# P802.3ck D1.4
# Common-mode comments discussion

Matt Brown, Huawei, 802.3ck Editor-in-Chief

# Introduction

- Slides to help address comments related to the CC topic on common-mode noise, RLCD, ILCD, etc.

# Comments 119, 24
# Clause 162 RX RLCD

| CI 162 | SC 162.9.4 | P 158 | L 16 | # 119 |

Ran, Adee — Intel

Comment Type **TR**    Comment Status **D**    *RX RLCD*

(addressing TBD)
Rx differential to common-mode (conversion) input return loss refers to 92.8.4.3 with value TBD.

In clause 92 the RLCD of Tx and Rx have the same specifications - eq (92–2) in 92.8.3.3 and eq (92–21) in 92.8.4.3, respectively, which are identical; and there is no RLCD for cable assembly.

The conversion loss specifications may need more work, but for the purpose of technical completeness, it is suggested to use the same equation used for the cable assembly, since in both cases the measurement involves mated connectors and results should be comparable.

As an alternative consider removing this specification (the Rx owns its performance).

*SuggestedRemedy*

Add a subclause for Rx differential to common mode return loss, with equation identical to equation (162–9), or point to (162–9).

*Proposed Response*    *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy.
For task force discussion.

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| CI 162 | SC 162.9.4 | P 158 | L 16 | # 24 |

Brown, Matt — Huawei

Comment Type **T**    Comment Status **D**    *RX RLCD*

In Table 162-13, the specified value for receiver differential to common-mode return loss is TBD

*SuggestedRemedy*

Provide a value or equation and update PICS.

*Proposed Response*    *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #119.

**Table 162–13—Summary of receiver specifications at TP3**

| Parameter | Subclause reference | Value | Units |
|---|---|---|---|
| Signaling rate | 162.9.4.1 | $53.125 \pm 100$ ppm | GBd |
| Amplitude tolerance | 162.9.4.2 | 1200[a] | mV |
| Interference tolerance | 162.9.4.3 | Table 162–14 | — |
| Jitter tolerance | 162.9.4.4 | Table 162–15 | — |
| Effective return loss, ERL (min) | 162.9.4.5 | 7.3 | dB |
| Differential to common-mode return loss | 92.8.4.3 | TBD | dB |

[a]Amplitude is measured at TP2.

# Comments 118, 23
# Clause 162 TX RLCD

Ran, Adee — Intel

**Comment Type** TR   **Comment Status** D   **TX RLCD**

(addressing TBD)
Tx CM to differential return loss refers to 92.8.3.3 with equation TBD.

In clause 92 the RLCD of Tx and Rx have the same specifications - eq (92–2) in 92.8.3.3 and eq (92–21) in 92.8.4.3, respectively, which are identical; and there is no RLCD for cable assembly.

The conversion loss specifications may need more work, but for the purpose of technical completeness, it is suggested to use the same equation used for the cable assembly, since in both cases the measurement involves mated connectors and results should be comparable.

**SuggestedRemedy**

Add a subclause for Tx differential to common mode return loss, with equation identical to equation (162–9), or point to (162–9).

**Proposed Response**   **Response Status** W

PROPOSED ACCEPT IN PRINCIPLE.
For task force discussion.

Brown, Matt — Huawei

**Comment Type** T   **Comment Status** D   **TX RLCD**

In Table 162-10, the specified value for transmitter common-mode to differential mode return loss is TBD.

**SuggestedRemedy**

Provide a value or equation and update PICS.

**Proposed Response**   **Response Status** W

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #118.

#### Table 162–10—Summary of transmitter specifications at TP2

| Parameter | Subclause reference | Value | Units |
|---|---|---|---|
| Signaling rate, each (nominal) | | $53.125 \pm 50$ ppm[a] | GBd |
| Unit interval (nominal) | | 18.82353 | ps |
| Differential pk-pk voltage with Tx disabled (max)[b] | 93.8.1.3 | 30 | mV |
| DC common-mode voltage (max)[b] | 93.8.1.3 | 1.9 | V |
| AC common-mode RMS voltage, $v_{cmi}$ (max)[b] | 93.8.1.3 | 30 | mV |
| Differential pk-pk voltage, $v_{di}$ (max)[b] | 93.8.1.3 | 1200 | mV |
| Effective return loss, ERL (min) | 162.9.3.5 | 7.3 | dB |
| Common-mode to differential mode return loss (min) | 92.8.3.3 | See Equation (TBD) | dB |
| Common-mode to common-mode return loss (min) | 162.9.3.6 | 2 | dB |

# Comments 102
## Clause 162 CA RLCC, RLCD

| CI 162 | SC 162.11.6 | P 166 | L 37 | # 102 |
|--------|-------------|-------|------|-------|

Champion, Bruce — TE Connectivity

**Comment Type** T   **Comment Status** D   CA RLCC

There is a disrepancy between what is specifed for the MTF CM-to-CM RL and the cable assembly CM-to-CM RL.

