# Comment Resolution for Annex 120G Topics

Matt Brown, Huawei, 802.3ck Editor-in-Chief

# EH/VEC eye mask vs weighting
# Comments 211, 212

*Cl* **120G** *SC* **120G.5.2** *P* **277** *L* **6** # I-211

Dawe, Piers J G NVIDIA

*Comment Type* **TR** *Comment Status* **D** *EH/VEC method mask*

This draft has a (de-)weighted rectangular eye mask spec with mask height = max(EHmin, EA/VECmax) and effective mask width ~2x0.03 to 2x0.035 UI, although it is described as a histogram 2x0.05 UI wide. This is too narrow; compare 120E with ESMW of 0.2 or 0.22 UI. It's half as wide as TDECQ with histograms extending to +/-0.07 UI.

This de-weighted histogram might have worked if there had been a guarantee that no host or module would ever produce a fast, highly jittered eye, but we don't have that guarantee. Work needs to be done to repair the hole in the spec.

See healey_3ck_01a_1020 slide 6, orange dots for +/-0.025 UI which is the closest to the current draft. For VEC of 10 dB, EW can be anywhere in the range 160 to 290 mUI: an almost 2:1 range. Driver risetime is not reported; if it is always the COM default slowest-reasonable 7.5 ps, then even worse EW is possible with faster or peaked drivers. This is too much worse than 120E. As the plot shows, a wide range of eye widths are possible, so we don't need to allow the worst ones by an oversight.

De-weighting the sides of the histogram with flat top and bottom, rather than chamfering the corners, means that infringing the corners by a mile is counted the same as infringing by an inch, which is bad.
Most of the weight of samples is in the middle of the eye which is a waste of measurement time; we know the corners will fail first so we should measure them, not the middle Hence the 2-offsets approach of TDEC and healey_3ck_01a_1020.
The effective BER criterion of the (de-)weighted mask seems to be around 1e-4, not 1e-5 as before.

The distribution of repeated measurements is very skewed.

We need an eye mask that's more eye shaped, so that a higher proportion of the samples near the boundary are measured at full weight and contribute properly to the measurement. Eye mask measurement with a 10-sided mask has been pre-programmed into scopes for about 20 years, we should use established tools and methods where they work well.

The 10-sided mask controls the eye on the diagonal more strongly than the rectangular uniform histogram/mask because hits are collected over the time of the chamfer, rather than just in corners. The de-weighted rectangular histogram controls the eye on the diagonal more weakly than the rectangular uniform histogram/mask because hits are collected just in corners, and de-weighted.

*SuggestedRemedy*

Change from a 4-cornered weighted mask with corners at t = ts+/-0.05, V = y +/-H/2 to a 10-cornered unweighted mask with corners at t = ts+/-1/16, ts+/-0.05, ts+/-3/32, V = y +/-H/2, y +/-H*0.4, y. y is near VCmid, VCupp or VClow (vertically floating, as in D3.0).
H is max( EHmin, Eye Amplitude * 10^(-VECmax/20) ). Eye Amplitude is AVupp, AVmid or AVlow, as today.

This simple scalable method gives VEC results 0.5 to 1 dB more optimistic than the unweighted rectangular mask. It can remain as the EH and VEC limits are revised in the light of experience.

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
The comment does not provide sufficient evidence to support the proposed changes.

# EH/VEC method, mask vs weighting
# Comments 211, 212

*Cl* **120G** *SC* **120G.5.2** *P* **277** *L* **6** # I-212

Dawe, Piers J G NVIDIA

*Comment Type* **TR** *Comment Status* **D** *EH/VEC method mask*

The Gaussian weighting has the effect of destroying the histogram width, allowing bad fast eyes to pass, while failing less bad slow eyes. It gives the false impression that the histogram width still applies. With a weighting standard deviation of 0.02 UI, the eye height is measured at around +/-0.035 UI rather than the +/-0.05 UI with the unweighted histogram - depending on eye shape. Compare 120E with ESMW of 0.2 or 0.22 UI, and TDECQ with histograms extending twice as wide, to +/-0.07 UI.
This weighting is equivalent to relaxing the VEC spec by 1.5 to 2 dB - but it depends on the eye shape, it weakens the spec most for the worst-shaped eyes, which is bad. It applies a worse BER criterion than the 1e-5 intended.

