Cl **FM** *SC* *P* **2** *L* **9** # 28

D'Ambrosia, John Independent

Comment Type **E** *Comment Status* **A** *Bucket*

CDXS should be added to keywords

SuggestedRemedy

Add CDXS to Keywords

Response *Response Status* **C**

ACCEPT.

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

D'Ambrosia, John Independent

Comment Type **ER** *Comment Status* **R**

Given recent discussions regarding CAUI-4 interfaces, it is becoming obvious that terminology or the lack of it can cause significant confusion in subsequent conversations.

The CDAUI-16 and CDAUI-8 interfaces are specified, where FEC is necessary to meet the target BER.

SuggestedRemedy

includes the two following steps -
1. Add the following definition to 1.4 - FEC protected interface - An optional electrical interface, whose electrical characteristics and target symbol error ratio have been determined assuming the presence of forward error correction.

2. Define all optional electrical interfaces to be FEC protected interfaces. It is left to the editors to determine the appropriate location in 802.3bs for such a definition.

Response *Response Status* **C**

REJECT.
The CDAUI-16 and CDAUI-8 interfaces are fully specified in the relevant Annexes, including the symbol error ratio. The assumptions made to determine the required symbol error ratio should not be inculded in a definition of a term, especially one that is not needed in the current draft.

Cl **00** *SC* **0** *P* *L* # 26

Nowell, Mark Cisco

Comment Type **ER** *Comment Status* **R**

The use of roman numerals to identify the MAC rates associated with various interfaces worked well when the roman numerals were simple and the number of such identified interfaces were few.

P802.3by reverted to the more clear nomenclature approach of just stating the MAC rate with Arabic numbering to simplify the clarity when communicating. Not all participants have Euro-centric backgrounds where Roman numerals are better understood.

With new MAC rates being developed, this will continue to be an issue.

Propose to use change the terminology associated with the AUI, MII, and XS interfaces to maximize clarity and hopefully initiate a new consistency in 802.3 specs going forward.

CDAUI-n would become 400GAUI-n
CDMII would become 400GMII
CDXS would become 400GXS

A supporting presentation will be provided

SuggestedRemedy

Make global change of CDAUI-n to 400GAUI-n

Make Global change of CDMII to 400GMII

Make global change of CDXS to 400GXS

Response *Response Status* **C**

REJECT.

The terminology of CDAUI-n, CDMII, and CDXS was adopted via the baseline motions as described on page 6 of anslow_3bs_01_0315.
The issue of whether to change the names to start 400G was also debated in the Berlin Task Force meeting (see page 7 of anslow_3bs_01_0315) with no consensus to make the change.
See also comment #25

A straw poll of the Task Force was taken:
I support changing the terminology to:
400GAUI-n, 400GMII and 400GXS
Yes: 17
No: 17

Cl **00** *SC* **0** *P* **1** *L* **1** # 25

Lusted, Kent — Intel

Comment Type **TR** *Comment Status* **R**

The proposed PAR modification from the 200GSMF Study Group to P802.3bs will add a 200G rate to the project. If the PAR modification is accepted, then there be 200 Gb/s versions of the various interfaces within the P802.3bs draft, include an AUI, an MII and an XS.

Using the roman numeral convention "CC" for 200 is antiquidated and cumbersome in the nomenclature, ie. CCAUI or CCMII or CCXS.

Furthermore, at the Berlin 2015 Plenary meeting, the presentation http://www.ieee802.org/3/bs/public/15_03/lusted_3bs_01_0315.pdf shows that an online poll had consensus to make a change to the draft's nomenclature.

SuggestedRemedy

Change all instances of "CDAUI-n" to "400GAUI-n".
Change all instances of "CDMII" to "400GMII"
Change all instances of "CDXS" to "400GXS"

To be accompanied with a presentation.

Response *Response Status* **C**

REJECT.
See response to comment #26

Cl **00** *SC* **0** *P* **232** *L* **12** # 90

Ran, Adee — Intel

Comment Type **T** *Comment Status* **A**

There is no mention in 120B or 120C that the CDAUI-16 interfaces use NRZ encoding. Similarly 120D and 120E do not state PAM4 encoding.

SuggestedRemedy

Add text such as "CAUI-16 uses NRZ signaling over 16 electrical lanes" in an appropriate place, and similarly for the PAM4 cases.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
In 120B.1 and 120C.1 change:
"Each data path contains sixteen differential lanes, which ..." to:
"Each data path contains sixteen differential lanes using NRZ signaling, which ..."

In 120D.1 and 120E.1 change:
"Each data path contains eight differential lanes, which ..." to:
"Each data path contains eight differential lanes using PAM4 signaling, which ..."

Cl **1** *SC* **1.4** *P* *L* # 29

D'Ambrosia, John — Independent

Comment Type **E** *Comment Status* **A**

FEC Lanes are used in two places in Draft 1.2, on page 32 under 30.5.1.1.17 and 30.5.1.1.18 - i am not sure from this text what a FEC lane is.

SuggestedRemedy

add definition of "FEC Lane"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
The text in question is part of the base text. Since the P802.3bs draft does not have "FEC lanes", but PCS lanes, it is not appropriate to add a definition of "FEC lane" in this draft. However, comment #177 is changing the text in 30.5.1.1.17 and 30.5.1.1.18 which needs modification to cover the case of multiple PCS lanes.
See response to comment #177.

Cl **30** *SC* **30.5.1.1.17** *P* **32** *L* **15** # 177

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

The maximum rates of the counters in 30.5.1.1.17 and 30.5.1.1.18 are TBD

SuggestedRemedy

Replace TBD with appropriate values in both cases

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Replace TBD with 80 000 000 in both cases.
In both of the BEHAVIOUR DEFINED AS sections:
Change:
"or use a single FEC instance for multiple FEC lanes." to:
"or use a single FEC instance for all lanes."
In 30.5.1.1.17, show:
"for BASE-R, and 45.2.1.103 for RS-FEC)" changing to:
"for BASE-R, 45.2.1.103 for RS-FEC, and 45.2.3.47e for PCS FEC)"
In 30.5.1.1.18, show:
"for BASE-R, and 45.2.1.104 for RS-FEC)" changing to:
"for BASE-R, 45.2.1.104 for RS-FEC, and 45.2.3.47f for PCS FEC)"

Cl **45** *SC* **45.2.3** *P* **61** *L* **31** # 160

Ofelt, David — Juniper Networks

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

Need to add control bits, status bits, and new control registers for the pre-FEC degrade and fault feature

SuggestedRemedy

See ofelt_3bs_01_0316 for detailed changes

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **45** *SC* **45.2.3.14** *P* **59** *L* **28** # 176

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

As registers 3.33, 3.44, and 3.45 are not used in the 400GBASE-R PCS, remove the subclauses related to these registers from the draft.

SuggestedRemedy

Remove the subclauses related to registers 3.33, 3.44, and 3.45 from the draft.

Response *Response Status* **C**

ACCEPT.

Cl **93A** *SC* **93A.1** *P* **226** *L* **21** # 89

Ran, Adee — Intel

Comment Type **T** *Comment Status* **A**

Table 83D-6 should not apply to CDAUI-16, since the signaling rate is different.

SuggestedRemedy

Create a separate table for CDAUI-16 and refer to it.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Add a note to "Table 83D-6" with text:
With the exceptions given in 120B.4.

Cl **116** *SC* **116.3.2** *P* **70** *L* **12** # 32

D'Ambrosia, John — Independent

Comment Type **T** *Comment Status* **R**

Editor's note asks if a prefix is needed for the CDXS

SuggestedRemedy

Recommend that a prefix be added for CDXS

Response *Response Status* **C**

REJECT.
The need for a prefix for CDXS depends on the content of Clause 118.
While comment #33 proposes to populate Clause 118, it does not include the use of such a prefix.

Cl **116** *SC* **116.4** *P* **73** *L* **10** # 22

Gustlin, Mark — Xilinx

Comment Type **T** *Comment Status* **A**

Currently the delay constraits for the MAC and PCS sublayers are TBD. Proposed delay constraints were presented in the logic ad hoc (gustlin_01_0216_logic.

SuggestedRemedy

Change the TBDs to 98304, 192, 245.76 for the MAC sublayer delays.
Change the TBDS to 320000, 625, 800 for the PCS sublayer delays, also make the same change in the PCS clause.

Response *Response Status* **C**

ACCEPT.

Cl **116** *SC* **116.4** *P* **73** *L* **12** # 30

D'Ambrosia, John — Independent

Comment Type **E** *Comment Status* **A** *Bucket*

The CDMII Extender resides above the PCS, therefore it can not be included as part of a PHY, as noted in Note D.

SuggestedRemedy

Change Note D from
If a PHY includes the CDMII extender, then this includes two CDXS sublayers.

to

If an implementation includes the CDMII extender, the delay associated with the CDMII extender includes two CDXS sublayers.

Response *Response Status* **C**

ACCEPT.

Cl **116** *SC* **116.5** *P* **76** *L* **8** # 24

Gustlin, Mark — Xilinx

Comment Type **T** *Comment Status* **A**

The current skew constraints are magenta meaning they are tenative. Some data on our current PMD skew requirements were presented in the logic ad hoc (gustlin_03_0216_logic). The current magenta numbers are sufficient, and are not a burden in either FPGAs or ASIC/ASSPP.

SuggestedRemedy

Turn all skew point numbers blac (maximum and skew variation).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Turn all magenta entries in Table 116-4 and Table 116-5 black.
Also turn the corresponding numbers in the subclauses referenced in the Notes columns black.
See also comment #49.

Cl **116** *SC* **116.5** *P* **76** *L* **29** # 49

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **R**

Long ago, the AUI skew variation was rounded up from 1 to 1.5 UI at 10G to 2 UI at 10G, or the 0.2 ns here. Now that each ns contains 5 times as many bits per lane, and because 5 and 11 are not convenient binary numbers or bus widths, we should take out some of the padding.

SuggestedRemedy

For SP1, change 0.2 ns, 5 UI to 0.15 ns, 4 UI, with consequent changes to the other rows. One could change SP2 from 0.4, 11 to 0.3, 8 and make similar changes on the receive side.
Make changes in the other clauses to keep them in step.

Response *Response Status* **C**

REJECT.
The values for Skew and Skew Variation were discussed on the Logic Ad Hoc call on 23 February with a consensus to keep the values the same as in the current draft.
See comment #24

Cl **118** *SC* **118.1** *P* **86** *L* **42** # 33

D'Ambrosia, John — Independent

Comment Type **TR** *Comment Status* **A**

CDXS subclause yet to be completed.

SuggestedRemedy

1. Diagram 118-1 should highlight the CDMII extender sublayer, and not just the CDXX.
2. Add basic outline as follows
118.2 Summary of Major Concepts
118.3 Delay Constraints
118.4 Functional Block Diagram of CGMII Extender Sublayer
118.5 CDXS -
functional block diagram - use Figure 119-2 (bottom of diagram should be changed to reference CDMII, not PMA).
functions within the PCS -reference all of 119.2
118.6 Implementation of CDAUI-16
118.7 Implementation of CDAUI-8

Commenter intends to submit proposed text.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Pending presentation.

Change the text in subclause 118.1 to:
"This clause defines the functional characteristics for the optional CDMII Extender and CDMII Extender Sublayer (CDXS). Figure 118-1 shows the relationship of the CDMII Extender and CDXS sublayer with other sublayers to the ISO Open System Interconnection (OSI) reference model.

The CDMII Extender allows the extension of the CDMII to the PCS via a physical instantiation. The CDMII Extender is composed of a CDXS at the RS end, a CDXS at the PHY end with a physical instantiation of CDAUI-n between two adjacent PMA sublayers.

A CDMII Extender with the optional Energy-Efficient Ethernet (EEE) capability (see Clause 78) encodes and decodes Low Power Idle (LPI) signals. The assertion of LPI at the CDMII is encoded in the transmitted symbols. Detection of LPI encoding in the received symbols is indicated as LPI at the CDMII."

Update figure 118-1 as shown on page 4 of dambrosia_3bs_01_0316.

Make the additions shown on page 5 of dambrosia_3bs_01_0316.

Make the additions shown on page 6 of dambrosia_3bs_01_0316 (but do not add additional diagrams).

Modify this note:

[Editor's note: This clause yet to be completed. The CDXS is functionally identical to the PCS defined in
Clause 119.]
To:
[Editor's note: Management and register functions need to be added.]

Make all 120 Annexes consistent, call the PCS "400GBASE-R PCS" to be consistent with the rest of the clauses (imapcts 120B and 120D)

Cl **119** *SC* **119.1.2** *P* **89** *L* **26** # 64

Ran, Adee Intel

Comment Type **E** *Comment Status* **A** *Bucket*

Superfluous comma after "transcoding" - only two items

SuggestedRemedy

Delete the comma

Response *Response Status* **C**

ACCEPT.

Cl **119** *SC* **119.1.4** *P* **89** *L* **50** # 65

Ran, Adee Intel

Comment Type **T** *Comment Status* **R** *Bucket*

Do we need to use transfers/s here? The precedence for using this term is mostly in cases of bus transactions (clauses 49, 50, and 74). But here the text includes "on each of the 16 PCS lanes" which turns this "transaction rate" into bit rate on a serial logical interface. Only clause 82 uses this text while referring to each lane separately (this seems inadequate too).

Without looking at previous PCS clauses, "transfers" is confusing, since these seem to be plain bits that are transferred on each of the PCS lanes... unless this describes parallel transfers on the multi-bit service interface. But most of the text in this clause refers to lanes as independent bit streams, so it seems preferable not to introduce transfers at all.

Also, editorially, "each of the..." should be followed by "lanes" - if this is kept.

SuggestedRemedy

Preferably: change "Gtransfers/s" to "Gb/s" and change "lane" to "lanes".

Alternatively, keep "Gtransfers/s" but delete "on each of 16 PCS lane".

