Cl **78** *SC* **78.5.1** *P* **104** *L* **34** # r01-57

Hidaka, Yasuo — Fujitsu Laboratories of

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

What is inserted between the RS and a 200 Gb/s or 400 Gb/s PHY is 200GMII/400GMII Extender, and 200GXS/400GXS is a part of 200GMII/400GMII Extender.

SuggestedRemedy

Change "200GXS or 400GXS (see Clause 118)" to "200GMII/400GMII Extender (see Clause 118)".

Response *Response Status* **C**

REJECT.
The title of 78.5 is "Communication link access latency" and the dominant addition to the latency is caused by the addition of the 200GXS or 400GXS sublayers.
Also, the added text follows the existing text of this subclause, which starts: "The XGXS can be inserted between the RS and a 10 Gb/s PHY to transparently extend .".

Cl **90** *SC* **90.1** *P* **105** *L* **5** # r01-1

Anslow, Peter — Ciena Corporation

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

The text being modified is the second paragraph of 90.1

SuggestedRemedy

Change "first paragraph" to "second paragraph"

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made during publication.
Apply the Suggested Remedy.

Cl **116** *SC* **116.1.4** *P* **108** *L* **32** # r01-56

Hidaka, Yasuo — Fujitsu Laboratories of

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

Clause 118.1.1 states that the optional 200GMII/400GMII Extender can be inserted between the Reconciliation Sublayer and the PHY to transparently extend the reach of the 200GMII/400GMII. However, Clause 118 is not associated with any PHY types in Table 116-3, 116-4, 121-1, 122-1, 123-1, or 124-1. Also, it is not clear where we can use 200GMII/400GMII Extender in the description of 116.2.2.

Since the optional 200GMII/400GMII Extender can be inserted to transparently extend 200GMII/400GMII, it should be OK as optional for any PHY which is associated with 200GMII/400GMII. It should be also consistent with Figure 120A-7 in 120A.4 where 200GMII/400GMII Extender is associated with 200GBASE-DR4/FR4/LR4 or 400GBASE-FR8/LR8.

SuggestedRemedy

Add Clause 118 200GMII/400GMII Extender as optional to all PHY types associated with 200GMII or 400GMII in Table 116-3, 116-4, 121-1, 122-1, 123-1, and 124-1.

Insert the following paragraph to 116.2.2:
The optional 200GMII Extender (Clause 118) can be inserted between the Reconciliation Sublayer and the PHY to transparently extend the reach of the 200GMII. The optional 400GMII Extender (Clause 118) can be inserted between the Reconciliation Sublayer and the PHY to transparently extend the reach of the 400GMII.

Change the title of 116.2.2 to "200GMII/400GMII Extenders and 200GMII/400GMII Extender Sublayers (200GXS/400GXS)

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

In Table 116-3, add 118, 200GMII Extender as "O" for all PHY types
In Table 116-4, add 118, 400GMII Extender as "O" for all PHY types
In Table 121-1, add a row for 118-200GMII Extender, Optional
In Table 122-1, add rows for 118-200GMII Extender, Optional, Not applicable and 118-400GMII Extender, Not applicable, Optional
In Table 123-1, add a row for 118-400GMII Extender, Optional
In Table 124-1, add a row for 118-400GMII Extender, Optional

Insert the following paragraph to 116.2.2:
The optional 200GMII Extender (Clause 118) can be inserted between the Reconciliation Sublayer and the PHY to transparently extend the reach of the 200GMII. The optional 400GMII Extender (Clause 118) can be inserted between the Reconciliation Sublayer and

the PHY to transparently extend the reach of the 400GMII.

As the title of 116.2 is "Summary of 200 Gigabit and 400 Gigabit Ethernet sublayers", there is no need to change the title of 116.2.2.

Cl **116** *SC* **116.5** *P* **119** *L* **31** # r01-31

Dawe, Piers J G — Mellanox Technologie

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

Following up D3.0 comment 105: recently my colleague expressed surprise that the Skew Variation limits have not been fixed. They need updating according to the principles in http://ieee802.org/3/ba/public/may08/anslow_01_0508.pdf :
"Electrical functions will require some dynamic skew handling
SFI-5.2 specifies 1.5UI of relative wander
Relative Wander: Components of wander that are uncorrelated between any two in band signals
Poll of three vendors: ~ 1UI - 1.5UI
Should we round up to 2UI? How do you handle 0.5 anyhow?"
as explained in http://ieee802.org/3/cd/public/Jan17/wertheim_3cd_01_0117.pdf The unit interval here is 38 (or 19) ps not 97 ps. The 8/4-lane module PMA is a completely different design to a host SerDes, and naturally, Tx and Rx sides are different designs. These relatively small FIFOs (just a few UI) are very expensive per UI in e.g. power, and consume some power even if never used. I am aware of 802.3cd's decisions (D1.1 comment 80: straw poll). There is no disadvantage to making the changes because the spec is so sandbagged, no-one will be inconvenienced by taking out some slack.
giannakopoulos_01_1108.pdf said that dynamic skew was caused by "Electrical functions Temperature variation causing variable gate delay" and proposed 200ps (~2UI) for 10G lanes. Here we have 25G lanes.

SuggestedRemedy

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

Response *Response Status* **C**

REJECT.
This is the same suggested remedy as for comment i-105 against P802.3bs D3.0.
There was no consensus to make this change during the discussion of comment i-105 against P802.3bs D3.0.

There remains no concensus to make this change.

[Editor's note added after comment resolution completed.
The response to comment i-105 is:
The issue of whether to tighten the Skew Variation limits for PHYs using 25G lanes as proposed in http://ieee802.org/3/cd/public/Jan17/wertheim_3cd_01_0117.pdf was discussed in the P802.3cd Task Force in connection with comments #80 and #74 against P802.3cd D1.1 with the result that the same numbers as in the P802.3bs draft

were adopted for 50 Gb/s Ethernet. See:
http://www.ieee802.org/3/cd/comments/8023cd_D11_final_comment_responses_by_clause.pdf
]

Cl **119** *SC* **119.2.5.3** *P* **164** *L* **10** # r01-28

Wertheim, Oded — Mellanox Technologie

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

When FEC_bypass_indication_enable is asserted, and the hi_ser threshold is crossed, the PCS receive function sets the 66b block to EBLOCK_R without indicating LBLOCK_R (local fault) to the RS layer which as a result can't indicate remote faults to the peer RS layer.
The behavior is different from CL91 + CL82, where hi_ser in the FEC sublayer will result in hi_ber in the PCS layer that will return the PCS receive state machine to RX_INIT. When auto-negotiation is supported and enabled, it will cause the auto-negotiation to restart.
In CL119 if the SER is high but the error statistics is such that the port maintains align_status, the port will keep discarding traffic without indicating local fault to the local RS layer / remote fault to the peer RS layer.

SuggestedRemedy

Modify the text from:
the Reed-Solomon decoder shall cause the PCS receive function to set every 66-bit block to an error block (set to EBLOCK_R) for a period of 60 ms to 75 ms. This may be achieved by setting the synchronization header to 11 for all 66-bit blocks created by the 256B/257B to 64B/66B transcoder for this time period.
To:
the Reed-Solomon decoder shall set hi_ser causing the PCS receive function to return to RX_INIT (setting the received blocks to LBLOCK_R) for a period of 60 ms to 75 ms. When Auto-Negotiation is supported and enabled, assertion of hi_ser causes Auto-Negotiation to restart.

Add hi_ser to the RX_INIT condition in Figure 119-15--Receive state diagram, such that the new condition is: reset + !align_status + hi_ser.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Implement the changes shown in
http://www.ieee802.org/3/bs/public/17_05/gustlin_3bs_01_0517.pdf
with appropriate changes to the Clause 118 PICS

Cl **119** *SC* **119.2.6.2.2** *P* **166** *L* # r01-67

Muma, Scott

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

The definition of the current_pcsl variable only defines what it is and what it's for, but not how it is to be determined. Since it is updated in the alignment marker lock state diagram it is prior to FEC error corrections and so it seems like the value should be determined based on the process of comparing 12 known nibbles and determining the value matches if 9 or more match. It also needs to be stated what should be done if no match is found when current_pcsl is calculated. Once current_pcsl is fully defined the pcs_lane variable becomes redundant and can be deleted which simplifies the description. The AMP_COMPARE description must also be updated to clarify that current_pcsl must find a valid match on both the first and second comparisons for amp_match to be true.

SuggestedRemedy

First, add to the current_pcsl definition: 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. If a match is not found, than any comparisons of this variable will fail forcing a slip in the Alignment marker lock state diagram.

Second, replace "pcs_lane" in Figure 119-12 with "current_pcsl".

Third, delete pcs_lane and its definition in 119.2.6.2.2.

Fourth, change the last sentence of the AMP_COMPARE description to: If current_pcsl and first_pcsl both found a match and indicate the same PCS lane number, amp_match is set to true.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
[Editor's note: This comment was sent after the close of the comment period]
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.
Apply the Suggested Remedy with the following modification:
Change:
"If a match is not found, than any comparisons of this variable will fail forcing a slip in the Alignment marker lock state diagram."
To:
"If a match is not found, then the AMP_COMPARE function sets amp_match to false."

Cl **119** *SC* **119.2.6.2.2** *P* **166** *L* **48** # r01-29

Wertheim, Oded — Mellanox Technologie

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

Missing definition for the PCS_status variable

SuggestedRemedy

Add a PCS_status variable to the state variables.
PCS_status:
A Boolean variable that is true when align_status is true and hi_ser is false.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

See the response to comment #28

[Editor's note added after comment resolution completed.
The response to comment r01-28 is:
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Implement the changes shown in
http://www.ieee802.org/3/bs/public/17_05/gustlin_3bs_01_0517.pdf
with appropriate changes to the Clause 118 PICS
]

Cl **119A** *SC* **119A** *P* **325** *L* **10** # r01-18

RAN, ADEE — Intel

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

(page 321 according to footer in CMP document)

The padding for the alignment markers appear in table 119A-1 as bold italics, and in table 1129A-2 in bold Roman.

