Clause 162 D2.0 Comment Resolution

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Comments

Clause 162 (Howard)

Clause	Topic	Comments
162	PRBS9Q for EOJ test	~~133, 141, 236 li_01a, zivny_01, hidaka_01_041421~~
162	RIT Noise	~~207, healey_02~~
162	Dual port types	166, dawe_01_042821
162	TX vf	167
162	EOJ CRU BW	32
162	RIT reference channel	33, 195
162	RIT SNDR	197, 228, wu_01
162	RIT transition time	139
162	RLCC description	148, 169
162	RLCD/RLDC	172

Legend: [##,##,##] = related comments, ## = pivot comment, [##,##,author_nn] = related presentation

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comagenda_3ck_01_0521

Comment 166: Dual Port

C#166: Comment

Cl 162	*SC* 162.9.3	*P* 154	*L* 21	# 166
Dawe, Piers		Nvidia		
Comment Type TR		*Comment Status* D		*CR port type*

Comment 166, improve the CR loss allocations

- *Subclause* **162.9.3** *Page* **154** *Line* **21** *Type* **TR**
- The draft loss budget wastes over 3 dB in nearly every case.
- The recommended maximum insertion loss allocation for the host traces plus BGA footprint and host connector footprint, of 6.875 dB, compares very poorly with C2M's host insertion loss up to 11.9 dB, making passive copper expensive and unattractive for a switch, while a full range of NICs can be made within only 3.75 dB. Server-switch links will get made with an asymmetric loss budget, so it would be better for the standard to regularise what will happen anyway. By the way, many server-switch links will be asymmetric anyway (different form factors at server and switch ends), and that's already allowed in this draft.
- This change would also benefit CR switch-switch links because the shortest ports would get credit for their low loss.

