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Federal Department of Home Affairs FDHA
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Bluetooth

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Bluetooth is a transmission technology which enables data transmission between electronic devices via a radio connection. Typical applications are:

- Connecting headsets, headphones or hearing aids to mobile phones or DECT phones
- DECT phones for Internet telephony (Voice over IP)
- Wireless connections for audio and video systems
- Wireless connections between computers, printers, mice, digital cameras etc.
- Connection to external car antennas for mobile phones
- Patient monitoring in hospitals
- Connecting smartwatches or fitness trackers to mobile phones

Bluetooth devices are assigned to one of three classes: 1, 2 and 3. The radiation emitted from Bluetooth devices of classes 2 and 3 is weak and limited in range. Most of the Bluetooth applications used close to the body belong to one of these two classes. In the transmission mode, Bluetooth transmitters of the most powerful class 1 can cause exposure to radiation similar to that emitted by mobile phones if they are operated in the immediate vicinity of the body. The range for class 1 devices is up to 100 metres.

The radiation exposure caused by Bluetooth devices in all three classes is below the limits. Effects on health from long-term exposure to high-frequency electromagnetic fields remain uncertain. However, short-term effects from high-frequency radiation from Bluetooth devices are not expected.

Bluetooth hands-free headsets to minimise radiation from mobile phones

Bluetooth hands-free kits in classes 2 and 3 emit far less radiation than a mobile phone and thus significantly reduce radiation exposure to the head.

Federal Office of Public Health FOPH
Schwarzenburgstrasse 157, CH-3003 Bern

1 Technical data

1.1 Transmission power

There are three classes for various Bluetooth applications, each with a different range. (Table 1).The effective transmission power is usually lower than the maximum power as transmission is only ever strong enough for the receiving device to pick up the signal. The receiving device can measure the transmission power and request the transmitter to increase or reduce it if possible. This power regulation prolongs battery life and avoids interference with other Bluetooth networks.

Class	Peak transmission power (mW)	Maximum transmission power (mW)	Minimum transmission power (mW)	Range (m)
1	100	76	1	100
2	2,5	1,9	0,25	40
3	1	0,8	-	10

Table 1: Classes of Bluetooth Transmitters

1.2 Low-frequency fields:

Since a Bluetooth device only consumes power while it is transmitting and receiving, the battery is switched on and off repeatedly. This produces low-frequency magnetic fields from around 1 Hz (beacon) up to several thousand Hz.

2 Exposure

2.1 SAR value

The basic unit for measuring exposure to high-frequency radiation is absorbed energy per time interval and bodyweight, expressed as the specific absorption rate (SAR) in watts per kilogram (W/kg). SAR is measured for Bluetooth devices operated in proximity to the body (up to 13 cm). For devices operated further away from the body, the electrical field is also an important parameter. A study commissioned by the FOPH [1, 2] measured the SAR and the electrical field of the following applications:

- Two different Bluetooth USB plug-in antennas in classes 1 and 2 at the maximum data
- Two different hands-free headsets in class 3 (only SAR)

SAR values were measured in various parts of a phantom body. All SAR values measured were below the threshold of 2 W/kg (Table 2) [3].

	Class	SAR (W/kg)
Plug-in antenna (USB)	1	0,466
Plug-in antenna (USB)	2	0,0092
Hands-free headset	3	0,00117 - 0,00319

Table 2. SAR values of class 1, 2 and 3 Bluetooth devices

2.2 Electrical field

Figure 1 shows the electrical field in the proximity of Bluetooth USB plug-in antennas operating at maximum transmission power. The field decreases rapidly with increasing distance from the device. The measured field strengths of the Bluetooth devices are more than 20 lower than the threshold of 61 V/m at a distance of as little as 20 cm [3]. The electrical field decreases very rapidly with increasing distance. The measurements were carried out at maximum transmission power [1, 2]

