DATACOM CABLE SOLUTIONS

Gen*SPEED*® 10 MTP™ with Mosaic Crossblock™ Technology: A UTP That Performs Like a FTP/STP

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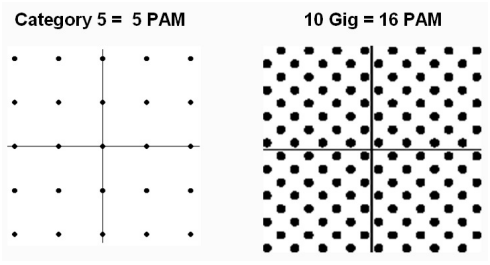
INTRODUCTION

What is Alien Crosstalk and why it is an issue for 10 Gig solutions?

With the evolution of computer networking and the vast amount of data deployed on these systems, the supporting infrastructure has been pushed to its limits. As such, one of the most difficult challenges has been to mitigate noise between copper-based cables used for high-speed data communication. Often referred to as Alien Crosstalk (i.e., ANEXT and AACRF), this type of noise has been identified as one of the most critical determinants of a successful 10 Gigabit system.

When two or more signal-carrying cables are placed next to each other, there will be electromagnetic coupling between the cables. This coupling appears as noise to the data communication signals on the other cable. This noise can affect the performance of the disturbed cable. This coupling is of particular concern in the industry because this signal cannot be compensated for. The term “alien” refers to the interference that comes from the surrounding cables and not the individual wires within the cable itself. The coupling that causes Alien Crosstalk will be strongest between pairs that have like pair lays (twist ratios). When a bundle of the same cables are pulled in together, Alien Crosstalk can have a strong affect on the performance of the cables in the bundle. As we will see, this particular parameter can be the Achilles Heel of a 10 Gig system.



Cat 6a cabling is designed to carry 10 Gigabit signaling, which employs a more sophisticated modulation code (i.e., PAM16 in the 425 MHz region) as compared to Cat 6 and Cat 5e cabling for 1 Gig systems that utilize PAM5 in the 80 MHz region. A 10 Gig signal contains 16 tightly spaced levels as opposed to the five levels of a 1 Gig signal. A computer that receives the data has to determine the signal level in a short period of time in order to process it correctly. In a typical Cat 6 cable, the levels are large enough for the computer to easily determine the differences between levels. In a 10 Gig system, however, the levels are compressed so closely together that any small variation in the signal can cause confusion for the computer. Imagine yourself sitting in a library and having a conversation with a group of people. In the library, it is easy to tell who is talking and to hear every word they say. Try to have that same conversation in a crowded restaurant and you will find it is much more difficult. You may not be able to catch every word that is said or may not realize who said what. Similarly, the clarity of a signal sent down a 10 Gig cable is sensitive to the noise around it. In order for the system to work properly we have to reduce the noise around the cable as much as possible. This leaves the industry challenged to design an unshielded 4-pair 10 Gig cable that can reduce the affect of outside noise. There have been several approaches to addressing this problem, including a larger cable with a thicker jacket, shorter lay lengths, and offering shielded 10 Gigabit solutions.

CURRENT SOLUTIONS

The first tactic in reducing the impact of noise is simply to increase the separation between cables by increasing the diameter of the cable. The farther away the pairs are from each other, the less they can affect one another. The drawback is that most installers have limited space in which to pull cable and thus, are looking for cables and bundles to be as small as

possible. Accordingly, if the cable is made smaller, the like pairs in each adjacent cable become closer to each other, resulting in Alien Crosstalk issues.

Another solution is to shorten the lay lengths on the pairs. Shorter lay lengths result in less differential mode coupling. Less coupling equals better Alien Crosstalk performance. However, common mode coupling and other parameters (e.g., attenuation and delay) limit the amount of reduction in lay length that one can apply. As a result, shorter lay lengths by themselves are not enough to get the needed performance.

The lack of demand for larger cables and limits on performance that can be obtained for shorter lay lengths makes these two solutions impractical. Another technique is to apply a metallic shield to the cable. Metallic shields help reduce outside differential noise from coupling into the pairs within the cable, and do not allow differential noise from inside the cable to leak out as long as the shield is properly grounded. There are a couple of ways to shield the pairs in a cable. F/UTP (Foil Twisted Pairs) cables apply an overall aluminum foil shield over the cable, while in S/FTP (Shielded Twisted Pairs) cables, each pair has its own individual shield. Shielded cables that are properly grounded will provide significantly better performance than UTP cable and can be made with a much smaller diameter.

Of course, FTP and STP cables are only effective if they are properly grounded. Shields are excellent at cancelling the differential electromagnetic energy around the cable and directing it away from the pairs. However, that energy needs a place to go. On a solid foil shielded cable, the common mode energy is free to move longitudinally along the cable and the drain wire used to ground the cable is what gives it a path away from the cable and into the earth.

