

## Effect of Electromagnetic Field (ELF) on Human's Body-Review

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**Abstract:** This study analyzed and showed the effects of electromagnetic fields on humans (current studies have shown that using a mobile phone for six hours or more each day for five days in a row causes sexual failure in the body). Frequency, wavelength, and energy are the three fundamental components of electromagnetic waves, which are short-range waves that occur from the oscillation of the electric field and the magnetic field. Additionally, non-ionizing radiation can be regarded as the magnetic field. This argues that this is because microwaves, cell towers, and other source of radiation are less toxic than ionizing radiation, they do not represent ionizing radiation. The high frequency has to have an impact on health because the wavelength is lower than the diameter of living cells, resulting in a consequence on the cell nucleus. Recent research demonstrates that a range of factors, such as the long - term exposure, exposing the organism to absorbing electricity energy, and increasing vibrations from x-rays and nuclear radiation, raise the body's exposure to electromagnetic waves.

**Keywords:** Electromagnetic waves, EMF, Headaches, LCD, power transmission networks, National Academy of Sciences and the National Cancer Institute, Cellular/PCS.

### تأثير المجال الكهرومغناطيسي (ELF) على جسم الإنسان – مراجعة

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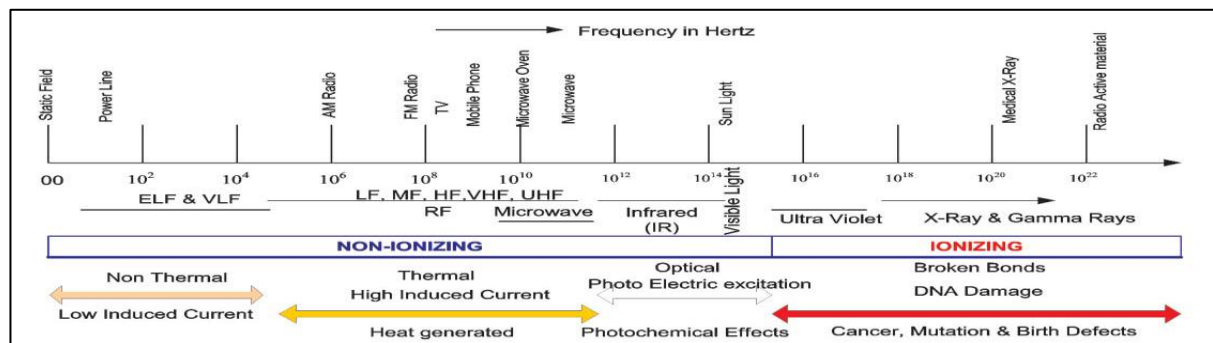
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**المستخلص:** تم في هذا البحث دراسة وتحليل وإظهار تأثيرات المجالات الكهرومغناطيسية على الإنسان (أثبتت الدراسات الحالية أن استخدام الهاتف المحمول لمدة ست ساعات أو أكثر يومياً لمدة خمسة أيام متتالية يسبب فشلاً جنسياً في الجسم). التردد والطول الموجي والطاقة هي المكونات الأساسية الثلاثة للموجات الكهرومغناطيسية. وهي موجات قصيرة المدى تنشأ من تذبذب المجال الكهربائي والمجال المغناطيسي. بالإضافة إلى ذلك، يمكن اعتبار الإشعاع غير المؤين بمثابة حقل مغناطيسي. ويجادل هذا بأن السبب في ذلك هو أن الموجات الدقيقة وأبراج الخلايا ومصادر الإشعاع الأخرى أقل سمية من الإشعاعات المؤينة. فهي لا تمثل الإشعاعات المؤينة. التردد العالي يجب أن يكون له تأثير على الصحة لأن الطول الموجي أقل من قطر الخلايا الحية، مما يؤثر على نواة الخلية. أظهرت الأبحاث الحديثة أن مجموعة من العوامل، مثل التعرض طويل الأمد، وتعرض الجسم لامتنصاص الطاقة الكهربائية، وزيادة الاهتزازات الناتجة عن الأشعة السينية والإشعاع النووي، تزيد من تعرض الجسم للموجات الكهرومغناطيسية.

**الكلمات المفتاحية:** الموجات الكهرومغناطيسية، المجالات الكهرومغناطيسية، الصداق، شاشات الكريستال السائل، شبكات نقل الطاقة، الأكاديمية الوطنية للعلوم والمعهد الوطني للسرطان، الخلوي/أجهزة الكمبيوتر.

