

# Review of Effects of Cell Phone Radiations on Human Health and its Possible Solutions

Kamal Singh<sup>1</sup>, Devraj Gautam<sup>2</sup>

<sup>1,2</sup>Department of ECE, Northern India Engineering College(GGSIPU), New Delhi

<sup>1</sup>kamalsliet@gmail.com

<sup>2</sup>devrajgautam10@gmail.com

**Abstract-** The cell phones have become the integral part of our day to day life but because of their enormous advantages we are neglecting their dark side which can prove to fetal if remains un-noticed for a long time. Cell phone acts as a source of harmful radiation and produces E-pollution. In this paper we have given the ill-effects of radiations due to cell phone and suggested some precautions which can reduce these.

**Keywords –** Electromagnetic Radiation (EMR), Specific Absorption Rate (SAR), Blood Brain Barrier (BBB), Base Trans receiver system (BTS), EM (Electromagnetic).

## I. INTRODUCTION

The Cell phones have proved to be revolutionary in terms of communication at anytime and anywhere but it accompanies with the radiation hazards if these are being emitted out beyond a certain limit and are not under controlled conditions. Human body is found to be an absorbent for these radiation and results are tested to be harmful and can cause even cancerous diseases. Cell phone users are increasing day by day as the demand and technology is upgrading. The cellular communication creates radiation pollution along with other microwave devices like radar, satellite, Wi-Fi, Wi-Max etc. These radiation may cause thermal or non-thermal effects and the non-thermal effects proves to be more harmful and disturbs the normal functioning of neurons, hemoglobin, cells, cavity fluids in brain, blood brain barrier etc. Mobile phones are having a rating of specific absorption rate (SAR) it is a measure of the power that a human body absorbs while using the mobile device which should be under safer limits prescribed by governing bodies like FCC or TRAI. Around 80% of the population across the globe has subscribed to mobile telephony services. India is having more than 900 million wireless connections today.

Electromagnetic radiations emitted from the cellphone can have the biological effects such as Neurodegenerative Disorders –Alzheimer, Parkinson's Immune System Degradation, Tinnitus and Ear Damage, Irreversible infertility, Effect on Skin , DNA Damage Increase in Cancer risk, Sleep Disorders.

Use of mobile phones before bed disturbs Stage 4 sleep, this stage is important for full recuperation of brain and body. We must take care the use of cell phone with the children as they are more vulnerable to the RF radiations. This effect is of concern since their skulls are not well developed and are smaller & thinner. RF radiations are more susceptible to genetic damage. The effect of EMR is also dependent on the immunity of an individual and is dose dependent. The same RF level may cause the different effects on the same community in any locality. The effect of penetration is also age dependent, RF penetration in the skull of an adult is around 25%, and that in an individual having age of 10 year it is 50% and it is about 75% for an age group of 5 years. Here the percentage value is given with respect to the maximum depth of brain.

International Agency for Research on Cancer (IARC), a part of WHO designates cell phones as "possible human carcinogen" [Class 2B], As per the research conducted, evidence of increase in glioma and acoustic neuroma, a type of brain cancer for mobile phone have been found. If cellphone is used 2hrs/month for 10 years then risk of glioma increases by 55% and by 26% for meningioma[4].

### A. Electromagnetic radiations

Electromagnetic radiation is described by the flow of photons in the space. Each photon contains acertain amount of energy, and the different types of radiations are defined by the amount of energy found in the photons. The electromagnetic spectrum is the range of all types of EM radiation. There are two types of EM radiations:

### B. Ionizing radiations

Theses waves contain high energy that overcome the binding energy of electrons in atoms/molecules and creates ions. Examples include ultraviolet rays, X-rays, gamma rays, cosmic rays, etc.

### C. Non-ionizing radiations

These waves do not carry high energy per quantum to make ions from atoms/molecules. These are low-frequency radiations. Examples are radio waves, microwaves, infrared waves, etc. [1].

