Mobile Communications and Health

Mobile phones and other wireless technologies have become an integral part of everyday life. But does using a mobile phone regularly, or living near a base station, have any implications for our health?

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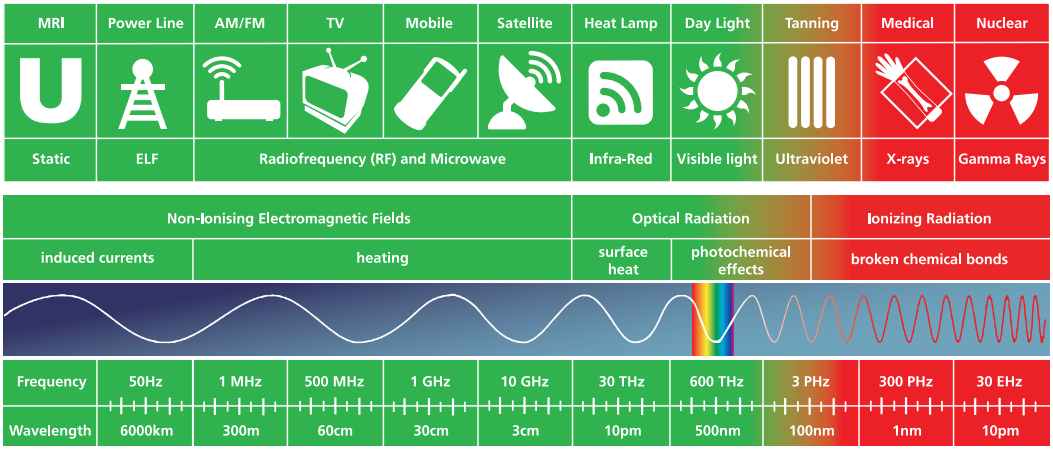
What are radio signals?

Radio signals are part of everyday life, emitted both by natural sources like the sun, the Earth and the ionosphere, and by artificial sources such as:

- mobile phone base stations
- broadcast towers
- radar facilities
- remote controls
- electrical and electronic equipment

Radio signals are a form of electromagnetic energy (or electromagnetic radiation - EMR), electric and magnetic fields moving together through space. Radio signals are non-ionising, which means that they cannot directly impart enough energy to a molecule to break or change chemical bonds. This is in contrast to ionising radiation, such as x-rays, which can strip electrons from atoms and molecules, producing changes that can lead to tissue damage and possibly cancer.



The Electromagnetic Spectrum

What are the biological effects and health hazards?

A biological effect occurs when a change can be measured in a biological system in response to a stimulus or change in the environment. However, a biological effect is not the same as a health hazard. A biological effect only becomes a health hazard when it damages the health of the individual or of his or her children.

It has been known for many years that exposure to sufficiently high levels of radio signals can heat biological tissue and potentially cause tissue damage if the human body cannot cope with the extra heat. Studies have consistently shown that the radio signals routinely encountered by the public are far below the levels needed to produce significant heating and increased body temperature.

Much of the public concern relates to the possibility of health hazards from long-term exposures at levels too low to produce measurable heating. There have been studies reporting biological effects but not health hazards at low levels. In many cases, the studies have not been subject to scientific peer review or the results have not been independently confirmed. The international consensus is that current limits are based on all the available scientific evidence, incorporate large safety factors and are highly protective of health.

What do the experts say?

"...the exposure to the general population that results from transmitters is very weak and one would not expect such exposure to produce a health risk as discussed in the previous report."

Statens Strålskydd Institut (Sweden), 2008

"...there seems not to be a need to modify the present guidelines to account for the risk of cancer or other long-term adverse effects not scientifically established."

International Commission on Non-Ionising Radiation Protection (ICNIRP), 2007

"...exposures to the radiofrequency energy produced by cellphones do not cause health problems... Reviews of all the research have not found clear, consistent evidence of any adverse effects."

Ministry of Health, National Radiation Laboratory (New Zealand), 2007

"The scientific evidence does not show a danger to users of wireless phones, including children and teenagers."

