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PoE and PoEP and its Impact on Cabling Systems

The way an innocent outsider sees it !

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PoE (IEEE 802.af) :

Powering systems already deployed on a large scale, unfortunately without the required in depth implication in time of all standardization groups concerned.

In ISO/IEC we assume a maximum conductor current of 175 mA in each of the 8 conductors

That was the result of a severe underestimation of the problems occurring in reality by the standardization groups concerned with these issues, i.e. TIA and ISO/IEC

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PoEP (IEEE 802.at) :

In ISO/IEC we assume in the moment that a current of 420 mA per conductor is anticipated in each of the eight conductors. That amounts per cable in the worst case to four times 840 mA over the phantom circuits of all four pairs.

This fact could not be unambiguously confirmed so far, and requires a VERY CLEAR liaison statement.

While the specified resistances did not change the resistance unbalance has been reduced for the cables from 3 to 2 %.

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PoE (IEEE 802.af) :

Main problems from a cabling point of view :

1.) Heating of the cables
2.) Lack of specifications to downgrade the maximum ambient temperatures in order to not exceed the rating temperatures
3.) Lack of installation mitigation practices to cope with the heating of the cables
4.) Connector degradation due to sparking (now being addressed in IEC 48B, but even here the liaison was ambiguous and has to be clarified)

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PoE (IEEE 802.af) :

The heating of the cables occurs primarily in and close to the equipment room, where the cables are tightly bundled. The equipment rooms are generally air conditioned. However in the case of a failure of the air conditioning the powering should be shut down and corresponding warning signals or alarms have to be emitted, even up to the potential users of powering. Close to the equipment room the ambient temperature has to be limited such that the rating temperature will not be exceeded in any conductor in the bundle under assumption of a reasonable percentage of powering of cables in the bundle (to be used also : mitigation)

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PoE (IEEE 802.af) :

So far nobody looked at the heating problems of patch cables, which have inherently, due to their stranded conductors, a substantially higher resistance (29 versus 19 Ohm/100 m loop resistance)

They are therefore more prone to heating than the horizontal cables.

All the Cat. 5 cables in the installed base have according to IEC 61156 – 2 to – 4 a conductor resistance unbalance of 3 % while Cat. 5e and up have a CRU of 2 %. TIA specifies 5 %, but uses the ASTM D 4566 definition

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PoEP (IEEE 802.at) :

If IEEE 802.at anticipates currents in the order of 420 mA, then they have to also very clearly express their desire to get the resistance of the conductors reduced, primarily the patch cables.

Horizontal cables have already a lower resistance to cope with the attenuation requirements, but it should also be reflected in the relevant specification requirements.

The patch cables pose a more serious problem. So far ISO/IEC specifies a maximum attenuation increase of patch cables of 50 %. (TIA 20%)

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PoEP (IEEE 802.at) :

But, that is not all : In order to cope with the requirements of 10GBase-T several manufacturers envision to use patch cables with increased resistance, which may also be screened.

Thus even screened patch-cables with 28AWG stranded conductors are proposed and in fact also already marketed and deployed.

Evidently with such cables the problems to be expected upon deployment of PoEP are extreme.

A much closer cooperation between IEEE 802.at IEEE 802.an and with ISO/IEC and TIA is mandatory

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How to resolve the problems on the installed base :

1.) Carrying out complete heating trials on a bundle of 37 cables, using a current normalization to reflect the performance of Cat. 5 cables (24 AWG and/or 0.5 mm conductors)

2.) Heating only the first or second layer or both, a current loading of the cables under steady state conditions of 16.2; 32.4 and 48.6 % can be simulated (realistically these values will hardly ever be exceeded)

3.) Derivation of maximum allowable ambient temperatures based on the above.

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4.) Carrying over the obtained results into the relevant standards, i.e. ISO/IEC and TIA

5.) Reflect in the relevant code standards, i.e. UL 444/CSA 22.2 No 214 bi-national standard and others (on an international scale) the allowance to reduce ambient temperature to cope with the maximum allowed conductor temperature

6.) Request a change of the relevant electrical codes to reflect the option of limiting the ambient temperature to cope with the maximum allowed conductor temperature

7.) Request the development of mitigation options

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Incidentally, CSA is already working on this issue, to reflect PoE and PoEP in the Canadian Electrical Code (CEC)

It is a bit more tedious to get it into the National Electrical Code in the US, as this is handled by the National Fire Protection Agency (NFPA), who is anticipating to update the NEC by 2008 only !

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There is definitely some help required from US companies to carry the torch to move the National Fire Protection Agency (NFPA) to reflect our needs and to get them nailed down in the NEC at the latest by 2008 !

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Keystone in this undertaking is and remains the heating trials, which have to be carried out in a reliable and UNBIASED way.

This leads to the following suggestion:

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A Proposal :

For carrying out the heating trials while maintaining an general acceptance of the results, it is suggested to get an independent Test Lab involved.

Erik Bech (erb@delta.dk) is willing to undertake such tests, as he mentioned in Buenos Aires, but evidently he has to look for some project sponsors for this undertaking. As this is in the interest of the entire IEEE 802.3af and 802.3at group, a cost sharing is suggested to finance these trials. This has the advantage to also have the results in a foreseeable time frame.

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Test Method :

The test method for carrying out such trials has been developed within IEC 46C WG7, refined by ISO/IEC JTC1/SC25 WG3 and finalized within IEC 46C WG7

This test method is available to the members of IEEE 802.3af and IEEE 802.3at