IEEE P802.3cu D2.2 100 Gb/s per wavelength on SMF 2nd Working Group recirculation ballot comments

Cl **151** SC **151.8.5.4** P **69** L **18** # 20058

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **A** *Tx overshoot*

The 12% overshoot limit means that the largest magnitude tap coefficient minimum of 0.8 specified in 121.8.5.4 is too low. No signal with less than about 0.9 can pass this overshoot spec. Note that 140.7.5.1 is in IEEE Std 802.3cd. If we change this to 0.85, the overshoot limit (if applied at TP3) would bite first. It would be better to tighten this to 0.9 (higher for a better signal).
If in future the overshoot limit is propagated to other PAM4 PMDs in maintenance, the two limits in the proposed sentence could be consolidated again.

SuggestedRemedy

In 151.8.5.4 and 140.7.5.1 (in 802.3cd), change:
Tap 1, tap 2, or tap 3 has the largest magnitude tap coefficient, which is constrained to be at least 0.8. to:
Tap 1, tap 2, or tap 3 has the largest magnitude tap coefficient. For 100GBASE-DR, this is constrained to be at least 0.8, and for 100GBASE-FR1 and 100GBASE-LR1, it is constrained to be at least 0.85.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See comment #47

Piers changed his vote to satisfied based on email recevied Sat 4/25/2020 7:20 AM.

From: Piers Dawe <piersd@mellanox.com>
Sent: Saturday, April 25, 2020 7:20 AM
To: Ken Jackson <kjackson@sei-device.com>
Cc: Mark Nowell (mnowell) <mnowell@cisco.com>; Gary Nicholl (gnicholl) <gnicholl@cisco.com>
Subject: RE: [P802.3cu] D2.0 must be satisfied comments - due April 24 (Friday) COB

Ken,

I am satisfied for 58 and 70, about overshoot.

I am not satisfied for 59, 62, 68 and 69, about K = TDECQ – 10.log10(Ceq). As it's the same concept as error vector magnitude, which has the consensus in 802.3ct and 802.3cu, it's a nonsense to say it doesn't apply here also.

Piers

Cl **151** SC **151.7.1** P **63** L **29** # 20059

Dawe, Piers — Mellanox

Comment Type **TR** *Comment Status* **R** *Tx 10logCeq*

The limit for TDECQ - 10log10(Ceq) (also known as K) has been deleted from this table, but it is still needed to protect the receiver from the bad signals that are not caught by the TDECQ limit or the overshoot limit. All other optical PAM4 transmitter specs have such a limit, which was introduced a long time ago, in July 2018 (P802.3cd/D3.4), and its continued presence is needed to protect equalizers, receivers and receiver designs that were/are designed relying on it. Particularly 400GBASE-LR4-6 where the TDECQ limit is higher than for any existing SMF PMD.

To summarize the situation, we need different limits to exclude different kinds of bad signal: K protects receiver back end, TDECQ protects receiver front end and optical budget, overshoot spec against over-emphasised signals not caught by the other specs, and so on. We need them all, but K and TDECQ come off the same measurement, so not an extra cost.

SuggestedRemedy

Restore the limits for TDECQ - 10log10(Ceq) as before (3.4 dB for 400GBASE-FR4 and 3.5 dB for 400GBASE-LR4-6, same as the TDECQ limits).

Response *Response Status* **U**

REJECT.

See comment #87

Cl **151** *SC* **151.7.1** *P* **63** *L* **31** # 20062

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R** *Tx 10logCeq*

When limiting TECQ is needed, K(TP2) = TDECQ - 10log10(Ceq) must be limited too.

SuggestedRemedy

Under the row for TECQ in Table 140-6, insert a row for TECQ - 10log10(Ceq) (max), with the same limits as for TECQ. Also in Table 151-7.

Response *Response Status* **C**

REJECT.

The suggested remedy proposes to add a new transmitter parameter "TECQ -10log10(Ceq) (max)"

This proposal would appear to be counter to the decision made at the January 2020 meeting of the 3cu Task Force in Geneva, to remove a similar parameter "TDECQ - 10log10(Ceq) (max) which was confirmed in Straw Poll #1 taken on the Mar 17 Interim teleconference.

There is no consensus to implement the proposed change.

Straw Poll #1 taken on Mar 17 Interim:

With regards to the inclusion of TDECQ-10log(Ceq) parameter, I support:
a) Full removal from both Tx and Rx tables: 27
b) Reinstate for both Tx and Rx tables: 9
(17 Abstain)

Piers changed his vote from unsatisfied to satisfied based on an email on June 10 (see below).

