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Some comments to the IEEE requirement for an increased power rating of data grade channels

Two points seem to be critical in considering the increase of the power rating of data grade channels as specified in IS 11801:

1.) The power rating of the connectors, tested during plugging and unplugging under load
2.) The power dissipation of the cables

On the first point I should like to refer to the work done by the Siemon Company, using a RLC load at the end of the channel, which should be used as a guide line for assessing the performance of connectivity.

As to the second point, unfortunately IS 11801 is a bit imprecise, as there are specified resistance, current carrying capacity, operating voltage and power capacity (see also previously submitted document, which I attached here as well). Thus for the different channels are specified the following values in the table:

Table 1 : Specified Values in IS 11801

	Class D	Class E	Class F
Loop resistance [Ohm]	25	25	25
Minimum Current [A]	0.175	0.175	0.175
Operating Voltage [V]	72	72	72
Power Capacity [W / Pair]	10	10	10

Hence what is specified is the loop resistance, minimum current capacity, operating voltage and power capacity. However all are unfortunately specified as “shall – requirements” a fact which does not make any sense, as these requirements cannot be met. The only slight derogative made concerns the current carrying capacity which is specified as a minimum, i.e. which may exceed the indicated value.

This contravenes Ohms law as I already lined out, however in vain, during the discussion in WG3 on this subject.

In order to be able to reasonably assess the maximum power capacity of the channels, we have to first look at the components, i.e. the cables and the connectors.

For the cables we have the values indicated Table 2.

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Table 2 : Average dimensions and resistances for horizontal cables for different classes (Unfortunately the dimensions of insulations and jacketsare missing).

	0.5 mm Conductor Cables	Normal Cat 5e Cables (Class D)	Normal Cat 6 Cables (Class E & F)	Normal Cat 6+ Cables ("new Class E & F")
		Ave.	Ave.	Ave.
Dia [mm]	0.50000	0.52134	0.56515	0.56934
Cross-Section [sq mm]	0.19635	0.21346	0.25085	0.25459
Ohm/100 m	8.61159	8.25918	7.61886	7.56277
Loop Resistance [Ohm]	17.22319	16.51835	15.23771	15.12555
Horizontal Cables				
IEC - max. Loop Resistance [Ohm]	19.00000	19.00000	19.00000	17.00000
Patch Cables				
IEC - max. Loop Resistance [Ohm]	29.00000	29.00000	29.00000	25.00000

I referred already a long time ago to a document published by Steve Mayer, who used the classical method for determination of ampacity for insulated conductors. It should be noted, that these ampacities are based on relative good convection capabilities of the surroundings, and that the obtained current ratings will have to be decreased if the conductors are bundled in confined spaces.

The author used this classical method and tried to extend it to four pair cables in a two step approach, first the conductor approach was extended top a pair, where simply the radiation surface and the convection surface of the pairs has been taken into account. In a second step, the same method was applied to a tubular jacket, under the condition that the heat transfer from the insulated conductors to the inner jacket surface is based primarily on convection and radiation. Thus the direct contact conduction of heat, which is in reality due to the shape of the jacket and the helical shape of the pairs also very small, has been neglected. This seems to be a reasonable approach.

The obtained results indicate values for a cable which is freely exposed to heat convection into the surrounding.

It is therefore suggested to measure the surface temperature of a cable under a specific current load on all pairs once under the condition that there is a free convection of heat feasible, and in a second trial to use a tightly wound cable coil, in order to restrict the convection to a maximum. If for both cases the surface temperature of the wire is known under steady state condition in an air conditioned room then the factor for the current derating due to the bundling of cables can be established, using the Mathcad program supplied.

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