Food and Drug Administration, FDA (USA), 2003

Research

Over the past 50 years, there has been extensive research conducted into the possible health effects of exposure to many types of radio signals. As of July 2008, there were over 1000 publications on this topic in the World Health Organization (WHO) database.

Since 1995, more than 20 expert panels and government agencies have examined the scientific evidence and their consensus is that there are no established health hazards from exposures to radio signals at levels below the 1998 guidelines of the International Commission on Non-Ionising Radiation Protection (ICNIRP). WHO recommends adoption of the ICNIRP exposure guidelines.

However, the WHO has identified areas for continuing research to support future health risk assessments. Many research programmes have been guided by the WHO research recommendations and the WHO estimates that since 1997 over US $200million of funding has been allocated to such programmes.

What are the international exposure recommendations?

In 1998, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an independent scientific body recognised for its expertise by the WHO, issued guidelines for radio signal exposure that are applicable to mobile phones, base stations and other wireless devices.

The ICNIRP guidelines were developed following reviews of the scientific literature, including thermal and non-thermal effects, and are designed to provide protection against all established health hazards. The ICNIRP guidelines include substantial safety factors. ICNIRP monitors new scientific findings to ensure that the recommendations are protective of health.

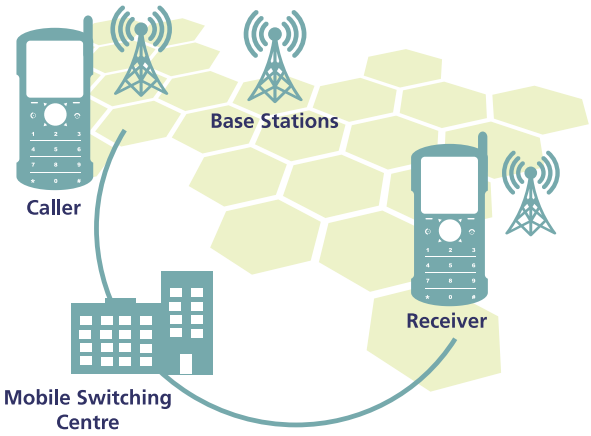
ICNIRP Guidelines

The ICNIRP guidelines are recommended by the WHO, the International Telecommunications Union (ITU) and the European Commission and have been widely adopted in Africa, Asia, Europe and the Middle East. Similar exposure standards are used in the Americas. Due to differences in scientific interpretation or in response to public concern some countries apply more restrictive standards. These measures provide no additional health protection and may lead to increased public concern.

How do mobile phones work?

Mobile phone networks are divided into geographic areas called cells, each of which is served by a base station. To communicate with each other, mobile phones and base stations exchange radio signals. The user connects to the base station via the handset and the system ensures that the connection is maintained as the user moves from one cell to another.

When a mobile phone is switched on, it responds to specific control signals from nearby base stations. Once it has located a suitable base station the phone initiates a network connection. The phone remains dormant, aside from occasional updates, until a call is made or received.



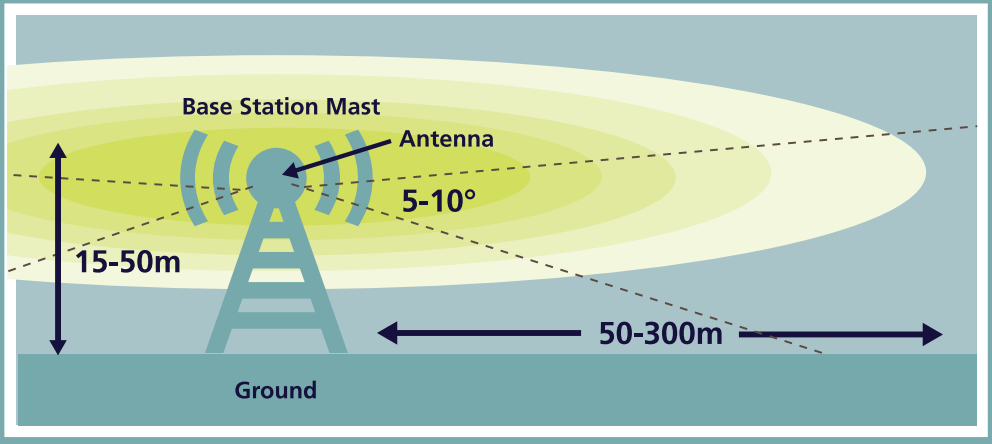
What is a base station?

