Cl **120E** *SC* **120E.4.2.1** *P* **254** *L* **50** # 1

Hidaka, Yasuo — Fujitsu Laboratories of

Comment Type **TR** *Comment Status* **X**

The min function in Equation (120E-2) will choose the best value among the upper, the middle, and the lower eyes, because the argument values such as AVupp/Vupp take a lower value for a better eye.

To choose the worst value among three eyes, the max function should be used.

Note: The referenced OIF draft has the same error.

SuggestedRemedy

Change min function in equation (120E-2) with max function.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.1.2** *P* **59** *L* **1** # 2

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **ER** *Comment Status* **X**

CDMII is not a port

SuggestedRemedy

Repalce "port" with "interface"

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 116.1..2 to 116.1.2]

Cl **122** *SC* **122.8.11** *P* **173** *L* **46** # 3

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Laser with strong relaxation will not pass PAM4 eye requirerment so there is no need to implicitly measure receiver upper BW

SuggestedRemedy

Remove receiver 3 dB electrical BW

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.8** *P* **173** *L* **27** # 4

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Transmitter optical waveform need to be measured with a CRU

SuggestedRemedy

The clock recovery unit (CRU) used in the optical waveform measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade. When using a clock recovery unit as a clock for BER measurements, passing of low- frequency jitter from the data to the clock removes this low-frequency jitter from the measurement.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.10** *P* **173** *L* **38** # 5

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Stress receiver sensitivity must tolerate low frequency jitter propagating from the transmitter downstream

SuggestedRemedy

Sinusoidal jitter componnet of stress receiver sensitivity is as following The sinusoidal jitter is used to test receiver jitter tolerance.

The amplitude of the applied sinusoidal jitter is dependent on frequency as specified in Table 87–13 and is illustrated in Figure 87–5.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.6** *P* **189** *L* **41** # 6

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **ER** *Comment Status* **X**

Does not read right "The center frequencies are members of the frequency grid for 100 GHz spacing and above defined in ITU-T G.694.1 and are spaced at 800 GHz."

SuggestedRemedy

Alternate text "The center frequencies grid spacing is 800 GHz, the center frquencies are member of ITU-T G.694.1 defined 100 GHz frequency grid."

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.8.8** *P* **195** *L* **50** # 7

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Transmitter optical waveform need to be measured with a CRU

SuggestedRemedy

The clock recovery unit (CRU) used in the optical waveform measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade. When using a clock recovery unit as a clock for BER measurements, passing of low- frequency jitter from the data to the clock removes this low-frequency jitter from the measurement.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.8.9** *P* **196** *L* **5** # 8

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Stress receiver sensitivity must tolerate low frequency jitter propagating from the transmitter downstream

SuggestedRemedy

Sinusoidal jitter componnet of stress receiver sensitivity is as following The sinusoidal jitter is used to test receiver jitter tolerance.

The amplitude of the applied sinusoidal jitter is dependent on frequency as specified in Table 87–13 and is illustrated in Figure 87–5.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.8.11** *P* **196** *L* **16** # 9

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Laser with strong relaxation will not pass PAM4 eye requirerment so there is no need to implicitly measure receiver upper BW

SuggestedRemedy

Remove receiver 3 dB electrical BW

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.1** *P* **228** *L* **17** # 10

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

OIF MR states reach is 50 cm but in Clause it says 25 cm

SuggestedRemedy

The reach will be 50 cm on improved PCB

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.D.1 to 120D.1]

Cl **120D** *SC* **120D.1** *P* **229** *L* **28** # 11

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Loss for equation is 20.457 dB instead of 20 dB at Nyquist of 13.275 GHz

SuggestedRemedy

Adjust euqation to get 20 dB
L=1.059+2.486*sqrt(f)+0.744*f
It might be helpful to also mention with nominal loss of 20 dB

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **231** *L* **31** # 12

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

No definition of CRU requirement to measure the output waveform and jitter

SuggestedRemedy

Add footnote to table or subection to be referenced
"The clock recovery unit (CRU) used in the optical waveform measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade. When using a clock recovery unit as a clock for BER measurements, passing of low- frequency jitter from the data to the clock removes this low-frequency jitter from the measurement."

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.5.3.1.1 to 120D.3.1.1]

Cl **120D** *SC* **120D.3.3.2** *P* **234** *L* **19** # 13

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Receiver jitter tolerance must test for full range of sinusoidal jiter componnet allowed to propagate down the link by the Golden PLL.

SuggestedRemedy

Replace Table 120-D-6 with Table 87-13 without identifying any specific test cases. Users will choose how many frequencies is required to gurantee interoperability

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.D.3.3.2 to 120D.3.3.2]

Cl **120E** *SC* **120E.1** *P* **241** *L* **2** # 14

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

CEI-28G-VSR-PAM4 is not right reference

SuggestedRemedy

The methodology is actually based on CAUI-4 CL83E with everhting scaled 2x the bit rate

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.E.1 to 120E.1]

Cl **120E** *SC* **120E.1** *P* **241** *L* **18** # 15

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Equation 120-E1 loss is 10.275 dB instead of 10.2 dB

SuggestedRemedy

Here is equation scaled to have loss of 10.2 dB
L=0.0801+0.5736*sqrt(f)+0.6046*f

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.E.1 to 120E.1]

Cl **120E** *SC* **120E.1** *P* **241** *L* **37** # 16

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Stright line loss up to 28 GHz is not representative of real channel under consideration
http://www.ieee802.org/3/bs/public/adhoc/elect/24Aug_15/mazzini_01_082415_elect.pdf

SuggestedRemedy

Need to add break at 18 GHz with same slope as CAUI-4 C2M
L=-22 + 2*f from 18 GHz to 28 GHz

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.E.1 to 120E.1]

Cl **120E** *SC* **120E.3.1** *P* **243** *L* **53** # 17

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Transition time is TBD

SuggestedRemedy

Minimum transition time = 10 ps
Add note between any two PAM levels

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 120.E.3.1 to 120E.3.1 and Page changed from 242 to 243]

Cl **120E** *SC* **120E.3.1.6** *P* **245** *L* **11** # 18

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Transition time is TBD

SuggestedRemedy

Repalce TBD with 12 ps

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 12E.3.1.6 to 120E.3.1.6]

Cl **120E** *SC* **120E.3.2** *P* **246** *L* **18** # 19

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Transition time is TBD

SuggestedRemedy

Repalce TBD with 12 ps

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 12E.3.2.1 to 120E.3.2]

Cl **120E** *SC* **120E.3.1.6** *P* **245** *L* **13** # 20

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Add sub section on the CRU requriements

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade. When using a clock recovery unit as a clock for BER measurements, passing of low- frequency jitter from the data to the clock removes this low-frequency jitter from the measurement.

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 12E.3.1.5 to 120E.3.1.6]

Cl **120E** *SC* **120E.3.2.1** *P* **245** *L* **34** # 21

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Add sub section on the CRU requriements

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade. When using a clock recovery unit as a clock for BER measurements, passing of low- frequency jitter from the data to the clock removes this low-frequency jitter from the measurement.

Proposed Response *Response Status* **W**

Cl **120E** *SC* **120E.3.3.2.1** *P* **247** *L* **54** # 22

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

10 MHz CRU adds extra burden to the host SerDes see
http://www.ieee802.org/3/bs/public/15_09/ghiasi_3bs_01b_0915.pdf

SuggestedRemedy

Replace 10 Mhz with 4 MHz
Also change Table 120E-4 reference to Table 88-13 with Table 87-13

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from 12E.3.3.2.1 to 120E.3.3.2.1]

Cl **120E** *SC* **120E.3.4** *P* **250** *L* **6** # 23

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

Single ended ouptut voltage TBD

SuggestedRemedy

Single output V=VCM + Diff pp Amp/4=2850+900/4=3075 mV

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1** *P* **250** *L* **50** # 24

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **X**

10 MHz CRU adds extra burden to the host SerDes see
http://www.ieee802.org/3/bs/public/15_09/ghiasi_3bs_01b_0915.pdf

SuggestedRemedy

Replace 10 Mhz with 4 MHz
Also change Table 120E-4 reference to Table 88-13 with Table 87-13

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **24** # 25

Gustlin, Mark Xilinx

Comment Type **T** *Comment Status* **X**

The group of alignment markers shall be inserted once every 161920 257-bit blocks, one alignment marker per PCS lane.

161920 is incorrect (distance of 8096 FEC codewarods). Per the adopted baseline, it should be 163840 257b blocks (distance of 8192 FEC codewords).

SuggestedRemedy

Change to:

The group of alignment markers shall be inserted once every 163840 257-bit blocks, one alignment marker per PCS lane.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.4** *P* **97** *L* **41** # 26

Gustlin, Mark Xilinx

Comment Type **T** *Comment Status* **X**

This is incorrect, should be every 8192nd codeword per the adopted baseline.

The first 2056 message bits in every 8096th codeword is the vector am_rx<2055:0> where bit 0 is the first bit received.

SuggestedRemedy

Change to:

The first 2056 message bits in every 8192nd codeword is the vector am_rx<2055:0> where bit 0 is the first bit received.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.1** *P* **84** *L* **41** # 27

Gustlin, Mark Xilinx

Comment Type **T** *Comment Status* **X**

This statement does not accurately reflect the data flow and is not consistent with Figure 119-2:
The PCS deskew process deskews and aligns the individual PCS lanes, removes the alignment markers, forms a single stream, and sets the align_status flag to indicate whether the PCS has obtained alignment. The PCS then processes the FEC blocks, transcodes the data back to 64B/66B, descrambles the data and then decodes the 64B/66B encoded data.

SuggestedRemedy

Change to:

The PCS deskew process deskews, aligns and reorders the individual PCS lanes, forms a single stream, and sets the align_status flag to indicate whether the PCS has obtained alignment. The PCS then processes the FEC codewords, removes alignment markers, descrambles the data, transcodes the data back to 64B/66B, and then decodes the 64B/66B encoded data.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119** *P* **81** *L* **1** # 28

Gustlin, Mark Xilinx

Comment Type **T** *Comment Status* **X**

There are many TBDs around how PCS lanes are formed from Codewords.
There has been consensus building around how to form the lanes.

SuggestedRemedy

Make the changes as detailed in gustlin_3bs_02_1115 on how to form the PCS lanes from codewords.
This includes forming them from two codewords as adopted in Motion #4 from the September 2015 meeting.

Proposed Response *Response Status* **W**

[Editor's note: Page set to 81]

Cl **00** *SC* **0** *P* *L* # 29

Anslow, Pete Ciena

Comment Type **E** *Comment Status* **X**

Many sections of this draft are making changes to clauses that are also being modified by P802.3bw (which has completed Sponsor ballot), P802.3bq, P802.3bn, P802.3bp, and P802.3by which are likely to be approved before P802.3bs.

SuggestedRemedy

Keep the base text of the draft in line with the 802.3 standard as modified by P802.3bw, P802.3bq, P802.3bn, P802.3bp, and P802.3by as they progress. Also, bring in any new instances of text that are added to any of these drafts that require modification for 400G with changes as appropriate.

Proposed Response *Response Status* **O**

Cl **00** *SC* **0** *P* **145** *L* **33** # 30

Anslow, Pete Ciena

Comment Type **T** *Comment Status* **X**

Having chosen to form the PCS lanes by symbol interleaving from two FEC codewords, the BER requirement for all four PMDs could be relaxed to 2.4E-4 (0.1 dB optical penalty) while still only requiring the total BER due to the electrical sub-links to be 3.5E-5 (see anslow_3bs_03_0915). This change was discussed on the SMF Ad Hoc call on 6 October and no objections were raised.

SuggestedRemedy

In 121.1.1, 122.1.1, and 123.1.1, change "2 x 10–4" to "2.4 x 10–4" (in black font).

Proposed Response *Response Status* **O**

Cl **00** *SC* **0** *P* **145** *L* **34** # 31

Anslow, Pete Ciena

Comment Type **T** *Comment Status* **X**

The format of the four D1.0 “Bit error ratio” subclauses follows that of Clause 95 where the additional errors due to CAUI-4 are negligible. For 400G, with 0.1 dB degradation allowed for the electrical link, a PMD that only gives an FLR of 6.2 x 10-11 when processed by Clause 119 FEC will not meet that FLR when additional errors from the electrical sub-links are added. This was discussed on the SMF Ad Hoc call on 6 October and no objections were raised to the principle of the proposed change.

SuggestedRemedy

In 121.1.1, 122.1.1, and 123.1.1, change "6.2 x 10-11" to "9.2 x 10-13" in two places for each subclause (in black font).
Also in each subclause, add the following sentence to the end of the first paragraph: "For a complete Physical Layer, the frame loss ratio may be degraded to 6.2 × 10–11 for 64-octet frames with minimum interpacket gap due to additional errors from the electrical interfaces."

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.2** *P* **170** *L* **22** # 32

Anslow, Pete Ciena

Comment Type **T** *Comment Status* **X**

Table 122-7 contains a row for "Receiver 3 dB electrical upper cutoff frequency, each lane (max)" with value "TBD".
Table 123-8 contains a row for the same parameter with a value of 21 GHz, whereas in Table 88-8 it has a value of 31 GHz (for a 25.8 GBd PMD).
This was discussed on the SMF Ad Hoc call on 6 October with a consensus to remove the parameter from both tables.

