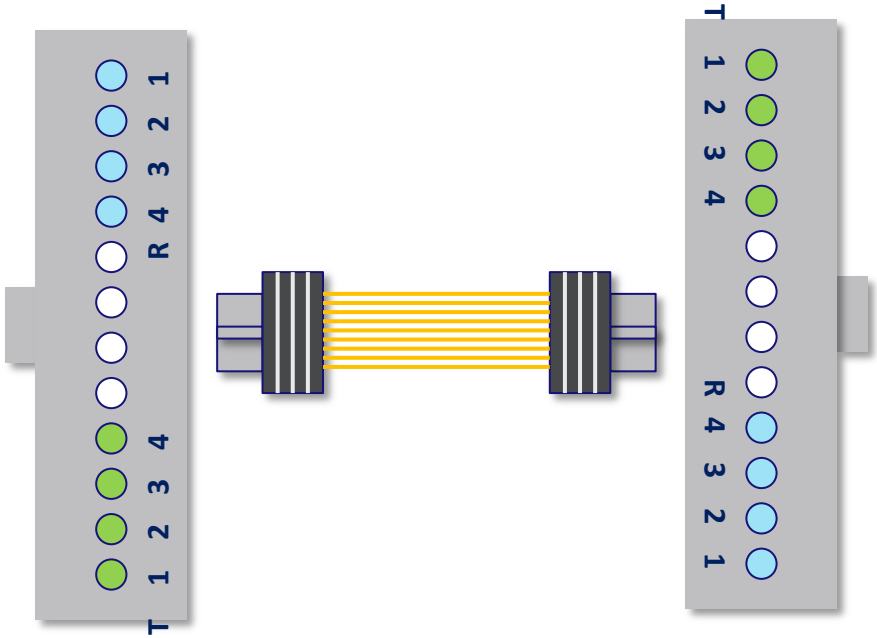


Implementations

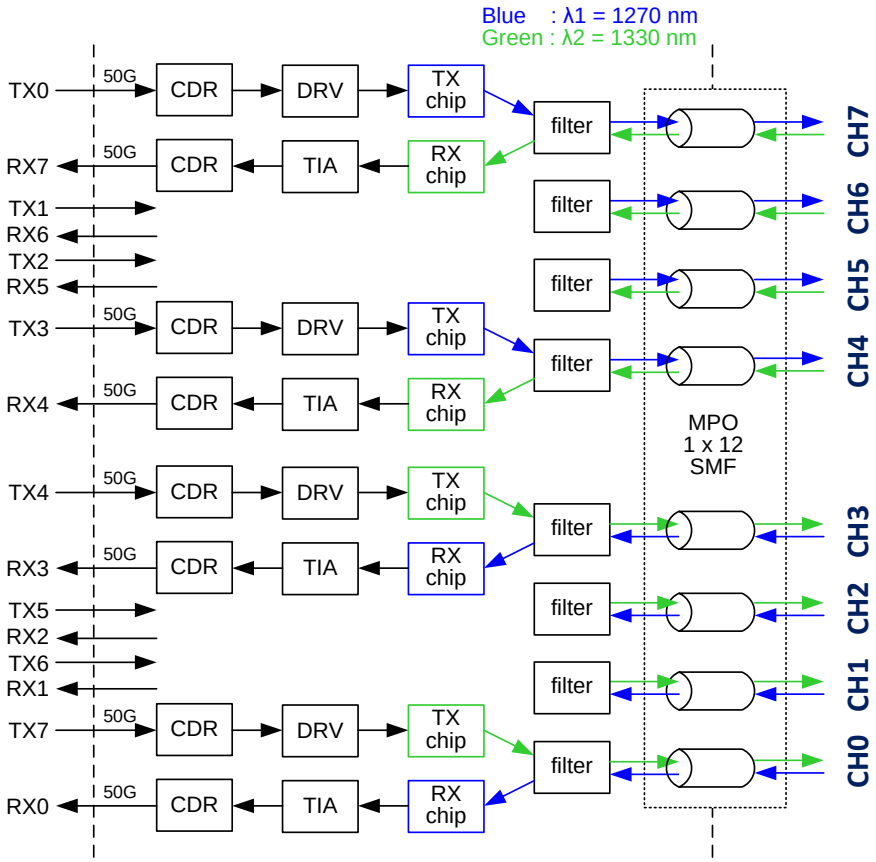
- Two implementations
  - The same specifications
  - PSM4 fiber fabric
- 2λ WDM TOSA/2λ WDM ROSA
  - Two LD's and optical filter in a TOSA package
  - Two PD's and optical filter in a ROSA package
- 2λ WDM BOSA
  - One LD, one PD and optical filter in a BOSA package

