802.3dj D2.0
Comment Resolution
Electrical Track

Adee Ran (Cisco), 802.3dj Electrical Lead Editor
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AC common mode

Comments 506, 504, 354, 507

AC common mode
Comments 506, 504, 354, 507

Cl 176D *SC* 176D.6.3 *P* 745 *L* 16 # 506

Dudek, Mike Marvell

Comment Type TR *Comment Status* X

The module AC common-mode input tolerance is 80mV max full band and 32mV for the low frequency. The allowed host output AC common-mode full band is however 85mV max (and 30mV max for the low frequency). The host output value should not be higher than the module input tolerance full band, and there isn't a reason why the module should tolerate more than the host outputs at low frequency.

SuggestedRemedy

Change the full band AC common-mode output voltage for the host from 85mV to 80mV. Consider also changing the low frequency from 30mV to 32mV to match the module tolerance.

Cl 176C *SC* 176C.6.3 *P* 723 *L* 39 # 504

Dudek, Mike Marvell

Comment Type T *Comment Status* X

The max value of Low Frequency AC common mode noise is 30mV for KR but 32mV for C2C with a tighter Block Error ratio requirement. There isn't a reasonable justification for this difference.

SuggestedRemedy

Change the C2C value to 30mV in table 176C-2.

Cl 176D *SC* 176D.6.5 *P* 747 *L* 12 # 354

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type T *Comment Status* X

In 802.3ck VCM(LF) was 32 mV which is more than 2x larger than limit in the DJ draft at TP4 with only 15 mV

SuggestedRemedy

Given that Module/TP4 would be the larget source of VCM(LF), recommend increasing to 20 mV

Cl 176D *SC* 176D.6.5 *P* 747 *L* 13 # 507

Dudek, Mike Marvell

Comment Type T *Comment Status* X

The Host AC common-mode input tolerance is 80mV max full band . The allowed module output AC common-mode full band is however only 60mV max . There isn't a reason why the host should tolerate more than the module outputs.

SuggestedRemedy

Change the host AC common-mode input tolerance full band from 80mV to 60mV

AC common mode
Comments 506, 504, 354, 507

VCM_{LF} values:

- In clauses 178 & 179 – same as those of 802.3ck (162 & 163).
- In Annex 176C – same as 802.3ck (120F)
- In Annex 176D –
  - Host output modified from 802.3ck (it was 32 mV) to match 179
  - Module input is the same as 802.3ck (does not match host output)

VCM_{FB} values were all 80 mV in 802.3ck

- For C2M host output, 85 mV adopted by ran_3dj_02_2405 (comment 186 against D1.0), but module input was not updated to match

Table 178–6—Summary of transmitter specifications at TP0v

Low-frequency peak-to-peak AC common-mode voltage, VCM_{LF} (max)	179.9.4.1	0.03	V

Table 179–7—Summary of transmitter specifications at TP2

AC common-mode peak-to-peak voltage (max)	176D.8.1		
Low-frequency, VCM_{LF}		0.03	V
Full-band, VCM_{FB}		0.08	V

Table 176C–2—Transmitter electrical characteristics at TP0v

Low-frequency peak-to-peak AC common-mode voltage, VCM_{LF} (max)	176C.6.3.2	0.032	V

(There are no AC CM tolerance specifications for the above)

Table 176D–2—Summary of host output specifications at TP1a

AC common-mode peak-to-peak voltage (max)	176D.8.1		
Low-frequency, VCM_{LF}		0.03	V
Full-band, VCM_{FB}		0.085	V

Table 176D–5—Summary of module input specifications at TP1a

Peak-to-peak AC common-mode voltage tolerance (min)	176D.8.10		
Low-frequency, VCM_{LF}		0.032	V
Full-band, VCM_{FB}		0.08	V

AC common mode
Comments 506, 504, 354, 507

Comment #354 suggest increasing the VCM_{LF} limit to 0.02 V noting the decrease from the 802.3ck value.

- VCM_{LF} values were modified from 802.3ck by comment #399 against D1.2, with a detailed justification.

Comment #507 addresses VCM_{FB} mismatch between C2M module output and host input.

- VCM_{FB} reduction from 80 mV to 60 mV adopted by ran_3dj_02_2405 (comment 186 against D1.0)
- Host input was not updated to match.
- The suggested remedy is to use 60 mV for both.

Cl **176D** *SC* **176D.5.4** *P* **701** *L* **23** # 399

Dawe, Piers Nvidia

Comment Type **T** *Comment Status* **A** *AC common mode*

AC common-mode voltages are not as large as this in practice, even at 200G/lane. Notice that while the full-band VCM is lower than for host output, the low-frequency VCM is the same, which is not realistic; a module does not have the very heavy-duty power supply that a host uses.

SuggestedRemedy

Halve the LF ACCM limit for module output (Table 176E-2) because the module output is measured in the MCB which should have a clean power supply.
Also in Table 176E-3, host input ACCM tolerance.
We may need a sentence of explanation: the host must tolerate this much module-generated ACCM, as well as any that it generates itself.

Response *Response Status* **C**

ACCEPT IN PRINCIPLE.

Change the LF ACCM limit for module output (Table 176D-2) from 0.03 V to 0.015 V.
Apply the corresponding change in Table 176D-3, host input ACCM tolerance.

Table 176D–3—Summary of module output specifications at TP4

AC common-mode peak-to-peak voltage (max)	176D.8.1		
Low-frequency, VCM_{LF}		0.015	V
Full-band, VCM_{FB}		0.06	V

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

Peak-to-peak AC common-mode voltage tolerance (min)	176D.8.10		
Low-frequency, VCM_{LF}		0.015	V
Full-band, VCM_{FB}		0.08	V

AC common mode
Comments 506, 504, 354, 507

Observations

- C2M host specifications are based on CR assumptions with some modifications due to the higher host channel loss.
- For VCM_{FB}:
  - Host output increase to 85 mV was adopted by ran_3dj_02_2405, the rationale was “Higher AC common-mode noise can be allowed, since there is no additional contribution from the cable and remote host”. Also, longer host channel can have increased mode conversion.
  - Module input tolerance should match; Either **increase module input tolerance to 85 mV**, or decrease host output maximum back to 80 mV
  - Module output decrease to 60 mV was adopted by ran_3dj_02_2405, the rationale was “it is measured closer to the transmittter, and the host channel can cause large conversion to differential noise”
  - Host input tolerance should match; Either **decrease host input tolerance to 60 mV**, or increase module output maximum back to 80 mV
- For VCM_{LF} the different values for PMDs (30 mV) and AUIs (32 mV) originate from 802.3ck
  - The values were finalized by comments R1-29 (PMDs and host output), R2-20 (module output). The rationale was the different probabilities at which the peak-to-peak is defined: 1e-4 for PMDs, 1e-5 for AUIs.
  - In 802.3dj we specify VCM_{LF} to a probability of 1e-7 for both PMDs and AUIs, so there should be no difference.
  - **Recommend increasing to 32 mV everywhere**
- The reference for VCM_{LF} in Table 178-6 is stale - it should be 179D.8.1 as in all other tables.
- Except for C2M, there are no receiver tolerance specifications. This is not new, but we may consider adding explicit specifications.

Editor’s recommendations:

- For C2M module input, change VCM_{FB} tolerance to 0.085 V (aligning with host output)
- For C2M host input, change VCM_{FB} tolerance to 0.06 V (aligning with module output)
- Change VCM_{LF} maximum output to 0.032 V for KR and CR (aligning with C2C and C2M)
- Change VCM_{LF} tolerance to 0.032 V for C2M host and module inputs (aligning with outputs)
- In Table 178–6, change the reference from 179.9.4.1 to 179D.8.1

Reference impedance

Comments 59-62, 63, 64-66, 235, 236-239, 514, 595-599, 606-618, 620-624

Reference Impedance
Comments 59-62, 595-599, 606-608, 615-617, 620, 622, 624

ERL
(21)

C#	Clause	SC
59, 595, 616	178	178.9.2.1.2
617	178	178.9.2.2
596, 615	178	178.10.3
60, 597, 620	179	179.9.4.7
598	179	179.5.5
61, 599, 622	179	179.11.3
62, 606	176C	176C.6.3.5
607	176C	176C.7.3
608	176D	176D.8.2
624	179B	179B.4.2

These comments all propose changing the reference impedance R_0 **for ERL** to 92.5 Ω differential.

