D2.1 DISCUSSIONS CARRYING OVER; HOST OUTPUT SWING/PEAK

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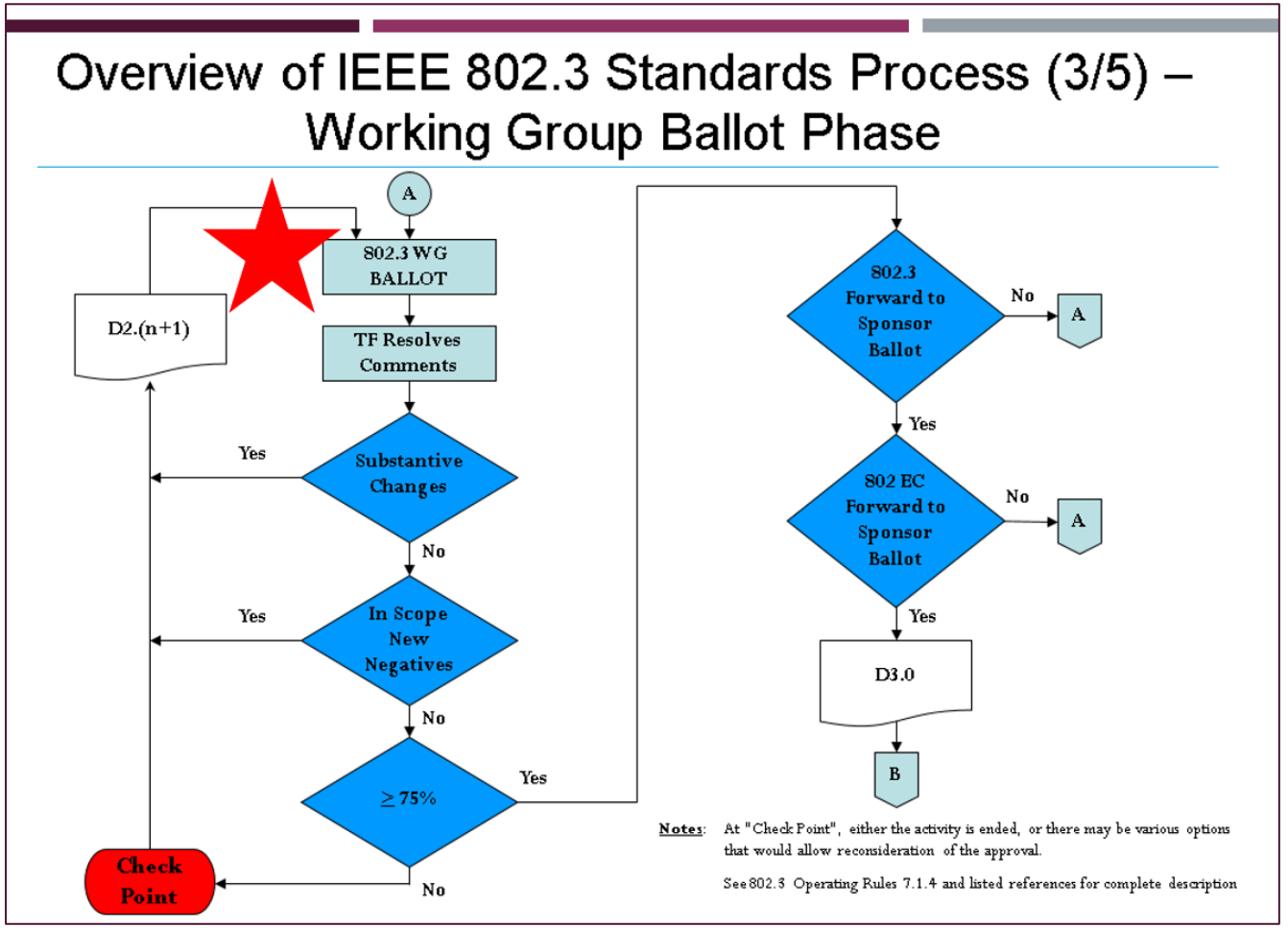
OUR STEP IN THE PROCESS

- As we approach Sponsor Ballot,
  - Watch substantive changes
  - Watch scope
  - Watch areas of contention that could impact our ability to progress