SuggestedRemedy

Remove the row for "Receiver 3 dB electrical upper cutoff frequency" from Table 122-7, Table 122-10, Table 123-8, and Table 123-11.
Also, delete subclauses 122.8.11 and 123.8.11.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.3** *P* **171** *L* **2** # 33

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **X**

In Table 122-8 and Table 122-13, there are references to the cabled optical fiber attenuation in dB/km that are TBD. Also, in 122.11.2.1, the loss allocated to connectors is 2 dB in magenta.
This was discussed on the SMF Ad Hoc call on 6 October with a consensus to set the fiber loss to 0.5 dB/km and the connector loss to 2.75 dB (to give a total of 3 dB for the channel insertion loss).

SuggestedRemedy

In Table 122-8 footnote a, change "TBD dB/km" to "0.5 dB/km" (in black font).
In Table 122-13, change "TBD or 0.5" to "0.5" and delete footnote a.
In 122.11.2.1, change "2 dB" to "2.75 dB" (in black font) and change "four connections" to "five connections" (in black font).

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **21** # 34

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **X**

In Table 123-7, the values for "Average launch power, each lane (min)" are magenta. The values of -3 dBm and -2.5 dBm are equivalent to the OMAouter (min) values with infinite ER.
This was discussed on the SMF Ad Hoc call on 6 October with no objection to changing these values to black font.

SuggestedRemedy

In Table 123-7, change the values of -3 and -2.5 for "Average launch power, each lane (min)" from magenta to black.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **23** # 35

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **X**

In Table 123-8, the value for "Damage threshold" is magenta. The value of 5.2 dBm is 1 dB above the value for "Average receive power, each lane (max)".
This was discussed on the SMF Ad Hoc call on 6 October with no objection to changing this value to black font.

SuggestedRemedy

In Table 123-8, change the values of 5.2 for "Damage threshold" from magenta to black.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.1** *P* **87** *L* **27** # 36

Ofelt, David — Juniper Networks

Comment Type **T** *Comment Status* **X**

The document describes the PCS as deleting idles to make room for the alignment markers and/or compensating for clocking differences. Our OTN reference point is higher up in the stack that this, so deleting idles here will violate the concept of an unmolested 64b66b codestream.

SuggestedRemedy

It would be better to change the description to a backpressure-based mechanism. I don't have a suggestion on how exactly to do this… If we end up not changing the description, then we need a note describing the implications of implenting your PCS in the way the standard describes.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.1** *P* **84** *L* **15** # 37

Ofelt, David — Juniper Networks

Comment Type **E** *Comment Status* **X**

The document says "Note that these serial streams originate from a common clock in each direction, but may vary in phase and 15
skew dynamically." It is unclear whether the common clock refers to the upper and lower sides but with independent transmit & receive clocks or if it refers to the transmit and receive clocks being common.

SuggestedRemedy

I think the transmit and receive clocks are independent…

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.3.1** *P* **85** *L* **19** # 38

Ofelt, David — Juniper Networks

Comment Type **E** *Comment Status* **X**

The C, O, T, and Z codes need to have their index numbers subscripted.

SuggestedRemedy

Subscript the numbers

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.3.2** *P* **85** *L* **40** # 39

Ofelt, David — Juniper Networks

Comment Type **E** *Comment Status* **X**

No need to mention that the sync bits always contain a transition since this encoding will never hit the line and may never directly exist.

SuggestedRemedy

Delete the relevant sentence.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.1** *P* **229** *L* **1** # 40

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

It is stated that the 8 differential lanes are AC-coupled but no further description of the properties of the AC-coupling are provided.

SuggestedRemedy

Incorporate the content of 93.9.4 (perhaps by reference).

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.1** *P* **229** *L* **4** # 41

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The reference to the transmitter training mechanism is TBD but the mechanism is explicitly defined in subsequent subclauses.

SuggestedRemedy

Replace "TBD" with "120D.3.1.1 and "120D.3.3.3".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.1** *P* **229** *L* **24** # 42

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

"The normative channel compliance is through chip-to-chip CDAUI-8 channel operating margin (COM)..." seems awkwardly worded.

SuggestedRemedy

Change to: "The channel is normatively defined using channel operating margin (COM) as described in 120D.4."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **230** *L* **41** # 43

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

The second sentence of the paragraph seems unnecessary and may end up being inaccurate as modifications are made to the draft annex.

SuggestedRemedy

Delete the sentence: "While the CDAUI-8 chip-to-chip transmitter requirements are similar to those in Clause 94, they differ in that they do not assume transmitter training or a back-channel communications path."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **231** *L* **22** # 44

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The transmitter equalizer coefficient range and resolution are defined in Table 120D-2 and Table 120D-3.

SuggestedRemedy

In Table 120D-1, replace the rows "Normalized coefficient step size(min)" through "Post-cursor full-scale range (max)" with references to Table 120D-2 and Table 120D-3.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **231** *L* **27** # 45

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

As demonstrated in <http://www.ieee802.org/3/bs/public/15_09/healey_3bs_01_0915.pdf>, the fit of a measured jitter distribution to a dual-Dirac model tends to underestimate bounded uncorrelated jitter (in this case CDJ) and over-estimate random jitter (in this case CRJ) by significant amounts. As a result, limits on the fit components can be onerous (in the case of CRJ) and/or not very meaningful (in the case of CDJ). A direct and more meaningful measurement of the peak-to-peak jitter is possible because of the higher target error ratio. If direct measurement is not possible due to constraints on test time, extrapolation of the peak-to-peak value based on a fit to the dual-Dirac model is acceptable since this will tend to over-estimate the peak-to-peak jitter. Non-Gaussian components of the jitter can bounded via a constraint on the RMS value or a second measurement of the peak-to-peak jitter at a higher probability e.g., 1E-2 (both of which are simple and direct measurements). Finally, measurement of clock-like test pattern is convenient but is unlikely to capture the full extent of the transmitter output jitter. It is better to use a reasonably rich PRBS pattern for the measurement.

SuggestedRemedy

In Table 120D-1, replace the CDJ and CRJ rows with "Output jitter, pk-to-pk (max)" and "Output jitter, RMS (max)". Add a new subclause, e.g., 120D.3.1.2, to define a new output jitter measurement based on PAM4-encoding PRBS13 or similar test pattern (not QPRBS13 as addressed in a different comment). Remove the JP03A test pattern as an optional PMA test pattern (120.5.10.2.1). A presentation will be provided with additional details for the proposed measurement method and requirement.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **231** *L* **28** # 46

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

IEEE 802.3 editorial convention <http://www.ieee802.org/3/WG_tools/editorial/requirements/words.html> is to use "pk-pk" as the abbreviation of "peak-to-peak".

SuggestedRemedy

Replace "pp" with "pk-pk".

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **231** *L* **34** # 47

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The reference 93.8.1.5.1 is incorrect. 94.3.12.5.2 is more appropriate for PAM4 signaling. However, 94.3.12.5.2 specifies QPRBS13 as the test pattern which is not appropriate for 400 Gb/s Ethernet (this is the subject of a comment against 120.5.10.2.3).

SuggestedRemedy

Change to: "The transmitter output equalization is characterized using the linear fit method described in 94.3.12.5.2 with the exception that the [to be named] test pattern is used. The state of the CDAUI-8 transmit output is manipulated via management."

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **231** *L* **37** # 48

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

Since c is a variable, it should be shown in italic text (2014 IEEE-SA Standards Style Manual 15.3).

SuggestedRemedy

Change "c" to italic text here and in similar instances throughout the annex.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.2** *P* **233** *L* **3** # 49

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

"Optional EEE operation" is TBD.

SuggestedRemedy

Since IEEE P802.3bs does not define "deep sleep" for 400 Gb/s Ethernet, remove subclause 120D.3.2.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.3.1** *P* **233** *L* **42** # 50

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The receiver jitter tolerance reqiurements are confusing. Table 120D-4 marks receiver jitter tolerance to be TBD. In 120D.3.3.1, item c) states that sinusoidal jitter is added to the test transmitter by modulating the clock source and Table 120D-5 includes a reference to Table 8-13 (likely intended to Table 88-13). Another receiver jitter tolerance test is defined in 120D.3.3.2.

SuggestedRemedy

There are a number of possible remedies.
1) In Table 120D-4, change the value for the jitter tolerance row to be "Table 120D-6". In 120D.3.3.1, remove item c) and "Applied pk-pk sinusoidal jitter" row from Table 120D-5.
2) In Table 120D-4, remove the "Jitter tolerance" row. In Table 120D-5, change the reference in the "Applied pk-pk sinusoidal jitter" row to be Table 88-13. Remove 120D.3.3.2.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.3.1** *P* **233** *L* **45** # 51

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The tests are normally ordered in terms of increasing insertion loss in receiver interference tolerance parameter tables.

SuggestedRemedy

Swap the test 1 and test 2 values.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **234** *L* **53** # 52

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The Global energy detect function is TBD.

SuggestedRemedy

Since IEEE P802.3bs does not define "deep sleep" for 400 Gb/s Ethernet, remove subclause 120D.3.2.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **235** *L* **17** # 53

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The Channel Operating Margin parameters table is incomplete.

SuggestedRemedy

A presentation will be submitted with suggested values.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **235** *L* **17** # 54

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

In Table 120D-7 Cd, zp, Cb, R0, and Rd are variables and should be shown in italic text (2014 IEEE-SA Standards Style Manual 15.3).

SuggestedRemedy

Change "Cp", "zp", "Cb", "R0" (R only), and "Rd" to italic text here and in similar instances throughout the annex.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.5** *P* **236** *L* **20** # 55

Healey, Adam — Avago Technologies

Comment Type **E** *Comment Status* **X**

Much of this subclause seems redundant (similar text appears in 120D.1 with the exception of the citation of an example).

SuggestedRemedy

Remove 120D.5. Move the sentenence "An example of a possible transmitter equalization tuning process using transmitter equalization feedback is provided in 83D.5." to an appropriate location in 120D.1 (suggest after the sentence "If implemented, the transmitter equalization feedback mechanism described in TBD may be used to identify an appropriate setting.").

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10.2.3** *P* **132** *L* **17** # 56

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

QPRBS13 is not an appropriate test pattern since, unlike the 100GBASE-KP4 PMA, the 400 Gb/s PMA does not include block termination. The definition of QPRBS13 requires every other cycle of the underlying PRBS13 pattern to be inverted. While this is presumably done to ensure DC balance, it can be shown that this is unneccessary and actually makes the DC balance of the resulting PAM4 sequence slightly worse.

SuggestedRemedy

Replace this test pattern with a [to be named] test pattern that is the result of a Gray mapping of the bits output from a PRBS13 pattern generator (where the "A" bit is the first bit output by the generator) to PAM4 symbols.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.3.2** *P* **234** *L* **19** # 57

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

For receiver interference tolerance, the maximum symbol error ratio is defined. In Table 120D-6, the maximum pre-FEC BER is defined.

SuggestedRemedy

In Table 120D-6, remove the "Maximum Pre-FEC BER" row. Add the following sentence to end of the last paragraph of 120D.3.3.2: "The RS-FEC symbol error ratio shall be less than or equal to 1E-5 for each case listed in Table 120D-6."

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.3.2** *P* **217** *L* **49** # 58

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

Since IEEE P802.3bs does not define "deep sleep" for 400 Gb/s Ethernet, remove subclause 120B.3.2.

SuggestedRemedy

Per comment.

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.1** *P* **217** *L* **1** # 59

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

It is stated that the 16 differential lanes are AC-coupled but no further description of the properties of the AC-coupling are provided.

SuggestedRemedy

Incorporate the content of 93.9.4 (perhaps by reference).

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.3.1** *P* **217** *L* **40** # 60

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The BER is TBD. Assuming that CDAUI-16 chip-to-chip is allowed to take advantage of the Forward Error Correction (FEC) in the PCS, a higher bit error ratio can be targeted. If this is the case, then changing only footnote d) of Table 83D-1 is not appropriate since the total uncorrelated jitter value (0.26 UI) is based on target BER of 1E-15. Such jitter would likely be too large for a higher BER target (such as 1E-6).

SuggestedRemedy

Change TBD to 1E-6. Also, in 93.8.1.7 specify that the total uncorrelated jitter (max) value is 0.19 UI as another exception to Table 83D-1.

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.3.3** *P* **218** *L* **2** # 61

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The BER is TBD. Assuming that CDAUI-16 chip-to-chip is allowed to take advantage of the Forward Error Correction (FEC) in the PCS, a higher bit error ratio can be targeted. If this is the case, then target [RS-FEC] symbol error ratio will likely be measured and the COM value increased (in these regards, the scenario has more in common with 100GBASE-KR4 than CDAUI-4 chip-to-chip).

SuggestedRemedy

Change the list of exceptions to include the following: 1) the signaling rate per lane is 26.5625 Gbd +/- 100 ppm, 2) the "Bit error ratio" row in Table 83D-5 is replaced with "Symbol error ratio" and the max values are 1E-5, and 3) the target values for the "COM including effects of broadband noise" row in Table 83D-5 are 3 dB. In addition, notes a) and b) from Table 83D-5 would no longer apply and note a) should actually be replaced with note a) from Table 93-6.

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.4** *P* **218** *L* **13** # 62

Healey, Adam — Avago Technologies

Comment Type **T** *Comment Status* **X**

The DER0 value is TBD. Assuming that CDAUI-16 chip-to-chip is allowed to take advantage of the Forward Error Correction (FEC) in the PCS, a higher bit error ratio can be targeted, the constraints imposed on the decision feedback equalizer (bmax) could be relaxed, and the target COM could be similar to what is used for 100GBASE-KR4.