*SuggestedRemedy*

Remove the Gaussian weighting and set the eye height and VEC limits (which need revision anyway) appropriately. ghiasi_3ck_01_0721, which was not given the presentation time it deserved, says that the minimum eye height in particular needs to be reduced for TP1 and TP4 far end.

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
The comment does not provide sufficient evidence to support the proposed changes.

#211 proposes to use a 12 point mask

#212 proposes to revert back to two-point measurement, rather than Gaussian weighting

# HO/MO/HI/MI eye width
# Comments 107, 108, 115, 116

*Cl* **120G** *SC* **120G.3.1** *P* **258** *L* **21** # I-107

Ghiasi, Ali — Ghiasi Quantum LLC,Marvell Semiconductor, Inc.

*Comment Type* **TR** *Comment Status* **D** *HO eye width*

ESMW/EW were removed in draft 1.4 with the introduction of the +/- 50 mUI rectangular window with VEO and VEC limits not passing the task force introduced Gaussian window which in effect reduces implicit minimum receiver eye opening. With current Gaussian window for typical high loss channel EW can be as little as 120 mUI, in comparisons CL120E min ESMW=220 mU. The 120 mUI can be further degraded for lower loss channel with pathological reflections/jitter may result in EW <100 mUI. Eye width opening is as critical as VEC/VEO, without explicit EW specifications and with current Gaussian window there is significant interoperability risk.

*SuggestedRemedy*

An explicit ESMW>=175 mUI specifications which is available in the scope might be the simplest, other alternative would be to go back to rectangular mask with +/- 50 mUI or introduce 10 sides mask as demonstrated in https://www.ieee802.org/3/ck/public/21_01/dawe_3ck_01_0121.pdf

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
In 50 Gb/s C2M as specified in Annex 120E, the receiver was a continuous time filter without a DFE. The horizontal eye shape after applying the soft CTF was meaningful. With these new 100 Gb/s C2M the reference receiver includes a DFE which effects a non-linear response dependent on the sampling time and DFE feedback assumptions over a wide time range. So using specifications for 50 Gb/s C2M is not a directly relevant precedence.
In order to ensure a wider eye opening in practice, or in another way to allow for the effects of jitter and sampling time uncertainty, the weighting function might be expanded by either (a) increasing the sigma value or (b) convolving with a bounded PDF such as a uniform (rectangular) PDF.
Further analysis along with a detail proposal is required.
For task force discussion.
Resolve in conjunction with comments #108, #115, and #116.

#108 MO Eye Width - ESMW>=150 mUI

#115 HI Eye Width - ESMW>=150 mUI

#116 MI Eye Width - ESMW>=175 mUI

# Topic HO/MO/HI/MI eye width

In D1.4, ESMW removed, EH/VEC measured over wider time interval

IEEE P802.3ck D1.3 100/200/400 Gb/s Electrical Interfaces Task Force 4th Task Force review comments

*CI* **120G** *SC* **120G.3.1** *P* **226** *L* **17** # 41

Healey, Adam Broadcom Inc.

*Comment Type* **T** *Comment Status* **A** *ew/esmw*

ESMW (eye symmetry mask width) is "TBD". Similarly, eye width specifications for stressed input parameters are also "TBD". These parameters will be difficult to define for a reference receiver that includes decision feedback equalization unless the behavior of the feedback signal in the vicinity of the threshold crossings is clearly defined. However, there are other, simpler means to enforce that the reference receiver output has a useable eye width. The most straight-forward implementation for this draft is to expand on a feature of the eye height and vertical eye closure measurement procedure referred to in 120G.5.2 item h). This items points to 120E.4.2 and 120E.4.3 for the method to measure eye height, vertical eye closure, and other parameters. Step 4) in 120E.4.3 states that the distribution of the signal voltage (from which eye height and vertical eye closure are derived) is to be measured over a window "within 0.025 UI of time TCmid". This essentially averages the distribution over the time window or, thought of a different way, is similar to having a uniform jitter distribution around TCmid. Use of such a window reduces the measured eye height and vertical eye closure for signals with narrower eye widths. The width of the window can be increased to provide higher degrees of protection.

