

TDP for PX30-D and PX40-D

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Overview

- Comments #77 and #78 of draft 1.0 review
TDP for PX30-D and PX40-D was 1.0 dB. However, it was 2.3 dB for PX20-D regardless of the same wavelength range of 1480 to 1500 nm.
- Measured TDPs of commercial 1G OLT transceivers to see if TDP of 1.0 dB for PX30-D and PX40-D is appropriate.

How to measure TDP?

Method. 1 (IEEE)

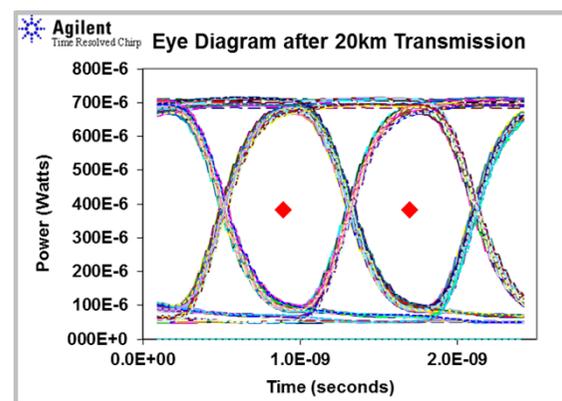
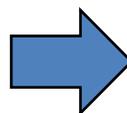
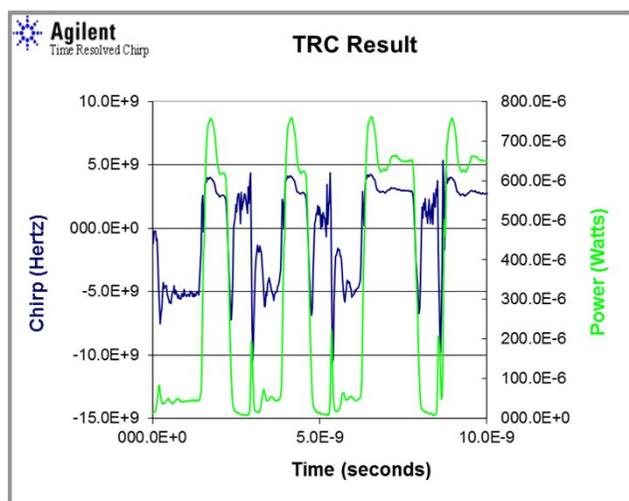
Use a *reference transmitter* and a *reference receiver* and measure BER in back-to-back transmission.

Use a *DUT transmitter* and a *reference receiver*, measure BER in actual transmission and compare the results.

Method.2

Measure “Time resolved chirp” (TRC) and calculate the waveform and penalty after transmission.

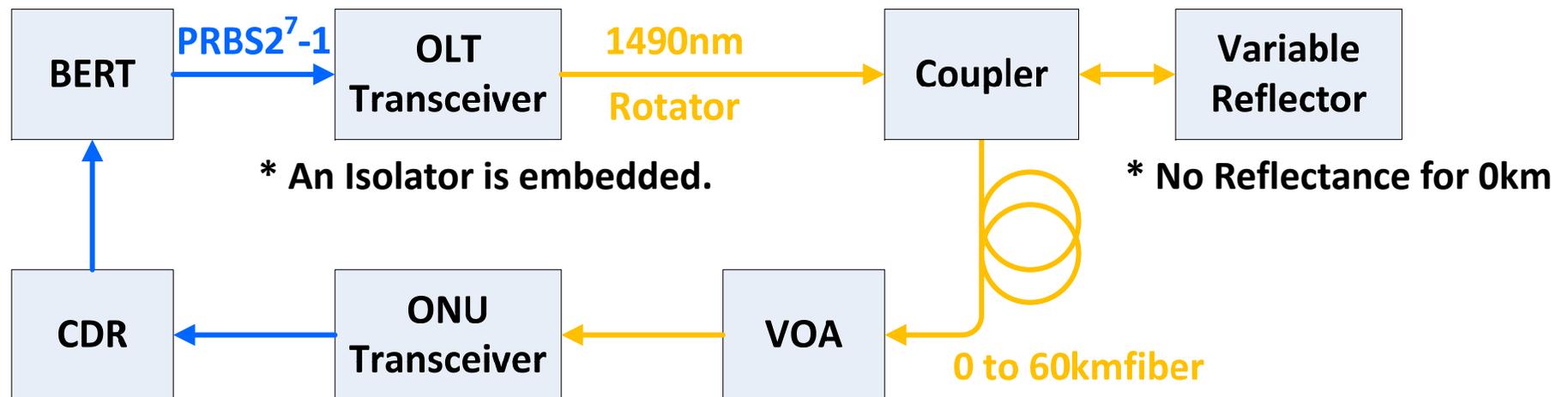
TRC quantifies the time variation of both the intensity and the frequency of a transmitter.



