802.3dj D2.3 Comment Resolution Electrical Topics

Adee Ran (Cisco), 802.3dj Electrical Track Lead Editor
Matt Brown (Qualcomm), 802.3dj Chief Editor
Adam Healey (Broadcom), 802.3dj electrical editor

Introduction

- This slide package was assembled by the 802.3dj editorial team to provide background and detailed resolutions to aid in comment resolution.
- Specifically, these slides are for the various electrical-track comments.

TX noise model

Comment #39

TX noise model Comment #39

178A.1.7.3 Transmitter output noise

For a given sampling time $t_s^{(0)}$, the power spectral density of the sampled transmitter noise at the input to the receiver discrete-time equalizer is defined by Equation (178A–19).

$$S_{tn}(\theta) = 10^{-SNR_{TX}/10}\left|\mathrm{DFT}[h_{tn}(n)]\right|^2/f_b \qquad (178A\text{–}19)$$

Comment proposes to add a factor of σ_X^2 to the transmitter output noise spectral density

This factor was present in D1.3 but removed in response to comment #511 (see 8023dj_D1p3_comments_final_id_250212)

It was removed to make the noise model consistent with the definition of transmitter signal-to-noise-and-distortion ratio (SNDR)

The transmitter output noise model is intended to represent impairments related to SNDR

The SNDR definition does not include a factor of σ_X^2

$$SNDR = 10\log_{10}\left(\frac{P_{Signal}}{\sigma_e^2 + \sigma_n^2}\right)$$

$$P_{Signal} = \sum_{i=0}^{N_p-1} p(M \times i + m_0)^2$$

More importantly, the SNDR specification limits have been computed using the current transmitter output noise model (see comment #481 in 8023dj_D2p0_comments_final_id_v2 and the documentation referenced in that comment response)

TX noise model
Comment #39 continued

Reference transmitter does not meet SNDR requirements

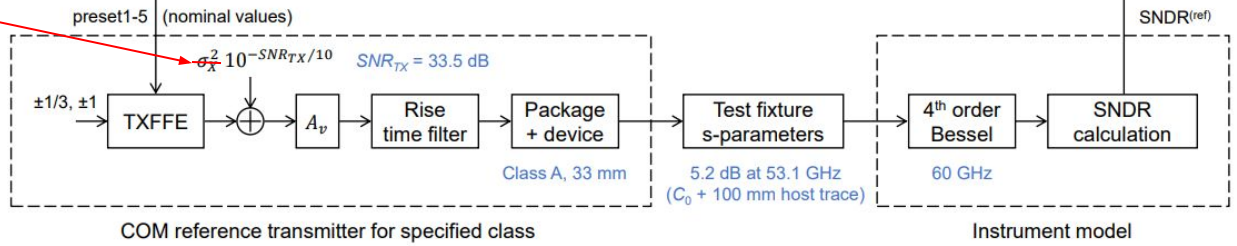
Coefficient initial conditions (nominal values)

Preset	c(−3)	c(−2)	c(−1)	c(0)	c(1)
1	0			1	0
2	0	0	0	0.5	0
3	0	0	−0.075	0.75	0
4	0	0.05	−0.2	0.75	0
5	−0.025	0.075	−0.25	0.65	0

Example calculation results

Preset	SNDR(ref), dB	Min. limit, dB
1	33.5	33.5
2	27.5	
3	30.7	
4	30.2	
5	28.7	

Error in slide



IEEE P802.3dj Task Force, November 2024 (r0) 5

Reference: healey_3dj_01_2411 slide 5

TX noise model
Comment #39 continued

Addition of a factor of σ_X^2 to the transmitter output noise model would make it inconsistent with the definition of SNDR.

The consequence would be that transmitter model used to compute Channel Operating Margin (COM) would not be consistent with transmitters that comply with the specification.

For the specification to be consistent, the σ_X^2 term would need to be added to the definition of SNDR, the SNDR limits would need to be adjusted accordingly, and the COM SNR_{TX} value may also need to be reconsidered.

