



A Pilot Study: Health Hazards of Electromagnetic Waves from BTS and Its Compliance through NEP

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Abstract: This paper presents the Study of a boon for better communication; cell phone usage nonetheless has many health hazards. Various studies indicate that the emissions from a cell phone can be extremely harmful, causing genetic damage, tumors, memory loss, increased blood pressure and weakening of the immune system, skin effect. The fact that this radiation is invisible, intangible, and enters and leaves our bodies without our knowledge makes it even more intimidating. Global System for Mobile Communications (GSM) and Code Division Multiple Access (CDMA), WCDMA and Wi-max are most prevalent second generation (2G) & 3G, Long Term Evolution (LTE) known as 4G Technology. This dissertation discusses on the analysis conducted to study the effect of electromagnetic radiation of mobile phone technologies with different frequencies and power level via experimental works. This research work provides the detailed procedure for the self-certification by the service provider (TSPs) and audit by the Telecom Enforcement Resource and Monitoring (TERM) cell of the Department of Telecommunications in respect of compliance to the norms for exposure to electromagnetic fields from Base Transceivers Stations of GSM, CDMA, W-CDMA, 3 G and 4G etc at different distance with respect to frequency band 300- 3000Mhz.

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

I. RADIATION FROM THE BTS

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).

II. 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.

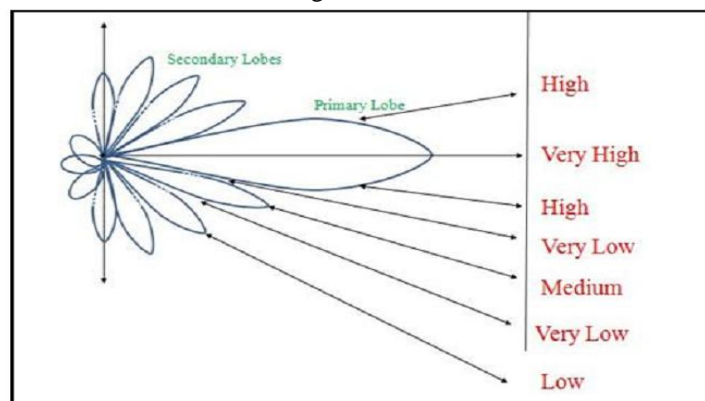


Fig.1: Radiation Pattern of Cell Tower Antenna

III. 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.

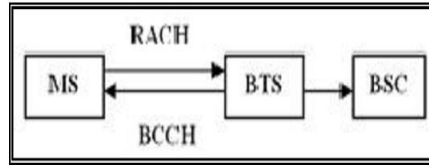


Fig.2: Block Diagram showing BSS

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.

IV. 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).

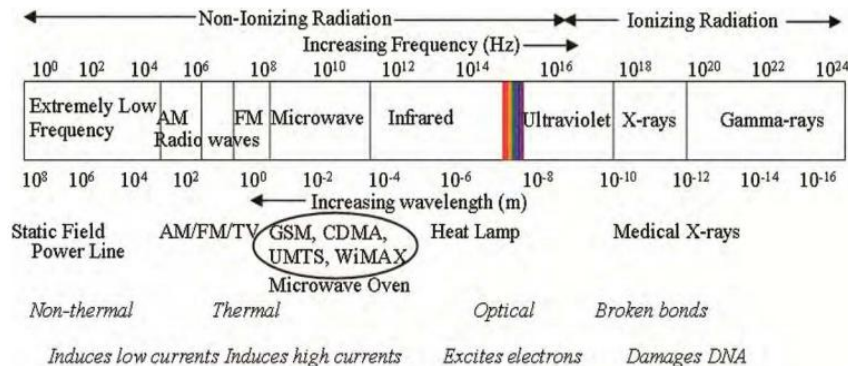


Fig.3: EM spectrum indicating radiation zones

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

V. BIOLOGICAL EFFECTS FROM BASE TRANSCRIVER STATION

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) Blood–brain barrier effects

. Swedish researchers from Lund University (Salford, Brun, Persson, Eberhardt, and Malmgren) have studied the effects of microwave radiation on the rat brain. They found a leakage of albumin into the brain via a permeated blood–brain barrier. This may lead to interaction of albumin with astrocytes resulting in epilepsy. Prof Leszczynski of Finland's radiation and nuclear safety authority found that, at the maximum legal limit for mobile radiation, one protein in particular, HSP 27, was affected. HSP 27 played a critical role in the integrity of the blood-brain barrier.

