MMF
Mobile Manufacturers Forum

Mobile Phones EMF/Health Fact Pack

In association with

GSM ASSOCIATION

Contents

1 Introduction

There has been a substantial growth in the use of mobile communication services over the last few years. This growth is expected to continue for the foreseeable future with the introduction of new and different technologies.

This document provides background information on the operation of mobile phones and their supporting infrastructure. It also provides answers to some of the most commonly asked questions with respect to health and safety.

2 How mobile telephony works

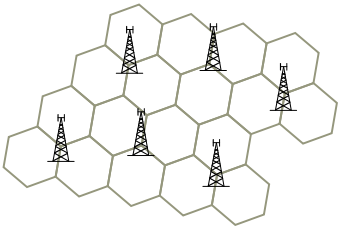


Figure 1: Structure of a network

When you make a call, your mobile phone sends radio waves also known as radio frequency (RF) fields. Radio waves have been used for many years by emergency services, taxis and radio and television broadcasters. RF fields are a form of non-ionising energy, which differs from ionising energy (such a gamma or x-rays) as it cannot break bonds in molecules.

The antenna of the nearest radio base station receives the radio waves and the base station then forwards the signal to a 'switch'. The switch connects the call to either the fixed line network or to another base station. Mobile communication networks are divided into geographic areas called 'cells', each served by a base station (Figure 1). The system is planned to ensure that mobile phones maintain the link with the network as users move from one cell to another. This process is called 'handover' – literally where the network hands over the call from one base station to another. The handover is seamless and the caller is not aware of the change.

The level of the signals sent between mobile phones and base stations is carefully optimised for the network to perform satisfactorily. The signals are closely regulated to prevent interference with other radio systems.

Detailed information on base stations can be found in the brochure 'Mobile Phone Base Stations EMF/Health Fact Pack', available on the MMF or GSMA website.

3 Mobile phone technologies

There are a number of different mobile phone technologies that use radio frequencies ranging from 450 MHz to 2,500 MHz (2.5 GHz). At present, many mobile phones in use are based on the mobile communications systems GSM (using TDMA technology), including GPRS and EDGE, or CDMA One (using CDMA technology).

More and more mobile phones incorporate 3G technologies. 3G stands for 'third generation' and is a collection of international standards and technologies aimed at increasing efficiency and improving the performance of mobile networks. 3G technologies combine high-speed mobile access with Internet Protocol-based (IP) services. IP is a network transport protocol used for exchanging data over the Internet. 3G mobile services offer enhancements such as greater data speeds, increased capacity for voice and data and the advent of packet data networks versus today's switched networks.

3G is a generic term covering a range of mobile network technologies, including WCDMA and CDMA2000. UMTS is a global 3G system implemented with WCDMA technology.

Mobile phones use adaptive power control as a means of reducing the transmitted power to the minimum possible whilst maintaining good call quality. For example, while using a phone the average power output can vary from the minimum level of less than 0.001 watt up to the maximum level, which is less than one watt (Figure 2). This feature is designed to prolong battery life and possible talk time.

Mobile communications technologies and systems

CDMA – Code Division Multiple Access

EDGE – Enhanced Data for GSM Evolution

GSM – Global System for Mobile Communications

GPRS – General Packet Radio Service

TDMA – Time Division Multiple Access

UMTS – Universal Mobile Telecommunications System

WCDMA – Wideband CDMA

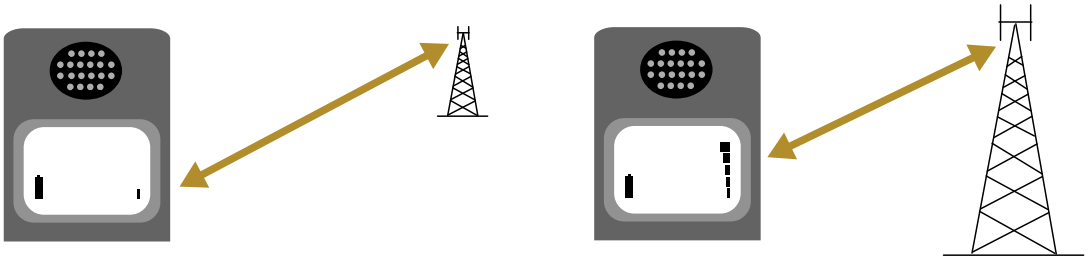
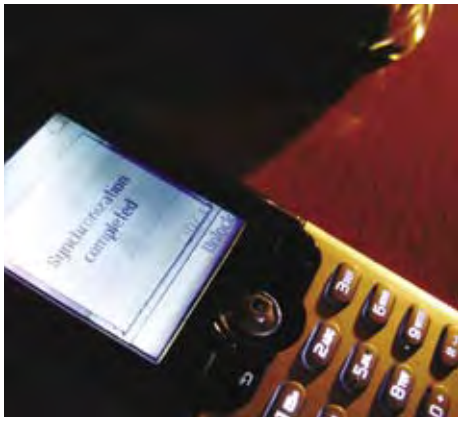


Figure 2: Signal strength is impacted by a number of factors but proximity to a base station is one of the most important.

