Comment Summaries: 93A, Cross-clause editorial, TP0v

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IEEE P802.3ck Task Force
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CC 162/163/120F Editorial

Comment 49

Cl **162** *SC* **162.9.3** *P* **147** *L* **1** # 49

Ran, Adee Intel

Comment Type **T** *Comment Status* **D** *editorial*

Footnote d includes important information for measurement that should be stated in the test procedure, not as a comment on the table (it does not change the specification).

SuggestedRemedy

Delete footnote d and instead add an informative NOTE in 162.9.3.3 (which is referred to by clause 163 and should also be used for 120F).

Also delete footnote e in Table 163-5.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

[Editor's note: CC: 163, 120F]

Also apply the implementation to 163.9.2 (note e in Table 163-5) and to 120F.3.1.

Implementation:

Output jitter (max) J_{RMS} J3u Even-odd jitter, pk-pk[d]	 162.9.3.3 162.9.3.3 162.9.3.3	 0.023 0.115 0.019	 UI UI UI
Unit interval nominal		18.82353	ps

[a]Measurement uses the method described in 93.8.1.3 with the exception that the PRBS13Q test pattern is used.
[b]Implementations are recommended to use the same step size for all coefficients.
[c]Measurement uses the method described in 120D.3.1.6 with the exception that the linear fit procedure in 162.9.3.1.1 is used.

146

Draft Amendment to IEEE Std 802.3-2018 IEEE *Draft* P802.3ck/D1.3
IEEE P802.3ck 100 Gb/s, 200 Gb/s, and 400 Gb/s Electrical Interfaces Task Force 1st September 2020

~~[d]If the measuring instrument is triggered by a clock based on the signaling rate divided by an even number, the even-odd jitter may not be correctly observed.~~

Insert

Note: If the measuring instrument is triggered by a clock based on the signaling rate divided by an even number, the even-odd jitter may not be correctly observed.

162.9.3.1 Transmitter output waveform

The transmit function includes programmable equalization to compensate for the frequency-dependent loss of the channel and facilitate data recovery at the receiver. The functional model for the transmit equalizer on each lane is the five-tap transversal filter shown in Figure 162–3.

93A

Comment 27

Cl **93A** *SC* **93A.1** *P* **195** *L* **24** **#** 27

Healey, Adam Broadcom Inc.

Comment Type **E** *Comment Status* **D** *description*

What is a "pad" in this context and does the description really fit this parameter? Note that this change to the parameter name, should it persist, should be propagated to every COM parameter table in IEEE Std 802.3 and not just the ones created or modified by this amendment. This does not seem worthwhile since the change to the name does not add any descriptive value.

SuggestedRemedy

Remove "pad" from the description of this parameter (i.e., undo the change). Update Tables 162-18, 163-11, and 120F-7 accordingly.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy. Also change "single-ended device bump capacitance" to "single-ended bump capacitance".

[Editor's note: CC: 162, 163, 120F]

Implementation:

Table 93A–1—COM parameters

Parameter	Reference	Symbol	Units
Signaling rate	93A.1.1	f_b	GBd
Maximum start frequency	93A.1.1	f_{min}	GHz
Maximum frequency step	93A.1.1	Δf	GHz
Device package model Single-ended device ~~pad~~ capacitance[a] Single-ended device series inductance[a] Single-ended ~~device~~ bump capacitance[a] Transmission line length[a] Single-ended package capacitance at package-to-board interface[a] Transmission line characteristic impedance[a] Transmission line 2 length[a] Transmission line parameter, a_1[b] Transmission line parameter, a_2[b] Transmission line 2 characteristic impedance[a]	93A.1.2	 C_d L_s C_b z_p C_p Z_c z_{p2} a_1 a_2 Z_{c2}	 nF nH nF mm nF Ω mm $ns^{1/2}$/mm ns/mm Ω

Also apply the implementation to Table 162-18, Table 162-11, Table 120F-7.

