802.3ck D2.2 Comment Resolution 163, 163A, 163B

Phil Sun, Credo
Howard Heck, Intel

163/120F Channel ERL Comment 57, 58

Cl **163** *SC* **163.10.1** *P* **215** *L* **9** # 57

Mellitz, Richardd — Samtec

Comment Type **TR** *Comment Status* **D** *Channel ERL (CC)*

Table 162-7 has a note for ERL "Cable assemblies with a COM greater than 4 dB are not required to meet minimum ERL". The same should apply to Table 163-10 channels for the same reason it was include included in table 162-2

SuggestedRemedy

For the entry "minimum channel ERL" add a note: "Channels with a COM greater than 4 dB are not required to meet minimum ER."

Proposed Response *Response Status* **W**

PROPOSED REJECT.
Comment #58 requests a similar change for the C2C channel characteristics.
The comment likely was intending to refer to Table 162-17 rather than Table 162-7.
The footnote a in Table 162-17 was inherited from Clause 136 in 802.3cd-2018. The footnote in Table 136-16 was added in 802.3cd Draft 3.3 per Draft 3.2 comment #r02-23.
https://www.ieee802.org/3/cd/comments/8023cd_D32_comment_received_by_clause.pdf
The comment does not provide sufficient evidence to make the proposed change.
[CC: 163, 120F]

Cl **120f** *SC* **120f.4** *P* **249** *L* **15** # 58

Mellitz, Richardd — Samtec

Comment Type **TR** *Comment Status* **D** *Channel ERL (CC)*

Table 162-7 has a note for ERL "Cable assemblies with a COM greater than 4 dB are not required to meet minimum ERL". The same should apply to Table 120F-7 channels for the same reason it was include included in table 162-2

SuggestedRemedy

For the entry "minimum ERL" add a note: "Channels with a COM greater than 4 dB are not required to meet minimum ER."

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.
Resolve using the response to comment #57.

Cl **136** *SC* **136.11** *P* **231** *L* **36** # r02-23

Mellitz, Richard — Samtec, Inc.

Comment Type **TR** *Comment Status* **X**

It does not seem reasonable that cable assemblies with good COM margin be subject to ERL specifications.

SuggestedRemedy

In Table 136-16 page 231 add a note: Cable assemblies with a COM greater than 4 dB are not required to meet minimum ERL.
Change line 28 on page 232 to Cable assembly ERL at TP1 and at TP4 shall be greater than or equal to 11 dB for cable assemblies that have a COM less than 4 dB.

Proposed Response *Response Status* **O**

163 ERL Parameter Comment 70

Cl **163** *SC* **163.9.2.1.2** *P* **209** *L* **15** # 70

Healey, Adam — Broadcom Inc.

Comment Type **T** *Comment Status* **D** *ERL parameter*

In Table 163-6, N is set to 20 UI but this seems to be too small given the 5 dB insertion loss allowance for the test fixture given in 163.9.2.1.1. Using the transmission line parameters in Table 162-20, a transmission line with 5 dB loss at 26.6 GHz can have a propagation delay almost twice N (and therefore a round-trip delay almost four times N). The significance of the N value is that reflections with delay larger than N are not considered in the ERL value. The N value should be extended so that all reflections added by the longest test fixtures allowed by the standard are counted in the ERL value. There is no obvious downside to increasing this value.

SuggestedRemedy

Change the "length of the reflection signal" N to 200.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
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.
However, the proposed change is an improvement to the draft.
Implement the suggested remedy.

163 TF RLcc
Comment 79, 14

Cl **163** SC **163.9.2.1.3** P **209** L **27** # 79

Dudek, Mike — Marvell

Comment Type **T** *Comment Status* **D** *TF RLcc*

As is stated in the editor's note the existing specification on the test fixture is not adequate to test the DUT. There is no reason that this test fixture can't use high quality RF connectors and therefore a significantly better performance should be obtainable.