SuggestedRemedy

Change the list of exceptions to include the following: a) the signaling rate per lane is 26.5625 Gbd +/- 100 ppm, b) DER0 is 1E-6, c) the bmax value is 1 for all n, and d) the minimum COM value is 3 dB.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **249** *L* **16** # 63

Dudek, Mike — QLogic

Comment Type **E** *Comment Status* **X**

Typo

SuggestedRemedy

replace QPRB13 with QPRBS13

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **249** *L* **31** # 64

Dudek, Mike — QLogic

Comment Type **TR** *Comment Status* **X**

QPRBS13 is too short a pattern for this test. The receiver could have significant low frequency issues, pass the test with this pattern and not work in a real system.

SuggestedRemedy

Change QPRBS13 to QPRBS31 Here and also on page 252 line 4.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1.1** *P* **251** *L* **49** # 65

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **X**

The channel attenuation number is the same as for CAUI4, but the host channel loss is 0.2dB higher and the module compliance board will also have a slightly higher loss.

SuggestedRemedy

Change the 13.8dB to 14.1dB (two places) and change the 10.25dB to 10.5dB. (This is making the assumption that the allowance for the host transmitter package loss should be 0.05dB higher at the higher frequency.)

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **252** *L* **35** # 66

Dudek, Mike — QLogic

Comment Type **E** *Comment Status* **X**

There are only two CTLE settings available for the module "any" is not appropriate.

SuggestedRemedy

Change "any single" to "either"

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **253** *L* **10** # 67

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

Duplication of information in the wrong bullet.

SuggestedRemedy

Delete "Apply a 0.25 UI-wide mask centered on TCmid. The 10-6 horizontal opening of the upper eye at VCupp, and the lower eye at VClow must both
extend beyond this mask." in bullet 9 as it is properly included in bullet 10

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.5.4** *P* **149** *L* **35** # 68

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

This global signal detect section is more applicable to a single lane system than a multi lane system.

SuggestedRemedy

Borrow from 100BASE-SR4 changing 4 to 16 lanes where appropriate change Table 121-4 adding "for amy lane" to the 1st row, and "for all lanes" to the 2nd row. (as was done in Table 95-4) On line 9 change "optical signal" to "optical signals on all 16 lanes" on line 36 change "optical signal" to "optical signals"

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.5** *P* **152** *L* **15** # 69

Dudek, Mike QLogic

Comment Type **TR** *Comment Status* **X**

The TDEC test should be adjusted for the different BER for this clause relative to clause 95.

SuggestedRemedy

after 95.8.5.2 add "with the exception that 2.x10^-4 replaces 5x10^-5 and 2.8782R replaces 3.8906R in equation 95-6". It may be worth putting TBC (to be confirmed by these numbers as the target BER may change.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.8** *P* **152** *L* **35** # 70

Dudek, Mike QLogic

Comment Type **TR** *Comment Status* **X**

The stressed receiver sensitivity test needs to be modified due to the different BER target.

SuggestedRemedy

Add after 95.8.8 with the following exceptions. Add the following bullets.
-The signaling rate of the test pattern generator is set to the rate defined in 121.7.2
-When using 95.8.5 to measure the SEC of the stressed receiver conformance test signal a BER of 2e-4 is used in place of 5e-5 and 2.8782R replaces 3.8906R in equation 95-6
-The Hit ratio for the stressed receiver eye mask definition is changed from 5e-5 to 2e-4

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.8.2** *P* **151** *L* **49** # 71

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

Pattern 5 has been modified by 121.8.1 and therefore references to Table 95-10 can cause the use of the wrong pattern.

SuggestedRemedy

Replace "Table 95–10" with "Table 95–10 as modified by 121.8.1" in this subclause and all other subclauses where it is used.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.12.4.5** *P* **160** *L* **42** # 72

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

Is this 16 lane inteface compliant to Hazard Level 1? The PICs doesn't match the TBD in 121.9.2

SuggestedRemedy

Make them match. (Change to TBD unless this 16 lane interface has been shown to be compliant to Hazard Level 1, which seems highly unlikely as 100GBASE-SR4 states level 1M.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.1** *P* **169** *L* **24** # 73

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

There are three different OMA inner values and any differences between them will result in a degraded TDP (TDP is an overall measure of the 4 level eye). We should also align the specification method between clause 122 and 123.

SuggestedRemedy

Delete the row for inner modulation amplitude min. Change the "Launch power in OMAinner minus TDP" to "Launch power in OMAouter minus TDP and increase the value to -0.8dBm. In table 122-7 change the stressed receiver sensitivity to OMA(outer). The informative Receiver sensitivity can stay as OMA inner as it is probably more infomative for comparison with NRZ.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.5** *P* **173** *L* **8** # 74

Dudek, Mike QLogic

Comment Type **TR** *Comment Status* **X**

For a TDP test a well specified reference receiver is required.

SuggestedRemedy

Add another subsection. 122.8.5.2 Reference Receiver. Section to say "The reference receiver has the following properties.
Bandwidth TBD
Equalization TBD
Sampling time each eye TBD
Threshold levels set procedure TBD.

Add a similar subsection as 123.8.5.2

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.3** *P* **170** *L* **44** # 75

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The Power budget (for max TDP) has to equal the launch power in OMA min inner -TDP + max TDP - Receiver sensitivity (OMA inner). It also has to equal the allocation for penalties (for max TDP) + unallocated loss + channel insertion loss. These numbers don't equate properly and the power budget is listed as TBD.

SuggestedRemedy

Replace the TBD for the power budget with 6.15dB. Increase the allocation for penalties for max TDP to 3.15dB. (line 51)

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.1** *P* **171** *L* **24** # 76

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The tests normally performed for NRZ with a square wave pattern are better performed with the "Transmitter linearity test pattern" defined in 120.5.10.2.4

SuggestedRemedy

Replace Square wave pattern with "Transmitter linearity test pattern." with the definition in 120.5.10.2.4

Make the same change to Table 123-10

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.1** *P* **171** *L* **28** # 77

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

A quaternary PRBS13 test pattern has been defined in 120.5.10.2.3 for use as a short repeating pattern in place of PRB9.

SuggestedRemedy

For pattern 4 put Quaternary PRBS13 (QPRBS13) defined in 120.5.10.2.3

Make the same change to Table 123-10.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.1** *P* **171** *L* **24** # 78

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The best pattern to measure OMA and RINxxOMA is the Tx linearity test pattern. defined in 120.5.10.2.4

SuggestedRemedy

Replace Square wave or 4 with Transmitter linearity test pattern on rows, 43, 45, and 50. Also replace the TBD's on page 172 line 9 with the same pattern.

Make the equivalent changes to Table 123-11

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.8.6** *P* **173** *L* **10** # 79

Dudek, Mike QLogic

Comment Type **TR** *Comment Status* **X**

It has always been unfortunate that the test patterns used for extinction ratio and OMA are different for NRZ systems. However history created the issue. Now that we need a new definition for extinction ratio we should take the opportunity to align them.

SuggestedRemedy

Replace "if measured using the methods specified in TBD." with "when calculated using equation new." Equation new to say "Extinction ratio = 10log((OMA level 3)/(OMA level 0))" In table 122-10 replace the pattern for extiction ratio with "Tx linearity test pattern."

Make the equivalent changes to section 123.8.6 and table 123-11

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.11.1** *P* **176** *L* **20** # 80

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

With such a short optical link the fiber attenuation/km max is not critical enough to provide two different values with sources for the numbers.

SuggestedRemedy

Just put 0.5 (dB/km) and delete the two footnotes.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.11.1** *P* **176** *L* **36** # 81

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The 2dB connection and splice loss doesn't match the insertion loss budget.

SuggestedRemedy

Change 2dB to 2.75dB. Change four connections to 6 connections and reduce the average insertion loss per connector to 0.459dB

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.5.8** *P* **189** *L* **12** # 82

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The transmit disable function is optional. There should not be a mandatory method of controlling it. Clause 95 uses "may" in the equivalent section.

SuggestedRemedy

Replace "shall" with "may"

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **35** # 83

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The stressed receiver sensitivy test is unlikely to be testing each inner eye individually and therefore it is more appropriate to be using the OMAouter as the measure for this test. (It is also the OMAouter(min) that is being used as the key parameter for the Tx tests.)

SuggestedRemedy

Change Stressed receiver sensitivity from OMAinner to OMAouter. It is good to leave the informative receiver sensitivity as OMA inner as this is potentially more informative.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.3** *P* **193** *L* **20** # 84

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

When comparing NRZ and PAM4 (or other modulation formats) it is useful to include the modulation penalty as an item in the comparisons but for a power budget in the standard it is more helpful to not include them in the budget as they are inherent. The inaccuracies in the thresholds of the Tx will be captured as part of TDP. Also in this budget there is no allocation for penalties in the Rx as the total allocation for penalties is equal to the TDP value.

We should also make the power budget methodology the same for clauses 122 and 123

SuggestedRemedy

Delete the "allocation for modulation penalties row. Reduce the power budgets from 11, 13.5 to 6.2,8.7. Increase the allocation for penatlies to 2.2, 2.4

Whatever is done from a methodology standpoint make it the same in both clauses.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.11.1** *P* **198** *L* **51** # 85

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

At 2km the difference between these two loss numbers is only 0.08dB. I would have thought that at this reach "outside plant cable" is quite likely to be used and we should therefore find the 0.08dB from within the remaining channel insertion loss budget. There is also a problem in 123.11.2.1 which says the connection insertion loss is only 2dB when it was 3.08dB.

SuggestedRemedy

delete "at 2km for 400GBASE-FR8 or" On page 199 line 7 Change "The maximum link distance is based on an allocation of 2 dB total connection and splice loss. For example,this allocation supports four connections with an average insertion loss per connection of 0.5 dB." to "The maximum link distance for 400GBASE-LR8 is based on an allocation of 2 dB total connection and splice loss. For example,this allocation supports four connections with an average insertion loss per connection of 0.5 dB. The maximum link distance for 400GBASE-FR8 is based on an allocation of 3dB total connection and splice loss."

Proposed Response *Response Status* **O**

Cl **A** *SC* **A** *P* **205** *L* **13** # 86

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The specification name for the OIF development in the editor's note is incorrect and the MR specification is also relevant for chip to chip.

SuggestedRemedy

Change "The OIF CEI-28G-VSR-PAM4 specification is currently being developed by the OIF and is expected" to "The OIF CEI-56G-VSR-PAM4 and CEI-56G-MR specifications are currently being developed by the OIF and are expected" Also change the name on page 241 line 2.

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex" to "A", Subclause changed form "annex A" to "A"]

Cl **120** *SC* **120.1.3** *P* **118** *L* **6** # 87

Dudek, Mike QLogic

Comment Type **E** *Comment Status* **X**

PCSL has not been used prior to this in this clause and the only previous uses in the document are part of boolean variables indicating the PCS lane numbers in clause 119

SuggestedRemedy

Change "PCSL" to "PCS lane (PCSL)"

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.1.4** *P* **118** *L* **53** # 88

Dudek, Mike QLogic

Comment Type **E** *Comment Status* **X**

missing periods.

SuggestedRemedy

Add a period after function. and also after connection on line 54 and page 119 line 29

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.2** *P* **121** *L* **44** # 89

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

There is no need to have two separate footnotes c and d in Figure 120-5 and it could be confusing to try to work out what the difference is (if there is one it isn't obvious)

SuggestedRemedy

Delete footnote d and replace the footnote pointer to d with c.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.2** *P* **122** *L* **12** # 90

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

It is ambiguous here whether lane is PCS lane or physical lane. As there may be skew between PCS lanes introduced in prior PMA's it would be good to alert the reader that the independence of arrival applies to the PCS lanes.

SuggestedRemedy

replace. "each lane" with "each PCS lane"

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.3.4** *P* **126** *L* **37** # 91

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

This should be skew at SP5 not at SP2. However I think there is a problem. THe PMA needs to tolrate this amount of skew whether or not it can be measured or not.

SuggestedRemedy

Delete "so that the skew can be measured at SP2" or at least change SP2 to SP5.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10.2.3** *P* **132** *L* **19** # 92

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The 100GBASE-KP4 training pattern specified in 94.3.10.8 contains additional pre-coding to include termination bits that are not part of the normal 400GBASE-R sequence.

SuggestedRemedy

Replace this training sequence with a more representative sequence such as a QPRBS13 like sequence that does not include this pre-coding such as the one being used in the OIF PAM4 clauses that have been sent in Liasion.

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.3.1** *P* **217** *L* **40** # 93

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

Footnote d is not a BER value it is a probability.

SuggestedRemedy

Change "the BER value" to "the value of the probability "

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **231** *L* **14** # 94

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The referenced equation 93-7 is for the 100GBASE-KR4 channel and therefore it is rather strange to point to it for the transmitter spec, however a more stringent specification like this one is likely to be needed. Also equation 93-8 does not exist. There is a significant likelihood also that these equations will have to change.

SuggestedRemedy

Create local equations and point to them. Copy the equation 93-7 for the differential return loss (no technical change) and copy equations 93-4 as the starting point for the common mode return loss. Extend their frequency range to 20GHz. Change the TC6 and TC7 PICS to match.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1.1** *P* **231** *L* **21** # 95

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **X**

The normalized coefficient step size min and max and pre-cursor and post cursor full-scale ranges are in conflict to section 120D.3.1.1. Singal to noise and distortion is also not part of "output jitter and linearity"

SuggestedRemedy

Use table 83D-1 as a template pointing at tables 120D-2 and 120D-3 for the equalization rows.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.3.1** *P* **233** *L* **43** # 96

Dudek, Mike QLogic

Comment Type **E** *Comment Status* **X**

Table 8-13 is not applicable. Also it is likely that the values for the table that was probably meant, (the equivalent one for CAUI4) will need to be changed, as the allowed Tx jitter has been reduced from the equivalent number for CAUI4.

