Approach for Black Link specifications to bound interchannel crosstalk

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Background

- A number of submissions have been presented laying out an approach to managing inter-channel crosstalk in a black link methodology
- The purpose of this is to summarize those presentations and provide illustrative examples

Note: The terms black link and DWDM link are used interchangeably in the following. The author recognizes that the terminology used in this proposal is likely to be updated based on 802.3ct ongoing discussions

Inter-channel Crosstalk

- Inter-channel Crosstalk is a significant contribution to the 75GHz spaced 400GBASE-ZR optical penalty
- This penalty was not a significant concern for 100GBASE-ZR
- Conventional inter-channel crosstalk definitions (802.3ct) are defined at the ratio of the total signal power to the integrated noise power
 - Signal & Noise can be measured on a power meter at the demux output
- Rx spectral-filtering in a coherent receiver removes the noise power outside of the filter bandwidth
 - The Rx filter bandwidth is not intended to be defined by 802.3cw



• In this illustration crosstalk within the filter BW will result in a penalty



• In this illustration crosstalk has no impact on performance, as it is outside of the Rx filter bandwidth



- Red and green curves illustrate two crosstalk examples, with the same integrated crosstalk
- A normal crosstalk definition that used (integrated noise power / integrated signal power) across this spectral bandwidth would be the same for the red & green curves
- Red Xtalk is rejected by filter \rightarrow No Penalty
- Green Xtalk is within filter BW \rightarrow Penalty

- Only some of the frequency content of the crosstalk shown below will result in a penalty
- With knowledge of the crosstalk spectral content, receiver designers can ensure that the crosstalk penalty is ≤ that allocated



Inter-channel Crosstalk paths



Figure 156-3-Example configuration of the black link approach



By specifying crosstalk path attenuation profiles, 802.3cw can provide the required information for the DWDM Link (Black Link) without specifying individual components

In this example, paths from $TP2_{n-1}$ and $TP2_{n+1}$ to $TP3_n$ are the crosstalk paths

Specifying the Tx spectral mask and the DWDM link spectral attenuation between ports allows calculation of the crosstalk power spectrum

Summary

- Our job is to define the specifications well enough that a receiver designer can ensure the performance targets are met for the worst-case interchannel crosstalk
- The proposal is to bound the crosstalk as follows:
 - Defining a Transmit spectral mask
 - Defining Link transfer functions
- Presentations have been made for both the Tx Spectral Mask and Link transfer function characteristics
 - <u>https://www.ieee802.org/3/ct/public/20_11/way_cw_01b_201116.pdf</u>
 - https://www.ieee802.org/3/cw/public/adhoc/21_0201/maniloff_3cw_01a_210201.pdf
- This provides a framework for 802.3cw to define the necessary information in 802.3cw

Thanks!