5G Networks' Influence on Health

By

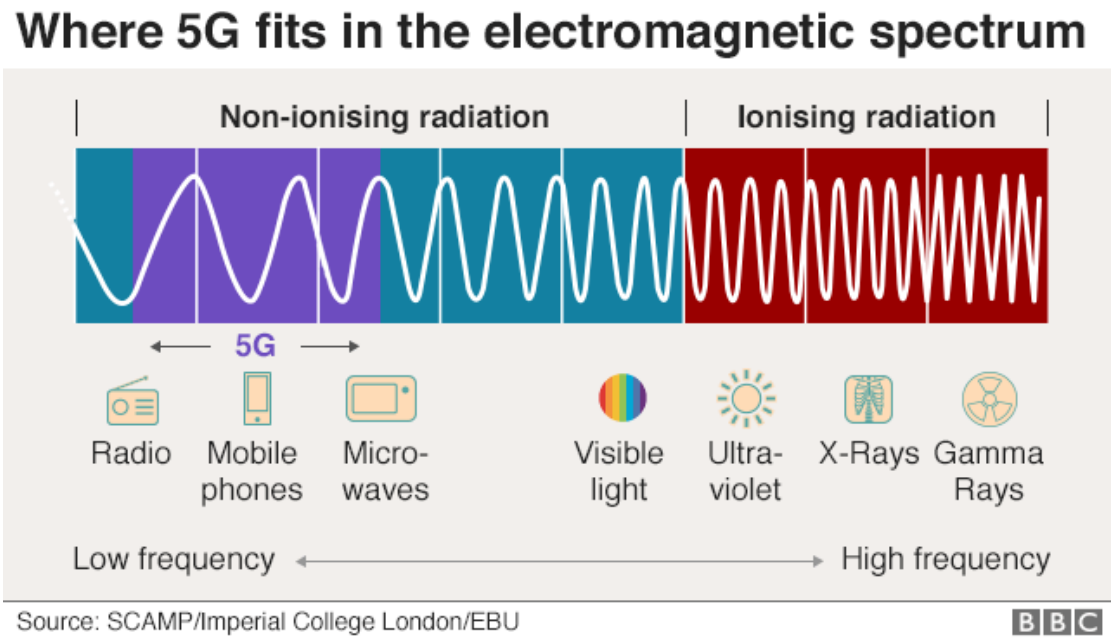
Wei Ling

Abstract

The fifth generation of telecommunication technologies, in abbreviation, 5G, is supposed to reach its commercial maturity by 2020 in Germany [1]. Not only faster communications are promised this time, 5G network would improve the communication industry by accomplishing revolutionary features such as real-time reactions, Internet of things, device to device communications and so on. However, such improvements are accompanied by concerns as antennas are deployed more intense and closer to the crowd compared to 4G. Such concern could date back to the time when radiofrequency (RF) electromagnetic radiation (EMR) was widely utilized in constructing communication systems. Nonetheless, this argument is never settled down, and will keep controversial in the foreseeable future. This essay is aimed at balancing the gain and cost of 5G-related health problems, and giving possible suggestions on the altitude people could have towards the evolution in communication technologies.

I. Characteristics of 5G

Before certain concerns about health problems to be discussed, technical features of 5G network should be briefly introduced at first. The basic theorem that facilitate contemporary telecommunication systems is electromagnetism. To be specific, electromagnetic radiation (EM radiation or EMR), a spectrum of variegated electromagnetic waves, is utilized to carry energy and information. These electromagnetic waves, specified by their frequencies, are wielded for different purposes and the segment where 5G signal locates is named as radiofrequency electromagnetic radiation (RF-EMR).



RF-EMR, ranging from 30kHz to 300GHz, belongs to the segment of the electromagnetic spectrum, which is called non-ionizing radiation. Non-ionizing refers that such radiation does not carry abundant energy to completely remove an electron from an atom or molecule, which means it will not cause immediate health hazard for it could not alter DNA structure directly. However, such feature does not promise it will not have chronic damage to health, and this is the point where the argument regarding the hazard of RF-EMR stands.

