

A Study and Mapping of Electromagnetic Radiation Levels from Mobile Towers in and Around Bangalore Region

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Abstract

High frequency radiations from Mobile Towers are known to have adverse effect on life of human beings, livestock and birds. The rapid development of mobile communication has led to installation of mobile towers in heavily habitat areas and cluster of towers being put up by different network providers has led to increased levels of radiation. At certain areas, this level may have reached dangerous levels as to cause long term effect. The paper aims to map the levels of radiation in selected areas of possible vulnerability and to locate high risk areas along with the measured radiation levels.

Keywords: *Electromagnetic Radiation; Electromagnetic Field (EMF); Radio Frequency (RF); Very High Frequency (VHF); Extremely Low Frequency (ELF)*

Introduction

In recent days, there have been discussions about air pollution, noise pollution, water pollution, soil pollution but a new form of pollution namely electric pollution is causing concern but it is not recognized as much as other pollutions. Electric pollution is the presence of higher levels of Electromagnetic radiation (EM radiation) and Electromagnetic fields (EMF) at certain locations which have hazardous short term and long-term effect on human beings and other living creatures [5].

Even sun rays which are a form of Electromagnetic (EM) radiation can be harmful as noticed in cases where people resorting to sun bathing for long duration have developed skin problems and in extreme cases leading to cancer. Another area where EM radiation was known to cause deleterious effect was X- rays. X- rays has such useful application in the field of medicine and industry was found to be dangerous after repeated exposures as was observed by early radiologist now X- rays are employed with due care and precaution to avoid its ill effects [9].

In the above context, microwave radiation from mobile towers has drawn the attention of and concern of the users. This problem is to be addressed urgently and detailed study of the levels of radiation at potential risky areas, the health problems associate with people and living creatures in such areas is to be conducted. Such studies have been done in advanced countries and many recommendations have been put forth to limit the radiation to certain level so that its ill effects are tolerable [1,2,4].

In our country, no such recommendation exists and because of this there is need to do extensive survey of risky areas and their associated radiation levels together with health problems noticed so that a consensus may be arrived to recommend to limit the radiation to levels tolerable under the existing conditions as a first step towards safety precautions against radiation hazard. Further continuous studies are required to review the levels suggested and eventually lead to legislation for control of radiation levels in the larger interest of human safety.

The radiation effects cause from very high frequency (VHF) with low power and extremely low frequency (ELF) with high power [3]. This paper deals with very high frequency with low power measurement of radiation levels and its effects.

Present Scenario of Mobile Towers

The mobile towers transmit microwave radiation in the range of 869 - 894 MHz (CDMA), 935 - 960 MHz (GSM 900) and power density is in vicinity is about 4.7 W/m² and in 1805 - 1880 MHz (GSM 1800) range is 9.2 W/m², now a day’s 3G network has entered in few cities and 4G is expected in near future [4].

Presently in India about seven lakhs mobile towers has been installed. In Bangalore, thousands of mobile towers are placed and also in most of these towers four to five transmitters are installed due to which the radiation level has increased. A number of places can easily be seen to have been exposed to high levels of radiation and are high risk areas [6].

It is reported that people are staying close to mobile towers and facing the transmitters and are still constructing high rise buildings facing the towers and in close proximity to them [5]. Thus, one can see there are already large number potentially risky areas where buildings exist and new buildings are being constructed continuously.

Methodology

The step by step procedure followed to measure electromagnetic fields intensity (μW/m²) is as shown in the flow chart below (Figure 1). The available radio frequency signals in free space were collected by using isotropic antenna. The radiation level present in the radio signals is loaded to the HF59BTM device which is analyzed using NFA soft.

