

To: 3P Customers and Business Partners

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Being unscreened or screened - thats the question

The technical challenge of 10 Gigabit Ethernet was the birth of alien crosstalk as a critical performance parameter. Alien crosstalk is a measure of the noise coming to a component, permanent link or channel from its installation neighbours, but does not include noise from other external sources as for instance mobile phones, radio transmitters and electric equipment. This alien crosstalk part of noise immunity became the important factor for cabling, and focus was subsequently put on EMC performance parameters in all international cabling, cable, connecting hardware, cord and installation standards. The world started changing and I firmly believe that this new technical focus will continue with increasing importance in the years to come. Attenuation and noise protection are keys to the future's network applications.

I have discussed methods to secure EMC performance of cabling in many earlier 3P Newsletters and it is therefore not the target in the present document. The subject here is much more simple (or complex): What is happening to the good old definitions and experience with screened and unscreened and how to identify noise immunity ?

1. Traditional understanding of unscreened and screened

In the past, i.e. before 10 Gigabit Ethernet, the world of screening was simple. Cabling was either unscreened or screened, and here screened meant being evident, well performing and continuous throughout the installation. To mix unscreened and screened components and to have unterminated screens was not considered proper knowing that it would reduce EMC performance. EMC performance was the only obvious reason for screening. Screening performance requirements were originally typically defined by transfer impedance and related parameters, which are still detailed with test method and requirements in all international standards for cabling and cabling components.

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2. Coupling attenuation

Back in the 90ties it was for the first time being considered that the market understanding of screened and unscreened had shortcomings, especially because "screened" covers a huge range of EMC performances and is therefore in reality being very unclear. As one out of many examples, FTP cables (now called F/UTP) were specified early in TIA standards, i.e. **only** screened cables without a braid. These types of cables may have noise immunity (coupling attenuation) worse than the best UTP or have very excellent performance, but it is pure chance what people have installed if the performance is just specified by referring to FTP and passing of transfer impedance requirements. This definition is simply all too open !

A new parameter was developed and being specified, i.e. coupling attenuation. This name perhaps sounds a little academic, but covers a simple concept with NEXT like performance from each pair to the surroundings of the component. This will define how much noise gets to the outside when signals are sent on the pairs or vice versa. This last point, noise coming from the outside to the signal pairs, is technically much more important today as it also relates to noise immunity and thus in a way also to alien crosstalk performance.

Coupling attenuation is equally valid for screened and unscreened. The test method and definition does not depend on it being applied for screened or not. It is simply an identification of how much noise is generated on the outside when injecting signal on the pairs.

The birth of coupling attenuation has been difficult. Although beautiful, the child was not wanted by many, called a European disease, and is still not fully accepted by some. Not because the technical significance is generally questioned today, but the method can fully compare noise immunity between unscreened and screened components and cabling. In TIA and ISO standards (only) a difference is made between unscreened and screened. For screened, EMC performance is defined by coupling attenuation and for unscreened, EMC performance is defined by balance. Balance and coupling attenuation is corresponding, but can not be directly compared as the way of measuring balance is different from measuring coupling attenuation (not noise to the outside of the component as for coupling attenuation, but to the other pairs serving as a ground).

The traditional definition of screened and unscreened is thus maintained in the latest TIA and ISO standards, and therefore does not provide a good guide when cabling has mixed unscreened and screened components.

A discussion point for those especially interested in the technical details of EMC performance:

A small, but important point for EMC performance is the applicable bandwidth of requirements. Coupling attenuation is an EMC parameter and as such applies for the same bandwidth as other EMC parameters, i.e. from 30 MHz to 1000 MHz independent on the Class / Category of the cabling or cabling components. Noise may disturb and even destroy electronics at far higher frequencies than used for the transmission, and therefore this 1000 MHz bandwidth is necessary. In some international standards I claim that there is a technical error by defining coupling attenuation as a normal transmission parameter, i.e. specified for the bandwidth of the Class / Category in question. One example of consequence is that a Class D / Category 5e cabling having cable with unterminated screen might have excellent performance at transmission frequencies

below 100 MHz, but have non-specified low performance at higher frequencies. Would anyone like to install such cabling knowing that the noise immunity at high frequencies could be critical although not covered by the specification? I think not, unless they were sure that the attached equipment was insensitive to the actual level of high frequency noise.

3. Unscreened with screened or screened with unscreened ?

As stated in the opening, alien crosstalk is critical for performance of 10 Gigabit Ethernet and many future application types. For well screened cabling alien crosstalk is in reality never critical as noise immunity is always far better than needed for alien crosstalk performance. Consequently it is specified in IEC and CENELEC cable standards that alien crosstalk does not need to be documented for screened cabling when noise immunity (coupling attenuation) is better than a specified threshold value. In ISO/IEC standards a similar requirement is found for cabling, but is here also applicable when the cables are totally unscreened. I do think that cabling with unscreened cables always needs to be verified for alien crosstalk even if the minimum specified coupling attenuation threshold value should pass. No such cabling with unscreened connectors and cables exists today, but if and when I still recommend to verify alien crosstalk. This last point is worth a good technical discussion, which is however outside the scope of the present 3P Newsletter.

Alien crosstalk of unscreened cabling and components is often very close to the limit and application of different types of screening of components may be used to improve alien crosstalk performance. Many options are open, like screened cords, screening of components not complying with the specified screening requirements, and different types of metal protection. Such measures may significantly improve alien crosstalk performance and are fully legitimate ways to improve transmission performance of an installation. The technical concept is new, and how should one consider such cabling? It is not unscreened in the sense that screens or metal protection are present and are easily identified. It is not screened in the sense that screening requirements can not be complied with and that unscreened parts of the cabling may be easily identified. We only have the two definitions unscreened and screened in the standards and here we have perfectly well argued cabling that is neither or both.

Addressing the issue in a standardisation committee was leading to the confirmation that screened is for components complying with screening requirements. Using this definition all other cabling would be unscreened, independent on presence of screens or not. This is unpleasant for the market as one would see a metal protection and still have to accept that the cabling is rated unscreened. And what if screening performance is just failing a little; is it then unscreened? (I think NOT) I believe that this makes a definition of unscreened necessary and has at least forced 3P to decide on an internal definition of unscreened. Unscreened cabling is for 3P cabling containing at least one unscreened component, i.e. a components for which screen continuity is not present. No wonder that "unscreened" cabling is a source of market confusion. 3P has in a few cases been confronted with the question why we rate 3P certified cabling as unscreened although screened components can be identified for the cabling in question. The discussion in the present 3P Newsletter is hopefully a support for understanding of this complex issue.

As described above different types of screens and metal protection may improve alien crosstalk, but the general EMC performance will (normally) be negatively affected. EMC performance of



screened cabling with interrupted, low performance, or partly covering screens will have a general degradation to the level of unscreened (this statement with all reservations and exceptions. Badly screened cabling might have much worse or better performance). To summarise: Having some kind of metal protection of the cabling components may improve alien crosstalk while degradation of EMC performance might still be kept on the same level as completely unscreened cabling. This needs of course to be verified in each individual case by carrying out coupling attenuation measurements of permanent links or channels.

Yours sincerely,
3P Third Party Testing

A handwritten signature in blue ink that reads "Poul Villien". The signature is written in a cursive, flowing style.

Poul Villien