

National Defence against Intentional Electromagnetic Interferences

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Two models were to be discussed namely the Risk and the Business model. However, due to the time constraint the latter was not taken into the discussion. Firstly, taken into discussion was the lightning phenomena. Lightning is a natural unintentionally electromagnetic source. The lightning causes an approximate 50 V to 100 V induced voltage between few hundred meters. This leads to the destruction of electronic equipment and components.

Though lightning provides unintentional natural electromagnetic interferences the voltage dips caused by plugging and operating motors in households will contribute to the electromagnetic interferences in other equipment. The television screen having it's images distorted whilst the blender is operational is a classic example which many households faced during the latter part of the 20th century. Most fuel stations prohibit customers to use their mobile phones while getting their vehicle pumped. Electromagnetic radiation emitted from the mobile phone can trigger a micro voltage arc with the ionized particles of the fuel causing severe fire risk. Though a possibility of such hazard prevails there are not much quantitative research on the topic. The

mentioned falls under unintentional artificial electromagnetic interferences. These artificial unintentional electromagnetic interferences can be armed into intentional EMPs. A terrorist mounting an EMP emitter in his/her vehicle and activating it in a fuel station could result in a catastrophic incident. Since modern world practices such as the bank industry and the administrative services are based on electronic modes of communication, they can be collapsed due to intentional electromagnetic interferences. The danger

poses in electromagnetic terrorism is that the infiltrator could come to the target until he/she is successful without rising any alarms. By intentionally electromagnetic interference, a skilled person can generate and direct an intentional electromagnetic signal, not only to a remote-control system but also to a wire control system does interfering with the controlling mechanism of the system. Further, the worst case is that the intruder taking over the control of the system in addition to the Intentional Electromagnetic Interference (IEMI). Therefore, mal operation standstill, or even destruction of equipment through IEMI to disrupt the civil society is a commonly known as electromagnetic terrorism or intentional electromagnetic interference.

The textbook definition of IEMI, is intentional malicious generation of electromagnetic energy introducing noise or signals into electrical and electronic systems, thus disrupting, confusing or damaging these systems for terrorist, criminal and industrial sabotage purposes. It was further explained by stating that electromagnetic emission that may cause an incident field, which exceeds 100 V/m, corresponding to a plane-wave free-space power density of 26.5 W/m², is treated as a high power environment where the exposed electrical equipment may encounter a range of issues from temporary signal losses to permanent hardware damage.

When discussing about the risk involved an electromagnetic emitter can be mounted to a vehicle and can be brought near a power line. By illuminating the emitter, it can totally collapse the power grid leading to a regional brown out due to the induced voltage impulse. Further, it will also cause permanent damage to other ancillary services such as communications lines too.

Terrorists, criminals, careless and stubborn people and maniacs are some who could use electromagnetic weaponry. Terrorists attack enemy target to achieve military and political gains, public services to disrupt the normal civilian life and make chaos among the people is common. Criminals may use electromagnetic weapons for personnel rivalries, gang warfare, mafia type attacks, etc. robberies, attacking locks security and alarm systems communication systems, etc. frauds illegal interfering with computer systems for accessing financial statements

secret documents, passwords, etc. The later is more defined in cyber security aspects.

The careless and stubborn people is a person who simply forgets or refuses to turn off a cellular phone or laptop computer radio, or any signal imaging device at critical places becomes a potential terrorist, even if he does not realize that. Therefore, it is essential to educate the public that even normal citizen can be a terrorist who kills hundreds of people due to the carelessness and stubbornness.

The maniacs are ordinary people who have psychological imbalances and instability momentary. Therefore, persons with high knowledge in electromagnetism can destruct, destroy, or even sabotage systems, without any reason, without any particular reason just because they are mentally unstable.

There are numerous sabotaging devices reported recently. A very simple and cheap device can be designed with the microwave oven if one is skillful. Then an electromagnetic weapon can be created. A small inflatable umbrella antenna would give the device an effective 30 dB gain thus it can generate a field of 500 V to 1000 V per meter at a 10 m distance. This is strong enough to up-set most electronics used in banking, security, military, medical and public service control operations.

Impulse generators like TITAN Spectro Super Realtron can be bought from the shelves Ukraine, or most of the former Soviet Union countries. Many other extremely powerful impulse generators like for 400,000 V, Russian RADAN, and there

are several others can be bought in the similar manner.

Nowadays, telecommunication towers too can be used as an amplifier to for electromagnetic impulses.

Firstly, are the weak noises such as blenders and most household electrical equipment. These have taken better electromagnetic compatibility measures at the manufacturing stage, compared to 10 years or 15 years ago. Though there are much equipment in this range they are momentary and does not affect the system that much. Next is the RF jammers which is used by police and military. Thirdly are the ultra-wideband emitters, which can disrupt up to some extent, however, when ascended to narrow band, and high-power electromagnetic emitters the damage level increases as well. Finally, the top of the pyramid, are the high-power electromagnetic pulses which are usually generated by exploding nuclear weapons at high altitudes, so it can illuminate a very large area at ground level.

In the latter part of the last century many incidents have been reported. However, in 2004 and 2005 most developed countries blanketed this information from the public as the risk took a crescendo.

In today's world the normal electromagnetic generators can be mounted in drones and fly over critical installations, destroying the electronics. As far as the military is concerned aviation is at the risk of being attacked by IEMI. A landing aircraft would typically be at the height of 100 m at 2 km from the edge of the runway. Therefore, an

adjacent road having normal traffic can impose this threat. An electromagnetic field can be generated by mounting a radiator of reasonable size in the order of few hundred thousand of volts per meter if the source is HPM and few thousand volts per meter if it is UWB. In case the aircraft is not compatible enough to withstand such radiation level, the internal electronic network may fibrillate resulting the collapse of the aircraft. Further consequences will be severed if such happens to the control tower of the airport.

In the present context, an even graver scenario is the illumination of vulnerable positions at ground level with HPM or UWB by a low flying light enemy aircraft or drone. Such an aircraft or drone may carry a sizable radiator and kill many electronics without arousing much alarm in the neighborhood. An air mission that destroys security and alarm systems together with a synchronized ground mission may result a damaged beyond repair to the nation. The main emphasis which needs to be considered is that the attacker can attack multiple times without the victim knowing.

When Germany introduced antilock braking system there was a problem as it interfered with the radio transmitter nearby. It is conclusive that the speeding vehicles can be stopped via electromagnetic interferences.

The effects of the GHz range RF on living beings are available, up to some extent in documented literature in public domain, but such information is not available on the human effect.

A military academia combined research taskforce should be employed to investigate the vulnerability of vital electronic and electrical system to an electromagnetic attack. Consequently, systems should be strengthened in order to withstand a possible undesired electromagnetic illumination. In addition, detectors can be developed, improved or improvised at national level and installed at vital places, which emit warning signals of possible electromagnetic attacks. A team should be appointed to investigate the probability of electromagnetic intrusion to the control systems of public services and be ready to take measures before intolerable threats surface out. The government should also take precautions to protect computer data and software of legal and political importance, which may be prime targets of state terrorists and criminals.

Finally, it is proposed to the KDU in coordination with the Minister of Defense to assign a task force to formulate a mechanism to develop R&D and industry related to IEMI and EMC in Sri Lanka. Further, a task force is to liaise with countries that are in the forefront of research and industrial advancements in the field. The Sri Lanka standard institution is recommended to become at least an O-member at IEC TC 77 that works on electromagnetic compatibility and participates especially at TC 77C. If such regulations and guidelines are in motion it could pave the way to a sound business model that could attract sizable foreign income.