TIA TR-42 Liaison to IEEE

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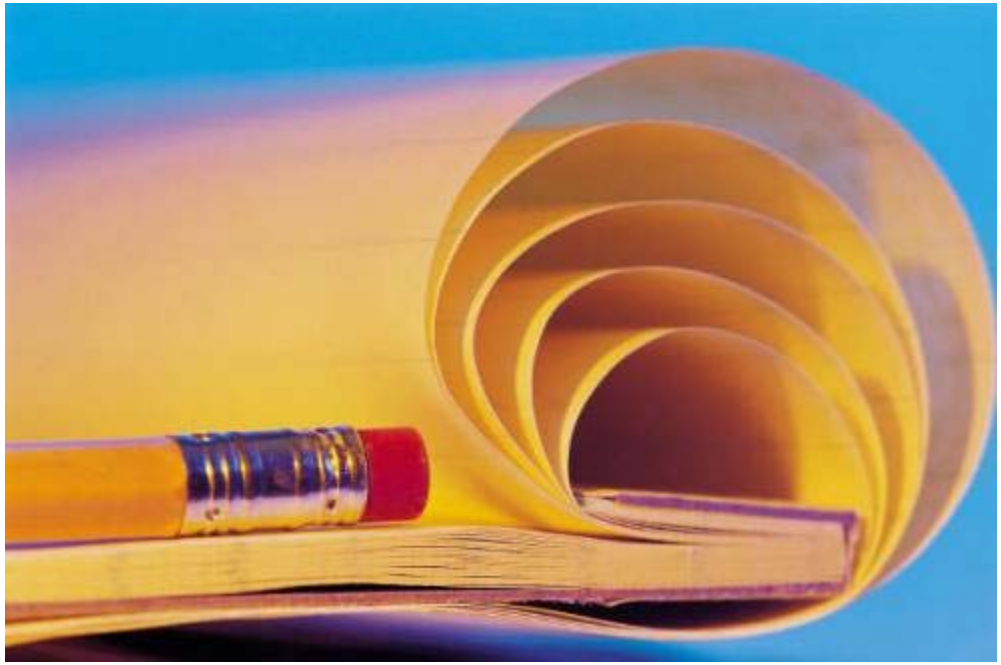
Impact of PHY Capabilities

- Extended frequency characterization required
- Alien crosstalk limits and test methods required
- Strategies to optimize SNR margin required

TIA has standards to produce!



Broad Market Potential

IEEE wants a 10GbE standard that will support new and existing cabling

- Next generation components shall support 10 GbE over copper-based horizontal cabling up to 100 meters
  - Augmented Category 6
  - Category 7
- Legacy category 6 installations shall be supported by guidelines and mitigation practices with limitations such as reduced channel length, etc.

TIA 10 GbE Cabling Standards

- **Legacy Cabling -**
  - TSB-155: 10 GbE operation over 55 meters of installed ‘568-B.1 category 6
- **New Installations -**
  - ‘568-B.2-1 (Augmented category 6): 10 GbE operation over 100-meter, 4-connector channels

TSB-155 Draft 1.3.1 Overview

"Additional Guidelines for 4-Pair 100 Ω Category 6 Cabling for 10GBASE-T Applications"

- Extended frequency characterization
- New: ANEXT, PSANEXT, AFEXT, PSAELFEXT
- Cabling (not component) requirements only
- Level IIIe field tester accuracy requirements
- Alien crosstalk mitigation methods

TSB-155 Extended Frequency

Extended frequency characterization of existing category 6 cabling limits from 250 MHz up to 500 MHz:

- Insertion loss*
- NEXT loss
- PSNEXT loss
- ELFEXT
- PSELFEXT
- Return loss
- Propagation delay
- Delay skew
- No specifications for balance yet

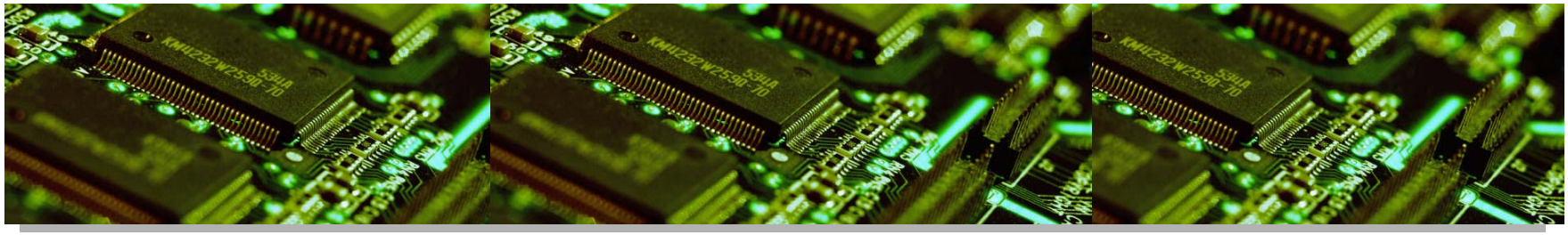
* with provisions for length scaling

TSB-155 SNR Disturbers

SNR = Signal to Noise Margin

Because 10 GbE can cancel internal crosstalk, external balanced noise sources dominate the SNR calculation

