

Structured Cabling Considerations for **2.5GBASE-T & 5GBASE-T**

While most data centers are prepared for current bandwidth demands and maintain up-to-date backbones, some enterprise networks are in danger of falling behind. Increased wireless traffic has already taxed many enterprise environments. IEEE 802.11ax standards, along with bring-your-own-device (BYOD) policies, encourage increased Wi-Fi activity and place significant strain on existing 1000BASE-T systems.

And it's not just businesses that are feeling the pressure to upgrade. Hospitals and schools are seeing significant jumps in data growth. Across the health care industry there is a huge push to support staff, patients, and visitors with reliable wireless access. High-speed internet is also vital for supporting student education at all levels. Whether performing online research for papers, giving in-class presentations, or engaging in extracurricular learning, students need greater bandwidth for quick access to information in order to achieve their goals. Both hospitals and schools will fail to meet the growing demand for reliable network performance without the right cabling infrastructure in place.

2.5GBASE-T and 5GBASE-T

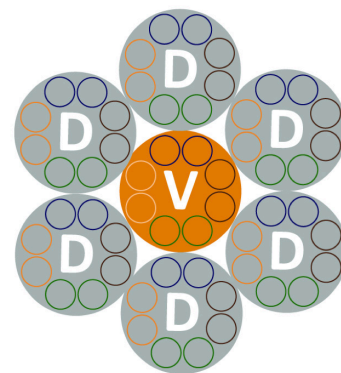
Increased wireless demand has pushed network speed requirements beyond 1 Gb/s. To support faster data rates, upgrading to a Cat 6A infrastructure is inevitable. However, with more than 70 billion meters of Cat 5e and Cat 6 cable installed over the last 12 years, many facilities and IT managers are hesitant to spend the resources on a complete Cat 6A upgrade.

Both IEEE and TIA attempted to address this issue by developing standards for 2.5GBASE-T and 5GBASE-T. The released IEEE 802.3bz and TIA TSB-5021 specifications allow enterprise networks to swap out active gear and transmit 2.5 Gb/s and 5 Gb/s speeds over existing Cat 5e or Cat 6 cabling, extending the life of their current infrastructure.

This option is ideal for networks that anticipate a moderate increase in bandwidth demand. It can also be useful for facilities needing a short-term, easily adopted solution that provides greater bandwidth until a full infrastructure upgrade can be implemented. In either case, additional considerations should be taken prior to deployment.

Alien Crosstalk

Since Cat 5e and Cat 6 are designed to support 1000BASE-T, alien crosstalk (AXT) is not typically specified. When running higher data rates over existing Cat 5e and Cat 6 cabling, AXT may become an issue, especially for longer cable runs with significant bundled cable lengths.



AXT limits are not directly specified for 2.5GBASE-T or 5GBASE-T. However, Alien Limited Signal-to-Noise Ratio (ALSNR)—a new measure based on AXT, attenuation, and other factors—was developed to assess a channel’s susceptibility to AXT, as well as its ability to support 2.5 Gb/s and 5 Gb/s speeds. A recent risk assessment of ALSNR testing, as noted in **Tables 1 and 2**, shows there is a medium to high risk for Cat 5e and Cat 6 infrastructures not meeting the ALSNR requirement at longer channel lengths.

Tables 1 and 2 are based on modeling, testing, and the ALSNR calculation included in TSB-5021. They indicate typical risks associated when a 2.5 Gb/s or 5 Gb/s system is not operating correctly for a Cat 5e or Cat 6 channel, given overall channel length and bundled length of cable in the channel.

Generally, the longer the overall channel length and the more bundled length of cable in the channel (shown as Victim Length in the tables), the greater the risk. Cat 6 poses less risk than Cat 5e; using either for 5 Gb/s poses more risk than 2.5 Gb/s.

