Cl **162** *SC* **162.14.3** *P* **194** *L* **23** # R3-1

Ran, Adee Cisco Systems, Inc.

Comment Type **E** *Comment Status* **X**

Item "AUIFEC" is relevant only for 100GBASE-CR1 and only with CAUI-n (AUI-n is irrelevant, it cannot be above the FEC) .
Item "PCS400" feature name is "400GBASE-R PCB".

SuggestedRemedy

Change "AUIFEC" feature to "CAUI-n C2C" and status "CR1:O".
Change "PCS400" feature name to "400GBASE-R PCS".

Proposed Response *Response Status* **O**

Cl **163** *SC* **163.13.3** *P* **220** *L* **16** # R3-2

Ran, Adee Cisco Systems, Inc.

Comment Type **E** *Comment Status* **X**

There is no 200GBASE-P PMA.
There are two items named PMA200, the second should be for 400GBASE-R PMA.
Item PCS400 has incorrect subclause reference, 162.9.4.8.

SuggestedRemedy

In the first "PMA200" item, change feature to "200GBASE-R PMA".
In the second one, change item to "PMA400", and feature to "400GBASE-R PMA".

Change subclause reference for item PCS400 to "162.1".

Proposed Response *Response Status* **O**

Cl **120F** *SC* **120F.5.2** *P* **250** *L* **36** # R3-3

Ran, Adee Cisco Systems, Inc.

Comment Type **E** *Comment Status* **X**

The PICS for annex 120G is missing the "Protocol summary" and "Date of Statement" tables that appear in all other PICS sections.

SuggestedRemedy

Add these tables as appropriate.

Proposed Response *Response Status* **O**

Cl **162B** *SC* **162B.5.1** *P* **298** *L* **8** # R3-4

Ran, Adee Cisco Systems, Inc.

Comment Type **E** *Comment Status* **X**

Cross-reference "Figure 162B" should be "Annex 162B".

SuggestedRemedy

Change per comment.

Proposed Response *Response Status* **O**

Cl **162C** *SC* **162C.3.1** *P* **313** *L* **8** # R3-5

Ran, Adee Cisco Systems, Inc.

Comment Type **E** *Comment Status* **X**

Cross-reference "Annex 162C.3" should be "Annex 162C".

SuggestedRemedy

Change per comment.

Proposed Response *Response Status* **O**

Cl **120G** *SC* **120G.3.2** *P* **260** *L* **8** # R3-6

Dawe, Piers J G NVIDIA

Comment Type **T** *Comment Status* **X**

A module is allowed to make 80 mV pk-pk AC common-mode voltage yet its differential pk-pk voltage is limited to 845 or 600 mV, so pmax must be less than 422.5 or 300 mV. Taking off 15 dB (as for one interpretation of the SCMR formula) gives 75 or 53 mV, which seems high anyway. A module contains very sensitive amplifiers (so is motivated to be quiet), and does not contain the long paths that might have skew which cables and hosts have. The host has to suffer all this AC CM, unlike when it's receiving from a CR cable with significant attenuation - yet the next i/o in the host ASIC might be trying to receive from a CR cable. This is bad for crosstalk.
https://ieee802.org/3/ck/public/22_06/ghiasi_3ck_01c_0622.pdf and comment R2-9 give more information.
Summary: the changed definition of VCM_FB gives a welcome reduction in pk-pk AC common-mode voltage yet it is still too large.

SuggestedRemedy

Reduce the max. module output full-band peak-to-peak AC common-mode voltage, VCM_FB, from 80 mV to 65 mV (50 mV would be better). Make the same change for the min host input full-band peak-to-peak AC common-mode voltage tolerance, VCM_FB.
Or, different limits for short and long modes could be used.

Proposed Response *Response Status* **O**

Cl **120G** *SC* **120G.5.2** *P* **274** *L* **44** # R3-7

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **X**

I-209: the range of gDC, gDC2 combinations for TP4 should be a subset of the TP1a ones, because the range of channels is a subset of the TP1a ones.
I-206: The limits for TP4 gDC, gDC2 should not be the same for short and long output modes.

SuggestedRemedy

Fix. Use values in I-208 and I-209 or choose better values.

