Cl **FM** *SC* **FM** *P* **11** *L* **27** # i-154

Hidaka, Yasuo — Fujitsu Laboratories of

Comment Type **T** *Comment Status* **D**

This paragraph lists major additions with higher speeds. Since 802.3bs adds higher speeds of 200 Gb/s and 400Gb/s, it should be listed.

SuggestedRemedy

After "... 100 Gb/s operation (also called 100 Gigabit Ethernet).", add the following:

IEEE Std 802.3bs added 200 Gb/s operation (also called 200 Gigabit Ethernet) and 400 Gb/s operation (also called 400 Gigabit Ethernet).

Proposed Response *Response Status* **O**

Cl **0** *SC* **0** *P* *L* # i-41

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination contains: "every instance when "mid", "min", or "max" is subscripted, it should appear in an upright font, both in the text and in the equation. This is also the same for terms such as "RLM", "Pave", and "Pth1" which are presented inconsistently throughout this draft"

SuggestedRemedy

Correct the font used for variables in the text and equations throughout the draft so that they are in accordance with the IEEE style manual

Proposed Response *Response Status* **O**

Cl **0** *SC* **0** *P* *L* # i-166

Behtash, Saman — Exsilica

Comment Type **T** *Comment Status* **D**

Please consider changing NRZ to PAM2 keeping in mind that PAM4 is also an NRZ modulation scheme.

SuggestedRemedy

Proposed Response *Response Status* **O**

Cl **0** *SC* **0** *P* *L* # i-42

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

As the expected approval order for amendments to IEEE Std 802.3-2015 that are before P802.3bs is decided by the Working Group Chair, account for any changes to the base standard made by these amendments.

SuggestedRemedy

Account for any changes to the base standard made by any further amendments announced to be ahead of P802.3bs as well as updates to any of the earlier amendments.

Proposed Response *Response Status* **O**

Cl **0** *SC* **0** *P* *L* # i-6

Berger, Catherine

Comment Type **G** *Comment Status* **D**

This draft meets all editorial requirements.

SuggestedRemedy

Proposed Response *Response Status* **O**

Cl **1** *SC* **1.5** *P* **35** *L* **53** # i-56

King, Jonathan — Finisar Corporation

Comment Type **T** *Comment Status* **D**

An abbreviation for SER is needed

SuggestedRemedy

To the list of new abbreviations, add SER Symbol Error Ratio

Proposed Response *Response Status* **O**

Cl **30** *SC* **30.5.1.1.15** *P* **39** *L* **0** # i-46

Slavick, Jeff — Broadcom Limited

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

aFECAbility does not include Clause 119, which does include a FEC engine. So we have the FEC block counters, but no indicator that the FEC engine is there.

SuggestedRemedy

Change: A read-only value that indicates if the PHY supports an FEC sublayer for forward error correction
(see 65.2, Clause 74, Clause 91, and Clause 108)
To: A read-only value that indicates if the PHY supports forward error correction (see 65.2, Clause 74, Clause 91, Clause 108, and Clause 119).

Proposed Response *Response Status* **O**

Cl **30** *SC* **30.5.1.1.18** *P* **40** *L* **30** # i-12

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

"Each element of this array contains a count of corrected FEC blocks" seems to be a copy/paste error. aFECUncorrectableBlocks should count uncorrectable rather than corrected blocks

(The error appears in the base document, however the paragraph is amended so may be in scope of the project)

SuggestedRemedy

Change "corrected" to "uncorrectable".

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.1.4** *P* **45** *L* **0** # i-47

Slavick, Jeff — Broadcom Limited

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

In 45.2.1.1.4 PMA remote loopback control bits, the definition of the bits refer to the PMA subclause and extended ability register.

SuggestedRemedy

Change: For 40/100 Gb/s operation, the remote loopback functionality is detailed in 83.5.9. For 40/100 Gb/s operation, the remote loopback ability bit is specified in the 40G/100G PMA/PMD extended ability register.
To: For operation at rates greater than 10Gb/s the rate appropriate extended ability register indicates if the PMA/PMD supports the remote loopback feature.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.1.5** *P* **45** *L* **0** # i-48

Slavick, Jeff — Broadcom Limited

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

In 45.2.1.1.5 PMA local loopback control bits, the definition of the bits refer to the PMA subclause and extended ability register.

SuggestedRemedy

Change: The local loopback function is mandatory for the 1000BASE-KX, 10GBASE-KR, 10GBASE-X, 40GBASE-KR4, 40GBASE-CR4, and 100GBASE-CR10 port type and optional for all other port types, except 2BASE-TL, 10PASS-TS, and 10/1GBASE-PRX, which do not support loopback. A device's ability to perform the local loopback function is advertised in the local loopback ability bit of the related speed dependent status register. A PMA that is unable to perform the local loopback function shall ignore writes to this bit and shall return a value of zero when read. For 10 Gb/s operation, the local loopback functionality is detailed in 48.3.3 and 51.8. For 40/100 Gb/s operation, the local loopback functionality is detailed in 83.5.8. For 10/40/100 Gb/s operation, the local loopback ability bit is specified in the PMA PMD status 2 register.
To: For port types that contain an optional local loopback, a device's ability to perform the local loopback function is advertised in the local loopback ability bit in the PMA/PMD status 2 register. A PMA that is unable to perform the local loopback function shall ignore writes to this bit and shall return a value of zero when read.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.9** *P* **50** *L* **25** # i-50

Slavick, Jeff — Broadcom Limited

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

The deletion of 10G, not states all PMDs provide a reeive detect function. Not sure that's true, plus MDIO shouldn't necessarily be stating which PMD types have what mandatory functions.

SuggestedRemedy

Remove the 2nd sentence

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.14e** *P* **45** *L* **41** # i-49

Slavick, Jeff — Broadcom Limited

Comment Type **ER** *Comment Status* **D**

400G is missing from the MDIO register bit name, but is used in the definition of the bit. 200G equivalent does have the 200G in the name and description.

SuggestedRemedy

400G to 1.24:15 name and description

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.1** *P* **102** *L* **9** # i-13

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

The list of supported PHY types in should not include the new AUIs, since they are transparent to LPI (unlike 25GAUI, XLAUI and CAUI-n, which have special behavior in deep-sleep LPI). PMDs which are transparent to LPI (like all optical PMDs) are not listed.

However, the list should include the 200GXS and 400GXS, since they do have special requirements for relaying LPI signaling, which do apply in fast wake (similar to XGXS).

SuggestedRemedy

Change "the 200GAUI-8 or 200GAUI-4" to "the 200GXS".
Change "the 400GAUI-16 or 400GAUI-8" to "the 400GXS".

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.5** *P* **103** *L* **4** # i-14

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

A PHY that includes 200GXS/400GXS subayers will have an additional delay due to the PCS/FEC processing.

Table 78-4 should indicate that. The LPI timing parameters for these sublayers are not defined.

Since these sublayers practically form a full 200GBASE-R/400GBASE-R link, it makes sense to assume that their timing parameters are the same as the corresponding PHYs.

The XLAUI/CAUI-n row in the base document can serve as a model. The additonal interface increases the transmitter delay Tw_sys_tx (by definition) but does not necessarily affect other patameters.

SuggestedRemedy

Add a new row with "PHY or interface type" 200GXS/400GXS, and Tw_sys_tx =0.34, with a new table footnote (b) stating:

b) The minimum Tw_sys_tx of a PHY is increased by the indicated period for each instance of 200GXS/400GXS on the transmit path. A PHY that includes 200GXS/400GXS on the receive path may require an increase of Tw_sys_tx on the link partner; this may be negotiated using LLDP (see 79.3.5).

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.5.1** *P* **103** *L* **17** # i-15

RAN, ADEE Intel

Comment Type **T** *Comment Status* **D**

78.5.1 (not included in the draft) is titled "10 Gb/s PHY extension using XGXS". Its content is relevant for 200GXS and 400GXS too.

The text in the existing subclause seems to include an incorrect statement (a maintenance request will be submitted). The suggested remedy includes modified text.

SuggestedRemedy

Bring 78.5.1 into the draft.

Change its title from "10 Gb/s PHY extension using XGXS" to "PHY extension using extender sublayers".

Insert the following new paragraph at the end of 78.5.1:
"The 200GXS/400GXS (Clause 118) can be inserted between the RS and a 200 Gb/s or 400 Gb/s PHY, respectively, to transparently extend the physical reach of the 200GMII/400GMII. The LPI signaling can operate through the 200GXS/400GXS with the PHY timing parameters
modified as described in Table 78-4."

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.5.2** *P* **103** *L* **19** # i-16

RAN, ADEE Intel

Comment Type **T** *Comment Status* **D**

There is no need to list the new AUIs here since they are transparent to LPI (unlike 25GAUI, XLAUI and CAUI-n).

Other interfaces and PMDs which are transparent to LPI (like all optical PMDs) are not listed.

SuggestedRemedy

Remove 78.5.2 and the editorial instructions to change it from this amendment.

Proposed Response *Response Status* **O**

Cl **93A** *SC* **93A.1.4.2** *P* **318** *L* **11** # i-79

Mellitz, Richard Samtec, Inc.

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

The meaning of fp2 changes between equation 93A-21a and 93A-22. This is a source of much confusion. In equation 93A-22 fp2 is used as the highest frequency pole. In 93A-21a fp2 is meant to be a low frequency pole associated with fz2.

SuggestedRemedy

In equation 93a-21a change fp2 and fz1 to syntax based on equation 120E-2

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "92A.1.4.2" to "93A.1.4.2"]

Cl **93A** *SC* **93A.1.4.3** *P* **318** *L* **7** # i-55

RAN, ADEE Intel

Comment Type **T** *Comment Status* **D**

*** Comment submitted with the file 92284600003-Suggested change to Eq 93A-22.pdf attached ***

The amendment of this annex to include a new CTLE transfer function was done in a way that is likely to confuse readers that are familiar with the old CTLE.

In previous clauses that used COM, equation 93A-22 was used with f_p2 as a high-frequency pole, essentially limiting the bandwidth of the CTLE. In the clauses that use the new low-frequency CTLE (such as 120D) f_p2 is redefined to be a low-frequency pole, with value equal to the new parameter f_z2.

Assigning a new and different meaning to an existing parameter is not a good idea.

Instead of introducing a new equation, it is preferable to re-use equation 93A-22, keep the existing meaning of all variables, and add a new zero-pole pair for the low-frequency CTLE, with defaults that cause this pair to cancel when used in the old clauses.

When invoking COM, as in table 120D-8, this will enable keeping the existing meaning of f_p2 and specifying the low-frequency CTLE separately.

SuggestedRemedy

Delete eq 93A-21a and instead modify eq 93A-22 as in the attachment, using a new parameter f_LF which will replace f_z2.

Instead of the text that was added to 93A.1.4.3, add a statement that when g_DC2 is not provided, it takes the value 0 and f_LF takes the value 1 (arbitrary, zero and pole will cancel out).

In Table 93A-1, delete the parameter f_z2 and remove the modification in the table row. Instead, add a new row "Continuous time filter, low-frequency pole" with symbol f_LF, and a comment as in D3.0.

In table 120D-8 (COM parameters), delete the row for f_z2, add f_LF with value f_b/40 and change value of f_p2 to f_b.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.1.3** *P* **107** *L* **35** # i-163

D'Ambrosia, John Futurewei Technologie

Comment Type **E** *Comment Status* **D**

The following is stated - "200GBASE-R represents a family of Physical Layer devices using the Physical Coding Sublayer for
200 Gb/s operation over multiple PCS lanes (see Clause 119). But Clause 119 uses language "200GBASE-R PCS". The same is also true for the reference to 400GBASE-R, which uses the 400GBASE-R PCS.

SuggestedRemedy

Change sentences to read -
"200GBASE-R represents a family of Physical Layer devices using the 200GBASE-R PCS for
200 Gb/s operation over multiple PCS lanes (see Clause 119)."
"400GBASE-R represents a family of Physical Layer devices using the 400GBASE-R PCS for
400 Gb/s operation over multiple PCS lanes (see Clause 119)."

