P802.3ck D2.0
Clause/Annex 163, 163B, 120F
Comment Resolution

Phil Sun, Credo Semiconductor
Matt Brown, Huawei, 802.3ck Editor-in-Chief

Introduction

- This slide package provides information to assist in reviewing and closing comments against Clause 163 and Annexes 120F and 163B.

Comments Overview

Clause	Topic	Comments
163B	TP0a	22
120F	CM voltage	114
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163	RIT COM	138 [presentation anticipated]
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163B	ERL package	53

Comment [22]: TP0a

Cl **163B** *SC* **163B.1** *P* **297** *L* **12** # 22

Brown, Matt Huawei

Comment Type **E** *Comment Status* **D** *TP0a*

The test point name TP0a is now obsolete. References to TP0a in Annex 163B are also references to TP0v, but for a specific example.

SuggestedRemedy

In 163B.1 delete the second sentence.
In the first paragraph in 163B.2 change TP0a to TP0v.
In the heading of Table 163B-1, change TP0a to TP0v.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE. AIP.
Implement the suggested remedy. For task force review.
[Editor's note: Changed line from 297 to 12.]

163B.1 Overview

An example test fixture meeting the requirements for TP0v is described in this annex. In this example, the TP0v point is referred to as TP0a.

120F Comment #114

Cl **120F** *SC* **120F.3.1** *P* **219** *L* **10** # **114**

Ran, Adee Cisco

Comment Type **TR** *Comment Status* **D** *CM voltage*

The common mode voltage limits for C2C transmitter should have been changed to 1.0 V max and 0.2 V min, as in the KR transmitter (Table 163–5).

This change has been requested in comment #58 against D1.1, which was resolved with AIP, but for some reason the resolution was implemented only in clause 163 and not here.

(the response to that comment was:
ACCEPT IN PRINCIPLE.
The following presentation was reviewed by the task force:
http://www.ieee802.org/3/ck/public/20_03/ran_3ck_01a_0320.pdf
Implement the changes proposed on slides 4 and 5 in the referenced presentation, except set the cutoff frequency to 50 kHz and maximum common mode voltage of 1V. Implement with editorial license.")

SuggestedRemedy

Change the common mode limits to 1 V and 0.2 V, as in Table 163–5.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
In Table 120F-1…
Change "Common-mode voltage (max)" value to 1 V.
Change "Common-mode voltage (min)" value to 0.2 V.

Table 120F–1—Transmitter electrical characteristics at TP0v

Parameter	Reference	Value	Units
Signaling rate, each lane (range)		53.125 ± 50 ppm[a]	GBd
Differential peak-to-peak output voltage[b] (max) Transmitter disabled Transmitter enabled	93.8.1.3	 35 1200	 mV mV
Common-mode voltage[b] (max)	93.8.1.3	1.9	V
Common-mode voltage[b] (min)	93.8.1.3	0	V
AC common-mode output voltage[b] (max, RMS)	93.8.1.3	30	mV
Difference effective return loss, *dERL* (min)	120F.3.1.1	-3	dB

Table 163–5—Summary of transmitter specifications at TP0v

Parameter	Reference	Value	Units
Signaling rate		53.125 ± 50 ppm[a]	GBd
Differential pk-pk voltage (max)[b] Transmitter disabled Transmitter enabled	93.8.1.3	 30 1200	 mV mV
DC common-mode voltage (max)[b]	93.8.1.3	1.0	V
DC common-mode voltage (min)[b]	93.8.1.3	0.2	V
AC common-mode RMS voltage (max)[b]	93.8.1.3	30	mV
Difference effective return loss, *dERL* (min)	163.9.2.2	-3	dB

Slide 4 from ran_3ck_01a_0320.

March 2020 P802.3ck telephonic interim 4

Proposed changes (1)

- Change common mode voltage specifications in both Table 163–5 and Table 120F–1 as shown:

DC common-mode voltage (max.)[1]	93.8.1.3	~~1.9~~ 0.9	V
DC common-mode voltage (min.)[1]	93.8.1.3	~~0~~ 0.2	V

Note: Modified from 0.8
in suggested remedy

D1.1 comment #58

Cl **163** *SC* **163.9.1** *P* **175** *L* **35** # **58**

Ran, Adee Intel

Comment Type **T** *Comment Status* **A**

As was discussed in the January 2020 meeting there is interest in enabling DC-coupled channels in some applications (mainly backplane and C2C) when the two link partners support this operation. Avoiding AC coupling capacitors in the channels can help board design, improve signal integrity, and reduce costs, and it is becoming a common requirement.

