



LTE: Technology and Health

4G and Mobile Broadband



LTE Technology and Health

Mobile Broadband typically refers to providing customers with high speed data while on the move. There are several technologies capable of delivering commercial Mobile Broadband services. The GSM Association (GSMA) has produced this brief to describe key features of the technology and address some of the questions related to exposure to radio signals from LTE antennas and devices.

WHAT IS LTE, AND WHAT BENEFITS DOES IT PROVIDE?

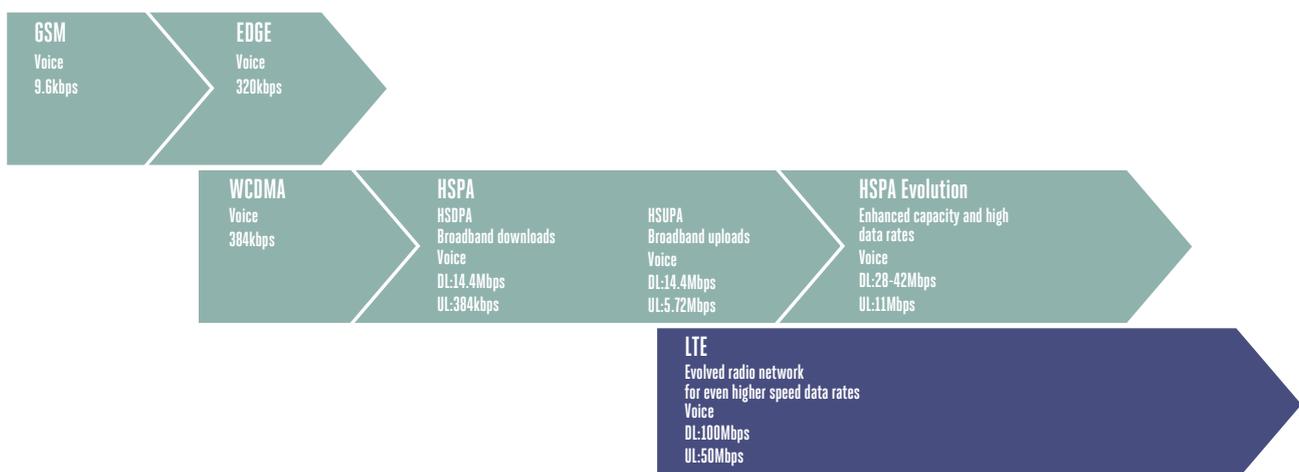
Long Term Evolution (LTE) is designed to deliver very fast data speeds – faster than most home wired broadband services. LTE has the advantage of being backwards compatible with existing GSM and 3G technologies, enabling mobile operators to deploy LTE and continue to provide a seamless service across existing networks.

LTE-Advanced is designed to enable even higher data rates by supporting higher order MIMO (Multiple In Multiple Out) antenna technology and combining multiple carriers.

The figure below shows data rates for Mobile Broadband technologies. 3G/WCDMA is a third generation mobile system. High Speed Packet Access (HSPA) technology is already delivering Mobile Broadband services and HSPA Evolution is a technical enhancement. LTE is the next step on the GSM technology road map after HSPA. The first commercial LTE networks were launched in Oslo, Norway and Stockholm, Sweden in December 2009. By the middle of 2013 more than 200 LTE networks were in operation worldwide. Global LTE coverage is projected to rise to approximately 60% of the world's population by 2018.

www.gsma.com/aboutus/gsm-technology

EVOLUTION OF MOBILE TECHNOLOGIES





WHEN LTE IS LAUNCHED WILL IT REPLACE EXISTING MOBILE NETWORKS?

As consumers expect to be able to use their mobile phone virtually everywhere, LTE will initially be deployed in parallel with existing mobile services. This also means continuity of service for customers who can continue to use their phones on existing networks. The first LTE devices were Mobile Broadband modems (USB 'dongles') that plug into laptops. Now other wireless devices such as smartphones and tablets increasingly also support LTE.

