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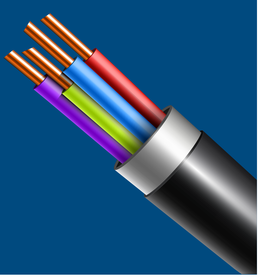
Applying Cat.6A Cabling Systems in Smart Buildings

Structured cabling systems are continually evolving as their scope of network technology, and of its application scenarios, widens. However, the value of these technologies, especially cabling technology, only becomes apparent in their practical application. Over the past decade, Cat.5e and Cat.6 cabling systems have dominated the mainstream building cabling market. But the rapid and widespread deployment of Mobile 5G, while continuously promoting development of the Internet of Things, and improving the digital office facilities, travel and lifestyle choices available to the populace, is also driving changes in data-usage habits, and imposing increasing requirements on smart buildings' network systems. This is accelerating the replacement of Cat.5e and Cat.6 cabling with Cat.6A systems, pushing the latter to the forefront among smart building cabling systems.



As you are probably aware, costs are much lower for networks constructed using electrical interface switches than for those with fibre interfaces, and electrical interfaces therefore continue to capture major shares of the horizontal building cabling and system terminal markets. In the structured cabling market, Cat.6A systems are generally categorized into shielded or unshielded systems, and conform to the ANSI/TIA 568.2-D Cat.6A and ISO/IEC 2nd Class EA standards. Cat.6A cabling systems can be used in high-speed LAN application scenarios including 10BASE-T, 100BASE-T, 1GBASE-T, 2.5G/5GBASE-T and 10GBASE-T, with transmission bandwidths up to 500 MHz.

01 Cat.6A Cabling Systems in Wireless Wi-FI Networks

In 2020, the number of Internet of Things (IoT) devices is expected to rapidly increase, reaching 10 billion devices, creating greatly increased demands for high-density network access (including Wi-Fi), and making Wi-Fi connectivity essential for both social or office use. Existing router interfaces use 2.4G and 5G frequency bands. Meanwhile, the introduction and application of the WIFI6 standard has greatly improved the distribution and coverage of WIFI networks, with data interface rates increasing from 1G Base-T to 2.5G and 5G Base-T, delivering a faster, more stable Internet experience to users.

People's daily and working lives are increasingly inseparable from networks, and Wi-Fi technologies now see broad global adoption. So, which transmission media are best suited to wireless 2.5G and 5G Wi-Fi networks?

	2.5G BASE-T	5G BASE-T
Installed Cat.5e System	√	Requirement of extending frequency
Installed Cat.6 System	√	√
Installed Cat.6A System	√	√

Table 1 Internal Cabling Parameters Supporting 2.5G and 5G Applications

0 m <= Binding Cabling Length <= 50 m	Cat.5e	Cat.6	Cat.6A
2.5 GBASE-T			Determined
5 GBASE-T, determined			Determined

50 m <= Binding Cabling Length <= 75 m	Cat.5e	Cat.6	Cat.6A
2.5 GBASE-T			Determined
5 GBASE-T, determined			Determined

75 m <= Binding Cabling Length <= 100 m	Cat.5e	Cat.6	Cat.6A
2.5 GBASE-T			Determined
5 GBASE-T, determined			Determined

ALSNR Risk	High	Medium	Low

Table 2 Risks of ALSNR Supporting 2.5G and 5G Applications

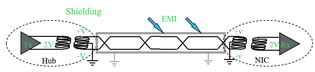
Tables 1 and 2 show that Cat.5e and Cat.6 cabling systems are currently incapable of supporting 2.5/5G Base-T application.

In 2020, multiple Wi-Fi 6 network routers came to market, with transmission rates as high as 9.6 Gbps. Gartner's statistics indicate that these Wi-Fi 6 network routers will be widespread by 2023, by which time the value of their market will have increased to USD 5.25 billion from a mere USD 250 million in 2019. Wireless Wi-Fi networks' increasingly important role in people's daily lives and work is driving Cat.6A cabling systems' gradually replacement of Cat.5e and Cat.6 cabling systems in smart buildings, and emergence as a mainstream option.

