

# KPN and Electromagnetic Fields

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Electromagnetic Fields (EMF), or radiation, has attracted increasing attention lately. This document explains KPN's basic assumptions in this respect: why this debate is important for KPN, what the recent developments are and their impact, the standards that apply to EMF and the institutes that are involved.

## What is KPN's view on EMF?

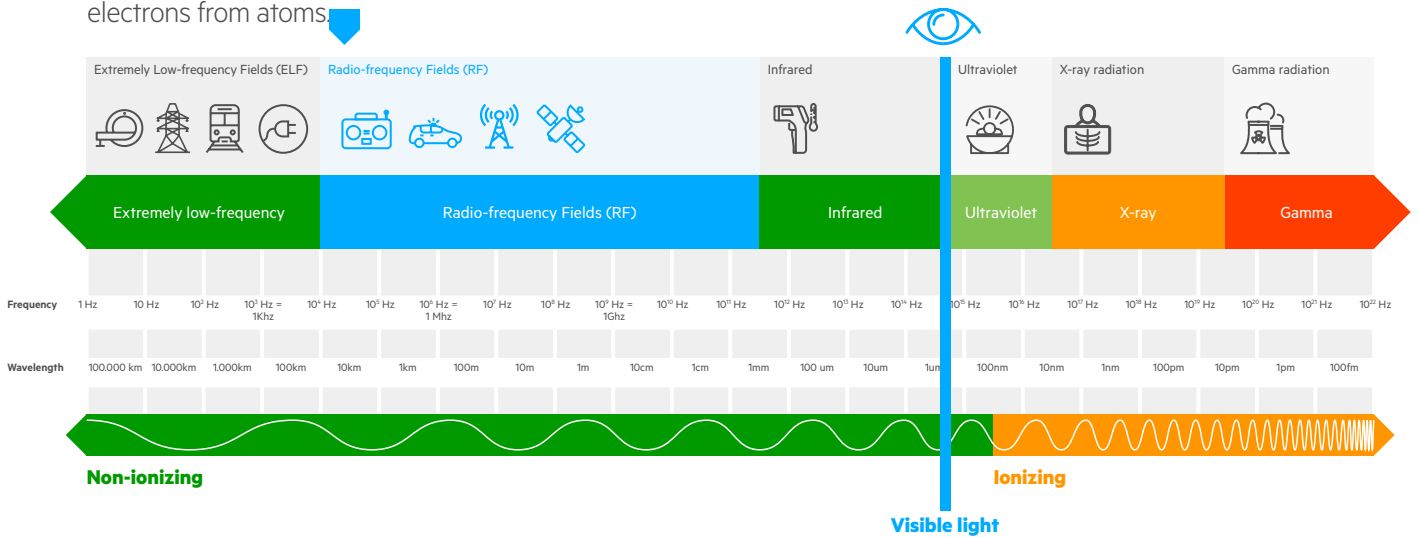
KPN is aware of social concerns about EMF emitted by mobile networks. As a provider of mobile communication services, KPN has clearly defined its role in the debate on radiation.

- KPN believes that conscientious handling of the health concerns about 5G (and health concerns about EMF emitted by mobile networks in general) is of crucial importance. As a supplier of vital infrastructure, KPN guarantees a mobile network that is safe for people and the environment.
- KPN complies at all times with the exposure limits determined by the ICNIRP (International Commission on Non-Ionizing Radiation Protection), an international group of independent scientists.
- As a provider of 5G and operator of a national mobile network, KPN adheres closely to these ICNIRP guidelines and other advisory guidelines published by the government.
- KPN keeps up with the latest scientific developments in this area by monitoring the publications of leading bodies, such as the Gezondheidsraad (Health Council of the Netherlands), Kennisplatform EMV (Dutch EMF Knowledge Platform), the RIVM (Dutch National Institute of Public Health and Environmental Protection) and the Antennebureau (Dutch Antenna Monitoring Agency), and complies with all the advisory guidelines and recommendations. Upon request, KPN provides data to scientists to support their research in the area of EMF and health.
- KPN acts immediately when the government updates standards or advisory guidelines based on new scientific information.
- KPN cooperates fully with all relevant authorities, including the regulatory body Agentschap Telecom (Radiocommunications Agency Netherlands), in conducting EMF surveys (i.e. taking regular measurements in the vicinity of transmitter masts) and publishing the measurement results.
- KPN is committed to a safe, responsible rollout of 5G and sees public support and coordination with stakeholders as essential elements.
- KPN contributes as much useful and factual information as possible to the public debate on EMF. In doing so, KPN takes into account the general perception that KPN is a commercial provider and therefore a biased party. Other parties, such as the government, the RIVM and Kennisplatform EMV, are appropriately positioned to independently coordinate the public debate on EMF.

