



# Austria can be confident.

We care about mobile communications and health.



# Mobile communications and health

Mobile communications users worldwide have 7.8 billion active SIM cards for voice and data traffic. For most of us, the mobile phone has become an indispensable part of our daily lives: In Austria alone, SIM card penetration already exceeds 147%\*. If the SIM cards used purely for technical solutions are added, these figures would be much higher.

The future of telecommunications as well as many other technical applications depends on mobile wireless communication.

However, controversial statements about the possible effects of electromagnetic waves raise many questions. As the market and innovation leader, A1 is well aware of its responsibility in the long-standing debate about the potential health effects, all the more so given the ubiquitous spread of the technology. One way in which A1 fulfils this responsibility is by providing the public with information.

This brochure therefore summarises the most important issues concerning mobile communications and health.

Our priority is whatever is necessary to protect your health and safety. A1 is guided here by the best available scientific information and protection concepts. Because this is about all of our futures.

If you have any further questions, the EMF team at A1 is available to help: [emf@a1.at](mailto:emf@a1.at)

Your A1 EMF Team

\* Source: [www.rtr.at/de/inf/TK\\_Monitor\\_Q1\\_2018/RTR\\_Telekom\\_Monitor\\_Q1\\_2018.pdf](http://www.rtr.at/de/inf/TK_Monitor_Q1_2018/RTR_Telekom_Monitor_Q1_2018.pdf)

# Contents

Mobile communications and health.....	3
Contents.....	4
Basic principles of mobile communications.....	5
Effects of radio waves .....	6
Scientific findings .....	9
Health Protection by Limit Values .....	12
FAQ .....	21
Imprint .....	24

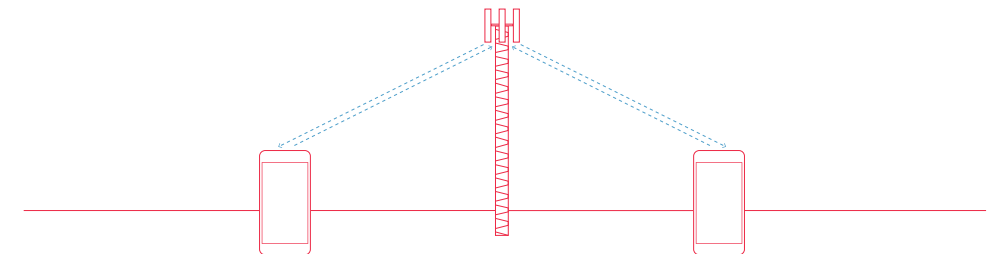
# Basic principles of mobile communications

We can make calls and surf the Web on a mobile phone only if there is a base station nearby. The more people who do this in a location, the greater the number of base stations that are required.

## Base stations and mobile phones go together

Base stations are in periodic contact with mobile phones that are switched on. Both of them send and receive radio waves in order to establish a connection. Calls can be made and data can be transmitted only if there is a base station nearby. However, the capacity of each individual base station is limited. If a large number of people are using smartphones or Net Cubes, a greater number of base stations is required. This is why they are built where demand is greatest.

Almost 5.4 million Austrians use A1's mobile network. Our task is to provide top-quality nationwide coverage. And of course, we take extreme care to comply with the applicable limit values for Austria.



