To: 3P Customers and Business Partners

Your Ref.	Your Date	Our Ref.	Our Date
		5497@PV	2006.02.23

3P Newsletter No. 1/2006

10 Gigabit Ethernet Developments

The most significant communication cabling development is undoubtedly 10 Gigabit Ethernet over twisted pair copper. This impressive increase in dataspeed over copper has been discussed in the earlier 3P Newsletters No. 1/2005 and No. 3/2005, but as the developments have accelerated since then it is now felt that an update on the situation could be helpful for the market. The present 3P Newsletter will therefore discuss the status of the latest developments.

In spite of the expected agreement of transmission requirements by IEEE this summer, still a few problems remain to be solved for the cabling. These concern some outstanding specification issues as indicated below and a new major problem with specification of power back-off.

Power back-off is applied by the 10 Gigabit Ethernet application in order to reduce alien far end crosstalk noise when a short disturbing permanent link or channel is close to a long victim permanent link or channel. The signal on the short disturber is reduced automatically by the electronics to reduce its noise impact on the weak signal of the long victim permanent link or channel. However, specification of this power back-off has only lately been considered by the standardisation work. At the recent meeting ISO/IEC decided to implement this factor by proposing a new modified parameter "normalised power sum alien ACR-F" instead of the so far specified "alien power sum ELFEXT" (ACR-F is now recognised as a more correct name than the earlier applied designation ELFEXT). This new performance parameter adds yet another complication to the 10 Gigabit Ethernet cabling specification, but is necessary to cover the latest development of the IEEE application.

The general updating of standardisation activities is discussed below.

...../2

3P Third Party Testing
Agern Allé 3
DK-2970 Hoersholm
Denmark

Telephone: +45 45 57 22 00
Telefax: +45 45 76 57 08
E-mail: 3Ptest@3Ptest.dk
Homepage: http://www.3Ptest.dk

VAT-ID Number DK 18408945
Aps.No. 220.590
Bankers: Den Danske Bank

1. Channel Standardisation

The standardisation of 10 Gigabit Ethernet over twisted pair copper has continued rapidly and is now close to being mature with respect to channel requirements. Channel requirements are specified in all the latest drafts and draft proposals from IEEE, ISO/IEC, CENELEC and TIA/EIA. Availability of some or all of the documents is still limited as they are only drafts or draft proposals, but we are however close to the scheduled publication of the IEEE 10 Gigabit Ethernet specification during the summer of this year.

3P is presently using the requirements of the, at any time, latest draft documents in our 10 Gigabit Ethernet certification activities, and the requirements are consequently available from 3P. The present 3P Newsletter is not intended to discuss the technical details of electrical transmission parameters, but more to provide an overview of the latest developments.

As discussed in earlier 3P Newsletters, the 10 Gigabit Ethernet developments go in two different directions, i.e.

A: Standardisation of established Class E / Category 6 and Class F cabling for 10 Gigabit Ethernet
B: Standardisation of new "3rd generation" Class E_A / Category 6A and Class F_A cabling for minimum 10 Gigabit Ethernet

The difference between the two is that the requirements for the 3rd generation cabling are more demanding than required by 10 Gigabit Ethernet as it is intended to support also new applications that might be developed in the next many years. An earlier discussed practical detail is that **unscreened** established Class E / Category 6 cabling supports 10 Gigabit Ethernet on shorter lengths of cabling (likely around 55 metres) while the new unscreened Class E_A / Category 6A cabling is intended to support 10 Gigabit Ethernet to the conventional max. 100 metres channel lengths.

The applicable standards were discussed in 3P Newsletter No. 3/2005, and it should here only be added that the latest issue of both TIA/EIA drafts is now 3.0, and that the ISO/IEC drafts have been updated during the recent meeting in February 2006.

The **names** of the new classes were also discussed in 3P Newsletter No. 3/2005.

2. Permanent Link and Component Standardisation

Since the last 3P Newsletter No. 3/2005 in October much work has been done with respect to development of the very important permanent link and component requirements. A brief status of developments is given below.

Permanent links:

It has been discussed to include permanent link requirements in the ISO/IEC technical report for established Class E / Category 6 cabling and in the first amendment to 2nd edition ISO/IEC 11801.

It was decided during the last ISO/IEC meeting that informative permanent link requirements are included in the technical report, while no permanent link requirements are presently considered for the amendment. Permanent link and component requirements will be specified in a new amendment later.

Cables:

The biggest obstacle for specifying cables for 10 Gigabit Ethernet is the alien crosstalk requirements. Presently IEC has drafted two different test methods, i.e. "6-around-one" and "4 on a drum". The latter method is presently drafted as the only one by CENELEC.

The two methods will give a little different results with the last method probably being more strict. This small difference could become critically significant for **unscreened** Category 6_A cables if the requirements of the "4 on a drum" method are not relaxed accordingly. Therefore it is of course a major issue which test method and limit will apply, and this is still subject to intensive discussions in the cable committees.