Table 1: Category 5e Alien Limited SNR Risk Matrix

CATEGORY 5E	SPEED	VICTIM LENGTH		
		1m - 20m	20m - 75m	75m - 100m
Bundled distance up to 20m	2.5 Gb/s	Negligible	Negligible	Negligible
	5 Gb/s	Negligible	Negligible	Low
Bundled distance up to 20m - 75m	2.5 Gb/s	N/A	Low	Medium Low
	5 Gb/s	N/A	Medium Low	Medium Low
Bundled distance up to 75m - 100m	2.5 Gb/s	N/A	N/A	Medium
	5 Gb/s	N/A	N/A	High

Note:

Risk refers to risk of bundled cable configurations not supporting an ALSNR *min* greater than or equal to 28 dB. Information gathered from Table 22 of TIA TSB-5021.

High	Medium High	Medium	Medium Low	Low	Negligible
------	-------------	--------	------------	-----	------------

Table 2: Category 6 Alien Limited SNR Risk Matrix

CATEGORY 6	SPEED	VICTIM LENGTH		
		1m - 20m	20m - 75m	75m - 100m
Bundled distance up to 20m	2.5 Gb/s	Negligible	Negligible	Negligible
	5 Gb/s	Negligible	Negligible	Low
Bundled distance up to 20m - 75m	2.5 Gb/s	N/A	Negligible	Negligible
	5 Gb/s	N/A	Low	Medium
Bundled distance up to 75m - 100m	2.5 Gb/s	N/A	N/A	Medium Low
	5 Gb/s	N/A	N/A	Medium High

Note:

Risk refers to risk of bundled cable configurations not supporting an ALSNR *min* greater than or equal to 28 dB. Information gathered from Table 23 of TIA TSB-5021.

High	Medium High	Medium	Medium Low	Low	Negligible
------	-------------	--------	------------	-----	------------

For example, a 100-meter Cat 5e channel with 75 meters of bundled cable poses a high risk of not performing correctly for 5 Gb/s. A 75-meter Cat 6 channel with 20 meters of bundled cable poses only a negligible risk when used for 2.5 Gb/s. There is no risk when using Cat 6A, as shown in **Table 3**.

Table 3: Category 6A Alien Limited SNR Risk Matrix

CATEGORY 6A	SPEED	VICTIM LENGTH		
		1m - 20m	20m - 75m	75m - 100m
Bundled distance up to 20m	2.5 Gb/s	No Risk		
	5 Gb/s			
Bundled distance up to 20m - 75m	2.5 Gb/s			
	5 Gb/s			
Bundled distance up to 75m - 100m	2.5 Gb/s			
	5 Gb/s			

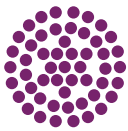
Note:

Risk refers to risk of bundled cable configurations not supporting an ALSNR *min* greater than or equal to 28 dB.
 Information prepared by Leviton System Verification Lab.



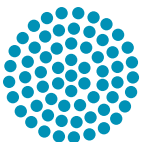
If a channel fails to operate correctly for the application intended, field testing and mitigation steps may be required. This can include anything from separating a limited amount of existing cables up to and including replacement of all channel components (cable and connectors) with Cat 6A. For these reasons, up front replacement/upgrade of links to Cat 6A and running dedicated 10 Gb/s active equipment may be the lowest cost solution for large networks and networks with links greater than 50 meters. This alternative can be cost modeled before making a final decision.

Power Over Ethernet



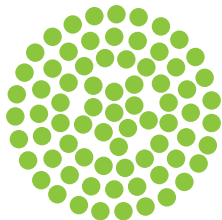
Cat 5e

For most enterprise applications, Power over Ethernet (PoE) remains a convenient method for powering network devices, especially wireless access points (WAP). More than 20 million enterprise access points ship annually and a significant portion of these will be powered using PoE. This consumption directly correlates with a greater need for more cabling. Additional cabling can create issues with regards to heat generation/dissipation. To offset these issues, a larger gauge size is required.



Cat 6

Leviton performed a number of experiments with new and future iterations of IEEE PoE systems, including power up to 200 watts. During these tests, Leviton found significant differences in temperature increases between Category 5e, 6, and 6A.