*SuggestedRemedy*

Remove references to ESMW and eye height from Annex 120G. Change 120G.5.2 item h) to the following: "From the eye diagram, compute eye height and vertical eye closure using the methodologies defined in 120E.4.2 and 120E.4.3 with the following exceptions. The value of TCmid is set to the sampling phase t_s determined in step d) (skipping steps 1) through 3) from 120E.4.2). The CDFs of the signal voltages computed in 120E.4.2 steps 4) through 6) are the average values over the time interval t_s-0.05 UI to t_s+0.05 UI. The feedback coefficients b(n) determined in step d) are constant over the averaging time interval."

Note that eye height and vertical eye closure limits may need to be adjusted to account for the reductions to these values via the averaging window.

*Response* *Response Status* **C**

ACCEPT IN PRINCIPLE.

[Editor's note: Addresses incomplete specification.]

It is assumed that in the suggested remedy, the intent was to refer to eye width rather than eye height.
The EW and ESMW specifications are incomplete both in values and in method as the draft is currently written.
Implement suggested remedy with editorial license, except remove "eye width" rather than "eye height".
Add an editorial note that all EH and VEC values currently specified may need to be adjusted to account for this new methodology.
For task force discussion.

[Editor's note (to be removed prior to closing this comment): The following is an alternate response based on consensus presentation healey_02.]

The following related presentations were reviewed by the task force:
https://www.ieee802.org/3/ck/public/20_10/healey_3ck_01a_1020.pdf
https://www.ieee802.org/3/ck/public/20_10/dawe_3ck_01a_1020.pdf
https://www.ieee802.org/3/ck/public/20_10/healey_3ck_02_1020.pdf

Based on the results of straw poll #12 there is strong consensus for Alt #2 with TBD = 50 mUI.

Implement with editorial license the proposal for Alt 2 in healey_02 with TBD = 50 mUI.

Straw Poll #9:
I support the EW/ESMW direction of (Chicago rules):
A: Keep ESMW and eye width
B: Replace EH, ESMW, and eye width with an eye mask as proposed in dawe_3ck_01_1020
C: Remove ESMW and eye width and redefine EH and VEC as proposed in healey_3ck_01a_1020
D: Remove ESMW and eye width and leave EH and VEC as is
Results: A: 9, B: 10, C: 24, D: 6

Straw poll #12
[Chicago rules]
I would support replacing ESMW and EW with the following option from healey_3ck_02_1020:
A. "Alt. 2" with TBD = 50 mUI
B. "Alt. 1" with TBD1 = 25 mUI and TBD2 = 25 mUI
C. "Alt. 1" with TBD1 = 50 mUI and TBD2 = 20 mUI
D. "Alt. 2" with TBD = 70 mUI

A: 18 B: 8 C: 4 D: 9

# Topic EH/VEC method Comments 211, 212

In D2.2, EH/VEC measurement method changed to use Gaussian weighting function, rather than two points

## D2.1 Comment #39 - where we moved to weighted mask

July 2021

The following presentation analyzed the effect of the currently specified measurement method. A similar analysis is required to make any changes.
Https://www.ieee802.org/3/ck/public/20_10/healey_3ck_01a_1020.pdf

The following presentation was reviewed by the task force:
https://www.ieee802.org/3/ck/public/21_07/ran_3ck_01a_0721.pdf

Per straw polls 5, 6, and 7 there was consensus to implement the proposal in ran_01a (slide 9) with sigma_r set to 0.02 UI.

Implement the method in ran_01a (slide 9) with sigma_r set to 0.02 UI.

Straw poll #5 (chicago rules) direction
Straw poll #6 (pick one) direction
For the eye opening method in 120G.5.2 I would support:
A: a weighted method similar to comment #39 and ran_01a
B: a multi-sided eye mask similar to comment #106
C: no change
D: need more information
#5: A: 25 B: 15 C: 13 D: 11
#6: A: 15 B: 8 C: 11 D: 5

Straw poll #7 (decision)
I support resolving comment #39 using the proposal in ran_01a (slide 9) except with standard deviation (sigma_r) of 0.02 UI.
Yes: 21
No: 11

## D2.2 Comment #95 - where we checked again

October 2021

Per straw poll #9 and #10 there is no consensus to change the measurement method.