Current channel specs refer back to 93.9.4 where it is stated that AC coupling capacitors may not exist between TP0 and TP5, but in that case some specifications may need modifications for interoperability (without stating the modifications explicitly). This leaves the burden of defining new Rx and Tx specifications to implementers and integrators - with no standard to assist them.

Indeed, the current transmitter specifications in 120F.3.1 and in 163.9.1 allow high common mode voltage up to 1.9 V, which is detrimental for DC coupling with modern CMOS devices. This high value is also not useful for Tx design with modern applications.

DC coupling can be supported by limiting the Tx common mode voltage to a more reasonable and useful range. If this is done, the existing specs may be useable without change for DC coupled channels (although receivers may still need special support for this).

This proposal is specific for KR and C2C specifications which require on-board AC coupling; CR and C2M have AC coupling in the cable and in the module, respectively, so they need a separate discussion.

SuggestedRemedy

In the transmitter characteristics tables of Clause 163 and Annex 120F, Change the Tx common mode voltage to be between 0.2 and 0.8 volts.

Additional content may be beneficial for the AC coupling subclauses. I intend to provide some text in a presentation, to complement the suggested Tx specs.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

The following presentation was reviewed by the task force:
http://www.ieee802.org/3/ck/public/20_03/ran_3ck_01a_0320.pdf

Implement the changes proposed on slides 4 and 5 in the referenced presentation, except set the cutoff frequency to 50 kHz and maximum common mode voltage of 1V. Implement with editorial license.

120F Comment #15

Cl **120F**	*SC* **120F.3.2.4**	*P* **225**	*L* **1**	**#** 15

Brown, Matt — Huawei

Comment Type **TR** *Comment Status* **D** *jitter tolerance*

In the exception list in 120F.3.2.4, the last exception (item d) is a repeat of an exception (item i) in 120F.3.2.3. Since 120F.3.2.4, is referencing 120F.3.2.3, the exception in item d is not required.

SuggestedRemedy

In 120F.3.2.4, delete the last exception (item d).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
For task force discussion.

120F.3.2.4 Receiver jitter tolerance

Receiver jitter tolerance is verified for each pair of jitter frequency and peak-to-peak amplitude values listed in Table 162–15. The test setup shown in Figure 93–12, or its equivalent, is used. The test channel meets the insertion loss requirement for Test 2 in Table 120F–5. The synthesizer frequency is set to the specified jitter frequency and the synthesizer output amplitude is adjusted until the specified peak-to-peak jitter amplitude for that frequency is measured at TP0v. The test procedure is the same as the one described in 120F.3.2.3, with the following exceptions:

a) No broadband noise is added.

b) The test channel COM, calculated per items d) through g) in 120F.3.2.3, is at least 3 dB.

c) For the COM parameter calibration described in 120F.3.2.3 item e), the test channel transmitter J_{RMS} and J4u values are measured with the jitter frequency and amplitude set according to Case F from Table 162–15.

d) ~~As an alternative to using the scrambled idle test pattern and measuring FEC symbol error ratio it is permissible to use the PRBS31Q pattern as described in 120.5.11.2.2 and bit error ratio testing. In this case the required bit error ratio is equal to the required FEC symbol error ratio divided by 10. Note that this requirement can be somewhat more stringent than using the scrambled idle test pattern and measuring FEC symbol error ratio, and therefore failing this test requirement with the PRBS31Q pattern does not necessarily imply a failure of the jitter tolerance test.~~

120F.3.2.3 Receiver interference tolerance

Receiver interference tolerance is defined by the procedure in Annex 93C with the exception that transmitter equalization is configured by management (see 120D.3.2.3) to the settings that provide the lowest FEC symbol error ratio. The receiver on each lane shall meet the FEC symbol error ratio requirement with channels matching the Channel Operating Margin (COM) and loss parameters for Test 1 and Test 2 in Table 120F–5. The following additional considerations apply to the interference tolerance test.

a) The test transmitter is constrained such that for any transmitter equalizer setting the differential peak-to-peak voltage (see 93.8.1.3) is less than or equal to 800 mV.

b) The ERL of the test channel measured at TP5 replica towards TPt meets the requirements in 120F.4.3.

c) The lower frequency bound for the noise spectral density constraints, f_{NSD1}, is 1 GHz.