Editors' recommendation:
Reject.
The draft is self-consistent as it is written.
The proposed change would introduce an inconsistency between the noise model and the definition of the impairment it is intended to represent.
A consensus proposal including a self-consistent set of changes could be considered during Standards Association ballot.

Note: the comment does not apply to the substantive changes between IEEE P802.3dj D2.2 and D2.3 or the unsatisfied negative comments from previous drafts. Hence it is not within the scope of the recirculation ballot.

Host/module connector

Comment #57

Host/module connector Comment #57

Cl **176D** *SC* **176D.3** *P* **819** *L* **38** # 57

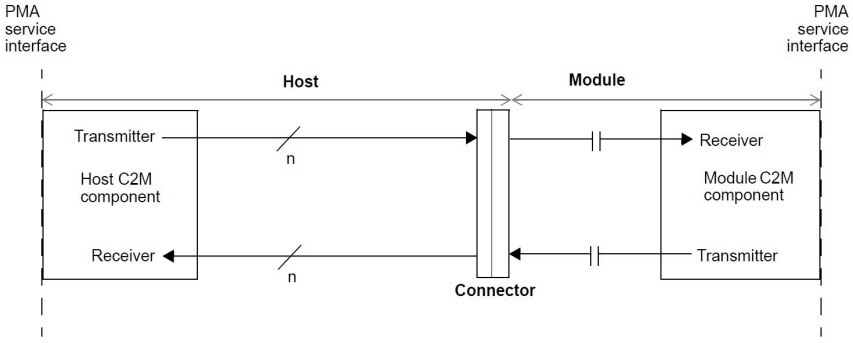
Healey, Adam — Broadcom, Inc.

Comment Type **E** *Comment Status* **X**

In Figure 176D-2, the delineation between host and module is shown to be the outer edge of the box labeled "connector". However, in Figures 176D-4 and 176D-5, the host and module are shown to extend to the line in the middle of a simlar looking "connector" box. Figure 176D-2 should be changed to be consistent with the other figures.

SuggestedRemedy

In Figure 176D-2, move the point where the arrows delineating "host" and "module" meet to align with the line in the middle of the box labelled "connector". If there is ambiguity about what this line represents, add a note to the figure indicating that the line corresponds to the "mating point of the MDI connector" similar to what is described in 179B.2.1 and 179B.3.1.



NOTE—The number of lanes n is 1 for 200GAUI-1, 2 for 400GAUI-2, 4 for 800 GAUI-4, and 8 for 1.6TAUI-8.

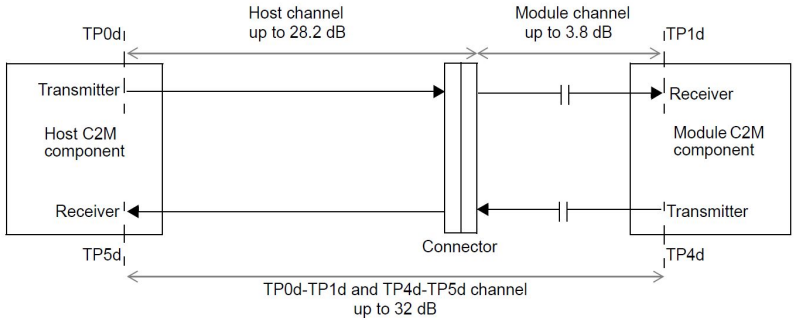
Figure 176D–2—200 Gb/s per lane AUI-C2M link diagram

Figures 176D-2 and 176D-6 are intended to show the delineation points between the host and the module.

Up until D2.2 they included one box labeled “connector” which represented the host’s receptable, explicitly stated as part of the host channel.

Following resolution of comment #405 against D2.2, in D2.3 the box was split and is now it supposedly represents two mated connectors (host receptable and module plug) although the label still says “connector”.

Note that the term “connector” is overloaded and ambiguous; It is used in different contexts as either “half of an interface” (receptacle or plug) or “the union of receptacle to plug”. This is possibly a source of confusion here too.