Reference Impedance
Comments 63-66, 514, 609-614, 618, 621, 623

Measurement (11)

C#	Clause	SC
63, 611	178	178.9.1
618	178	178.10
64, 612	179	179.9.3
623	179	179.9.5.3
621	179	179.11
65, 613	179	179.11.1
66, 614	176C	176C.6.2
609	176D	17D.7.2
610	178A	178A.1.3
514	179B	179B.1

These comments all propose changing the reference impedance to 92.5 Ω differential (**for non-ERL measurements**).

Reference Impedance

D2.0 values:

- R_0 = 50 Ω adopted during D1.0 comment resolution
  - COM parameter table in all clauses
- R_d = 46.25 Ω adopted during D1.0 comment resolution
  - COM parameter table in all clauses
- Reference impedance for differential specifications is 100 Ω since D1.0
  - Exists in PMDs: 178.9.1, 179.9.3; cable assembly: 179.11.1; C2C: 176C.6.2
  - Not mentioned for KR channel (178.10) nor anywhere in Annex 176D
- Refer to slides 8-10 of ran_3dj_01f_2406-comment_resolution_electrical.

The numerous comments on this topic indicate a trend to change the reference impedance (R_0) to 46.25 Ω.

- This would make all RL/ERL measurements refer to the **intended** characteristic impedance (which R_d is equal to).
- IL will show lower ILD for impedance-matched channels.

Cl 178 *SC* 178.9.1 *P* 275 *L* 39 # 395

Kocsis, Sam Amphenol

Comment Type T *Comment Status* R R_0

The reference impedance should match the system impedance, Rd as defined in COM spreadsheets.

SuggestedRemedy

92-ohm, TBD, or straw poll based on proposed values presented in Task Force contributions

Response *Response Status* C

REJECT.
The suggested remedy does not provide sufficient detail for the CRG to understand the requested changes, e.g., which specifications and measurements should use the proposed reference impedance.

There's no consensus to make changes. Further work and consensus building on this topic is encouraged.

Cl 178 *SC* 178.10.1 *P* 285 *L* 40 # 396

Kocsis, Sam Amphenol

Comment Type T *Comment Status* A COM R_d

Rd(t) = "TBD"

SuggestedRemedy

Change "TBD" to "92-ohm" to match majority of contributions to the Task Force, and better align with Zc definition in package

Response *Response Status* C

ACCEPT IN PRINCIPLE.
There are several comments on this topic. The CRG reviewed the editorial team's notes on slide #8-10 of https://www.ieee802.org/3/dj/public/24_06/ran_3dj_01c_2406.pdf.

Following straw poll #E-2 (see below) there is consensus to make the following change.
Change Rdt and Rdr in COM device parameters tables (Table 178-12, Table 179-15, Table 176D) from TBD to 46.25 Ohm.
Implement with editorial license.

For the record, there was consensus on having the reference impedance statements (178A.1.3, 178.9.1, 179.9.3, 179.11.1, and 176D.3.2) define a reference single-ended impedance of X Ohm for all frequency-domain specifications, e.g., insertion loss, return loss, and ERL, and adding a similar statement in 176E. The value of X was not decided.
This response does not prescribe any changes in this regard.

The following straw polls were taken:

Straw poll #E-1 (direction)
I would support changing Rdt and Rdr in COM device parameters tables (Table 178-12, Table 179-15, Table 176D) from TBD to X Ohm (same as the reference single-ended impedance of X Ohm for all frequency-domain specifications).
Y: 12 N: 12 A: 8

Straw poll #E-2 (direction)
I would support changing Rdt and Rdr in COM device parameters tables (Table 178-12, Table 179-15, Table 176D) from TBD to 46.25 Ohm.
Y: 18 N: 5 A: 9

Reference Impedance Comments 236-239

COM differential output amplitude (4)

C#	Clause	SC
236	178	178.10
237	179	179.11.7.1
238	176C	176C.7.1
239	176D	176D.7.2

These comments propose changing COM differential output amplitudes to account for changing to 46.25 Ω reference impedance.

- A_v from 0.385 V to 0.415 V
- A_{fe} from 0.385 V to 0.415 V
- A_{ne} from 0.481 V to 0.608-0.611 V

The current values were calculated (see ran_3dj_04a_2409 slide 20) as:

A_v: $2*V_{f(min)}*R_d/(R_d+R_L)=2*\mathbf{0.4\ V} * 46.25/(46.25+50)=0.385$ V
A_{fe}: Same as A_v
A_{ne}: $2*V_{f(max)}*R_d/(R_d+R_L)=2*\mathbf{0.5\ V} * 46.25/(46.25+50)=0.481$ V

Where R_L is the **load** impedance (50 Ω for scopes, where v_f is measured).

The calculation for the proposed values is unclear. Note also that there are no comments proposing to change the scope termination impedance, and it seems unlikely that this will happen.

Comments #235 and #610

Comment #610 suggests changing the reference impedance defined in 178A.1.3 from 100 Ω to 92.5 Ω

Comment #235 suggests adding to Annex 178A equations that change the s-parameter port reference impedance. No justification is provided.

However, it is observed that:

- The reference impedance for the measured channel s-parameters must agree with the value of the single-ended reference resistance parameter R_0
- Equations proposed in #235, or their equivalent, would be useful to describe how to convert the s-parameter reference impedance to a value that agrees with R_0
- This would allow a clause or annex to define whatever reference impedance is desired without requiring changes to Annex 178A

Editor's recommendation:

- Response to comment #235: Implement the changes shown with editorial license.
- Resolve comment #610 with the response to comment #235.

178A.1.3 Measurement of the channel under test

The S-parameters for each signal path are measured between the test points specified by the clause or annex that utilizes this calculation. It is recommended that the scattering parameters be measured with a uniform frequency step from a start frequency no greater than 10 MHz to a stop frequency of at least 67 GHz. The measurement frequency step corresponds to the time span of the pulse response derived from the S-parameters (see 178A.1.6). The frequency step should be chosen to be small enough so that all significant components of the pulse response are included.

The reference impedance for the differential-mode S-parameters must be twice the single-ended reference resistance R_0 specified for the calculation of COM. When the single-ended reference impedance for the measurement R_m differs from R_0, the measured differential-mode S-parameters $S^{(m)}$ can be transformed using Equation (178A–4) where n is 2, Z_0 is $2R_0$, and Z_m is $2R_m$.

$$S = A^{-1}(S^{(m)} - \rho)(I - \rho S^{(m)})^{-1} A \quad (178A–4)$$

where

A	is an $n \times n$ diagonal matrix with diagonal values $\sqrt{Z_0/Z_m}/(Z_0 + Z_m)$
I	is an $n \times n$ identity matrix
ρ	is an $n \times n$ diagonal matrix with diagonal values $(Z_0 - Z_m)/(Z_0 + Z_m)$

Note that Equation (178A–4) can be used to transform the reference impedance of any $n \times n$ S-parameter matrix from any real Z_m to any real Z_0.

~~The reference impedance for the measurement of differential-mode S-parameters is 100 Ω.~~

Reference Impedance
Comments 59-66, 236-239, 514, 595-599, 606-609, 611-618, 620-624

Editorial team recommendation:

- Change reference impedance for all ERL measurements to 92.5 Ω differential (add explicit statement in the ERL subclauses).
- Change reference impedance for frequency-domain measurements (IL, RLCD, RLDC, RLCC) to 92.5 Ω diff., 23.125 Ω CM. Specify for both PMDs and channels/cable assemblies.
- Specify that transmitter time-domain measurements are made with a 50 Ω single-ended load.
- Change R_0 in all COM tables to 46.25 Ω. No change in A_v, A_{ne}, A_{fe}.
- Implement in 178, 179, 176C, 176D, as appropriate.