Response *Response Status* **C**

REJECT.

The terminology is consistent with caluse 49 and 80, and also consistent with how the term 'transer' is used for the inter-sublayer interfaces.

Cl **119** *SC* **119.2** *P* **97** *L* **39** # 161

Ofelt, David Juniper Networks

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

Need to add tx alignment marker bits, rx alignment marker bits, high SER, degraded SER, and PCS-MDIO mapping for the pre-FEC degrade and fault feature

SuggestedRemedy

See ofelt_3bs_01_0316 for detailed changes

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **119** *SC* **119.2.1** *P* **92** *L* **6** # 66

Ran, Adee Intel

Comment Type **T** *Comment Status* **R** *Bucket*

PCS is composed of transmit and receive processes. But later it is described in terms of receive and transmit channels. "Channel" is an overloaded term and this seems like an unusual usage - "transmit channel" and "receive channel" are not defined anywhere.

SuggestedRemedy

Rephrase this subclause to avoid "transmit channel" and "receive channel" and instead use "transmit process" and "receive process" as appropriate.

Response *Response Status* **C**

REJECT.

The 'channel' terminology is consistent with clause 49 and clause 80.

Cl **119** *SC* **119.2.1** *P* **92** *L* **44** # 67

Ran, Adee Intel

Comment Type **E** *Comment Status* **R** *Bucket*

This sentence could be reworded to be shorter and more readable.

SuggestedRemedy

Change

"The PCS shall provide transmit test-pattern mode for the scrambled idle pattern (see 119.2.4.9), and shall provide receive test-pattern mode for the scrambled idle pattern"

to

"The PCS shall provide transmit test-pattern mode and receive test-pattern mode for the scrambled idle pattern (see 119.2.4.9)"

Response *Response Status* **C**

REJECT.

It is correct as it is, and the suggested remedy would be a little confusing since 119.2.4.9 only applies to the transmit.

Cl **119** *SC* **119.2.4.2** *P* **95** *L* **5** # 68

Ran, Adee Intel

Comment Type **T** *Comment Status* **A**

The transcoding process seems similar and possibly identical to the one specified in clause 91. If there are differences, we could help the reader by pointing them out (e.g. in an introductory paragraph or a NOTE). If it is identical, perhaps the content can be replaced by a reference to 91.5.2.5.

Similarly for the back-transcoding process in 119.2.5.7.

SuggestedRemedy

per comment.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Add the following note after line 8:
Note: This transcoder differs from that described in 91.5.2.5, there is no scrambling of the first 5 bits since this clause scrambles the complete 257-bit blocks after transcoding. (Format as a note)

Cl **119** *SC* **119.2.4.4** *P* **97** *L* **15** # 69

Ran, Adee Intel

Comment Type **T** *Comment Status* **A**

"The pad shall not be checked on receive" - no PICS - and why is that a normative requirement? Should if be verified? How?

This subclause describes insertion so receive operation is out of place here.

SuggestedRemedy

Change to "the pad contents may be ignored on receive".

Consider deleting this sentence or moving it to 119.2.5.5, as it describes receiver operation.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

There is not a good place to say that the pad contents are ignored on rx other than the current place.

See response to comment #3.

Cl **119** *SC* **119.2.4.4** *P* **97** *L* **25** # 70

Ran, Adee Intel

Comment Type **E** *Comment Status* **A** *Bucket*

"163 840 257-bit blocks" is confusing. It seems justifiable to make an exception to the convention of separating thousands in this case.

SuggestedRemedy

Change to "163840 257-bit blocks" here and elsewhere.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change "163 840 257-bit blocks"
to "163 840 x 257-bit blocks"

In two places

Cl **119** *SC* **119.2.4.4** *P* **97** *L* **43** # 21

Koehler, Daniel MorethanIP

Comment Type **T** *Comment Status* **A**

A detailed marker mapping function is missing. The following text suggests a way of describing the mapping function.

SuggestedRemedy

The alignment markers shall be mapped to am_txmapped<2055:0> in a manner that yields the same result as the following process.
With a PRBS9 generator creating a pad data field of pad<519:0> where bit 0 is the first bit created by the free running PRBS generator.
With common marker cm<47:0> and unique marker for lane i being um_i<47:0> construct a matrix of 16 rows and 120 bit columns as follows:

With i=0..15 (1)
am_txpayloads<i, 23:0> = cm<23:0>;
am_txpayloads<i, 31:24> = pad<(8i+7) : 8i>;
am_txpayloads<i, 55:32> = cm<47:24>;
am_txpayloads<i, 63:56> = pad<(128+8i+7) : (128+8i)>;
am_txpayloads<i, 87:64> = um_i<23:0>;
am_txpayloads<i, 95:88> = pad<(256+8i+7) : (256+8i)>;
am_txpayloads<i, 119:96> = um_i<47:24>;

Given i=0..15 and k=0..11 and y=i+16k, am_txmapped_tmp may then be derived from am_txpayloads per the following expression.

am_txmapped_tmp<(10y+9):10y> = am_txpayloads<i,(10k+9):10k>; (2)

To ensure all markers appear linear on each output lane, the inverse of the lane symbol distribution must be applied (see 119.2.4.7). That is, every 2nd group of 16 symbols the odd/even symbols are swapped.
This is achieved as follows:

Given w=0..11 and y=0..7 and x=16w+2y; (3)

for even w: (copy two symbols)
am_txmapped<10x+9 : 10x> = am_txmapped_tmp<10x+9 : 10x>;
am_txmapped<10(x+1)+9 : 10(x+1)> = am_txmapped_tmp<10(x+1)+9 : 10(x+1)>;

for odd w: (swap two symbols)
am_txmapped<10x+9 : 10x> = am_txmapped_tmp<10(x+1)+9 : 10(x+1)>;
am_txmapped<10(x+1)+9 : 10(x+1)> = am_txmapped_tmp<10x+9 : 10x>;

Finally to fill up 8x257-bit this am_txmapped<1919:0> is followed by 136bit pad as:

am_txmapped<2055:1920> = pad<519:384>;

The result of the alignment marker mapping function is a deterministic mapping between alignment marker payloads and PCS lanes ensuring all bits are transmitted in the exact same order as placed into above am_txpayloads matrix rows. It compensates the permutation caused by the 10-bit symbol lane distribution and interleave of following functions.

Note: This mapping fills prbs bits 0..7 in lane 0 bit positions 24..31 continuing with prbs bits 8..15 in lane 1 bit positions 24..31 up to prbs bits 120..127 in lane 15 bit positions 24..31.
It continues with prbs bits 128..135 in lane 0 bit positions 56..63 to prbs bits 248..255 in lane 15 bit positions 56..63.
It continues with prbs bits 256..263 in lane 0 bit positions 88..95 to prbs bits 376..383 in lane 15 bit positions 256..263.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to comment #3

Cl **119** *SC* **119.2.4.4** *P* **98** *L* **6** # 3

Butter, Adrian GLOBALFOUNDRIES

Comment Type **TR** *Comment Status* **A**

The alignment marker encodings in Table 119-1 contain many "TBDs". Further analysis of this alignment marker structure (with 64-bit common part and 56-bit unique part) reveals undesirable clock content which is reduced using a shorter alignment marker (with 48-bit common part and 48-bit unique part). To reduce the complexity of alignment marker processing logic for the shorter marker, as well as increase format compability of the shorter marker with that defined in 802.3bj, padding based on PRBS9 sequences is both interleaved with and appended to the marker. Refer to http://www.ieee802.org/3/bs/public/adhoc/logic/feb9_16/gustlin_01_0216_logic.pdf for details.

SuggestedRemedy

Modify the text, Figure 119-4 and Table 119-1 contained in 119.2.4.4 as specified in butter_3bs_01_0316 (with editorial license).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Modify the text, Figure 119-4 and Table 119-1 contained in 119.2.4.4 as specified in butter_3bs_02a_0316 (with editorial license).

Cl **119** *SC* **119.2.4.4** *P* **100** *L* # 1

McDermott, Thomas Fujitsu

Comment Type **T** *Comment Status* **A**

The AM's are inserted so they appear once every 163840 257b blocks according to paragraph 119.2.4.4. The interpretation of the text is that there are (163840-8 = 163832) data blocks in between each AM (itself 8 blocks). Figure 119-6 drawing is clear, but the figure text seems to say that there are 163840 257b data blocks in between the AM insertions.

SuggestedRemedy

Change "163 840 257-bit blocks between AM insertions" to "AM appears once every 163 840 257-blocks" to match the text in 119.2.4.4.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE. [Editor's note: Comment type set to T and subclause changed from 2.4.4 to 119.2.4.4]

See response to comment #3

Cl **119** *SC* **119.2.4.5** *P* **100** *L* **32** # 2

Butter, Adrian GLOBALFOUNDRIES

Comment Type **T** *Comment Status* **A**

There is no clear connection between variables tx_scrambled_am and tx_scrambled_am_j. Also, defining tx_scrambled_am as 257 bits does not align with the width implied in 119.2.4.4, page 97, line 25.

SuggestedRemedy

Modify 119.2.4.5 to define tx_scrambled_am as 10,280 bits (equal to 2 FEC codeword message blocks) via adopting the text contained in butter_3bs_01_0316 (with editorial license).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Adopt the text contained in butter_3bs_02a_0316 (with editorial license).

Cl **119** *SC* **119.2.4.6** *P* **100** *L* **48** # 71

Ran, Adee Intel

Comment Type **E** *Comment Status* **R**

This subclause seems to borrow from 91.5.2.7 which defines two different codes with t as a parameter. But in this subclause there is only one code. t can be stated clearly.

In addition, most of the text and equations are similar or identical to their 91.5.2.7 equivalents. It would be helpful for the reader to have references instead of identical text and point out differences where they exist.

SuggestedRemedy

Define t=15 and/or change occurrences of t in the text, equations and figures to the value 15 (e.g. in Figures 119-7 and 119-8).

Consider replacing text and equations with references to 91.5.2.7 with additions as necessary for the codeword interleaving.

Response *Response Status* **C**

REJECT.

The is a preference within the logic track to keep the t as is and not replace it with 15. Also there is preference to retain the equations in this subclause and not refer back to clause 91.

Cl **119** *SC* **119.2.4.6** *P* **100** *L* **51** # 162

Dillard, John — Microsemi

Comment Type **E** *Comment Status* **A**

The wording of this paragraph seems a little confusing, and as it mostly restates what was already described in 119.2.4.5, is redundant.

SuggestedRemedy

Suggest removing (most of) it, or rewording it (drop mention of the transcoder, alignment markers).

Possible wording:

The PCS sublayer shall implement RS(544,514). The PCS distributes a group of 40 257-bit blocks from tx_scrambled_am on a 10-bit round robin basis into two 5140-bit message blocks, Ma and Mb, as described in 119.2.4.5. These are then encoded using RS(544,514) encoder into codeword A and codeword B, respectively.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change:
The PCS sublayer shall implement RS(544,514). The PCS distributes a group of 40 257-bit blocks on a 10-bit round robin basis to two 5140-bit blocks, therefore each 514-symbol message corresponds to one half of a group of 40 257-bit blocks produced by the transcoder (with the exception of the alignment marker blocks being directly inserted periodically into the data stream)

To:
The PCS shall implement an RS(544,514) based FEC encoder. The PCS distributes a group of 40 257-bit blocks from tx_scrambled_am on a 10-bit round robin basis into two 5140-bit message blocks, Ma and Mb, as described in 119.2.4.5. These are then encoded using RS(544,514) encoder into codeword A and codeword B, respectively.

Cl **119** *SC* **119.2.4.6** *P* **102** *L* **1** # 163

Dillard, John — Microsemi

Comment Type **E** *Comment Status* **A**

Regarding the mention of the example codewords: while Annex 91A (table 91A-3) does show an example of resulting parity given a set of 257-bit blocks, I believe those blocks are illegal in regards to 802.3bs due to the different approach to scrambling.

SuggestedRemedy

Suggest ammending Annex 91A or adding an annex 119? with an example of a pair of legal codewords
I will attempt to provide a supporting document

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Add annex 119A, and change the reference from 91A to 119A. Text for annex 119A is in dillard_3bs_01_0316. Editorial license to change the bit ordering to be consistent with the rest of the draft.

Cl **119** *SC* **119.2.4.6** *P* **102** *L* **8** # 72

Ran, Adee — Intel

Comment Type **E** *Comment Status* **A** *Bucket*

There is only one code here so column heading can be just g_i.

Alternatively, this table can be replaced with a reference to the RS(544,514) columns in table 91-1.

SuggestedRemedy

Change heading or delete this table and refer to 91-1 instead.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Chane the heading to just g_i

Cl **119** *SC* **119.2.4.8** *P* **103** *L* **5** # 164

Dillard, John — Microsemi

Comment Type **E** *Comment Status* **A** *Bucket*

In figure 119-8 the input is referred to as XLGMII/CGMII

SuggestedRemedy

Change to CDMII

Response *Response Status* **C**

ACCEPT.

Cl **119** *SC* **119.2.4.9** *P* **104** *L* **3** # 130

Le Cheminant, Greg keysight Technologies

Comment Type **T** *Comment Status* **R**

Internal test pattern generator passes scrambled idle pattern through FEC encoder. Testing FEC encoded patterns is difficult for both test equipment and burdensome for internal error checkers

SuggestedRemedy

Add the ability to bypass FEC encoder for testing purposes. (Possibly never FEC encode the test pattern)

Response *Response Status* **C**

REJECT.

FEC is integral to the PCS, there is no definition of what the bypass of the FEC encoder is. If it is burdensome to test the FEC parity bits, then simply ignore them.

Cl **119** *SC* **119.2.5.2** *P* **104** *L* **37** # 73

Ran, Adee Intel

Comment Type **T** *Comment Status* **A** *Bucket*

The de-interleaving here is a required functionality, not an ability ("Can" means "is able to").

