Consideration of BLER method using PMA measurements

Related to comment #307 against D2.2

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Supporters

- Matt Brown, Qualcomm

Background

- Test methods in 174A.9.6 and 174A.9.7 evaluate BLER performance of all physical lanes in AUIs and PMD.
- Two types of error histograms are needed by the methods:
  - Measured error histogram $H_m^{(i)}(k)$ by a PMA for lane i of one particular ISL
  - Theoretical error histogram $H_a(k)$ accounts for all other ISLs that are not measured by the PMA
- Comment #307 against D2.2 pointed out how to calculate $H_a(k)$ is not clear, and some change is needed. The response suggested to provide evidence for this change.

174A.9.6 BLER method for all lanes using PMA measurements

This test method evaluates the performance of all physical lanes in an AUI component or PMD by measuring all physical lanes as a group using error checkers and counters in the PMA. Compliance is determined by measuring an error histogram on each lane, combining the histograms from all lanes, and determining the BLER number for the set of lanes. If this test passes, then the PHY or xMII Extender will meet the expected codeword error ratio.

Determine the BLER as follows:

a) For each lane i, measure the error histogram $H_m^{(i)}(k)$ (see 174A.9.3).
b) Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$.
c) Initialize $H_e(k)$, the composite error histogram, with $H_a(k)$.
d) For each lane i, iteratively assign the result of hconv[$H_e(k)$, $H_m^{(i)}(k)$] (see 174A.9.4) to $H_e(k)$.
e) The measured BLER is equal to $H_e(16)$.

Cl **174A** *SC* **174A.9.6** *P* **748** *L* **12** # 307

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Comment Type **T** *Comment Status* **R** *block error ratio (CK)*

When using Equation (174A-5) to calculate Ha(k), the value of p should be specified to be 1 as Ha(k) is a theoretical histogram without per-lane simulation. Ha(k) should reflect the error distribution over all lanes of an AUI.

SuggestedRemedy

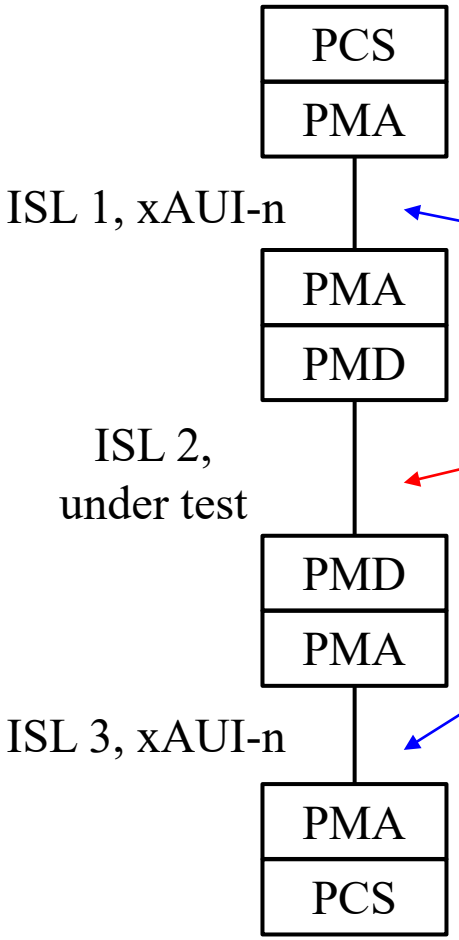
Change the sentence "Calculate the error histogram Ha(k) for the added BER using Equation (174A-5) with BER = BERadded." to "Calculate the error histogram Ha(k) for the added BER using Equation (174A-5) with
BER = BERadded and p = 1."
Do the same change for Line 33 on Page 748 and Line 10 on Page 751.

Response *Response Status* **C**

REJECT.
The current method uses a value of p based on the number of lanes in on the interface. In a real application only a 1/p portion of each RS-FEC codeword would appear on each lane. This test method as currently written reflects this reality. Although might be the case that simplifying this approach by setting p to 1 universally would yield the same result, no evidence to this effect has been provided. Evidence to support the proposed change is required.

Example

Without loss of generality, assume the ISL between PMDs is under test.



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Determine the BLER as follows:

a) For each lane i, measure the error histogram $H_m^{(i)}(k)$ (see 174A.9.3).

b) Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$.

c) Initialize $H_e(k)$, the composite error histogram, with $H_a(k)$.

d) For each lane i, iteratively assign the result of hconv[$H_e(k)$, $H_m^{(i)}(k)$] (see 174A.9.4) to $H_e(k)$.

e) The measured BLER is equal to $H_e(16)$.

The upper limit for $H_m^{(i)}(k)$ is defined by the histogram $H_{max}(k)$. $H_{max}(k)$ is the probability of k error test symbols in a test block with given random bit errors with a BER equal to BER_{max}. Compute the histogram $H_{max}(k)$ using Equation (174A–5), where $n = 544 / p$ and $BER_{max} = BER_{total} - BER_{added}$.

$$H_{max}(k) = \frac{n!}{k!(n-k)!} RSSER^k (1 - RSSER)^{n-k} \quad (174A–5)$$

$$RSSER = 1 - (1 - 2BER_{max})^5 \quad (174A–6)$$

- $H_a(k)$ should reflect how RS symbol errors are distributed over all lanes of not tested ISLs.
- In step b), there is no convolution of per-lane error histograms to obtain $H_a(k)$ but using 174A-5.
- Using 174A-5 needs to specify both BER_{max} and n (or p). Already have $BER_{max} = BER_{added}$.
- As no convolution is defined, we should additionally specify $n = 544$ (or $p = 1$) when calculating $H_a(k)$ using 174A-5.

Suggested Change

For both 174A.9.6 and 174A.9.7,

- Option 1:
  - Change step b) "Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$" to "Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$ and $n = 544$".
- Option 2:
  - Change step b) "Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$" to "Calculate the error histogram $H_a(k)$ for the added BER using Equation (174A–5) with $BER_{max} = BER_{added}$ and $p = 1$".

Thanks!