

# Horizon Scanning Series

## The Internet of Things

### *Electromagnetic energy emissions and health*

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## **Input paper to the Australian Council of Learned Academies on the impact of Internet of Things**

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) provides expert advice on radiation protection and nuclear safety matters to the Australian Government. In order to provide the best advice on the protection of the Australian public from the effects of radiation, ARPANSA undertakes its own research and reviews the relevant scientific research, including exposure to radiofrequency (RF) electromagnetic energy (EME) emissions from telecommunications sources.

Internet of things will rely heavily on the 5th generation of mobile communication networks, also called 5G. Mobile phone networks and other wireless telecommunications sources emit low-level RF EME and some members of the public have some concerns of adverse health effects. Of particular concern is the new 5G network.

### **What is RF EME?**

RF EME is the transfer of energy by radio waves in the frequency range between 100 kHz to 300 GHz. It is mainly used for telecommunications purposes including radio and television broadcasting, mobile telephony, Wi-Fi, satellite communications etc. Measurement surveys have shown that exposure to RF EME in the environment from various sources is very low and typically much lower than the allowable limit for safety in the Australian RF Standard (Karipidis et al, 2017).

### **Is RF EME harmful?**

Exposure to sufficiently high levels of RF EME can heat biological tissue and potentially cause tissue damage. The amount of environmental RF EME routinely encountered by the general public is too low to produce significant heating or increased body temperature. At low levels of exposure to RF EME (ie field intensities lower than those that would produce measurable heating) the evidence for production of harmful biological effects is ambiguous and unproven. Although there have been studies reporting a range of biological effects at low levels, there has been no indication that such effects might constitute a human health hazard (SCENIHR, 2015). No long term effects from RF EME have been proven. Some epidemiological studies have shown an association between heavy mobile and cordless phone use and brain cancer. However, limitations of the methodology in these studies prevent conclusions of causality being drawn from these observations (IARC, 2013).

### **What is 5G?**

In Australia, mobile phones and a range of other communication devices operate using 3G (3rd generation) and 4G (4th generation) technologies (ACEBR, 2018). 5G is the new generation, of mobile communication technology that uses new and more efficient methods for connectivity between devices that will enable, for example, the Internet of Things. 5G will initially operate at frequencies similar to those used by current technologies. In the future 5G will operate at higher frequencies, which are also called 'millimetre waves'.



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### **Are millimetre waves harmful?**

At the frequencies where current mobile phone technology operates (including 4G and 5G) some of the energy is absorbed into the body however it is too low to produce any significant heating of tissue. Millimetre waves that will be used by 5G in the future do not penetrate past the skin (ARPANSA, 2002). When the 5G network begins to use millimetre waves the energy level will again be small and no appreciable heating will occur in the skin.

### **How is the public protected?**

ARPANSA has published an Australian Standard that sets limits for exposure to RF EME (ARPANSA, 2002). These limits are set well below levels at which harm to people may occur. The operating frequencies of the 5G network are included within the limits set by the ARPANSA Standard. 5G infrastructure and devices emitting RF EME are regulated by the Australian Communications and Media Authority, and emissions are required to comply with the limits of the ARPANSA Standard. At exposure levels below the limits of the ARPANSA standard, it is the assessment of ARPANSA and international organisations such as the World Health Organisation and the International Commission on Non-Ionising Radiation that there is no established scientific evidence to support any adverse health effects.

### **Conclusion**

No health effects are expected from exposure to RF EME related to 5G. It is however important to continue the research in order to reassure the Australian population. ARPANSA therefore has made recommendations for areas where we can build on the body of knowledge (ARPANSA, 2017). The recommendations include research for millimetre waves and for emerging technologies that use them like 5G.

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