SuggestedRemedy

Replace "table 8-13" with a local table that has the same contents as table 88-13 but with TBD values.

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.1** *P* **57** *L* **4** # 97

Slavick, Jeff Avago Technologies

Comment Type **T** *Comment Status* **X**

The third paragraph of contains a list of AUI's EEE operates over which is missing CDAUI

SuggestedRemedy

Add CDAUI-n for 400Gb/s to list

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **14** # 98

Slavick, Jeff Avago Technologies

Comment Type **T** *Comment Status* **X**

A new mdio registers were created for the CDAUI-n recommended peaking register, transmitter equalization, which has identical function to the CAUI-4 version (45.2.1.96).

SuggestedRemedy

Remove 45.2.1.116a and rename 45.2.1.96 to support both CDAUI-n and CAUI-4. Update the text to reference appropriate annexes for 400G.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **14** # 99

Slavick, Jeff Avago Technologies

Comment Type **T** *Comment Status* **X**

A new mdio register was created for the CDAUI-n recommended peaking register but only for the first 4 lanes

SuggestedRemedy

Expand the recommended peaking registers to cover all 16 lanes of the CDAUI-16 interface

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.101.1** *P* **0** *L* **0** # 100

Slavick, Jeff Avago Technologies

Comment Type **T** *Comment Status* **X**

FEC bypass indication enable MDIO register is missing

SuggestedRemedy

Bring in 45.2.1.101.1 from 802.3by and add reference to appropriate Clause 119 sub-clause

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.102** *P* **0** *L* **0** # 101

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

RS-FEC status register needs updates

SuggestedRemedy

Bring in 45.2.1.102.2 and update FEC align status, FEC AM lock *, FEC bypass indication to include Clause 119. Create new MDIO register to show the FEC AM lock status of lanes 4-15

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.124** *P* **50** *L* **50** # 102

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The replacement text at the end of the paragraph is repeating the same thing twice. Replace the last 4 sentences with

SuggestedRemedy

For the 400GBASE-R PMA and 100GBASE-KP4 PMA/PMD, the assertion of register 1.1501 bits 8, 9, 10 and 11 operates in conjection with register 1.1501 bit 3. If bit 1.1501.3 is not asserted, then register 1.1501 bits 8, 9, 10 and 11 have no effect. For other PMA/PMD types register 1.1501 bits 8,9,10 and 11 have no effect.

Proposed Response *Response Status* **W**

[Editor's note: Page set to 50]

Cl **45** *SC* **45** *P* **0** *L* **0** # 103

Slavick, Jeff — Avago Technologies

Comment Type **TR** *Comment Status* **X**

PCS receive link status includes 10/40/100BASE-R but is missing 400G

SuggestedRemedy

Add 400 to the list

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.3.6.1** *P* **54** *L* **0** # 104

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

PCS type selection only describes looking at bits 2:0, but 400G has now made it a 4b field (3:0)

SuggestedRemedy

Update the sub-section to refer to the appropriate fields in registers 3.8 and 3.7

Proposed Response *Response Status* **W**

[Editor's note: Page set to 54]

Cl **45** *SC* **45.2.3.9** *P* **0** *L* **0** # 105

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

400G has fast wake but no PCS MDIO register to indicate if feature is available

SuggestedRemedy

Add 400GBASE-R to Table 45-125 and create a new subsection to define the bit

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.3.17** *P* **0** *L* **0** # 106

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Support for Scrambled Idle test pattern should be part of the 400GBASE-R PCS

SuggestedRemedy

Add 400G to the list of rates supporting scrambled idle test pattern

Proposed Response *Response Status* **O**

Cl **120B** *SC* **120B.1** *P* **216** *L* **17** # 107

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Length of a CDAUI should not be included. It could be read that this section only applies to channels of that distance.

SuggestedRemedy

Remove "of approximately 25cm in length" from the last sentence in 120B.1

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2** *P* **84** *L* **35** # 108

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

AM0 is common to all lanes, not repeated within in lane.

SuggestedRemedy

Change "It attains alignment marker lock based on the repeated AM0 value on each one of the PCS lanes."
to "It attains alignment marker lock based on the common AM0 pattern that is trasnmitted on every PCS lane."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2** *P* **84** *L* **35** # 109

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The deskew process is done as part of the post alignment marker routine.

SuggestedRemedy

Change "After alignment markers are found on all PCS lanes, the individual PCS lanes are identified using TBD. The PCS lanes can then be reordered and deskewed."
to "After alignment markers are found on all PCS lanes, the individual PCS lanes are identified using TBD and then re-ordered and deskewed."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4** *P* **87** *L* **36** # 110

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The amount of data needed to added is more then just alignment markers, the pad is there too. You're also pointing to 119.2.4.4 for details on them, have the reader go there to see bit counts

SuggestedRemedy

Remove "120-bit"

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **13** # 111

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Don't want the pad bits to be all 0, or the PRBS to get stuck at 0.

SuggestedRemedy

Change: "The pad bits shall be set to a free running PRBS9 pattern, defined by the polynomial x9 + x5 + 1."
To: "The pad bits shall be set to a (non-zero) free running PRBS9 pattern, defined by the polynomial x9 + x5 + 1."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **9** # 112

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

AM insertion occurs into the Single stream of data, so there aren't any PCS lanes yet. The inserted pattern is done to account for the future PCS lane creation

SuggestedRemedy

Change: "In order to support deskew and reordering of individual PCS lanes at the receive PCS, alignment markers are added periodically to each PCS lane. Each alignment marker is defined as a unique 120-bit block. The alignment markers are insertead as a group, aligned to the ... "
To: "In order to support deskew and reordering of individual PCS lanes at the receive PCS, alignment markers are added periodically for each PCS lane. The alignment marker for each PCS lane is a unique 120-bit block. The alignment markers for all PCS lanes are inserted as a group, aligned to the ..."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **24** # 113

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Adding "one alignment marker per PCS lane" is confusing remove it

SuggestedRemedy

Delete ", one alignment marker per PCS lane"

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **34** # 114

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Missing how to map the AM blocks into the group to account for the symbol distribution method.

SuggestedRemedy

Add a paragraph to 119.2.4.4 to talk about how to form the AM payload to account for RS-symbol distribution so the AM ends up on each physical lane as desired

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.3** *P* **97** *L* **28** # 115

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

Bypass error indicationis not included. This is a very useful feature to reduce latency.

SuggestedRemedy

Add the error indication paragraphs from 91 (with editorial licesnse).
"The Reed-Solomon decoder may optionally provide the ability to bypass the error indication feature to reduce the delay contributed by the RS-FEC sublayer. The presence of this option is indicated by the assertion of the FEC_bypass_indication_ability variable (see X). When the option is provided it is enabled by the assertion of the FEC_bypass_indication_enable variable (see X).

When FEC_bypass_correction_enable is asserted, the decoder shall not bypass error indication and the value of FEC_bypass_indication_enable has no effect.

When FEC_bypass_indication_enable is asserted, additional error monitoring is performed by the RS-FEC sublayer to reduce the likelihood that errors in a packet are not detected. The Reed-Solomon decoder counts the number of symbol errors detected on all four FEC lanes in consecutive non-overlapping blocks of 8192 codewords. When the number of symbol errors in a block of 8192 codewords exceeds K, the Reed-Solomon decoder shall cause synchronization header rx_coded<1:0> of each subsequent 66-bit block that is delivered to the PCS to be assigned a value of 00 or 11 for a period of 60 ms to 75 ms. As a result, the PCS sets hi_ber=true, which inhibits the processing of received packets.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.2.2** *P* **100** *L* **2** # 116

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

amp_valid will only be checking the common (AM0) portion of the AM blocks.

SuggestedRemedy

Change "if the received 120-bit block is a valid alignment marker payload. The alignment marker payload, mapped to an PCS lane according to the porcess described in 119.2.4.4, consists of 120b known bits."
To: "if the received 64-bit block is a valid common marker. See Figure 119-5 and Table 119-1 for the common marker pattern."

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.2** *P* **121** *L* **44** # 117

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

In Figure 120-5, Footnote C is optional, Footnote D is also optional. Don't need both

SuggestedRemedy

Remove footnote c and replace the d reference in Figure 120-5 with c

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.4** *P* **123** *L* **7** # 118

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The skew buffers tolerate or allow for the skew variation, don't need both words

SuggestedRemedy

Change: "buffers are filled to allow tolerating the Skew Variation"
to: "buffers are filled tolerating the Skew Variation"

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5** *P* **124** *L* **5** # 119

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The relationship of baudrate to data rate is solely dependent upon the PAM2 v. PAM4 value and not the PCS lane count.

SuggestedRemedy

Change: "Note that the signaling (Baud) rate is equal to the bit rate when the number of physical lanes is 16 (bits are sent or received on the lanes), and equal to half of the bit rate when the number of lanes is 8 or 4 (PAM4 symbols are sent or received on the lanes)."
To: "Note that the signaling (Baud) rate is equal to
the bit rate when PAM2/NRZ are sent or received on the lane,, and equal to half of the bit rate when PAM4 symbols are sent or received on the lanes."

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.6.1** *P* **128** *L* **13** # 120

Slavick, Jeff — Avago Technologies

Comment Type **T** *Comment Status* **X**

The bit order for gray mapping is {A,B} with A being 1st bit. I believe that's opposite of what is desired. A stream of 00111001 (transmitted right bit first in PAM2) would convert to 0312->0213 (gray) in the current scheme while I would expect it to be 0321->0231.

SuggestedRemedy

Change the two instances of {A,B} to {B,A} in 120.5.6.1

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1** *P* **32** *L* **8** # 121

Marris, Arthur — Cadence Design Syst

Comment Type **E** *Comment Status* **X**

The style manual specifically says (18.2.2) "Replace shall be used only for figures and equations" and "Change shall be used when text and tables are being modified (...) (deletions and instructions) should be indicated".

SuggestedRemedy

Use editing instruction "change" rather than "replace" here.

Proposed Response *Response Status* **O**

Cl **78** *SC* **78.1** *P* **57** *L* **5** # 122

Marris, Arthur — Cadence Design Syst

Comment Type **T** *Comment Status* **X**

Add CDAUI-n to the list of supported interfaces in the third paragraph of 78.1.

SuggestedRemedy

Change first sentence of third paragraph of 78.1 to read:
"EEE supports operation over twisted-pair cabling systems, twinax cable, electrical backplanes, optical fiber, XGXS for 10 Gb/s PHYs, XLAUI for 40 Gb/s PHYs, CAUI-n for 100 Gb/s PHYs, and CDAUI-n for 400 Gb/s PHYs."

Add CADUI-8 and CDAUI-16 to Table 78–1 with a footnote saying that "shutdown is not supported for CDAUI-n"

Proposed Response *Response Status* **O**

Cl **117** *SC* **117.1.7** *P* **72** *L* **13** # 123

Marris, Arthur — Cadence Design Syst

Comment Type **T** *Comment Status* **X**

For fast wake it is the system that is in the low power state rather than the PHY.

SuggestedRemedy

Change:
"when the PHY is in its low power state"
To:
"until the system recovers from its low power state"

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.4** *P* **234** *L* **52** # 124

Marris, Arthur — Cadence Design Syst

Comment Type **T** *Comment Status* **X**

It is not necessary to specify CDAUI shutdown and there is no need for the enrgy detect signal.

SuggestedRemedy

Delete 120D.3.4

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex" to "120D"]

Cl **120B** *SC* **120B.3.2** *P* **217** *L* **49** # 125

Marris, Arthur — Cadence Design Syst

Comment Type **T** *Comment Status* **X**

CDAUI should probably just keep running normally while transporting LPI. The only thing to consider is whether significant power can be saved by allowing a higher BER while transporting LPI.

SuggestedRemedy

Change:
"[Editor's note: As none of the current 400G PMDs support deep sleep, should optional CDAUI-16 shutdown be specified here?]"
To:
"[Editor's note: If significant power can be saved by allowing a higher BER while transporting LPI then consider introducing signalling of the TX_LI and RX_LI states from the PCS to the CDAUI layers and introducing power saving measures when the PCS is in these states.]"

Same applies for 120D.3.2.

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex" to "120B"]

Cl **116** *SC* *P* **59** *L* # 126

D'Ambrosia, John — Independent

Comment Type **ER** *Comment Status* **X**

All named PHYs use "R" as the second letter in the suffix, based on the use of 400GBASE-R encoding. However, -DR4, -FR8, and -LR8 use PAM4 signaling. In the case of 100GBASE-KP4, which uses 100GBASE-R encoding, "P" was used as the second letter in the suffix, and denoted "implementing more than 2-level pulse amplitude modulation (PAM)."

SuggestedRemedy

change the names of the PHYs to the following -
400GBASE-DR4 to 400GBASE-DP4
400GBASE-FR8 to 400GBASE-FP8
400GBASE-LR8 to 400GBASE-LP8

change accordingly throughout the rest of the document.

