The Need for Pre-Coder for Optical PMDs

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Overview

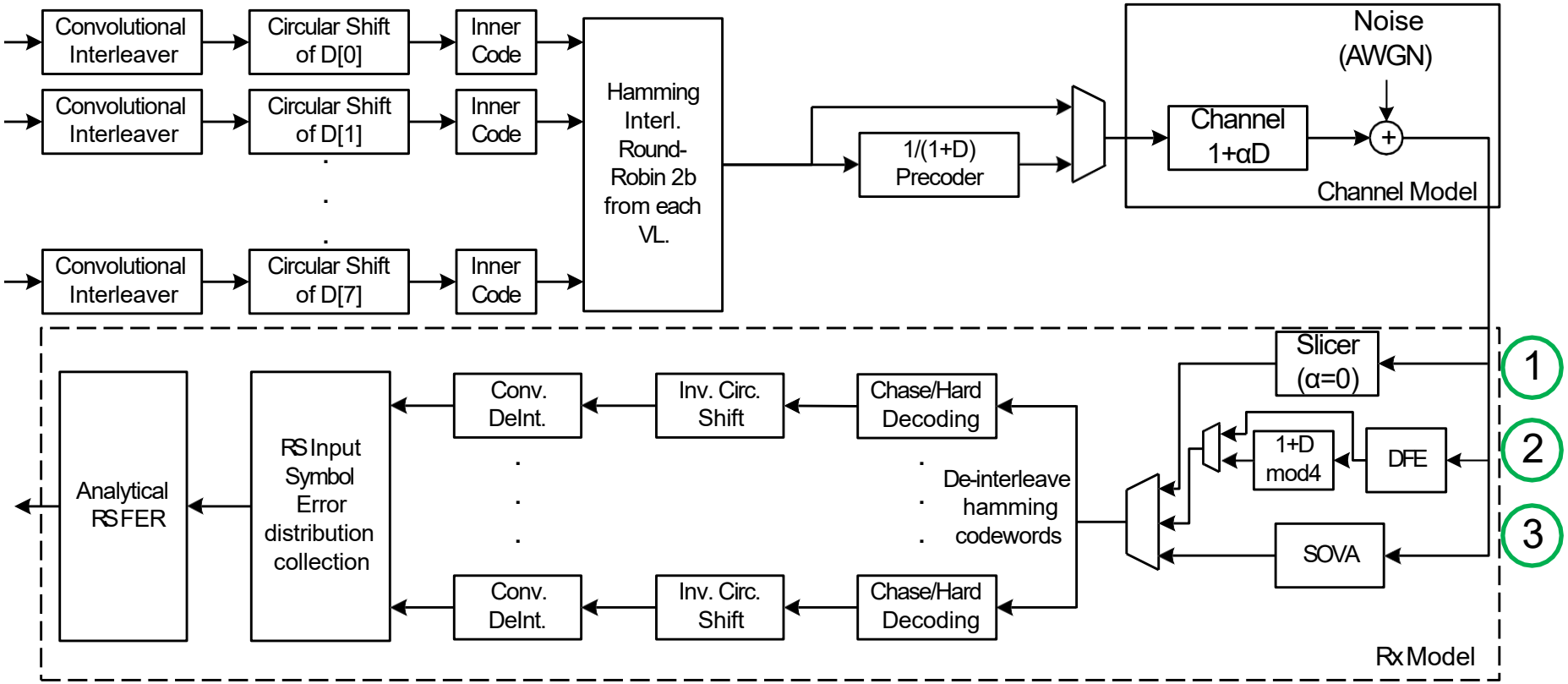
- **Pre-coder implementation for FECi**
- **Benefit of pre-coder with FECi PMDs**
- **Recommendations**
- **Addressing D1.0 comments.**

