Cl **151** *SC* **151.8.5.4** *P* **69** *L* **18** # 58

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* **U**

ACCEPT IN PRINCIPLE.

See comment #47

Cl **151** *SC* **151.7.1** *P* **63** *L* **29** # 59

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** # 62

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* **U**

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)

Cl **140** *SC* **140.6.1** *P* **41** *L* **34** # 68

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* **U**

REJECT.

See response to comment #62

Cl **140** *SC* **140.6.1** *P* **41** *L* **32** # 69

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** # 70

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* **U**

ACCEPT IN PRINCIPLE.

See comment #47

Cl **140** SC **140.6.1** P **41** L **42** # 72

Ingham, Jonathan — Broadcom

Comment Type **TR** *Comment Status* **R** *Tx overshoot*

The material reviewed by the Task Force in order to justify the introduction of a Tx over/under-shoot limit is merely anecdotal and ultimately unconvincing.
In particular, I refer to cole_3cu_01b_0120, where Tx waveforms at 26.6 GBd (clearly of questionable relevance to this Task Force) are shown to lead to Rx LOL for 13.5% and 19% overshoot. The introduction of a new specification and the associated limit value of 12% on the basis of these isolated examples is the wrong conclusion. The observed LOL can be attributed to the performance of the particular Rx used for the measurements. Some implementers may have an Rx that performs poorly with 5% overshoot in the input waveform, whilst others may have an Rx that performs well with 30% overshoot. To set the limit based on the examples provided in cole_3cu_01b_0120 is inappropriate. In addition, it is not clear how overshoot is defined in this study, again rendering it difficult to justify the setting of a limit based on the results.
Constraining the Tx performance by introducing an additional specification potentially reduces yield and increases cost. Since there is no evidence that a new constraint is required for the PMD specifications under development by this Task Force, the over/under-shoot specification should be removed. 50 GBd PAM4 SMF PMDs have already undergone rigorous qualification and interoperability studies by end users, without the need being identified for any Tx over/under-shoot constraint other than the existing constraint on the largest magnitude tap coefficient in the reference equalizer.
Finally, with the continuing transition to optical interfaces that are reliant on Rx equalization, the interpretation of constraints on features of the TP2 waveform, especially if measured without the reference equalizer, is increasingly uncertain. This applies not only to traditional mask constraints but also to the constraint introduced in this draft. This is why the existing constraint on the largest magnitude tap coefficient in the reference equalizer is a superior method to control over/under-shoot.

SuggestedRemedy

In Table 140-6, delete the line with description "Transmitter over/under-shoot (max)". In Table 140-10, delete the line with parameter "Transmitter over/under-shoot". Delete subclause 140.7.11.

Response *Response Status* **U**

REJECT.

There is no consensus to implement the suggested remedy.

See comment #47

Cl **151** *SC* **151.7.1** *P* **63** *L* **38** # 73

Ingham, Jonathan
Broadcom

Comment Type **TR** *Comment Status* **R** *Tx overshoot*

The material reviewed by the Task Force in order to justify the introduction of a Tx over/under-shoot limit is merely anecdotal and ultimately unconvincing.
In particular, I refer to cole_3cu_01b_0120, where Tx waveforms at 26.6 GBd (clearly of questionable relevance to this Task Force) are shown to lead to Rx LOL for 13.5% and 19% overshoot. The introduction of a new specification and the associated limit value of 12% on the basis of these isolated examples is the wrong conclusion. The observed LOL can be attributed to the performance of the particular Rx used for the measurements. Some implementers may have an Rx that performs poorly with 5% overshoot in the input waveform, whilst others may have an Rx that performs well with 30% overshoot. To set the limit based on the examples provided in cole_3cu_01b_0120 is inappropriate. In addition, it is not clear how overshoot is defined in this study, again rendering it difficult to justify the setting of a limit based on the results.
Constraining the Tx performance by introducing an additional specification potentially reduces yield and increases cost. Since there is no evidence that a new constraint is required for the PMD specifications under development by this Task Force, the over/under-shoot specification should be removed. 50 GBd PAM4 SMF PMDs have already undergone rigorous qualification and interoperability studies by end users, without the need being identified for any Tx over/under-shoot constraint other than the existing constraint on the largest magnitude tap coefficient in the reference equalizer.
Finally, with the continuing transition to optical interfaces that are reliant on Rx equalization, the interpretation of constraints on features of the TP2 waveform, especially if measured without the reference equalizer, is increasingly uncertain. This applies not only to traditional mask constraints but also to the constraint introduced in this draft. This is why the existing constraint on the largest magnitude tap coefficient in the reference equalizer is a superior method to control over/under-shoot.

SuggestedRemedy

In Table 151-7, delete the line with description "Transmitter over/under-shoot (max)". In Table 151-11, delete the line with parameter "Transmitter over/under-shoot". Delete subclause 151.8.12.

Response *Response Status* **U**

REJECT.

There is no consensus to implement the suggested remedy.

See comment #47