Based on the describing text, it seems that they should not be italics, since the "pad" bits are not part of the alignment marker.

SuggestedRemedy

Change pad bits formatting from bold italics to bold Roman.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made during publication.
Apply the Suggested Remedy.

Cl **120** *SC* **120.1.4** *P* **189** *L* **44** # r01-33

Dawe, Piers J G — Mellanox Technologie

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

Item b2, 8 lane NRZ physical instantiation ... is juxtaposed with b3, 26.5625 GBd by 8 lane PAM4 physical instantiation.
But PAM4 could be NRZ or RZ and NRZ can be PAM4, PAM2 or other. The "opposite" of PAM4 is PAM2.

SuggestedRemedy

Change NRZ to PAM2 in the 13 places + 7 PICS entries that it's used, explaining that PAM2 is aka NRZ as often as appropriate. E.g. change "using 2-level NRZ (also known as PAM2) signaling" to "using PAM2 (also known as 2-level NRZ) signaling", change:
120.5.11.1 Test patterns for NRZ encoded signals
For a 200GBASE-R PMA with 8 output lanes or a 400GBASE-R PMA with 16 output lanes using 2-level NRZ encoding, the test patterns in this clause may be supported.
to
120.5.11.1 Test patterns for PAM2 encoded signals
For a 200GBASE-R PMA with 8 output lanes or a 400GBASE-R PMA with 16 output lanes using PAM2 (also known as 2-level NRZ) encoding, the test patterns in this clause may be supported.

Response *Response Status* **C**

REJECT.

In the resolution of comment i-166 (D3.0) it was decided to add a parenthetical "(also known as PAM2)" in two instances only, and not replacing NRZ with PAM2 or making PAM2 the primary term rather than an alternative. This proposal would go against the spirit of the i-166 resolution by making PAM2 the primary term and NRZ an alternative.

Cl **120** *SC* **120.5.11.2.3** *P* **202** *L* **18** # r01-32

Dawe, Piers J G — Mellanox Technologie

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

Following up D3.0 comment 109: this SSPRQ is not suitable for use in TDECQ or stressed receiver calibration because measurements with this pattern do not give the correct (post FEC) penalty. Neither dawe_3bs_01a_0317 nor anslow_01_0417_smf show a suitable pattern. See associated comment against 121.8.5.3, 122, 124.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty after FEC with a random payload measures as minimally compliant (i.e. also 0.4 dB baseline wander penalty) on a pre-FEC BER basis with SSPRQ. This will be a pattern between the red and light brown curves in dawe_3bs_01a_0317 slide 6.

Response *Response Status* **U**

REJECT.

A similar proposal was made in i-109 which was rejected. No consensus has been reached on changes to this pattern in the ad hoc calls.

After further discussion there is still no consensus for a change to the draft.

[Editor's note added after comment resolution completed.
The response to comment i-109 is:
The current SSPRQ pattern was adopted for use in the TDECQ test (after presentation of its baseline wander characteristics) by comment 50 against D1.3. A straw poll was taken in association with that comment: Do you support adopting the SSPRQ pattern for TDECQ and SRS calibration in Clauses 122 and 123? Yes 41 No 2 .
Comments i-130, i-133, and i-145 proposed to change the first seed in Table 120-2 but these comments were not accepted.
]

Cl **120** *SC* **120.5.11.2.3** *P* **205** *L* **54** # r01-30

RAN, ADEE Intel

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

(page 202 according to footer in CMP document)

This is a follow-up on unsatisfied comment i-17. That comment was resolved by adding the text:
"Test patterns that are intended for transmitter testing, such as square wave, may not be correctly recovered by an adjacent PMA".

Although we may think SSPRQ is intended for transmitter testing, this is not stated explicitly; actually "tests pattern intended for transmitter testing" are not defined anywhere.

I am concerned that testers might try to feed SSPRQ from a pattern generator into a receiver placed into remote loopback, as a way of conducting some receiver test. SRS in the PMD clauses is defined with other test patterns (PRBS31Q or scrambled idle), but some people are creative. In addition, the receiver tests in Annex 120D do not state which pattern should be used.

SSPRQ creates non-representative conditions (that occur once in several millennia with random data) many times per second. This characteristic was discussed in many presentations, but is not stated anywhere in the standard. It follows that a receiver may display "unacceptable BER" with SSPRQ while having a healthy margin for operation with real data.

The nature of SSPRQ should be noted, and BER testing with SSPRQ should be explicitly discouraged.

The suggested remedy, if accepted, would satisfy comment i-17 as well.

SuggestedRemedy

Add a the following text (which is partly based on 120.5.11.1.2) at the end of 120.5.11.2.3:

Note that SSPRQ is intended to be checked by external test gear, and no SSPRQ checking function is provided within the PMA. SSPRQ is not representative of regular traffic and is unsuitable for BER testing.

Response *Response Status* **C**

REJECT.

The other clauses specify how each test pattern is used in the particular test procedures for which it is designed. There are no PMA checkers for most of the test patterns (e.g., PRBS9, Square Wave (NRZ or Quaternary), PRBS13Q), and there is no need to call out specifically that there is no PMA-based checker for SSPRQ which is neither specified nor required for the tests using this pattern.

None of the PMA generated test patterns are representantive of normal traffic: some are more stressful in various dimensions (PRBS31, PRBS31Q, Square Wave NRZ and Quaternary), others are more benign than normal traffic (e.g., PRBS9), and hence there is no need to call out this property specifically for SSPRQ.

For the receiver tests in Annex 120D, the interference tolerance test uses scrambled idle and the jitter tolerance test uses scrambled idle or PRBS31Q.

Cl **120** *SC* **120.5.11.2.4** *P* **203** *L* **21** # r01-34

Dawe, Piers J G Mellanox Technologie

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

This says "A square wave transmitted over a 200GAUI-4 or 400GAUI-8 may not be correctly forwarded to the output of the PMD sublayer." Which is true, but the output of the PMD sublayer is the receiving PMD's service interface, and we have established that the square wave might not contain the "correct" PAM4 symbols even at TP2, because the Tx side CDR doesn't see enough transitions for healthy operation - however, the signal can still be used for measuring OMA in the RIN procedure.

SuggestedRemedy

Delete "sublayer".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change:
"A square wave transmitted over a 200GAUI-4 or 400GAUI-8 may not be correctly forwarded to the output of the PMD sublayer." to:
"A square wave transmitted over a 200GAUI-4 or 400GAUI-8 may not be correctly forwarded to the PMD transmitter output."

Cl **120D** *SC* **120D.1** *P* **350** *L* **34** # r01-58

Hidaka, Yasuo — Fujitsu Laboratories of

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

The term "bidirectional" is not clear.

In IEEE802.3-2015, the term "bidirectional" is used in various contexts in the following clauses: 1.2.3, 1.4.245, 4.1.1, 11.3.1, 16.5.2.3, 22.2.2.14, 22.3.4, 22.4.4.2, 32.7.3, 40.7.5, 45.4.2, 47.2, 55.7.4, 56.1.3, 58, 58.10, 59, 59.10, 81.3.4, 83D.1.
It is often used in the context such as "bidirectional signal" (22.2.2.14, 22.3.4, 22.4.4.2, 45.4.2), "bidirectional optics" (1.2.3), "simultaneous bidirectional" (32.7.3, 40.7.5, 55.7.4) where the transmission is done on the same optical or electrical medium in both directions at the same time or different time.
The term "bidirectional link" is used in the same context only in 83D.1, and not popular in IEEE802.3.

In order to differentiate chip-to-chip interface of 120B and 120D from chip-to-module interface of 83E, 120C, and 120E where "link" is used without preceding "bidirectional", we may use "symmetric link" rather than "bidirectional link".

Alternatively, it may be also OK to just use the term "link" without preceding "bidirectional".

SuggestedRemedy

Change "bidirectional link" to "symmetric link" in the following locations:

Clause 120B.1, P335, L34.
Clause 120B.1, P335, L43.
Clause 120D.1, P350, L34.
Clause 120D.1, P350, L43.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Change "bidirectional link" to "link" in the following locations:

Clause 120B.1, P335, L34.
Clause 120B.1, P335, L43.
Clause 120D.1, P350, L34.
Clause 120D.1, P350, L43.

Cl **120D** *SC* **120D.1** *P* **351** *L* **41** # r01-59

Hidaka, Yasuo — Fujitsu Laboratories of

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

For Equation (120D-1), the channel loss at the Nyquist frequency is not necessarily 20.457 dB, but lower than or equal to 20.457 dB.

SuggestedRemedy

Change "20.457 dB" to "lower than or equal to 20.457 dB".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Apply the Suggested Remedy.

Cl **120d** *SC* **120d.1** *P* **368** *L* **49** # r01-5

Mellitz, Richard — Samtec, Inc.

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

Line 24 suggests that the supported insertion loss budget is characterized by equation 120E-1. Higher data rates tend to move technology, both in silicon and interconnect. The form of Equation 120E-1 suggests PCB material. Cables which connect from a host device to a MDI connector have an insertion loss characteristic which has a much stronger square root of frequency. Hence this technology will likely fail this loss specification. However many of these channel will pass all other electrical requirements. See presentation.