Transmitted power levels vary depending on the geographical area of the cell, but the range is anything from less than a watt to 100 watts or more; lower for indoor base stations.

At an outdoor site, one or more antennas transmit the radio signals. Each is typically 15-30cm in width and 1-3 metres high, depending on the frequency of operation. The transmit pattern of the antennas is narrow vertically, but broad horizontally, so that the radio signal level directly beneath the antennas is very low. Typical levels in publicly accessible areas are 50 to 50,000 times below international safety recommendations.

Illness Clusters

There has been speculation regarding claims of illness clusters (particularly cancer) near base stations. However, subsequent examinations by independent health authorities have not identified any true clusters linked with either proximity to the base stations or the low level radio signals they transmit. Rare diseases are often distributed randomly in the community. Given the widespread presence of base stations there may be chance instances of apparent clusters as antenna sites need to be located where people use phones.



Base Stations: Beam shapes and directions

'Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.'

WHO, May 2006

Mobile phones

Compliance of mobile phones is based on assessment of the Specific Absorption Rate (SAR), which is the unit of measurement for the amount of RF energy absorbed by the body. The SAR is determined at the highest certified power level in laboratory conditions, however, the actual SAR level of the phone while operating can be well below this value.

Mobile phones use adaptive power control to reduce the transmitted power to the minimum possible whilst maintaining good call quality. This prolongs talk time and minimises interference to other callers. For example, during a voice call the average power output of a phone can vary from 0.001 watt up to the maximum level which is less than 1 watt. When coverage is good, such as close to a base station, the output level may be similar to that of a home cordless phone.

The view of the WHO is that the international exposure recommendations are protective of all persons and that no special precautions are needed for mobile phone use. If individuals are concerned, they might choose to limit their exposure by limiting the length of calls, or using 'hands-free' devices to keep mobile phones away from the head and body. Bluetooth earpieces use very low radio powers and will also reduce exposure.

Mobile phone shields

Various products are being marketed that claim to increase the safety of mobile phone use. These products generally take the form of shielded cases, earpiece pads/shields, antenna clips/caps, special batteries and absorbing buttons.

A mobile phone automatically operates on the lowest power necessary to maintain call quality. If an add-on device adversely affects the phone's antenna, the phone will attempt to transmit more power up to its specified maximum.

Scientific evidence does not indicate any need for shields on mobile phones. They cannot be justified on health grounds and the effectiveness of many such devices in reducing exposure is unproven. If individuals are concerned, personal "hands-free" devices have been shown to reduce exposures by at least a factor of 10 by allowing the phone to be used away from the head and body.

Children and radio signals

Some parents are concerned about whether there are health risks for children using mobile phones or where base stations are sited close to schools, day care centres or homes.

National authorities in some European countries have recommended precautionary restrictions on phone use by younger children due to concern about possible greater vulnerability and to limit longer lifetime exposures if there is an unrecognised health risk.

Health authorities in other countries, such as Australia, the Netherlands, the USA and the WHO have concluded that current scientific evidence does not justify specific measures and that international safety guidelines are protective of all persons, including children and pregnant women.

FAQs & myths

I've read that mobile phones can cause cancer. Is this true?
There is no convincing scientific evidence that the use of mobile phones can cause brain tumours or other cancers in humans. It is the consensus of the world wide scientific community that the low powered radio signals produced by a mobile phone do not have sufficient intrinsic energy to affect genetic material.

What about other health risks?
Independent scientific institutions around the world review relevant research as it is published. The consensus of these expert groups is that there is no demonstrable evidence of a risk to human health from mobile phone radio signals.