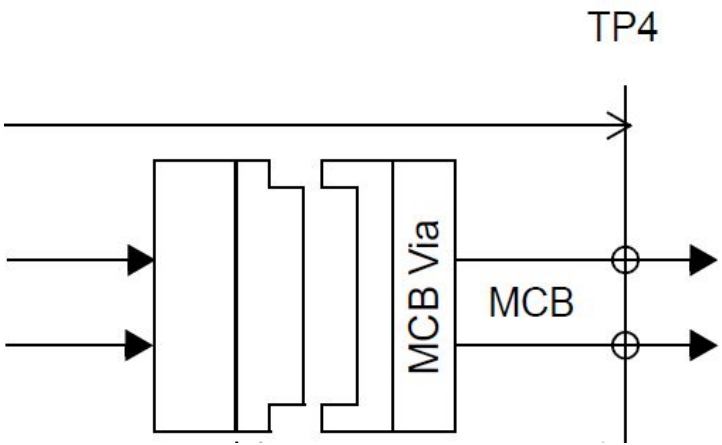


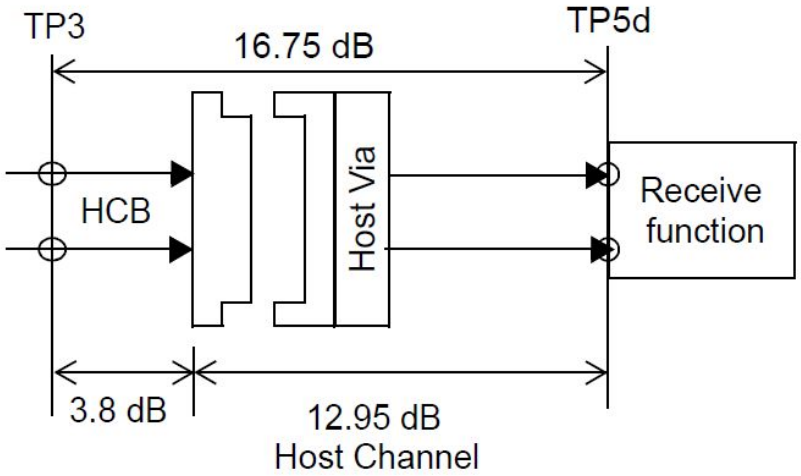
NOTE—For loss budgeting purposes, the host channel loss is from TP0d to the center of the edge connector of the module.

Figure 176D–6—Reference insertion loss budget at 53.125 GHz

Host/module connector
Comment #57 (cont.)

Compare to these representations of MCB and HCB in Figure 179A-1, which illustrate a plug and a receptacle (even though these terms are not used).





Host/module connector Comment #57 (cont.)

Figures 176D-4 and 176D-5 are intended to show the compliance points, not the host/module connection.
The “split rectangle” in these figure is not labeled “connector” and does not adequately show the connection of the host/module to the test fixture (it is not the focus of these figures).

It can be assumed that the vertical lines indicate the mating points between the receptable and plug, but it is not stated explicitly (the terms *receptable* and *plug* are not used anywhere in this annex).

Compare to figure 176D-7a which does illustrate the plug-and-receptacle connectivity.

