

EC CablingNews

Data cables with copper plated aluminium conductors

By Erik Bech – 6 January 2012

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For some years now we have seen cheap cables on the market, where the conductors are made of aluminium plated with a thin layer of copper. These cables are cheap because the cost of aluminium is about one third compared to that of copper. As high frequency currents are conducted close to the surface of a conductor due to the skin effect, the copper plating determines the high frequency performance of the cable. At DC however, the current is conducted in the whole conductor. Performance at low frequencies and DC is therefore mainly determined by the properties of aluminium. The resistance of aluminium is 52% higher than that of copper. Therefore, one can expect the DC loop resistance to be too high for this kind of cable.

EC Cabling has tested a Category 5e cable with copper plated aluminium conductors. This cable was handed over to us by one of our customers. The cable has no information of the manufacturer, but it is marked for compliance with ISO/IEC 11801 and TIA/EIA 568B. This is not correct as ISO/IEC 11801 refers to IEC 61156 for compliant cables and in this standard it is required that the conductors shall be made by solid or stranded copper. It is illegal to state compliance with these standards, for cables with aluminium conductors. Pure copper conductors are also required in the European cable standards (EN 50288 series).

Our test shows the expected results due to the aluminium conductors, but also that this cable has a poor quality. There are parameters that are not complying and have no margin. For these parameters the reason is not the conductor material, but just poor manufacturing. For the parameters that are dependent on the conductor material, we see that the attenuation is a little too high at low and medium frequencies. This deviation is small and applications will normally not fail due to that. The DC loop resistance is measured to 29 Ω . The limit is 19 Ω . This may become a problem, if the cabling is used for systems, which are powered over the local area network. Especially for the new power over Ethernet plus specification where a supply current up to 0.6 A is used. Excessive heating in a cable bundle may happen if cables with too high loop resistance are used.

Another big problem with aluminium conductors is their behaviour in insulation displacement, IDC contacts, as those used in connecting hardware. Copper and aluminium behave differently in these contacts. Copper is deformed in the IDC, but continues to maintain a pressure force in the contact, which serves to maintain low contact resistance. Aluminium is also deformed in the IDC, and the initial contact resistance may be low. But after some time the aluminium will be permanently deformed and the pressure in the contact will be low, which means that the contact will be loose and the contact resistance unstable. Another problem is oxidation if the copper plating is penetrated by the IDC contact.

So, as a conclusion, is it really a good idea to use copper plated aluminium conductors in data cables? The question is not so silly. Aluminium conductors are heavily used in high power cables. The following pros and cons can be said about this:

On the one hand, a cable with copper plated aluminium conductors can be made compliant with transmission requirements and it is cheaper than a cable with pure copper conductors. On the other hand, aluminium is not allowed in the current ISO/IEC 11801 and TIA/EIA 568B standards, and a cable with aluminium conductors cannot comply with the requirements for DC loop resistance, unless the conductor diameter is increased to about 0.65 mm. The risk for loose contacts in IDC's should exclude use of aluminium conductors in cabling networks.

Right now the situation is that these cables are sold cheaply at the low cost market. The cost for a good certified Category 5e cable is, however low, especially compared to the total cost of a computer system. For this reason DELTA EC Cabling recommends usage of standardised good quality cables. This is important to improve reliability of the computer systems on which we are so dependent today.

Our test report, N312708P: Performance testing of data communication cable, Category 5E with copper plated aluminium conductors is made available on request.