

A Review on Effects of Mobile SIM Radiation

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Abstract - There is a rapid increase in the usage of mobile phones will implicitly effects on the human health and immune system. In today's world, we are living in the electromagnetic radiation field and runs on the 3G/4G technology. This paper discusses about the radiation emitted from the mobile handsets and clear distinction about the ICNIRP guidelines strictly followed by the mobile operators. It also concerns with the public health, causes and effects of mobile radiation on public health. There are no scientific evidences which prove that these radiations from mobile handsets will harm to human till now. But this paper can give a review on the studies of human health and mobile radiation. In this paper we aim to provide review of some studies that concentrate on the biological effects of mobile radiation on the human health, particularly brain and human immune system in a network of mobile users. Our conclusion shows that long term exposure to the electromagnetic radiations in a network will cause long term adverse effects on the human life

Keywords - Electromagnetic Radiation(EMR), Radio Frequency Radiation(RFR), ICNIRP

I. INTRODUCTION

Mobile communication technology usage has been quickly develop internationally in the last 10 decades, which has ensued in concern of public about the harmful health effect of Electromagnetic (EM) radiation that are discharged by cell phones. As per statistics, depicts that the total number of smart phone users worldwide increasing day-by-day. Now it is forecast to reach 2.1 billion, as it grows 5 billion in 2020. People spent their most of the time with the mobile phone handsets. As it is considering as a public health issue, ICNIRP set some guidelines to the mobile users. Electromagnetic waves generated by mobile phone network systems which emit invisible radiation. The Sources of Electromagnetic waves from Mobile Phone Base Stations (BTS) and Mobile Phone Handsets. Mobile phones, sometimes known as cellular phones or handsets, form an integral part of modern telecommunications and are fast becoming a social lifestyle. In some parts of the world, they are the most reliable or the only phones available. In others, mobile phones are very popular because they allow people to maintain constant and continuous communication without hampering their freedom of movement. The individual mobile phone operates by communicating with a fixed installation known as a base station or a telecommunications structure. Since the mobile phone and its base station is a two-way radio, they produce radiofrequency (RF) radiation as a means of communicating and expose the people near them to RF radiation. The radiation emitted by EMF

depends on several factors like temperature and humidity which influences the EM radiations. In the crowded places, the temperature predicts to be slightly greater than the normal room temperature because of less humidity. In places like classrooms, movie halls, work places, many IT industries etc. The radiation from Mobile phone Base stations (BTS) or mobile towers which affect birds [1]. The radiation emitted from mobile phone communication technology is a non ionizing radiation. Increase in the usage of growth of smart phones and using more than two Sims in the mobile handsets. As of Today, most of the mobile users use a dual SIM which leads to increase in radiation emission by almost a factor of 2X as compared to single SIM. Mobile operators use radiofrequency waves in the range up 300MHz-3GHz that can be harmful to human body. Millions of people around the world use mobile phones as a communication tool every day. Base stations or telecommunication towers are continuously being erected. Because of this, scientists worldwide are concerned about the potential health risks associated with the use of this device. Even small adverse effects on health could have major public health implications. Mobile Phone handsets acts like low-powered radio frequency transmitters, when it is powered on, then it starts to receive the radio frequencies operating at 0.2 watts of power. There are no issues when the devices are operating at 10-30 cm distance away from the human body. While the physical effects of non-ionizing radiation is negligible on the human health. There are no proven facts that RF radiations will cause cancer [2] and effects on human health. Doctors, Public health specialists and many society groups believe that prolonged exposure to radio frequency radiation can cause DNA damage, reduce sperm count, increase memory loss and risk of even cause cancer. So the regular mobile phone user will have a risk in high exposure to these radiations. The main interest for this project is to measure the mobile signal radiation from the Mobile phone handsets, which are mostly close to the residential area covering the GSM bands of 0.9GHz, 1.8GHz, 2.1GHz, and 2.5GHz.

II. LITERATURE SURVEY

Electromagnetic radiation consists of electromagnetic waves, which are synchronized oscillations of electric and magnetic fields that propagate the speed of light. The radiation is of two types: Ionizing Radiation (UV rays, gamma rays, X-rays, cosmic rays) and Non- ionizing Radiation (Above Visible light, Radio waves, Micro Waves, Infrared rays etc.) The effects of non- ionizing radiation which is discussed in this paper is negligible. But the prolonged exposure to the radiation will affect the human life. Cell phones use non-ionizing radiation, which doesn't

damage DNA the way ionizing radiation does. The cell phone radiation operates more like very low power microwaves, but nobody really likes to think of leaning their face on a low-powered microwave. Mobile phone sim's use radio waves for the communication in the range of 450-3800 MHz [4]. The Below chart depicts that the sources of EMR used in mobile communication.

