

# 5G

## Health and Safety



## **1.0 Introduction**

- 1.1 Cellnex UK sites transmit nothing more than ordinary radio waves.
- 1.2 Radio waves are electromagnetic fields, and unlike ionising radiation (such as X-rays or gamma rays), can neither break chemical bonds nor cause ionisation in the human body.
- 1.3 In the UK, radio waves have been used by a whole range of public and commercial communication networks since the dawn of radio in 1922, when the BBC opened its first regular public broadcasting station (in the world) in London. Radio waves have underpinned the UK's growth, prosperity and social inclusion. Radio waves have ensured the safety of our communities and supported national security. The UK's public radio and television broadcasting networks have been transmitting non-ionising radio waves in the UK since the 1920s.
- 1.4 Cellnex UK sites support a range of wireless communication services that rely on radio waves, particularly mobile communication base stations, that operate in the wider public interest.
- 1.5 The health effects of exposure to radio waves have been researched extensively over several decades, and very many publications can be found in scientific journals and elsewhere. Coordinated research around the world has addressed concerns about the growth of mobile communications technologies from around the year 2000.
- 1.6 Through extensive studies providing peer reviewed evidence, no causal link has been discovered between mobile connectivity and a risk to health.

## **2.0 Mobile Connectivity and 5G**

- 2.1 Mobile phones are now ubiquitous throughout our society and many companies, industries, organisations and individuals rely upon such essential connectivity. Mobile communications technology has developed through several generations and there are now many mobile communication sites,

known as 'base stations', installed throughout the UK, providing services to users of mobile phones and other connected devices.

- 2.2 5G reflects the next technological revolution, which will bring significant social, economic and environmental benefits to the country. This is likely to include autonomous vehicles, interconnected industrial machinery and robotics used in logistics, medicine, manufacturing, agriculture and health care services. This list will be ever expanding, such is the significance of 5G.
- 2.3 In order to prepare the UK for this connectivity revolution, 5G is being deployed throughout the UK by the mobile network operators (MNOs). In the UK the MNOs are BT/EE, Vodafone, O2 and Three. Initially the MNOs will be deploying 5G in cities and towns and along major transport routes, but eventually this will be deployed to the whole of the UK.
- 2.4 Radio frequency is a scarce resource and is highly regulated to ensure efficiency of use and avoid interference between uses. The MNOs can only use spectrum allocated to them by Government, via Ofcom the industry regulator. In allocating spectrum for particular uses, Ofcom will have regard to internationally agreed standards, to allow international use and roaming.
- 2.5 To ensure effective use, frequency is generally allocated via auction, with conditions to ensure wide geographical coverage and high quality service. In the UK the current mobile networks operate at frequencies of around 900Mhz and between 1.8GHz and 2.1GHz.
- 2.6 With regard to 5G, Ofcom has designated the following frequencies, which fall into three main categories:
  - Low frequency spectrum (the 700 MHz band), with likely emphasis on rural areas as the signal can cover larger areas
  - Mid-frequency spectrum (the 3.4–3.8 GHz band) for large bandwidths to provide necessary network capacity and to enable higher speeds – the first deployments of 5G mobile services are likely to use this band in towns and cities; and

- Higher frequency spectrum (26 GHz band), sometimes known as millimetre wave (“mmWave”) - providing ultra-high capacity but with very small coverage ranges.

2.7 All these frequencies have been ‘reallocated’ from previous uses such as terrestrial television broadcasting, defence and satellite communications. So, these frequencies are not new and have been used for many years in wireless communications services across the UK, now simply reallocated for mobile connectivity.

2.8 Similar to previous generations of mobile installations, 5G will consist of various types of infrastructure necessary to allow the network to operate, including antennas, radio towers, masts and dedicated in-building systems. This is no different to other forms of essential public infrastructure which are now common place in our cities, town and rural areas.

2.9 5G networks will work in conjunction with existing networks such as 4G, but will have site specific siting requirements to reflect the apparatus to be used. In many cases, existing ‘macro’ (main) 3G/4G mobile base stations will be first upgraded to allow for new 5G equipment and service provision. ‘Small cell’ technology will also become a growing feature of 5G networks, particularly in dense urban areas like cities and towns, mainly offering additional data capacity necessary to support a range of uses, including innovative new uses like Connected Autonomous Vehicles and new connected medical applications.