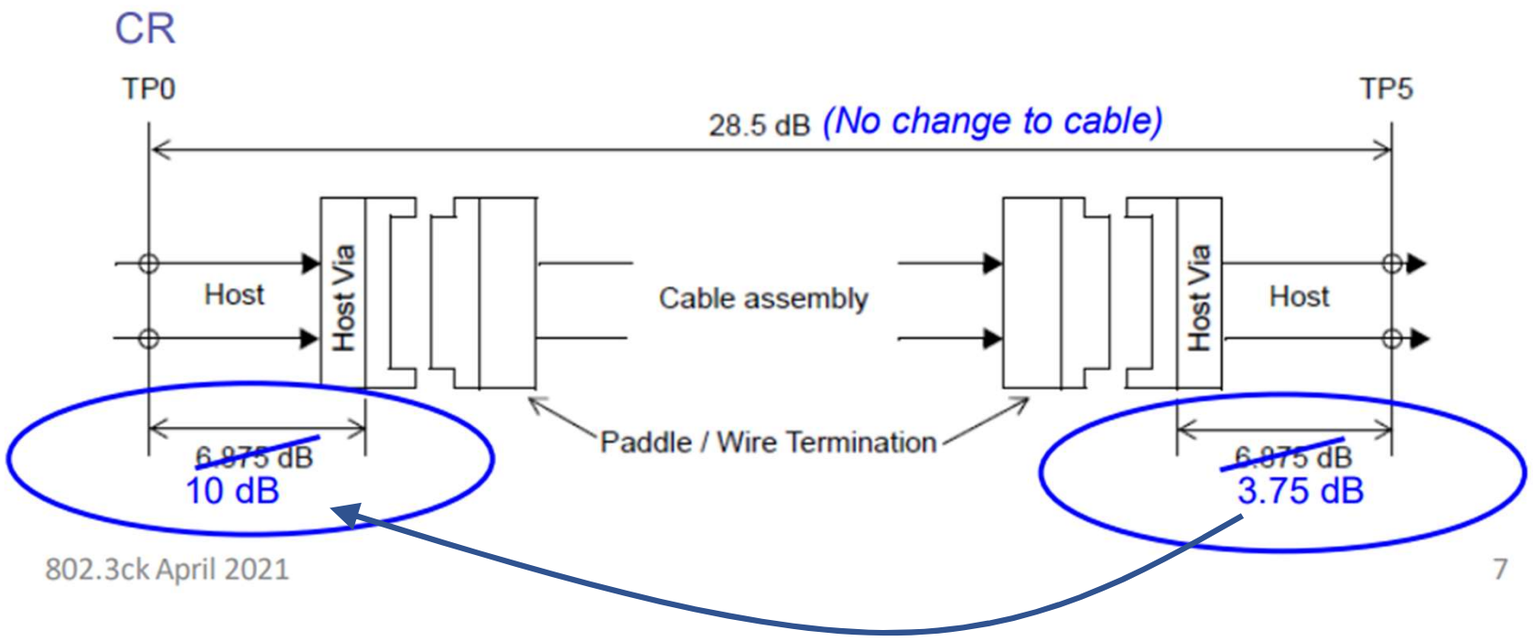
dawe_01_042821, slide 11

Comment 166: *Suggested Remedy*

- As we have done for C2M, create two kinds of CR ports. Host loss allocations of 3.75 dB and 10 dB. Short can connect to short or long with same cable as today; long to long is not supported. Add entries in Clause 73 Auto-Negotiation to advertise short and long to the other end.
- In Table 162-10, provide separate limits for Linear fit pulse peak (min).
- In Table 162-14, provide separate rows for Test channel insertion loss: for testing the short host input the values for Test 2 are 10-6.875 = 3.125 dB higher (26.75 dB and 27.75 dB), while for the long host input the values for Test 2 are 6.875-3.75 = 3.125 dB lower (20.5 dB and 21.5 dB). No change needed for Test 1.
- In 162A.4, provide two equations for each of IL_PCBmax and for ILHostMax and show them in Fig 162A-1 and 2. In 162A.5, provide two Value columns in Table 162A-1. Adjust figures 162A-3 and 4.
- For discussion: should a "long" cable, 19.75+2*(6.875-3.75) = 19.75+6.25 = 26 dB max (maybe 3 m) be defined? A CR link could have no more than one of the three host, cable, and host being "long".
- We could choose other names than "short" and "long" for the ports, possibly "short" and "medium" (as a C2M host can be "longer"), or A and B, somewhat like USB.
- In 162.11.7.1.1, zp, representing the extra loss a host has above an MCB, could be made asymmetric but I believe that would not bring an improvement in accuracy.
- There could be a third kind of CR port with 6.875 dB but this would not be useful for server-switch links, would be useful for only a subset of switch-switch links, for which passive copper is a subset anyway, so it doesn't seem worthwhile.

dawe_01_042821, slide 12

C#166: Proposed Loss Budget



Source: dawe_01_042821, slide 7

Proposal moves 3.125 dB from server to switch.

C#166: Proposed Response

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The suggested remedy would require two different CR port types. The suggested remedy does not provide a complete solution for the new port type.
The assymetric-port approach was discussed early in this project.
Straw Poll #1 from the July 2018 Task Force meeting indicated strongest support for the current specification.
https://www.ieee802.org/3/ck/public/18_07/minutes_3ck_0718_approved.pdf
Reference
https://www.ieee802.org/3/ck/public/adhoc/apr28_21/dawe_3ck_adhoc_01_042821.pdf.
For task force discussion.

Straw Poll #1:

I would support the port type direction of…

A: Universal port only (interoperable Optical and passive DAC)
B: Asymmetric ports (two different host loss for each end of the cable - IE: A side, B side)
C: Dual Ports (optics only port and interoperable Optical/DAC - IE: Port Type 1, Port Type 2)
D: Universal C2M port only (interoperable Optical and active copper cable)
E: More information

(chicago rules)
A: 26 B: 17 C: 34 D: 13 E: 46

https://www.ieee802.org/3/ck/public/18_07/minutes_3ck_0718_approved.pdf

C#167 Tx vf

Cl **162**	*SC* **162.9.3**	*P* **154**	*L* **21**	# 167

Dawe, Piers — Nvidia

Comment Type **E** *Comment Status* **D** *TX vf*

Clumsy "x vf" way of defining linear fit pulse peak (min)

SuggestedRemedy

Use "Linear fit pulse peak ratio" as in 163 and 163A.3.2.1. Note the unit in the table changes to V/V.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The existing text is consistent with other clauses (e.g. CL136) and the comment does not provide sufficient justification to support the suggested remedy.