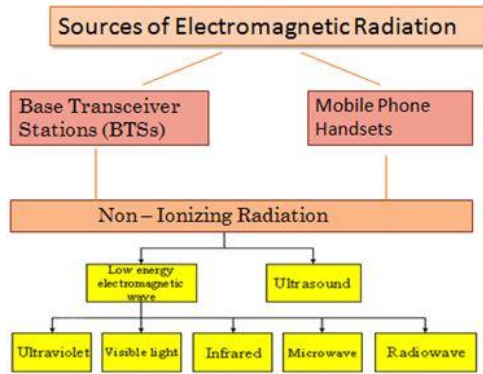


Figure 1: Sources of EMR

A. ICNIRP Guidelines - Electromagnetic waves are combination of electric field strength and magnetic field strength. The frequencies that are allowable 100khz-10Ghz by ICNIRP SAR Limits [4]. SAR is the Specific Absorption Rate, is a measure of the rate at which energy is absorbed by the human body when exposed to radio frequency and electromagnetic field. EM radiations from 1W and it operate within prescribed Specific Absorption Rate (SAR) which gives the amount of radio waves absorbed by body tissues while using mobile phones.

ICNIRP Guidelines

Frequencies(MHz)	EFS(v/m)	MFS(A/M)
1-2	87/√F	0.73/√F
10-400	27.5	0.073
400-2000	1.375*√F	0.0037*√F
2000-3000	61	0.16

Specific Absorption Rate (SAR) VALUE = $\sigma E^2/\rho$

Where Conductivity of Body Tissue - σ
 Electric Field Density - E
 Density of Body - ρ

Energy Absorbed per kilogram is 1.6 W/Kg depends on its human body weight [4]. The SAR limit to the whole body (W/Kg) for the occupational exposure limit is 0.4 and general public exposure is 0.08. These limits are considered only for a six-minute time period when the mobiles are in contact with the human body. But in today's human life-style the exposure to these type of radiations is high because of human body are in long -time exposure to the mobiles. So it is necessary to check these radiations, which leads to cause and disturb the human's life.

There is a rapid advancement in the mobile communication technology. Mobile wireless technology is developing extremely fast in Present times. It is emerging in all the fields of mobile communication such as internet access, location based services, video conferencing system, mobile financial services, mobile entertainment services etc. The below figure depicts the various types of generations that are used in mobile communication.

Thus from the analysis of the generations that are used in mobile communications. Increase in the bandwidth and carried frequency means less coverage. Lower signals produce more radiation. Increase in the bandwidth, which increase the operating frequency, which increase the radiation. Today, everyone lives on data signals more than voice signals. The increase in the bandwidth results to a burden on the frequency band. Therefore this weakens the strength of the signal which leads to emitting radiation. Relation is derived as

Bandwidth \propto Frequency \propto (EM) Radiation

Table 1: Comparison of Four Generations of Mobile Communication.

1G	2G	3G	4G	
AMPS,NMT, TACS	IS-95, GSM ,CDMA	IMT2000, WCDMA	LTE,WIMA X,VOLTE	Technology
Analog	25MHz	25MHz	100MHz	Bandwidth
800MHz	900-1800MHz	2100 MHz	850MHz 1800MHz	Operating Frequency
Narrow	Narrow	Wide	UltraWide	Band Type
30KHZ	800KHZ	5Mhz	15MHZ	Carried frequency

B. Causes and Effects - Using a lot mobile phone can harm your brain, particularly teenager and children who are under 16years old. If you constantly use mobile phones, it might you feel dizzy, or cause blood-brain barrier, or ears problems [3]. In addition, when you use mobile phones while you are driving, can cause a fatal accident. Moreover, "radiations emitted from the phone are dead harmful for the eardrum", and it has been proved by many scientist [8]. It has irritating effect on other people in restaurants, cinema halls, and buses etc., from users shouting down their phone. Owning a mobile phone in your hand can solve many issues and hold most of information around the world. Mobile phone is a good technology which has added quality to our lives. It's up to us how we can maximize its advantages over disadvantages.

- **Hormonal imbalance** - Women and men were exposed to higher levels of EM radiations for a night in the laboratory which increased their serum estrogen levels in women and decreased the testosterone levels in men [6].Endocrine glands are specialized cells which produce chemicals called hormones into the body. The imbalance effect on hormones due to radiation caused by the long

term exposure to the mobile phones is too high. In men, it leads to low sperm count, reduces muscle mass, reduces hair growth [8]. In Women, constipation and weight gain etc.