Reference wavelength $\lambda_0 = 1300 \text{ nm}$
Dispersion slope = $0.093 \text{ ps/nm}^2\text{-km}$
4th Bessel Thomson Filter

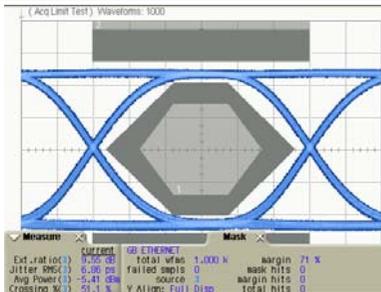
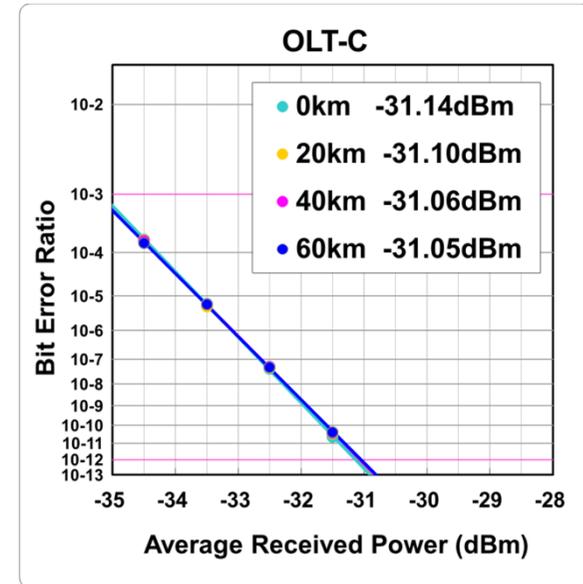
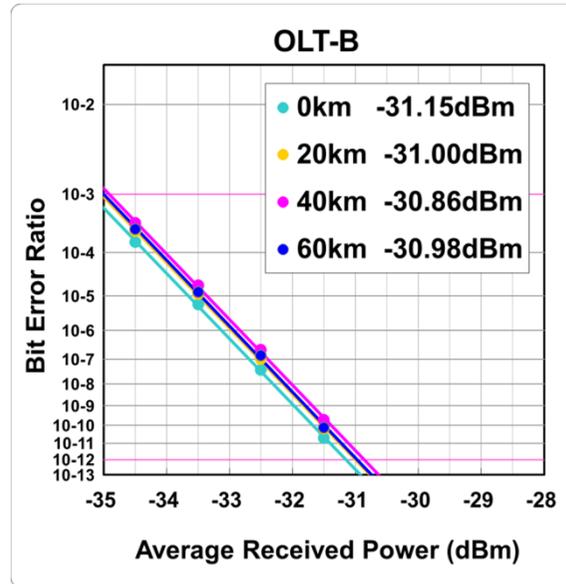
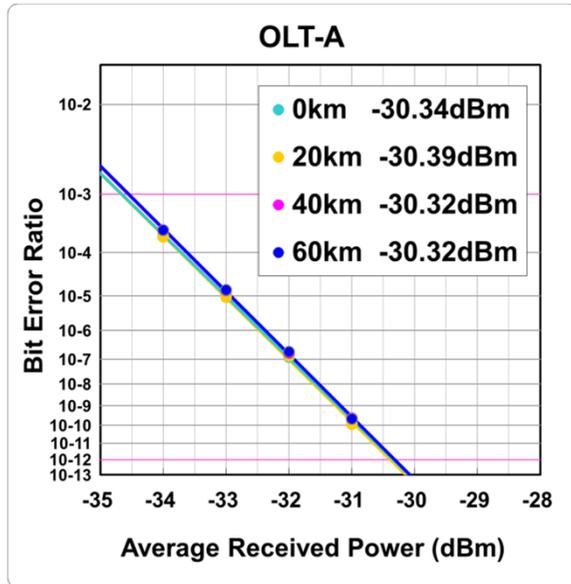
Setup for BER Measurement

- OLT : 3 types of commercial transceivers with an isolator
- ONU : a commercial transceiver (*not reference receiver*)

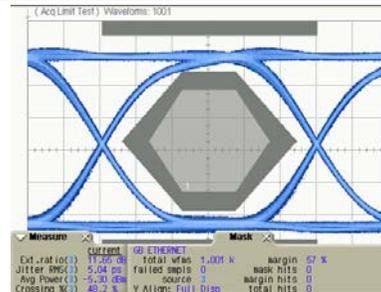


BER Results

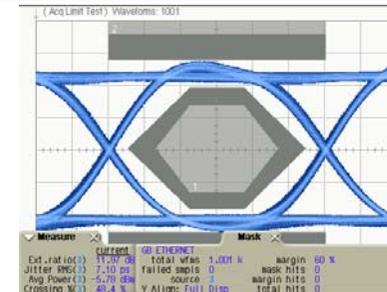
20km transmission penalty is less than 0.2dB.



