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# **Alien Crosstalk Measurements**

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# Alien Crosstalk Overview

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- How does installation practice affect alien NEXT?
- Measurement method and test setup
- NEXT Measurement results
- Summary

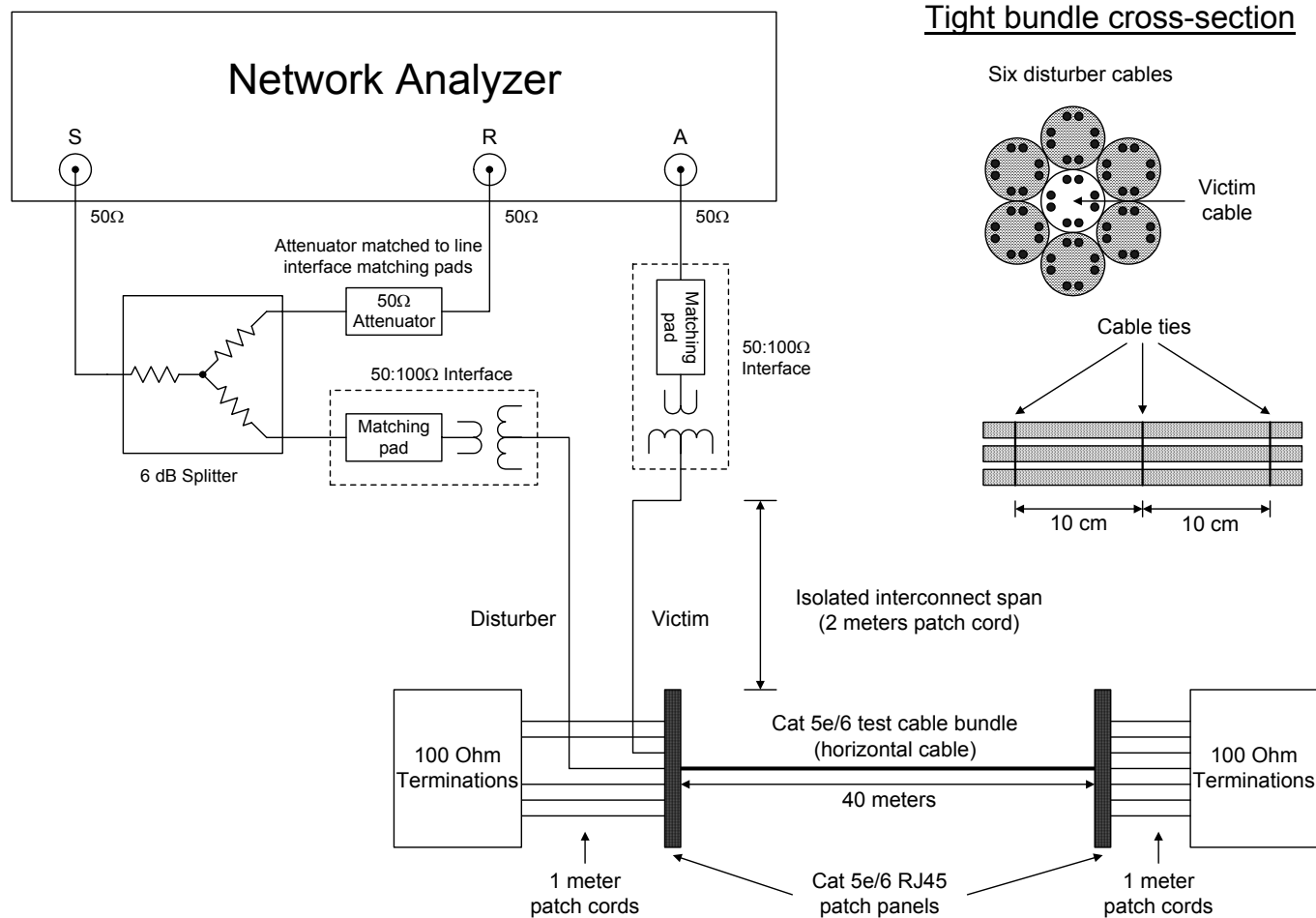
# Alien Crosstalk Cable Test Bed



Bundled cable

Unbundled cable

# Alien NEXT Measurement Setup

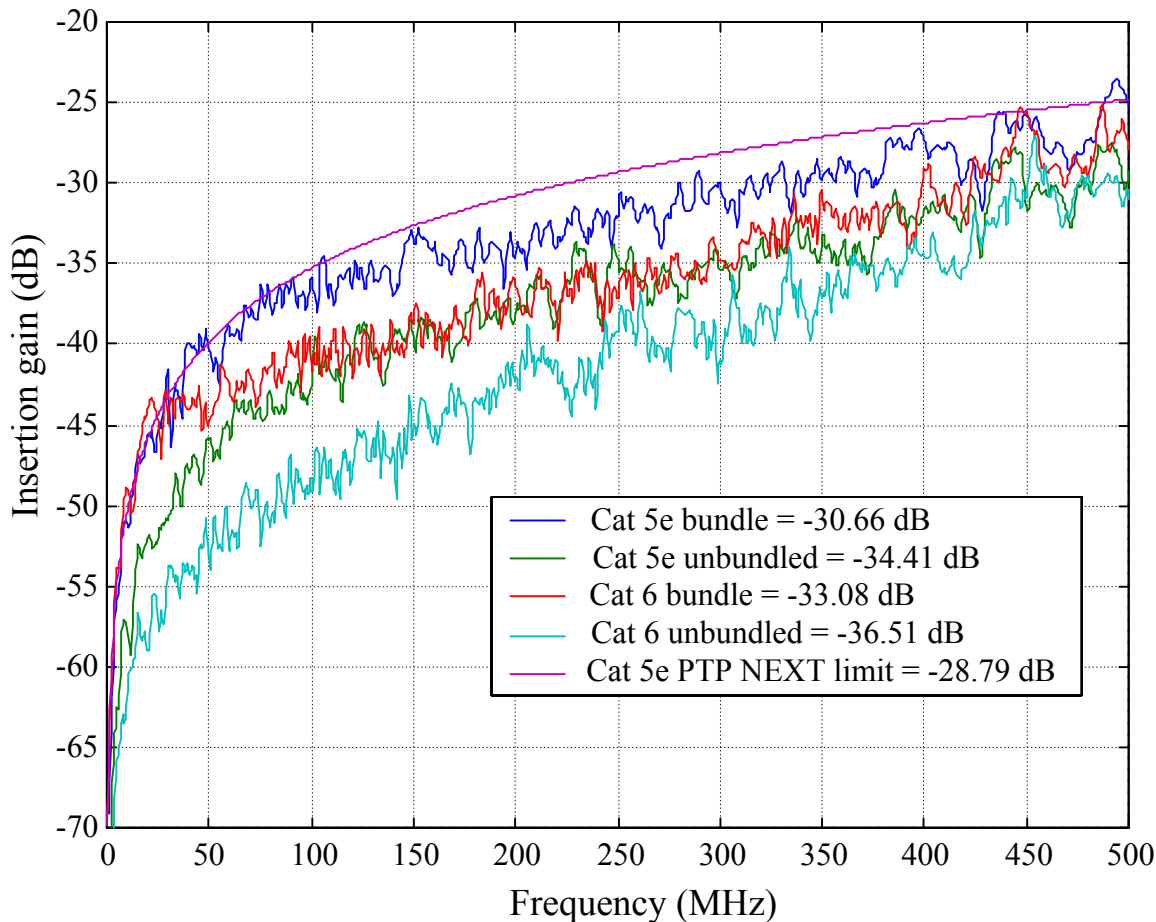


# Figure of Merit

- Figure of merit used to compare effects independent of twist pitch
- Measure coupling between same wire pairs of victim and disturber cable (i.e. pair 1 disturber cable into pair 1 victim cable, etc)
  - Same twist pitch pair coupling is dominant
  - Reduces number of measurements (96 measurements become 24)
- Calibrate out insertion loss from balun (test fixture) and interconnect patch cord (between balun and patch panel).
- Calculate power sum of all same pair coupling measurements between the victim cable and six (surrounding) disturber cables
- Power sum result is integrated from DC to 500 MHz to obtain total power coupling figure of merit
- Figure of merit allows meaningful comparison of visually indistinguishable data plots.

