

Think Screening



Introduction : Why screening ?

Screened systems are designed to reduce EMI (electromagnetic interference). EMI has a negative impact on transmission performance and data-traffic speed over structured cabling systems. The higher the application speeds, the more complex the communication protocols, the more susceptible to noise factors. Noise from within the cabling itself includes return loss, NEXT and FEXT. These can be reduced to a small residual noise by means of echo and NEXT cancellation techniques within the active receive/transmit equipment. But now more than ever, with the arrival of 10Gbase-T, the Ethernet application offering 10Gigabit per second transmission speeds, external noise is identified as being the factor the most threatening to data integrity. Examples of external noise sources are adjacent data cables of all possible classes, power cabling installation, light sources, elevator engines, electrical and wireless office equipment etc.

Standardisation work is at present very active on defining one of these external factors called the alien crosstalk. Alien crosstalk is the crosstalk coupling originating in the first layer of surrounding cables within an installed bundle of cables. True that these are physically the noise sources closest to the victim cable. This does make it a very important factor, but not the only one; other sources add to the harmful noise environment, which are overlooked by only considering alien crosstalk. Moreover it is quite a challenge to simulate alien crosstalk influences in a real-life installation by a theoretical test method.

Two efficient ways identified to tackle the alien crosstalk are

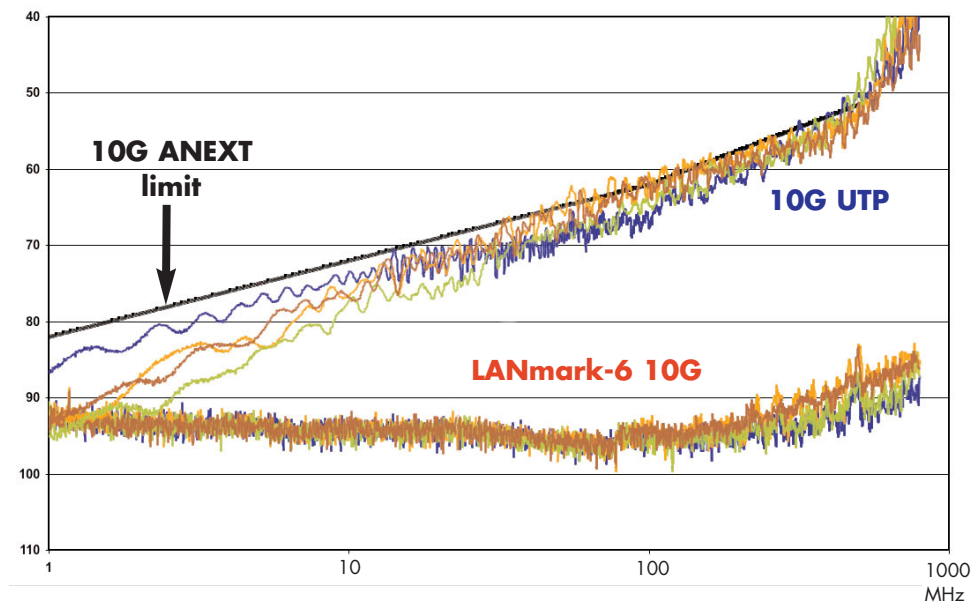
- Using screened solution
- For UTP: cable geometry forcing physical separation

Screened solutions not only offer massive headroom to alien crosstalk limits, they offer a degree of noise immunity which is not limited to alien crosstalk only.

The current 10G UTP cables designed to enforce physical separation have several disadvantages, which turn out as important hidden cost factors when installing them. These hidden costs for 10G UTP make it more expensive to install than a screened system and include:



- 10G UTP is physically larger than FTP so will require more containment
- currently undefined but some kind of expensive field testing for alien crosstalk will be necessary. At best 10G UTP solutions are only marginally compliant for alien crosstalk and therefore need to be tested in the true installation, but this is at present impossible
- connector spacing or placement requires extra cabinet space and patching difficulties
- UTP cable designs will require spacing considerations to mitigate alien crosstalk within bundles, both for cable laying as for patchcord arrangement: installation guidelines will require double spacing, wider cable ducts etc, adding to the total installation cost



All of the suppliers of 10G UTP solutions relying on physical separation to overcome the alien crosstalk issues concentrate merely on the cable design. It has to be clear though that the cable might be the longest part of the complete installation, it is definitely not the only part. It is as with screening: continuity throughout the complete system is vital for a correct EMI performance. The same counts for these 10G UTP systems.

Physical separation needs to be ensured throughout the complete system. It counts for cable but also for patch panels, outlets, cross-connects, consolidation points and not in the least for the patchcords! And it might consider the physical separation from the 2 or 6 or 8 surrounding cables or connections, but what about electrical power lines and electrical and wireless office equipment generating background noise? Also that aspect is vital to maintain the full 10G transmission speeds. That should start to make you think that bit further...



Time to start thinking screening

Choosing a screened solution not only eliminates these special installation considerations, it offers a more robust system not only tackling the theoretical alien crosstalk but the much broader external noise that can affect healthy data-traffic. A properly installed screened cabling system offers at least 20dB better EMI immunity than a UTP cabling system (coupling attenuation).

What might people discourage installing screened cabling if this is the so simple solution for securing healthy data-traffic? An argument often heard in favour of UTP cabling is that screened cabling requires an extra earthing infrastructure whereas UTP does not. This is a strange argument since an earthing structure is primarily for reasons of safety and not for EMC purposes. This fear is fed by the UTP-companies that have no expertise in screened cabling whatsoever so it serves them well to spread the fear as much as possible. A simple counter-argument that puts a silence to this argument is that coax-cable is also a screened cable. Has anyone ever held back the installation of coax when there was the need for it, simply by fearing earthing necessities?



