Difference R_{peak}

Comments #303, #350, #351

Adee Ran, Cisco

Purpose: addressing these TBDs

Table 179–7—Summary of transmitter specifications at TP2 *(continued)*

Parameter	Subclause reference	Value	Units
Linear fit pulse peak ratio, R_{peak} (min) Host class HL Host class HN Host class HH	179.9.4.1.2	 TBD TBD TBD	 — — —
Level separation mismatch ratio R_{LM} (min)	179.9.4.2	0.95	—

179.9.4.1.2 Steady-state voltage and linear fit pulse peak ratio

The linear fit pulse peak v_{peak} and steady-state voltage v_f are defined using the linear fit pulse response $p(1)$ through $p(M \times N_v)$ with $N_v = 400$, measured with transmit equalizer set to preset 1 (no equalization). The linear fit procedure for obtaining $p(k)$ and the values of M and N_p are defined in 179.9.4.1.1.

v_{peak} is defined as the maximum value of $p(k)$.

v_f is defined as the sum of the linear fit pulse $p(1)$ through $p(M \times N_v)$ divided by M.

The linear fit pulse peak ratio R_{peak} is defined by Equation (179–5).

$$R_{peak} = \frac{v_{peak}}{v_f} \tag{179–5}$$

Table 176D–1—Summary of host output specifications at TP1a

Parameter	Reference	Value	Units
Linear fit pulse peak ratio, R_{peak} (min)	176D.7.4	TBD	—

Table 176D–2—Summary of module output specifications at TP4

Parameter	Reference	Value	Units
Linear fit pulse peak ratio, R_{peak} (min)	176D.7.4	TBD	—

176D.7.4 Steady-state voltage and linear fit pulse peak ratio

Steady-state voltage (v_f) and linear fit pulse peak ratio (R_{peak}) are defined in 179.9.4.1.2.

Previously…

- We used to have minimum numbers for R_{peak} (or equivalently for v_{peak} as a fraction of v_f) for all interfaces…
  - In recent CR clauses, these values were obtained by simulations of a pulse response through a reference package and a provided host channel (including HCB).
  - This was possible because it only required a maximum host channel model, the measurement fixture was relatively well-defined, and there was only one value to pick.
- In 802.3ck we adopted a new method (dR_{peak}) for KR/C2C where the test fixture is application-specific and loosely specified…
  - Defined in 163A.3.2.1, with reference values calculation specified in 163A.3.1.1
  - It was not extended to CR because it wasn't critical for that case.
  - It was not extended to C2M because there was no R_{peak} parameter for that interface.

Motivation

- There are 3 CR host classes, in addition to C2M host (1) and module (1), which all have R_{peak} as TBD
  - The numeric values of the limits will be quite different and require a detailed contribution with several options
  - The “difference” methodology can get us to technical completeness faster
- The measured value will depend on the test fixture (HCB or MCB), which can vary (e.g. based on connector type, width, and tolerance)
  - Test fixture variation is a growing concern
  - Using a method which takes into account the measured fixture s-parameters (in mated state) would reduce the dependence

How is it done

163A.3.1 Reference parameter determination

The methods for obtaining the v_f, v_{peak}, and ERL reference parameters using the measured scattering parameters and the reference transmitter and package models are defined below, and are outlined in Figure 163A–2.

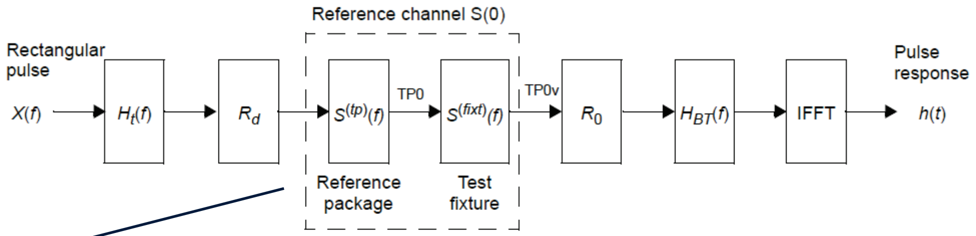

Figure 163A–2—Configuration for transmitter reference steady-state voltage, pulse peak, and ERL

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

Obtain the scattering parameters of the reference channel, $S^{(0)}$, using Equation (163A–1), where the cascade() function is defined in 93A.1.2. 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.

$$S^{(0)} = \text{cascade}(S^{(tp)}, S^{(fixt)}) \tag{163A–1}$$

The existing method builds the reference channel from a reference transmitter + package, the measured S-parameters of the test fixture, and the measurement filter.