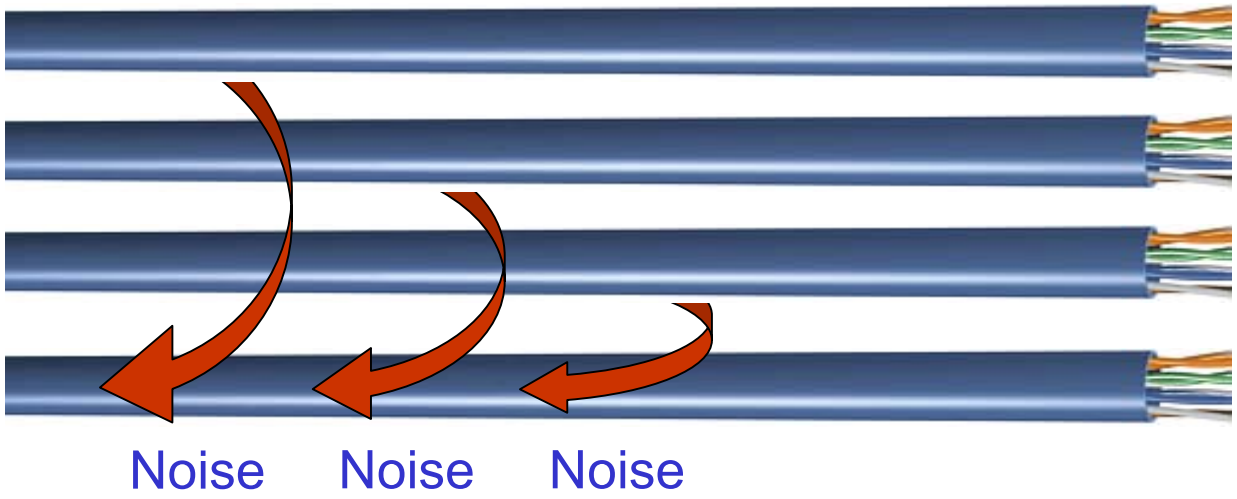
This previously uncharacterized noise source is called alien crosstalk



Alien Crosstalk

Alien Crosstalk: What is it?

- Differential noise coupled from one twisted-pair cabling component to another
- Current DSP technology can not compensate for **inter-channel** crosstalk



TBS-155 Alien Crosstalk Limits

"10GBASE-T is designed to operate over at least 55 meters of category 6 cabling within a 'reasonable' worst case alien crosstalk environment"

- Pair-to-pair ANEXT loss*
- Power sum ANEXT loss
- Pair-to-pair AELFEXT*
- Power sum AELFEXT

* for future study – assigned to project team

TSB-155 PSAXT Constants

PSANEXT loss and PSELFEXT limits are derived from a PSAXT to insertion loss ratio

This calculated PSAXT to insertion loss ratio is called a “constant”

In this manner, the relationship between overall channel length and SNR margin is taken into account to ensure the broadest support of the installed base of cabling

PSAXT Constant Example

PSANEXT loss limits at 100 MHz versus channel length for PSAXTIR > 0

- 55 meters 47 dB
- 70 meters 52 dB
- 85 meters 57 dB
- 100 meters 62 dB

TSB-155 Average PSAXT

"Average" PSANEXT loss and PSAELFEXT limits are included to accommodate IEEE 802.3an, draft 2.0 updates

Average PSANEXT loss and PSAELFEXT limits are 1.0 dB more stringent than PSNEXT loss and PSAELFEXT limits

