Cl **122** *SC* **122.7.1** *P* **45** *L* **35** # P-197

Nowell, Mark Cisco

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

Public Review Comment no. [197] by [mnowell@cisco.com] on draft designation [802.3cn]:This comment touches a number of different numbers in the draft beyond the one identified in the comment.

The recent technical contributions reviewed in the P802.3cu Task Force indicate that new technical information has been made available since this draft went into SA ballot. The TDECQ value of 3.4 dB seems low (or the reach too long) for the chromatic dispersion that the 400GBASE-ER8 transmitter will experience.

In http://www.ieee802.org/3/cu/public/Sept19/stassar_3cu_01_0919.pdf it was showed that due to dispersion a CWDM based 100 Gb/s PAM4 signal would experience excessive chromatic dispersion limiting the reach of the interface. Based on this contribution and other contributions, the P802.3cu TF concluded that the reach should be reduced to 6km.

The general rule of thumb is that the dispersion penalty scales with the square of the data rate. Therefore, it should be expected that the maximum dispersion that the 400GBASE-ER8 should be ~ 4x that defined in P802.3cu. However, comparing the adopted baseline in P802.3cu http://www.ieee802.org/3/cu/public/Sept19/lewis_3cu_02a_0919.pdf to the values in D3.0 of P802.3cn we find for negative dispersion that this results in -35.2 ps/nm vs -201 ps/nm.

This is ~5.7x higher in D3.0 which seems excessive given the lower TDECQ in D3.0 regardless of the other differences between 100 Gb/s and 50 Gb/s.

SuggestedRemedy

Re-examine the 400GBASE-ER8 link budget to ensure the same criteria is applied given the new insights and wealth of experimental evidence examined in P802.3cu.

Based on the simple rule of thumb this would suggest a max negative dispersion of ~ -140 ps/nm which is close to the 30km reach called out in D3.0.

Suggested change is to reduce the max reach to 30 km and reconcile that numbers in the rest of the link budget.

This includes but is not limited to:
- remove 40km column for 400GBASE-ER8 from Table 122-13 and Table 122-17
- Reduce Max DGD to 8.8ps for 400GBASE-ER8 in Table 122-17
- update dispersion length coefficient for 400GBASE-ER8 for reduced length in Table 122-16

Proposed Response *Response Status* **W**

PROPOSED REJECT.
As noted in the comment, the IEEE P802.3cu project is addressing solutions based on 100 Gb/s PAM4 signaling, while the IEEE P802.3cn project (that is the subject of this comment) is addressing solutions based on 50 Gb/s PAM4 signaling. Therefore, a detailed analysis, not a rule of thumb approach, is necessary.
The data for the highest CD penalty (TDECQ-SECQ) vs dispersion values submitted to the P802.3cu project was present in http://www.ieee802.org/3/cu/public/May19/anslow_3cu_02a_0519.pdf#page=4 presented on 23 May 2019. All data regarding CD penalty (TDECQ-SECQ) vs dispersion that has been made available to the P802.3cu task force since then has been lower penalty for a given dispersion. There have been 3 ballots of the P802.3cn draft subsequent to 23 May 2019 and no comments were received claiming that the CD penalty for 400GBASE-ER8 is too high.
Using the rough "rule of thumb" cited in the comment, the dispersion limits of +37 ps/nm and -201 ps/nm for the 400GBASE-ER8 PMD would be roughly equivalent to 9 ps/nm to -50 ps/nm at the wavelength extremes for the measurements shown on http://www.ieee802.org/3/cu/public/Sept19/stassar_3cu_01_0919.pdf#page=11
All of the measurement results in the region of +9 ps/nm show a value of TDECQ - SECQ of less than 1 dB.
In the region of -50 ps/nm, measurement results are shown for 8 different devices. Of those only one would be expected to exceed 2 dB of CD penalty. Looking at the value of TDECQ for these 8 devices, 6 of them would be expected to meet the 3.4 dB TDECQ limit despite the fact that they are running at 53.125 GBd, which is double the symbol rate of the 400GBASE-ER8 PMD.
Taking all of the 100 Gb/s device results illustrated in stassar_3cu_01_0919.pdf and averaging the SECQ values gives 2.34 dB. Taking the 6 separate 50 Gb/s results from the central chart on http://www.ieee802.org/3/cd/public/July18/mazzini_3cd_01d_0718.pdf#page=10 gives an average TDECQ of 1.06 dB, which is lower than the average of the 100 Gb/s results by 1.28 dB. A shift of this amount in the 100 Gb/s TDECQ results would bring all of them except one below the 3.4 dB limit. Consequently, the 100 Gb/s per lane data submitted to the IEEE P802.3cu project does not show that the penalty allowed for in the P802.3cn 400GBASE-ER8 budget is not adequate for a reach of 40 km as required by the Task Force adopted objectives and as described in the project CSD responses.