If governments allocate low frequency spectrum from the Digital Dividend, LTE has the potential to deliver mobile broadband coverage to rural and urban areas. This will enable high speed Internet access regardless of where people live.

The GSMA generally supports spectrum liberalisation, essentially the removal of technology restrictions to enable new mobile technologies to be deployed within the same band or bands as existing technologies. For example, 3G or HSPA could be deployed in spectrum bands where traditionally GSM has been used.

Where governments allow flexibility in the choice of technology, network operators may deploy LTE in the frequencies currently used to provide mobile services. In some cases this may be a replacement for GSM or 3G and in other cases it will be an additional radio technology. If a new license, with additional fees, is required before LTE services can be provided this may delay rollout.

www.gsma.com/spectrum/

WHAT KIND OF RESEARCH EXISTS REGARDING LTE AND POSSIBLE HEALTH EFFECTS?

Based on the current state of scientific knowledge expert bodies consistently conclude that the international standards provide health protection for all persons and are relevant to all mobile technologies, including LTE. The essential characteristics of LTE signals in respect of exposure are comparable to those of existing mobile technologies. These similarities refer especially to the transmission power and also to the relevant frequency range. Indeed, the frequency bands which will be used by LTE were previously allocated to other mobile or radio services, for example TV. The existing scientific research and safety standards refer to the whole frequency range up to 300 GHz. Therefore, existing health risk assessments are valid independently of the mobile technology (GSM, 3G, LTE) for the whole frequency range.

In April 2010 the German Federal Agency for Radiation Protection assessed LTE in response to a question in the German Bundestag (parliament) and concluded:

'These frequencies adjoin the frequency bands previously used for mobile communication and researched in the German Mobile Telecommunication Research Programme (DMF). Therefore, no significant differences to previously used mobile communication frequencies are to be expected regarding possible biological effects: The German Mobile Telecommunication Research Programme has shown that there were no indications of a damaging effect of mobile communication within the effective limit values.'

www.bfs.de/en/elektro

ARE NEW SAFE EXPOSURE LIMITS NEEDED FOR THE LTE SYSTEM?

No, because current international safety guidelines for radio technologies are valid for the whole frequency range planned for LTE deployments. These guidelines are recognised by the World Health Organization (WHO) as providing protection for all persons against all established health effects.

Public Health England (PHE) states:

'From an exposure perspective, the AGNIR [Advisory Group on Non-ionising Radiation] report states that 4G networks are very similar to other mobile communications networks, and PHE expects public exposures to remain well within the ICNIRP [international] guidelines after the deployment of 4G services in the UK.'

The International Commission on Non-ionizing Radiation Protection (ICNIRP) is a non-governmental organization formally recognised by WHO. The main conclusion from the WHO reviews is that exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health.

www.who.int/emf/

HOW DO THE EXPOSURES FROM LTE ANTENNAS COMPARE TO OTHER MOBILE AND RADIO SERVICES?

Measurements of LTE antenna sites have found that typical exposures are similar to current wireless networks, and other sources, such as TV. The level of exposure in a particular position will depend on many factors including antenna height, and distance to the antenna.

The WHO has concluded that for mobile and wireless networks:

'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.'

www.who.int/mediacentre/factsheets/fs304/en/index.html

In Germany measurements of network upgrades found that LTE levels were at the same order of magnitude as those from GSM or 3G. Where LTE antennas were added to a site with existing GSM or 3G antennas, the total exposure increased but was still only a small fraction of recommended limits. The results of the nationwide German measurements are summarised in the figure on the next page.

http://www.izmf.de/sites/default/files/IZMF_LTE-brochure_screen.pdf

The LTE network aims to maximize the data rate using the available radio resources. The amount of customer data traffic will affect the amount of power being transmitted. Assessments for compliance with exposure limits are generally conducted for designed maximum power. This may not be representative of everyday conditions. Research on a Swedish network of more than 5,000 sites found that even in high data traffic periods the transmitted power was less than 12% of the maximum 90% of the time.