--- the following added 2021/10/4 ---

Straw poll #9 (pick one)
Straw poll #10 (chicago)
(direction)
I support the following method of determining eye height and VEC:
A: weighted window per Draft 2.2 (no change)
B: weighted window per Draft 2.2, except increase standard deviation
C: unweighted window per Draft 2.1 (perhaps with different width) ← D3.0 Comment 212
D: mask per D2.2 comment #101 ← D3.0 Comment 211
#9: A: 17 B: 5 C: 6 D: 2
#10 A: 22 B: 12 C: 7 D: 3

# Topic EH/VEC method
# Comments 211, 212

Potential straw polls:

First straw poll
I support the following direction of the eye opening specification method:
A. weighted window per Draft 3.0 (as is or with some improvements)
B. revert to evenly weighted window per D3.0 comment #212
C. 10pt mask per D3.0 comment #211
(Chicago rules & choose one)

Assuming option A above prevails:
Second straw poll
To address eye width issues expressed, I support the following method to modify the weighted window:
A. no change
B. “wider” weighting mask (e.g., larger sigma, alternate distribution shape)
C. add jitter specification
D. revive eye width
(Chicago rules & choose one)

# EH/VEC method, # of samples Comments 210

*Cl* 120G *SC* 120G.5.2 *P* 276 *L* 21 # I-210

Dawe, Piers J G NVIDIA

*Comment Type* T *Comment Status* D *EH/VEC method*

This says "a minimum of 3 samples per symbol, or equivalent. Collect sufficient samples equivalent to at least 1.2 million PAM4 symbols to allow for construction of a normalized cumulative distribution function (CDF) to a probability of 10^-5 without extrapolation."
With a uniform-weighted histogram/mask, one needs several times 1e5 samples in the 0.1 UI window to get several hits in each tail. If samples are distributed uniformly across time, and using 10 for "several" for simplicity, we need 10 * 1e5 / 0.1 = 10 million samples. The first sentence implies that maybe several times fewer are needed, but still, 1.2 million seems too few for a reference (accurate) measurement.
If Gaussian weighting is used (which it should not be, see another comment) then one needs many more de-weighted hits to get to a false 1e-5 in the tails.
Also, giving a number is like telling the test engineer to use an instrument with a certain precision. That's not the standard's business; we say what the outcome of an accurate, possibly idealised, measurement must be, and the test engineer balances cost, time, margin, accuracy and so on. Including choosing how many samples.

*SuggestedRemedy*

Change "equivalent to at least 1.2 million PAM4 symbols" into an example, with a higher number, or delete it.

*Proposed Response* *Response Status* W

PROPOSED REJECT.
There are two concerns being discussed in the comment. The first is whether the equivalent number of symbols suggested is sufficient. The second is whether this number should be provided at all, leaving it to the test engineer to determine an appropriate number.
It also seems as though the proposed number of samples per symbol is assuming a real-time scope with asynchronous clock. If the clock was synchronous there would be at most 1 sample within the measurement window with 100 mUI width. Instead the number of samples specified should be those falling within the weighting window AND distributed throughout the weighting window.
It seems some guidance is required to give the test engineer some confidence they are on the right track. If the task forces agrees that an example with more appropriate numbers is required then a specific value is required. Some analysis and a detailed proposal is necessary.
For task force discussion.

Perform the following step once:

a) Capture the PRBS13Q signal $y_1(k)$ with the effect of low-pass response equivalent to the specified receiver noise filter with associated parameter $f_r$ in Table 120G–11 (instead of the test system response specified in 120G.3.1), and using a clock recovery unit with a corner frequency of 4 MHz and slope of 20 dB/decade. The capture includes a minimum of 3 samples per symbol, or equivalent. Collect sufficient samples equivalent to at least 1.2 million PAM4 symbols to allow for construction of a normalized cumulative distribution function (CDF) to a probability of $10^{-5}$ without extrapolation.