Cl **122** *SC* **122.7.3** *P* **48** *L* **37** # P-198

Nowell, Mark Cisco

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

Public Review Comment no. [198] by [mnowell@cisco.com] on draft designation [802.3cn]:Table 122-13 lists the illustrative power budgets based on the normative transmit and receive specifications in Tables 122-11 and 122-12.

The Allocation for penalties for 400GBASE-ER8 calls out 3.9 dB implying 0.5 dB allocated beyond the TDECQ of 3.4dB.

Per http://www.ieee802.org/3/cn/public/19_01/anslow_3cn_03_0119.pdf this 0.5 dB is allocated as 0.25 dB for MPI and 0.25 dB for DGD.

However, as identified in that presentation the DGD penalty was shown to exceed 0.25 dB (0.6 dB) and that further review was required.

SuggestedRemedy

Was the suggested further analysis completed. Commenter could not find it. Hard to make a suggested change until the analysis is completed and the impact is understood. On an already tight link budget an extra 0.35 dB is significant but this might become less impactful if the reach is reduced.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The analysis in http://www.ieee802.org/3/cn/public/19_01/anslow_3cn_03_0119.pdf was purely simulation based. Two of the simulations gave predicted penalties of around 0.25 dB and a third predicted around 0.6 dB.
Subsequent to this presentation, a contribution to the IEEE P802.3cu project http://www.ieee802.org/3/cu/public/cu_adhoc/cu_archive/shuai_3cu_adhoc_050119.pdf presented results of simulations and a measurement of the DGD penalty for a real transmitter with 12 ps of DGD for 53.125 GBd PAM4 with a worst case split between the two principal states of polarization of the optical signal. This measured result was reasonably close to the curve for the simulated worst case DGD penalty. The specification of 10.3 ps for the maximum DGD in the P802.3cn draft is at a symbol rate that is half of the value for this measurement, so is equivalent to a DGD value of 5.15 ps on the curve shown in shuai_3cu_adhoc_050119.pdf referenced above which gives a predicted penalty of 0.25 dB.
Both MPI and DGD are statistical effects where the limits in the draft have been set to keep the expected penalty to be below 0.25 dB under "worst case" conditions with the probability that the worst case is present at any one time being very low. Consequently, the probability that the MPI and DGD values at any one time combine to give a penalty that is greater than the 0.5 dB in the budget at the same time that the transmitter shows a worst case TDECQ penalty is extremely low.

Cl **45** *SC* **45** *P* **22** *L* **1** # P-199

Cole, Chris Finisar

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

Public Review Comment no. [199] by [chris.cole@finisar.com] on draft designation [802.3cn]:50GBASE-FR, 50GBASE-LR, 50GBASE-ER need 1 suffix to be consistent with 802.3 convention, pages 22 to 27, lines 1 to 54 pn each page

SuggestedRemedy

Change to 50GBASE-FR1, 50GBASE-LR1, 50GBASE-ER1 everywhere in the document

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The PHY types 50GBASE-FR, 50GBASE-LR, and 50GBASE-ER are consistent with 802.3 convention. There are no PHY types in IEEE Std 802.3-2018 or any of its approved amendments that end in R1.
The PHY types 50GBASE-FR and 50GBASE-LR were defined by IEEE Std 802.3cd-2018 and any changes to these PHY types (including their names) are outside of the scope of this project.
The 50GBASE-ER name was adopted by the P802.3cn Task Force in Motion #4 from the November 2018 meeting (Y:48, N:0, A:3) and is consistent with the names of a large number of existing IEEE 802.3 single lane PHY types:
5GBASE-KR, 10GBASE-KR, 25GBASE-KR, 25GBASE-CR, 25GBASE-SR, 25GBASE-LR, 25GBASE-ER, 40GBASE-FR, 50GBASE-KR, 50GBASE-CR, 50GBASE-SR, 50GBASE-FR, 50GBASE-LR, 100GBASE-DR.
The PHY names in the P802.3ck project that have R1 at the end (100GBASE-CR1 and 100GBASE-KR1) are in addition to the existing PHYs 100GBASE-CR4, 100GBASE-CR2, 100GBASE-KR4, and 100GBASE-KR2. In the case of 50GBASE-ER, there are no existing PHY types 50GBASE-Erx, 50GBASE-LRx, or 50GBASE-FRx.

Cl **122** *SC* **122** *P* **45** *L* **16** # P-200

Cole, Chris Finisar

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

Public Review Comment no. [200] by [chris.cole@finisar.com] on draft designation [802.3cn]:400G ER8 can only support 30km, lines 16 to 18

SuggestedRemedy

Keep 200GBASE-ER4 2 m to 30 km || 2 m to 40 kma, Change 400GBASE-ER8 to 2 m to 30 km only, make same changes everywhere else in the entire document

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 43, line 12.

