NEW TECHNOLOGIES AND HEALTH: WHICH PROTECTION IN AN EVER-CHANGING SCENARIO?

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ICNIRP Guideline

GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC, AND ELECTROMAGNETIC FIELDS (UP TO 300 GHZ)

www.icnirp.org
ICNIRP Statement

GENERAL APPROACH TO PROTECTION AGAINST NON-IONIZING RADIATION

www.icnirp.org
STEPS IN THE DEVELOPMENT OF GUIDELINES

- Critical review of the literature
- Identification of health and biological effects relevant for health
- Identification of the critical effect
- Establishment of basic restrictions
- Derivation of reference levels
Any single observation or study may indicate the possibility of a health risk related to a specific exposure.

However, risk assessment requires information:

- From studies that meet **quality criteria**
- From the **totality** of science
The evaluation process used by ICNIRP consists of three steps:

- Evaluating single studies in terms of their relevance
- Reviewing all the information for each health effect
- Combining the outcomes into an overall evaluation
A decision must be made whether the available evidence allows the identification of an exposure hazard, i.e. an adverse health effect that is caused by an NIR exposure.

By this identification, the effect becomes “established”.

Science-based exposure limits are set with regard to established effects.
SEQUENCE OF ACTIONS

- Identification of gaps and research agenda: WHO
- Syntesis of overall knowledge: ICNIRP
- Evaluation of carcinogenicity: IARC
- Overall evaluation of health hazard: WHO-ICNIRP
- Revision of standards: ICNIRP
SETTING LIMITS FOR THRESHOLD EFFECTS

- Established health effects
- Reduction factor
- “Safe” exposure

Threshold of effects
Exposure limit

Exposure level
REVISION OF ICNIRP GUIDELINES

• Static magnetic fields 2009
• ELF electric and magnetic fields 2009
• Radiofrequency and microwaves 2012 (?)
WHY TO REVISE A STANDARD?

- New scientific evidence (new effects, changes in thresholds, refinement of dosimetry)
- Outdated research database
- New technologies (frequency, signal profile, source characteristics, exposure modalities)
Exposure to radiofrequency radiation emitted from low power devices, such as citizen's band radios, land mobile and marine transmitters, and walkie-talkies, can be excluded from consideration in assessing compliance with the prescribed limits provided the radiofrequency output power of the device is 7 W or less. Such devices generate only very localized fields.

*ICNIRP Guidelines, 1988*

The clause was eliminated in the 1998 revision of the guidelines.
THE EXCLUSION REVISED

Both calculations and experimental studies in tissue-equivalent phantoms have revealed that the existing basic limits may be significantly exceeded when using a portable radio or radiotelephone emitting 7 W.

ICNIRP 1996
ICNIRP ON NEW TECHNOLOGIES

ICNIRP STATEMENT ON EMF-EMITTING NEW TECHNOLOGIES

The International Commission on Non-Ionizing Radiation Protection*

INTRODUCTION

Recent developments in telecommunication and wireless technology have led to increasing numbers of new devices and systems that emit radio frequency (RF) electromagnetic (EM) energy. Implementing these developments has resulted in large numbers of individuals in the workplace or in the general public being exposed to RF-EMF.

The guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP 1998) provide advice for permissible exposure levels that cover the entire spectrum of non ionizing radiation (NIR), including the RFs used in new technologies. However, there are questions being posed about health effects associated with exposure to these new systems and devices which have not been tested per se in terms of health risks. They may have signal characteristics that are unique, still different from the currently used technologies, and they may also cause the total level of exposure to rise because of the superposition of electromagnetic fields (EMFs) emitted by new and existing sources.

The aim of this Statement is to compile a list of the new technologies under development, soon-to-be or recently deployed, which could lead to increased levels of exposure to NIR at the workplace or in daily life, and to assess the need for further research to evaluate their NIR safety and health implications. However, the technologies that are included in this Statement are not limited to mobile or wireless communication; they encompass all EMF-emitting devices. Given the technological, regulatory, and marketing challenges, the timing of the introduction or deployment of any of the products is somewhat uncertain. It should be noted that experience of the cellular-mobile telephone industry indicates that once the technology is deployed, the adoption rate could easily explode. While it takes advanced technology to develop a product, the availability of low-cost, high-quality, and high-performance components from around the world would push the price of the new product down through large-scale production. See the Appendix for a list of technical and organizational acronyms.

