

Electromagnetic(EM) Radiation From Radio Base Station(RBS) And Reduce Its Impact On Environment

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ABSTRACT : Electromagnetic waves generated by different wireless systems like mobile systems, satellite systems, microwave links...etc. facilitates our communications throughout the world. These waves have many effects on environment as well as our daily lives. Cell phones communicate with nearby RBS mainly through radiofrequency (RF) waves, a form of energy in the electromagnetic spectrum between FM radio waves and microwaves. Like FM radio waves, microwaves, visible light, and heat, they are forms of non-ionizing radiation. This means they do not directly damage the DNA inside cells, which is stronger (ionizing) types of radiation such as x-rays, gamma rays, and ultraviolet (UV) light are thought to be able to cause cancer. At very high levels, RF waves can heat up body tissues.

KEYWORDS : Electromagnetic radiation (EM radiation or EMR), Radio Base Station (RBS), GSM.

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I. INTRODUCTION

Mobile phones are used widely throughout the world for easier connectivity and wireless communication. Mobile phones have a darker side also as these emit the electromagnetic radiations which cause many health risks. The mobile phones handsets and the antennas used for wireless communication are studied as primary sources of electromagnetic radiations. This paper has also reviewed long-term and short-term effects of mobile phones. Long-term usage of mobile phones cause health hazards such as cancer, high blood pressure, miscarriages, DNA damage, hormonal imbalance etc. While their short-term uses can cause conditions like insomnia, depression, headaches, sleep disorders, etc. To minimize the health issues related to the exposure of radiations the safety guidelines provided by various organizations such as ICNIRP should be followed. Following some simple mobile phone usage habits such as the time, distance between the mobile and body, etc. Can prevent the various health hazards from the radiations of the mobile phones. Electromagnetic field level generated by base stations in different points.

II. ELECTROMAGNETIC(EM) WAVE

Electromagnetic(EM) waves, making up electromagnetic radiation, can be imagined as self propagating transverse oscillating waves of electric and magnetic fields. This diagram shows a linearly polarized, plane EM-wave propagating from left to right (along X-axis, in left-handed coordinates). The electric field is in a vertical plane (X/Z axes) and the magnetic field in a horizontal plane (X/Y axis). The electric and magnetic fields in polarized EM waves are always in phase and in planes at 90 degrees to each other.

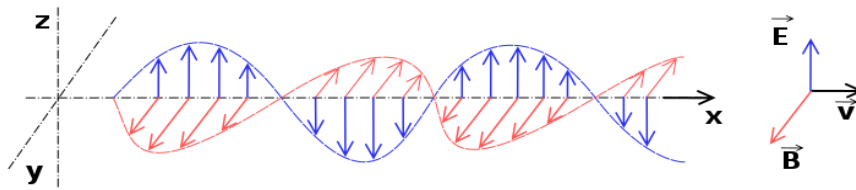


Fig: Electromagnetic (EM) waves

III. ELECTROMAGNETIC(EM) RADIATION

Electromagnetic radiation consists of electromagnetic waves, which are synchronized oscillations of electric and magnetic fields that propagate at the speed of light through a vacuum. The oscillations of the two fields are perpendicular to each other and perpendicular to the direction of energy and wave propagation, forming a transverse wave. The wave front of electromagnetic waves emitted from a point source (such as a light bulb) is a sphere. The position of an electromagnetic wave within the electromagnetic spectrum can be characterized by either its frequency of oscillation or its wavelength. Electromagnetic waves of different frequency are called by different names since they have different sources and effects on matter. In order of increasing frequency and decreasing wavelength these are radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays and gamma rays.

Electromagnetic radiation (EM radiation or EMR) refers to the waves (or their quanta, photons) of the electromagnetic field, propagating (radiating) through space-time, carrying electromagnetic radiant energy. It includes radio waves, microwaves, infrared, (visible) light, ultraviolet, X-rays and gamma rays.