(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.

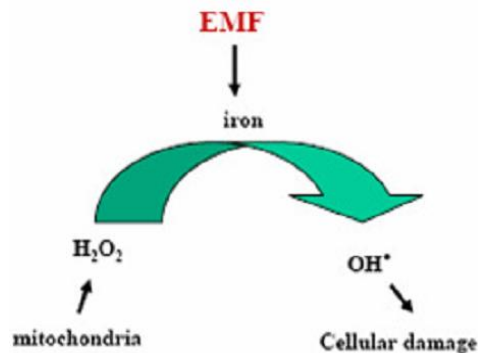


Fig.5: The Fenton Reaction

(iii) Electromagnetic hypersensitivity

Some users of mobile handsets have reported feeling several unspecific symptoms during and after its use; ranging from burning and tingling sensations in the skin of the head, headaches, sleep disturbances, dizziness, loss of mental attention, reaction times and memory retentiveness, fatigue, malaise, tachycardia (heart palpitations), to disturbances of the digestive system. Reports have noted that all of these symptoms may even be attributed to stress and that current research is not at such an advanced stage that it may be able to distinguish between the symptoms.

(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 whosuffer 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.

VI. NATIONAL EMF PORTAL

EMF Survey is integral part of EMF Compliance commitment as per DOT-TEC for every cellular operator. All operators have been doing these activities independently; however for the purpose of analysis of cumulative effects every operator has to share site technical configuration data with others for all sites within vicinity of 20mts. One time sharing of this

data is supposed to be easier, although lot of challenges in coordination and related to format exists. COAI/AUSPI along with the guidance from DOT/TEC has come up with a solution to make common & reliable platform for collaboration, report preparation and accessibility to all operators, COAI Management, DOT and general public. Electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed to varying degrees of EMF, and the levels will continue to increase as technology advances. The big challenges arrive in sharing and updating of the database in case any of the operators make any changes in the site configuration.

Steps to generate an EMF Compliance Report using NEP Portal:-

- 1. TSP Site and Tenancy Creation
- 2. TSP Survey Initiation, Locking and Self Certificate Generation
 - 2.1 Locking a Survey
 - 2.2 TSP Survey Initiate and Survey Locking
 - 2.3 Generate Self Certificate
 - 2.4 TSP Self Certificate Generation and Initiation
 - 2.5 TSP OTS Self Generation and Initiation
- 3. TSP Broadband Measurement
 - 3.1 TSP Broadband Measurement Flow
 - 3.2 TSP Narrowband Flow

VII. SELECTIVE RADIATION METER (SRM NARDA TOOL)

The Selective Radiation Meter (SRM) is a hand-held selective measuring device for safety analysis of RF and microwave electromagnetic fields. The SRM can be used by broadcasters, radio network operators, measurement service providers and public authorities to selectively measure the field exposure produced by individual telecom services and assess the results in accordance with the applicable standards. Most measurements re-quired in the mobile radio sector can be performed di-rectly using the hand-held device.

Every SRM has the ability to perform single or mul-tiple measurements that can be averaged and/or stored in the meter for download to a computer. You can set-up the SRM the way you like and store a complete configura-tion for later use or repeated uses. You can set up parameters for time controlled storing that only logs the data you want above a certain threshold level. Each system has an embed-ded GPS receiver and microphone, so every stored reading is supplied with GPS coordinates and can have an audio de-scription added. The US version of the SRM consists of a basic unit (meter) and a 3-axis, E-field antenna. The meter is really an optimized spectrum analyzer covering 9 kHz to 6 GHz and modified to make accurate field strength readings with the help of our antennas.

Narrow Band Low Frequency Measurement



Broad Band High Frequency Measurement



VIII. 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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