



Non-ionizing electromagnetic radiation: state of play

military-Earth thinking notebook

Le Chef de bataillon Clara VAHRAMIAN

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In an environment where the effects of cumulative electromagnetic radiation are unknown, where mobile or WiFi data traffic is growing at an increasing rate, the need to protect the environment from the effects of electromagnetic radiation is becoming increasingly important. Battalion Commander Clara Vahramian believes that the responsibility for prevention lies not only with manufacturers and telecommunications companies, but also with users.

Every day 2.5 billion GB (Gigabytes) of data are generated worldwide, nearly two-thirds of which will transit via WiFi or mobile. However, the current trend in Western countries is to "hunt" for electromagnetic waves; in other words, the connected citizen would like to enjoy digital facilities without suffering from electromagnetic pollution.

We are talking here about the microwave range from 100 Mhz to 300 Ghz, the so-called non-ionising frequencies, abbreviated as NIR.

Although manufacturers and Internet service providers (ISPs) are subject to national or European health standards, no scientific body is to date able to assess the potential nuisance caused by the multiplication of emission sources, a veritable breeding ground in which we live daily.

It is therefore up to the connected citizen to adopt responsible behaviour, likely to keep him away from risks that are still difficult to define.

Reminder of health issues

- Electromagnetic wave behaviour

Up to 100 Mhz, the human body is relatively transparent, it is traversed by radiation. But

above 100 Mhz, part of the radiation is absorbed,

first below the epidermis, then more and more superficially, concentrated on thinner and thinner layers of tissue.

The frequencies used in mobile telephony, from 700 to 3,500 Mhz, are exactly part of these so-called penetrating frequencies.

Above 300 Ghz, the (infra-red) waves no longer pass through the human body and are no longer absorbed.

See the diagram of ionization as a function of frequencies at the end of the article.

- Effects on the human body

Thermaleffects (high exposure cases)

Between 100 Mhz and 300 Ghz, there is generalized heat stress of the body and excessive localized heating of the tissues.

These effects are even greater when the body or a part of the body acts as an antenna, i.e. for a length $L = \lambda/4$ with λ being a given wavelength. In this case, the body or part of the body acts as a resonator.

For example, the 700 Mhz band, gives a wavelength $\lambda = \text{speed/frequency} = 42 \text{ cm}$. Let $\lambda/4 = 11 \text{ cm}$ as the best resonator. It is for example the size of the gall bladder, an organ particularly sensitive to NIR because it is poorly irrigated and therefore unsuitable for thermoregulation.

Thermal effects become deleterious if the body temperature rises by one to two degrees. The effects are numerous; among them are severe alterations in neurological, hematological and reproductive functions.

At 43°C, the body suffers irreversible damage. This corresponds to an exposure of 150 W/kg.

- Athermal effects

These effects occur at low levels of exposure, that is, at the levels to which we are continually exposed. They are difficult to study and there is not enough hindsight to assess their consequences over a human lifetime. Yet some studies have shown a change in blood formulation in rats exposed to low levels of emissions over a prolonged period of time. More generally, the WHO classifies microwaves as "possibly carcinogenic".

Actions taken by manufacturers and public authorities

- Manufacturers motivated by economic interests

Motivated by substantial energy savings, telephone operators are seeking to limit the transmission power of their cell phones and GSM antennas as much as possible. The less

the device emits, the less energy it consumes, the greater its autonomy will be.

The Specific Absorption Rate (SAR) is the energy absorbed by an individual in the immediate vicinity of a radiating device. It is limited by the European Community to 2 W/kg head/trunk, but it is becoming a selling point for certain brands of smartphones, which are able to restrict it to 0.25 W/kg.

Moreover, some uninformed citizens wrongly complain about the multiplication of GSM antennas. On the contrary, this densification makes it possible to reduce the power of the antenna.

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