

5G Wireless Networks

Overview of the Technology and Related Health Research | September 2019

Key Terms

Hertz (Hz): the unit of time by which frequency is measured and expressed

- 1 hertz (Hz) = 1 cycle per second
- 1 kilohertz (kHz) = 1,000 cycles per second or 1,000 Hz
- 1 megahertz (MHz) = 1 million cycles per second or 1,000,000 Hz
- 1 gigahertz (GHz) = 1 billion cycles per second or 1,000,000,000 Hz

What is 5G, and how does it compare to previous networks?

Fifth-generation cellular network technology, also known as “5G,” is a new wireless network that will provide faster internet speeds for cellular phones and other wireless-enabled devices. Previous networks operated on lower frequencies; lower frequencies have the ability to penetrate walls and other materials that might block the frequency waves. 5G networks operate on a combination of low, medium, and high frequencies, ranging from 600 MHz—47 GHz⁺¹. For comparison, 4G operates on a range of 2 GHz—8 GHz, a far lower frequency and shorter frequency range. While 5G’s higher frequency waves will provide faster internet speeds, their ability to penetrate walls and other materials, as well as to travel great distances, is greatly reduced. Due to this shorter reach of 5G frequencies, small cells (miniature cellular towers) will be installed throughout cities and towns. This will result in users living much closer to the sources of the frequency waves, compared to previous networks that broadcasted from cell towers that were located miles away from users.² Figure 1 provides an example of 5G deployment.

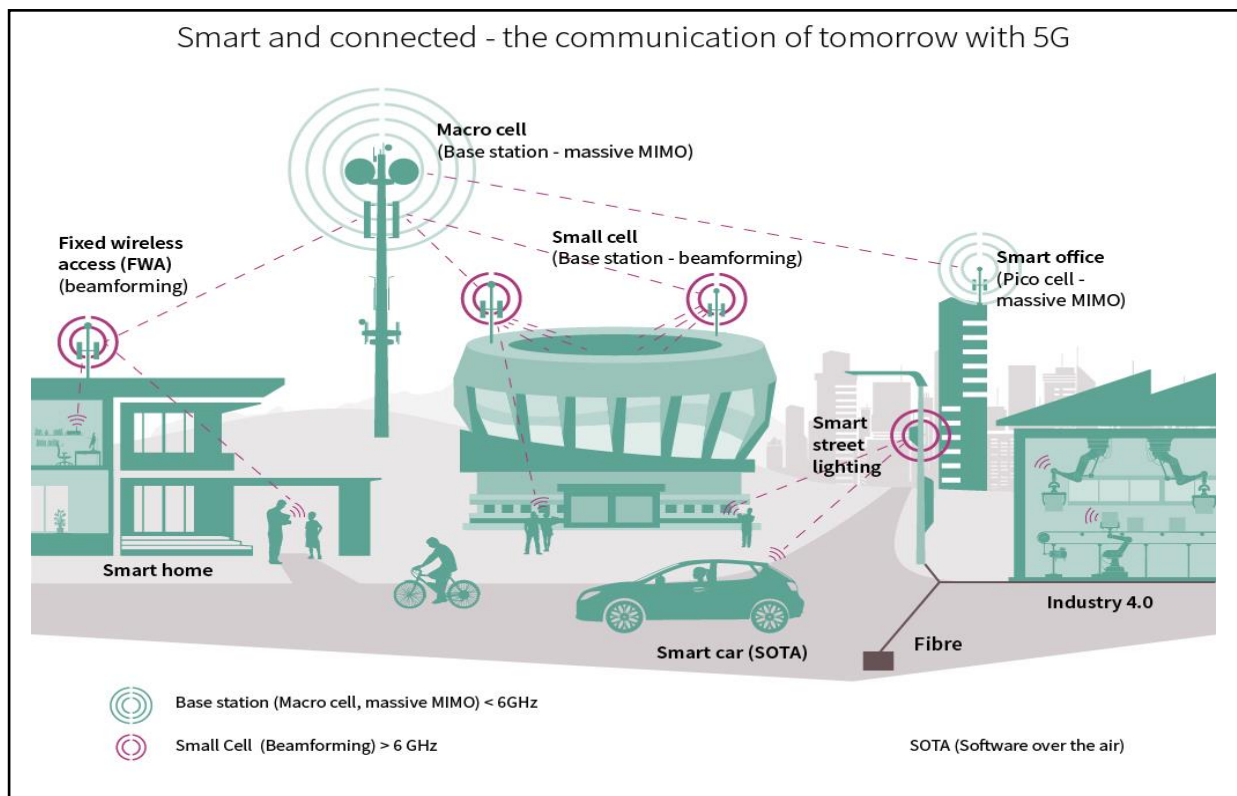


Figure 1: 5G Communication Technologies (image adopted from CISA, Department of Homeland Security)²