MOBILE COMMUNICATION AND WIRELESS TECHNOLOGIES

While the present document focuses on new mobile communication and wireless technologies, the motivation comes from the rapid growth of the cellular mobile telephone industry and the pervasive use of wireless devices in all walks of life. We will therefore begin with a brief discussion on the evolution of cellular mobile communication technologies, although the distinction among various generations of mobile communications is blurring. Note that a description of the earlier generations is omitted, especially for epidemiological studies of cell phone exposures.

Generations of Mobile Communications

1G systems

The first generation (1G) mobile telephones were analog systems—typically operating at 450 MHz using frequency modulation. The analog systems deployed in various parts of the world vary slightly different: namely, Nordic Mobile Telephone (NMT) mainly in the North European countries, American Mobile Phone Service (AMPS) in the U.S., and the Nippon Telephone and Telephone (NMT) system in Japan. The radiated powers of the 1G systems are typically 600 mw. At present, these services have either stopped or are running at a low level of traffic in most parts of the world. Apart from mobile handsets and base stations, analog systems are also used for cordless telephones. These 1G devices are important for the epidemiological studies of long-term exposure or any effect associated with long latency.

* ICNIRP, 2, K. G. Zanganger, Freiherr von Lande, 1, 87616 Würzburg, Germany. The former address of K. G. Zanganger has been changed to Zangangerstrasse 2, D-97074 Würzburg, Germany. Copyright © 2000 Health Physics Society. www.icnirp.org

IRPA 12
Buenos Aires, Argentina, 19-24 October 2008
Possible Health Risks to the General Public from the Use of Security and Similar Devices

Executive Summary of the Concerted Action QLK4-1999-01214
"Development of advice to the European Commission on the risk to health of the general public from the use of security and similar devices employing pulsed and continuous electromagnetic fields"
Fifth Framework Programme of the European Commission, Quality of Life, Key Action 4: "Environment and Health, Health impact of electromagnetic fields"

EU Concerted Action 2002

IRPA 12
Buenos Aires, Argentina, 19-24 October 2008
Exposure expected to be less than for 3G systems
ALARA FOR EMF?

Cost

Total Cost

Exposure Level

UNKNOWN

COUNTRY-DEPENDENT

Cost of Health Detriment

Social Cost

IRPA 12
Buenos Aires, Argentina, 19-24 October 2008
The time needed for a technology to be developed and spread out is much shorter than the time needed for research to investigate possible health effects. In the absence of specific data, the best use should be made of knowledge about other technologies.

To what extent can we extrapolate:
- from one frequency range to another?
- from one signal to another?
- from one source to a similar one?
- from one exposure condition to a different one?
### FAR-FIELD INDOOR EXPOSURE POWER DENSITY

<table>
<thead>
<tr>
<th>System</th>
<th>Maximum Power Density (W/m²)</th>
<th>Average Power Density (W/m²)</th>
<th>ICNIRP ref. devel (W/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM-900</td>
<td>0.082</td>
<td>0.026</td>
<td>4.5</td>
</tr>
<tr>
<td>GSM-1800</td>
<td>0.035</td>
<td>0.008</td>
<td>9.0</td>
</tr>
<tr>
<td>GSM-900+1800</td>
<td>0.101</td>
<td>0.034</td>
<td>6.3</td>
</tr>
<tr>
<td>Wi-Fi (2.4)</td>
<td>0.017</td>
<td>0.004</td>
<td>10</td>
</tr>
</tbody>
</table>

Values averaged over the volume of the whole body

*After J. Lin (ICNIRP Workshop, Prague 2008)*
## LOCAL EXPOSURE FROM A LAPTOP COMPUTER

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>$\varepsilon_r$ (S/m)</th>
<th>$\sigma$ (S/m)</th>
<th>10-g SAR (W/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.45</td>
<td>39.2</td>
<td>1.80</td>
<td>1.61</td>
</tr>
<tr>
<td>5.25</td>
<td>35.9</td>
<td>4.71</td>
<td>0.53</td>
</tr>
<tr>
<td>5.80</td>
<td>35.3</td>
<td>5.27</td>
<td>0.59</td>
</tr>
</tbody>
</table>

ICNIRP Limit: 2.0 W/kg

100 mW Wi-Fi patch antenna placed 10 mm below planar phantom

Kang and Gandhi, IEEE EMC 2004
FINAL CONSIDERATIONS

- Time for the development of new technologies is much shorter than time needed for an evaluation of its biological effects
- It is virtually impossible to carry out comprehensive research for each frequency, signal, and source
- Some research (e.g. epidemiology) is impossible without the technology in place
- The best use should be made of knowledge gained for similar situation
- Interim recommendations may be provided while research is in progress