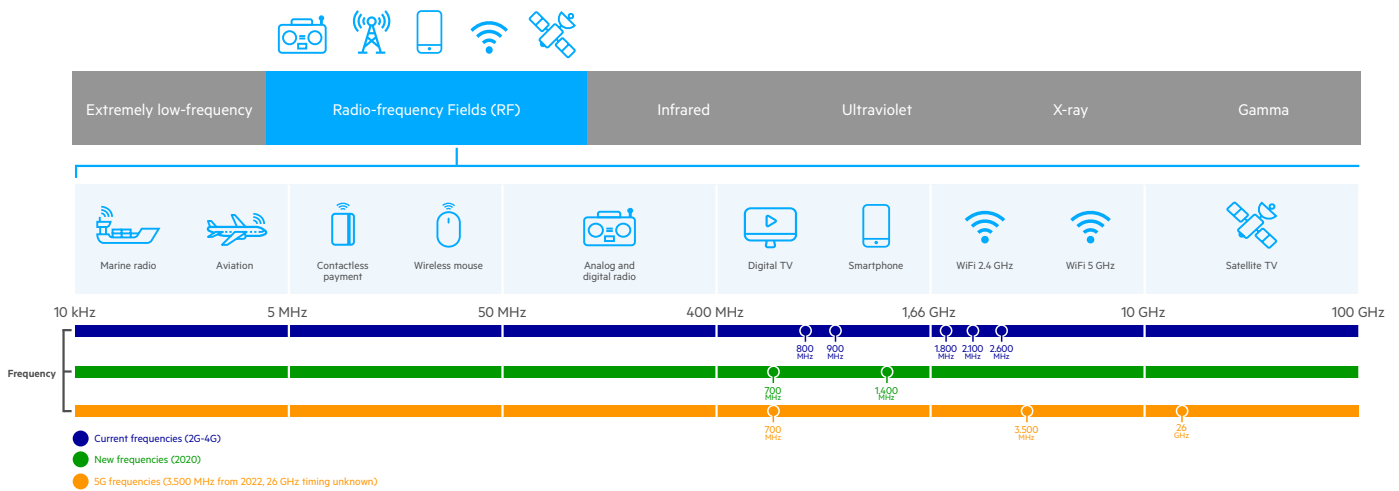
## What are Electromagnetic Fields (EMF)?

Broadly speaking, there are two types of electromagnetic fields: ionizing and non-ionizing radiation. This distinction is important. When people hear the term 'radiation', they generally think of dangerous forms of radiation such as x-rays and gamma rays. These are examples of ionizing radiation where the emitted particles or waves carry sufficient energy to detach electrons from atoms.

As a result, ionizing radiation can damage the DNA in human cells. This contrasts with the non-ionizing radiation associated with all low-frequency electromagnetic fields (between 10 kHz and 300 GHz). These radio-frequency fields are used for radio, television, mobile telephones and other appliances and have no ionizing effect.



The image below shows the radio frequency fields including the different frequencies.



## Exposure limits determined by the ICNIRP

The ICNIRP (International Commission on Non-Ionizing Radiation Protection) has determined the exposure limits for non-ionizing radiation. This commission consists of an international group of independent scientists.

The scientists took the health effects of non-ionizing radiation into account when establishing these ICNIRP guidelines. Strong electromagnetic fields emitted by mobile networks can cause localized heating in parts of the body or the skin, sometimes referred to as 'thermal effects'.

