Support for comment 54 draft 1.2: How should noise be managed in TDECQ with virtual emulation of the fiber span?

- Marlin Viss
- David Leyba
- Greg D. Le Cheminant

All affiliated and employed by Keysight Technologies

IEEE P802.3db Short Reach Fiber Task Force

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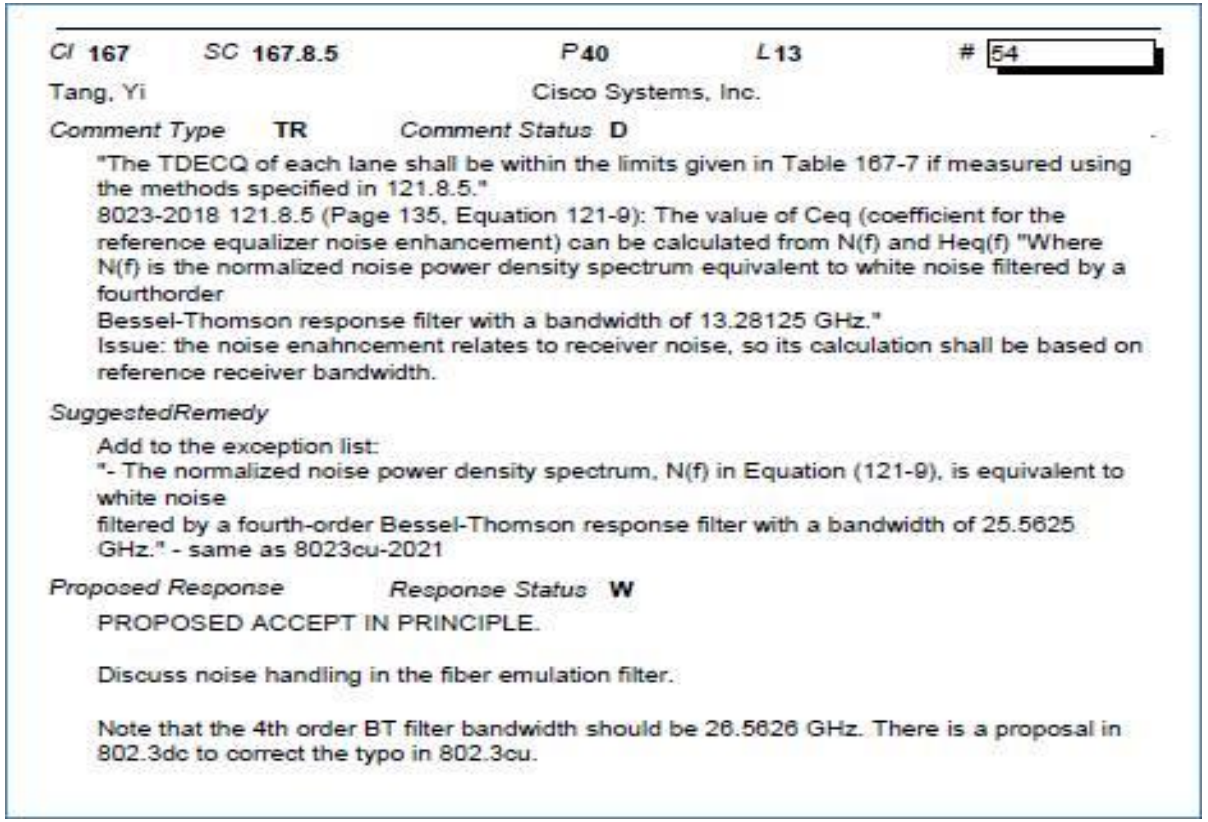
Comment 54 from Yi Tang

- *Issue: The noise enhancement relates to the receiver noise so its calculation shall be based on reference receiver bandwidth"*

- We need to consider in 802.3db that the TX signal is being observed/managed through a virtual fiber in addition to the reference receiver



Cl 167 SC 167.8.5 P40 L13 # 54

Tang, Yi Cisco Systems, Inc.

Comment Type **TR** *Comment Status* **D**

"The TDECQ of each lane shall be within the limits given in Table 167-7 if measured using the methods specified in 121.8.5."
8023-2018 121.8.5 (Page 135, Equation 121-9): The value of Ceq (coefficient for the reference equalizer noise enhancement) can be calculated from N(f) and Heq(f) "Where N(f) is the normalized noise power density spectrum equivalent to white noise filtered by a fourthorder
Bessel-Thomson response filter with a bandwidth of 13.28125 GHz."
Issue: the noise enahncement relates to receiver noise, so its calculation shall be based on reference receiver bandwidth.

SuggestedRemedy

Add to the exception list:
"- The normalized noise power density spectrum, N(f) in Equation (121-9), is equivalent to white noise
filtered by a fourth-order Bessel-Thomson response filter with a bandwidth of 25.5625 GHz." - same as 8023cu-2021

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Discuss noise handling in the fiber emulation filter.

Note that the 4th order BT filter bandwidth should be 26.5626 GHz. There is a proposal in 802.3dc to correct the typo in 802.3cu.

Some basics of TDECQ

- We consider how much noise can be added to a signal to reach the target SER
- This is done for the TX under test as well as a virtual ideal TX, the ratio of noises being the eye closure penalty
- The noise addition should use only noise that is consistent with a receiver having 26.56 GHz bandwidth and not influenced by fiber. To include fiber effects would result in a new virtual transmitter and how eye closure penalty impacts the link budget
- We also need to ensure noise is managed correctly through the fiber model (when a sampling scope is used)

Proposal for text to manage added noise

- We want to leverage Clause 121, the basis for TDECQ analysis, but it is used by multiple clauses
- Clauses that leverage TDECQ from clause 121 have noted exceptions to manage differences

A small change to Clause 121 meets the needs of clause 167 while maintaining how it is used elsewhere

- 121.8.5.3 contains this text:

- *If an equivalent-time sampling oscilloscope is used, the impact of the sampling process, and the reference equalizer on transmitter noise must be compensated for, so that the correct magnitude of noise is present at the output of the equalizer.*

- A small modification satisfies the needs of 802.3db:

- *If an equivalent-time sampling oscilloscope is used, the impact of the sampling process, any fiber model, and the reference equalizer on transmitter noise must be compensated for, so that the correct magnitude of noise is present at the output of the equalizer.*

A small change for managing noise bandwidths

- From clause 121:

The value of C_{eq} can be calculated from the product of the normalized noise power density spectrum $N(f)$ at the input of the reference equalizer and the normalized frequency response $H_{eq}(f)$ of the reference equalizer, as shown in Equation (121–9).

$$C_{eq} = \sqrt{\int_f N(f) \times |H_{eq}(f)|^2 df} \qquad (121\text{–}9)$$

where

$N(f)$ is the normalized noise power density spectrum equivalent to white noise filtered by a fourth-order Bessel-Thomson response filter with a bandwidth of 13.28125 GHz.

- Add a clarifying sentence to: …..with a bandwidth of 13.28125 GHz. *This is the bandwidth of the reference equalizer and does not include the fiber model if used.*

- For 802.3db the reference receiver bandwidth is 26.5625 GHz and needs to be stated in the exceptions on how clause 121 is used (where we reference clause 121)