What to do with TP0a and TP5a

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802.3ck Chief Editor

Thoughts on TP0v

KR/C2M Tx test fixture, draft 1.2

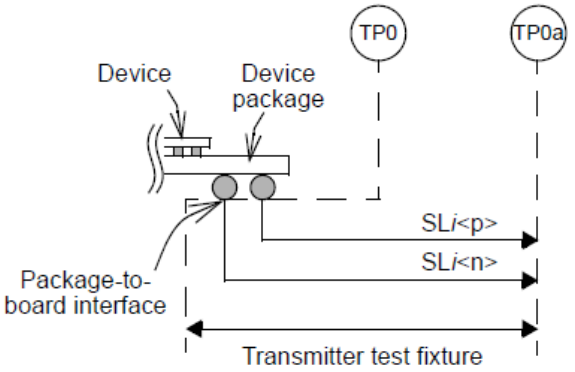

Figure 163–3—Transmitter test fixture and test points

163.9.1.2 Transmitter test fixture

Unless otherwise noted, measurements of the transmitter are made at the output of a test fixture (TP0a) as shown in Figure 163–3.

The insertion loss of the test fixture shall be between 1.2 dB and 1.6 dB at 26.56 GHz. The magnitude of the insertion loss deviation of the test fixture shall be less than or equal to 0.1 dB from 0.05 to 26.56 GHz.

The reference insertion loss of the test fixture is defined by Equation (163–1).

$$IL_{ref}(f) = 0.0037 + 0.1052\sqrt{f} + 0.0337f \qquad 0.05 \le f \le 53.125 \qquad (163\text{–}1)$$

where

$ILref(f)$	is the reference insertion loss in dB
f	is the frequency in GHz

The effects of differences between the insertion loss of an actual test fixture and the reference insertion loss are to be accounted for in the measurement. The reference insertion loss is illustrated in Figure 163–4.

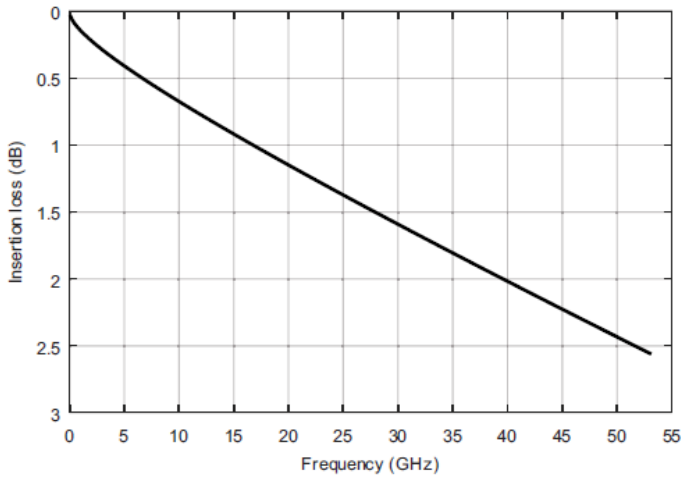

Figure 163–4—Test fixture reference insertion loss

The differential return loss of the test fixture shall meet Equ

$$RL_d(f) \ge \begin{cases} 20 - f & 0.05 \le f \le 5 \\ 15 & 5 < f \le 25 \\ 22.5 - 0.3f & 25 < f \le 53.125 \end{cases}$$

where

$RL_d(f)$	is the differential return loss of the test fixture in dB
f	is the frequency in GHz

The return loss limit is illustrated in Figure 163–4.