Because mobile phones and transmitter masts may not generate fields that exceed these exposure limits, the thermal effects are limited to a heat increase of no more than 1 degree Celsius. In scientific research involving exposure to transmission signals below the exposure limits, no evidence of possible adverse health effects has been found. According to the ICNIRP, there is also no scientific evidence indicating that other effects (known as 'non-thermal effects') have an adverse effect on health.

The first ICNIRP guidelines were published in 1998 and adopted by the European Commission in 1999 in the form of a recommendation to all European Member States advocating adoption of these exposure limits in each State's national legislation. In the Netherlands, these guidelines are specified in a covenant between the government and the mobile providers. The ICNIRP guideline varies depending on the spectrum band. The recommended level is between 41 V/m and 61 V/m for the spectrum bands used by the Dutch mobile networks (from 700 MHz to 2600 MHz).

	50 Hz		900 MHz			1800 MHz			2100 MHz		
Country:	electric field strength (V/m)	magnetic density (µT)	electric field strength (V/m)	magnetic density (µT)	equivalent plain wave power density (W/m <sup>2</sup> ):	electric field strength (V/m)	magnetic density (µT)	equivalent plain wave power density (W/m <sup>2</sup> ):	electric field strength (V/m)	magnetic density (µT)	equivalent plain wave power density (W/m <sup>2</sup> ):
1999/519/EC	5000	100	41	0.14	4.5	58	0.20	9	61	0.20	10

[Source: Comparison of international policies on electromagnetic fields RIVM 2018]

The ICNIRP recently revised its guidelines based on twenty years of scientific research. The new, updated ICNIRP guidelines were published in March 2020 and are therefore completely up to date again. The Dutch government intends to incorporate these new guidelines in new legislation in order to be able to legally enforce compliance.

In the Netherlands, Agentschap Telecom measures the field strengths and the Antennebureau issues information on antennas and EMF. The information published by the Antennebureau (see below) indicates that the ICNIRP guidelines include a generous safety margin: the exposure limits defined by the ICNIRP are 50 times lower than the point at which thermal effects occur (maximum temperature increase of 1 °C).

## Guideline, exposures, field strength

### ICNIRP guideline

1°C

#### Factor 50



#### ICNIRP exposure limits

##### Recommended by the EU and applied in NL

Radio broadcasting frequencies > 28 V/m  
2G | 3G | 4G | 5G > 39 - 61 V/m

#### Factor 10



#### Electromagnetic Field Strength in the Netherlands

##### Randomly measured by Agentschap Telecom

0,5 - 3V/m

[Source: Antennebureau, May 11, 2020]

Furthermore, the results of the EMF measurements carried out by Agentschap Telecom show that the actual radiation levels achieved by Dutch mobile operators are 10 times smaller than these exposure

limits. These measurement results are available to the public and shown on a [map of the Netherlands](#). KPN is also well below the ICNIRP guideline at all times.

## Why is EMF important for KPN?

The introduction of new technologies such as 5G has led to concerns among Dutch citizens. KPN is convinced that 5G has a positive effect, because it provides infrastructure for innovative services that can be of great value to both businesses and all other users.

The rollout of new technologies has also been affected by social and political resistance in the past. The rollout of UMTS for example, when KPN encountered local resistance. In this case, there were also concerns about the health aspects of UMTS, the third mobile network generation (3G). Remarkably, the launch of LTE (4G) hardly led to any concerns about radiation and health.

## Which institutions are involved in EMF?

**The ICNIRP (International Commission on Non-Ionizing Radiation Protection)** is an international group of scientists who, in 1998, determined the maximum permitted electromagnetic field strength, referred to as the exposure limits or ICNIRP guidelines. The ICNIRP regularly assesses whether the exposure limits need to be amended. These limits were reviewed extensively in 2020 and amended to reflect the results of all scientific studies carried out during the past twenty years. The new ICNIRP guidelines also apply specifically to all the frequency bands where 5G can be used (for example, greater attention is paid to the higher 'mmWave' frequency bands).