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.1.4** *P* **108** *L* **27** # i-164

D'Ambrosia, John Futurewei Technologie

Comment Type **E** *Comment Status* **D**

The 802.3 standard for 100GbE (Table 80.3 and Table 80.4) designate whether the table is for optical or electrical solutions. Table 116-3 and 116-4 do not make similar designations. 802.3cd has also adopted the approach of designating the type

SuggestedRemedy

Change title of 116-3 to "Table 116-3--PHY type and clause correlation (200GBASE optical)"
Change title of 116-4 to ""Table 116-4--PHY type and clause correlation (400GBASE optical)"

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.5** *P* **116** *L* **16** # i-37

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination states: "For example, words such as "ensure," "guarantee," "maximize," minimize," etc., should be modified, if they are inaccurate.

SuggestedRemedy

Change "Skew Variation must be limited to ensure that each PCS lane always traverses ..." to "Skew Variation should be limited so that each PCS lane always traverses ..."

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.5** *P* **119** *L* **8** # i-104

Dawe, Piers J G — Mellanox Technologie

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

Table 116-7 has 80 ns for optical skew, and 100 ns for electrical (PCB), PMD and PMA skew. This is the same in ns as 802.3ba, but a total of 76,500 bits instead of 18,562.5, or 4.12 times as many bits to buffer. While this may not be as expensive as just a few bits in an optical module, some of this is an avoidable cost. The Skew limits need updating according to the principles used there (see http://ieee802.org/3/ba/public/may08/anslow_01_0508.pdf). The unit interval here is 38 (or 19) ps not 97 ps, and the number of lanes is 4 not 10.

SuggestedRemedy

Change SP1 from 29 ns, ~770 UI to 16 ns, ~425 UI.
Change SP2 from 43 ns, ~1142 UI to 24 ns, ~628 UI.
Change SP3 from 54 ns, ~1434 UI to 35 ns, ~930 UI.
Change SP4 from 134 ns, ~3559 UI to 115 ns, ~3055 UI.
Change SP5 from 145 ns, ~3852 UI to 126 ns, ~3347 UI.
Change SP6 from 160 ns, ~4250 UI to 134 ns, ~3559 UI.
Change "At PCS receive" from 180 ns, ~4781 UI to 145 ns, ~3852 UI.
Make the equivalent changes in the following clauses.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.5** *P* **119** *L* **29** # i-105

Dawe, Piers J G — Mellanox Technologie

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

The Skew Variation limits need updating according to the principles in http://ieee802.org/3/ba/public/may08/anslow_01_0508.pdf as explained in http://ieee802.org/3/cd/public/Jan17/wertheim_3cd_01_0117.pdf The unit interval here is 38 (or 19) ps not 97 ps. The 8/4-lane module PMA is a completely different design to a host SerDes, and naturally, Tx and Rx sides are different designs. These relatively small FIFOs (just a few UI) are very expensive per UI in e.g. power, and consume some power even if never used.

SuggestedRemedy

Change SP1 from 0.2 ns, ~5 UI, N/A to 0.11 ns, ~3 UI, N/A.
Change SP2 from 0.4 ns, ~11 UI, N/A to 0.22 ns, ~6 UI, NA.
Change SP3 from 0.6 ns, ~16 UI, ~32 UI to 0.42 ns, ~11 UI, ~22 UI.
Change SP4 from 3.4 ns, ~90 UI, ~181 UI to 3.22 ns, ~86 UI, ~171 UI.
Change SP5 from 3.6 ns, ~96 UI, N/A to 3.42 ns, ~91 UI, N/A.
Change SP6 from 3.8 ns, ~101 UI, N/A to 3.53 ns, ~94 UI, N/A.
Change "At PCS receive" from 4 ns, ~106 UI, N/A to 3.73 ns, ~99 UI, N/A.
Make the equivalent changes in the following clauses.
It doesn't matter much if the SP4,5,6 and "At PCS receive" limits are changed or not.

Proposed Response *Response Status* **O**

Cl **117** *SC* **117.1.1** *P* **122** *L* **24** # i-81

Trowbridge, Stephen — Nokia

Comment Type **E** *Comment Status* **D**

Item (h) makes it sound as though two identical XS sublayers are used.

SuggestedRemedy

Change "200GMII/400GMII can be extended through the use of two 200GXS/400GXS sublayers" to "200GMII/400GMII can be extended through the use of a pair (DTE XS and PHY XS) of 200GXS/400GXS sublayers"

Proposed Response *Response Status* **O**

Cl **117** *SC* **117.1.5** *P* **123** *L* **4** # i-36

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination states: "For example, words such as "ensure," "guarantee," "maximize," minimize," etc., should be modified, if they are inaccurate.

SuggestedRemedy

Change "The 200GMII/400GMII maximizes media independence by ..." to "The 200GMII/400GMII provides media independence by ..."

Proposed Response *Response Status* **O**

Cl **118** *SC* **118.1.1** *P* **130** *L* **9** # i-160

D'Ambrosia, John — Futurewei Technologie

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

Clock content / 4 lane interleaving issues related to the 200G/400G BASE-R PCS have been noted in
http://www.ieee802.org/3/bs/public/adhoc/elect/19Dec_16/anslow_01_121916_elect.pdf.
The 200GXS is identical in function to the 200GBASE-R PCS in Clause 119 with the addition of the functions
defined in 118.2. The 400GXS is identical in function to the 400GBASE-R PCS in Clause 119 with the addition of the functions
defined in 118.2. Therefore, any changes made to the 200GBASE-R or 400GBASE-R PCS's or constraints on them must be properly mirrored onto the respective 200GXS and 400GXS.

SuggestedRemedy

Resolution of the clock content / 4 lane interleaving issue must be properly mirrored onto the respective 200G/400G XS.

Proposed Response *Response Status* **O**

Cl **118** *SC* **118.1.2** *P* **130** *L* **15** # i-162

D'Ambrosia, John — Futurewei Technologie

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

The following is stated - "The 200GXS is identical in function to the 200GBASE-R PCS in Clause 119..." and "The 400GXS is identical in function to the 400GBASE-R PCS in Clause 119...". However, no reference to the word "is" is defined in the style guideline. Shall, should, may, and can are defined in 6.4.7 of the IEEE-SA Standards Board Operations Manual.

SuggestedRemedy

Change sentence to read -
"The 200GXS, if implemented, shall be identical in function to the 200GBASE-R PCS in Clause 119...."
"The 400GXS, if implemented, shall be identical in function to the 400GBASE-R PCS in Clause 119..."

Proposed Response *Response Status* **O**

Cl **118** *SC* **118.2.2** *P* **132** *L* **16** # i-82

Trowbridge, Stephen — Nokia

Comment Type **ER** *Comment Status* **D**

Error in implementing change to Arabic numerals

SuggestedRemedy

Change "CCMI or 400GMIII" to "200GMII or 400GMII"

Proposed Response *Response Status* **O**

Cl **118** *SC* **118.5.3** *P* **138** *L* **9** # i-161

D'Ambrosia, John — Futurewei Technologie

Comment Type **T** *Comment Status* **D**

The PICS for 200GXS AND 400GXS refer to the substitution of the XS for the respective PCS and point to 118.1, but this concept is actually introduced in 118.1.2.

SuggestedRemedy

Move PHYXS and DTEXS above 200GXS and 400GXS. Change subclause reference for 200GXS and 400GXS to 118.1.2.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119** *P* **143** *L* **1** # i-7

Gustlin, Mark — Xilinx, Inc.

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

The 400G and 200G PCS has shown to have unusual clock content for a few PCS muxing and skew combinations when performing 4:1 muxing. See http://www.ieee802.org/3/bs/public/adhoc/elect/19Dec_16/anslow_01_121916_elect.pdf for an explenation of the concerns.

SuggestedRemedy

Make the proposed changes to the draft as specified in gustlin_3bs_01_0317.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.3.2** *P* **147** *L* **48** # i-83

Trowbridge, Stephen — Nokia

Comment Type **E** *Comment Status* **D**

The word "unused" is not clear

SuggestedRemedy

Change "All unused values of block type field" to "All block type values not listed in Figure 82-5"

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.1** *P* **149** *L* **1** # i-43

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

The text: "Note--The stream of 66-bit blocks generated by this process, together with the FEC_degraded_SER and rx_local_degraded bits are used as the reference signal for mapping to OTN. See ITU-T G.709 [B50]." is misleading as G.709 has not been modified to include this information.

SuggestedRemedy

Change the note to: "Note--The stream of 66-bit blocks generated by this process, together with the FEC_degraded_SER and rx_local_degraded bits should be used as the reference signal for mapping to OTN."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **151** *L* **23** # i-52

Slavick, Jeff — Broadcom Limited

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

At the end of the 2nd paragraph you talk about a "Fixed pad" but have never introduced it at this point. So defining what that is would be useful.

SuggestedRemedy

Delete: "The fixed pad within the alignment markers and the PRBS9 pad at the end of the alignment maker group are ignored on receive." from the 2nd paragraph and add "The unique pad (UP0-UP2) within the alignment markers and the PRBS9 pad at the end of the alignment maker group are ignored on receive." to the end of the 4th paragraph

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **151** *L* **32** # i-9

Gustlin, Mark — Xilinx, Inc.

Comment Type **E** *Comment Status* **D**

Description is not as clear as it could be.

SuggestedRemedy

Change " and reassemble the aggregate stream before descrambling is performed." to "and reassemble the aggregate stream before FEC decoding is performed."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **151** *L* **50** # i-84

Trowbridge, Stephen — Nokia

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

The pre-FEC degrade signaling description is incomplete. Missing behavior when clause 119 PCS is below a clause 118 XS or when clause 119 PCS receives LD from far end.

SuggestedRemedy

See presentation. Proposed remedy includes changes to clauses 116, 118, 119. Make the accompanying change to clause 45 for the PCS registers.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.5** *P* **157** *L* **20** # i-35

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

In "m_A and m_B", m_A should be m subscript A and m_B should be m subscript B

SuggestedRemedy

Change m_A to m subscript A and change m_B to m subscript B

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.8** *P* **160** *L* **1** # i-102

Wertheim, Oded — Mellanox Technologie

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

The scrambler and bit distribution scheme that we use in clause 119 creates for a set of {lanes, delays} a 53GBd pattern with a limited clock content and large percent of transitions with the same LSB.

SuggestedRemedy

Few remedy options are available in the PCS level:
a. Change the pre-FEC distribution to 257b round robin (compared with the current 10b).
b. Move the scrambler above the transcoding (similar to 802.3bj)
c. Add a PRBS7 as proposed in anslow_01_121916_elect

In addition, we can investigate options to solve the issue in lower layers as discussed in gustlin_01_0217_logic

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.3** *P* **163** *L* **27** # i-51

Slavick, Jeff — Broadcom Limited

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

The degrade feature doesn't define what to increase the count by when an uncorrectable codeword occurs.

SuggestedRemedy

Add: "If the decoder determines that a codeword was uncorrectable, then the number of symbol errors detected is increased by the number of RS symbols in the codeword (assume all symbols were in error)." into the last paragph of 119.2.5.3
or add: "If the decoder determines that a codeword was uncorrectable, then the counter tracking symbol errors is set to it's maximal value (immediately causing a degrade condition to occur)." into the last paragraph of 119.2.5.3

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.2.1** *P* **165** *L* **22** # i-11

Gustlin, Mark — Xilinx, Inc.

Comment Type **E** *Comment Status* **D**

Add hyphen to # bit

SuggestedRemedy

Change "72 bit" to 72-bit to be consistent with the rest of the clause, do the same for the other examples on this page.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.2.2** *P* **166** *L* **10** # i-10

Gustlin, Mark — Xilinx, Inc.

Comment Type **E** *Comment Status* **D**

Variables are not all alphabetized, for example align_status and first_pcsl.

SuggestedRemedy

Alphabetize them.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.2.3** *P* **167** *L* **33** # i-8

Gustlin, Mark — Xilinx, Inc.

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

The last sentence of AMP_COMPARE is incorrect and partly leftover from clause 91.

SuggestedRemedy

Change "If current_pcsl and first_pcsl are 0, amp_match is set to true." to "If current_pcsl and first_pcsl indicate the same pcs lane number, amp_match is set to true."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.6** *P* **181** *L* **19** # i-1

Brown, Matthew Applied Micro (AMCC)

Comment Type **E** *Comment Status* **D**

Several subclause heading levels are level 3 but should be level 4 as follows:
119.6.5
119.6.6
119.6.7

Note that this caused a bit of a problem when amending this subclause in P802.3cd.

