



A Survey: Biological Effect on Health Hazards through Electromagnetic Radiation from Mobile Base Transceiver

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Abstract: *This paper presents the Theoretical Analysis of Base Transceiver Station (BTS) and Power Transmission Lines Effects on the Human Body in Lagos Environs. This was achieved using the measured and calculated values of some electromagnetic parameters such as power density, and electric field intensity. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) exposure limit for BTS antennas is 0.1 W/m² (100 mw/m²). Mobile Phone usage has been rapidly spread globally and to provide proper coverage (signal strength), numbers of cell towers are also increasing worldwide generating a public concern as to whether frequent utilization of such devices is unsafe. Effects of Mobile Tower Radiations are seen in many countries. So, in this paper, we have discussed Effects of Mobile Tower Radiations and case studies of different countries to address the issue.*

Keywords— Mobile Tower Radiations, Electromagnetic Radiations, Signal Strength, Mobile Phone

I. INTRODUCTION

People use mobile phones for the purpose of communication at home, work or anywhere they are but only few are concerned about the their health implications and possible safety measures. Most of the People are not aware of Mobile Phone and Cell Tower Radiations which are very harmful due to electromagnetic radiation (EMR) exposure. This paper is divided in to two sections. In first section, effects of mobile towers radiations have been discussed while in second section, we have reviewed case studies of different countries.

II. RADIATION FROM THE CELL TOWER

GSM900 base station antenna transmits in the frequency range of 935 - 960 MHz This frequency band of 25 MHz is divided into twenty sub-bands of 1.2 MHz, which are allocated to various operators. There may be several carrier frequencies (1 to 5) allotted to one operator with upper limit of 6.2 MHz bandwidth. Each carrier frequency may transmit 10 to 20W of power. So, one operator may transmit 50 to 100W of power and there may be 3-4 operators on the same roof top or tower, thereby total transmitted power may be 200 to 400W. In addition, directional antennas are used, which typically may have a gain of around 17 dB (numeric value is 50), so effectively, several KW of power may be transmitted in the main beam direction [3]. The density of cell towers is directly connected to the density of population. Also, the radiation pattern of directional antennas is something which is very critical in the whole transmission process (see fig.1).

III. FREQUENCY RANGES OF TOWERS

Antennas on Cell tower transmit in the frequency range of:

- 869 - 890 MHz (CDMA)
- 935 - 960 MHz (GSM900)
- 1805 – 1880 MHz (GSM1800)
- 2110 – 2170 MHz (3G)

Radiation Pattern of Cell Tower Antenna is shown in Fig.1.

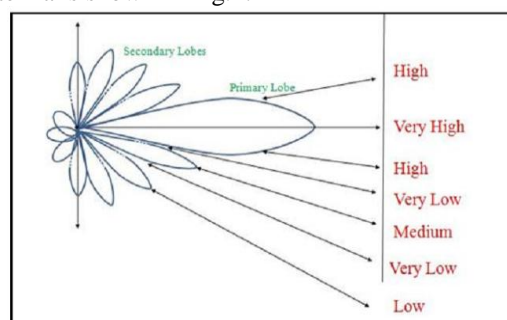


Fig.1: Radiation Pattern of Cell Tower Antenna

IV. BASIC CONCEPT OF COMMUNICATION

MS (Mobile station) is used by a mobile subscriber to communicate with the mobile network. Several types of MS's exist, each allowing the subscriber to make and receive calls. GSM MS's consist of Mobile equipment (ME) and subscriber

identity module (SIM). Mobile has 4 modes: Active, Busy, Ringing, and Idle. One MS is latched with minimum 6 BTS's (Base transceiver station) at a time; out of which 1 is selected which has maximum RX level (Range). From the MS to BTS, interface exist is Um interface (Air interface) on which information from MS goes on channel RACH (Random access control channel) when user insert SIM in the ME. From BTS, control information is sent to MS on the channel BCCH (Broadcast control channel). Fig.2 shows the basic block diagram of BSS (Base Station System) which consist of BTS & BSC.

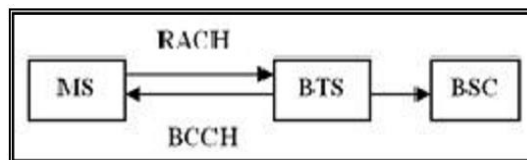


Fig.2: Block Diagram showing BSS

In the above fig., show BSC (Base station controller) controls number of BTS's and have functions of Radio Resource and Radio the Base Station Management which includes cell description data, the traffic and event management, signal strength and quality during call, etc. Segment which controls number of BSC's is MSC (Mobile service switching center) which is the exchange performs all switching, signalling and routing functions. Operation of charging, billing and service provisioning is done by MSC.

