Low Frequency IL Proposal for P802.3cy

Natalie Wienckowski

February 22, 2022

Link Segment IL limit below 10 MHz?

- Link Segment Insertion Loss (IL) is not defined below 10 MHz
  - Concern from PHY designers that the IL could be excessive in this range with no limits
  - Physics of the cable and connectors don't allow for "high" IL at low frequencies
    - See next slide for data provided that shows there are no peaks or valleys below 10 MHz
  - Inclusion of passive parts, inductors and capacitors, can cause peaks, or valleys in the IL at low frequencies
  - Passive parts are not included in cable harness assemblies
  - Passive parts may be included on the printed circuit board (PCB), e.g. for PoDL

general motors

Wienckowski_3cy_01a_02_22_22

Cable IL Measurements

- https://www.ieee802.org/3/cy/public/adhoc/DiBiaso_Bergner_Cuesta_3cy_adhoc_01_091620.pdf

- https://www.ieee802.org/3/cy/public/adhoc/Patel_3cy_01a_0920.pdf

- https://www.ieee802.org/3/cy/public/adhoc/mueller_3cy_01_0920.pdf

- https://www.ieee802.org/3/cy/public/adhoc/boyer_3cy_01_10_14_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/mueller_3cy_01_10_14_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/koeppendoerfer_3cy_01_10_28_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/DiBiaso_Bergner_Cuesta_3cy_adhoc_01b_10_28_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/mueller_3cy_01_12_01_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/boyer_3cy_01_12_08_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/neulinger_3cy_01_12_15_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/mueller_3cy_01a_12_15_20.pdf

- https://www.ieee802.org/3/cy/public/adhoc/BergnerCuestaDiBiaso_3cy_01a_01_19_21.pdf

- https://www.ieee802.org/3/cy/public/jan21/neulinger_3cy_01_01_26_21.pdf

- https://www.ieee802.org/3/cy/public/adhoc/Gianordoli_Silvano_de_Sousa_3cy_01a_02_09_21.pdf

- NOTE: There may be others that I missed. This was not intentional. I didn't include the presentations that referred to these to suggest IL limits.

general motors

Link Segment IL limit below 10 MHz?

- Why not define link segment IL below 10 MHz
  - Every cable assembly is tested at End of Line (EoL) for quality
  - Minimum specified frequency for any s-parameter will be the step size used for EoL testing
  - 1 MHz minimum link segment IL frequency -> 10x as much memory to save EoL test data compared to 10 MHz minimum link segment IL frequency (this also applies to the raw cabling and connectors
  - Test time is increased
    - More memory writes
    - More calculations are required
  - Testing with different step sizes over different frequency ranges is not practical

general motors

4

MDI Insertion Loss

- Passive parts may be included on the printed circuit board (PCB), e.g. for PoDL, EMC, etc.

- Low frequency IL limit should be defined

- Options for minimum frequency

  - 1 MHz, same as P802.3bp and P802.3ch

  - 2.5 MHz, scaled from P802.3ch as is the operating frequency

  - Less than 8.3 MHz, to accommodate 16.667 MHz Auto-Negotiation signals, e.g. 5 MHz to avoid awkward steps

- Γ will be used to represent the minimum frequency in the following slides as we haven't selected a specific frequency.

general motors

Wienckowski_3cy_01a_02_22_22

Proposed Change to P802.3cy D0.5

165.5.5.1 Host Test Fixture

- Add frequency range to equation 165-17

$$IL_{htfref}(f) = \left(0.09144 \left(\frac{f}{1000} \right) + 0.51054 \left(\frac{f}{1000} \right)^{0.45} \right) \times 0.3334 dB \qquad (165-17)$$

where

f is the frequency in MHz: $\Gamma \le f \le 9000$

Proposed Change to P802.3cy D0.5

165.5.5.2 Link Segment Test Fixture

- Add frequency range to equation 165-18

$$IL_{lstfref}(f) = \left(0.09144\left(\frac{f}{1000}\right) + 0.51054\left(\frac{f}{1000}\right)^{0.45}\right) \times 0.3334dB \qquad (165-18)$$

where

f is the frequency in MHz: $\Gamma \le f \le 9000$

general motors

Proposed Change to P802.3cy D0.5

165.5.5.3.1 Insertion loss

- Add frequency range to equation 165-21

$$IL_{mtfref}(f) = 0.06109\left(\frac{f}{1000}\right) + 0.3404\left(\frac{f}{1000}\right)^{0.45} + 0.2\sqrt{\left(\frac{f}{2500}\right)} \qquad (165\text{--}21)$$

where

f is the frequency in MHz: $\Gamma \leq f \leq 9000$

Proposed Change to P802.3cy D0.5

165A

- Change minimum frequency in the following:
    - 165A.2.1 Host PCB trace loss on 165A-1 and 165A-2
    - Change "$10 \leq f \leq 9000$" To   "$\Gamma \leq f \leq 9000$"

- Don't change minimum frequency in the following:
    - 165A.3 TP0 to TP5 channel insertion loss
    - Link Segment IL starts at 10 MHz so the complete channel is not defined in this range

Questions?

Straw Poll

Straw Poll on value of Γ

- I would support a value of Γ of (vote for all that you would support):

  - 1 MHz

  - 2 MHz

  - 2.5 MHz

  - 5 MHz

  - 10 MHz (current value)

general motors

Thank you