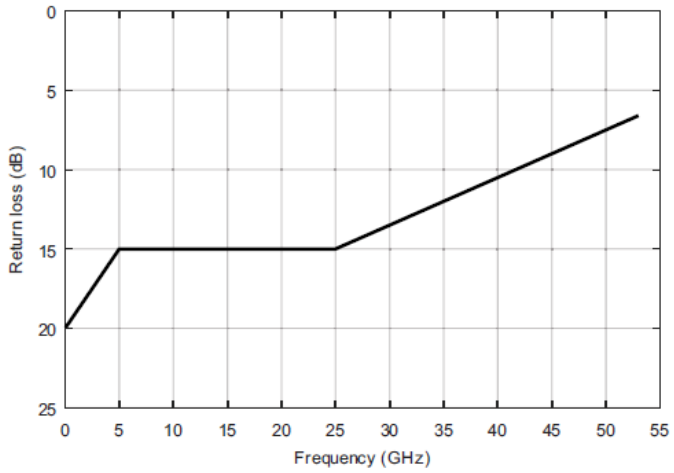

Figure 163–5—Test fixture reference return loss limit

The common-mode return loss of the test fixture shall be greater than or equal to 10 dB from 0.05 GHz to 26.56 GHz.

Draft 1.2 defined a Tx test fixture for KR and C2M from TP0 to TP0a.

Insertion loss was specified to be within a small range at Nyquist and close to a prescribed curve. Differences from the curve were “to be accounted for in the measurement”.

Differential and common-mode return loss were also specified.

Draft 1.2 comments

D1.2 comment #33/#153 request TP0a is to be replaced by TP0v.
The main differences are (a) the insertion loss may vary but must be less than specified max value and (b) methodologies were provided to account for the actual characteristics of the test fixture.
TP0a is to be retained as an informative specification (or example).

Cl **163** *SC* **163.9.1** *P* **177** *L* **26** # 33

Ben Artsi, Liav — Marvell Technology

Comment Type T *Comment Status* A *TP0v*

TP0a has been shown to be extremely difficult to be used as a point to measure Specified Tx compliance parameters.

SuggestedRemedy

Measurement to be done at a newly defined TP0v which may vary according to implementation.
A presentation will be provided with details, parameters values and method.

Response *Response Status* C

ACCEPT IN PRINCIPLE

The following presentations were reviewed:
http://www.ieee802.org/3/ck/public/20_07/benartsi_3ck_01_0720.pdf
http://www.ieee802.org/3/ck/public/20_07/heck_3ck_01a_0720.pdf

Strawpoll #1.
I support use of the TP0v methodology as proposed in benartsi_3ck_01_0720.
A: Yes
B: No
C: Need more information
Choose one.
A: 16 B: 1 C: 21

Implement using the contents of heck_3ck_01a_0720 with editorial license, with the following exceptions:
- on slide 9, in value column change 0 to TBD (3 times)
- use different annex, e.g., 163A

Cl **163** *SC* **163.9.1.2** *P* **178** *L* **52** # 153

Ran, Adee — Intel

Comment Type T *Comment Status* A *bucket2*

(Cross-clause)
The test feature normative insertion loss requirements are not realistic for real devices, especially with multiple lanes.

Also, as presented in http://www.ieee802.org/3/ck/public/20_01/mellitz_3ck_01a_0120.pdf, the variations allowed within the recommendations create significant variations in results of compliance parameters. This is obvisouly not a viable methodology anymore.

It is suggested to replace the test fixture requirements with an explicit equation describing s-parameters of a transmission line with 4 dB IL (using equation 93A–14 with appropriate parameters) such that TP0a is well-defined, and create informative specifications at this TP0a. Alternatively, informative specifications can be given at TP0.

Normaitve requirements should use a new methodology based on measued or extracted test fixture s-parameters.

Also applies to Annex 120F.

SuggestedRemedy

A presentation with more details will be provided.

Response *Response Status* C

ACCEPT IN PRINCIPLE.

This comment applies to both 163 and 120F.

The commenter is referring to the following presentation:
http://www.ieee802.org/3/ck/public/20_07/benartsi_3ck_01_0720.pdf

The new test point TP0v and related test fixture are adopted per the response to comment #33.

Retain the TP0a test point and test fixture specifications, but change to an informative specification.

Implement with editorial license.

Test fixture with TP0v specification

The TP0 to TP0v test fixture implement with IL limits at Nyquist, ILD up to Nyquist, ERL, and CMRL.

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.