How can we be sure that this research is accurate?
Sophisticated and sensitive research methods using well-tried models for assessing health risks from other agents have been applied to investigate the safety of mobile phones. Many research institutions and the guidelines according to which such research is conducted, are controlled by government and independent bodies around the world. Research results are continually reviewed at an international level by organisations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the World Health Organization (WHO).

I live close to a base station. Am I at risk?
The consensus scientific view is that there are no health risks from living near a base station. Mobile phone base stations use low power radio transmitters to reduce interference to nearby sites. Recent measurement surveys show that exposures to base station radio signals range from 0.002% to 2% of the levels of international exposure guidelines, depending on a variety of factors such as the proximity to the antenna and the surrounding environment. This is lower or comparable to RF exposures from radio or television broadcast transmitters. It is only in areas close to the antennas that the recommended limits may be exceeded and the network operator prevents public access to these areas by placing the antennas near the top of the mast or high on a building.

Why are there so many restrictions on using mobile phones in hospitals?
At short range, the radio signal from a mobile phone may cause interference with electronic medical devices. At distances greater than 1-2m, the possibility is substantially reduced. It is possible for mobile phones to be used in designated areas of hospitals.

Why can't I use my mobile phone when I fly?
It is standard practice on aircraft to turn off all types of radio transmitters and certain other electrical devices unless they have been demonstrated not to cause interference to aircraft systems. There have been recent successful trials of mobile phone use on aircraft in Europe and the USA, and plans for commercial operations have been announced.

I've heard reports of mobile phones causing explosions at petrol stations, is this true?
There is no evidence of any established link between radio signals from mobile phones or base stations and petrol station fires. In fact, a 2005 report for the Australian Transport Safety Bureau concluded that of 243 reported incidents around the world none was associated with telecommunication equipment; instead, many of the fires were ignited by the discharge of static electricity from the human body.

How do we know that 3G and the other new radio technologies are safe?
There is a large body of existing scientific research at frequencies above and below those for 3G services, and a growing body of science using these particular signals. Expert groups have not established any signal specific effects, so the scientific consensus is that compliance with current safety standards provides protection against all known health effects.

Are some people more sensitive to radio signals?
The WHO concluded in Fact Sheet No. 296 of December 2005 that while self-reported headaches and other symptoms were real, there was no scientific basis to link the symptoms to exposure to radio signals. Furthermore, the WHO says that treatment should focus on medical management of the health symptoms and not on reducing exposure to radio signals.

I've read stories claiming that mobile phones can affect male fertility and sperm quality, is this true?
Some preliminary scientific studies have reported a link, however, these studies have generally not properly accounted for lifestyle factors, for example, diet, smoking, etc. The consensus view of expert public health bodies, including the WHO, is that there are no adverse health effects associated with the radio signals used by mobile phones or base stations.

Should I be concerned about the wireless network in my office or at my child's school?
The UK Health Protection Agency advises that on the basis of current scientific information Wi-Fi equipment satisfies international guidelines and, therefore, there is no reason why schools and others should not use Wi-Fi equipment. In addition, the WHO concluded in May 2006 that '...there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.'

Are the stories that mobile phones can cook eggs or make popcorn pop really myths?
They are both myths. There is simply not enough power from a mobile phone to produce either effect. A mobile phone has a maximum average power of about 0.25 watts, compared to 900 watts or more from a microwave oven.

Does a lower SAR mean that a phone is safer?
No. Variations in SAR do not mean that there are variations in safety. While there may be differences in SAR levels among phone models, all mobile phones must meet RF exposure guidelines.

Where can I get the SAR value for my phone?
SAR information for many phones is now included with the instructions as well as being published on the company website.

Key reference sites for mobile phones and health

World Health Organization (WHO)
www.who.int/emf

European Commission Health-EU Portal
ec.europa.eu/health-eu

U.S Food and Drug Administration and Federal Communications Commission Cell Phone Facts
www.fda.gov/cellphones/

U.K. Health Protection Agency
www.hpa.org.uk/radiation/

International Commission on Non-Ionizing Radiation Protection
www.icnirp.org

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