V. EM RADIATION AND STANDARDS

Electromagnetic (EM) radiation is a form of energy exhibiting wave-like behaviour as it travels through space. It has both electric and magnetic field components, which oscillate in phase perpendicular to each other and perpendicular to the direction of energy propagation. When referring to biological radiation exposures, EM radiation is divided into two types: ionising and non-ionising. Because the human body is composed of about 60 percent water, ionising and non-ionising radiations refer to whether the RF energy is high enough to break chemical bonds of water (ionising) or not (non-ionising). Technically, all radiation and fields of the electromagnetic spectrum that do not normally have sufficient energy to produce ionization in matter; characterized by energy per photon less than about 12 electron volts (eV).

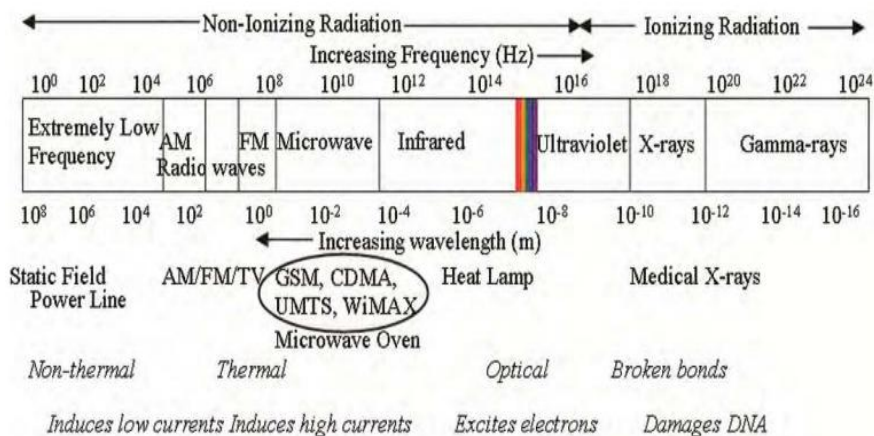


Fig.3: EM spectrum indicating radiation zones

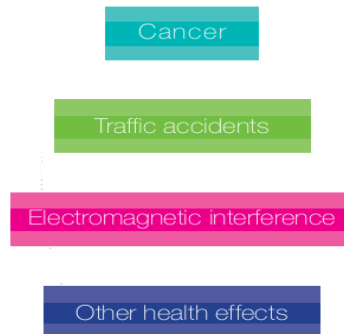
In any particular exposure situation, measured or calculated values of any of these quantities can be compared with the appropriate reference level. Compliance with the reference level will ensure compliance with the relevant quantities like current density (electric/magnetic field intensity), specific absorption rate (SAR), and power density. If the measured or calculated value exceeds the reference level, it is necessary to test compliance with the relevant field quantity and to determine whether additional protective measures are necessary.



Fig.4: Marking of different zones around a base station antenna

VI. BIOLOGICAL EFFECTS FROM BASE TRANSMITTER STATION

Since its inception, there have been concerns about the ill-effect of the mobile towers and mobile phones. Despite being a relatively newly acknowledged form of pollution, EMRs and their negative impacts on biological systems and environment have already been reported by several studies. However most of the available scientific literature on the negative environmental effects of electromagnetic fields reports the results of experimental and epidemiological studies examining the impact on various aspects of human health [5]. When a human body is exposed to the electromagnetic radiation, it absorbs radiation, because human body contains 70% of liquid. Radiation from cell phone towers has been associated with greater increase in brain tumor. This is due to the damage in the blood brain barrier and the cells in the brain which are concerned with learning, memory and movement. Current scientific evidence indicates that exposure to RF fields, such as those emitted by mobile phones and their base stations, is unlikely to induce or promote cancers. Several studies are under way to Determine whether the results of some studies on animals have any relevance to cancer in human beings. Recent epidemiological studies have found no convincing evidence of an increased cancer risk or any other disease with mobile phone use.



(i) Risk to Children and Pregnant Women

Children are more vulnerable to cell phone radiation as they:

- Absorb more energy than adults from the same phone owing to their smaller head and brain size, thinner cranial bones to their smaller head and brain size, thinner cranial bones and skin, thinner, more elastic ears, lower blood cell volume, as well as greater conductivity of nerve cells and the energy penetrates more deeply. Tumors in the mid brain are more deadly than in the temporal lobe,
- Children's cells reproduce more quickly than adults which makes cancers more deadly,
- Their immune system is not as well developed as adults hence are less effective against fighting cancer.
- Children have longer life time exposure.

