O-band DWDM NRZ transmission of 100G-EPON

Hanhyub Lee, and Hwan Seok Chung, ETRI
Nowook Park, KT

IEEE P802.3ca *100G-EPON* Task Force
January 18-22, 2016
Atlanta, GA, USA

Smart & Green Technology Innovator
ETRI

Supporters

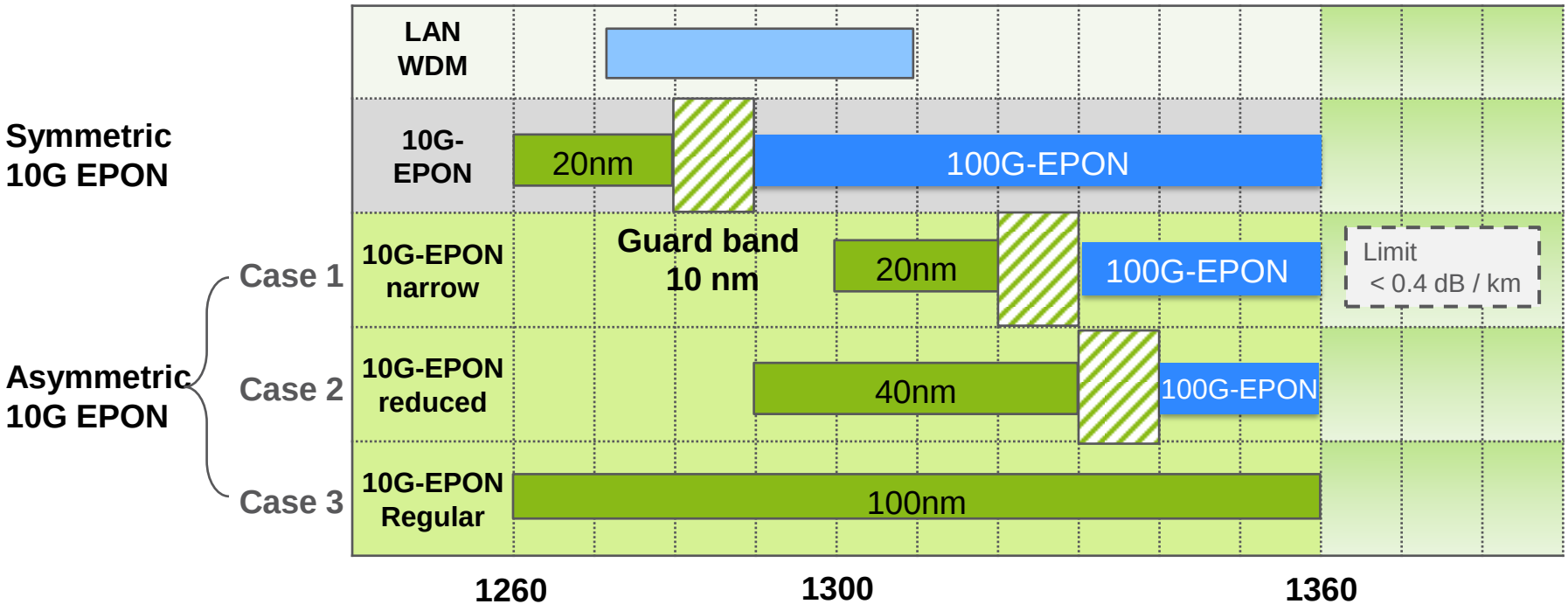
- Eugene Dai, Cox Communications

Five major topics[1]

- Coexistence Requirements
- Wavelength Plan
- Line code
- ONU Tuning of 25G ONUs
- Spectrum needed

[1] PMD work area topics, Frank Effenberger, conference call December 2015,

Coexistence Requirements: WDM Coexistence Wavelength Plan : O-band



- O-band is one of candidates for WDM coexistence considering that it is…
  - High chromatic dispersion tolerance over 25 Gb/s transmission
  - Mature technology, available today for 100GE, and Multi vendor
  - Easy to archive and available as laser diode
- In the case of coexistence with asymmetric 10G-EPON, an available band is reduced because of 1G upstream.