LOOKING BACK

- Watching for "sticking points" or big discussions → tend to have straw poll(s)
- Many of our discussions resulted in changes to the draft
- Seemingly 2 open discussions from D2.1
  - AC CM Noise
  - HO Output Swing

Straw Poll	D2.1 Comment	Topic	Result
1/2	123	AC CM Noise	General support expressed for the direction, closed 15:16 for implementing as is.
3/4	46	AC CM Noise	Made change to draft
5/6/7	39	EO Method	Made change to draft
8	51	MO AC CM Noise Tolerance	Made change to draft
9	53	HI SI Method	Made change to draft
10	92	Host/CA IL	Consensus to leave as is
11/12	100	ERL Tfx	Made change to draft
13	37	HO Output Swing	Noted some agreement on issue, closed 10:14 to not implement.

AC CM NOISE

- Presented in D2.1 Comment Resolution
  - D2.1 Comment 123
  - https://www.ieee802.org/3/ck/public/21_07/mellitz_3ck_01a_0721.pdf
- Rich presented at 9/8 Ad Hoc
  - https://www.ieee802.org/3/ck/public/adhoc/sept08_21/mellitz_3ck_adhoc_01_090821.pdf
- Updated presentation/proposal online:
  - https://www.ieee802.org/3/ck/public/21_09/mellitz_3ck_01_0921.pdf
  - D2.2 Comment 59

Cl **162** SC **162.9.3** P **163** L **10** # 123

Mellitz, Richard Samtec

Comment Type **TR** *Comment Status* **R** *AC CM noise*

Table 162-10 specifies AC common-mode RMS voltage, vcmi (max) note b just changes to a PRBS13Q with method described in 93.8.1.3. The problem is that coherent CM signal are included in differential measurements like SNDR, Jitter, and Linear fit pulse peak ratio. That means it is the coherent part if AC CM is double counted.

SuggestedRemedy

Add note to line 10 (vcmi) indicating that the CM mode measurement is only for the non-coherent CM part of the measurement.

This applies to Tables 163-5, 120F-1, 120G-1, and 120G-3

Draft 2.1

Response *Response Status* **U**

REJECT.

[Editor's note: Changed clause/subclause from 163/163.9.3.]

This comment does not apply to the substantive changes between IEEE P802.3ck D2.1 and D2.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.

The following presentation was reviewed by the task force:
https://www.ieee802.org/3/ck/public/21_07/mellitz_3ck_01a_0721.pdf.
Resolve in conjunction with comment #46.

Based on straw poll #2, there is not sufficient consensus to implement the proposed changes.

Straw poll #1 (direction)
I would support the AC CM voltage test methodology in Comment #123 and the related presentation mellitz_3ck_01_0721.
Yes: 18
No: 6
Need more information: 13
Abstain: 3

Straw poll #2 (decision)
For the resolution of comment #123, I support adopting the AC CM voltage test methodology in Comment #123 and the related presentation mellitz_3ck_01a_0721.
Yes: 15
No: 16

[Editor's note: CC: 163, 120F, 120G]

Cl **93A** SC **93A** P **237** L **44** # 59

Mellitz, Richardd Samtec

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

Common mode measurements are not well enough defined to precisely specify CM voltage at TP0v, TP1a, TP4 and TP2. In addition, all aspects of a common mode voltage may not be detrimental as illustrated in mellitz_3ck_adhoc_01_090821.

SuggestedRemedy

Add section "93A.6 Common Mode measurements". See presentation

Draft 2.2

Proposed Response *Response Status* **O**

HO OUTPUT SWING

- Presented in D2.1 Comment Resolution
  - D2.1 Comment 37
  - https://www.ieee802.org/3/ck/public/21_07/ran_3ck_04b_0721.pdf
- Updated proposal in comment:
  - D2.2 Comment 37

Draft 2.1

Cl **120G** *SC* **120G.5.1** *P* **264** *L* **31** # 37

Ran, Adee Cisco systems

Comment Type **TR** *Comment Status* **R** *signal level (CC)*

This clause is referred to in Table 120G-1 and Table 120G-3 for the parameter differential PtP output voltage (max), among others.