# HI/MI SIT BER Comment 199

*Cl* 120G *SC* 120G.3.3.5.3 *P* 268 *L* 10 # I-199

Dawe, Piers J G NVIDIA

*Comment Type* T *Comment Status* D *HI/MI BER*

There's a problem with identifying which lanes are relevant. For example, if a host has QSFP-DD ports, there are 8 host lanes (per physical port), but there may be just 1, 2 or 4 lanes in each AUI. "The host electrical output is enabled on all lanes with any of the patterns above" is fine, it includes all the neighbours. While for "The host BER is the average of the BER of each of its lanes", only the lanes in the PMA (AUI) under test are relevant. "Module BER" in 120G.3.4.2.3 is even more open to misinterpretation because we are so clear how many lanes a module has. But, terminology for this has been set up: the term "interface BER" is used 19 times in the base document, and is defined in 86.8.2.1, 86.8.4.7, 86.8.4.8, 95.8.1.1 and 86A.5.3.8.1. 86A is an electrical spec. "host BER" and "module BER" are used just once each.

*SuggestedRemedy*

Change paragraph to:
The relevant BER is the interface BER, which is the average of the BER of each of the lanes in the AUI under test.
If the test is performed with PRBS31Q, the BER of a PMA lane may be calculated using the bit error counter in the PMA test pattern checker (see 120.5.11.2.2) as the number of bit errors divided by the number of received bits.
If the test is performed with scrambled idle or another valid 100GBASE-R, 200GBASE-R, or 400GBASE-R sequence, the interface BER may be calculated using the host FEC decoder error counters (see 91.6 and 119.3.1), as the number of FEC symbol errors divided by the number of received bits.
Similarly in 120G.3.4.2.3.

*Proposed Response* *Response Status* W

PROPOSED REJECT.
Each AUI is defined only by the lanes it uses regardless of how many may be active on the host or module. The BER for the AUI is the net for all lanes used by the AUI. For instance, for a 200GAUI-2, the BER is the net BER for the 2 lanes used by that 200GAUI-2.

**120G.3.3.5.3 Host stressed input test procedure**

After the stress has been calibrated, the pattern generator is set to generate PRBS31Q, scrambled idle, or another valid 100GBASE-R, 200GBASE-R, or 400GBASE-R sequence. The HCB is unplugged from the MCB and is plugged into the host under test. The host electrical output is enabled on all lanes with any of the patterns above. The test is repeated with sinusoidal jitter set to each of the six cases in Table 162–16.

If the test is performed with PRBS31Q, the host BER may be calculated using the bit error counter in the PMA test pattern checker (see 120.5.11.2.2) as the number of bit errors divided by the number of received bits. The host BER is the average of the BER of each of its lanes.

If the test is performed with scrambled idle or another valid 100GBASE-R, 200GBASE-R, or 400GBASE-R sequence, the host BER may be calculated using the host FEC decoder error counters (see 91.6 and 119.3.1), as the number of FEC symbol errors divided by the number of received bits.

The number of received bits may be estimated based on the test time.

Methods of extracting the received bit pattern and counting errors other than the ones described above may be used if they generate equivalent results.

Revised response…

ACCEPT IN PRINCIPLE.

Rather than redefine other terms, e.g., "interface BER", "host BER", "module BER", for this purpose, it would be better to avoid such nomenclature altogether by using descriptive terms. Also, for the FEC decoder since it might be a real host or a piece of test equipment remove the word host there.

In 120G.3.3.5.3…
Change "The host BER is the average of the BER of each of its lanes."
To "The BER for the AUI under test is the average of the BER of each of its lanes."
Change "the host BER may be calculated using the host FEC decoder error counters"
To: "the BER for the AUI under test may be calculated using the FEC decoder error counters"

In 120G.3.4.3.3…
Change: "The module BER is the average of the BER of each of its lanes."
To: "The BER for the AUI under test is the average of the BER of each of its lanes."
Change: " The module BER is calculated using the host FEC decoder error counters"
To: "The BER for the AUI under test is calculated using the FEC decoder error counters"

# EH/VEC method, # of samples Comment 27

*Cl* 120G *SC* 120G.3.3.5.1 *P* 266 *L* 6 # I-27

Brown, Matthew Huawei Technologies Canada

*Comment Type* T *Comment Status* D *HI SIT BUJ*

The BUJ generation method is based on that specified in 120E.3.4.1.1. Since the BUJ pattern signaling rate doubles compared to that in 120E.3.4.1.1, the corner frequency frequency limits for the BUJ jitter filter should be scaled the same to give the same jitter distribution.

*SuggestedRemedy*

Change: "The low-pass filter has 20 dB/decade rolloff with a –3 dB corner frequency between 150 MHz and 300 MHz."
To: "The low-pass filter has 20 dB/decade rolloff with a –3 dB corner frequency between 600 MHz and 1.2 GHz."