### **3.0 Health and safety compliance**

3.1 Throughout the history of mobile connectivity there have been concerns raised with regards to the Health and Safety of these systems. A great deal of research has been undertaken throughout the world into the effects of electromagnetic radiation and radio signals and to date there has been no evidence to indicate that the systems so far operated and those intended to be operated have caused any discernible adverse health effects.

- 3.2 Over 50 years of scientific research has already been conducted into the possible health effects of the radio signals used for mobile phones, base stations and other wireless services including frequencies planned for 5G.
- 3.3 Cellnex UK does not set its own health and safety standard but relies on these guidelines covering the safety of radio transmissions, which have been adopted by the UK Government on the advice of the UK Health Security Agency (UKHSA), replacing Public Health England. Advice by other Government Public Health bodies in Scotland, Wales and Northern Ireland will therefore largely adopt the same guidance.
- 3.4 The UKHSA guidance on the health and safety of mobile phone base stations can be found below:

<https://www.gov.uk/government/publications/mobile-phone-base-stations-radio-waves-and-health/mobile-phone-base-stations-radio-waves-and-health>

- 3.5 This has since been updated to reflect considerations relating to 5G mobile connectivity:

<https://www.gov.uk/government/publications/5g-technologies-radio-waves-and-health/5g-technologies-radio-waves-and-health>

- 3.6 Significantly, UKHSA advises that:

*“..many measurements have been made and these continue to show that exposures of the general public to radio waves are well within the international health-related guideline levels that are used in the UK. These guidelines are from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and underpin health protection policies at UK and European levels”.*

*“It is possible that there may be a small increase in overall exposure to radio waves when 5G is added to an existing network or in a new area. However, the overall exposure is expected to remain low relative to*

*guidelines and, as such, there should be no consequences for public health”.*

- 3.7 UKHSA’s main advice about radio waves from mobile base stations is therefore that the guidelines of the International Commission on Non-Ionising Radiation Protection (ICNIRP) should be adopted for limiting public exposure to mobile communication network apparatus.
- 3.8 ICNIRP is formally recognised as an official collaborating non-governmental organisation by the World Health Organisation (WHO) and the International Labour Organization (ILO). ICNIRP is also consulted by the European Commission. The ICNIRP guidelines apply to frequencies up to 300 GHz and cover exposures arising from new 5G base stations (including mmWave technology) as well as from older technologies.
- 3.9 It is worth noting that the ICNIRP Guidelines were adopted by the UK in 2004, because they contain a greater ‘precautionary factor’ than the previous UK guidelines by an additional factor of 100%. This was a key part of the UK Government’s response to the Stewart Report on Mobile Phones and Health, published in 2000, which recommended a precautionary approach. Another key part was the establishment of a research programme that forms part of the large body of peer reviewed scientific research that has built up over the last 50 years and which has not found any causal link with any health effects, other than the well understood thermal effects.
- 3.10 It should also be appreciated that mobile installations are low powered, typically operating between a few watts to a maximum of 100 watts, depending on the type of installation and whether it hosts one or all of the MNOs. Mobile technology also uses Adaptive Power Control to operate at the lowest levels necessary to provide an effective service – power outputs therefore increase and decrease accordingly to public usage. Mobile installations therefore generally comply with the ICNIRP guidelines by a factor of hundreds and in many cases thousands.

3.11 Whilst it is true that some of the 5G frequencies will operate at higher powers, they will remain low powered and still have to operate within the ICNIRP guidelines which have been recently amended in 2020.

3.12 ICNIRP provides a series of Frequently Asked Questions and explains that the new guidelines cover exposures from 5th Generation (5G) mobile telecommunications.

<https://www.icnirp.org/en/rf-faq/index.html>

3.13 The new guidelines states that:

*“ICNIRP (2020) has made a number of changes.....will ensure that 5G is **not able to cause harm**”.*

3.14 The ICNIRP guidelines consider both thermal and non-thermal effects of radiofrequency electromagnetic fields (RF EMF):

*“ICNIRP considers all potential adverse health effects, and sets restrictions to ensure that none occur, regardless of the mechanism of interaction between the exposure and the body. The lowest exposure levels that can cause adverse health effects are due to thermal mechanisms, and so restrictions have been set based on the thermal effects, as these will protect against any other effects that could occur at higher exposure levels”.*

3.15 In common with previous generations and all forms of electronic communications, 5G installations will have health and safety (ICNIRP) compliance zones where the public will be excluded and these may vary depending on base station type, e.g. macro or small cell, and antenna use and type. The larger antennas likely to be required on some macro base stations may bring particular siting and design considerations, especially where they are an addition to existing configurations. For example, this may require antennas to be sited higher off roof level and / or for a greater fenced area to keep out members of the public. The key constant to emphasise however, is that ICNIRP compliance would be retained in all nearby areas accessible by the public and

given the way power outputs drop exponentially, then that is likely to remain within a considerable margin.

