Discussion Slides - Annex 120G gdc

Beth Kochuparambil

120G	MI SI calibration + gdc	72, 131, dudek_01
120G	EO RR bbmax/gdc	100, 98(R+), 99(R+), 115, 72

Wording

120G.3.4.3.2 Module stressed input test calibration

The stressed input signal is calibrated by the following procedure.

[. . .]

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 -13 dB.

g) Eye height and VEC are measured at TP1a as described in 120G.5.2. The pattern generator random jitter and differential peak-to-peak voltage are adjusted so that the eye height of the smallest eye matches the target value and VEC is within the limits in Table 120G–10. The differential peak-to-peak input voltage tolerance given in Table 120G–9 is not exceeded. ~~For the high-loss case, the reference receiver CTLE is limited to settings where $g_{DC} + g_{DC2}$ is less than or equal to –13 dB. This restriction does not apply for the low-loss case.~~ The pattern generator pre-emphasis and reference receiver settings that minimize VEC are used.

Cl **120G**	*SC* **120G.3.4.3.2**	*P* **274**	*L* **17**	# 131

Dawe, Piers — Nvidia

Comment Type **T** *Comment Status* **D** *MI SI calibration*

This is open to misinterpretation: "For the high-loss case, the reference receiver CTLE is limited to settings where gDC + gDC2 is less than or equal to -13 dB. This restriction does not apply for the low-loss case." Even the previous text, "The CTLE setting, gDC+gDC2, has to be less than or equal to -13 dB" was misinterpreted to mean that there is no constraint on gDC + gDC2 for the low loss case. Yet the limits for the appropriate test point in Table 120G-11 still apply.
Actually, for a stressed signal calibration, we are looking for a signal where the optimum CTLE setting obeys the rules (so that the signal is not low stress but outside the expected range, but right stress and in the expected range).
See another comment for whether -13 dB is the right value.

SuggestedRemedy

Change "Eye height and VEC are measured at TP1a as described in 120G.5.2." to "Eye height and VEC are measured at TP1a as described in 120G.5.2, with an additional constraint for the high-loss case: the reference receiver CTLE setting that minimizes VEC has gDC + gDC2 less than or equal to -13 dB."
Delete "For the high-loss case, the reference receiver CTLE is limited to settings where gDC + gDC2 is less than or equal to -13 dB. This restriction does not apply for the low-loss case."

GDC Values

Slides 5-9	Comment walk through
Slides 10-11	All together
Slide 12	Proposed Response

120G.3.4.3.2 Module stressed input test calibration

The stressed input signal is calibrated by the following procedure.

[. . .]

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 -~~13~~ dB.

g) Eye height and VEC are measured at TP1a as described in 120G.5.2. The pattern generator random jitter and differential peak-to-peak voltage are adjusted so that the eye height of the smallest eye matches the target value and VEC is within the limits in Table 120G–10. The differential peak-to-

-10.5

120G.5 Measurement methodology

120G.5.2 Eye opening measurement method

Table 120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Units
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	$0.75 \times f_b$	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	 –2 to –9 –2 to –12 –4 to –12 –6 to –13 1.0	 dB

-11

-10

-4 to -9

Cl **120G** *SC* **120G.3.4.3.2** *P* **274** *L* **17** # 72

Dudek, Mike Marvell

Comment Type **TR** *Comment Status* **D** *MI SI calibration*

The optimum value of CTLE peaking (gdc+gdc2) when calibrating the high loss stressed module receiver test is only 10.5dB. See Dudek_3ck_01_0921. Requiring at least 13dB is degrading the signal making it difficult to generate the signal (see e.g. Snapshot of Receiver Module Input Tests (no convergence on high-loss TP1a channel) and private discussions). Note also that the maximum allowed peaking for testing the host output should not be significantly different from this value. A presentation will be made.