*Proposed Response* *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy.
For task force discussion.

X

There is an error in the suggested remedy as it quadruples the current bandwidth frequencies, rather than doubles them. Change the response to the following:

PROPOSED ACCEPT IN PRINCIPLE.
Change: "The low-pass filter has 20 dB/decade rolloff with a –3 dB corner frequency between 150 MHz and 300 MHz."
To: "The low-pass filter has 20 dB/decade rolloff with a –3 dB corner frequency between 300 MHz and 600 MHz."

**120G.3.3.5.1 Host stressed input test setup**

Bounded uncorrelated jitter may not be available in all stressed pattern generators or bit error ratio testers. It can be generated by driving the pattern generator external jitter modulation input with a low-pass filtered pseudo-random pattern. The pattern should be either PRBS7 or PRBS9 (see 83.5.10) with a signaling rate approximately 1/10 of the stressed pattern signaling rate (e.g., 5.3125 GBd). The clock source for the PRBS generator is asynchronous to the pattern generator clock source. The low-pass filter has 20 dB/decade roll-off with a –3 dB corner frequency between 150 MHz and 300 MHz.

**120E.3.3.2.1 Host stressed input test procedure**

Bounded uncorrelated jitter provides a source of bounded high probability jitter uncorrelated with the signal stream. This jitter stress source may not be present in all stressed pattern generators or bit error ratio testers. It can be generated by driving the pattern generator external jitter modulation input with a filtered PRBS pattern. The PRBS pattern length should be between PRBS7 and PRBS9 with a signaling rate approximately 1/10 of the stressed pattern signaling rate (e.g., 2.65625 GBd). The clock source for the PRBS generator is asynchronous to the pattern generator clock source to assure non-correlation of the jitter. The low-pass filter that operates on the PRBS pattern to generate the bounded uncorrelated jitter should exhibit 20 dB/decade roll-off with a –3 dB corner frequency between 150 MHz and 300 MHz. This value also has to be below the upper frequency limit of the pattern generator external modulator input. Random jitter and bounded uncorrelated jitter are added such that the output of the pattern generator approximates the 200GAUI-4 and 400GAUI-8 C2C output jitter profile given in Table 120D–1.

Transition time of 150 MHz and 300 MHz filters is:
2.2 / (2*pi * 150 MHz) = 2.33 ns
2.2 / (2*pi * 300 MHz) = 1.17 ns

7 symbols @ 2.56 GBd = 2.73 ns (saturating)
9 symbols @ 2.56 GBd = 3.52 ns (saturating)

7 symbols @ 5.31 GBd = 1.32 ns (not quite saturating)
9 symbols @ 5.31 GBd = 1.69 ns (not quite saturating)

# HI SIT calibration, transition time
# Comments 196, 203

*Cl* **120G** *SC* **120G.3.3.5.2** *P* **267** *L* 2 **#** I-196

Dawe, Piers J G NVIDIA

*Comment Type* **T** *Comment Status* **D** *HI SIT calibration*

It may not be feasible to obtain a pattern generator signal with the right rise time (transition time with "no equalization"), or perfect compliance boards, but that's OK if the loss board is tweaked to allow for this.

*SuggestedRemedy*

Add text: The reference host channel may be adjusted so that combination of the pattern generator output transition time (see step a), the HCB and the reference host channel has the effect of the ideal setup described here.
There is another comment for 120G.3.4.3.2.

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
It is always possible to make up for the shortcomings of test equipment on hand by adjusting the entire setup to result in the same result. It is not necessary to state that for every test.

**120G.3.3.5.2 Host stressed input test calibration**

a) The pattern generator is set to generate a PRBS13Q pattern (see 120.5.11.2.1). The transition time (see 120G.3.1.4) measured at TP4a with the pattern generator output equalization configured for "no equalization" is as specified in Table 120G–8. The initial signal level is set to the differential peak-to-peak input voltage tolerance given in Table 120G–7.

*Cl* **120G** *SC* **120G.3.4.3.2** *P* **271** *L* **30** **#** I-203

Dawe, Piers J G NVIDIA

*Comment Type* **T** *Comment Status* **D** *HI SIT calibration*

It may not be feasible to obtain a pattern generator signal with the right rise time (transition time with "no equalization"), or perfect compliance boards, but that's OK if the loss board is tweaked to allow for this.