SuggestedRemedy

Change 2 dB to 6dB.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement suggested remedy.
Remove the editor's note.
For task force review.

Cl **163** SC **163.9.2.1.3** P **209** L **33** # 14

Lusted, Kent — Intel Corporation

Comment Type **ER** *Comment Status* **D** *TF RLcc*

There is an editor's note to be removed in the next draft, pending improvements to the test fixture specification.

SuggestedRemedy

Resolve the test fixture improvements and remove the editor's note

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the result of comment #79.

163.9.2.3 Transmitter common-mode to common-mode return loss

The common-mode to common-mode return loss shall be greater than or equal to *RLcc* (min) in Table 163–5 at all frequencies between 0.2 GHz and 40 GHz.

Common-mode to common-mode return loss, *RLcc* (min)	163.9.2.3	3.25	dB

Observation: transmitter has a tighter RLcc limit than its test fixture in existing draft.

163 TX ISI_RES Comment 71

Cl **163** *SC* **163.9.2.6** *P* **210** *L* **38** # 71

Healey, Adam — Broadcom Inc.

Comment Type **T** *Comment Status* **D** *TX ISI_RES*

The ISI_RES metric does not discriminate between the ISI caused by the test fixture and the ISI intrinsic to the transmitter under test. We are only interested in the latter and the impact of the test fixture should be considered. The test fixture impact is considered in ERL measurements by calculating the difference between the expected ERL and the measured ERL where the expected ERL is computed using a reference transmitter model and a measurement of the test fixture. It seems a similar process could be used to compute the difference between an expected ISI_RES and measured ISI_RES. However, effectiveness of such a process, or other processes, has not yet been demonstrated. At a minimum, it seems that a note like the one in 120D.3.1.7 (which defines a similar measurement for a similar purpose) should be included to advise users of the impact of the test fixture and encourage users to mitigate the impact.

SuggestedRemedy

Add the following note to the end of 163.9.2.6:
"NOTE- The observed ISI_RES can be significantly influenced by the measurement setup, e.g., reflections in cables and connectors. Careful calibration of the measurement setup is recommended."

Also change the title of 163.9.2.6 to "Residual intersymbol interference" (remove the hyphen per <https://www.ieee802.org/3/WG_tools/editorial/requirements/words.html>).

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy.
[Editor's note: Changed page from 211 to 210.]

163.9.2.6 Residual inter-symbol interference

Residual intersymbol interference *ISI_RES* is determined using Equation (163–1). The linear fit pulse response $p(k)$ and error $e(k)$ are determined using the linear fit procedure in 162.9.3.1.1 with the exception that $N_p = 11$.

$$ISI\_RES = 20\log_{10}\left(\frac{\sigma_e}{p_{max}}\right) \quad (163\text{–}1)$$

where

ISI_RES	is the residual intersymbol interference in dB
σ_e	is the standard deviation of linear fit error $e(k)$
p_{max}	is the maximum value of linear fit pulse response $p(k)$

The residual intersymbol interference shall meet the specification *ISI_RES* (max) in Table 163–5.

120D.3.1.7 Transmitter output residual ISI

SNR_{ISI} is defined by Equation (120D–9) computed from p_{max} and $ISI_{cursors}$ after these have been re-calculated with the continuous time filter described in 93A.1.4.3 using the parameters in Table 120D–8 applied and optimized for maximum SNR_{ISI}. The SNR_{ISI} specification shall be met for all transmit equalization settings.

$$ISI_{cursors} = [p(t_p + M \times (N_b + 1)), p(t_p + M \times (N_b + 2)), \ldots, p(t_p + M \times (N_p - D_p - 1))] \quad (120D\text{–}8)$$

$$SNR_{ISI} = 20\log_{10}\left(\frac{p_{max}}{\sqrt{\sum(ISI_{cursors}^2)}}\right) \quad (120D\text{–}9)$$

$ISI_{cursors}$ are computed from the linear fit pulse response, $p(k)$ in accordance with 120D.3.1.3, using Equation (120D–8), where

t_p	is the index of the linear fit pulse where $p(t_p)$ equals p_{max}
M	is the oversampling ratio of the measured waveform and linear fit pulse as defined in 85.8.3.3.4
N_p	is the linear fit pulse length given in 120D.3.1.3
N_b	is given in Table 120D–8

NOTE—The observed SNR_{ISI} can be significantly influenced by the measurement setup, e.g., reflections in cables and connectors. High-precision measurement and careful calibration of the setup are recommended.