## Introduction

The main cases that are being studied very effectively in the engineering and medical sectors around the world concern electromagnetic fields and their obviously damaging effects on the human body. The process through which electromagnetic waves (Fig. 1) travel through space after being generated by a radio frequency source.



**Fig.1. Electromagnetic spectrum. Adapted from " Electromagnetic Radiation .High Frequency Design EMR & HUMAN HEALTH",by**

**Ali Zamanian & Cy Hardiman(2005) ,p16-26.**

There are two types of electromagnetic sources that are used: natural electromagnetic sources (such as the sun and a few far-off stars). The human body alone, anomalous sources (such as television sets, radio receivers, radio stations, computers, mobile phones, household electrical equipment, television, and mobile phone stations), or atmospheric discharges like thunder (A, 2001) (Zamanian & Hardiman, 2005). Mobile phones have a lot of room, making them ideal for presenting electromagnetic field research. Mobile phone effects on the human body are regarded as irreversible and permanent factors. (M, Renda, SH, & M A, 2001) Computer displays produce EMF frequencies in the range of 0 to 1015 Hz. Most recent studies have shown that liquid crystal displays (LCD) have lower EMF generation than cathode ray tube (CRT) displays, which have a larger danger. The large distance from the screen lowers the impact of electromagnetic radiation, according to recent measurements. (Kenneth J, 2000)

## Biological Action of Electromagnetic Fields

The 1950s to 1960s saw rapid advances in electricity, radar, television, radio transmission, and mobile communications, which significantly raised the Earth's electromagnetic field levels. More powerful than known electromagnetic fields by a factor of more than 10. The intensity of electromagnetic fields is 10-15 times greater than the allowable norms in locations with high populations and several mobile operator transmitters nearby. With the development of the fourth and fifth generations' networks and the emergence of opposing viewpoints, there was a dearth of information regarding the strength of electromagnetic radiation that affects humans and humans as well as the transmitted messages. Near power lines, transformers, and other electrical infrastructure, there is a 50 Hz electromagnetic field that affects nearby wildlife. Although it can be extremely intense close to sources and reduces relatively quickly with distance, its impact on people who live close to power networks has not yet been well investigated. (OA, Loktionov; OE, Kondrateva; NV, Zvonkova; DA, Burdyukov,; January 27,2022) (Dolchinkov, Loktionov, Korolev, & Dolchinkova, SEP. 2021) Depending on the voltage running through the network, the distance from the conductor, the weather, and other factors, the electromagnetic radiation from power transmission networks has a constant frequency of 50 Hz and varies in intensity. As a result, the study, which was carried out in a few specific Moscow neighborhoods, revealed a rise in headaches among those who live close to the electrical grid. An increase in the number of people experiencing headaches and anxiety coincides with an increase in stress. According to the most recent findings of research conducted by a number of experts and academics, residents in apartment buildings located close to power lines with a voltage of more than 220 kilovolts are subject to the highest sources of electromagnetic radiation. Because measurements, study, and analysis of the impact of this sort of electromagnetic radiation on humans were conducted at the beginning of this century in sizable, highly populated cities, this type of radiation was not even detectable 20 years ago. The first people to experience the effects of this radiation were members of the technical personnel, who also experienced incidents of worker health deterioration as the first 220 kV transmission line was being built. He oversaw the 400 kV power lines' operation. This resulted in the publication of a large number of studies in this area, which served as the foundation for the first laws restricting the use of an electric field with a frequency of 50 Hz.

The study concentrated not just on the workers, but also on people who resided close to these potent sources of 50 Hz electromagnetic radiation. (Kruzilko a, et al., 2020) Moscow-based research revealed that those who live close to these power systems experience heart illness 50% more frequently, cancer 38% more frequently, and headaches 2.5 times more frequently. An experiment done in Moscow revealed that people who live close to these power networks get headaches and heart issues 2.5 times more frequently than those who do not. There is also a tendency to shorten the age at the commencement of these ailments. By 50% for disease and 38% for cancer. The same findings were found in other nations, including China, Germany, France, and a number of other nations, and they point to a decline in the age at which these diseases' initial symptoms are noted. The made observations and study should be carried out once more in the ensuing years, and the outcomes should be examined. Along with detecting trends of stability or change, these trends can be used as a foundation for action to revise the guidelines for acceptable exposure to electromagnetic fields. And ideally, this should occur throughout the entire planet rather than just in one nation. The influence of electromagnetic radiation from transmission networks on individuals can only be lessened in this way, which takes a lot of labor and document preparation. Most people are exposed to electric and magnetic fields from a variety of sources, including electrical equipment, communication gadgets, radio, and television, as a result of recent advancements in science and modern industry.