d) In the calculation of COM, if the transmitter is a device with known s-parameters and transition time T_r, these parameters should be used instead of the transmitter package model in 93A.1.2. If a calibrated instrument-grade transmitter is used, the transmitter device package model $S^{(tp)}$ is omitted from Equation (93A–3) in the calculation of COM. The filtered voltage transfer function $H^{(k)}(f)$ calculated in Equation (93A–19) uses the filter $H_t(f)$ defined by Equation (93A–46), where Tr is calculated as $T_r = 1.09 \times T_{rm} – 4.32$ ps and T_{rm} is the measured 20% to 80% transition time of the signal at TP0v. T_{rm} is measured using the method in 120E.3.1.5. T_{rm} is measured with the transmitter equalizer turned off.

e) For the calculation of test channel COM, the following parameters are based on values measured from the test transmitter. The parameter SNR_{TX} is set to the measured value of SNDR with Np=11, the parameter R_{LM} is set to the measured value of R_{LM}, and the parameters A_{DD} and σ_{RJ} are calculated from the measured values of J4u and J_{RMS} using Equation (120D–10), and Equation (120D–11), respectively.

f) Other COM parameters are set according to the values in Table 120F–7.

g) COM is calculated using both Test 1 and Test 2 device package model transmission line lengths listed in Table 120F–7 on the receiver side. The value of COM is taken as the lower of the two calculated values.

h) The test pattern is the scrambled idle test pattern defined in 119.2.4.9.

i) As an alternative to using the scrambled idle test pattern and measuring FEC symbol error ratio it is permissible to use the PRBS31Q pattern as described in 120.5.11.2.2 and bit error ratio testing. In this case the required bit error ratio is equal to the required FEC symbol error ratio divided by 10. Note that this requirement can be somewhat more stringent than using the scrambled idle test pattern and measuring FEC symbol error ratio, and therefore failing this test requirement with the PRBS31Q pattern does not necessarily imply a failure of the interference tolerance test.

j) A test system with a fourth-order Bessel-Thomson low pass response with 40 GHz 3 dB bandwidth is to be used for measurement of the signal applied by the pattern generator and for measurements of the broadband noise.

Comment [138]: RIT COM

Cl **163** *SC* **163.9.3.4** *P* **192** *L* **9** # 138

Hidaka, Yasuo Credo Semiconductor, Inc.

Comment Type **TR** *Comment Status* **D** *RIT COM*

The equation "T_r = 1.09 * T_rm - 4.32 ps" remains unchanged since it was adopted for clause 111 in IEEE P802.3by project to account for TP0 - TP0a effect. (See https://www.ieee802.org/3/by/public/Jan16/ran_3by_01b_0116.pdf, slide 13.)

Correction of transition time by this equation is not valid any more, because the symbol rate has been doubled and the test point has been changed from TP0a to TP0v.

We should calibrate T_r at the signal source so that the reference transition time at TP0v including the effect of the reference package model and the test fixture matches to the measured transition time at TP0v.

When a BERT is used as TX, it is not necessary to calibrate the transition time at the signal source to match the measured transition time at TP0v, because it is easy to measure the transition time at the signal source (i.e. the BERT output) directly without the test fixture. Using the measured transition time directly at BERT output without calibration is more accurate and error free in comparison to calibrating the transition time at the signal source to match the measured transition time after the test fixture at TP0v.

Note that in the former specs, the correction of transition time must be used even if a BERT is used as TX, because the transition time must be measured at TP0a after the test fixture, not directly at the BERT output.

Note that this equation is not used in CR spec, because the transition time of the BERT output is directly measured without test fixture. This equation is also not used in OIF CEI spec, because the test point is equivalent to TP0, not TP0a in OIF CEI spec.

There is the same issue in 120F.3.2.3 step d.

SuggestedRemedy

Change step e as follows:

In the calculation of COM, if the transmitter is a device with known S-parameters and transition time Tr, these parameters should be used instead of the transmitter package model in 93A.1.2. If the transmitter is a calibrated instrument-grade transmitter, the transmitter device package model S^(tp) is omitted from Equation (93A–3), TP0 to TP0a trace or replica trace in Figure 93C-2 through Figure 93C-4 is omitted, and Tr in Equation (93A-46) is same as the measured 20% to 80% transition time Trm of the signal source using the test setup in Figure 93C-3 without TP0 to TP0a trace. If the transmitter is not a device with known S-parameters and transition time nor a calibrated instrument-grade transmitter, Tr in Equation (93A-46) is calibrated so that the reference 20% to 80% transition time Tr^(ref) calculated according to 163A.3.1.X matches to the measured 20% to 80% transition time Trm of the signal at TP0v using the test setup in Figure 93C-3 including TP0 to TP0v trace. The measured 20% to 80% transition time Trm is measured with the transmitter equalizer turned off and using the method in 120E.3.1.5.