Proposed Response *Response Status* **O**

Cl **1** *SC* **1.4** *P* **25** *L* **28** # 127

D'Ambrosia, John Independent

Comment Type **ER** *Comment Status* **X**

Defintitions for -DR4, -FR8, and -LR8 do not reflect their PAM-4 modulation

SuggestedRemedy

Change defintions as noted below
1.4.72e 400GBASE-DR4: IEEE 802.3 Physical Layer specification for 400 Gb/s using 400GBASE-R encoding and 4-level pulse amplitude modulation over four lanes of single-mode fiber, with reach up to at least 500 m. (See IEEE Std 802.3, Clause 122.)

1.4.72f 400GBASE-FR8: IEEE 802.3 Physical Layer specification for 400 Gb/s using 400GBASE-R encoding and 4-level pulse amplitude modulation over eight WDM lanes on single-mode fiber, with reach up to at least 2 km. (See IEEE Std 802.3, Clause 123.)

1.4.72g 400GBASE-LR8: IEEE 802.3 Physical Layer specification for 400 Gb/s using 400GBASE-R encoding and 4-level pulse amplitude modulation over eight WDM lanes on single-mode fiber, with reach up to at least 10 km. (See IEEE Std 802.3, Clause 123.)

Proposed Response *Response Status* **O**

Cl **1** *SC* **1.4** *P* **25** *L* # 128

D'Ambrosia, John Independent

Comment Type **ER** *Comment Status* **X**

add definitions for CDMII Extender and CDXS

SuggestedRemedy

add following
CDMII Extender - The 400 Gigaibt Media Independent Interface Extender consists of two CDXS sublayers with a physical instantiation of a CDAUI between them. It is being defined as a mechanism for future 400 Gigabit Ethernet PHYs that will utilizie a PCS sublayer different than Clause 119,

CDXS Sublayer - The 400 Gigabit Extender Sublayer (CDXS) is part of the CDMII Extender (Clause 118). Its functionality is identifical to the PCS Sublayer (Clause 119).

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.5** *P* **66** *L* **30** # 129

D'Ambrosia, John Independent

Comment Type **ER** *Comment Status* **X**

CDMII is defined as 100 Gb/s in Fig. 116-3

SuggestedRemedy

change 100 to 400

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.4** *P* **65** *L* **7** # 130

D'Ambrosia, John Independent

Comment Type **TR** *Comment Status* **X**

Table 116-3 does not include any delay constraints on the CDMII Extender or CDXS. Furthermore, there could be a CDMII based on 16x265 or 8x50 CDAUI. there could be different delay contraints related to the electrical interfaces because of the different signaling.?

SuggestedRemedy

1. Modify entry for 400GBASE-R PCS to 400GBASE-R PCS / CDXS
2. Two options to address the CDMII Extender
2a - add entry for CDMII Extender with all subsequent columns TBD. THere may need to be two table entries for a 16x25 CDAUI and an 8x50 CDAUI
2b - add note that states CDMII Extender includes 2 CDXS, 2 PMA sublayers, and a CDAUI. THere may need to be two table entries for a 16x25 CDAUI and an 8x50 CDAUI.

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "11add" to "116"]

Cl **118** *SC* **118.1** *P* **78** *L* **5** # 131

D'Ambrosia, John Independent

Comment Type **TR** *Comment Status* **X**

As noted, the clause is yet to be completed, but the current direction seems to be causing some issues through the basic architeture defined in the document. THe clause is titled CDMII Extender, but then the first sentence states that it is defining the functional characteristics for the CDMII extender sublayer (CDXS). Per dambrosia_3bs_02b_0115 - the CDXS is a sublayer in the CDMII Extender - not the CDMII. There is no description of the CDXS sublayer in Clause 116.2 summery of 400G Sublayers

SuggestedRemedy

1. Change title of Clause 118 to CDMII Extender and CDXS Sublayer
2. Add column in Table 116-2 for Clause 118 (CDMII Extender / CDXS). Entries for all PHYs to be optional.
3. Add subclause in 116.2 describing CDXS. Proposed Text
The 400 Gigabit Extender Sublayer (CDXS) is part of the CDMII Extender (Clause 118). It is identifical in function to the PCS (Clause 119).

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.2** *P* **170** *L* **27** # 132

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

Condition 1 for Stressed RX sensitivity

SuggestedRemedy

See Presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "7.3" to "122.7.2"]

Cl **122** *SC* **122.7.2** *P* **170** *L* **29** # 133

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

Condition 2 for Stressed Receiver sensitivity

SuggestedRemedy

See Presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "7.3" to "122.7.2"]

Cl **122** *SC* **122.8.1** *P* **171** *L* **24** # 134

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

Test pattern TBD

SuggestedRemedy

See Presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "8.1" to "122.8.1"]

Cl **122** *SC* **122.8.4** *P* **172** *L* **28** # 135

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

Definition of oma inner/outer

SuggestedRemedy

See presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "8.4" to "122.8.4"]

Cl **122** *SC* **122.8.5.1** *P* **172** *L* **44** # 136

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

Optical return loss TBD

SuggestedRemedy

See presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "8.5.1" to "122.8.5.1"]

Cl **122** *SC* **122.8.8** *P* **173** *L* **27** # 137

Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**

TX eye definition

SuggestedRemedy

See presentation

Proposed Response *Response Status* **W**

[Editor's note: Subclause changed from "8.8" to "122.8.8"]

Cl **122** *SC* **122.8.10** *P* **173** *L* **41** # 138
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
TBD for test conditions for RX stressed receiver sensitivity tests

SuggestedRemedy
See Presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "8.10" to "122.8.10"]

Cl **122** *SC* **122.10** *P* **175** *L* **47** # 139
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
Optical return loss TBD

SuggestedRemedy
See Presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "10" to "122.10"]

Cl **122** *SC* **122.11.1** *P* **176** *L* **20** # 140
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
Attenuation at 1304.5nm TBD

SuggestedRemedy
See Presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "11.1" to "122.11.1"]

Cl **122** *SC* **122.7.1** *P* **169** *L* **36** # 141
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
Optical return loss TBD

SuggestedRemedy
See presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "7.1" to "122.7.1"]

Cl **122** *SC* **122.7.1** *P* **169** *L* **40** # 142
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
TX eye mask TBD

SuggestedRemedy
See presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "7.1" to "122.7.1", Page changed from 40 to 169, Line set to 40]

Cl **122** *SC* **122.7.2** *P* **170** *L* **22** # 143
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
Rx 3 dB cutoff frequency

SuggestedRemedy
See presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "7.1" to "122.7.2"]

Cl **122** *SC* **122.7.2** *P* **170** *L* **24** # 144
Palkert, Thomas Molex

Comment Type **T** *Comment Status* **X**
Stressed receiver sensitivity (oma inner)

SuggestedRemedy
See presentation

Proposed Response *Response Status* **W**
[Editor's note: Subclause changed from "7.3" to "122.7.2"]

Cl **45** *SC* **45.2.1** *P* **32** *L* **34** # 145

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

There are no RS-FEC Lanes in 802.3bs. The RS-FEC is an integral part of the PCS , and therefore there are only PC Lanes. Also RS-FEC symbol errors are monitored as part of the PCS. As far as I know there is no way to map RS-FEC symbol errors to specific PMA/PMD lanes, and so any mention of RS-FEC symbol unders should be under the PCS register section.

SuggestedRemedy

Change RS-FEC Lane to PCS Lane. and move any reference of RS-FEC symbol error counts to the PCS register section.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1** *P* **33** *L* **7** # 146

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

The "recommend CTLE value" only applies to CDAUI-16 (16x25G). Similar comment applies to line 9 and line 12.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16. Check for consistency throughtout rest of Clause.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.107** *P* **43** *L* **6** # 147

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

There are no FEC Lanes in 802.3bs. The FEC is an integral part of the PCS. Any registers associated with the RS-FEC should be included in the PCS register section and not the PMA/PMD register section.

SuggestedRemedy

Move any reference to RS-FEC to the PCS register section. Add PCS registers associted with the PCS BER monitor function showin in Figure 119-2.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **16** # 148

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

This section only applies to CDAUI-16.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a.1** *P* **43** *L* **44** # 149

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

This section only applies to CDAUI-16.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **14** # 150

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

This section only applies to CDAUI-16 C2M. There probably needs to be a similar section added to address any registers associated with the CDAUI-8 C2M interface. This interface is adaptive and therefore the register information is likely to be different.

SuggestedRemedy

Add a section to cover the registers associated with adaptive CDAUI-8 C2M interface.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.1.4** *P* **60** *L* **4** # 151

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

In Table 116-2 shouldn't we distinguish between CDAUI-n C2C and C2M clauses, e.g. that Clause 120B is CDAUI-16 C2C and Clause 120C is CDAUI-16 C2M ? ?

SuggestedRemedy

Identify CDAUI-n C2C and C2M Clauses in the table.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.4** *P* **65** *L* **5** # 152

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

In Table 116-3 the maximum delay for the different PMDs seems high. Where do these numbers come from ? The slowest PMD is SR16 with a bit period of 40ps. 2m of fiber is equivalent to 10ns.

SuggestedRemedy

Reduce the PMD maximum delays to 10.48ns.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **9** # 153

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

the alignment marker is also used to

SuggestedRemedy

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **91** *L* **4** # 154

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

Is Table 119-1the format of the alignment markers as they are inserted into the data stream, or the way the should appear on the 16x PCS lanes after the FEC encode and symbol distribution (Figure 119-2)

SuggestedRemedy

I believe this is the format of the alignment markers at the output of the PCS, and it might be worth clarifying this fact.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **21** # 155

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

It is important to make it clear that the reciever has to be able to find the alignment markers in the presence of a high bit error rate. Although the alignment markers are technically covered by the FEC (not sure this is necessary), the recevier has to be able to lock onto them prior to decoding the FEC , and therefore cannot take advantage of the fact that the alignment markers are covered by the FEC.

SuggestedRemedy

Suggest adding some text to make this clear.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **24** # 156

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

"shall be inserted once every 161920 257-bit blocks, one alignment marker per PCS lane". I thought PCS lanes were only created after the FEC encoder and symbol distribution as shown in Figure 119-2. I don't believe there are any PCS lanes at this stage of the description.

SuggestedRemedy

Suggest removing the text "one alignment marker per PCS lane" ..

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **90** *L* **27** # 157

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"There is a portion that is common across all alignment markers, and then a unique portion per PCS lane." It is unclear to me the reason/value for having a common marker and a unique marker.

SuggestedRemedy

Suggest adding some brief text explaining the reason for having a common and unique part. At the end of the day you have to lock onto to the unique part anyway to be able to reoder the PCS lanes, so what value does having a separate common part have ?

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.4.4** *P* **92** *L* **25** # 158

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

Figure 119-6. I giess it isn't clear to me what happens at the bottom right of the figure where the 'zig-zag' is (rows 13-15). What is transmitted in RS symbol 12 for PCS lanes 13,14 and 15 ? I guess the blank does not mean that nothing is transmitted in thos PCS lanes, but that the RS symbol carries normal 257 bit data rather than alignment marker ?

SuggestedRemedy

Suggest clarifying this in the figure. Perhaps use a different shading to show that RS Symbol 12 of PCS lanes 13,14 and 15 contains 'real' 257b data, and is not blank.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.1** *P* **96** *L* **43** # 159

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"The RS-FEC receive function forms 16 bit streams by concatenating the bits from each of the 16 PMA:IS_UNITDATA_i.indication primitives". It reads a little strange and almost like you are somehow chopping the data into 16 bit blocks which I don't beleive is the intentent.

SuggestedRemedy

Suggest adding the word separate as below: "The RS-FEC receive function forms 16 separate bit streams by concatenating the bits from ….."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.1** *P* **96** *L* **47** # 160

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

Suggest changing the text.

SuggestedRemedy

Change the text to read " After alignment marker lock is achieved on each of the 16 lanes (bit streams), inter-lane Skew is removed as specified ….." OR "After alignment marker lock is achieved on all of the 16 lanes (bit streams), inter-lane Skew is removed as specified ..."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.2** *P* **97** *L* **4** # 161

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"The PCS lane number is defined by the alignment marker that is mapped to each PCS lane (see 119.2.4.4)."

SuggestedRemedy

Suggest changing the text to read; "The PCS lane number is defined by the unique portion of the alignment marker that is mapped to each PCS lane (see 119.2.4.4)."

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.5.3** *P* **97** *L* **34** # 162

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

It is not clear to me how the FEC decoder achieves the following "it shall ensure that, for every 257-bit block within the 34 codeword, the synchronization header for all 66-bit blocks at the output of the 256B/257B to 64B/66B 35 transcoder, rx_coded_0<1:0>, is set to 11."

SuggestedRemedy

Procide a description of how this is assumed to achieved. Is it via some kind of in-band signalling , or is it assumed to be out-of-band , or is the exact method left to the implementor and not covered in the standard ? If it is the later it would still be useful to list a couple of examples.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.3** *P* **104** *L* **44** # 163

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

Figure 119-11. Has this figured been modified from the one used in 802.3ba to account for the fact that the alignment marker lock has to be achieved reliably in the presence of a high bit error rate (i.e. pre FEC decoder).

SuggestedRemedy

Please clarify.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.3** *P* **105** *L* **42** # 164

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

Figure 119-13. Where did Figure 119-12 go to ?

SuggestedRemedy

Appear to be missing a Figure, or Figures need to be renumbered.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.3** *P* **105** *L* **42** # 165

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

Figure 119-13. Do we want to add a Hi_BER condition , based on monitoring the preFEC bit error rate, as a condition for dropping out of PCS sync ?

SuggestedRemedy

This is something I have discussed with Dave Ofelt before. Some customer would like to have a user prograammable bit error rate threshold (in this case based on monitoring the FEC) as a condition for causing the PCS to drop out of sync. Perhaps a topic for a future contribution.

