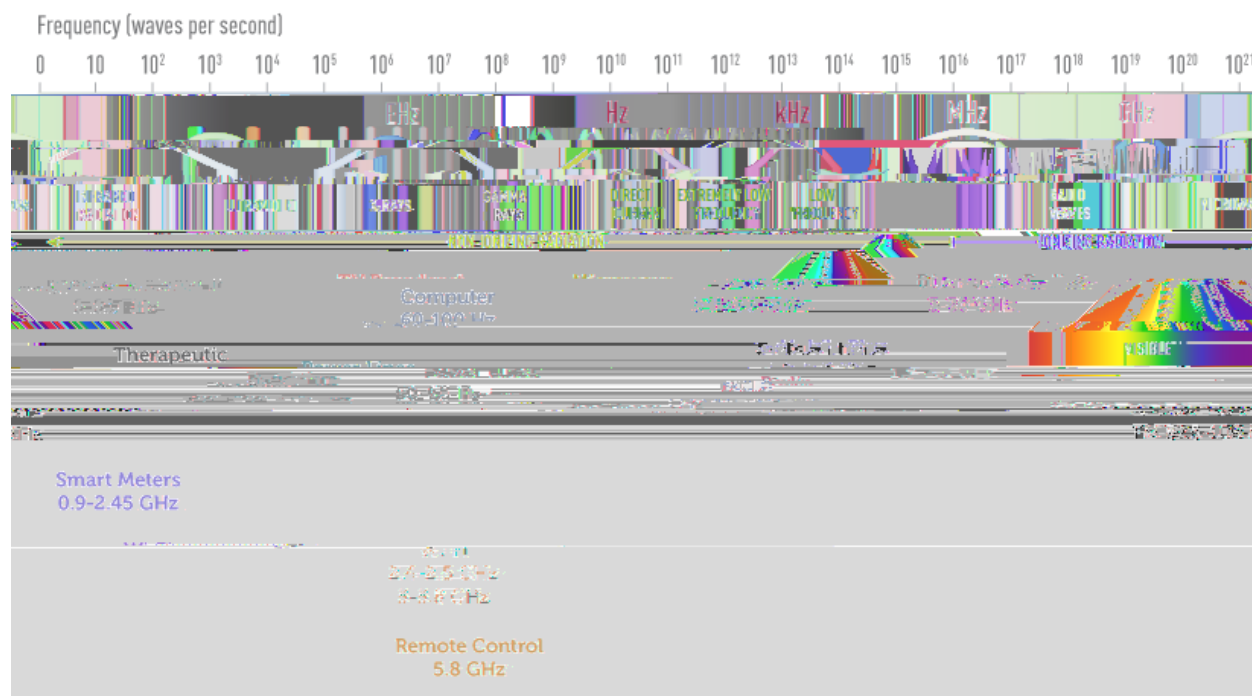




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stronger (**ionizing**) types of radiation such as [x-rays](#), [gamma rays](#)², and [ultraviolet \(UV\) rays](#)³ are thought to be able to cause cancer.

ELECTROMAGNETIC SPECTRUM



The electromagnetic spectrum illustration above shows the possible frequencies of electromagnetic energy, ranging from extremely low frequencies (such as those from power lines) to extremely high frequencies (such as x-rays and gamma rays), and includes both non-ionizing and ionizing radiation.

At very high levels, RF waves can heat up body tissues. But the levels of energy used by cell phones and towers are much lower.

When a person makes a cell phone call, a signal is sent from the phone's antenna to the nearest base station antenna. The base station responds to this signal by assigning it an available RF channel. RF waves transfer the voice information to the base station. The voice signals are then sent to a switching center, which transfers the call to its destination. Voice signals are then relayed back and forth during the call.

When RF signals are transmitted back and forth to the base station during calls, the RF waves produced at the base station are given off into the environment, where people can be exposed to them.

On the ground near a cell phone tower

RF waves from a cell phone tower antenna, like those from other telecommunication antennas, are directed toward the horizon (parallel to the ground), with some downward scatter. Base station antennas use higher power levels than other types of land-mobile antennas, but much lower levels than those from radio and television broadcast stations. The amount of energy from RF waves decreases rapidly as the distance from the antenna increases. As a result, the level of exposure to RF waves at ground level is much lower than the level close to the antenna.