Electromagnetic waves are emitted by electrically charged particles undergoing acceleration and these waves can subsequently interact with other charged particles, exerting force on them. EM waves carry energy, momentum and angular momentum away from their source particle and can impart those quantities to matter with which they interact. Electromagnetic radiation is associated with those EM waves that are free to propagate themselves ("radiate") without the continuing influence of the moving charges that produced them, because they have achieved sufficient distance from those charges. Thus, EMR is sometimes referred to as the far field. In this language, the near field refers to EM fields near the charges and current that directly produced them specifically, electromagnetic induction and electrostatic induction phenomena.

In quantum mechanics, an alternate way of viewing EMR is that it consists of photons, uncharged elementary particles with zero rest mass which are the quanta of the electromagnetic force, responsible for all electromagnetic interactions. Quantum electrodynamics is the theory of how EMR interacts with matter on an atomic level. Quantum effects provide additional sources of EMR, such as the transition of electrons to lower energy levels in an atom and black-body radiation. The energy of an individual photon is quantized and is greater for photons of higher frequency. This relationship is given by Planck's equation $E = h\nu$, where E is the energy per photon, ν is the frequency of the photon, and h is Planck's constant. A single gamma ray photon, for example, might carry ~100,000 times the energy of a single photon of visible light.

The effects of EMR upon chemical compounds and biological organisms depend both upon the radiation's power and its frequency. EMR of visible or lower frequencies (i.e. visible light, infrared, microwaves and radio waves) is called non-ionizing radiation, because its photons do not individually have enough energy to ionize atoms or molecules or break chemical bonds. The effects of these radiations on chemical systems and living tissue are caused primarily by heating effects from the combined energy transfer of many photons. In contrast, high frequency ultraviolet, X-rays and gamma rays are called ionizing radiation, since individual photons of such high frequency have enough energy to ionize molecules or break chemical bonds. These radiations have the ability to cause chemical reactions and damage living cells beyond that resulting from simple heating and can be a health hazard.

IV. RADIO FREQUENCY (RF)

Radio frequency (RF) refers to the rate of oscillation of electromagnetic radio waves in the range of 3 kHz to 300 GHz, as well as the alternating currents carrying the radio signals. This is the frequency band that is used for communications transmission and broadcasting. Although RF really stands for the rate of oscillation of the waves, it is synonymous to the term "radio," or simply wireless communication.

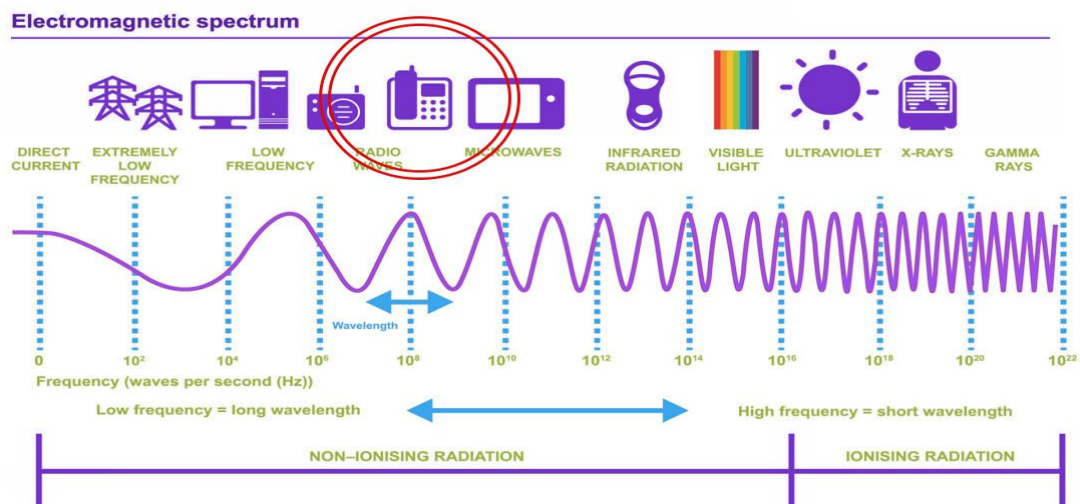


Fig: Electromagnetic (EM) Spectrum

Radio frequency is being used in a lot of fields, but in the context of information and communications technology it refers to the frequency band at which wireless telecommunications signals are being transmitted and broadcast. The frequency band is being divided into different parts, which are then assigned to different technology industries. This is known as the radio spectrum. For example, the VHF (very high frequency) band, which ranges from 30-300 MHz, is being used for FM radio, TV broadcasts, and amateur radio and its counterparts. For a lot of electronic communication devices, the ultra-high frequency (UHF) band is being used. This is the space used by mobile phones, wireless LAN, Bluetooth, and TV and land radio.