Comment 233

Cl **93A**	*SC* **93A.1.2.1**	*P* **198**	*L* **3**	**#** 233

Dawe, Piers — Nvidia

Comment Type **T** *Comment Status* **D** *cascade*

Do we need to consider cascading 4-port networks?

SuggestedRemedy

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The comment is in the form of a question and there is not remedy provided.

Comment 234

Cl **93A** *SC* **93A.1.2.1** *P* **198** *L* **10** **#** 234

Dawe, Piers Nvidia

Comment Type **T** *Comment Status* **D** *cascade*

It may be helpful to the reader (particularly someone programming this function) to know that cascade() is associative.

SuggestedRemedy

Add a sentence:
cascade is associative: cascade(S(w), cascade(S(x), S(y))) = cascade(cascade(S(w), S(x)), S(y)).

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Although the forms shown in the suggested remedy are valid, they can be deduced from equations already provided.

TP0v: 163A/120F/163

Comments 29 & 62

Cl **163** *SC* **163.9.2** *P* **176** *L* **44** # 29

Healey, Adam Broadcom Inc.

Comment Type **T** *Comment Status* **D** *TP0v method*

The reference to 163A.3.2.2 is in danger of becoming circular. Annex 163A is mostly written to be generic and states that PHY/interface-specific parameters are "specified by the clause that invokes this method". However, no such specifications can be found in this clause, or in Annex 120F, that provides this information. This includes "test channel requirements", electrical characteristics used to compute S^(tp), values for Tr, fr, At, Tb, etc. One could assume that "test channel" requirements are given in the transmitter test fixture definition in 163.9.2.1, and the other values are the same as those used to compute COM from 163.10.1, but this should not be left to assumptions. It is unclear whether test 1 or test 2 (or test 1 AND test 2) characteristics for S^(tp) should be used and clarity on this point needs to be provided.

SuggestedRemedy

Add a new subclause to Clause 163 and change the reference for "dERL", "dvf", and "dvpeak" to this new subclause. The content of this subclause should be specifications for the PMD/interface-specific parameters that Annex 163A says are to be defined by the "clause that invokes this method". Similar changes would be necessary for Annex 120F.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Resolve using the response to comment #62.
[Editor's note: CC: 163, 120F]

Cl **163** *SC* **163.9.2** *P* **176** *L* **48** # 62

Ran, Adee Intel

Comment Type **T** *Comment Status* **D** *TP0v method*

dv_f and dv_peak refer directly to 163A.3.2.1, but some parameters are missing for the calculations:

A_t - should be taken from table 163-11 (or specify as the value 0.4 V)
z_p - should be the maximum value from table 163-11

SuggestedRemedy

Add a subclause under 162.9.2 (similar to 163.9.2.3 for dERL) to define the calculation of dv_f and dv_peak; in that subclause, point to 163A.3.2.1 and supply the required parameters as in the comment.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement suggested remedy under 163.9.2 with editorial license.
For task force discussion
[Editor's note: CC: 163, 120F]

Implementation: Insert 163.9.2.1 with definitions and values or calculations (as appropriate) for T_r, f_r, A_t, T_b, dv_f, dv_peak, & test fixture. Specify reference package conditions (1, 2, or both).

Comment #205

Cl **163A** *SC* **163A.1** *P* **280** *L* **47** # 205

Wu, Mau-Lin MediaTek

Comment Type **T** *Comment Status* **D** *TP0v method*

By adopting "TP0v" test fixture methodology, not only ERL, vf, vpeak, but also AC common-mode RMS voltage shall be scaled by IL of TP0v test fixture.

SuggestedRemedy

If we take the V_ACCM as the notation for "AC common-mode RMS voltage", propose to change the blocks of "Measured ERL, V_f, V_peak" & "Reference ERL, V_f, V_peak" in Figure 163A-1 to "Measured ERL, V_f, V_peak, V_ACCM" & "Reference ERL, V_f, V_peak, V_ACCM".
The paragraphs in Annex 163 related to this change shall be modified accordingly. Some new paragraphs may need if necessary.
Plan to provide one contribution, wu_3ck_01_1120.pdf, for more details.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

The proposed remedy is not sufficiently complete to implement.
Pending presentation and task force discussion.
[Editor's note: Add presentation URL.]