SNDR

Comments 481, 351, 736, 737, 355, 356, 414, 542

dSNDR/Reference SNDR
Comments 351, 736, 737, 355, 356, 414

Cl 178 *SC* 178.9.2.7 *P* 365 *L* 12 # 351

Ghiasi, Ali — Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* X

The reference pacakge A and B SDNR are known specific value

SuggestedRemedy

I belive these are the value in https://www.ieee802.org/3/dj/public/24_11/healey_3dj_01_2411.pdf page 5 at least for package A, for service to community reference SNDR should be provided

Proposed Response *Response Status* O

Cl 179 *SC* 179.9.4 *P* 394 *L* 37 # 736

Dawe, Piers — Nvidia

Comment Type TR *Comment Status* X

Difference signal-to-noise-and-distortion ratio, dSNDR is too arcane and not justified for CR where the compliance board is properly defined and adjustment for its deviation is allowed

SuggestedRemedy

Change to SNDR, or delete and use EECQ

Proposed Response *Response Status* O

Cl 179 *SC* 179.9.4.5 *P* 399 *L* 1 # 737

Dawe, Piers — Nvidia

Comment Type TR *Comment Status* X

Difference signal-to-noise-and-distortion ratio, dSNDR too arcane and not justified for CR where the compliance board is properly defined and adjustment for its deviation is allowed

SuggestedRemedy

Change to SNDR, or delete and use EECQ

Proposed Response *Response Status* O

Cl 176D *SC* 176D.8.7 *P* 754 *L* 20 # 355

Ghiasi, Ali — Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* X

The dSNDR procedure for host is not clear as some some of the paragraph are for determination of reference SNDR but the last paragraph is for actual measurement of DUT SNDR.

SuggestedRemedy

Here are sugestions:
- Please separate the measurement of reference channel SNDR from measurement of DUT SNDR
- After definition of reference SNDR "calculate reference SNDR"
- In the 2nd part clarly identify this procedure is for measurement of DUT SNDR add to sentense "...of 6 ps is used for measurement of DUT SNDR"
- Then last step is dSNDR=DUT SNDR - Ref SNDR

Proposed Response *Response Status* O

Cl 176D *SC* 176D.8.7 *P* 754 *L* 34 # 356

Ghiasi, Ali — Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* X

The dSNDR procedure for module is not clear as some some of the paragraph are for determination of reference SNDR but the last paragraph is for actual measurement of DUT SNDR.

SuggestedRemedy

Here are sugestions:
- Please separate the measurement of reference channel SNDR from measurement of DUT SNDR
- After definition of reference SNDR "calculate reference SNDR"
- In the 2nd part clarly identify this procedure is for measurement of DUT SNDR
- Then last step is dSNDR=DUT SNDR - Ref SNDR

Proposed Response *Response Status* O

Cl 176D *SC* 176D.6.4 *P* 746 *L* 34 # 414

Mi, Guangcan — Huawei Technologies Co., Ltd

Comment Type TR *Comment Status* D *(Electrical) SNDR*

As Ali's contribution ghiasi_3dj_02b_2505, dSNDR is a complicated parameter. Rich's contribution further proposed to set a set of SNDR_ref values.

For module vendors, both SNDR and dSNDR are newly introduced, and dependent on the IL at the host side. It is not practical for the module vendors to test for all the IL variations.

SuggestedRemedy

The AUI C2M methodology affects both the SERDES/euqipment and the optical module community. The newly introduced parameters need to be open for consideration from both sides, and find consensus in simplfying the measurements.

dSNDR/Reference SNDR Comments 481, 542

Cl 179 *SC* 179.9.4.5.3 *P* 400 *L* 30 # 481

Healey, Adam Broadcom, Inc.

Comment Type T *Comment Status* D *(Electrical) SNDR*

It has been demonstrated that the reference SNDR is a weak function of the test fixture s-parameters. This suggests that the SNDR test can be greatly simplified by specifying a fixed set of reference values that are a function of the preset. The reference values should be derived from the equivalent SNDR produced by the COM transmitter model under similar conditions.

SuggestedRemedy

Replace the dSNDR procedure with a comparison of the measured SNDR to a limit that is a function of the preset. Set the limits to the SNDR^(ref) values on slide 5 of <https://www.ieee802.org/3/dj/public/24_11/healey_3dj_01_2411.pdf> for presets 1 to 5. Set the limit to 31 dB for preset 6. Add a note that the limits are consistent with parameter values in the corresponding COM table. If desired, the subclause defining reference SNDR can be retained as documentation of the procedure used to define the limits.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
There are several comments related to SNDR/dSNDR.
The editorial team will prepare a proposal for resolving all these comments.
For CRG discussion after reviewing the editorial proposal.

Cl 176D *SC* 176D.8.7 *P* 754 *L* 36 # 542

Levin, Itamar Altera corp.

Comment Type T *Comment Status* D *(Electrical) SNDR*

no reference / example test-fixture like in the previous annex 163B, that meets the requirements for TP0

SuggestedRemedy

can we add an example rest-fixture annex for 200G similar to 163B with the COM values to serve as a reference for dVf, dSNR, etc'?

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
The test fixtures for AUI-C2M are specified in Annex 179B. Their reference ILdd as functions of frequency are given in equations 179B-1 and 179B-2, which can serve as examples.
Reference values are currently only required for dSNDR, which is a subject of several other comments.
Resolve using the response to comment #481.

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	

Source: healey_3dj_01_2411, slide 5

If we replace dSNDR with SNDR, there will be no need for an example test fixture.

Reference SNDR
Comments 481, 351, 736, 737, 355, 356, 414, 542

CR

- Promote 179.9.4.5.1 (Measured SNDR) into 179.9.4.5 (Difference signal-to-noise-and- distortion ratio), renaming as required.
- In 179.9.4.5, add a table based on healey_3dj_01_2411 slide 5, adding **preset 6** with a limit of **31 dB**. Add text noting that the limits are consistent with the values in Table 179-18.
- Delete 179.9.4.5.2 (Reference channel transfer function) and 179.9.4.5.3 (Reference SNDR).
- Change the specification in Table 179-7 to SNDR with “Value” referring to the new table.

KR/C2C

- Change the specifications in Table 178-6 and Table 176C-2 to SNDR with “Value” referring to the new table.
- In 178.9.2.7, eliminate the dashed list of exceptions, delete the second item and pull the first one into the text paragraph.

AUI C2M

- Change the specifications in Table 176D-2 and Table 176D-3 to SNDR with “Value” referring to the new table.
- In 176D.8.7, delete the second dashed item (“In the calculation of the reference channel transfer function…”) from the lists of exceptions for both host output and module output.

Editor’s recommendation:

- Implement the changes listed on this slide with editorial license.

ITOL & min channel loss for KR/C2C

Comments

COM Quantization noise

Comments #243-253 (method)
Comments #254-261 (parameter values)

COM quantization noise method (comments #244 to #253)

References:

[1] IEEE P802.3dj May 2025 Task Force interim meeting shakiba_3dj_01b_2505
[2] Attachment to D2.0 comment #243 8023dj_D2p0_comment_243_attachment

From minutes_3dj_2505_unapproved

Straw Poll #1:
For the quantization noise modeling in COM Annex 178A, I prefer the direction of:

- A. no change
- B. direct method (e.g. shakiba_3dj_01a_2505, slide 5 & 15)
- C. need more information/something else
- D. abstain

(choose one)

Results: A: 14, B: 28, C: 8 , D: 10

Comment #243

Cl **178A** *SC* **178A** *P* **777** *L* **26** # 243

Shakiba, Hossein Huawei Technologies Canada

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

Add quantization noise.

SuggestedRemedy

Add a new section "178A.1.7.6 Quantization noise". Please refer to slides 3-5 of the accompanying document for the proposed sub-section content and text.

- Support for adding a quantization noise model indicated in May 2025 interim meeting straw poll #1.
- Accompanying document referred to in comment #243 is reference [2].
- Need agreement on values for new parameters.

COM quantization noise parameter values (comments #254-261)

Reference:

[3] 26 June 2025 IEEE P802.3dj Joint Electrical/Logic/Optics ad hoc shakiba_3dj_adhoc_01b_250626

Parameter	Draft 2.0 (no change)	[3] Option 1	[3] Option 2	[3] Option 3.a [2] slides 15-18	[3] Option 3.b	[3] Option 4
One-sided noise spectral density, eta_0	1e-8	5e-9	7.4e-9 Cl. 178 7.4e-9 Cl. 179 4.6e-9 An. 176C 2.4e-9 An. 176D	5e-9	7.5e-9	1e-8
Noise-equivalent quantization bits, N_qb	n/a	5.48 Cl. 178 5.48 Cl. 179 6.08 An. 176C 6.37 An. 176D	6	6	6	6
Quantization clip probability, P_qc	n/a	(2 x DER 0) 4e-4 Cl. 178 4e-4 Cl. 179 1.34e-5 An. 176C 4e-5 An. 176D				

From 3dj_adhoc_Straw_Polls_250626

Straw Poll #1:

For the modeling of quantization noise in COM Annex 178A, I would support the proposed Option 3.a or Option 3.b eta_0 and N_qb values (CR/KR, C2M, C2C) in shakiba_3dj_adhoc_01b_250626 (page 15)

Y: 21 N: 1 NMI: 2 A: 11

Straw Poll #2:

For the modeling of quantization noise in COM Annex 178A, I prefer proposed eta_0 and N_qb values (CR/KR, C2M, C2C) in shakiba_3dj_adhoc_01b_250626 (page 15) (chicago rules)

A. option 3a

B. option 3b

C. abstain

Results: A: 6, B: 17, C: 12

COM quantization noise recommendations

Editor's recommendations:

- Resolve comment #243 as follows
  - Implement the changes in 8023dj_D2p0_comment_243_attachment slides 3 to 14 with editorial license
  - Add new parameters to, and update existing parameters in, the COM tables in Clause 178, Clause 179, Annex 176C, and Annex 176D with the values from Option 3.b in shakiba_3dj_adhoc_01b_250626
- Resolve comments #244 to #261 with the response to comment #243.