SuggestedRemedy

Change Equation 120E-1 include representation of cabling and interconnect advancements to the form in equation 93A-51 i.e. a0 + a1*sqrt(f) + a2*f + a4*f^2
with
[a0 a1 a2 a4] = [0.05 1.65 0.155 0.0117]

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Change "The supported insertion loss budget is characterized by Equation (120E-1) and illustrated in Figure 120E-4. "
to "The recommended insertion loss budget is characterized by Equation (120E-1) and illustrated in Figure 120E-4. "

Add "recommended" to the title of Figure 120E-4.

Straw Poll:
a):
Change the right hand side of Equation 120E-1 to the right hand side of the equation given in Slide 14 "Option B" of
http://www.ieee802.org/3/bs/public/adhoc/elect/24Apr_17/mellitz_01b_042417_elect.pdf
b):
No change to Equation 120E-1
a):10; b):0;

Change the right hand side of Equation 120E-1 to the right hand side of the equation given in Slide 14 "Option B" of
http://www.ieee802.org/3/bs/public/adhoc/elect/24Apr_17/mellitz_01b_042417_elect.pdf.
Update Figure 120E-4 to match the updated equation.

Cl **120D** *SC* **120D.3.1.1** *P* **352** *L* **50** # r01-35

Dawe, Piers J G — Mellanox Technologie

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

J4 isn't like J2 and J9 because it excludes correlated jitter.

SuggestedRemedy

Consider changing its name to J4u.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change "J4" to "J4u"

Cl **120D** *SC* **120D.3.1.1** *P* **353** *L* **24** # r01-36

Dawe, Piers J G — Mellanox Technologie

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

Transmitter Output residual ISI SNR_ISI (max) 38 dB is too high - probably can't measure the IC through the test fixture and cables.

SuggestedRemedy

Start by checking whether Gaussian assumptions are tripping us up.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.

See response to comment #r01-22

[Editor's note added after comment resolution completed.
The response to comment r01-22 is:
In Table 120D-1:
Change the minimum SNR_ISI value from 38 to 34.8 dB.
Change the minimum SNDR from 31 to 31.5 dB.
Change Linear fit pulse peak (min) from 0.736*Vf to 0.76*Vf

In Table 120D-8:
Change Av and Afe values from 0.45 to 0.44

Add another NOTE at the end of 120D.3.1.7:
NOTE 2--The observed SNR_ISI can be significantly influenced by the measurement setup, e.g. reflections in cables and connectors. High-precision measurement and careful calibration of the setup are recommended.
]

Cl **120D** *SC* **120D.3.1.1** *P* **353** *L* **49** # r01-37

Dawe, Piers J G — Mellanox Technologie

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

Put the subclauses in the right order, as in Clause 93 and Table 120D-1.

SuggestedRemedy

Swap 120D.3.1.1, Output jitter and 120D.3.1.8, Transmitter differential output return loss.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Re-order 120D.3.1 sub-clauses to match the reference order in Table 120D-1, by making "Output jitter" 120D.3.1.8, and "Transmitter differential output return loss" 120D.3.1.1

Grant editorial license to correct any references to these sub-clauses appropriately.

Cl **120D** *SC* **120D.3.1.1** *P* **357** *L* **29** # r01-20

RAN, ADEE — Intel

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

(page 353 according to footer in CMP document)
(text not changed from D3.0)

SNR_ISI should be specified as minimum value, not maximum value (higher values are better).

SuggestedRemedy

Change "SNR_ISI(max)" to "SNR_ISI(min)".

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.1.1** *P* **357** *L* **29** # r01-22

RAN, ADEE — Intel

Comment Type **GR** *Comment Status* **A**

(page 353 according to footer in CMP document)

Current SNR_ISI value of 38 dB is too high to be the minimum requirement (although stated as maximum - this is the subject of another comment).

In measurements performed with state-of-the-art scope and an instrument-grade pattern generator, connected by a short instrument-grade cable, the best SNR_ISI achieved was 39.3 dB, and that was with equalization off. This is only 1.3 dB better than the current minimum. This may be an "ISI floor" of the scope, cables, etc., or actual ISI in the transmitter.

Using a packaged transmitter with a supplied evaluation board, high-performance connectors, with short cables to the same scope, resulted in only 36.9 dB at room temperature and without equalization.

With maximum equalization, the pulse peak will be 60% of the unequalized peak, while the ISI can be assumed to be roughly the same. This will result in a degradation of 4.4 dB in SNR_ISI, so the instrument-grade transmitter will actually have SNR_ISI of only 34.9 dB.

For the channels targeted by the C2C specification, and with a CTLE+DFE equivalent assumed in the receiver, operating at the maximum Tx equalization state is unlikely (as this would reduce the signal and exacerbate the effects of TX ISI, crosstalk and other noises). The COM analysis of contributed channels resulted in Tx equalization much lower than the maximum. Therefore, it is reasonable not to judge the transmitter by this state. More likely, the Tx equalization will reduce the peak by up to 2 dB relative to the unequalized pulse.

To achieve technical feasibility with a broad market potential, the standard should allow some margin for manufacturing variability and temperature dependence. The specification should be such that an instrument-grade transmitter will have a margin of ~2 dB.

At the bottom line, the proposal is to specify minimum SNR_ISI as 4 dB below the best measured value with an instrument-grade unequalized transmitter, or 35.3 dB.

The current value was set by comment i-69 which states: "the RSS sum of the SNDR and SNRisi should equal the RSS sum of the TxSNR used in COM plus the SNRisi produced by the COM package". The normalized RSS of the current values of SNDR and SNR_ISI is 0.03, or 30.2 dB below the signal; to keep it the same with SNR_ISI of 35.3 dB, the required SNDR should be slightly increased to 31.8 dB.

SuggestedRemedy

Change the minimum SNR_ISI value from 38 to 35.3 dB.

Change the minimum SNDR from 31 to 31.8 dB.

In 120D.3.1.7, change "The SNR_ISI specification shall be met for all transmit equalization

settings" to "The SNR_ISI is measured with Local_eq_cm1 and Local_eq_c1 set to zero".

Add another NOTE at the end of 120D.3.1.7:
NOTE 2--The observed SNR_ISI can be significantly influenced by the measurement setup, e.g. reflections in cables and connectors. High-precision measurement and careful calibration of the setup are recommended.

Response *Response Status* **U**

ACCEPT IN PRINCIPLE.

In Table 120D-1:
Change the minimum SNR_ISI value from 38 to 34.8 dB.
Change the minimum SNDR from 31 to 31.5 dB.
Change Linear fit pulse peak (min) from 0.736*Vf to 0.76*Vf

In Table 120D-8:
Change Av and Afe values from 0.45 to 0.44

Add another NOTE at the end of 120D.3.1.7:
NOTE 2--The observed SNR_ISI can be significantly influenced by the measurement setup, e.g. reflections in cables and connectors. High-precision measurement and careful calibration of the setup are recommended.

Cl **120D** *SC* **120D.3.1.1.1** *P* **353** *L* **48** # r01-60

Hidaka, Yasuo Fujitsu Laboratories of

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

If some transitions have lower jitter than other transitions, choosing the size of all sets is not necessarily enough, because when the sizes of the sets for high jitter transitions is lower than the sizes of the sets for low jitter transitions, the calculated jitter becomes lower.

SuggestedRemedy

Change
"The size of all sets should be chosen to enable calculation of J4 (as defined below) with sufficient accuracy."
to
"The size of each should be balanced and the size of all sets should be chosen to enable calculation of J4 (as defined below) with sufficient accuracy."

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change
"The size of all sets should be chosen to enable calculation of J4 (as defined below) with sufficient accuracy."
to
"The 12 sets should be of equal size and the size of all sets should be chosen to enable calculation of J4 (as defined below) with sufficient accuracy."

[Note J4 has been changed to J4u by another comment.]

Cl **120D** *SC* **120D.3.1.1.2** *P* **354** *L* **40** # r01-61

Hidaka, Yasuo Fujitsu Laboratories of

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

Since line 40 through line 45 is the body of the description starting on line 38, they should have lower indent than line 38.

Also, it should use the same style as line 46 through line 52.

SuggestedRemedy

Format line 40 through line 45 in the same way as line 48 through line 52 as follows:

- Indent down
- Enumerate line 40 as 1) and line 44 as 2)
- Remove dashes on line 41 and 42

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Format line 40 through line 45 in the same way as line 48 through line 52 as follows:

- Indent down
- Enumerate line 40 as A) and line 44 as B)
- Remove dashes on line 41 and 42

Cl **120D** *SC* **120D.3.1.1.2** *P* **355** *L* **1** # r01-4

Anslow, Peter Ciena Corporation

Comment Type **G** *Comment Status* **A** *Bucket*

"jiitter" should be "jitter"

SuggestedRemedy

change "jiitter" to "jitter"

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.1.7** *P* **358** *L* **38** # r01-9

Healey, Adam — Broadcom Ltd.

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

While M and Np are parameters of equations defined in 85.8.3.3.5, it is not accurate to say that they are defined there. The final clause of this note "Nb is found in Table 120D-8" implies the note is intended to point the user where values for these parameters may be found. This makes the reference to 85.8.3.3.5 even more misleading.

SuggestedRemedy

Change the note to be "NOTE -- M is the oversampling ratio of the measured waveform and linear fit pulse as defined in 85.8.3.3.4 and Np is the linear fit pulse length defined in 120D.3.1.3. Nb is defined in Table 120D-8. "

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to comment #r01-38

[Editor's note added after comment resolution completed.
The response to comment r01-38 is:
Change the NOTE to a paragraph: "Where M is the oversampling ratio of the measured waveform and linear fit pulse as defined in 85.8.3.3.4 and Np is the linear fit pulse length given in 120D.3.1.3. Nb is given in Table 120D-8. "

See also comment #r01-9
]

Cl **120D** *SC* **120D.3.1.7** *P* **358** *L* **38** # r01-38

Dawe, Piers J G — Mellanox Technologie

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

The contents of this NOTE aren't just fluff, they are needed to use the equation.

