TERAHOP

Transmitter Spec. with Tx_DP (Comments #432, 433, 434, 435)

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TeraHop

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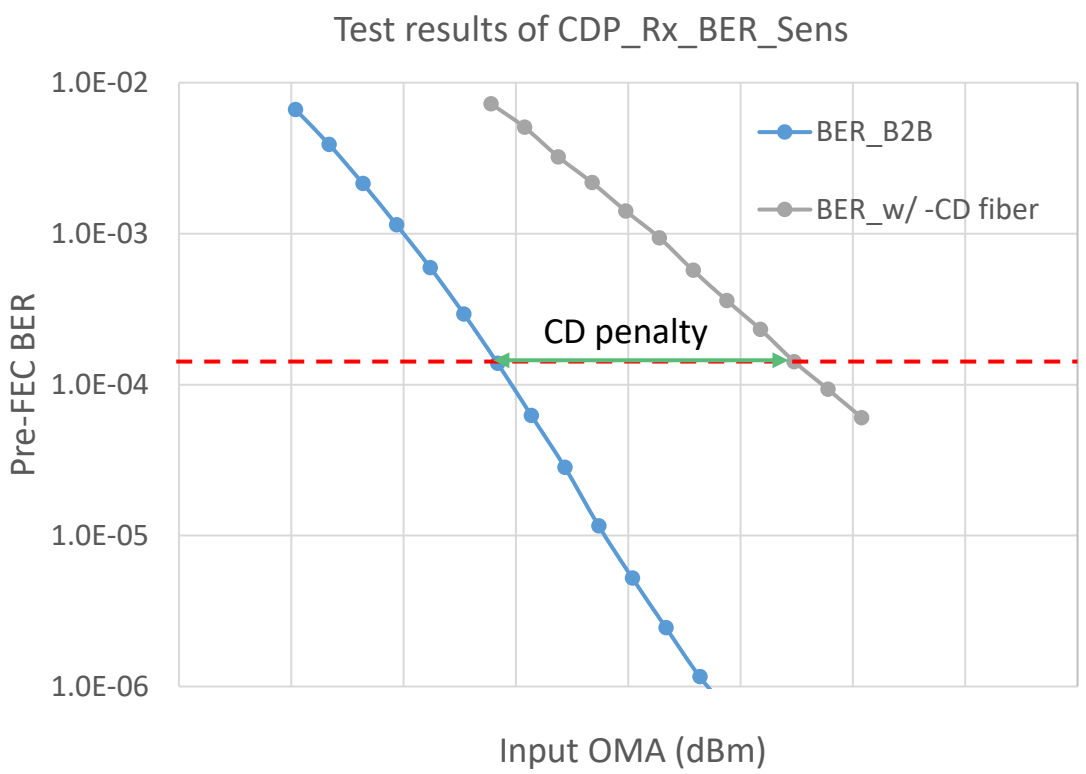
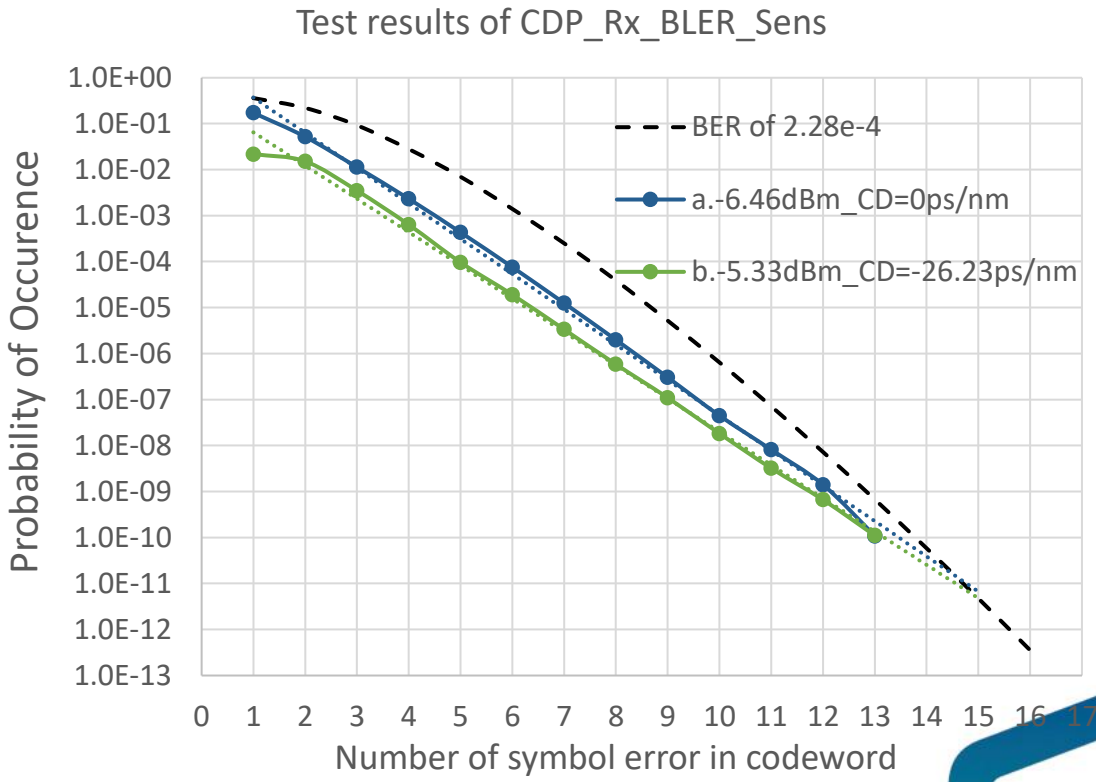
Background Information

