BIG TICKET ITEMS

IEEE P802.3CK - 100 GB/S, 200 GB/S, AND 400 GB/S ELECTRICAL INTERFACES TASK FORCE

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TASK FORCE STATUS

- Initial SA Ballot completed
  - 238 comments resolved
  - Editors working on draft 3.1
  - Recirculation is anticipated to launch within the next week

- Draft 3.1 to be announced and located - https://www.ieee802.org/3/ck/private/index.html
  - Username: 802.3ck

- Upcoming Ad Hocs
  - March 23 (while ballot is open), March 30, April 6
  - Discussion of recirculation hot topics (SNDR, sigma_TX, J3u, CR/CA RLcc, etc.)

ONE OF OUR BIGGEST CHANGES IN D3.1: COMMON MODE – COMMENT #103

Table 162–10—Summary of transmitter specifications at TP2

Parameter	Subclause reference	Value	Units
Signaling rate, each lane (range)	162.9.3.1	53.125 ± 50 ppm[a]	GBd
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 peak-to-peak voltage (max) Low frequency, $V_{CMPP\text{-}LF}$ High frequency, $V_{CMPP\text{-}HF}$	163.9.2.7	 60 80	 mV mV
			mV

163.9.2.7 Peak-to-peak AC common-mode voltage

Peak-to-peak AC common-mode voltage is defined as the AC common-mode voltage (see 93.8.1.3) range measured at TP0v that includes all except 10^{-4} of the measured distribution, from 0.00005 to 0.99995 of the cumulative distribution.

Low-frequency peak-to-peak AC common mode voltage, $V_{CMPP\text{-}LF}$, is determined using the AC common-mode voltage measured with a low-pass filter defined by Equation (163–2).

High-frequency peak-to-peak AC common mode voltage, $V_{CMPP\text{-}HF}$, is determined using the AC common-mode voltage measured with a high-pass filter defined by Equation (163–3).

$$H_{LF}(f) = H_r(f) \qquad (163\text{–}2)$$

$$H_{HF}(f) = 1 - H_r(f) \qquad (163\text{–}3)$$

where

$H_r(f)$ is defined by Equation (93A–20) with f_r set to 100 MHz

The low-frequency peak-to-peak AC common-mode voltages shall meet the specification for $V_{CMPP\text{-}LF}$ (max) in Table 163–5.

NOTE—V_{CMPP} measurement may be sensitive to mismatches between the single-ended paths in the test fixture and the test setup. Careful design and calibration of the test system are recommended.

ANOTHER BIG DISCUSSION WAS J3U – COMMENTS 156 & 171

162.9.3.4 Output jitter

Output jitter is characterized by three parameters, J3u, J_{RMS}, and even-odd jitter. These parameters are calculated from measurements with a single transmit equalizer setting to compensate for the loss of the transmitter package and host channel. The equalizer setting is chosen to minimize any or all of the jitter parameters.

J3u and J_{RMS} are calculated using the measurement method specified in 120D.3.1.8.1. $J3u_{03}$ is calculated the same way as J3u except that the jitter calculation uses only transitions R03 and F30 in Table 162–12.

Even-odd jitter is calculated using the measurement method specified in 120D.3.1.8.2. with the following exceptions:

a) The test pattern is either PRBS13Q or alternatively PRBS9Q. PRBS9Q is defined in 120.5.11.2.a. Meeting the even-odd jitter requirement with only one pattern is sufficient.

b) If the test pattern is PRBS13Q, the corner frequency of the clock recovery unit (CRU) is set to 4 MHz or to 1 MHz. Meeting the even-odd jitter requirement with only one CRU bandwidth is sufficient.

NOTE 1—If the measuring instrument is triggered by a clock based on the signaling rate divided by an even number, the even-odd jitter may not be correctly observed.

NOTE 2—J3u is sensitive to measurement noise being converted to timing errors. Hence, accounting for measurement noise effects is recommended.