- **DNA damage** - The structure of DNA will damage due to long exposure to the human body tissues [7]. The tissues of human will exposed to the radiation heat caused by the mobile handset contact with the human body. This will lead to new genetical problems to the next generations.
- **Stress** - Stress is the major problem which is seen rarely in the young people. With the advancement of technology, even children also face the same problem of long term usage of mobile phones [3]. Young people face the stress problem due to hectic schedule, moreover that keeping the head in the mobiles for long-time.
- **Miscarriages and high Blood Pressure** - In India, most of the problems that come from high blood pressure patients. Long time exposure of mobile radiation will increase the chance of miscarriages in women [7]. Women with higher levels of exposure were at a nearly 3 times greater risk of miscarriage compared to the women with lowest levels of exposure.
- **Cell damage and cell dead** - Rupture of cells in human body will lead to damage of the cells and cells may die. It also affects the process of mitosis and meiosis process in the human body and also human immune system [8]. In fact, the primary hazard of mobile phone radiation is not brain cancer per se but rather systemic cellular and mitochondrial damage, which is harmful to health in general and can contribute to any number of health problems and chronic diseases.
- **Heart Problems** - Men face the heart problems in major because they always place the mobile handsets near to their heart. Mobile Sims emits some sort of radiation when it is active.
- **Mental Illness** - Mental health problems have been increasing among young people in the world. It leads to disorders, distress, depression, sleep disorders, headaches etc. The mobile radiation effects psychologically on the human brains.

C. Control Measures -

- Never store your phone in your pocket except in certain cases.
- Do not keep your cell phone near a heart.
- In schools and colleges do not use mobile phone devices for the intellect that it is dangerous for the young people and it is recommended to utilize the land line telephone [5].
- Do not utilize the cell phone for long time chat; use the headphones for extended calls. If long conversations by mobile phone must be conducted on daily basis then distance should be placed between the body and the source of the EM radiations, which will help in minimizing the exposure level [5]. For example, one can use headset with the mobile phone so that a distance can

be maintained between the body and the mobile phone handset.

- Switch off the mobile when not in use.
- Don't keep mobile beside or near your bed when you are sleeping [5].
- Keep away the mobile phones from children and infants.
- Pregnant women should keep cell phones away from their abdomen and men who wish to become fathers should never keep phones on in their pocket [5].

III. CASE STUDY

Case 1- A cohort study of 550,000 users was carried out in Denmark [9]. This is a retrospective cohort study of the incidence of cancer in all 420,095 users of cellular telephones during the period of 1982 to 1995. Overall, 3391 cancers were found, with 3825 expected, which yielded a significantly decreased standardized incidence ratio of 0.89. No increased incidence was seen for cancers of the brain or nervous system, of the salivary gland or for leukemia, cancers which were of a priori interest. The results do not support the hypothesis of an association between the use of these telephones and tumors of the brain or salivary gland, leukemia, or other cancers [9].

Case 2 - A study is carried out to see if mobile phone radiation disturbs sleep patterns at the University of Zurich in year 2000 [9]. Electromagnetic field from mobile phone use in bed significantly increases brain activity during early, non-rapid-eye-movement sleep. 16 people were subjected to electromagnetic radiation similar to mobile phone use for 30 minutes before they went to sleep. Increased brain activity lasted up to 50 minutes. This effectively means that people will soon have to accept that mobile phone do have a biological effect.

Case 3 - A new major study in Finland looked at the effects of mobile phone radiation on human cells rather than those of rats [9]. In this two year study research found that exposing human cells to mobile phone radiation damaged the blood brain barrier. This study has also demonstrated that mobile phones can affect cells without heating them.

IV. DISCUSSION

From the three case studies, long duration of exposure of human cells to mobile phone radiation will lead to damage of cells and a cancer. Temperature and humidity is one of the factors that depend on the Electromagnetic radiation. In a network of high mobiles usage, there is a high amount of sort of radiation because of less humidity. In both the case studies, there is no proven fact that mobile radiation will leads to brain cancer, May it depends on other factors. The tests concluded there is an effect in the women miscarriages with the high level of exposure. The studies proved that there is a psychological illness on the human brain. There is a need for the declined use of mobiles and to reduce the high level of exposure to the non-ionizing radiation. There is a positive and negative impact on the human health and the human immune system.

V. CONCLUSION AND FUTURE SCOPE

Although research studies on the impact of Mobile phones radiation on health remains inconclusive, previous research results has taken the prevention of heating effects as a basis for exposure guidelines. But new research recent results demonstrate that mobile phones can affect cells without heating them. In this survey, we derive a relation that comes from the theoretical data that lies on whenever there is an increase in the bandwidth, increase in the frequency, which results in increase in the radiation. Concluding that there is radiation effect on the public where there is huge usage of mobile phones which are considered to be in a network. With the temperature rise of $1\text{ }^{\circ}\text{C}$, there is hidden effects on the behavior of human and moreover work needed to proven the facts scientifically. Till now, there is no correlation between brain tumours and mobile radiation.

In the Future, we derive a model or a solution which minimizes the effects and loss due to mobile radiation in a network. To minimize the health problems related to the exposure of radiations model a solution to the problem the safety guidelines provided by various organizations such as ICNIRP and SAR values should be followed.

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