KR link diagram

Comments 640, 303, 92, 304, 302

KR Link Diagram

Comments 640, 303, 92, 304, 302

Cl **178** *SC* **178.8.1** *P* **360** *L* **24** **#** 92

Bruckman, Leon Nvidia

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

The ILT function and SIGNAL_OK handling is missing. In the optical PMDs appears in the block diagram figures

SuggestedRemedy

In Figure 178-2 add the ILT function above the PMD transmit and receive functions. Show the SIGNAL_OK as an input to the ILT function at the left side and as an output to the ILT function in the right side (refer for example to Figure 180-2)
Apply also to Figure 179-2.

Proposed Response *Response Status* O

Cl **178** *SC* **178.8.1** *P* **360** *L* **15** **#** 640

Swenson, Norman Nokia, Point2

Comment Type **ER** *Comment Status* **X**

The test points in the figure are not the test points at which the OMD is spoecified. The PMD is specified at TP0v, which is not shown in the figure. The first sentence starting with "The test points" implies that these are the only test points.

SuggestedRemedy

Change the title of the section from "Specified Test Points" to "Referenced Test Points". Delete the word "The" at the beginning of the first sentence. Add a sentence after the first sentence that reads: "The PMD is specified at test points TP0v and TP5v (see 178.9.2.1 and 178.9.3.1)."

Proposed Response *Response Status* O

Cl **178** *SC* **178.8.1** *P* **360** *L* **33** **#** 302

Brown, Matt Alphawave Semi

Comment Type **ER** *Comment Status* **X**

Figure 178-2. The interface at TP0 is helpfully labelled as "package-to-board interface". A similar label would be helpful at TP0d.

SuggestedRemedy

Add a label at TP0d "die-to-package interface".
Apply similar change to Figure 176C-2.

Proposed Response *Response Status* O

Cl **178** *SC* **178.8.1** *P* **360** *L* **23** **#** 303

Brown, Matt Alphawave Semi

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

The PMD ends and the medium begins at the MDI. According to 178.11 the MDI is at TP0 and TP5, not at TP0d and TP5d. Further, in most cases "channel" spans from TP0 to TP5; though there are some cases that reference the TP0d to TP5d channel, e.g., "Maximum insertion loss from Tp0d to Tp5d, ILdd, at 53.125 GHz (recommended)" in Table 178-11.

SuggestedRemedy

In Figure 178-2, make the following changes:
Show the PMD ending and "channel" beginning at TP0 and TP5.
Add a label at TP0 and TP5 "MDI".
Apply similar changes to Figure 176C-2.

Proposed Response *Response Status* O

Cl **178** *SC* **178.8.1** *P* **360** *L* **32** **#** 304

Brown, Matt Alphawave Semi

Comment Type **ER** *Comment Status* **X**

The die is labelled "device", whereas the "device" is the combination of die and package.

SuggestedRemedy

Change label pointing to the die on the left side of the Figure 178-2 to "Die".

Proposed Response *Response Status* O

KR Link Diagram

Comments 640, 303, 92, 304, 302

Proposed changes to 178.8.1/Figure 178-2.

- 92: Add the ILT function & SIGNAL_OK above PMD function.
- 302: Label “Die-to-package interface at TP0d. Also apply to Figure 176C-2.
- 303: Show channel going from TP0 to TP5. Add “MDI” at TP0 & TP5. (and in Figure 176C-2)
- 304: Change label on die at left from ‘device’ to ‘die’.
- 640: Change subclause title. Add sentence to 1st paragraph stating that the PMD is specified at TP0v & TP5v.
    - Note: the MDI is specified at TP0 & TP5 (ref 178.11).

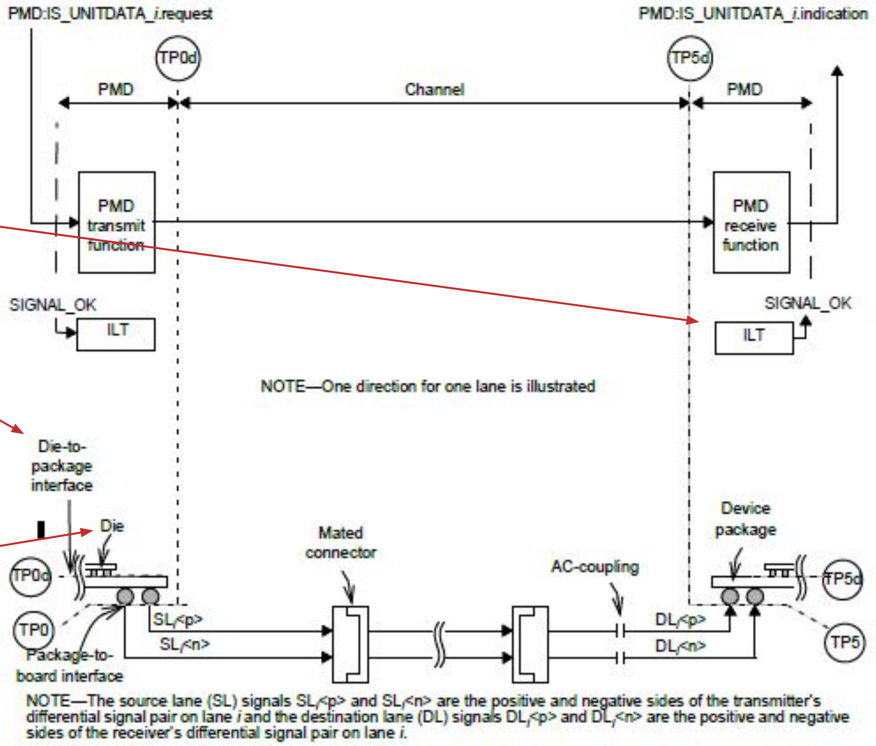


Figure 178–2—200GBASE-KR1, 400GBASE-KR2, 800GBASE-KR4, or 1.6TBASE-KR8 link

KR SCMR

Comment 48

SCMR
Comment #48

The comment proposes to align SCMR (eq 178-1) with SNDR (eq 179-9)

$$SNDR^{(meas)} = 10\log_{10}\left(\frac{P_{Signal}}{\sigma_e^2 + \sigma_n^2}\right) \quad (179\text{-}9)$$

$$m_0 = 1 + (k_{peak} - 1) \bmod M \quad (179\text{-}7)$$

$$P_{Signal} = \sum_{i=0}^{N_p - 1} p(M \times i + m_0)^2 \quad (179\text{-}8)$$

$$\mathrm{SCMR} = 20\log_{10}\left(\frac{v_{peak}}{VCM_{FB}}\right) \quad (178\text{-}1)$$

Change to

$$SCMR = 10log_{10}\left(\frac{p_{signal}^2}{VCM_{FB}^2}\right)$$

Editor's recommendation: Implement the suggested remedy.

CI 178 *SC* 178.9.2.6 *P* 364 *L* 53 # 48

Mellitz, Richard Samtec

Comment Type TR *Comment Status* X

SNDR(meas) replaced V_peak^2 with P_signal. SCMR should be aligned with SNDR(meas) (eq 179-9)

SuggestedRemedy

SNDR(meas) replaced V_peak^2 with P_signal. SCMR should be aligned with SNDR(meas) (eq 179-9)
Replace equation 178-1 with
SCMR= 10*log10(P_signal / VCM_FB^2)
In P365 line 4
Replace:
V_peak is defined in 179.9.4.1.2
With
P_signal is defined in equation 179-8

Proposed Response *Response Status* O

SNDR/SCMR/SNR_TX
[6 comments, 178/179]

In agenda

CI 179 *SC* 179.9.4.1.1 *P* 312 *L* 42 # 45

Mellitz, Richard Samtec

Comment Type TR *Comment Status* X

SNDR reduces with loss and used that way for equation 178A–18.

