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Transmitter Spec. with Tx_DP

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TeraHop

Background Information

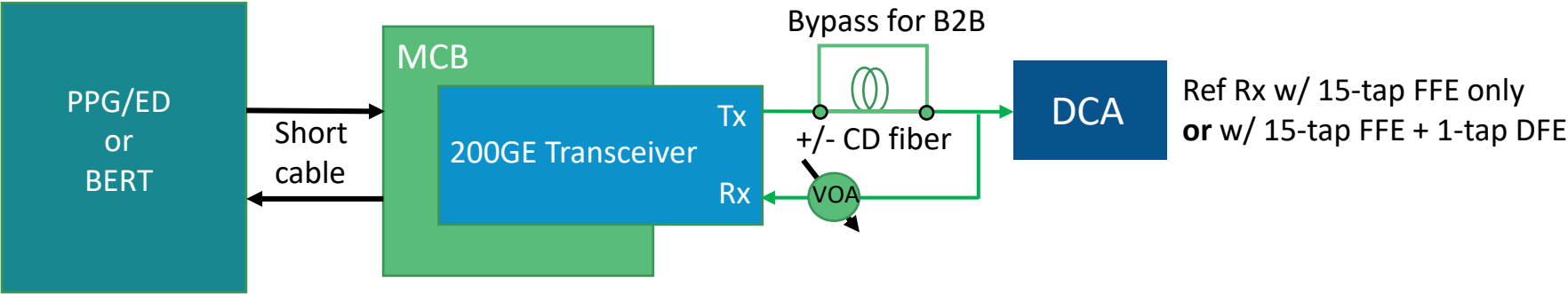
- Most 802.3dj PMDs are based on IMDD technology
- With baud rate increase, fiber chromatic dispersion (CD) tolerance decreases rapidly as inverse of baud rate 2 , dispersion penalty becoming important factor to consider
- Within current 802.3dj, CD penalty is expressed as $|TDECQ - TECQ|$ (see 802.3dj draft 2.2), and Transmitter power specification is intimately tied to $\max(TECQ, TDECQ)$ as additional power budget
- Recent progress in 802.3dj included introduction of Block error test and “Functional receiver” to strengthen robustness of product specification, test and interoperability.
- In this work, we provide test data on product samples comparing actual optical fiber dispersion penalties based on TDECQ-TECQ, bit-error-ratio based receiver sensitivity penalty, and block error ratio based receiver sensitivity penalty, and propose a Tx_DP definition, and transmitter specification based on Tx_DP definition



Testing of Fiber Chromatic Dispersion Penalty

- Define terminology:
 - **CDP_TDECQ-TECQ:** CD penalty characterized by delta of TDECQ and TECQ
 - **CDP_Rx_BER_Sens:** CD penalty characterized by delta of pre-FEC bit error ratio (BER) based Rx_Sens
 - **CDP_Rx_BLER_Sens:** CD penalty characterized by delta of post-FEC block error ratio (BLER) based Rx_Sens