Contributors

- **Zvi Rechtman – Nvidia**
- **Xiang He – Huawei**

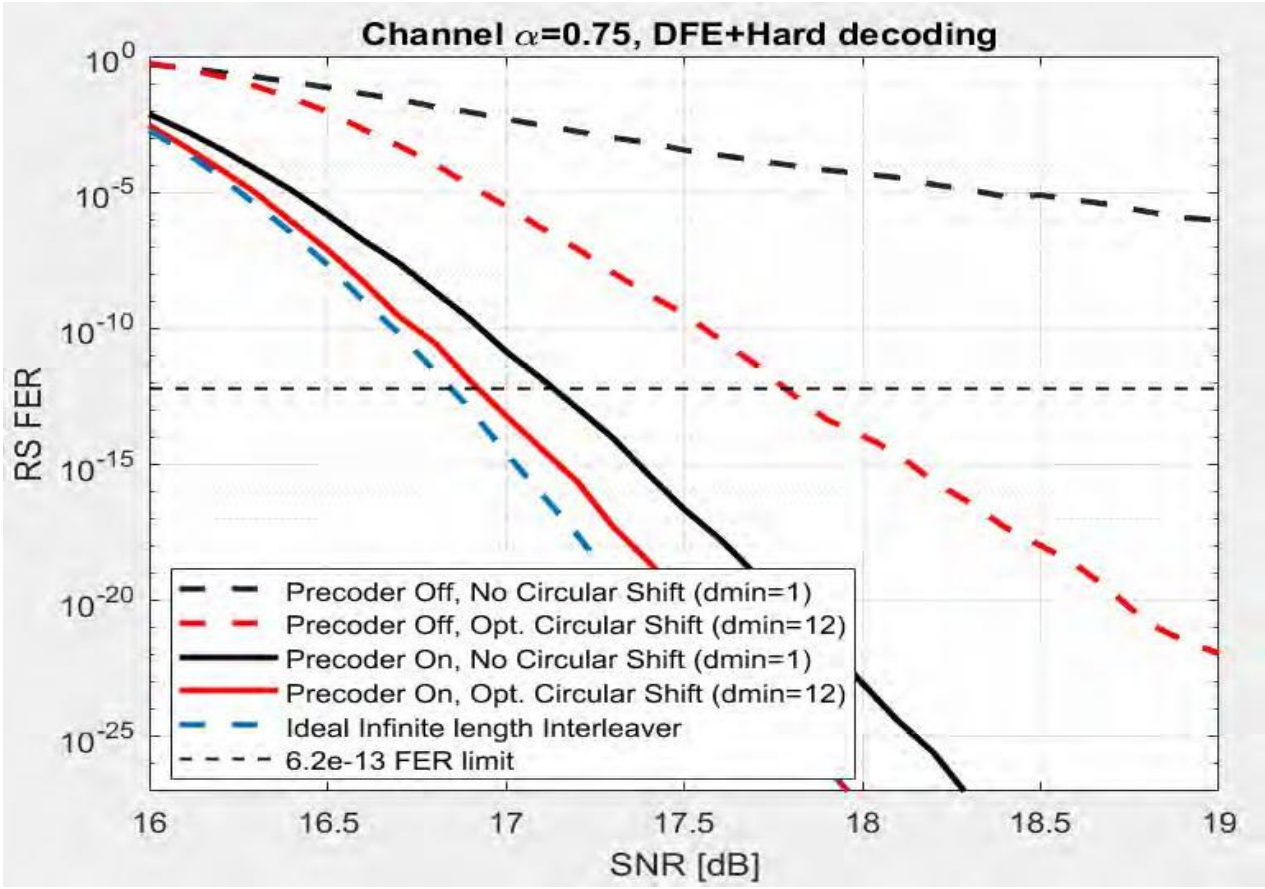
Pre-Coder with Concatenated FEC PMDs

- **Pre-coder implementation for concatenated FEC is similar to FECo implementation**
  - riani_3dj_01a_2303 showed pre-coder implementation and impact of burst error on FECi PMDs for ideal slicer with a=0, pre-coder with DFE, SOVA receiver.