The majority of people are exposed to electric and magnetic fields as a result of recent advancements in modern science and industry from a variety of sources, including electrical equipment, communication devices, and radio and television broadcasts. The most common sources are increasingly becoming cell phones, cordless phones, wireless LANs, and radio towers. The radio frequency range from 100 kHz to 300 GHz is utilized by even medical scanners, microwave ovens, and radar systems. And they all obstruct space, which has an impact on the inhabitants of it. The radio frequency fields that are constantly surrounding the human body expose it to energy that accumulates over time. Since exposure depends on a variety of factors, including distance and power of the sources. (Lyubomir Lazov, Nikolay Todorov Dolchinkov, Jordan Shterev Ivanov, Madlen Nikolaeva Peneva, Denitsa Angelova Bojhanova, 2019) A discontinuity at a frequency of 100 kHz causes a change in the nature of the change, which is followed by monotony at a frequency of 1–10 GHz. The majority of the energy absorbed by electromagnetic radiation is transformed into heat. (D.Sokolov. & V.Sobyna, 2018) ,and this process is brought on by the dielectric loss. The projection area of the body on planes perpendicular to the incident (D.Sokolov. & V.Sobyna, 2018) wave might differ significantly from the effective surface of the human body, which depends on the field frequency. The results must be approximated in order to be approved. The complicated image of distributed energy emitted by the body is influenced by significant variations in the electrical characteristics of fat, skin, muscle, subcutaneous tissue, and other tissues. The effects of radiation can be reversible and, in the case of high intensity or low systemic radiation, but beyond the maximum, irreversible because it is nearly impossible to determine the distributed thermal energy released in the body during irradiation. They cause burns, deaths, hemorrhages, changes in cell structure, disruptions in the nourishment of tissues, organs, or the body as a whole, as well as changes in the form and appearance of human body tissues and organs. The peripheral and central nervous systems' tissues are altered; these changes are seen at various frequencies. The ganglia are injured, and the neurons' structures are altered. People who operate in environments with high levels of electromagnetic radiation typically experience fatigue fast as well as headaches, overall weakness, and chest pain. increased perspiration, heightened irritation, and disturbed sleep. People have convulsions, memory loss, voice loss, brittle nails, etc. Energy flux density, field strength, and exposure time are used to quantitatively assess the dangers of electromagnetic effect. The limit values for electric and magnetic fields vary depending on frequency range, and scientific research shows that electromagnetic fields have significant biological activity across all frequency ranges. (Dolchinkov N. T., 2020) The influence of the thermal process is shown by the electromagnetic field at rather high levels, according to contemporary theory. The electromagnetic field is also thought to have an informational or non-thermal influence on the organism at low levels (at radio frequencies above 300 MHz and below  $1 \text{ mW} / \text{cm}^2$ ). It is still unclear how EMFs function in the second example. The results of the research show that the nervous system is one of the most sensitive systems to electromagnetic radiation. The methods of influence of electromagnetic environmental systems are numerous and different: intermittent and permanent, local and general, combined from many sources and combined with other harmful environmental factors. Large aberrations of low intensity are observed at the level of neurons as well as at the level of solitary neural structures. Memory alterations occur with an increase in nerve activity. Stress is felt by those who are exposed to electromagnetic radiation. The brain contains some structures that are extremely susceptible to electromagnetic radiation. There have been reports of changes in the chemoencephalitis barrier's permeability, which could result in unanticipated negative consequences. I have already gathered enough proof that electromagnetic radiation and the fields it produces are harmful to the immune system's ability to operate. A laser is a concentrated beam of electromagnetic energy or monochromatic

light. It also has a particular impact on human organs because it is a particular electromagnetic radiation. The impact of this kind of electromagnetic radiation on the human eye is among the most hazardous forms . (Marshall & Sliney, 2000) The biological effects of optical radiation are primarily restricted to the skin and eyes because it is absorbed in the outer layers of the body, though systemic effects can also happen. Depending on whatever area of the skin or eye absorbs the radiation and the sort of reaction taking place, different wavelengths have distinct effects: photochemical actions predominate in the ultraviolet range, whereas thermal effects predominate in the infrared region. (Lazov, Kondratieva O, & Dolchinkov , 2019)