From: Piers Dawe <piersd@mellanox.com>
Sent: Wednesday, June 10, 2020 5:29 AM
To: Mark Nowell (mnowell) <mnowell@cisco.com>; Kenneth Jackson <kpjackson001@gmail.com>
Cc: Gary Nicholl (gnicholl) <gnicholl@cisco.com>
Subject: RE: [P802.3cu] D2.1 must be satisfied comments - due June 9 (Tuesday) COB

All,

A couple of changes as below:

Com. No.	Draft	Clause	Subclause	Page	Line	Type	Satisfaction
20059	2.0	151	151.7.1	63	29	TR	Unsatisfied
Need K limit (at the usual TP3)							
20062	2.0	151	151.7.1	63	31	TR	Satisfied
Need K limit at TP2							
20068	2.0	140	140.6.1	41	34	TR	Satisfied
Need K limit at TP2							
20069	2.0	140	140.6.1	41	32	TR	Unsatisfied
Need K limit (at the usual TP3)							
28	2.1	140	140.7.5b	46	8	TR	
Satisfied	Overshoot at TP2 and TP3 +/- dispersion, compensate for scope noise						
29	2.1	140	140.7.5c	46	38	TR	Unsatisfied
Peak-to-peak power, limit max and min separately							
30	2.1	140	140.6.1	41	51	TR	Unsatisfied
Need K limit, improve accuracy of TDECQ method							

Piers

Cl **140** *SC* **140.6.1** *P* **41** *L* **34** # 20068

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R** *Tx 10logCeq*

When limiting TECQ is needed, K(TP2) = TDECQ - 10log10(Ceq) must be limited too.

SuggestedRemedy

Under the row for TECQ in Table 140-6, insert a row for TECQ - 10log10(Ceq) (max), with the same limits as for TECQ. Also in Table 151-7.

Response *Response Status* **C**

REJECT.

See response to comment #62

Piers changed his vote from unsatisfied to satisfied based on an email on June 10 (see below).

From: Piers Dawe <piersd@mellanox.com>
Sent: Wednesday, June 10, 2020 5:29 AM
To: Mark Nowell (mnowell) <mnowell@cisco.com>; Kenneth Jackson <kpjackson001@gmail.com>
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Subject: RE: [P802.3cu] D2.1 must be satisfied comments - due June 9 (Tuesday) COB

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20068	2.0	140	140.6.1	41	34	TR	Satisfied
Need K limit at TP2							
20069	2.0	140	140.6.1	41	32	TR	Unsatisfied
Need K limit (at the usual TP3)							
28	2.1	140	140.7.5b	46	8	TR	
Satisfied	Overshoot at TP2 and TP3 +/- dispersion, compensate for scope noise						
29	2.1	140	140.7.5c	46	38	TR	Unsatisfied
Peak-to-peak power, limit max and min separately							
30	2.1	140	140.6.1	41	51	TR	Unsatisfied
Need K limit, improve accuracy of TDECQ method							

Piers

Cl **140** *SC* **140.6.1** *P* **41** *L* **32** # 20069

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R** *Tx 10logCeq*

The limit for TDECQ - 10log10(Ceq) (also known as K) is missing from two columns here, but it is still needed to protect the receiver from the bad signals that are not caught by the TDECQ limit or the overshoot limit. All other optical PAM4 transmitter specs have such a limit, which was introduced a long time ago, in July 2018 (P802.3cd/D3.4), and its continued presence is needed to protect equalizers, receivers and receiver designs that were/are designed relying on it.

To summarize the situation, we need different limits to exclude different kinds of bad signal: K protects receiver back end, TDECQ protects receiver front end and optical budget, overshoot spec against over-emphasised signals not caught by the other specs, and so on. We need them all, but K and TDECQ come off the same measurement, so not an extra cost.

SuggestedRemedy

Restore the limit for TDECQ - 10log10(Ceq) for 100GBASE-FR1 100GBASE-LR1, as before (3.4 dB, same as the TDECQ limit).

Response *Response Status* **U**

REJECT.

See comment #87

Cl **140** *SC* **140.7.11** *P* **46** *L* **33** # 20070

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **A** *Tx overshoot*

We need to agree a measurement method for overshoot, and agree a limit. We should have an idea of what the threat is to design a useful defence, but here is a measurement proposal that at least should give consistent results.
First, notice that limiting overshoot at TP2 is pointless if chromatic dispersion can make it higher at TP3.
Also notice that a measurement on a square wave measures the worst of pre-emphasis and post-emphasis, but a real signal's overshoot can be determined by the sum of these.
This is a bad choice of pattern anyway because PMAs may fail to lock on it and forward the signal correctly to the PMD.
Also notice that traditional peak measurements are distorted by scope noise, particularly for optical scopes at such high bandwidths.