Also refer to
https://www.ieee802.org/3/ck/public/adhoc/sept09_20/wu_3ck_adhoc_01_090920.pdf

Comment #205 – How to derive V_{ACCM} at TP0v

- Take V_{ACCM} as the notation for "AC common-mode output voltage"
- Procedures to derive dV_{ACCM}
- Define V_{ACCM} at source (Device TX out or TP0, TBD) as TBD mV
- Derive reference V_{ACCM} based on Equation (TBD)
  - Equation is TBD
- Measured V_{ACCM} at TP0v
- Calculate difference between measured and reference AC common-mode output voltage (max), dV_{ACCM} as
  - Measured V_{ACCM} – reference V_{ACCM}

- Proposals
- Define V_{ACCM} at source (Device TX out or TP0, TBD) as TBD mV
- Change the blocks in Figure 163A-1
  - Measured **ERL**, V_f, V_{peak} → Measured **ERL**, V_f, V_{peak}, V_{ACCM}
  - Reference **ERL**, V_f, V_{peak} → Reference **ERL**, V_f, V_{peak}, V_{ACCM}
- The paragraphs in Annex 163 related to this change shall be modified accordingly
  - Some new paragraphs may need
  - Editorial license

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https://www.ieee802.org/3/ck/public/20_10/ wu_3ck_01_1020.pdf

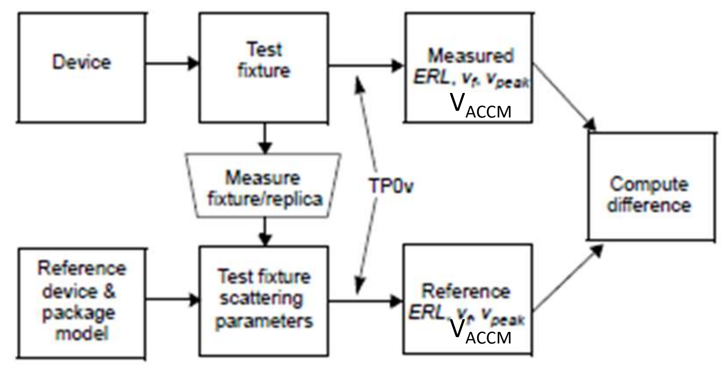


Figure 163A–1—Measurement method for transmitter reference steady-state voltage, pulse peak and ERL

Comment #30

Cl **163A** *SC* **163A.2** *P* **281** *L* **4** # 30

Healey, Adam Broadcom Inc.

Comment Type **E** *Comment Status* **D** *TP0v method*

The "test channel" requirements are not defined by the clause that invokes this method but "test fixture" requirements might be. It seems like this is the only place "transmitter test channel" or "test channel" are used. The same entity is referred to as the "TP0-TP0v channel" in 163A.3.1.

SuggestedRemedy

Change the title of 163A.2 to "Test fixture" and replace its contents with the following: "The test fixture is between test points TP0 and TP0v as shown in Figure 163A-2. Test fixture requirements are specified by the clause that invokes this method."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Implementation:

163A.2 ~~Test points~~ Test fixture

~~The transmitter test channel is defined between test points TP0 and TP0v in the transmitter test fixture, and is depicted in Figure 163A–2. The test channel requirements are specified by the clause that invokes this method.~~

The test fixture is between test points TP0 and TP0v as shown in Figure 163A-2. Test fixture requirements are specified by the clause that invokes this method.