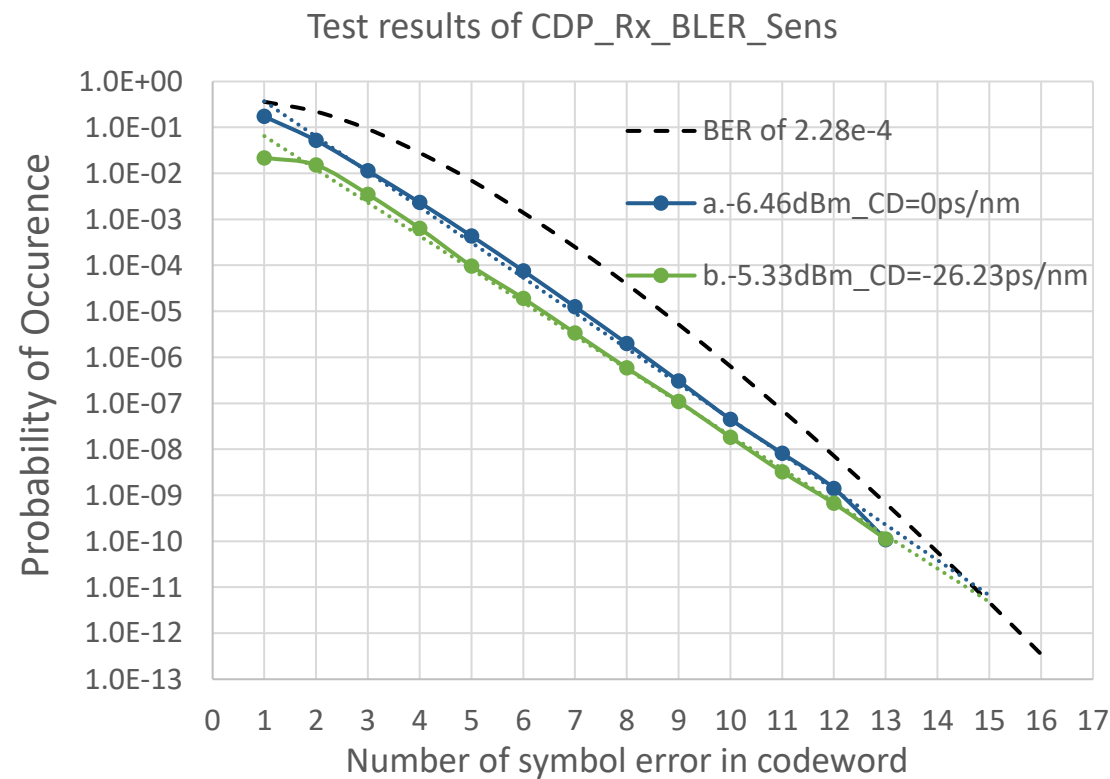
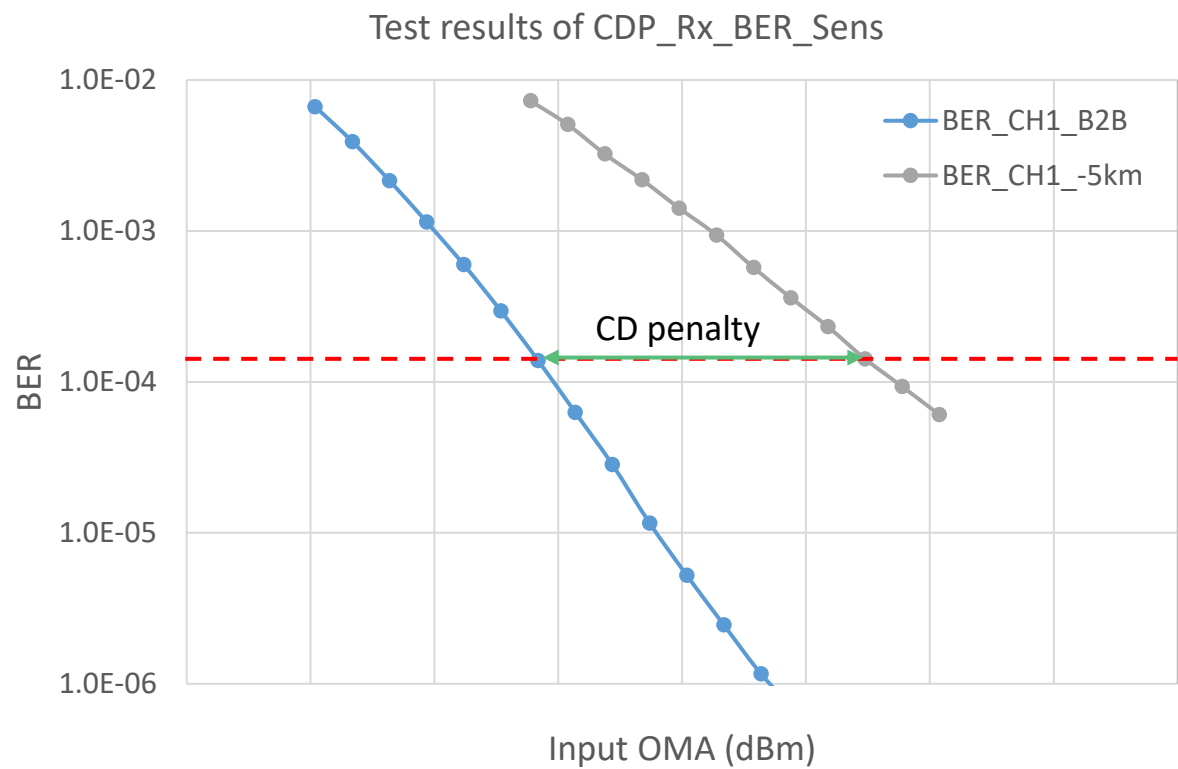
Test Setup Diagram



	Zero dispersion point (nm)	Dispersion slope (ps/nm ² *km)
Positive CD fiber	1300.3~1301.2	~0.090
Negative CD fiber	1324.8~1325.7	~0.091