SuggestedRemedy

Change -13dB to -10.5dB. Also in Table 120G-11 change the gdc values for TP1a range for -1<GDC2 <0 to -2 to -11,
the range for -2<GDC2 <-1 to -4 to -10, and
the range for -3<GDC2 <-2 to -4 to -9

https://www.ieee802.org/3/ck/public/21_09/dudek_3ck_01_0921.pdf

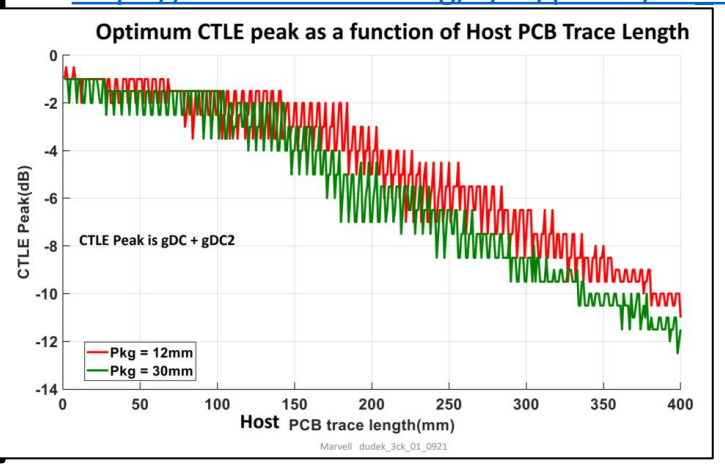


Table 120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Units
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	0.75 × f_b	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	-1 –2 to –9 –2 to –12 –4 to –12 –6 to –13 1.0	dB
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	 –3 0 0.5	
Continuous time filter, DC gain for TP4 near-end Minimum value Maximum value Step size	g_{DC}	 –5 –1 1.0	
	g_{DC2}	 –2 0 0.5	
	g_{DC}	 –9 –2 1.0	dB
	g_{DC2}	 –3 –1 0.5	dB
	f_z	12.58	GHz

-11 per comment #72

-10

-4 to -9

Cl **120G** *SC* **120G.5.2** *P* **277** *L* **29** # 115

Dawe, Piers — Nvidia

Comment Type **T** *Comment Status* **D** *EO RR gdc*

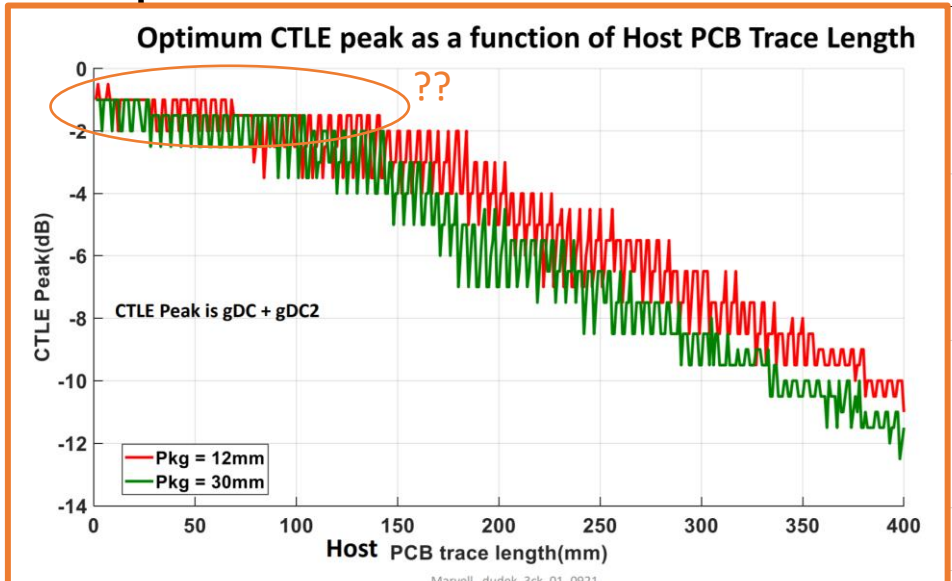
In D2.1, max gDC for TP4 near-end was increased from -2 to -1. While hosts typically have bigger packages and more trace loss than modules, neither is required (e.g. an on-board repeater).

SuggestedRemedy

Consider if max gDC for TP1a should be increased similarly.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The comment does not provide sufficient justification to implement the proposed changes nor does the suggested remedy provide sufficient detail to implement.



https://www.ieee802.org/3/ck/public/21_09/dudek_3ck_01_0921.pdf

120G.5 Measurement methodology

120G.5.2 Eye opening measurement method

Table 120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Unit
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	0.75 × f_b	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	 –2 to –9 –2 to –12 –4 to –12 –6 to –13 1.0	 dB
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	 –3 0 0.5	 dB
Continuous time filter, DC gain for TP4 near-end Minimum value Maximum value Step size	g_{DC}	 –5 –1 1.0	 dB
Continuous time filter, DC gain 2 for TP4 near-end Minimum value Maximum value Step size	g_{DC2}	 –2 0 0.5	 dB
Continuous time filter, DC gain for TP4 far-end Minimum value Maximum value Step size	g_{DC}	 –9 –2 1.0	 dB
Continuous time filter, DC gain 2 for TP4 far-end Minimum value Maximum value Step size	g_{DC2}	 –3 –1 0.5	 dB
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58	GHz