- 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 I TDECQ – TECQ I (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
- Finally, we propose a Tx_DP definition, and Tx OMA power specification based on Tx_DP definition

Terminology and Testing Methodology of CD Penalty

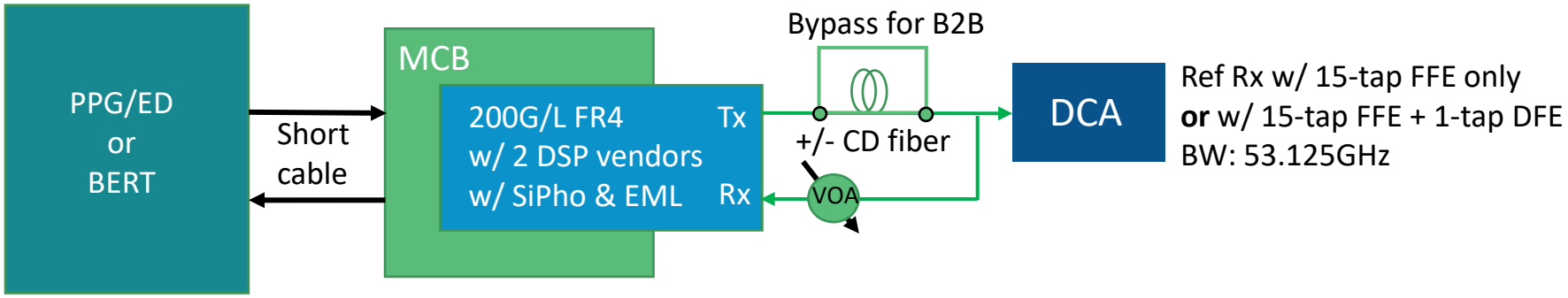
- Define terminology:
  - **CDP_TDECQ-TECQ:** CD penalty characterized by delta of TDECQ and TECQ, aka TDECQ – TECQ
  - **CDP_Rx_BER_Sens:** CD penalty characterized by delta of pre-FEC bit error ratio (BER) based Rx_Sens w/ and w/o CD fiber
  - **CDP_Rx_BLER_Sens:** CD penalty characterized by delta of post-FEC block error ratio (BLER) based Rx_Sens, which be derived by Rx input OMA power for two threshold error histogram curves w/ and w/o CD fiber