$\lambda = 1489.599\text{nm}$
 $\Delta\lambda_{\text{rms}} = 0.0379\text{nm}$
 ER = 9.55dB, Margin = 71%



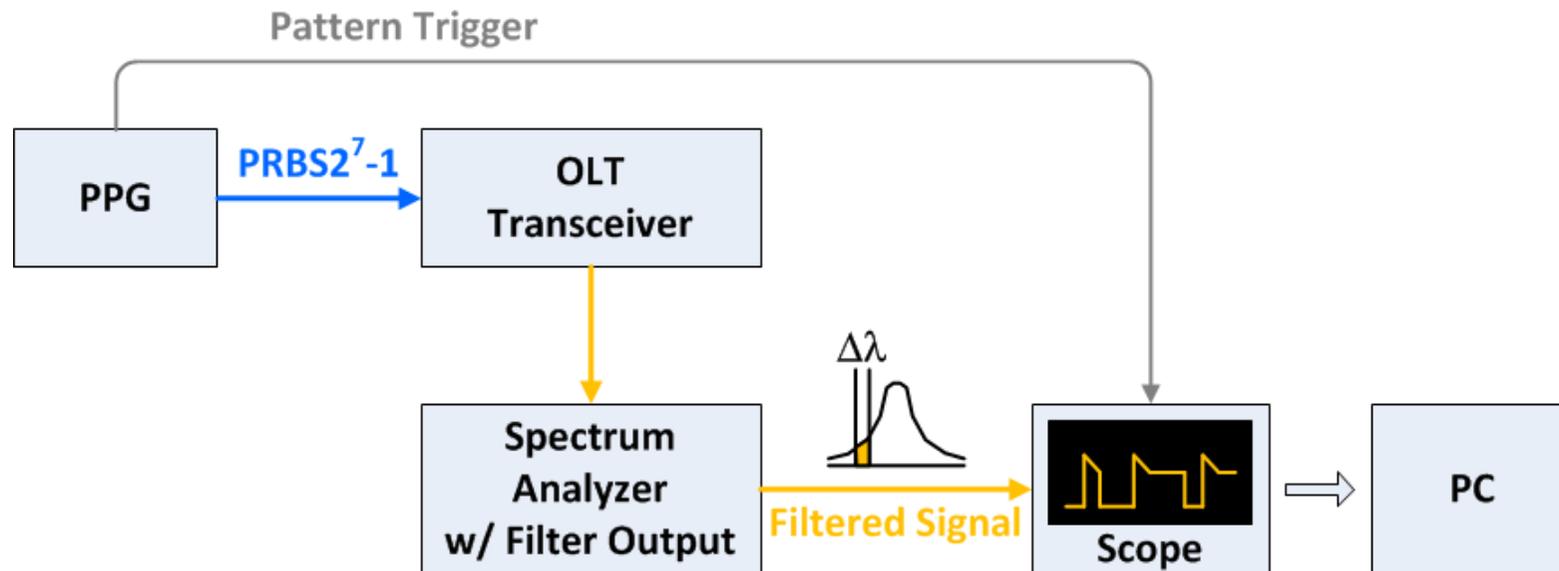
$\lambda = 1492.166\text{nm}$
 $\Delta\lambda_{\text{rms}} = 0.0453\text{nm}$
 ER = 11.65dB, Margin = 57%



$\lambda = 1488.801\text{nm}$
 $\Delta\lambda_{\text{rms}} = 0.0437\text{nm}$
 ER = 11.97dB, Margin = 60%