Earthing

Earthing is very important! It is of a vital importance, and must be carefully considered in every building, in every installation. And every really means every, whether a data cabling installation is present or not or whether it is screened or unscreened. The earthing network inside a building is used for various reasons but the main purpose is to provide protection against the dangers of working with electricity for persons, livestock and equipment. Earthing is a low resistance connection to a zero potential point for safety. It is life-threateningly dangerous to deny the importance of a proper earthing of your building just because the fact that UTP cabling would be installed. And this is where often misleading information is spread to scare off the installation of a screened cabling. As if a building should not provide safety protection when UTP cabling is installed. It often seems that the choice of installing screened cabling is the trigger that activates the consideration process of verifying the proper earthing of the building. And that is very good news as at least you can rely on the fact that in a building with screened cabling, your life is not in danger as at least the earthing network has been carefully considered and investment in the mandatory life safety requirements has not been neglected. Several standards exist about earthing including standards, laws, national regulations and manufacturers specifications. National or local regulations always prevail over any other guidelines. The international standard IEC 364-5-548 addresses the earthing arrangements and equipotential bonding for information technology installations such as local area networks.

This standard applies irrespective whether screened or unscreened cabling is used. The standard advises using a mesh structure when using unscreened or screened cabling.

This mesh structure diverts currents from the cables, provides screening between the floors and reduces the susceptible loop for magnetic fields. For general safety of all humans, livestock and equipment in the building, there should always be a Protective Earthing (PE), properly interconnecting different earth pins in a building.

The PE is capable of diverting the low frequency power currents thus the currents associated with safety. When installing screened cabling often the risk for ground loops is used to scare of this choice. But when the earthing of the building is properly considered, this PE will be the route ground loops will choose, not the cabling.

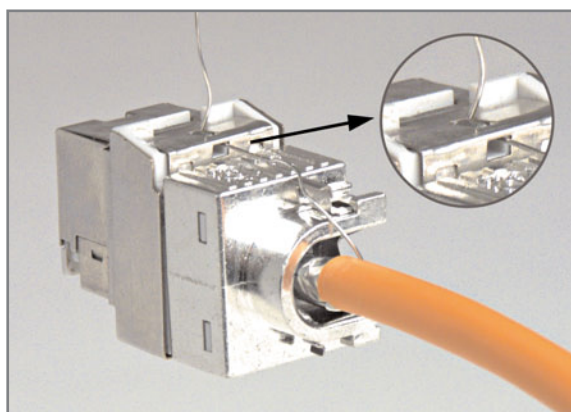
Independent of the cabling type chosen, screened or unscreened, earth connections of all metallic parts of the cabling, including cabinets, patch panels are mandatory to ensure safety unless otherwise specified by national regulations.

They aim to avoid voltages between all metallic parts and apply in all circumstances.

Within the cabinet, all metallic parts need to be interconnected to avoid voltages for example in case of lightning. The frame must also be earthed to the earth key. This earth key needs to be connected to the protective earth of the building.



All this counts for safety reasons and independent of whether your data cabling is unscreened or screened. In any case always local safety regulations need to be followed! The only thing that adds for screened cabling, is the earthing connection by means of a drainwire. The drainwire must be connected at least at a single side to the protective earth if the cabling does not extend over different equipotential zones. Otherwise double sided earthing is required together with improvement of the earthing network.



Grounding

EMC deals with electromagnetic interaction between active equipment. An apparatus may not generate EMI at frequencies to which other items of apparatus are susceptible. As addressed above, screened cabling offers high protection against electromagnetic interference ensuring the ultimate of healthy data-traffic. Screening quality of the cabling components as well as proper grounding is mandatory to ensure the EMC effectiveness. Grounding offers a direct connection to a large conducting surface with zero potential. This is exactly what has by Nexans been considered during cabling component design and has been made as easy and simple as possible. Nexans' screened cables have been especially designed to offer easy connection to the outlets and patch panels by offering the metallic side outwards. As such, the foil does not need to be folded back to ensure proper grounding contact with the connectors or the clip-on of the patch panels. Never was it so easy to perform end-to-end continuity of the screening optimising EMC performance. And this is what ensures the ultimate of healthy data-transfer.



Annex : Terminology

Earth

The conductive mass of the earth, whose electric potential at any point is conventionally taken as equal to zero. In some countries the word “ground” is used instead of “earth.”

Earth electrode

A conductive part or a group of conductive parts in intimate contact with and providing an electrical connection to earth.

Earthing network

The part of an earthing installation that is restricted to the earth electrodes and their interconnections.

Main earthing terminal

A terminal or bar that is provided for the connection of protective conductors, including equipotential bonding conductors and conductors for functional earthing, if any, to the means of earthing.

Earthing conductor

A protective conductor that connects the main earthing terminal or bar to the earth electrode.

Equipotential bonding

Electrical connection putting various exposed conductive parts and extraneous conductive parts at a substantially equal potential.

Equipotential bonding conductor

A protective conductor for ensuring equipotential bonding.

Neutral conductor (N)

A conductor that is connected to the neutral point of a system and capable of contributing to the transmission of electrical energy.

Protective conductor (PE)

A conductor that is required by some measures for protection against electric shock by electrically connecting any exposed metallic conductive parts



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