



# Baby monitor

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This fact sheet covers devices that monitor a baby via audio or video. It does not cover the advanced features of baby monitors that monitor a baby's bodily functions.

There are several types of baby monitors that operate via radio transmitters:



## **Audio or video baby monitors with 1-way or 2-way communication**

An audio or video baby monitor consists of a baby unit and a parent unit.

The baby unit is placed near the baby and, depending on the type, can record the baby's noises or even videos. In any case, it transmits and, in the case of 2-way devices, can also receive. The parent unit receives the noises or even videos in any case and, in the case of 2-way devices, can also transmit people's voices. Baby units with automatic voice activation (also called VOX) only transmit above a fixed or adjustable noise level. According to the manufacturer's specifications, devices with ECO mode further reduce radiation in standby mode.

Some devices constantly check whether the parent unit is still within range of the baby unit. To do this, the baby unit sends a short test signal every few seconds.

## **Walkie-talkie baby monitors**

There are walkie-talkies that can be used both as radios and as baby monitors. Walkie-talkies can operate at significantly higher transmission powers to achieve a greater range. Unlike other baby monitors, they are therefore only suitable to a limited extent as low-radiation baby monitors.

## **Baby monitor with networked camera**

This type of baby monitor consists of a network camera that connects to the internet via Wi-Fi or a mobile network. The camera sends a video recording to a mobile phone.

## **Baby monitor functionality with a mobile phone and a smartwatch or with two mobile phones**

Current mobile phone operating systems are able to detect characteristic noises and trigger notifications. A mobile phone placed in the children's room can detect the noises of a baby via Bluetooth, WLAN or mobile network and send a notification to a parent unit, consisting of a paired smartwatch or a second mobile phone. To function as a baby monitor, special apps are required on the devices involved.

## **Exposure to radiation**

The FOPH has measured the radiation emitted by audio baby monitors with different transmission powers. The radiation levels decrease very rapidly with increasing distance from the device and are always below the limit value. Even if the child touches the device during operation, the devices comply with the limit value. The radiation emitted by WLAN or Bluetooth devices, walkie-talkies or mobile



phones used as baby monitors at a distance of one metre from the child is also below the limit values.

Based on current scientific knowledge, radiation from baby monitors is not expected to be harmful to health. To minimise radiation exposure and ensure safe operation of the devices, the following measures can be taken:

- Ensure that the baby unit and parent unit are connected to each other via radio. Radio connections can be disrupted by walls, ceilings, furniture, windows and other objects and obstacles.
- Check that devices with the "automatic voice control" function (VOX function) activated are positioned and adjusted with a selectable noise level so that the baby's noises are transmitted.
- Place the baby unit at least one metre away from the cot to minimise radiation.
- If the baby monitor is powered by the mains and you are using a power supply (adapter), ensure that the distance between the adapter and the cot is at least 50 cm.
- Set the baby monitor to 'automatic voice monitoring' mode to minimise radiation. Check that the baby monitor is working before leaving the room.
- Do not use walkie-talkies as baby monitors if you want a low-radiation device.
- It is your personal responsibility to only move far enough away that you can return to your child as quickly as possible. Therefore, be careful with systems where the baby unit consists of a network camera, smartwatch or mobile phone connected to the parent unit, e.g. your mobile phone, via the cloud, mobile network or an extended WLAN network. Such configurations can allow excessive distances between you and your child.



# 1 Technical data

## 1.1 High-frequency fields

Baby monitors operate on different frequency bands with different transmission powers and ranges (Table 1). Devices that transmit continuously (continuous carrier) are not permitted on some frequency bands. A baby monitor can only transmit above a certain noise level. Depending on the device, this level is either preset or can be selected. This automatic voice control is called VOX (Voice Operated Exchange).

In baby monitors with range control, the baby unit sends a signal every few seconds that allows the parent unit to check whether the connection is still working. In some devices, this function can also be deactivated. In two-way devices, where both units transmit and receive, the parent unit can perform range control.