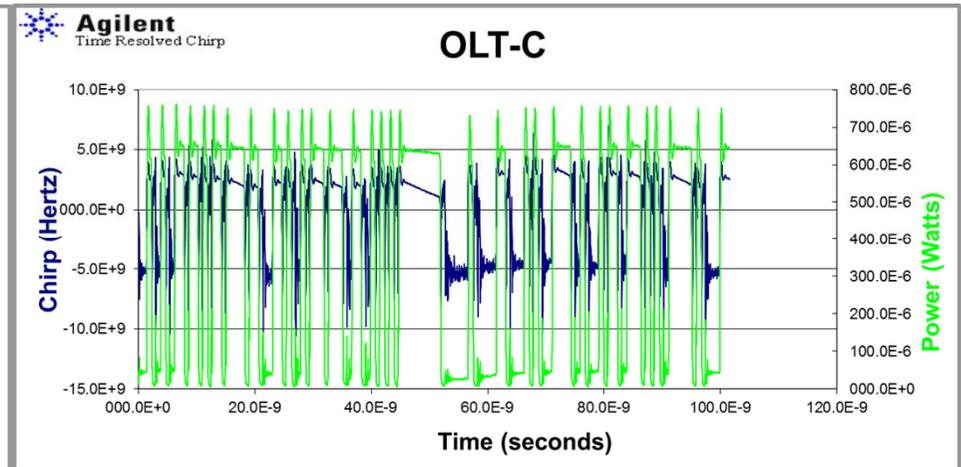
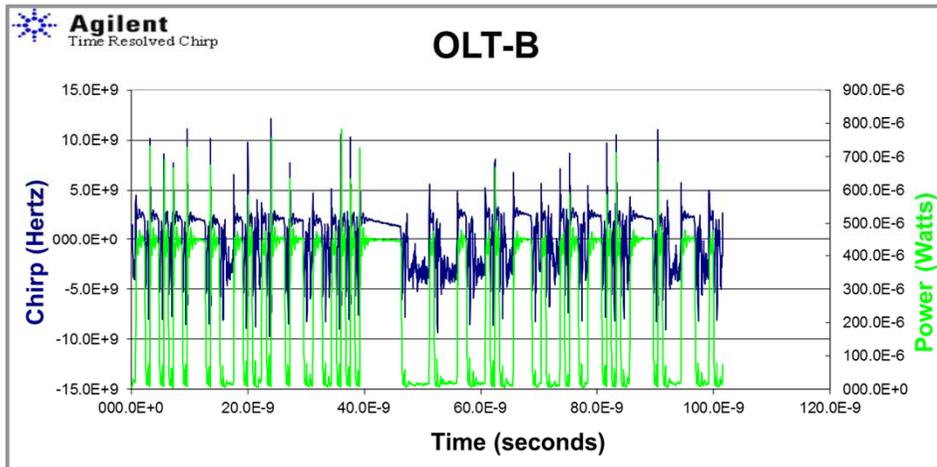
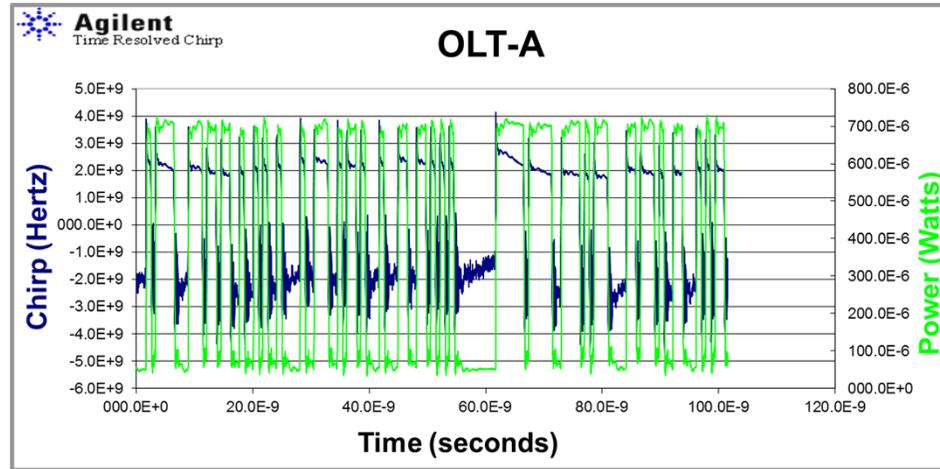
Setup for TRC Measurement

- Optical spectrum analyzer passes optical signal in $\Delta\lambda$.
- Sweep $\Delta\lambda$ and measure the waveform of $\Delta\lambda$.
- Acquire the time variation of the intensity and the frequency of a transmitter.