- 3.16 If for whatever reason existing compliance zones or new ones required due to the introduction of 5G technology cannot be created, then the site would be deemed unsuitable. However, as the same frequencies allocated for 5G have been used previously for television broadcasting, defence and satellite purposes and at significantly higher power outputs, this is not likely to be widespread as those former uses complied with the same applicable guidelines.
- 3.17 Previous generations of mobile connectivity have been subject to an Ofcom 'testing programme' to assess Electromagnetic Field (EMF) measurements at mobile base station sites across the UK. Ofcom has now continued such testing to base stations now providing 5G and to date has assessed thirty-three 5G sites in 10 UK cities. A link to that report is provided below:

[https://www.ofcom.org.uk/data/assets/pdf\\_file/0021/214644/emf-test-summary-010321.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0021/214644/emf-test-summary-010321.pdf)

- 3.18 Consistent with its testing programme for previous generations of mobile connectivity, Ofcom advises that the measured EMF levels from 5G-enabled mobile phone base stations:
- Remain at small fractions of the levels identified in the ICNIRP Guidelines, the highest level recorded being approximately 1.5% of the relevant levels
  - 5G currently contributes a small amount to the EMF levels measured at each location.
- 3.19 In summary, every installation on a site owned or managed by Cellnex UK will be compliant with these international standards adopted by the UK Government and will be certified as such with all applications for planning permission. The ICNIRP guidelines seek to protect against the well-known thermal effects of radio emissions and include a significant precautionary factor. These guidelines apply to all forms of electronic communications and mobile technology is one



of the lowest powered of these. National planning policy remains clear that provided an application is certified as ICNIRP compliant, then local planning authorities should not seek to effectively set different guidelines through the refusal of planning permission.

#### 4.0 Monitoring and Future Research

4.1 It should be noted that exposure measurements made by one of PHE's predecessor organisations found that "*many exposure measurements have been made in the UK at publicly accessible locations near to base stations, and these have consistently been well within the ICNIRP guideline levels*".

4.2 Notwithstanding this, UKHSA continues to monitor the health-related evidence applicable to radio waves, including in relation to base stations, and is committed to updating its advice as required.

4.3 Cellnex UK will clearly consider any new guidance as and when produced by UKHSA or other relevant advisors.

#### 5.0 Additional Resources

5.1 The following resources may also be helpful:

- The ICNIRP guidelines, can be found here: [www.icnirp.org/](http://www.icnirp.org/)
- ICNIRP FAQs: <https://www.icnirp.org/en/rf-faq/index.html>
- UKHSA – 5G: <https://www.gov.uk/government/publications/5g-technologies-radio-waves-and-health/5g-technologies-radio-waves-and-health>
- Radio spectrum in the UK is regulated by Ofcom: [www.ofcom.org](http://www.ofcom.org)
- Ofcom 5G: <https://www.ofcom.org.uk/spectrum/information/innovation-licensing/enabling-5g-uk>
- Ofcom EMF measurements near 5G mobile phone base stations: [https://www.ofcom.org.uk/data/assets/pdf\\_file/0021/214644/emf-test-summary-010321.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0021/214644/emf-test-summary-010321.pdf)
- UK Government Parliamentary Briefing Note: <https://commonslibrary.parliament.uk/research-briefings/cbp-7883/>

- The Health and Safety Executive website describes the responsibilities of mobile communications network operators in relation to radio transmissions: <https://www.hse.gov.uk/radiation/nonionising/emf.htm>
- The NHS has also published advice: <https://www.nhs.uk/conditions/mobile-phone-safety/>
- The UK MNOs publish their policies in relation to mobile phones, masts and public health on their websites.
- <https://www.vodafone.com/news/technology/5g-and-health>
- <https://www.telefonica.com/en/sustainability-innovation/environment/electromagnetic-fields/>
- <https://ee.co.uk/our-company/corporate-responsibility/building-trust/responsible-network>
- <https://www.three.co.uk/blog/5g-health-and-safety.html> Mobile UK is an organisation that represents the UK MNOs. It to, publishes health and safety information: <http://mobileuk.org/health-and-safety.html>

## Cellnex UK