The MTF CM-to-CM RL limit is set to -3 dB. When MTFs designed close to this limit are used in cable assembly Tp1-Tp4 channels, the Tp1-Tp4 CM-to-CM RL will fail the -2 dB limit.

*SuggestedRemedy*

It is recommended to use the following equation to take into account the worst case MTF design.

Return Loss(f) ≥ 1.8 for 0.05 ≤ f ≤ 40

*Proposed Response*   **Response Status** W

PROPOSED ACCEPT IN PRINCIPLE.
Implement suggested remedy. Pending review of cited presentation.
https://www.ieee802.org/3/ck/public/21_01/champion_3ck_01_0121.pdf

### 162.11.6 Common-mode to common-mode return loss

The cable assembly common-mode to common-mode return loss shall meet Equation (162–11).

$$Return\_loss(f) \geq 2 \qquad (162–11)$$

for $0.05 \leq f \leq 40$ GHz

where

$Return\_loss(f)$ is the common-mode to common-mode return loss at frequency $f$ in dB

$f$ is the frequency in GHz

Review the following presentation:
https://www.ieee802.org/3/ck/public/21_01/champion_3ck_01_0121.pdf

# Comments 101
# Clause 162 CA RLCC, RLCD

| | | | | |
|---|---|---|---|---|
| CI 162 | SC 162.11.4 | P 165 | L 8 | # 101 |

Champion, Bruce — TE Connectivity

| Comment Type | T | Comment Status | D | CA RLCD |
|---|---|---|---|---|

Cable Assembly Diff-to-Common Mode Return loss is too tight for high volume production testing at the higher frequencies. Failures are occuring because of testing artifacts and not because of poor cable assemblies. A slight relaxation of the limit is requested to account for this.

SuggestedRemedy

It is recommended to use the following equation for this limit:

Return Loss(f) ≥ 22-10(f/26.56) for 0.05 ≤ f < 26.56
Return Loss(f) ≥ 19 - 7(f/26.56) for 26.56≤ f ≤ 40 GHz
See presentation

Proposed Response     Response Status  W

PROPOSED ACCEPT IN PRINCIPLE.
Implement suggested remedy.
Pending review of cited presentation.
https://www.ieee802.org/3/ck/public/21_01/champion_3ck_02_0121.pdf

Review the following presentation:
https://www.ieee802.org/3/ck/public/21_01/champion_3ck_02_0121.pdf

The cable assembly differential to common-mode return loss shall meet Equation (162–9).

$$Return\_loss(f) \geq \begin{cases} 22 - 10(f/26.56) & 0.05 \leq f < 26.56 \\ 15 - 3(f/26.56) & 26.56 \leq f \leq 40 \end{cases} \qquad (162\text{–}9)$$

where

$Return\_Loss(f)$ is the cable assembly differential to common-mode return loss at frequency $f$ in dB

$f$ is the frequency in GHz

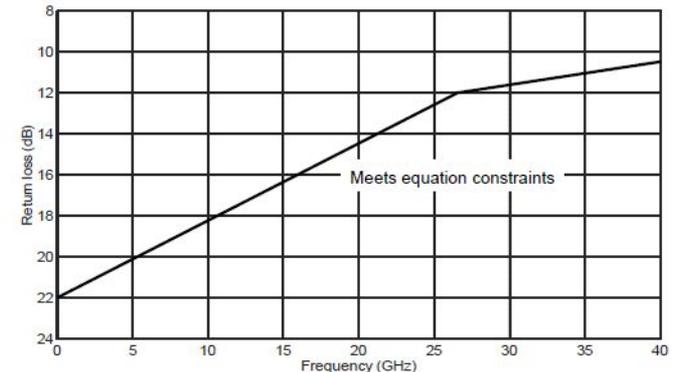The cable assembly differential to common-mode return loss is illustrated in Figure 162–5.

