Copper Cabling Performance

- *Cat5 Installed base performance*
- *Cat5e performance*
- *Cat6 performance*
- *Noise immunity for applications*
- *Alien NEXT and ELFEXT*
- *Extended Frequency Performance*
Cat5 Installed Base

• Component performance specified for NEXT, Insertion Loss, and Return Loss

• Channel performance not field verified, Cabling measurement specifications (TIA TSB-67) came later.

• After the fact, Channel Return Loss and ELFEXT were specified in TIA TSB-95.

• During this time, connector design was not well understood, so cabling installed performance varied widely.

• Even so, many installed channels may meet Cat5e performance requirements (with a handwave).
Cat5 Channel Performance

NEXT

ELFEXT

Return Loss

Attenuation
**Cat5e Channel Performance**

**NEXT**

**ELFEXT**

**Return Loss**

**Attenuation**
Cat6 Channel Performance

NEXT

-120.00  -100.00  -80.00  -60.00  -40.00  -20.00  0.00

1 10 100 1000

ELFEXT

-100.00  -90.00  -80.00  -70.00  -60.00  -50.00  -40.00  -30.00  -20.00  -10.00  0.00

1 10 100 1000

Return Loss

-70.00

1 10 100 1000

Attenuation

-45.00

1 10 100 1000
Channel Performance

• Channel performance for Cat5 and Cat5e was compared to Cat5e limits.
• Cat5 and 5e limits are only specified to 100 MHz. Limit lines beyond 100 MHz are for information only.
• Cat6 limits are specified to 250 MHz. Limit lines beyond 250 MHz are for information only.
• Cat5e and Cat6 Cabling is expected to conform to the specified requirements with some margin. This is commonly verified by field testing.
Cable Bundling and Alien Crosstalk

- **Category 5e**
- **Category 6**
Alien Crosstalk in Cat5e and Cat6 installations

- *Cat 5e Alien PSNEXT cable only spec (for Bundled and Hybrid Cables)*
  
  \[35.3 - 15 \log(f/100) + 3 \text{ dB}\]

  -or-

  \[38.3 - 15 \log(f/100) \text{ dB}\]

- *Cat 6 Alien PSNEXT cable only spec (for Bundled and Hybrid Cables)*

  \[41.1 - 15 \log(f/100) \text{ dB}\]

Both reverting to 65dB for PSNEXT values higher than 65dB
Alien Crosstalk in Cat5e and Cat6 installations

- Real world installation on existing network
- Cables tightly bound with velcro straps
- Cable of interest at center of bundle
- Bundle leading into ceiling on cable runway
Alien Crosstalk in Cat5e installation

- 24 Cat 5e cables
- Bound configuration
- Permanent links
- 6.8dB margin to cable spec
- 7.8dB to link spec
- 8.4dB margin to channel spec
Alien Crosstalk in Cat6 installation

- 24 Cat 6 cables
- Bound configuration
- Permanent links
- 4.1dB margin to cable spec
- 4.8dB to link spec
- 5.5dB margin to channel spec
Evaluation of Alien Crosstalk in Cat5e and Cat6 installations

• Cat5e, and Cat6 installations were evaluated for Alien NEXT

• Positive margin to current TIA/EIA specifications for Cat5e and Cat6 cable link and channel measurements were demonstrated.

• It is important to follow installation guidelines for bundled cabling.
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• Horizontal Cabling Selection Market Study
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