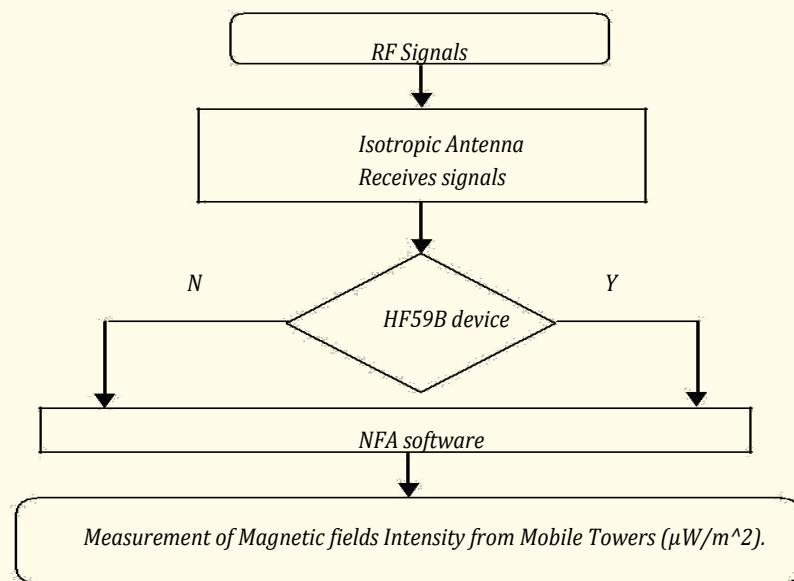


Figure 1: Measurement of radiation level.

Measurement Setup

To measure the radiation levels of these sites, a measurement setup consisting of HF59BTM device and isotropic antenna is used (Figure 2). This device receives the maximum radiation signals available in free space which are emitted from mobile towers from different directions at several places. The measurement of radiation setup is as shown below (Figure 3).



Figure 2: Radiation measuring device HF59BTM and isotropic antenna.

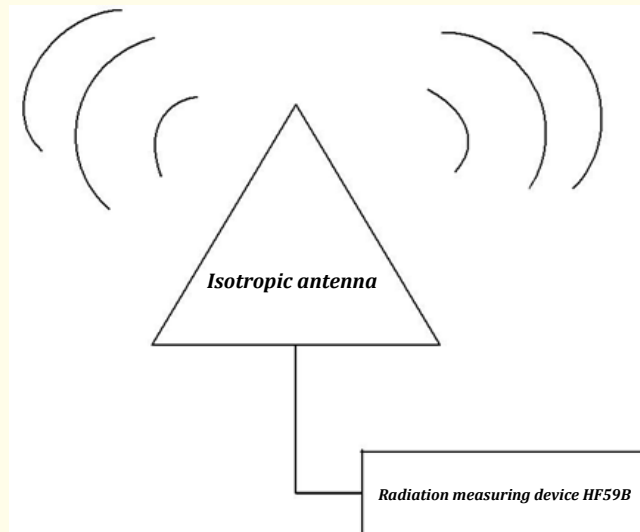


Figure 3: Experimental setup to measure radiation levels.

Effects on Human Beings

The radiations emitted from mobile towers have a direct impact on human life. These radiations are classified as low level and high-level radiation. The exposure to these radiations has certain biological effects which are listed below.

1. Low level radiation exposure effects are every small and they are not detected.
2. In high level radiation, when there is less exposure it causes skin damage, Nausea, Vomiting, fatigue, sleep disturbances [10], headache [5], hearing problem, dizziness [9], Bone marrow damage, Damage in white blood cell [8] and damage to cells lining the small intestine.
3. Normal exposure of radiation ($0.002 \mu\text{W}/\text{m}^2$) which causes sleep disorders, abnormal blood pressure, weakness, limb pain, joint pain [8], digestive problem [8].

4. In high level radiation with prolonged exposure, it has resulted in the following hazards.
5. Among children it has resulted in leukemia [5,9], Growth retardation, small head. Brain size and mental retardation.
6. Among adults, Breast cancer, Bladder colon, liver cancer, lung cancer, stomach cancer and ovarian cancer have occurred [2,3,9].
7. In many cases loss of hair has been noticed among people exposed to medium level of radiation.
8. Even damage to the DNA of human body has been reported in some cases [9].

Radiation Levels Measured and Analysis of the Data Obtained

The radiation norms given by ICNIRP (International Commission for Non – Ionizing Radiation Protection) guidelines in India at 1998 for safe power density is given by $f/200$, where frequency (f) is in MHz, has been considered [4].

The route for measurement in Bangalore was started using a ground position system (GPS) instrument for navigation from Minerva Circle to konanakunte cross for the first set of readings as shown in route map (Figure 4) and measured radiation levels are showed in (Figure 5). The second set of readings was measured from konanakunte cross to Kagglipura as shown in route map (Figure 6) and measured radiation levels are showed in (Figure 7-9), the third set of readings was measured from Minerva circle to City Railway station as shown in route map (Figure 10) and measured radiation levels are showed in (Figure 11,12). The table 1 shows the radio frequency radiation (RFR) levels in various places in the range less than 2 KHz and greater than 2 KHz around the Bangalore region. The measurements of radiation levels at Bangalore were measured on 5th June 2015 between 9:00 AM to 1:00 PM. The radiation levels have been measured at the distance ranging from 50 to 100 m surrounding the tower.