Figure 162–5—Differential to common-mode cable assembly return loss

# Comments 121, 26
# Clause 163 RX RLCD

| CI 163 | SC 163.9.3 | P 187 | L 41 | # 121 |

Ran, Adee — Intel

Comment Type **TR**    Comment Status **D**    **RX RLCD**

(addressing TBD)
Rx Differential to common-mode (conversion) input return loss refers to 93.8.1.4 with value TBD. This subclause uses equation (93-5) to define the limit.

The conversion loss specifications may need more work, but for the purpose of technical completeness, it is suggested to use a piecewise-linear equation similar to (93-5). Boundary lines are suggested to match the ones used in OIF CEI-112G-LR for the 53.125 GHz signaling frequency.

As an alternative consider removing this specification (the Rx owns its performance).

*SuggestedRemedy*

Add a new subclause for Rx differential to common mode return loss with the equation:

$RLdc(f) \geq 25-20*(f/fb)$ for $0.05 \leq f \leq fb/2$
$RLdc(f) \geq 15$ for $fb/2 < f \leq 40$
where f is the frequency in GHz and fb=53.125.

*Proposed Response*    Response Status **W**

PROPOSED ACCEPT IN PRINCIPLE.
Add a new subclause for RLCD
$RLcd(f) = 25-20*(f/fb)$ for $0.05 <= f <= fb/2$
$RLcd(f) = 15$ for $fb/2 < f <= 40$
where f is the frequency in GHz and fb=53.125.
Update PICS
Implement with editorial license.

| CI 163 | SC 163.9.3 | P 187 | L 41 | # 26 |

Brown, Matt — Huawei

Comment Type **T**    Comment Status **D**    **RX RLCD**

In Table 163-8, the specified value for receiver differential to common-mode return loss is TBD

*SuggestedRemedy*

Provide a value or equation and update PICS.

*Proposed Response*    Response Status **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using response to comment #121

**Table 163–8—Summary of receiver specifications at TP5v**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| Difference effective return loss, *dERL* (min) | 163.9.3.2 | -3 | dB |
| Differential to common-mode input return loss | 93.8.1.4 | TBD | dB |
| Interference tolerance | 163.9.3.3 | Table 163–9 | — |
| Jitter tolerance | 163.9.3.4 | Table 162–15 | — |

# Comments 122, 27
# Clause 163 Channel ILCD

| | | | | | |
|---|---|---|---|---|---|
| *CI* 163 | *SC* 163.10.4 | *P* 192 | *L* 44 | # | 122 |

Ran, Adee             Intel

*Comment Type*    **TR**      *Comment Status*   **D**           *channel ILDC*

(addressing TBD)
For the KR PHY, the channel "differential to common-mode conversion loss of TP0 and TP5" is TBD.

For the CR PHY this parameter is specified in 162.11.5 as "The difference between the cable assembly differential to common-mode conversion loss and the cable assembly insertion loss" with equation (162-10).

For the purpose of technical completeness, a similar equation can be used for KR.

*SuggestedRemedy*

Rewrite this subclause based on 162.11.5, substituting "TP0 to TP5 channel" for "cable assembly" with editorial license.

*Proposed Response*      *Response Status*   **W**

PROPOSED ACCEPT.

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| | | | | | |
|---|---|---|---|---|---|
| *CI* 163 | *SC* 163.10.4 | *P* 192 | *L* 44 | # | 27 |

Brown, Matt             Huawei

*Comment Type*    **T**      *Comment Status*   **D**           *channel ILDC*

The specified value for channel differential to common-mode conversion loss is TBD.

*SuggestedRemedy*

Provide a value or equation and update PICS.

*Proposed Response*      *Response Status*   **W**

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #122

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**163.10.4 Channel differential to common-mode conversion loss**

The differential to common-mode conversion loss of TP0 and TP5 shall meet the requirement of TBD.

# Comment 139
# Clause 163/120F Channel RLCD

| CI 163 | SC 163.10 | P 190 | L 28 | # 139 |
|---|---|---|---|---|

Ran, Adee — Intel

**Comment Type** T    **Comment Status** D    channel RLCD (CC)

There is no specification for RLDC for the KR channel.

Without such specification, a channel can cause a strong common mode reflection signal that will be fed into the Tx - and since Tx RLCD/RLCC are not defined either, a differential or common mode signal can be reflected back without control.