### Electrical Power Line Effects

The electromagnetic fields emitted from power lines are one of the most significant topics discussed in the real estate and energy industries (Fig. 2). Each year, new studies and conflicting reports are published. While it is simple to shield a residence from the electric fields created by neighboring power lines, it is far more challenging to do the same for the magnetic fields. Compared to overhead lines, burying electricity transmission lines is more expensive but provides better protection for the magnetic field. (Zamanian & Hardiman, 2005)



**Fig.2. Electric power line. Adapted from" Possible effects of electromagnetic fields (EMF) on human health--opinion of the scientific committee on emerging and newly identified health risks ", by Anders Ahlbom .et ..al( 2008)**

The relationship between electromagnetic field exposure and a number of disorders, including depression, childhood leukemia, and disease disorders, has been investigated using animal research experiments, cellular laboratory studies, computer simulations, a clinical study, and human (epidemiological) studies. central and nervous systems. cancer, including skin, breast, and other forms. Numerous research from the past have produced contradictory results. While some of these reports established a relationship between these reports and bad health outcomes, others did not. The National Academy of Sciences and the National Cancer Institute, however, have recently discovered credible papers claiming that there is no proof of a connection between electromagnetic fields and cancer. These studies show that power transmission lines are much less likely to be carcinogenic than previously believed.

### Radio Frequency Radiation

Radio waves, radio frequency emissions, or radio frequency radiation are the terms used to describe the great majority of what is referred to as RF energy in the frequency ranges LF, MF, HF, VHF, UHF, or microwaves. For all frequencies between 30 kHz and 300 GHz, the phrase "RF Power" is used. The following are RF energy's benefits:. (Zamanian & Hardiman, 2005) (Majumder & Caffery, 2004) The biological effects of RF radiation are inversely correlated with the frequency and are proportional to the rate of energy absorption. Similar to how microwave ovens cook food, radiofrequency energy has the capacity to heat human tissue, but if the exposure is severe or prolonged, it can be harmful. Because the body is not designed to disperse the large amounts of heat produced, tissue injury may result from exposure to high levels of radiofrequency energy. Skin burns, severe burns, heat exhaustion, heat stroke, and heat stroke are all potential injuries. Cataracts result from a lack of blood flow that cools the cornea.

### Broadcast Stations

Commercial AM/FM radio and television stations broadcast at very high RF energy levels. Some of their antennas have power outputs of many megawatts, and they are typically installed in tall towers or other structures where no people will be present. However, RF radiation from AM/FM radio and TV broadcast stations is absorbed by people more so than it is by base station and mobile phone antennas. The effects of radiation taken from either source are roughly the same once it has been absorbed, according to an Australian group that had data showing that living close to television transmission towers increased the risk of leukemia in children. While in the UK, the opposite was accurate. In these instances, follow-up investigations found no conclusive link between radiofrequency exposure and the prevalence of childhood leukemia. (Zamanian & Hardiman, 2005) (Cibon, 2004)

### Cellular Telephones, Cordless Phones and Hand-Held Radios

A tiny antenna is typically attached to or incorporated into the body of most computers and cordless phones. Cell phones expose users to more radio frequency exposure than other radio frequency systems since their antennas are so close to their heads. Since cordless phones have a very low RF power output and portable two-way radios are typically used in talk and push mode with intermittent transmission, cordless home phones and other portable two-way radios have a similar impact. (Cooper, 7 Dec.2018) (Simić, June,2007) Cell phones, personal computers, portable radios, and cordless phones' frequency bands and average radiated power are displayed in Table 1 for the United States.