Mobile communication is a two-way form of communication

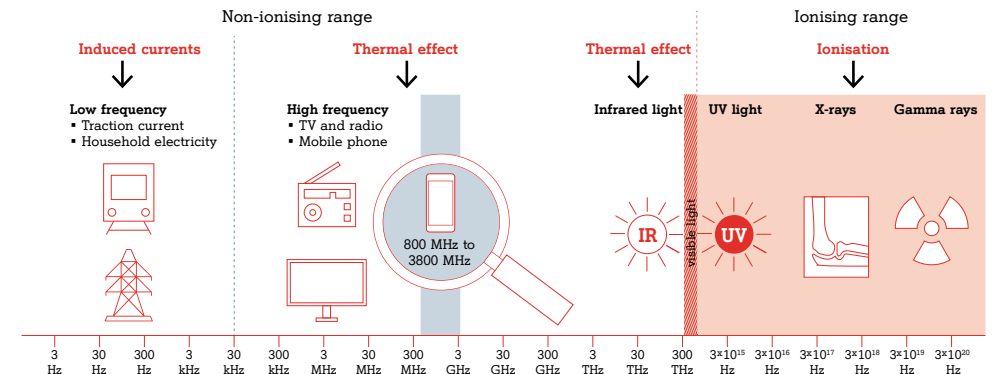
# Effects of radio waves

Radio, television and solar radiation – throughout our lives, we have always been surrounded by electromagnetic radio waves. Whether they are hazardous to the human body depends on their frequency and strength.

The technology to transmit information via radio waves has been used for more than a century. From the very outset, research was conducted into the potential adverse effects on human health. The World Health Organisation constantly addresses all issues that concern human health worldwide, i.e. whether electromagnetic fields pose a health risk. In the case of mobile communications, the World Health Organisation (WHO) has issued clear recommendations limiting the intensity (strength) of radio waves.

## Radio waves and their applications

The oscillations of electromagnetic fields cover a wide frequency spectrum. For more than 100 years now we have been using electromagnetic waves to transmit information, for example radio or television signals. Mobile communication also uses electromagnetic fields. In Austria, mobile providers use the transmission frequencies between 800 and 3800 MHz. Electromagnetic waves are a natural part of the world around us. However, only a tiny part of the spectrum is visible to us as light. We see objects by the visible light they reflect. However, the full range of the electromagnetic spectrum is incredibly wide and the properties of the individual fields are very different.



At higher frequencies, the wavelength is shorter and the energy is greater. If the energy is sufficient to break molecular bonds, we call the radiation ionising. These are the frequencies of 750 THz and above. X-rays are an example of this.

**i** **Wavelength** is defined as the **spatial period of a periodic wave**.

The **frequency**, which is measured in hertz (Hz), states how many cycles the wave completes per second.

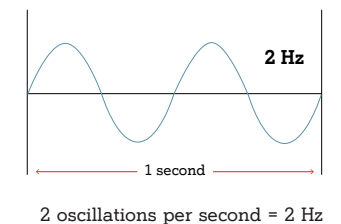
$$1 \text{ Hz} = 1/\text{s}$$

Other frequently used units are:

$$1 \text{ kilohertz (kHz)} = 1,000 \text{ Hz}$$

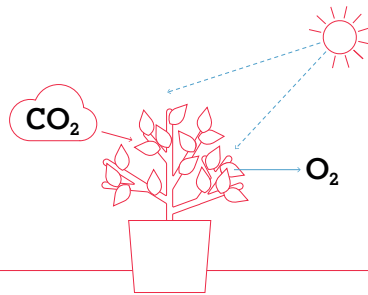
$$1 \text{ megahertz (MHz)} = 1,000,000 \text{ Hz}$$

$$1 \text{ gigahertz (GHz)} = 1,000,000,000 \text{ Hz}$$





As we go downwards through the spectrum, the frequency decreases and completely different action mechanisms kick in. Some of the frequencies of light are the very basis of life on this planet. The quantum energy of sunlight is the energy source for photosynthesis by plants.



Below the frequency of light, the waves take the form of infrared radiation; even further down the scale, the frequencies are those used by mobile phones. At these frequencies, the energy is lower, and at this non-ionising end of the spectrum it is just about strong enough to make molecules or parts of molecules oscillate. When this energy is absorbed by the human body, it is converted into heat.

However, a biologically significant effect occurs only when the heat is so intense that the body can no longer compensate for it biologically. The heat generated in the body by radio waves does not present a health risk. It's a lot less than the thermal effect of sunbathing or sport for example.

# Scientific findings

International scientific studies and reputable independent bodies – including the World Health Organisation – say: “It remains unlikely that mobile communications have an adverse effect on health.”

