5G, EMF Exposure and Safety

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Introduction

The debate on health concerns related to Electromagnetic Field (EMF) exposure has been ongoing through every generation of mobile technology. The adoption of 5G and expanded use of features such as the use of millimetre wave (mmWave) spectrum and small cells has resulted in heightened media discussion, and some misinformation.

This booklet provides an introduction to 5G technology, an explanation as to how 5G networks operate, and provides an overview of the international safety guidelines for the levels of EMF exposure.

Misinformation around the safety of 5G technology has also gained media traction. Providing answers to some common questions, the Frequently Asked Questions section addresses issues in respect to 5G, public health and the environment.

5G, EMF Exposure and Safety

What is 5G?

5G is the next generation of mobile technology that will transform the role of mobile connectivity in society. Designed to support new applications through gigabit data rates, low latency and high reliability, it will also provide efficient support for larger numbers of connections, enabling the Internet of Things (IoT).

In technical terms 5G delivers improved data rates (up to 100 times faster than current mobile networks), supporting virtually instant access to services and applications, with network latency significantly reduced. In addition, it offers network slicing technology making it possible to dedicate a unique part of a 5G network for a particular service.

How does a 5G network work?

5G networks will use a combination of smart antenna technologies and small cells to deliver radio signals where they are needed.

Conventional antennas provide coverage similar to how a floodlight illuminates a wide area. New 5G smart antennas act like flashlights, providing coverage where it is needed and reducing unwanted signals. Smart antennas increase capacity and improve efficiency.

Small cells are currently used by mobile networks to provide localised coverage and/or capacity and their use will expand with 5G. They may be mounted on street lights or inside buildings where over 80% of mobile usage occurs.

Many initial 5G deployments will be at frequencies similar to 3G/4G mobile networks and Wi-Fi. This also means that many existing antennas sites can be reused for 5G.

To achieve higher capacity 5G can also use higher frequencies that are used today by the mobile and satellite industries for other purposes. These frequencies are known as millimetre-waves (mmW or mmWaves).

The core part of the 5G network will initially use 4G control functions before transitioning to standalone 5G networks.

What are the international exposure guidelines and why are they relevant?

First published in 1998, the International Commission for Non-Ionizing Radiation Protection (ICNIRP) guidelines on limiting exposure to radiofrequency EMF (RF-EMF), establish limits to protect workers and the public. Wireless technologies operate in compliance with these guidelines or national regulations, and the World Health Organisation (WHO) formally recognises this independent non-governmental organisation.

The ICNIRP 1998 guidelines form the basis of regulatory limits for mobile network antennas and devices in most parts of the world and are supported by the WHO.

In March 2020, the 1998 ICNIRP guidelines were updated. The updated guidelines cover all frequencies used for mobile communications, including the frequencies used for 5G.

As part of the ICNIRP review process, an extensive assessment was carried out of the available scientific evidence and research on EMF and health, and this review covered studies across the entire radio frequency spectrum including the frequencies that can be used for 5G.

The review concluded that the 1998 limits provide protection for 5G. The 2020 Guidelines also introduce better and more detailed guidance, in particular, for frequencies above 6 GHz.

The WHO has concluded that EMF exposure below the limits recommended in the ICNIRP guidelines do not appear to have any known consequence on health.

The ICNIRP strongly recommends that countries update to the new ICNIRP (2020) guidelines.

Why is it necessary to harmonise RF-EMF exposure limits?

The WHO strongly promotes the use of international standards that provide the same or similar level of health protection for all people and endorses the guidelines of ICNIRP.

The WHO notes that large disparities between national limits and international guidelines can foster confusion for both regulators and policy makers, increase public anxiety, and provide a challenge to manufacturers and operators of communications systems who need to tailor their products to each market.

Restrictive limits do not offer any additional health protection against established health effects and do not lead to lower exposures in public areas. They make mobile network deployment less efficient, make co-location of antennas difficult, and increase the number of antenna sites that are required.

Is mobile safe?

The radio signals used by mobile technologies are extensively researched and have been for decades. The frequencies used for mobile operate in compliance with national or international EMF exposure guidelines, which cover all frequencies currently used by 5G and under consideration for 5G.

In March 2020 ICNIRP stated that the 1998 guidelines still provide protection against all known health effects of high-frequency radiation within the frequency range 100 kHz – 300 GHz (5G is using frequecies below 1 GHz, 1-6 GHz and above 6 GHz). The final limits for Radio Frequency transmitting devices, such as mobile phones and tablets, intended for use by the public are unchanged below 6 GHz. The 2020 update provides additional guidelines for frequencies above 6 GHz. This update has been anticipated by the industry for some time and test methods exist to ensure the compliance of 5G devices in the market. Public health agencies and expert groups consistently conclude that the guidelines protect all persons (including children) against all established health risks.

Mobile operators encourage national regulatory authorities to adopt international recommendations on EMF exposure levels for mobile communications to protect industry workers, mobile consumers and the public.

Frequently Asked Questions

Every generation of mobile technology has sparked some health discussion, however, the radio signals used by mobile technologies have been extensively studied for decades and the scientific evidence gathered is the basis for international safety guidelines.