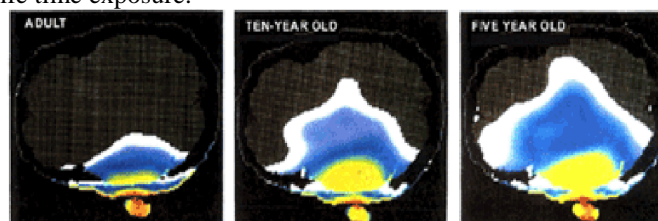


Fig.5: Absorption of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 MHz)

(ii) DNA damage

Cellular telephone frequencies can lead to damaged DNA. Studies show that microwave exposure at levels below the current FCC exposure standard, produces single and double strand breaks in DNA. EMR causes membrane leakage due to loss of calcium ions. Leaks in the membranes of lysosomes (small bodies in living cells packed with digestive enzymes) release DNAase (an enzyme that destroys DNA), which explains the fragmentation of DNA seen in cells exposed to mobile phone signals.

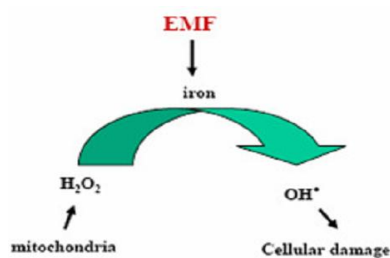


Fig.6: The Fenton Reaction

(iii) Effects on Stress Proteins (Heat Shock Proteins)

Non-thermal effects of Radio frequency radiation accumulate over time and the risks are more pronounced after several years of exposure. The effects are not observed in the initial years of exposure as the body has certain defense mechanisms and the pressure is on the stress proteins of the body, namely the heat shock proteins (HSPs).

The highly conserved HSPs accumulate in cells exposed to heat and a variety of other stressful stimuli like heavy metal poisoning and oxygen deprivation. HSPs, which function mainly as molecular chaperones, allow cells to adapt to gradual changes in their environment and to survive in otherwise lethal conditions. This further demonstrates that ELF and RF exposures can be harmful, and it happens at levels far below the existing public safety standards. HSPs are known to inhibit natural programmed cell death (apoptosis), whereby cells that should have 'committed suicide' continue to live.

(iv) Effect on Skin

Radiation from cell towers and mobile phones affects human skin. People who talk often on cell phones have a higher concentration of the transthyretin protein than those who do not. Transthyretin is formed in the liver; it helps transport vitamin A in the body and plays an important role in nervous diseases such as Alzheimers. The symptoms of Morgellons disease include those of electromagnetic hypersensitivity (EHS); may be based on how body uses electric currents to repair wounds to the skin. People who suffer from this condition report a range of skin symptoms including crawling, biting and stinging sensations; granules, threads or black speck-like materials on or beneath the skin and/or lesions (e.g., rashes or sores).

(v) Tinnitus and Ear Damage

Tinnitus, popularly known as "Ringxiety"- is the psychological disease of hearing phantom sound and sensation of cell phone ring and it has been reported among millions of cell phone users in the world. People with severe tinnitus may have trouble hearing, working or even sleeping. The radiation emitted by mobile phones may damage the delicate workings of the inner ear, and long-term and intensive mobile phone use for more than four years and for longer periods than 30 minutes in a day are at a higher risk of developing hearing loss, which cannot be reversed.

VII. CONCLUSION

Most of the People are not aware of Cell Tower Radiations which are very harmful due to electromagnetic radiation (EMR) exposure. People living near cell tower receive strong signal strength but at the expense of health. So, little bit poor connectivity is better to have better health. The operators providing wireless communication should consider seriously this study and ITU-T recommendations, and follow the Test Procedure for Measurement of Electromagnetic Fields from Base Station Antenna (For Telecommunication Sector)

No: TEC/TP/EMF/001/02.SEP. 2012 (Supersedes Issue-SEP 2012) guidelines in order to keep the operation of base station transceivers in compliance with regulations concerning environmental protection against non-ionizing radiation. Further, it is important to note that the present threshold limits prescribed by the ICNIRP are considered to be rather too generous and hence, there is a need to review and remedy the situation and not wait until it becomes the subject matter of a public-interest petition in the light of possible environmental adverse effects.

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