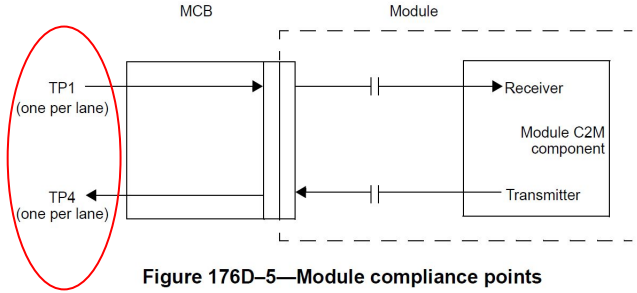


Figure 176D–5—Module compliance points

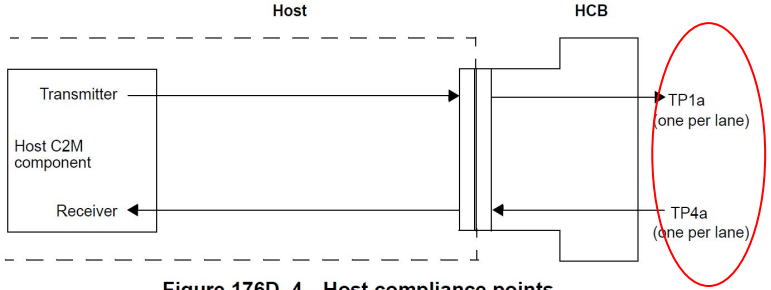


Figure 176D–4—Host compliance points

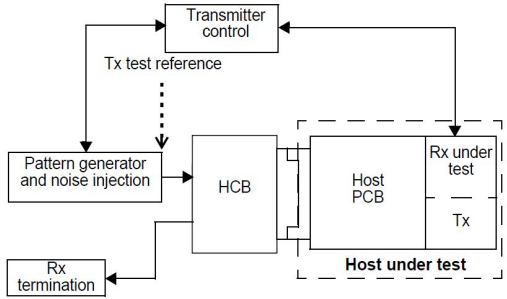


Figure 176D–7a—Host interference tolerance test setup

Host/module connector Comment #57 (cont.)

Cl **176D** *SC* **176D.3** *P* **819** *L* **38** # 57

Healey, Adam — Broadcom, Inc.

Comment Type **E** *Comment Status* **X**

In Figure 176D-2, the delineation between host and module is shown to be the outer edge of the box labeled "connector". However, in Figures 176D-4 and 176D-5, the host and module are shown to extend to the line in the middle of a simlar looking "connector" box. Figure 176D-2 should be changed to be consistent with the other figures.

SuggestedRemedy

In Figure 176D-2, move the point where the arrows delineating "host" and "module" meet to align with the line in the middle of the box labelled "connector". If there is ambiguity about what this line represents, add a note to the figure indicating that the line corresponds to the "mating point of the MDI connector" similar to what is described in 179B.2.1 and 179B.3.1.

Figure 176D-2 is illustrative, and labeled “Link diagram”. As such it is correct.

The suggested remedy would be an improvement, but the editor considers it only a partial solution. Additional changes to indicate plug, receptacle, and mating point, and to align the figures and clarify them, would be preferable.

Implementing a partial change at this point would keep the scope open for additional comments.

The editor’s preference is to have a more complete proposal for changes to figures in Annex 176D during SA ballot.

Editors’ recommendation:
Reject.
Figure 176D-2 is correct as a link diagram.
The proposed change could be considered an improvement, but it is partial and not essential at this time.
A detailed proposal for adding details to figures in Annex 176D and making them consisent could be considered during Standards Association ballot.

ILT/RTS/APSU wording

Comment #25

ILT/RTS/APSU wording Comment #25

Cl 179 SC 179.8.4 P 423 L 25 # 25

Huber, Thomas Nokia

Comment Type E *Comment Status* X

"ILT startup protocol" is confusing, given that the combination of ILT and RTS is named Autonomous Path Startup.

SuggestedRemedy

Change "ILT startup protocol" to "ILT function", if the intent is to refer to ILT being complete, or to "autonomous path startup function", if the intent is that ILT and RTS are complete.

The term "startup protocol" is not defined anywhere in this amendment.
Also, the definition of the global signal detect uses remote_rts, which is set by the ILT function (per-interface, see 178B.8.2.1) and indicates the status of the peer interface, not necessarily completion of the startup function.

"start-up" protocol" is also mentioned in 179.9.5.3.5 (ITOL test procedure). Other test procedure subclauses refer to the ILT function instead.

Suggested changes:

179.8.4 PMD global signal detect function

The PMD global signal detect function is used by the PMD to indicate the ~~successful completion of the ILT startup protocol (see 179.8.9)~~ status of the peer interface. The variable Global_PMD_signal_detect is set to the value of remote_rts in the ILT function (see 178B.8.2.1).