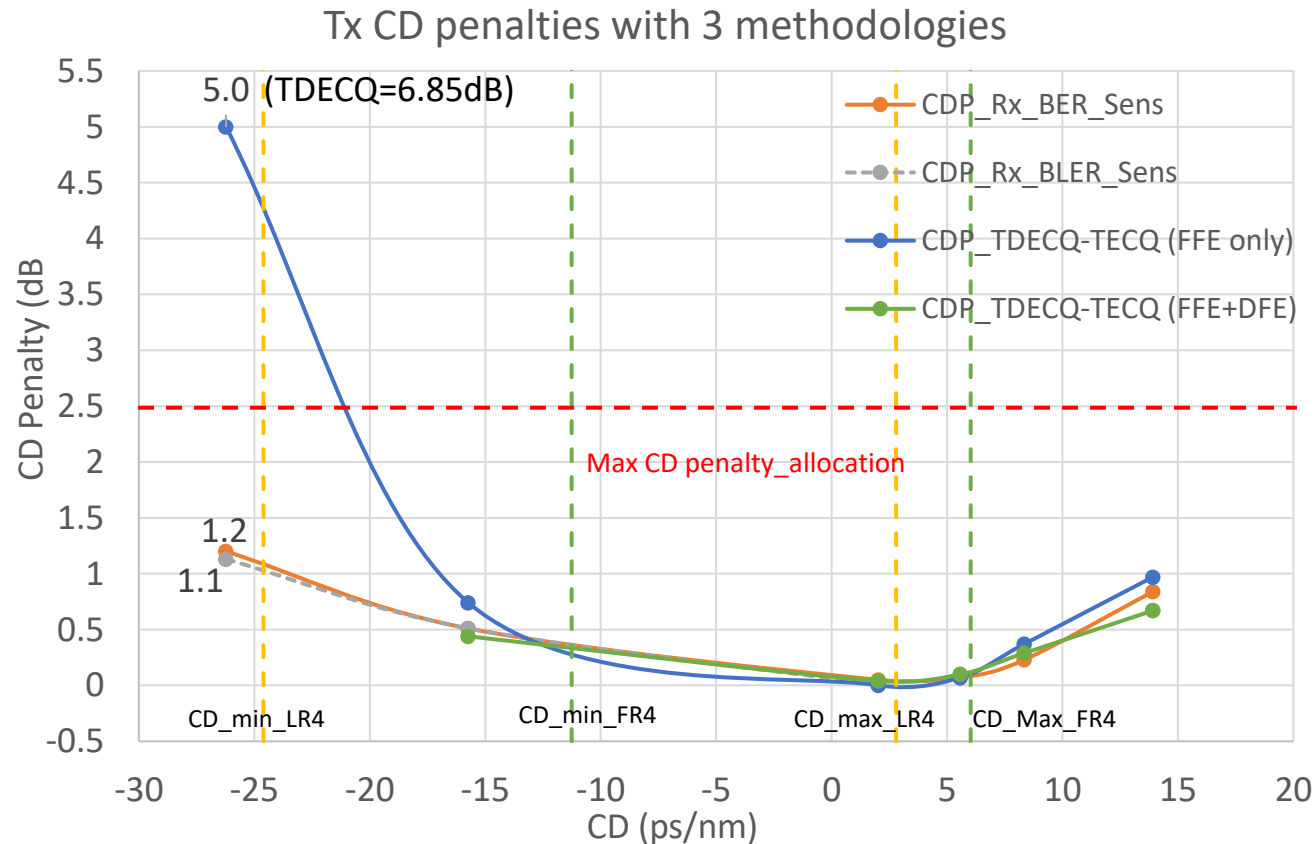


Example of CDP_Rx_BER_Sens and CDP_Rx_BLER_Sens