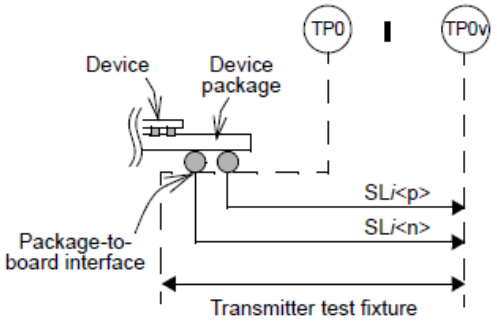

Figure 163–3—Transmitter test fixture and test points

163.9.2.1.1 Test fixture insertion loss

The insertion loss of the test fixture shall be less than 5 dB at 26.56 GHz. The magnitude of the insertion loss deviation of the test fixture shall be less than or equal to 0.2 dB from 0.05 to 26.56 GHz.

163.9.2.1.2 Test fixture effective return loss

ERL of the test fixture at TP0v is computed using the procedure in 93A.5 with the values in Table 163–6. Parameters that do not appear in Table 163–6 take values from Table 163–11.

Table 163–6—Test fixture 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	20	UI
Equalizer length associated with reflection signal	N_{bx}	0	UI
Twice the propagation delay associated with the test fixture	T_{fx}	0	ns
Tukey window flag	*tw*	1	—

163.9.2.1.3 Test fixture common-mode return loss

The common-mode return loss of the test fixture shall be greater than or equal to 10 dB from 0.05 GHz to 26.56 GHz.

Test fixture with TP0v example (TP0a)

Per D1.2 comment #153 the test fixture with TP0a specifications was retained as an example for a TP0 to TP0v test fixture.

163.9.2.2 Example transmitter test fixture (informative)

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

The insertion loss of the test fixture is between 1.2 dB and 1.6 dB at 26.56 GHz. The magnitude of the insertion loss deviation of the test fixture is less than or equal to 0.1 dB from 0.05 to 26.56 GHz.

The insertion loss of the test fixture is defined by Equation (163–1).

$$IL(f) = 0.0037 + 0.1052\sqrt{f} + 0.0337f \qquad 0.05 \le f \le 53.125 \qquad (163\text{–}1)$$

where

$IL(f)$ is the insertion loss in dB
f is the frequency in GHz

The insertion loss is illustrated in Figure 163–4.

Effective return loss and common-mode return loss meet the requirements in 163.9.2.1.

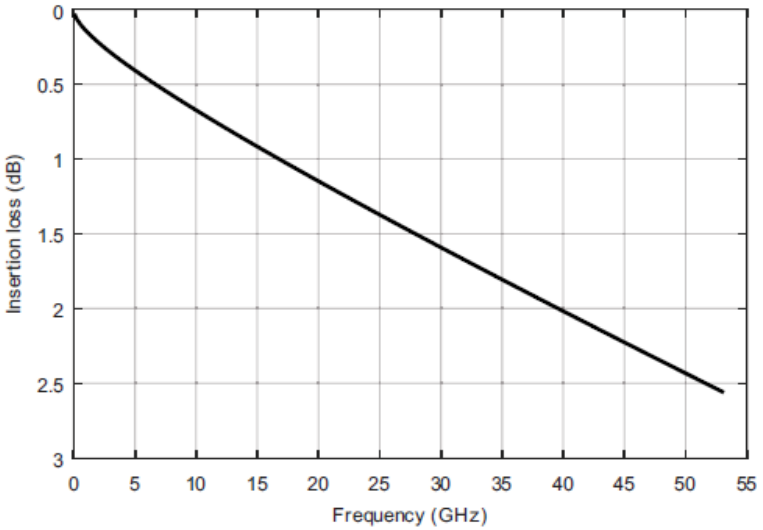

Figure 163–4—Test fixture reference insertion loss

When measured using this test fixture, the reference values determined according to the methodology in 163A.3 take values listed in Table 163–7.

Table 163–7—Summary of transmitter reference values at TP0a

Parameter	Reference	Value	Units
Effective return loss	163.9.2.3	TBD	dB
Transmitter steady-state voltage, v_f	162.9.3.1.2	TBD	V
Transmitter linear fit pulse peak, v_{peak}	162.9.3.1.2	TBD	V

Measurements using the transmitter

TP0v is located after the newly specified test fixture.