Devices that allow video surveillance of the baby transmit continuously during video transmission.

Frequency (MHz)	Automatic VOX voice control	Max. transmission power (mW)	Maximum range (m) according to the manufacturer
27	Yes	100	400
40.7		10	150
446 Walkie-talkie	Yes	500	5000
865	Yes	10	400
1900		250	300
2400		10	300

Table 1: Transmission frequency of baby monitors

## 1.2 Low-frequency fields

Baby monitors are battery-powered or connected directly to the mains via a power supply unit (adapter). The power supply unit remains in operation even when the baby monitor is completely switched off. It often contains a low-cost transformer with poor efficiency and generates rather strong 50 Hz magnetic fields (stray fields) in the immediate vicinity. At a distance of 50 cm, however, these stray fields are greatly reduced.

# 2 Limit values

## 2.1 High-frequency electromagnetic radiation

The International Commission on Non-Ionising Radiation Protection (ICNIRP) assesses the effects of



electromagnetic fields on health. It provides recommendations on limit values [1], which in turn form the basis for the limit values in the EU Council Recommendation [2]. The EU limit values define the basic requirements that electrical products must meet in Europe and Switzerland in order to be considered safe from an electromagnetic field perspective.

These limit values are based on scientifically proven acute effects in humans when fields exceed a certain intensity. The limit values for the general population are 50 times lower than the value at which acute effects occur.

There are two categories of limit values: the so-called basic restrictions and the reference levels derived from them. Depending on the frequency range, they have different values or represent different physical quantities.

Baby monitors generate high-frequency electromagnetic radiation or high-frequency electric electromagnetic fields (hereinafter referred to as electric fields). A person's body can absorb this radiation and heat up. The limit values restrict this heating so that it does not pose a health risk.

The basic limits for frequencies up to 10 GHz are specific absorption rates (SAR). These are decisive for baby monitors. The SAR indicates the amount of electromagnetic radiation (expressed as radiation power in watts) absorbed by a given mass of the human body (kg). The basic limit for the torso and head is the most stringent and amounts to 2 W/kg, calculated on a body volume of 10 grams. This means that in the body volume most exposed to radiation, i.e. 10 grams, the SAR must not exceed 0.02 W/kg. The SAR is particularly suitable for evaluating devices that people normally use on the surface of the body or in close proximity to the body.

SAR can only be determined using complex procedures. This requires

- measurements must be carried out in a so-called phantom. Phantoms are models of the irradiated parts of the body. They are filled with a liquid that corresponds as closely as possible to the electrical properties of the human body. Phantoms can reproduce the geometry of a body part or have a simplified shape. To determine the maximum SAR, a robotic measuring antenna measures the volume of liquid in three dimensions and determines the most irradiated point. The measurement results depend heavily on the distance between the irradiated device and the phantom during the measurement. The respective measurement distances are defined in the measurement standards.
- or a computer model that reproduces the tissues and organs of the human body and their electrical properties as accurately as possible in three dimensions. A computer simulation superimposes a three-dimensional measurement of the radiation around a radiating device onto the virtual electrical model of the body. The computer simulation then calculates the SAR in the virtual body based on these two spatial pieces of information.

The so-called reference levels are much easier to verify. They are derived mathematically from the basic restrictions. If they are complied with, the basic restrictions are also complied with. Reference values only apply to persons who are exposed to uniform radiation and are therefore particularly suitable for situations where a radiation-emitting device is located at a certain distance from a person. They refer to electric fields in the high-frequency range and have the unit of measurement volt/metre (V/m).



## 2.2 Long-term effects

These recommended limit values do not take into account potential long-term effects. The reason for this is that the ICNIRP considers scientific knowledge on the harmful effects of long-term exposure to electromagnetic fields to be insufficient.