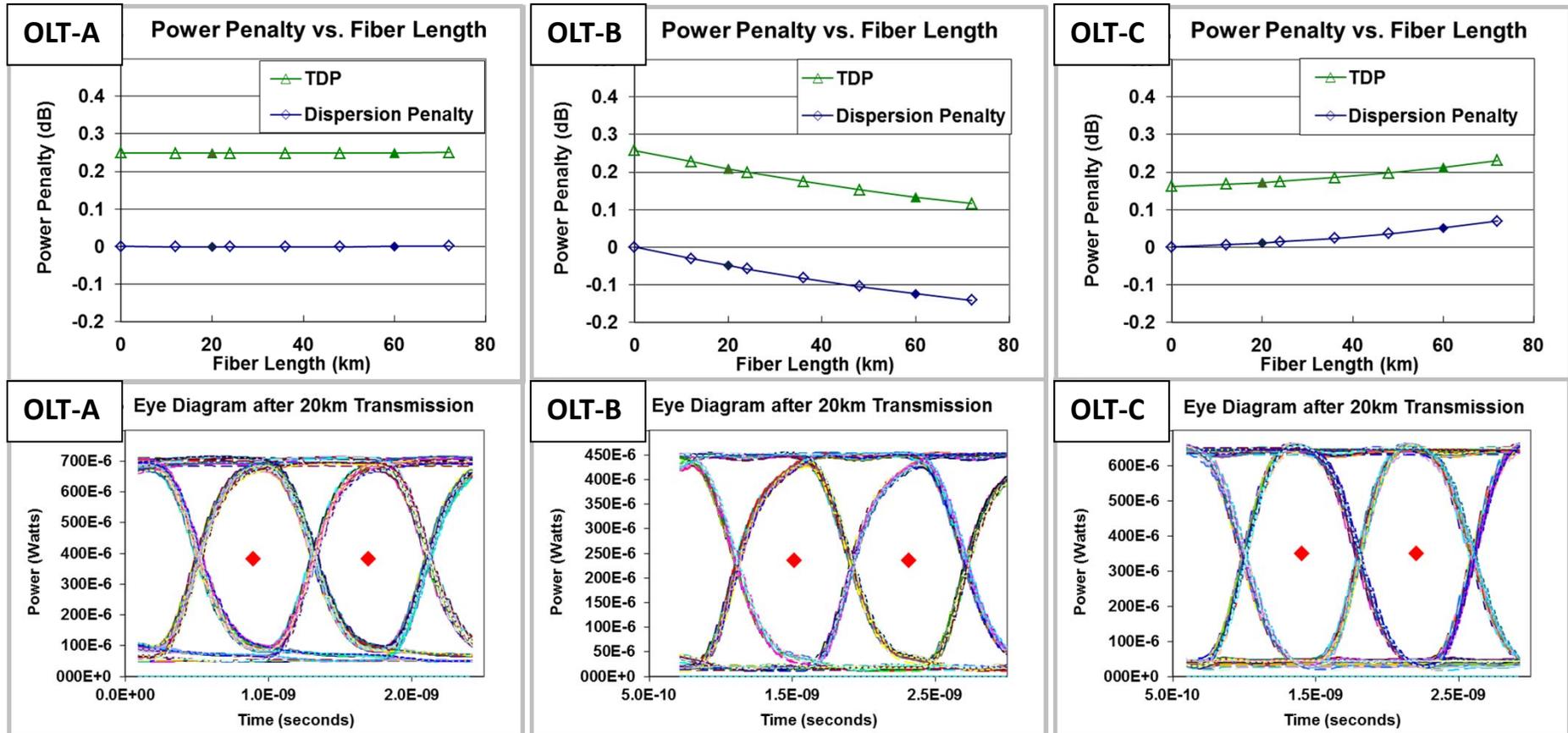
TRC Measurement Results

Chirp is within 20 GHz bandwidth.



TDP Simulation Results

TDP at 0 to 20 km is less than 0.3 dB.



$\lambda = 1489.599 \text{ nm}$

$\Delta\lambda_{\text{rms}} = 0.0379 \text{ nm}$

Dispersion = 14.54ps/nm-km

$\lambda = 1492.166 \text{ nm}$

$\Delta\lambda_{\text{rms}} = 0.0453 \text{ nm}$

Dispersion = 14.71ps/nm-km

$\lambda = 1488.805 \text{ nm}$

$\Delta\lambda_{\text{rms}} = 0.0437 \text{ nm}$

Dispersion = 14.49ps/nm-km

Summary

For commercial 3 types of OLT transceivers,

- Measured 20 km transmission penalties were less than 0.2 dB.
- Calculated TDPs from measured “Time resolved chirp” were less than 0.3 dB.

TDP of 1.0 dB for PX30-D and PX40-D is reasonable.