

## Electromagnetic Pollution

**Article by: Dr. Ahilan Kanagasundaram, Senior Lecturer, Department of Electrical & Electronic Engineering, Faculty of Engineering, University of Jaffna**

In recent times, the level of electromagnetic pollution is increasing due to technological advances. Radio and TV broadcasting towers, cellular towers, microwave transmission links, Bluetooth devices, WiFi routers and Electronic devices such as smartphones, tablets, microwave ovens act as an electromagnetic pollution sources. Since the usage of electromagnetic pollution sources is increased, the health concerns have also been raised. Electromagnetic field above certain level may cause biological effects on human body and it may lead to health implications. In response to this concern, several organizations including World Health Organization, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), British Health Protection Agency, International Agency for Research on Cancer have been studying the health effects of electromagnetic pollution for last two decades. This article studies how electromagnetic pollutions are increasing due to technological advances.

The electromagnetic radiation spreads out the energy as it goes. Electromagnetic pollution level is determined by the frequency and intensity of electromagnetic fields. Electromagnetic spectrum spans a range of wavelengths and frequencies, and it can be divided into a number of regions: (1) radio waves, (2) microwaves, (3) infrared (IR), visible light, ultraviolet (UV), X-rays and gamma rays.

Radio waves are up to 3 GHz and radio frequencies are used in mobile base transceiver station, wireless LAN, radio and television, mobile phones, tablets and computers. Bluetooth uses 2.45 GHz. 2.4 GHz and 5 GHz frequencies are used for WIFI. Microwave have frequencies from 3 GHz to 300 GHz. It's used for high bandwidth point to point transmission, radar communication and 5G. Microwave ovens operates at the frequency of 2.45GHz and microwave ovens are limited to 5mW/cm<sup>2</sup> at approximately 2 inches from the oven surface. Visible light comes in a range of around 430THz to 770THz and frequency range of x-rays and gamma rays are very high.

Telecommunications Regulatory Commission of Sri Lanka (TRCL) approves the frequency allocations. In Sri Lanka, 900MHz and 1800MHz are being used for 2G mobile communications and 2100MHz is used for 3G mobile communication, 1800MHz and 2300MHz are used for 4G mobile communication.

The 5G technology is evolved from previous generation of 3G and 4G technologies. The 5G network frequency band comes in two sets. Frequency range 1 (or sub-6 GHz) is from 450 MHz to 6 GHz and frequency range 2 (or mmWave) is from 24.25 GHz to 52.6 GHz.

The microwave link uses up to 80 GHz for point-to-point communication. Service providers are using higher frequency for high capacity links and high power is transmitted for long distance communications as the power of electromagnetic radiation goes down at increasing rate with the distance. The point-to-point microwave links are producing higher electromagnetic pollution as high frequency is used and higher power is transmitted.

For all radio and microwave frequencies (0 to 300 GHz), maximum power levels are designed to avoid any adverse health effects. International Commission on Non-Ionizing Radiation Protection (ICNIRP) has released new guidelines on limiting electromagnetic fields in the rage of 100 kHz to 300 GHz in 2020. The guidelines cover many applications including 5G technologies.

In Sri Lanka, TRCSL has adapted the ICNIRP guidelines on limiting electromagnetic radiation. Telecommunication service providers should make sure that power density of electromagnetic waves are within the limits as defined by ICNIRP guideline.

The frequencies of radio and microwave are much lower than ionizing radiation such as x-ray and gamma ray and the transmitting power is also limited by regulation bodies. Therefore, they don't have

enough energy to break molecular bonds or ionizing of atoms in the human body. There is no conclusive evidence yet to suggest that electromagnetic radiation causes adverse health effects including cancer, electro hypersensitivity, and infertility. However, the heating effect occurs from 100 kHz onward. Studies on the effects of non-ionizing radiation are being conducted, indicate mixed results and it make take a while to clearly understand its health consequences and develop appropriate guidelines and standards. It would be prudent to develop innovative solutions to cut down unnecessary exposure while ensuring the technological benefits. Such solutions would be attractive to both Telecommunication service providers and users.

#### **Disclaimer**

**This article was prepared on behalf of the Young Scientists Forum (YSF) of National Science and Technology Commission (NASTEC). NASTEC-YSF gives the younger scientists in Sri Lanka a platform to independently voice their opinion on science and technology that could enrich the decision-making processes at NASTEC.**

**This disclaimer is therefore to inform readers that the views, thoughts, and opinions expressed in the article belong solely to the author, and not necessarily to the NASTEC.**