**Table 1· Typical portable/mobile radio equipment**

Type of Radio	Frequency(MHz)	Average radiated power
Cellular/PCS	824-849 MHz 1850-1990 MHz	A few hundred milliwatts
Two-way,hand-held (walkie-talkie)	30,50,150,450 and 800 MHz bands	Between 2 and 5 watts
Cordless telephone	49,915,2450 MHz	Tens of milliwatts

### Vehicular Mobile Telephones and Radios

An antenna is mounted outside the car, typically on a window, roof, fender, or trunk, for mobile phones and automotive (non-cellular) radios. Between the user's radio or mobile phone and the radio frequency energy emitted by the antenna, the metal surface of the vehicle acts as an insulator. It also acts as protection from RF energy in addition to separating the user from the antenna. Despite the average radiated power being high—between 10 and 100 watts—mobile device users cannot be exposed to RF energy due to these two factors. (Zamanian & Hardiman, 2005)

### RF Exposure Concerns

The amount of energy needed to ionize or damage DNA in human tissue is billions of times lower in electromagnetic radiation from cellular/wireless and portable radios. However, because of how quickly and widely this technology is being used, there are already worries about potential negative health impacts, notably brain tumors. (Bourse, 2002) (Lopez, Filipovic, & Ignatenko, 2014) With a reasonable degree of confidence, these studies (from the United States and other nations) appear to rule out any connection between cancer and electromagnetic radiation from these devices. More and more scientific authorities are shifting their opinions on the use of these kinds of wireless gadgets. Many of these specialists think that EMR at higher wattage ranges is related to cancer risk. (WORLD HEALTH ORGANIZATION, 2001) Risks, so long as access to the antennas is restricted. To date, no study has offered definite proof that cell phones can lead to any illnesses. However, ongoing research is looking more deeply at this problem. Concerns about potential connections between cell phone use and ear cancers have recently surfaced in papers from Europe, with youngsters at higher risk than adults. It is crucial to keep in mind that cordless phones, cell phones, and computers are relatively new technology, and in the absence of extensive research, it is hard to show that any product or exposure is fully safe. Therefore, a suitable "preventive" strategy is for adults to limit the length of their mobile phone conversations and to discourage youngsters from using their phones frequently and for extended periods of time. Instead, utilizing them raises the danger of driving accidents. According to the findings of numerous studies, chatting on a cell phone while driving considerably raises the likelihood of an accident; in fact, some claim that it is nearly as risky as driving while intoxicated. (Federal Communications Commission FCC, 2013) (Weng, D.G, T.H., Dong, & Mc Callum, 2004) The

amount of energy in the electromagnetic radiation emissions from cellular/wireless and portable radios is far less than what is required to ionize or harm DNA in human tissue. Therefore, the quick and broad adoption of this technology prompts worry about potential harmful health impacts including brain tumors. Even the link between electromagnetic radiation from these devices and cancer is minimized in these studies. (Bourse, 2002) (Lopez, Filipovic, & Ignatenko, 2014) The attitudes toward the use of these kinds of wireless devices have changed as a result of the increasing number of scientific specialists. Many of these scientists think that electromagnetic radiation with larger wattage ranges increases the risk of cancer. (WORLD HEALTH ORGANIZATION, 2001) As long as people are prevented from getting close to the antennas, the scientific community agrees that the power from base stations situated in radio sites is too low to constitute a health concern. No investigation or study to yet has offered solid proof that cell phones can lead to any illnesses. However, ongoing research is looking more deeply at this problem. Concerns about potential connections between cell phone use and ear cancers have recently surfaced in papers from Europe, with youngsters at higher risk than adults. It is crucial to keep in mind that cordless phones, cell phones, and computers are relatively new technology, and in the absence of extensive research, it is hard to show that any product or exposure is fully safe. Therefore, a suitable "preventive" strategy is for adults to limit the length of their mobile phone conversations and to discourage youngsters from using their phones frequently and for extended periods of time. The perceived risks of using a cell phone while driving are not related to radiation exposure, but rather to the increased chance of collisions. According to the findings of numerous studies, using a cell phone while driving significantly raises the risk of an accident; in fact, some claim that it is almost as dangerous as driving while intoxicated. (Federal Communications Commission FCC, 2013) (Weng, D.G, T.H., Dong, & Mc Callum, 2004)

#### Communication Links

Operating between 1 GHz and 60 GHz in frequency, microwave communication connections. Living tissues exposed to radio frequencies like microwave radiation will therefore produce heat. Particularly susceptible to harm from microwave energy is the human eye. Furthermore, after exposure to extremely high frequencies, cataracts were created in controversial studies on the effects of microwaves on the eye. When used for communication, microwave links convey extremely concentrated beams of energy directly through space between antennas, which are often mounted on special towers (Fig. 3). It is unlikely that someone will unintentionally go into the path of this kind of energy as a result of this activity. (Zamanian & Hardiman, 2005) (Kunkel, 2012)



