

Comment #72

Supporting Material

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Introduction

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It is stated that the DWDM channel is specified using black link methodology, which specifies the parameters in Table 154-10. This table, however targets a DWDM channel with amplification. While this meets the objective of the project, it does not adequately address the reach requirements of the Cable/MSO distribution networks noted in the project's CSD response for Broad Market potential. Data submitted in https://www.ieee802.org/3/B10K/public/18_05/schmitt_b10k_01a_0518.pdf highlights the reach needs (citing data for <30km, <40km, <60km, <80km, and <120km), as well as noting that in the survey that a significant amount of optical channels were not amplified.

Background – IEEE P802.3ct

- PAR Scope

- Define physical layer specifications and management parameters for the transfer of Ethernet format frames at 100 Gb/s at reaches greater than 10 km over DWDM systems.

- Task Force Objective

- Provide a physical layer specification supporting 100 Gb/s operation on a single wavelength capable of at least 80 km over a DWDM system.

- CSD Broad Market Potential Statement

- Ethernet is being adopted in new application areas that require longer transmission distances than currently specified by the IEEE 802.3 Ethernet standard for 100 GbE. Optical solutions targeting 80 km over DWDM systems will address the bandwidth growth and reach requirements of Cable/MSO distribution networks and mobile backhaul networks where reaches in excess of 40 km are required or where fiber availability drives the need for multiple instances of Ethernet over a DWDM system.

Input – “Cable Operator Inputs for 100G+ Beyond 10k”

Reference: https://www.ieee802.org/3/B10K/public/18_05/schmitt_b10k_01a_0518.pdf

MSO Optical Distance Survey (from Beyond 10km PHYs MSO Reference Channels)

- Surveyed CableLabs member companies for information on current optical link distances from headend/hub to current fiber node
- 12 cable operators from Europe and North America responded
- Weighted average of survey results based on number of subscribers per operator

- <30km: 69%
- <40km: 88%
- <60km: 94%
- <80km: 98%
- <120km: 100%

5/21/18

Additional MSO Plant Survey Results

- Number of optical channels
 - 1 channel: 50%
 - 2 to 15 channels: 37%
 - 16+ channels: 13%
 - Future trend: shifting to more optical channels per fiber (roughly 1/3 each)
- Optical amplification
 - No amplification: 81%
 - Hub only: 12%
 - Other: 7%
- Bidirectional transmission method
 - Single fiber: 21%
 - Fiber pair: 79%
 - Future trend: expecting single fiber percentage to grow

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Reference - Straw Poll #5 – Jan 2019

- I support the development of 100GBASE-ZR / 400GBASE-ZR that defines operation over both amplified and (shorter reach) unamplified DWDM systems.
- Yes – 11+13 = 24
- No - 0
- Need more info - 0
- Abstain - 0

Draft 3.0 Observations

- 154.1 Overview –

- Line 7, P 101 – “This clause specifies the 100GBASE-ZR PMD together with the associated medium, which is a single-mode fiber based DWDM channel which may contain one or more optical amplifiers and is specified using black link methodology (see 154.6).”

- 154.6 The DWDM Channel

- Line 41 P 107 – “In this case the medium is a single-mode fiber based DWDM channel defined in the form of a black link, which may contain one or more optical amplifiers.”
- Unamplified black link not defined.

- Table 154-9 – 100GBASE-ZR receive characteristics

- Amplified / Unamplified Rx characteristics
- [Normative] Footnote b states – “This parameter is not necessary to support amplified DWDM links up to at least 80 km of single-mode fiber, but has been added to allow operation on unamplified links.”

Recommendations

- Develop 1 PMD that supports a black link
- The black link is an engineered link that needs to address amplified / unamplified parameters
 - Per 154.6, Line 46 154.6 – “The black link is intentionally “black”, implying that no details are provided on how the link is constructed, configured or operated so that the end-to-end parameter requirements are met. “
 - However -
 - An amplified link should be designed to support a Rx OSNR of 19.5 dB (0.1nm)
 - It is assumed that the 80 km objective can be met with an amplified link
 - An unamplified link should be designed to support a Rx OSNR of 35 dB (0.1nm)
 - Needed to support broad market potential but does not need to support 80km
 - Achievable Reach can be left to implementer of black link