¹ “The FCC’s 5G FAST Plan,” Federal Communications Commission, September 9, 2019, <https://www.fcc.gov/5G>

² “Overview of risks introduced by 5G adoption in the United States,” Department of Homeland Security, July 31, 2019, https://www.dhs.gov/sites/default/files/publications/19_0731_cisa_5th-generation-mobile-networks-overview_0.pdf

Are there proven health risks to using 5G?

One of the biggest concerns with 5G is the lack of government-sanctioned studies to specifically and consistently determine whether 5G's higher frequency waves, and the closer proximity of users to the sources of these waves, are harmful to people. Independent studies and groups³ claim that, because 5G (and previous wireless network generations) emits radiofrequency electromagnetic radiation (RFR), it will result in many health problems, including cancer. Some of their concern stems from a 2014 World Health Organization (WHO) fact sheet classifying RFR as “possibly carcinogenic to humans” due to an inconclusive study indicating increased risk of certain types of cancer in users with the highest cumulative hours of cell phone use over several years.⁴ Additionally, a study performed by the National Toxicology Program (NTP) found that 2G and 3G RFR caused cancer in male rats.⁵

However, the Federal Communications Commission (FCC) states that 5G and previous, lower-frequency networks operate within frequency ranges that emit *non-ionizing* RFR that is unable to cause “molecular changes that can lead to damage in biological tissue, including effects on DNA, the genetic material of living organisms.”⁶ Non-ionizing radiation operates within the range of 30 kHz–300 GHz, as does 5G (see Figure 2).

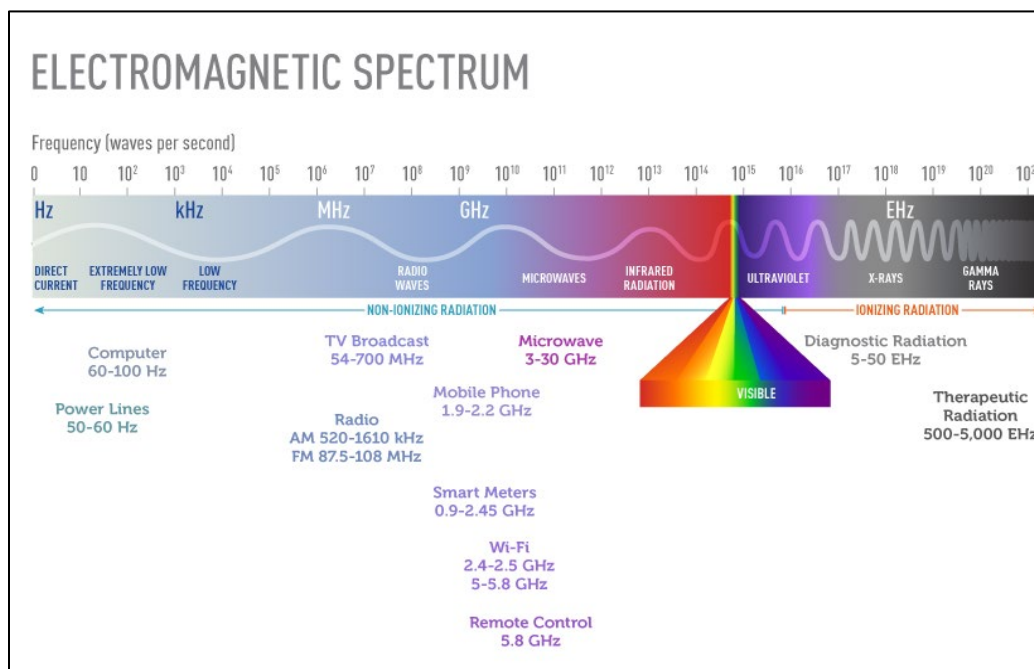


Figure 2: Electromagnetic Spectrum (image adopted from the National Cancer Institute)⁷