TSB-155 AXT Field Testing

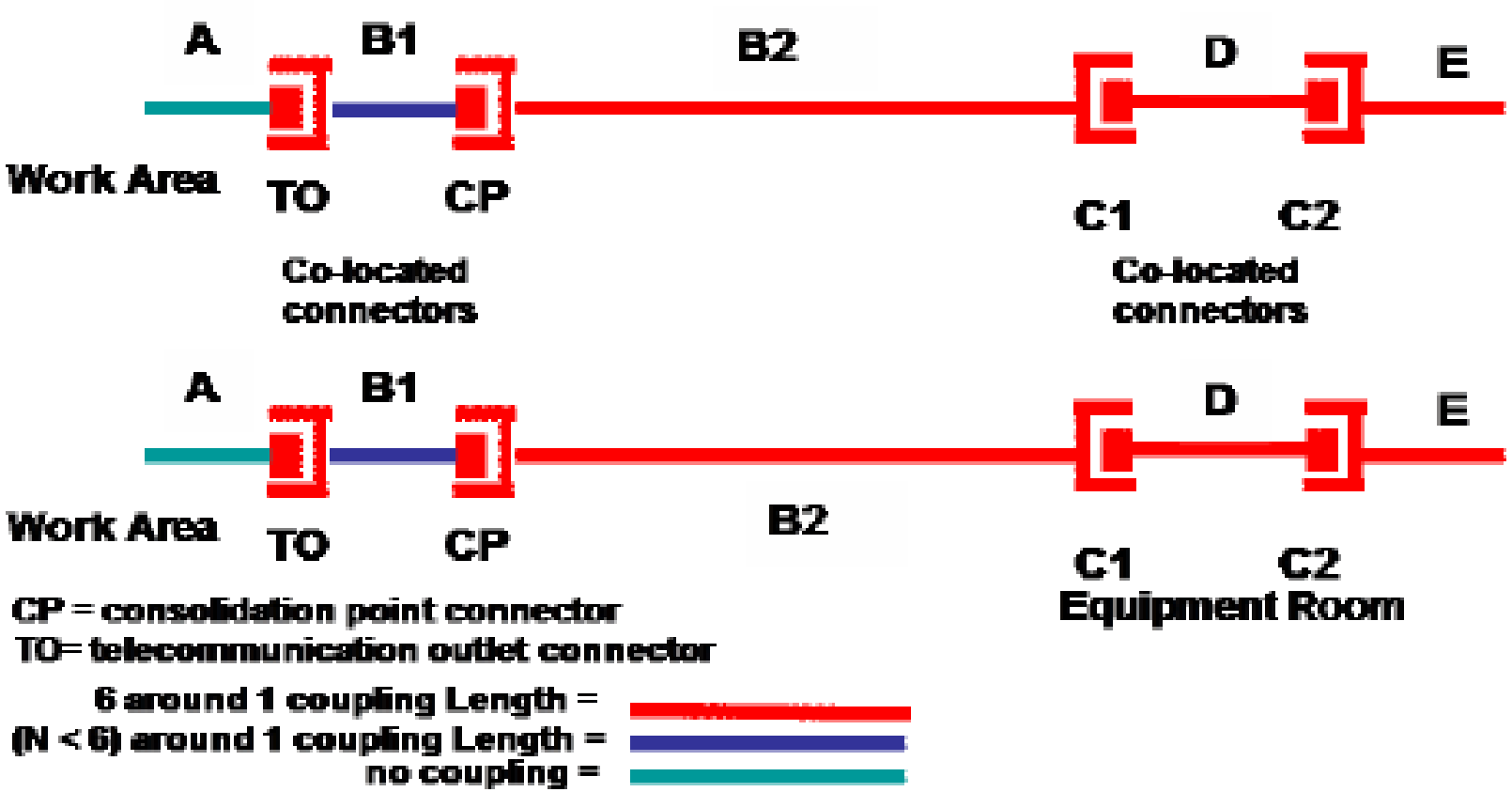
Field test requirements are not mandatory

Level IIIe field tester accuracy requirements are detailed in annex B

Representative schematics of channel and permanent link alien crosstalk test configurations are provided

(No laboratory methods are provided)

TSB-155 AXT Test Configuration



TSB-155 AXT Field Test Strategies

- Only test channels identified to support 10 GbE
- Most AXT occurs in the first 20 meters
- Guidance related to the need to test channels with certain installation types or insertion loss performance is TBD