The question whether electromagnetic fields potentially pose a health risk is a key one for science, and a great deal of research has been carried out in this area since the mid-20th century. As a result, protection concepts were developed that seek to keep the effects on humans as low as possible. This is true of all wireless applications.

Science observes the interaction between humans and radio waves today in a much more sophisticated way than when research was in its infancy – and our knowledge is growing steadily.

In Austria, there is an independent interdisciplinary panel of experts, the Scientific Advisory Board for Radio (WBF), which advises the Federal Ministry for Transport, Innovation and Technology (BMVIT).

At the WBF Expert Forum 2018\*, Austrian and international experts from a wide range of disciplines analysed a total of 172 scientific studies on the topic of mobile communications and health carried out between July 2017 and June 2018. After reviewing the studies, the Expert Forum concluded that “the current data confirms the previous WBF findings: ‘It remains unlikely that mobile communications have an adverse effect on health.’”

“Analysis of the latest research results shows there are no indications that radio frequency fields have adverse health effects.” This is the conclusion of the European Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in its latest opinion on the potential health effects of exposure to

\* [www.bmvit.gv.at/telekommunikation/wbf/expertenforum/index.html](http://www.bmvit.gv.at/telekommunikation/wbf/expertenforum/index.html)

electromagnetic fields (EMF). The summary says: “The results of current scientific research show that there are no evident adverse health effects if exposure remains below the levels defined in current standards.”\*

The limit values set by the Independent Commission on Non-Ionizing Radiation Protection (ICNIRP) take into account all previous scientific findings and effects of radio waves and thus form the basis for legal limit value regulations. The World Health Organisation (WHO), the European Union and numerous expert committees rely on the limit values issued by ICNIRP. These are also valid in Austria and are currently implemented by OVE Technical Specification R23-1, compliance with which is mandatory. These serve to protect people. Protection of people is also the top priority for A1.

The updated World Health Organisation (WHO) Fact Sheet 193 points out that there is no consistent evidence of adverse health effects from exposure to radio waves. One reason why the current limit value has been confirmed is the safety factor of 50 incorporated in the existing limit values. The valid WHO limit values, which are the one we use in Austria, are subjected to repeated tests during the evaluation of scientific studies. All studies are evaluated according to a catalogue of criteria.

### The five key questions for the evaluation are:

- Is there proof of a biological effect on humans or animals?
- Is the effect caused by mobile phones?
- Is there a health effect?
- Can a threshold value be identified above which an effect occurs?
- Has the effect been confirmed by other research groups?

\* [ec.europa.eu/health/scientific\\_committees/docs/citizens\\_emf\\_de.pdf](https://ec.europa.eu/health/scientific_committees/docs/citizens_emf_de.pdf)

## Mobile communications and pacemakers

Modern pacemakers must be constructed so that they are not susceptible to interference from radio waves emitted by other devices. International standards are applied on the basis of Directive 90/385/EEC, which ensures the protection of people with electronic implants. For calls with a mobile phone, a connection is made between a base station and the mobile phone. For each call, the mobile phone and the base station send and receive radio signals. In rare cases, the mobile phone can cause interference with the pacemaker. A study by the University of Cologne has shown that only 2% of the 200 pacemakers tested could suffer interference due to mobile phones. At distances of more than two centimetres between the mobile phone and pacemaker, no interference was detectable for any of the tested pacemakers. Pacemakers are virtually immune to interference by base stations due to the distance to the base station. Interference would be possible only if you were to stand directly in front of a base station – but this area is not accessible to the public. For information about the interference immunity of your pacemaker, contact your doctor. As interference to pacemakers cannot be completely ruled out, we recommend you keep a distance of 15–20 centimetres between the pacemaker and the phone. Therefore, you should not put your mobile phone into your breast pocket. If these precautions are followed, even people with cardiac pacemakers can safely use mobile phones.



Attention! If you have a pacemaker, you should not enter areas where they are banned.