On the other end of the spectrum, *ionizing* radiation (X-rays and gamma rays) that is *not* used by 5G or previous generation networks *can* result in damage to biological tissue. According to the National Cancer Institute (NCI), “there is currently no consistent evidence that non-ionizing radiation increases cancer risk in humans...the only consistently recognized biological effect of radiofrequency radiation in humans is heating (the ability of

³ “5G Crisis Awareness & Accountability,” Online Summit, August 26—September 1, 2019, <https://the5gsummit.com/>; “What You Need to Know about 5G Wireless and ‘Small’ Cells,” Environmental Health Trust, https://ehtrust.org/wp-content/uploads/5G_What-You-Need-to-Know.pdf

⁴ “Electromagnetic fields and public health: mobile phones,” World Health Organization, October 8, 2014, <https://www.who.int/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones>

⁵ “Cell Phone Radio Frequency Radiation,” National Toxicology Program, November 2018, <https://ntp.niehs.nih.gov/results/areas/cellphones/index.html>

⁶ “RF Safety FAQ,” Federal Communications Commission, November 25, 2015, <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#Q2>

microwave ovens to heat food is one example of this)...there are no other clearly established effects on the human body from radiofrequency radiation.”⁷

The same NCI study also accounts for “inconsistent” results from multiple experimental studies in different countries and from different agencies on the effects of RFR. In 2015, the European Commission Scientific Committee on Emerging Newly Identified Health Risks determined that, “overall, the epidemiological studies on cell phone radio frequency electromagnetic radiation exposure do not show an increased risk of brain tumors or of other cancers of the head and neck region. The Committee also stated that epidemiologic studies do not indicate increased risk for other malignant diseases, including childhood cancer.”⁷

What more can be done to understand 5G?

To the researcher’s knowledge, no governing body, including the United States government, has published conclusive and consistent evidence indicating harmful biological effects to humans caused by 5G or RFR; however, this means there is considerable basis for further studies to be generated on these issues. Interested parties can look to ongoing studies being done by the NTP, WHO, and the U.S. Food and Drug Administration (FDA) on RFR exposure and 5G:

- NTP Bioeffects Research on RFR: <https://ntp.niehs.nih.gov/results/areas/cellphones/index.html> (sign up for email updates on the research)
- WHO Electromagnetic Field Project: <https://www.who.int/peh-emf/en/>
- FDA Radiation-Emitting Products—Current Research: <https://www.fda.gov/radiation-emitting-products/cell-phones/current-research-results> (also see “Cell Phone Industry Actions” at this link)

What is the current status of 5G in Utah?

Lastly, the FCC recently announced Salt Lake City as one of two “innovation zones” for 5G roll-out⁸: the Platform for Open Wireless Data-driven Experimental Research (POWDER) is administered by the University of Utah in partnership with Salt Lake City and the Utah Education and Telehealth Network⁹. Another POWDER partner, the Utah Department of Transportation (UDOT)¹⁰, is overseeing the buildout of Utah’s 5G infrastructure, which was enabled by S.B. 189, Small Wireless Facilities Deployment Act, in the 2018 General Legislative Session¹¹. UDOT’s website contains instructions and resources regarding the small wireless facilities (SWF) permit application process for wireless providers who wish to install the SWFs needed for 5G (see Figure 3).



Figure 3: SWF Application Process Steps (image adopted from the Utah Department of Transportation)

⁷ “Cell Phones and Cancer Risk,” National Cancer Institute, January 9, 2019, <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet#what-is-radiofrequencyradiation-and-how-does-it-affect-the-human-body>

⁸ “FCC Establishes First Two Innovation Zones,” FCC News, September 16, 2019, <https://docs.fcc.gov/public/attachments/DOC-359737A1.pdf>

⁹ POWDER, University of Utah, sourced September 26, 2019, <https://powderwireless.net/>

¹⁰ Statewide Small Wireless Facilities (5G),” Utah Department of Transportation, sourced September 26, 2019, <https://www.udot.utah.gov/main/?p=100:pg:0:::1:T,V:5114>,

¹¹ 2018 S.B. 189 Small Wireless Facilities Deployment Act, Utah State Legislature, sourced September 26, 2019, <https://le.utah.gov/~2018/bills/static/SB0189.html>