

Electromagnetic Radiation and Public Health

The electromagnetic energy/radiation (EMR) consists of waves of electric and magnetic energy which are simultaneously propagated in free space. In the 20th century, exposure to artificial sources of EMR has increased rapidly, due to the demands for electricity and the development of wireless technology.

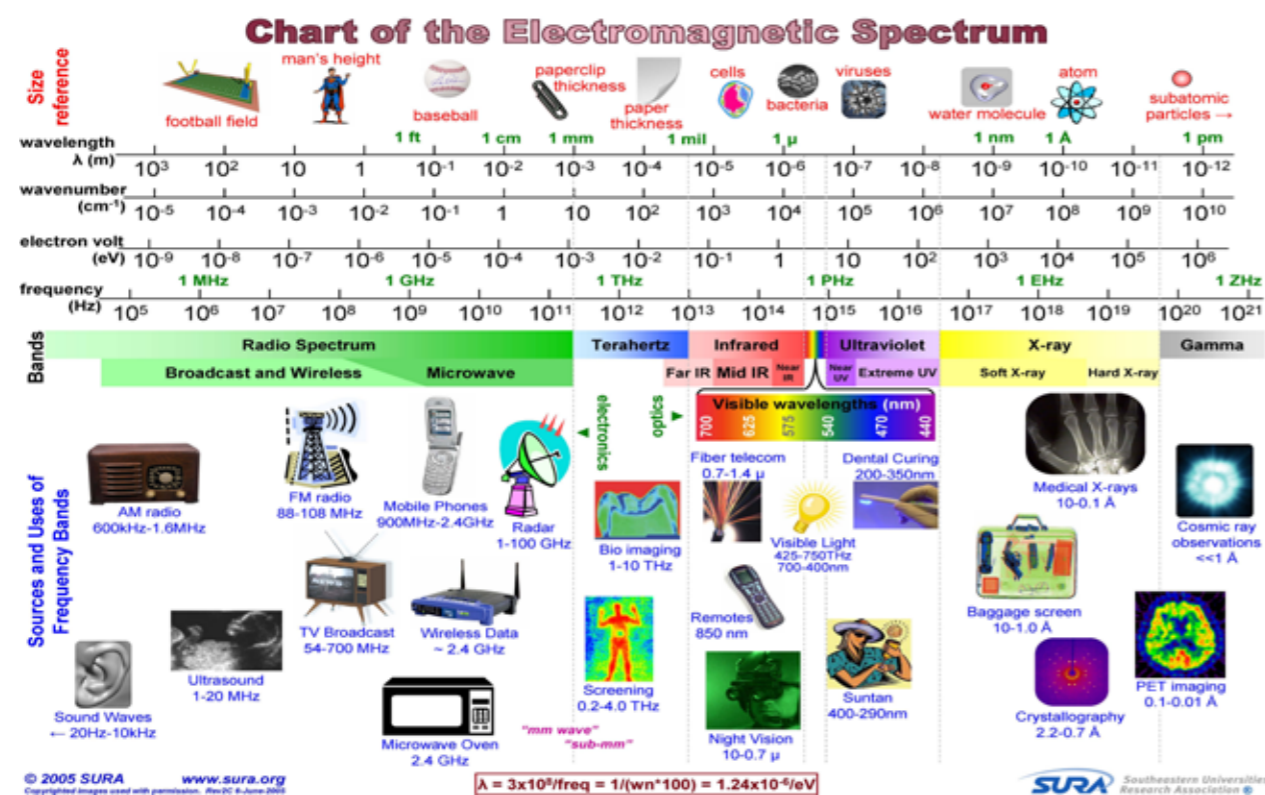


Figure 1: Electromagnetic Spectrum

In general, the EM spectrum (Figure 1) can be classified into static and low frequency fields (transmission line, domestic electronic appliances, computers) and high frequency fields or radio waves (radars, radio and television broadcast installations, mobile phones, mobile communications base stations, anti-theft systems). The most important use of radio waves is in telecommunications.

Radio waves belong to the category of non-ionizing radiation. The most important biological effect of radio waves is the increase of temperature of tissues when exposed to radio

waves. Radiation is partly absorbed and penetrates the body at only a small depth.

The unit used for the measurement of radio waves quantity absorbed by the body is called Specific Absorption Rate-SAR. It is presented in Watts/kilogram (W/kg) or milliwatts/gram (mW/g).

Scientific studies have reached the conclusion that exposure to radio waves has no harmful effects in health. To this day, no studies have verified the causality between this type of radiation and cancer.

However, this technology is very recently discovered and therefore no possible long-term effects can be ruled out.