SuggestedRemedy

Change the listed headings to heading level 4.

Proposed Response *Response Status* **O**

Cl **119A** *SC* **119A** *P* **319** *L* **36** # i-54

Slavick, Jeff Broadcom Limited

Comment Type **E** *Comment Status* **D**

Missing space after cxb

SuggestedRemedy

Add the space

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.1.1** *P* **183** *L* **10** # i-85

Trowbridge, Stephen Nokia

Comment Type **T** *Comment Status* **D**

The PMA is not only for the PCS to connect to a range of physical media. It is also used to connect the DTE XS to the PHY XS.

SuggestedRemedy

Change "The PMA allows
the PCS (specified in Clause 119) to connect in a media-independent way with a range of physical media." to "The PMA allows
the PCS (specified in Clause 119) to connect in a media-independent way with a range of physical media, or for the DTE XS to connect to the PHY XS (specified in Clause 118).

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.1** *P* **190** *L* **20** # i-17

RAN, ADEE Intel

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

As noted in 120.5.11.2.4, a square wave may not be received correctly by the CDR of the PMA at the receive side of the 200GAUI-4 or 400GAUI-8 (whether or not it is adjacent to the PMD).

There is nothing in this clause that states that the PMA _receiver_ expects a CDR-friendly pattern and may not work well with a square wave (or, for that matter, with SSPR).

The PMA receiver behavior should only be specified for PCS data and for PRBS31/PRBS31Q. SSPR and square wave are used for transmitter testing, and we should not expect CDRs to operate with the same performance as with valid data. But as the text stands there is no special treatment for these patterns - the BER requirements in all AUI annexes are pattern-agnostic. This is an overkill.

This subclause seems to be the right place to state that the PMA receiver is not expected to cope with this kind of patterns.

SuggestedRemedy

Add a new paragraph at the end of 120.5.1:

"Clock and data recovery specifications apply for receiving PCS encoded data or PRBS31/PRBS31Q test patterns. Feeding other patterns (such as square wave or SSPR/SSPRQ) into a PMA through a physically instantiated interface may yield unexpected results".

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10** *P* **196** *L* **24** # i-44

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

This says: "The ability to perform this function is indicated by the Remote_loopback_ability status variable." but there is no Remote_loopback_ability status variable. There are, however, "200G_Remote_loopback_ability" and "400G_Remote_loopback_ability" variables.

SuggestedRemedy

Change the first two sentences of this paragraph to:
"The ability to perform this function is indicated by the 200G_Remote_loopback_ability and 400G_Remote_loopback_ability status variables for the 200GBASE-R PMA and 400GBASE-R PMA, respectively. If a Clause 45 MDIO is implemented, the 200G_Remote_loopback_ability and 400G_Remote_loopback_ability variables are accessible through bit 1.23.15 (45.2.1.14e.1) and bit 1.24.15 (45.2.1.14f.1), respectively."

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10** *P* **196** *L* **25** # i-53

Slavick, Jeff — Broadcom Limited

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

The remote_loopback_ability bit is in the extended register for each 200G and 400G.

SuggestedRemedy

Change: "this variable is accessible through bit 1.13.15 (45.2.1.12.1)." to "this variable is accessible through bit 1.23.15 (45.2.1.14e) for a 200GBASE-R PMA and bit 1.24.15 (45.2.1.14f) for a 400GBASE-R PMA."

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.1** *P* **198** *L* **9** # i-106

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

Usually we say in which order a sequence goes, as done for the seed at line 7. One could reverse engineer this but anyway...

SuggestedRemedy

Please state which end of this sub-sequence comes first. Also for 120.5.11.2.2 p 199 line 41.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **200** *L* **31** # i-107

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

This is convoluted and hard to follow, worse now that the seeds are not the starting bit sequences any more.

SuggestedRemedy

Please add a table of beginning and end bit and PAM4 symbol sequences. Table 120D-2, PRBS13Q pattern symbols used for jitter measurement, is an example of a helpful table.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **200** *L* **43** # i-108

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

SSPRQ is use on the Tx side only, as is clear from MDIO registers. Also it is not intended to be multiplexed up (i.e. one would not generate SSPRQ in a PMA with 50 Gb/s lanes to test a 100 Gb/s/lane PMD Tx, but one could generate it in the 100 Gb/s/lane PMA).

SuggestedRemedy

Change "A PMA may optionally include" to "A Tx direction PMA may optionally include"

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **200** *L* **51** # i-18

RAN, ADEE — Intel

Comment Type **E** *Comment Status* **D**

The paragraphs following the sentence "The SSPRQ pattern is a repeating 2^16-1 PAM4 symbol sequence constructed as follows", excluding the last paragraph in this subclause are a list of steps required to create the pattern. To aid the reader, they should be in list format.

SuggestedRemedy

Use dash list format for the paragraphs from "Bit sequence A..." until "The repeating SSPRQ pattern..." (inclusive).

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **201** *L* **5** # i-109

Dawe, Piers J G — Mellanox Technologie

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

This SSPRQ is not suitable for use in TDECQ or stressed receiver calibration because measurements with this pattern do not give the correct penalty.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty (before and after FEC) with a random payload measures as minimally compliant (i.e. also 0.4 dB penalty) with SSPRQ.
It may be necessary to adjust another seed to get appropriate transition density characteristics.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **201** *L* **37** # i-101

Wertheim, Oded — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Generating SSPRQ on all 8 lanes with at least 31UI delay between the patterns, requires to either keep 8 separate SSPRQ state machines and corresponding PRRBS generators or maintain a delay buffer for each lane, with the largest one larger than 7x31UI = 434 bit. Both options add complexity to the design, this is especially significant if implemented within the optical module PMA (adjacent to the PMD)

SuggestedRemedy

Remove the requirement for 31UI delay between the lanes and evaluate an option to use SSPRQ test pattern only on the lane under test, using a simpler test pattern on the other lanes such as PRBS13Q which we already keep per lane.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **201** *L* **37** # i-110

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Generating SSPRQ dynamically is quite complicated, and generating 8 copies of it with offsets is more complicated. It's probably OK to use other patterns on the aggressors (see another comment against 121.8.5.1). Generating 8 offsets of SSPRQ then overwriting 7 of them with PRBS13Q is clumsy; generating a single SSPRQ among 8 lanes of PRBS31Q or scrambled idle is not supported by this draft.

SuggestedRemedy

If SSPRQ victim with other patterns for aggressors is acceptable, change the SSPRQ generator to a single-lane generator (no need for the multi-lane facility that PRBS13Q has). Change the registers in Clause 45 accordingly.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.3** *P* **201** *L* **38** # i-111

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Generating 8 lanes of this complicated pattern with at least 31 UI offset between any two lanes sounds quite involved. Only 1 UI offset is enough do give excellent decorrelation, better than 100-200 UI, and there is a spur at about 450 UI. So we want at least 1 UI between SP2 to SP3, because SSPRQ is for testing optical transmitters only (not optical receivers). The allowed Skew at SP3 is 54 ns or about 1,435 UI at 26.5625 GBd, and the allowed Skew Variation per PMA is 0.2 ns or 5.3 UI. The pattern is 8191 UI long so 8 lanes cannot be offset enough to take up any Skew. We don't need 31 UI to cover the Skew Variation.

SuggestedRemedy

Changing 31 to 16 would help a little, but using different aggressors (see other comments) seems to be better.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.4** *P* **201** *L* **46** # i-19

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

The "note that" sentence is a part of normative text (see style manual 16.1), but it is not clear how it specifies anything: "may" means "is allowed to", but this clause specifies the PMA and the PMA has no special "allowance" (in the current text; see another comment) for not forwarding data correctly when the data is a square wave.

From discussions in the task force it seems that the intent of this text is that the square wave for testing a PMD should be generated on the PMA adjacent to the PMD, rather than transmitted over an AUI.

It would be better to have appropriate text standing out as an informative note (in a separate paragraph) after describing the feature.

SuggestedRemedy

Delete the sentence "Note that if a square wave is transmitted through a 200GAUI-4 or 400GAUI-8 it may not be correctly forwarded to the output of the PMD sublayer", and instead insert a paragraph break.

Add an informative note paragraph at the end of this subclause (after the "When enabled" paragraph):
"NOTE--A square wave transmitted over a 200GAUI-4 or 400GAUI-8 is not guaranteed to be received correctly. For testing PMD output, it is recommended that the square wave be generated at the PMA adjacent to the PMD."

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.2.4** *P* **202** *L* **42** # i-112

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

When the RIN measurement has been changed to a more convenient pattern such as PRBS13Q or possibly removed (see other comments)...

SuggestedRemedy

The square wave (quaternary) test pattern will be unnecessary, and it and the associated MDIO registers can be removed.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.11.3** *P* **201** *L* **5** # i-93

Ghiasi, Ali — Ghiasi Quantum LLC

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

Define SSPRQ2 pattern which include portion with low transition density (TD)

SuggestedRemedy

SSPRQ2 pattern consit of
Std PRBS31 with 0x00000002 with length of 10924 bits
Std PRBS31 with 0x34013FF7 with length of 10924 bits
PRBS31 with TD~0.683 0xCCCCCCCC with length of 10924 bits

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B** *P* **333** *L* **6** # i-2

Brown, Matthew — Applied Micro (AMCC)

Comment Type **GR** *Comment Status* **D**

In Annex 120B, the title and text throughout use the generic acronyms 200GAUI-8 and 400GAUI-16 when referring specifically to the chip-to-chip version.

SuggestedRemedy

Throughout the annex including the annex title make use of the defined acronym C2C and refer to 200GAUI-8 C2C and 400GAUI-16 C2C as is done in 802.3by-2016 and P802.3cd.

Proposed Response *Response Status* **O**

Cl **120C** *SC* **120C** *P* **340** *L* **7** # i-3

Brown, Matthew — Applied Micro (AMCC)

Comment Type **GR** *Comment Status* **D**

In Annex 120C, the title and text throughout use the generic acronyms 200GAUI-8 and 400GAUI-16 when referring specifically to the chip-to-module version.

SuggestedRemedy

Throughout the annex including the annex title make use of the defined acronym C2M and refer to 200GAUI-8 C2M and 400GAUI-16 C2M as is done in 802.3by-2016 and P802.3cd.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D** *P* **348** *L* **7** # i-4

Brown, Matthew — Applied Micro (AMCC)

Comment Type **GR** *Comment Status* **D**

In Annex 120D, the title and text throughout use the generic acronyms 200GAUI-4 and 400GAUI-8 when referring specifically to the chip-to-chip version.

SuggestedRemedy

Throughout the annex including the annex title make use of the defined acronym C2C and refer to 200GAUI-4 C2C and 400GAUI-8 C2C as is done in 802.3by-2016 and P802.3cd.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **352** *L* **6** # i-113

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

Clause 94 should be deprecated and we should not refer to it in new clauses. The same definitions and figure as in 94.3.12.3 are in 93.8.1.3 and 83E.3.1.2.

SuggestedRemedy

Change the references to 94.3.12.3 (five here, one in 120D.3.2.1) to 93.8.1.3 or 83E.3.1.2.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **352** *L* **15** # i-74

Mellitz, Richard — Samtec, Inc.

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

Differential Return loss specified in clause 93 may not be relevant here and should be tied to the COM package model

SuggestedRemedy

annotate an equation for differential return loss. See presentation

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **352** *L* **26** # i-69

Dudek, Michael — Cavium

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

To close the budget the Tx specifications need to be no more relaxed than the Tx used in COM. COM uses 31dB for TxSNR which is the same value as the SNDR in table 120D-1 (using Np=200). The value for the SNRisi therefore should match the SNRisi created by the package in COM. That value is considerably larger than 32.3dB.

SuggestedRemedy

Increase the SNRisi value to 38dB. (Other combinations of TxSNR, SNDR, SNRisi and package parameters could be chosen, but the RSS sum of the SNDR and SNRisi should equal the RSS sum of the TxSNR used in COM plus the SNRisi produced by the COM package.)

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **351** *L* **49** # i-87

Healey, Adam — Broadcom Ltd.

