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## **Microwave radiation levels and effects on humans at 1000MHz Michael Peleg**

This document summarizes various effects of radio transmissions (that is, non-ionizing radiation) on humans known to me. It is focused on the frequency of 1000MHz and on the associated radiation levels.

### **ICNIRP Occupational threshold, 2500 microwatts/cm<sup>2</sup>**

This threshold is derived from the levels causing estimated rise in body temperature of 1°C reduced by a factor of 2 to 10 accounting for high environmental temperatures, physical activity, non-uniformity of heating and similar, see the ICNIRP document, reference [2], particularly the sections "Summary of biological effects and epidemiological studies (100 kHz–300 GHz)" and "GUIDELINES FOR LIMITING EMF EXPOSURE".

This is considered safe by the ICNIRP [2] provided the worker or soldier is exposed under known conditions and is trained to be aware of potential risk and to take appropriate precautions. The soldiers also should not use alcohol and drugs as mentioned in [2], section "Summary of biological effects and epidemiological studies (100 kHz–300 GHz)".

An average temperature rise of more than 1°C is considered by the ICNIRP harmful and capable of causing a serious and irreversible damage. The dangerous exposure time is related to human thermal time constants (minutes) and maybe shorter for eyes and similar. The time to irreversible damage is of course much shorter than that if the radiation level is much higher than the above limit.

### **ICNIRP General public threshold, 500 microwatts/cm<sup>2</sup>**

This limit is reduced by a factor of 5 relative to the occupational limit. This reduction is explained in [2] by the subject being unaware of the risks and so not careful avoiding the danger. Also danger factors related to some health problems, alcohol consumption, use of some medicines and age are stated in [2], section "GUIDELINES FOR LIMITING EMF EXPOSURE" as a reason. I think the public would riot if its temperature would be risen by the authorities by 1°C, workers and soldiers are more manageable.

## **Carcinogenic (Cancer-Causing) influence, indicated at 5 to 10 microwatts/cm<sup>2</sup> (about 6 volt/meter) and above**

Carcinogenic effects are identified in the scientific literature. Hardell et. al., see reference [3], present an about 3 fold rise in risk of head tumors after 10 years of using cell phones based on an epidemiological research. Many (tens to hundreds) of other earlier published scientific articles point to carcinogenic effects of non-ionizing radiation based on human epidemiological studies, animal experiments, DNA damage in cells and other. The results raise heavy suspicion of carcinogenic effects, although they are not considered an absolute and rigorous proof.

The Israeli Mevaker Ha-Medina report, reference [1], presents hundreds of not sufficiently investigated cancer cases in the IDF suspected as caused by non-ionizing radiation.

Five cancer cases among young workers in the Rafael Antenna Ranges facility happened from 1982 to 1995, exhibiting very high statistical significance and very high personal risk, see the expert opinion [4]. Probably additional cases occurred there since then. Many similar cases occurred in the IDF, were characterized by very high percentage of cancer cases in highly exposed groups of soldiers and were reported in the Israeli press.

## **Other non-thermal effects, 1 microwatt/cm<sup>2</sup> and above**

Other effects on humans were reported.

## **Israeli Ministry of Environmental Protection Directive, about 50 microwatts/cm<sup>2</sup>**

This directive results from applying the precaution principle because of concerns about the non-thermal effects. It is used in Israel mainly to limit human exposure from cellular phone base-stations.

## **Swiss and Italian radiation safety directives, 2 to 10 microwatts/cm<sup>2</sup> at 1000 MHz**

These countries and others care about their citizens more than we do.

## **Typical exposure in Tel Aviv from cell phone base-stations, about 1 microwatts/cm<sup>2</sup> at 1000 MHz**

This explains why cell phones operate so well in Switzerland despite the stringent Swiss limits on radiation.

## **Public protest, Demonstrations, Antenna Burning and loss of value of houses in Israel. About 5 to 50 microwatts/cm<sup>2</sup> at 1000 MHz**

This indicates clearly what the Israelis think about radiation risks and highlights the immorality of exposing unknowing and/or helpless soldiers to levels higher than 10 microwatts/cm<sup>2</sup> (about 6 volt/meter).

### **Other frequencies and special waveforms**

ICNIRP guidelines permit much higher radiation power density levels in the following scenarios:

1. Lower frequency. The reason cited by ICNIRP is that the energy passes thru the human body without warming it.
2. Higher frequency. The reason cited by ICNIRP is that the energy is partly reflected from the surface layers of the human body without warming it.
3. Low duty cycles. The reason cited by ICNIRP is that the average warming of the body is lowered by the duty cycle, so very high peak power of radar pulses is permitted.

The above upward adjustments of the permitted exposure, while valid from the thermal perspective, should be not applied when considering the non-thermal effects, such as cancer, since they have no justification except for the thermal one.

### **References**

[1] Israeli state comptroller annual report 52A, 2001,  
הדו"ח השנתי של מבקר המדינה 52א לשנת 2001, פרק "הטיפול בסיכוני קרינה אלקטרומגנטית בלתי מייננת בצה"ל".

[2] *ICNIRP Guidelines*  
GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHz)  
International Commission on Non-Ionizing Radiation Protection, 1998

[3] Lennart Hardell , Michael Carlberg and Hansson Mild: "Pooled analysis of two case-control studies on use of cellular and cordless telephones and the risk for malignant brain tumours diagnosed in 1997-2003" Springer-Verlag 2006, Int Arch Occup Environ Health (2006)

[4] Expert opinion by Elihu D Richter MD, MPH, Sr Lecturer and Head, Unit of Occupational and Environmental Medicine, Hebrew University-School of Public Health and Community Medicine, Oct 20 2002