

## ELECTROMAGNETIC COMPATIBILITY AND CABLES

**EMC:** Capability of a system or device to maintain its functions (without irreparable electromagnetic failure) in the electromagnetic environment it is present.

Device should not emit undesired EM signals that affect other devices nearby, and at the same time, it should not be affected by undesired signals emitted by the other devices.

Cables that connect devices to each other are amongst the main factors that determine EMC quality. Because cables not only transmit undesired signals from one point to another (conductivity interference) but also emit signals, which travel through them, to the environment like an aerial (radiation interference). Quality of shielding material and cable shield earthing are two basic elements that determine cable performance.

### 1-SCREENING

Can be defined as isolating two environments from each other in terms of electromagnetic field.

Screening effectiveness (SE, Screening effectiveness, ratio of field intensity in the absence of a screen to field intensity in the presence of a shield) is used as a typical measure of screening.

Its unit of measurement is decibel (dB). High SE means good screening effectiveness.

$$SE(f) = 20 \log_{10} [E(f) / E_0(f)] \text{ [dB]}$$

Materials to be chosen for screening purposes can be divided into three groups;

#### 1-High-performance materials:

100% covering made of materials like steel, copper and stainless steel  
(Screening effectiveness of 80-120 dB)

#### 2-Standard-performance materials:

Conductive metal plates (screening effectiveness of 20-40 dB)

#### 3-Low-performance materials:

Metallized fabric structures, conductive paper materials (conductive polymers),(screening effectiveness of 15-30 dB)

In practice, many problems can be solved by screening effectiveness of 40 dB.

Screening effectiveness of 100-120 dB can be required for military systems.

The values required in specifications for instrument cables, coaxial cables, data transmission cables are around 80- 100 dB.

### 2-EARTHING

It is defined as either voluntary or involuntary connection of an electric circuit or device to earth (soil potential) or a surface big enough to be a substitute for earth by means of a conductive interconnection.

Earth is accepted as absolute reference (zero volts).

For the earthing to be accomplished in a real sense of a word, all devices must be brought to this absolute zero point.

Some structures that can substitute earth in practice:

- Steel construction buildings
- Vehicle body (car, plane, ship)
- Water pipes
- Earth electrode systems
- Earthing plate, grid, etc.

Direction of screening and earthing are important since cables are generally used to transmit signals between source and load. Unwanted electric fields are well-screen in a cable which is shielded only on the load side.

However, this is not sufficient for screening the magnetic fields. Electric field shielding is better when earthing is applied on both load and source sides, and by doing so magnetic shielding is obtained as well. (Screening effectiveness increases by 10-20dB)

Magnetic leak is decreased by using twisted pair conductor (by diminishing the area between the conductors and allowing reverse current flows by means of twists).

When earthing is applied on both sides, effective electric and magnetic screening is obtained.