Proposed Response *Response Status* **O**

Cl **162** *SC* **162.11** *P* **187** *L* **33** # R3-8

Dawe, Piers J G NVIDIA

Comment Type **E** *Comment Status* **X**

There are many more than "three cable assembly types". There should be two loss categories (see comment I-180), and according to 162D.1.1 there are multiple cable assembly types, as 162D.1 says. Some cables can be in all of a, b and c.

SuggestedRemedy

I think what we have here are "cable assemblies for three PHY types". Also at lines 44. At page 187 line 33, "for the three cable assembly types" could be deleted, or changed to "for 100GBASE-CR1, 200GBASE-CR2, or 400GBASE-CR4"

Proposed Response *Response Status* **O**

Cl **162** *SC* **162.11.7** *P* **187** *L* **35** # R3-9

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **X**

R2-16: the draft spec does not provide a precise reproducible definition of cable COM because 93A.1.1 recommends including frequencies up to at least 53.125 GHz while the test fixtures of specified in Annex 162B are specified to 50 GHz. Including out-of-spec elements in a measurement is bad practice; it is better to stop at 50 GHz and use consistent extrapolation. As we have agreed the test fixture frequency range fmax after plenty of discussion, no more information is needed. We have to use it in the spec.
The responses are filtered by the sinc function for NRZ signalling + driver Gaussian filter Tr (8.5 dB at 50 GHz) + minimum ~16 dB cable loss even at 40 GHz + PCBs + packages + Butterworth filter (8.5) + p2 of the CTLE. So there is very little energy above 50 GHz and the COM result is quite tolerant to the extrapolation.
The ambiguity of "93A.1.1 "It is recommended ... from a start frequency no larger than fmin" is either building inaccuracy into the spec, or is unnecessary. Whichever, it should be avoided. Measurements from 50 MHz are commonplace, particularly with the higher bandwidth VNAs that go to 50 GHz.
For these cable lengths, a 10 MHz step should be good enough.

SuggestedRemedy

In Table 162-11, insert a row for fmax, value 50 GHz.
At the beginning of this paragraph, insert "COM is based on measurements with uniform frequency step Delta f from fmin to fmax. The cable responses at lower and higher frequencies are estimated by careful extrapolation as necessary".
For 162 and 120F: Add fmax row in Table 163-11 and 120F-8.
163A.3.1 refers to 93A.1.1, so add similar clear reference to fmin, Delta f and fmax there.
In Table 93A-1, add a row for fmax, with a note that for clauses that don't provide an explicit fmax, there is a recommendation in 93A.1.1.

Proposed Response *Response Status* **O**

Cl **162** *SC* **162.9.4.8** *P* **173** *L* **20** # R3-10

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **X**

R2-16: the draft spec does not provide a precise reproducible definition of ERL because 93A.5.1 refers to 93A.1.1 which recommends including frequencies up to at least 53.125 GHz while the test fixtures of specified in Annex 162B are specified to 50 GHz. Including out-of-spec elements in a measurement is bad practice; it is better to stop at 50 GHz and use consistent extrapolation. As we have agreed the test fixture frequency range fmax after plenty of discussion, no more information is needed. We have to use it in the spec.
The reflection response is filtered by the sinc function for NRZ signalling (21 dB at 50 GHz) + driver Gaussian filter Tr (15) + Butterworth filter (8.5) + Tukey filter (17.7) + twice the test fixture trace loss. So there can be very little energy between 50 GHz and 53.125 GHz where the Tukey filter cuts off.
The ambiguity of "93A.1.1 "It is recommended ... from a start frequency no larger than fmin" is either building inaccuracy into the spec, or is unnecessary. For ERL, it's probably unnecessary: it's a tiny fraction of the bandwidth and reflections should be low there. Whichever, it should be avoided. Measurements from 50 MHz are commonplace, particularly with the higher bandwidth VNAs that go to 50 GHz.
A 10 MHz step should be good enough: probably coarser would work, but we can leave such cost reduction to implementers.

SuggestedRemedy

Because 93A.1.1 doesn't enforce the start, step and stop frequencies, we could add text in our ERL definitions to do so, or, better and more forward-looking, modify the sentence in 93A.5.1 from:
See 93A.1.1 for scattering parameters measurement recommendations including frequency step, start frequency, and stop frequency.
to
Some clauses define some ERL parameters by reference to COM parameter tables, which take precedence over the scattering parameters measurement recommendations including frequency step, start frequency, and stop frequency in 93A.1.1.
Then the modifications for COM definition in another comment will apply to ERL in all clauses too.