Cat 6A

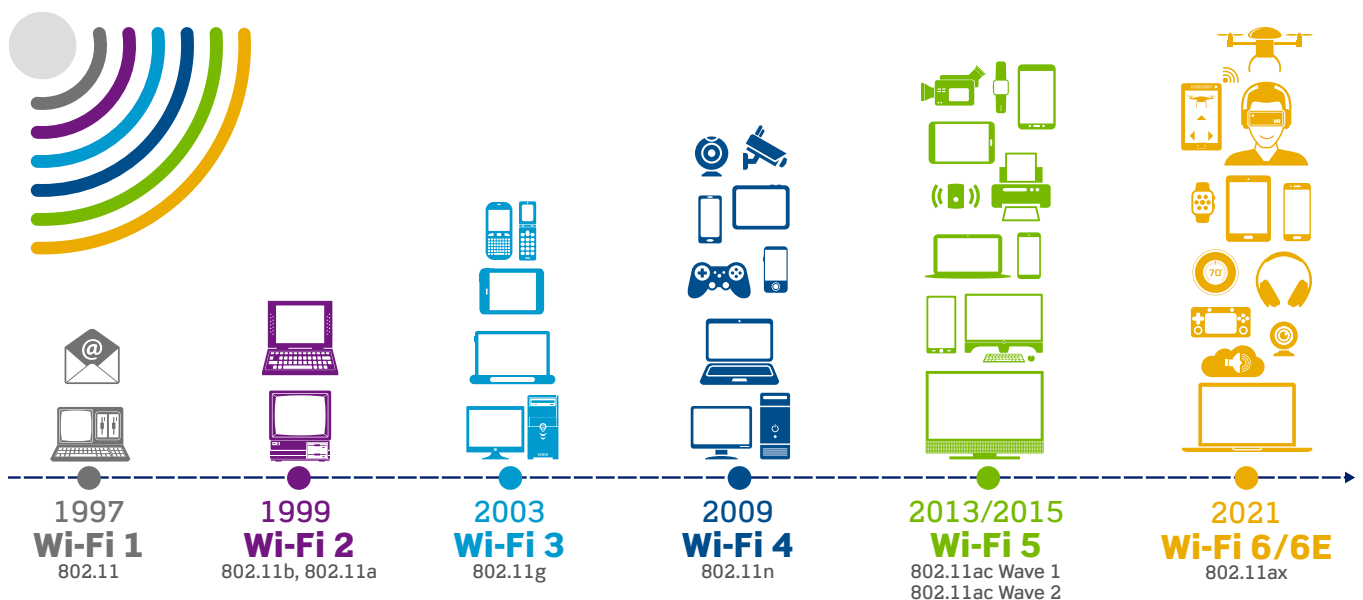
Existing Cat 5e or Cat 6 cabling can, in many instances, support 2.5GBASE-T and 5GBASE-T in regards to transmission performance. However, because of the technical designs implemented to support higher speeds, newer WAPs require more power and generate more heat.

Traditional Cat 5e and Cat 6 cables generate more heat than Cat 6A. When used in large bundles, the cable's temperature could increase enough to significantly impact performance and in some cases exceed the temperature rating of the cable.

Wireless Demand

The biggest driving factor for 2.5 Gb/s and 5 Gb/s deployment is also its greatest challenge. The bandwidth demand for wireless is increasing at a faster rate than that of wired networks. As the demand for greater wireless performance continues to grow, even 5 Gb/s networks may struggle to keep up. The latest wireless standard 802.11ax supports more than 10 Gb/s.

Whether upgrades are implemented today or in the future, many enterprise environments already desire 10 Gb/s network speeds to support enough bandwidth to accommodate business and customer demands. Even a Cat 6 infrastructure may only suffice through the next few years, limiting the long-term capability of 2.5GBASE-T and 5GBASE-T.