## 3 Exposure

### 3.1 Exposure from audio baby monitors

In 2005, on behalf of the FOPH, a study by the IT`IS Foundation determined the exposure of three different audio baby monitors [3]. Despite their age, these measurements still represent the current state of knowledge. In order to generate the maximum possible radiation for the measurements, the devices were subjected to a continuous sound and then kept in continuous operation.

The electric field in the vicinity of one of the continuously operating baby monitors is strongly dependent on distance (Table 2, Figure 1).

Device	Transmission frequency [MHz]	Electric field reference level [V/m]	Electric field [V/m]		
			Distance 5 cm	Distance 20 cm	Distance 100 cm
Baby monitor 1	40,695	28	37.5	3.2	-
Baby monitor 2	863	40	4.5	1.4	0.43
Baby monitor 3	446	29	41.6	8.5	3.2

Table 2 Electric fields of baby monitors

At the recommended operating distance of one metre, the electric fields are below the reference levels and amount to 0.43 V/m (baby monitor 2) and 3.2 V/m (baby monitor 3) respectively. For baby monitor 1, the measured reference level is missing because, due to the low transmission frequency, the physical assumptions for electric fields do not apply for greater distances from the source. At a distance of less than 10 cm, the electric fields of two devices exceed the reference level. For this reason, the SAR of two baby monitors was determined in a phantom (Table 3). The SAR of both devices is well below the basic restriction of 2 W/kg [2].

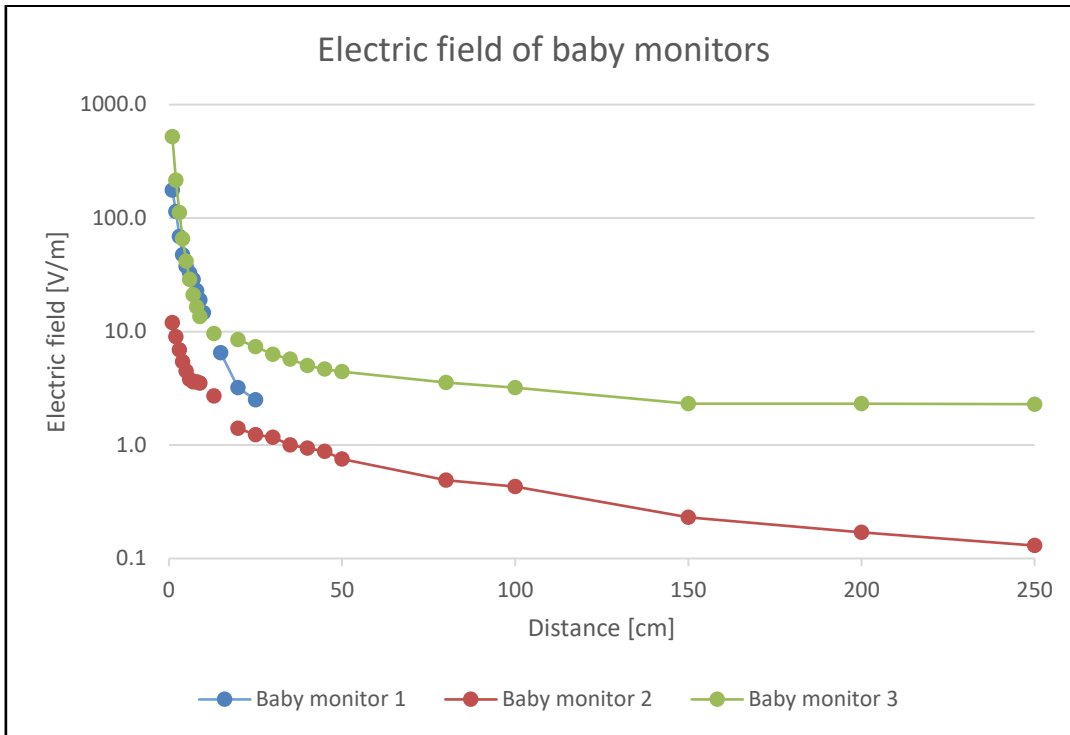


Figure 1: Electric field (E-field) of three different baby monitors [3].

