100BASE-T normative 350uH inductance specification and IEEE P802.3at

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Issue

- Clause 25 incorporates TP-PMD by reference

  25.2 Functional specifications

  The 100BASE-TX PMD (and MDI) is specified by incorporating the FDDI TP-PMD standard, ANSI X3.263: 1995 (TP-PMD), by reference, with the modifications noted below.

- Subclause 9.1.7 of ANSI X3.263: 1995
  - Specifies a worst case droop of transformer
    - Minimum 350 uH with any DC bias between 0 mA and +8 mA
- Normative for 100BASE-T PHYs
  - Not listed in 25.2 modifications to X3.263
- PoE+ increases DC current imbalance in transformer
  - This in combination with the 350 uH minimum is an issue
    - See DC Current Imbalance - Steve Ellsworth http://www.ieee802.org/3/poep_study/public/mar05/ellsworth_1_0305.pdf#Page=7

ANSI X3.263-1995 (TP-PMD)

9.1.7 Worst case droop of transformer

Baseline Wander tracking by the receiver is dependent on the worst case droop that can be produced by a transmitter. Droop is directly related to the Open Circuit Inductance (OCL) which varies with temperature, manufacturing tolerance, and bias current.

Worst case Baseline Wander Frames vary the transformer bias which causes the droop to change with data content. This variation must be accounted for by the receiver to track the Baseline Wander over long frames. Variation in inductance caused by bias of the transformer can be on the order of 2:1.

The minimum inductance measured at the transmit pins of the AOI shall be greater than or equal to 350 uH with any DC bias current between 0 mA and +8 mA injected as shown in figure 13.

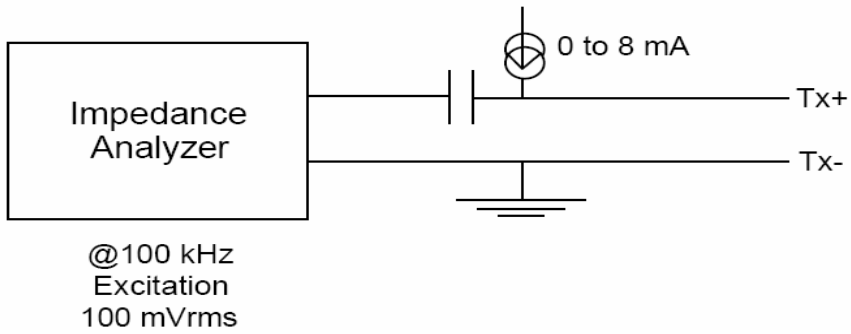


Figure 13

Problem

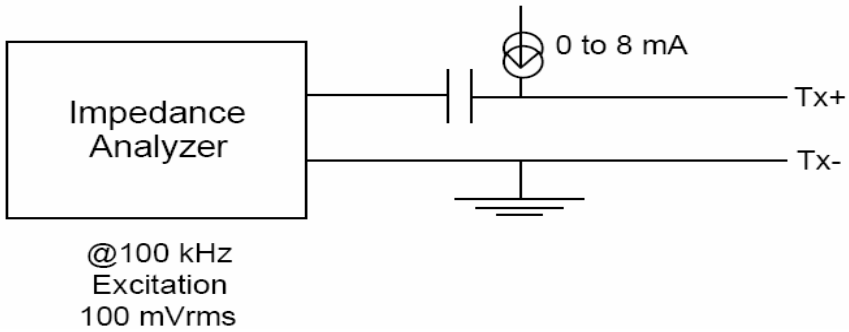
- Baseline wander can cause bit errors
  - Inductance requirement is one fix
    - But this is an implementation approach
  - Other approaches may now be available
    - But due to standard inductance still has to be met
- BER performance is actual requirement
  - And meeting BER is all that should matter
    - Implementation to achieve this not of interest
      - Should not be mandated by standard

Idea

- Add a new modification to ANSI X3.263 in 25.2
- Allow either
  - Compliance with the ANSI X3.263 inductance specification
  - If sufficient, compliance with a BER performance specification
    - No BER objective referenced in 100BASE-T
      - Not in either IEEE Std 802.3-2005 or ANSI X3.263
      - 10BASE-T BER objective is 10^{-8} (see 14.1.3.1 item c)
      - 1000BASE-T BER objective is 10^{-10} (see 40.1.1 item g)
      - FDDI PHY BER objective is 2.5×10^{-10} ($\sim 10^{-9.602}$)
        - » Specified in ISO/IEC 9314-20
    - Other approaches such as POE only exception or transmitter output templates may be required
      - The BER is on whole link
        - » Be able to build Transmitters and Receives that interoperate