# Effects of Bundling and Cable Type

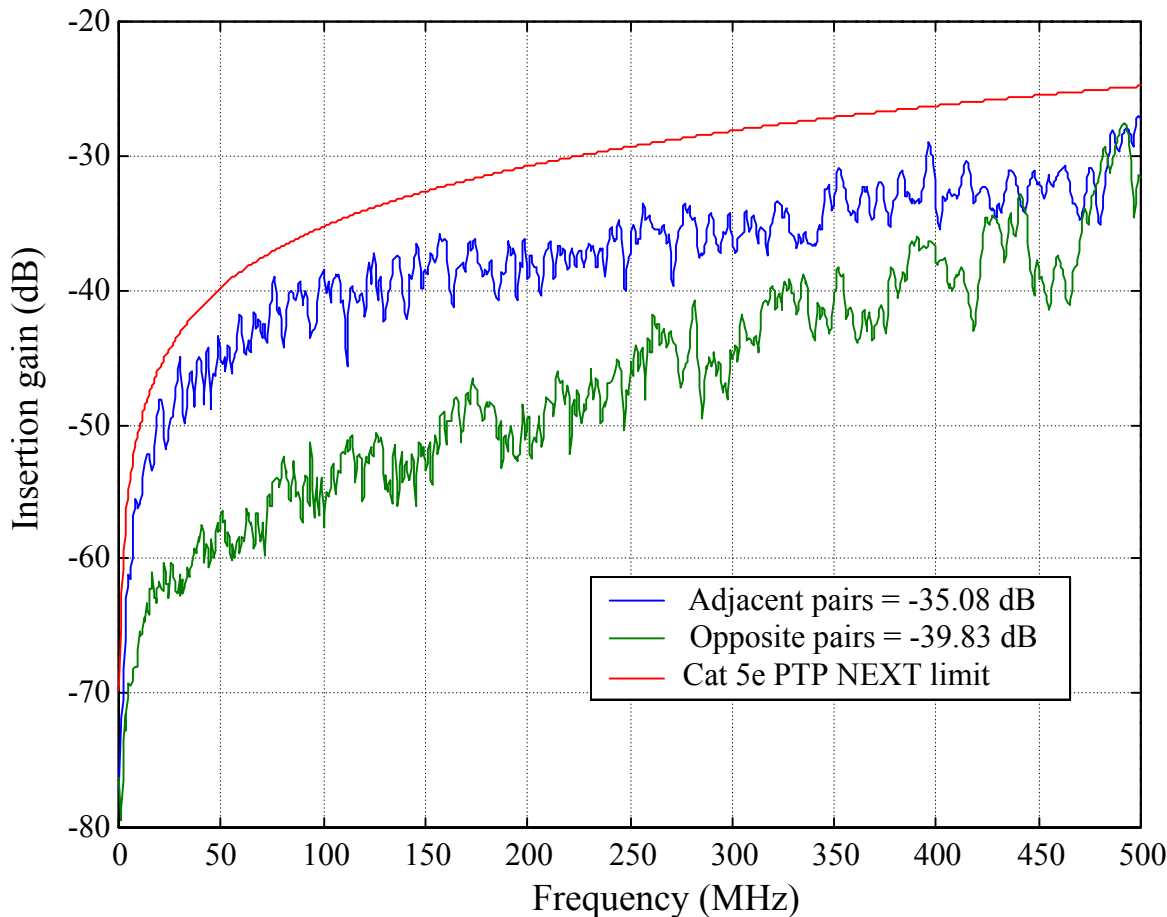
Measured Power Sum Alien NEXT Coupling - 6 Disturber Cables



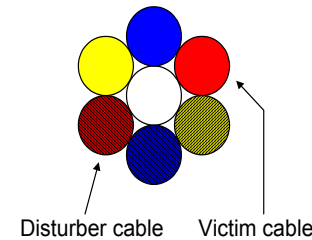
- All test cases are six disturber cables; two disturbers in adjacent patch panel ports
- Unbundling reduces coupling about 4 dB
- Cat 6 has 2-3 dB advantage over Cat 5e.
- Variation in bundling may be more important than cable category.

