

January 7, 2009

**STATEMENT OF FINNISH RADIATION AND NUCLEAR SAFETY AUTHORITY (STUK)  
CONCERNING MOBILE PHONES AND HEALTH**

Mobiles phones became more common in the mid 1990s. The RF radiation exposure caused by the first NMT phones was multifold compared to that caused by the present mobile phone models. By the end of 1990s the GSM network was initiated and along with it the maximum radiation power emitted by the phones decreased to about one tenth of the early days. In addition, the modern mobile phones self-adjust their power as low as possible according to the operating situation so that the connection to the base station is maintained.

The increase in the use of mobile phones has also increased the need for information on the safety of mobile phones and base stations. Finns and the Finnish media have often expressed their request to STUK for more accurate information on health risks of mobile phones and the safety of the present radiation limits.

**What is mobile phone radiation?**

Mobile phones and base stations send radio-frequency waves. Radio waves are non-ionising radiation. Contrary to ionising radiation, radio waves do not have enough energy to break any chemical bonds, or cause damage to human genotype, the DNA-molecule. Thus, radio waves cannot this way cause cancer.

**Limit values**

The exposure to RF radiation is given as a SAR (specific absorption rate) value that describes the wattage of the radio waves absorbed by human body or a part of it. The SAR value absorbed by head and body must not exceed 2 watts per kilo, and by arms and legs 4 watts per kilo (W/kg), respectively.

The limit values are set by the Decree 294/2002 of the Ministry of Social Affairs and Health that controls the exposure of population to ionising radiation. The Decree came into force in Finland in May 2002 and it is based on the EU Council Recommendation made in 1999 and the guidelines of ICNIRP, the International Commission for Non-Ionising Radiation Protection, dated in 1998.

In case the SAR value emitted by a mobile phone is below the given limit value, 2 W/kg, the absorbed wattage from the radio waves elevates the temperature on the surface of brains at most 0,3 °C. This kind of increase in the temperature is not known to cause any health effects. The temperature of brains can vary by one degree in normal conditions and only an increase of five degrees starts to cause cell damage.

STUK supervises the SAR values of mobile phones with tests. According to these tests, the typical SAR value of a mobile phone is little less than 1 W/kg when operating at full power. The highest SAR value measured so far made for the GSM and UMTS mobile phones is about 1,4 W/kg. The maximum SAR value for the nowadays already obsolete NMT phones might have been even 5 W/kg. The technological evolution has thus developed mobile phones towards safer direction.

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### **Ratio of radiation emitted by mobiles phones and base stations**

The radiation exposure caused by base stations is negligible because the distance between the person and the base station antenna is long and the radiation, i.e. the radio waves, is not aimed at places with no restrictions for the public. A mobile phone operating at maximum power exposes its user to RF radiation that is at least a hundred times more powerful than that emitted by a base station.

The power of mobile phone is at highest in a weak transmitting field, e.g. in a basement, in a moving car or a train. In a strong field, the automatic power adjustment of the modern mobile phones (GSM and UMTS, i.e. 3G phones) reduces the emitting power at best down to one thousandth part of the maximum. When the base station network is dense, the phone always has a good connection to the base station and the phone user's exposure to mobile phone radiation is minimised.

### **Present knowledge on health effects of RF radiation**

The biological effects of radio waves have been studied for decades. The known direct health effects of RF radiation are due to absorption of energy from the radio waves into the body causing warming-up of tissues. Health hazards emerge if the human temperature regulation cannot eliminate the excess heat. RF exposures of this magnitude occur, however, only in exceptional working conditions, like in mast operations, radar mounting and industrial high-frequency heating.

The effects of mobile phone radiation have been examined, for example, using cell studies. It has been observed that the RF radiation emitted by a mobile phone can temporarily change the activity of certain proteins in cell cultures and also in the human skin. The observed biological changes do not however indicate a health risk.

At Turku University in Finland, among others, the scientists have made neuropsychological studies to determine whether mobile phone radiation could have an influence on e.g. memory and deduction. In these studies, they have not found any reproducible evidence that mobile phone radiation would have any cognitive influence.

When examining the exposure of children, the calculations demonstrate that a mobile phone held against the ear causes an exposure on the brain surface double of that for adults. The difference is due to children's thinner skull bone and more elastic earlobe. The exposure is however focused to such a small area that the warming-up of children's brain tissue is not any heavier than with adults.