SuggestedRemedy

Insert a subsection e) Loss correction factor for fitted pulse measurements. See presentation

Proposed Response *Response Status* O

CI 179 *SC* 179.9.4.6 *P* 315 *L* 17 # 47

Mellitz, Richard Samtec

Comment Type TR *Comment Status* X

SNDR reduces with loss and used that way for equation 178A–18.

SuggestedRemedy

change
The transmitter SNDR is defined by the measurement method described in 120D.3.1.6
to
The transmitter SNDR is defined by the measurement method described in 120D.3.1.6 plus a power loss factor defined in xxxx

Proposed Response *Response Status* O

The following presentation was reviewed by the task force at the May interim meeting:
https://www.ieee802.org/3/dj/public/24_05/mellitz_3dj_02_2405.pdf
The presentation suggested effectively changing the definition of the "signal" component of SNDR as shown in the excerpts below.
The motivation is that this way the SNDR measurement at different losses between the source and the measurement point yield consistent results.

The presentation suggests a specific way of writing this definition as a correction factor "So we don't change prior standards", but this can be done specifically for the clauses in this project without affecting other standards.

Comment #47 seems to suggests essentially the same change.

- For the "S" in SNDR use the power variance of the signal at the measurement point as follows which is the in time and frequency domain
  - $\sigma_P^2 = \sum_1^{M(N_p - Dp-1)} p(n)^2$
  - Instead of p_{max}
- Consider SNDR as a ratio of signal power variance to noise power variance
  - Perhaps: SNDR should be $10 * log_{10}\left(\frac{\sigma_P^2}{\sigma_e^2+\sigma_n^2}\right)$

If the proposal is adopted, implementing this proposal would preferably done with broad editorial license.

Other comments (shown on subsequent slides) are based on this proposed change.

June 2024 IEEE P802.3dj Task Force 17

ran_3dj_01f_2406.pdf

Amplitude tolerance

Comments 410, 667

Amplitude tolerance
Comment 410

Cl 176D SC 176D.8.11 P 755 L 21 # 410

Mi, Guangcan Huawei Technologies Co., Ltd

Comment Type TR *Comment Status* D *Amplitude tolerance*

beginning of this section, the amplitude tolerance is said to be define as the maximum steady state voltage. In this note, it says the steady-state voltage is defined with preset 1. In the same time, the receiver is not required to tolerate preset 1 unless it specifically requests it.

It is very confusing which voltage is used and how it is defined.

SuggestedRemedy

Please clarify.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
The first sentence continues with "such that it satisfies the error ratio allocation requirements specified in 176D.2 when it operates in DATA mode".
The second paragraph defines the steady-state voltage as being a transmitter metric, and clarifies that a receiver under test can control the equalizer setting to create a suitable output signal.
These two paragraphs together imply that the signal seen by the receiver is different from the definition of steady-state voltage. The note makes this more explicit.
However, this may be clarified further by some rewording.

In the first paragraph, change "as the maximum steady-state voltage (see 176D.8.4)" to "as the maximum transmitter steady-state voltage".
In the second paragraph, change "The steady-state voltage is measured for the transmitter that is connected that is connected to the input of the receiver under test" to "The transmitter steady-state voltage is measured as specified in 176D.8.4 at the output of the transmitter used in the test".

Proposed change (modified from the original response)

176D.8.11 Amplitude tolerance

Amplitude tolerance of a receiver is defined as the maximum transmitter steady-state voltage ~~(see 176D.8.4)~~ that the receiver can tolerate ~~at its input~~, such that it satisfies the error ratio allocation requirements specified in 176D.2 when it operates in DATA mode (see Annex 178B).

The transmitter steady-state voltage is measured as specified in 176D.8.4 ~~for the transmitter that is connected to the input of the receiver under~~ at the output of the pattern generator used in the test. ~~A receiver under test is allowed to control the transmit equalizer coefficients of the transmitter using the ILT protocol (see 176D.8.6) to create suitable output signal.~~

NOTE—Steady-state voltage is defined with preset 1. It is not initially generated by a transmitter, due to the initialize setting in Table 176D–9. The receiver is not required to tolerate preset 1 unless it specifically requests it.

The pattern generator is initially configured to transmit training frames as defined in 178B.6. During this initialization period, the device under test (DUT) may configure the pattern generator transmit equalizer to the coefficient settings it would select using the ILT function (see 176D.8.6). The coefficient settings may be communicated via the ILT protocol or by other means. After the transmit equalizer has been configured, the block error ratio is measured as specified in 174A.8.

For a host, the input signal is applied at TP4a and measured at TP4. For a module, the input signal is applied at TP1 and measured at TP1a.

Additional text taken from the ITOL subclause, plus a reference to the test method of 174A.8.

Amplitude tolerance Comment 667

Cl 179 *SC* 179.9.5.2 *P* 406 *L* 10 # 667

Ran, Adee Cisco Systems

Comment Type TR *Comment Status* D ATOL

As noted in comment #263 against D1.4, the amplitude tolerance required by a receiver (at its input, TP3) is not a swing identical to the output of the transmitter. This is due to both channel attenution and initial Tx equalization (which is addressed by another comment). This is despite the fact that the tolerance is defined using the output of the transmitter (but this value is at TP2).

The comment suggested adding an informative NOTE to highlight this non-trivial fact for readers. SImilar comments exist in Amplitude tolerance subclauses of AUIs, both C2C and C2M.

In https://www.ieee802.org/3/dj/public/25_03/ran_3dj_03_2503.pdf it was referred to as "Change B" (slide 3).

There was consensus to apply this change, as recorded in straw polls #TF-7 and #TF-8 (see minutes_3dj_2503_approved, page 17).

SImilar notes should be use for all instances of amplitude tolerance.

SuggestedRemedy

Implement change B as shown on slide 3 in ran_3dj_03_2503, with editorial license.

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
Straw polls #TF-8 and #TF-8 in the March 2025 meeting (see <https://www.ieee802.org/3/dj/public/25_03/minutes_3dj_2503_approved.pdf#page=17> and the related presentation <https://www.ieee802.org/3/dj/public/25_03/ran_3dj_03_2503.pdf#page=3>) indicated strong support of the direction suggested in this comment: in "choose one", options B-D (which include the suggested remedy) had a total of 35, while options A and E (which do not include it) had 24.

Note that a similar informative NOTE appears in the receiver amplitude tolerance definitions of C2C (176C.6.4.2) and C2M (176D.8.11). These notes include "the initialize setting in Table 176D-9" which is currently different from the one in Table 179–8. However, comment #666 suggests to make the initialize settings the same in both tables.

Change the text of the PMD receiver amplitude tolerance subclauses (178.9.3.3 and 179.9.5.2) to align them with the AUI annexes (176C.6.4.2 and 176D.8.11), including the informative NOTEs, with the appropriate wording, values, and references for each clause. Implement with editorial license.

The comment suggests clarifying that **the amplitude tolerance requirement does not mean the receiver has to tolerate the maximum transmitter output voltage at its input** (referring to the presentation ran_3dj_03_2503).

In addition, it suggests aligning the amplitude tolerance text to that of Annex 176D (addressed by comment #667), which is phrased as a specific test (pattern generator, etc.).

Assuming the response to #667 is adopted, such alignment would require some changes due to the existence of a cable assembly between the Tx and Rx.

Existing text in 179.9.5.2:

179.9.5.2 Receiver amplitude tolerance

When a PMD receiver is connected to a compliant transmitter that has a steady-state voltage (see 179.9.4.1.2) equal to the Amplitude tolerance value in Table 179–10, using a compliant cable assembly with the minimum insertion loss specified in 179.11.2, the PMD receiver operation shall enable a block error ratio as specified in 179.2.

The receiver is allowed to control the transmitter equalizer coefficients, using the ILT function (see 179.8.9) or an equivalent process, to meet these requirements.

Amplitude tolerance
Comment 667

Existing text in 179.9.5.2

179.9.5.2 Receiver amplitude tolerance

When a PMD receiver is connected to a compliant transmitter that has a steady-state voltage (see 179.9.4.1.2) equal to the Amplitude tolerance value in Table 179–10, using a compliant cable assembly with the minimum insertion loss specified in 179.11.2, the PMD receiver operation shall enable a block error ratio as specified in 179.2.