"in the style of TP1a"

Cl **120G** *SC* **120G.5.2** *P* **277** *L* **38** # 98

Dawe, Piers — Nvidia

Comment Type **TR** *Comment Status* **D** *EO RR gdc*

The limits for TP4 gDC, gDC2 should not be the same for short and long output modes. Obviously, different channels will need different CTLE settings. Obviously, CTLE settings that only signals outside what the spec is designed for use, should be excluded, to make implementers set up their product correctly.

SuggestedRemedy

Create separate limits for TP4 short and long output modes, so 4 sets for TP4+, in the style of TP1a. If you don't have any better numbers, create them anyway with the same numbers in each set - but see another comment.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
This comment is a restatement of D2.1 comment #103 and D2.0 comment #183, which were rejected on the basis of providing insufficient justification and detail.
This comment provides expanded justification, but the suggested remedy does not provide sufficient detail to implement.

Response *Response Status* **U**

Draft 2.1, #103

REJECT.

This comment is a restatement of D2.0 comment #179, which was rejected on the basis of insufficient justification and detail. It adds request to provide 4 sets of values in the style used for TP1a but does not provide specific values. No further justification is provided.

The comment does not provide sufficient justification for the proposed changes nor does the suggested remedy provide sufficient detail to implement.

Response *Response Status* **U**

Draft 2.0, #183

REJECT.

The comment does not provide sufficient justification to support any changes and the suggested remedy does not provide sufficient detail to implement.

120G.5 Measurement methodology

120G.5.2 Eye opening measurement method

Table 120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Unit
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	$0.75 \times f_b$	GHz
Continuous time filter, DC gain for TP1a	g_{DC}		
Range for $g_{DC2} = 0$		–2 to –9	dB
Range for $-1 \le g_{DC2} < 0$		–2 to –12	dB
Range for $-2 \le g_{DC2} < -1$		–12	dB
Range for $-3 \le g_{DC2} < -2$			
Step size			
Continuous time filter, DC gain 2 for TP1a	g_{DC2}		
Minimum value		–3	dB
Maximum value		0	dB
Step size		0.5	dB
Continuous time filter, DC gain for TP4 near-end, short	g_{DC}		
Minimum value		–5	dB
Maximum value		–1	dB
Step size		1.0	dB
Continuous time filter, DC gain 2 for TP4 near-end, short	g_{DC2}		
Minimum value		–2	dB
Maximum value		0	dB
Step size		0.5	dB
Continuous time filter, DC gain for TP4 far-end, short	g_{DC}		
Minimum value		–9	dB
Maximum value		–2	dB
Step size		1.0	dB
Continuous time filter, DC gain 2 for TP4 far-end, short	g_{DC2}		
Minimum value		–3	dB
Maximum value		–1	dB
Step size		0.5	dB
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58	GHz

"Create separate limits for TP4 short and long output modes"

Cl **120G** *SC* **120G.5.2** *P* **277** *L* **38** # 98

Dawe, Piers — Nvidia

Comment Type **TR** *Comment Status* **D** *EO RR gdc*

The limits for TP4 gDC, gDC2 should not be the same for short and long output modes. Obviously, different channels will need different CTLE settings. Obviously, CTLE settings that only signals outside what the spec is designed for use, should be excluded, to make implementers set up their product correctly.

SuggestedRemedy

Create separate limits for TP4 short and long output modes, so 4 sets for TP4+, in the style of TP1a. If you don't have any better numbers, create them anyway with the same numbers in each set - but see another comment.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
This comment is a restatement of D2.1 comment #103 and D2.0 comment #183, which were rejected on the basis of providing insufficient justification and detail.
This comment provides expanded justification, but the suggested remedy does not provide sufficient detail to implement.