163/163A RITT Transition Time
D2.2 Text for Comment [32, 54], [30, 28, 29], 4, 12, 17

e) For the calculation of test channel COM, the transmitter model is determined in one of the following ways.

— 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. T_r is determined at the die bump and defined according to the method in 120G.3.1.4 except that there is no observation filter.

— If a calibrated instrument-grade transmitter is used, the TP0 to TP0a trace in Figure 93C–2 and Figure 93C–3 and TP0 to TP0a replica trace in Figure 93C–4 are omitted and the transmitter device package model $S^{(tp)}$ is omitted from Equation (93A–3). 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 T_r is the transmitter transition time measured using the method in 120G.3.1.4 and adjusted to remove the effect of the observation filter.

— If the transmitter is not a device with known S-parameters and transition time nor a calibrated instrument-grade transmitter, T_r in Equation (93A–46) is calibrated such that the reference transition time $T_r^{(ref)}$ determined according to 163A.3.1.3 is the transmitter transition time measured at TP0v with transmitter equalization off by setting coefficients to preset 1 values (see 162.9.3.1.3), using the method in 120G.3.1.4 and adjusted to remove the effect of the observation filter.

163/163A RITT Transition Time
D2.2 Text for Comment 32, 54

Equation 163A-2 includes a BT filter,
but Figure 163A-3 does not.

Calculate the voltage transfer function for the full signal path, $H^{(0)}(f)$, using Equation (163A–2).

$$H^{(0)}(f) = H_t(f)H_{21}(f)H_{BT}(f) \qquad (163A–2)$$

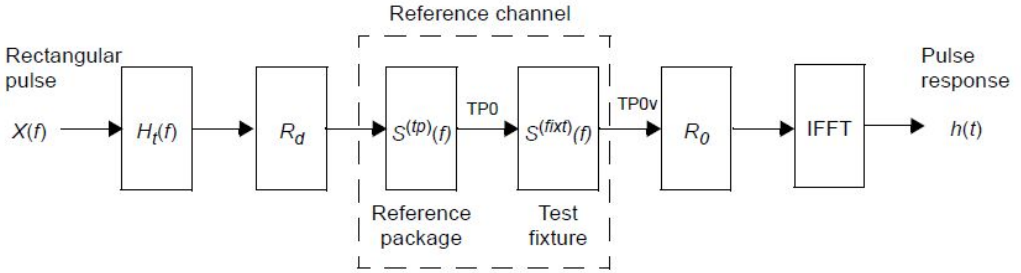

Figure 163A–3—Configuration for transmitter reference transition time

Editor's note (to be removed in the next draft: This method needs to be aligned with the interference tolerance test in 163 and 120F.

163/163A RITT Transition Time Comment 32, [54, 17]

Cl **163** *SC* **163.9.3.5** *P* **213** *L* **13** # 32

Ran, Adee Cisco

Comment Type **TR** *Comment Status* **D** *RITT transition time (CC)*

In the third case, the measured value is compared to a reference value Tr(ref); there is no need to have the measurement "adjusted to remove the effect of the observation filter", because the observation filter is also included in the calculation of Tr(ref) in 163A.3.1.3 (H_BT(f) in Equation 163A-2).

Following up on unsatisfied comment #21 against D2.1 it seems that the filter is indeed missing from Figure 163A-3. If the calibration of the ITT in 120F becomes aligned to 163 (subject of another comment), then the editor's note in 163A.3.1.3 will be addressed.