Proposed Response *Response Status* **O**

Cl **119** *SC* **119.2.6.2.2** *P* **99** *L* **45** # 166

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

cw_bad_count used in Figure 119-3 is not listed

SuggestedRemedy

Please add a description of the cw_bad_count variable

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.1.3** *P* **118** *L* **6** # 167

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"Adapt the PCSL formatted signal" Is PCSL defined somewhere else. This is the first time I have come across the term in the document.

SuggestedRemedy

Define PCSL.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.1.3** *P* **118** *L* **19** # 168

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

Do we need to mention Grey Coding as a principal function ?

SuggestedRemedy

Add another entry into the list to say something like "Perform Grey coding where PAM4 coding is used for the physical lalnes" OR "Perform Grey coding where the number of physical lanes is 4 or 8"

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.1.4** *P* **118** *L* **54** # 169

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

I think it reads better to list CDAUI-16 before CDAUI-8.

SuggestedRemedy

Swap the order of bullets 2 and 3, i.e. list CDAUI-16 first , followed by CDAUI-8.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.2** *P* **120** *L* **14** # 170

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

Figure 120-3 uses 'm' inputs and 'n'outputs, whereas section 120.1.4 on page 118 talks about "p" inputs and "q" outputs.

SuggestedRemedy

Suggest using consisitent terminology, i.e. either m/n or p/q.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.3** *P* **122** *L* **18** # 171

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

"….cross input lanes, and multiplex PCSLs to output lanes."

SuggestedRemedy

Suggest adding the word 'bit' in front of multiplex. "….cross input lanes, and bit multiplex PCSLs to output lanes."it is important ot make it clear that although the PMA may be dealing with PAM4 symbols on it;'s iterfaces, that any itnernal multiplexing/demultiplexing is peformed at the bit level on the PCS Lane bit streams,and with no knowledge of any PAM4 symbol boundaries.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.2** *P* **121** *L* **46** # 172

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

Shouldn't this functional block diagram also show the optional grey coding/decoding and PAM4 symbol encoding/decoding that is required depending on the number of physical input and output lanes that instantiated ?

SuggestedRemedy

Modify diagaram to show optional grey encoding/decoding and pam4 symbol encoding/decoding, on both p and q interfaces.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.4** *P* **127** *L* **10** # 173

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

"The maximum cumulative delay contributed by up to three PMA stages in a PHY " . What happens if there are more than three stages of PHY ? Is the delay constrint unspecified ?

SuggestedRemedy

Propose replace the phrase "up to three" with "all the", i.e. "The maximum cumulative delay contributed by all the PMA stages in a PHY "

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.4** *P* **127** *L* **21** # 174

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

The maximum delay for the PMA of 92.16ns seems fairy high, given that we recently made a change to the FEC architecture (from serial to parallel fill of the codewords) just to save 12ns !

SuggestedRemedy

Propose tightening up the maximum PMA delay constrint after consulting with PMA chip vendors.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.5** *P* **127** *L* **25** # 175

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

Good section on clocking. However I think it would be useful to add a sentence to state that if the data on a given output lane comes from multiple input lanes (which I assume only happens when # input lanes > # output lanes), that an elastic buffer must be incuded to remove the skew variation (as defined in table 116-5) between the different input lanes before the data is bit mutiplexed onto the output lane.

SuggestedRemedy

Add a note to make it cear that elastic buffers must be used to remove skew variation betweem input lanes, if mutiple input lanes are multiplexed onto a single output lane.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.5.10** *P* **150** *L* **30** # 176

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

"If the PMD has detected a local fault on the transmitter, the PMD shall set PMD_transmit_fault to one"

SuggestedRemedy

Provide some additional calification on 'local fault" ? Does it mean a 64B66B PCS ordered set definiton of local fault or something else ? Given that the PMD does not process 64B66B codewords I suspect it is something else.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.3** *P* **171** *L* **3** # 177

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

The 'allocation for penalties" in Table 122-8 includes a 0.5dB penality for MPI. In the FR8/LR8 PMD specifiations the MPI penality is not called out separately but I believe included in the TDP .

SuggestedRemedy

I am not sure what the right solution is here (either calling out MPI separaltely or including it in TDP), but whatever solution we agree to should be common across DR4, FR8 and LR8.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.11.3** *P* **176** *L* **45** # 178

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

Need to add a diagram to show the optical lane mapping to the MPO-12 connector, similar to Figure 121-4 in Clause 121 for the SR16 PMD.

SuggestedRemedy

Add a figure to show the optical lane mapping to the MPO-12 connector.

Proposed Response *Response Status* **O**

Cl **121** *SC* **121.11.3.2** *P* **156** *L* **26** # 179

Nicholl, Gary Cisco Systems

Comment Type **E** *Comment Status* **X**

The note for description for Figure 121-5 mentions a MPO-16 connector. I believe this is incorrect and it should be an MPO-32 connector.

SuggestedRemedy

Change MPO-16 to MPO-32 in the description of Figure 121-5.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **47** # 180

Nicholl, Gary Cisco Systems

Comment Type **T** *Comment Status* **X**

Is there a reason why the min TDP specification is different between FR8/LR8 (1dB) and DR4 (0.8dB) ?

SuggestedRemedy

If there is no technical reason for the values being different I suggest being consistent across DR4, FR8 and LR8.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.3** *P* **193** *L* **18** # 181

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

The 'allocation for penalities' in Table 123-9 is identical to the max TDP penality sspecified in Table 123-7. I believe this is because the TDP is assumed to include the MPI penality. This is different from the DR4 specification in Clause 122 , where the MPI penality is called out separately from the TDP.

SuggestedRemedy

Suggeest that we come up with a consistent method for addressing MPI across all of the SMF PMDs.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1** *P* **241** *L* **1** # 182

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"The chip-to-module interface is defined using a specification and test methodol- 1
ogy that is similar to that used for CEI-28G-VSR-PAM4 defined in OIF-CEI-03.x [Bx1]."
Shouldn't the reference be to CEI-56G-VSR-PAM4 and not CEI-28G-VSR-PAM4

SuggestedRemedy

Change "28G" to "56G"

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **244** *L* **1** # 183

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

How do you measure the BER of the indivudal PAm4 eyes ? Isn't the only think you can measure the BER of the aggregate PAM4 signal ?

SuggestedRemedy

Please provide some clarification as to how this shsould be measured.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **252** *L* **34** # 184

Nicholl, Gary — Cisco Systems

Comment Type **E** *Comment Status* **X**

"For modules, any single CTLE setting as described in 120E.3.2.1.1…."

SuggestedRemedy

Replace "modules" with "module compliace" so that the sentence now reads "For module compliance, any single CTLE setting as described in 120E.3.2.1.1. This makes it consistent with the host compliance sentence on line 36.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1** *P* **240** *L* **10** # 185

Nicholl, Gary — Cisco Systems

Comment Type **T** *Comment Status* **X**

There is absolutely no mention in this Clause that the module should use an adaptive CTLE equalizer.

SuggestedRemedy

Even if it is not necessary as part of the normative specifiation, I think there should at be an informative note stating that it is assumed the the module shall use an adaptive CTLE equalizer, and that the mdoule shall not rely on the host to provide any information on the CTLE settings.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.1** *P* **230** *L* **10** # 186

Tooyserkani, Pirooz — Cisco Systems

Comment Type **T** *Comment Status* **X**

ILD is not specified for the Chip-to-Chip interface IL plot or table. PAM4 signal is more sensitive to ISI than NRZ

SuggestedRemedy

Add ILD number either in ILDrms figure or mask in the IL plot

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.4** *P* **235** *L* **10** # 187

Tooyserkani, Pirooz — Cisco Systems

Comment Type **T** *Comment Status* **X**

No ILD parameter in the COM table

SuggestedRemedy

Add ILD figure in the table

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.2** *P* **242** *L* **10** # 188

Tooyserkani, Pirooz — Cisco Systems

Comment Type **T** *Comment Status* **X**

ILD is not specified for the Chip-to-Module interface IL plot or table. PAM4 signal is more sensitive to ISI than NRZ

SuggestedRemedy

Add ILD number either in ILDrms figure or mask in the IL plot

Proposed Response *Response Status* **O**

Cl **120C** *SC* **120C.3.4** *P* **224** *L* **5** # 189

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

Adaptive equalization for the CDAUI-16 receiver is not included explicitly in the body of Clause 120C although it is included in the PICS.

SuggestedRemedy

As adopted in P802.3by Clause 109B.3.4, add "Channel equalization is provided by an equalizer in the module which uses the reference CTLE setting provided by the host or an adaptive equalizer in the module which does not use the setting provided by the host."

Proposed Response *Response Status* **O**

Cl **120C** *SC* **120C.5.3** *P* **226** *L* **11** # 190

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

Item ADR does not mention equalization when adaptive is really describing the behavior of the equalizer. This item in the PICS should be about adaptive equalization.

SuggestedRemedy

Change "ADR" to "ADE" and change "Adaptive receiver" to "Adaptive equalizer." This suggested remedy aligns with that adopted by P802.3by for 109B.5.3.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4** *P* **249** *L* **37** # 191

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

There is no text describing Adaptive CDAUI-8 receiver equalization.

SuggestedRemedy

Similar to what was adopted in P802.3by for Clause 109B.3.4, add to end of first paragraph "Channel equalization is provided by an adaptive equalizer in the module."

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.5.3** *P* **257** *L* # 192

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

There is no item to cover the major capability of Adaptive Equalizer, which is mandatory.

SuggestedRemedy

Add the following.

Item: ADE
Feature: Adaptive equalizer
Subclause: 120E.3.4
Value/Comment: See 120E.3.4.
Status: M
Support: Yes [ ] No [ ]

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1** *P* **33** *L* **7** # 193

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

Table 45-3. For Register address 1.499, the Register name should be CDAUI-16 chip-to-module recommended CTLE, since CDAUI-8 chip-to-module does not use recommended CTLE. CDAUI-8 chip-to-module only uses Adaptive Equalization.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **14** # 194

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

This subclause pertains only to CDAUI-16, so title of this subclause should use CDAUI-16 and not CDAUI-n.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **19** # 195

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

Table 45–90a. This table only pertains to CDAUI-16 and not CDAUI-8. The name of the table should be "CDAUI-16 chip-to-module..."

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a** *P* **43** *L* **44** # 196

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

Table 45–90a. CDAUI-16 chip-to-module recommended CTLE register bit definitions need to be per lane and not per module. The 16 lanes are likely to be sufficiently different that a common value will not be valid. CDAUI-8 uses only Adaptive Equalization, so this register does not pertain.

SuggestedRemedy

Expand register to cover all 16 lanes.

Proposed Response *Response Status* **O**

Cl **45** *SC* **45.2.1.116a.1** *P* **43** *L* **44** # 197

Maki, Jeffery — Juniper Networks

Comment Type **TR** *Comment Status* **X**

This subclause only pertains to CDAUI-16. CDAUI-8 only uses Adaptive Equalization.

SuggestedRemedy

Replace CDAUI-n with CDAUI-16.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.1.1** *P* **242** *L* **3** # 198

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

As this annex deals in PAM4 symbols, there isn't a bit error ratio unless we define one. As a PMA may split up and rearrange the symbols before the signal gets to a PCS or pattern checker, measuring PAM4 symbol error ratio isn't convenient.

SuggestedRemedy

For this and similar situations (400GBASE-DR4, 400GBASE-FR8, 400GBASE-LR8, Chip-to-chip CDAUI-8), define bit error ratio as the bit error ratio after PAM4 decoding/Gray (de)mapping.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **243** *L* **53** # 199

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

The C2M CAUI-4 host output 20% to 80% transition time min is 10 ps. Here for C2M CDAUI-8, the signalling rate is a little higher, the transmitter should be a little faster and may be using some FFE to get a reasonable opening of a multilevel eye. The compliance board is the same. So a lower limit should apply. On the other hand, the host output already contains most of the channel impairments from the connector, so it would be surprising if a very fast host output would ever be a worst case. We need to review the reflection specs before finalising this.

SuggestedRemedy

Change magenta TBD to magenta 9, or delete the row. Update the PICS.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.3** *P* **244** *L* **42** # 200

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

As PAM4 is affected (Tilde)3x as much by reflections as NRZ, we should see if there is an opportunity to improve the return loss specs. Both product and compliance boards may have improved since 802.3bj.

SuggestedRemedy

Consider tightening the return loss specs by a couple of dB, closer to CEI-28G-VSR. Possibly the module can do this easier than the host.
Including 120E.3.3.1

Proposed Response *Response Status* **W**

[Editor's note: Tilde character replaced by (Tilde) in Comment text.]

Cl **120E** *SC* **120E.3.1.5** *P* **244** *L* **50** # 201

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Need to say what transition time we are talking about, or change PAM4 to NRZ ;)

SuggestedRemedy

Say that we are specifying isolated edges from 0 to 3 and from 3 to 0. Say where they are found in our preferred medium-length pattern (QPRBS13 or similar).

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **245** *L* **8** # 202

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

QPRBS13 isn't described in 92.2.9.3. 94.2.9.3 points to 94.3.10.8, which describes a PRBS13 with termination bits, Gray coded, precoded, PAM4 coded. In this project we don't have termination bits or precoding.