02 Cat.6A Cabling Systems in Classified Networks

When constructing smart systems for government office buildings, we must inevitably deal with the relationship between cabling for classified and non-classified network systems. Compared with other networks, construction of classified networks imposes higher quality and information security requirements. So how can we effectively guarantee the construction quality and security of such networks?

Based on a comprehensive consideration of construction costs, transmission capacities and future trends, adoption of whole-series Cat.6A shielded cabling designs is recommended. Cat.6A cabling systems possess electromagnetic interference-resistance properties effectively reducing line-to-line crosstalk and high-frequency noise interference via twisted-pair data transmission, and ensuring accurate data transmission while eliminating potential signal leakage risks.



03 Cat.6A Cabling Systems in Medical Environments

As computer networking systems have rapidly developed over recent years, many institutions related to national welfare and the people's livelihoods, including hospitals, schools, governmental agencies and banks, have integrated network system construction into their institutions as a whole, turning networks into their indispensable tools. Hospitals are responsible for important medical and clinical research, and advanced medical instruments and network information technologies are indispensable to modern hospitals' operation. Electronic medical devices are ubiquitously present in hospitals, continuously emitting electromagnetic waves of varied wavelengths into the surrounding environment during their operation ("electromagnetic emission"). These electromagnetic waves cannot be seen, but their objective existence is unquestionable, and excessive electromagnetic emission constitutes electromagnetic pollution. The numerous medical instruments present in hospitals may pose serious risks of electromagnetic interference to computer network systems, impacting their normal use. If the network system equipment does not possess good interference-resistance properties, it may also affect the normal use of medical instruments. Meanwhile the risk of theft of medical research data and patient information present on hospital computer networks may be increased.

Buildings' cabling systems are typically installed for long service cycles, often longer than 10 years, necessitating consideration of both current and future demands trends during such systems' design. Cat.6A shielded cabling systems' long service cycle under building installation, cost-effectiveness, and excellent electromagnetic interference resistance properties have already made them important solutions in medical environments.

04 Cat.6A Cabling Systems in PoE Application Scenarios

Grand View Research has predicted that transmission rates will reach 10G Base-T, and that the number of devices requiring power supply via PoE will rapidly increase by 2025, when the value of the global PoE market is expected to reach USD 3.77 billion. In engineering projects, cabling systems should be designed to be capable of supporting transmission at faster network rates, and also the PoE power supply demands of higher power devices. The increasing power consumption of 4PPoE technologies, which can cause device overheating, with deleterious effects on structured cabling systems' transmission performance and safety, must therefore be carefully considered in different application environments, and during the sustainable green development of next-generation PoE.

Trade Name	Standard	System Category	System Class	Maximum Current of Each Pair of Twisted Pair	Maximum Supply Power of Power Supply Equipment (PSE)	Maximum Receiving Power of Powered Device (PD)	Used Pairs of Twisted Pair
PoE	IEEE 802.3af	Type 1	Class 1	--	4W	3.84W	2
			Class 2	--	7W	6.49 W	2
			Class 3	350mA	15.4W	13W	2
PoE+	IEEE 802.3 at	Type 2	Class 4	600mA	30W	25.5W	2
4-pair PoE	IEEE 802.3bt Type 3	Type 3	Class 5	--	45W	40W	4
			Class 6	600mA	60W	51W	4
			Class 7	--	75W	62W	4
4-pair PoE	IEEE 802.3bt Type 4	Type 4	Class 8	960mA	90W	72W	4

The heat generated by cables is proportional to the current they carry, making the number of cables permitted in a single cable harness an important consideration. Compared with Cat.5e and Cat.6 cabling systems, Cat.6A cabling systems exhibit lower DC resistance and better heat dissipation performance, leading industry standard setters, such as TIA, to recommend deployment of 4PPoE in Cat.6A cabling systems.

05 Conclusions

Aside from the application scenarios mentioned above, social media, games, mobile payments, live video broadcasting, HD video monitoring, etc. are also creating greater demands for higher network rates among individuals, and stimulating more rapid upgrading of existing networks by enterprises in related industries.

Since buildings' cabling systems' s service cycles are long, generally over 10 years, such systems must be designed both to fulfill current and future demands. Full consideration of all factors, including construction costs, transmission capacities and future development trends, will make the need apparent to replace smart buildings' Cat.5e and Cat.6 cabling with Cat.6A systems.