

Updated PMD tolerance with synchronous Baud-Rate Sampling and Equalization (BRSE) for 800G-LR1

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Supporters

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Introduction

- 10 km wavelength selection is still open in 800G-LR1:
 - In July 2023 Plenary, straw poll #14, regarding adoption of O band for single wavelength 10km 800 Gb/s was conducted [1]:

I would support adoption of the O band optical parameters as defined in maniloff_3dj_01_2307.pdf slides 7-9 as the baseline optical specification for the single wavelength 10 km 800Gb/s optical PMD

Results (all): Y: 44, N: 12 , NMI: 30 , A: 30
 - In [2], Maniloff et al. suggested that “More data is needed to make determination for 10km wavelength”.
- O-band allows potential power savings of the entire solution:
 - “Reduced Chromatic Dispersion at 10km allows the potential for time domain DSP” [2]
 - “O-band for 10km provides potential pathways for reduction of module power” [2]
 - “C-band will consume ~10% to 15% more (total DSP) power than O-band for 120Gbaud 16QAM” [3]

[1] https://www.ieee802.org/3/dj/public/23_07/motions_3cwdfdj_2307.pdf

[2] https://www.ieee802.org/3/dj/public/23_09/maniloff_3dj_01a_2309.pdf

[3] oif2022.346.00, “800G LR1 wavelength consideration: O-band or C-band”

Motivation for this contribution

- O-band allows additional power savings using baud-rate processing architecture:
 - “O-band has the potential to use baud-rate sampling to further reduce DSP power” [3]
 - [4] made the case for a dedicated low-power and low-cost coherent solution based on O-band, concatenated RS544/BCH(126,110) FEC, and a synchronous baud rate sampling architecture.
 - Total power of the baud rate sampling ADC can be reduced by approximately 50% as compared to oversampling ratio of $M/N = 1.2$
 - In [5], Gui et al. presented a feasibility study on baud rate sampling and equalization for 800G-LR1 “Due to its multiple benefits, BRSE is a promising coherent-lite approach for **further evaluation**”.
- This contribution provides new information on synchronous baud rate sampling tolerance to channel artifacts, specifically skew and PMD.

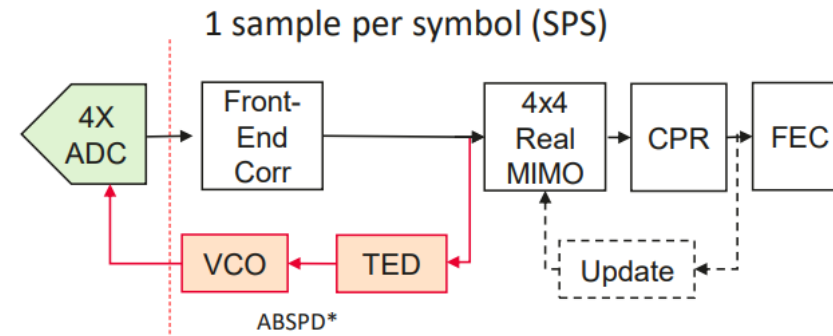
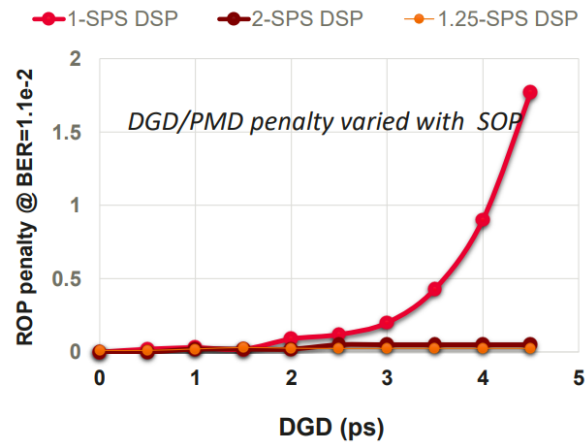
[3] oif2022.346.00, “800G LR1 wavelength consideration: O-band or C-band”