SuggestedRemedy

Use a PRBS13 with just Gray coding and PAM4 coding. This could be defined in 120.5.10 or e.g. 123.8.1.
Similarly in 120E.3.3.2, 120E.3.4.1.1.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **246** *L* **18** # 203

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **X**

The minimum module output transition time in CEI-28G-VSR is 9.5 ps. Here for C2M CDAUI-8, the transmitter should be a little faster and may be using some FFE to get a reasonable opening of a multilevel eye, so a lower limit should apply. C2M CAUI-4 set the limit slower to match the signal through pair of mated compliance boards; as the loss in a module can be much less than the HCB loss, this constrains the module to be slower (=worse, usually) than it need be. See another comment for what to do about the crosstalk calibration.

SuggestedRemedy

Change magenta TBD to magenta 7.5 ps.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **247** *L* **54** # 204

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Not sure what the reference CDR bandwidth for PAM4 should be.

SuggestedRemedy

For now, make the "10 MHz" magenta (3 places in 120E, 1 in 121.3.2, 1 in 123.3.2).
For now, make the references to Table 88-13 magenta (Table 120E-4, Table 120E-7).

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **249** *L* **11** # 205

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

Even-odd jitter as defined in 92.8.3.8.1 uses PRBS9. It would be convenient to be able to use QPRBS13, as for eye height, eye width measurements. It looks like it should work. Measuring just the zero crossings (ignoring upper and lower eyes) should be enough.

SuggestedRemedy

Allow use of QPRBS13, measuring just the zero crossings, for even-odd jitter.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **249** *L* **28** # 206

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

Test vertical eye closure should be revised to align with Table 120E-2 CDAUI-8 module output, max 5.8 dB, as was done in CEI-56G-VSR-PAM4.

SuggestedRemedy

Change "4.8 dB to 5.8 dB with a target value of 5.3 dB" to "5.3 dB to 6.3 dB with a target value of 5.8 dB".

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **249** *L* **31** # 207

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

We wouldn't use a medium-length pattern like QPRBS13 for a sensitivity test if we don't have to. We should use a long pattern: CAUI-4 uses Pattern 5 (with or without FEC encoding), Pattern 3, or a valid 100GBASE-R signal, CEI-56G-VSR-PAM4 uses QPRBS31. We should allow the use of existing test equipment (which test binary signals and can handle PRBS31) and/or a PCS for checking.

SuggestedRemedy

Change "QPRBS13, or a valid 400GBASE-R signal" to "Pattern 5 (with or without FEC encoding), Pattern 3, or a valid 400GBASE-R signal".
(Pattern 5 is scrambled idles. Pattern 3 is PRBS31, which if generated on the /16 lanes will be converted by the PMA(s) to QPRBS31 on the /8 lanes.)
Similarly in 120E.3.4.1.1.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4** *P* **250** *L* **6** # 208

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

Single-ended voltage tolerance range should be either -0.4 to 3.3 V, as in Table 83E-7 CAUI-4 module input, or possibly -0.45 to 3.35 V (Table 120E-1+/- 50 mV) if we think Table 83E-7 is wrong. If the 50 mV is for large module or card supply currents, they won't be seen in calibration at TP1a: the module can create them at its own risk.

SuggestedRemedy

Change TBD to -0.4 to 3.3 V.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1.1** *P* **251** *L* **20** # 209

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

The target pattern generator 20% to 80% transition time in the module stressed input test should be just the same as for C2M CAUI-4 if we allow a similar pattern generator and define transition time the same way. Although the PAM4 product might be faster than CAUI-4, we don't need the pattern generator to be faster. Also, we should say where this is measured. A convenient place which seems in line with 802.3bj practice would be at an equivalent TP0a,~1.35 dB at 12.89 GHz after the output of the patten generator, as described in 93.8.1.1 Transmitter test fixture. (for test equipment, this loss would be SMA cables between pattern generator and scope, rather than a PCB). Our choice of measurement point would affect the target pattern generator transition time.

SuggestedRemedy

Change magenta TBD ps to magenta 9.5 ps. Alternatively, use the limit for the host output (8 ps). Also, we should say where this is measured. A convenient place would be at an equivalent TP0a, (Tilde)1.35 dB at 12.89 GHz after the output of the patten generator, as idescribed in 93.8.1.1 Transmitter test fixture (for test equipment, this loss would be SMA cables between pattern generator and scope, rather than a PCB). Our choice of measurement point would affect the target pattern generator transition time.

Proposed Response *Response Status* **W**

[Editor's note: Tilde character replaced by (Tilde) in Suggested Remedy text.]

Cl **120E** *SC* **120E.4.2** *P* **252** *L* **31** # 210

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

In NRZ there are 2 levels, in PAM4 there are 4. So we have only half as many samples for each. Also, a change in the spec BER in 120E.1.1 would affect the number of samples we need.

SuggestedRemedy

Change "at least 4 million bits" to "at least 8 million bits".

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **254** *L* **1** # 211

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

The eye width spec is not always 0.25 UI.

SuggestedRemedy

Replace the fixed 025 UI with a reference to the appropriate table.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **254** *L* **2** # 212

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

The 10^-6 horizontal opening of the upper eye at VCupp, and the lower eye at VClow must both extend beyond this mask. But according to the baseline, this applies to the middle eye too, and I didn't see that.
Editorial: openings plural, extra "of"s.

SuggestedRemedy

Change to "The 10^-6 horizontal openings of the upper eye at VCupp, of the middle eye at zero and of the lower eye at VClow must all extend beyond this mask.
Update Figure 120E-12.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **253** *L* **13** # 213

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

Figure 120E-12 makes Figure 120E-11 redundant.

SuggestedRemedy

Use just one figure.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2.1** *P* **254** *L* **50** # 214

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

"VEC=10.log10(min(AV/V...))" for an output spec this should be max.
It would be more useful to define VEC=10.log10(sum(AV)/3*min(V)), to protect the receiver from unequal eyes.
Notice that sum(AV) is simply the mean 3 in the central 5% of the eye minus the mean 0 in the central 5%.
For an input test we want all three VECs to be right (adjust what to do this?)

SuggestedRemedy

Define VEC=10.log10(sum(AV)/3*min(V)). Consider how to control the stressed signal to get the three eyes right.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.3.2.1** *P* **247** *L* **53** # 215

Dawe, Piers — Mellanox

Comment Type **ER** *Comment Status* **X**

stress signal

SuggestedRemedy

stressed signal, as in 83E.3.3.2.1.
Bring the draft into line with the corrections and improvements made in P802.3bx. All clauses and annexes as needed.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.4.2** *P* **252** *L* **48** # 216

Dawe, Piers Mellanox

Comment Type **ER** *Comment Status* **X**

"construct the CDF of the signal voltage of the middle eye at time TCmid" could take a very long time with an equivalent-time scope that samples evenly across the eye, and doesn't represent a realistic receiver with tolerances. Use a 5% window as for CAUI-4.

SuggestedRemedy

Change to "construct the CDF of the signal voltage of the middle eye within 0.025 UI of time TCmid"

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.4.1.1** *P* **252** *L* **5** # 217

Dawe, Piers Mellanox

Comment Type **ER** *Comment Status* **X**

Don't use inconsistent terminology.

SuggestedRemedy

Change "The module CDAUI-8 receiver under test" to "The module under test"

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.1** *P* **169** *L* **34** # 218

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **X**

As 38.6.4 said in 1998, and 52.9.6, "This procedure describes a component test which may not be appropriate for a system level test depending on the implementation", which is why some clauses have made it informative or omitted it altogether. If RIN is bad enough to matter, it will contribute to TDP or TDEC, which is going to be a required spec anyway and with FEC, is practical to measure. Measuring RIN is just repeating most of the same work for no clear benefit except for diagnostics, which is not what an 802.3 spec is for. We can't set a RIN limit well until we have an idea of the reference receiver.

SuggestedRemedy

Turn all the row magenta for now.

Proposed Response *Response Status* **O**

Cl **122** *SC* **122.7.1** *P* **169** *L* **16** # 219

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **X**

SMSR isn't in the baseline so should not be in the draft, except possibly as an editor's suggestion in magenta or in an editor's note.
SMSR might be a spec that one would buy lasers to but this is an interface level spec, and the effects of SMSR are captured in TDP (or TDEC). Of the many SMF optical clauses, only 87, 88, 89 have this spec. Measuring SMSR would require a high-grade optical spectrum analyser that is not otherwise needed, and this is supposed to be a cost-effective relatively short-range PMD.
We don't know what value would be appropriate; the common value is for NRZ PHYs with no FEC.

SuggestedRemedy

Delete the SMSR spec.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **38** # 220

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

As 38.6.4 said in 1998, and 52.9.6, "This procedure describes a component test which may not be appropriate for a system level test depending on the implementation", which is why some clauses have made it informative or omitted it altogether. If RIN is bad enough to matter, it will contribute to TDP or TDEC, which is going to be a required spec anyway and with FEC, is practical to measure. Measuring RIN is just repeating most of the same work for no clear benefit except for diagnostics, which is not what an 802.3 spec is for. We can't assess this proposed RIN limit until we have an idea of the reference receiver.

SuggestedRemedy

Delete the row, or turn all of it magenta for now.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **16** # 221

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **X**

SMSR isn't in the baseline so should not be in the draft, except possibly as an editor's suggestion in magenta or in an editor's note.
SMSR might be a spec that one would buy lasers to but this is an interface level spec, and the effects of SMSR are captured in TDP (or TDEC). Of the many SMF optical clauses, only 87, 88, 89 have this spec. Measuring SMSR would require a high-grade optical spectrum analyser that is not otherwise needed.
It's difficult to do an SMSR measurement with the WDM multiplexer in place. We don't know what value would be appropriate; the common value is for NRZ PHYs with no FEC.

SuggestedRemedy

Delete the SMSR spec.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.1.1** *P* **183** *L* **47** # 222

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

If PMD service interface is symbol based, there is no BER at that point. Need to rephrase as the BER that would be found after PAM4 decoding and Gray (de-)mapping. This is more practical than using or symbol error ratio because we can use existing pattern checkers on the /16 lanes after a PMA function.

SuggestedRemedy

For this and similar clauses and annexes, define BER as the BER that would be found after PAM4 decoding and Gray (de-)mapping.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.2** *P* **184** *L* **49** # 223

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

"data streams" is more vague than "bit streams" used in NRZ clauses, and falls foul of the way the MAC divides the signal into data and not-data portions and the PCS divides it into data blocks or control blocks. 116.3 says "independent streams of data units", so does 80.3.1. 94.3.1.1 has "four parallel continuous streams of encoded symbols, tx_symbol, one stream for each lane. Each of the tx_symbol parameters can take one of four values: –1, –1/3, +1/3, or +1... four parallel symbol streams... four streams of data units... four parallel continuous streams of encoded symbols, one stream for each lane. Each of the rx_symbol parameters can take one of four values: –1, –1/3, +1/3, or +1... four parallel encoded symbol streams.

SuggestedRemedy

At lines 49 and 53 and in 123.5.2 and 123.5.3, change "data streams" to "streams of PAM4 symbols" to be consistent with all those NRZ clauses. At line 47, change "data streams" either to "streams of PAM4 symbols" or to "streams of data units".
Similarly in Clause 122.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.2** *P* **188** *L* **23** # 224

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

"Optical power at TP3 >= receiver sensitivity (OMAinner)" is ambiguous: what measure of optical power on the LHS if the RHS is in OMA? Monitoring OMA for a PAM4 signal seems too onerous.

SuggestedRemedy

Consider changing to match the last optical clause we signed off, after much review, which has:
Optical power at TP3 >= average receive power, each lane (min) in Table 95-7
So,
Optical power at TP3 >= average receive power, each lane (min) in Table 123-8

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **23** # 225

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Outer Optical Modulation Amplitude (OMAouter), each lane (max)

SuggestedRemedy

Might be more follow useful to specify the peak-to-peak amplitude, as in the eye mask test (without an equalizer).

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **33** # 226

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

TDP needs a reference transmitter and a reference receiver. This looks like it needs an equalizing reference receiver. Getting an accurate equalizing reference receiver looks difficult. This is a good topic for an ad hoc!

SuggestedRemedy

Use TDEC so that the equalizing reference receiver can be in software. We may then need a subsidiary spec, or admonishments, about baseline wander.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.1** *P* **191** *L* **43** # 227

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Looking at the TDP limits for 100GBASE-LR4 and 100GBASE-ER4, there is hope that the middle of the three PAM4 eyes will be somewhat open.

SuggestedRemedy

Consider specifying a conventional eye mask as if NRZ (middle eye only), without a reference equalizer. This allows the receiver and particularly its CDR to get started. We could also consider an equalized multilevel eye mask like CDAUI-8.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **31** # 228

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

I'm not convinced that we ever need OMAinner.

SuggestedRemedy

For the difference in receive power between any two lanes we can use OMAouter.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **35** # 229

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

We don't usually consider receiver sensitivity for a different modulation format to what it's meant for.

SuggestedRemedy

If we keep receiver sensitivity as an item, define it the usual way, which in this case would be OMAouter with the numbers increased by 5 (or 4.8?) dB.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **35** # 230

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

if receiver sensitivity isn't normative,

SuggestedRemedy

It would be better not in this table. in fact, better not mentioned.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **37** # 231

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Receiver 3 dB electrical upper cutoff frequency, each lane, 21 GHz, looks like a value for design purposes not specification. Hard to specify or measure with an equalizing receiver.

SuggestedRemedy

Delete the table row, here and in Table 123–11 and in 123.12.4.5. Delete 123.8.11. Similarly in Clause 122.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **192** *L* **39** # 232

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

"Stressed receiver sensitivity (OMAinner)": eventually there will be lots of detail in the stressed receiver sensitivity section, so we can make this more convenient for a top-down reader who isn't involved with the modulation format. It would be too unrealistic to test the receiver with an NRZ signal.

