

# 400GbE DMT Tolerance to MPI using DMT Test Chip

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# Introduction

- We have shown MPI tolerance for DMT with worst case conditions in the experiments and simulations with off-line processing.
  - Less than 0.5dB for 4x100G/lambda DMT for link budget
  
- In this contribution we show performance variation caused by fluctuation of fiber characteristics due to external factors such as environmental temperature variation on live transmission experiment using DMT test chip.
  - Studied MPI tolerance under dynamic MPI variation conditions

Reference Model for MPI Specification

- Reference model

Case	Reflectance			Note
	TOSA	In-line Connectors	ROSA	
1	-26dB	4 connectors, -35dB	-26dB	Reports in September meeting
2	-26dB	4 connectors, -26dB <sup>*1</sup>	-26dB	Increase of reflectance of in-line connectors
3	-26dB	6 connectors, -26dB <sup>*1</sup>	-26dB	Increase of reflectance and the number of in-line connectors

\*1: Reference from 100GBASE-LR4 draft

MPI Tolerance for DMT

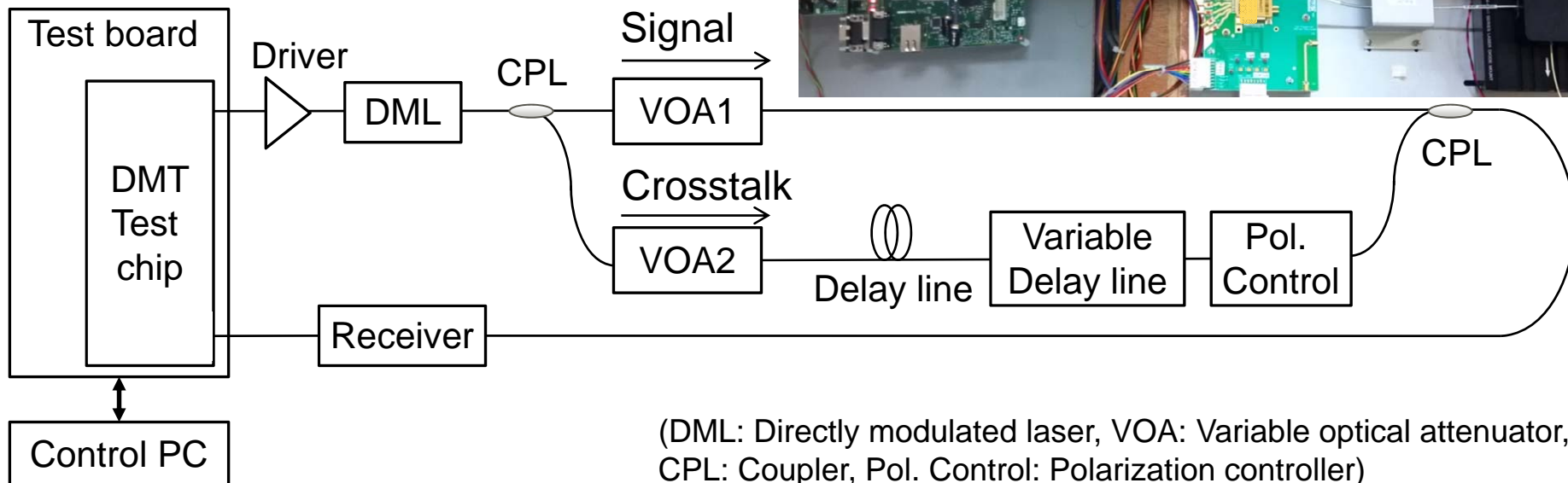
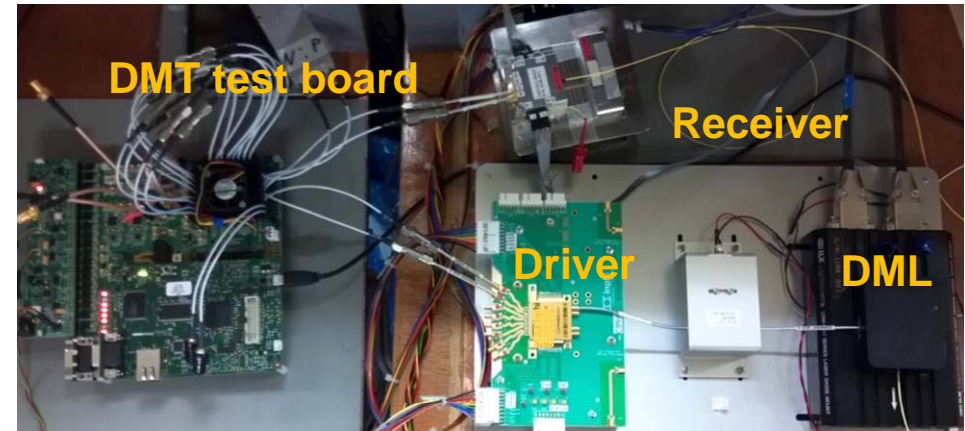
Case	Crosstalk <sup>*1</sup>	Sensitivity penalty
1	-49dB	<0.1dB
2	-40dB	0.3dB
3	-37.5dB	0.5dB