# Health protection by limit values

To protect the health of mobile phone users, WHO exposure limits are in use in Austria. A1 adheres to these so you can make and receive calls around the clock without any health effects.

The limit values recommended by the WHO for the use of mobile phones are set out in the binding OVE Technical Specification R23-1. Compliance with this specification eliminates any danger caused by electromagnetic fields.

Essentially, there are two relevant limit values: The basic limit value tells us how much transmitting power is absorbed by the body and is expressed as the SAR value in W/kg. The reference level value tells us how strong the electromagnetic field outside the body may be without causing the basic limit value to be exceeded.

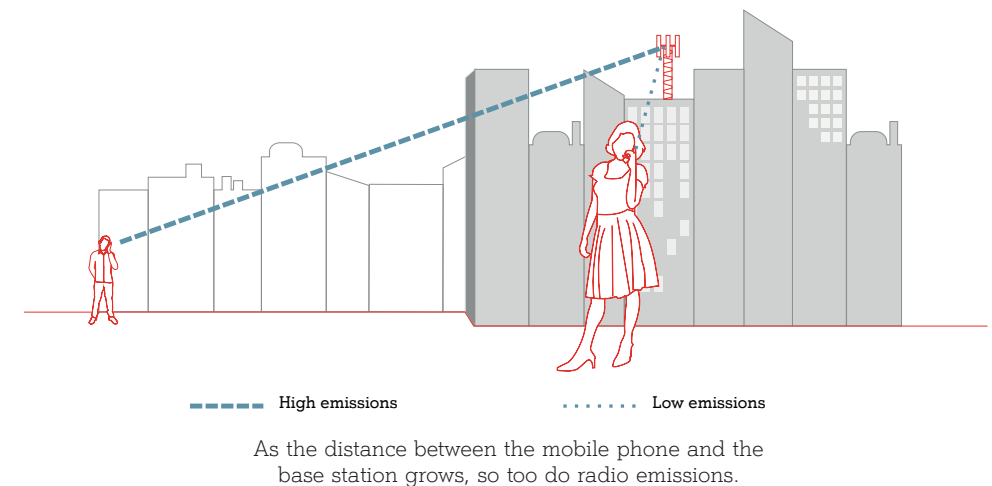
When scientific committees set these limit values, they examine all the known effects of electromagnetic fields on the human body and assess whether they can have an impact on health. The only proven health relevant effect of mobile phone radio waves is a thermal effect.

## The Specific Absorption Rate (SAR)

To ensure that any thermal effect resulting from mobile communication signals remains within limits – and thus has no negative effects on health – the amount of energy that is absorbed by the body and turned into heat is measured. The

result of such measurements is known as the specific absorption rate (SAR value). The maximum permissible SAR value for smartphones is 2 W/kg.

**i** The SAR is a **physical value [W/kg]** and indicates how much of a mobile phone's transmission power [W] is absorbed by the body per kilogramme of tissue mass [kg]. The SAR threshold for mobile phones of 2 W/kg ensures that mobile phone users can **talk on the phone 24/7 without suffering any adverse health effects**. In accordance with the applicable standards, all mobile phones must comply with the SAR limit value.



The SAR for a mobile phone is stated for its maximum transmitting power. However, just because a manufacturer of a mobile phone states that a mobile phone has a lower SAR than another phone (that has a higher SAR) does not automatically mean greater safety during calls. The better the connection between the mobile phone and the base station, the lower transmission power that is required. So, the deciding factor is the distance of the nearest base station from the mobile device. A well-developed mobile communication network thus means less exposure to radio frequency radiation during calls.

i

Every mobile phone manufacturer wishing to sell its device in Europe, and thus also in Austria, must measure the SAR according to strict rules and must state the value in the operating instructions. This value is calculated as the **total of all wireless applications (Bluetooth, Wi-Fi etc.) of the mobile phone transmitting at its highest power level.** When a device is in use, the actual SAR values are usually well below the values stated. The following two standards ensure that these measurements are always conducted according to the same rules:

▪

**EN 50360** Product standard to demonstrate the compliance of wireless communication devices, with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 300 MHz to 6 GHz: devices used next to the ear

▪

**EN 50566** Product standard to demonstrate the compliance of wireless communication devices with the basic restrictions and exposure limit values related to human exposure to electromagnetic fields in the frequency range from 30 MHz to 6 GHz: hand-held and body mounted devices in close proximity to the human body

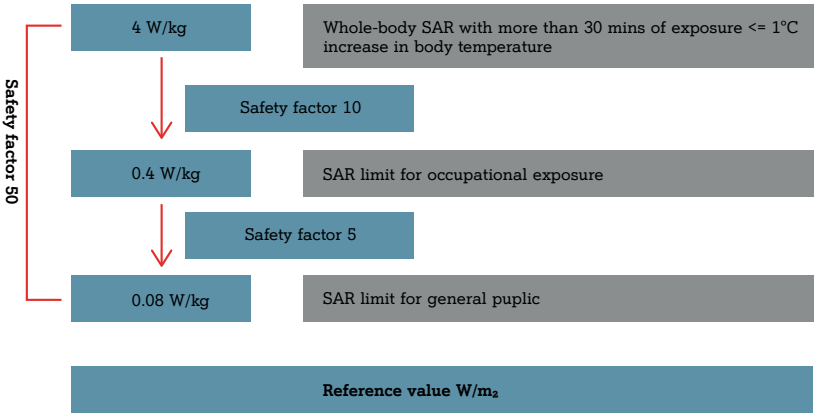
Calculation of limit values

Compliance with these limit values means users can talk on the phone 24/7 without suffering any adverse health effects. As mentioned earlier, the only proven health-relevant effect of radio waves used in mobile communications is the heating of tissue. This becomes relevant to human health however only if there is an increase in core body temperature of more than 1°C. To achieve this with radio waves would require constant exposure to electromagnetic waves of roughly 6 W/kg. As a precaution, the International Commission for non-ionizing Radiation (ICNIRP) has defined a threshold of 4 W/kg for whole-body exposure.

Starting from this threshold, the recommended limit for occupational exposure – e.g. for engineers who come into close contact with the base stations – is reduced by a safety factor of 10, and a SAR of 0.4 W/kg is defined as the limit value for what is called occupational exposure.

In the case of workers who are exposed to electromagnetic fields in the course of their occupation, it can be assumed that the individuals concerned are healthy and of working age. Moreover, this group also receives special training. But what about all other members of the general public? Here, ICNIRP has applied an additional safety factor of 5 and set the threshold for the general public at 0.08 W/kg (a total safety factor of 50).

This safety factor of 50 included in the limit values means there is an adequate level of protection even for the sick, the elderly and children. Despite this, there are repeated calls for lower limit values even though there is no scientific justification for this. Most national and international institutions therefore base their recommendations on the scientifically-based thresholds of the WHO. The Austrian legislature has also chosen to follow this scientific advice, so these limits are binding for A1.

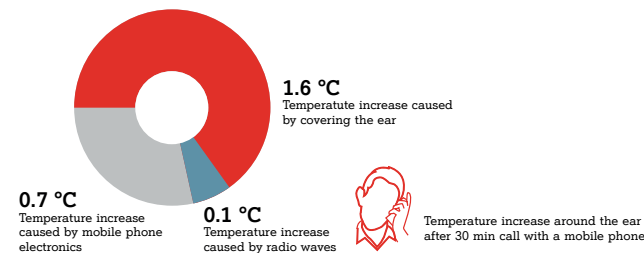


Principle behind the limit values



### How is the thermal effect perceived?

The thermal effect of radio waves is often equated with the feeling of having warm ears when making calls – however, this assumption is false. Studies on the use of mobile phones have shown that most of this thermal effect is caused by covering the ear with the phone and only a small fraction by radio waves.