SuggestedRemedy

Apply the spec to the same cases as TECQ and TDECQ: TP2, TP3 with most positive chromatic dispersion, and TP3 with most positive chromatic dispersion.
Use the same pattern and observation bandwidth as for T(D)ECQ so that determining the overshoot is another free by-product of measuring for T(D)ECQ, with a much simpler, non-iterative, calculation: in tables 140-10 and 151-11, remove the row for "Transmitter over/under-shoot", and here and in, delete "test pattern specified for transmitter over/under-shoot in Table 140-10".
Find the scope noise.
Create a vertical histogram from the measured waveform (not the equalized one).
Convolve the histogram with the noise that could be added to it at maximum T(D)ECQ, RSS-reduced by the scope noise.
Find the two points where the CDFs come to a number such as 5e-5.
Either find the distance from the "three" level to the upper point, and from the lower point to the "zero" (these are the overshoot and undershoot before normalisation), or find the distance from the average level to the upper point, and from the lower point to the average (these are the peak excursions).
Normalise by either OMA or standard deviation of the waveform. The former is more familiar, the latter avoids the pattern dependency of the OMA definition.
Limit upper and lower separately because excursions on just one side could overload a receiver.
Adjust the limits according to information I haven't seen at time of writing, or insert an editor's note for tables 140-6 and 151-7: "The limit for transmitter over/under-shoot needs confirmation before Standards Association ballot".
Delete most of 151.8.12 but refer to 140.7.11.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

See comment #47

Piers changed his vote to satisfied based on email recevied Sat 4/25/2020 7:20 AM.

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Subject: RE: [P802.3cu] D2.0 must be satisfied comments - due April 24 (Friday) COB

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I am not satisfied for 59, 62, 68 and 69, about K = TDECQ – 10.log10(Ceq). As it's the same concept as error vector magnitude, which has the consensus in 802.3ct and 802.3cu, it's a nonsense to say it doesn't apply here also.

Piers

Cl **140** *SC* **140.7.5c** *P* **46** *L* **38** # 21029

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R** *peak-to-peak power*

The positive and negative peaks of an optical signal can be very different. An obvious example is a directly modulated laser, but other transmitters are not symmetric also. A receiver O to E circuit is not necessarily symmetrical either - the optical input is naturally "single ended". Therefore, the positive and negative peaks must be limited separately.

SuggestedRemedy

Change "Transmitter peak-to-peak power" which is Pmax - Pmin to "Transmitter power excursion", defined as max(Pmax-Paverage, Paverage-Pmin). Take 3 dB off the limits in Table 140-6.
Make similar changes in Clause 151.

Response *Response Status* **U**

REJECT.

The measurement methodology and associated limits in D2.1 are based on measured data presented in rodes_3cu_01_032420 and associated presentations.

Changing the test methodology and limits would require supporting data. There is no consensus to make the proposed change at this time.

Cl **140** *SC* **140.6.1** *P* **41** *L* **51** # 21030

Dawe, Piers Mellanox

Comment Type **TR** *Comment Status* **R** *10logCeq*

Although the relative and absolute overshoot limits catch some bad transmitters that the K limit would catch, they don't catch all of them. P802.3ct and P802.3cw have the equivalent of a K limit, so it's not unnecessary. The motivation for removing it was poor accuracy of the TDECQ method.

SuggestedRemedy

Reinstate the K limit for 100GBASE-FR1, 100GBASE-LR1, 400GBASE-FR4 and 400GBASE-LR4-6. For these PMDs, apply it at TP2 as well as at TP3, same as TECQ. Improve the accuracy of the TDECQ method.

Response *Response Status* **U**

REJECT.

This is a similar comment to #59, #62, #68, #69, and #87 against D2.0. These five comments were rejected by the task force due to an earlier decision to remove 10logCeq and replace it with overshoot limits.

The response to #87 is included here for reference.

Based on the results of Straw Poll #1 taken at the 3/17 interim conference call , the Task Force consensus was to maintain the decision made at the 802.3cu TF meeting in Geneva to remove “TDECQ-10Log10(Ceq) and to clean up the draft to correctly reflect this decision (including among other changes to remove “SECQ-10Log10(Ceq)” from the receiver specifications).

Straw Poll #1:
With regards to the inclusion of TDECQ-10log(Ceq) parameter, I support:
a) Full removal from both Tx and Rx tables: 27
b) Reinstate for both Tx and Rx tables: 9
(17 Abstain)