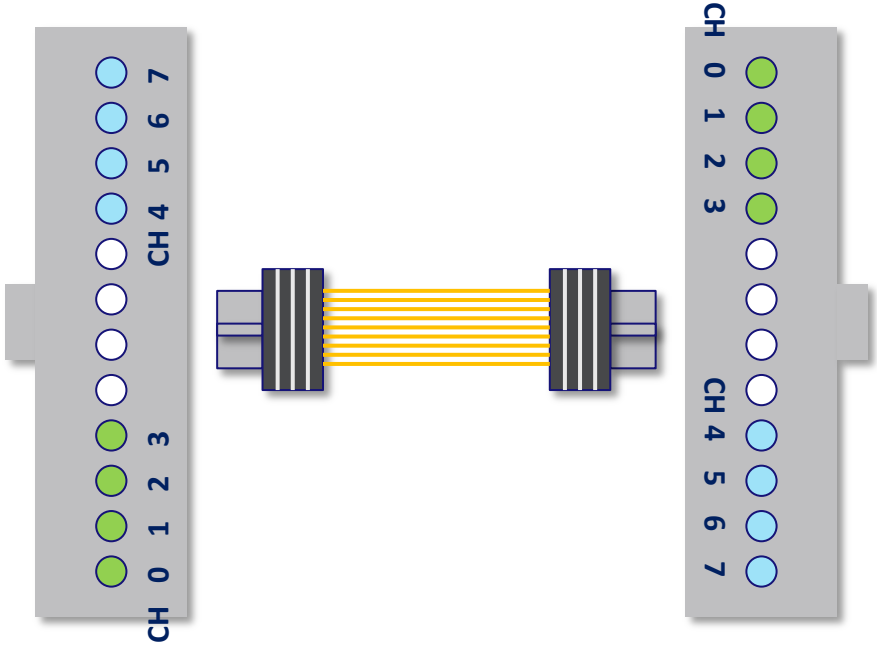
2λ WDM TOSA/2λ WDM ROSA Implementation





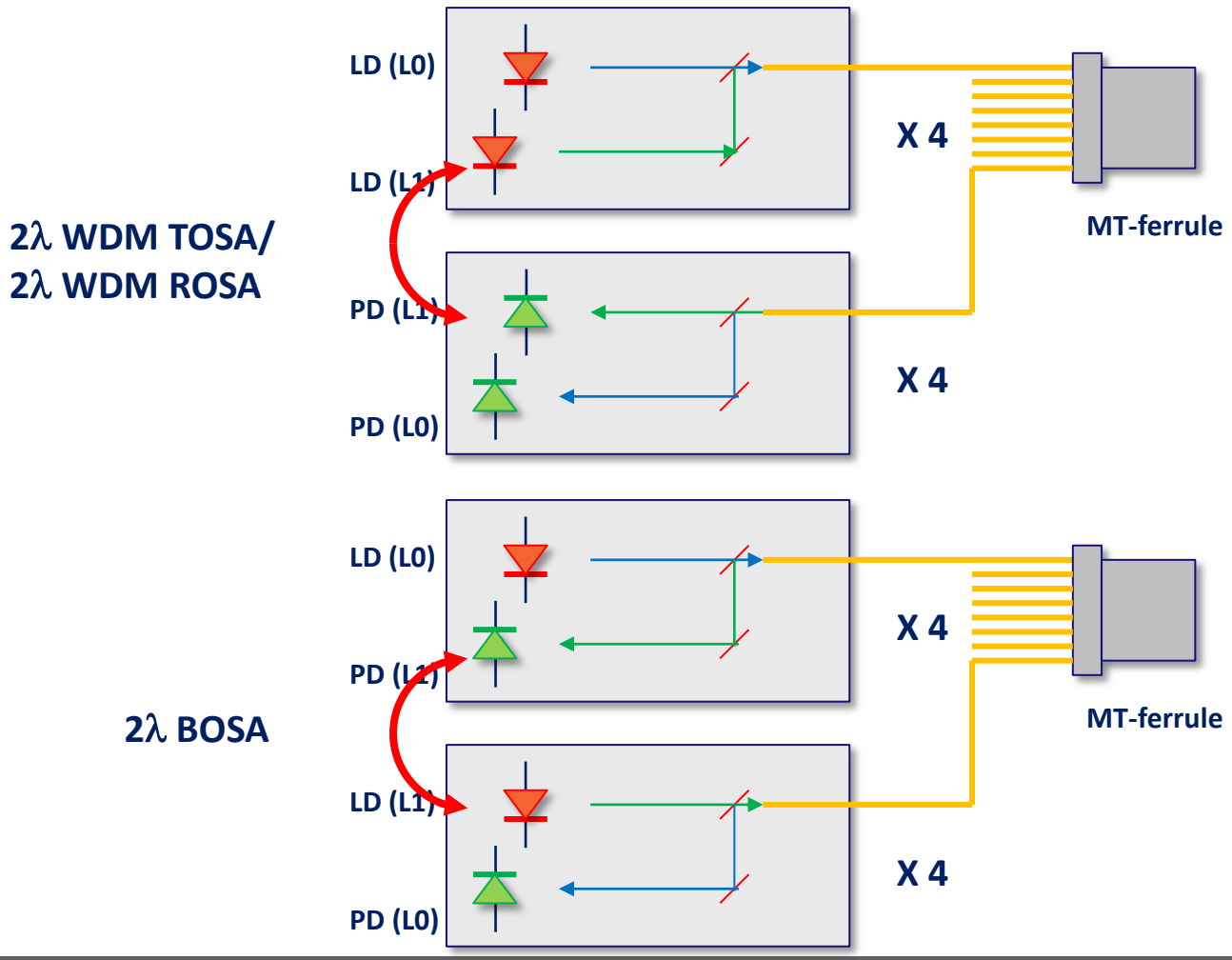
2λ WDM BOSA Implementation





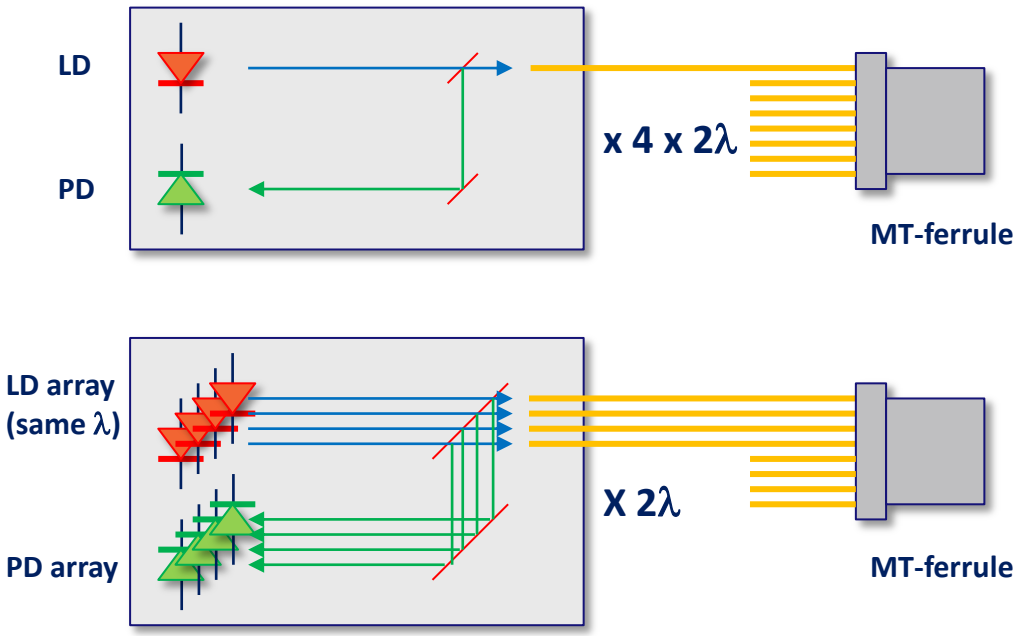
Comparison

- We will investigate which implementation is best for cost and space.



Examples of BOSA using Array Devices

- Use of array devices reduce the cost
  - Array devices are applicable in favor of robustness against channel-to-channel cross-talk with higher transmitter SNDR margin
  - The same wavelength 4-channel DML array cost is not significantly increased by well controlled process
  - Significant cost reduction by reducing number of parts such as package, filter and PD array



Thank you