*SuggestedRemedy*

Add text: The combination of the pattern generator output transition time (see step a) and the implementations of the frequency-dependent attenuator and the MCB, may be chosen together so that the combination has the effect of the ideal parts described here.
There is another comment for 120G.3.3.5.2.

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
Resolve using the response to comment #196.

**120G.3.4.3.2 Module stressed input test calibration**

The stressed input signal is calibrated by the following procedure.

a) The pattern generator is set to generate a PRBS13Q pattern (see 120.5.11.2.1) with transition time (see 120G.3.1.4) at the output of the pattern generator as specified in Table 120G–10. The initial signal level is set to the differential peak-to-peak input voltage tolerance given in Table 120G–9.

# HI SIT VEC/EH
# Comments 194, 198, 197

*Cl* **120G** *SC* **120G.3.3.5.1** *P* **266** *L* **15** # I-194

Dawe, Piers J G NVIDIA

*Comment Type* **TR** *Comment Status* **D** *HI SIT VEC/EH*

The host stressed input signal is emulating a module so obviously it must obey the same rules. VEC and eye height must be in spec for both near end and far end. Ensuring this is part of the calibration process. See comment against page 267, line 25.

*SuggestedRemedy*

Change "short or long mode far-end test" to "short or long mode far-end calibration or long mode near-end verification"

*Proposed Response* *Response Status* **W**

PROPOSED REJECT.
The comment does not show that calibrating only for far-end is any worse than calibrating at both.

*Cl* **120G** *SC* **120G.3.3.5.2** *P* **267** *L* **21** # I-197

Dawe, Piers J G NVIDIA

*Comment Type* **TR** *Comment Status* **D** *HI SIT near-end*

The host stressed input signal is emulating a module so obviously it must obey the same rules. VEC and eye height must be in spec for both near end and far end. Ensuring this is part of the calibration process. See comment against line 25.
This says "parameters in Table 120G-5 for far-end host channel type and the requested mode": but in one case, the near end needs a parameter from the table.

*SuggestedRemedy*

Change "for far-end host channel type and the requested mode" to "for host channel type and the requested module output mode".

*Proposed Response* *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The comment refers to another comment which is #198.
Resolve using the reponse to comment #198.

The measurement receiver used for test calibration includes:

— clock recovery unit (CRU) that acts as a high-pass jitter filter with a 3 dB corner frequency of 4 MHz and a slope of 20 dB/decade,
— reference host channel to be configured for short or long mode far-end test as specified in 120G.3.2.2.1, and
— a reference receiver as specified in 120G.5.2.

f) The reference host channel is configured in the same way as in 120G.3.2.2.1 using the parameters in Table 120G–5 for far-end host channel type and the requested mode (short or long).

# HI SIT VEC/EH
# Comments 194, 198, 197

*Cl* **120G** *SC* **120G.3.3.5.2** *P* **267** *L* **25** # I-198

Dawe, Piers J G NVIDIA

*Comment Type* **TR** *Comment Status* **D** *HI SIT near-end*

The signal needs to be verified with the near end channel so that its eye height is at least the target and its VEC is no more than VEC (max) in the table. If it fails at NE, the signal must be adjusted to bring it into compliance. Also, the stressed input signal needs to obey the rules for differential peak-to-peak output voltage.

*SuggestedRemedy*

Change
... adjusted to minimize VEC, so that the eye height of the smallest eye matches the target value and VEC is within the limits in Table 120G-8.
to
... adjusted to minimize far-end VEC, so that the far-end eye height of the smallest eye matches the target value, far-end VEC is within the limits in Table 120G-8, and differential peak-to-peak output voltage, near-end VEC and eye height are within the limits in Table 120G-3.
Also (see other comments),
Include separate near-end and far-end VEC limits in Table 120G-8. As there will be more than one eye height limit for module output, there will be multiple EH targets here: it may be simpler to refer to Table 120G-3, Module output characteristics at TP4, rather than list them all again here.