Comment #128

Cl **163A** *SC* **163A.2** *P* **281** *L* **3** **#** 128

Hidaka, Yasuo Credo Semiconductor

Comment Type **T** *Comment Status* **D** *TP0v method*

TP0 is the interface between Transmitter package ball and PCB as shown in Figure 163-3. TP0 is not stable for measurement, because TP0 is highly non-TEM mode. A replica test fixture may have a test point corresponding to TP0, but this cannot be exactly same as TP0 due to the difficulty of measurement at TP0. In order to remind this difference, we should make the label of the test point for replica test fixture different from TP0.
We should not assume replica test fixture is same as actual test fixture.
Also for clarification, I suppose we should differentiate the label of TP0v between the test fixture attached to DUT and the replica test fixture.

SuggestedRemedy

Use TP0r and TP0vr as the labels for the test points where the replica test fixture may be used.

Proposed Response *Response Status* **W**

PROPOSED REJECT.

Defining different test point labels is not necessary or helpful. The suggested remedy does not add clarity to the specification.

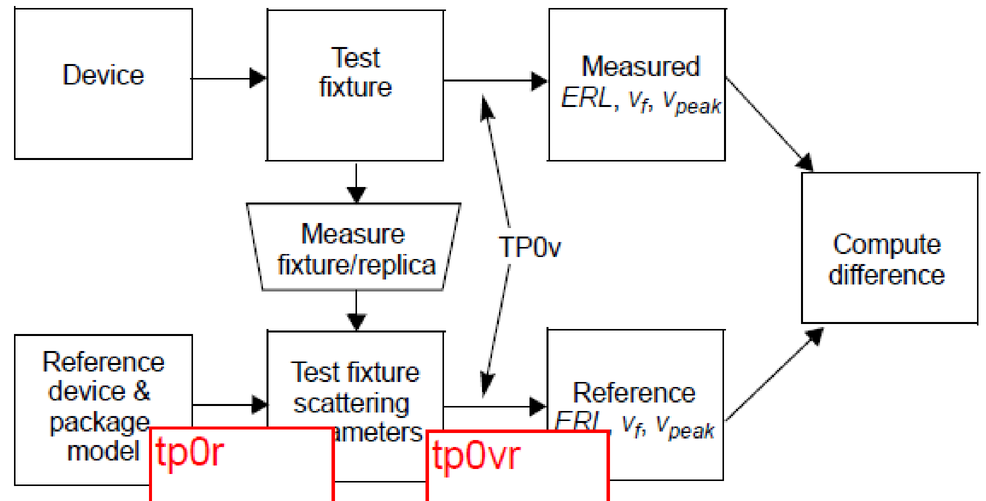


Figure 163A–1—M meth mitter reference steady-state voltage, pulse peak and ERL

Comment #35

Cl **163A** *SC* **163A.3.1** *P* **281** *L* **25** *#* 35

Healey, Adam Broadcom Inc.

Comment Type **T** *Comment Status* **D** *TP0v method*

In Figure 163A-2, termination resistance at TP0v should represent an instrument and not a device (i.e., it should be the reference resistance R_0 and not the device resistance R_d).

SuggestedRemedy

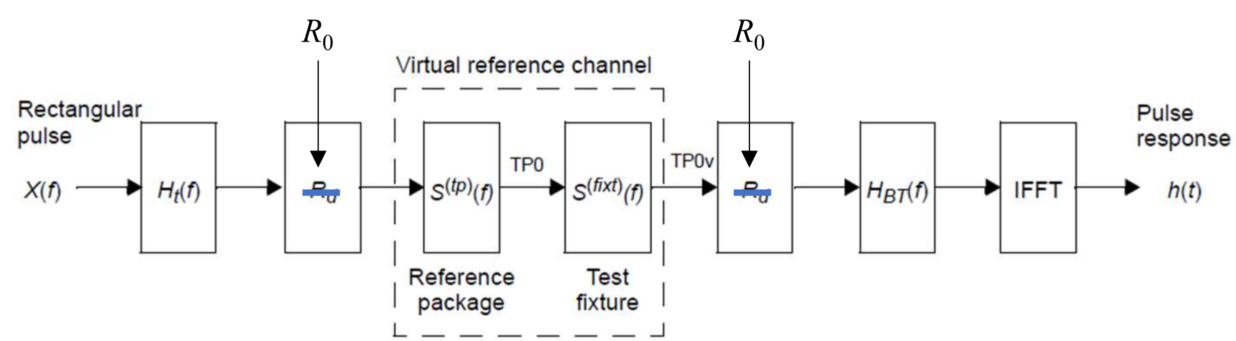
Replace "R_0" with "R_d".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Implementation:



NOTE—The transmitter reference package uses the maximum length specified by the referring subclause.

Figure 163A–2—Configuration for transmitter reference steady-state voltage, pulse peak and ERL

Comment #58

Cl **163A** *SC* **163A.3.1** *P* **281** *L* **40** # 58

Ran, Adee Intel

Comment Type **T** *Comment Status* **D** *TP0v method*

"The scattering parameters for the reference package, S(tp), are determined using the method in 93A.1.2, with electrical characteristics specified in the clause that invokes this method"

Typically there are two reference package for the Tx and two possibly other ones for the Rx. It is not stated which one should be used.

A DUT should be allowed to be as "bad" as the worst of the two reference packages for any of the parameters.

Editorially it seems that this should be stated separately in 163A.3.1.1 for v_peak and v_f and in 163A.3.1.2 for ERL (although the same rule applies in both cases).

SuggestedRemedy

Add a sentence in 163A.3.1.1 after the paragraph "The reference pulse response peak (...) is the peak value of h(t)"

such as the following:

"If the invoking clause lists more than one set of reference package parameters, the calculation is performed with each set, and the minimum value is used as the reference value."

Add a similar sentence at the end of 163A.3.1.1 (after the definition of v_f(ref)) and at the end of 163A.3.1.2 (for ERL reference).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Implementation:

The reference pulse response peak, $v_{peak}^{(ref)}$, is the peak value of *h(t)*.

From the output pulse response calculate the reference value for the transmitter output steady state voltage, $v_f^{(ref)}$, using Equation (163A–3).

$$v_f^{(ref)} = \sum_{i=0}^{n_v} h(t-(i \cdot t_b)) \quad (163A\text{–}3)$$

where

t_b is the unit interval in ps

N_v represents the number of symbols to take into account and has the same value as for the measured steady-state voltage in 162.9.3.1.2.

163A.3.1.2 Effective return loss reference value

Effective return loss (ERL) is defined in 93A.5. The ERL reference value is determined as follows. Obtain the pulse time-domain reflection (PTDR) response from $S^{(0)}$ using Equation (93A–58) and Equation (93A–59). Determine the ERL reference value from the PTDR response using the method in 93A.5.2.

Insert the following text at the locations marked with the arrows above.

If the invoking clause lists more than one set of reference package parameters, the calculation is performed with each set, and the minimum value is used as the reference value.

Comment #139

Cl **163** *SC* **163.A.3.1** *P* **281** *L* **25** # 139

Ghiasi, Ali Ghiasi Quantum/Inphi

Comment Type **TR** *Comment Status* **D** *TP0v method*

Why is the cascaded reference package with test fixture called virtual reference channel, shouldn't this be the DUT reference channel? When testing a real device the package will be DUT package, using reference is confusing as it could imply IEEE COM reference package.

SuggestedRemedy

Repalce virtual with DUT, and replace reference package with DUT package

Proposed Response *Response Status* **W**

PROPOSED REJECT.

IEEE specifies interfaces not devices, and the term DUT is not used.

Comment #277 & 278

Cl **163A** *SC* **163A.3.1** *P* **281** *L* **22** **#** 277

Dawe, Piers Nvidia

Comment Type **T** *Comment Status* **D** *TP0v method*

I don't like the term "virtual reference channel". It's no more unreal than the other blocks in this figure. I didn't find any other "reference channel" in this draft.

