

Category 6A Cable Choosing a Shielded or Unshielded Solution

You have decided upon a Category 6A infrastructure to support your network needs. You realize that 10 gigabit Ethernet is your application of choice or you grasp that at the rate that throughput demand is growing, not preparing for 10 gigabit Ethernet will significantly hinder future network upgrades. But now, another decision is waiting to be made. Should you go with an unshielded Category 6A solution or a shielded one? What are the main advantages and disadvantages of each? The purpose of this paper is to identify the strengths and weaknesses of each solution so that the appropriate decision can be made.

Category 6A is the latest infrastructure performance level to be widely accepted. Accommodating network speeds that are 10 times that of the previous application (1 gigabit Ethernet), 10 gigabit Ethernet over a Category 6A infrastructure offers the throughput that many users now demand. This increase in the data burden of that application, however, requires a higher level of performance from the infrastructure than previous solutions were capable of providing.

Category 6A cable, in accordance to the TIA/EIA 568-C.2 standard, is tested from 1 to 500MHz. This wide range of frequency is required to handle the frequencies at which 10GBase-T (10 gigabit Ethernet) operates. As a result of the higher frequencies utilized by 10GBase-T, alien crosstalk performance parameters are incorporated into the TIA/EIA standard for Category 6A cable and connectivity. Alien crosstalk occurs when signal from a cable jumps to an adjacent cable. Alien crosstalk, like crosstalk that occurs between the pairs within a cable, will have a detrimental impact on a cable's ability to send and receive data packets. Category 6A is the first cable category standard to include alien crosstalk performance parameters. Figure 1 shows the required alien crosstalk test configuration (known as "six around one") for verification of Category 6A performance. The inner cable, called the victim, is evaluated while the outer cables are energized.

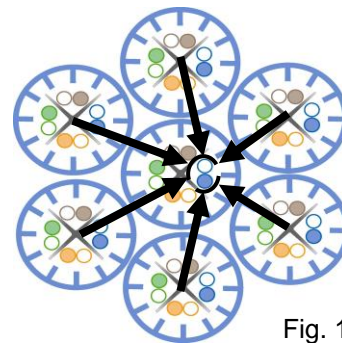


Fig. 1

Alien crosstalk can be mitigated by a couple approaches. It can be overcome by creating space (air) between the cores of adjacent cables, usually accomplished by means of adding internal space under the jacket, in the case of UTP (Unshielded Twisted Pairs) cable, which by design helps create space between adjacent cable cores,

or by using some type of physical barrier to block alien crosstalk. Most UTP cables use a combination of unique non-metallic fillers that play a role in separating the conductors within the cable and impact alien crosstalk with adjacent cables. Shielded cables, on the other hand, incorporate a metallic tape barrier to mitigate alien crosstalk. Shielded cables also offer other advantages that UTP cables do not. This will be addressed later in this paper.

The ANSI/TIA-568-C.2 standard, produced by the American National Standards Institute and the Telecommunications Industry Association, governs the electrical and physical characteristics for category cable. The standard states that category cable must be smaller than 0.354 inches in outside diameter, regardless of whether the cable is shielded or unshielded. (It is worth noting that if you are researching UTP cables for your Category 6A solution, obtain a physical sample as part of your evaluation process. Sample testing of cables on the market has shown discrepancies between many cables' actual outside diameter and that which is represented in the company's marketing literature.)

Due to the use of space and fillers as a barrier against alien crosstalk, UTP cables tend to be larger in diameter than shielded cables. In fact many UTP cable designs fall close to the maximum diameter permitted. As a result of the larger outside diameters of the UTP cables, larger conduit and hanging devices must be used to support them. This can add cost to a project as well as necessitate more pathway space for the cables. UTP cables are an established cable design that is simple to terminate since they do not possess shields and the prerequisite drain wire. This translates to quicker termination times and thus reduced cost. UTP cable and unshielded connective hardware (jacks and patch panels) also tends to cost less than their shielded counterparts. These factors, and the belief that bonding and grounding of rack equipment in a shielded solution also adds cost to a project, lend one to believe that there is a significant cost difference between unshielded and shielded solutions with unshielded being cheaper.

However, though there is some truth to that belief, the difference may be smaller than perceived. Regarding the bonding and grounding of the rack equipment, this process should be done regardless of whether the solution is a shielded or unshielded solution. This is outlined in standard ANSI-J-STD-607-A. There is no real savings in bonding and grounding between shielded and unshielded solutions since both must be tied into the building's grounding system.