Following the publication of the ICNIRP guidelines, The European Commission issued a recommendation to all Member States in 1999, urging them to adopt these guidelines in national legislation. These ICNIRP guidelines are also referred to in the product standards for transmitter masts and mobile phones. **The European commission** is currently investigating whether a new recommendation is required in order to ensure application of the 2020 ICNIRP guidelines in all European countries. (The European Commission is not authorized to enforce the ICNIRP guidelines as a mandatory requirement; it can only recommend their adoption.)

**The Dutch government** intends to incorporate the new ICNIRP guidelines in legislation in 2020 to ensure official monitoring. At present, the 1998 ICNIRP guidelines are referred to in [the Antenna Covenant](#), which has been signed by all providers of mobile telecommunication services in the Netherlands, the government and the VNG (the Association of Dutch Municipalities).

**The Agentschap Telecom** (Radiocommunications Agency Netherlands) is the regulatory body for radio communication frequencies and performs random checks to [measure](#) EMF levels and ensure that they comply with the agreements stated in the Antenna Covenant, i.e. the (old) ICNIRP guidelines. To date, all field strength measurements carried out by Agentschap Telecom indicate that KPN and the other providers of mobile telephony fall comfortably within these limits. [Click here](#) for more information.

**The Antennebureau** (Dutch Antenna Monitoring Agency) is the government agency responsible for publishing information about antennas for wireless and mobile communication. [The Antennebureau](#) informs citizens about the health effects of antennas and provides information on EMF.

**The Kennisplatform EMV** (the Dutch EMF Knowledge Platform) brings together institutions that have scientific knowledge related to EMF with organizations that have first-line contacts in connection with this topic. The knowledge platform sees itself as an intermediary between science and the general public, and interprets scientific research for citizens. The following parties are members of Kennisplatform EMV: RIVM, TNO, DNV GL, GGD GHOR Nederland, Agentschap Telecom and ZonMw. The Gezondheidsraad has an advisory role within [the knowledge platform](#).

**The ‘commissie EM-velden’ of the Gezondheidsraad** (EM fields committee of the Health Council of the Netherlands) is a multidisciplinary committee that assesses published research results. Some research studies are rejected because they do not meet the scientific requirements, meaning that the evidential value of the study is too low to draw any conclusions based on it. [Click here](#) for more information.

**The RIVM** (Dutch National Institute of Public Health and Environmental Protection) helps the government protect citizens, patients and employees against the harmful effects of radiation. At the instruction of Agentschap Telecom, the RIVM has analyzed the relevant peer-reviewed scientific literature to gain information on exposure to and the possible health effects of 5G systems. [Click here](#) for more information. In addition, Agentschap Telecom and the RIVM have performed field strength measurements at 5G test sites.

**The World Health Organization (WHO)** has a [separate website](#) that provides information about 5G and health, and also publishes tips on the use of [mobile phones](#).

**The Scientific Committee on Health, Environmental and Emerging Risks (SCHEER)** is an independent committee that advises the European Commission on health, the environment and emerging risks. [Click here](#) for more information. SCHEER also includes 5G in its research program.

**The International Agency for Research on Cancer (IARC)** is an intergovernmental agency and part of the United Nations’ World Health Organization. This agency investigates the cause of cancer based on the mechanisms of carcinogenesis and engages in epidemiological and toxicological research. [Click here](#) for more information.

### What does the science say about radiation emitted by transmitter masts and mobile telephony?

No evidence of possible adverse health effects has been found in the scientific research investigating exposure to transmission signals below the ICNIRP’s exposure limits. The ICNIRP guidelines focus on thermal effects – localized warming of the body due to EMF. Non-thermal effects have been investigated by many researchers, but have never been scientifically proven. These studies investigated the likelihood of developing brain tumors and DNA damage. Possible effects on the human sensory system, brain, nervous system, heart and blood vessels, hormones, immune system, fertility and effects during pregnancy have also been investigated.

The research does seem to indicate an increased risk of developing two types of brain tumor when using a mobile phone. However, the significance of this evidence is not clear as of yet. The International Agency for Research on Cancer (IARC) has not ruled out the possibility that these indications were caused by chance, bias or other factors. Based on these uncertainties, the IARC has assessed mobile transmission signals as “potentially carcinogenic in humans”. The opinion of the IARC is an important signal to the scientific community, indicating a need to continue research into a possible connection between mobile phones and the likelihood of developing brain tumors.