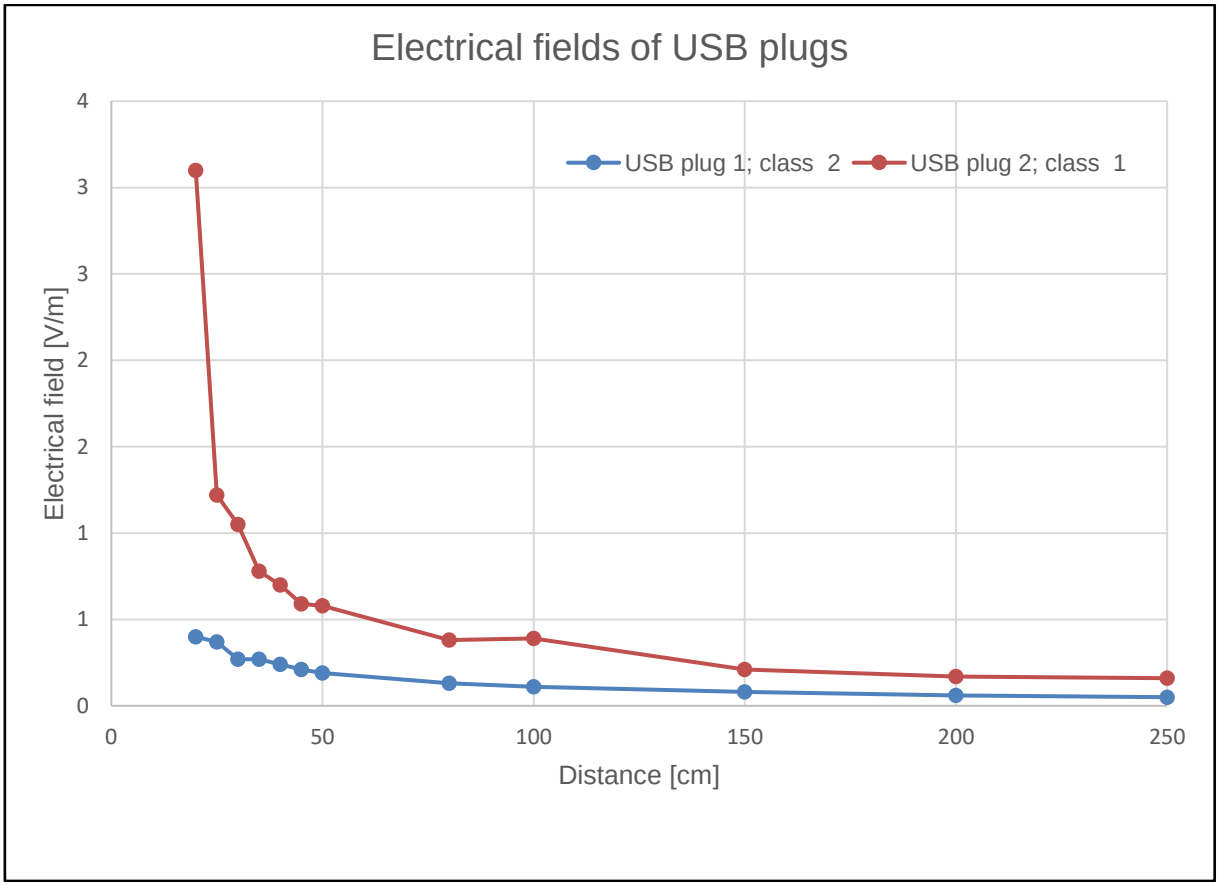

Figure 3: Maximum electrical field (E field) as a function of distance for two Bluetooth USB plugs in different classes.

In order to save energy and avoid interference with other devices Bluetooth normally reduces the transmission power if the connection between the devices is good. This produces an even smaller E field and lower SAR values.

3 Effects on Health

3.1 High-frequency electromagnetic fields

Based on the current state of knowledge and available exposure measurements, the high-frequency radiation emitted by Bluetooth networks is too weak to have an acute impact on health due to an increase in temperature following absorption.

In 2011 the International Agency for Research on Cancer (IARC) classified high-frequency electromagnetic fields as possibly carcinogenic (Group 2B) [6]. This, however, was based only on studies that saw a possible connection between telephoning with a mobile phone or a cordless telephone and the occurrence of brain tumours. The overall data was found to be limited by the IARC, as these studies on brain tumours and mobile phones and cordless phones have shortcomings in regard to the study design and the estimation of the length of exposure. A connection between exposure to mobile and cordless phones and other illnesses or symptoms could not be determined. In addition, the IARC could not determine any connection between effects on health and high-frequency radiation emitted from other devices, such as for example Bluetooth. Short-term health effects are not to be expected as the present threshold values avoid acute damage.

3.2 Effects on the auditory nerve

Various studies on animal experimentation with electromagnetic radiation from Bluetooth transmitters showed no effect on the inner ear and had no impact on the basic hearing function. In tests with humans Bluetooth transmitters likewise showed no significant modifications to auditory nerve activity [5, 6].

4 Regulation in Law

Bluetooth devices are subject to the Ordinance on Telecommunications Installations (FAV) [7], which sets out basic requirements for protecting the health and safety of persons who use or are exposed to radiation from telecommunications installations. These requirements are elaborated in Swiss-European standards. The limits specified in these standards correspond to those given in the 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) - Publications Office of the EU.

Manufacturers are responsible for ensuring that their appliances comply with the conformity criteria. In Switzerland, no authority checks whether Bluetooth devices meet these standards (23.4244 | Mobile phones emit more radiation than permitted. The time has come to check the NIR limits in Switzerland too! | Item of business | The Swiss Parliament – available in German, French and Italian).

5 References

1. Kramer A. et al. Development of Procedures for the Assessment of Human Exposure to EMF from Wireless Devices in Home and Office Environments. 2005. IT'IS Bericht.

2. Kühn S et al. Development of Procedures for the EMF Exposure Evaluation from Wireless Devices in Home and Office Environments. Supplement 1: Close-to-Body and Base Station Wireless Data Communication Devices. 2006. IT'IS Bericht.
3. 1999/519/EC: Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (OJ L 199 30.07.1999, p. 59, ELI: **http://data.europa.eu/eli/reco/1999/519/oj**)
4. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 102, 2012, Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields.
5. Yildirim G et.al. Effects of elctromagnetic fields formed by bluetooth on hearing (2013) Journal of International Advanced Otology, 9 (1), pp 61-70.
6. Mandalà M. et al., Effect of bluetooth and mobile phone electromagnetic fields on the human auditory nerve (2014) Laryngoscope, 124 (1), pp. 255-259.
7. Ordinance of 25 November 2015 on Telecommunications Installations (FAV), SR 784.101.2.

Contact

Federal Office of Public Health FOPH

str@bag.admin.ch