TRANSMIT EQUALIZER CONTROL FOR C2C

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Background

- Tx equalization control in previous PHYs has been defined with two flavors:
  - PMD control function – aka training protocol, PMD start-up protocol
    - Initially in Clause 72 (72.6.10) with a 3-tap FFE, reused for all subsequent NRZ KR/CR PMDs
    - For PAM4, an updated control function with a 4-tap FFE has been defined in 136.8.11 (see healey_3cd_01a_0716), also used in Clause 137
    - It is re-used in P802.3ck with adjustment to a 5-tap FFE
  - AUI C2C control – through management variables and optional MDIO registers
    - Suitable for a 3-tap FFE
    - An optional Transmitter equalization feedback function (83D.3.3.2) enables management-controlled closed-loop adaptation (ran_01_0714_optx)
    - Initially in Annex 83D (83D.3.1.1), reused for subsequent NRZ AUI-C2C annexes
    - Also re-used for the 50G/lane PAM4 AUI-C2C defined in 120D.3.1.5 without change (3 taps)
    - Included in D1.1 of P802.3ck without change…

What's the problem?

Cl **120F** *SC* **120F.1** *P* **194** *L* **33** # 268

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Comment Type **T** *Comment Status* **D** *withdrawn*

"If implemented, the transmitter equalization feedback mechanism described in 120D.3.2.3 may be used to identify an appropriate setting"

That mechanism supports the equalizer that was specified in the original CAUI-4 C2M (Annex 83D), which has only 3 taps with 5% coefficient resolution. The PAM4 AUIs defined in 802.3.bs (120D.3.1.5) and re-used in 802.3cd have kept this structure.

However, in we now have a 5-tap equalizer with 2% resolution. Even if pre-cursor tap c(-3) is removed as suggested in 120F.3.1.4 it would not be identical to the FFE in Annex 83D.

Re-using this method for 100GAUI-1 is impossible if the specified Tx equalizer is different from what it was in Annex 83D. A new method should be defined.

Also applies to 45.2.1.129.

SuggestedRemedy

I am planning a presentation with some possible solutions.

Proposed Response *Response Status* **Z**

PROPOSED REJECT.

This comment was WITHDRAWN by the commenter.

- The AUI C2C control defined in previous projects is suitable only for a 3-tap FFE.
  - With 53.125 GBd signaling this isn't enough
  - The current Tx equalizer model and analysis uses a 5-tap FFE (3 precursors). Maybe 4 will be enough, but not 3.
- The existing method has direct control over coefficients with 5% resolution.
  - This is too coarse for c(-2) and possibly c(-3).
- Draft 1.1 is incomplete…
  - We need another control scheme!

What do we want for a C2C interface?

- Management-controlled scheme as in previous AUI-C2Cs?
- Or maybe a training protocol as in PMDs?
- … or the best parts of each?

Comparison

Feature	PMD control function	Existing C2C	Comments
Handshake logic	Within the PMD	Management	Affects start-up time for multi-lane devices
Known startup sequence	Yes	No	Important for staggered power on
Start w/NRZ before PAM4	Yes	No	Can help CDR lock, unknown links
Time to link	Timer controlled	Not specified	Can help CDR lock, unknown links
Forced configuration	Possible (if training is disabled)	Possible	Useful for known links
Live changes	Not supported	Possible	When PMD is in DATA mode
“Request” generation logic	Not specified	Not specified	Out of scope; can be internal to the PMD or external, either way

Can the drawbacks of training be addressed?

- Forced configuration can be a useful feature for known links
  - Easy to add a new preset for a “programmable” setting, programming can be implementation specific
- Live changes can be enabled for C2C if there is management access to the registers in both devices
  - Is there interest in this direction?

Possible paths forward

1. Define a direct register-based control similar to Annex 83D and 120D.3.1.5, but with 4/5 taps and finer resolution as needed
   - We will need new registers, since the current ones are full
2. Define a new function for AUI-C2C, similar to the PMD control function
   - Practically the same small logic block
   - Signal detect primitive already exists in the PMA – easy to use
   - Consider adding “programmable” preset
3. Do something else?