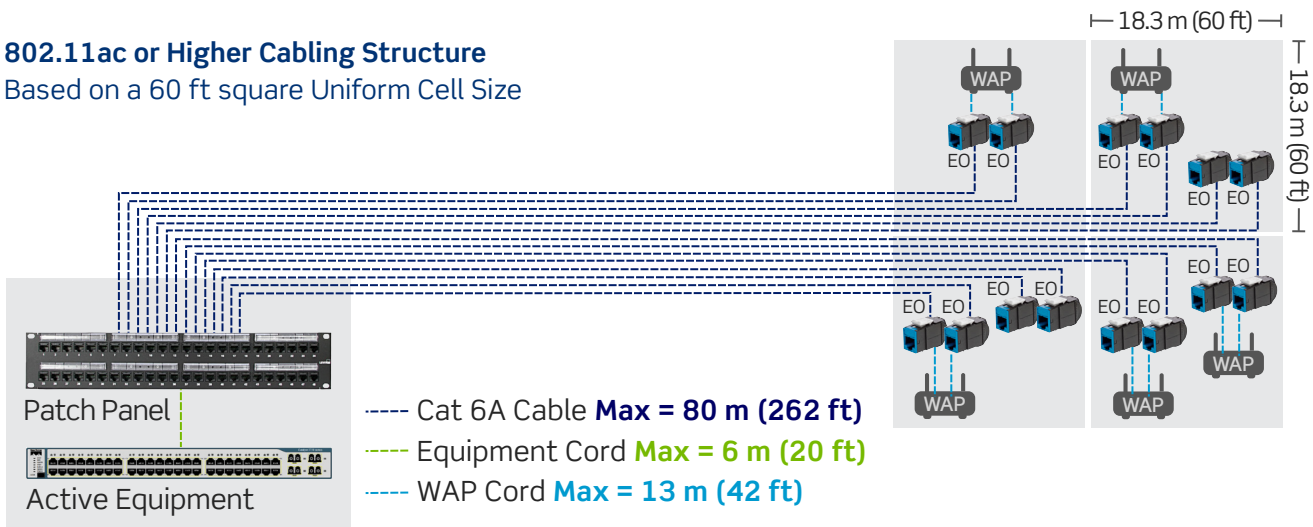


It's important to consider your anticipated needs and plan accordingly. Some facilities only need a small boost in bandwidth, but networks that intend on using 2.5GBASE-T or 5GBASE-T as a short-term solution will require additional tech refreshes long term. In this instance, a 10GBASE-T upgrade would provide greater overall cost savings and prepare your infrastructure to handle emerging wireless demands.

Prepping for Long-Term Demand

TIA TSB-162-B, Telecommunications Cabling Guidelines for Wireless Access Points, recommends installing Cat 6A for horizontal cabling to WAPs. TSB-162-B also recommends using a grid-based zone cabling architecture, with at least two Cat 6A cable runs to each WAP in the grid. Two cable runs will ensure backup power to the WAP in PoE applications, and prepare the infrastructure for future expansion and data requirements. Also, Cat 6A cabling is able to support more current capacity at the maximum allowable temperature and is needed to minimize temperature increases while supporting devices that require more power.

802.11ac or Higher Cabling Structure Based on a 60 ft square Uniform Cell Size



Making the Smart Choice

Leviton strongly recommends deploying Cat 6A cabling for all new enterprise installations. It supports greater lengths and provides better AXT suppression at higher frequencies. Leviton Cat 6A solutions support high-power PoE up to 100 watts - allowing networks to extend to a wider selection of devices. Cat 6A UTP cable featuring Leviton-patented segmented isolation wrap delivers performance close to that of shielded cable, but doesn't require grounding or bonding, making it easier to install and terminate.

Businesses that upgrade their enterprise cabling infrastructure today with Cat 6A will not only prepare their workplace to meet increased wireless demand, but will be ready for 2.5 Gb/s, 5G Gb/s, and 10 Gb/ applications. However, if a Cat 6A upgrade does not meet your budget, Leviton Cat 5e and Cat 6 components can support 2.5 Gb/s and 5 Gb/s speeds within the guidelines and limitations of TSB-5021. Unfortunately, because of the inherent limitations of all Cat 5e and Cat 6 cabling, diversity of channel configurations, installation practices, and cabling environments, Leviton cannot offer warranties or guarantees of performance on 2.5GBASE-T and 5GBASE-T installations using Cat 5e or Cat 6 components.

Data centers, businesses, government agencies, hospitals, and schools all require higher performance networks and greater bandwidth to meet today's wireless data needs. Leviton has designed its Cat 6A systems to support demanding wireless networks. Our UTP and shielded solutions all meet IEEE, TIA, and ISO/IEC requirements for mission-critical networks running at 10 Gb/s, and performance has been verified by independent testing labs. You can learn more about Leviton systems at Leviton.com/wireless.