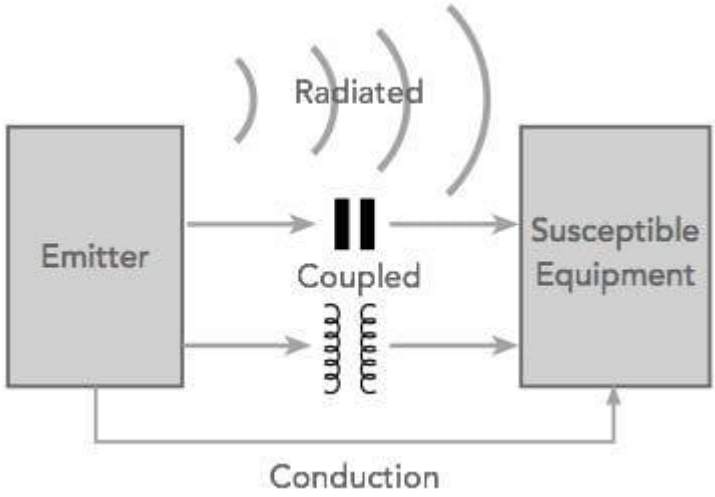
What is EMC: Electromagnetic Compatibility Basics

EMC is of increasing importance as the number of wirelessly connected devices increase. Defining what EMC is and understanding the concepts enable electromagnetic compatibility to be achieved from the outset.

Electromagnetic compatibility, EMC is the concept of enabling different electronics devices to operate without mutual interference - Electromagnetic Interference, EMI - when they are operated in close proximity to each other.

All electronics circuits have the possibility of radiating of picking up unwanted electrical interference which can compromise the operation of one or other of the circuits.



What is EMC - definition

Often when dealing with EMC it is necessary to ask: what is EMC; and to have a definition.

EMC definition: EMC is defined as the ability of devices and systems to operate in their electromagnetic environment without impairing their functions and without faults and vice versa.

Electromagnetic compatibility, EMC ensures that operation does not influence the electromagnetic environment to the extent that the functions of other devices and systems are adversely affected.

EMC awareness build-up

In the early days of electronics comparatively few items of electronics equipment were in use. However today the number of electronics items in everyday has vastly risen. Some of these transmit signals, while many others are sensitive receivers. Others may utilise digital electronics systems that could be falsely triggered by transient signals. These any many more examples may EMC a crucial element of any electronics design.

In the early days of electronics systems, pops, bangs and general noise received by radios were taken as being part of "experience" of listening to a radio - even if they were man-made from other local electrical equipment.

Some of the first major concerns of the effects of electrical interference on electronics systems arose from military applications. After the Second World War, with the rise in importance of nuclear weapons, the electronic pulse generated by an explosion and its effect on equipment became a concern. Also the effects of high powered radar systems on equipment were also a concern.

Later the risks to electronics equipment associated with ESD became visible. Not only did these damage the electronics equipment, but they could also set false triggers.

During the 1970s the use of logic circuitry grew rapidly, and with this the switching speeds increased. The opened up these circuits to the effects of EMI, and realisation grew of the need for EMC precautions to be incorporated into the design if these items were to work satisfactorily in the real world.

As a result of this growing realisation, many nations became aware of EMC as a growing problem. Some started to issue directives to the manufacturers of electronic equipment, defining standards that the equipment should meet before equipment could be sold. The European Community was one for the first areas where EMC requirements were enforced. While many were sceptical at first, the introduction of EMC standards has raised standards and enabled most types of equipment to operate alongside each other without interference. This has been particularly important with the rapid growth in the use of mobile phones

EMC basics

The aim of employing EMC measures is to ensure that a variety of different items of electronics equipment can operate in close proximity without causing any undue interference.

The interference that gives rise to impaired performance is known as Electromagnetic Interference, EMI. It is this interference that needs to be reduced to ensure that various items of electrical equipment are compatible and can operate in the presence of each other.

There are two main elements to EMC:

- ***Emissions:*** The EMI emissions refer to the generation of unwanted electromagnetic energy. These need to be reduced below certain acceptable limits to ensure they do not cause any disruption to other equipment.
- ***Susceptibility & immunity:*** The susceptibility of an item of electronics to EMI is the way it reacts to unwanted electromagnetic energy. The aim of the design of the circuit is to ensure a sufficiently high level of immunity to these unwanted signals.

Electromagnetic interference, EMI

Electromagnetic interference, EMI is the name given to the unwanted electromagnetic radiation that causes potential interference to other items of electronics equipment.

There are many ways in which electromagnetic interference can be carried from one item of equipment to another. Understanding these methods is a key to mitigating the effects of the electromagnetic interference.

EMI can be divided into two categories:

- ***Continuous interference:*** The continuous interference is often in the form of a radio signal or oscillation that is maintained. It could be from an unscreened oscillator, or it may be in the form of wideband noise.
- ***Impulse interference:*** This form of interference consists of a short impulse. It may arise from an electrostatic discharge, lightning, or a circuit being switched.

Apart from understanding the form of the interference, it is also necessary to know how the interference is travelling from the transmitting device to the receiving device. Unfortunately this is not always easy to discover as many of the paths are difficult to define. However good initial design alleviates many problems.

EMC standards

With the growing awareness and need to maintain high standards of electromagnetic compatibility many standards have been introduced to help manufacturers meet the levels they need to maintain full electromagnetic compatibility.

Many years ago the levels of EMC were low and interference often occurred - taxis driving past a house whilst using their radio telephone were quite likely to disrupt the operation of a television, and there were many other instances.

As a result, it became necessary to introduce EMC standards to ensure the required levels of compatibility were attained.

EMC is now an integral part of any electronics design project. With standards now implemented and enforced across the world, any new product needs to meet and have been tested to ensure it meets the relevant EMC standards. While this presents an additional challenge to the electronics design engineer, it is essential that good EMC practices have been employed and that the EMC performance of the product is sufficient to ensure it operates correctly under all reasonable scenarios.