The content is only a reference back to 120E.3.1.2: "The signal levels are as defined in 120E.3.1.2". 120E.3.1.2 does have a definition of differential signal but also states that "Unless otherwise noted, differential and common-mode signal voltages are measured with a PRBS13Q test pattern".

But PRBS13Q is not an appropriate signal for measurement of the PtP output voltage, because it has a maximum run length of 7 symbols and does not have any spectral content below 3 MHz. Much longer runs are possible in real data. Measurement with PRBS13Q over a lossy channel between the transmitter and the measurement point, without sufficient equalization, can thus yield peak-to-peak value lower than the value that real data would create.

Since there is no way to control the transmitter's swing or equalization, this may cause events of higher signal levels than the receiver expects, and cause periods of high BER, which can span many FEC symbols and cause uncorrectable codewords.

It is proposed to define the differential PtP explicitly as a requirement for any data pattern, and recommend to measure it using a pattern that contains low-frequency content, such as PRBS31Q or SSPRQ.

The definition of signal levels measurement using PRBS13Q also applies for CR/KR/C2C but in these cases the transmitter can be controlled to reduce the signal to an adequate level for the receiver, so it is less of an issue.

SuggestedRemedy

Replace the content of 120G.5.1 with the following:

"The definition of differential and common-mode signals can be found in 120E.3.1.2. The signal levels specifications for host and module outputs hold for any data pattern. It is recommended to measure differential peak to peak signal levels with PRBS31Q or SSPRQ test pattern."

Consider applying similar changes in 162, 163, and 120F, with editorial license.

Response *Response Status* **U**

REJECT.

This comment does not apply to the substantive changes between IEEE P802.3ck D2.1 and D2.0 or the unsatisfied negative comments from the initial ballot.
Hence it is not within the scope of the recirculation ballot.

The proposal to refer "any data pattern" is rather broad.

SSPRQ has been previously used only for optical transmitter testing and has no advantages for this test.
It is not clear that similar changes are warranted for 162, 163, and 120F since the insertion loss to the test point is smaller.

There was some agreement that this specifications should be improved but there was no consensus on a resolution.

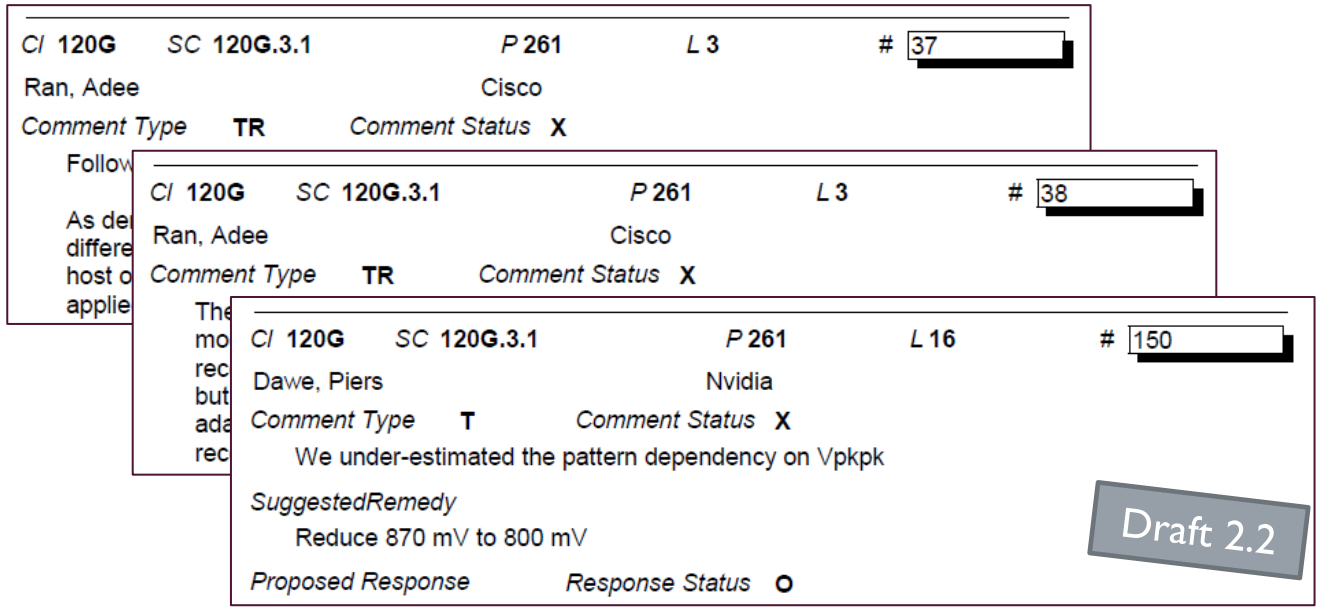
[Editor's note: CC: 120F, 120G, 162, 163]

