



# SHIELDED AND UNSHIELDED CABLE MAKING THE RIGHT CHOICE

The argument over shielded vs unshielded cabling and which provides the best solution for copper structured cabling networks, is a long-running one. The choice between unshielded twisted pair (UTP) cable and foil twisted pair (FTP), (or screen twisted pair (ScTP) as it tends to be known in the US), is not always a straight forward one. In fact, choosing the right shielded technology for the application from the wide range of options available, and making sure it is installed and operating correctly, is actually far more important than the choice of FTP or UTP.

Common practise varies around the world. In the UK most of Europe and USA and Asia, UTP cable is generally accepted as being the most cost-effective option adequate to meet the requirements of most installations. In Germany, and other parts of Europe including parts of France, Switzerland, and Austria, FTP is the norm.

Wherever the system is being installed, the issue is actually one of data integrity. Protecting data from potentially corrupting electromagnetic interference (EMI) is the essential aim of shielding systems. Environments where shielded solutions may be an advantage include noisy locations prone to electromagnetic interference, such as industrial facilities and airports and those running critical systems, such military installations and hospitals.

A well-designed and properly installed FTP cabling network undoubtedly offers improved signal integrity over an unshielded system. However, in order to work effectively, the shielding must be properly earthed. In practice this is not always easy to achieve. A badly earthed, shielded system will actually offer poorer performance levels than one which is not shielded in the first place. In the worst case, the shield itself can become a radiating source, producing current earth loops, or capturing ambient emissions and radiating harmful interference right next to the data cable.

## Types of shielding

There are different types of shielding. Two or more twisted pair or quad cables may be wrapped in an overall screen or shield. Alternatively, each pair of twisted cables may be individually shielded. Further, these individually shielded cables may or may not be covered by a second, overall shield (known as pairs in metal foil (PiMF)).

Whatever the design, to be effective the shield must be electrically continuous from end-to end and properly earthed. In selecting a shielded cabling system, it is also important to choose a total, end-to-end engineered solution. Mixing components from different systems can cause problems with impedance mis-match.

The cost of a shielded system, including the extra installation work required, is typically 2030% more than the equivalent UTP solution.

## Standards and regulations

EMI, or radio frequency interference (RFI) is any unwanted signal which adversely affects the operation of a device or system. In Europe, regulations governing emissions from and immunity to the effects of electromagnetic radiation are set down in the EMC Directive 89/336/EEC and its subsequent amending directive 92/31/EEC. In the United States, the Federal Communications Commission (FCC) lays down similar rules on emissions, for any equipment made or sold in the USA.

Emissions are determined by measuring the field strength of the radiation being generated. Measurement in volts / metre, normally in the frequency range 30kHz to 1000MHz. The EMC Directive includes a product family standard for information technology equipment, EN55022, which sets out tests procedures and acceptable limits for EMI emissions.

Immunity (or susceptibility) to EMI is determined by tests which confirm that equipment will continue to operate effectively in the presence of appropriate levels of EMI. There is no product family standard for IT equipment for immunity testing yet, so for the moment it is covered by the generic standards EN50082-1 (domestic, commercial and light industry) and EN50082-2 (industrial environment). These and the IEC1000-4 series of basic standards are used for immunity testing of IT equipment.





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What is not entirely clear, is how the cabling structure fits into this picture. Advice given to Molex Premise Networks in the UK by a DTI appointed Competent Body confirmed that structured cabling is excluded from the regulations under SI 2372: 1992 Rule 13, because it is accepted that large installations like those in buildings cannot be assessed for EMC. Further, Rule 17 of the SI classifies the cabling system as passive and therefore outside the scope of the electromagnetic directive.

The UK's Electromagnetic Compatibility Test Laboratories (EMCTLA) is quoted as saying that cabling products are not liable to cause electromagnetic disturbance or the performance of which is liable to be affected by such disturbance. A CE mark is not therefore required to be displayed on cabling components; in fact it would be illegal to do so.

## Responsibility

Secondary responsibility for the electromagnetic compatibility of the installed IT system is shared between the manufacturer of the active equipment and the system installer. However, the ultimate responsibility to ensure that compliance with the directive is achieved lies with the owner of the system.

Molex Premise Networks has been carrying out EMC tests on a range of installations over some time now, in order to gather data to better advise end-users and installers on EMC and shielding issues. In tests of typical configurations including active equipment and cabling components, both UTP and FTP solutions meet the appropriate emissions and immunity standards if they are installed correctly.

## The way ahead

Twisted pair cables achieve electromagnetic compatibility by coupling the signal in each half of the pair, so that positive and negative signals cancel each other out. In order to work effectively, the twisting must be well balanced.

The testing of cables for longitudinal balance is the subject of current debate. The possibility of including such tests in the standard European standard EN50173 is under consideration. The method of testing put forward is one based on coupling attenuation, but many people believe the method to be at best flawed, or even entirely inadequate. Other methods of testing for longitudinal balance include line injection and antennae techniques.

Category 7, currently in draft in the International Standards Committee ISO/IEC/SC25, will specify PiMF shielding, terminated to a shielded connector. It is anticipated that this level of shielding will be necessary to support the performance demands of the standard which specifies transmission at a bandwidth of about 600MHz. The alternative, which requires no shielding and offers higher performance than any copper solution, is of course, fibre.

For the present, the choice of whether to shield or not, and if so what type of shielding to use is still a complex one. The best advice that end-users can follow is to take advice from experienced network designers for each new installation.

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