

This **special issue** of the BERENIS newsletter contains a brief overview of the new guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP 2020), as well as a statement of the BERENIS expert group.

New ICNIRP guidelines for radiofrequency electromagnetic fields (ICNIRP 2020)

a) Derivation of the guidelines

In March 2020, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has published new guidelines (ICNIRP 2020). These guidelines cover the RF-EMF frequency range from 100 kHz to 300 GHz, replacing the corresponding sections of the 1998¹ and 2010² versions. In addition to currently used frequencies for 3G and 4G mobile phone, Wi-Fi and Bluetooth communication as well as DAB, the revised guidelines also cover the frequency range above 6 GHz, which will probably be used more intensively for mobile communications in the future. According to ICNIRP, the guidelines were developed on the basis of review reports on the topic, evaluations of individual studies, scientific workshops and an extensive public consultation process. For the development of the guidelines, ICNIRP considers effects being “harmful to human health and scientifically substantiated”.

The identification of the “adverse health effect threshold” was based on the relevant literature on thermal and non-thermal effects on biological systems. According to ICNIRP, only thermal effects meet the criteria for sufficient evidence of adverse health effects, and therefore, the threshold values were based on thermal mechanisms. In order to account for uncertainty, additional reduction factors were applied to determine the restriction values. For whole-body exposure of e.g. mobile phone base stations, the proposed restriction value for the specific absorption rate (SAR) is 50 times lower than the threshold for human health effects assumed by ICNIRP. For local exposure from devices used close to the body, such as mobile phones, the reduction factor is 10. For occupationally exposed individuals, the reduction factors are 10 and 2 for whole-body exposure and local exposure, respectively.

b) Comparison of the new and previous guidelines

The basic restrictions for whole-body exposure are still expressed as SAR and remain unchanged compared to the previous ICNIRP guidelines: 0.4 W/kg for occupational exposure and 0.08 W/kg for the general public. With regard to mobile communication frequencies, this corresponds to field strengths from 36 V/m (700 MHz) to 61 V/m (2 GHz). For frequencies of 2 GHz and above, the relevant measure is power flux density, which should not exceed 10 W/m². A modification in the new guidelines is that whole-body exposure is averaged over 30 minutes instead of 6 minutes, because new data show that steady-state conditions for whole-body exposure are reached after 30 minutes. Another modification is that occupational exposure of pregnant women should not exceed exposure of the general public to protect the foetus.

For local exposure, the SAR per 10 g of tissue remains 2 W/kg for the head and torso and 4 W/kg for the limbs, or an absorbed power flux density of 20 W/m² at frequencies above 6 GHz (averaged over 6 minutes). In addition, more detailed specifications are given for local exposure with regard to short exposure durations of less than 6 minutes, and with regard to exposure of small body regions of a few square centimetres (averaged over 4 cm² from 6 GHz to 30 GHz, and 1 cm² above 30 GHz). These more

¹ ICNIRP (1998): Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). International Commission on Non-Ionizing Radiation Protection. Health Phys 74:494–521.

² ICNIRP (2010): Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). International Commission on Non-Ionizing Radiation Protection. Health Phys 99:818–836.

precise specifications are important for the use of higher frequencies (above 6 GHz) to adequately protect the population.

c) Statement of BERENIS

- In principle, the new guidelines do not change the level of protection of the population. The more precise guidelines for short-term and small-area exposures above 6 GHz should be considered by Swiss legislation before such frequencies are used for mobile communication in the future.
- Although ICNIRP stated that there is no evidence for health effects below the RF-EMF exposure limit values, there are still some uncertainties in this respect. There is sufficient evidence that RF-EMF exposure of the brain in the range of 1-2 W/kg has measurable effects on the brain's electrical activity. Furthermore, in cell and animal studies, relatively consistent effects on oxidative stress and on cellular signalling pathways have been found also below the limit values, while it is not clear whether these effects are associated with long-term health consequences. On the other hand, epidemiological research regarding long-term whole-body exposure above 1 V/m is insufficient.
- In view of these uncertainties, BERENIS continues to recommend consequent application of the precautionary principle. In Switzerland, the precautionary principle for emissions from stationary transmitters (e.g. mobile phone base stations and radio transmitters) is specified by the "installation limit value" in the Ordinance on Protection against Non-Ionising Radiation (NISV). The radiation from mobile handsets (e.g. mobile phones) is not subject to the precautionary principle of the Swiss Environmental Protection Act. The highest exposures, up to 2 W/kg, result from the use of mobile and cordless phones near the body, and potentially other transmitters operating close to the body. For these local exposures, the reduction factor given in the ICNIRP guidelines is lower compared to whole-body exposure. Exposure should also be minimized in these situations.
- Notably, only few scientific studies are available to date with regard to the planned implementation of frequency bands above 6 GHz for mobile communications. Therefore, evaluations and statements about potential health effects in this frequency range include a high degree of uncertainty. EMF in this frequency range are absorbed on the surface of the body, and therefore, human health effects on skin and eyes can be considered most relevant. As these high frequency EMF are absorbed more effectively than the current mobile phone frequency bands³ by insects and other small animals, ecological impacts should receive more attention. These knowledge gaps should be reduced by research to help evaluate possible effects on health and the environment.

References

ICNIRP (2020): **Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz)**. International Commission on Non-Ionizing Radiation Protection. Health Phys 118(5):483-524.

³ Thielens A, Greco MK, Verloock L, Martens L, Joseph W (2020): Radio-Frequency Electromagnetic Field Exposure of Western Honey Bees. Sci Rep. 2020;10(1):461.

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Additional information:

[BERENIS - Swiss expert group on electromagnetic fields and non-ionising radiation](#)

[List of abbreviations \(pdf\)](#)