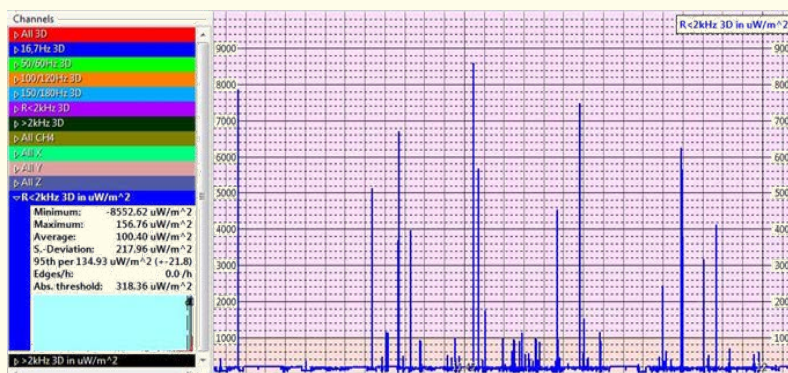


Figure 4: Radiation levels from Minerva Circle to konanakunte cross (<2 KHz).

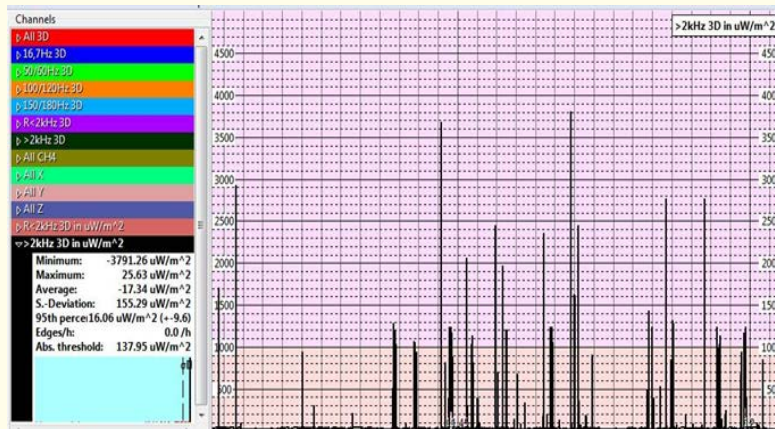


Figure 5: Radiation levels from Minerva Circle to konanakunte cross (>2 KHz).

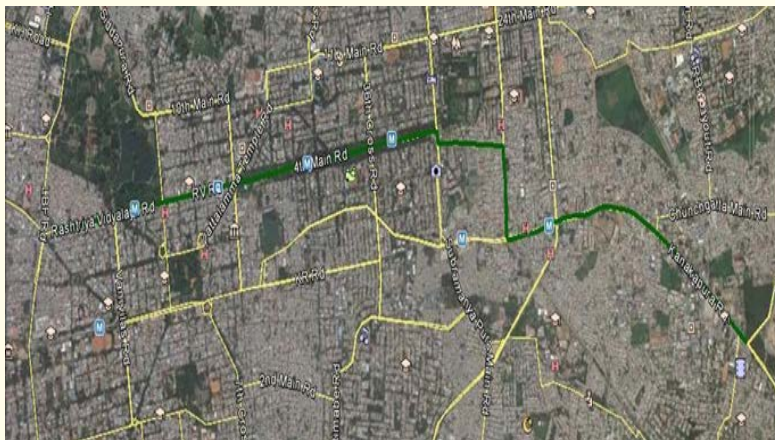


Figure 6: GPS route from Minerva Circle to konanakunte cross.