Radio frequency is produced by oscillating current a specified number of times and then radiating it off a conductor, referred to as an antenna, into empty space (this refers to space occupied by air rather than solid objects and does not refer to outer space) as electromagnetic radio waves. RF signals are sent and received.

V. RADIO BASE STATION (RBS)

Radio Base Station (RBS) is the commercial name given to the family of Base Stations developed by Ericsson, typically constituting a sizable part of the Radio Access Network (RAN). Radio Base Station is also the generic name to be used instead of BTS (Base Transceiver Station) which are typically denoting GSM-era radio base station technology. For other vendors, specific equipment names are used such as Huawei DBS (Huawei DBS3900 for example) or NSN Flexi base stations.

A Radio Base Station (RBS) is a piece of equipment that facilitates wireless communication between user equipment (UE) and a network. UEs are devices like mobile phones (handsets), WLL phones, computers with wireless Internet connectivity. The network can be that of any of the wireless communication technologies like GSM, CDMA, wireless local loop, Wi-Fi, Wi-MAX or other wide area network (WAN) technology. A network may be any wireless technology, like Code Division Multiple Access (CDMA), Global System for Mobile Communications (GSM), Worldwide Interoperability for Microwave Access (WiMAX) or Wi-Fi. However, because a BTS is associated with mobile communications technologies, it refers to the equipment that creates the "cell" in a cellular network. Sometimes, an entire base station, plus its tower, are improperly referred to as a RBS/BTS or cell phone tower.

As part of a cellular network, a RBS/BTS has equipment for the encryption and decryption of communications, spectrum filtering equipment, antennas and transceivers (TRX) to name a few. A RBS/BTS typically has multiple transceivers that allow it to serve many of the cell's different frequencies and sectors.

VI. RADIO BASE STATION (RBS) OPERATION

RBS/BTS may be free-standing towers or mounted on existing structures, such as trees, water tanks, or tall buildings. The antennas need to be high enough to adequately cover the area. Base stations are usually from 50-200 feet high. 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 radiofrequency 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. The energy from a cellular phone tower antenna, like that of other telecommunication antennas, is 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 decreases rapidly as the distance from the antenna increases. As a result, the level of exposure to radio waves at ground level is very low compared to the level close to the antenna.