[4] https://www.ieee802.org/3/dj/public/23_05/carusone_3dj_01a_2305.pdf

[5] https://www.ieee802.org/3/dj/public/23_05/gui_3dj_01a_2305.pdf

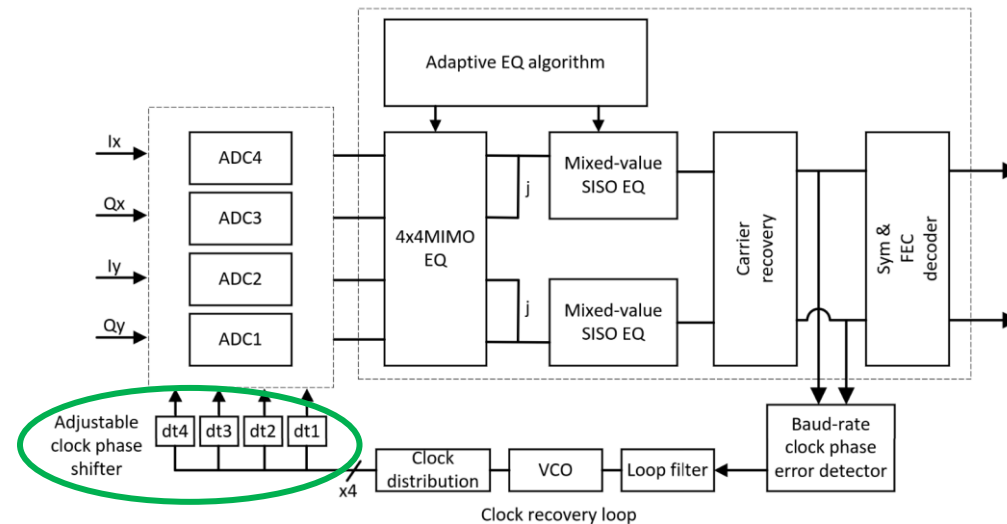
PMD tolerance **without** individual ADC clock optimization

- In [5], Gui et al. presented an Rx architecture based upon real valued 4x4 MIMO equalization
- This architecture doesn't include ADC clock optimization for each one of the 4 ADCs
- This architecture is limited < 3 ps for DGD [5].



A modified baud rate DSP architecture **with** individual ADC clock optimization

- A modified baud rate DSP architecture is presented below
 - The main difference to the architecture in [5] is the addition of individual clock phase correction for each one of the 4 ADCs, as suggested in [6]
- This architecture is **insensitive to Rx X-Y skew**

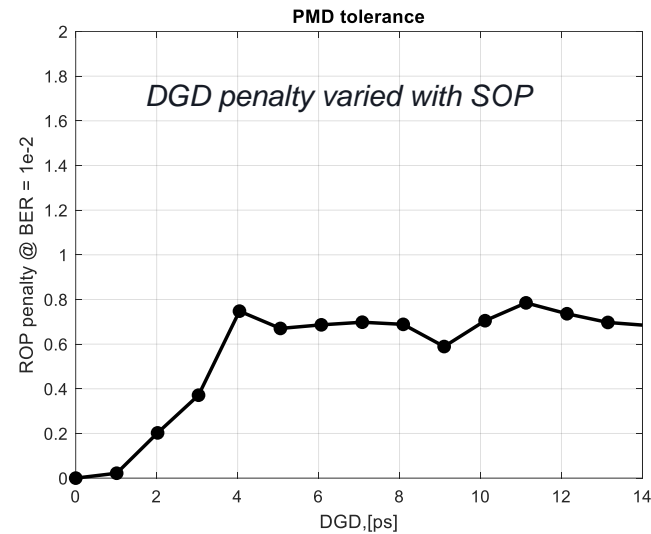


[5] https://www.ieee802.org/3/dj/public/23_05/gui_3dj_01a_2305.pdf

[6] X. Zhou, R. Urata and H. Liu, "Beyond 1 Tb/s intra-data center interconnect technology: IM-DD or coherent?", J. Lightw. Technol., vol. 38, no. 2, pp. 475-484, Jan. 2020.

PMD tolerance of a modified baud rate DSP architecture with individual ADC clock optimization

- A PMD tolerance sensitivity analysis with the modified baud rate DSP architecture with individual ADC clock optimization was conducted
 - Max. 0.8dB degradation for total PMD up to 14ps



Summary

- We have updated the feasibility study on the use of synchronous baud rate sampling and equalization for 800G-LR1
- The new results include individual clock phase optimization for each of the 4 ADCs meeting 800G-LR1 requirements
 - Tolerance to PMD < 14ps
- Recommendation:
 - Adopt O-band for 10km, allowing reduced power 800G-LR1 implementations