Comment Type **E** *Comment Status* **D**

Since output jitter is at the end of Table 120D-1, it would be more consistent if 120D.3.1.1 were moved to the end of 120D.3.1 and furthermore consolidated with 120D.3.1.8 Even-odd jitter.

SuggestedRemedy

Relocate the subclase to the end of 120D.3.1 and merge the contents with 120D.3.1.8. Such consolidatation would eliminate some redundancies (such as the definition of the jitter measurement filter and configuration of aggressor transmitters). Refer to the organziation of 92.8.3.8.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **43** # i-86

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **D**

It is stated that each histogram should include at least 1E6 hits. Is it necessary to be this prescriptive? Some users of the standard may find it acceptable to acquire fewer hits and extrpolate to find the J4 value. While such extrapolation would tend to over-estimate J4, the user may be able to accept the inaccuracy (due to margin to the specification) and benefit from lower test times.

SuggestedRemedy

In 92.8.3.8.2, it is stated that "the number of acquired samples should be sufficiently large to yield consistent measurement results." It is suggested that similar language be used here.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **43** # i-114

Dawe, Piers J G — Mellanox Technologie

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

Following 52.9.9.3 and 86.8.3.3.1, this says "Each histogram should include at least 10^6 hits." Recommending such a detail (at least 10,000 hits then) was OK for a single-lane stressed eye calibration in 52.9.9.3, and not right for the multi-lane yes/no J2 Jitter product spec in 86.8.3.3.1, where the trade-off between margin and accuracy applies. But 10,000 hits x 4 or 10 lanes on a module wasn't terrible, and we did not make the same mistake for J9. Here, we have a million hits, times multiple emphasis settings, times over a hundred lanes on each switch. It's far too much, and not necessary.

SuggestedRemedy

Delete "Each histogram should include at least 10^6 hits". If some guidance is thought necessary, add at line 49, "NOTE--As usual, the trade-off between measurement accuracy and number of hits is a matter for the implementer. At least a few times 2 x 10^4 hits in the histogram would be expected for a measurement of J4. A measurement of J_RMS alone would need fewer samples."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **43** # i-26

RAN, ADEE — Intel

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

The procedure described from line 43 to line 50 was subject to several comments against D2.2. This comment is an aggregate of comments 38, 39, 11, 12, and 13.

It seems that the desirable definition of J4 should use the range that results in all but 1e-4 of the total population of transition, where the subset of measurements related to each transition is adjusted to remove the average of that subset.

Similiarly J_RMS should be the RMS of the population after the same adjsutment.

The population size can be left to the test implementer's engineering judgement.

SuggestedRemedy

Replace lines 43 to 50 with the following:

For each transition i, 1<=i<=12, of the transitions specified in Table 120D-2, obtain a set S_i = {t_i(1), t_i(2), ...} of transition times modulo the period of the pattern. The size of each set should chosen to enable calculation of J4 (as defined below) with sufficient accuracy.

Calculate the average of each set, t_i_Avg, and subtract it from all elements of that set, to create S_i0={t_i(1)-t_i_Avg, t_i(2)t_i_Avg, ...}.

From the union of the zero-average sets S_0 = U (S_i0, i=1 to 12), create an estimated probabilty distribution f_J(t).

J4 is defined as the zero-centered time interval that includes all but 10^-4 of the elements of S_0, from the 0.005th to the 99.995th percentile of f_J(t).

J_RMS is defined as the standard deviation of f_J(t).

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **43** # i-115

Dawe, Piers J G — Mellanox Technologie

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

We don't need each of the 12 measurements to be within the J4 or Jrms limits; we just need the aggregate to do so because in COM we make all the edges have the jitter. Recognising this we can improve measurement time and cost 12-fold, which we need to do with multiple emphasis settings and up to over a hundred lanes on each IC. See another comment for why "an estimate of".

SuggestedRemedy

After the first sentence, insert "Align the means of each histogram then add them together to obtain an estimate of the jitter probability density distribution." Delete "J4 is the maximum of the 12 measurements. J_RMS is the root mean square of the 12 measurements."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **47** # i-116

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

I would think that a "probability density distribution" exists whether measured or not, it's a property of the signal. But "the jitter histogram" could be taken as one of the 12 measured histograms at line 43, including sampling errors.

SuggestedRemedy

Change "of the jitter histogram" to "of the jitter probability density distribution".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **50** # i-68

Dudek, Michael — Cavium

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

The target BER is 1e-5. J4 is equivalent to 5e-5 BER on a BERTscan for NRZ or 5e-5 PAM4 symbol error rate which is only 2.5e-5 BER if there is no error extension. (The COM DER is also 1e-5 which is the probability of the first symbol being in error). Each transition only occurs with a probabilitiy of 1/16 so requiring the worst of the edges to meet the J4 criterion is more stringent than necessary.

SuggestedRemedy

Combine the probabilities of all the 12 edges and use the RMS and J4 for the combined probabilities for the measurement. Insert a sentence at line 44 "Combine these 12 histograms to create a single histogram for all the edges" Delete the sentence "J4 is the maximum of the 12 measurements. JRMS is the root mean square of the 12 measurements."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.2** *P* **353** *L* **33** # i-62

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D**

The second sentence in the paragraph already says that the mean signal levels are defined in 120D.3.1.2.1. There is no need to repeat this.

SuggestedRemedy

Delete "The calculation of the mean signal levels is defined in 120D.3.1.2.1." It was agreed that this is a potential improvement in the comment resolution to D2.2

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.3** *P* **354** *L* **21** # i-117

Dawe, Piers J G — Mellanox Technologie

Comment Type **ER** *Comment Status* **D**

94.3.12.5.2 is about 17 lines long; this section which refers to it is 11 lines, mostly listing exceptions to 94.3.12.5.2. 94 should be deprecated anyway.

SuggestedRemedy

Write a complete subclause without reference to 94.3.12.5.2 or 72.6.10.2.3.1; copy from 94.3.12.5.2 and 136.9.3.1.2 as necessary

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.4** *P* **354** *L* **34** # i-28

RAN, ADEE Intel

Comment Type **E** *Comment Status* **D**

Parentheses and numbers should not be italicised. Also, mutliplication should be denoted by a cross character.

SuggestedRemedy

Change numbers and parentheses to upright font.

Add cross character (0xD7) between "M" and "Nv".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.4** *P* **354** *L* **34** # i-27

RAN, ADEE Intel

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

The current steady-state voltage specification uses p(k), which is determined from the linear fit procedure, which is calculated separately for each equalizer setting. This specification reads as if it applies in all equaliztion settings.

It is impossible that the specified minimum steady-state voltage in Table 120D-1 (0.4 V) will be met in all equalization settings (due to limitation on peak-to-peak swing), and this is not the intent.

To be consistent with all precedent electrical clauses and AUI specifications, steady-state voltage should be specified only in unequalized state,

SuggestedRemedy

Change FROM
"The linear fit pulse, p(k), is determined according to the linear fit procedure in 120D.3.1.3"
TO
"The linear fit pulse, p(k), is determined according to the linear fit procedure in 120D.3.1.3 with Local_eq_cm1 and Local_eq_c1 set to 0".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.5** *P* **354** *L* **44** # i-29

RAN, ADEE Intel

Comment Type **E** *Comment Status* **D**

Incorrect cross reference: 120D.3.1.2 describes transmitter linearity. The linear fit method is a different thing, and is described in 120D.3.1.3.

SuggestedRemedy

Change cross reference from 120D.3.1.2 to 120D.3.1.3.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.7** *P* **356** *L* **23** # i-158

Hidaka, Yasuo Fujitsu Laboratories of

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

Optimization of two parameters of the second-order CTLE as described in 93A.1.4.3 with parameters in Table 120D-8 is not required for the loss of package and test fixture.
The CTLE defined for chip-to-module interface in 120E.3.1.7 should be sufficient.

This is re-submission of comment #33 for D2.2.

SuggestedRemedy

Change
"SNR_ISI is defined by Equation (120D-8) computed from p_max and ISI_cursors after these have been re-calculated with the continuous time filter described in 93A.1.4.3 using the parameters in Table 120D-7 applied and optimized for maximum SNR_ISI."
to
"SNR_ISI is defined by Equation (120D-8) computed from p_max and ISI_cursors after these have been re-calculated with the selectable continuous time linear equalizer (CTLE) which is described in 120E.3.1.7 by Equation (120E-2) with coefficients in Table 120E-2 and illustrated in Figure 120E-9 applied and optimized for maximum SNR_ISI."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.7** *P* **356** *L* **24** # i-159

Hidaka, Yasuo — Fujitsu Laboratories of

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

The SNR_ISI specification is defined to be met for all transmit equalization settings. When the transmit equalization settings is stronger than required, the SNR_ISI includes not only ISI due to reflection, but also ISI due to over-equalization, because the CTLE in the COM parameter cannot suppress the high-frequency component.

This is re-submission of comment #36 for D2.2.

SuggestedRemedy

Change
"The SNR_ISI specification shall be met for all transmit equalization settings."
to
"The SNR_ISI specification shall be met for all transmit equalization settings excepting those settings which makes the mean value of ISI_cursors always negative regardless of the continuous time filter settings."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.7** *P* **356** *L* **38** # i-31

RAN, ADEE — Intel

Comment Type **E** *Comment Status* **D**

Per the style manual (16.1), "Note" should be all-caps, followed by an em dash and use the note paragraph format.

SuggestedRemedy

per comment

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **356** *L* **9** # i-30

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

The current definition of OEJ includes a measurement triggering one in 3 repeats of the PRBS13Q, and using the "first" and the "second" pattern in each capture.

Since PRBS13Q is an odd-length pattern, the first and second pattern out of a group of 3 will exchange their even/odd roles on each capture, so each histogram will include both "even" and "odd" transitions; the means of these histograms, T3 and T4, are expected to be equal up to a measurement error. This was confirmed in lab measurement.

It seems that this part of the procedure can be removed.

SuggestedRemedy

Delete list item 2.

Change list item 3 to read "Calculate even-odd jitter for this transition as |(T2 - T1)|".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **356** *L* **40** # i-32

RAN, ADEE — Intel

Comment Type **E** *Comment Status* **D**

The first three paragraphs of 120D.3.1.8, describing even-odd jitter signal, transitions, thredholds, filter, and what other lanes are transmitting, seem to repeat the correpsonding text of "output jitter" in 120D.3.1.1. If there are any differences, they are difficult to identify.

It would help the readers to have the even-odd jitter definitions within the output jitter subclause, share definitions where it is possible, and note differences where they exist.

SuggestedRemedy

Preferably, move the specific even-odd measurement text, p357 lines 1-25, to 120D.3.1.1, noting any differences from the "output jitter" definitions (after resolving other comments), with editorial license, and delete 120D.3.1.8.

Alternatively, only reorder subclauses so that even-odd jitter is adjacent to output jitter.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **356** *L* **40** # i-157

Hidaka, Yasuo — Fujitsu Laboratories of

Comment Type **ER** *Comment Status* **D**

Specification of jitter is split to 120D.3.1.1 and 120D.3.1.8.

This is re-submission of comment #35 for D2.2.

SuggestedRemedy

Reorganize 120D.3.1.1 and 120D.3.1.8 as follows:

120D.3.1.1 Output jitter
120D.3.1.1.1 J4 and J_RMS jitter
120D.3.1.1.2 Even-odd jitter

Change the references in Table 120D-1 as follows:

J_RMS (max) 120D.3.1.1.1
J4 (max) 120D.3.1.1.1
Even-odd jitter (max) 120D.3.1.1.2

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **356** *L* **40** # i-63

Dudek, Michael — Cavium

Comment Type **E** *Comment Status* **D**

It would read better if this Even-Odd Jitter section were placed next to the Output jitter section.

SuggestedRemedy

Make this a subsection 120D.3.1.1.2 . Also relabel the existing section 120D.3.1.1.as a sub-section 120D.3.1.1.1 called "J4 and Jrms" It was agreed that this is a potential improvement in the comment resolution to D2.2

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **356** *L* **50** # i-33

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

"Even-odd jitter is measured with a single-pole high-pass filter with a 3 dB bandwidth of 4 MHz"

What is this filter applied to?

If this text stays here, it should refer to the CRU.