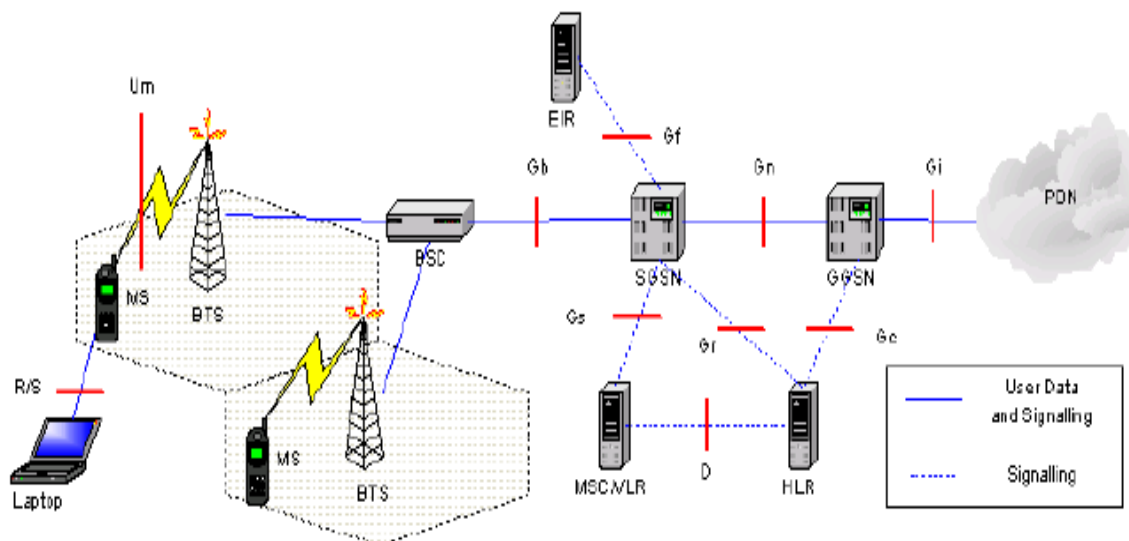


Fig: GSM (Global System for Mobile Communication) Architecture

Public exposure to radio waves from cell phone tower antennas is slight for several reasons. The power levels are relatively low, the antennas are mounted high above ground level, and the signals are transmitted intermittently, rather than constantly.

At ground level near typical cellular base stations, the amount of RF energy is 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.

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.

The level of RF energy inside buildings where a base station is mounted is typically much lower than the level outside, depending on the construction materials of the building. Wood or cement block reduces the exposure level of RF radiation by a factor of about 10. The energy level behind an antenna is hundreds to thousands of times lower than in front. 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.

VII. EFFECT OF EM RADIATION ON ENVIRONMENT

Cell phones communicate with nearby RBS mainly through radiofrequency (RF) waves, a form of energy in the electromagnetic spectrum between FM radio waves and microwaves. Like FM radio waves, microwaves, visible light, and heat, they are forms of non-ionizing radiation. This means they do not directly damage the DNA inside cells, which is stronger (ionizing) types of radiation such as x-rays, gamma rays, and ultraviolet (UV) light are thought to be able to cause cancer. At very high levels, RF waves can heat up body tissues.

The adverse health effects depend on factors such as the type of radiation (ionizing or non-ionizing) the quantity of dose absorbed the rate at which the dose was absorbed radio sensitivity of the cells involved the polarization of the EMF wave and the distance from the source. The quantity of EMF doses absorbed by the human body is an important factor and is measured in units called the specific absorption rate

(SAR) or gray, an amount of radiation that releases one joule of energy per kilogram of matter. RF fields below 10 GHz (to 1 MHz) penetrate exposed tissues and produce heating due to energy absorption. The depth of penetration depends on the frequency of the field and is greater for lower frequencies. Absorption of RF fields in tissues is measured as a Specific Absorption Rate (SAR)

Within a given tissue mass. The unit of SAR is watts per kilogram (W/kg). SAR is the quantity used to measure the "dose" of RF fields between about 1 MHz and 10 GHz. In practice, direct measurements of SAR are only feasible under laboratory conditions. Recommended maximum exposure levels in terms of electric and magnetic field strength as well as power density are therefore given in addition to SAR limits.

Both the telecommunications industry and the biomedical engineering research sector have multiplied peer-reviewed scientific studies to determine whether prolonged exposure to electromagnetic waves poses a danger to human health. Biologists concede a wide range of opinion on the subject. While numerous scientific studies report that exposure to EMF has an impact on human tissues and cell development, experts do not agree on how much exposure may lead to health risks for adults or children.

VIII. SOME EXPRESSED CONCERN ABOUT EM RADIATION

1. The Environmental Protection Agency (EPA) states:

At very high levels, RF energy is dangerous. It can heat the body's tissues rapidly. However, such high levels are found only near certain equipment, such as powerful long-distance transmitters. Cell phones and wireless networks produce RF, but not at levels that cause significant heating. In addition, RF energy decreases quickly over distance. At ground level, exposure to RF from sources like cell phone towers is usually very low. Some people are concerned about potential health effects, especially on the developing brains and bodies of children. Some studies suggest that heavy long-term use of cell phones could have health effects. Other studies don't find any health effects from cell phone use. Long-term studies on animals exposed to the RF found in wireless networks (Wi-Fi) have, so far, found no health effects. Scientists continue to study the effects of long-term exposure to low levels of RF.