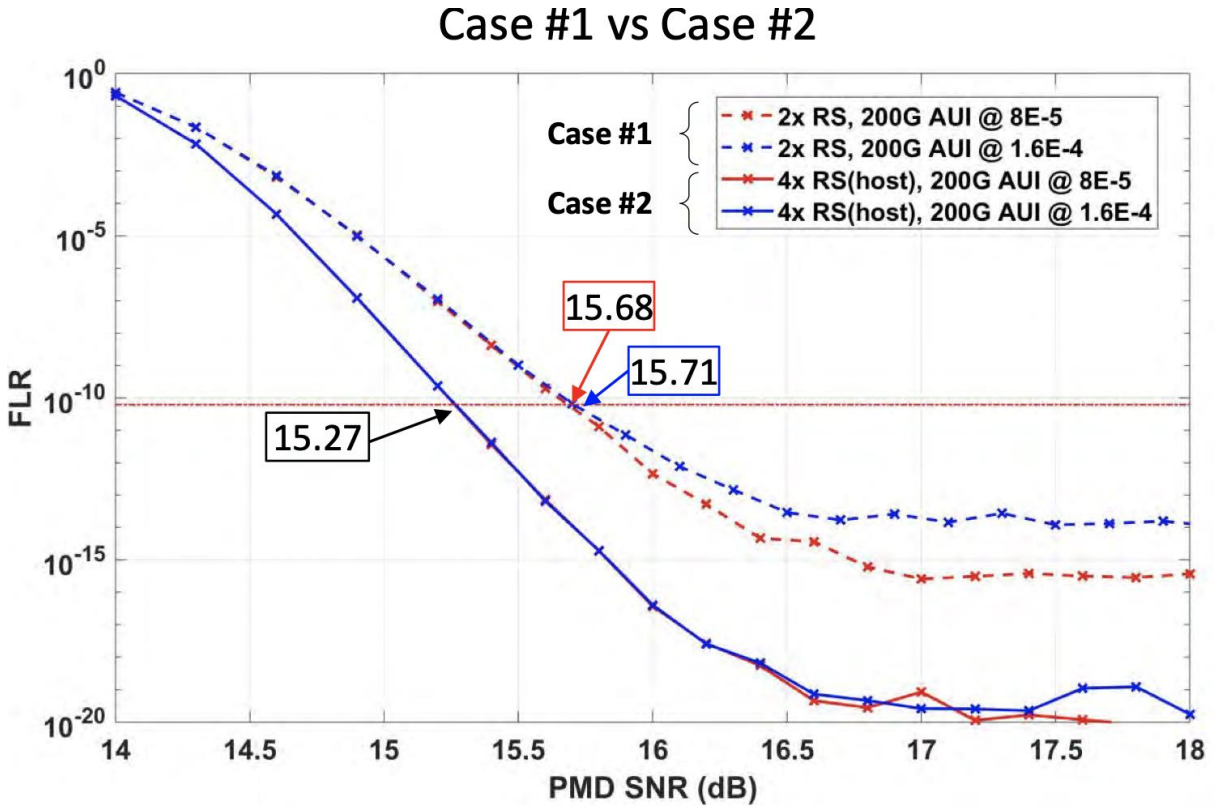
FECi PMDs Benefit from Pre-Coder

- **riani_3dj_01a_2303 results shows even for the case of optimum CI dmin=12 there is ~0.8 dB of SNR penalty**
  - On FECi PMDs either the pre-coder is enabled across the board or needs to be controlled with OLT
- **Two major reason driving α> 0.5 are:**
  - TIA/VGA/ADC cascaded BW may only be in the mid 30 GHz
  - Reducing receive noise BW with strong DFE may improve sensitive if burst errors are mitigated with pre-coder.



FECo PMDs Benefit from Pre-Coder

- **he_3dj_02a_2307 two-part link simulation for 4 RS code words the PMD showed no SNR benefit from pre-coder**
  - Considering some early deployment that actually see benefit from pre-coder, I reached out to He regarding result in the he_3dj_02a_2307
  - He has confirmed that error extension on optical PMD were not included in analysis and result in he_3dj_02a_2307 and shown here
  - He has confirmed ~0.7 dB burst penalty when error extension on optical PMD is included which is similar to Riani results for FECi riani_3dj_01a_2303.



g.

Precoding	AUI BER (per PHY)	Total AUI BER	PMD BER Threshold	
			Case #1	Case #2
ON	4E-5	8E-5	2.45E-3	3.55E-3
OFF	8E-5	1.6E-4	2.38E-3	3.55E-3

Add Pre-Coder Option for FECi and FECo Optical PMDs

- **See comments submitted by Ghiasi on D1.0**
  - Insert text for pre-coder support for FECi in 177.4.7.2
  - Pre-coder provide significant benefit for FECi PMDs, therefore pre-coder should be on all time or controlled with OLT for FECi PMDs
    - Clause 182 – FR1 and DR2-2 FECi PMDs
    - Clause 183 – FR4 and LR4 FECi PMDs.
  - Pre-coder provide significant benefit for FECo PMDs, therefore pre-coder should be on all time or controlled with OLT for FECo PMDs
    - Clause 180 – DRx FECo PMDs
    - Clause 181 – FR4-500 FECo PMD
- **If we decide to to enable pre-coder on all the time, then pre-FEC BER would need to be adjusted up.**

Summary

- **Pre-coder can provide significant benefit for FECi and FECo PMDs and is necessary for both FECi and FECo PMDs considering large burst penalty**
  - Unless pre-coder is controlled with link training OLT then pre-coder should be enabled for all FECi and FECo PMDs
  - The drawback of enabling pre-coder all the time is that require slightly adjusting up the pre-FEC BER and as shown by riani_3dj_01a_2303 SVOA receiver show no benefit from pre-coder
- **The best option to mitigate larger burst error ~0.7-0.8 dB is to use pre-coder**
  - The best way to avoid penalizing some receiver implantations and/or adjusting pre-FEC BER is to control the pre-coder through OLT.

D1.0 Comments Addressed by the Contribution

- **Comment 145 – CL 181.4 insert new pre-coder section**
- **Comment 146 – CL 180.4 insert new pre-coder section**
- **Comment 147 – CL 182.4 insert new pre-coder section**
- **Comment 148 – CL 183.4 insert new pre-coder section**
- **Comment 582 – CL 177.4.7.2 insert pre-coder text**
  - Pre-coder implementation with concatenated FEC should be defined in the CL 177.4.7.2
  - FECi PMD clauses 182 and 183 should point to CL 177.4.7.2 pre-coder.