Protection Limits against EMR

The International Commission on Non-Ionizing Radiation Protection-ICNIRP evaluates scientific results in the fields of epidemiology, medicine, biology, physics and mechanics from all over the world and announces guidelines with limits for safe exposure to radiation. These limits are subject to periodic review and

are acknowledged by the World Health Organisation (WHO). The most recent guidelines by ICNIRP were published in 1998 and adopted by CENELEC (Comité Européen de Normalisation Electrotechnique) and the European Council.

In Greece, the legislation regarding protection of the public against non-ionizing radiation is the Joint Ministerial Decision 53571/3839, (Government Gazette 1105/B/06-09-2000), "Measures to protect the public from the operation of land-based antennas", and L. 3431/2006, (Government Gazette 13/A/3-2-2006), on "Electronic Communications and other provisions", Article 31.

According to L.3431/2006, there must be no accessible areas surrounding each antenna installation which transmits EMR where the levels of exposure exceed 70% of the ICNIRP limits. Moreover, in the case of an antenna installation at a distance less than 300 meters from the perimeter of nursery buildings, schools, care homes and hospitals, the levels of public exposure must not exceed 60% of the ICNIRP limits.

The Greek Atomic Energy Commission is the competent body for monitoring EMR exposure limits for the public. Radiation measurements are carried out by the Greek Atomic Energy Commission or by bodies which have been authorised by the commission.

Exposure to Base Stations Radiation

The fixed antennas used for wireless communications are called mobile communications base stations (BS) and are usually installed on multi-storey buildings or pillars.

For the provision of mobile telephony services, an area is divided into smaller geographical areas, the "cells". The BS is installed in the appropriate position within the cell ensuring full coverage thereof.

The cells for GSM BSs have a maximum range of 1-10 km in agricultural areas and a few hundred

meters in urban areas. Uninterrupted communication of a mobile phone user on the move is achieved by the successive communication of the user with the BSs along his path.

In case the BSs are installed at greater distances, network coverage is not satisfactory and there is a possibility of call interruption. Every BS can serve up to a certain maximum amount of calls. Therefore, increase of number of users results to the need for increasing the number of BSs.

Exposure to Mobile Phone Radiation

Mobile phones are low power, radio wave transponders, which with the help of the appropriate built-in antenna and electronic equipment turn voice and digital data into radio waves and vice versa. When someone makes a call from his mobile phone, the phone transmits radio waves that are propagated into the air until they reach the closest BS. The BS forwards the call to another BS and finally the call is sent through the mobile telephony network to the BS located close to the user who is being called. Then, the last BS sends radio waves which are received by the mobile phone of the user receiving the call and the waves are again converted into sound (voice).

The average power of transmission of mobile phones is low, i.e. 0.5W or lower. Moreover, mobile phones adjust their power to the lower level permitted for reliable communication with the BS. In general, the closer the mobile phone user is to the BS, the lower the frequency transmitted by the mobile phone and the SAR value caused by the device on the user's head is reduced.

Therefore, a densification of the mobile telephony BS network results to a reduction of the power that is transmitted from mobile phones.

ICNIRP has established the SAR limits produced to the head by mobile phones to 2 W/kg per 10 gr. mass of contiguous tissue in the head for a period of 6 minutes.

Any device on sale in the European Union that complies with the limits that have been set out bears the CE sign. The device operating manual contains the SAR limits.

Sensitive Groups

Children are a particularly sensitive group since their heads and skulls are smaller, their nervous system is still developing and they are estimated to inevitably have a longer-term exposure compared to an adult.

Moreover, increased sensitivity may also be due to the presence of implanted medical devices (orthopaedic metal devices, metal heart valves, implanted systems for medication administration). For heart pacemakers, the most important problem results from the EM interference phenomenon. People with pacemakers must hold the mobile phone, even when it is on stand by mode, at a distance of at least 15 cm from the pacemaker.

Protective Measures

Here are some precautionary that mobile phone users can apply:

- > Use the mobile phone in areas where the signal quality is satisfactory and not in closed spaces (lifts, basements, metro, car, etc.).
- > Use of hands-free equipment (hands free, bluetooth).
- > Short calls.
- > Use of fixed phones wherever possible or use of the SMS service instead of a call.
- > You must discourage children from using mobile phones.

In this framework EETT has proceeded with issuing two informative leaflets on "Electromagnetic Radiation and Mobile telephony - The Scientific Data" and "Mobile phones and mobile telephony antennas - What we should know". These leaflets are available online at EETT's website (http://www.eett.gr/opencms/sites/EETT/Publications/Informative_Documentation).