The smaller diameter of shielded cables (usually below 0.30 inches) allows for smaller conduit and pathways than most Category 6A UTP cables, so resulting in a cost savings. Though the shielded cable and shielded connectivity do tend to cost more, in addition to helping overcome alien crosstalk, the shielding also provides the added benefit of increased immunity from outside electronic interference. Known as EMI (electromagnetic interference) and RFI (radio frequency interference), this interference is generated by motors, light fixtures, electrical wiring, other electronic devices and even atmospheric conditions. As more and more devices become networked, data

cabling is finding itself in physical locations that tend to be detrimental to its performance. The presence of interference, or noise, near the cables can corrupt data transmissions on category cable and severely hinder their performance. When data is critical to the daily operation of a business, which it is for most, a shielded solution seems to be the best option. Shielded cables with metallic barriers provide exceptional protection from this noise. In fact recently, a well-known financial institution in New York installed over 18 million feet of shielded Category 6A cable in its new headquarters to ensure maximum throughput. With financial transactions, seconds or even fractions of seconds can mean substantial gains or losses.

Overall, shielded Category 6A cables also perform better than their Category 6A UTP counterparts simply because the metallic barrier offers superior protection from unwanted external noise than most other means. Figure 2 shows the difference in alien crosstalk performance between a leading Category 6A UTP cable and the shielded version (F/UTP) from the same manufacturer. Since a wider margin to the limit line is desirable, the F/UTP Category 6A cable clearly has more margin or headroom (performance beyond the standard) than the UTP cable does.

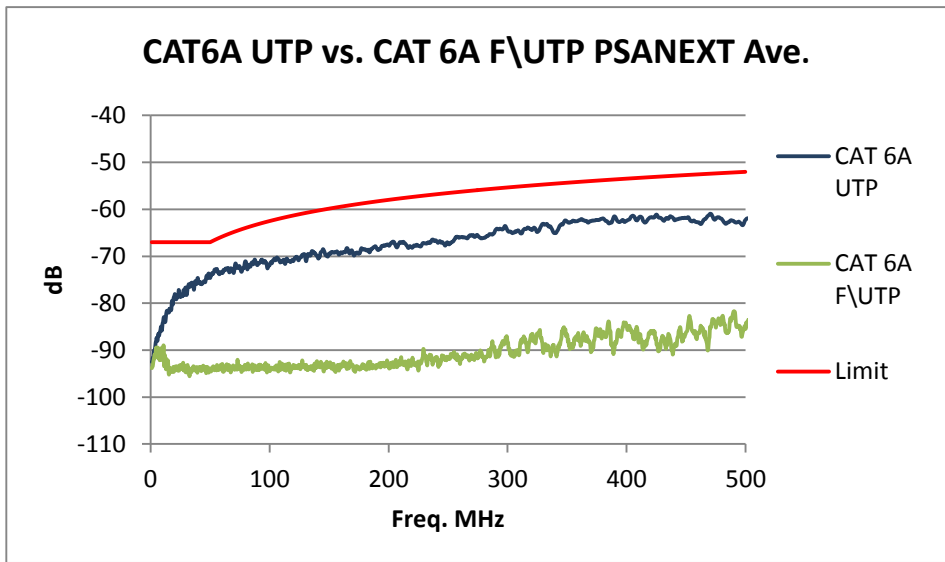


Fig. 2

In addition to choosing between shielded or unshielded cables, there are at least two types of shielded Category 6A cable designs to choose from. See Figure 3. Some manufacturers offer a shielded cable with foil around each of the four individual pairs. This cable, known as U/FTP (overall Unshielded, but Foil over Twisted-Pairs), offers excellent shielding performance. It is, however, more challenging to terminate than other constructions since each pair is individually wrapped in foil. F/UTP (Foil shield over Unshielded Twisted Pairs)



Fig. 3

cable requires a more technologically advanced manufacturing process to build it, but is significantly easier to terminate and has a smaller outside diameter than the U/FTP cable. F/UTP cable utilizes a single foil shield wrapped around the cable core and includes a drain wire. F/UTP cable takes less time to terminate than U/FTP. And, using shielded jacks and patch panels with F/UTP cable has never been easier. Every leading connectivity manufacturer now offers a shielded solution for Category 6A. With an abundance of shielded components on the market and some manufacturers offering lifetime warranties on these solutions, utilizing a shielded solution for Category 6A is very easy to do.

In summary, you should carefully evaluate your current and future throughput needs before selecting the appropriate network infrastructure. The cable infrastructure is the most complicated and costly to replace if upgrading is necessary. Don't let it become the bottleneck for network traffic. If you are operating gigabit Ethernet today, how long will it be before the desire to move to 10 gigabit Ethernet arises? Basically, if you are installing a cable infrastructure, install the most advanced solution possible. With the added benefits that a shielded solution offers, you should strongly consider that option. You may not need all the advantages that it can offer today, but the likelihood that you will absolutely need them down the road is virtually guaranteed.