179.9.5.3.5 Test procedure

The pattern generator is first configured to transmit the training pattern defined in 179.8.9. During this initialization period, the device under test (DUT) configures the pattern generator transmit equalizer coefficients and precoding to the settings it would select using the ~~start-up protocol~~ ILT function described in 179.8.9 and the receiver is tuned using its optimization method. The settings may be communicated via the ~~start-up protocol~~ ILT function or by other means.

AC coupling

Comment #19

AC coupling Comment #19

Cl **176D** SC **176D.6.1** P **821** L **35** # 19

Kutscher, Noam Marvell

Comment Type **T** *Comment Status* **X**

There is no DC blocker on the test setup of the host figure - TX as well as RX paths + no description of the DC block on the host input. The module connected in the host TX and RX path has dc blockers(page 819) allowing the host device to operate at it's own voltages, we should add the DC blockers also in the host TX and RX test setup to allow the same conditions.

SuggestedRemedy

Add DC blocker between the HCB and the Tp1a and Tp4a + definition in 176D.6.6 host input - as done on176D.6.4 line 50, on the right of the HCB

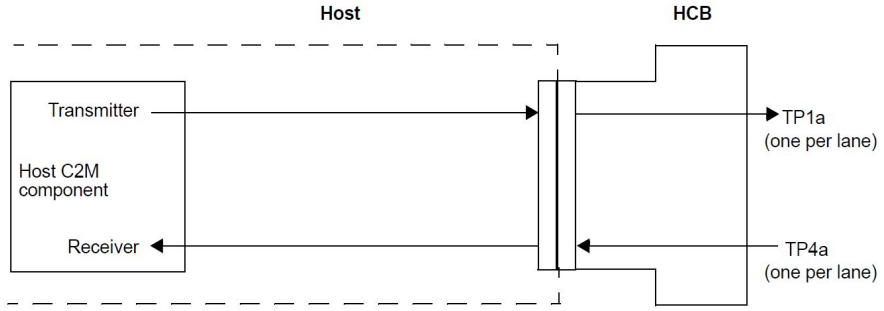


Figure 176D–4—Host compliance points

In discussion with the commenter he indicated that the main issue is that *host input characteristics do not specify a test setup with AC coupling*, unlike host output (module input and output are specified to be AC coupled within the module).

176D.6.6 Host input characteristics

A host shall meet the host input specifications given in Table 176D–4.

Table 176D–4—Summary of host input specifications at TP4a

Parameter	Reference	Value	Units

176D.6.4 Host output characteristics

A host shall meet the host output specifications given in Table 176D–2 on each lane.

Unless specified otherwise, host output signal measurements are made for each lane separately using a fourth-order Bessel-Thomson low-pass response with a 3 dB bandwidth of 60 GHz, with AC-coupled connection from TP1a to 50 Ω single-ended loads in the test equipment.

A more adequate place for indicating the required AC coupling is in the host input test setup.

AC coupling
Comment #19 (cont.)

Previous host input test setup diagrams, e.g. Figure 120G-9, included “DC blocks” between the pattern generator and the HCB.

