What are the Electromagnetic Effects?

Means for testing and evaluation (T&E) of these phenomena are very expansive, bulky and not full-time used. Therefore, the member states decided to co-operate in this field by mutual use of common capabilities. This helps to avoid the building of new facilities in one country and closing other facilities in another country, which will save the budgets, preserve the skilled human resources and assure to the exchange of experiences and test results approval.

Following EME are tested:

- Electromagnetic Interference (EMI);
- Electromagnetic Compatibility (EMC);
- Electrostatic Discharge (ESD);
- Lightning Electromagnetic Pulse (LEMP;
- Nuclear Electromagnetic Pulse (NEMP);
- High-Power Microwaves (HPM);
- High Intensity Radiated Fields (HIRF)
- Hazards of Electromagnetic Radiation to Ordnance (HERO).

Electromagnetic interference (EMI) is an unwanted disturbance that affects an electrical circuit due to either electromagnetic conduction or electromagnetic radiation emitted from an external source. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit. EMI can be intentionally used for radio jamming, as in some forms of electronic warfare, or can occur unintentionally, as a result of spurious emissions. It frequently affects the reception of AM radio in urban areas.

Electromagnetic compatibility (EMC) is the branch of electrical sciences which studies the unintentional generation, propagation and reception of electromagnetic energy with reference to the unwanted effects that such energy may induce. The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipments which use electromagnetic phenomena, and the avoidance of any interference effects.
In order to achieve this, EMC pursues two different kinds of issues. **Emission** issues are related to the unwanted generation of electromagnetic energy by some source, and to the countermeasures which should be taken in order to reduce such generation and to avoid the escape of any remaining energies into the external environment. **Susceptibility** or **immunity** issues, in contrast, refer to the correct operation of electrical equipment, referred to as the victim, in the presence of unplanned electromagnetic disturbances.

Electrostatic discharge (ESD) is the sudden and momentary electric current that flows between two objects at different electrical potentials caused by direct contact or induced by an electrostatic field. The term is usually used in the electronics and other industries to describe momentary unwanted currents that may cause damage to electronic equipment.
ESD is a serious issue in solid state electronics, such as integrated circuits. Either of these materials can suffer permanent damage when subjected to high voltages, as a result there are now a number of antistatic devices that help prevent static build up.

Lightning is an atmospheric discharge of electricity usually accompanied by thunder, which typically occurs during thunderstorms, and sometimes during volcanic eruptions or dust storms. In the atmospheric **electrical discharge**, a leader of a bolt of lightning can travel at speeds of 60,000 m/s (220,000 km/h), and can reach temperatures approaching 30,000 °C, hot enough to fuse silica sand into glass channels known as fulgurites which are normally hollow and can extend some distance into the ground. There are some 16 million lightning storms in the world every year.

The complex **nuclear electromagnetic pulse** (NEMP) is usually described in terms of 3 components, and these 3 components have been defined as such by the international standards commission called the International Electrotechnical Commission (IEC). The 3 components of NEMP, as defined by the IEC, are called **E1**, **E2** and **E3**.

The **E1** pulse is the very fast component of NEMP. The **E1** component has an intense electric field that can quickly induce very high voltages in electrical conductors. **E1** is the component that can destroy computers and communications equipment and is too fast for ordinary lightning protectors. The **E1** component is produced when gamma radiation from the nuclear detonation knocks electrons out of the atoms in the upper atmosphere. The electrons travel in a generally downward direction at relativistic speeds (more than 90 percent of the speed of light). This essentially produces a large pulse of electrical current vertically in the upper atmosphere over the entire affected area. This electrical current is acted upon by the Earth's magnetic field to produce a very large, but very brief, electromagnetic pulse over the affected area.

The **E2** component of the pulse has many similarities to the electromagnetic pulses produced by lightning. Because of the similarities to lightning-caused pulses and the widespread use of lightning protection technology, the **E2** pulse is generally considered to be the easiest to protect against.

The **E3** component of the pulse is a very slow pulse, lasting tens to hundreds of seconds, that is caused by the nuclear detonation heaving the Earth's magnetic field out of the way, followed by the restoration of the magnetic field to its natural place. The **E3** component has similarities to a geomagnetic storm. Like a geomagnetic storm, **E3** can produce geomagnetically induced currents in long electrical conductors, which can then damage components such as power line transformers.

High-Power Microwaves (HPM) are characterized by electromagnetic energy with wavelengths as small as centimeters or millimeters, and can be used at moderate power levels for radio frequency communications or for radar. High-power microwaves can be created as an instantaneous electromagnetic pulse, for example, when a powerful chemical detonation is transformed through a special coil device, called a flux compression generator, into an intense electromagnetic field. Other methods can also be used to create a reusable HPM weapon, such as combining reactive chemicals or using powerful batteries and capacitors to create EMP. HPM energy can be focused using a specially-shaped antenna, or emitter, to produce effects similar to HEMP within a confined area, or over a limited distance. Unlike HEMP, however, HPM radiation uses shorter wave forms at higher-frequencies which make it highly effective against electronic equipment and more difficult to harden against. A mechanically simple, suitcase-sized device, using a chemical explosive and special focusing antenna, might theoretically produce a one-time, instantaneous HPM shockwave that could disrupt many computers within a 1-mile range. Also, HPM energy at higher power levels (megawatts), and powered for a longer time interval, reportedly could cause physical harm to persons near the source emitter, or possibly in the path of a narrowly focused energy beam.

High Intensity Radiated Field (HIRF) is radio frequency energy to cause damage to unprotected electronic circuits and potentially injure bio-organisms. Radio-Frequency Energy is non-ionizing electromagnetic radiation. Effects on tissue are through heating. Electronic

components are affected via rectification of the RF and a corresponding shift in the bias points of the components in the field.

Hazards of Electromagnetic Radiation to Ordnance (HERO) - the high intensity radio frequency (RFR) fields produced by modern radio and radar transmitting equipment can cause sensitive electroexplosive devices (EEDs) contained in ordnance systems to actuate prematurely. The Hazards of Electromagnetic Radiation to Ordnance (HERO) problem was first recognized in 1958. The prime factors causing the problem have been increasing ever since. The use of EEDs in ordnance systems has become essential. At the same time, the power output and frequency ranges of radio and radar transmitting equipment have also increased. RFR energy may enter an ordnance item through a hole or crack in its skin or through firing leads, wires, and so on. In general, ordnance systems that are susceptible to RFR energy are most susceptible during assembly, disassembly, loading, unloading, and handling in RFR electromagnetic fields. The most likely results of premature actuation are propellant ignition or reduction of reliability by dudding. Where out-of-line Safety and Arming (S + A) devices are used; the actuation of EEDs may be undetectable unless the item is disassembled. If the item does not contain an S + A device, or if RFR energy bypasses the S + A device, the warhead may detonate