Proposed Response *Response Status* **O**

Cl **93A** *SC* **93A.5.1** *P* **234** *L* **3** # R3-11

Dawe, Piers J G NVIDIA

Comment Type **T** *Comment Status* **X**

The reflection response for ERL is filtered by the transmitter Ht and receiver Hr. Part of Hctf is not static, so rightly it is not included here, but the effect of fp2 is always there, so it should be included in ERL.
Including it will improve the accuracy and relevance of ERL measurements by making them more like the use-case and less susceptible to high-frequency measurement artifacts.

SuggestedRemedy

Define a first order low-pass filter H2 = 1/(1+jf/fp2). Modify Eq 93A-58 to include H2, with text saying that if a clause does not specify fp2 for ERL, Hp2 is set to 1. Adjust the ERL limits appropriately.
162, 163 and 120F will pick up the fp2 value from the COM tables. For 120G, because we have the same ERL limit as 162, and 120F has the same fp2 as 162, but 120G has a different fp2, we should set fp2 explicitly, overriding Table 120F-8, and value of the ERL will be different for the same reflection response and the revised limit will be different accordingly.
Modify figures 163A-2 and 4 to show H2.

Proposed Response *Response Status* **O**

Cl **163A** *SC* **163A.2** *P* **319** *L* **4** # R3-12

Dawe, Piers J G NVIDIA

Comment Type **E** *Comment Status* **X**

4.Test

SuggestedRemedy

Insert space

Proposed Response *Response Status* **O**

Cl **120G** *SC* **120G.3.1** *P* **257** *L* **22** # R3-13

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **X**

As comments I-107, I-108, I-115, I-116, I-211, I-212, R1-55, R2-17, R2-19, https://ieee802.org/3/ck/public/22_06/dawe_3ck_01a_0622.pdf and https://ieee802.org/3/ck/public/20_10/healey_3ck_01a_1020.pdf discuss, the draft does not ensure adequate eye width because eye width does not correlate well to the weakened definition of VEC in the draft. In experiments we have seen eye widths between 90 mUI and 160 mUI for VEC = 12 dB, even before the effect of reflections shown in https://ieee802.org/3/ck/public/21_09/dudek_3ck_01_0921.pdf slide 7. This is way too much variation, and too low, for a spec limit. There can be a great variety of eyes for only slightly different channels, and unsymmetric eyes are possible (significantly different to left and right) as in dawe_3ck_01a_0622. The draft spec skews the spec to passing signals with bad eye width, which endanger the link BER, while failing usable signals with better eye width.

SuggestedRemedy

Add ESMW spec limits:
Host output and module stressed input >= 110 mUI;
Module output and host stressed input >= 130 mUI.
ESMW is defined around ts in the same way that ESMW is defined around Tcmid in 120E.
For the stressed input calibration, these are limits not targets.

The reason for host spec being less than module is that almost all the bad stuff is in the host measurement, but not all the host channel and package impairments are in the module measurement, even "far end".
The limits in 120E are host 220 mUI, module near 265 mUI, module far 200 mUI (with a less capable equaliser), so these specs are allowing much worse eyes than 120E, but (if ESMW is added) not totally out of control.

Proposed Response *Response Status* **O**

Cl **163** *SC* **163.9.2.6** *P* **208** *L* **24** # R3-14

Dawe, Piers J G NVIDIA

Comment Type **T** *Comment Status* **X**

This formula for SCMR divides a 1-sided peak voltage by a 2-sided peak-to-peak voltage, which is comparing apples to oranges. The reader doesn't know if what is really meant is literally what's printed, which would be strange, or the ratio of the 2-sided quantities (or the ratio of the 1-sided quantities, which would be near enough the same), which would be normal.

SCMR should be defined on an apples-to-apples basis so we can re-use it in a future project.

If v_peak is 237 mV as in the example in Table 163B-1 (a minimum for that example test fixture), 15 dB implies a VCM_FB of 42 or 84 mV depending. If v_peak is, say, 400 mV, 15 dB implies a VCM_FB of 71 or 142 mV. I expected something around 80 mV pk-pk but that's near to both alternatives so even after some investigation, I can't tell which is meant.

SuggestedRemedy

Define SCMR as 20*log10(2*v_peak/VCM_FB). Depending on what is intended, change the limit from 15 dB to 21 dB, in tables 163-5 and 120F-1.

Proposed Response *Response Status* **O**