TSB-155 AXT Mitigation Methods

Annex C provides recommended techniques to reduce alien crosstalk

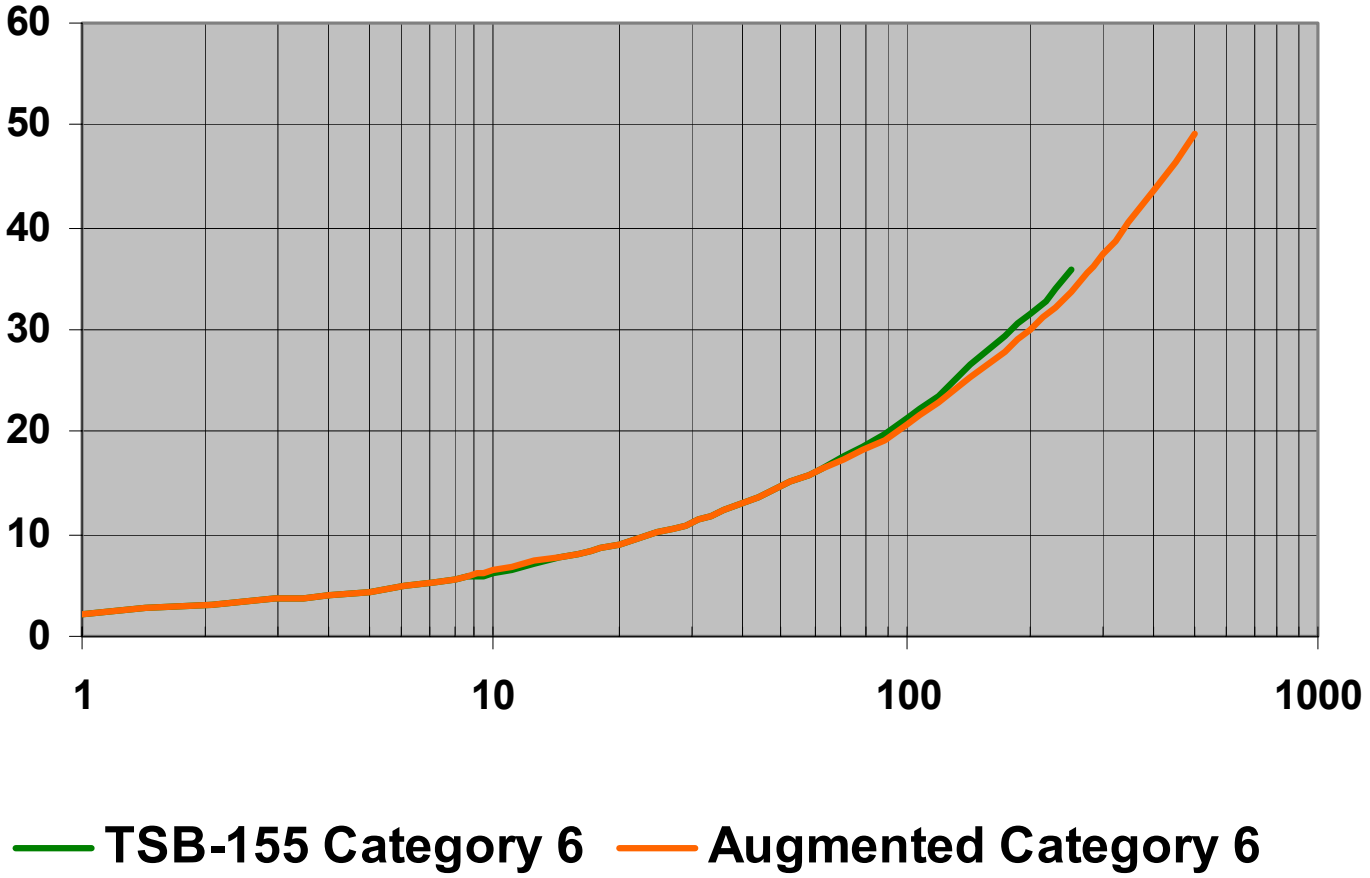
- Use non-adjacent patch panel positions
- Separate/use improved equipment cords
- Unbundle cables in the first 5 – 20 meters
- Separate cords in the first 5 – 20 meters
- Reconfigure cross-connect as interconnects
- Replace connectors with augmented category 6

‘568-B.2-10 Draft 1.4 Overview

“Transmission Performance Specifications for 4-Pair 100 Ω Augmented Category 6 Cabling ”