SuggestedRemedy

Define stressed receiver sensitivity here by OMAouter.

Proposed Response *Response Status* **O**

Cl **123** *SC* **123.7.2** *P* **193** *L* **20** # 233

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Editor's note: Do we maintain the "Allocation for modulation penalties" as shown in the agreed baseline to define this "fixed" difference or would we prefer to make a difference between OMAinner and OMAouter?
First, why is it 5 dB rather than 4.8? We don't usually consider receiver sensitivity for a different modulation format to what it's meant for.

SuggestedRemedy

Define an implied unstressed receiver sensitivity by OMAouter. Delete the "allocation for modulation penalties" row. Put PAM4 issues like nonlinearity penalty in the "allocation for penalties". Then the budget will be understandable by those who read some of the many NRZ budget tables.

Proposed Response *Response Status* **O**

Cl **116** *SC* **116.3** *P* **61** *L* **26** # 234

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Too many service interface definitions. All the ones for 100G and work that builds on 802.3ba should all be the same and generic.

SuggestedRemedy

Combine 116.3 and 80.3.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10.2** *P* **131** *L* **26** # 235

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Want to allow QPRBS31, compatible with existing test equipment (which test binary signals and can handle PRBS31), as CEI-56G-VSR-PAM4 uses.

SuggestedRemedy

Add optional QPRBS31 generators and checkers.
If a QPRBS31 on a /4 or /8 lane is demuxed to /16 NRZ lanes, binary PRBS31 signals can be checked with conventional test equipment.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10.2** *P* **131** *L* **32** # 236

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Unnecessary special patterns from KP4.

SuggestedRemedy

Delete JP03A and JP03B. Delete 120.5.10.2.4 Transmitter linearity test pattern - it's too unrealistic and we can use QPRBS9 or QPRBS13 instead.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.10.2.3** *P* **132** *L* **27** # 237

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

The 100GBASE-KP4 training pattern isn't compatible with P802.3bs because it includes termination bits and precoding.

SuggestedRemedy

Revise this to use a QPRBS13 without termination bits and precoding. Also I believe there is no need to re-initialize the scrambler: the pattern should be 8191 symbols long as in CEI-56G-VSR-PAM4.

Proposed Response *Response Status* **O**

Cl **120** *SC* **120.5.3.2** *P* **126** *L* **23** # 238

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

200 ps represents about 1" of PCB, or 80 bits, which costs power to buffer in an optical module, e.g. one with a CDAUI-16 input and 8-lane or 4-lane optics. To get that much Skew Variation one might imagine lanes that differ in length by 10" (over possibly 2 CAUI hops: C2C then C2M), and PCB trace effective dielectric constant that differ by 10% over operating temperature and humidity; is this too conservative? In 802.3ba we chose this number without accurate information; now we should review it because we have 4x as much to buffer, and we have the experience.

SuggestedRemedy

Review whether this much Skew Variation is ever needed; reduce the limit to e.g. 100 or 150 ps if appropriate.

Proposed Response *Response Status* **O**

Cl **120C** *SC* **120C.1.1** *P* **223** *L* **22** # 239

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

C2M CDAUI-16 BER is TBD. Shouldn't it be just the same as CDAUI-8, because it has the same place in the architecture?

SuggestedRemedy

Change
The bit error ratio (BER) shall be less than TBD with any errors sufficiently uncorrelated to ensure an acceptably high mean time to false packet acceptance (MTTFPA) assuming 64B/66B coding.
to
The bit error ratio (BER) shall be less than 10^-6 provided that the error statistics are sufficiently random that this results in a frame loss ratio (see 1.4.223) of less than 6.2 x 10^-13 for 64-octet frames with minimum interpacket gap when processed according to Clause 119.
If the error statistics are not sufficiently random to meet this requirement, then the BER shall be less than that required to give a frame loss ratio of less than 6.2 x 10^-13 for 64-octet frames with minimum interpacket gap when processed according to Clause 119.

Proposed Response *Response Status* **O**

Cl **120C** *SC* **120C.4** *P* **224** *L* **13** # 240

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Need to choose a probability limit for eye height and width appropriate to the spec BER.

SuggestedRemedy

Maybe use EH8 and EW8?

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **245** *L* **11** # 241

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

As we are using the same transition boards as for C2M CAUI-4, unless we use a crosstalk generator with much more sophisticated emphasis, the target transition time will be the same. If we want more crosstalk we should adjust the amplitude (see another comment).

SuggestedRemedy

Change target transition time from TBD ps to 12 ps, here, in 120E.3.2.1 and 120E.3.4.1.1.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1.6** *P* **245** *L* **10** # 242

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

We can't easily change the target transition time (see another comment) and what actually matters for crosstalk is slew rate, so if 900 mV/12 ps isn't enough, we can do something we couldn't do for CAUI-4 without breaking faith with existing designs:

SuggestedRemedy

Increase the crosstalk amplitude to e.g. magenta 1.1 V TBC. BUT also add a footnote to Table 120E-3, CDAUI-8 host input, saying that the host should withstand (e.g. 1.1 V) in host output testing, although the input doesn't have to work correctly in that situation.
Similarly in 120E.3.3.2.1, but the amplitude may be different depending on the host and module minimum transition times.
Similarly in 120E.3.4.1.1.

Proposed Response *Response Status* **O**

Cl **120E** *SC* **120E.3.1** *P* **243** *L* **41** # 243

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

The RMS AC common-mode output voltage limit, 17.5 is the same as for C2M CAUI-4 yet 100GBASE-CR4 has 30 mV, 100GBASE-KR4 has 12 mV, and C2C CDAUI-8 following 100GBASE-KP4 has 30 mV although its PICS says 12. A little intrapair skew is to be expected at the multilane connector, and it seems that 30 mV could be tolerated for C2M CAUI-4. Here for C2M CDAUI-8, the signalling rate is a little higher, the transmitter should be a little faster and may be using some FFE to get a reasonable opening of a multilevel eye, so for the same channels, a higher limit should apply.

SuggestedRemedy

Change 17.5 to 20 or 25, here and in Table 120E-2 for the module output. Update the PICS.

Proposed Response *Response Status* **O**

Cl **120D** *SC* **120D.3.1** *P* **230** *L* **44** # 244

Valliappan, Magesh Broadcom

Comment Type **T** *Comment Status* **X**

An optional differential precoder (as in 94.2.2.6 Precoding) should be included to allow receivers that use larger DFE taps to attain better effective BER through FEC. Motivation is in http://www.ieee802.org/3/bs/public/15_09/hegde_3bs_01a_0915.pdf

SuggestedRemedy

Add a line stating – “CDAUI8 Transmitter shall provide an optionally enabled precoder described in 94.2.2.6”

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **5** # 245

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

I don't think we can use square wave for PAM4; a transmitter with a linearity control circuit would not behave normally if there were no ones and twos. We can find runs of each level in QPRBS13, and for an optical link without too much memory, probably QPRBS9 will be usable too.

SuggestedRemedy

Consider removing square wave from 122 and 123, and modifying 120 so that it isn't an option for a PAM4 PMA output.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **7** # 246

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

TBD to replace PRBS31

SuggestedRemedy

QPRBS31 - see other comments.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **9** # 247

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

TBD to replace PRBS9

SuggestedRemedy

QPRBS13 (not the KP4 one - see another comment). Not sure if QPRBS9 is long enough to be useful.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **25** # 248

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

I think we can avoid using OMAinner. And we can't measure it for a PAM4 transmitter with the square wave in Table 123-10.

SuggestedRemedy

If we don't need OMAinner, delete the row. If we do, delete "Square wave or"

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **27** # 249

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

In P802.3bm, we determined that any valid 100GBASE-SR4 signal is well enough scrambled to be equivalent to Pattern 5 (RS-FEC encoded scrambled idle). The same is true here (even more so as the pre-FEC spec BER is higher).

SuggestedRemedy

Change "3 or 5" to "3, 5 or valid 400GBASE-R signal", twice in this table.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.1** *P* **194** *L* **37** # 250

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

Pattern for calibration of OMA for receiver tests would be the same as for OMA in general.

SuggestedRemedy

Change TBD to 4, or delete the row.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.5** *P* **194** *L* **53** # 251

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

TDP would need a hardware reference receiver as well as a reference transmitter; this spec expects an equalizing reference receiver and I don't see how an accurate one can be obtained.

SuggestedRemedy

Use TDEC. Keep the dispersive channel as in 123.8.5.1. For a reference receiver, consider the traditional 19 GHz BT4 filter, but with a CTLE as in CAUI-4 or CDAUI-8. Maybe peaking settings 1, 2, 3 and a no-CTLE setting. The pattern would have to be something that a scope could process e.g. QPRBS13 or QPRBS15. Consider if a separate spec to control baseline wander is needed.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.6** *P* **195** *L* **35** # 252

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

In this clause the purpose of an extinction ratio spec is to contain reflection noise (MPI, multi path interference). So it should be measured on a representative signal, or even use a spec such as min(EH6)/(peak signal)

SuggestedRemedy

Use min(EH6)/(peak signal) as seen by the equalising receiver
or min(EH6)/(mean three) as seen by the equalising receiver
or (mean three)/(mean zero) as seen by the equalising receiver.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.7** *P* **195** *L* **39** # 253

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

This RIN method has problems:
It requires a measurement when the transmitter isn't modulated, which is not realistic and there is no guarantee that the noise would be the same when it's modulated;
It would need modification because we are using PAM4 modulation (we cannot expect a transmitter designed for to even set its output levels the same if modulated with NRZ);
The measurement bandwidth would have to be adjusted for the receiver equalization, which is expected to be a function of something else about the transmitter.

SuggestedRemedy

As we don't need it - delete the section and the RIN spec row.
Similarly in Clause 122.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.7** *P* **195** *L* **43** # 254

Dawe, Piers Mellanox

Comment Type **E** *Comment Status* **X**

The optical return loss is TBD dB.

SuggestedRemedy

The optical return loss is set to the value for optical return loss tolerance (max) given in Table 123-7.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.8** *P* **195** *L* **52** # 255

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

"Transmit eye: we need new definition and test method for the PAM4 transmitter optical waveform".

SuggestedRemedy

Consider the standard NRZ eye algorithm with a very small region 1 and the usual 19 GHz BT4 filter.
Also an eye spec with a 19 GHz BT4 filter plus CTLE like CAUI-4 or CDAUI-8: use an algorithm for PAM4 eye measurements similar to 120E.4.2 Eye width and eye height measurement method, but with "relative mask" limits not "absolute mask" limits.
For both, the hit ratio would be approaching 1e-2, higher than for 100GBASE-SR4 because we are using stronger FEC.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.8.9** *P* **199** *L* **14** # 256

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

The baseline says Maximum Discrete Reflectance TBD, so does Table 123-9. This says -26 which appears to have been copied from 88.11.2.2 which is NRZ. Presumably this must be better: Clause 122 has -35.

SuggestedRemedy

Change to -35, or magenta TBD until we have a better understanding of the effects of reflection noise.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.11.2.2** *P* **196** *L* **1** # 257

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **X**

(Unstressed) receiver sensitivity is not normative and we would need to define it for PAM4: we can't expect that a receiver designed for PAM4 will behave normally with an NRZ signal.

SuggestedRemedy

Easier to delete the section, and not mention receiver sensitivity.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **123** *SC* **123.7.2** *P* **192** *L* **29** # 258

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **X**

It seems that 400GBASE-FR8 and 400GBASE-LR8 would be interoperable if it were not that the maximum output from 400GBASE-LR8 (5.7 dBm) could overload a 400GBASE-FR8 receiver (5.5 dBm).

SuggestedRemedy

Please explain if they are meant to be interoperable. If so, tweak the maxima and overload specs to support it.

Proposed Response *Response Status* **W**

[Editor's note: This comment was sent after the close of the comment period.]

Cl **120B** *SC* **120B.3.1** *P* **217** *L* **40** # 259

Li, Mike — Altera

Comment Type **TR** *Comment Status* **X**

CDAUI-16 BER should be the same as CAUI-4, which is 1e-15, as from the host point, likely the same SERDES will support both, and it would be beneficial to make them consistent, which saves the cost in terms of design and test

SuggestedRemedy

change BER from TBD to 1e-15 for CDAUI-16 c2c link

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex 120D" to "120B"]

Cl **120B** *SC* **120B.3.3** *P* **218** *L* **2** # 260

Li, Mike — Altera

Comment Type **TR** *Comment Status* **X**

CDAUI-16 BER should be the same as CAUI-4, which is 1e-15, as from the host point, likely the same SERDES will support both, and it would be beneficial to make them consistent, which saves the cost in terms of design and test

SuggestedRemedy

change BER from TBD to 1e-15 for CDAUI-16 c2c RX

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex 120D" to "120B"]

Cl **120B** *SC* **120B.4** *P* **218** *L* **13** # 261

Li, Mike — Altera

Comment Type **TR** *Comment Status* **X**

CDAUI-16 DER0 should be the same as CAUI-4, which is 1e-15, as from the host point, likely the same SERDES will support both, and it would be beneficial to make them consistent, which saves the cost in terms of design and test

SuggestedRemedy

change DER0 from TBD to 1e-15 for CDAUI-16 c2c COM

Proposed Response *Response Status* **W**

[Editor's note: Clause changed from "Annex 120D" to "120B"]