

# Chapter 9

## EMI and EMC

ACMA Foundation Syllabus 7

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### EMI and EMC

Electromagnetic compatibility (EMC) and electromagnetic interference (EMI) are frequently referred to when discussing the regulatory testing and compliance of electronic and electrical products.

### Electromagnetic Interference (EMI)

EMI can be defined as interference that impacts the functioning of an electronic device. Sources of EMI can sometimes be environmental events but more often the EMI source is another electronic device or electrical system. Common electronic sources are transmitters, cellphones, welders, motors and LED screens.

EMI is also called RFI (Radio Frequency Interference) however EMI is any frequency of electrical noise, whereas RFI is a subset of noise on the EMI spectrum.

There are two types of RFI.

- Conducted EMI is unwanted high frequencies that ride on the AC wave form.
- Radiated EMI is emitted through the air.

### Causes of EMI

Interference occurs when an unwanted signal disrupts the use of your television, radio or cordless telephone. Interference may prevent reception altogether or may cause only a temporary loss of a signal. The interference may affect the quality of the sound or picture produced by your equipment.

The origin for any EMI may come from many sources.

- External noise – other electrical equipment nearby.
- Natural origins - electrostatic interference and electrical storms.
- Radio Frequency Interference (RFI) –radio systems signals
- Crosstalk - in cabling

### Intermodulation

Intermodulation distortion is the undesired combination of several signals in a nonlinear device which produces a new unwanted frequency. This new frequency can cause interference in adjacent receivers. Intermodulation can also be produced in rusty or corroded tower joints, guy wires, turnbuckles and anchor rods or any nearby metallic object acting as a nonlinear “mixer/rectifier” device.

### Eliminating EMI Influence

Methods to reduce or eliminate EMI:

**Filtering** - EMI filters can suppress electromagnetic noise transmitted through conduction. These filters extract any unwanted signals while allowing desirable signals to pass. A choke is an example of a Low Pass Filter removing EMI.

**Grounding** - Grounding devices provides a low impedance path for EMI to dissipate and can mitigate the ill-effects of EMI.

**Decoupling** – Decoupling capacitors in circuits is good practice. Decoupling capacitors in power supplies reduce the possibility of EMI entering the device from the power mains.

**Shielding or Blocking** - EMI shielding is the practice of blocking the electromagnetic field from impacting the device. These barriers are made of conductive or magnetic materials. You will find

EMI shielding in your cell phones, in the microwave oven door, as well as your computers and keyboards.

A Faraday shield is a good example of blocking EMI.

### Choke

A choke is a simple inductor that eliminates high frequency spikes. In essence it is a low pass filter.

A simple choke can be made by winding wire around a ferrite core.

### Reducing Interference

- Monitor and moderate power output.
- Site your antenna from other antennas e.g. TV
- Avoid any frequencies that are known to cause interference in your area.
- Fit a balun to the antenna.
- Conducted interference can be removed by placing chokes on affected cables.
- Install a mains filter to prevent interference getting into the mains lines.
- Show goodwill to neighbours if problems occur.

### Electromagnetic Compatibility (EMC)

It is rare for electronics devices to operate in isolation as they are usually engineered to function in the presence of some form of EMI. This is particularly important in military-grade, medical and avionics equipment.

EMC is a measure of a device's ability to operate as intended in its shared operating environment while not affecting the ability of other equipment within the same environment to operate as intended. They all must play together.

Testing how a device will react when exposed to electromagnetic energy is known as immunity (or susceptibility) testing. Measuring the amount of EMI generated by the device's internal electrical systems is known as emissions testing.

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*Have fun and stay safe.*