Straw poll #13 (decision)
I support closing comment #37 updating 120G.5.1 as follows:
"The signal levels are as defined in 120E.3.1.2, with the exception that differential signal voltage is measured with a PRBS31Q (see 120.5.11.2.2) test pattern or a valid 100GBASE-R, 200GBASE-R, or 400GBASE-R signal."
Y: 10
N: 14

HO OUTPUT SWING

- In fact, there 3 comments on this topic: 37, 38, 150

- Asked Adee to help illustrate the difference
- We should understand the proposals & discuss
- Will need to close comments in 2 weeks



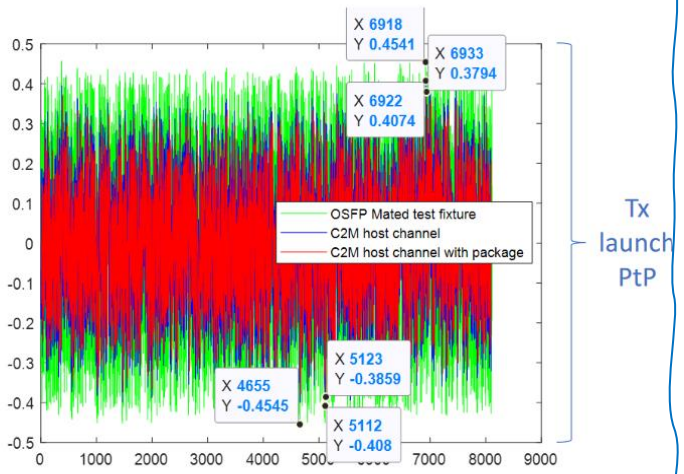
Host output differential voltage

Subject of comment #37 against D2.1 and [ran_3ck_04b_0721]

PRBS13Q

Channel	min/max with PRBS13Q [mV]	% of true PtP	True PtP if 900 mV is measured [mV]
C2M Host channel	-408, +407	84%	1042
C2M Host channel +COM 31 mm pkg	-386, +386	79%	1100
OSFP Mated Test Fixture	-455, +458	93%	957

Measurement with PRBS13Q is much lower than the launch PtP and is channel dependent.
With scrambled data the signal can reach the launch voltage.
The dynamic range that the receiver will need to handle can't be deduced from the measurement.



The issue was acknowledged but there was no consensus for the proposed change (measure with PRBS31Q)

It is not clear that similar changes are warranted for 162, 163, and 120F since the insertion loss to the test point is smaller.

There was some agreement that this specifications should be improved but there was no consensus on a resolution.

[Editor's note: CC: 120F, 120G, 162, 163]

Straw poll #13 (decision)
I support closing comment #37 updating 120G.5.1 as follows:
"The signal levels are as defined in 120E.3.1.2, with the exception that differential signal voltage is measured with a PRBS31Q (see 120.5.11.2.2) test pattern or a valid 100GBASE-R, 200GBASE-R, or 400GBASE-R signal."
Y: 10
N: 14

Concerns were raised about practicality of measurement with PRBS31Q.
(all other C2M specs are measured with PRBS13Q).

Comments against D2.2 (1 – pattern dependency)

Cl **120G** *SC* **120G.3.1** *P* **261** *L* **3** # **37**

Ran, Adee — Cisco

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

Following up on unsatisfied comment #37 against D2.1:

As demonstrated in https://www.ieee802.org/3/ck/public/21_07/ran_3ck_04b_0721.pdf, the differential peak to peak specification measured with PRBS13Q is broken, especially for host output, because the result is strongly dependent on the host channel and equalization applied.

