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10BT Amplitude Optimization

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Why Worry About 10BT Amplitude?

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- 10BT signal amplitude was specified for an obsolete cable
  - Twisted Pair Model used in template measurements is based on the DIW cable
  - Most modern cable plants are Cat-5 or better – very little Cat-3 and almost no DIW cable in existence today
- 10BT as specified can achieve >180m of reach over Cat-5 cable
  - Wasteful as there is no standards compliant cabling infrastructure that provides that reach
  - 10BT PHYs exceed amplitude template specifications over 100m of Cat-5 cable
- Reducing 10BT amplitude for Cat-5 or better cable plants WILL save power over existing 10BT designs while maintaining backward compatibility with existing 10BT PHYs
  - The power supplied to the load will be reduced by 30%. For the same VDD and the same LD efficiency, the supply power should drop by the same amount
  - The benefit from a lower supply voltage will be on top of that
- Enable migration of multi-speed PHYs that also support 10BT to newer process technologies that do not support high IO voltages
  - This is critical to allow multi-speed PHY to continue to exploit newer process technologies and decrease power consumption

Every Watt Counts !!!

Relevant specifications

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- IEEE Std 802.3
  - Insertion Loss @ 5MHz: 6.50dB – 7.07dB
  - Insertion Loss @ 10MHz: 9.7dB – 10.45dB
- TPM (Fig 14-7) sims
  - Insertion Loss @ 5MHz: 6.69dB
  - Insertion Loss @ 10MHz: 9.88dB

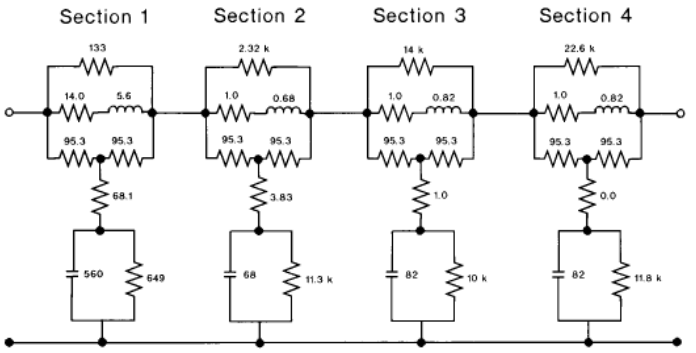

Figure 14–7—Twisted-pair model

- TIA/EIA-568-B.2 - Horizontal Cable 100m
  - Cat-3 @ 5MHz: ~6.5dB
  - Cat-3 @ 10MHz: ~9.7dB
  - Cat-5/5e @ 5MHz: ~4.5dB
  - Cat-5/5e @ 10MHz: ~6.5dB

Proposal

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- Delta Cat-5/5e vs. TPM
  - 2.16dB @ 5MHz
  - 3.38dB @ 10MHz
- Delta Cat-5/5e vs. Cat-3
  - 2dB @ 5MHz
  - 3.2dB @ 10MHz
- An amplitude reduction of 3dB is safe to maintain full compatibility with Cat-5/5e or better cabling and legacy PHYs
- The 5MHz content can be managed by proper pre-emphasis or by slightly reworking points H, I, L, and K of the template

- Minimal work on Fig 14-9:
  - Redefine the values for points H, I, L, K

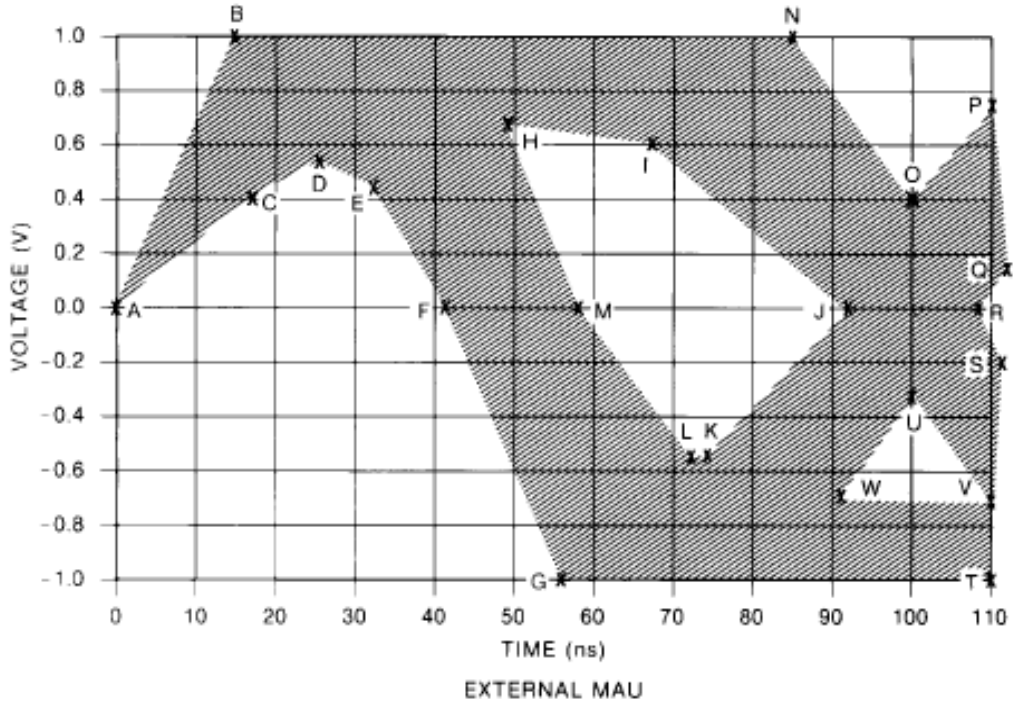

Figure 14–9—Voltage template

  - Remark: A typical 10BT signal after 100m Cat-5e cable DOES NOT fit Fig 14-9 template (2.5V * 0.473 = 1.18V)