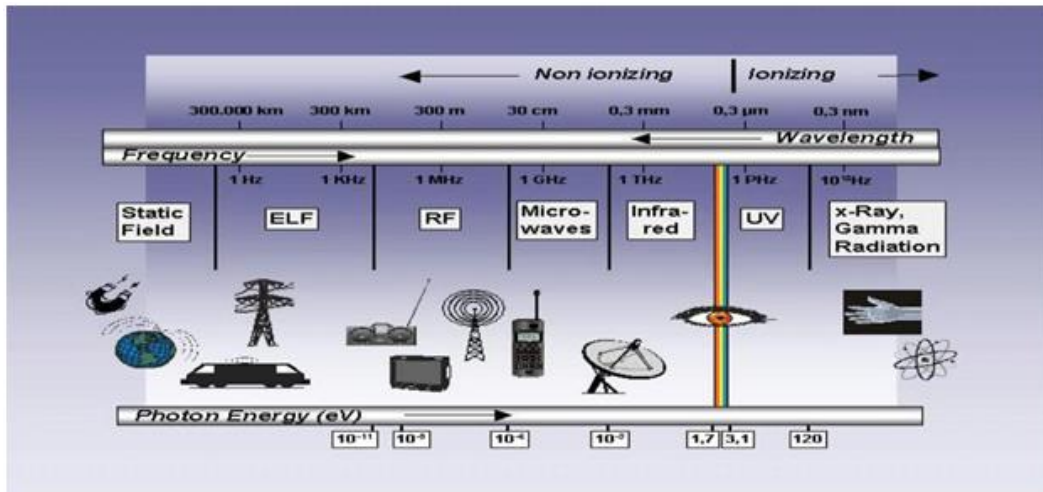


Fig. 1 Electromagnetic Frequency Spectrum [8]

## II. EM RADIATIONS SOURCES

Although there can be many kind of sources for generation of radiation pollution like microwave oven, radar, Wi-max, Wi-Fi etc. but when cellphone radiation is to be dealt with then there are following two primary sources:

1. Radiations from Base Transceiver Station (BTS)
2. Radiations from mobile phone handsets

Since the radiations coming out of such equipments/devices are in such a range of frequency which cannot break the atoms into ions so the effect of such radiations is of non-ionizing nature. Other sources of radiation are as mentioned below:

Broadcast devices such as TV, Radio generates power in the range of KW in UHF and VHF range, Portable phones generates about 5 W in VHF / UHF range), Pager / Cordless phone generates less than 1 Watt of power in VHF range. Microwave oven produces 2000W of power but only 5 mW leaks out of the door of microwave oven at 2.4 GHz band. Cellular towers working in 800/900 MHz band generates power of about 25 W while cellular phone produces 0.5 W. Wi-Fi access points are having power less than one W and PDA works in mill watts range.

a) *Radiations from Base Transceiver Station (BTS):* The primary aim of BTS is to provide wireless link between the user and the network. It has highly directional antennas to locate the mobile station and transfer the data. The maximum exposure to radiations will be at the peak hour when all the channels are used and the sector having the highest call traffic will have the highest exposure to EM radiations.

b) *Radiations from mobile phone handsets:* In on condition the cellphone are always in touch with the cellular towers to update their locality and to get the best possible radio signal strength. Cellphones are accompanied with their SAR value. It expresses the power absorbed per mass of tissue and it is measured in Watts per Kilogram (W/Kg). As per WHO research reports this value should be less than 1.6 watt/kg[1].

## III.

## EFFECTS OF EM RADIATIONS

The harmful effects of EM radiations come into picture when the power level and exposure time increases beyond the level prescribed by governing body. Some of the effects are given as follow:

1. Effect on Human brain
2. Cognitive effects
3. Electromagnetic hypersensitivity
4. Thermaleffects
5. Effect on insects
6. Effect on Plants
7. Impacts on Bio-System and Ecosystem [2].

### A. Thermal Effect of EM Radiation

Talk on cellular phone for more than 20 minutes raises the temperature of head up to by 2 degree Celsius. Initially the temperature rises slowly but after around 12minutes of talk time the temperature rises sharply as shown in figure2 [6,12].

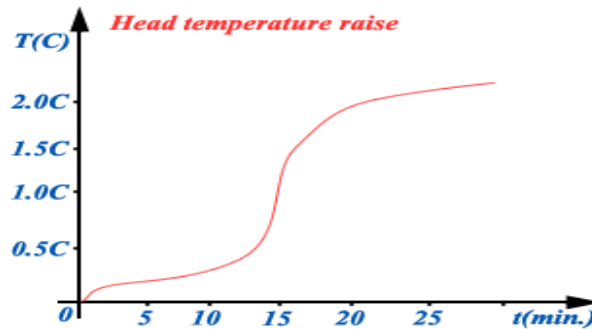


Fig. 2 Thermal Effect of EM Radiation

Health and immunity are very much linked together and it differs from person to person so effect of same EM radiation may differ from person to person. Radiation may cause short term disorders which involve sleep disorders, headaches, depression, memory loss, etc. while long-term effects can be brain tumor, cancer, DNA damage, etc. [5].