Since the proposal to define/measure this parameter with other patterns was not accepted, this comment proposes a new specification, based on PRBS13Q, to verify that the output swing is not too high. Namely, v_f using the linear fit procedure, similar to 162.9.3.1.2, with the exception that the transmitter equalization is not specified (it is whatever the host sets it to).

v_f represents the asymptote of the (linear) step response of the transmitter, including any equalization applied. It can be used to predict the effect of arbitrarily long runs which are not present in PRBS13Q itself.

The suggested limit corresponds to Vdiffptp of 900 mV which was the assumed value for the host in all earlier C2M specifications. This limit may be somewhat too high but changing it is a different topic.

SuggestedRemedy

Add a row to Table 120G–1 with Parameter: Steady-state voltage v_f (max), Reference: 120G.5.4, Value: 450, Units: mV.

Add subclause 120G.5.4 with the following text:
120G.5.4 Steady-state voltage
The steady-state voltage v_f is defined as the sum of the linear fit pulse p(1) through p(M×Nv) divided by M with the specific equalization used by the transmitter. Nv is set equal to Np. The linear fit procedure for obtaining p and the values of M and Np are defined in 162.9.3.1.1.

New method

Address the same issue in another way:

- Re-use the established v_f specification from C162 (which is likely measured anyway when testing hosts)
- Calculated from host output measurement with PRBS13Q (same data collection)
- Receiver (module) can assume $2\times v_f$(max) is the maximum input (up to termination mismatch) – regardless of pattern
  - No need for minimum – covered by EH/VEC
- This is an addition, not a replacement of the Vdiffptp spec

- Suggested remedy enables 900 mV launch voltage (as in COM analysis in many presentations) with no equalization
  - Or higher launch voltage with Tx equalization
  - This comment is about the method – limit may be different (comment #38)

Cl **120G** *SC* **120G.3.1** *P* **261** *L* **16** # **150**

Dawe, Piers — Nvidia

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

We under-estimated the pattern dependency on Vpkpk

SuggestedRemedy

Reduce 870 mV to 800 mV

Change the limit

Another proposal to address the problem

This change would not guarantee a limit at the module input – so insufficient by itself, but it does not contradict the proposal in #37

Comments against D2.2 (2 – the limit value)

Cl **120G** *SC* **120G.3.1** *P* **261** *L* **3** # 38

Ran, Adee Cisco

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

The host output differential peak-to-peak voltage is defined at TP1a so it is close to what a module input will have. The limit of 870 mV is too high for modern module host-side receivers which may used low-voltage CMOS processes. The reference CTLE is fully linear but real CTLEs may become nonlinear with such large signals and it may messs with its adaptation and CDR functionality and create much worse BER than what the reference receiver predicts.

Note that the module output "short" setting, which assumes a low-loss host channel (such that the receiver is close to the measurement point TP4), has a differential peak to peak limit of 600 mV.

SuggestedRemedy

Change the value of Differential peak-to-peak output voltage (max) with transmitter enabled from 870 to 600 mV.

In addition, if the steady-state voltage specification is added (subject of another comment), set the limit of that specification to 300 mV.

Comment is about the assumed swing, regardless of the pattern.

The proposal in this comment is to limit the host output VdiffPtP (measured at TP1a, near module input) to 600 mV.

Hosts should use Tx equalization as necessary to attenuate low frequencies.

If we adopt the v_f specification (comment #37), then v_f (max) of 300 mV would be a sufficient protection, with or without reducing VdiffPtP to 600 mV.

Straw poll (1)

- To address pattern dependency of Vdiffptp measurement, I prefer
  A. Adding v_f(max) specification (comment #37)
  B. Reducing the limit (comment #150)
  C. Both A and B
  D. No change
  E. Need more information

Straw poll (2)

(Wording assumes C was preferred in straw poll 1. Otherwise, we can delete some text)

- For the peak at TP1a, I prefer
  A. Vdiffptp (max)=600 mV and v_f(max)=300 mV (comment #38)
  B. Vdiffptp (max)=800 mV (comment #150) and v_f(max)=450 mV (comment #37)
  C. Vdiffptp (max)=800 mV and v_f(max)=300 mV (combined)
  D. No change
  E. Need more information

THANK YOU!