SuggestedRemedy

Instead of NOTE--M and Np are defined in 85.8.3.3.5, and Nb is found in Table 120D-8, annotate Eq 120D-7 per style guide: "where M and Np are defined in 85.8.3.3.5, and Nb is found in Table 120D-8."

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change the NOTE to a paragraph: "Where M is the oversampling ratio of the measured waveform and linear fit pulse as defined in 85.8.3.3.4 and Np is the linear fit pulse length given in 120D.3.1.3. Nb is given in Table 120D-8. "

See also comment #r01-9

Cl **120D** *SC* **120D.3.1.8** *P* **358** *L* **43** # r01-40

Dawe, Piers J G — Mellanox Technologie

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

This isn't a measurement standard. Don't add a "shall" to the measurement.

SuggestedRemedy

Change "The reference impedance for differential return loss measurements shall be 100 ohm." to "The reference
impedance for differential return loss is 100 ohm."

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.1.8** *P* **358** *L* **43** # r01-39

Dawe, Piers J G — Mellanox Technologie

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

Use consistent terminology. It seems that "This output impedance requirement" is referring to the differential output return loss spec.

SuggestedRemedy

In "This output impedance requirement applies to all valid output levels", delete "output impedance".

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.1.8** *P* **358** *L* **46** # r01-41

Dawe, Piers J G — Mellanox Technologie

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

I doubt that the low frequency RL at 14.25 dB is significant for signal integrity compared with the 8.7 dB at 6 GHz. This RL is much tighter than CEI-56G-MR at low (and high) frequency but looser between 4 and 9 GHz.

SuggestedRemedy

Change 14.25 - f to 12 -0.625f

Response *Response Status* **U**

REJECT.
No consensus to make a change at this time, but further investigation is encouraged.

[Editor's note added after comment resolution completed. The consensus view was that further investigation of the effect of Return Loss at low frequencies should take place, but no change to the equation can be justified at this time.]

Cl **120D** *SC* **120D.3.2.1** *P* **365** *L* **9** # r01-23

RAN, ADEE Intel

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

(page 361 according to footer in CMP document)

Small font in green cross-reference to 93.8.1.3.

SuggestedRemedy

Change to the same size as surrounding text.

Response *Response Status* **C**

ACCEPT.

Cl **120D** *SC* **120D.3.2.1** *P* **365** *L* **22** # r01-24

RAN, ADEE Intel

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

(page 361 according to footer in CMP document)

Having an equation in the middle of a list is cumbersome, the similar text was changed in 802.3cd and all equations were moved after the list.

Also, "Where Q4 is 3.8906" is within the text and before the equation; it seems misplaced, and will be more so if the equation is moved.

Also, the number is not justified in the text (although justification was discussed in task force presentations).

SuggestedRemedy

Move Equation 120D-11 to a location after the list.

Delete the quoted words from item d, and place them in a new paragraph following Equation 120D-11.

Add a NOTE after this paragraph:
NOTE--Q4 is an approximated solution of Q(Q4) = 5*10^-5, where the Q function is defined in Equation (95-1).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Move Equations 120D-10 & 120D-11 after the list.

Delete "Where Q4 is 3.8906." from item d, and place it in a new paragraph following Equation 120D-11.

Cl **120e** *SC* **120e.1.1** *P* **369** *L* **29** # r01-12

Ghiasi, Ali Ghiasi Quantum LLC

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

In sufficientclarity definition of the BER, should add someitbg similar to what we have in CL 121-124

SuggestedRemedy

The bit error ratio (BER) when processed according to Clause 120 shall be less than 1x10-5 provided that the error statistics are sufficiently random that this results in a frame loss ratio (see 1.4.223) of less than 1.7e-12 for 64-octet frames with minimum interpacket gap when processed according to Clause 120 and Clause 119. For a complete Physical Layer, the frame loss ratio may be degraded to 6.2e-11 for 64- 48 octet frames with minimum interpacket gap due to additional errors from the electrical interfaces.

If the error statistics are not sufficiently random to meet this requirement, then the BER shall be less than 51 that required to give a frame loss ratio of less than 1.7e-12 for 64-octet frames with minimum interpacket gap.

Response *Response Status* **C**

REJECT.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.0 and IEEE P802.3bs/D3.1 or the unsatisfied negative comments from the previous ballots. Hence it is not within the scope of the recirculation ballot.

With a BER of 1E-5 and a probability of a burst continuing of 0.75, the expected frame loss ratio is not 1.7E-12, but 3.27E-17 (when analyzed according to the methods used in http://www.ieee802.org/3/bs/public/adhoc/logic/oct23_15/anslow_01_1015_logic.pdf and earlier presentations). This is equivalent to one uncorrectable codeword every 26 years, which is clearly not a practical measurement limit.

Cl **120E** *SC* **120E.3.2** *P* **376** *L* **5** # r01-42

Dawe, Piers J G — Mellanox Technologie

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

Far-end pre-cursor ratio doesn't seem like the right tool to solve the issue raised in healey_3bs_01a_0317, which seeks to outlaw "transmitter A1" that gives more than 4 dB COM anyway, so the limit for far-end pre-cursor ratio seems too restrictive. The complaint seems to be that even if the eye is open after the software channel, some receivers might struggle after their own package loss.

SuggestedRemedy

If there is an issue, consider increasing the loss in the software channel to moving the "far end" to after a reasonable package loss, and making a small adjustment the FE eye height and width to compensate. Anyway, relax the far-end pre-cursor ratio limit. If a limit remains, consider if there needs to be a minimum as well as a maximum limit.
Review the way this works for a reasonable variety of channels.

Response *Response Status* **U**

REJECT.
The commenter has not provided any evidence to support his assertion that the limit for far-end pre-cursor ratio is more restrictive than necessary.

Cl **120E** *SC* **120E.3.2** *P* **381** *L* **1** # r01-25

RAN, ADEE — Intel

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

In the continuation of Table 120E-3, the caption is truncated.

SuggestedRemedy

Fix it somehow (perhaps break into two lines).

Response *Response Status* **C**

ACCEPT.

Cl **120E** *SC* **120E.3.2.1** *P* **376** *L* **27** # r01-43

Dawe, Piers J G — Mellanox Technologie

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

Following up on D3.1 comment 123: there is no need for 31 UI offset between lanes for module testing: the 1 ns (about 27 UI) of Skew that is called out in footnote a to Table 116-7 is mostly Skew that the host might make, not Skew between module input and PMD circuitry. giannakopoulos_01_0508 said:
'PMA to PMD connection
- Traces should in any case be carefully laid out
- Should be less than 1" (per direction), which is 0.45 ns (RX and TX)'
The point is that the lanes should not be correlated in the module, and as both the input and output signals are available, the tester can find out what is really needed if he wishes. For PRBS13Q, only 1 UI offset at the point of crosstalk is enough to give excellent decorrelation; PRBS31Q is believed to behave similarly. In some test setups, there is a master PRBS generator and an arrangement of splitters and cables; the cables must be kept short for good performance. 31 UI x 7 steps at 26.5625 GBd and 5 ns/m is 1.63 m - too long. The optical clauses have added "so that the symbols on each lane are not correlated within the PMD" so that the intent is given, not just an over-zealous rule.

SuggestedRemedy

As the paths between the test points and the PMA and PMD circuitry are not likely to differ by more than 1" or about 5 UI, change "For the case where PRBS13Q or PRBS31Q are used with a common clock, there is at least 31 UI delay between the patterns on one lane and any other lane." to "For the case where PRBS13Q or PRBS31Q are used with a common clock, there is enough delay between the patterns on one lane and any other lane that the symbols on each lane are not correlated within the module. At least 8 UI is recommended.". Also in 120E.3.4.1.1 Module stressed input test procedure.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

In 120E.3.2.1, 120E.3.1.6, 120E.3.3.2.1 and 120E.3.4.1.1:
After "there is at least 31 UI delay between the test pattern on one lane and the pattern on any other lane", add "so that the symbols on each lane are not correlated within the PMD".

Cl **120E** *SC* **120E.3.3.2.1** *P* **379** *L* **34** # r01-10

Healey, Adam — Broadcom Ltd.

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

It is stated that the eye height and width are to be measured using the methodology given in 120E.4.2 and that the reference receiver is configured to maximize the eye height and width. However, the loss channel is never mentioned here or in the references and the only indication that it is needed is the definition of "far-end" eye height and width requirements in Table 120E-5. Readers not intimately familiar with the intent of the standard may not realize the loss channel is also included from this keyword alone.

SuggestedRemedy

It would be helpful to add the following points of emphasis to the paragraph starting at line 34. Change the first sentence to "The far-end eye height and width, measured to a probability of 10^(-5), are then measured at TP4 with the reference receiver defined in 120E.3.2.1.1 using the measurement methodology given in 120E.4.2. Note that the reference receiver for far-end eye height and width measurements includes a loss channel." Change the end of the last sentence of the paragraph to "...smallest eye given in Table 120E-5 with the setting of the CTLE that maximizes...".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.
However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

Apply the Suggested Remedy.

Cl **120E** *SC* **120E.4.1** *P* **383** *L* **9** # r01-44

Dawe, Piers J G — Mellanox Technologie

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

OIF VSR-PAM4 has FOM_ILD spec on the mated compliance boards. As PAM4 is so sensitive to reflections (ILD), it would be advisable to add one here also

SuggestedRemedy

Add FOM_ILD spec, limit 0.1 dB.

Response *Response Status* **C**

REJECT.

FOM_ILD is already defined in Clause 92.11.3.1, but with a value of 0.13dB.

No consensus shown for a change in this value at this point.