2. International Agency for Research on Cancer (IARC) states:

The International Agency for Research on Cancer (IARC) has classified RF fields 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. IARC also noted that exposure to the brain from RF fields from cell phone base stations (mounted on roofs or towers) is less than 1/100th the exposure to the brain from mobile devices such as cell phones.

3. US Federal Communications Commission (FCC) states

Radiofrequency emissions from antennas used for cellular and PCS [personal communications service] transmissions result in exposure levels on the ground that are typically thousands of times below safety limits. These safety limits were adopted by the FCC based on the recommendations of expert organizations and endorsed by agencies of the Federal Government responsible for health and safety. Therefore, there is no reason to believe that such towers could constitute a potential health hazard to nearby residents or students.

RBS are not known to cause any health effects. But if you are concerned about possible exposure from a cell phone tower near your home or office, you can ask a government agency or private firm to measure the RF field strength near the tower (where a person could be exposed) to ensure that it is within the acceptable range.

4. Some people expressed

Some people have expressed concern that living, working, or going to school near a cell phone tower might increase the risk of cancer or other health problems. At this time, there is very little evidence to support this idea. In theory, there are some important points that would argue against cellular phone towers being able to cause cancer.

First, the energy level of radiofrequency (RF) waves is relatively low, especially when compared with the types of radiation that are known to increase cancer risk, such as gamma rays, x-rays, and ultraviolet (UV) light. The energy of RF waves given off by cell phone towers is not enough to break chemical bonds in DNA molecules, which is how these stronger forms of radiation may lead to cancer.

Second issue has to do with wavelength. RF waves have long wavelengths, which can only be concentrated to about an inch or two in size. This makes it unlikely that the energy from RF waves could be concentrated

enough to affect individual cells in the body.

Third, even if RF waves were somehow able to affect cells in the body at higher doses, the level of RF waves present at ground level is very low—well below the recommended limits. Levels of energy from RF waves near cell phone towers are not significantly different from the background levels of RF radiation in urban areas from other sources, such as radio and television broadcast stations.

IX. RESEARCH REPORT ABOUT EM RADIATION

In one large study, British researchers compared a group of more than 1,000 families of young children with cancer against a similar group of families of children without cancer. They found no link between a mother's exposure to the towers during pregnancy (based on the distance from the home to the nearest tower and on the amount of energy given off by nearby towers) and the risk of early childhood cancer.

In another study, researchers compared a group of more than 2,600 children with cancer to a group of similar children without cancer. They found that those who lived in a town that could have exposed them to higher than average RF radiation from cellular phone towers in the previous 5 years had a slightly higher risk of cancer, although not of any certain type of cancer (like leukemia or brain tumors). This study estimated the children's possible exposure based on the number of towers in their town and how strong the signals were from the towers. It did not look at actual exposure of any individual child based on how far their home or school was from a tower. This limitation reduces confidence in the results of the study. One study looked for signs of DNA and cell damage in blood cells as a possible indicator of cancer-causing potential.

The amount of exposure from living near a cell phone tower is typically many times lower than the exposure from using a cell phone. About 30 studies have looked at possible links between cell phone use and tumors in people. Most studies to date have not found a link between cell phone use and the development of tumors, although these studies have had some important limitations. This is an area of active research.

X. LAB STUDY REPORT ABOUT EM RADIATION

Laboratory studies have looked at whether the types of RF waves used in cell phone communication can cause DNA damage. Most of these studies have supported the idea that the RF waves given off by cell phones and towers don't have enough energy to damage DNA directly. Because of this, it's not clear how cell phones and towers might be able to cause cancer, but research in this area continues.

Some scientists have reported that RF waves may produce other effects in human cells (in lab dishes) that might possibly help tumors grow. However, these studies have not been verified, and these effects weren't seen in a study that looked at the blood cells from people living near a cellular phone tower.