(Ref.: farhood\_01\_1112)

- -37.5dB crosstalk translates to 0.5dB sensitivity penalty.
- DMT can allow degradation for -26dB reflectance and 6 connectors.

# Experimental Setup

- 116 Gbps Discrete Multi-Tone (DMT)
- Live evaluation of DMT transmission performance using DMT test chip
- MPI emulated by interfering signal with attenuated signal copy
- Adjusted for worst case condition
  - Aligned polarization of signal with copy/crosstalk signal for maximum interference

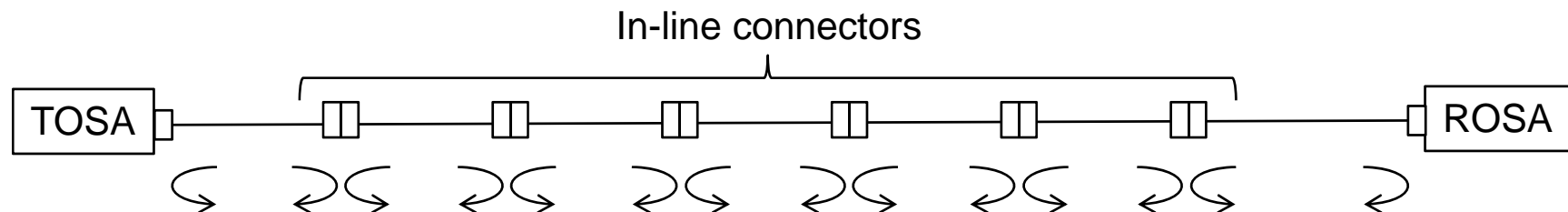


# Experimental Parameters

## DMT test chip features

Parameter	Value
Test chip process	28nm CMOS
Bitrate	116Gbps
Sampling rate	58GS/s
Number of subcarriers	256
Cyclic prefix	16
PRBS length	$2^{31}-1$

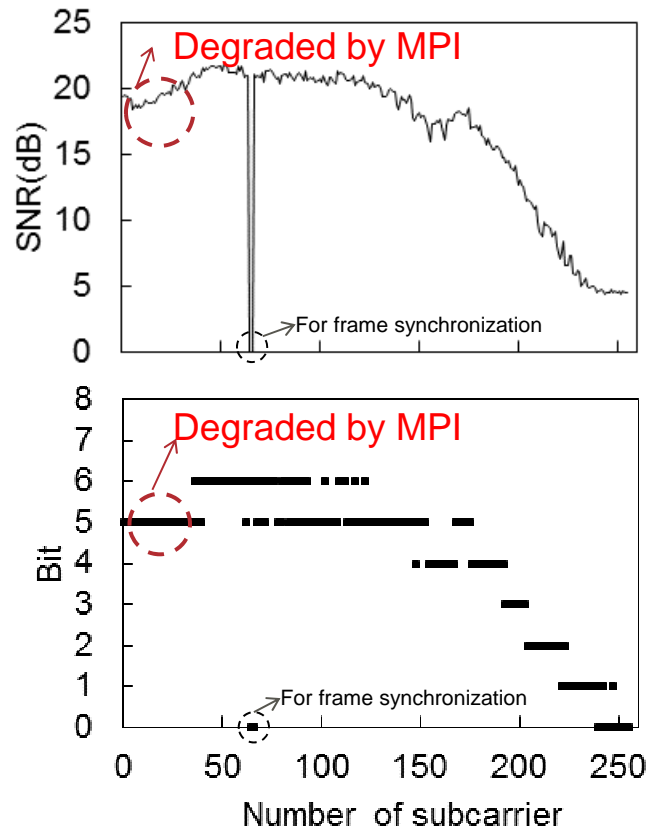
## Reference model for MPI specification