SuggestedRemedy

Change to state that "Even-odd jitter is measured with a clock recovery unit (CRU) with a corner frequency of 4 MHz and a slope of 20 dB/decade".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **357** *L* **1** # i-89

Healey, Adam — Broadcom Ltd.

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

The even-odd jitter measurement requires that each of the 12 transitions identified in Table 120D-2 be measured 4 times. This implies 48 measurements need to be made to obtain a single EOJ result. To measure the result to within +/-1% of the specification limit, up to 10^5 samples per measurement would need to be taken (based on the crude analysis contained in another comment). Under these conditions, the measurement time is likely to significantly exceed what would be required for uncorrelated jitter measurements (given proposals to consolidate the distributions of the 12 edges rather than perform 12 individual measurements). However, it seems the key issue is that the test procedure is overly prescriptive. For example, acquiring two (or three) consecutive cycles of the QPRBS13 waveform with sufficient averaging would also allow the measurement of EOJ across the 12 transitions, possibly take less time, and could further be used for transmitter output waveform measurements.

SuggestedRemedy

Generalize the description of the even-odd jitter measurement to enable a wider set of options for implementation. For example, it is not necessary to state that the user should obtain a histogram and calculate the mean time from it. It only needs to be stated that the mean time be measured. Also, if the expected transition times can be computed (as suggested in 92.8.3.8.1), it is not necessary to capture 3 cycles of the PRBS13Q waveform (i.e., 2 will suffice using the method in 92.8.3.8.1).

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.8** *P* **357** *L* **16** # i-88

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **D**

The variance of an estimate of the mean of a normal distribution made from n samples is the variance of the distribution divided by n. An even-odd jitter measurements is a linear combination of 4 such measurements and, assuming the measurement errors are not correlated, the variance of the even-odd jitter measurements is the variance of the uncorrelated jitter distribution times 4/n. Assuming the RMS value of the uncorrelated jitter distribution is 23 mUI (assume a normal distribution even though that is not strictly allowed), the standard deviation of the even-odd jitter measurement (with n=1000) is 23 mUI / sqrt(250) or about 1.5 mUI. Therefore, without even counting other sources of measurement error the +/- 1-sigma value on the even-odd jitter measurements could be about 16% of the specification value. This seems to be a significant error. Therefore, it seems reasonable to ask if the recommendation that at least 1000 samples be used is good advice.

SuggestedRemedy

In 92.8.3.82, it is stated that "The number of acquired samples should be sufficiently large to yield consistent measurement results." It is suggested that similar language be used here rather than provide a fixed number and imply results taken with such a number are "accurate enough".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2** *P* **357** *L* **36** # i-75

Mellitz, Richard — Samtec, Inc.

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

Differential Return loss specified in clause 93 may not be relevant here and should be tied to the COM package model

SuggestedRemedy

annotate an equation for differential return loss. See presentation

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2.1** *P* **358** *L* **6** # i-70

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

Wrong reference 120D.3.1.2 is linearity.

SuggestedRemedy

Change reference to 120D.3.1.5

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2.1** *P* **358** *L* **8** # i-64

Dudek, Michael — Cavium

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

This is a follow up to the un-satisfied comment #118 on draft 2.1 and comment # 49 on draft 2.2. The change to Np from 13 to 200 while calibrating the Interference Tolerance test allows the test system to have bad reflections after 13UI that won't appear in the measurement of TxSNDR (and hence input to TxSNR for the COM calibration). This will overstress the receiver.

SuggestedRemedy

Either use Np =13 for the measurement of the TxSNDR of the test transmitter Replace "The parameter SNRTX is set to the measured value of SNDR" with "The parameter SNRTX is set to the measured value of SNDR with Np=13,
or add an extra very tight specification of SNRisi of 45dB for the test transmitter. (Variations in SNRisi of the test transmitter will cause repeatability issues in the interference tolerance test if not calibrated out by the first solution). Add an extra bullet after a) at line 53 page 357. SNRisi of the test transmitter shall be greater than 45dB.
It was agreed that this is a potential improvement in the comment resolution to D2.2

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2.1** *P* **358** *L* **14** # i-71

Dudek, Michael — Cavium

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

There is an error in equation 120D-9. If sigmaRj=0 Add=J4/2. Putting this into equation 120D-9 does not provide the correct result. Also there is no way that this equation can yield Add=0

SuggestedRemedy

Fix the equation.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2.1** *P* **358** *L* **44** # i-72

Dudek, Michael Cavium

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

There isn't a step 11 in 93C.2 in 802.3-2015, or 802.3by. Also this method is assuming that the FEC symbols are kept to the single lane that is under test. (i.e. FEC lanes and physical lanes are one and the same).

SuggestedRemedy

Change the reference to a new section that describes how to measure the FEC symbol error ratio when only one lane is being stressed. Also reference this section from 120E.3.3.2.1 page 377 line 35 and 120E.3.4.1.1 page 380 line 5

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **360** *L* **4** # i-73

Dudek, Michael Cavium

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

Simulations presented in the 802.3cd task force have shown that the value of COM for 20dB channels varies significantly based on the values of Zc and Rd and that the presently used values do not provide the worst case result. No single set of values is the worst case for all channels. Some channels are showing 0.5dB less COM than the worst case package for that channel. (See http://grouper.ieee.org/groups/802/3/cd/public/adhoc/archive/hidaka_020117_3cd_adhoc.pdf and further as yet unpublished work)

SuggestedRemedy

Change the COM specification for the channel to 3.5dB here while leaving the COM calibration target for the receiver interference tolerance test at 3.0dB.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **360** *L* **18** # i-34

RAN, ADEE Intel

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

The device package model used here has different parameters from the one used in clause 93: lower capacitance value (C_p changed from 150 fF to 110 fF, C_d changed from 250 fF to 280 fF) and better matching to the reference impedance (Z_c changed from 78.2 Ohm to 85 Ohm). This means that the COM calculation assumes other (likely better) device termination than what was used in clause 93.

These values appear as early as D1.1 and seem to be based on a proposal in http://www.ieee802.org/3/bs/public/15_11/healey_3bs_02_1115.pdf (comment #53 against D1.0).

However, the return loss specifications in Table 120D-1 and Table 120D-5 refer back to 93.8.1.4 with no change. Therefore the assumption that device termination is better is not aligned with the device specifications; there is a hole in the budget.

Note that the return loss specifications and their alignment with COM were discussed at length in 802.3bj with multiple contributors and supporters, see:
- http://www.ieee802.org/3/bj/public/sep12/benartsi_3bj_02_0912.pdf
- http://www.ieee802.org/3/bj/public/jan13/mellitz_3bj_01b_0113.pdf
- http://www.ieee802.org/3/bj/public/may13/benartsi_3bj_01a_0513.pdf
- http://www.ieee802.org/3/bj/public/jul13/benartsi_3bj_01_0713.pdf
- http://www.ieee802.org/3/bj/public/mar14/healey_3bj_01_0314.pdf (particularly slide 24)

The proposal in healey_3bs_02_1115 does not discuss device return loss required by the modified parameters, and I am not aware of any evidence or consensus that actual devices meet return loss masks tighter than the ones defined in 93.8.1.4. Therefore, this specification should be kept, and the COM package model has to be aligned with it, otherwise we will be fooling ourselves.

This alignment does not interfere with meeting any of the project objectives so there should be no impact on the project approval.

Note that Z_c is not a parameter in COM (does not appear in Table 93A-1 even as amended by this project).

SuggestedRemedy

Change package model in Table 120D-8 to be aligned with clause 93 and annex 93A:

For C_d, set value to 2.5e-4 nF
For C_p, set value to 1.8e-4 nF
Remove the line with Z_c (not a COM parameter).

Alternatively, keep the new package model and create new and more strict return loss specifications. In that case, Z_c should become a COM parameter (add it to Table 93A-1 and make the 78.2 a default value).

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **360** *L* **18** # i-76

Mellitz, Richard Samtec, Inc.

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

Clause 93 and Annex 83D COM package parameters were the same. I believe this was based on the same device being used in multiple board applications. Using the same argument, Annex 120D package parameter should align with Clause 137 COM parameters.

SuggestedRemedy

Align Annex 120D COM package parameters should align with Clause 137 COM package parameters. That is: set Cd to 1.8e-4 and Zc to 90 and eta_0 1.64e-8

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E** *P* **365** *L* **1** # i-118

Dawe, Piers J G Mellanox Technologie

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

Are there discrepancies between CEI-56G-VSR-PAM4 and Annex 120E for which Annex 120E should change?

SuggestedRemedy

?

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E** *P* **365** *L* **7** # i-5

Brown, Matthew Applied Micro (AMCC)

Comment Type **GR** *Comment Status* **D**

In Annex 120E, the title and text throughout use the generic acronyms 200GAUI-4 and 400GAUI-8 when referring specifically to the chip-to-module version.

SuggestedRemedy

Throughout the annex including the annex title make use of the defined acronym C2M and refer to 200GAUI-4 C2M and 400GAUI-8 C2M as is done in 802.3by-2016 and P802.3cd.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1** *P* **365** *L* **52** # i-77

Mellitz, Richard Samtec, Inc.

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

It has not been shown that insertion loss budget shown in equation 120e-1 will meet the Host and Module eye opening requirements if all Host, Module, and test fixture parameters occur simultaneously

SuggestedRemedy

Either put a note in to that effect or lower the loss to that suggest in ghiasi_3bs xx_0315

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1** *P* **366** *L* **9** # i-94

Ghiasi, Ali Ghiasi Quantum LLC

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

C2M specification can't support 10.2 dB loss given high amount of crosstalk as defiend in CL92 MDI and CL120D like transmitter

SuggestedRemedy

Need to make some key decision here as we can't have a specification with set of recommendation that is nearly impossible to make it work. Here are the options:
Option I- Adjust equation 120E-1 for 7.5 dB loss=0.059+0.4222*sqrt(f)+0.445*f
Option II- Reduce MDI crosstalk MDFEXT=2.8 mV and MDNEXT=0.8 mV
If we want to go with option 1 we could add note that engineered link up to 10.2 dB are possible for lower crosstalk MDI but they are outside the scope of this standard.
See ghiasi adhoc presentation from Feb 20th, 2017 for the full detail

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1** *P* **366** *L* **24** # i-78

Mellitz, Richard Samtec, Inc.

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

It has not been shown that insertion loss budget shown in equation 120e-1 will meet the Host and Module eye opening requirements if all Host, Module, and test fixture parameters occur simultaneously

SuggestedRemedy

Either put a note in to that effect or lower the loss to that suggest in ghiasi_3bs xx_0315

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **369** *L* **17** # i-96

Ghiasi, Ali — Ghiasi Quantum LLC

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

EW at TP1a is 0.22 UI but EW at TP5 is 0.2 UI, if anything the EW at TP1a should be smaller due to much larger package

SuggestedRemedy

Reduce EW from 0.22 to 0.2 UI

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **369** *L* **18** # i-95

Ghiasi, Ali — Ghiasi Quantum LLC

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

To support 10.2 dB need to reduce 32 mV to 30 mV
The TP5 eye opening is 30 mV and given that host ASIC has much large package if anything TP1a should have smaller eye

SuggestedRemedy

If we want to support 10.2 dB then reduce EH to 30 mV
See See ghiasi adhoc presentation from Feb 20th, 2017 for the full detail

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **369** *L* **19** # i-119

Dawe, Piers J G — Mellanox Technologie

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

The host is allowed to output a signal with large peak-to-peak amplitude but very small EH - in other words, a very bad signal. If the module is exactly like the reference receiver, that would work - but that's not a reasonable "if".

SuggestedRemedy

We may need some other spec to protect the module from unexpected signals.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **370** *L* **41** # i-120

Dawe, Piers J G — Mellanox Technologie

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

There is no need for 31 UI offset between lanes. For PRBS13Q, only 1 UI offset is enough to give excellent decorrelation, better than 100-200 UI offset, and there is a spur at about 450 UI. PRBS31Q is believed to behave similarly (but it's such a long pattern I haven't checked). In some test setups, there is a master PRBS generator and an arrangement of splitters and cables; the cables must be kept short for good performance. 31 UI x 7 steps at 26.5625 GBd and 5 ns/m is 1.63 m - too long.