Another critical cable parameter is the attenuation of Category 6 cables. The actually needed attenuation requirements for unscreened and screened cables to support 10 Gigabit Ethernet are very different as attenuation is only critical if the alien crosstalk is on the limit, which will normally only apply for unscreened cables. This means that well screened cables do not require the strict attenuation requirements originally drafted (on the other hand it would of course be an advantage to keep the principle of having the same transmission performance requirements of both unscreened and screened components). I believe that the future Category 6_A / Category 6A specifications will contain screened cable attenuation requirements, which do not require unnecessary additional cable costs due to bigger copper diameter. Different unscreened and screened cable requirements or alternatively marginally relaxed and common unscreened and screened cable requirements are both options considered by international standardisation.

Connecting hardware:

Draft standards for connecting hardware are proposed by both IEC and TIA/EIA. Requirements and test methods are proposed, including the alien crosstalk.

A special point is a new test method for NEXT and FEXT. This new way of measurement contains a direct probing instead of the Category 6 specified de-embedded NEXT method. Comparing the Category 6 and Category 6_A requirements some small difference in NEXT limits will appear. 3P has had a number of market queries as to whether this implies that different performance requirements up to 250 MHz will apply. The answer to this question is that it is exactly the same performance being specified up to 250 MHz. The difference in limit is only caused by the new test method, which for instance is now giving higher dB values for pair combination 3/6 - 4/5 than the "old" de-embedded NEXT method. Change of the test method therefore does not mean change of the performance.

Patch cords and equipment cords:

No Category 6_A cord proposal has yet been circulated from IEC, but Category 6A cord requirements have been drafted by TIA/EIA. It should be noted that alien crosstalk requirements

of cords are not considered separately, but will be compliant without testing if the applied flexible cable observes the alien crosstalk requirements specified for the cable.

3. Laboratory Testing of Alien Crosstalk

Alien crosstalk is the new critical parameter for 10 Gigabit Ethernet and therefore also for the future 3rd generation cabling. Field testing of alien crosstalk is not obviously easy and so far not well experienced by the market. Consequently laboratory testing of representative samples of permanent links or channels has become a market approach to demonstarte 10 Gigabit Ethernet compliance.

The test method is specified by TIA/EIA, but so far no IEC test procedure has been proposed. I expect that a first proposal will be discussed at the coming IEC TC 46 WG 9 standardisation meeting 16 - 17 March 2006.

4. Field Testing of Alien Crosstalk

Field testing of alien crosstalk is demanding, both with respect to field tester hard and software, and to know-how and experience of the operator.

Field testers for alien crosstalk will involve interconnection of main and remote units during measurement, for instance and most practically through unused permanent links of the installation. No commercially available field tester is presently on the market, but I expect that market requirements to field testing of alien crosstalk will accelerate developments. A prototype field tester for alien crosstalk has been applied by 3P for gathering experience with both measurement technology and alien crosstalk performance of established Class E / Categroy 6 cabling.

The main problem with in-field alien crosstalk testing of installations will surely be selection of the worst case permanent links and channels for the testing. The testing itself is no major problem as long as the field tester has a practical and easy data processing system. However, it is impossible to measure all combinations of outlets (could well be millions of possibilities) and therefore an initial selection of test strategy must be made. Longest permanent links and channels need to be included in the testing, but also cable bundling sizes, and applied port positions and performance of the panels need to be considered. It will be a major task for the future alien crosstalk installation test standards to specify / recommend the selection procedure for the worst case outlets to be tested as only a small fraction of possible combinations can be covered.

A field testing procedure for in-field alien crosstalk measurements is drafted by TIA/EIA. IEC will discuss the first draft specification at the coming IEC TC 46 WG 9 standardisation meeting.

5. Market Developments for 10 Gigabit Ethernet

10 Gigabit Ethernet is primarily intended for high data transmission environments like data centres. Cabling standards for data centres are being developed by both ISO/IEC, CENELEC and TIA/EIA, which corresponds well with the time of release of the new IEEE applications. The question for me is only to which extent the new twisted pair copper cabling can outperform fiber optical cabling for data center applications.

...../5

However, I do expect that twisted pair 10 Gigabit Ethernet cabling will have a significant impact on the future market development with respect to screening, success of Class F cabling and horizontal cabling.

The 10 Gigabit Ethernet application is the first one which officially recognises that **screened cabling** is having generally less critical performance than unscreened. It has (together with industrial cabling requirements) forced international standardisation committees to focus very strongly on EMC performance, which has now become a primary performance concern. Three different levels of EMC will be included in future cabling standards and passing of the most strict requirements will be extremely difficult for unscreened cabling, but very simple for screened. I therefore predict that we will in the next 2-5 years see a trend world wide going from unscreened to screened due to the evident benefits of (separately) screened permanent links and channels.

Class F cabling is for the first time being quoted by an application standard as a supporting media. Class F cabling will already today support 10 Gigabit Ethernet for the maximum specified cabling length. I therefore expect that Class F or may be more likely Class F_A cabling will gain growing success in the future as the benefits are now evident. I still expect that TIA/EIA will be forced to also include this type of cabling in a future amendment as it to me appears unacceptable for TIA/EIA not to specify all cabling quoted by IEEE.

Last but not least the history of cabling developments strongly indicates that the new higher classes of cabling and applications will be implemented in the horizontal cabling with growing market demand through the next 2-8 years. This will consequently change the major volume of future installed cabling to the new Class E_A / Category 6A and/or Class F_A.

We are certainly entering years of extensive developments of the cabling market.

Yours sincerely,
3P Third Party Testing

Poul Villien