

The Impact of 5G network on Human Health

Enxhi Shkurta
Department of Signal Theory and
Communications
Technical University of Catalonia
(UPC)
Barcelona, Spain 08034
enxhi.shkurta@alu-etsetb.upc.edu

Maria Ntemiri
Department of Computing and
Communications
Lancaster University (UK)
Lancaster, Lancashire LA1 4YW
m.ntemiri@lancaster.ac.uk

Burak Karabulut
Department of Computer
Technologies and Information
Systems
Bilkent University (TR)
burak.karabulut@ug.bilkent.edu.tr

Abstract

Mobile communication systems have recorded a tremendous growth over the past few decades. With the 5G system expected to increase data rate it means that even more BSs would have to be deployed to support the increasing mobile user demands. Due to the amount of radiation it exposes users to, there are concerns that this network might bring problems on human health. This paper gives an overview of Electromagnetic Field (EMF) exposure from mobile systems, the duration of this exposure from a typical GSM mobile phone, the exposure impact of a person to EMF and concludes with an explanation of why 5G network is not hazardous for human body.

Keywords: 5G, EMF, SAR, RF radiation, MIMO, mmWave

Why 5G is believed to be harmful

In order for 5G network to achieve its expected performance target in terms of capacity, it has to rely on several technologies and advanced techniques such as densification, MIMO (system with multiple transmit and receive antennas) and mmWave (specific part of the radio frequency spectrum between 24GHz and 100GHz, with a very short wavelength). Multiple radio access technologies are also incorporated into the creation of 5G network, in order to enable other facilities including density, latency, availability and reliability. This implies that, with current technologies not being decommissioned, the EMF exposure will increase. Densification, which is a rise in the number of small cells deployed also leads to a soar in the EMF exposure. The main effect of mmWave on the human body, is an increase in temperature that can be hazardous in many different ways regarding the heating effect on the eyes, head tissues and skin.

5G should not lead to worrying

Current evidences show no harm from 5G technologies, hence no proof for the above mentioned concerns. mmWave has high reflection rates leading to not being perilous to your skin, tissues, or bones. It dissipates easily in moist. Since the first two layers of the skin have high water content, 15-40% (epidermis) and 70-80% (dermis), even though epidermis allows permeation of mmWave, it gets absorbed to a large content in dermis, leading to no risk for the tissue. Skin is safe as well considering that at 60 GHz, 30-40% of the incident power is reflected on skin surface. Blood flow in the skin diffuses heat caused by mmWave. Eyes are considered vulnerable to mmWave effects. Nevertheless, experiments using 60GHz mmWave radiation on non human, primates' eyes showed no ocular damages. [4] The antennas in massive MIMO systems use very low power such that the power per antenna is inversely proportional to the number of antennas at the BS. This brings about a considerable reduction in the transmit power of the BS, and consequently EMF exposure levels. Accordingly,

massive MIMO will result in the reduction of the safety distance for future BS deployment, paving the way for 5G and beyond network densification. [3]

Moreover, IARC (International Agency For Research on Cancer) had a program, since 1971 that convenes experts to look on all possible hazard candidates to see whether they are carcinogenic or not. In 2011, as a result of one of the groups, radiation that comes from cellphones are classified as "possibly carcinogenic". [6] This implies for all the cellphones and related technologies and 5G is not special case for it. When people hear the phrase "possibly carcinogenic" which is group 2B, they tend to forget "possibly" part and just believe that it is carcinogenic.

That is not the fact. According to WHO (World Health Organization), "possibly carcinogenic" is explained as "limited evidence of carcinogenicity" and when other 2B group elements are checked, it can be seen that coffee and pickled vegetables are also in there. [5] CDC (Communications Commission), FC (Food and Drug Administration) and the NIH (National Cancer Institute), they all agree that there are no established health effects caused by mobile phone use yet. [5] One can say that over-exposure to any network technologies may be potentially harmful and 5G is not unique.

References:

- [1] European Environmental Agency. Late Lessons II Chapter 21 – Mobile Phone Use and Brain Tumour Risk: Available from: <http://www.eea.europa.eu/publications/late-lessons-2>
- [2] Guraliuc AR, Martellosio A, Pasian M, et al. Near-field user exposure in forthcoming 5G scenarios in the 60 GHz band. *IEEE Trans. Antennas Propag.* 2017;65(12):6606–15.
- [3] Zhao K, Gustafson C, Liao Q, et al. Channel characteristics and user body effects in an outdoor urban scenario at 15 and 28 GHz. *IEEE Trans. Antennas Propag.* 2017;65(12):6534–48
- [4] Health effects on mmWave radiation, Infineon Technologies AG 11.2018
- [5] World Health Organization/International Agency for Research on Cancer 2011
- [6] CNBC Is 5G safe? 2019, link available from: <https://www.youtube.com/watch?v=Ag1hkV2Upww>