Straw Poll
a) Change to 0.11dB
b) No change (0.13dB)
a: 3; b: 6;

Cl **120E** *SC* **120E.4.1** *P* **387** *L* **51** # r01-26

RAN, ADEE — Intel

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

"as given" seems to be a typo.

Also, the terminating period of this sentence is misplaced (it appears in the beginning of the following equation)
.

SuggestedRemedy

Change "as given" to "is given".

Move the terminating period to its proper position.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.7.1** *P* **221** *L* **36** # r01-45

Dawe, Piers J G — Mellanox Technologie

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

Following up on bs D3.0 comment 127 and 57, and cd comments 129, 138, 200: extinction ratio of 4.5 dB is not DML or SiP EAM friendly, costing electrical power and/or bandwidth and/or lower output power, hence the cost of this PMD, and the related 200GBASE-FR4, 200GBASE-LR4, 400GBASE-FR8, 400GBASE-LR8, 50GBASE-FR and 50GBASE-LR. As MPI penalty is a weak function of extinction ratio for PAM4, the limit can be reduced. For an example of a modern direct-mod PMD spec and what a receiver can receive, 100GBASE-SR4 has a 2 dB limit. A transmitter optimized for PAM4 is likely to have a lower extinction ratio than one for NRZ, to reduce distortion.

SuggestedRemedy

Reduce the extinction ratio limit from 4.5 dB to e.g. 3.5 dB. Either add 0.02 dB to the budget, or adjust the TDECQ limit according to the actual extinction ratio, which is obtained as a by-product of the TDECQ measurement anyway, so that the link margin and receiver sensitivity are not affected. See king_3cd_02_0317.pdf and new presentation.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

In Table 121-6, change "Extinction ratio, each lane (min)" from 4.5 dB to 3.5 dB.

Cl **121** *SC* **121.7.1** *P* **221** *L* **37** # r01-8

Hayakawa, Akinori

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

The maximum RIN_OMA spec of 200GBASE-DR4 was changed from -142 to -136 dB/Hz in 802.3bs, Draft 2.2. However current RIN_OMA spec of 200GBASE-DR4, that is more tolerant in sensitivity requirement than FR and LR, is still unecessarily low referring 50GBASE-FR and LR specified in 802.3cd Draft 1.3.

SuggestedRemedy

In Table 121-6 change the RIN_OMA max value from -136 to -132 dB/Hz.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment r01-46

[Editor's note added after comment resolution completed.
The response to comment r01-46 is:
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in
http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4
]

Cl **121** *SC* **121.7.1** *P* **221** *L* **37** # r01-46

Dawe, Piers J G — Mellanox Technologie

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

Following up D3.0 comment 128: the RIN limit (-136) is tighter than it needs be: in Clause 139, 50GBASE-FR and 50GBASE-LR, it's -132. RIN is included in TDECQ so we don't need a separate tight spec for it.

SuggestedRemedy

Change -136 to -132 here and in Table 122-9 (twice) and Table 122-10 (twice).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in
http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4

Cl **121** *SC* **121.8.4** *P* **224** *L* **9** # r01-47

Dawe, Piers J G — Mellanox Technologie

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

This now says "The OMAouter is measured
using a test pattern specified..." - but whether it's measured or not is beside the point.

SuggestedRemedy

Change to "The OMAouter is defined for a test pattern specified..." or just "OMAouter is defined for a test pattern specified...". Similarly in 122 and 124.

Response *Response Status* **C**

REJECT.
The proposed wording is not an improvement. The wording in D3.1 was just agreed at the Vancouver meeting.

[Editor's note added after comment resolution completed.
The consensus view was that the current wording simply states how the measurement is done and does not imply anything about whether this parameter has to be tested or not, so changing to "defined" is not an improvement.]

Cl **121** *SC* **121.8.5.1** *P* **227** *L* **52** # r01-13

RAN, ADEE
Intel

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

(page 224 according to footer in CMP document)

This is a follow-up on i-131 due to changes in 121.8.5.a and 121.8.5.3 which make it more relevant.

The 31-UI offset is now required "so that the symbols on each lane are not correlated within the PMD". But that is incorrect; the symbols are fully correlated, with a constant offset.

The rebuttal of comment i-131 claimed that having crosstalk "locked to the pattern under test" enables it to be "correctly processed by the equalizer". But this makes the crosstalk strongly correlated with the measured signal (even with 31 UI offset) and appear as a high-probablity noise component (due to the short SSPRQ length); where in real life, crosstalk will be totally uncorrelated with the transmitter signal, and likely closer to Gaussian. This results in overly pessimistic accounting of crosstalk.

With TDECQ being tested without averaging (as now added in 121.8.5.3), there seems to be no need for requiring the SSPRQ pattern on all lanes. The statistics of uncorrelated crosstalk will be represented better if the measurement is done with adjacent lanes transmitting a signal with a different period, such as PRBS31Q or PRBS13Q. Since the measurement is not averaged, the statistics can be captured correctly.

In addition for making it a more representative test, controlling SSPRQ per lane and not requiring a 31-UI offset (which does not really help anyway) may reduce complexity in the PMA design.

SuggestedRemedy

Require TDECQ measurement to be performed with SSPRQ transmitted only on the lane under test, with other lanes transmitting PRBS31Q or a valid PCS pattern.

Change SSPRQ generator control to be per-lane (in 120.5.11.2.3 and 45.2.1.124).

Delete the requirement to have at least a 31 UI delay between lanes in 120.5.11.2.3 and in 121.8.5.1, and delete the words "so that the symbols on each lane are not correlated within the PMD" (they are incorrect).

Apply corresponding changes in the TDECQ subclauses of other PMD clauses.

Grant license to the editors to implement the changes correctly across the multiple clauses involved.

Response *Response Status* **U**

REJECT.
This comment makes a similar proposal to comment i-131, which was rejected with the response:

"The TDECQ test (and SECQ test) are based on capturing the complete SSPRQ pattern and passing it through a reference equalizer. The measurement is allowed to be made using an equivalent-time sampling oscilloscope. By requiring that all lanes are receiving the SSPRQ pattern, any crosstalk from the other lanes is locked to the pattern under test, captured by the oscilloscope as a distortion of the waveform and correctly processed by the equalizer. Because of the offset between the lanes, the crosstalk will be different for the various occurrences of each symbol type. If the draft is changed to allow PRBS13Q or PRBS31Q on the other lanes, then the crosstalk will no longer be locked to the pattern under test and will appear as noise when captured using an equivalent-time sampling oscilloscope and will not be processed correctly by the reference equalizer since the frequency profile of the crosstalk is lost."

The advantage of retaining the frequency content of the crosstalk when using an equivalent time oscilloscope outweighs any advantage of improved randomness when using a different pattern on the other lanes.

Cl **121** *SC* **121.8.5.1** *P* **231** *L* **9** # r01-16

RAN, ADEE Intel

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

(page 228 according to footer in CMP document)

This is a follow-up on unsatisfied comment i-23.

This section has improved from the previous version, but the new text and equations here are long and repetitive.

The equations 121-5, 121-7 and 121-8 are the same except for the value of the threshold. They can be merged into one equation and the text can be simplified and made easier to read.

Also, Gth1(yi) and other values are used multiple times in the first two paragraphs following equation 121-4, before being defined in the third paragraph. a cross-reference to the equation would make the process easier to follow.

It would be even better to define the process with equations rather than text. I will try to create a formatted proposal in a follow-up.

The suggested remedy would also satisfy comment i-23.

SuggestedRemedy

Merge equations 121-5, 121-7 and 121-8 into one equation, similar to 121-5 but with "Gth1" changed to "Gthj" and "Pth1" changed to "Pthj" (italic j in both).
Add after the equation "where j=1 to 3 is the index of the sub-eye".

Change the two paragraphs following equation 121-4 FROM
Each element of the cumulative probability function, CFL1(yi), is multiplied by a value Gth1(yi), and then summed to calculate an approximation for SERL1, the partial SER for threshold 1. Each element of the cumulative probability function, CFL2(yi), is multiplied by a value Gth2(yi), and then summed to calculate an approximation for SERL2. Each element of the cumulative probability function, CFL3(yi), is multiplied by a value Gth3(yi), and then summed to calculate an approximation for SERL3. The sum of the three partial SERs is the SER associated with the left histogram, SERL.

Each element of the cumulative probability function, CFR1(yi), is multiplied by a value Gth1(yi), and then summed to calculate an approximation for SERR1, the partial SER for threshold 1. CFR2(yi) and CFR3(yi) are treated similarly to calculate SERR2, and SERR3, the partial SERs for threshold 2 and threshold 3. The sum of the three partial SERs is the SER associated with the right histogram, SERR.

TO
For each of the three sub-eyes, an approximated partial SER is calculated for the right and the left histograms, using the following process with j=1 to 3.

Each element of the cumulative probability function, CFLj(yi), is multiplied by a corresponding value Gthj(yi) defined by Equation (121-5), and the resulting products are summed to yield SERLj, the partial for the left histogram SER for threshold j. SERRj, the partial for the right histogram SER for threshold j, is calculated similarly from CFRj(yi).

The SER associated with the left histogram, SERL, is the sum of the three values of SERLj. The SER associated with the left histogram, SERL, is is the sum of the three values of SERRj.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Merging Equations 121-5, 121-7 and 121-8 into a single equation would reduce the repetition but it would become less obvious that the process has to be performed three times, so making this change would not improve clarity.