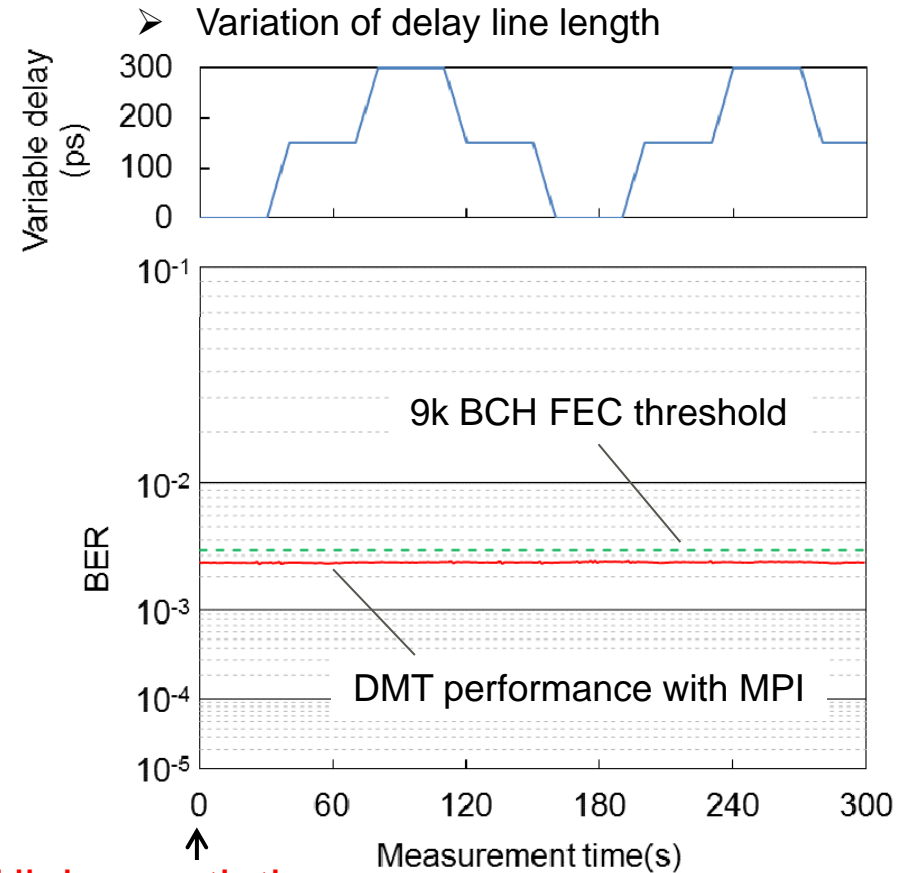
Reflectance			Corresponded crosstalk	Note
TOSA	In-line Connectors	ROSA		
-26dB	4 connectors, -26dB	-26dB	-40dB	Ref.: 100GBASE-LR4 draft

# Influence to MPI Tolerance due to Delay Variation

## ■ Bit allocation at DMT link negotiation



## ■ DMT live transmission characteristics



## DMT link negotiation

- SMF 5m and variable delay line, which is changed from 0 to 300ps
- There is no variation due to length variation of delay line during 300 seconds.
  - Baud-rate for each subcarrier of DMT is relatively low (about 110MHz).
  - Frequency, where performance is degraded, is not changed.

- Experiment on MPI tolerance on live transmission using DMT test chip.
  - We evaluate performance variation due to length of delay line in the case of reflectance of TOSA, ROSA and in-line connector of -26dB.
  - There is no performance variation due to delay variation.
  
- MPI tolerance of 0.5dB is sufficient for 4x100G/lambda DMT including dynamic MPI variation.
  
- With real-time DMT(PRBS31), we have demonstrated no degradation of performance under dynamically changing MPI.



Thank you