Test Setup and CD Configuration

Test Setup Diagram

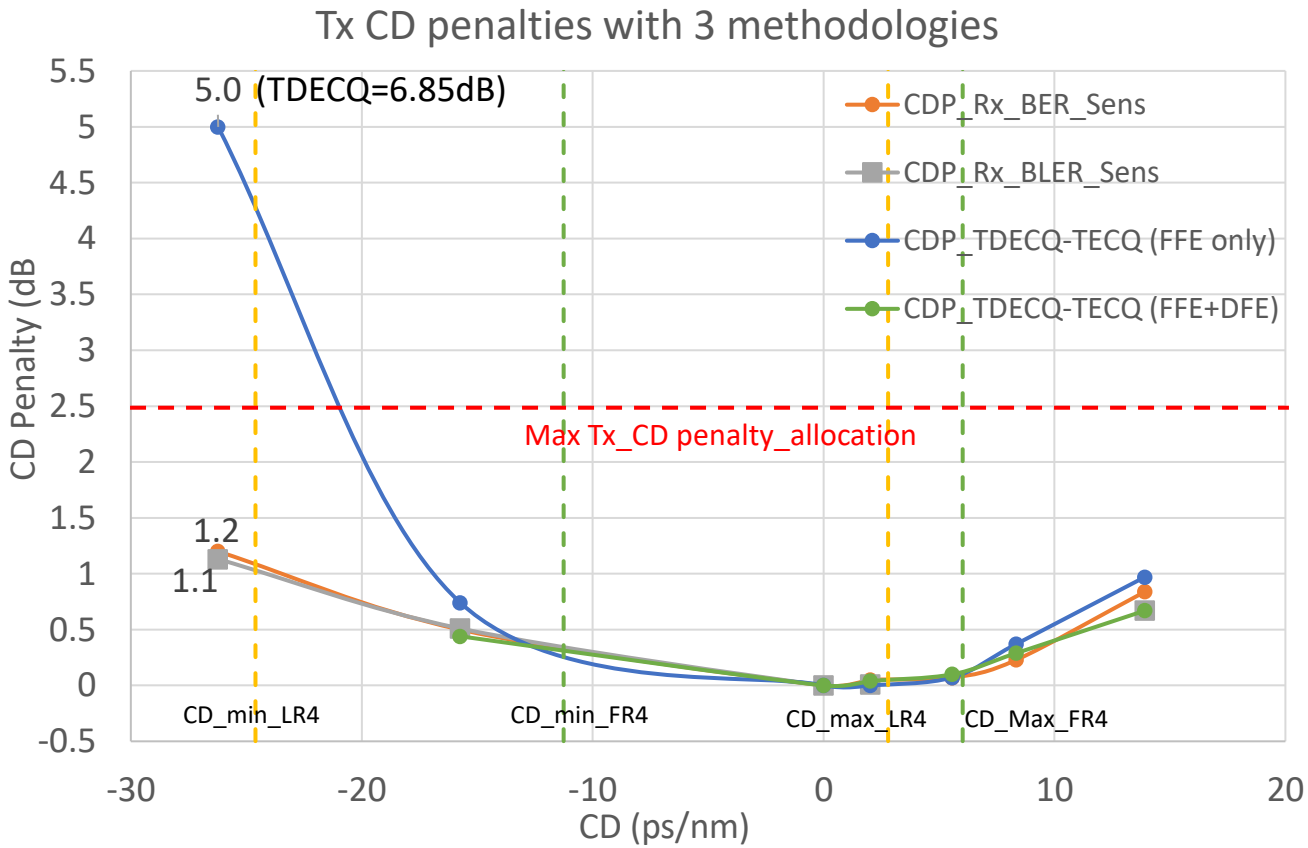


	Zero dispersion point (nm)	Dispersion slope (ps/nm^2*km)
Positive CD fiber	1300.3~1301.2	~0.090
Negative CD fiber	1324.8~1325.7	~0.091

Fiber-WL combinations	-5km@1271nm	-3km@1271nm	+2km@1311nm	+2km@1331nm	+3km@1331nm	+5km@1331nm
CD (ps/nm)	-26.23	-15.74	2.02	5.57	8.35	13.92