LTE PROMISES FASTER DATA RATES THAN CURRENT MOBILE TECHNOLOGIES, DOES THAT MEAN HIGHER EXPOSURES FROM THE ANTENNA SITES AND WILL THIS GROW WITH MORE DATA TRAFFIC?

We all expect more from mobile applications, and services at home, at work and on the move. LTE will improve data speeds and network capacity by carrying data more efficiently. This is needed to meet the high expectations and demands customers place on mobile communication applications and services both in their professional and private life. The power from an LTE base station will vary in response to the amount of data traffic. The maximum exposure levels will be similar to other mobile services using similar transmitter powers.

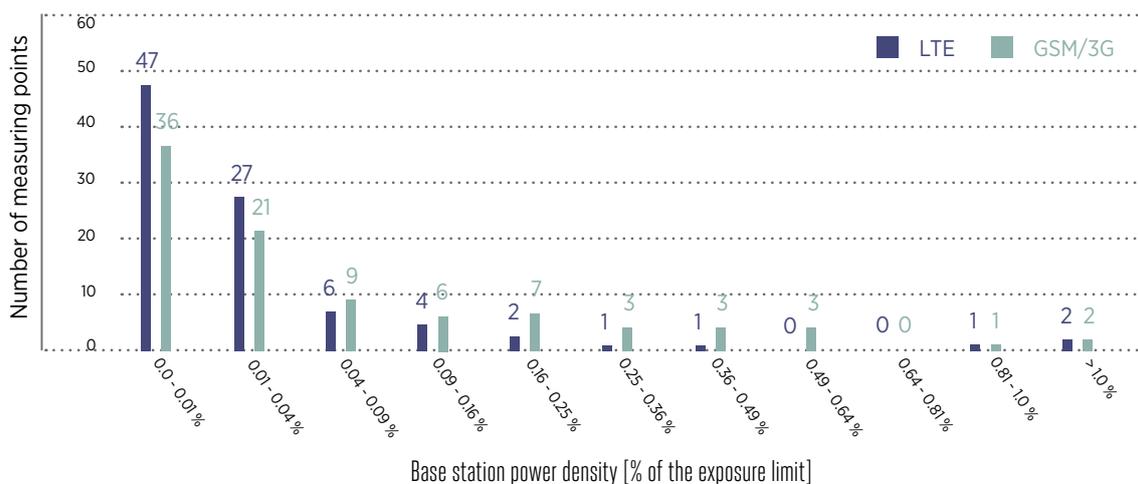
ARE THERE SAFETY STANDARDS FOR LTE DEVICES?

Yes, LTE devices have to comply with the same limits as mobile phones. LTE devices include data modems (such as USB ‘dongles’, smartphones and tablets. Exposure guidelines for mobile phones and devices used close to the head or body specify the maximum level of RF energy that can be absorbed with a large safety margin. The term for the amount of RF energy absorbed by the body or the head during a phone call or use of a mobile device is the Specific Absorption Rate or SAR. SAR is expressed in units of watts per kilogram (W/kg).

The maximum SAR level for a mobile phone used against the head or body in accordance with the international guidelines is 2 W/kg measured over a 10 gram averaging mass. Some countries use other limit values. LTE devices (including smartphones) are tested for SAR compliance at the highest certified power level in laboratory conditions.

<http://www.youtube.com/watch?v=WwKYB1NpXQo>
www.sartick.com

NATIONWIDE GERMAN LTE AND GSM/3G MEASUREMENTS



The horizontal axis shows the measured level as a percentage of the exposure limit in different ranges from <0.01% up to >1%. The vertical axis shows the number of measured points for each technology (LTE and GSM/3G) in each percentage range. Most measurements (47 for LTE and 36 for GSM/3G) were less than <0.01% of the limit. Only two measurements for each of LTE and GSM/3G did the measured level exceed 1%.

Source: IZMF (2013)

DO I NEED TO TAKE ANY PRECAUTIONS WHEN I USE MY LTE DEVICE?