# Effect of Bundling Proximity

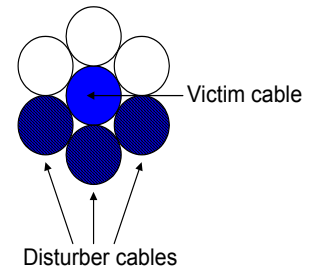
Measured Power Sum Alien NEXT - Three Disturber Cables



Opposite pairs



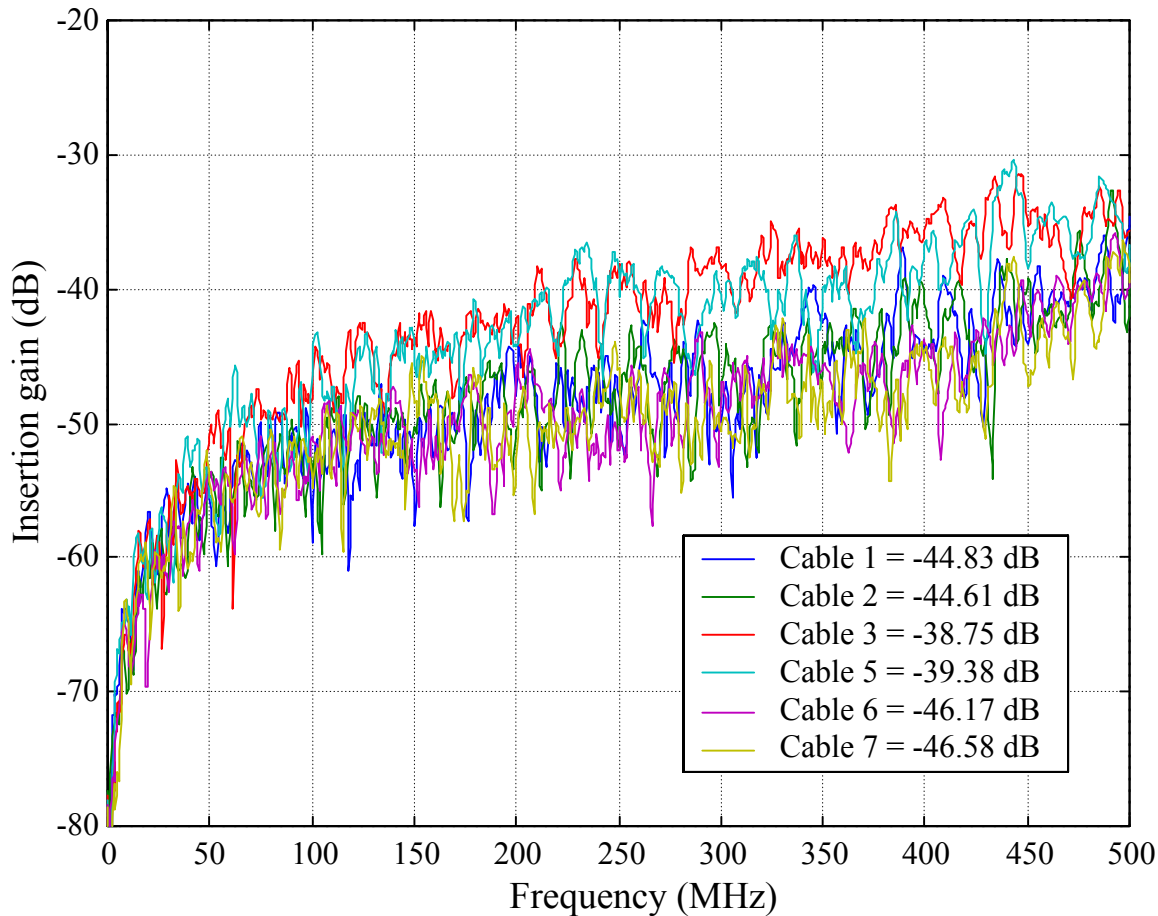
Adjacent pairs



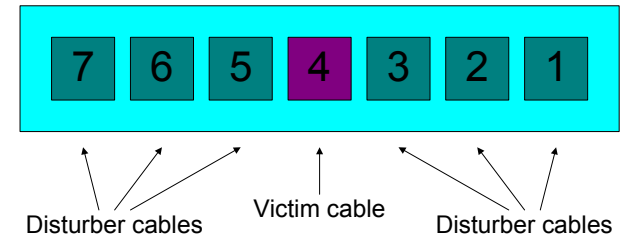
- No victim/disturbers in adjacent patch panel ports.
- Opposite cables separated by width of one (center) cable over entire span.
- Separation reduces coupling 4-5 dB; correlates with unbundled test case.