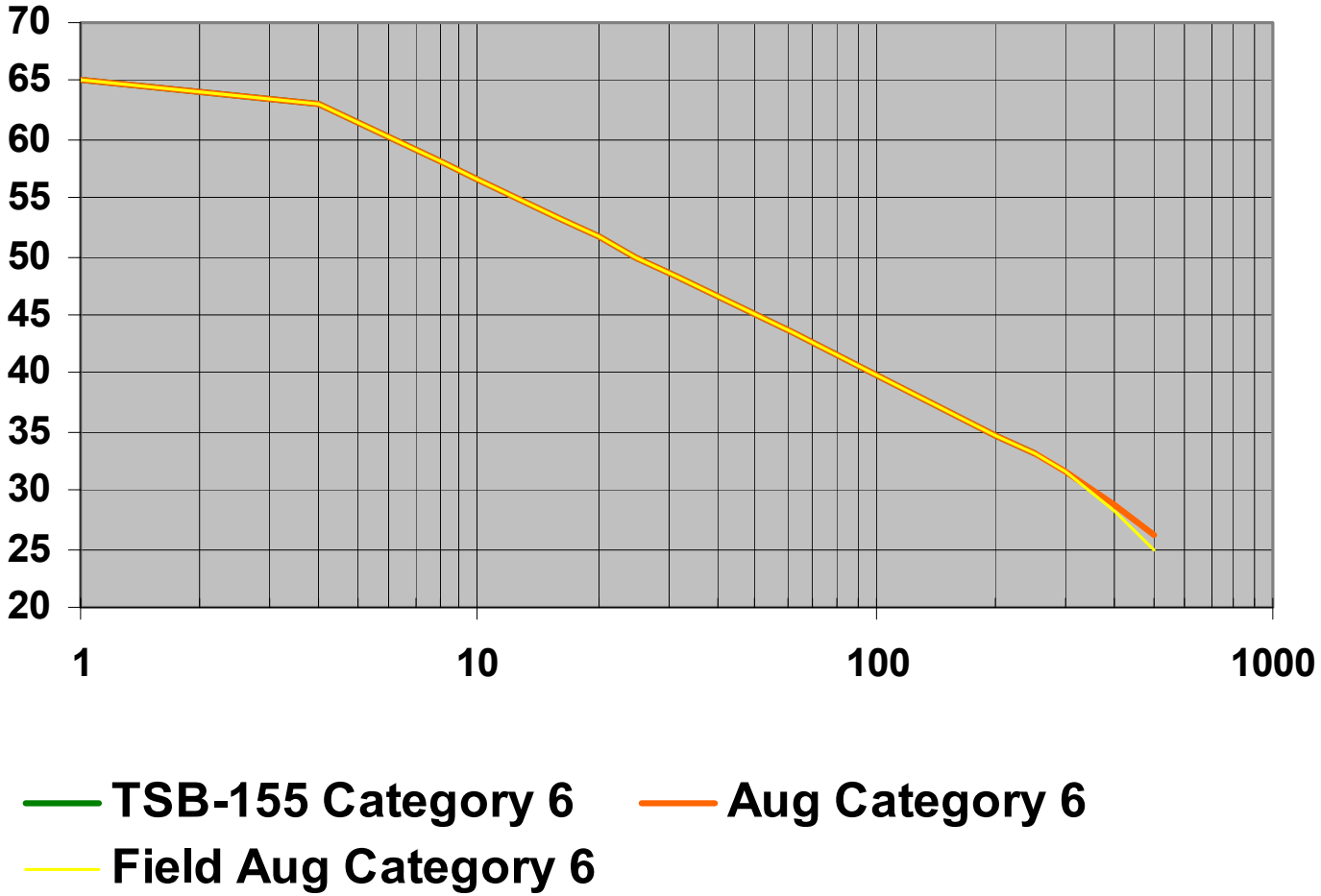
- Extended frequency characterization
- Component and cabling requirements
- Headroom for all existing cabling parameters
- New: ANEXT, PSANEXT, AFEXT, PSAELFEXT
- Laboratory and field test requirements