The possibility that health effects, which occur below the level of the exposure limits, will be discovered in the future cannot be ruled out. The main focus here is on the possible effects of long-term exposure. The WHO does not see the IARC assessment as a reason for recommending tightening the exposure limits for mobile phones and transmitter masts. The indications are not substantial enough to justify such an action. The Gezondheidsraad came to the same conclusion. An important point here is that the number of brain tumors in the Netherlands and in other countries does not show a sharp increase, as you would expect in view of the enormous increase in the use of mobile phones in recent decades. [Click here](#) for more information.

In the Netherlands, research is also being conducted to investigate the health effects of mobile phone radiation. The COSMOS research study, which involves several hundred thousand people in six European countries (a 'cohort'), is currently ongoing. This study tracks the participants over a long period of time to determine whether there is a correlation between the level of mobile phone use and health effects in the long term. KPN collaborates by providing data for this research on request. The effects considered by the study include cancer, benign tumors, cerebrovascular disease and less serious ailments such as headaches and sleep disorders. The study started in 2017 and new international results are expected in 2021. Based on advice issued by the Gezondheidsraad in 2019, the Dutch government has decided to extend the Dutch part of the research until 2023. [Click here](#) for more information.

### **Will 5G increase the level of electromagnetic radiation?**

The electromagnetic fields generated by 5G antennas are similar to those of 2G, 3G and 4G antennas because 5G uses the same basic transmission techniques. At present, it is not clear whether 5G technology will lead to an increase in the general public's exposure to electromagnetic fields, because 5G has not yet been introduced on a significant scale. Different opposing effects are to be expected. Some scientists expect 5G to lead to higher exposure, because the increase in mobile communications (more data use) will require a greater number of antennas and an extension of the number of spectrum bands used per transmitter mast. On the other hand, 5G makes use of more energy-efficient techniques, meaning that some antennas are able to send extremely focused signals to devices. This could lead to reduced bystander exposure. In any case, even after the introduction of 5G, the total exposure to electromagnetic fields must remain below the ICNIRP exposure limits and compliance will be closely monitored.

### **Will more antennas be needed?**

KPN is currently upgrading its entire mobile network. This upgrade includes the use of technology-neutral antennas. In other words, the antennas we use are not specifically designed for 5G, but can also support 2G, 3G, 4G and 5G. Initially, KPN will use the existing, roughly 5,000 antennas for 5G. In the coming years, the number of antennas will increase by roughly 10% in order to ensure good coverage and sufficient capacity throughout the Netherlands. [Click here](#) for more information.

In the longer term, smaller, less powerful 5G antennas may also be added. These units are known as small cells. These small antennas are likely to be incorporated in street furniture such as bus shelters and lamp posts, and are designed to provide extra network capacity in very busy locations (such as a main railway station and a stadium). At the moment KPN does not have any small cells in use and also has no solid plans to install them. However, we do expect small cells to be introduced when the most appropriate spectrum bands for this type of unit become available; i.e. the 3.5 GHz band and the 26 GHz band. This is not expected to happen in the Netherlands for a few years yet. Even when they are available, mobile operators are not expected to roll out their networks nationwide in these bands. The threatening predictions of antennas on every street corner voiced in the media are therefore highly unlikely - only the busiest places and cities will be equipped with small cells to ensure adequate capacity for local demand.

## What can I do to limit radiation exposure?

The electromagnetic radiation emitted by all mobile networks (1G to 5G inclusive) reduces proportionally as you move further away from the antenna. When you use your mobile phone to make a call, it also emits electromagnetic radiation. The further you are from a transmitter mast, the more powerful the signal your mobile phone has to transmit in order to reach the transmitter mast. If you are close to a transmitter mast, your mobile phone does not have to transmit such a powerful signal to reach the mast. Due to the height involved and the distance between you and the transmitter masts, you will almost always be exposed to more electromagnetic radiation from your mobile phone than from the transmitter mast when you make a call, simply because your mobile phone is much closer to your body than the transmitter mast.