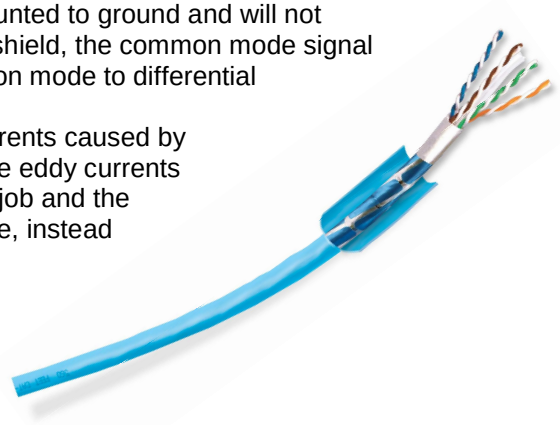
Properly grounding the shields can be expensive and labor-intensive. Each shield must be properly grounded to achieve the desired effect. This is an added step over and above what is required for UTP. In STP cables, there are four or five shields that must be connected, adding additional labor. The hardware required to achieve shielded contact is also more expensive and complex than that used for a UTP cable. An improperly grounded cable or grounding system can have electromagnetic interference issues as well as ground loop current flow.

MOSAIC TWISTED PAIR

At General Cable, we have developed a solution that incorporates the best of both worlds. Our Gen*SPEED*® 10 MTP™ utilizes a Mosaic Crossblock™ layer that allows the cable to perform like an FTP cable, but install like a UTP cable. The key concept around a Mosaic Crossblock™ is to break up the metallic blocks into short enough sections to avoid the negative radiating coupling effects of a non-terminated shield. In other words, because the mosaic sections are under a quarter wave length of the transmitting signal, they greatly reduce resonance. Further, each brick in the mosaic is an island unto itself and are separated by insulating layers of Mylar. This is important in order to reduce the level of electromagnetic emissions as well as to reduce the cable's susceptibility. In addition, the metallic blocks are very thin, causing a highly attenuated path. This in turn dissipates the noise coupled on to the shield, which means that there is no need to ground the cable.

You may be thinking, "Why not use a solid continuous shield, and just not ground it?" The solid shield surrounding the wire pairs within the cable (grounded or ungrounded) has low longitudinal impedance and can support a common mode signal. When a ground is applied to the shield, the induced common mode signal on the shield will be shunted to ground and will not convert into a differential signal. If a ground is not applied to the shield, the common mode signal will reflect at the cable ends and cause mode conversion (common mode to differential mode), increasing the noise level in the cable.

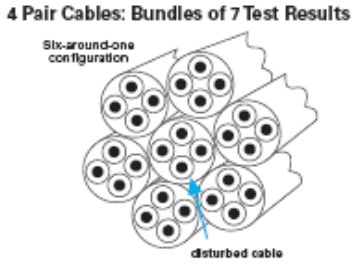
Solid shields are also very susceptible to longitudinal currents caused by power ground loops or outside electric fields. This means that the eddy currents that were set up to cancel out those fields can no longer do their job and the shield will start to act like an antenna, drawing energy to the cable, instead

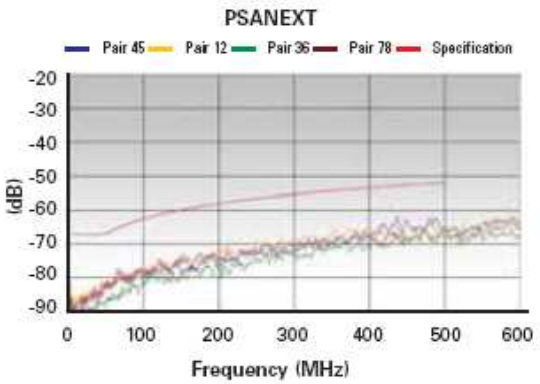


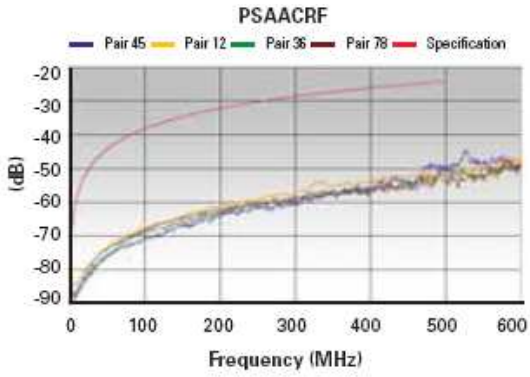
of keeping it away. The Mosaic Crossblock's small metallic blocks have large longitudinal impedance and cannot support a longitudinal current like a traditional UTP cable. Its unique design minimizes the effect of coupled fields while eliminating the need to ground it.

THE RESULTS

The Mosaic Crossblock provides industry-leading Alien Crosstalk protection for UTP. The results clearly show a 12-15 dB improvement.







CONCLUSION

In summary, with the increased complexity of 10 Gig systems, it is necessary to design cables that are able to mitigate the problem of alien crosstalk while maintaining ease of use, which leads to reduced installation time and costs. General Cable's Gen*SPEED*® 10 MTP™ cable design provides the performance and size of a traditional FTP or STP cable, while being as easy to use and install as a UTP cable.

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