Approximately 20 general population studies concerning the causal relation of possible tumour risk and mobile phone use have been carried out. On the grounds of the studies to date, it is not possible to make such a conclusion that mobile phones would cause a health risk. Nevertheless, certain analyses that combine several earlier studies have reported an increased risk of brain tumour in people who have used a mobile phone for a long time (more than ten years). These studies however involve uncertainties. One source of error is a memory illusion related to the fact that mobile phone use and call durations that took place many years ago are difficult to recall exactly.

Since it takes years to develop a cancer and mobile phones have been in common use only for about ten years, the possibility, that a link between mobile phone use and cancer might be found in later population studies, cannot be ruled out.

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The health risks of mobile phones are continuously studied. There are many ongoing research projects in STUK at the moment, too. In 2009 an extensive follow-up study is launched as a part of a joint international venture. In the study, the occurrence of head and neck tumours and pathologies of nervous system and brain blood circulation of mobile phone users is intended to be followed for several years.

### **International recommendations: WHO and ICNIRP**

The limit values the International Commission for Non-Ionising Radiation Protection, ICNIRP, sets are based on situations where the absorption of radiation into tissues is maximal. According to ICNIRP, the limit values include remarkable safety margins that protect all individuals, also including children.

The World Health Organization, WHO, has noted for its part in its assessment conclusions that the present scientific knowledge calls for no specific precautions concerning mobile phone use. If people are concerned, they can restrict their children's or their own exposure to RF radiation by controlling the mobile phone call durations and using hands-free devices.

### **National recommendations**

Various national authorities have stated quite analogously that the current research evidence does not suggest that mobile phone radiation has adverse effects on health below permitted maximum exposure levels. However, since there are still gaps in knowledge, the authorities in some countries recommend a precautionary approach to mobile phone use, especially concerning children.

A scientifically justified precaution is keeping a mobile phone far from a pacemaker because the pacemaker's functioning might be interfered by the radiation of a nearby mobile phone. There is no scientific need shown for other precautions, such as the use of hands-free devices, but it is good to take them, especially if one is concerned about the possible health risks.

### **It would be good to restrict children's use of mobile phones**

There is only scarce research evidence on children and mobile phones, and it is not easy to get more – in research ethical sense, children are a special group, which is why the intended study must be very well-founded. Research evidence is neither available on young people's using habits of mobile phones. Studies have been made with young test animals but these results are not directly applicable to humans.

Children nevertheless have a special status as mobile phone users, among others, because brains continue to develop even up to 20 years of age. It should also be taken into account that children will have much more time to use mobile phones than adults today who started their regular mobile phone use only about ten years ago. The risk of long-term use of mobile phones cannot however be assessed with certainty until mobiles phones have been in use for several decades.

On the grounds of the above-mentioned facts, STUK states that it is reasonable to restrict children's use of mobile phones the following ways:

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- parents are recommended to advise their children to use rather SMS messages than mobile phone calls
- parents may restrict the number of their children's mobile phone calls and their duration
- parents are recommended to guide their children to use a hands-free that minimises the exposure of head significantly. When using a hands-free it is recommended to keep the mobile phone at least a few centimetres away from the body.
- it is not recommended to use mobile phones in weak fields.

STUK does not find it justifiable to totally prohibit children's use of mobile phones. Mobile phones also create safety because they make children's communication with parents easier.

If an adult person is concerned about his/her own exposure to RF radiation, it is possible to reduce the exposure accordingly as explained above in connection of children.

### **Pacers and mobile phones**

The radio-frequency electromagnetic fields (RF-EMF) and waves might make contact with a pacemaker via the electrode conductors that lead to the heart. The RF voltage thus entering the pacemaker's electronic system may interfere some of the devices but does not cause any permanent changes to the pacemaker's functions. The possibility of interference is greatest when the mobile phone case makes contact with the skin at the same place where the pacemaker or its electrode conductor situates and decreases accordingly when the distance grows.

The interference in the pacemaker may incur the patient uncomfortable sensations, such as palpitation, but is usually harmless. It should however be taken into account that a pacemaker with a defibrillator may under interference cause an unnecessary electric pulse to the heart which may be dangerous.

Mobile phones can be used safely enough if the distance between the mobile phone and the pacemaker, its electronic system and the electrode conductor is at least 20 centimetres. This should be remembered especially when using a hands-free because in this case the phone itself can be e.g. in the breast pocket. Holding the mobile phone on the ear is safer as regards the reliable functioning of a pacemaker.