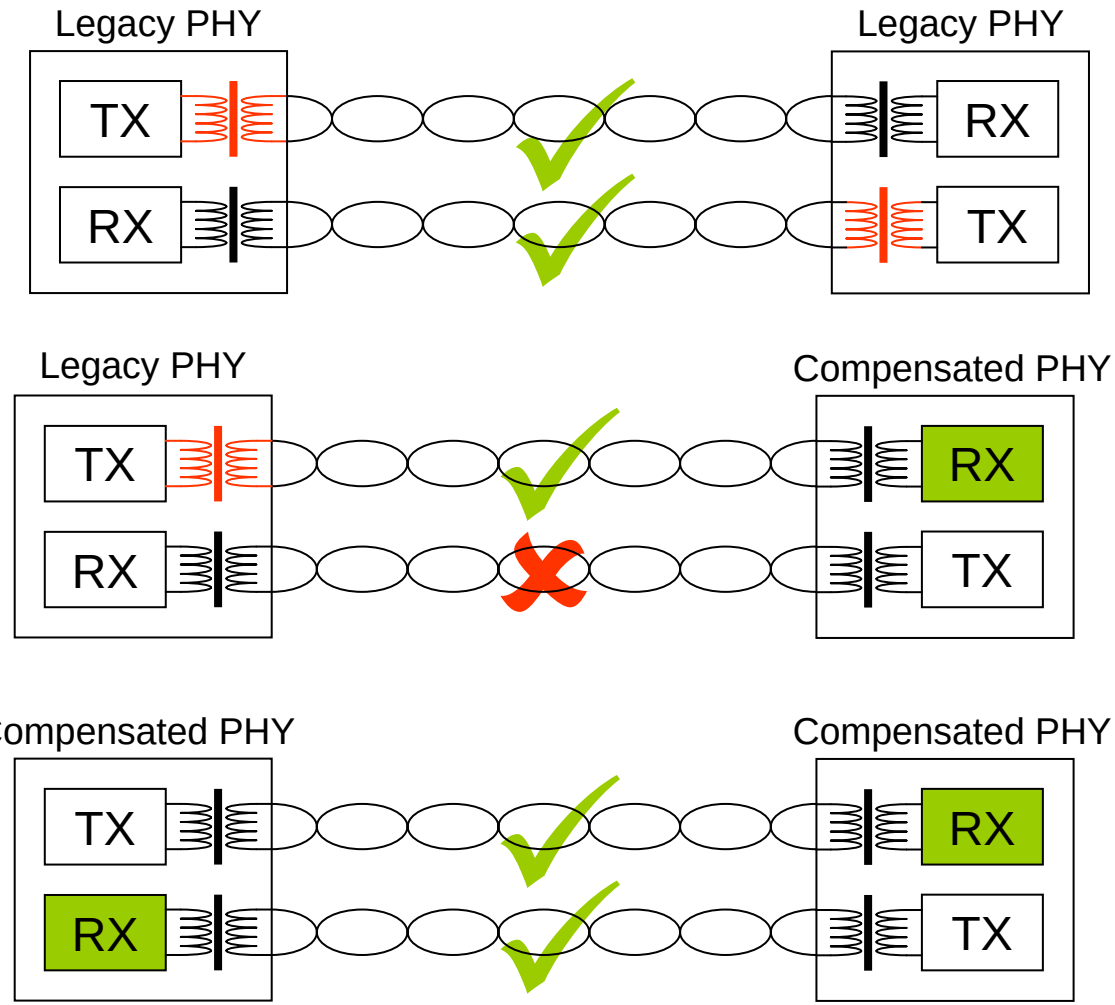
But if only it was that easy …

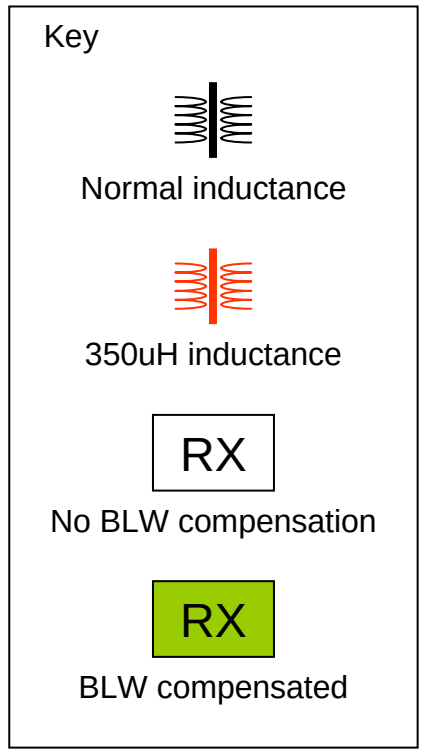
- High inductance is specified for Transmit side
  - This is what we want to remove need for



- BER is usually specified for Receiver
  - Using complaint transmitter
  - And worse case channel
- Compensation for BLW implemented in receiver

Problem is mixed configuration





Next steps

- Will such a change help with PoE magnetics ?
  - No point doing this if it doesn't
    - And would make change out of scope of IEEE P802.3at
  - Would like to hear feasibility from magnetic experts
    - Cost analysis relative to PoE with and without change
- Is proposed BER alternative useful ?
  - Is there a PoE only solution ?
    - Require all POE+ devices support compensated PHY
    - Don't need to meet inductance when sourcing power
  - Will it allow PHY implementations enough freedom
  - Can it be met by PHY implementations
  - Is there a better way to approach this
    - What about a transmit template
  - Need to engage PHY expertise

Next steps

- Need to confirm
  - Will a change help with PoE magnetics
  - Is not requiring inductance when sourcing power sufficient
- Propose an adhoc conference call to discuss the approaches available to provide an additional, alternative, conformance requirement to ANSI X3.263 subclause 9.1.7.
- Report back to IEEE 802.3

Motion

- Authorise the formation of an adhoc to discuss the approaches available to provide an additional, alternative, conformance requirement to ANSI X3.263 subclause 9.1.7. Appoint Mr. Law as the Chair of the Ad-Hoc. Report results back to IEEE 802.3

- M: Diab
- S: Law