Insertion Loss



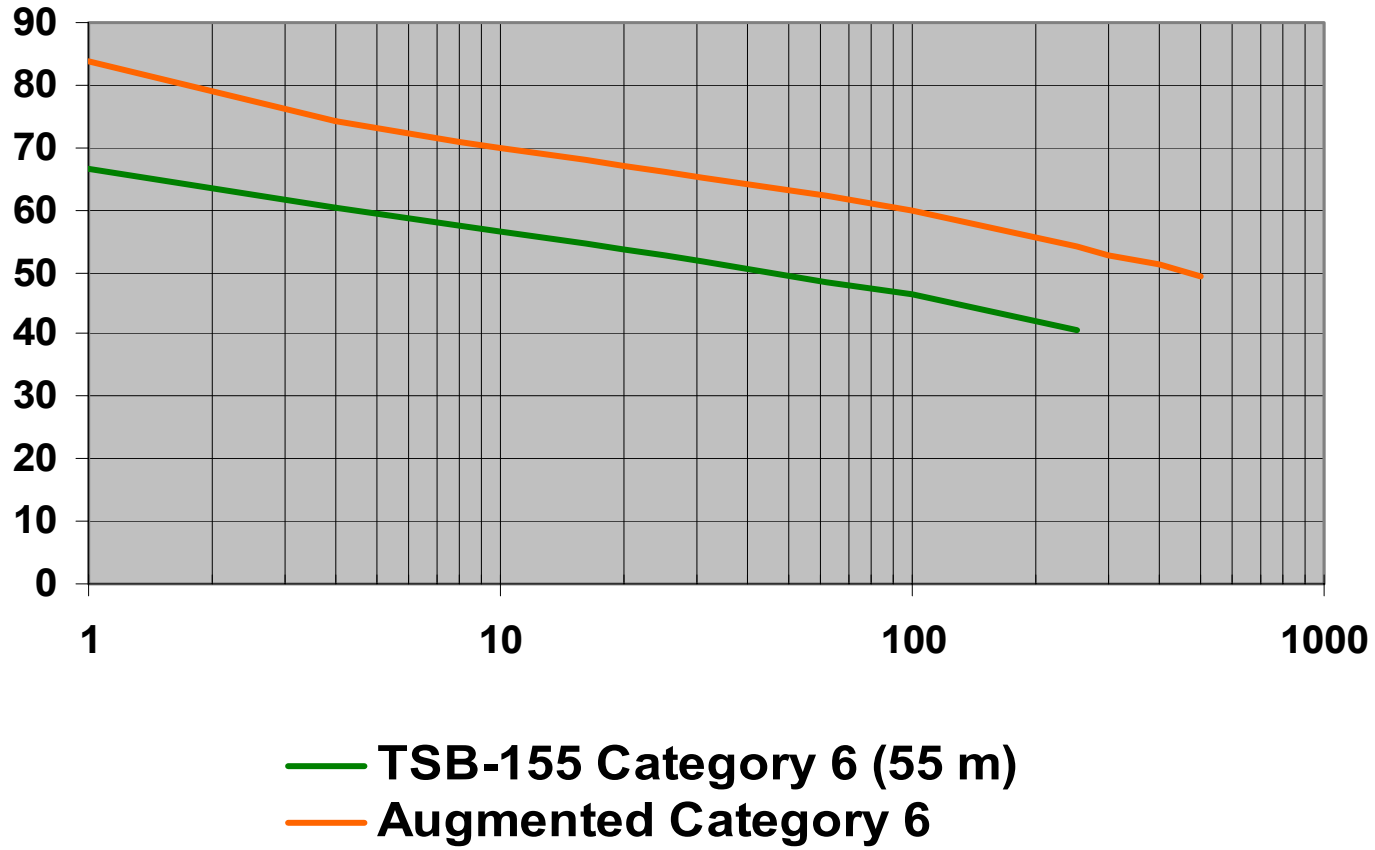
27% insertion loss headroom

NEXT Loss



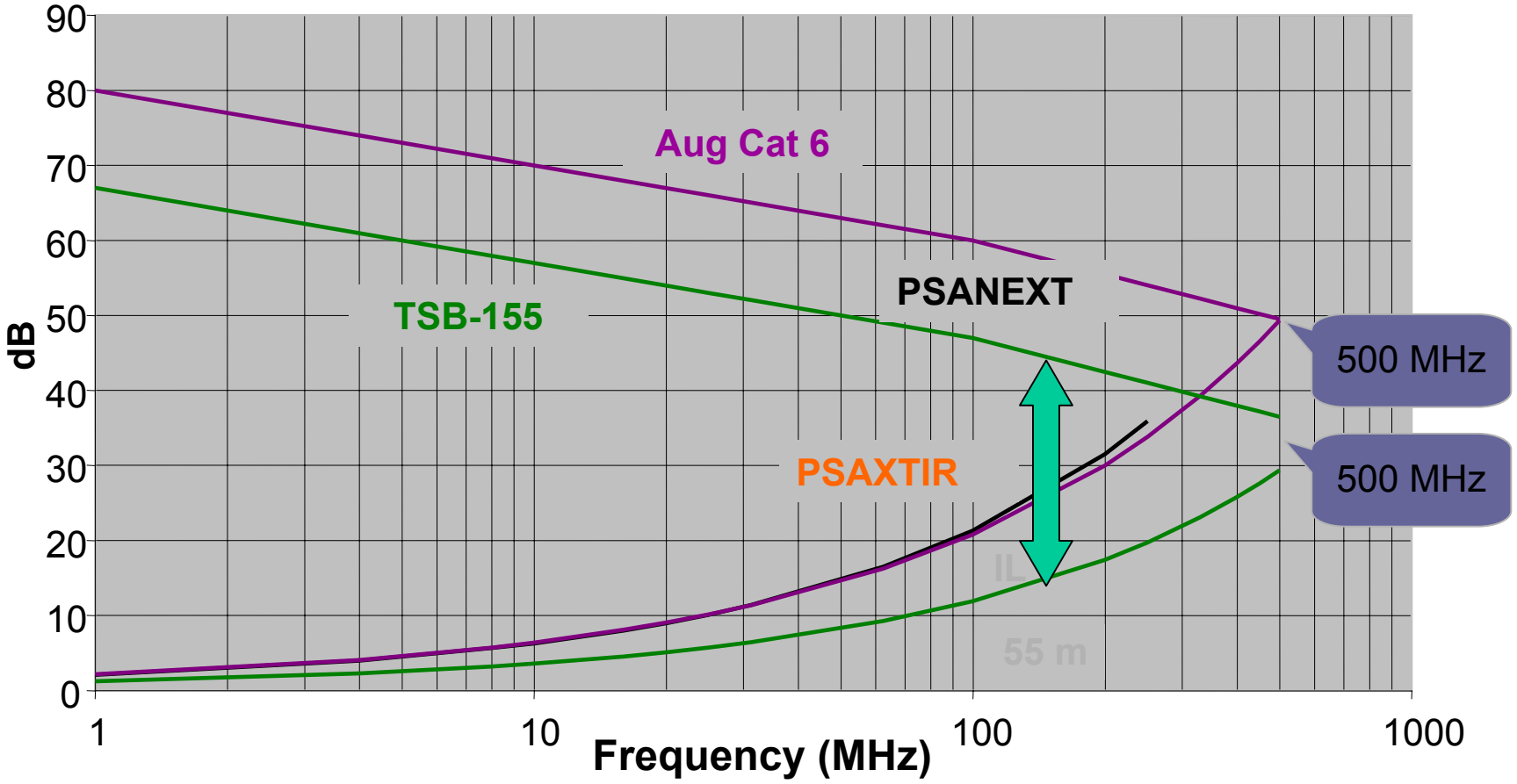
Extended frequency limits – no add'l headroom