Device	SAR [W/kg]	Frequency [MHz]	Transmission power [mW]	Basic limit [W/kg]
Baby monitor 2	0.01	863	10	2
Baby monitor 3	0.08	446	500	2

Table 3: SAR of two baby monitors.

The results are of the same order of magnitude as those obtained in a similar study conducted by the German Federal Office for Radiation Protection [4].

### 3.2 Exposure from current baby monitors

The SAR data for current baby monitors manufactured since 2020 come from the US telecommunications authority, the Federal Communications Commission (FCC). The FCC has published test reports on the SAR of baby monitors, which manufacturers had to evaluate in relation to US limit values [5]. Although the data do not refer to the European market, they allow the order of magnitude of radiation from baby monitors to be estimated.

The US SAR limit values are stricter, as the basic limit is 1.6 W/kg and, unlike in the EU and Switzerland, the tissue mass to be evaluated is only 1 g instead of 10 g. Based on a selection of 10 current baby monitors, the following conclusions can be drawn:

- The measurements were taken at a distance of 0 cm from the phantom.



- On average, the maximum SAR of baby monitors is less than a quarter of the American limit value, and no baby monitor exceeds this value.

### **3.3 Exposure to combinations of mobile phones and smart-watches**

Current mobile phone operating systems are capable of detecting characteristic noises and triggering notifications. A mobile phone placed in a child's bedroom can detect the noises of a baby via Bluetooth, WLAN or the mobile network and send a notification to a parent unit, consisting of a paired smartwatch or a second mobile phone.

Measurements of Bluetooth and WLAN transmitters are described in detail in the relevant FOPH fact sheets. They show that the radiation from these transmitters attenuates significantly at a distance of one metre. Measurements of the electric field around mobile phones are rare, as mobile phones are assessed on the basis of SAR values. An older study on American GSM mobile phones shows that mobile phone radiation decreases significantly at a distance of one metre [6].

### **3.4 Exposure from walkie-talkies**

An earlier study on commercially available walkie-talkies shows that European limit values are generally complied with. The study also examined a walkie-talkie transmitting at maximum power. It shows that even in this case, the European SAR limit values are complied with, while the stricter American values are not [7].

## **4 Health effects**

Based on current knowledge, the high-frequency radiation generated by baby monitors is too weak to increase body temperature through absorption in such a way as to cause demonstrable acute health effects.

In 2011, the International Agency for Research on Cancer (IARC) classified high-frequency electromagnetic fields as potentially carcinogenic (group 2B) [8]. However, this is based only on studies that see a possible correlation between the use of mobile or cordless phones and the onset of brain tumours. The IARC considers the available data to be limited, as these studies on brain tumours and mobile and cordless telephony have shortcomings in terms of study design and estimation of exposure duration. No correlation could be established between exposure to mobile and cordless phones and other diseases or symptoms. Furthermore, the IARC found no correlation between health effects and high-frequency radiation emitted by other devices, such as baby monitors. No short-term health effects are expected, as current limit values prevent acute damage.

The possible long-term effects of low-intensity high-frequency electromagnetic radiation, such as that found in baby monitors, are unknown. This uncertainty can be mitigated by using VOX mode and keeping the baby monitor at a sufficient distance from the child to minimise radiation exposure.



## 5 Regulations

Baby monitors are subject to the Swiss Ordinance on Telecommunications Installations (OTI) [9]. The TIA sets out the basic requirements for the protection of the health and safety of persons using telecommunications installations or exposed to radiation from such installations. These requirements are specified in Swiss-European standards. OFCOM regulates the maximum transmission power according to frequency band and application in its technical interface requirements [RIR] [10].

The criteria for compliance with the requirements correspond to the limit values recommended by the EU [2]. The manufacturer is responsible for ensuring that its equipment complies with the criteria for compliance with the standards. In Switzerland, no authority checks the compliance of baby monitors with these limit values [11].

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