### Reference value

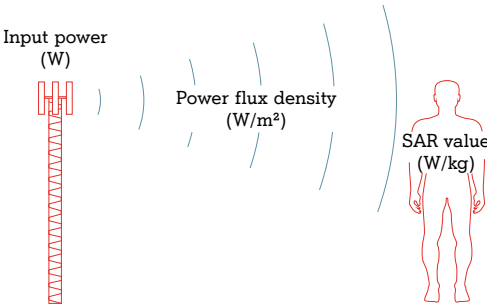
As the SAR (basic restriction) cannot be measured directly in the human body; in practice, the reference level value is normally used. This tells us how strong the electromagnetic field outside the body can be without causing the basic restriction value to be exceeded. This value is easy to measure and is expressed either as electric field strength  $E[V/m]$  or as power flux density in watts per square metre  $S[W/m^2]$ . So the limit value for power flux density is similar to the SAR and is derived from it.

WHO limit values in the OVE Specification R23-1:2017			
At 800 MHz	4 W/m²	At 1800 MHz	9 W/m²
At 900 MHz	4.5 W/m²	At 2000 MHz	10 W/m²

Limit values for emissions from mobile communications installations

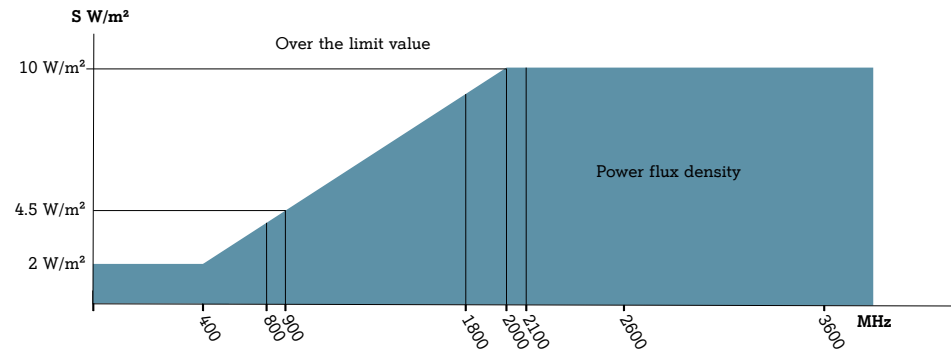
### What are emissions?

Emissions (= radio waves at a specific location) can be either calculated on the basis of technical factors or measured directly on site. The results of emission measurements are the power flux density ( $S$ ) expressed in watts per square metre ( $W/m^2$ ).



### Why do the limit values for power flux density vary?

The limit values  $[W/m^2]$  are different for the individual mobile frequencies. This is because the absorption – and thus the thermal effect in the body – depends on the frequency of the radio waves. Energy from waves in the higher frequency range is absorbed by the body to a lesser extent. This is why the limit values for the power flux density of the different networks differ although the SAR value remains the same. So, the limit value at 900 MHz is  $4.5 W/m^2$ , but for applications that use higher frequencies (such as 2600 MHz) it is  $10 W/m^2$ . Compliance with the reference values always guarantees compliance with the basic limit value ( $SAR < 0.08 W/kg$ ).



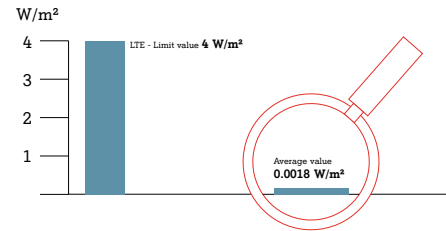
Limit values for power flux density at different mobile communications frequencies

## Protection for all

To make certain that WHO limit values are being complied with, the telecommunications authority regularly measures the emissions of radio applications. Of course, this also includes measuring the emissions from mobile communication installations.

Since 2007, the Mobile Communications Forum (FMK) has been carrying out a series of nation wide emissions measurements at more than 500 measurement points to obtain an overview of emissions throughout Austria.