*Proposed Response* *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
In D3.0, the host stressed input test the signal is calibrated for far-end (i.e., with a representative host channel). This would result in appropriate transmitter settings for a host with a fairly high-loss channel. However, for hosts with a lower loss channel this might be a problem if the signal is not within module requirements for near end measurement with the same pattern generator settings as used for the far end.
Implement the suggested remedy.

g) Eye height and VEC are measured at TP4 as described in 120G.5.2. The pattern generator amplitude and random jitter are adjusted, while the pattern generator output equalization and reference receiver settings are adjusted to minimize VEC, so that the eye height of the smallest eye matches the target value and VEC is within the limits in Table 120G–8. The differential peak-to-peak voltage measured at TP4 does not exceed the differential peak-to-peak input voltage tolerance given in Table 120G–7.

# HI SIT VEC/EH
# Comments 194, 198, 197

From page 266…

The measurement receiver used for test calibration includes:
— clock recovery unit (CRU) that acts as a high-pass jitter filter with a 3 dB corner frequency of 4 MHz and a slope of 20 dB/decade,
— reference host channel to be configured for short or long mode far-end test calibration or long-mode near end verification as specified in 120G.3.2.2.1, and
— a reference receiver as specified in 120G.5.2.

From page 267…

f) The reference host channel is configured in the same way as in 120G.3.2.2.1 using the parameters in Table 120G–5 for ~~far-end~~ host channel type and the requested module mode (short or long).
g) Eye height and VEC are measured at TP4 as described in 120G.5.2. The pattern generator amplitude and random jitter are adjusted, while the pattern generator output equalization and reference receiver settings are adjusted to minimize far-end VEC, so that the far-end eye height of the smallest eye matches the target value ~~and~~, near-end VEC is within the limits in Table 120G–8, and differential peak-to-peak output voltage, near-end VEC, and eye height are within the limits in Table 120G-3. The differential peak-to-peak voltage measured at TP4 does not exceed the differential peak-to-peak input voltage tolerance given in Table 120G–7.

# HI SIT VEC/EH
# Comment 71

*Cl* **120G** *SC* **120G.3.4.3.2** *P* **271** *L* **31** # I-71

Ran, Adee Cisco Systems, Inc.

*Comment Type* **TR** *Comment Status* **D** *HI SIT calibration*

The text in list item g has been changed from D2.2 to D2.3 in a way that makes it possibly confusing to readers, as shown in comment #31 against D2.3.

The intent is to limit the space of reference receiver configurations to those with gDC+gDC2<=10.5 dB. The other configurations are not expected to be checked or optimized for VEC by setting the PG equalization, and the VEC that can be achieved with other configurations is irrelevant; analytically, a signal created by PG equalization optimized for a high gDC setting will be over-equalized with a lower gDC setting.

The text should be rephrased to clarify this. The suggested remedy is based on the wording in D2.2 .

*SuggestedRemedy*

Change from

"Eye height and VEC are measured at TP1a as described in 120G.5.2 with the exception for the high-loss case that the reference receiver CTLE setting that minimizes VEC has gDC + gDC2 less than or equal to –10.5 dB"

to

"Eye height and VEC are measured at TP1a as described in 120G.5.2. For the high-loss case, an exception is made that the reference receiver CTLE is limited to settings where gDC + gDC2 is less than or equal to –10.5 dB".

*Proposed Response* *Response Status* **W**

PROPOSED ACCEPT.

# HI SIT VEC/EH
# Comment 71

g) Eye height and VEC are measured at TP1a as described in 120G.5.2 ~~with the exception for the high-loss case that the reference receiver CTLE setting that minimizes VEC has gDC + gDC2 less than or equal to –10.5 dB~~. For the high-loss case, an exception is made that the reference receiver CTLE is limited to settings where gDC+gDC2 is less than or equal to -10.5dB.
h) The pattern generator amplitude, output equalization, and random jitter are adjusted together~~, while the pattern generator output equalization and reference receiver settings are adjusted~~ to minimize VEC, so that the eye height of the smallest eye matches the target value ~~and~~ VEC is within the limits in Table 120G–10~~. T~~and the differential peak-to-peak voltage measured at ~~TP4~~TP1a does not exceed the differential peak-to-peak input voltage tolerance given in Table 120G–9. The pattern generator output equalization has to be set such that for the resulting signal, the same VEC is achieved with or without the limitations on gDC and gDC2 in item g).

Other calibration procedures resulting in a signal that meets these requirements may be used.