Several studies in rats and mice have looked at whether RF energy might promote the development of tumors caused by other known carcinogens (cancer-causing agents). These studies did not find evidence of tumor promotion, but this is still an area of research.

A large study by the US National Toxicology Program (NTP) exposed groups of lab rats and mice to RF energy over their entire bodies for about 9 hours a day, starting before birth and continuing for up to 2 years (which is the equivalent of about 70 years for humans, according to NTP scientists). In a draft report of the final results (released in February 2018), the study found an increased risk of tumors called malignant schwannomas of the heart in male rats exposed to RF radiation. But some aspects of this study make it hard to know just how these results might apply to RF exposure from cell phone towers in people. For example, there was no increased risk among female rats or among male or female mice in the study. The doses of RF radiation in the study were also generally higher than those people are exposed to when using cell phones (much less being near a cell phone tower). The male rats in the study exposed to RF waves also lived longer, on average, than the rats who were not exposed, for unclear reasons. Still, the results add evidence to the idea that the signals used in cell phone communication might potentially impact human health.

XI. REDUCE ELECTROMAGNETIC(EM) RADIATION EFFECT BY TECHNICALLY

Recently, the WHO(World Health Organization) came out with a statement that Cell Phones may be hazardous to your health. They made this conclusion after they had a conference in which world scientists, doctors etc., examined the data from one study done in Sweden and concluded that despite all of the other years where they could not make a determination, this year they could.

Was this politically motivated, where the WHO, the organization that created the scare of h1n1 virus, SARs, and Mad Cow, actually needed some more limelight to become relevant or is this real possibility, that is, Cell Phones used for long periods of time can cause tumors in the brain. In looking at the study, several key facts come out of it. Some of them are based on their assumptions and some as well that are based on logic.

1. Limiting Exposure to Electromagnetic fields (up to 300 GHz). The Board of NRPB has recommended the adoption in the UK of the guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) for limiting exposures to electromagnetic fields (EMFs) between 0 and 300 GHz. This follows a thorough review of current scientific knowledge on the effects of EMFs and an extensive consultation exercise. The Board recognizes the need to adopt a cautious approach in the interpretation of scientific knowledge and the benefits of common international guidelines.

2. All mobile companies can develop these systems that they can reduce microwave systems and use the best alternative which fiber optic cables proposed alternative using fiber optic system instead of microwave link, there are many advantages like increase in data rate transmission, radiation risks atmosphere effects on the system and reduction in radiation effects on human. radiation will weaken the microorganism further), and any pregnant woman. EM radiation is readily absorbed by the amniotic fluid in which the embryo and then the fetus develop

3. Avoid using the phone in a confined space such as an elevator, basement, underground station, caravan, etc. In these situations the strength of the signal both sending and receiving is much greater thus the radiation is much more intense.

4. Equip yourself preferably with: a mobile phone with the lowest possible SAR rating (Specific Absorption Rate of microwave radiation by human body tissues). The regulation limit is 1.1W/kg for eye-sockets and cheeks and a phone with an external antenna, because even if it is less trendy, the omnidirectional antenna broadcasts with maximum efficiency and therefore uses a weaker signal than one with an inbuilt antenna. The fashion factor matters less than the health factor.

5. Avoid using the mobile phone who has any metallic object in or on their head, whether magnetic or not, such as amalgam fillings and dental bridges, metal plates, screws, clips, body ornaments, earrings or metal framed glasses. The same is true for those with walking frames, wheelchairs or metal crutches, so as to avoid increasing radiation by the phenomena of reflection, amplification, resonance, passive reemission, etc .

6. Make use of protective items to shield his/her self from radiation, such as a metal phone carrying case, protective anti-radiation fabric and veils, metallic foil wallpaper, anti-radiation paint, etc, all which have been proved to be effective.

7. Trying as he/she can as possible making calls using landlines which emit no radiation, and which can often be used for free and for unlimited time via the Internet, even for phone calls abroad.