Linear fit pulse peak (min)	162.9.3.1.2	$0.397 \times v_f$	V

21
22

C#32 EOJ CRU B/W

Cl **162** *SC* **162.9.3.4** *P* **158** *L* **39** # **32**

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type **TR** *Comment Status* **D** *EOJ CRU BW*

"Meeting even-odd jitter requriement with only one CRU bandwidth is sufficient" is not clear

SuggestedRemedy

What is the intention of only one CRU bandwidth, please make it clear.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The suggested remedy does not provide sufficient detail to implement.

b) The corner frequency of the clock recovery unit (CRU) may be set lower than 4 MHz. Meeting the even-odd jitter requirement with only one CRU bandwidth is sufficient.

C#33 RIT Test Channel

Cl **162** *SC* **162.9.4.3** *P* **161** *L* **36** # **33**

Ghiasi, Ali — Ghiasi Quantum/Inphi

Comment Type **TR** *Comment Status* **D** *RIT channel*

Table 162-14 references table 110-8 and figure 110-3b, but unlike CL 110 for the case of low loss channel Test 1 frequency dependent attenuator is zero because the loss of cable assembly=test chanel loss

SuggestedRemedy

If the low loss channel also include frequency dependent attenuator then please increase loss by 4.75 dB, if the intention was to not include frequncy dependent attenuator then a note would be helpful

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The frequency-dependent attenuator is excluded from the test channel used for Test 1 in order to create the minimum loss channel with a compliant cable.
For task force discussion.

Table 162–14—Interference tolerance test parameters

Parameter	Test 1 (low loss)		Test 2 (high loss)		Units
	Min	Max	Min	Max	
Test pattern	Scrambled idle encoded by FEC				
FEC symbol error ratio required[a]	$< 10^{-3}$				
Test channel insertion loss at 26.56 GHz[b]	10.5	11.5	23.625	24.625	dB
Cable assembly insertion loss at 26.56 GHz	10.5	11.5	17.75	19.75	dB
COM[c]	3		3		dB

[a] See 162.9.4.3.5 for definition of FEC symbol error ratio.
[b] Insertion loss between the two test references (see Figure 110–3b).
[c] The COM value is the target value for the SNR_{TX} calibration defined in 162.9.4.3.3 item f. The SNR_{TX} value measured at the Tx test reference should be as close as practical to the value needed to produce the target COM. If lower SNR_{TX} values are used, this would demonstrate margin to the specification but this is not required for compliance.

C#195 RIT Test Channel

Cl **162**	*SC* **162.9.4.3.2**	*P* **162**	*L* **4**	# 195

Dudek, Mike — Marvell

Comment Type **T** *Comment Status* **D** *RIT channel*

An extra exception is needed for the test channel loss.

SuggestedRemedy

Change to "The test channel is the same as the one defined in 110.8.4.2.2, except that the cable assembly meets the requirements of 162.11, the test channel loss meets the requirements of table 162-14 and the cable assembly test fixture meets the requirements of 162B.1.2."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

162.9.4.3.2 Test channel

The test channel is the same as the one defined in 110.8.4.2.2, except that the cable assembly meets the requirements of 162.11 and the cable assembly test fixture meets the requirements of 162B.1.2.

162.9.4.3.2 Test Channel

The test channel is the same as the one defined in 110.8.4.2.2, except that the cable assembly meets the requirements of 162.11, the test channel loss meets the requirements of table 162-14 and the cable assembly test fixture meets the requirements of 162B.1.2.

C#197 & 228 RIT SNDR

Cl **162** *SC* **162.9.4.3.3** *P* **162** *L* **36** # **197**

Dudek, Mike — Marvell

Comment Type **TR** *Comment Status* **D** *RIT SNDR*

SNDR should be measured as appropriate for this clause not as for C2C at 25G.

SuggestedRemedy

Change "SNDR is measured at the Tx test reference using the procedure in 120D.3.1.6, with the exception that the linear fit in120D.3.1.3 is performed with a pulse length (Np) of 15 UI." to "SNDR is measured at the Tx test reference using the procedure in 162.9.3.3"

Proposed Response *Response Status* **W**

PROPOSED ACCEPT.