In Equations 121-5, 121-7, and 121-8, change "y_i - P_th1" to "y - P_th1"

Cl **121** *SC* **121.8.5.3** *P* **226** *L* **8** # r01-48

Dawe, Piers J G Mellanox Technologie

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

Following up on D3.0 comment 133: the draft says Pattern 6 (SSPRQ) should be used for TDECQ. Today's SSPRQ is more stressful in pre-FEC measurements than the service pattern (long scrambler) with FEC, so today's TDECQ measurement does not give the correct penalty for a range of reasonable and compliant transmitters. Same problem in clauses 122 and 124. See associated comment against 120.5.11.2.3.

SuggestedRemedy

Change the first seed in Table 120-2 to one for which a minimally compliant transmitter with 0.4 dB baseline wander penalty after FEC with a random payload measures as minimally compliant (i.e. also 0.4 dB baseline wander penalty) on a pre-FEC BER basis with SSPRQ. This will be a pattern between the red and light brown curves in dawe_3bs_01a_0317 slide 6.

Response *Response Status* **U**

REJECT.
This topic has been discussed at the SMF Ad Hoc with no consensus being reached for a change.
After further discussion there is still no consensus for a change to the draft.

[Editor's note added after comment resolution completed.
Evidence that no change is needed was given in:
http://www.ieee802.org/3/bs/public/17_05/anslow_3bs_03_0517.pdf
]

Cl **121** *SC* **121.8.5.3** *P* **228** *L* **33** # r01-11

Ghiasi, Ali — Ghiasi Quantum LLC

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

When integral was replaced the "Sum" sign missing in front of EQ 121-6

SuggestedRemedy

Add sum sign

Response *Response Status* **C**

REJECT.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

Equation 121-5 is the integral of a function over a small interval y_i - Dy/2 to y_i + Dy/2 [where Dy is Delta y].
The assumption being made in Equation 121-6 is that this integral can be approximated by the value of the function in the centre of the interval (y_i) multiplied by Dy. Consequently, there is no summation sign missing from the equation.

Cl **121** *SC* **121.8.5.3** *P* **229** *L* **16** # r01-14

RAN, ADEE — Intel

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

(page 226 according to footer in CMP document)

The text here says:
"to find the largest noise that could be convolved with the signal"

and then in the same paragraph
"the amount of noise that can be added to the signal"
and
"finding the noise that can be added"

Noise is really coupled by addition, not convolution (it is only the PDFs that are combined by convolution), so the first sentence should be changed.

SuggestedRemedy

Change "could be convolved with the signal" to "could be added to the signal".

In the paragraph following equation 121-3, change
"in effect, convolve the PAM4 waveform with noise"
to
"in effect, include the effect of noise added to the PAM4 waveform".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
Change "could be convolved with the signal" to "could be combined with the signal".
In the paragraph following equation 121-3, change:
"in effect, convolve the PAM4 waveform with noise" to:
"in effect, combine the PAM4 waveform with noise".

Cl **121** *SC* **121.8.5.3** *P* **230** *L* **46** # r01-15

RAN, ADEE — Intel

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

(page 227 according to footer in CMP document)

The terms CFL1 to CFL3 are written here with a full-size "L", inconsistent with later occurrences and with the corresponding terms CFR1 to CFR3, which are written with a subscript "R".

SuggestedRemedy

Change to use subscript "L" wherever these terms occur.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.8.5.3** *P* **232** *L* **25** # r01-17

RAN, ADEE Intel

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

(page 229 according to footer in CMP document)

The text above equation 121-9 refers to "the normalized frequency response Heq(f) of the reference equalizer".

In Electrical Engineering terms (which many readers of IEEE standards are familiar with), the frequency response of a system is the Fourier Transform of its impulse response; and it describes the voltage transfer function of a linear system with a harmonic input. Although 802.3 does not define this term, several definitions (from other standards) in the Standards Dictionary are consistent with this meaning.

For example: "frequency response: The complex gain (magnitude and phase) as a function of input frequency, or the Fourier transform of the impulse response." (IEEE Std 1057-2007 IEEE Standard for Digitizing Waveform Recorders)

With this definition, the power spectrum density should use the squared magnitude of the frequency response. This is a well-known result in analysis of linear systems fed by white noise.

See for example Equation 9-55 in Hwei P. Hsu: Schaum's Outline of Signals and Systems, Third Edition McGraw-Hill Professional, 2014 (https://accessengineeringlibrary.com/browse/schaums-outline-of-signals-and-systems-third-edition/c9780071829465ch09)

The suggested remedy, if accepted, would also satisfy comment i-25.

SuggestedRemedy

In Equation 121-9, replace Heq(f) by |Heq(f)|^2.

Response *Response Status* **C**

ACCEPT.

Cl **121** *SC* **121.8.5.4** *P* **229** *L* **229** # r01-3

Leizerovich, Hanan

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

This subclause defines the reference equalizer, while some of it's characteristics and the method of setting it is mentioned in other subclauses. This may cause some confusion to the reader for following on the usage of this equalizer and understanding why only part it's characteristics are here.

SuggestedRemedy

1. Move the following text from "121.8.5.3 TDECQ measurement method" to "121.8.5.4 TDECQ reference equalizer" (page 226, line 22):
The sum of the equalizer tap coefficients should always be equal to 1.

2. Add the following text in the same paragraph:
The taps are optimized according to the method stated in 121.8.5.3.

3. Make a similar fix in 122.8.5.4

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

However, adding helpful information is an improvement to the draft.
Add "The sum of the equalizer tap coefficients is equal to 1." at the end of the first paragraph of 121.8.5.4 and 122.8.5.4.

Cl **121** *SC* **121.8.9.1** *P* **230** *L* **27** # r01-49

Dawe, Piers J G — Mellanox Technologie

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

Following up on D3.0 comment 145: calibrating the signal for stressed receiver testing with this draft's SSPRQ then testing the receiver with PRBS31Q or scrambled idle won't work because the apparent penalty will be very different with the two patterns (more in calibration, less in receiver testing, leaving a hole in the spec). This affects clauses 122 and 124 also.

SuggestedRemedy

See other comments for making a measurement with SSPRQ relate to penalty with FEC in service. Here, the draft simply says "The BER is required to be met for the lane under test on its own": I think we need at least to refer to the text in 121.1.1: "If the error statistics are not sufficiently random to meet this requirement, then the BER shall be less than that required to give a frame loss ratio of less than 1.7 x 10-12 for 64-octet frames with minimum interpacket gap."

Response *Response Status* **C**

REJECT.
Note d in Table 121-7 is applied to the stressed receiver sensitivity and says: "Measured with conformance test signal at TP3 (see 121.8.9) for the BER specified in 121.1.1", so the stressed receiver sensitivity BER is already referred to 121.1.1. The text the commenter is referring to does not define what the BER requirement is except that it has to be met for the lane under test on its own.

Cl **121** *SC* **121.8.9.2** *P* **232** *L* **18** # r01-51

Dawe, Piers J G — Mellanox Technologie

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

It is not apparent that the pattern used in this paragraph is not the one used in the previous paragraph - the text is like earlier SRS sections where the same pattern is used and as far as I can see, one has to turn to Table 121-10 to learn this.

SuggestedRemedy

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

Response *Response Status* **C**

REJECT.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

The fact that the patterns are different is clearly stated in earlier subclauses. 121.8.9.2 details "Stressed receiver conformance test signal characteristics and calibration". It is not a step-by step procedure for the SRS measurement itself, so it is not necessary to describe the pattern change here.

Cl **121** *SC* **121.8.9.2** *P* **232** *L* **18** # r01-50

Dawe, Piers J G — Mellanox Technologie

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

This paragraph is about doing the test, not "121.8.9.2 Stressed receiver conformance test signal characteristics and calibration". See the structure of 52.9.9 Stressed receiver conformance test.

SuggestedRemedy

Give it its own subclause.

Response *Response Status* **C**

REJECT.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

This subclause is not about performing the test, it is about "Stressed receiver conformance test signal characteristics and calibration". It is equivalent to 87.8.11.2 in that respect.

Cl **122** *SC* **122.7.1** *P* **252** *L* **35** # r01-52

Dawe, Piers J G — Mellanox Technologie

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

Following up on bs D3.0 comment 148 and cd comments 129, 138, 200: this extinction ratio limit is not good for low cost of these PMDs, and the related 200GBASE-DR4, 50GBASE-FR and 50GBASE-LR. See more against 121.7.1; see king_3cd_02_0317.pdf and new presentation.

SuggestedRemedy

Reduce the extinction ratio limit from 4.5 dB to e.g. 3.5 dB. Adjust the TDECQ limit according to the actual extinction ratio, which is obtained as a by-product of the TDECQ measurement anyway, so that the link margin and receiver sensitivity are not affected.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
In Table 122-9:
In the row for "Launch power in OMAouter minus TDECQ, each lane (min)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values -1.7 and -0.9 dBm
"Extinction ratio < 4.5 dB" with values -1.6 and -0.8 dBm
Also:
change "Extinction ratio (min)" from 4.5 dB to 3.5 dB
change footnote b to "Even if the TDECQ < 1 dB for an extinction ratio >= 4.5 dB or TDECQ < 0.9 dB for an extinction ratio < 4.5 dB, the OMAouter (min) must exceed this value."

In Table 122-10:
In the row for "Launch power in OMAouter minus TDECQ, each lane (min)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values -1 and -0.3 dBm
"Extinction ratio < 4.5 dB" with values -0.9 and -0.2 dBm
Also:
change "Extinction ratio (min)" from 4.5 dB to 3.5 dB
change footnote b to "Even if the TDECQ < 1 dB for an extinction ratio >= 4.5 dB or TDECQ < 0.9 dB for an extinction ratio < 4.5 dB, the OMAouter (min) must exceed this value."