At ground level near typical cellular base stations, the amount of energy from RF waves is hundreds to thousands of times less than the limits for safe exposure set by the US Federal Communication Commission (FCC) and other regulatory authorities. It is very unlikely that a person could be exposed to RF levels in excess of these limits just by being near a cell phone tower.

On a roof with a cellular antenna

When a cellular antenna is mounted on a roof, it is possible that a person on the roof could be exposed to RF levels greater than those typically encountered on the ground. But even then, exposure levels approaching or exceeding the FCC safety guidelines are only likely to be found very close to and directly in front of the antennas. If this is the case, access to these areas should be limited.

Indoors with a base station mounted on the outside of the building

The level of energy from RF waves inside buildings where a base station is mounted is typically much lower than the level outside, depending on the construction materials of the building. Antennas are pointed away from the side of the building, and the energy level **behind** the antenna is hundreds to thousands of times lower than in front. On top of this, wood or cement block reduces the exposure to energy from RF waves by a factor of about 10. Therefore, if an antenna is mounted on the side of a building, the exposure level in the room directly behind the wall is typically well below the recommended exposure limits.

Near a 5G base station

Newer, smaller versions of base stations (often referred to as **small cells**), which are part of fifth generation (5G) cellular networks, are discussed below.

Do cell phone towers cause cancer?

What they say about RF radiation in general

Based on a review of studies published up until 2011, the **International Agency for Research on Cancer (IARC)** has classified RF radiation as “possibly carcinogenic to humans,” based on limited evidence of a possible increase in risk for brain tumors among cell phone users, and inadequate evidence for other types of cancer. (For more information on the IARC classification system, see [Known and Probable Human Carcinogens](#)⁴.)

More recently, the **US Food and Drug Administration (FDA)** issued a technical report based on results of studies published between 2008 and 2018, as well as national trends in cancer rates. The report concluded: “Based on the studies that are described in detail in this report, there is insufficient evidence to support a causal association between radiofrequency radiation (RFR) exposure and [tumor formation].”

So far, the **National Toxicology Program (NTP)** has not included RF radiation in its *Report on Carcinogens*, which lists exposures that are known to be or reasonably anticipated to be human carcinogens.

What studies have shown

Researchers generally use two types of studies when trying to determine if something might cause cancer:

- **Studies looking at groups of people**
- **Studies done in the lab (using lab animals or cell cultures)**

- Researchers in Taiwan compared children with cancer to a group of similar children without cancer. They found slightly higher overall risk of cancer in those who lived in towns that had an estimated RF exposure from cell phone towers that was above the midpoint level in the study. However, this finding was less apparent when RF exposure was categorized in other ways.

Both of these studies relied on estimates of RF exposure. Neither of them measured the actual exposure of people to RF waves from nearby cell phone towers. This limitation

1. www.cancer.org/cancer/risk-prevention/radiation-exposure/radiofrequency-radiation.html
2. www.cancer.org/cancer/risk-prevention/radiation-exposure/x-rays-gamma-rays.html
3. www.cancer.org/cancer/risk-prevention/sun-and-uv/uv-radiation.html
4. www.cancer.org/cancer/risk-prevention/understanding-cancer-risk/known-and-probable-human-carcinogens.html
5. www.cancer.org/cancer/risk-prevention/radiation-exposure/cellular-phones.html
6. www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety
7. www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/cell-phones
8. www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet
9. www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet
10. www.niehs.nih.gov/health/topics/agents/emf/index.cfm
11. www.niehs.nih.gov/health/topics/agents/cellphones/index.cfm

Additional resources

Along with the American Cancer Society, other sources of information include:

Federal Communications Commission RF Safety FAQ: www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety⁶

Food and Drug Administration Cell Phones: www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/cell-phones⁷

National Cancer Institute Cell Phones and Cancer Risk: www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet⁸ Electromagnetic Fields and Cancer: www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet⁹

National Institute of Environmental Health Sciences Electric and Magnetic fields: www.niehs.nih.gov/health/topics/agents/emf/index.cfm¹⁰ Cell Phone Radio Frequency Radiation: www.niehs.nih.gov/health/topics/agents/cellphones/index.cfm¹¹

** Inclusion on this list does not imply endorsement by the American Cancer Society*

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