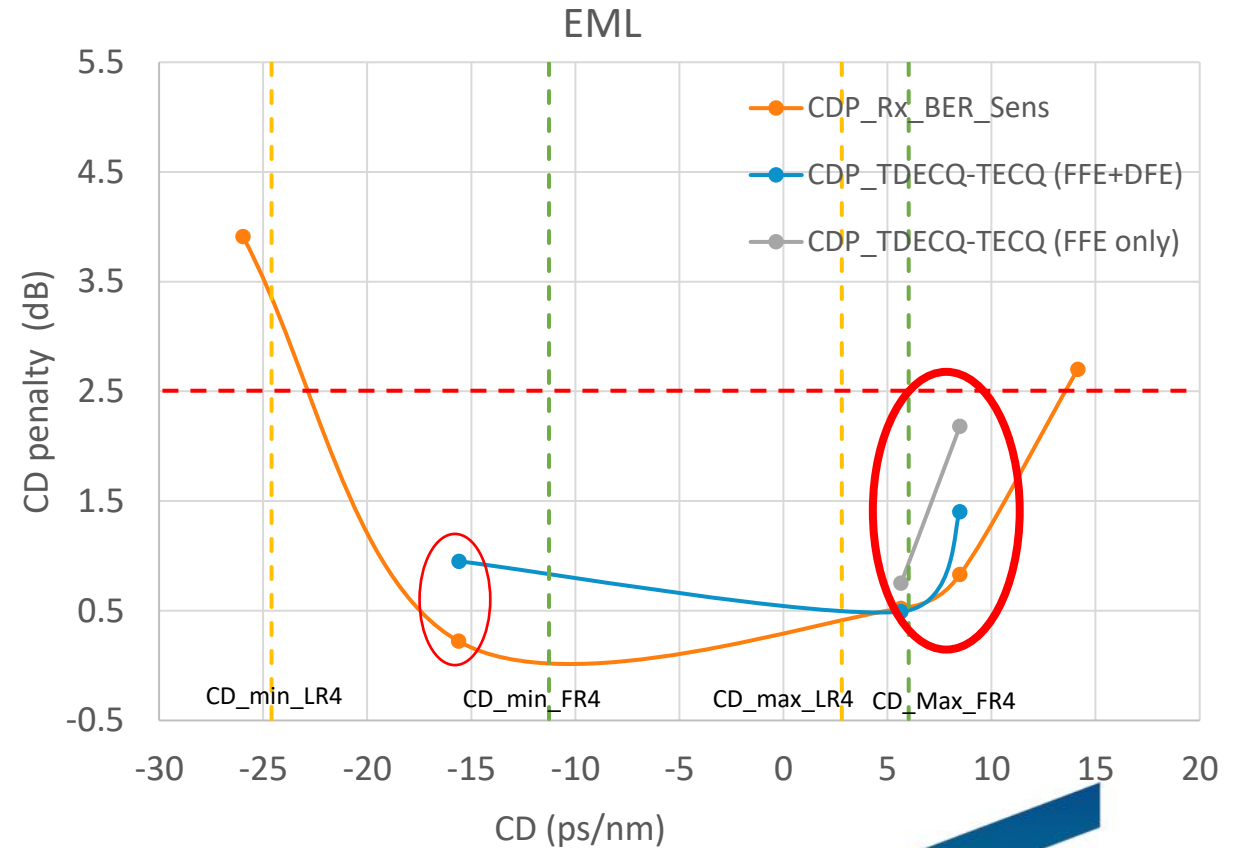
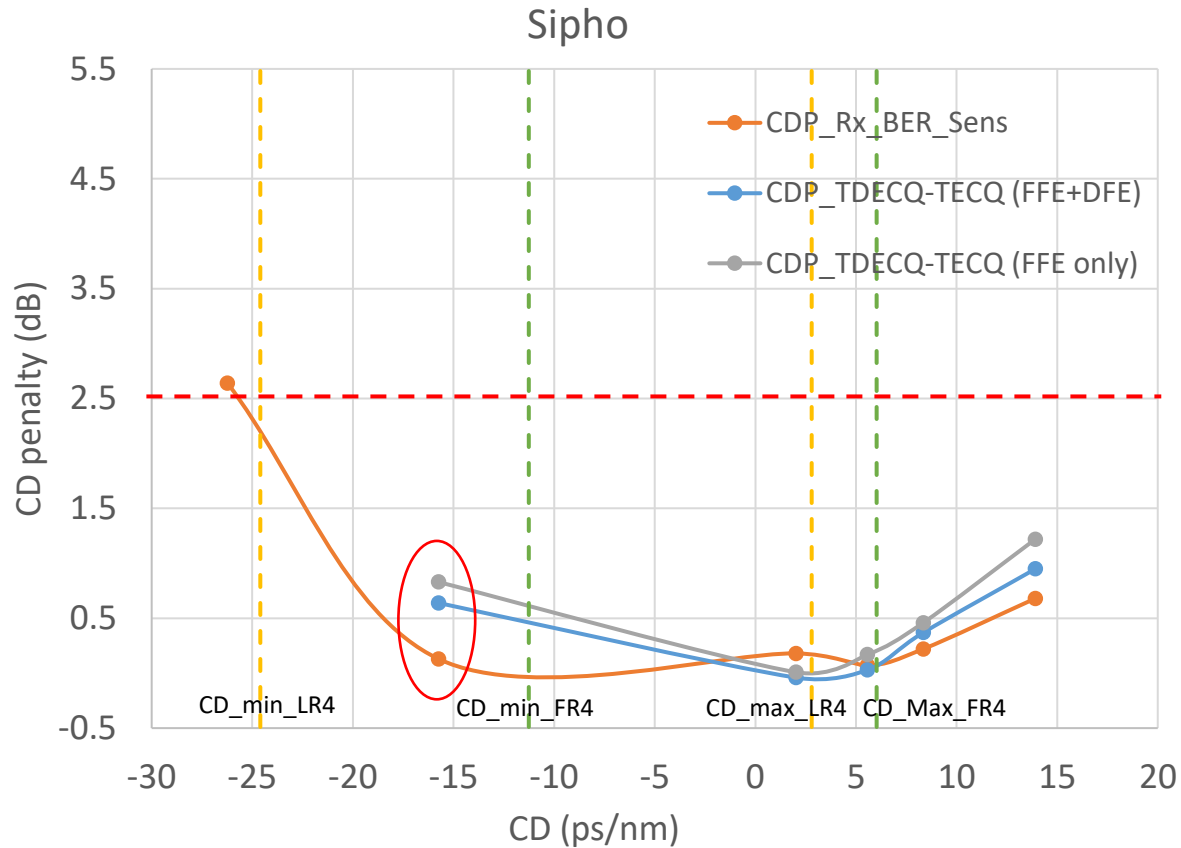
3 Types of CDP Comparisons