Also, missing period

SuggestedRemedy

Change "can be" to "is". Add terminating period.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change "can be" to "are" and add "." to the end of the sentence.

Cl **119** *SC* **119.2.5.3** *P* **104** *L* **37** # 74

Ran, Adee Intel

Comment Type **T** *Comment Status* **R**

I could not find a justification for changing 1e-6 to 1e-16. Note that this is the probability per event of a codeword with more than t errors - which is a rare event (this is not per bit or per symbol).

Also, there is an expectation here: probability _is_ expected to be below the value.

Also, this sentence can be shorter and clearer.

SuggestedRemedy

Change
"The probability that the decoder fails to indicate a codeword with t+1 errors as uncorrected is not expected to exceed 10^-16. This limit is also expected to apply for t+2 errors, t+3 errors, and so on"
to
"The probability that the decoder fails to indicate a codeword with more than 15 symbol errors as uncorrected is expected to be lower than 10^-16".

Unless there is a justification, change 10^-16 above to 10^-6.

Response *Response Status* **C**

REJECT.

The statement is correct as is.
The equation for calculating the bound for faling to detect errors can be found on page 4 of: http://www.ieee802.org/3/bj/public/jan12/cideciyan_01_0112.pdf
10^-16 was calculated from this equation. The value is required to be below 10^-16 in order to maintain an acceptable MTTFPA at high BER.

Cl **119** *SC* **119.2.5.5** *P* **105** *L* **24** # 75

Ran, Adee Intel

Comment Type **E** *Comment Status* **R** *Bucket*

Badly formed sentence.

SuggestedRemedy

Change
"Every 8192nd codewords the first 2056 bits of rx_scrambled_am blocks is the vector am_rx<2055:0>"
to
"Every 8192nd codeword, the first 2056 bits of rx_scrambled_am blocks are the vector am_rx<2055:0>"

Response *Response Status* **C**

REJECT.

Correct as is.

Cl **119** *SC* **119.2.6.2.2** *P* **107** *L* **24** # 23

Gustlin, Mark Xilinx

Comment Type **T** *Comment Status* **A**

The variable amp_valid currently has two TBDs on how the bits in the AMs are compared. In addition the definition needs to be cleaned up a little given the new format of the AMs. Porposed solution and reasoning was presented in gustlin_02_0216_logic.

SuggestedRemedy

Change the definition of amp_valid to:
Boolean variable that is set to true if the received 120-bit block is a valid alignment marker pay-load. The alignment marker payload, mapped to a PCS lane according to the process described in 119.2.4.4, consists of 96 known bits. The 48 bits of the common marker portion are compared on a nibble-wise basis (12 comparisons). If 9 or more nibbles in the candidate block match the corresponding known nibbles in the common portion of the alignment marker payload, the candidate block is considered a valid alignment marker payload.

Change the definition of pcs_lane to:
A variable that holds the PCS lane number (0 to 15) received on lane x of the PMA service interface when amps_lock<x>=true. The PCS lane number is determined by the alignment marker payloads based on the mapping defined in 119.2.4.4. The 48 bits that are in the positions of the unique marker bits in the received alignment marker payload are compared to the expected values for a given payload position and PCS lane on a nibble-wise basis (12 comparisons). If 9 or more nibbles in the candidate block match the corresponding known nibbles for any payload position on a given PCS lane, then the PCS lane number is assigned accordingly.

Response *Response Status* **C**

ACCEPT.

Cl **119** *SC* **119.2.6.2.2** *P* **108** *L* **31** # 165

Dillard, John Microsemi

Comment Type **E** *Comment Status* **A** *Bucket*

Reference to XLGMII/CGMII incorrect?

Same issue on line 50

SuggestedRemedy

Change to CDMII

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change the two instances and also the one on page 110 line 8.

Cl **119** *SC* **119.2.6.2.3** *P* **109** *L* **22** # 76

Ran, Adee Intel

Comment Type **T** *Comment Status* **R**

In the definition of R_TYPE, "For EEE capability" isn't very clear. Only reading the NOTE (informative?) after the list of values reveals that returning the LI classification is only supported for a PCS with the EEE capability. The text describing this classification case is more complex than it should be.

Also applies to T_TYPE.

SuggestedRemedy

In the definition of R_TYPE, change
"LI; For EEE capability, the LI type is supported where the vector contains a sync header of 10, a block type field of 0x1E and eight control characters of 0x06 (/LI/)."
to
"LI; The vector contains a sync header of 10, a block type field of 0x1E and eight control characters equal to 0x06 (/LI/). Returned only if the PCS supports the EEE capability."

In the definition of T_TYPE, change
"LI; For EEE capability, this vector contains eight /LI/ characters."
to
"LI; The vector contains eight /LI/ characters. Returned only if the PCS supports the EEE capability."

Consider removing the NOTE in both cases.

Response *Response Status* **C**

REJECT.

It is correct as it and is consistent with clause 49 and 82.

Cl **119** *SC* **119.2.6.3** *P* **109** *L* **31** # 166

Dillard, John Microsemi

Comment Type **E** *Comment Status* **A** *Bucket*

The refernece to table 119-1 for valid control characters is incorrect.
This issue is also seen on pg 110 lines 8,10

SuggestedRemedy

Was this supposed to refer to table 49-1 ?

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change the reference to table 82-1 (3 instances)

Cl **119** *SC* **119.2.6.3** *P* **110** *L* **33** # 77

Ran, Adee Intel

Comment Type **E** *Comment Status* **A** *Bucket*

"2780528 10-bit Reed-Solomon symbols" is confusing. Alignment markers are not defined in terms of RS symbols so stating the offset this way might not be very helpful.

It seems justifiable to make an exception to the convention of separating thousands in this case.

SuggestedRemedy

Change to "278528 10-bit Reed-Solomon symbols", or to "2 785 280 bits".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change 278 528 10-bit Reed-Solomon
to
278 528 x 10-bit Reed-Solomon

Cl **119** *SC* **119.2.6.3** *P* **110** *L* **53** # 78

Ran, Adee Intel

Comment Type **T** *Comment Status* **A** *Bucket*

"May not" which appears in this paragraph twice is ambiguous in English (can be either prohibitive or optional). Usage of "may" here does not strictly follow the style manual - it is not defining an option.

802.3bq has switched to using "are not guaranteed" in a similar case.

SuggestedRemedy

Change "may not" to "are not guaranteed to" in both cases.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change:
the scrambler may not be operational during reset
to:
the scrambler is not guaranteed to be operational during reset

Cl **119** *SC* **119.2.6.3** *P* **114** *L* **44** # 79

Ran, Adee Intel

Comment Type **E** *Comment Status* **R** *Bucket*

The boxes in figures 119-11 and 119-12 are not dotted, they are dashed.

SuggestedRemedy

Change "dotted box" to "dashed box" in figures 119-11 and 119-12.

Response *Response Status* **C**

REJECT.

This is consistent with Clause 49 and 82 as is.

Cl **119** *SC* **119.4** *P* **117** *L* **17** # 80

Ran, Adee Intel

Comment Type **T** *Comment Status* **A**

"If a Clause 45 MDIO is implemented, then the PCS shall."

This seems like a conditional normative statement. Is it really conditional on MDIO being implemented? The PICS items L1 and L2 are mandatory.

This also applies to other places in the draft that refer to clause 45, such as 122.5.5.

SuggestedRemedy

Rephrase to clarify. If necessary, add that loopback may be enabled by other means.

Go over the draft and apply corresponding changes if necessary.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

To make the stament clearer, make this change:
Change:
If a Clause 45 MDIO is implemented, then the PCS shall be placed in the loopback mode when the loopback bit from the PCS control 1 register (bit 3.0.14) is set to a one. In this mode, the PCS shall accept data on the transmit path from the CDMII and return it on the receive path to the CDMII. In addition, the PCS shall transmit what it receives from the CDMII to the PMA sublayer, and shall ignore all data presented to it by the PMA sublayer.
To:
When the PCS is in loopback, the PCS shall accept data on the transmit path from the CDMII and return it on the receive path to the CDMII. In addition, the PCS shall transmit what it receives from the CDMII to the PMA sublayer, and shall ignore all data presented to it by the PMA sublayer. If a Clause 45 MDIO is implemented, then the PCS is placed in the loopback when the loopback bit from the PCS control 1 register (bit 3.0.14) is set to a one.

Cl **119** *SC* **119.6.3** *P* **119** *L* **18** # 81

Ran, Adee Intel

Comment Type **T** *Comment Status* **A** *Bucket*

Why is this feature optional? It points to 119.6.5 (inside the PICS) but test pattern is defined in 119.2.4.9, which does not define it as optional.

SuggestedRemedy

Delete *JTM and make item JT1 mandatory.

Response *Response Status* **C**

ACCEPT.

Cl **120** *SC* **120.1.3** *P* **125** *L* **17** # 82

Ran, Adee Intel

Comment Type **T** *Comment Status* **A**

The PMA may also need to perform PAM4 decoding (not just encoding), if it is used to convert between 16 lanes (NRZ) and 4 or 8 lanes (PAM4), since this operation requires bit-muxing.

This is shown in figure 120-5 and described in detail in 120.3, but is missing from the text here.

SuggestedRemedy

Change "encoding" to "encoding and decoding".

Also, add appropriate text in 120.2 to include PAM4 decoding into bits before/after the bit mux function when changing widths.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change item j) to "encoding and decoding".
No need to add text to 120.2 about the details, since this is a high-level description. How you get from PAM4 symbols to/from pairs of bits is explained in detail in 120.5.6.1.

Cl **120** *SC* **120.3** *P* **129** *L* **18** # 83

Ran, Adee Intel

Comment Type **E** *Comment Status* **A**

There seem to be superfluous commas around "bit-multiplexed".

SuggestedRemedy

Delete the commas, possible rephrase the sentence.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change:
The bit stream represented by the input symbols carries, bit-multiplexed, 16/p PCSLs on each physical input lane.
To:
The bit-stream represented by the input symbols carries 1/16p bit-multipexed PCSLs on each physical input lane

Cl **120** *SC* **120.5** *P* **130** *L* **30** # 84

Ran, Adee Intel

Comment Type **T** *Comment Status* **R**

PCSL format applies to bits (logical), not to a signal (electrical).

SuggestedRemedy

Change "signal" to "bit stream".

Response *Response Status* **C**

REJECT.
While "bit stream" would not be incorrect in this sentence, there are numerous instances of the word "signal" throughout at least clauses 82, 83, 119, 120 that are used to describe digital rather than optical or electrical signals. The CDMII is always called a signal even though this is a logical format without any defined physical instantiation. There are even mixtures of "stream" and "signal", e.g., "Note-The stream of 66-bit blocks generated by this process is used as the reference signal for de-mapping from OTN." Since these mixtures of words don't seem to have confused readers for the last 6 years, no need to overhaul the terminology for this particular project.

Cl **120** *SC* **120.5.6.1** *P* **135** *L* **8** # 85

Ran, Adee Intel

Comment Type **E** *Comment Status* **A**

This subclause does not seem to belong below 120.5.6 (Signal drivers). It defines conversion between PAM4 and NRZ which is part of the functionality of the PMA, not only for driving signals but also for receiving (as shown in figure 120-5). The title should be "PAM4 encoding and decoding".

SuggestedRemedy

Promote this subclause to level 2 and rename it to "PAM4 encoding and decoding".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Promote 120.5.6.1 to a 3rd level heading (120.5.7), but not for the reasons given.
The internal architecture of the PMA is all bits, and the conversion to/from PAM4 symbols all occurs when symbols are transmitted or received. But it is clearer to keep the elements of PAM4 encoding and decoding together in one subclause rather than splitting the transmit (PAM4 encode) part into 120.5.6 and putting the receive (PAM4 decode) into 120.5.1.
While the proposed change of title would not be incorrect, removing the familiar term "Grey coding" from the subclause title forces readers to go read the subclause to check that it does what they expect. So do not change the subclause title.

Cl **120** *SC* **120.5.10.1.1** *P* **137** *L* **14** # 131

Le Cheminant, Greg keysight Technologies

Comment Type **T** *Comment Status* **R**

Internal error counter only requred to count "one or more" errors. As the link no longer runs error free , counting only one error will not allow validation to specified pre-FEC BER

SuggestedRemedy

Change text to read "error counter should be able to count sufficient errors to verify specified pre-FEC BER"

Response *Response Status* **C**

REJECT.
Insufficient remedy proposed. There was considerable discussion during P802.3ba that led to the current text (counting at least one error whenever one or more bit errors occurs in a 1000-bit sliding window), as requiring counting of every bit error precluded possible parallel implementations. The proposed replacement text is too nebulous a phrase to know how you would test to verify that the requirement has been met.

Cl **120** *SC* **120.5.10.2.1** *P* **138** *L* **30** # 50

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R**

When 120D's jitter definitions have changed from this JP03A pattern to PRBS13Q...

SuggestedRemedy

Check that the optical clauses haven't adopted it, delete this subclause and recover the MDIO bits.

Response *Response Status* **C**

REJECT.
JP03A is used by CDAUI-8 C2C via reference to 94.3.12.6.1.
It would be appropriate to remove it if Clock random jitter, RMS (max) and Clock deterministic jitter, pk-pk (max) are re-defined to use a different pattern, however, this has not yet been done.
(Removing it from the draft would un-allocate bits 1.1500.6 and 1.1500.7)

Cl **120** *SC* **120.5.10.2.2** *P* **138** *L* **49** # 51

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A**

When 120D's definition of even-odd jitter has changed from this JP03B pattern to PRBS13Q...

SuggestedRemedy

Check that the optical clauses haven't adopted it, delete this subclause and recover the MDIO bits.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
JP03B was used by CDAUI-8 C2C via reference to 94.3.12.6.2 but comment #57 has changed the reference and now PRBS13Q is used instead.
Remove the JP03B test pattern from Clause 120 and make appropriate changes to Clause 45.