In Table 122-13:
In the row for "Power budget (for maximum TDECQ)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values 6.7, 6.5, 9.3, and 9.2 dB
"Extinction ratio < 4.5 dB" with values 6.8, 6.6, 9.4, and 9.3 dB
In the row for "Allocation for penalties (for maximum TDECQ)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values 2.7, 2.5, 3, and 2.9 dB
"Extinction ratio < 4.5 dB" with values 2.8, 2.6, 3.1, and 3 dB

In Table 122-19:
Change the entries for -39 dB, -40 dB and -38 dB to -40 dB, -41 dB and -39 dB, respectively

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Cl **122** *SC* **122.7.1** *P* **252** *L* **37** # r01-6

Hayakawa, Akinori

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

Maximum RIN_OMA specs of 50GBASE-FR and LR were changed from -136 to -132 dB/Hz in 802.3cd, Draft 1.3. To use these PMDs as break out cables for 200GBASE-FR4 and LR4, the maximum RIN_OMA specs of 200GBASE-FR4 and LR4 must be consistent with 50GBASE-FR and LR respectively.

SuggestedRemedy

In Table 122-9 change the RIN_OMA max value from -136 to -132 dB/Hz for both FR and LR.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment r01-46

[Editor's note added after comment resolution completed.
The response to comment r01-46 is:
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4
]

Cl **122** *SC* **122.7.1** *P* **253** *L* **40** # r01-7

Hayakawa, Akinori

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

Maximum RIN_OMA specs of 50GBASE-FR and LR were changed from -136 to -132 dB/Hz in 802.3cd, Draft 1.3. To use these PMDs as break out cables for 400GBASE-FR8 and LR8, the maximum RIN_OMA specs of 400GBASE-FR8 and LR8 must be consistent with 50GBASE-FR and LR respectively.

SuggestedRemedy

In Table 122-10 change the RIN_OMA max value from -136 to -132 dB/Hz for both FR and LR.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment r01-46

[Editor's note added after comment resolution completed.
The response to comment r01-46 is:
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4
]

Cl **123** *SC* **123.7** *P* **280** *L* **4** # r01-63

Kolesar, Paul CommScope, Inc.

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

The IEC equivalent of TIA-492AAAE has passed CDV ballot without a disapproving vote. It can proceed to publication without additional ballot. The disposition of the standard will be officially determined at the 86A meeting the week of April 24.

SuggestedRemedy

Request a report on the status of IEC 60793-2-10 edition 6. Consider replacing "or fiber compliant to TIA-492AAAE" with "or type A1a.4". Note that while approval of the IEC CDV ballot allowed OM5 content to remain in ISO 11801-1, the approval of the OM5 term is pending completion of ISO's FDIS ballot.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

In 123.7, replace " fiber compliant to TIA-492AAAE" with "type A1a.4 (OM5)"

In Table 123-5, replace "wideband MMF (TIA-492AAAE)" with "OM5".

In Table 123-6, replace "Wideband MMF (TIA-492AAAE)" with "OM5".

In 123.10, replace "wideband MMF (TIA-492AAAE)" with "OM5" (in three places).

In Table 123-7, replace "wideband MMF " with "OM5", and in note c, replace "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4"

In 1.3 change "IEC 60793-2-10:2011" to "IEC 60793-2-10"

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Cl **123** *SC* **123.7** *P* **280** *L* **16** # r01-62

Kolesar, Paul CommScope, Inc.

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

The IEC equivalent of TIA-492AAAE has passed CDV ballot without a disapproving vote. It can proceed to publication without additional ballot. The disposition of the standard will be officially determined at the 86A meeting the week of April 24.

SuggestedRemedy

Request a report on the status of IEC 60793-2-10 edition 6. Consider replacing "(TIA-492AAAE)" with "(type A1a.4)". Note that the OM5 cabling name is likely to be approved with the FDIS ballot of 11801-1. Then the cell entry cab be simplified to "0.5 m to 100 m for OM5".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to #r01-63

[Editor's note added after comment resolution completed.
The response to comment r01-63 is:
In 123.7, replace " fiber compliant to TIA-492AAAE" with "type A1a.4 (OM5)"

In Table 123-5, replace "wideband MMF (TIA-492AAAE)" with "OM5".

In Table 123-6, replace "Wideband MMF (TIA-492AAAE)" with "OM5".

In 123.10, replace "wideband MMF (TIA-492AAAE)" with "OM5" (in three places).

In Table 123-7, replace "wideband MMF " with "OM5", and in note c, replace "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4"

In 1.3 change "IEC 60793-2-10:2011" to "IEC 60793-2-10"

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]

Cl **123** *SC* **123.10** *P* **283** *L* **29** # r01-64

Kolesar, Paul CommScope, Inc.

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

The IEC equivalent of TIA-492AAAE has passed CDV ballot without a disapproving vote. It can proceed to publication without additional ballot. The disposition of the standard will be officially determined at the 86A meeting the week of April 24.

SuggestedRemedy

Consider replacing "(TIA-492AAAE)" with "(IEC type A1a.4)" or adding "IEC type A1a.4" in three instances within the paragraph. Note that while approval of the IEC CDV ballot allowed OM5 content to remain in ISO 11801-1, the approval of the OM5 term is pending completion of ISO's FDIS ballot.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to #r01-63

[Editor's note added after comment resolution completed.
The response to comment r01-63 is:
In 123.7, replace " fiber compliant to TIA-492AAAE" with "type A1a.4 (OM5)"

In Table 123-5, replace "wideband MMF (TIA-492AAAE)" with "OM5".

In Table 123-6, replace "Wideband MMF (TIA-492AAAE)" with "OM5".

In 123.10, replace "wideband MMF (TIA-492AAAE)" with "OM5" (in three places).

In Table 123-7, replace "wideband MMF " with "OM5", and in note c, replace "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4"

In 1.3 change "IEC 60793-2-10:2011" to "IEC 60793-2-10"

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]

Cl **123** *SC* **123.10** *P* **283** *L* **39** # r01-65

Kolesar, Paul CommScope, Inc.

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

The IEC equivalent of TIA-492AAAE has passed CDV ballot without a disapproving vote. It can proceed to publication without additional ballot. The disposition of the standard will be officially determined at the 86A meeting the week of April 24.

SuggestedRemedy

Consider replacing "(TIA-492AAAE)" with "(IEC type A1a.4)" or adding the IEC standard alongside of the TIA standard. Note that the OM5 name is likely to approved with the FDIS ballot of 11801-1. Then the heading can be simplified to "OM5".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to #r01-63

[Editor's note added after comment resolution completed.
The response to comment r01-63 is:
In 123.7, replace " fiber compliant to TIA-492AAAE" with "type A1a.4 (OM5)"

In Table 123-5, replace "wideband MMF (TIA-492AAAE)" with "OM5".

In Table 123-6, replace "Wideband MMF (TIA-492AAAE)" with "OM5".

In 123.10, replace "wideband MMF (TIA-492AAAE)" with "OM5" (in three places).

In Table 123-7, replace "wideband MMF " with "OM5", and in note c, replace "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4"

In 1.3 change "IEC 60793-2-10:2011" to "IEC 60793-2-10"

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]

Cl **123** *SC* **123.11.1** *P* **284** *L* **31** # r01-66

Kolesar, Paul CommScope, Inc.

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

The IEC equivalent of TIA-492AAAE has passed CDV ballot without a disapproving vote. It can proceed to publication without additional ballot. The disposition of the standard will be officially determined at the 86A meeting the week of April 24.

SuggestedRemedy

Consider replacing "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4". Note that the OM5 name is likely to approved with the FDIS ballot of 11801-1. Then the heading in the table at line 13 that currently says "Wideband MMF" can be simplified to "OM5".

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See response to #r01-63

[Editor's note added after comment resolution completed.
The response to comment r01-63 is:
In 123.7, replace " fiber compliant to TIA-492AAAE" with "type A1a.4 (OM5)"

In Table 123-5, replace "wideband MMF (TIA-492AAAE)" with "OM5".

In Table 123-6, replace "Wideband MMF (TIA-492AAAE)" with "OM5".

In 123.10, replace "wideband MMF (TIA-492AAAE)" with "OM5" (in three places).

In Table 123-7, replace "wideband MMF " with "OM5", and in note c, replace "TIA-492AAAE" with "IEC 60793-2-10 type A1a.4"

In 1.3 change "IEC 60793-2-10:2011" to "IEC 60793-2-10"

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]

Cl **124** *SC* **124.7.1** *P* **298** *L* **31** # r01-19

Wertheim, Oded Mellanox Technologie

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

The specified Extinction ratio creates a burden on SiP based EMLs, it requires higher swing that results in a higher power consumption and a longer device which results in higher capacitance and reduced modulator bandwidth. Reducing the min ER to 3.5 dB can reduce SiP EML based solutions cost and power. Other transmitter specs such as TDECQ can be adjusted to compensate for the small increase in MPI penalty (0.12 dB) without a need to modify the receiver spec. Alternatively, the transmitter spec can be written such that there's no need modify the transmitter spec for higher ER transmitters.

SuggestedRemedy

Change the Extinction ratio (min) to 3.5 dB.
Similarly, change the Extinction ratio (min) to 3.5 dB in the 200GBASE-DR4 transmitter spec (121.7.1) and 400GBASE-LR8/FR8, 200GBASE-LR4/FR4 (122.7.1).

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comments r01-53, r01-45, and r01-52

[Editor's note added after comment resolution completed.
The response to comment r01-53 is:
In Table 124-6, change "Extinction ratio, each lane (min)" from 5 dB to 3.5 dB.

The response to comment r01-45 is:
In Table 121-6, change "Extinction ratio, each lane (min)" from 4.5 dB to 3.5 dB.