The variation in insertion loss of the TP0 to TP0v TF is accounted for by determining the expected output given a marginal reference transmitter according to the method specified in new Annex 163A.

For this scheme to be consistent with the previous TP0 to TP0a TF, the reference transmitter must be specified such that the calculated results at TP0v (bottom path) are the same as those we previously specified using the TP0 to TP0a. Once this translation is done, the previous TP0a specifications are moot.

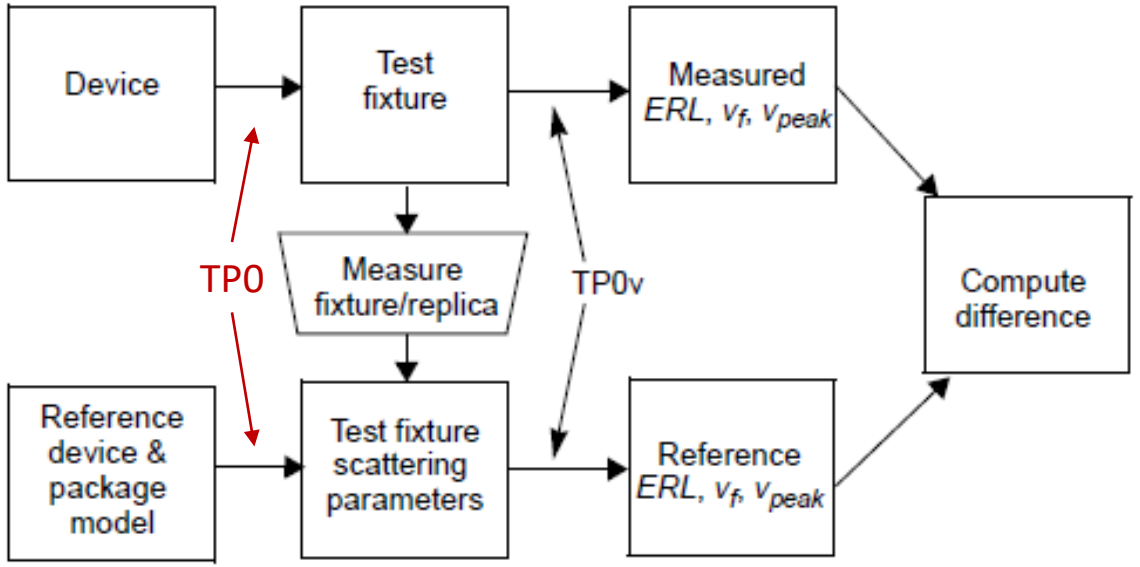

Figure 163A–1—Measurement method for transmitter reference steady-state voltage, pulse peak and ERL

Tx specifications for TP0v instead of TP0a

- In D1.2 when measured at TP0a
  - the values for KR transmitter are
    - v_{peak} (min): TBD
    - ERL (min): TBD
    - vf range : 0.4 to 0.6
  - the values for C2C transmitter are
    - v_{peak} (min): TBD
    - ERL (min): TBD
    - vf range : TBD
- So really, there's not much to reconcile.
  - Shouldn't v_f be pretty much independent of test fixture?

What to do with TP0a

- Once we determine the characteristics of the reference transmitter…
  - we are shifting the reference specifications from TP0a to TP0
  - for measurements we are translating them to TP0v
  - TP0a becomes moots and there is no value in retaining it
- Recommendation
  - Delete the example test fixture and any references to term TP0a
  - Define specifications based on requirements at TP0 and translate them to TP0v.

Thoughts on TP5v

KR/C2M Rx test fixture, draft 1.2 and 1.3

163.9.3.2 Receiver test fixture

Unless otherwise noted, measurements of the receiver are made at the output of a test fixture (TP5a) as shown in Figure 163–5.