SuggestedRemedy

As the paths between the test points and the host PMA front-end circuitry are not likely to differ by more than 50 mm or about 10 UI, change 31 to 12. Also in 120E.3.3.2.1 Host stressed input test procedure.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **370** *L* **42** # i-121

Dawe, Piers J G — Mellanox Technologie

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

This crosstalk generator is intended to represent a module, and generate broadband energy. The spec allows an implementer to achieve the letter of the spec by using a lot of emphasis but miss the intention.

SuggestedRemedy

This transition time spec should be replaced by a slew time spec, e.g. 4.5 ps between +/- 0.1 V. Definition of slew time similar to transition time but with fixed thresholds instead of the signal-dependent 20% and 80%. Same for the counter propagating crosstalk channels during calibration of the module stressed input signal (120E.3.4.1.1).
We don't need to change the spec for the crosstalk generator in the opposite direction because that's a slower signal so an implementer won't be using emphasis.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.7** *P* **372** *L* **28** # i-103

Maki, Jeffery — Juniper Networks, Inc.

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

Table 120E-2--Reference CTLE coefficients includes values of 8.5 dB and 9.0 dB.

SuggestedRemedy

Limit Table 120E-2--Reference CTLE coefficients to a maximum value of 8.0 dB to align with current OIF CEI-56G-VSR-PAM4 specification. Update Figure 120E-9--Reference continuous time linear equalizer (CTLE) characteristic to use 8.0 dB as the maximum CTLE gain curve.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.2** *P* **373** *L* **50** # i-97

Ghiasi, Ali — Ghiasi Quantum LLC

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

Eye opening at TP4 is not consistent with requirement of 30 mV at TP5. It is nearly impossible to deliver 90 mV at TP4!

SuggestedRemedy

Reduce TP4 EH from 90 mV to 70 mV

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.2** *P* **373** *L* **54** # i-98

Ghiasi, Ali — Ghiasi Quantum LLC

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

Text missing that for given module setting with just going through the CTLE setting the module must deliver required eye opening at TP4 and TP5

SuggestedRemedy

Add text that for given module setting the TP4 and TP5 EH and EW must be met by sellecting just the approporiate CTLE

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.2** *P* **374** *L* **10** # i-122

Dawe, Piers J G — Mellanox Technologie

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

The module output transition time min. spec is there to protect the module's input from too much crosstalk when connected to a host with more NEXT than the MCB. "Too much" doesn't depend on the module's output amplitude setting, so we should have an absolute spec here not a relative one.

SuggestedRemedy

This transition time spec should be replaced by a slew time spec, e.g. 3.5 ps between +/- 0.1 V. Definition of slew time similar to transition time but with fixed thresholds instead of the signal-dependent 20% and 80%.
There is less need to change the transition time spec for the host output because the connector is on the host board, so the NEXT is already in the measurement.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.2.1** *P* **374** *L* **26** # i-123

Dawe, Piers J G — Mellanox Technologie

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

There is no need for 31 UI offset between lanes. For PRBS13Q, only 1 UI offset is enough to give excellent decorrelation, better than 100-200 UI, and there is a spur at about 450 UI. PRBS31Q is believed to behave similarly (but it's such a long pattern I haven't checked). In some test setups, there is a master PRBS generator and an arrangement of splitters and cables; the cables must be kept short for good performance. 31 UI x 7 steps at 26.5625 GBd and 5 ns/m is 1.63 m - too long.

SuggestedRemedy

As the paths between the test points and the PMA front-end circuitry are not likely to differ by more than 20 mm or about 4 UI, change 31 to 6. Also in 120E.3.4.1.1 Module stressed input test procedure.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.2.1.1** *P* **375** *L* **1** # i-91

Healey, Adam — Broadcom Ltd.

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

It was observed in multiple presentations (see <http://www.ieee802.org/3/bs/public/15_09/smith_3bs_01a_0915.pdf> and <http://www.ieee802.org/3/bs/public/16_01/hegde_3bs_01_0116.pdf>) that fixed pre-cursor equalization in the module transmitter was important in closing the chip-to-module link budget. The motivation for <http://www.ieee802.org/3/bs/public/16_05/hegde_3bs_02_0516.pdf>, which serves as the basis for the material in 120E.3.2.1.1, was to ensure the "TX would have to provide the desired precursor component". However, it has since been observed that a transmitter can meet the far-end eye height and width requirements without the pre-cursor component. Given its apparent importance, a more rigorous method for verification is needed.

SuggestedRemedy

Consider specifying that a PRBS13Q waveform be captured at the module output and post-processed using the linear fit procedure described in 120D.3.1.3. It should then be possible to verify that the pre-cursor ISI is within the range expected from the cited link budget analyses. A supporting presentation with specific text will be provided.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **377** *L* **34** # i-65

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

There is no mention of error counters in 119.2.5.3.

SuggestedRemedy

Change "119.2.5.3" to "119.3.1" It was agreed that this is a potential improvement in the comment resolution to D2.2

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1.1** *P* **379** *L* **2** # i-99

Ghiasi, Ali — Ghiasi Quantum LLC

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

Parameters in Table 120E-8 are more strength than TP5 parameters, given large host ASIC package if anything these parmaters should be smaller than TP5

SuggestedRemedy

Reduce ESMW=0.2 UI
Reduce eye width = 0.2 UI
Reduce eye height =30 mV

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1.1** *P* **379** *L* **26** # i-90

Healey, Adam — Broadcom Ltd.

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

It is stated that "for the high loss case, pre-emphasis capability is likely to be required in the pattern generator to meet the TP4a eye height and eye width specifications." It seems like this should be "TP1a" since it is the "crosstalk generator" that is connected to TP4a and it has no eye height/width requirements.

SuggestedRemedy

Change "TP4a" to "TP1a".

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.1** *P* **380** *L* **25** # i-80

Mellitz, Richard — Samtec, Inc.

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

Table 92-13 suggest ICN should be less than a particular value (MDNEXT 1.8 mv, MDFEXT 4.8 mv). That will produce a very large variation of host test results for the same host and different test cards.

SuggestedRemedy

Change table 92-13 to include tight range for ICN for MDNEXT 1.4 mV to 1.6 mV and MDFEXT 4.4 mV to 4.6mV. Or adopted a COM test suggested in mellitz_3bs_02a_1116 with COM parameters specified in mellitz_3cd_01_1116_COM and file config_com_ieee8023_93a=200GAUI-4_and_400GAUI-8_C2M_120e_MTF.xls.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.1** *P* **380** *L* **28** # i-100

Ghiasi, Ali — Ghiasi Quantum LLC

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

Assuming we want to support 10.2 dB channel then need to tighten the MDFEXT and MDNEXT limit of CL 92

SuggestedRemedy

Add Table 92-13 to this section with new limits for crosstalk
MDFEXT=2.8 mV
MDNEXT=0.8 mV
See ghiasi presentation from Feb 20th Adhoc

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.1** *P* **380** *L* **29** # i-124

Dawe, Piers J G — Mellanox Technologie

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

We need mated compliance board specs too.

SuggestedRemedy

Add mated compliance board specs by reference to 92.11.3, but instead of MDFEXT<4.8 mV and MDNEXT<1.8 mV, use the OIF values: ICN<3.9 mV RMS, MDNEXT <1.35 mV RMS, MDFEXT <3.6 mV RMS.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.1** *P* **380** *L* **29** # i-66

Dudek, Michael — Cavium

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

It has been shown in http://grouper.ieee.org/groups/802/3/bs/public/adhoc/elect/30Jan_17/ghiasi_01_013017_elect.pdf that the 5.1mV crosstalk of the mated MCB/HCB significantly affects the measurement of host output eye height.

SuggestedRemedy

Add the following sentence at the end of the paragraph. "The performance of the mated compliance boards is as described in 92.11.3 except that the MDFEXT shall be less than 3.5mV, and the Integrated Crosstalk Noise (ICN) shall also be less than 3.5mV.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.1** *P* **380** *L* **30** # i-125

Dawe, Piers J G — Mellanox Technologie

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

To calibrate the measurements with the MCB, we need the reference loss of the mated compliance boards.

SuggestedRemedy

Add the mated compliance board reference loss, same as 136A.5:
0.471*sqrt(f(GHz))+0.1194*f(GHz)+0.002*f(GHz)^2, for 0.01 GHz <= f <= 25 GHz.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **380** *L* **43** # i-67

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

The target BER is 1e-5. All probabilities in the eye measurement are based on CDF's relative to the number of symbols, and the BER is expected to be only 0.5*symbol error ratio. The criterion is the 1e-5 of the cdf's. There is therefore a factor of two difference between the eye CDF probabilities and the target error ratio. However as the same methodology is used for testing the output and calibrating the input signals this doesn't create a "hole or margin" in the specifications it just makes the Tx specification somewhat tighter and the Rx specification somewhat easier.

SuggestedRemedy

Consider changing all instances of 1e-5 to 2e-5 for the CDF's and probabilities in the eye diagram section.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.7.1** *P* **220** *L* **23** # i-126

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

This PMD transmits up to 500 m at a wavelength between 1304.5 and 1317.5 nm on fibre with a dispersion minimum between 1300 and 1324 nm. The dispersion must be between -0.93 and +0.8 ps/nm. The unit interval is 37.6 ps and the side mode might be 1.5 nm away from the main mode. So if a side mode is not suppressed, it won't cause a problem to the CDR, just look like up to 0.7 ps or 0.02 UI of jitter: small and already included in the TDECQ measurement. There is no need for this very tight wavelength spec AND an SMSR spec for this PMD.

SuggestedRemedy

Delete the SMSR spec or use a more conventional wavelength spec.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.7.1** *P* **220** *L* **34** # i-57

King, Jonathan — Finisar Corporation

Comment Type **T** *Comment Status* **D**

Analysis of measured data (king_3bs_01_0217_smf.pdf) shows that lane by lane transmit disable is not reliably manufacturable with a -20 dBm average power limit for the average power of Off Tx, each lane.

SuggestedRemedy

In Table 121-6 in the row "Average launch power of OFF transmitter, each lane (max)" change the value to -16 dBm. Make corresponding change in Table 121-4.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.7.1** *P* **220** *L* **36** # i-127

Dawe, Piers J G — Mellanox Technologie

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

Requiring an extinction ratio of 4.5 dB restricts the range of transmitter technologies, pushing up the cost of this PMD, and 50GBASE-FR and 50GBASE-LR if they are aligned. Yet it does not benefit the link or the receiver significantly (they are protected by the TDECQ spec, and MPI penalty is a weak function of extinction ratio for PAM4 - very few 100th of dB difference). For an example of a modern direct-mod PMD spec and what a receiver can receive, 100GBASE-SR4 has a 2 dB limit. A transmitter optimized for PAM4 is likely to have a lower extinction ratio than one for NRZ, to reduce distortion.

SuggestedRemedy

Reduce the extinction ratio limit from 4.5 dB to 3 dB.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.7.1** *P* **220** *L* **37** # i-128

Dawe, Piers J G — Mellanox Technologie

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

The purpose of the RIN spec has changed from something to ensure a good transmitter to something to ensure a good TDECQ measurement. The limit should be adjusted for the intended purpose.

SuggestedRemedy

When the way TDECQ handles measured noise and noise enhancement is clear, relax the RIN limits in 121, 122 and 124 according to what is necessary for successful TDECQ measurement

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.1** *P* **222** *L* **12** # i-129

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Tables 121-9, 122-14 124-9, Test patterns, are identical, and likely to stay so. 120E refers to Table 124-9. Table 138-11 and 139-9 are almost identical.

SuggestedRemedy

It would be better to show the table just once, e.g. in Clause 121 because that's the first one. But because the patterns are not PMD-specific anyway, it might be better in e.g. 116.1.5.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.1** *P* **222** *L* **39** # i-130

Dawe, Piers J G — Mellanox Technologie

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

This SSPRQ pattern will give misleading results when testing a range of transmitters - both product transmitters (line 39) and SRS signals (line 44). Same problem in clauses 122 and 124.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty (before and after FEC) with a random payload measures as minimally compliant (i.e. also 0.4 dB penalty) with SSPRQ.
It may be necessary to adjust another seed to get appropriate transition density characteristics.
Similarly in clauses 122, 124.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.4** *P* **223** *L* **9** # i-20

RAN, ADEE — Intel

Comment Type **T** *Comment Status* **D**

The response to comment #49 on D2.1 had the unfortunate effect that the OMA specification is now stated as conditional: "if measured using a test pattern specified..." in all clauses.