Table 162-10

Output jitter (max)		
J_{RMS}	0.023	UI
$J3u_{03}$	0.115	UI
J3u	0.125	UI
Even-odd jitter, pk-pk	0.025	UI

Table 163-5

Jitter (max)[c]		
J_{RMS}	0.023	UI
$J3u_{03}$	0.106	UI
J3u	0.115	UI
Even-odd jitter, pk-pk	0.025	UI

Table 120F-1

Output jitter		
J_{RMS} (max)	0.023	UI
J4u (max)	0.128	UI
$J4u_{03}$ (max)	0.118	UI
Even-odd jitter (max)	0.025	UI

CA/CR COMMON MODE RETURN LOSS – COMMENTS 178 &181

Cl **162** *SC* **162.9.3.6** *P* **172** *L* **27** # I-178

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **R** *TX RLcc*

As for the mated test fixtures and the cable, this common mode return loss spec RLcc becomes useless at the frequency when the MCB loss is 2/2 dB, which is only 10 GHz. The spec should trend down with the MCB trace loss at 0.1 dB/GHz.

SuggestedRemedy

Use a frequency-dependent mask 2 dB 0.2 <= f <= 4, 1.6+0.1*f dB 4 < f <= 30, 8.5-0.13f 30 < f <= 40. f is in GHz. See another comment for cable RLcc, 162.11.6.

Response *Response Status* **U**

REJECT.

Per straw poll #21, there is not consensus to make the proposed change.

Straw poll #21 (decision)
I support changing the CR TX RLcc as proposed in the suggested remedy in comment i-178.
Yes: 9
No: 10

Cl **162** *SC* **162.11.6** *P* **185** *L* **28** # I-181

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **R** *CA RLcc*

We need a common mode return loss spec RLcc to stop large common-mode voltages building up through multiple low-loss reflections. As we know, this common mode return loss spec RLcc becomes useless at the frequency when the MCB loss is 1.8/2 dB, which is only 8.5 GHz. The impedance the cable presents is mostly related to the connector, so it's much like the mated test fixtures' RLcc, except at the very lowest frequencies where the cable loss is very small and both connectors can be seen by the measurement. This proposal allows for that.

SuggestedRemedy

Use a frequency-dependent mask 1.2 dB 0.05 <= f <= 4, 0.76+0.11*f dB 4 < f <= 30 GHz. f is in GHz. See another comment for Tx, Table 162-11, 162.9.3.6.

Response *Response Status* **U**

REJECT.

Per straw poll #22, there is not consensus to make the proposed change.

Straw poll #22 (decision)
I support changing the CA RLcc as proposed in the suggested remedy in comment i-181.
Yes: 10
No: 10

SNR_TX & SNDR – COMMENT 53

- **Ad Hoc & #10 Presentation:**
- "Proposed changes to SNR_TX and SNDR ", Adee Ran
  - https://www.ieee802.org/3/ck/public/22_01/ran_3ck_01_0122.pdf
  - https://www.ieee802.org/3/ck/public/22_01/ran_3ck_03a_0122.pdf

Proposal

To better account for transmitter noise introduced after equalization (σ_2):

1. For calculation of channel COM, the following Equation replaces 93A-30 (with editorial license to prevent the change from affecting previously defined clauses and annexes):

$$\sigma_{TX}^2 = \left[\frac{h^{(0)}(t_s)}{c(0)}\right]^2 10^{-\frac{SNR_{TX}}{10}}$$

   where $c(0)$ is the Tx equalizer coefficient used in the evaluation of $h^{(0)}$ (see equation 93A–21).

2. Change the definition of SNDR (Tx measured specification) in 162.9.3.3 to account for the effect of equalization on p_{max} (to match the definition above). The following equation replaces Equation 120D-7:

$$SNDR = 10\log_{10}\frac{\left(p_{max}/c(0)\right)^2}{\sigma_e^2 + \sigma_n^2}$$

   where $c(0)$ is the calculated coefficient in the linear pulse fit of the measurement (equation 162–2) from which SNDR is calculated.