162.9.4.3.3 Test channel calibration

f) The SNR_{TX} value that results in the required COM value for the test is calculated. The injected noise (see 162.9.4.3.4) is set such that the SNDR matches the calculated SNR_{TX} value. SNDR is measured at the Tx test reference using the procedure in 120D.3.1.6, with the exception that the linear fit in 120D.3.1.3 is performed with a pulse length (N_p) of 15 UI.

Cl **162** *SC* **162.9.4.3.3** *P* **162** *L* **36** # **228**

Wu, Mau-Lin — MediaTek Inc.

Comment Type **TR** *Comment Status* **D** *RIT SNDR*

For the calculation of SNDR measured at the Tx test reference, the linear fit in 120D.3.1.3 is performed with a pulse length (N_p) of 15 UI. The pulse length (N_p) shall be long enough to cover all 'linear response', such as reflection due to package length.In this case, the calculated SNDR includes nonlinearity only, instead of the far-away 'linear' reflection.
The 15 UI spec here is the same as 50GBASE-CR, which is not reasonable for 100GBASE-CR1. We shall need a larger value of N_p here.
In 'li_3ck_01_1020', the authors proposed to consider TX + RX EQ capability to decide N_p value. In that contribution, N_p = 29 was proposed for Clause 163. I found no clues why we have different N_p value for Clause 162, since their TX + RX EQ capability are similar.

SuggestedRemedy

By considering the pulse length to at least cover reflection due to package trace length, whose maximum value is 31 mm. By considering the dielectrics constant, D_k, as in the range of 3.5 ~ 4.0, the location of reflection due to 31 mm trace length is around 22 ~ 24 taps after main cursor. Therefore, adopt N_p = 29 as Clause 163 seems reasonable.
Proposed to N_p value from 15 to 29.

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
For task force discussion

C#197&228 RIT SNDR

f) The SNR_{TX} value that results in the required COM value for the test is calculated. The injected noise (see 162.9.4.3.4) is set such that the SNDR matches the calculated SNR_{TX} value. SNDR is measured at the Tx test reference using the procedure in 162.9.3.3.

SR proposed in C#197

162.9.3.3 Output SNDR

The transmitter SNDR is defined by the measurement method described in 120D.3.1.6 with the exception that the linear fit procedure in 162.9.3.1.1 is used.

162.9.3.1.1 Linear fit to the measured waveform

The following procedure is used to determine the linear fit pulse response, linear fit error, and normalized transmitter coefficient values.

Set the transmitter under test to transmit the PRBS13Q test pattern (defined in 120.5.11.2.1). For each configuration of the transmit equalizer, capture at least one complete cycle of the test pattern at TP2, as specified in 85.8.3.3.4. The clock recovery unit (CRU) used in the measurement has a corner frequency of 4 MHz and a slope of 20 dB/decade.

In the following calculations, M should be an integer not less than 32. Interpolation of the captured waveform may be used to achieve this.

Compute the linear fit pulse response $p(k)$, k=1 to $M \times N_p$, from the captured waveform, as specified in 85.8.3.3.5, with $N_p = 200$ and $D_p = 4$, where the aligned symbols $x(n)$ are assigned normalized amplitudes −1, $-ES$, ES, and 1 to represent the PAM4 symbol values 0, 1, 2, and 3 respectively. ES is defined as $(|ES1| + |ES2|)/2$ where $ES1$ and $ES2$ are calculated according to 120D.3.1.2.

$N_p = 29$

Proposed in C#228.

C#139 RIT Transition Time

Cl **162** *SC* **162.9.4.3.3** *P* **162** *L* **26** # 139

Hidaka, Yasuo — Credo Semiconductor, Inc.

Comment Type **T** *Comment Status* **D** *RIT transition time*

In 120E.3.1.5, transition time is measured with 33GHz BT4 filter.

SuggestedRemedy

Change "T_r is measured using the method in 120E.3.1.5 with the transmit equalizer turned off
(i.e., coefficients set to the preset 1 values, see 162.9.3.1.3)."
to
"T_r is measured using the method in 120E.3.1.5 with the transmit equalizer turned off (i.e., coefficients set to the preset 1 values, see 162.9.3.1.3) with an exception that the waveform is observed through a fourth-order Bessel-Thomson low-pass response with a 3 dB bandwidth of 40 GHz.."