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

Multiple contributions have been provided containing measurements that demonstrate the feasibility of 40 km operation regarding CD penalty:
http://www.ieee802.org/3/B10K/public/17_11/sone_b10k_01a_1117.pdf
http://www.ieee802.org/3/B10K/public/18_01/yamamoto_b10k_01a_0118.pdf
http://www.ieee802.org/3/B10K/public/18_09/jackson_b10k_01_0918.pdf

The data used in
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 400GBASE-ER8 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:63, N:0, A:7.
The devices reported in these presentations could not have been optimised for the 400GBASE-ER8 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.
Consequently, insufficient evidence has been provided to demonstrate that there is an issue with the draft supporting 40 km as required by the Task Force adopted objectives and as described in the project CSD responses.

Cl **122** *SC* **122** *P* **46** *L* **21** # P-201

Cole, Chris Finisar

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

Public Review Comment no. [201] by [chris.cole@finisar.com] on draft designation [802.3cn]:Outer Optical Modulation Amplitude (OMAouter), each lane (min)b for 200GBASE-ER4 of 3.4 dBm it too high, lines 21 to 22

SuggestedRemedy

Change Outer Optical Modulation Amplitude (OMAouter), each lane (min)b for 200GBASE-ER4 to 1.2 dBm

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 44, line 21 (Table 122-9).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 200GBASE-ER4 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:61, N:0, A:3.
The devices reported in these presentations could not have been optimised for the 200GBASE-ER4 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.
Consequently, insufficient evidence has been provided to demonstrate that an OMAouter (min) of 3.4 dBm is too high, or that a reduction of 2.2 dB in the receiver sensitivity that this change to the transmitted power would necessitate (as proposed in comment 203) can be met.

Cl **122** *SC* **122** *P* **46** *L* **27** # P-202

Cole, Chris Finisar

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

Public Review Comment no. [202] by [chris.cole@finisar.com] on draft designation [802.3cn]:Launch power in OMAouter minus TDECQ, each lane (min): for extinction ratio > 4.5 dB for 200GBASE-ER4 of 2 dBm is too high, lines 27 to 28

SuggestedRemedy

Change Launch power in OMAouter minus TDECQ, each lane (min): for extinction ratio > 4.5 dB for 200GBASE-ER4 to -0.2 dBm, Change all other limits in this table consistent with the OAM (min) reduction by 2.2dB.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 44, line 27 (Table 122-9).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 200GBASE-ER4 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:61, N:0, A:3.
The devices reported in these presentations could not have been optimised for the 200GBASE-ER4 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.
Consequently, insufficient evidence has been provided to demonstrate that an OMAouter minus TDECQ (min) of 2 dBm is too high, or that a reduction of 2.2 dB in the receiver sensitivity that this change to the transmitted power would necessitate (as proposed in comment 203) can be met.

Cl **122** *SC* **122** *P* **48** *L* **18** # P-203

Cole, Chris Finisar

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

Public Review Comment no. [203] by [chris.cole@finisar.com] on draft designation [802.3cn]:TX OAM (min) reduced by 2.2dB in Table 122-9, lines 18 to 54

SuggestedRemedy

Change all limits in this table consistent with the TX OAM (min) reduction by 2.2dB in Table 122-9

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 46, line 18 (Table 122-11).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 200GBASE-ER4 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:61, N:0, A:3.
The devices reported in these presentations could not have been optimised for the 200GBASE-ER4 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.

The 2.2 dB reduction in Tx OMAouter (min) in the suggested remedy refers to the proposal in Public review comments 201 and 202 to reduce the Tx OMAouter (min) and OMAouter minus TDECQ (min) by 2.2 dB for 200GBASE-ER4.

Insufficient evidence has been provided to demonstrate that the current values of Tx OMAouter (min) and OMAouter minus TDECQ (min) are too high, or that a reduction of 2.2 dB in the receiver sensitivity as proposed in this comment can be met.

Cl **122** *SC* **122** *P* **47** *L* **26** # P-204

Cole, Chris Finisar

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

Public Review Comment no. [204] by [chris.cole@finisar.com] on draft designation [802.3cn]:Outer Optical Modulation Amplitude (OMAouter), each lane (min)b for 400GBASE-ER8 of 2.4 dBm is too high, lines 26 to 27

SuggestedRemedy

Change Outer Optical Modulation Amplitude (OMAouter), each lane (min)b for 400GBASE-ER5 to 0.2 dBm

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 45, line 26 (Table 122-10).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 400GBASE-ER8 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:63, N:0, A:7.
The devices reported in these presentations could not have been optimised for the 400GBASE-ER8 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.
Consequently, insufficient evidence has been provided to demonstrate that an OMAouter (min) of 2.4 dBm is too high, or that a reduction of 2.2 dB in the receiver sensitivity that this change to the transmitted power would necessitate (as proposed in comment 206) can be met.