# Effects of Patch Panel Port Placement

Measured Power Sum Alien NEXT Coupling into Victim Cable 4



Cat 5e/Cat6 Patch panel

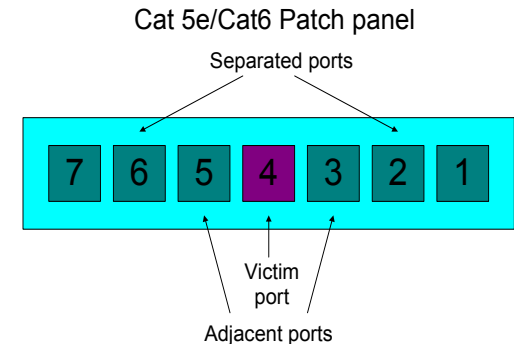


- Test case is unbundled Cat 5e
- Cables on adjacent plug ports of patch panel (cables 3 and 5) are dominant disturbers (> 5 dB)



# Adjacent vs. Separated Patch Panel Ports

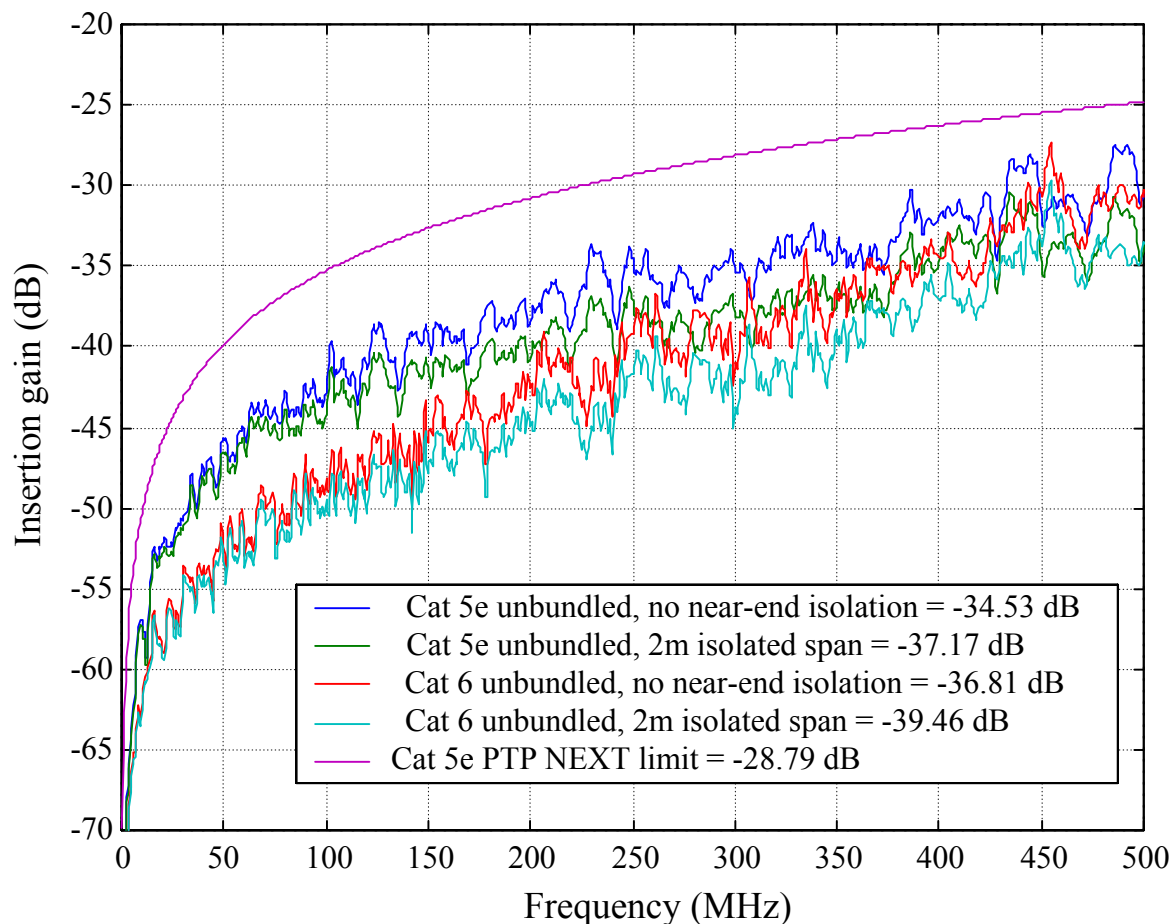
Test Configuration	Measured Power Sum Alien NEXT Coupling (2 disturber cables)	
	Adjacent ports	Non-adjacent ports
Cat 5e bundled/Cat 5e patch panel	-34.07 dB	-36.13 dB
Cat 5e unbundled/Cat 5e patch panel	-36.07 dB	-42.62 dB
Cat 5e unbundled/Cat 5e Keystone panel	-37.05 dB	-44.28 dB
Cat 6 bundled/Cat 6 patch panel	-37.13 dB	-38.23 dB
Cat 6 unbundled/Cat 6 patch panel	-39.53 dB	-43.41 dB
Cat 6 unbundled/Cat 6 Keystone panel	-44.49 dB	-45.10 dB