Continuous time filter, DC gain for TP4 near-end, long Minimum value Maximum value Step size	g_{DC}
Continuous time filter, DC gain 2 for TP4 near-end, long Minimum value Maximum value Step size	g_{DC2}
Continuous time filter, DC gain for TP4 far-end, long Minimum value Maximum value Step size	g_{DC}
Continuous time filter, DC gain 2 for TP4 far-end, long Minimum value Maximum value Step size	g_{DC2}

120G.5 Measurement methodology

120G.5.2 Eye opening measurement method

Table 120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value
Signaling rate	f_b	53.125
Receiver 3 dB bandwidth	f_r	0.75 × f_b
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	 –2 to –9 –2 to –12 –4 to –12 –6 to –13 1.0
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	 –3
Continuous time filter, DC gain for TP4 near-end Minimum value Maximum value Step size	g_{DC}	
Continuous time filter, DC gain 2 for TP4 near-end Minimum value Maximum value Step size	g_{DC2}	 0.5
Continuous time filter, DC gain for TP4 far-end Minimum value Maximum value Step size	g_{DC}	 –9 –2 1.0
Continuous time filter, DC gain 2 for TP4 far-end Minimum value Maximum value Step size	g_{DC2}	 –3 –1 0.5
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58

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Cl **120G** *SC* **120G.5.2** *P* **277** *L* **46** # 99

Dawe, Piers — Nvidia

Comment Type **TR** *Comment Status* **D** *EO RR gdc*

As a lot of the channel for TP4 far-end is known exactly and the max loss to TP4 far end is less than to TP1a, the range of gDC, gDC2 combinations should be a subset of the TP1a ones.

SuggestedRemedy

For Continuous time filter, DC gain for TP4 far-end (gDC), change to sets of limits that depend on gDC2 in the same style as for TP1a. The allowed values should be subsets of those for TP1a. For TP4 long far end, use minimum gDC 1 dB higher than allowed for TP1a; for TP4 short far end, 3 dB higher than for TP1a.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
This comment is a restatement of D2.1 comment #104 and D2.0 comment #178, which were rejected on the basis of providing insufficient justification and detail.
This comment provides no new justification, but does provide more details for implementation.

	Current TP4 far-end	Proposed short	Proposed long
Range for gDC2 = 0	N/A	N/A	N/A
Range for -1 < gDC2 < 0	N/A	N/A	N/A
Range for -2 ≤ gDC2 ≤ -1	-2 to -9	-4 to -9	-4 to -11
Range for -3 ≤ gDC2 < -2	-2 to -9	-6 to -10	-6 to -12

44
45
46

Response *Response Status* **U**

REJECT.
This comment is a restatement of D2.0 comment #178, which was rejected on the basis of insufficient justification and detail. No further justification or implementation detail is provided.
The comment does not provide sufficient justification for the proposed changes nor does the suggested remedy provide sufficient detail to implement.

Draft 2.1, #104

Response *Response Status* **U**

REJECT.

The comment does not provide sufficient justification to support any changes and the suggested remedy does not provide sufficient detail to implement.

Draft 2.0, #178

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120G.5 Measurement methodology
120G.5.2 Eye opening measurement method

120G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Units
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	$0.75 \times f_b$	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	 –2 to –9 –2 to –12 –4 to –12 –6 to –13 1.0	dB
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	 –3 0 0.5	dB
Continuous time filter, DC gain for TP4 near-end Minimum value Maximum value Step size	g_{DC}	 –5 –1 1.0	dB
Continuous time filter, DC gain 2 for TP4 near-end Minimum value Maximum value Step size	g_{DC2}	 –2 0 0.5	dB
Continuous time filter, DC gain for TP4 far-end Minimum value Maximum value Step size	g_{DC}	 –9 –2 1.0	dB
Continuous time filter, DC gain 2 for TP4 far-end Minimum value Maximum value Step size	g_{DC2}	 –3 –1 0.5	dB
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58	GHz

For your reference, Draft 2.2
(as it sits today)

120G.5 Measurement methodology
120G.5.2 Eye opening measurement method

120G–11—Eye opening reference receiver parameter values

If we accept them all

Parameter	Symbol	Value	Units
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	0.75 × f_b	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	#115 #72 -1 to –9 -1 to -11 –4 to -10 -4 to -9 1.0	dB
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	 –3 0 0.5	dB
Continuous time filter, DC gain for TP4 near-end, short Range for -2 ≤ gDC2 < 0 Step size	g_{DC}	 -1 to -5 1.0	
Continuous time filter, DC gain 2 for TP4 near-end, short Minimum value Maximum value Step size	g_{DC2}	 –2 0 0.5	
Continuous time filter, DC gain for TP4 far-end, short Range for -2 ≤ gDC2 < -1 Range for -3 ≤ gDC2 < -2 Step size	g_{DC}	#99 -4 to -9 -6 to -10 1.0	
Continuous time filter, DC gain 2 for TP4 far-end, short Minimum value Maximum value Step size	g_{DC2}	 –3 –1 0.5	
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58	GHz