Proposed Response *Response Status* **W**

PROPOSED ACCEPT IN PRINCIPLE.
Implement the suggested response with editorial license.
[Editor's note: changed subclause from 162.9.4.3 to 162.9.4.3.3.]

Ref: hidaka_3ck_01e_0521

Implement the suggested response with editorial license per hidaka_3ck_01e_0521 slides 5-7.

C#148 & 169 CCRL

CI 162 SC 162.9.3.6 P 159 L 18 # 148

Kochuparambil, Beth Cisco

Comment Type E *Comment Status* D *RLCC description*

Description may or may not be helpful for those reading the standard. I do, however, note that previous clauses (examples are 92.10.6 and 110.10.6) do NOT describe why we limit CM return loss, but instead just define the limit. Perhaps this description of the re-reflections concept is helpful to readers, it was somewhat confusing until reading it multiple times.

SuggestedRemedy

Remove the first paragraph of this section. "Common-mode signals can be returned [. . .] To reduce this effect, a minimum common-mode to common-mode return loss is specified."

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
For task force discussion.

162.9.3.6 Common-mode to common-mode return loss

~~Common-mode signals can be returned to the transmitter by differential-to-common-mode reflections of the cable or receiver. Any common-mode signal reflected back into the channel by the transmitter can be converted to a differential signal and result in differential noise into the receiver. To reduce this effect, a minimum common-mode to common-mode return loss is specified.~~

The common-mode to common-mode return loss shall be greater than or equal to 2 dB at all frequencies between 0.2 GHz and 40 GHz.

CI 162 SC 162.9.3.6 P 159 L 30 # 169

Dawe, Piers Nvidia

Comment Type TR *Comment Status* D *RLCC description*

1. This paragraph claims that the minimum common-mode to common-mode return loss is specified to reduce reflections of signals that were generated originally as differential and end up as differential. This is not the case: it is included to contain a gross build-up of CM voltage on the line caused by repeated reflections, that is otherwise unbounded.
If it had been intended to address mixed-mode issues it would be a tighter spec, but that's not viable for front-panel connectors. Other specs such as Rx Differential to common-mode return loss and Tx Common-mode to differential mode return loss (both 12 dB at Nyquist, total 24) and Differential to common-mode cable assembly conversion loss (10 dB each way) are there to address the mixed-mode issues, and this spec at only 2 dB won't make much difference to them.
2. This is a standard, not an attempt at a textbook. We don't give any justifications for most other specs; there is no reason that this one should be different.

SuggestedRemedy

Delete the paragraph

Proposed Response *Response Status* W

PROPOSED ACCEPT IN PRINCIPLE.
Resolve using the response to comment 148.
[Editor's note: Changed page from 157 to 159.]

C#172 RLDC

Cl **162** *SC* **162.9.4.6** *P* **164** *L* **46** # **172**

Dawe, Piers — Nvidia

Comment Type **E** *Comment Status* **D** *return loss*

In C2M-like specs the Rx Differential to common-mode return loss and Tx Common-mode to differential mode return loss differ by 3 dB at low frequency, for a good reason, but in this clause they are the same. Also, the Differential to common-mode cable assembly conversion loss is more lenient than these specs.

SuggestedRemedy

Review the relation between these three limits and adjust if necessary.

Proposed Response *Response Status* **W**

PROPOSED REJECT.
The suggested remedy does not provide sufficient detail to implement.

TX RLDC

162.9.3.7 Common-mode to differential return loss

The transmitter common-mode to differential return loss shall meet Equation (162–5).

$$Return\_loss(f) \geq \begin{cases} 22 - 10(f/26.56) & 0.05 \leq f < 26.56 \\ 15 - 3(f/26.56) & 26.56 \leq f \leq 40 \end{cases} \quad (162\text{–}5)$$

where

Return_Loss(f) is the transmitter common-mode to differential return loss at frequency *f* in dB

f is the frequency in GHz

RX RLCD

162.9.4.6 Differential to common-mode return loss

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

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

where

Return_Loss(f) is the receiver differential to common-mode return loss at frequency *f* in dB

f is the frequency in GHz