Apply the same change as above to 120F.3.2.3 step d.

Add a new sub clause in 163A.3.1.X to calculate the reference 20% to 80% transition time Tr^(ref) using the following equation:

Tr^(ref) = T_80 - T_20 (163A-X)
u(t) = integral of h(tau)/T_b from -inf to t (163A-Y)
T_80 is a solution of u(t) = 0.8 * vf^(ref) in terms of t.
T_20 is a solution of u(t) = 0.2 * vf^(ref) in terms of t.

where
Tr^(ref) is the reference 20% to 80% transition time.
u(t) is the output step response.
T_80 is the time to reach 80% of the reference steady-state voltage.
T_20 is the time to reach 20% of the reference steady-state voltage.
T_b is the unit interval in ps.
vf^(ref) is the reference steady-state voltage calculated by Equation (163A-3).

Obtain the output pulse response, h(t), using Equation (93A-23) and Equation (93A-24) with H^(0)(f) from Equation (163A-2), where A_t and T_b are specified by the clause that invokes this method.
Obtain the output step response, u(t), by integrating h(t)/T_b from minus infinite to t using Equation (163A-Y).
From the output step response, find the time to reach 20% and 80% of the reference steady-state voltage vf^(ref) as T_20 and T_80, respectively.
From T_20 and T_80, calculate the reference 20% to 80% transition time Tr^(ref) using Equation (163A-X).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The equation "T_r = 1.09 * T_rm - 4.32 ps" is incorrect for the speed and test point defined in this spec.
Implement the suggested remedy with editorial license.
For task force discussion.

Comment [170]: channel IL

Cl **163** *SC* **163.10.2** *P* **195** *L* **49** # 170

Dawe, Piers Nvidia

Comment Type **T** *Comment Status* **D** *channel IL*

51.8 dB at 40 GHz, at least 23.3 dB beyond the loss at Nyquist and further filtered by the transmitter and receiver, is unlikely to affect performance and may exclude some acceptable channels which are good to 30 GHz then less good at 40.

SuggestedRemedy

Replace the straight part of the limit with one that curves down (with an f^2 term), with a reduced fmax.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The suggest remedy does not provide sufficient detail to implement.

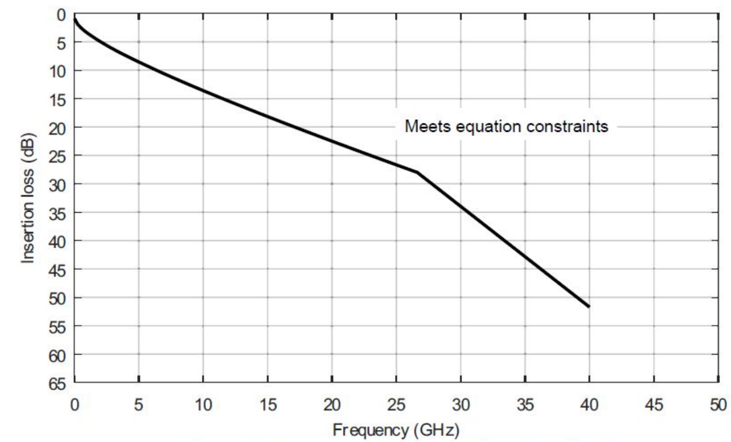

Figure 163–6—Channel insertion loss limit

Comment [17, 152, 16, 153] TP0a

Cl **163** *SC* **163.10** *P* **193** *L* **43** # 17

Brown, Matt Huawei

Comment Type **ER** *Comment Status* **D** *channel summary*

It would be beneficial to include a specification summary table for the KR channel similar to the Tables for KR TX (Table 120F-5), KR RX (Table 163-8), and CR Channel (Table 162-16). The text in 163.10 is not complete and can be replaced with a summary table.

SuggestedRemedy

Delete the current text in 163.10.
Create a new table similar to Table 162-16 to summarize the KR channel characteristics including related introductory text.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.
Resolve in conjunction with comment #16.
[Editor's note: CC: 120F, 163]

Cl **120F** *SC* **120F.4** *P* **225** *L* **49** # 16

Brown, Matt Huawei

Comment Type **ER** *Comment Status* **D** *channel summary*

It would be beneficial to include a specification summary table for the C2C channel similar to the Tables for C2C TX (Table 120F-1), C2C RX (Table 120G-4), and CR Channel (Table 162-16).