SuggestedRemedy

Change its name to "reference channel" or "reference test channel" throughout.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Cl **163A** *SC* **163A.3.1** *P* **281** *L* **31** **#** 278

Dawe, Piers Nvidia

Comment Type **T** *Comment Status* **D** *TP0v method*

The material in the NOTE needs to be normative.

SuggestedRemedy

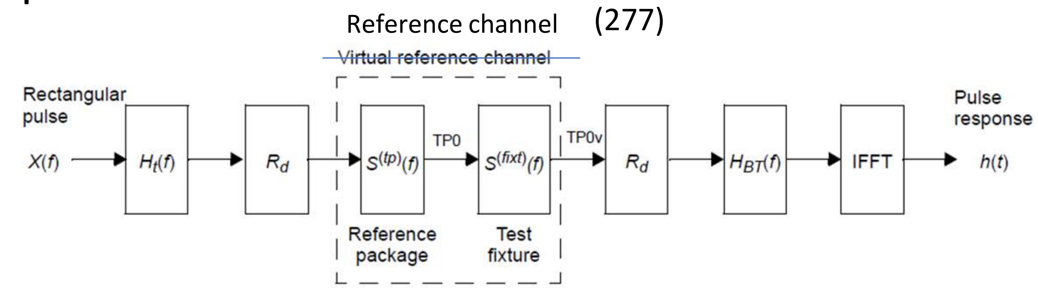
Move it to regular text at line 42

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Implementation:



~~NOTE—The transmitter reference package uses the maximum length specified by the referring subclause.~~

Figure 163A–2—Configuration for transmitter reference steady-state voltage, pulse peak and ERL

Insert
(278)

Note: The transmitter reference package uses the maximum length specified by the clause that invokes this method.

Measure the scattering parameters of the TP0-TP0v channel for the device and lane under test, $S^{(fixt)}$, using the method specified in 93A.1.1.

Comment #36

Cl **163A**	*SC* **163A.3.1.1**	*P* **281**	*L* **48**	# 36

Healey, Adam — Broadcom Inc.

Comment Type **T** *Comment Status* **D** *TP0v method*

Equation (93-17) defines GAMMA1 and GAMMA2 to be equal and furthermore a function of Rd. The termination at the TP0v should represent an instrument load and therefore would be better defined to be R0 independent of Rd.

SuggestedRemedy

Change the first paragraph of 163A.3.1.1 to the following: "Calculate the voltage transfer function, H_21(f) from the scattering parameters of the virtual reference channel, S^(0), using Equation (93A-18) where GAMMA1 is given by Equation (93A-17) and GAMMA2 is set to 0. In Equation (93A-17), the single-ended reference resistance R_0 is set to 50 [Ohms] and the single-ended termination resistance, R_d, specified by the clause that invokes this method."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

Implementation:

163A.3.1.1 Steady-state voltage and pulse peak reference values

~~Calculate the voltage transfer function, $H_{21}(f)$, of the terminated virtual reference channel from $S^{(0)}$ using Equation (93A–17) and Equation (93A–18) with the reference impedance, R_0, set to 50 Ω and the single-ended termination, R_d, specified by the clause that invokes this method.~~

Calculate the voltage transfer function, $H_{21}(f)$ from the scattering parameters of the virtual reference channel, $S^{(0)}$, using Equation (93A-18) where Γ_1 is given by Equation (93A-17) and Γ_2 is set to 0. In Equation (93A-17), the single-ended reference resistance R_0 is set to 50 ohms and the single-ended termination resistance, R_d, specified by the clause that invokes this method.

Comment #39

Cl **163A**	*SC* **163A.3.1.1**	*P* **282**	*L* **25**	*#* 39

Healey, Adam — Broadcom Inc.

Comment Type **T** *Comment Status* **D** *TP0v method*

The annex is mostly written to be generic so citing the specific value for N_v defined in 162.9.3.1.2 seems out of place. Will the same value of N_v apply to future clauses that may employ this method?