SuggestedRemedy

In the third item, delete "and adjusted to remove the effect of the observation filter".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The resolution to this comment is dependent on the resolution to comment #54, which proposes changes to the transition time measurement method in 163A.3.1.3.
For task force discussion.

Cl **163A** *SC* **163A.3.1.1** *P* **322** *L* **23** # 54

Hidaka, Yasuo Credo Semiconductor

Comment Type **TR** *Comment Status* **D** *RITT transition time (CC)*

As a result of resolution for comment #73 on D2.1, the observation filter (i.e. BT4 filter) was removed from the measurement of transmitter transition time for RX interference tolerance test in clause 163.9.3.5, step e. Therefore, the observation filter should be removed from the calculation of transmitter reference transition time.
Besides, Figure 163A-3 should include the step response.

This comment is continuation from comment #21 on D2.1.

SuggestedRemedy

Add a new equation to define H^(0)_noBT(f) by removing H_BT(f) from Equation (163A-2). This new equation is labeled as (163A-X) below.

On line 23, change "H^(0)(f) from Equation (163A-2)" to "H^(0)_noBT(f) from Equation (163A-X)".

Change h(t) to h_noBT(t) on line 23 and in Equation (163A-5) on line 37.

Change u(t) to u_noBT(t) on line 26 and line 43 and in Equation (163A-5) on line 37.

In Figure 163A-3, change h(t) to h_noBT(t). After h_noBT(t), add a block of Equation (163A-5) (or just a capital Sigma) followed by u_noBT(t) with a label of "Step response".

Remove editor's note at the top of page 322.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy with editorial license.

163/163A RITT Transition Time Comment 32, [54, 17]

Cl **163A** *SC* **163A.3.1.3** *P* **322** *L* **3** # 17

Lusted, Kent — Intel Corporation

Comment Type **ER** *Comment Status* **D** *RITT transition time (CC)*

There is an editor's note to be removed in the next draft, to align the ITOL test in 163 and 120G.

SuggestedRemedy

Align the ITOL tests and remove the editor's notes

Proposed Response *Response Status* **W**

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

163/163A RITT Transition Time Comment 28, 29, [30, 4, 12]

Cl **163** *SC* **163.9.3.5** *P* **212** *L* **53** # 28

Ran, Adee — Cisco

Comment Type **TR** *Comment Status* **D** *RITT transition time (CC)*

"Tr is determined at the die bump" suggests that it should be measured or calculated; but measurement at the die bump is not feasible, and the S-parameters may include some on-die elements (as in the reference model, Figure 93A-2), so "at the die bump" is not always correct.

This item is about a case where Tr is _known_.
Just as the s-parameters, Tr should be a value provided with the transmitter describing the signal fed to the s-parameters network.

SuggestedRemedy

Change
"Tr is determined at the die bump and defined according to the method in 120G.3.1.4 except that there is no observation filter"
to
"Tr should be provided as the value at the input of the device S-parameters network, as defined in 120G.3.1.4 but with no observation filter".

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Change the sentence under discussion to:
"Tr is the transition time (see 120G.3.1.4) at the input of the device S-parameter network except that there is no observation filter"

Cl **163** *SC* **163.9.3.5** *P* **213** *L* **1** # 29

Ran, Adee — Cisco

Comment Type **T** *Comment Status* **D** *RITT transition time (CC)*

120G.3.1.4 is referenced by all three items in the list. It is a pointer to 120E.3.1.5 with modified measurement filter, and 120E.3.1.5 itself is not a "measurement method" but a definition of the transition time.

SuggestedRemedy

Change "defined according to the method in" to "defined in", in all three bullets.