The results of the **radio frequency measurement series 2017/2018** show that at all measurement points in Austria, the emissions fell well below the **applica-**



The result of the FMK measurement series shows that radiation levels fall well below the limit values

**ble limit values** for high-frequency electromagnetic fields. At the vast majority of measuring points, the emissions recorded were only a few thousandths of the limit values.\*

## Protection of workers

Binding limit values for occupational exposure in Austria are laid down in the Regulation of the Ministry of Labour, Social Affairs, Health and Consumer Protection concerning the protection of workers from the impact of electromagnetic fields (VEMF). This regulation transposes EU Directive 2013/35/EU into Austrian law and lays down exposure limits for people who encounter electromagnetic fields at the workplace. It also contains specific regulations to protect vulnerable groups and those in need of special protection.

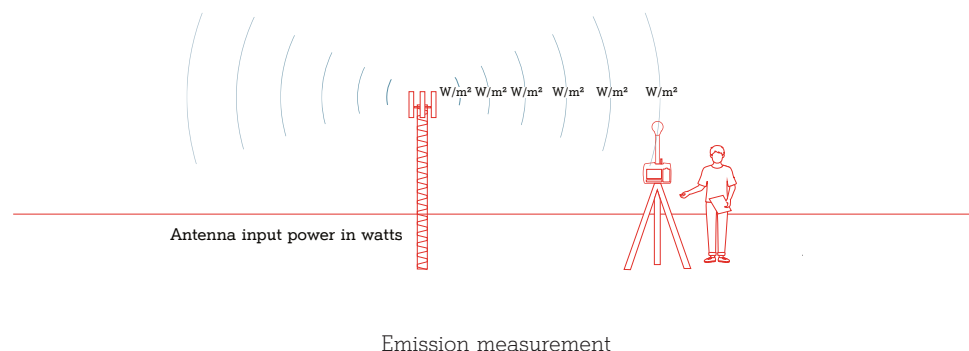
Amongst other things, the regulation requires that employers assess each workplace with regard to electromagnetic fields. The thresholds defined in the VEMF are to be used for occupational exposure.

Further information on this can be found at [www.fmk.at/gesundheits-umwelt/personenschutz-und-vorsorgewerte/arbeitnehmerschutz/](http://www.fmk.at/gesundheits-umwelt/personenschutz-und-vorsorgewerte/arbeitnehmerschutz/)

## Measuring emissions

As volumes of call traffic fluctuate, the emission levels at a base station vary depending on the location and the time of day. The greater the volume of traffic on the mobile network, the higher the total emission levels. Furthermore, some of the radio frequency radiation in the air is caused by other radio applications, such as radio and television masts, radar systems and even energy-saving light bulbs. It is therefore extremely important to decide where and how the measurements will be carried out. Using suitable and standardised measuring devices, emissions can be measured at a specific point. The results of the measurements are expressed in watts per square metre (W/m²) and compared with the permissible limits.

\* Test report ([messwerte.fmk.at](http://messwerte.fmk.at))



## Calculating emissions

Using calculations, it is possible to determine the expected emissions even before a base station is constructed. The results of emission calculations show the emissions that will be generated when a base station is operating at its theoretical maximum load. Of course, that maximum is only rarely encountered in practice, so the calculations generally overestimate the emissions, and the values previously calculated are rarely reached.

Before any mobile communications installation is brought into use, A1 conducts tests to check for compliance with the reference value.

The public has no direct access to the base station antenna. Furthermore, a safety distance of 4–10 metres must be observed, outside of which the emissions fall markedly below the reference values.

# FAQ

## ? Who checks compliance with limit values in Austria?

! If it is suspected that limit values for radio waves have been exceeded, the telecommunications authority carries out checks. A1 also checks its own base stations on a regular basis.

## ? Do the exposure limits protect children?

! The limit values defined in OVE Technical Specification R23-1: 2017 provide an additional safety margin for the protection of children, the sick and elderly. This applies both to base stations and to mobile phones, which are rigorously tested for compliance with the limit values.