- DUT: A Siphon MZM based 200G/L FR4 TRx module with the DSP from vendor A
- Measurements points collected at different dispersion value by setting up proper fiber-wavelength combinations
- Much higher penalties with CDP_TDECQ-TECQ vs. CDP_Rx_BER_Sens and CDP_Rx_BLER_Sens



CDP for SiPho MZM and InP EML Based Transceiver Samples

- DUTs: SiPho MZM and InP EML based 200G/L FR4 modules
- Both DUTs are with DSPs from vendor B
- SiPho showed more stable operations over the full range of dispersion at lower CDP
- EML sample: CDP_TDECQ-TECQ much higher vs. CDP_Rx_BER_Sens near CD_Max_FR4



Test Results Discussions

- Test results for Tx CD penalties with 3 methodologies presented
 - CDP_TDECQ-TECQ
 - CDP_Rx_BER_Sens
 - CDP_Rx_BLER_sens
- CDP_TDECQ-TECQ much higher vs. CDP_Rx_BER_Sens, CDP_Rx_BLER_sens
- Artificially high CDP_TDECQ-TECQ unnecessarily drive higher Tx Power requirements, therefore drive higher cost
- Propose to define Tx_OMA_min requirements based on Rx_BLER_Sens_CDP
- Propose to define a new term
$$\text{Tx_DP} = \max(\text{Rx_BLER_sens_CDP}, 0)$$



Proposed Comments to 802.3dj Draft 2.2

- In Table 183–6 800GBASE-FR4/LR4:
 - Replace $\max(\text{TECQ}, \text{TDECQ})$ with $\max(\text{TECQ}, \text{TECQ} + \text{Tx_DP})$
 - Replace $|\text{TDECQ} - \text{TECQ}|$ with Tx_DP
- In clause 183.9.9 (TFSEH)
 - Add a new definition $0 \leq \text{Tx_DP_allocation} \leq 2.5\text{dB}$
 - Replace $\max(\text{DUT_TECQ}, \text{DUT_TDECQ})$ with $\text{DUT_TECQ} + \text{Tx_DP_allocation}$
- The functional receiver (FRx) is a VOA followed by an optical receiver (ORx) that complies with optical PMD characteristics.
 - **VOA_level** = $\text{Tx_DUT_power_budget} - \text{Test_SMF_power_budget} - \text{ORx_TECQ_allocation} - \text{Test_margin}$
= $(\text{Channel_insertion_loss} - \text{Test_SMF_loss}) + (\text{MPI} + \text{DGD_penalty_allocation} - \text{Test_SMF_MPI} + \text{DGD_penalty})$
+ $(\text{Tx_DP_allocation} - \text{Test_SMF_DUT_CD}) + \text{DUT_TECQ} - \text{ORx_TECQ_allocation} - \text{Test_margin}$



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THANK YOU