Cl **120** *SC* **120.5.10.2.5** *P* **141** *L* **14** # 52

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A**

When 120D's definition of level separation mismatch ratio (linearity) has changed from this transmitter linearity test pattern to PRBS13Q...

SuggestedRemedy

Check that the optical clauses haven't adopted it, delete this subclause and recover bit 1.1501.11.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Transmitter linearity test pattern was used by CDAUI-8 C2C via reference to 94.3.12.5.1 but comment #145 has changed the reference and now PRBS13Q is used instead.
Remove the transmitter linearity test pattern from Clause 120 and make appropriate changes to Clause 45.

Cl **120B** *SC* **120B.1** *P* **225** *L* **2** # 101

Ghiasi, Ali Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

AC coupling is defined to be <50 Khz

SuggestedRemedy

For 10 GbE it was common practice to have 50 KHz low cutoff for DC blocks, we are operating 2.5x faster. It makes sense to increase the DC block to at least 100 KHz.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz." to:
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 100 kHz."
[Editor's note: Clause changed from 120 to 120B, subclause changed from 120.b1 to 120B.1]

Cl **120C** *SC* **120C.1** *P* **231** *L* **10** # 122

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **A**

With the increase in Nyquist frequency from CAUI-4 (3% higher) the loss numbers can't be the same when using the same equation. With the higher allowed BER there should be no issue having a little more loss in the channel.

SuggestedRemedy

In Figure 120C-2 change 7.3dB to 7.5dB. (This will make this the same as for CDAUI-8)

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
In Figure 120C-2, change 7.3 dB to 7.5 dB and change the title to "Chip-to-module insertion loss budget at 13.28 GHz"

Cl **120C** *SC* **120C.3.1** *P* **231** *L* **35** # 123

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **A**

There is a conflict between 120C.3.1 and 120C.4. 120C.3.1 would imply that the eye diagrams for the host output are measured for no FEC whereas 120C.4 is saying that eye diagrams are measured as for RS-FEC.

SuggestedRemedy

Either (preferred) on line 35 add "and the eye height and eye width are measured as specified in 109B.3.2.1 for the module output of a PHY that includes an RS-FEC sublayer."
or
in 120C.4 insert "module output" between "The" and "eye"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
109B.3.2.1 is specific to the module output eye.
In 129C.4, change: "The eye height, ..." to:
"The module output eye height, ..."

Cl **120D** *SC* **120D.1** *P* **236** *L* **17** # 6

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

The cited electrical interface length has been magenta 25cm for a ballot cycle without any comments or contributions requesting a change.
Change 25 cm (Magenta) to 25 cm (Black).

SuggestedRemedy

Change 25 cm (Magenta) to 25 cm (Black).

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.1** *P* **237** *L* **3** # 106

Ghiasi, Ali Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

AC coupling is defined to be <50 Khz

SuggestedRemedy

For 10 GbE it was common practice to have 50 KHz low cutoff for DC blocks, we are operating 2.5x faster. It makes sense to increase the DC block to at least 100 KHz.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz"
to
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 100 kHz"

[Editor's note: Clause changed from 120 to 120D, subclause changed from 120.d1 to 120D.1]

Cl **120D** *SC* **120D.3.1** *P* **239** *L* **27** # 57

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A**

94.3.12.6.2 uses an extremely unrepresentative test pattern, but we can measure EOJ at the same time and with the same pattern as other things.

SuggestedRemedy

Using two repeats of PRBS13Q, define EOJ as the difference of the average of even and odd edge timings, as in 92.8.3.8.1. Do we measure EOJ for all three sub-eyes or just the middle one?

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Use Even-Odd jitter measurement defined in Annex 120E.3.3.2

Change "Reference" cell in "Even-odd jitter (max)" row of Table 120D-1 from "94.3.12.6.2" to "120E.3.3.2"

Cl **120D** SC **120D.3.1** P **239** L **27** # 149

Hegde, Raj — Broadcom Corporation

Comment Type **T** *Comment Status* **A**

The current TX jitter budget does not reflect implementational constraints associated with a PAM-4 transmitter

SuggestedRemedy

The clock random and deterministic jitter specs need to be updated to accomodate wider range of TX designs. A presentation will be made in support of this comment

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
While there is agreement that a change to the output jitter specifications in Table 120D-1 is needed, there is insufficient consensus on the detail of these changes to enable the draft to be modified at this time.

Cl **120D** SC **120D.3.1** P **239** L **27** # 56

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **A**

This contains "Clock random jitter" and "Clock deterministic jitter". But there probably isn't an accessible clock, the method of 94.3.12.6.1 uses a real-time scope, an unrepresentative pattern, a jitter filter that is too much tailored to a particular design, an extremely low jitter corner frequency, and too much extrapolation.

SuggestedRemedy

Specify J2 Jitter and J4 Jitter (or J5), which are directly measurable, using QPRBS13 if measuring uncorrelated jitter, QPRBS31 if including correlated jitter. Do we measure jitter for all three sub-eyes or just the middle one?

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to Comment #149

Cl **120D** SC **120D.3.1.1** P **238** L **51** # 27

Mellitz, Richard — Intel Corporation

Comment Type **TR** *Comment Status* **A**

To better support a SNDR of 31 dB, scope quantization errors and pattern truncation errors should to be removed.

SuggestedRemedy

The transmitter output equalization is characterized using the linear fit method described in 94.3.12.5.2 with the exceptions that the PRBS13Q test pattern (see 120.5.10.2.3) and two fits are performed. One is performed with a Dp value of 2 and an Np value of 13 and the other wiith a Dp value of 2 and an Np Value 4000. Sigma_e is determined in both cases and is assigned the parameters names of sigma_e1 for the compuation with the Np value of 14 and sigma_e2 for the compuation with the Np value of 4000. Vfinal and Pmax as decribed in 92.8.3.7 are determined in the computation using an Np value of 13. SNDR is computed as in eq. 92.9 using sigma_e computed as the square root of the sigma_e1^2 - sigma_e2*^2.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
More information needed

Cl **120D** SC **120D.3.1.1** P **238** L **53** # 99

Healey, Adam — Broadcom Ltd.

Comment Type **E** *Comment Status* **A** *Bucket*

N_p and D_p are variables and should be italic text.

SuggestedRemedy

Per comment.

Response *Response Status* **C**

ACCEPT.

Cl **120D** SC **120D.3.1.1** P **239** L **18** # 91

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

The transmitter linearity test method defined in 94.3.12.5.1 can misinterpret linear distortion (e.g., settling time of the step) as non-linear level separation mismatch.

SuggestedRemedy

Measured the signal levels from a PRBS13Q waveform. Define V_A, V_B, V_C, V_D to be average voltage corresponding to the 0, 1, 2, and 3 values, respectively, in the PRBS13Q test pattern.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of Comment #145

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **18** # 55

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **A**

94.3.12.5.1's method of measuring linearity uses a completely unrepresentative test pattern and can give unrepresentative results.

SuggestedRemedy

Extract the levels from PRBS13Q as discussed.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of Comment #145

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **18** # 95

Healey, Adam — Broadcom Ltd.

Comment Type **E** *Comment Status* **A** *Bucket*

In Table 120D-1, the parameter names under the heading "Output waveform" do not align with their respective values.

SuggestedRemedy

Change the formating of the "Parameter" column to achieve the correct alignment.

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **18** # 145

Hegde, Raj — Broadcom Corporation

Comment Type **T** *Comment Status* **A**

Currently, the entry in the Reference column for RLM(min) in Table 120D-1 points to 94.3.12.5.1 for the transmitter linearity measurement method. This measurement method allows for large asymmetry between -1/3 and +1/3 levels.

SuggestedRemedy

Change the measurement method to tighten the allowed asymmetry in the TX output. A consensus measurement method has been developed and presented in the ad-hoc. An updated presentation will be submitted in support of this comment.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Make the changes documented in healey_3bs_02_0316.pdf

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **21** # 93

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

A limit of 0.8 for the ratio pmax/vf is challenging for test equipment (see http://www.ieee802.org/3/by/public/adhoc/architecture/ran_021716_25GE_adhoc.pdf).

SuggestedRemedy

Include a Gaussian filter in the COM transmitter model that represents practical (non-zero) rise and fall times for the source that drives the package model. Use the updated model as the basis for a new limit on pmax/vf.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Insufficient remedy provided to enable changes to be made to the draft at this time. What is new value of pmax/vf ?

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **22** # 104

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A** *CRU BW*

No definition of CRU for measurement of output waveform and jitter

SuggestedRemedy

Add footnote to table or subection to be referenced
"The clock recovery unit (CRU) used in the electrical 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."
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz will increase transmitter penalty jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate and show that there is a transmitter penalty if we reduce the CRU BW to 2 MHz. These result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Add the following note to the "Output waveform" section of Table 120D-1 : "The clock recovery unit (CRU) used in the output waveform measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade."

Add the following note to the "Output jitter" section of Table 120D-1 : "As an exception to 94.3.12.6.1, the clock recovery unit (CRU) used in the jitter measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade."
e

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **24** # 146

Hegde, Raj — Broadcom Corporation

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

In Table 120D-1, Signal-to-noise-and-distortion ratio (min) is set at 31dB. With PAM4 transmitters having a richer variety of transitions and more mechanism to generate distortion, a relaxed budget would allow for ease of implementation.

SuggestedRemedy

Allow the SNDR spec to be reduced to 29dB for higher de-emphasis levels. An updated presentation will be submitted in support of this comment.

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **120D** *SC* **120D.3.1.1** *P* **239** *L* **27** # 92

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A** *CRU BW*

The output jitter requirements refer to 94.3.12.6.1. That subclause high-pass filters the jitter using a 1.6 MHz corner frequency (and 3 dB of peaking at ~6 MHz). This does not agree with the jitter tolerance corner frequency implied by 120D.3.2.2.

SuggestedRemedy

Include an exception to the requirements of 94.3.12.6.1 that replaces the high-pass filter parameters with those that agree with the jitter tolerance requirements in 120D.3.2.2.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of comment 104

Cl **120D** *SC* **120D.3.2.1** *P* **241** *L* **22** # 98

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

Annex 93C requires the specification of a test pattern. No test pattern is defined in either 94.3.13.3 or this subclause.

SuggestedRemedy

Specify the test pattern for interference tolerance (and jitter tolerance) measurements. Since the measured quantity is "RS-FEC symbol error ratio", the test pattern seems likely to be "scrambled idle encoded by RS-FEC" or similar.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Modify the exception for the test pattern in 120D.3.2.1 as inserted by comment #96 to define the test pattern as the scrambled idle pattern defined in Clause 119

Cl **120D** *SC* **120D.3.2.1** *P* **241** *L* **22** # 96

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

The list of exceptions to the receiver interference tolerance requirements referenced in 94.3.13.3 is incomplete. For example, 94.3.13.3 requires that the test transmitter meet the specifications in 94.3.12 and that R_LM be set to 0.92. These are not the correct values for CDAUI-8.

SuggestedRemedy

Since 94.3.13.3 is essentially a reference to Annex 93C with some clarifications, referencing this subclause with another set of clarifications is not a service to the reader. Remove the reference to 94.3.13.3 and list the requirements to implement the Annex 93C procedure for CDAUI-8 in this subclause.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Make the changes documented in healey_3bs_03_0316.pdf without the modifications to item c) that would be needed if the proposal in hegde_3bs_03_0316.pdf had been adopted and making the following changes:
In the first paragraph:
Change "the exceptions" to: "the exception"
Delete "and there is no RSS_DFE4 requirement for the test channels"
Restore the "RSS_DFE4" row in Table 120D-5 and associated footnote.

Cl **120D** *SC* **120D.3.2.1** *P* **241** *L* **38** # 97

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

It appears that P802.3by has done away with the "coefficients of fitted insertion loss" and "RSS_DFE4" parameters for the interference tolerance test channel (presumably because the parameters are difficult to control and COM-based broadband noise calibration procedure will modulate the noise amplitude as a function of the test channel properties). Are these parameters needed for this interference tolerance test?

SuggestedRemedy

Consider simplifying Table 120D-5 by removing the "coefficients of fitted insertion loss" and "RSS_DFE4" rows. However, Annex 93C specifically states that the implementer is required to "(b) verify that RSS_DFE4 is greater than or equal to the value specified". Rather than modify Annex 93C, it would be better to add an exception in 120D.3.2.1 stating that there is no RSS_DFE4 requirement for the test channels.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
The "coefficients of fitted insertion loss" have been removed, but "RSS_DFE4" has not been removed.
See response to comment #96

Cl **120D** *SC* **120D.3.2.2** *P* **240** *L* **14** # 105

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A** *CRU BW*

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
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz will increase transmitter penalty jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate and show that there is a transmitter penalty if we reduce the CRU BW to 2 MHz. These result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #58

Cl **120D** *SC* **120D.3.2.2** *P* **242** *L* **3** # 94

Healey, Adam — Broadcom Ltd.

Comment Type **T** *Comment Status* **A**

The list of exceptions to the receiver jitter tolerance requirements referenced in 94.3.13.4 is incomplete. For example, in 94.3.13.4.1 (Test setup), it is stated that the test channel meets the requirements for Test 2 in 94.3.13.3 and this is the wrong channel for a CDAUI-8 chip-to-chip test. 94.3.13.4.1 also contains some ambiguities. It states that "Tx and channel noise sources are disabled" but there is no "Tx noise source" in the test setup (other than the instrinsic SNDR of test transmitter which presumably cannot be disabled). Secondly, it is unclear how the test channel can "meet the requirements for the channel used for Test 2" with the Rx noise source disabled. The lack of broadband noise implies the maximum COM value is likely to be exceeded.

SuggestedRemedy

Since 94.3.13.4 is essentially a reference to Annex 93C with some clarifications, referencing this subclause with another set of clarifications is not a service to the reader. Replace the contents of 120D.3.2.2, with the exception of Table 120D-6, with the following text.