   (if the measurement is done with equalization off, the equation becomes equivalent to 120D-7)

3. SNDR is defined as the maximum value across Tx equalization settings.

   (measurement with all possible settings is not feasible)

To prevent degradation of COM for previously analyzed channels:

1. Change SNR_{TX}
   - In Table 162–19, change the value of SNR_{TX} from 32.5 dB to 36.9 dB.
   - In Table 163–11 and Table 120F–8, change the value of SNR_{TX} from 33 dB to 37.4 dB.

   (4.4 dB increase correspond to an assumed minimum c(0) value of 0.6)

2. Change SNDR (min) specification to follow the change in SNR_{TX}.
   - In Table 162–10, change the value of SNDR (min) from 31.5 dB to 35.9 dB.
   - In Table 163–5 and Table 120F–1, change the value of SNDR (min) from 32.5 dB to 36.9 dB.

   (the tightening of the limit is partially offset by the change in the definition of SNDR in the previous slide, which will improve measured results)

Editorial license to be provided for implementing all of the above in a clean way.

Straw poll #24 (direction)
I support adopting SNDR and sigma_tx calculation as proposed on slide 3 of ran_3ck_03a_0122.
Yes: 7
No: 2
Need more information: 20

FURTHER WORK ENCOURAGED

MODULE OUTPUT TEST CHANNEL

CI **120G** *SC* **120G.3.2.2.1** *P* **263** *L* **14** # I-189

Dawe, Piers J G NVIDIA

Comment Type **TR** *Comment Status* **R** *MO test channel*

If we include an allowance for host transmitter package loss for the host stressed input test, it would make sense to include the same allowance for far-end module output specs. As the change is to the reference host channel which is in software, it's convenient to do, rather than rely on extrapolation.

SuggestedRemedy

Increase the two far-end lengths by 2.2 dB (taking 16 dB to 18.2 dB, aligning with 120G.3.4.3.2). In Table 120G-11, increase bbmax(1) from 0.4 to 0.55. Reduce module output eye height by 2.2 dB.

Response *Response Status* **U**

REJECT.

The total host side insertion loss prescribed is 9.6 dB for the synthetic transmission line and 2.3 dB for the module compliance board for a total of 11.9 dB, which matches with the maximum host insertion loss recommendation in Figure 120G-2.

The comment proposes that the module output should be measured with the maximum host insertion loss plus an allocation similar to that used in the frequency-dependant attenuator in 120G.3.4.3.2 then scale the eye height proportionally and increase the DFE tap range.

The reasoning for making the changes seems sounds, but insufficient analysis has been provided to show that the changes to the DFE tap range and the eye height value are appropriate.

There is some interest in increasing the channel loss as proposed, but there is insufficient analysis provided to support the proposed new values for bbmax and eye height. Further analysis and consensus is encouraged.

TX SCOPE FILTER

CI **162** *SC* **162** *P* **166** *L* **6** # I-224

Zivny, Pavel Tektronix, Inc.

Comment Type **T** *Comment Status* **R** *TX measurement*

The "using a test system with a fourth-order Bessel-Thomson low-pass response with 40 GHz 3 dB bandwidth." allows for large range of result change depending on the end of B-T filter compliance. This can readily be corrected by specifying the roll-off, as has been done in optical standards for years - see e.g. 140.7.5 Transmitter and dispersion eye closure for PAM4 (TDECQ).
Reasoning: experiments show that for realistic signals the sensitivity (of measurment results) to roll-off compliance becomes insignificant past about 55 GHz. Presentation available.

SuggestedRemedy

Append "using a test system with a fourth-order Bessel-Thomson low-pass response with 40 GHz 3 dB bandwidth" with "compliant (to the B-T response) to at least 58 GHz, and lower or the same level as the 58 GHz response thereafter".

Response *Response Status* **C**

REJECT.

According to straw poll #7 there is no consensus to implement the suggested remedy. Further consensus and analysis is encouraged.

Straw poll #7
I support specifying the scope filter response in line with the suggested remedy in comment i-224.
Yes: 11
No: 13

https://www.ieee802.org/3/ck/public/22_01/zivny_3ck_01b_0122.pdf

THANK YOU!