SuggestedRemedy

Create a new table similar to Table 162-16 to summarize the C2M channel characteristics including related introductory text.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.
Resolve in conjunction with comment #17.
[Editor's note: CC: 163, 120F]

Cl **163** *SC* **163.10** *P* **193** *L* **43** # 152

Kochuparambil, Beth Cisco

Comment Type **E** *Comment Status* **D** *channel summary*

Introduction to channel characteristics mention IL and ERL, but not COM.

SuggestedRemedy

Add "and COM 163.10.1" to the end of this paragraph.

Resulting sentence would read: "Channels shall meet the ERL requirements in 162.10.3 and COM requirements in 163.10.1."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #16 and #17.

Cl **120F** *SC* **120F.4** *P* **225** *L* **48** # 153

Kochuparambil, Beth Cisco

Comment Type **E** *Comment Status* **D** *channel summary*

There is no overview paragraph in the channel characteristics

SuggestedRemedy

Insert a similar paragraph to 163.10 with appropriate modifications. "Channels are recomments to meet… Channels shall meet..."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #16.

Comment [17, 152, 16, 153] Changes to 163

163.10 Channel characteristics

~~Channels are recommended to meet the insertion loss limits in 163.10.2. Channels shall meet the ERL requirement in 163.10.3.~~

Table 163–x provides a summary of the channel characteristics for 100GBASE-KR1, 200GBASE-KR2, and 400GBASE-KR4, and references to the subclauses addressing each parameter.

Table 163–x—Channel characteristics summary

Description	Reference	Value	Unit
Minimum COM	163.10.1	3	dB
Maximum insertion loss at 26.56 GHz (recommended)	163.10.2	28	dB
Minimum channel ERL	163.10.3	9.7	dB
Differential to common-mode return loss	163.10.4	Equation 163-5	dB
Differential to common-mode conversion loss	163.10.5	Equation 163-6	dB
Common-mode to differential conversion loss	163.10.6	Equation 163-6	dB
Maximum AC-coupling 3 dB corner frequency	163.10.7	50	kHz

Comment [17, 152, 16, 153] Changes to 120F

120F.4 Channel characteristics

Table 120F–x provides a summary of the channel characteristics for 100GAUI-1 C2C, 200GAUI-2 C2C, and 400GAUI-4 C2C interfaces, and references to the subclauses addressing each parameter.

Table 120F–x—Channel characteristics summary

Description	Reference	Value	Unit
Minimum COM	120F.4.1	3	dB
Maximum insertion loss at 26.56 GHz (recommended)	120F.4.2	20	dB
Minimum channel ERL	120F.4.3	9.7	dB
Differential to common-mode return loss	120F.4.4	Equation 163-5	dB
Maximum AC-coupling 3 dB corner frequency	120F.4.5	50	kHz

120F/163/163A Comments 54, 49, 55 (part 1)
ERL Example

Cl 163 *SC* 163.9.2.2 *P* 189 *L* 38 # 49

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D *ERL example*

No reference to Annex 163B which provide referene ERL

SuggestedRemedy

Please provide reference to CL 163B

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #54.

Cl 163 *SC* 163.9.3 *P* 190 *L* 16 # 55

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D *ERL example*

No reference to Annex 163B which provide referene ERL

SuggestedRemedy

Please provide reference to CL 163B

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #54.

Cl 120F *SC* 120F.3.1.1 *P* 220 *L* 22 # 54

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type TR *Comment Status* D *ERL example*

No reference to Annex 163B which provide referene ERL

SuggestedRemedy

Please provide reference to CL 163B and explain that dERL of -3 dB would mean in case of reference package ERL 9.95 dB

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
This subclause references the appropriate test methodology in 163A.3.2.2. The test fixture specification in 163.9.2.1, as referenced from 120F.2, points to the example test fixture in Annex 163B.
However, it might be helpful to refer to the reference parameters examples in Annex 163B from Annex 163A, as well.
After the first paragraph in 163A.3 and 163A.4, add a new paragraph as follows:
"An example test fixture and its reference values are provided in 163B.3."

163.9.2.2 Transmitter difference ERL

The difference ERL of the transmitter at TP0v is computed using the procedure in 163A.3.2.2 with the values in Table 163–7. Parameters that do not appear in Table 163–7 take values from Table 163–10. The value of T_{fx} is twice the delay from TP0 to TP0v.