"Receiver jitter tolerance is verified for each pair of jitter frequency and peak-to-peak amplitude values listed in Table 120D-6. The test setup shown in Figure 93-12, or its equivalent, is used. The test channel meets the insertion loss requirement for Test 2 in Table 120D-5. The synthesizer frequency is set to the specified jitter frequency and the synthesizer output amplitude is adjusted until the specified peak-to-peak jitter amplitude for that frequency is measured at TP0a. The test procedure is the same as the one described in 120D.3.2 [Interference Tolerance], with the exception that no broadband noise is added.

The receiver under test shall meet the RS-FEC symbol error ratio requirements for each case in Table 120D-6."

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Replace the contents of 120D.3.2.2, with the exception of Table 120D-6, with the following text.

"Receiver jitter tolerance is verified for each pair of jitter frequency and peak-to-peak amplitude values listed in Table 120D-6. The test setup shown in Figure 93-12, or its equivalent, is used. The test channel meets the insertion loss requirement for Test 2 in Table 120D-5. The synthesizer frequency is set to the specified jitter frequency and the synthesizer output amplitude is adjusted until the specified peak-to-peak jitter amplitude for that frequency is measured at TP0a. The test procedure is the same as the one described in 120D.3.2, with the exception that no broadband noise is added.

The receiver under test shall meet the RS-FEC symbol error ratio requirements for each case in Table 120D-6."

Cl **120D** *SC* **120D.3.2.2** *P* **242** *L* **14** # 34

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A** *CRU BW*

This jitter tolerance test appears to have a jitter corner frequency of fb/8496 or 3.126471 MHz. This appears to be inherited from Clause 94, and such a low frequency will cost extra design effort because it's close to the power supply switching frequencies. Also it's unlike anything else in 10, 25, 100 or 400G Ethernet (not counting Clause 94), so will make problems if using 120D as an AUI.

SuggestedRemedy

Change the corner frequency to 5 or 10 MHz for now.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of comment 104

Cl **120D** *SC* **120D.3.2.2** *P* **242** *L* **14** # 58

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **A**

Specifying jitter tolerance at just two frequencies leaves holes in the spec. But quite a coarse grid of test points can fill them unless there are strong peaks in the jitter spectrum, which previous specs implied isn't the case because they use spot frequencies. The 5 or 6 points proposed would be much cheaper to test than a continuous line with a multitude of candidate test points.

SuggestedRemedy

Suggest 5 or 6 points:
f/100 f/5 f/2 f 2f 5f, or
f/100 f/3 f 3f 10f, where f is the jitter corner frequency, with SJ amounts from the usual mask: 0.05 UI above the jitter corner requency, rising as the inverse of frequency below.
Therefore, 5 0.25 0.1 0.05 0.05 0.05, or
5 0.15 0.05 0.05 0.05 UI.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This was discussed at the 29th Feb Electrical ad hoc and there was consensus that this was an improvement over the existing 2 points.
Change Table 120D-6 to add 3 additional "Case" columns (C, D & E).
Set the "RS-FEC Symbol error ratio" value cells of the new columns to match the existing value of "Case A".
Set the "Jitter frequency" value cells of the 5 columns to 40 KHz, 1.333 MHz, 4 MHz, 12 MHz, & 40 MHz
Set the "Jitter Amplitude" value cells of the 5 columns to 5, 0.15, 0.05, 0.05, & 0.05.
(All text in Black).

Cl **120D** *SC* **120D.4** *P* **243** *L* **17** # 35

Dawe, Piers Mellanox

Comment Type **E** *Comment Status* **A**

280 nF ... 110 nF

SuggestedRemedy

2.8 x 10^-4 nF ... 1.1 x 10^-4 nF

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Although healey_3bs_02_1115 said 280 nF, this is 1000000 x the capacitance in CAUI-4 C2C.
I think that he meant 280 fF. This would be 0.28 pF or 2.8 x 10^-4 nF.

Change 280 to 2.8 x 10^-4
Change 110 to 1.1 x 10^-4

Make values black

Cl **120D** *SC* **120D.4** *P* **243** *L* **18** # 7

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "Single-ended device capacitance" (Cd), and "Single-ended board capacitance" (Cb) values have been in magenta text for a ballot cycle without any comments or contributions requesting a change. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for these values to remain in magenta.
Change the text color of these values to black.

SuggestedRemedy

In Table 120D-7:
Change "Single-ended device capacitance" (Cd) value text color from Magenta to Black.
Change "Single-ended board capacitance" (Cd) value text color from Magenta to Black.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of comment 35

Cl **120D** *SC* **120D.4** *P* **243** *L* **41** # 124

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **A**

The COM table here includes a Continuous time filter 2 which is not described in Annex 93A.

SuggestedRemedy

Amend Annex 93A to include the option of a second Continous time filter.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
The editor is given editorial license to make this change.

Cl **120D** *SC* **120D.4** *P* **243** *L* **41** # 8

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "Continuous time filter , DC gain 2", "Continuous time filter, zero frequencies" and "Continuous time filter, pole frequencies" values have been in magenta text for a ballot cycle without any comments or contributions requesting a change. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for these values to remain in magenta.
Change the text color of these values to black.

SuggestedRemedy

In Table 120D-7:
Change "Continuous time filter , DC gain 2, Minimum value" value text color from Magenta to Black.
Change "Continuous time filter , DC gain 2, Maximum value" value text color from Magenta to Black.
Change "Continuous time filter , DC gain 2, Step size" value text color from Magenta to Black.
Change "Continuous time filter, zero frequencies" (Fz1, Fz2) values text color from Magenta to Black.
Change "Continuous time filter, pole frequencies" (Fp1, Fp2) values text color from Magenta to Black.

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.4** *P* **244** *L* **5** # 9

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "Level seperation mismatch ratio", (R_lm) value has been in magenta text for a ballot cycle. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In Table 120D-7:
Change "Level seperation mismatch ratio" (R_lm) value text color from Magenta to Black.

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.4** *P* **244** *L* **7** # 143

Hegde, Raj Broadcom Corporation

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

The transmitter signal to noise ratio - SNR_TX may not reflect an updated SNDR definition for the CDAUI-8 TX in Table 120D-1.

SuggestedRemedy

SNR_TX needs to be updated to reflect the modified SNDR specification (please refer to the comment on SNDR for further details) A presentation will be made in support of this comment

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **120D** *SC* **120D.4** *P* **244** *L* **10** # 10

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "Decision feedback equalizer (DFE) length", value has been in magenta text for a ballot cycle. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In Table 120D-7:
Change "Decision feedback equalizer (DFE) length" value text color from Magenta to Black.

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.4** *P* **244** *L* **12** # 11

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "Normalized DFE coefficient magnitude limit, for n=1", value has been in magenta text for a ballot cycle. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In Table 120D-7:
Change "Normalized DFE coefficient magnitude limit, for n=1" value text color from Magenta to Black

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.4** *P* **244** *L* **17** # 12

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120D-7:
The "One-sided noise spectral density", value has been in magenta text for a ballot cycle. Changes that have been made to other values in this table during D1.1 comment resolution were made in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In Table 120D-7:
Change "One-sided noise spectral density" value text color from Magenta to Black

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.1** *P* **248** *L* **52** # 36

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R**

A sentence has been added that isn't in 83E and should not be here: "The low-frequency 3 dB cutoff of the AC-coupling within the module shall be less than 50 kHz." For the transmit side, this spec is unnecessary because there is a module stressed input test with a long pattern. For the receive side (module output), the spec is not viable because no way of testing it is given (only one side of the AC coupling is accessible, unlike a passive copper link). 50 kHz is what 40GBASE-CR4 uses, at 10.3125 GBd, 24.44 dB, no FEC. This is 26.5625 GBd, 10.2 dB, with FEC but PAM4, so it could work fine with a higher low-frequency 3 dB cutoff anyway.

SuggestedRemedy

Delete the sentence.

Response *Response Status* **C**

REJECT.
This sentence was specifically added in response to comment #112 on draft 1.1, and agreed to in D1.1 comment resolution.
There was no consensus to remove this sentence.

Cl **120E** *SC* **120E.1** *P* **248** *L* **53** # 107

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

AC coupling is defined to be <50 Khz

SuggestedRemedy

For 10 GbE it was common practice to have 50 KHz low cutoff for DC blocks, we are operating 2.5x faster. It makes sense to increase the DC block to at least 100 KHz.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 50 kHz"
to
"The low-frequency 3 dB cutoff of the AC-coupling shall be less than 100 kHz"

[Editor's note: Clause changed from 120 to 120E, subclause changed from 120.e1 to 120E.1]

Cl **120E** *SC* **120E.1** *P* **249** *L* **20** # 108

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

Equation 120E-1 has a loss of 10.9 dB which is inconsistant with Figure 120E-2 with loss of 10.2 dB

SuggestedRemedy

Please correct the equation to have loss of 10.2 dB as given below by just removing factor 1.076:
L=< (0.0801 + 0.5736*sqrt(f)+ 0.6046*f)

Response *Response Status* **C**

ACCEPT.
See resolution of Comment #15 on D1.0

[Editor's note: Clause changed from 120 to 120E, subclause changed from 120.e1 to 120E.1]
.

Cl **120E** *SC* **120E.3.1.2** *P* **252** *L* **22** # 37

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **A**

"Unless otherwise noted, differential and common-mode signal levels are measured with a PRBS13Q test pattern": what do you mean by "signal levels"? Levels 0, 1, 2 and 3?

SuggestedRemedy

Change "signal levels" to "signals".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change "Unless otherwise noted, differential and common-mode signal levels are measured with a PRBS13Q test
pattern."
to
"Unless otherwise noted, differential and common-mode voltages are measured with a PRBS13Q test
pattern.".

Cl **120E** *SC* **120E.3.1.6** *P* **252** *L* **51** # 113

Ghiasi, Ali — Ghiasi Quantum LLC

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

Host output eye must be measurd with a reference CRU

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 2 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.
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

The requirement for a reference CRU and it's bandwidth are defined as part of the eye width and height measurement methodology in 120E.4.2, which is referenced in this sub-clause. There is no need to specify it here.

Cl **120E** *SC* **120E.3.1.6** *P* **252** *L* **54** # 109

Ghiasi, Ali — Ghiasi Quantum LLC

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

Host output eye must be measurd with a reference CRU

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 2 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.
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

See resolution of Comment #113

Cl **120E** *SC* **120E.3.1.6** *P* **253** *L* **5** # 13

Szczepanek, Andre — Inphi

Comment Type **ER** *Comment Status* **A**

The "target transition time", value has been in magenta text for a ballot cycle. Changes were made to other transition time values during D1.1 comment resolution in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In the text "target transition time of 12 ps" change the text color of "12" from Magenta to Black

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.1.6.1** *P* **253** *L* **39** # 38

Dawe, Piers — Mellanox

Comment Type **E** *Comment Status* **R**

Gratuitous clutter

SuggestedRemedy

Delete all the 2pi in Eq 120-2 and Table 120-2, change Grad/s to GHz, four times.

Response *Response Status* **C**

REJECT.
The format is identical to that used in Annex 83E.

Cl **120E** *SC* **120E.3.2** *P* **255** *L* **47** # 14

Szczepanek, Andre — Inphi

Comment Type **ER** *Comment Status* **A**

In Table 120E-3:
The "ESMW (Eye Symmetry mask width)", value has been in magenta text for a ballot cycle. The equivalent host module value was changed to black in D1.1 comment resolution. There is no reason for this value to remain in magenta.
Change the text color of this value to black

SuggestedRemedy

In Table 120E-3:
Change "ESMW (Eye Symmetry mask width)" value text color from Magenta to Black

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of Comment #128

Cl **120E** *SC* **120E.3.2** *P* **255** *L* **47** # 128

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **A**

ESMW is in Magenta. It is also smaller (0.25) than the value being used for the host input stressed test (0.4) which is black. These numbers need to be aligned to close the budget. It would be very difficult for a host to recover a signal that has such a small value.

SuggestedRemedy

Change the value to 0.4 and make it black.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.2** *P* **255** *L* **47** # 39

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **A**

ESMW value is wrong: should match eye width here and ESMW in Table 120E-5, host stressed input parameters.

SuggestedRemedy

Change 0.25 to 0.4

Response *Response Status* **C**

ACCEPT.
See resolution of Comment #128

Cl **120E** *SC* **120E.3.2** *P* **256** *L* **13** # 126

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **A**

The Bit error rate requirement is only 1e-5 in section 120E.1.1. There is no need to measure the PAM4 eyes or jitter etc. to 10^-6 probability

SuggestedRemedy

Change 10^-6 to 10^-5 in two places. Also on page 259 lines 18 and 19 and 31, page 261 lines 42 and 43 page 262 line 44, 53, 54. and page 263 line 10. And change the number of samples on page 262 line 43 to 400 thousand.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.2.1** *P* **252** *L* **31** # 110

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **D** *CRU BW*

Module output must be measurd with a reference CRU

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 2 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.
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

The requirement for a reference CRU and it's bandwidth are defined as part of the eye width and height measurement methodology in 120E.4.2, which is referenced in this sub-clause. There is no need to specify it here.

Cl **120E** *SC* **120E.3.2.1** *P* **256** *L* **19** # 114

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **D** *CRU BW*

Module output must be measurd with a reference CRU

SuggestedRemedy

The clock recovery unit (CRU) for the eye measurement has a corner frequency of 2 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.
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

See resolution of Comment #110

Cl **120E** *SC* **120E.3.3.2** *P* **257** *L* **41** # 127

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **A**

There is no definition of what "the time of each transition is". This section implies that it is all transitions from all levels to all other levels.

SuggestedRemedy

Add additional paragraphs stating the following or create another sub clause (120E.4.3) that contains this information.