The response to comment r01-52 is:
In Table 122-9:
In the row for "Launch power in OMAouter minus TDECQ, each lane (min)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values -1.7 and -0.9 dBm
"Extinction ratio < 4.5 dB" with values -1.6 and -0.8 dBm
Also:
change "Extinction ratio (min)" from 4.5 dB to 3.5 dB
change footnote b to "Even if the TDECQ < 1 dB for an extinction ratio >= 4.5 dB or TDECQ < 0.9 dB for an extinction ratio < 4.5 dB, the OMAouter (min) must exceed this value."

In Table 122-10:
In the row for "Launch power in OMAouter minus TDECQ, each lane (min)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values -1 and -0.3 dBm
"Extinction ratio < 4.5 dB" with values -0.9 and -0.2 dBm
Also:
change "Extinction ratio (min)" from 4.5 dB to 3.5 dB
change footnote b to "Even if the TDECQ < 1 dB for an extinction ratio >= 4.5 dB or TDECQ < 0.9 dB for an extinction ratio < 4.5 dB, the OMAouter (min) must exceed this value."

In Table 122-13:
In the row for "Power budget (for maximum TDECQ)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values 6.7, 6.5, 9.3, and 9.2 dB
"Extinction ratio < 4.5 dB" with values 6.8, 6.6, 9.4, and 9.3 dB
In the row for "Allocation for penalties (for maximum TDECQ)"
Create two sub options:
"Extinction ratio >= 4.5 dB" with values 2.7, 2.5, 3, and 2.9 dB
"Extinction ratio < 4.5 dB" with values 2.8, 2.6, 3.1, and 3 dB

In Table 122-19:
Change the entries for -39 dB, -40 dB and -38 dB to -40 dB, -41 dB and -39 dB, respectively

with editorial license
]

Cl **124** *SC* **124.7.1** *P* **298** *L* **31** # r01-53

Dawe, Piers J G Mellanox Technologie

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

Following up on bs D3.0 comment 151 and 58, and cd comments 130, 139, 211: this extinction ratio limit is not good for low cost of this PMD, and the related 50GBASE-FR and 50GBASE-LR. See more against 121.7.1; see king_3cd_02_0317.pdf and new presentation.

SuggestedRemedy

Reduce the extinction ratio limit from 5 dB to e.g. 3.5 dB. Either add 0.03 dB to the budget, or adjust the TDECQ limit according to the actual extinction ratio, which is obtained as a by-product of the TDECQ measurement anyway, so that the link margin and receiver sensitivity are not affected.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

In Table 124-6, change "Extinction ratio, each lane (min)" from 5 dB to 3.5 dB.

Cl **124** *SC* **124.7.1** *P* **298** *L* **33** # r01-54

Dawe, Piers J G — Mellanox Technologie

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

Following up on D3.0 comment 128: the RIN limit (-142) is tighter than it needs be: in Clause 140, 50GBASE-FR and 50GBASE-LR it's -136. RIN is included in TDECQ so we don't need a separate tight spec for it.

SuggestedRemedy

Change -142 to -136.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment r01-46

[Editor's note added after comment resolution completed.
The response to comment r01-46 is:
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4
]

Cl **124** *SC* **124.7.1** *P* **298** *L* **33** # r01-27

Stassar, Peter — Huawei Technologies

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

In order to remain consistent with a recent modification in draft 1.3 802.3cd for 100GBASE-DR4 the RIN21.4OMA value should be changed from -142 to -136 dB/Hz, as proposed and following a justification in king_3cd_03_0317

SuggestedRemedy

In Table 124-6 change the value for RIN21.4OMA from -142 to -136 dB/Hz

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
See response to comment r01-46

[Editor's note added after comment resolution completed.
The response to comment r01-46 is:
In line with agreements for IEEE P802.3cd D1.3, on the basis of information in http://www.ieee802.org/3/cd/public/Mar17/king_3cd_03_0317.pdf
In Table 121-6, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-DR4
In Table 122-9, change RIN_OMA from -136 to -132 dB/Hz for 200GBASE-FR4 and LR4
In Table 122-10, change RIN_OMA from -136 to -132 dB/Hz for 400GBASE-FR8 and LR8
In Table 124-6, change RIN_OMA from -142 to -136 dB/Hz for 400GBASE-DR4
]

Cl **124** *SC* **124.8.5** *P* **301** *L* **40** # r01-21

Lewis, David — Lumentum

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

Data will be presented at the 25-April SMF ad hoc and at the 22-May interim meeting in support of changing the TDECQ reference equalizer for 400GBASE-DR4 transmitters.

Although the TDECQ reference equalizer does not imply any particular receiver equalizer implementation, there will be unecessary margin in the link budget if the penalty based on TDECQ is overstated. Feedback from those developing 53 GBd PAM4 receiver ICs is that for the forseeable future, the receiver's ADC will acquire 1 sample per symbol and the equalizer will have a minimum of 7 T-spaced FFE taps. It is therefore reasonable to specify a TDECQ/SECQ reference equalizer with 5 T-spaced FFE taps for 400GBASE-DR4.

TDECQ testing of high quality 53 GBd PAM4 transmitters is failing the 2.5 dB limit in Table 124-6.

Experimental results show that increasing the reference equalizer length from 5*T/2 to 7*T or longer reduces TDECQ to below 2.5 dB.

Short equalizers such as 5*T/2 or 3*T result in higher TDECQ compared to longer equalizers such as 5*T or 7*T. See lecheminant_01_1016_smf page 4 and mazzini_01a_0317_smf page 8.

SuggestedRemedy

Change from: The TDECQ of each lane shall be within the limits given in Table 124-6 if measured using the methods specified in 121.8.5.1, 121.8.5.2, and 121.8.5.3 using a reference equalizer as described in 121.8.5.4, with the following exceptions:
-- The signaling rate of the test pattern generator is as given in Table 124-6.
-- The combination of the O/E converter and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of 38.68 GHz.

Change to: The TDECQ of each lane shall be within the limits given in Table 124-6 if measured using the methods specified in 121.8.5.1, 121.8.5.2, and 121.8.5.3 with the following exceptions:
-- The signaling rate of the test pattern generator is as given in Table 124-6.
-- The combination of the O/E converter and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of 38.68 GHz.
-- The reference equalizer is a 5 tap, T spaced, feed-forward equalizer (FFE), where T is the symbol period.
NOTE--This reference equalizer is part of the TDECQ test and does not imply any particular receiver equalizer implementation.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

However, the changes suggested are an improvement to the draft that would otherwise need to be made in Maintenance.

In 124.8.5, change:
Change "- The combination of the O/E converter and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of 38.68 GHz." to:
"- The combination of the O/E converter and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 26.5625 GHz."

In 121.8.5.4, change "5 tap, T/2 spaced" to "5 tap, T spaced"
In 122.8.5.4, change "5 tap, T/2 spaced" to "5 tap, T spaced"

In 121.8.5.1, change:
"The combination of the O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of 19.34 GHz." to:
"The combination of the O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz."

In 122.8.5.1, change:
"The combination of the O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of 19.34 GHz." to:
"The combination of the O/E and the oscilloscope has a fourth-order Bessel-Thomson filter response with a bandwidth of approximately 13.28125 GHz."

Cl **124** *SC* **124.8.5** *P* **301** *L* **45** # r01-2

Leizerovich, Hanan

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

This subclause refers to 121.8.5.1 for TDECQ conformance test setup. One of the requirement there is at least 31 UI delay between the test pattern on one lane and the pattern on any other lane. The offset of 31 UI was chosen as being large enough that it would not be removed by the 1 ns (about 27 UI).
While this value is relevant 26.5625GBd, it should be changed for 53.125GBd.

SuggestedRemedy

Add another exception:
- There shall be at least 63 UI delay between the test pattern on one lane and the pattern on any other lane.

Response *Response Status* **C**

REJECT.
This comment does not apply to the substantive changes between IEEE P802.3bs/D3.1 and IEEE P802.3bs/D3.0 or the unsatisfied negative comments from the initial ballot. Hence it is not within the scope of the recirculation ballot.

The skew of 1ns is caused by the AUI, which is at 26.5625 GBd, so there is no need for a change.

Cl **124** *SC* **124.8.9** *P* **302** *L* **31** # r01-55

Dawe, Piers J G Mellanox Technologie

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

Following up on D3.0 comment 153: if the jitter corner frequency for 26.5625 GBd (NRZ and PAM4) is 4 MHz, the low frequency (sloping) part of the jitter mask should scale with signalling rate, i.e. align if expressed in time vs. frequency, to avoid a need for a poorly specified wander buffer in the 2:1 muxes in a 400GBASE-DR4 module. Compare 87.8.11.4 and 88.8.10: 4 MHz for 10.3125 GBd, 10 MHz for 25.78125 GBd. History: anslow_3bs_04_0316 does not contain reasoning, refers to ghiasi_3bs_01_0316 which does not address wander and buffering.

SuggestedRemedy

Add another exception for the SRS procedure, with a table like Table 121-12 but with the frequencies doubled.
Or, replacing second row after the header row:

80 kHz < f <= 500 kHz	4e5/f
500 kHz < f <= 1 MHz	2e11/f^2
1 MHz < f <= 4 MHz	2e5/f

Response *Response Status* **U**

REJECT.
This issue was already discussed in response to comment i-153 to D3.0 which was:
"The jitter corner frequency was extensively discussed within the Task Force with multiple presentations on the topic. The CRU corner frequency was chosen to be 4 MHz for all interfaces (including 400GBASE-DR4) in the March 2016 TF meeting as recorded in: http://www.ieee802.org/3/bs/public/16_03/anslow_3bs_04_0316.pdf."

The possible need for a buffer was discussed in presentations made leading up to this decision. For example, see:
http://www.ieee802.org/3/bs/public/16_01/ghiasi_3bs_01a_0116.pdf#page=15

There was no consensus to make a change to the draft.