The receiver is allowed to control the transmitter equalizer coefficients, using the ILT function (see 179.8.9) or an equivalent process, to meet these requirements.

Proposed replacement text, based on 176D.8.11. Differences are highlighted.

Amplitude tolerance of a receiver is defined as the maximum transmitter steady-state voltage that the receiver can tolerate, using the low-loss test channel specified in 179.9.5.3.2, such that it satisfies the error ratio allocation requirements specified in 179.2 when it operates in DATA mode (see 179.8.2).

The transmitter steady-state voltage is measured as specified in 179.9.4.1.2 at the output of the pattern generator used in the test.

NOTE—The voltage observed at the receiver input is attenuated by the test channel and possibly by transmit equalization in the pattern generator, which is configured by the receiver. The receiver is not required to tolerate the maximum transmitter output voltage at its input.

The pattern generator is initially configured to transmit training frames as defined in 178B.6. During this initialization period, the device under test (DUT) may configure the pattern generator transmit equalizer to the coefficient settings it would select using the ILT function (see 179.8.9). The coefficient settings may be communicated via the ILT protocol or by other means. After the transmit equalizer has been configured, the block error ratio is measured as specified in 174A.8.

Depending on the resolution of #666, the NOTE may also need to refer to the “initialize” value as in 176D.8.11.

CR host classes
C2C package classes

Comments 370, 372, 373, 362

CR host classes
Comment 370, 372

Cl 179 *SC* 179.9.4 *P* 394 *L* 46 # 370

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* D *CR host classes*

Reference to host classes missing

SuggestedRemedy

Please reference table 179A-1

Proposed Response *Response Status* W

PROPOSED REJECT.
The existence of three host classes is stated in the overview subclause, 179.1, including the fact that they have different electrical specifications.
Table 179A-1 (mentioned in the suggested remedy) is not a definition of host classes - it only includes recommendations for insertion losses, and is informative. It is not a helpful reference.
The proposed change does not improve the technical clarity or accuracy of the text.

Cl 179 *SC* 179.11.7.1 *P* 417 *L* 8 # 372

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* D *CR host classes*

The only place that host classes are defined is in Table 179A-1

SuggestedRemedy

Need reference to table 179A-1 or Host classes should be added to the glossary

Proposed Response *Response Status* W

PROPOSED REJECT.
Resolve using the response to comment #370.

Table 179–7—Summary of transmitter specifications at TP2

Parameter	Subclause reference	Value	Units
. . .			
Output jitter (max)	179.9.4.6		
J_{RMS}		0.023	UI
EOJ_{03}		0.025	UI
$J4u_{03}$			
Host class HL		0.120	UI
Host class HN		0.124	UI
Host class HH		0.128	UI

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.

CR host classes
Comment 370, 372

Cl 179 *SC* 179.9.4 *P* 394 *L* 46 # 370

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* D *CR host classes*

Reference to host classes missing

SuggestedRemedy

Please reference table 179A-1

Proposed Response *Response Status* W

PROPOSED REJECT.
The existence of three host classes is stated in the overview subclause, 179.1, including the fact that they have different electrical specifications.
Table 179A-1 (mentioned in the suggested remedy) is not a definition of host classes - it only includes recommendations for insertion losses, and is informative. It is not a helpful reference.
The proposed change does not improve the technical clarity or accuracy of the text.

Cl 179 *SC* 179.11.7.1 *P* 417 *L* 8 # 372

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* D *CR host classes*

The only place that host classes are defined is in Table 179A-1

SuggestedRemedy

Need reference to table 179A-1 or Host classes should be added to the glossary

Proposed Response *Response Status* W

PROPOSED REJECT.
Resolve using the response to comment #370.

179.1 Overview

This clause specifies the 200GBASE-CR1, 400GBASE-CR2, 800GBASE-CR4, and 1.6TBASE-CR8 PMDs and the associated baseband media. The PMDs provide point-to-point 200 Gb/s, 400 Gb/s, 800 Gb/s, and 1.6 Tb/s Ethernet links on one, two, four, or eight lanes, respectively, over twinaxial copper cable. The specifications for the four PMDs are similar, except for the number of lanes and associated parameters, and the MDI.

There are four associated annexes. Annex 179A provides information on parameters that might not be testable in an implemented system, since the test points they are associated with are typically inaccessible. Annex 179B specifies test fixtures. Annex 179C specifies MDIs. Annex 179D describes host and cable assembly types.

When forming a complete Physical Layer, a PMD shall be connected to the appropriate sublayers (as specified in Table 179–1 through Table 179–4) and to the medium through the appropriate MDI, as illustrated in Figure 179–1.

PMDs defined in this clause conform to one of three host classes. The electrical specifications are separate for each host class.

Cable assemblies defined in this clause conform to one of four classes, which differ by the maximum insertion loss.

Operation of Ethernet links is provided for specific combinations of host classes and cable assembly classes, as listed in Table 179–15 and Table 179A–4.

Table 179–15—Cable assembly class and host class valid combinations

Cable assembly class	Host classes, transmitter side	Host classes, receiver side	Number of combinations
CA-A	HN or HL	HL, HN, or HH	6
	HH	HL or HN	2
CA-B	HL	HL, HN, or HH	3
	HN	HL or HN	2
	HH	HL	1
CA-C	HL	HL or HN	2
	HN	HL	1
CA-D	HL	HL	1

CR host classes
Comment 370, 372

The comments suggest adding references to Table 179A-1 in two places. However, this table is not a definition or specification of the host classes - it is only an **informative** recommendation for host design.

The host output specifications (Table 179-7) and the COM partial host model parameters (Table 179-17) are **normative**, and should not refer to this table.

The overview in 179.1 provides the context of having three host classes and their combinations with cable assembly classes.

Editor’s recommendation: reject both comments.

179A.4 Host channel insertion loss

The recommended differential insertion loss at 53.125 GHz for the host channels, consisting of controlled impedance PCB, device package, and host connector, are given in Table 179A–1 and illustrated in Figure 179A–1. The recommended maximum differential insertion loss at 53.125 GHz for (TP0d-to-TP2) or (TP3-to-TP5d) for each of the host channels are given in Table 179A–1, and illustrated in Figure 179A–1. The recommended maximum differential insertion loss (TP0d-to-TP2) or (TP3-to-TP5d) are consistent with the host channels and an assumed mated connector insertion loss of 2.45 dB.

Table 179A–1—Recommended differential insertion loss limits at 53.125 GHz

	Host channels	TP0d to TP2 or TP3 to TP5d
Host class	Range (dB)	Max (dB)
Host-Low (HL)	4.45 to 8.95	12.75
Host-Nominal (HN)	4.45 to 13.95	17.75
Host-High (HH)	4.45 to 18.5	22.75

CR host classes
Comment 373

Cl 179 *SC* 179.11.7.1 *P* 417 *L* 8 # 373

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type TR *Comment Status* D *CR host classes*

Table 179-17 provide partial channel for different host classes, it would be helpful to also include the losses for the 3 partial channels

SuggestedRemedy

Host Partial HL Class loss = 1.72 dB
Host partial NL Class loss = 9.4 dB
Host partial HH Class loss = 14.35 dB
If one adds the MCB loss of 3.2 dB to the above value then that would give host channel see below and similar to Table 179A-1
Host HL Class loss = 4.9 dB
Host NL Class loss = 9.4 dB
Host HH Class loss = 14.35 dB
The above losses are the not max or min losses, some explanation why value in table 179-17 are chossen would be helpfull.
For the HH case if we go with Zp=140 mm will result in loss of 18.3 dB when MCB is included which inline to max loss in table 179A-1.

Proposed Response *Response Status* W

PROPOSED REJECT.
The comment suggests adding the ILdd values corresponding to the partial host channel of each host class. That could be done by adding another row in Table 179-17.
However, the ILdd value is just a result of the existing information in the table, and is not a specification by itself. Thus, this row would only be informative. Moreover, it would not represent the whole host channel and thus would not be helpful for implementers (and might cause confusion).
The NOTE below the table includes references to the informative annexes where the recommended host channel ILdd values are listed.

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.