The time of a transition from 0 to 3, 3 to 0, 1 to 2, or 2 to 1 is the time at which the signal crosses the mid point of Vmid defined in 120E.4.2.
The time of a transition from 0 to 1 or 1 to 0 is the time at which the signal crosses the mid point of Vlow defined in 120E.4.2.
The time of a transition from 2 to 3 or 3 to 2 is the time at which the signal crosses the mid point of Vupp defined in 120E.4.2.
The time of transitions from 0 to 2, or 2 to 0, is the time at which the signal crosses the mean value of the 1 level signal in the central 0.05UI of the eye.
The time of transitions from 1 to 3, or 3 to 1, is the time at which the signal crosses the mean value of the 2 level signal in the central 0.05UI of the eye.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.3.2** *P* **257** *L* **47** # 18

Szczepanek, Andre — Inphi

Comment Type **T** *Comment Status* **A**

The TBD in the sentence "Even-odd jitter shall be less than or equal to TBD UI regardless of the transmit equalization setting." is an unecessary duplication of the even-odd jitter specification in tables 120E-6, and 120E-9

SuggestedRemedy

Change
"Even-odd jitter shall be less than or equal to TBD UI regardless of the transmit equalization setting."
to
"The Even-odd jitter specification shall be met regardless of the transmit equalization setting."

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.3.3** *P* **258** *L* **39** # 15

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

In Tables 120E-5 & 120E-8:
The "Applied pk-pk sinusoidal jitter" value should be black not magenta in color.
Although there is support for defining additional frequencies no consensus presnation has been adopted. Unitil this happens this value should be made black.

SuggestedRemedy

In Tables 120E-5:
Change the "Applied pk-pk sinusoidal jitter" value from magenta to black in color.
In Tables 120E-8:
Change the "Applied pk-pk sinusoidal jitter" value from magenta to black in color.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution to comment 40

Cl **120E** *SC* **120E.3.3.3** *P* **258** *L* **39** # 40

Dawe, Piers Mellanox

Comment Type **T** *Comment Status* **A**

The reference to the jitter mask in Table 88-13 with its multitude of implied test cases can be replaced by a set of 5 or 6 test cases.

SuggestedRemedy

0.1 2 5 10 20 50 MHz
5 0.25 0.1 0.05 0.05 0.05 UI
or
0.1 3.333 10 30 100 MHz
5 0.15 0.05 0.05 0.05 UI.
Also in Table 120E-8.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Create a new table loosely based on Table 120D-6 but with 3 additional "Case" columns (C, D & E), and no "RS-FEC Symbol error ratio" row.
Set the "Jitter frequency" value cells of the 5 columns to 40 KHz, 1.333 MHz, 4 MHz, 12 MHz, & 40 MHz
Set the "Jitter Amplitude" value cells of the 5 columns to 5, 0.15, 0.05, 0.05, & 0.05.
In Tables 120E-5 and 120E-8 replace the reference to Table 88-13 with a reference to this new table (in Black).

Cl **120E** *SC* **120E.3.3.3.1** *P* **255** *L* **20** # 115

Ghiasi, Ali Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A** *CRU BW*

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 2 MHz
Also change Table 120E-4 reference to Table 88-13 with Table 87-13
see http://www.ieee802.org/3/bs/public/15_09/ghiasi_3bs_01b_0915.pdf for background material and http://www.ieee802.org/3/bs/public/15_07/ghiasi_3bs_01_0715.pdf plan to consolidate these two presentation for Atlanta as ghiasi_3bs_01_0116.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
In 120E.3.3.3.1 change "A reference CRU with a corner frequency of 10 MHz" to "A reference CRU with a corner frequency of 4 MHz"
In 120E.3.4.1.1 change "A reference CRU with a corner frequency of 10 MHz" to "A reference CRU with a corner frequency of 4 MHz "
In 120E.4.2 change "Capture PRBS13Q using a clock recovery unit with a corner frequency of 10 MHz" to "Capture PRBS13Q using a clock recovery unit with a corner frequency of 4 MHz"

Cl **120E** *SC* **120E.3.3.3.1** *P* **258** *L* **46** # 111

Ghiasi, Ali Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A** *CRU BW*

10 MHz CRU adds extra burden to the host SerDes

SuggestedRemedy

Replace 10 Mhz with 4 MHz
Also change Table 120E-4 reference to Table 88-13 with Table 87-13
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz will increase transmitter penalty jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate and show that there is a transmitter penalty if we reduce the CRU BW to 2 MHz. These result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment 115

Cl **120E** *SC* **120E.3.3.3.1** *P* **258** *L* **47** # 144

Hegde, Raj — Broadcom Corporation

Comment Type **T** *Comment Status* **A** *CRU BW*

The reference CRU bandwidth is currently set at 10MHz. Several implementation styles may find this setting too high.

SuggestedRemedy

Change the reference CRU bandwidth to 4MHz. A presentation will be submitted in support of this comment

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment 115

[Editor's note: Clause changed from CL120 to 120E]

Cl **120E** *SC* **120E.3.3.3.1** *P* **258** *L* **47** # 5

Szczepanek, Andre — Inphi

Comment Type **ER** *Comment Status* **D** *CRU BW*

The CRU corner frequency, value of "10MHz" has been in magenta text since the D1.0 ballot cycle (it was black D1.0). Consensus has not been achieved on changing the value yet.
If consensus is not achieved to change the value during D1.2 comment resolution then the colour of the value should be changed back to Black.
This change should be applied to all references to 10 MHz CRU bandwidth in 120E.

SuggestedRemedy

In 120E.3.3.3.1 (Page 258, Line 47) change colour of "10MHz" from Magenta to Black.
In 120E.3.4.1.1 (Page 260, Line 53) change colour of "10MHz" from Magenta to Black.
In 120E.4.2 (Page 262, Line 42) change colour of "10MHz" from Magenta to Black.

Proposed Response *Response Status* **Z**

REJECT.

This comment was WITHDRAWN by the commenter.

Cl **120E** *SC* **120E.3.3.3.1** *P* **258** *L* **48** # 129

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **R**

A PAM4 module output eye width of 0.4UI can be generated two different ways with very different effects on a host. It could be with slow edges and little jitter which would be relatively benign for a host. However it could also be with fast edges (only limited by the 33GHz scope bandwidth) and with a lot of uncorrelated jitter.

SuggestedRemedy

Change the scope bandwidth for measuring the Module output eye and calibrating the host stressed input signal to be 20GHz.

Response *Response Status* **C**

REJECT.
No consensus to change at this point

Straw Poll :
In 120E.4.2
Change "The reference receiver
includes a fourth-order Bessel-Thomson low-pass filter response with 33 GHz 3 dB bandwidth"
to
"The reference receiver
includes a fourth-order Bessel-Thomson low-pass filter response with 20 GHz 3 dB bandwidth"

For 3; Against 0; Need more information 10

Cl **120E** *SC* **120E.3.3.3.1** *P* **259** *L* **2** # 17

Szczepanek, Andre Inphi

Comment Type **T** *Comment Status* **A**

"stressed pattern data rate (2.65625 GBd)."
should be baud rate given this is PAM4

The same issue is present in the Module clause 120E.3.4.1.1

SuggestedRemedy

Change
"stressed pattern data rate (2.65625 GBd)."
to
"stressed pattern baud rate (2.65625 GBd)."
in 120E.3.3.3.1 and 120E.3.4.1.1

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Baud is already a rate. "Symbol rate" is better wording.

Change
"The data rate should be approximately 1/10 of the stressed pattern data rate (2.65625 GBd)."
to
"The PRBS signaling rate should be approximately 1/10 of the stressed pattern signaling rate (2.65625 GBd)."
in 120E.3.3.3.1 and 120E.3.4.1.1

Cl **120E** *SC* **120E.3.3.3.1** *P* **259** *L* **7** # 20

Szczepanek, Andre Inphi

Comment Type **TR** *Comment Status* **A**

Change the specification of pattern generator jitter characteristics used in the setup phase of Stressed receiver test calibration to use the profile used in Annex 120D (C2C) transmitter jitter characterization.
Change both Host and Module stressed input test procedures.

SuggestedRemedy

Remove Tables 120E-6, & 120E-9
In 120E.3.3.3.1, change
"Random jitter and bounded uncorrelated jitter are added such that the output of the pattern generator approximates a jitter profile given in Table 120E-6"
to
"Random jitter and bounded uncorrelated jitter are added such that the output of the pattern generator approximates the CDAUI-8 C2C Output jitter profile given in Table 120D-1"

In 120E.3.4.1.1, change
"Random jitter and bounded uncorrelated jitter are added such that the output of the pattern generator approximates a jitter profile given in Table 120E-9"
to
"Random jitter and bounded uncorrelated jitter are added such that the output of the pattern generator approximates the CDAUI-8 C2C Output jitter profile given in Table 120D-1"

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.3.3.1** *P* **259** *L* **10** # 41

Dawe, Piers Mellanox

Comment Type **E** *Comment Status* **A**

The settings in this table aren't the ones used in the test, they are temporary settings for a first stage in calibration. It would help to change the title to something that reflects this.

SuggestedRemedy

Change "Pattern generator jitter characteristics" to "Pattern generator initial jitter settings".
Also Table 120E-9.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of Comment #20

Cl **120E** *SC* **120E.3.3.3.1** *P* **259** *L* **13** # 42

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **R**

The point of Table 120E-6, pattern generator jitter characteristics, is to get the uncorrelated high probability jitter right before tweaking the Gaussian jitter (RJ) in a later step to get to the target eye width. So setting RJ and TJ at this stage is missing the point: they are going to change anyway. There is no need for jitter parsing rigmarole and back-extrapolation errors: we can set J2 and J4 targets that can be directly measured. The jitter at this stage should be significantly more than for a C2C CDAUI IC, because C2M is supposed to be easier.

SuggestedRemedy

J2 Jitter 0.1 UI
J4 Jitter 0.2 UI
Max even-odd jitter (pk-pk) 0.035 UI (same as 83E)
Same for Table 120E-9.

Response *Response Status* **C**

REJECT.
See resolution of Comment #20

Cl **120E** *SC* **120E.3.3.3.1** *P* **259** *L* **24** # 16

Szczepanek, Andre — Inphi

Comment Type **ER** *Comment Status* **A**

The "target transition time", value has been in magenta text for a ballot cycle. Changes were made to other transition time values during D1.1 comment resolution in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In the text "target transition time of 12 ps" change the text color of "12" from Magenta to Black

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.4.1.1** *P* **260** *L* **53** # 112

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A** *CRU BW*

10 MHz CRU adds extra burden to the host SerDes

SuggestedRemedy

Replace 10 Mhz with 2 MHz
Also change Table 120E-4 reference to Table 88-13 with Table 87-13
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment 115

Cl **120E** *SC* **120E.3.4.1.1** *P* **260** *L* **54** # 147

Hegde, Raj — Broadcom Corporation

Comment Type **T** *Comment Status* **A** *CRU BW*

The current reference CRU bandwidth of 10MHz may be too high for several implementation styles.

SuggestedRemedy

Change the reference CRU bandwidth to 4MHz. A presentation will be submitted in support of this comment.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment 115

Cl **120E** *SC* **120E.3.4.1.1** *P* **261** *L* **30** # 19

Szczepanek, Andre Inphi

Comment Type **TR** *Comment Status* **A**

The TBD in this sentence needs to be defined.
"The target pattern generator 20% to 80% transition time in the module stressed input test is TBD ps.
Use a value of 9.5ps for this value. There was agreement on this value at the Feb 22nd Electrical ad hoc call

SuggestedRemedy

Change:
"The target pattern generator 20% to 80% transition time in the module stressed input test is TBD ps."
to
"The target pattern generator 20% to 80% transition time in the module stressed input test is 9.5 ps."

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.4.1.1** *P* **261** *L* **51** # 4

Szczepanek, Andre Inphi

Comment Type **ER** *Comment Status* **A**

The "target transition time", value has been in magenta text for a ballot cycle. Changes were made to other transition time values during D1.1 comment resolution in black. There is no reason for this value to remain in magenta.
Change the text color of this value to black.

SuggestedRemedy

In the text "target transition time of 12 ps" change the text color of "12" from Magenta to Black

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.4.2** *P* **262** *L* **34** # 148

Hegde, Raj Broadcom Corporation

Comment Type **T** *Comment Status* **A**

The current eye width and height measurement method does not allow for a large enough pre-cursor in the module TX necessary to overcome the channel loss. The receiver needs a large pre-cursor but the eye width and height could be too low with the larger precursor.

SuggestedRemedy

modify the step 2) in 120E.4.2 to allow a pre-cursor term equivalent to be added to the reference receiver. A presentation will be submitted in support of this comment.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Make the changes proposed in hegde_3bs_04_0316 with editorial license, with the following exceptions:
Do not make the change to the first sentence in 120E.3.2
In Table 120E-3, make:
the Near end Eye Width (min) 0.265 UI
the Far end Eye Width (min) 0.22 UI

Cl **120E** *SC* **120E.4.2** *P* **262** *L* **41** # 132

Le Cheminant, Greg keysight Technologies

Comment Type **T** *Comment Status* **A**

The method described to obtain data samples to create CDF's from which to derive eye widths and heights implies a real-time oscilloscope methodology by specifying a minimum sample rate of 3 samples per bit. This potentially precludes the use of equivalent-time 'sampling' oscilloscopes which otherwise should be capable and often preferred for making the required measurements. The minimum sample rate is only important insofar as it sets an expected accuracy for a real-time acquisition process

SuggestedRemedy

Replace the sentence: "Capture PRBS13Q using a clock recovery unit with a corner frequency of 10 MHz and slope of 20 dB/decade and a minimum sampling rate of 3 samples per bit." with the following:

"Capture the PRBS13Q using a clock recovery unit with a corner frequency of 10 MHz and a slope of 20 dB/decade and either a minimum of 3 samples per symbol, or a sampling process that provides equivalent or better accuracy"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Replace the sentence: "Capture PRBS13Q using a clock recovery unit with a corner frequency of 10 MHz and slope of 20 dB/decade and a minimum sampling rate of 3 samples per bit." with the following:

"Capture the PRBS13Q using a clock recovery unit with a corner frequency of 4 MHz and a slope of 20 dB/decade. The capture includes a minimum of 3 samples per symbol, or equivalent."