## ? Why are base stations situated so close to buildings?

! Base stations are required wherever mobile phone users are mostly located. If the base station and the mobile phone are close to each other, they only need their lowest transmission power to communicate. In a well-planned mobile network, emissions are reduced to a minimum.

## ? What does the SAR value really mean?

! The specific absorption rate (SAR) is the rate at which the transmission power of a mobile phone is absorbed by the body during a call. The SAR of a mobile phone is determined by the maximum phone transmitting power that is technically available. The maximum permissible SAR value of 2 W/kg for mobile phones ensures that you can make calls continuously all day without any harmful effects on your health. To comply with the applicable standards, all mobile phones must operate within the SAR limit value.

## ? Does my mobile phone ever reach the specified SAR value?

! Thanks to intensive research, we possess extensive knowledge about the effects of mobile communications. The resulting limit values mean we are protected against harmful effects. The international scientific community expects that this will not change in the future.

## ? Are there any long-term health effects?

! Thanks to intensive research, we possess extensive knowledge about the effects of mobile communications. The resulting limit values mean we are protected against harmful effects. The international scientific community expects that this will not change in the future.

## ? Is there a law in Austria regarding radio systems and health?

! The Telecommunications Act § 73(2) requires compliance with standards that protect human life and health.

## ? Why your ear gets warm when making a call?

! The warming of your ear is largely caused by covering the ear. This effect is produced whenever the ear is covered by an object. Mobile phone electronics also contribute to warming whilst a call is in progress. Only an insignificantly small part of the warming is caused by radio waves.

## ? What are emissions in mobile communications?

! Emissions are radio waves at a particular location and can be calculated and measured. The results, however, are always a snapshot at that moment since emissions vary depending on the time of day and location.

## ? Can pulsed radio waves harm the human body?

! Pulsed radio waves are oscillation packages interrupted by brief pauses. All scientific findings indicate that these radio signals travel back and forth far too quickly for them to have a stimulating effect on muscles or nerves or to interfere with the human body in any other way.

## ? Do radio waves have non-thermal effects?

! Non-thermal effects, as distinct from thermal effects which are the result of temperature, are presumed biological effects of electromagnetic fields. These effects would occur in the human body irrespective of any increase in temperature. The suspicions relate to the occurrence of non-thermal effects such as the effect of electromagnetic fields on sleep patterns or on memory. This is a subject of discussion, but according to evaluations of the latest scientific findings, non-thermal effects with an adverse effect on health are neither proven nor probable.

## Imprint

If you have any questions, please contact the EMF Team:

**E-mail:** [emf@a1.at](mailto:emf@a1.at)

**Tel:** 050 664-0

**Further information is available at** [A1.net/gesundheit](http://A1.net/gesundheit)

Federal Ministry for Transport, Innovation and Technology (BMVIT):  
[www.bmvit.gv.at/telekommunikation/index.html](http://www.bmvit.gv.at/telekommunikation/index.html)

Scientific Advisory Board for Radio at the Federal Ministry  
for Transport, Innovation and Technology (WBF):  
[www.bmvit.gv.at/telekommunikation/wbf/expertenforum/index.html](http://www.bmvit.gv.at/telekommunikation/wbf/expertenforum/index.html)

Mobile Communications Forum (FMK):  
[www.fmk.at/en](http://www.fmk.at/en)

International Commission on Non-Ionizing Radiation Protection (ICNIRP):  
[www.icnirp.org](http://www.icnirp.org)

World Health Organisation (WHO):  
[www.who.int/peh-emf/en/](http://www.who.int/peh-emf/en/)

EMF-Portal of the Research Centre for Bioelectromagnetic Interaction (FEMU):  
[www.emf-portal.org/en](http://www.emf-portal.org/en)

**Publisher and media owner**  
A1 Telekom Austria AG  
Lassallestraße 9, 1020 Wien

2019 © A1 Telekom Austria AG

**A1.net**