All equipment transmitting radio signals must comply with national or international safety requirements, which also applies to LTE devices. Some devices are designed to have a small minimum separation from the body when in use, typically 15–25 mm depending on the device. This is to ensure that the device operates more efficiently and also meets the SAR requirements. If a separation is required this will be described in the documentation accompanying the device. No other precautions are required.

In June 2011, the WHO stated:

‘A large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established for mobile phone use.’

www.who.int/mediacentre/factsheets/fs193/en/index.html



I AM CONCERNED, HOW CAN I REDUCE MY EXPOSURE?

The power (and hence the radiofrequency exposure to a user) falls off rapidly with increasing distance from the device. A person using a mobile phone away from their body – for example when text messaging, accessing the Internet, or using a “hands free” device – will therefore have a much lower exposure than someone holding a phone against their head.

Keep in mind that using the LTE device in areas of good reception also decreases exposure as it will transmit at reduced power.

LTE devices are low-powered radio transmitters with peak powers of up to 0.2 watts. The device only transmits power when it is turned on. LTE devices are tested for compliance with exposure standards at their highest certified power level in laboratory conditions.

**Better connection,
lower transmit power,
longer talk time**



IS THE AMOUNT OF POWER AFFECTED BY HOW MUCH DATA I SEND?

The power level and duration of transmission is determined by many factors including the amount of data being sent, the network data rate and the quality of the radio connection. More data is sent when transmitting an image than a text message. Remember that an LTE device is only transmitting small amounts of data when viewing an Internet site as it is mostly receiving information. Published measurements show that transmit power levels from LTE devices are similar to those from 3G for similar data rate services.

All mobile technologies adapt their transmitted power to operate at the lowest level possible by taking account of the type of service (voice or data) and the quality of the radio link between the mobile device and nearby antenna sites. This also minimises interference to other nearby mobile devices.

www.gsma.com/publicpolicy/mobile-and-health/mobile-devices

WILL YOU NEED TO PUT UP NEW ANTENNA SITES FOR LTE, LIKE YOU HAVE FOR 3G?

As LTE has different frequency requirements to those of existing mobile services new antennas may be required. Where possible an operator will place these antennas at an existing site and at other times new locations will be required. In some countries mobile operators are working together to jointly deploy LTE networks. This means fewer new sites, saving on cost of equipment and operating the network.

Site sharing with other radio installations or existing structures, where technically feasible and in line with competition law and licensing conditions, is factored into decisions on the most environmentally appropriate base station solution. Appropriate siting and design may reduce the visual profile of antennas.



HOW DO LTE DATA RATES AFFECT THE SIZE OF THE COMPLIANCE ZONES AROUND NETWORK ANTENNAS?

Mobile networks are designed to use only the power needed to provide quality services. Too much power would cause interference and affect all users. One of the features of LTE is that it is able to allocate different data rates to different users, in order to use the total capacity most efficiently. This means that the transmitted power will vary in response to the amount of mobile data traffic.

Compliance zones for LTE antennas are assessed using the planned maximum power for the base station and are independent of the LTE data rates. The zone typically extends a few metres in front of the antenna and a small distance above, below and behind the antenna. If an antenna could be accessible to the public, then there are signs and barriers to advise them of the antenna, and how to proceed safely. The antennas are positioned so the public cannot access these areas.

HOW DOES THE COMPLIANCE ZONE FOR LTE ANTENNAS COMPARE TO THAT FOR 3G?

The size of the compliance zone for LTE antennas will be similar to that of other mobile services using similar transmitter powers. Compliance zones for antennas operating multiple technologies (GSM, 3G and LTE) will be greater and assessed using the planned maximum power for all technologies. Access and shutdown procedures for maintenance workers may be agreed between the mobile operator and the rooftop landlord when the antenna is installed.

www.gsma.com/publicpolicy/mobile-and-health/mobile-networks/working-near-antennas

WHERE TO GO FOR MORE INFORMATION

www.gsma.com/health



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