Cl **122** *SC* **122** *P* **47** *L* **32** # P-205

Cole, Chris Finisar

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

Public Review Comment no. [205] by [chris.cole@finisar.com] on draft designation [802.3cn]:Launch power in OMAouter minus TDECQ, each lane (min): for extinction ratio > 4.5 dB for 200GBASE-ER4 of 1 dBm is to high, lines 32 to 33

SuggestedRemedy

Change Launch power in OMAouter minus TDECQ, each lane (min): for extinction ratio > 4.5 dB for 200GBASE-ER4 to -1.2 dBm, Change all other limits in this table consistent with the OAM (min) reduction by 2.2dB.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 45, line 32 (Table 122-10).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 400GBASE-ER8 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:63, N:0, A:7.
The devices reported in these presentations could not have been optimised for the 400GBASE-ER8 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.
Consequently, insufficient evidence has been provided to demonstrate that an OMAouter minus TDECQ (min) of 1 dBm is too high, or that a reduction of 2.2 dB in the receiver sensitivity that this change to the transmitted power would necessitate (as proposed in comment 206) can be met.

Cl **122** *SC* **122** *P* **49** *L* **10** # P-206

Cole, Chris Finisar

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

Public Review Comment no. [206] by [chris.cole@finisar.com] on draft designation [802.3cn]:TX OAM (min) reduced by 2.2dB in Table 122-10, lines 10 to 54

SuggestedRemedy

Change all limits in this table consistent with the TX OAM (min) reduction by 2.2dB in Table 122-10

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The page number referenced by this comment is appropriate to version D3.1 of the P802.3cn draft. Since the public review is on version D3.0 of P802.3cn, this comment should reference Page 47, line 10 (Table 122-12).

The Task Force reviewed
http://www.ieee802.org/3/cn/public/tf_interim/19_0924/cole_3cn_01_190924.pdf

The data used in cole_3cn_01_190924.pdf on optical power levels comes from presentations to the IEEE 802.3 Beyond 10km Optical PHYs Study Group prior to the adoption of the optical budget in the baseline for 400GBASE-ER8 in November 2018 (which is the same budget as in the latest P802.3cn draft) with vote Y:63, N:0, A:7.
The devices reported in these presentations could not have been optimised for the 400GBASE-ER8 application that had yet to be defined. It is therefore not valid to try to assess manufacturing yield from these reported results.

The 2.2 dB reduction in Tx OMAouter (min) in the suggested remedy refers to the proposal in Public review comments 204 and 205 to reduce the Tx OMAouter (min) and OMAouter minus TDECQ (min) by 2.2 dB for 400GBASE-ER8.

Insufficient evidence has been provided to demonstrate that the current values of Tx OMAouter (min) and OMAouter minus TDECQ (min) are too high, or that a reduction of 2.2 dB in the receiver sensitivity as proposed in this comment can be met.

Cl **139** *SC* **139** *P* **73** *L* **1** # P-207

Cole, Chris Finisar

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

Public Review Comment no. [207] by [chris.cole@finisar.com] on draft designation [802.3cn]:50GBASE-FR, 50GBASE-LR, 50GBASE-ER need 1 suffix to be consistent with 802.3 convention, pages 73 to 87, lines 1 to 54 on each page

SuggestedRemedy

Change to 50GBASE-FR1, 50GBASE-LR1, 50GBASE-ER1 everywhere in the document

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The PHY types 50GBASE-FR, 50GBASE-LR, and 50GBASE-ER are consistent with 802.3 convention. There are no PHY types in IEEE Std 802.3-2018 or any of its approved amendments that end in R1.
The PHY types 50GBASE-FR and 50GBASE-LR were defined by IEEE Std 802.3cd-2018 and any changes to these PHY types (including their names) are outside of the scope of this project.
The 50GBASE-ER name was adopted by the P802.3cn Task Force in Motion #4 from the November 2018 meeting (Y:48, N:0, A:3) and is consistent with the names of a large number of existing IEEE 802.3 single lane PHY types:
5GBASE-KR, 10GBASE-KR, 25GBASE-KR, 25GBASE-CR, 25GBASE-SR, 25GBASE-LR, 25GBASE-ER, 40GBASE-FR, 50GBASE-KR, 50GBASE-CR, 50GBASE-SR, 50GBASE-FR, 50GBASE-LR, 100GBASE-DR.
The PHY names in the P802.3ck project that have R1 at the end (100GBASE-CR1 and 100GBASE-KR1) are in addition to the existing PHYs 100GBASE-CR4, 100GBASE-CR2, 100GBASE-KR4, and 100GBASE-KR2. In the case of 50GBASE-ER, there are no existing PHY types 50GBASE-ERx, 50GBASE-LRx, or 50GBASE-FRx.