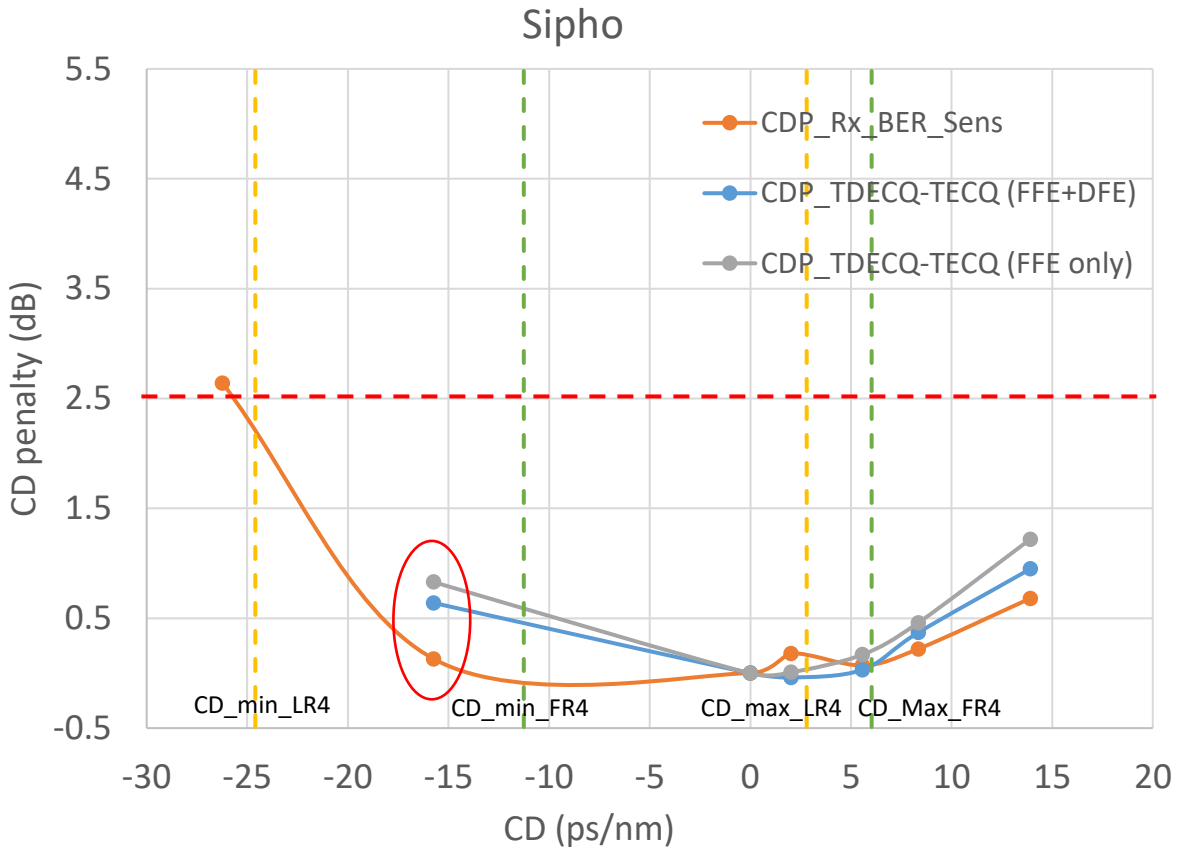
3 Types of CDP Comparisons

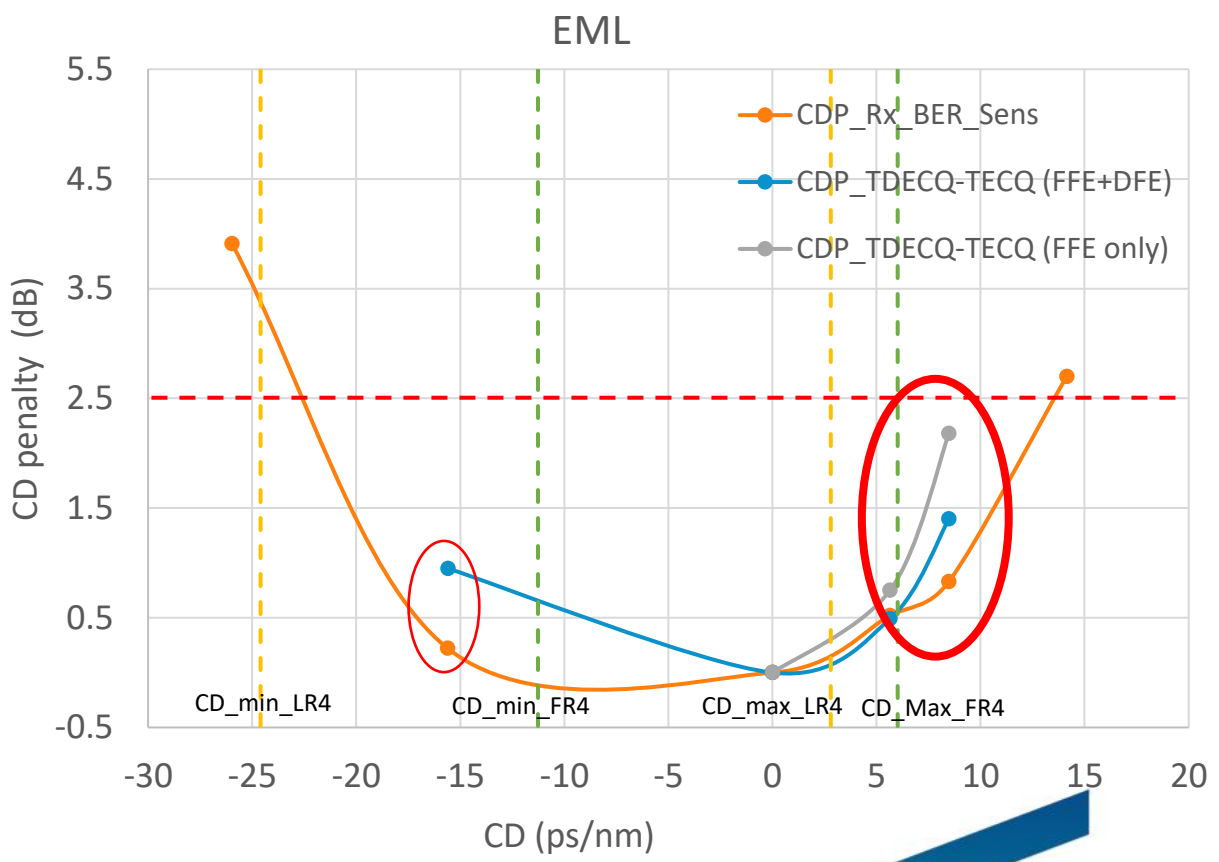
- DUT: A Sipho MZM based 200G/L FR4 TRx module with the DSP from vendor A
- Measurement points collected at different dispersion values by setting up proper fiber-wavelength combinations
- Much higher penalties with CDP_TDECQ-TECQ vs. CDP_Rx_BER_Sens and CDP_Rx_BLER_Sens



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 to keep Rx with similar performance
- SiPho Tx 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 (or even not be measurable) at both positive and negative CD boundaries
- Artificially high CDP_TDECQ-TECQ unnecessarily drive higher Tx Power requirements, therefore drive higher cost

- Propose to specify Tx_OMA_min requirements based on CDP_Rx_BLER_Sens
- Propose to define a new term
  - Tx_DP = max (CDP_Rx_BLER_sens, 0)

Comments and Suggested Remedy for 802.3dj D2.2

- In Table 183–6 800GBASE-FR4/LR4:
  - Replace max(TECQ, TDECQ) with TECQ + Tx_DP
  - Replace | TDECQ – TECQ | with Tx_DP
  - Replace TDECQ with TECQ + Tx_DP

- In clause 183.9.9 (TFSEH)
  - Add a new definition 0 <= Tx_DP_allocation <= 2.5dB
  - Replace max(DUT_ TECQ, DUT_TDECQ) with DUT_TECQ + Tx_DP_allocation
- The functional receiver (FRx) is a VOA followed by an optical receiver (ORx) that complies with optical PMD characteristics.
  - **VOA_level =** Tx_DUT_power_budget - Test_SMF _power_budget - ORx_TECQ_allocation - Test_margin

  = (Channel_insertion_loss - Test_SMF_loss) + (MPI+DGD_penalty_allocation - Test_SMF_MPI+DGD_penalty) + (Tx_DP_allocation - Test_SMF_DUT_CD) + DUT_TECQ - ORx_TECQ_allocation - Test_margin

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THANK YOU