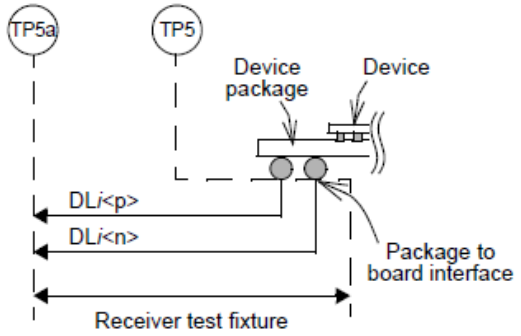

Figure 163–5—Receiver test fixture and test points

The insertion loss of the test fixture shall be between 1.2 dB and 1.6 dB at 26.56 GHz. The magnitude of the insertion loss deviation of the test fixture shall be less than or equal to 0.1 dB from 0.05 GHz to 26.56 GHz.

The reference insertion loss of the test fixture is defined by Equation (163–1). The effects of differences between the insertion loss of an actual test fixture and the reference insertion loss are to be accounted for in the measurement. The reference insertion loss is illustrated in Figure 163–4.

The differential return loss of the test fixture shall meet Equation (163–2). The return loss limit is illustrated in Figure 163–6.

The common-mode return loss of the test fixture shall be greater than or equal to 10 dB from 0.05 GHz to 26.56 GHz.

The RX test fixture (TF) for KR and C2M is defined from TP5a to TP5.

Insertion loss is specified to be within a small range at Nyquist and close to a prescribed curve. Differences from the curve were “to be accounted for in the measurement”.

Differential and common-mode return loss are also specified.

In D1.3, the Rx TF was not updated to align with the updated Tx TF.

KR/C2M Rx TF alignment with Tx TF

Change the Rx test fixture specification to align with the Tx test fixture specification as follows:

163.9.3.2 Receiver test fixture
Unless otherwise noted, measurements of the receiver are made at the input of a test fixture (TP5v) as shown in Figure 163–5 and as described in Annex 163A.

163.9.3.2.1 Test fixture insertion loss
The insertion loss of the test fixture shall meet the requirements in 163.9.2.1.1.

163.9.3.2.2 Test fixture effective return loss
ERL of the test fixture at TP5v shall meet the requirements in 163.9.2.1.2.

163.9.2.1.3 Test fixture common-mode return loss
The common-mode return loss of the test fixture shall meet the requirements in 163.9.2.1.3.

Replace references to TP5a with TP5v.

Replace receiver ERL specification with dERL specification used for Tx.

The stressed eye set already calibrates the RX fixture into the broader stressed input test fixture. So no changes are required there.

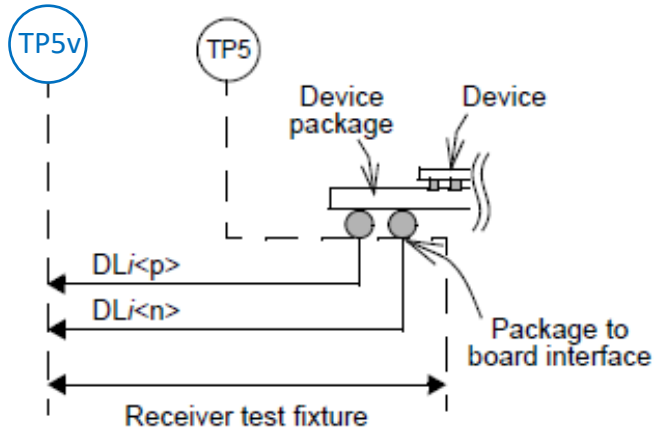

Figure 163–5—Receiver test fixture and test points

Note that the reference to Annex 163A relates to measurements like return loss. Setting up a stressed eye would be "otherwise noted" in the corresponding subclause.

The reference receiver package model would be the same as for the transmitter.

Conclusions

Conclusions

- Remove the Tx example test fixture and all remaining references to TP0a.
- Specify transmitter based on reference transmitter and specifications at TP0 and referred to TP0v.
- Align the Rx test fixture specifications with the new Tx test fixture specifications.

Thanks