

Application Note 01/98

Cable sharing - what's that?

The meaning of **Cable sharing** is nothing else but the use of a single cable for multiple applications. In case of structured in-door cabling, multiple tasks can be two data services or one data service and a telephone service. What makes cable sharing special and why do you need different cables for this than for single use?

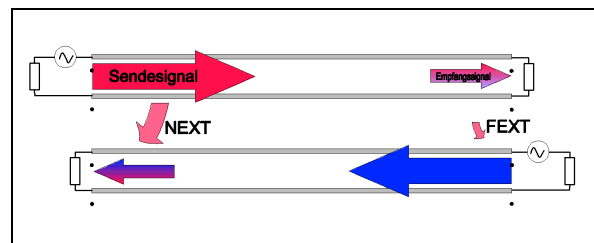
During transfer of signals via a single line, two things happen from a systems point of view: The signal first is attenuated and second disturbed. The attenuation of a copper cable depends on the limited conductivity of copper. Signal disturbances are caused by different sources, depending on the application. Let's take a brief look at the standard application of Category 5 cables so we can judge the effects of multiple services on a cable. Finally we will see, how a rational cable sharing solution can be implemented without classical pair shield technique by using our new designed **UC400 S24 4P** cable.

Basics of digital signal transmission

The conductor bound transfer of data or - in the more general sense - signals is limited by a series of characteristic interference sources of the transmission line. From these interference effects such as thermal noise or far-end crosstalk (FEXT), the dominating disturbance during data transfer at the wire lengths used in LAN, is near-end crosstalk (NEXT).

This effect behaves like noise with regard to the system concept (as it is random and therefore unpredictable), however, it is bound with the used transmission level on the line via the near-end crosstalk attenuation of the cable.

Two paired lines, being involved in data transfer, are



picture 1: Basic concept of crosstalk

schematically shown in figure 1, embodying forward and backward path. While the desired signal's level decreases with increasing link length due to line attenuation, the dominating disturbance signal NEXT remains on constant level. Transmission of information is only possible, if the coded information can be recognized, i.e. the received attenuated signal must be larger for a certain amount than the disturbance signal NEXT.

In the tertiary level of local area networks, application lengths of maximum 90 m + 10 m are calculated. This demand leads directly to the more simply manageable size

$$ACR = a \cdot l - NEXT$$

a = length dependent attenuation

l = Link length 100 m

ACR stands for Attenuation-Crosstalk-Ratio and can be understood as a property of the passive network, which that must have a certain level to enable high-speed data transfer.

What happens during cable sharing?

We consider as cable sharing all applications, where multiple transmission and receive channels occur in one single cable. In such a case there occur diverse noise overlays at the receiver (see figure 2). These overlays lead among others to following disturbance components:

PSNEXT = Powersum NEXT, i.e. the sum of the powers of the crosstalk interferences.

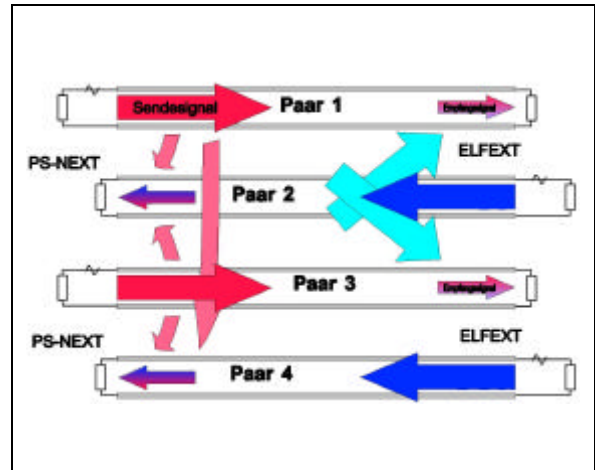
Example: If a NEXT of 35 dB results from each of two channels, the PSNEXT is $10\log 2 = 3$ dB worse, that is 32 dB.

ELFEXT = Equal level far end crosstalk, the far-end crosstalk (FEXT) related to the receive level (equal level) .

During signal transmission the dominating disturbance signal has to be regarded, so during multi pair operation the PSNEXT and additionally the ELFEXT step in place of the NEXT .

Conventions of the EN50173

In the EN50173, section 7.5.2 the possibility of cable sharing is already provided. Here the above-mentioned effect Powersum NEXT is mentioned as well as the requirement of an additional system margin of 6 dB. What does this mean? Cable sharing is typically practised with two different services. In this case, the transmission levels of both services can differ. If the "stronger" transmitter disturbs the "weaker" receiver within the cable, the signal-to-noise ratio at the receiver additionally decreases by the difference of the transmission levels. The margin of 6dB allows a general difference in the transmission powers by factor two, whereby most common applications are covered. A cable, suitable for cable sharing with two Category 5 - Class D services, requires an additional NEXT safety distance of $(6+3)\text{dB} = 9\text{dB}$. In order to guarantee this high performance level, up to now exclusively PIMF cables were used for Cable sharing.



picture 2: crosstalk during multi pair operation

The ideal cable for cable sharing: UC400 S24 4P

Our new developed UC400 S24 4P joins a series of interesting aspects for data network installations of today and tomorrow:

- ‘ It fulfills all requirements of the ISO/IEC 11801 2nd ed. Category 6 - Class E upto 200 MHz
- ‘ It allows cable sharing of two Category 5 - Class D applications by using one single 4paired cable
- ‘ It offers simplest mountability without costly mounting of pair screens

The NEXT level of the patented cable design reaches 57 dB (!) at 100 MHz and has a safety distance of 25 dB to the demands of the Category 5-Standard. Even after claiming 9dB margin for cable sharing, a system margin of 16dB remains, guaranteeing a high "hit rate" even under difficult installation conditions.

With this innovative product the user receives both a profitable implementation of two Category 5-Class D-links and the option of future adaptations to the Category 6 Class E standard which is still pending.

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