8. More important is antenna located designed, cell phone that have their antenna located behind the ear piece of the cell phone and others that are located behind the microphone or mouth piece. There was no distinction made between these two cases. Close proximity to the area behind the ear and above, energy transmitted by the cell phone has a higher intensity than that transmitted by the antenna behind the mouth piece. For the signal to travel into the brain area, the signal must pass through the jawbone, the moisture of the mouth and on to the brain. The energy of the cell phone at 5" from the antenna we can be measured with the spectrum analyzers we have and it was 10 dB or ten times less than that of the energy directly at the ear.

Antennas are a crucial component of any connected device such as a mobile phone product. But choosing the right antenna for an application presents a key design challenge.

SAR - The SAR measures the amount of energy absorbed by the human body when the phone is transmitting and maximum power. The peak absorption must be less than 1.6 mW/g in the US [over 1 gram of tissue] and less than 2 mW/g in the EU [over 10 grams of tissue]. The location and type of antenna significantly affect by the SAR value.

TRP - Cell carriers (AT&T, Verizon, China Mobile, etc) set minimum specifications for the amount of total radiated power (TRP) for every frequency band the phone will support. TRP is a function of the radios transmit power and the antenna efficiency.

11. The most stringent international exposure limits in the western world for RF radiation used by digital mobile telephony were set by the International Radiation Protection Association (IRPA) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). These criteria were established to protect biological tissue from temperature increases(thermal effects). The ICNIRP exposure limits are given either in terms of Radiation Intensity (Power Density) usually in mW/cm², either in terms of Specific Absorption Rate (SAR) which is defined as the radiation power, absorbed by the unit mass of tissue, in W/kg. Only the radiation intensity in air outside the body can be readily and objectively measured in exposed individuals. The SAR is difficult to be determined for every single tissue as is different for different tissues and radiations. The best way for determining SAR is by computational approximate methods like the Finite Difference Time Domain (FDTP) method, the Finite Element Method (FEM), or the Method of Moments (MoM).

According to the ICNIRP exposure criteria, the maximum permitted radiation intensity (in mW/cm²) for the general population exposure is given according to radiation frequency and it is $f/2$ (f in GHz). Therefore, **at 900MHz, the intensity limit according to these criteria is 0.45mW/cm². At 1800 MHz the corresponding limit is 0.9 mW/cm².** In terms of SAR the ICNIRP limits for the general population are 0.08 W/Kg (for whole-body average absorbed power) and 2 W/Kg (for the head and trunk). All the above values are to be averaged over any 6min period during the 24-h day. (IRPA 1988; ICNIRP 1998). **For the frequency 25-800 Hz, the IRPA-ICNIRP limits for the general population are for electric field intensity E, the value $250/f$ and for magnetic induction B, the value $50/f$, (E in kV/m, B in G, f in Hz).** Therefore, at 217 Hz, (the pulse repetition frequency of digital mobile telephony radiations), the ICNIRP limits are 1.15kV/m and 0.23 G for up to 24h exposure during the day, (IRPA 1990; ICNIRP 1998). As we shall see, during the years after the establishment of the IRPA-ICNIRP exposure criteria, it has been shown that the vast majority of health effects of digital mobile telephony radiations are non-thermal and a lot of biological effects were recorded at radiation intensities much lower than the values of these criteria. This is the reason why several countries in Europe have established much more stringent national exposure criteria, like Italy, Poland, Russia (10 μ W/cm²).

XII. REDUCE ELECTROMAGNETIC(EM) RADIATION EFFECT BY PERSONALLY

Below are some precautions and recommendations hope be useful for anyone want to reduce the cell phone radiation effect:

1. Phone calls must be limited to those that are absolutely necessary and try to not exceed about five to six minutes which is the time the body needs to adjust and if it is possible using hands-free kit and hold the phone more than 20/30cm away from his/her body in order to limit the impact of radiation on yourself.
2. Trying to not carry your phone directly on body, even on stand-by, and do not use it less than one meter away from another person, in order to reduce the effect of 'passive' radiation.
3. When he/she be on the bed try not keep a mobile phone beside the bed at night switched on because even when on stand-by it is in contact with the nearest phone mast and emits radiation at regular intervals.
4. Avoid using the phone while in any vehicle to be safety from accidents, also, when stationary an enclosed metal container produces the "Faraday cage" effect, which maximizes the damaging impact of radiation, reflecting not only on the person phoning but also on other passengers, especially children. Thus it is essential to step out of the vehicle before making a call, as well as, when want to use it inside train, bus, etc. Avoid this case because since its antenna will be constantly scanning for contact using the maximum signal strength and the radiation from both incoming and outgoing signal will be intensified. Try to not allowing children to use a mobile phone at all because they are still growing. With their lighter body weight the radiation is more damaging, especially to the brain, weakening the Blood-Brain Barrier (BBB), and to the reproductive organs/ovaries, etc. and those elder should be discouraged from using a mobile phone, as well as anyone in a weakened state.
5. By phoning with a headset (Wired or Bluetooth, Wireless), the phone is moved away from the head. It is an effective way of reducing exposure to head waves. (EHT Note: Bluetooth still exposes the brain to RF so we do not recommend this.)
6. By using SMS to communicate, one reduces the emission of waves of his telephone. Indeed, to send an SMS, the phone "connects" to the nearest relay antenna only the time to send the message. During a conversation, the phone connects to the nearest relay antenna and renews the connection regularly, especially on the go. The level of emission of waves is therefore more important. Also when sending an SMS, the notebook is away from the head.
7. Read the information in of cell phone manual: Must find out about the level of exposure to the waves of your mobile phone: this is the DAS, whose display becomes mandatory at the points of sale in April 2011. The DAS (Specific Absorption Rate (SAR)) phones Mobile device quantifies the user's maximum exposure level to electromagnetic waves, for use at the ear.

XIII. CONCLUSION

Now can be concluded that electromagnetic fields are harmful and can have adverse effect on human body depending upon the intensity and frequency of electromagnetic field. It is always a good idea to avoid the unnecessary exposure to electromagnetic fields whenever possible. Though technology makes our life very comfortable but at the expense of our health, it is our first duty to save our life. Thus we should use technology wisely so that we can save our self as well as mother earth. These negative effects are particularly important in the electromagnetic fields in the Radiofrequency (RF) zone which are used in communications, radio and

television broadcasting, cellular networks and indoor wireless systems. Along with the widespread use of technological products in daily life, the biological effects of electromagnetic waves have begun to be more widely discussed. EMR exposure at the highest frequencies (X-Rays, Gamma rays) is a source of serious biological damage.

REFERENCES

- [1]. Wikipedia, the free encyclopedia (online): "(i) Mobile Phone radiation and health, and (ii) Electromagnetic Radiation and health".
- [2]. World Health Organization, "Electromagnetic Fields and public health-Mobile phones: Fact sheet" June 2011, No.193
- [3]. Aruna Tyagi, Manoj Duhan and Dinesh Bhatia, "Effect of mobile phone radiation on brain activity-GSM vs CDMA. International Journal of Science, Technology and Management". Apr 2011; vol 2(issue 2),pg 1-5
- [4]. EPA (employer), Research Center for Iran Telecommunications(executor), research project "Designing Standard Levels for Electromagnetic Waves of Mobile Phones," 2004
- [5]. Porcelli M, Cacciapuoti G, Fusco S, Massa R, d'Ambrosio G, Bertoldo C, De Rosa M, Zappia V. Non-thermal effects of microwaves on proteins: thermophilic enzymes as model system. FEBS Lett. 1997; 402(2-3): 102-6.
- [6]. De Pomerai DI, Smith B, Dawe A, North K, Smith T, Archer DB, Duce IR, Jones D, Candido EP. Microwave radiation can alter protein conformation without bulk heating. FEBS Lett. 2003; 543(1-3): 93-7.
- [7]. Mancinelli F, Caraglia M, Abbruzzese A, d'Ambrosio G, Massa R, Bismuto E. Non-thermal effects of electromagnetic fields at mobile phone frequency on the refolding of an intracellular protein: myogl. J Cell Biochem. 2004; 93(1): 188-96.

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