SuggestedRemedy

Change the definition of N_v to the following: "represents the number of symbols to include in the steady state voltage calculation". Add a sentence that the value of N_v is defined by the clause that invokes this method.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggsted remedy with editorial license.

Implementation:

$$v_f^{(ref)} = \sum_{i=0}^{n_v} h(t-(i \cdot t_b)) \quad (163A\text{–}3)$$

where

t_b is the unit interval in ps

N_v ~~represents the number of symbols to take into account and has the same value as for the measured steady-state voltage in 162.9.3.1.2.~~

Represents the number of symbols to include in the steady state voltage calculation. The value of N_v is defined by the clause that invokes this method.

Comment #37

CI 163A SC 163A.3.1.2 P 282 L 30 # 37

Healey, Adam Broadcom Inc.

Comment Type T *Comment Status* D *TP0v method*

Equation (93A-58) and Equation (93A-59) do not calculate the PDTR response from S^(0). There is an additional step required to obtain the reflection coefficient s_ii(f) for the case where R_d is not equal to R_0. Also, the value of T_fx should be 0.

SuggestedRemedy

Replace the contents of 163A.3.1.2 with the following: "The reference reflection coefficient at TP0v is given by Equation (93A-7) where [s_22]^(x) is GAMMA1 as defined by Equation (93A-17) and [s_ii]^(y) are the components of the scattering matrix of the virtual reference channel S^(0). In Equation (93A-17), the single-ended reference resistance R_0 is set to 50 [Ohms] and the single-ended termination resistance, R_d, specified by the clause that invokes this method. The referece pulse time-domain reflection (PTDR) response is computed from the referece reflection coefficient at TP0v using Equation (93A–58) and Equation (93A–59). The reference ERL value is determined from the reference PTDR response using the method in 93A.5.2 with T_fx set to 0 and other parameters specified by the clause that invokes this method."

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Implementation:

163A.3.1.2 Effective return loss reference value

~~Effective return loss (ERL) is defined in 93A.5. The ERL reference value is determined as follows. Obtain the pulse time-domain reflection (PTDR) response from $S^{(0)}$ using Equation (93A-58) and Equation (93A-59). Determine the ERL reference value from the PTDR response using the method in 93A.5.2.~~

The reference reflection coefficient at TP0v is given by Equation (93A-7) where $s_{22}^{(x)}$ is Γ_1 as defined by Equation (93A-17) and $s_{ii}^{(y)}$ are the components of the scattering matrix of the ~~virtual~~ reference channel $S^{(0)}$. In Equation (93A-17), the single-ended reference resistance R_0 is set to 50 Ohms and the single-ended termination resistance, Rd specified by the clause that invokes this method. The reference pulse time-domain reflection (PTDR) response is computed from the reference reflection coefficient at TP0v using Equation (93A–58) and Equation (93A–59). The reference ERL value is determined from the reference PTDR response using the method in 93A.5.2 with ~~T_{fx} set to 0 and other~~ parameters specified by the clause that invokes this method.

Comment #59

Cl **163A** *SC* **163A.3.2.2** *P* **283** *L* **12** # 59

Ran, Adee Intel

Comment Type **E** *Comment Status* **D** *TP0v method*

Both ERL(ref) and ERL(meas) in equation 163A-6 are undefined terms.

SuggestedRemedy

Add below the equation

"Where
ERL(ref) is the ERL reference value defined in 163A.3.1.2
ERL(meas) is the measured Effective return loss"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.

Implement the suggested remedy with editorial license.

Implementation:

163A.3.2.2 Effective return loss

Measure the effective return loss using the method defined in 93A.5.

The difference between the measured and reference ERL, *dERL*, is calculated using Equation (163A–6).

$$dERL = ERL^{(meas)} - ERL^{(ref)} \tag{163A–6}$$

where	$ERL^{(\text{ref})}$ is the ERL reference value defined in 163A.3.1.2 $ERL^{(\text{meas})}$ is the measured effective return loss