The OMA has to be within the specified range regardless of whether it is measured or not.

This applies to 121.8.4, 122.8.4, and 124.8.4.

SuggestedRemedy

Change in all three clauses
FROM:
"within the limits given in Table XXX if measured using a test pattern using specified for OMAouter in Table YYY"
TO:
"within the limits given in Table XXX. OMA_outer is measured using a test pattern specified in Table YYY"

(no change in the table numbers)

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.1** *P* **223** *L* **49** # i-131

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

This says all (8+8) lanes should use the same test pattern, SSPRQ. Generating SSPRQ dynamically is quite complicated, generating 8+8 copies of it with offsets is more complicated, generating 16 copies from memory needs 16 instances or an arrangement of splitters and cables... This seems to be an issue whether using two product PMAs or test equipment. As we may have multi-lane PRBS13Q or PRBS31Q or scrambled idle for other purposes, would it be OK to use them instead?

SuggestedRemedy

Allow alternative patterns such as PRBS13Q or PRBS31Q or scrambled idle on the aggressor lanes as done elsewhere e.g. 120E. Also in 122.8.5.1.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.1** *P* **223** *L* **50** # i-132

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

There is no need for 31 UI offset between lanes. Only 1 UI offset is enough to give excellent decorrelation, better than 100-200 UI, and there is a spur at about 450 UI. 120.5.11.2.3 asks for 31 UI but that's at a PMA and some of that is consumed by lane-to-lane skew before and through the PMD. The paths through the PMD are not likely to differ by more than 10 mm or about 2 UI. Adding a justification so that implementers can't easily evade the spirit of the spec.

SuggestedRemedy

Change "There shall be at least 31 UI delay between the test pattern on one lane and the pattern on any other lane." to "There shall be at least 4 UI delay between the test pattern on one lane and the pattern on any other lane, so that the lanes are not correlated within the PMD."
Similarly in 122.8.5.1.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **6** # i-60

Dudek, Michael — Cavium

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

The change to use the equalized eye for measuring OMAouter creates signficant potential confusion. The defition is for TDECQ but by inference it might be assumed to be used for all OMAouter measurements as the same name is used. If the equalizer were used for other measurements of OMAouter it would effect all the link budgeting because the DC gain of the equalizer depends on the tap weights. On a dispersive channel Tx OMAouter minus Rx OMAouter would not equal the channel loss, because the tap weights would be different for the Tx signal versus the Rx signal.

SuggestedRemedy

Put the gain Cdc into the reference equalizer so that the reference equalizer has 0dB gain at dc.
Replace OMAouter*Cdc with OMAouter in equation 121-9.
Delete lines 1 and 2 on page 228.
add in 121.8.5.4 at line 13. "The reference equalizer contains a gain element with gain Cdc which ensures that the equalizer has unity DC gain for all equalizer settings." Move lines 4 to 9 on page 228 (including equation 121-10) immediately after this.
Alternatively clarify that OMAouter used in TDECQ is not the same as the OMAouter used in measuring the output of the Tx or calibrating the stressed input to the Rx. Change "OMAouter is measured according to 121.8.4 on the equalized signal" to "For this subsection only, OMAouter is measured on the equalized signal according to 121.8.4"

Make the equivalent changes in clauses 122.8.5.4

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **8** # i-133

Dawe, Piers J G — Mellanox Technologie

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

The draft says Pattern 6 (SSPRQ) should be used for TDECQ. But SSPRQ is a short, deliberately stressful pattern and therefore a TDECQ measurement does not give anything like the correct penalty for a range of reasonable compliant transmitters. Same problem in clauses 122 and 124.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty (before and after FEC) with a random payload measures as minimally compliant (i.e. also 0.4 dB penalty) with SSPRQ.
It may be necessary to adjust another seed to get appropriate transition density characteristics.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **9** # i-134

Dawe, Piers J G — Mellanox Technologie

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

This says "...the oscilloscope is set up to capture samples from all symbols in the complete pattern". But with only 1 sample/UI, the record of the high frequency components of the signal would be made up by the instrument and test method, probably inaccurately. For comparison, 120E.4.2, Eye width and eye height measurement method, says "the capture includes a minimum of 3 samples per symbol, or equivalent", but an optical signal is likely to contain more high frequency components than 200GAUI-4, that could be good or bad.

SuggestedRemedy

Add "The capture includes a minimum of seven samples per symbol, or equivalent."

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **9** # i-135

Dawe, Piers J G — Mellanox Technologie

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

I didn't see a statement of whether averaging is used or not. The noise of the signal is an impairment that should be part of the measurement, and a correction is made for the noise of the scope sigma_s in Eq. 121-7. So averaging should not be used.

SuggestedRemedy

State that averaging is not used.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **11** # i-59

King, Jonathan — Finisar Corporation

Comment Type **T** *Comment Status* **D**

TDECQ could be improved: to fix the incorrect noise treatment in Equation 121-7, remove the described use of 'minimum mean square error' to equalize the captured waveform, and show an example of how added noise and equalizer taps must be iterated in order to minimize TDECQ.

SuggestedRemedy

Apply changes shown in king_3bs_04_0217_smf.pdf, with editorial license

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **12** # i-21

RAN, ADEE Intel

Comment Type **E** *Comment Status* **D**

The unqualified "OMA" used four times in this subclause is not defined. There is a definition of "OMA_outer" in 121.8.4 which is mentioned earlier.

As an alternative to the suggested remedy, it is also possible to rename OMA_outer to simply OMA, since no other OMA is defined.

SuggestedRemedy

Change "OMA" to "OMA_Outer" across this subcluase

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **12** # i-137

Dawe, Piers J G Mellanox Technologie

Comment Type **T** *Comment Status* **D**

If we constrain the reference equalizer to maintain OMA, there would be a condition that Cdc = 1. We don't have to; we can let the optimiser choose nearly 1.

SuggestedRemedy

If we do so, add the condition.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **12** # i-136

Dawe, Piers J G Mellanox Technologie

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

Because the selection of samples for optimization depends on the trial equalizer setting, it's not clear that optimizing MMSE then finding TDECQ has an advantage over optimizing TDECQ. Both are iterative, and, optimizing an intermediate thing adds doubt or error.

SuggestedRemedy

Probably we should go back to minimizing the value of TDECQ directly, as in D2.1.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **13** # i-138

Dawe, Piers J G Mellanox Technologie

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

The window for equalizer tuning (the central 0.1 UI of the eye diagram) doesn't match the histogram windows for TDECQ used later. The inconsistency will degrade the measurement (making the result worse, but by an amount that depends on the signal). It costs nothing to make this consistent, even with two histograms. The stats from both histograms should be combined so that there is just one optimized equalizer setting.

SuggestedRemedy

Do the tuning with the histogram windows used later (0.43 to 0.47 UI and 0.53 to 0.57 UI, combined).

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **225** *L* **13** # i-139

Dawe, Piers J G Mellanox Technologie

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

If we continue with MMSE, it should be loaded with the amount of noise that could be added for the TDECQ under test, adjusted for scope noise already in the measurement.

SuggestedRemedy

Either go back to minimizing the value of TDECQ directly, or if we continue with MMSE, add noise loading to the mean square error calculation per comment.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **226** *L* **38** # i-22

RAN, ADEE Intel

Comment Type **T** *Comment Status* **D**

The term "symbol error ratio" is used (along with the "unofficial" acronym) in several places, including within this draft, referring to the _FEC symbol_ error ratio, e.g. with 10-bit symbols. Here it seems to be used for _PAM4 symbol_ error ratio, but it is not stated that this is a different meaning than the usual one.

In addition, there is no definition of what this ratio means; it is actually not something that is measurable in a BER test, but rather a mathematical result.

There is another term, detector error ratio (DER), that is used in several recent clauses when referring to physical receiver (PMD or AUI) decisions, regardless of the modulation. It is defined precisely in 93A.1.7, and it would be adequate to use it here too.

(Note that, contrary to the resopnse to comment #8 against D2.2, the PAM4 symbol error ratio here does not take into account any bursts resulting from receiver implementation; it is purely a result of combination of the measurement statistics and a noise PDF - there is no real receiver involved. Therefore it is equivalent to the "detector error ratio" definition in 93A.1.7. However, in this case it is with additional noise so an explicit definition is preferable.)

SuggestedRemedy

Option 1: Change "symbol error ratio" to "detector error ratio" three times in this subclause. No need to introduce an acronym for this term. After the first occurrence, add a definition: "The detector error ratio is the probability that an ideal detector fails to identify the PAM4 symbol that was transmitted from the signal with the added noise".

Option 2: Change "symbol error ratio" to "PAM4 symbol error ratio", with no acronym, three times in this subclause. After the first occurrence, add a definition: "The PAM4 symbol error ratio is the probability that an ideal detector fails to identify the PAM4 symbol that was transmitted from the signal with the added noise".

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **227** *L* **2** # i-23

RAN, ADEE Intel

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

The sentence "Each element of the cumulative probability function Cf1(yi) is multiplied by a value Gth1(yi), and then summed to calculate an approximation for the partial symbol error ratio (SER) for threshold 1" isn't quite clear.

What is "Each element of the cumulative probability function"? is it each term of the sum? What are the summation limits?

As a service to readers, please write the required calculation required to find the "approximation for the partial symbol error ratio (SER) for threshold 1" in equation form.

I assume the required calculation is

SER_1 = Sigma{y_i=-inf}{y_i=inf}C_f1(y_i)*G_th1(y_i)

SuggestedRemedy

Add a new equation (see comment, correct if necessary).

Replace the sentence "Each element of the cumulative probability function Cf1(yi) is multiplied by a value Gth1(yi), and then summed to calculate an approximation for the partial symbol error ratio (SER) for threshold 1" with a reference to the new equation.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **227** *L* **22** # i-25

RAN, ADEE Intel

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

The noise definitions in the TDECQ calculation mix power and amplitude/RMS terms without clear indication which is which, and seem to include an error in the calculation of C_eq.

The noise R is an RMS value.

C_eq is a noise power enhancement compensation term.

N(w) is power spectral density; S_eq(w) is stated as frequency response, but this term is typically used for H_eq(w), the Fourier transform of the equalizer's continuous-time pulse response (T/2 pulse with energy 1). The noise transfer function is then the absolute square of the frequency response, |H_eq(w)|^2. It is not obvious that this is the intent.

C_dc is an "amplitude" correction term (unlike C_eq which is a power term).

This is very confusing and error prone. It would be useful to clarify which terms are RMS and which are power.

SuggestedRemedy

In line 22 change "The noise, R" to "The RMS value, R, of the noise".

In line 29 change "noise enhancement" to "noise power amplification".

In line 33, change "frequency response S_eq(w)" to "continuous frequency response H_eq(w)".

In equation 121-8, change "S_eq(w)" to "|H_eq(w)|^2".

Consider adding H_eq(w) to the equation definition list after N(w): "H_eq(w) is the Fourier transform of the equalizer's response to a T/2 pulse with energy 1".

Consider eliminating the term C_dc and using the coefficients A_i directly in equation 121-9, to minimize confusion with C_eq.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.3** *P* **228** *L* **9** # i-140

Dawe, Piers J G Mellanox Technologie

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

It may be possible to make a bad transmitter (e.g. with a noisy or distorted signal), use emphasis to get it to pass the TDECQ test, yet leave a realistic, compliant receiver with an unreasonable challenge.

SuggestedRemedy

Define TDECQrms = 10*log10(C_dc*A_RMS/(s*3*Qt*R)) where A_RMS is the standard deviation of the measured signal after the 19.34 GHz filter response and s is the standard deviation of a fast clean signal with OMA=0.5 and without emphasis, observed through the 19.34 GHz filter response (from memory I believe s is about 0.82). Require that TDECQrms shall not exceed the limit for TDECQ. If we think it's justified, we could allow a slightly higher limit for TDECQrms.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.4** *P* **228** *L* **12** # i-155

Hidaka, Yasuo Fujitsu Laboratories of

Comment Type **T** *Comment Status* **D**

Since error is calculated over only the central 0.1 UI of the eye diagram, the sampling interval of error is effectively almost 1.0UI, because error in the remaining 0.9UI is ignored. T/2-spaced FFE is unstable, because error in the remaining 0.9UI is ignored. T/2-spaced FFE will be stable, if error is calculated over the central 0.5 UI of the eye diagram. If we insist on the central 0.1UI of the eye diagram, we should use 0.9T-spaced FFE or T-spaced FFE.