- Patch panel coupling becomes very significant ( $> 4$  dB) for unbundled cable; less significant ( $< 2$  dB) for tightly bundled cable.
- Patch panel coupling depends on proximity, terminal layout geometry, and quality of installation.
- Keystone jacks in panel frames produce less coupling for Cat 5e installations.
- Alien NEXT effects from wiring installation may not be detected by cable analyzers.

# Effect of Near-end Cable Isolation

Measured Power Sum Alien NEXT Coupling - Six Disturber Cables



- Add extra physical isolation (> 10 cm separation) between disturber and victim cables on short span between equipment and patch panel.
- Produces attenuated NEXT behavior
- Reduction better than 1 dB attenuation per meter isolated span length.

# Summary of All NEXT Coupling Effects

Test Configuration (Six disturber cables)	Power Sum Alien NEXT Coupling	
	Cat 5e	Cat 6
Bundled with adjacent patch panel ports	-30.68 dB	-33.22 dB
Bundled, no adjacent patch panel ports	-31.67 dB	-33.83 dB
Bundled, no adjacent patch panel ports, 2 meter isolated near-end span	-33.28 dB	-35.92 dB
Unbundled with adjacent patch panel ports	-34.53 dB	-36.81 dB
Unbundled, no adjacent patch panel ports	-38.08 dB	-38.47 dB
Unbundled, no adjacent patch panel ports, with 2 meter isolated near-end span	-40.34 dB	-41.16 dB
Unbundled with adjacent Keystone ports	-35.61 dB	-40.13 dB
Unbundled, no adjacent Keystone ports	-39.28 dB	-40.22 dB

- Unbundling provides 3-4 dB reduction
- Not using adjacent patch panel ports provides 2-4 dB reduction
- Isolating the first two meters of the channel provides 2.5 dB reduction
- Specific reductions are greater for Cat 5e installations than Cat 6 installations
- Keystone jack panels provide 1 dB improvement for Cat 5e, 3-4 dB improvement for Cat 6 (no adjacency coupling with Cat 6 Keystone jacks)

# Alien Crosstalk Summary

- Worst-case alien crosstalk power sum may be as bad as Cat 5e pair-to-pair NEXT
- Alien NEXT variations from installation practice
  - Affected by cable bundling, cable type (category), patch panel coupling, and near-end cable separation
  - Patch panel coupling may be dominant effect for unbundled cables (> 4 dB degradation)
  - Alien NEXT effects from wiring installation may not be detected by cable analyzers
- Different installation practices will cause significant variations in observed alien NEXT energy.