Power Sum ANEXT Loss



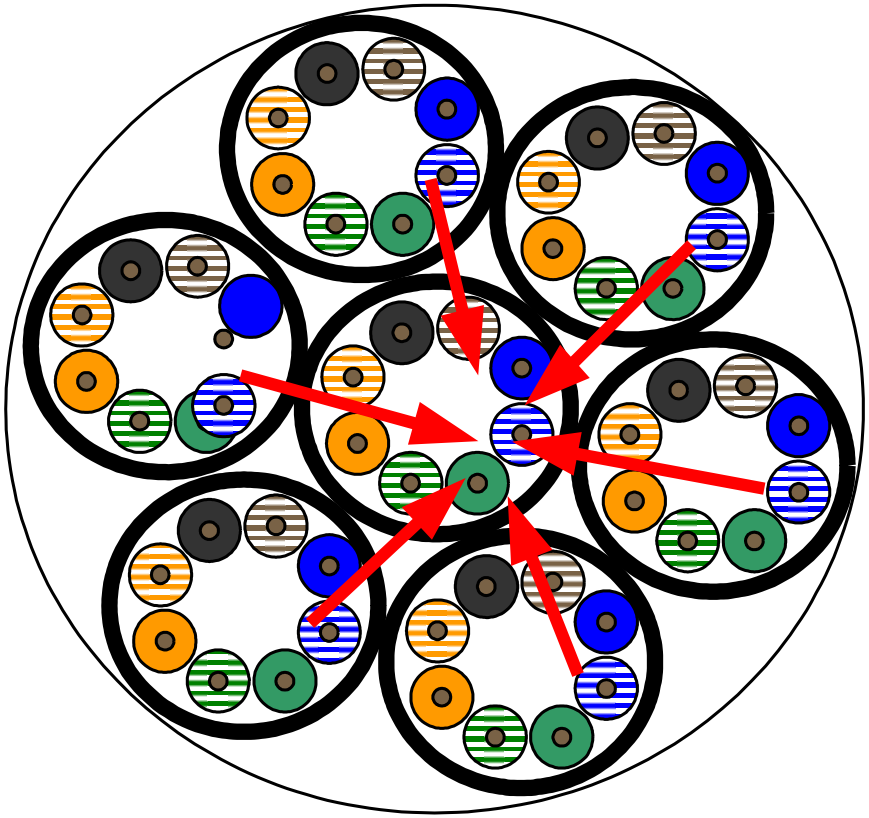
79% PSANEXT loss headroom

500 MHz of Bandwidth - PSAXTIR



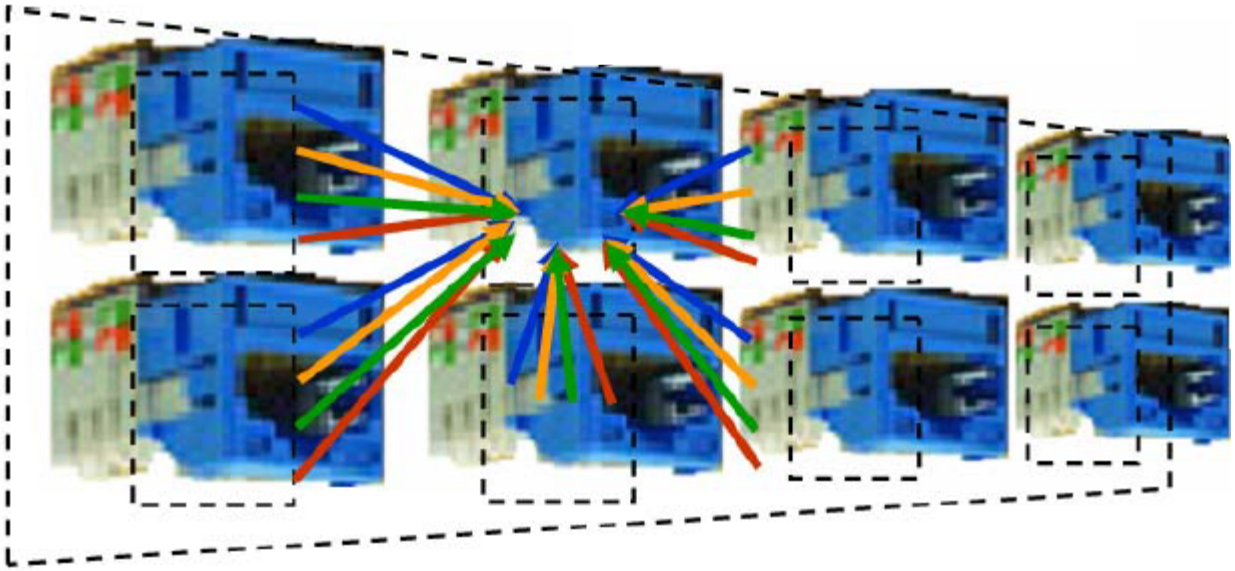
‘568-B.2-10 Lab Methods

Cables shall be tested in a “6-around-1” configuration



‘568-B.2-10 Lab Methods

Channels will be constructed from “worst case” cable configurations and disturbing connector arrangements



’568-B.2-10 Power Sum AXT

The significance of “Significance” in the lab

Only pair-to-pair AXT measurements that exceed the “significant” disturber threshold (<20 dB TBD) established by the standard are used in power sum calculations

Channel configurations may differ depending upon components – the result is a simplified measurement matrix

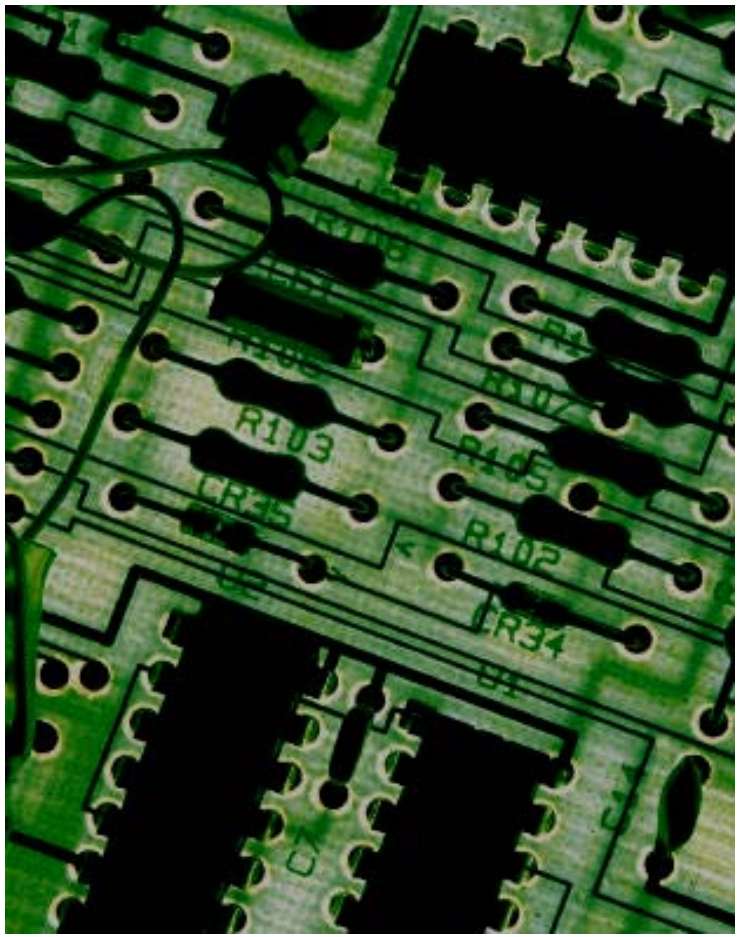
’568-B.2-10 PSAXT Guidelines

Annex D provides general guidelines for laboratory PSAXT testing

- Check for averaging of AXT in large cable bundles to reduce testing
- Begin testing at areas where many cables converge
- Only cables in the same bundle contribute to AXT
- Most AXT occurs in the first 20 meters
- AXT contributions from cables that contain some distance before they start running in parallel can be ignored

TIA Homework Items

- Alien crosstalk to insertion loss ratio or AXTIR
- AFEXT related to power back-off levels
- Level IIIe and beyond
- Laboratory measurement methods
- Mitigation methods



Conclusion

- There is a significant market demand for 10 GbE in the next 5 years for data centers and horizontal distribution
- 10 GbE timeline is about 14 months away
- 10 GbE sets a new benchmark for performance using a new measure of SNR and bandwidth
- TSB-155 and ‘568-B.2-10 are still targeted to publish prior to the 10 GbE publication window

Stay Tuned!

NEXT TIA Meeting

June 6-10

Montreal, Quebec, CAN

For more information

www.grouper.ieee.org

www.tiaonline.org

www.bicsi.org