Change "and adjusted" to "adjusted" in the second bullet.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve the concern about the first bullet using the response to comment #28.
In the second bullet change "Tr is the transmitter transition time measured using the method in 120G.3.1.4 and adjusted to remove the effect of the observation filter" to "Tr is the measured transmitter transition time (see 120G.3.1.4) adjusted to remove the effect of the observation filter"
Resolve the concern about the third bullet using the response to comment #30.
Implement with edtorial license.

Comment #54 discusses whether BT filter is included for Tr calculation at TP0v.

163/163A RITT Transition Time Comment 28, 29, [30, 4, 12]

Cl **163** SC **163.9.3.5** P **213** L **9** # 30

Ran, Adee Cisco

Comment Type **ER** *Comment Status* **D** *RITT transition time (CC)*

The third item in this list is very unclear. My understanding is that it is about a case where the transmitter is a packaged device with unknown S-parameters and transition time, but it contains some test fixture (defined as TP0-TP0a in 93C) with known S-parameters, and the signal can be measured at TP0a.

In this case, the _reference_ transmitter model should be used, but its transition time should be adjusted so that the reference value matches the _measured_ transition time at TP0a.

This should be written more clearly.

SuggestedRemedy

Change the third item to
"If the transmitter comprises a device with unknown S-parameters and transition time, and a TP0 to TP0a trace with known S-parameters, then the transmitter device package model S^(tp) in 93A.1.2 is used, and Tr is determined from measurement at TP0a and the TP0 to TP0a S-parameters. The transmitter's transition time (as defined in 120G.3.1.4) is measured at TP0a with transmitter equalization turned off by setting coefficients to preset 1 values (see 162.9.3.1.3). Tr is set as the value in Equation (93A–46) that would result in the reference transition time Tr(ref), determined according to 163A.3.1.3, being equal to the measured transition time."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Change the third item to
"If the transmitter is composed of a device with unknown S-parameters and transition time then the transmitter device package model S^(tp) in 93A.1.2 is used, and Tr is determined from measurement at TP0v and the TP0 to TP0v S-parameters. The transmitter transition time (see 120G.3.1.4) is measured at TP0v with transmit equalization turned off by setting coefficients to preset 1 values (see 162.9.3.1.3). Tr is set as the value in Equation (93A–46) that would result in the reference transition time Tr(ref), determined according to 163A.3.1.3 with fb and Av equal to values in Table 163-11, being equal to the measured transition time."
Implement with editorial license.

Comment #54 discusses whether BT filter is included for Tr calculation at TP0v.

163/163A RITT Transition Time Comment [30, 4, 12]

Cl **163** SC **163.9.3.5** P **213** L **11** # 4

Brown, Matt — Huawei

Comment Type **E** *Comment Status* **D** *RITT transition time (CC)*

Some words are missing.

SuggestedRemedy

Change "determined accord to 163A.3.1.3 is the transmitter transition time"
To: "determined accord to 163A.3.1.3 is equal to the transmitter transition time"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the resolution to comment #30.

Bullet 3

Cl **163** SC **163.9.3.4** P **213** L **12** # 12

Brown, Matt — Huawei

Comment Type **T** *Comment Status* **D** *RITT transition time (CC)*

In 163.9.3.4, step e, the reference transition time is "determined according to 163A.3.1.3". In 163A.3.1.3 the pulse response is calculated as follows, requiring Av and fb as input from the invoking clause. "Obtain the output pulse response, h(t), as defined in 93A.1.5,with H(0)(f) from Equation (163A–2), where Av and fb are specified by the clause that invokes this method." The parameters Av and fb are not provided in 163.9.3.4. For calculation of transition time the amplitude is not important so Av could be set to an arbitrary value, e.g., 1.

SuggestedRemedy

In 163.9.3.4 specify fb equal to 53.125 GBd and Av equal to 400 mV.
Alternately...
In 163.9.3.4 specify fb equal to 53.125 GBd. In 163A.3.1.3 specify that the value of Av is 1.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
fb and Av use values in Table 163-11
Resolve together with comment #30.
[Editor's note: Changed line number from blank to 12.]