II. Health Concerns about Telecommunication Systems in General

International EMF Scientist Appeal, signed by more than 240 scientists, asserts that: Nonionizing electromagnetic fields (EMF) would have effects on living organisms. “Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as

there is growing evidence of harmful effects to both plant and animal life. [2]"

In order to verify these assertions, numerous experiments were conducted. The typical experiment accessing the harm of RF-EMR is exposing rats to radiation from mobile phones starting before they were born. Such experiments are conducted for many times by different institutions or laboratories in different countries, leading to completely confronting conclusions. The most recent one conducted by National Institutes of Health of the United States in 2018 is citied the most frequently. Joel M. Moskowitz, director of the Center for Family and Community Health, School of Public Health, University of California, Berkeley claimed that "Two years of exposure to cell phone RFR(RF-EMR) increased cancer in male rats and damaged DNA in rats and mice of both sexes." [3]. In another report by Reality Check team, BBC News, it does admit that male rats developed a type of cancerous tumor in the heart, but it immediately mentions that "No cancer link was found for the female rats or the mice studied", and it also claims that "Rats exposed to the radiation lived longer than those in the control group" [4], leading to the conclusion that these experiments are unreputable and hence not sufficiently convincing. Such conflicts derive directly from the original report of National Toxicology Program, where ambiguous conclusions are left, making even more intense arguments. (National Institutes of Health Public Health Service U.S. Department Of Health And Human Services (2018). *Toxicology And Carcinogenesis Studies In Hsd:Sprague Dawley Sd Rats Exposed To Whole-Body Radio Frequency Radiation At A Frequency (900 Mhz) And Modulations (Gsm And Cdma)Used By Cell Phones)*

III. Health Concerns about 5G Specific Problems

Nevertheless, the above-mentioned arguments have already existed ever since the late 90s, where the concept of electronic health was invented [5]. Yet, these are not those problems exclusively belong to 5G. The main issue of these problems falls on the unique spectrum utilized by 5G, which extends its bandwidth, falling into a segment called "microwave". This spectrum is famous for its usage in heating, which is used by microwaves-oven. Though it sounds terrifying for using "microwaves" to communicate, it is only dangerous when it is really powerful and those living creatures are really close. So, it is not the logic that people do not use it beforehand because it is dangerous but rather it is the result of balancing the cost of manufacturing and the effeteness of heating. Actually, part of this segment was already in use by Wi-Fi, Bluetooth and other small transmitters, and it hardly leave any obvious and immediate adverse effect on our health at this point.

However, though high frequency radiation could carry more information at the same time compared to low frequency radiation because of its greater energy density. It is poor at diffraction, meaning more base stations must be deployed in

order to cover all the places, leaving concerns about the negative effect about the abundant energy. In a study conducted by Imtiaz Nasim and Seungmo Kim in Georgia Southern University, human exposure to RF fields in 5G downlink is measured with two parameters: power density (PD), and specific absorption rate (SAR). It reveals that 5G(3GPP Release 14) downlinks would "yield significantly higher levels of PD and SAR compared to a Release 9 (3GPP standard for 4G network)" [6]. Yet, it is unclear that whether such growth in both PD and SAR could indicate any adverse effect on health. The heating effect of these signals though increased, would be detained by skin in millimeters.

IV. Conclusion

The possible influence of 5G network on health is uncertain at this point. People should be fully sensitive to any signs of adverse effect on health. However, they should also be aware of the positive contributions 5G could offer. Telecommunication technologies are born with controversies, a plethora of questions have remained uncertain for decades, yet rumors also arise. This is, in part, attributed to the ambiguous altitude the World Health Organization have towards telecommunication technologies [7][8]. So, in order to keep judicious in such a sophisticated circumstance, optimism and vigilance are both needed as this essay suggests.

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