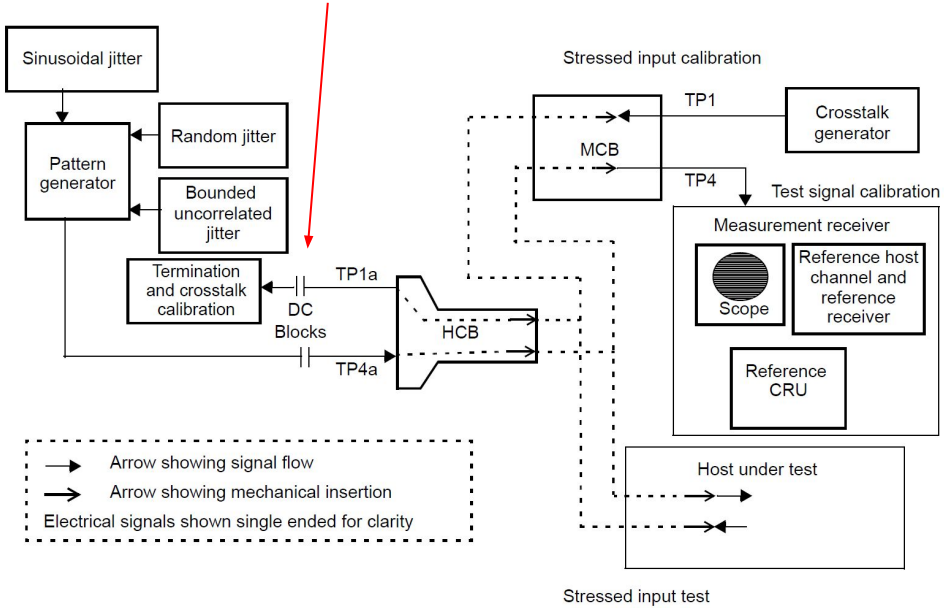


Figure 120G–9—Example host stressed input test

176D.8.13.1 Test setup

Host interference tolerance is defined based on the test setup shown in Figure 176D–7a. The test channel is shown in Figure 176D–7b. The test is performed with addition of noise at the pattern generator, calibrated such that the channel operating margin (COM) calculated with the test channel and the transmitter’s measured parameters matches the value in Table 176D–11.

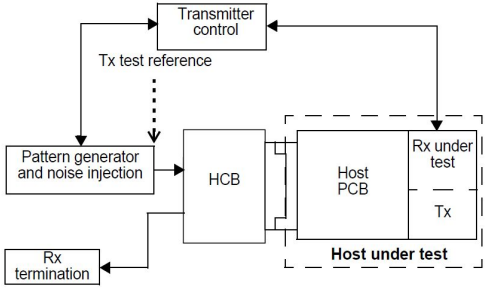


Figure 176D–7a—Host interference tolerance test setup

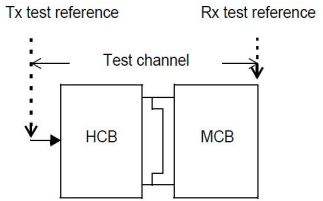


Figure 176D–7b—Host test channel calibration

Figure 176D-7a does not.

AC coupling
Comment #19 (cont.)

Possible change:

Add an indication of “DC blocks” between the pattern generator and the HCB, as in Figure 120G-9

176D.8.13.1 Test setup

Host interference tolerance is defined based on the test setup shown in Figure 176D–7a. The test channel is shown in Figure 176D–7b. The test is performed with addition of noise at the pattern generator, calibrated such that the channel operating margin (COM) calculated with the test channel and the transmitter’s measured parameters matches the value in Table 176D–11.

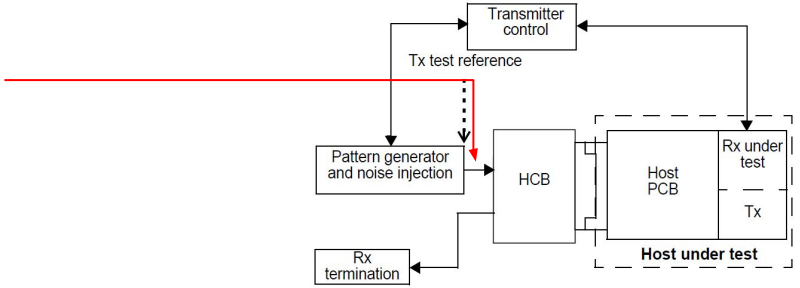


Figure 176D–7a—Host interference tolerance test setup

Not required here - this channel is only used for COM calibration.

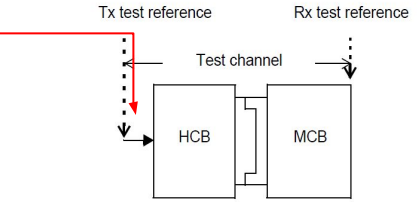


Figure 176D–7b—Host test channel calibration

Note: the comment does not apply to the substantive changes between IEEE P802.3dj D2.2 and D2.3 or the unsatisfied negative comments from previous drafts. Hence it is not within the scope of the recirculation ballot.