The conversion loss specifications may need more work, but for the purpose of technical completeness, the channel RLDC from 162.11.4 can be used.

Also in missing 120F.

**SuggestedRemedy**

Add a new subclause for channel differential to common mode return loss, based on 162.11.4 with the same limits, with editorial license.

Apply similarly in 120F.

**Proposed Response**    **Response Status** W

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy.
For task force discussion.
[Editor's note: CC 163, 120F]

# Comment 126, 35
# Clause 120G AC common-mode noise

CI 120G    SC 120G.3.2        P 234        L 30        # 126

Ran, Adee                            Intel

Comment Type   ER    Comment Status  D          TP4 AC CM noise

(Addressing editor's note requiring confirmation)
Editor's note indicates that AC common-mode specification needs confirmation. It has not
been confirmed that the existing limit of 17.5 mV RMS is obtainable, but there is no
consensus on another value.

Work is planned to refine the measurement method to allow separation of different sources
of common mode signal and fine-tuned specification, but it will likely continue into later
phases of P802.3ck.

This should not preclude progressing to WGB with the current method and limit.

SuggestedRemedy

Delete the editor's note.

Proposed Response      Response Status  W

PROPOSED ACCEPT.

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CI 120G    SC 120G.3.2        P 234        L 32        # 35

Brown, Matt                          Huawei

Comment Type   T    Comment Status  D          TP4 AC CM noise

The editor's note indicates that the value specified for the module output AC CM noise
requires confirmation. No proposals to change the specified values have been accepted.
However, it should be noted that there is ongoing discussion on this topic.

SuggestedRemedy

Remove the editor's note.

Proposed Response      Response Status  W

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment #126.

## Table 120G–3—Module output characteristics (at TP4)

| Parameter | Reference | Value | Units |
|---|---|---|---|
| Signaling rate, each lane (nominal) | | 53.125[a] | GBd |
| AC common-mode output voltage (max, RMS) | 120G.5.1 | 17.5 | mV |
| Differential peak-to-peak output voltage (max) | 120G.5.1 | 900 | mV |
| Near-end eye height, differential (min) | 120G.3.1.5 | 24 | mV |
| Near-end vertical eye closure (max) | 120G.3.1.5 | 7.5 | dB |
| Far-end eye height, differential (min) | 120G.3.1.5 | 24 | mV |
| Far-end vertical eye closure (max) | 120G.3.1.5 | 7.5 | dB |
| Common-mode to differential return loss (min) | 120G.3.1.2 | Equation (120G–1) | dB |
| Effective return loss, ERL (min) | 120G.3.2.3 | TBD | dB |
| Differential termination mismatch (max) | 120G.3.1.3 | 10 | % |
| Transition time (min, 20% to 80%) | 120G.3.1.4 | 7.5 | ps |
| DC common-mode voltage (min)[b] | 120G.5.1 | −350 | mV |
| DC common-mode voltage (max)[a] | 120G.5.1 | 2850 | mV |

[a] The signaling rate range is derived from the PMD receiver input.
[b] DC common-mode voltage is generated by the host. Specification includes effects of ground offset voltage.

Editor's note (to be removed prior to publishing D2.0): The adopted baseline indicated that the values
specified for the following parameters require confirmation:
- AC common-mode output voltage (max, RMS)

# Comment 138
# Clause 120G TP4a/TP4/TP1 RLDC

CI **120G**  SC **120G.3.3**  P **237**  L **37**  # 138

Ran, Adee  Intel

Comment Type  **T**  Comment Status  **D**  *TP4a/TPRLCD (bucket1)*

For module output (120G.3.2, table 120G-3), host input (120G.3.3, table 120G-6), and module input (120G.3.4, table 120G-9), the reference subclause for "Common-mode to differential return loss (min)" is incorrect - 120G.3.1.2 discusses ERL.

There is one subclause that discusses RLCD, 120G.3.1.1, but it is currently specific to host output.

*SuggestedRemedy*

Change reference from 120G.3.1.2 to 120G.3.1.1 in the 3 tables.

Rephrase the text in 120G.3.1.1 to refer to both host and module, output and input.

Proposed Response  Response Status  **W**

PROPOSED ACCEPT IN PRINCIPLE.
The reference to 120G.3.1.2 is incorrect and should be 120G.3.1.1.
By convention, it is common to refer to specifications for different test points without changing the text in the referenced subclause. No changes to the text in 120G.3.1.1 are required.
For RLCD in Table 120G-3, Table 120G-6, and Table 120G-9, change the reference to 120G.3.1.1.