Continuous time filter, DC gain for TP4 near-end, long Range for -2 ≤ gDC2 < 0 Step size	g_{DC}	 -1 to -5 1.0
Continuous time filter, DC gain 2 for TP4 near-end, long Minimum value Maximum value Step size	g_{DC2}	 –2 0 0.5
Continuous time filter, DC gain for TP4 far-end, long Range for -2 ≤ gDC2 < -1 Range for -3 ≤ gDC2 < -2 Step size	g_{DC}	#99 -4 to -11 -6 to -12 1.0
Continuous time filter, DC gain 2 for TP4 far-end, long Minimum value Maximum value Step size	g_{DC2}	 –3 –1 0.5

120G.5 Measurement methodology
120G.5.2 Eye opening measurement method

20G–11—Eye opening reference receiver parameter values

Parameter	Symbol	Value	Units
Signaling rate	f_b	53.125	GBd
Receiver 3 dB bandwidth	f_r	$0.75 \times f_b$	GHz
Continuous time filter, DC gain for TP1a Range for $g_{DC2} = 0$ Range for $-1 \le g_{DC2} < 0$ Range for $-2 \le g_{DC2} < -1$ Range for $-3 \le g_{DC2} < -2$ Step size	g_{DC}	#72 –2 to –9 –2 to -11 –4 to -10 -4 to -9 1.0	dB
Continuous time filter, DC gain 2 for TP1a Minimum value Maximum value Step size	g_{DC2}	–3 0 0.5	dB
Continuous time filter, DC gain for TP4 near-end Range Step size	g_{DC}	#98 -1 to -5 1.0	dB
Continuous time filter, DC gain 2 for TP4 near-end Minimum value Maximum value Step size	g_{DC2}	–2 0 0.5	dB
Continuous time filter, DC gain for TP4 far-end Range Step size	g_{DC}	#98 -2 to -9 1.0	dB
Continuous time filter, DC gain 2 for TP4 far-end Minimum value Maximum value Step size	g_{DC2}	–3 –1 0.5	dB
Continuous time filter, zero frequency for $g_{DC} = 0$	f_z	12.58	GHz

Editor's Recommendation

Comment	Response
72	Accept, analysis/presentation is justification
115	Reject, limited justification
99	Reject, limited justification
98	AIP; accept editorial change of the TP1a style makes it easier to read. With 99 rejected, no justification requiring separate entries for short/long.

120G.3.4.3.2 Module stressed input test calibration

The stressed input signal is calibrated by the following procedure.

[. . .]

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.

#72

bbmax Value

Cl **120G** *SC* **120G.5.2** *P* **277** *L* **32** # 100

Dawe, Piers — Nvidia

Comment Type **TR** *Comment Status* **D** *EO RR bbmax*

My recent simulations don't use gDC as strong as the table allows, but occasionally, the first DFE tap hits the limit of 0.4

SuggestedRemedy

Increase bbmax(1) from 0.4 to 0.5, increase the minimum for gDC at TP1a and TP4 long far end.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
This comment does not apply to the substantive changes between IEEE P802.3ck D2.2 and D2.1 or the unsatisfied negative comments from previous drafts. Hence it is not within the scope of the recirculation ballot.
The comment provides only annecdotal evidence.
For task force discussion.

Proposal has 3 parts

- Increase bbmax(1) from 0.4 to 0.5
- Increase minimum gDC values for TP1a
  - No proposal given here
  - Done by Mike Dudek in comment 72
- Increase minimum gDC values for TP4
  - No proposal given here
  - Proposal given in comment 99

Table 120G–11—Eye opening reference receiver parameter values *(continued)*

Parameter	Symbol	Value	Units
Continuous time filter, pole frequencies	f_{p1} f_{p2}	20 28	GHz GHz
Continuous time filter, low-frequency pole/zero	f_{LF}	f_b / 40	GHz
Decision feedback equalizer (DFE) length	N_b	4	UI
Normalized DFE coefficient maximum limit $n = 1$ $n = 2$ $n = 3$ or 4	$bb_{max}(n)$	 0.4 0.15 0.1	 — — —
Normalized DFE coefficient minimum limit $n = 1$ $n = 2$ $n = 3$ or 4	$bb_{min}(n)$	 0.1 –0.15 –0.05	 — — —
One-sided noise spectral density	η_0	4.1×10^{-8}	V^2/GHz