The difference ERL at TP0v shall be greater than or equal to *dERL* (min) in Table 163–5.

163.9.3 Receiver characteristics

Receiver electrical characteristics are specified at TP5v. The receiver shall meet the specifications given in Table 163–8.

120F.3.1.1 Transmitter difference effective return loss (ERL)

The transmitter difference ERL at TP0v is computed using the procedure in 163A.3.2.2 with the values in Table 120F–2. Parameters that do not appear in Table 120F–2 take values from Table 120F–7. The value of T_{fx} is twice the delay from TP0 to TP0v.

Table 120F–2—Transmitter and receiver ERL parameter values

Parameter	Symbol	Value	Units
Transition time associated with a pulse	T_r	0.01	ns
Incremental available signal loss factor	β_x	0	GHz
Permitted reflection from a transmission line external to the device under test	ρ_x	0.618	—
Length of the reflection signal	N	200	UI
Equalizer length associated with reflection signal	N_{bx}	6	UI
Tukey window flag	*tw*	1	—

The difference ERL at TP0v shall be greater than or equal to *dERL* (min) specified in Table 120F–1.

120F/163/163A Comments 54, 49, 55 (part 2) ERL Example

163.9.2.1 Transmitter test fixture

Unless otherwise noted, measurements of the transmitter are made at the output of a test fixture (TP0v) as shown in Figure 163–3 and described in Annex 163A. An example test fixture is described in Annex 163B.

163.9.3.1 Receiver test fixture

Unless otherwise noted, measurements of the receiver are made at the input of a test fixture (TP5v) as shown in Figure 163–4.

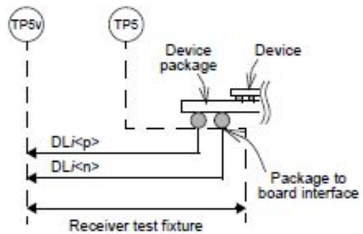

Figure 163–4—Receiver test fixture and test points

Receiver test fixture characteristics are the same as specified in 163.9.2.1.

120F.2 Compliance points

The electrical characteristics for the 100GAUI-1 C2C, 200GAUI-2 C2C, and 400GAUI-4 C2C interfaces are defined at test points as described in 163.9.2.1 and 163.9.3.1.

163A.3 Test methods for transmitters

Methods for determining the reference parameter values are specified in 163A.3.1. Parameter measurements and determination of the differences between measured and reference parameters are described in 163A.3.2. Specific pass/fail requirements for each parameter are specified by the clause that invokes these methods. An example test fixture and its reference values are provided in 163B.3.

163A.4 Test methods for receivers

Methods for determining the reference parameter values are specified in 163A.4.1. Parameter measurements and determination of the differences between measured and reference parameters are described in 163A.4.1.2. Specific pass/fail requirements for each parameter are specified by the clause that invokes these methods. An example test fixture and its reference values are provided in 163B.3.

Comment [53]: ERL package

Cl **163B** *SC* **163B.2** *P* **297** *L* **22** # 53

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type **TR** *Comment Status* **D** *ERL package*

We have provided reference ERL for only 31 mm package

SuggestedRemedy

Please also provide ERL data for the 12 mm package as well

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
[Editor's note: Change clause/subclause to 163B/163B.2.]
The methodology in 163A.4.1.1 and parameters from 163/120F require ERL reference to be calculate at two package lengths, however only one package length is provided in this example.
Add a sentence at the end of the first paragraph as follows:
"Although clauses using the TP0v methodology may require the ERL reference value to be calculate at more than one package length, only one is shown here."

163B.2 Characteristics

This example test fixture is defined using the PCB trace model in 162.11.7.1, with $z_p = 71$ mm, and parameter values in Table 162–19, with the exception that C_0 and C_1 are both 0. This results in a TP0 to TP0a insertion loss of 2.8 dB at 26.5625 GHz. The reference values are calculated for the transmitter characteristics of Clause 163. The reference transmitter device and package model uses the parameter values $T_r = 7.5$ ps, $f_r = 0.75 \times f_b = 39.8438$ GHz, $z_p = 31$ mm, and $A_v = 0.413$ V. The values of v_{peak} and v_f are calculated with $f_b = 53.125$ GBd and $N_v = 200$.

The insertion loss of the example test fixture is approximated by Equation (163–1) which is illustrated in Figure 163B–1.