The WHO and Kennisplatform EMV have published several tips for users who wish to take additional action to reduce their personal exposure to radiation while making calls. [Click here](#) for more information. One possibility is to make calls wearing earphones so that the telephone can be held further from your body. In addition, the SAR values of mobile phones vary depending on the make and model. SAR stands for Specific Absorption Rate, which indicates the amount of radio frequency energy absorbed by the body while using a mobile phone. Manufacturers are obliged to perform SAR tests and make the associated reports available. More information on this topic can be found on the websites of the [ICNIRP](#) and the [FCC](#).

## Do higher frequency bands involve more risks?

In addition to general concerns about the effects of EMF on health, a group of people who suffer from electromagnetic hypersensitivity have voiced specific concerns about the use of higher frequencies (such as the 3.5 GHz band and the 26 GHz band) when rolling out 5G networks. According to these people, insufficient research has been carried out into the health effects of using these high frequency bands for 5G technology. KPN does not expect any scientific research in this area to produce significantly different results as the radio waves are essentially the same as in the other bands. Obviously KPN will cooperate fully with measurement tests of these bands performed by the regulatory authorities and with properly organized scientific research.

It should be noted that these bands are already used for other applications. For example, the 3.5 GHz band is used for local applications in the south of the Netherlands (in the north of the country, this band is reserved for the satellite ground station in Burum) and the 26 GHz band is used for point-to-point connections (radio relay connections), which are also subject to EMF guidelines. Consequently, these '5G frequencies' are not yet available in the Netherlands for 5G applications. The 3.5 GHz band will only be made available after September 2022. As for the 26 GHz band, the Dutch government does not yet have concrete plans for making these frequencies available. However, experiments with these bands are already being conducted in the Netherlands, based on experimental licenses. [Click here](#) for more information.

Inspectors from Agentschap Telecom, the radio communications regulator, are invited to take EMF measurements every time these experimental licenses are put into operation for the first time. This condition is stated in the experimental license. In addition, KPN facilitates testing by scientists in the mmWave bands, such as the 26 GHz band, when using them for experiments with 5G. This approach ensures that scientific research in these new 5G bands can be carried out faster and more efficiently.



## What does beamforming technology mean for my health?

In addition to general health concerns about the health effects of radiation, some of the people suffering from electromagnetic hypersensitivity are concerned about a new technology called 'beamforming'. In 'beamforming', dozens of small antennas (massive MIMO) send highly focused signals to devices and can also 'track' these devices (subject to a limited degree of mobility). Technical diagrams explaining this concept sometimes unintentionally raise concerns about targeted tracking of all movements of users in these focused beams.

KPN is also investigating the possibilities of using this new technology in its mobile network. We are convinced that 'beamforming' can actually lead to a reduction in bystander exposure levels. Furthermore, the user only receives a focused antenna signal when actually communicating. Because this is new technology, KPN advocates monitoring developments and continued research to assess this technology. Agentschap Telecom is already performing measurements in areas where KPN is experimenting with this technology.

## What are the next steps in research into and the rollout of 5G?

So far, scientific research has not revealed any evidence that EMF radiation caused by 5G - or mobile communication in general - is harmful to health in humans or animals, or has an adverse impact on the environment. However, scientific research is never-ending by nature; KPN expects that research into 5G will continue in the future. We encourage this without being directly involved or adopting a specific viewpoint; KPN is a commercial provider of 5G and in this role we communicate as transparently as possible to all our users and welcome questions from researchers at independent scientific institutes.

In the run-up to a large-scale rollout of 5G, KPN will obviously adhere strictly to the ICNIRP guidelines on the maximum radiation levels, as published in March 2020. In addition, we cooperate fully with the EMF test measurements carried out by Agentschap Telecom, which [are published online](#).

Mobile telephony continues to develop, and so does research into its effects. We keep track of these developments and feel it important that the Dutch public is kept well-informed. Obviously, KPN will comply with any new advisory guidelines drawn up by government agencies (such as the Antennebureau), the Gezondheidsraad, Kennisplatform EMV and the RIVM based on new scientific information.