4 Mobile phones safety: guidelines and research

Guidelines and research



In 1998, the globally recognised, independent International Commission on Non-Ionizing Radiation Protection (ICNIRP) released guidelines that recommend RF exposure limits that provide ample margins of protection to all members of the population. The ICNIRP guidelines have been widely adopted in many countries around the world and turned into national safety standards. The guidelines apply to mobile phones, base station sites and other wireless devices.

The biological effects of radio frequency electromagnetic fields have been studied for more than 50 years with over €200 million spent on research in the last decade alone.

As of October 2005, there were over 1700 peer-reviewed publications in the World Health Organization (WHO) research database relating to the biological effects of RF fields. Included in these papers are more than 400 independent, peer reviewed studies conducted at frequencies used by mobile communications. Over half of these have looked for associations between cancer and radio waves.

Information on the various studies undertaken in this field is available from the WHO website http://www.who.int/peh-emf/research/database/en/.

All established health effects of RF exposure at the frequencies used for mobile communications relate to heating. When radio wave energy is absorbed into our bodies, a heating effect may occur depending on the intensity of exposure. No significant heating effect occurs from exposure to radio waves within the exposure guidelines.

So-called 'non-thermal' effects – those that might occur at exposure levels too low to cause heating – have been explored at length. The consensus of health experts is that the results of these studies have been inconsistent and have failed to establish the existence of repeatable non-thermal effects.

Expert Reviews

Since 1995, more than 20 expert panels and government agencies have examined the scientific evidence regarding health effects from RF exposure. The consistent conclusion of these reviews is that the scientific knowledge shows that there is no evidence of harmful effects to the general population from RF exposure below internationally accepted exposure guidelines.

The WHO in 2004 said:

> *In the area of biological effects and medical applications of non-ionizing radiation approximately 25,000 articles have been published over the past 30 years. Despite the feeling of some people that more research needs to be done, scientific knowledge in this area is now more extensive than for most chemicals. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields.*

The views of the industry concerning the health effects of RF exposure from mobile phones, base stations and other mobile communications systems are in agreement with the conclusions of the WHO and many other expert review panels commissioned by official national and international organisations. These reviews have consistently concluded that there is no credible or convincing evidence that RF exposure from mobile phones, base stations or other wireless devices operating within ICNIRP exposure limits causes cancer or any adverse human health effects.

Member companies of the Mobile Manufacturers Forum test their products to ensure their adherence to these safety guidelines.

5 Demonstrating compliance: Specific Absorption Rate

The concept of Specific Absorption Rate (SAR) is used to quantify the amount of energy being absorbed by the body. Manufacturers demonstrate compliance with national and international safety standards and guidelines on the basis of compliance testing utilsing SAR measurements.

Understanding SAR

Although the SAR is determined at the highest certified power level in laboratory conditions, the actual SAR level of the phone while operating can be well below this value. This is because of the adaptive power control mentioned previously and other factors, including how the phone is used.

Variations in SAR among phone models do not mean that there are variations in safety. Users can have confidence in their safety due to the existence of science-based guidelines recognised by authorities around the world.

Following a voluntary initiative introduced by the MMF and its members in 2001, SAR values and what they signify are available to users in their phones' user manuals, on the manufacturers' websites and on the MMF website (which lists more than 400 handsets available today).

6 Further sources of information

1 **ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)**
http://www.icnirp.de/documents/emfgdl.pdf

2 **World Health Organisation International EMF Project.**
http://www.who.int/peh-emf

3 **L'Agence Française de Sécurité Sanitaire Environnement et du Travail (AFSSET)**
http://www.afsset.fr/

4 **UK Health Protection Agency - Electromagnetic Fields.**
http://www.hpa.org.uk/radiation/understand/radiation_topics/emf/index.htm

5 **La Asociación Española Contra el Cáncer - Campos Electromagnéticos Y Cáncer Preguntas Y Respuestas.**
http://www.todocancer.com/ESP/Informacion+Corporativa/Publicaciones/Otros Campos+Electromagneticos.htm

6 **Report of the Health Council of the Netherlands.**
http://www.gr.nl

7 **Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).**
http://www.arpansa.gov.au/

8 **Council of the European Union Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC).**
http://europa.eu.int/eur-lex/pri/en/oj/dat/1999/l_199/l_19919990730en00590070.pdf

9 **Professor John Moulder – Mobile Telephony and Human Health FAQ.**
http://www.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html

10 **The Wireless Information Resource Centre (WIRC) of Canada.**
http://www.wirc.org


The Mobile Manufacturers Forum is an international association of radio communications equipment manufacturers.

For more information, please visit the MMF's website at www.mmfai.org.

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