Asymmetric 10G-EPON ONU OTRx[2]

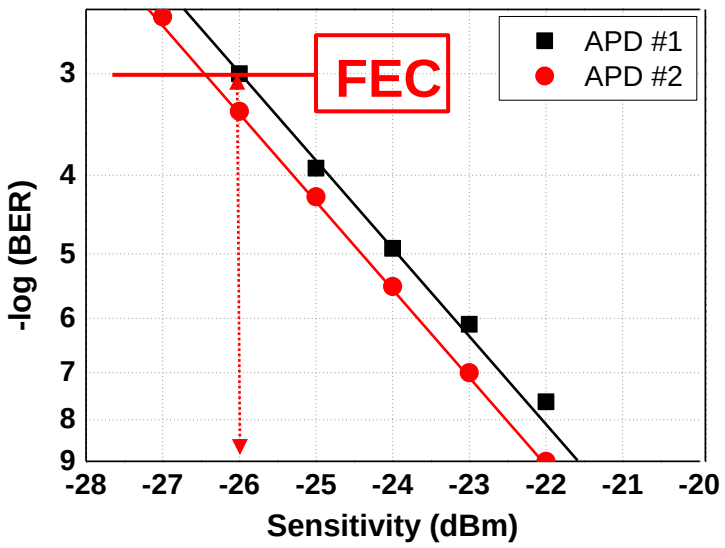
	Form factor	Data rate Tx	Data Rate Rx	Tx	Rx	Wavelength (Tx/Rx)	Distance
Vendor A	SFP+	1.25 Gb/s	10.3 Gb/s	**DFB-LD**	APD	1310 nm / 1577 nm	20 km
Vendor B	SFP+	1.25 Gb/s	10.3 Gb/s	**DFB-LD**	APD	1310 nm / 1577 nm	30 km
Vendor C	SFP+	1.25 Gb/s	10.3 Gb/s	**DFB-LD**	APD	1310 nm / 1577 nm	30 km
Vendor D	SFP+	1.25 Gb/s	10.3 Gb/s	**DFB-LD**	APD	1310 nm / 1577 nm	-

[1] http://www.optcore.net/optcore/html_products/Asymmetric-10G-EPON-ONU-Transceiver-Module-745.html
[2] http://www.sourcephotonics.com/sp_web/products/broadband-access/
[3] http://www.ligentphotonics.com/files/product-list-04.shtml
[4] http://www.xgiga.cn/Files/Product/ex-u1231-30d.pdf

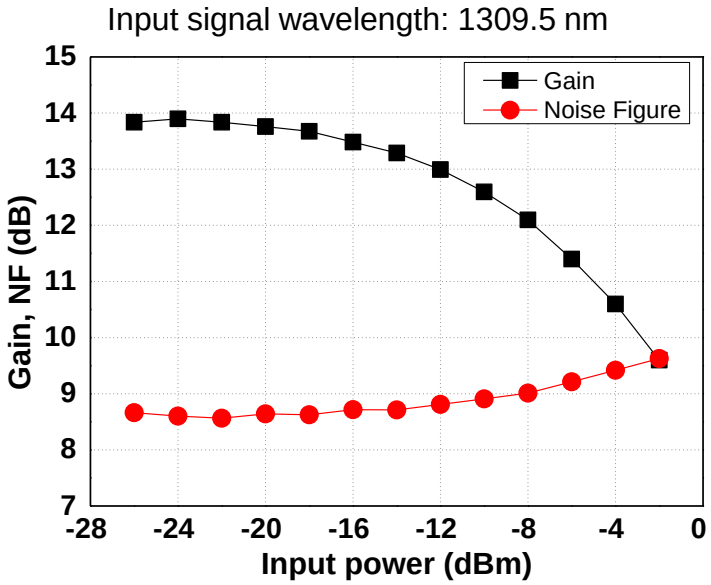
As survey results, most of the vendor provide 10G-EPON ONU transceivers based on DFB-LDs.