The table was added by the response to comment #92 against D1.2
(See slide 7 in ran_3dj_02a_2411)
The values were chosen such that:
ILdd(Partial host channel) + ILdd(reference MTF) = ILdd(TP0d to TP2)

Table 179A–1—Recommended differential insertion loss limits at 53.125 GHz

Host class	Host channels Range (dB)	TP0d to TP2 or TP3 to TP5d Max (dB)
Host-Low (HL)	4.45 to 8.95	12.75
Host-Nominal (HN)	4.45 to 13.95	17.75
Host-High (HH)	4.45 to 18.5	22.75

C2C package classes
Comment 362

Cl **176C** *SC* **176C.6.3** *P* **724** *L* **22** # 362

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type **TR** *Comment Status* **D** *(Electrical) Package class*

J4U03 has two values, package A and package B, not clear what determines actual DUT package as Class A or Class B. Is it total loss? What happens if one has Class B package with short trace, is that class A?

SuggestedRemedy

Please provide how to determine DUT package is Class A or B.
Also add reference to table 176C-7

Table 176C–2—Transmitter electrical characteristics at TP0v *(continued)*

Parameter	Reference	Value	Units
…			
Output jitter (max)	176C.6.3.6		
J_{RMS}		0.023	UI
EOJ_{03}		0.025	UI
$J4u_{03}$			
Tx package Class A		0.118	UI
Tx package Class B		0.12	UI

The existence of two package classes is stated in the last paragraph of 176C.3.

This annex defines specifications for two classes of C2C transmitters and two classes of C2C receivers, identified by transmitter package class and receiver package class, respectively. The package is either class A or class B. Devices conform to electrical specifications of either class A or class B. The required characteristics of the electrical interconnect between two devices depend on the transmitter package class on one device and the receiver package class on the other device.

Table 176C-7, mentioned in the suggested remedy, contains reference package model parameters. It is not a definition/specification of the package classes and should not be referenced.

Similar text appears in 178.1, the "Overview" subclause.
It makes sense to move this text into the overview 176C.1.

Editor's recommendation:
ACCEPT IN PRINCIPLE.
Move the last paragraph of 176C.3 to 176C.1, with editorial license.

ERL Tfx

Comments 139, 361

ERL Tfx
Comments 139, 361

Cl **179** *SC* **179.11.3** *P* **413** *L* **8** # 139

Noujeim, Leesa Google

Comment Type **T** *Comment Status* **D** *(Electrical) ERL*

ERL calculation shouldn't de-embed to just before mating interface; this language was inherited from adjustment of HCB, but doesn't apply to CATF in the same way. CA ERL should include the connector and launch but this would be removed with the definition of Tfx currently in the draft

SuggestedRemedy

Reword to remove reference to the mating interface discontinuity; Tfx should include the RF test connector only.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
CATF (MCB) can have discontinuities or loss prior to the mating interface. These should be time gated, otherwise the measurement can be influenced by the CATF more than the cable itself.
However, the text is unclear about whether the CATF connector should be included in the measurement or time-gated out. This may be worth clarification.
For CRG discussion of what the intent is.

Cl **176D** *SC* **176D.8.2** *P* **752** *L* **29** # 361

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type **TR** *Comment Status* **D** *(Electrical) Tfx*

Line 30 says that "Tfx equal to twice the test fixture delay", statement is not clear.

SuggestedRemedy

Tfx for measurement of Host Input/Output is twice the HCB delay.
Tfx for measurement of Module Input/Output is twice the MCB delay.
Suggest to move Tfx into the table and make the above as footnotes in the table.
We shouldn't state in IEEE standard "Tfx is provided by the test fixture provider", what about if fixture suplier doesn't!

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The test fixture delay is defined in detail in the second paragraph of 176D.8.2 for both host and module measurements. Based on these definitions, the statement should be clear.
The suggested remedy does not match the second paragraph and would not improve clarity.
The statement that Tfx is provided by the test fixture provider" was added by the response to comment #199 against D1.1, see <https://www.ieee802.org/3/dj/comments/D1p1/8023dj_D1p1_comments_final_clause.pdf#page=77>. It should be understood as a requirement. The suggested remedy does not provide an alternative phrasing for this statement.

179.11.3 Cable assembly ERL

The cable assembly ERL at TP1 and at TP4 is defined by the procedure in 93A.5 with the values in Table 179–14 and Table 179–16, and with T_{fx} equal to twice the test fixture delay. The test fixture delay is defined as the propagation delay between the test connector and the cable-facing connection, excluding the mating interface discontinuity. T_{fx} is provided by the test fixture provider.

This comment is specifically about the span of Tfx in a cable assembly test fixture (aka MCB).

176D.8.2 Effective return loss (ERL)

ERL is computed using the procedure in 93A.5 with the values in Table 176D–7 and Table 176D–8, and with T_{fx} equal to twice the test fixture delay. T_{fx} is provided by the test fixture provider.

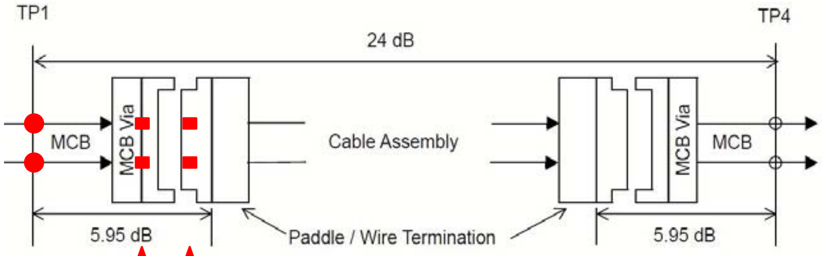
For host input and output ERL, the test fixture delay is defined as the propagation delay between the test connector and the host-facing connection, excluding the mating interface discontinuity. For module input and output ERL, the test fixture delay is defined as the propagation delay between the test connector and the module-facing connection, excluding the mating interface discontinuity.

This comment seems to address both MCB and HCB.

ERL Tfx
Comments 139, 361

For Adee Review

Possible time-gating options in an MCB/CATF:



A: MCB connector pads

B: Receptacle mating point (Cable/HCB pads/Gold Fingers)

C: Somewhere else?

(Top of Figure 179A–1)

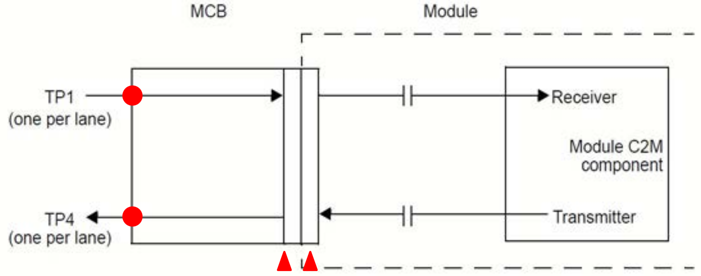
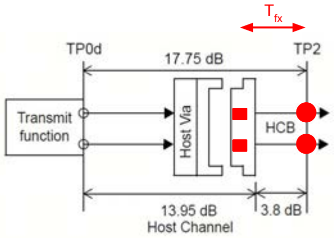


Figure 176D–5—Module compliance points

Discussion points:

- ERL for cable assembly / module should include anything that is not included in the host.
- For host ERL: “the test fixture delay is defined as the propagation delay between the test connector and the host-facing connection, excluding the mating interface discontinuity”
  - The receptacle is excluded from Tfx, thus included in the host



(from Figure 179A–1)

- Option A would make the ERL dependent on the MCB’s receptacle
  - But Tfx is relatively well-defined and easy to measure
- Option B would reduce the dependence
  - Measurement of Tfx may require mating the MCB to a cable or HCB

ERL Tfx
Comments 139, 361

Cl **179** *SC* **179.11.3** *P* **413** *L* **8** # 139

Noujeim, Leesa Google

Comment Type **T** *Comment Status* **D** *(Electrical) ERL*

ERL calculation shouldn't de-embed to just before mating interface; this language was inherited from adjustment of HCB, but doesn't apply to CATF in the same way. CA ERL should include the connector and launch but this would be removed with the definition of Tfx currently in the draft

SuggestedRemedy

Reword to remove reference to the mating interface discontinuity; Tfx should include the RF test connector only.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
CATF (MCB) can have discontinuities or loss prior to the mating interface. These should be time gated, otherwise the measurement can be influenced by the CATF more than the cable itself.
However, the text is unclear about whether the CATF connector should be included in the measurement or time-gated out. This may be worth clarification.
For CRG discussion of what the intent is.

Cl **176D** *SC* **176D.8.2** *P* **752** *L* **29** # 361

Ghiasi, Ali Ghiasi Qunatum/Marvell

Comment Type **TR** *Comment Status* **D** *(Electrical) Tfx*

Line 30 says that "Tfx equal to twice the test fixture delay", statement is not clear.