Several myths around the safety of 5G technology have, however, gained some media traction. The following provides answers to some of the common questions that have surfaced in print, broadcast and social media.

Is 5G carcinogenic?

The International Agency for Research on Cancer (IARC), which reviews evidence for cancer hazards, classifies radio frequency signals in the same group as eating pickled vegetables (i.e. that there was limited evidence that they could cause cancer in humans). Eating processed meat falls in a higher classification than radio signals (i.e. there is stronger evidence that they might cause cancer in humans).

ICNIRP says that trends in brain cancer incidence rates do not show any increase since mobile phones were introduced, and concludes that no effects of radio signals on cancer have been substantiated.

The WHO says that studies provide no indication that base stations signals increases the risk of cancer or any other disease.

In February 2020 , the US Food and Drug Administration in a review of animal and epidemiological studies of radio signals and cancer concluded that:

"To date there is no consistent or credible evidence of health problems caused by the exposure to radio frequency energy emitted by cell phones".

Do we need more research on 5G before we can claim that it is safe for consumers?

Over the past two decades, extensive studies on radio signals used by mobile technologies have been undertaken and research continues. The WHO stated in February 2020 that:

"To date, and after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies... Provided that the overall exposure remains below international guidelines, no consequences for public health are anticipated."

Based on strong scientific evidence, international safety guidelines include all the frequencies under consideration for 5G. The GSMA and its members welcome ongoing independent research.

Is 5G dangerous for the environment?

The same exposure limits that protect people also protect the environment. The responsible German government agency (Bundesamt für Strahlenschutz) has stated that there is no scientifically reliable evidence of a risk to animals and plants exposed to radio signals at or below the limits in the international guidelines. In addition, the Antenna Bureau in the Netherlands (Antennebureau) has also refuted conspiracy-theorist claims that 5G tests harmed birds.

In addition, one of the goals of 5G is a 90% reduction in energy use. This will be achieved by reducing the power of transmitters when they are not in use, implementing sleep modes and reducing the amount of signaling needed to maintain connectivity.

I've heard children could be at greater risk. How can they be protected?

There have been many independent scientific reviews and these have consistently concluded that the international guidelines are protective of all persons, including children. However, there are currently few studies specific to children and this topic remains an active research area. The international exposure guidelines have been developed based on conservative assumptions to be protective of all persons.

National authorities in some countries recommend voluntary precautionary restrictions on phone and Wi-Fi use by younger children due to concern about possible greater vulnerability and to limit longer lifetime exposures if there is an unrecognised health risk. The WHO does not recommend specific measures for groups such as children and pregnant women.

Mobile phones are designed to automatically reduce power to the lowest possible level to make a quality connection. When used in areas of good reception a mobile phone will operate at lower transmit power.

I have read social media articles linking the spread of COVID-19 with 5G. Is this true?

No. WHO states that there is no link between 5G and COVID-19, confirming that viruses cannot travel on radio waves and/or mobile networks.

The WHO maintains that COVID-19 is spread through respiratory droplets when an infected person coughs, sneezes or speaks.

5G mobile networks do not spread COVID-19 and the GSMA urges governments around the world to take swift action against disinformation, vandalism and threats against mobile networks.

There have been reports that link 5G with interference with weather forecasting and its potential consequences. Is this correct?

Technical studies conducted by the International Telecommunications Union (ITU) confirm that 5G will not cause any harm to existing services, including weather forecasting. With the separation between weather forecasting spectrum and potential 5G spectrum, as well as reasonable power limits supported by most governments and the mobile industry, 5G presents no risk to weather forecasting.

Will 5G increase my exposure to EMF?

There may be a small localised increase in exposure levels when 5G is added to an existing site or when coverage is provided in a new area. However, 5G total exposure levels will remain below - and very low relative to - the international exposure limits. Based on the results from measurements of trial and commercial 5G networks the exposure levels will be similar to existing mobile services. Advanced base station designs and new technology features that are part of 5G provide higher capacity to meet consumer demand. As such, additional antennas will be required, and the number of small cell installations will increase. All mobile communication systems are designed, however, to minimise power to reduce systems interference.

Will large numbers of small cells for 5G mean an increase in exposure?

One of the goals of 5G deployments is to provide much higher data rates and the use of small cells will provide this enhanced capacity. Based on the results from current 5G trials and commercial networks, expected maximum exposure levels will be similar to existing mobile services and a small fraction of the international exposure guidelines.

Are testing standards in place for 5G devices and networks?

An international standard for assessment of mobile networks exists for all planned 5G frequencies.

Many initial 5G deployments will be at frequencies similar to existing 3G/4G mobile networks, and the same mobile device compliance limit values will also apply to 5G devices.

For 5G devices operating in frequency bands higher than those used by current mobile phones, new test procedures are in development and standardisation activities have been initiated.

The International Electrotechnical Commission has published a Technical Report providing guidance on current test methods. A final international technical standard will be completed by 2021.

How do you respond to petitions calling for 5G to be stopped?

The science mentioned in these petitions is already well known to the international scientific community and has been evaluated by independent expert groups who consistently conclude that the international guidelines protect all members of the public and the environment.

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