SuggestedRemedy

Option 1: Change T/2-spaced FFE to 0.9T-spaced FFE.

Option 2: Change T/2-spaced FFE to T-spaced FFE.

Option 3: Calcualte the mean square error over the central 0.5 UI of the eye diagram.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5.4** *P* **228** *L* **12** # i-165

Behtash, Saman — Exsilica

Comment Type **T** *Comment Status* **D**

Please consider changing the reference equalizer to a T spaced equalizer.

SuggestedRemedy

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.7** *P* **228** *L* **19** # i-141

Dawe, Piers J G — Mellanox Technologie

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

In this draft (following 52.9.6), square wave is proposed for measuring the signal strength in a RIN measurement procedure. Clause 52 is 10GBASE-S/L/E, an NRZ clause. We should not use square wave here because it isn't PAM4; e.g. any transmitter linearity control circuits may fail because two of the expected PAM4 levels are missing. There is no need to use a special unnatural pattern for this. Using a mixed-frequency pattern is much more convenient and gives a slightly more relevant RIN, closer to SNR, anyway.

SuggestedRemedy

If a RIN spec is needed, define it based on PRBS13Q. All PAM4 optical clauses. Remove square wave for PAM4 from the draft.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.7** *P* **228** *L* **30** # i-142

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

This text "Each lane may be tested individually with the sum of the optical power from all of the lanes not under test being below -30 dBm" seems like it would apply to a WDM PMD, not here. Or is the idea that the output from all optical lanes is coupled into one power meter?

SuggestedRemedy

Delete the item? Also in 124.8.7.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.7** *P* **228** *L* **32** # i-143

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

With a 19.34 GHz front end and an equalizer capable of noise shaping in the reference receiver, and product receivers that must be equalizing too, the -3 dB limit of 26.6 GHz seems wrong. It is likely that real receivers will roll off steeply between the Nyquist frequency and the signalling frequency.

SuggestedRemedy

Change "approximately equal to the signaling rate (i.e., 26.6 GHz)" to "approximately 19.34 GHz". Also in 122.8.7.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.7** *P* **228** *L* **35** # i-144

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

Please add the warning in 52.9.6.

SuggestedRemedy

Add "This procedure describes a component test that may not be appropriate for a system level test depending on the implementation.".

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.9.1** *P* **229** *L* **24** # i-39

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination states: "For example, words such as "ensure," "guarantee," "maximize," minimize," etc., should be modified, if they are inaccurate.

SuggestedRemedy

Change "Baseline wander and overshoot and undershoot should be minimized." to "Care should also be taken to avoid excessive baseline wander, overshoot, and undershoot." Make the same change in 122.8.9.1

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.9.2** *P* **230** *L* **41** # i-145

Dawe, Piers J G — Mellanox Technologie

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

Calibrating the signal for stressed receiver testing with this draft's SSPRQ then testing the receiver with PRBS31Q or scrambled idle won't work because the apparent penalty will be very different with the two patterns. This affects clauses 122 and 124 also.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty (before and after FEC) with a random payload measures as minimally compliant (i.e. also 0.4 dB penalty) with SSPRQ.
It may be necessary to adjust another seed to get appropriate transition density characteristics.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.9.2** *P* **231** *L* **13** # i-146

Dawe, Piers J G — Mellanox Technologie

Comment Type **E** *Comment Status* **D**

The pattern used in this paragraph is not the one used in the previous paragraph. This was stated in an earlier subclause, but it should be mentioned here in this step-by-step procedure.

SuggestedRemedy

Change "Each receiver lane is conformance tested in turn." to "The test pattern is changed from Pattern 6 (SSPRQ) to Pattern 3 (PRBS31Q) or Pattern 5 (scrambled idle) according to Table 121-10 and Table 121-9, and each receiver lane is conformance tested in turn."

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.9.3** *P* **231** *L* **29** # i-40

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination states: "For example, words such as "ensure," "guarantee," "maximize," minimize," etc., should be modified, if they are inaccurate.

SuggestedRemedy

Change "Care should be taken to minimize the noise/jitter introduced by the O/E ..." to "Care should be taken to avoid excessive noise/jitter being introduced by the O/E ..."
Make the same change in 122.8.9.3

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.9.3** *P* **231** *L* **32** # i-38

Anslow, Peter — Ciena Corporation

Comment Type **E** *Comment Status* **D**

The Pre-ballot Mandatory Editorial Coordination states: "For example, words such as "ensure," "guarantee," "maximize," minimize," etc., should be modified, if they are inaccurate.

SuggestedRemedy

Change "apply appropriate guard bands to ensure that the stressed receiver ..." to "apply appropriate guard bands so that the stressed receiver ..."
Make the same change in 122.8.9.3

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.1** *P* **251** *L* **35** # i-148

Dawe, Piers J G — Mellanox Technologie

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

Requiring an extinction ratio of 4.5 dB restricts the range of transmitter technologies, pushing up the cost of this PMD and, unless they do better, 50GBASE-FR and 50GBASE-LR. Yet it does not benefit the link or the receiver significantly (they are protected by the TDECQ spec, and MPI penalty is a weak function of extinction ratio for PAM4 - very few 100th of dB difference). For an example of a modern direct-mod PMD spec and what a receiver can receive, 100GBASE-SR4 has a 2 dB limit. A transmitter optimized for PAM4 is likely to have a lower extinction ratio than one for NRZ, to reduce distortion.

SuggestedRemedy

Reduce the extinction ratio limit from 4.5 dB to 3 dB.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.3** *P* **255** *L* **32** # i-61

Dudek, Michael — Cavium

Comment Type **T** *Comment Status* **D**

The footnote to the channel insertion loss is strange. Saying that it won't support operation at 10km isn't true if the channel insertion loss meets the 6.3dB specification. (which is a normative specification in table 122-17).

SuggestedRemedy

Delete the footnote here and add a footnote to the 6.3 in table 122-17 that says "In order for 400GBASE-LR8 to meet this specification with 10km of fiber using the 0.46dB/km at 1272.55nm attenuation for optical fiber cables derived from Appendix I of ITU-T G.695 the connection insertion loss must be less than 1.7dB."

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.5.3** *P* **259** *L* **12** # i-149

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

As far as I can see, the reference equalizer in 122.8.5.4 is identical to the one in 121.8.5.4

SuggestedRemedy

Change "with the exception that the reference equalizer is as specified in 122.8.5.4." to "with the reference equalizer specified in 122.8.5.4."

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.5.4** *P* **259** *L* **17** # i-156

Hidaka, Yasuo — Fujitsu Laboratories of

Comment Type **T** *Comment Status* **D**

Since error is calculated over only the central 0.1 UI of the eye diagram, the sampling interval of error is effectively almost 1.0UI, because error in the remaining 0.9UI is ignored. T/2-spaced FFE is unstable, because error in the remaining 0.9UI is ignored. T/2-spaced FFE will be stable, if error is calculated over the central 0.5 UI of the eye diagram. If we insist on the central 0.1UI of the eye diagram, we should use 0.9T-spaced FFE or T-spaced FFE.

SuggestedRemedy

Option 1: Change T/2-spaced FFE to 0.9T-spaced FFE.

Option 2: Change T/2-spaced FFE to T-spaced FFE.

Option 3: Calcualte the mean square error over the central 0.5 UI of the eye diagram.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.11.2.2** *P* **266** *L* **10** # i-147

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

The maximum discrete reflectance for SMF has been -26 dB at least since Gigabit Ethernet (1998). Why would we allow worse reflections now?

SuggestedRemedy

Even if the numbers in this draft would work, it may be better to change -25 and -22 to -26, for consistency.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.2** *P* **274** *L* **12** # i-45

Anslow, Peter — Ciena Corporation

Comment Type **T** *Comment Status* **D**

The parameters are defined by 116.3.3.1 through 116.3.3.3. This means that "rx_bit" should be "rx_symbol"

SuggestedRemedy

Change "rx_bit" to "rx_symbol" on lines 12 and 14
Make the same change on page 276, line 50

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.7.1** *P* **297** *L* **16** # i-150

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

This PMD transmits up to 500 m at a wavelength between 1304.5 and 1317.5 nm on fibre with a dispersion minimum between 1300 and 1324 nm. The dispersion must be between -0.93 and +0.8 ps/nm. The unit interval is 18.8 ps and the side mode might be 1.5 nm away from the main mode. So if a side mode is not suppressed, it won't cause a problem to the CDR, just look like up to 0.7 ps or 0.037 UI of jitter: small and already included in the TDECQ measurement. There is no need for this very tight wavelength spec AND an SMSR spec for this PMD.

SuggestedRemedy

Delete the SMSR spec or use a more conventional wavelength spec.

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.7.1** *P* **297** *L* **29** # i-58

King, Jonathan — Finisar Corporation

Comment Type **T** *Comment Status* **D**

Analysis of measured data (king_3bs_01_0217_smf.pdf) shows that lane by lane transmit disable is not reliably manufacturable with a -20 dBm average power limit for the average power of Off Tx, each lane.

SuggestedRemedy

In Table 124-6 in the row "Average launch power of OFF transmitter, each lane (max)" change the value to -15 dBm. Make corresponding change in Table 124-4.

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.7.1** *P* **297** *L* **31** # i-151

Dawe, Piers J G — Mellanox Technologie

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

Requiring an extinction ratio of 5 dB restricts the range of transmitter technologies, pushing up the cost of this PMD, and 100GBASE-DR if it is aligned. Yet it does not benefit the link or the receiver significantly (they are protected by the TDECQ spec, and MPI penalty is a weak function of extinction ratio for PAM4 - very few 100th of dB difference). Depending on technology, a transmitter optimized for PAM4 may need a lower extinction ratio than one for NRZ, to reduce distortion.

SuggestedRemedy

Reduce the extinction ratio limit from 5 dB to e.g. 3 dB.

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.8.1** *P* **299** *L* **27** # i-92

Ghiasi, Ali — Ghiasi Quantum LLC

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

Clock content issue as it has been raised as result of certain PCS combination with certain delay may reduce the nominal PAM4 trasnition density from 0.75 to 0.683, 400GBASE-DR4 receiver need to be tested with mix transition density pattern

SuggestedRemedy

Add pattern 7 "SSPRQ2" then in table 124-10 for stress sensitivity test repalce pattern 6 with pattern 7.
Other less desirable optinon are to reduce TX golden PLL BW from 4 MHz to 2.88 MHz or increase the jitter tolerance corner from 4 MHz to 5.36 MHz, see http://www.ieee802.org/3/bs/public/adhoc/logic/feb16_17/ghiasi_01_0217_logic.pdf

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.8.7** *P* **301** *L* **8** # i-152

Dawe, Piers J G — Mellanox Technologie

Comment Type **T** *Comment Status* **D**

With a 38.68 GHz front end and an equalizer capable of noise shaping in the reference receiver, and product receivers that must be equalizing too, the -3 dB limit of 53.2 GHz seems wrong, as well as expensive. It is likely that real receivers will roll off steeply between the Nyquist frequency and the signalling frequency.

SuggestedRemedy

Change "approximately equal to the signaling rate (i.e., 53.2 GHz)" to "approximately 38.68 GHz".

Proposed Response *Response Status* **O**

Cl **124** *SC* **124.8.9** *P* **301** *L* **28** # i-153

Dawe, Piers J G — Mellanox Technologie

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

If the jitter corner frequency for 26.5625 GBd (NRZ and PAM4) is 4 MHz, shouldn't it be 8 MHz for 53 GBd PAM4? Or at least, the low frequency (sloping) part of the mask should scale with signalling rate, i.e. align if expressed in time vs. frequency. Compare 87.8.11.4 and 88.8.10: 4 MHz for 10.3125 GBd, 10 MHz for 25.78125 GBd.

SuggestedRemedy

Add another exception with a table like Table 121-12 but with the frequencies doubled.

Proposed Response *Response Status* **O**