SuggestedRemedy

Tfx for measurement of Host Input/Output is twice the HCB delay.
Tfx for measurement of Module Input/Output is twice the MCB delay.
Suggest to move Tfx into the table and make the above as footnotes in the table.
We shouldn't state in IEEE standard "Tfx is provided by the test fixture provider", what about if fixture suplier doesn't!

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The test fixture delay is defined in detail in the second paragraph of 176D.8.2 for both host and module measurements. Based on these definitions, the statement should be clear.
The suggested remedy does not match the second paragraph and would not improve clarity.
The statement that Tfx is provided by the test fixture provider" was added by the response to comment #199 against D1.1, see <https://www.ieee802.org/3/dj/comments/D1p1/8023dj_D1p1_comments_final_clause.pdf#page=77>. It should be understood as a requirement. The suggested remedy does not provide an alternative phrasing for this statement.

179.11.3 Cable assembly ERL

The cable assembly ERL at TP1 and at TP4 is defined by the procedure in 93A.5 with the values in Table 179–14 and Table 179–16, and with T_{fx} equal to twice the test fixture delay. The test fixture delay is defined as the propagation delay between the test connector and the cable-facing connection, excluding the mating interface discontinuity. T_{fx} is provided by the test fixture provider.

Editor's recommendations (based on option B):

In 179.11.3, change from:
"The test fixture delay is defined as the propagation delay between the test connector and the cable-facing connection, excluding the mating interface discontinuity"
To:
"The test fixture delay is defined as the propagation delay between the test fixture's coaxial connector and the mating point with a cable assembly or a TP2 or TP3 test fixture".

In 176D.8.2 change from:
"For module input and output ERL, the test fixture delay is defined as the propagation delay between the test connector and the module-facing connection, excluding the mating interface discontinuity."
To:
"For module input and output ERL, the test fixture delay is defined as the propagation delay between the test fixture's coaxial connector and the mating point with a module or an HCB".

Change other instances of "test connector" to "test fixture's coaxial connector".

CR Test Fixture

Comments 658,289,594,601,513,512,600

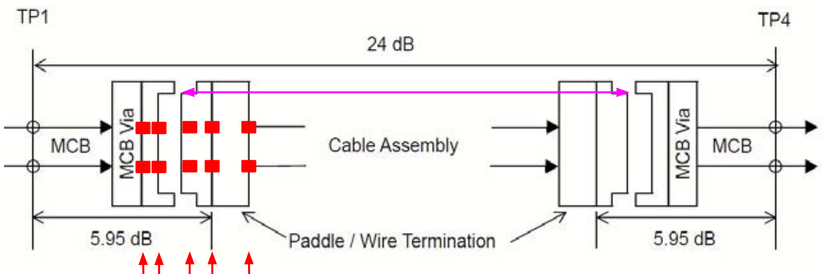
CR Test Fixture Comments 658

For Adee Review

CR Test Fixtures are meant to be used to measure and assess cable assembly compliance, Clause 179.

Discussion points:

- Is the text “Paddle / Wire Termination” in the Figure clear, and useful?



MCB connector pads

MDI receptacle interface

Receptacle mating point (Cable / HCB pads / Gold Fingers)

Ambiguous Test Point

Paddlecard / DAC wire termination

(Top of Figure 179A–1)

Cl **179A** *SC* **179A.5** *P* **821** *L* **4** *#* 658

Swenson, Norman Nokia, Point2

Comment Type **TR** *Comment Status* **D** *(Electrical) CR test fixture*

What is the extra rectangle labeled Paddle/Wire Termination shown in Fig. 179A-2 that is not shown in the mated test fixtures in Fig 179A-1? It is not explained in the text.

SuggestedRemedy

Clarify

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The rectangle and labels "Paddle/Wire Termination" serve as demarcation of the cable assembly and the host channel, in Figures 179A-1, 2, and 3. The "Paddle" and "Wire Termination" are structures associated with the cable assembly, and are not necessarily present in an HCB (or Mated Test Fixture). The labels are used to identify specific structures that are not documented elsewhere in the figure.

These figures provide illustration as appropriate within an informative Annex. Similar figures with the same features are included in in Annex 162A, added by IEEE Std 802.3ck.

The suggested remedy does not contain sufficient detail for the CRG to discuss a specific change.

CR Test Fixture
Comments 289, 594, 601, *513*

For Adee Review

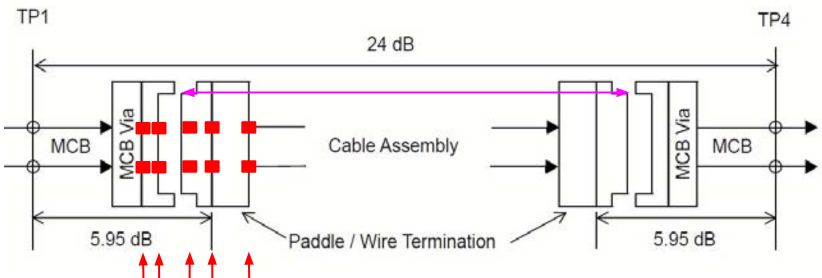
CR Test Fixtures are meant to be used to measure and assess cable assembly compliance, Clause 179.

Annex 179A is informative and Annex 179B is normative

The Figures to the left are in Annex 179A,
while the equations that derive 5.95dB and 3.8dB are in Annex 179B

Discussion points:

- It is critical that CR test fixtures are quantifiable and have consistent quality across implementations. We have introduced a new way of allocating budget in 3dj. Is this working?
- Would Eq. 179B-2 be better suited for Annex 179A?



MCB connector pads

MDI receptacle interface

Receptacle mating point
(Cable / HCB pads / Gold Fingers)

Ambiguous Test Point

Paddlecard / DAC wire termination

(Top of Figure 179A–1)

Cl **179A** *SC* **179A.5** *P* **820** *L* **39** # 289

Heck, Howard TE Connectivity

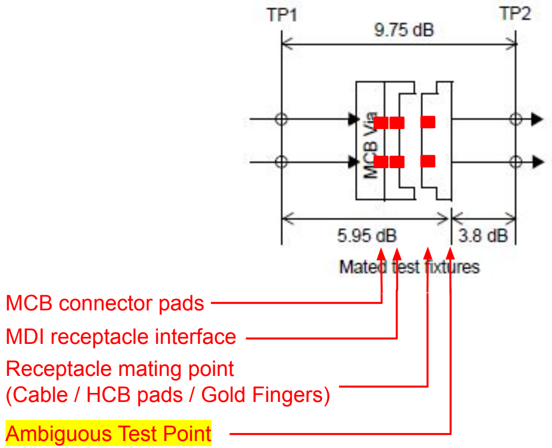
Comment Type **TR** *Comment Status* **D** *(Electrical) CR test fixture*

MCB loss specified in the lower left of Figure 179A-1 is not directly measurable as it is currently specified. Indirect measurement methods do not provide the necessary accuracy. The version of the figure in D1.4 was measureable and reverting back to it will resolve the problem. Equation 179B-2 requires modification to make it accurately represent the MCB insertion loss measured with the 2Xthru method

CR Test Fixture
Comments 513, 512, 600

For Adee Review

(Bottom of Figure 179A–1)



Discussion points:

- Is a process that requires both an MCB and an HCB (MTF) any better at providing a requirement for an MCB or HCB independently?
- How should we address nomenclature like “gold fingers” and “fixture printed circuit board”

CR Test Fixtures are meant to be used to measure and assess cable assembly compliance, Clause 179.

Annex 179A is informative and Annex 179B is normative

The Figures to the left are in Annex 179A,
while the equations that derive 5.95dB and 3.8dB are in Annex 179B

Cl **179B** *SC* **179B.2.1** *P* **823** *L* **34** # 513

Dudek, Mike — Marvell

Comment Type **TR** *Comment Status* **D** *(Electrical) CR test fixture*

The loss needs to be better defined to be less ambiguous.

SuggestedRemedy

Insert the sentence "The cable assembly tested fixture loss is equal to the loss of the mated test fixture minus the loss of the specific TP2 or TP3 test fixture printed circuit board loss used when measuring the mated text fixture loss." between the 1st and 2nd sentences.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
The suggested remedy addresses the amibiguity in the definiton of ILcatf, but introduces an additional ambiguity regarding the definition of ILtfref. As a result, the specification is not necessarily less ambiguous.
Discuss with comment #289.
[Editor's note: Changed Page from 823 to 824]

<topic>

<Comments>

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Comment