Fig. 3 · Microwave communication site. Adapted from " Electromagnetic Radiation .High Frequency Design EMR & HUMAN HEALTH", by Ali Zamanian & Cy Hardiman(2005) ,p16-26

#### Effect of Microwave Ovens on Human Health and Food

Unlike the effects of heating as in an ordinary oven, microwave cooking has different impacts on food. (Ahlbom, et al., 2008) (Amacher, 1998) Many individuals are worried about how microwave ovens' electromagnetic radiation could affect neighboring residents and the food they eat. Many individuals think that food prepared in microwaves becomes toxic and that they cause cancer. This assumption is untrue. ( El-Ghazaly, Radwan, & Said, 2014) (Abdel Aziz, El-Khozondar, Shabat, & Elwasife, 2010) Non-ionizing radiation and microwaves cannot harm molecules, whereas other types of ionizing radiation, such as X-rays, typically have local energy that can cause chemical damage to molecules in their path. When moist food or tissues are placed in a microwave oven, the appliance solely produces thermal energy, heating the items.

The level of RF radiation outside the oven is perfectly safe because microwave ovens are built and extensively tested to ensure that no microwave radiation escapes when the door is shut. A worn-out or defective oven door gasket may allow radioactive leakage, creating a potentially dangerous situation. Food cooked in a microwave oven doesn't experience any long-term consequences. Unlike the effects produced by heating, as in a traditional oven, there is no solid evidence that food prepared in a microwave undergoes any chemical changes. (Ahlbom, et al., 2008) (Amacher, 1998)

### Magnetic Resonance Imaging

An MRI can be produced based on the atoms' magnetic characteristics. The foundation of magnetic resonance technology is the body's tissues' ability to absorb and emit radio frequency radiation. (Zamanian & Hardiman, 2005) (Attia & Yehia, 2002) Strong magnets are necessary for MRI in order to create radio frequency radiation in the 1MHz to 100MHz range and a magnetic field that is 10,000 times greater than the Earth's natural magnetic field. The human body contains a very modest proportion of hydrogen atoms that are aligned with a steady magnetic field. When focused, radio wave pulses are given in the direction of the tissue's aligned hydrogen atoms, which will reflect a weak signal. Weak radio signals that are reflected are picked up and analyzed to produce the images. Because of the minute variations in signal strength between bodily tissues, MRI can create pictures with remarkable resolution that can distinguish between organs and possibly contrast between benign and malignant tissues (Figure 4). due to the fact that MRI does not employ ionizing radiation, the occurrence of harmful aftereffects. However, there are dangers associated with using an MRI incorrectly that could result in significant damage or even death. These risks are primarily a result of the following: (Kathiravan, 2013)

- Implanted electrical devices like pacemakers may be affected by the intense magnetic fields produced by MRI.
- Radiofrequency burns brought on by currents created in conductors unintentionally positioned on a patient's skin surface (eg, leads from ECG machines and other monitoring devices).



Fig. 4 - MRI machine, Adapted from "Electromagnetic Radiation .High Frequency Design EMR & HUMAN HEALTH", by Ali Zamanian & Cy Hardiman(2005) ,p16-26

### Conclusion

The presentation that was presented during the research demonstrated the significant significance of electromagnetic radiation and its useful applications in our day-to-day lives, including microwaves, televisions, and mobile phones, among others. There are some necessary precautions to be taken when dealing with it, including the recommendation that scientists wear special clothing when exposed to or near the radiation area and that the area exposed to radiation should be well ventilated in order to facilitate the movement of air, which in turn reduces the effect of the emitted radiation. It cannot be dispensed with, abandoned, or left until it has become one of the important requirements of life. Wet areas increase the impact of radiation, particularly in tissues, organs, and areas where the volume of blood is reduced, such as the ears and eyes, according to research and laboratory testing. High-intensity exposure to RF radio waves can cause a number of injuries, including skin burns, heart attacks, and eye darkening. RF radio waves' symptoms can include headaches, psychological distress, which is often accompanied by insomnia, difficulty concentrating, and feeling dizzy. We all realize that we get weary a lot of the time when we are exposed to mobile phone radiation for extended periods of time. The intensity of the radiation that the body or the house is subjected to must be measured in order to get a clearer picture, such as in the case of homes that are in the radiation path of cell towers.

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