- 120G.3 Electrical characteristics
  - 120G.3.1 Host output characteristics
    - 120G.3.1.1 Host output common-mode to differential return loss
    - 120G.3.1.2 Host output effective return loss (ERL)

## 120G.3.1.1 Host output common-mode to differential return loss

Common-mode to differential return loss of the host output is shown in Equation (120G–1) and illustrated in Figure 120G–5.

$$RLCD(f) \le \begin{cases} 22 - 20(f/53.125) & 0.01 \le f \le 26.56 \\ 15 - 6(f/53.125) & 26.56 < f \le 53.125 \end{cases} \qquad (120G-1)$$

where

RLCD  is the common-mode to differential return loss in dB
f  is the frequency in GHz

### Table 120G–3—Module output characteristics (at TP4)

| | | | |
|---|---|---|---|
| Common-mode to differential return loss (min) | 120G.3.1.2 | Equation (120G–1) | dB |

### Table 120G–6—Host input characteristics

| Parameter | Reference | Test point | Value | Units |
|---|---|---|---|---|
| Signaling rate, each lane (range) | | TP4a | 53.125 ± 100 ppm | GBd |
| Differential peak-to-peak input voltage tolerance (min) | 120G.5.1 | TP4 | 900 | mV |
| Common-mode to differential return loss (min) | 120G.3.1.2 | TP4a | Equation (120G–1) | dB |

### Table 120G–9—Module input characteristics

| Parameter | Reference | Test point | Value | Units |
|---|---|---|---|---|
| Signaling rate, each lane (range) | | TP1 | 53.125 ± 100 ppm | GBd |
| Differential pk-pk input voltage tolerance (min) | 120G.5.1 | TP1a | 900 | mV |
| Common-mode to differential return loss (min) | 120G.3.1.2 | TP1 | Equation (120G–1) | dB |

# Comment 32
# Clause 120G TP1a CM noise, PP voltage, RLCC (editor's note)

| CI 120G | SC 120G.3.1 | P 231 | L 33 | # 32 |

Brown, Matt                                    Huawei

Comment Type    T         Comment Status  D              CM noise, PP voltage, RLCC

The editor's note written in D1.0 indicates that the specified values for host output AC CM noise, PP output voltage, and RLCC require confirmation. No proposals to change the specified values have been submitted.

SuggestedRemedy

Remove the editor's note.

Proposed Response         Response Status  W

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested remedy.
For task force discussion.

**Table 120G–1—Host output characteristics at TP1a**

| Parameter | Reference | Value | Units |
|---|---|---|---|
| Signaling rate, each lane (range) | | $53.125 \pm 50$ ppm[a] | GBd |
| DC common-mode output voltage (max) | 120G.5.1 | 2.8 | V |
| DC common-mode output voltage (min) | 120G.5.1 | −0.3 | V |
| Single-ended output voltage (max) | 120G.5.1 | 3.3 | V |
| Single-ended output voltage (min) | 120G.5.1 | −0.4 | V |
| AC common-mode RMS output voltage (max) | 120G.5.1 | 17.5 | mV |
| Differential peak-to-peak output voltage (max) Transmitter disabled Transmitter enabled | 120G.5.1 | 35 870 | mV |
| Eye height, differential (min) | 120G.3.1.5 | 15 | mV |
| Vertical eye closure (max) | 120G.3.1.5 | 9 | dB |
| Common-mode to differential return loss (min) | 120G.3.1.1 | Equation (120G–1) | dB |
| Effective return loss, ERL (min) | 120G.3.1.2 | 7.3 | dB |
| Differential termination mismatch (max) | 120G.3.1.3 | 10 | % |
| Transition time (min, 20% to 80%) | 120G.3.1.4 | 7.5 | ps |

[a]For a PMA in the same package as the PCS sublayer. In other cases, the signaling rate is derived from the signaling rate presented to the PMA input lanes (see Figure 135–3 and Figure 120–3) by the adjacent PMA or FEC sublayers.

Editor's note (to be removed prior to publishing D2.0): The adopted baseline indicated that the values specified for the following parameters require confirmation:
- AC common-mode output voltage (max, RMS)
- Differential peak-to-peak output voltage (max), Transmitter enabled
- Common-mode to differential return loss (min)