**B. Effect on Blood Brain Barrier (BBB)**

It is a type of membrane which separates the zone of blood flowing in the veins and the brain’s neural area. The blood vessels in the brain and the surrounding tissue forms the BBB that can easily dispose heat but prolonged heating due to the cell phone radiations effect can alter brain functions and hearing ability[4][11].

**IV. PREVENTIONS FROM EM RADIATIONS**

**A. Safety guidelines for preventions of health hazards from the EM radiations**

Since we are surrounded with the electromagnetic waves so we cannot escape the effects if we want to use the services then we will have to face it. Fortunately or unfortunately we cannot sense these waves by our five senses. The data given by different governing organizations help us to know the safer limits for healthy usage. Following table1 indicate the power being radiated out under certain limits along with their frequency bands[3].

Table I  
Comparison of particular services

S. No.	EMF Source	Operating Frequency	Transmission Power	No. of subscribers
1.	AM/FM Tower	540 KHz-108 MHz	1 KW – 30 KW	380
2.	TV Tower	48 – 814 MHz	10– 500 Watt	1201
3.	Wi-Fi	2.4 – 2.5 GHz	10– 100 mW	
4.	Cell Towers	800,900,1800, 2100,2300 MHz	20 Watt	~ 5 lakh
5.	Mobile Phones	GSM-1800/CDMA GSM-900	1 - 2 Watt	900+ million

The table I indicates the comparison of different RF sources along with their Source, Power, Frequency and approximately no of subscribers using the particular services [3]. International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent body that studies the ill-effects of non-ionizing radiations on human health. It comprises of experts from various fields such as Epidemiology, Biology, Dosimetry and Optical Radiations, etc. In India, monitoring of the radiation emanating from the BTS is carried out by the Department of Telecommunications (DoT). The DoT has issued instructions regarding setting up of acceptable EMF radiation limits and the testing procedure to be followed. The Telecom Enforcement Resource & Monitoring (TERM) Cells, a unit of DOT, tests up to 10% of BTS sites selected randomly by them[3][4]. Additionally, BTS sites against which there are public complaints are also tested by TERM Cells. In 2008, DoT has adopted the ICNIRP guidelines and prescribed limits/levels for antennas (Base Station Emissions) for general public exposure [1]. Safe radiation levels should be adopted as 0.01W/m<sup>2</sup> which will reduce the transmission power from each mobile tower[10]. More number of repeaters and fiber optic solutions should be installed. The installation of antenna should be in such a way that it should not be installed in the direction of houses/buildings. The antennas should be installed away from the densely populated areas [6].

**B. The Precautionary measures that need to be taken to avoid these radiations include[13]**

1. Maintain sufficient distance from Wi-Fi Routers /Boosters and switch off the Data Pack on mobile or Wi-Fi when not in use.
2. Don’t keep any RF devices near to you while sleeping.

3. Adopt SMS mode of Communicate as compared to calling and if not possible then use Wired Headsets for long conversations.
  4. Mobile Phones having 'SAR' value less than 1.6W/kg should be bought.
  5. Keep distances – Hold the cell phone away from body to the extent possible and use a headset (or ear bud) to keep the handset farther from your head.
  6. Use a wired headset and limit the length of mobile calls.
  7. Put the cell phone on speaker mode- If the radio signal is weak since a mobile phone increases its transmission power during its weak signal strength which may not be safe.
  8. Metal & water are good conductors of radio waves so avoid using a mobile phone while wearing metal-framed glasses or having wet hair.
  9. A mobile phone first makes the communication at higher power and then reduces power to an adequate level more power is radiated during call connecting time so use your phone where reception is good.
  10. When your phone is ON, don't carry it in shirt or pant pocket it automatically transmits at high power every one or two minutes to check (poll) the network.
  11. Don't keep your mobile phones near to the children as they are more vulnerable to the exposure of radiation and also their skull thickness is not well developed.
  12. People having active medical implants should preferably keep the cell phone at least 15 cm away from the implant.
- Hence by practicing the above mentioned methods, the effect of EMR can be reduced, but it cannot be totally nullified.

## V. CONCLUSION

Mobile phones have made our life so fast and we remain always connected with rest of the world but if we look at the other side of working then it proves to be risky and certain constrictions. Then effect of radiations on certain ailments such as sleeplessness, headache, hormonal disorder, lack of concentration, ringing sound in brain, dizziness etc. can't be neglected. This paper has indicated the possible cause of long term or short term effects due to mobile phone. To minimize the health issues related to the exposure of radiations the safety guidelines provided by various organizations such as ICNIRP and FCC or TRAI should be followed. Take certain precautions such as smaller call timing and cellphone having lower SAR value.

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