Cl **120E** *SC* **120E.4.2** *P* **262** *L* **51** # 43

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A**

Measure the middle eye height and width just like the other two.

SuggestedRemedy

In step 3, rename MIDCDFL and MIDCDFR to MID0CDFL and MID0CDFR. Delete "Calculate the middle eye width (Hmid) as the difference in time between MIDCDFR and MIDCDFL with a value of 1e-6."
In step 5, add: Calculate the voltage center (VCmid) of the middle eye as the mid-point in voltage between MIDCDF1 and MIDCDF0 with a value of 1e-6.
Insert new step 8:
Use the differential equalized signal from step 2) to construct new CDFs of the signal for both the left edge (MIDCDFL) and right edge (MIDCDFR) of the middle eye at VCmid, as a distance from the center of the eye. Calculate the middle eye width (Hmid) as the difference in time between MIDCDFR and MIDCDFL with a value of 1e-6.
In steps 8 and 9 (now 9 and 10), refer to step 8 rather than 3.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.4.2** *P* **262** *L* **53** # 44

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A**

Make the eye timing extraction more like 10GBASE-R, CEI-56G-VSR-PAM4 and real CDRs.

SuggestedRemedy

Calculate the time center of the middle eye width
(TCmid) as the mid-point in time between MIDCDFR and MIDCDFL with a value of 1e-3. (rather than 1e-6)

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Straw Poll
Change
"Calculate the time center of the middle eye width
(TCmid) as the mid-point in time between MIDCDFR and MIDCDFL with a value of 1e-5 (changed from 1e-6 as result of previous comment resolution)."
to
"Calculate the time center of the middle eye width
(TCmid) as the mid-point in time between MIDCDFR and MIDCDFL with a value of 1e-3."

For 4; Against 0;

Cl **120E** *SC* **120E.4.2** *P* **263** *L* **15** # 45

Dawe, Piers — Mellanox

Comment Type **E** *Comment Status* **A**

UPPCDFR and UPPCDFL

SuggestedRemedy

UPPCDF1 and UPPCDF0. Similarly at line 18.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.4.2** *P* **265** *L* **1** # 46

Dawe, Piers — Mellanox

Comment Type **E** *Comment Status* **A**

VClow.C.

SuggestedRemedy

VClow.

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.4.2** *P* **265** *L* **2** # 47

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **A**

While it seems unlikely that the upper and lower eyes could pass the ESMW mask and the middle one fail, if it did it would be a bad signal, and the cost of logging the result is offset by the simplification of removing an exception.

SuggestedRemedy

Change "of the upper eye at VCupp, and of the lower eye at VClow" to "of the middle eye at VCmid, of the upper eye at VCupp, and of the lower eye at VClow".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change "of the upper eye at VCupp, and of the lower eye at VClow" to "of the middle eye at VCmid, of the upper eye at VCupp, and of the lower eye at VClow".
Edit Figure 120E-13 to add "Middle eye must extend beyond mask" to middle eye in the same manner as the upper and lower eyes

Cl **120E** *SC* **120E.4.2** *P* **266** *L* **2** # 125

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **A**

AVupp is incorrectly defined It is not the eye amplitude of the middle eye and logic one and logic zero are problematic for this.

SuggestedRemedy

Replace "is the eye amplitude of the middle eye of the equalized waveform. Eye amplitude is defined as the mean value of logic one minus the mean value of logic zero in the central 5% of the eye" with
"is the eye amplitude of the upper eye of the equalized waveform. Eye amplitude is defined for the upper eye as the mean value of the +1 signal minus the mean value of the +1/3 level signal in the central 5% of the eye"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Replace
"AVupp is the eye amplitude of the middle eye of the equalized waveform. Eye amplitude is defined as the mean value of logic one minus the mean value of logic zero in the central 5% of the eye"
with
"AVupp is the eye amplitude of the upper eye of the equalized waveform. Eye amplitude is defined for the upper eye as the mean value of the +1 signal minus the mean value of the +1/3 level signal in the central 5% of the eye"

Replace
"AVmid is the eye amplitude of the middle eye of the equalized waveform. "
with
"AVmid is the eye amplitude of the middle eye of the equalized waveform. Eye amplitude is defined for the middle eye as the mean value of the +1/3 signal minus the mean value of the -1/3 level signal in the central 5% of the eye"

Replace
"AVlow is the eye amplitude of the middle eye of the equalized waveform."
with
"AVlow is the eye amplitude of the lower eye of the equalized waveform. Eye amplitude is defined for the lower eye as the mean value of the -1/3 signal minus the mean value of the -1 level signal in the central 5% of the eye"

Cl **120E** *SC* **120E.4.2.1** *P* **266** *L* **2** # 48

Dawe, Piers — Mellanox

Comment Type **E** *Comment Status* **A**

Can we make this clearer, as logic one and logic zero could be misinterpreted in PAM4: "Eye amplitude is defined as the mean value of logic one minus the mean value of logic zero in the central 5% of the eye"?

SuggestedRemedy

?

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See resolution of Comment #125

Cl **121** *SC* **121.1.1** *P* **153** *L* **51** # 86

Ran, Adee — Intel

Comment Type **T** *Comment Status* **R**

"The bit error ratio (BER) shall be less than 2.4e-4..."

This is a normative BER requirement without a definition of "errors" or test conditions.

It seems to refer to a system consisting of transmitter, receiver, and channel, each of which can be built from several components coming from several vendors. It is not clear which of the components is responsible for this requirement and there is no way to guarantee meeting it. Under these circumstances there is no sense in this being a normative requirement.

Also applies to similar text in clauses 122 and 123.

SuggestedRemedy

Change to text such as "A system consisting of a compliant transmitter, compliant receiver and compliant channel is expected to operate at a bit error ratio (BER) less than 2.4e-4 at the PMD service interface".

Remove any PICS associated with this text.

Apply to clauses 122 and 123.

Response *Response Status* **C**

REJECT.
The BER defined in this subclause is referenced in several places in Clause 121 and applies to parameters such as TDEC.

Cl **121** *SC* **121.3.1** *P* **155** *L* **24** # 167

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

All three PMD's have:
Delay constraints: 8192 bit times (16 pause_quanta or 20.48 ns)
As the maximum delay time includes the delay through 2 m of fiber after the MDI (which is ~10 ns), this allows PMD implementations that are not module based to have an internal spool of fiber of up to about 2 m before the MDI.
This was discussed on the SMF Ad Hoc call on 2 February with no objection to the proposal to change the delay constraint values black.

SuggestedRemedy

In 121.3.1, 122.3.1, 123.3.1, and the corresponding rows of Table 116-3, change the delay constraint values black.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.5.2** *P* **157** *L* **40** # 87

Ran, Adee — Intel

Comment Type **T** *Comment Status* **A**

"bit stream" makes sense, "signal streams" does not; these are simply signals.

This applies to many places in the draft.

SuggestedRemedy

Change "optical signal streams" to "optical signals" consistently across the draft.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.7.1** *P* **160** *L* **23** # 119

Dudek, Mike — QLogic

Comment Type **T** *Comment Status* **A**

The TDEC specification is modified as well as BER.

SuggestedRemedy

replace "and the BER requirement is as specified in 121.1.1" with ",TDEC is modified as specified in 121.8.5 and the BER requirement is as specified in 121.1.1"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
"... ppm, and the BER requirement is as specified in 121.1.1." to:
"... ppm, TDEC is as specified in 121.8.5, and the BER requirement is as specified in 121.1.1."

Cl **121** *SC* **121.7.1** *P* **160** *L* **23** # 88

Ran, Adee Intel

Comment Type **E** *Comment Status* **A**

"Signaling rate, each lane" should be "signaling rate on each lane". Alternatively, enclose this parameter name with quotes, as in:

'with the exception that the "signaling rate, each lane" parameter specification is 26.5625 Gbd +/- 100 ppm.'

Similarly for 121.7.2.

SuggestedRemedy

per comment.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
...with the exception that the signaling rate, each lane is ... to:
...with the exception that the "signaling rate, each lane" is .

Make the same change in 121.7.2

Cl **121** *SC* **121.7.2** *P* **160** *L* **29** # 120

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **A**

The Stressed receiver sensitivity is also modified.

SuggestedRemedy

replace "and the BER requirement is as specified in 121.1.1" with ",Stessed receiver sensitivity is modified as specified in 121.8.8 and the BER requirement is as specified in 121.1.1"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
"... ppm, and the BER requirement is as specified in 121.1.1." to:
"... ppm, stessed receiver sensitivity is as specified in 121.8.8, and the BER requirement is as specified in 121.1.1."

Cl **121** *SC* **121.8.1** *P* **160** *L* **46** # 121

Dudek, Mike QLogic

Comment Type **T** *Comment Status* **A**

The pattern 5 (scrambled idle) should definitely be modified to use the Clause 119 PCS

SuggestedRemedy

Turn the magenta text to black.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.9.2** *P* **162** *L* **9** # 118

King, Jonathan Finisar

Comment Type **TR** *Comment Status* **A**

Hazard level is currently TBD
The subject was adressed in the MMF ad hoc of 11th Feb 2016 with presentation:

http://www.ieee802.org/3/bs/public/adhoc/mmf/16_02_11/johnson_3bs_01a_0216_mmf.pdf

which recommended that 400GBASE-SR16 should be designated hazard level 1M

SuggestedRemedy

Hazard level is currently TBD
The subject was adressed in the MMF ad hoc of 11th Feb 2016 with presentation:

http://www.ieee802.org/3/bs/public/adhoc/mmf/16_02_11/johnson_3bs_01a_0216_mmf.pdf

which recommended that 400GBASE-SR16 should be designated hazard level 1M

Replace 'TBD' with '1M' in 121.9.2, 121.9.7, and 121.12.4.5 (PICS item ES2)

Response *Response Status* **C**

ACCEPT.
Make the text black.
See also comments #60 and #61

Cl **121** *SC* **121.9.2** *P* **162** *L* **9** # 60

Kolesar, Paul CommScope

Comment Type **T** *Comment Status* **A**

The TBD for hazard level should be replced with 1M per contribution johnson_3bs_01a_0216_mmf.pdf to the MMF ad-hoc on 11 Feb 2016.

SuggestedRemedy

Replace "TBD" with "1M".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #118

Cl **121** *SC* **121.9.7** *P* **163** *L* **7** # 61

Kolesar, Paul CommScope

Comment Type **T** *Comment Status* **A**

The TBD for hazard level should be replced with 1M per contribution johnson_3bs_01a_0216_mmf.pdf to the MMF ad-hoc on 11 Feb 2016.

SuggestedRemedy

Replace "TBD" with "1M".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #118

Cl **122** *SC* **122** *P* **178** *L* **20** # 172

Anslow, Pete Ciena

Comment Type **T** *Comment Status* **A**

There has been significant discussion on the reflection budget for 400GBASE-DR4 and proposals for removing the various TBDs and magenta values.

SuggestedRemedy

Make the changes proposed on page 3 of anslow_3bs_03_0315 attached to this comment with editorial license.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Make the changes proposed on page 3 of
http://www.ieee802.org/3/bs/public/adhoc/smf/16_03_01/anslow_01_0316_smf.pdf

Cl **122** *SC* **122.6** *P* **177** *L* **36** # 59

Kolesar, Paul CommScope

Comment Type **E** *Comment Status* **A**

The TBD for the location of the optical lane assignement should be replaced with a reference to the subclause containtnig that information, namely 122.11.3.1.

SuggestedRemedy

Replace TBD with 122.11.3.1.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #169

Cl **122** *SC* **122.6** *P* **177** *L* **36** # 169

Anslow, Pete Ciena

Comment Type **E** *Comment Status* **A**

"The positioning of transmit and receive lanes at the MDI is specified in TBD."

SuggestedRemedy

Replace TBD with a cross-reference to 122.11.3.1

Response *Response Status* **C**

ACCEPT.
See also comment #59

Cl **122** *SC* **122.7.1** *P* **178** *L* **6** # 142

Liu, Hai-Feng Intel Corporation

Comment Type **T** *Comment Status* **A**

Update Tx characteristics in Table 122-6 with calculated MPI penalty

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.7.1** *P* **178** *L* **7** # 150

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 122-6. Update the link budget to reflect an MPI penality of 0.1dB (details in liu_01_0316). Update the transmitter reflectance (max) to -26 dB.

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.7.1** *P* **178** *L* **31** # 53

Dawe, Piers — Mellanox

Comment Type **T** *Comment Status* **R**

The reason for specifying extinction ratio is to ensure that the eye opening is not too small a fraction of the light level in that eye, or of the highest light level of the whole signal. As the eye opening depends strongly on how closed the eye is (e.g. how fast), the traditional SONET/IEC method is appropriate. One can apply that algorithm for NRZ to a PAM4 eye, although the reported extinction ratio is not what people are used to. One can generalise the algorithm to PAM4. For both these one needs to sync to an eye, which may be difficult if a lot of equalisation is allowed. I believe we want to measure the signal before equalisation, as effects such as MPI or modal noise occur before equalisation.

SuggestedRemedy

If a lot of equalisation is allowed, limit either:
the mean of the upper half of the signal to the lower half of the signal (unsynchronised extinction ratio), or:
the ratio of the average signal to the RMS of the signal.
If only a moderate amount of equalisation is allowed so that recovering the timing is not a problem and three eyes are visible, use the usual IEC method: the mean of the upper half of the signal over the lower half of the signal, in the central 20% of the UI. Consider if 20% should be reduced.
Observed through the usual 19.34 GHz BT4 filter.