The pulse response h(t) is calculated and from it, the reference v_f , v_{peak}, and R_{peak} (in 163A.3.2.1) are obtained.

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

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. If the invoking clause lists more than one set of reference package parameters, the calculation is performed with the longest package trace length.

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

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

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 maximum 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). The values for parameters N_v, M, and D_p are provided by the clause that invokes this method.

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

where

M	is the number of samples per unit interval
t_{max}	is the time where $h(t)$ reaches the maximum 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

$$R_{peak}^{(ref)} = \frac{v_{peak}^{(ref)}}{v_f^{(ref)}} \tag{163A–10}$$

What do we have in 802.3dj

- For CR there are three host classes…
  - Each has a partial host channel model which, with the reference mated test fixtures, spans the TP0d-TP2 channel
- For C2M there are Host and module
  - Host has a similar partial host channel model (with $z_p^{(h)}$=250 mm) which, with a reference MTF, spans the TP0d-TP1a channel
  - Module does not have a partial channel; The TP4d-TP4 channel is modeled as a package (with one of two trace lengths) and an MTF
- For host output (179 and 176D), it is proposed to redefine the reference channel of Equation 163A-1 (Figure 163A-2) to include the partial host channel too
- For module output (176D), it is proposed to use the same reference channel equation, with the longer package trace (case 2, 10 mm)

Table 179–17—Partial host channel model parameters per Host class

Parameter	Host class HL	Host class HN	Host class HH	Units
Package class	A	B	B	—
Package transmission line 1 length, $z_p^{(1)}$	8	15	45	mm
Partial host PCB transmission line length, $z_p^{(h)}$	9	70	60	mm

NOTE—For each host class, the sum of the differential insertion loss (ILdd) at 53.125 GHz of the partial host channel (excluding the device termination) and the reference mated test fixtures (see Equation (179B–5) and Figure 179A–1) is equal to the recommended maximum host channel insertion loss in 179A.4 for that host class.

- For $S^{(fixt)}$, use “mated test fixtures measured according to 178A.1.3” instead of the “Measured Tp0 to TP0v”
- Only one fixture is used in the measurement of the DUT; but mated with the complementary fixture, the combination should be compliant with the MTF specs
- … and that is all we need.

Proposal (1)

- Replace all R_{peak} specs in 179 and 176D (currently TBD) with specifications of dR_{peak} (max) >= 0
  - Defining dR_{peak} in 179.9.4.1.2, as shown in the next slide
- No change to v_f specs or definition
  - We have numeric minimum and maximum values (not TBD)
  - May be revisited in future drafts

Proposal (2)

- Define dR_{peak} by reference to Equation 163A–8 through Equation 163A–10
- Use $v_{peak}^{(meas)}$ and $v_f^{(meas)}$ are as defined in 179.9.4.1.2
- Use $v_{peak}^{(ref)}$ and $v_f^{(ref)}$ as defined in 163A.3.1.1 with the following considerations:
  - For host output (179 and 176D), redefine the reference channel of Equation 163A-1 (Figure 163A-2) to include the partial host channel corresponding to the host class that the device adheres to
  - For module output (176D), use the reference channel of Equation 163A-1 as it is; use the higher-loss package model (case 2, 10 mm trace)
  - For $S^{(fixt)}$, use “mated test fixtures measured according to 178A.1.3” instead of the “Measured Tp0 to TP0v”
- Add a requirement that the test fixture used in the measurement of $v_{peak}^{(meas)}$ and $v_f^{(meas)}$, mated with the complementary test fixture, comply with the MTF specifications in 179B.4

Notes

- Only one fixture is used in the measurement of the DUT; but mated with the complementary fixture, the combination has to be compliant with the MTF specs
  - This should reduce measurement variability
- With specified ILdd for the reference test fixture (or MTF) we could provide “reference for the reference” as a proxy
  - If this is work is done and contributed, it would be informative addition
  - Not required for technical completeness

That’s all

Questions?