[2] http://www.ieee802.org/3/NGEPONSG/public/2015_11/ngepon_1511_hanhyub_1.pdf

Wavelength Plan: O-band power budget



[25G APD receiver Sensitivity]



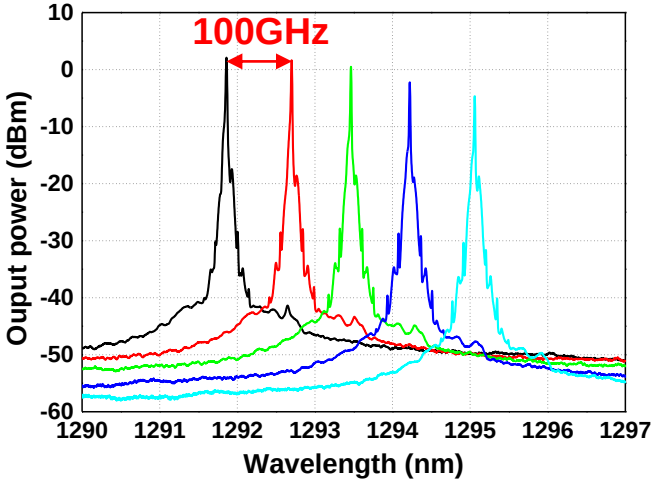
[O-band SOA Gain / NF]

- A 25G APD receiver and an O-band SOA are commercial available[1)]
  - XGM effect btw WDM channels will be analyzed.
- APD Receiver sensitivity at BER 10^{-3} is -26 dBm.

1) SEI TECHNICAL REVIEW · NUMBER 78 · APRIL 2014

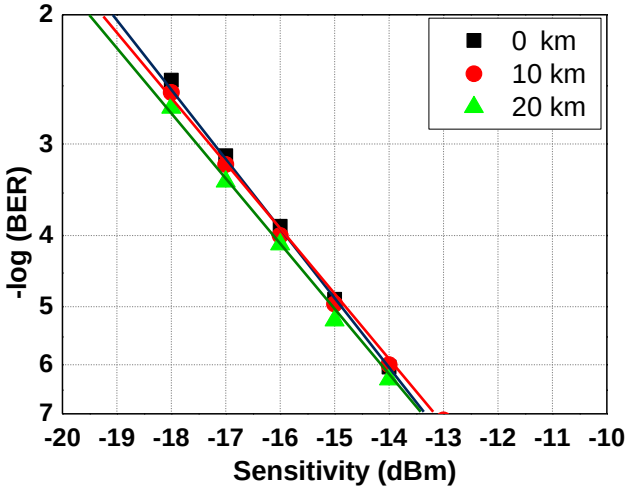
Line Code: NRZ
ONU Tuning of 25G ONUs: Tunable 25G transmitter
Spectrum needed: DWDM

O-band 25G EML, NRZ 25 Gb/s, PRBS 2^{31}-1

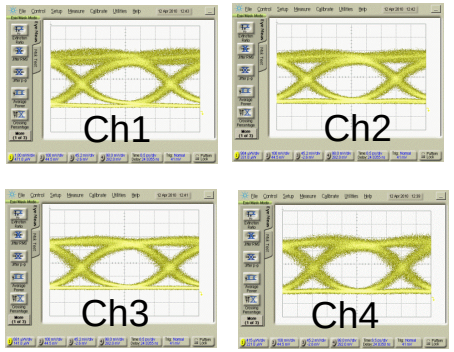


[Output spectrum]

O-band 25G EML, NRZ 25 Gb/s, PRBS 2^{31}-1



[BER performance]



[Optical eye diagram]

- For the 25G / 10G transmission, NRZ modulation formant is most suitable considering a simple configuration of transceiver.
- O-band 4-channel tunability with 100-GHz channel spacing was possible by using temperature control.
- It is expected that high power EMLs will be commercialized in order to satisfy 100G Ethernet LR4 specification (+4.5dBm)

Conclusions

- We experimentally confirmed technical feasibility of tunable NRZ 25Gb/s transmission in O-band.
  - DWDM 4-channel tunability with 100-GHz channel spacing was possible by using temperature control.
  - Link budget of PRX30 will be achieved with the help of an APD Rx and a SOA.
- O-band is a promising candidate for 25G NRZ transmission of 100G-EPON

Thank you!

Smart & Green Technology Innovator

ETRI