Response *Response Status* **C**

REJECT.
This (unclear) proposal is not in line with the consensus proposal from the SMF Ad Hoc 1 March. See also #168

Cl **122** *SC* **122.7.2** *P* **179** *L* **1** # 133

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Update Rx characteristics in Table 122-7 with calculated MPI penalty

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.7.2** *P* **179** *L* **1** # 151

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 122-7. Update the link budget to reflect an MPI penality of 0.1dB (details in liu_01_0316).

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.7.3** *P* **179** *L* **38** # 134

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Update power budget (for max TDP) in Table 122-8

SuggestedRemedy

Change from 6 dB to 5.6 dB

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.7.3** *P* **179** *L* **38** # 152

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 122-8. Update table to reflect an MPI penalty of 0.1dB and a maximum discrete reflectance of -45dB (details in liu_01_0316)

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.8.1** *P* **180** *L* **22** # 170

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

A square wave is not used by any existing test or likely to be used in any of the as yet undefined tests. The row for square wave was proposed to be removed here and in Clause 123 on the SMF Ad Hoc call on 16 February without objection.

SuggestedRemedy

Remove the square wave row from Tables 122-9 and 123-10.

Response *Response Status* **C**

ACCEPT.
In line with consensus from Ad Hoc Call on 16 February

Cl **122** *SC* **122.8.4** *P* **181** *L* **13** # 168

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

The definitions of OMAouter and ER for PAM4 optical signals were discussed on the SMF Ad Hoc calls of 2 and 16 February.
The consensus view was to base the OMAouter and ER definitions on the PRBS13Q sequence. The zero level was proposed to be the average of the central 2 unit intervals of the run of 6 zeros and the three level was proposed to be the average of the central 2 unit intervals of the run of 7 threes.

SuggestedRemedy

Introduce definitions of OMAouter and ER for PAM4 optical signals into Clauses 122 and 123 based on the zero level as the average of the central 2 unit intervals of the run of 6 zeros in the PRBS13Q pattern and the three level as the average of the central 2 unit intervals of the run of 7 threes in the PRBS13Q pattern, with editorial license.

Response *Response Status* **C**

ACCEPT.
In line with consensus reached during SMF Ad Hoc call

Cl **122** *SC* **122.8.5.1** *P* **181** *L* **31** # 175

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

As there has been no objection to the value of 2.24 ps for Max mean DGD in Table 122-11 and DGD_max in Table 122-12, these should be changed to black

SuggestedRemedy

Change 2.24 ps for Max mean DGD in Table 122-11 and DGD_max in Table 122-12 to black

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
The value for for Max mean DGD in Table 122-11 was discussed on the SMF Ad Hoc call of 1 March. Since Table 89-11 has a value for Max mean DGD of 0.5 ps for 2 km, the same value should be easily achievable for 0.5 km.
Change 2.24 ps for Max mean DGD in Table 122-11 to 0.5 ps in black.
Also, change 2.24 ps for DGD_max in Table 122-12 to black

Cl **122** *SC* **122.8.8** *P* **182** *L* **14** # 102

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

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 2 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.
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
There is currently no agreement as to whether or not a requirement for the transmitter optical waveform will be included.
However, there is agreement to use 4 MHz CRU bandwidth, which is the same as used in 86.8.3.1.

In 121.3.2, 122.3.2, and 123.3.2 delete:
"with the exception that the clock and data recovery units' high-frequency corner bandwidths are TBD MHz."

Cl **122** *SC* **122.8.10** *P* **180** *L* **25** # 103

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

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

SuggestedRemedy

Sinusoidal jitter is a componnet of stress receiver sensitivity.

The amplitude of the applied sinusoidal jitter is dependent on frequency as specified in Table 87-13 and is illustrated in Figure 87-5, but scaled from 4 Mhz to 2 MHz.

Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
A complete proposal for how the stressed receiver sensitivity test will be performed has not been provided.
See response to comment #102

Cl **122** *SC* **122.10** *P* **184** *L* **28** # 54

Dawe, Piers — Mellanox

Comment Type **E** *Comment Status* **R**

Table looks odd because note c takes so many lines.

SuggestedRemedy

Either make the table wider and/or move the first sentence "Differential Group Delay (DGD) is the time difference at reception between the fractions of a pulse that were transmitted in the two principal states of polarization of an optical signal", which already occurs four times in the base standard, to 1.4 Definitions.

Response *Response Status* **C**

REJECT.
[Editor's Note: Subclause changed from 122.1 to 122.10]
Note c in Table 122-12 is not broken, so it does not require fixing.

Cl **122** *SC* **122.11.2.2** *P* **185** *L* **17** # 135

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

SM APC MPO has better than 35 RL

SuggestedRemedy

change to - 45 dB, and add 4 as the maximum number of -45 dB reflections

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.11.2.2** *P* **185** *L* **17** # 153

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

SM APC MPO has better than 35 RL

SuggestedRemedy

change to - 45 dB, and add 4 as the maximum number of -45 dB reflections

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment #172

Cl **122** *SC* **122.11.3.2** *P* **185** *L* **22** # 62

Kolesar, Paul — CommScope

Comment Type **T** *Comment Status* **A**

Performance level D for insertion loss seems appropriate as a minimum requirement. Performance level 3 for return loss (i.e. 35 dB minimum) presently understates the capability of the angle-polished MPO which can deliver 55 dB minimum. But there is little benefit to requiring better than level 3 if the transmitter reflectance remains at 20 dB and the receiver reflectance remains at 26 dB.

SuggestedRemedy

Consider raising the return loss level to 2 (45 dB minimum) if the Tx and Rx specifications are improved from their present levels.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
"for performance level D/3." to:
"for performance level D/2." in black
Remove the Editor's note.
See also #172

Cl **122** *SC* **122.11.3.2** *P* **185** *L* **42** # 100

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **R**

Diagrm not clear

SuggestedRemedy

Suggest to add .optical lane assignments looking into MDI or 400Gbase-DR4 MDI optical lane assignments

Response *Response Status* **C**

REJECT.
The existing text:
"The four transmit and four receive optical lanes of 400GBASE-DR4 shall occupy the positions depicted in Figure 122-4 when looking into the MDI receptacle with the connector keyway feature on top."
is already very clear.

Cl **122** *SC* **122.12.4.6** *P* **191** *L* **4** # 136

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Item OC2 needs consistent max discrete reflectance

SuggestedRemedy

change to less than - 45 dB

Response *Response Status* **C**

ACCEPT.
See also #172

Cl **122** *SC* **122.12.4.6** *P* **191** *L* **8** # 154

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Need consistent max discrete reflectance

SuggestedRemedy

change to less than - 45 dB

Response *Response Status* **C**

ACCEPT.
See also #172

Cl **123** *SC* **123** *P* **200** *L* **21** # 173

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

There has been significant discussion on the reflection budget for 400GBASE-FR8 and proposals for removing the various TBDs and magenta values.

SuggestedRemedy

Make the changes proposed on page 4 of anslow_3bs_03_0315 attached to this comment with editorial license.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

In Table 123-7, set:
Average launch power, each lane (min) to -3 dBm
Outer Optical Modulation Amplitude (OMAouter), each lane (min) to 0 dBm
Launch power in OMAouter minus TDP, each lane (min) to -1 dBm
Optical return loss tolerance (max) to 19.8 dB
Transmitter reflectance (max) to -26 dB
In Table 123-8, set:
Average receive power, each lane (min) to -7 dBm
Receiver reflectance (max) to -26 dB
Receiver sensitivity (OMAinner), each lane (max) to -10.1 dBm
In Table 123-9, set:
Power budget (for maximum TDP) to 6.5 dB
Maximum discrete reflectance to -35 dB
Allocation for penalties (for maximum TDP) to 2.5 dB
In Table 123-12, set:
100GBASE-FR8 Optical return loss to 19.8 dB
In Table 123-13, set:
[Channel] Optical return loss (min) to 29 dB
In 123.11.2.2, set:
maximum discrete reflectance to -35 dB
Max number of -35 dB reflections to 4

A straw poll of the Task Force was taken:
I support basing the MPI budget for 400GBASE-FR8 on:
4 x -35 dB reflections 20
6 x -35 dB reflections 11

Cl **123** *SC* **123** *P* **200** *L* **21** # 174

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

There has been significant discussion on the reflection budget for 400GBASE-LR8 and proposals for removing the various TBDs and magenta values.

SuggestedRemedy

Make the changes proposed on page 5 of anslow_3bs_03_0315 attached to this comment with editorial license.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Make the changes proposed on page 4 of http://www.ieee802.org/3/bs/public/adhoc/smf/16_03_01/anslow_01_0316_smf.pdf

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Cl **123** *SC* **123.7.1** *P* **200** *L* **1** # 137

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Update Tx characteristics in Table 123-7 with calculated MPI penalty

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.1** *P* **200** *L* **1** # 155

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 123-7. Update the link budget to reflect an MPI penality of 0.3dB for FR8 and 0.5dB for LR8 (details in liu_01_0316). Update the transmitter reflectance (max) to -26 dB.

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.2** *P* **201** *L* **7** # 138

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Update Rx characteristics in Table 123-8 with calculated MPI penalty

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.2** *P* **201** *L* **8** # 156

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 123-8. Update the link budget to reflect an MPI penality of 0.3dB for FR8 and 0.5dB for LR8 (details in liu_01_0316).

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.3** *P* **202** *L* **7** # 139

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Update Table 123-9 with MPI penalties included

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.3** *P* **202** *L* **7** # 157

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Table 123-9. Update the link budget to reflect an MPI penality of 0.3dB for FR8 and 0.5dB for LR8 (details in liu_01_0316).

SuggestedRemedy

See presentation (liu_01_0316) at March meeting for details

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.3** *P* **202** *L* **16** # 63

Kolesar, Paul — CommScope

Comment Type **T** *Comment Status* **A**

With the increased sensitivity to MPI of PAM4 signalling compared to NRZ signaling, simply specifying the maximum discrete reflectance may no longer be sufficient to contain MPI penalties to tolerable levels. Additional constraints on the number of such reflectances in a channel may also be required. This may be partially covered by the channel optical return loss specifiation in Table 123-13, however measurement of this parameter in the field is unlikely to detect the worst-case reflectance experienced by the narrow line width transmission systems defined in clause 123.

SuggestedRemedy

Specify the maximum number of worst-case reflectances permitted in a channel. In addition, provide guidance on the trade-off between worst-case discrete reflectance and the number of such reflections permitted. For example, at a minimum specify this relationship for 26 dB reflectances and 35 dB reflectances, as both of these values have historical precedent in the installed base.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.7.3** *P* **202** *L* **22** # 171

Anslow, Pete — Ciena

Comment Type **T** *Comment Status* **A**

"The channel insertion loss is calculated using TBD plus an allocation for connection and splice loss given in 123.11.2.1." was discussed on the SMF Ad Hoc call on 16 February.

SuggestedRemedy

Change to "The channel insertion loss is calculated using the maximum distance specified in Table 123-6 for 400GBASE-FR8 and fiber attenuation of 0.5 dB/km plus an allocation for connection and splice loss given in 123.11.2.1." change the "a" to black.

Response *Response Status* **C**

ACCEPT.
Consensus reached during SMF Ad Hoc Call on 16 February

Cl **123** *SC* **123.8.8** *P* **204** *L* **41** # 116

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

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 2 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.
Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz may increase transmitter jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate if there will be a transmitter penalty if we reduce the CRU BW to 2 MHz. Overall there is benifit reduing the PLL BW to 2 MHz and these result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
There is currently no agreement as to whether or not a requirement for the transmitter optical waveform will be included.
However, there is agreement to use 4 MHz CRU bandwidth.
See response to comment 102.

Cl **123** *SC* **123.8.10** *P* **202** *L* **53** # 117

Ghiasi, Ali — Ghiasi Quantum LLC

Comment Type **TR** *Comment Status* **A**

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, but scaled from 4 MHz to 2 MHz.

Following presentation provided background material
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf
In Atlanta there were general consenous to further reduce CRU BW form 4 to 2 MHz to make it even easier for the receiver, I raised the concern that reducing CRU BW to 2 MHz will increase transmitter penalty jitter penalty. I have identified several representiavie PLL from ISSCC 2016 to invesitgate and show that there is a transmitter penalty if we reduce the CRU BW to 2 MHz. These result will be shown in ghiasi_3bs_01_0316.pdf

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
A complete proposal for how the stressed receiver sensitivity test will be performed has not been provided.
However, there is agreement to use 4 MHz CRU bandwidth.
See response to comment 102.

Cl **123** *SC* **123.11.2.2** *P* **207** *L* **45** # 158

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

lower max discrete reflectance is needed

SuggestedRemedy

change to - 35 dB, and add 4 and 6 as the maximum number of -35 dB reflections for FR8 and LR8, respectively

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.11.2.2** *P* **207** *L* **45** # 140

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

lower max discrete reflectance is needed

SuggestedRemedy

change to - 35 dB, and add 4 and 6 as the maximum number of -35 dB reflections for FR8 and LR8, respectively

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See comment #173 and comment #174

Cl **123** *SC* **123.12.4.7** *P* **213** *L* **24** # 159

Nicholl, Gary — Cisco Systems

Comment Type **TR** *Comment Status* **A**

Need consistent max discrete reflectance

SuggestedRemedy

change to less than - 35 dB

Response *Response Status* **C**

ACCEPT.
See also #173 and #174

Cl **123** *SC* **123.12.4.7** *P* **213** *L* **24** # 141

Liu, Hai-Feng — Intel Corporation

Comment Type **T** *Comment Status* **A**

Item OC2 needs consistent max discrete reflectance

SuggestedRemedy

change to less than - 35 dB

Response *Response Status* **C**

ACCEPT.
See also #173 and #174