Bullet 3

163A COM pkg 143

163A.3.1.1, p. 320-321

Cl **163A**	*SC* **163A.3.1.1**	*P* **321**	*L* **15**	# 143

Dawe, Piers — Nvidia

Comment Type **E** *Comment Status* **D** *COM pkg*

Duplication

SuggestedRemedy

Move this sentence to p 320 line 53: "If the invoking clause lists more than one set of reference package parameters, the calculation is performed with the longer package trace length." At line 35, delete "If the invoking clause lists more than one set of reference package parameters, the calculation in Equation (163A–3) is performed with the longer package trace length."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy with editorial license, maintaining consistency with the resolution to comment #52 and #53.

Calculate the voltage transfer function, $H_{21}(f)$, from the scattering parameters of the 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 Ω and the single-ended termination resistance, R_d, is specified by the clause that invokes this method.

Calculate the voltage transfer function for the full signal path, $H^{(0)}(f)$, using Equation (163A–2).

$$H^{(0)}(f) = H_t(f)H_{21}(f)H_{BT}(f) \quad (163A\text{–}2)$$

where

$H_t(f)$	is calculated using Equation (93A–46) with T_r specified by the clause that invokes this method
$H_{BT}(f)$	is calculated using Equation (52–2) with f_r specified by the clause that invokes this method

Obtain the output pulse response, $h(t)$, as defined in 93A.1.5, with $H^{(0)}(f)$ from Equation (163A–2), where A_v and f_b are specified by the clause that invokes this method.

The reference pulse response peak, $v_{peak}^{(ref)}$, is the peak value of $h(t)$. If the invoking clause lists more than one set of reference package parameters, the calculation is performed with the longer package trace length.

From the output pulse response calculate the reference value for the transmitter output steady state voltage, $v_f^{(ref)}$, using Equation (163A–3). The values for parameters N_v, M, and D_p are provided by the clause that invokes this method.

$$v_f^{(ref)} = \frac{1}{M}\sum_{i=1}^{MN_v} h\left(t_{max} + \left(\frac{i}{M} - D_p - \frac{1}{2}\right)T_b\right) \quad (163A\text{–}3)$$

where

M	is the number of samples per unit interval
t_{max}	is the time where $h(t)$ reaches the peak value
D_p	is the linear fit pulse delay
T_b	is the unit interval in ps
N_v	represents the number of symbols included in the steady-state voltage calculation

~~If the invoking clause lists more than one set of reference package parameters, the calculation in Equation (163A–3) is performed with the longest package trace length.~~

163B Example TF
Comment 147

Cl **163B** *SC* **163B.2** *P* **325** *L* **21** # 147

Dawe, Piers — Nvidia

Comment Type **T** *Comment Status* **D** *Example TF*

Complete the example

SuggestedRemedy

As this is a Clause 163 example, there's another package length zp = 12. Give both ERLs in 163B.3, e.g. in the text, with the lower value in Table 163B-1, and say which zp the ERL in the table is based on. Better, use two columns in table 163B-1.
Delete the sentence "Although clauses using the TP0v methodology may require the ERL reference value to be calculated at more than one package length, only one is shown here." - as far as I know, all clauses using the TP0v methodology require the ERL reference value to be calculated two package lengths.

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 example is to help check calculation results as in table 163B-1. One package length is sufficient.
This comment decribes a general suggestion but does not provide sufficient details to implement, e.g. exact values to be put in Table 163B-1.

Table 163B–1—Summary of transmitter reference values at TP0v

Parameter	Reference	Value	Units
Effective return loss, $ERL^{(ref)}$	163A.3.1.2	12.95	dB
Transmitter steady-state voltage, $v_f^{(ref)}$	163A.3.1.1	0.409	V
Transmitter linear fit pulse peak, $v_{peak}^{(ref)}$	163A.3.1.1	0.237	V
Transmitter pulse peak ratio, $R_{peak}^{(ref)}$	163A.3.2.1	0.580	-