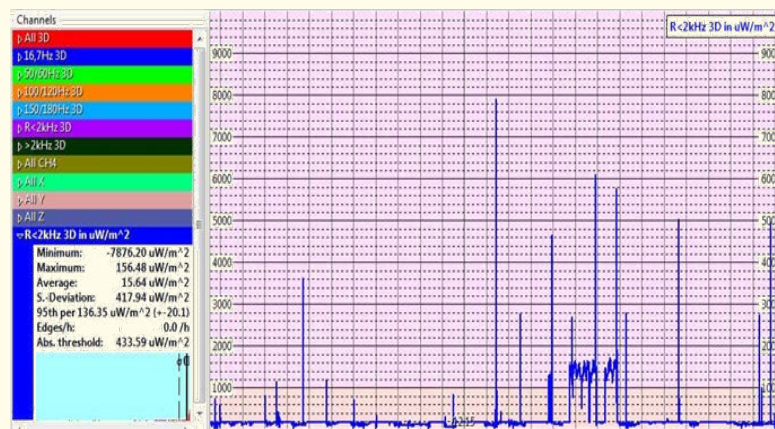


Figure 7: Radiation levels from konanakunte cross to kagglipura (<2 KHz).

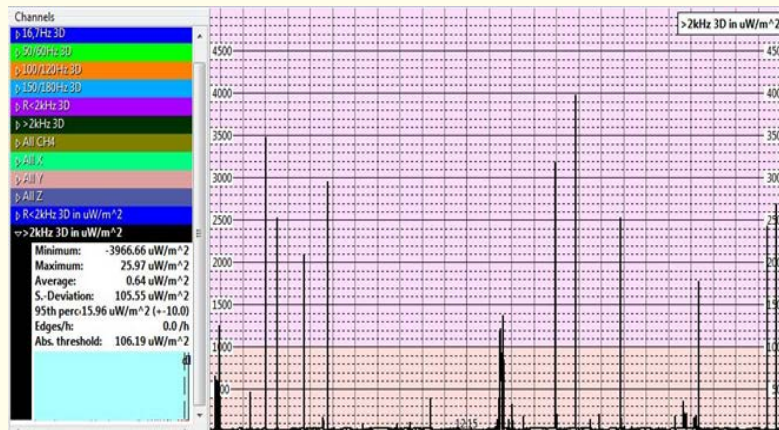


Figure 8: Radiation levels from konanakunte cross to kagglipura (>2 KHz).

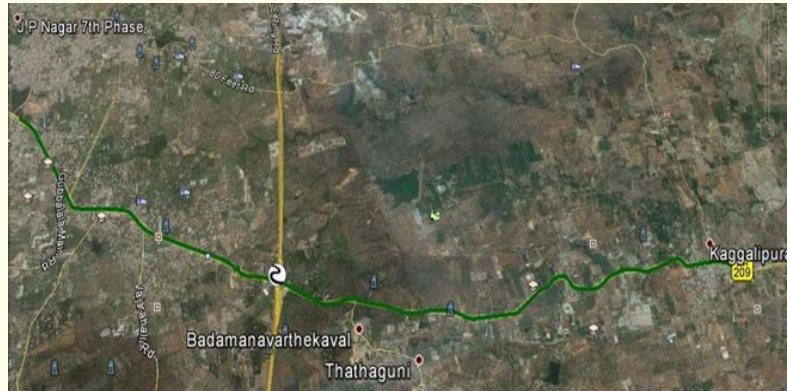


Figure 9: GPS route from konanakunte cross to kagglipura.

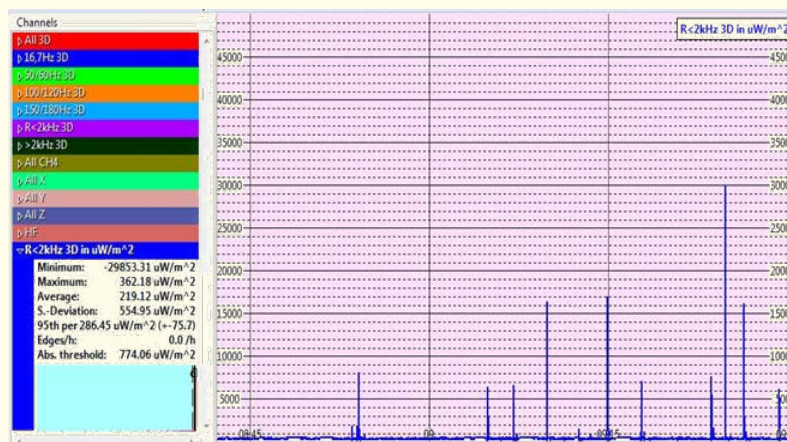


Figure 10: Radiation levels from Minerva Circle to City Railway station (<2 KHz).

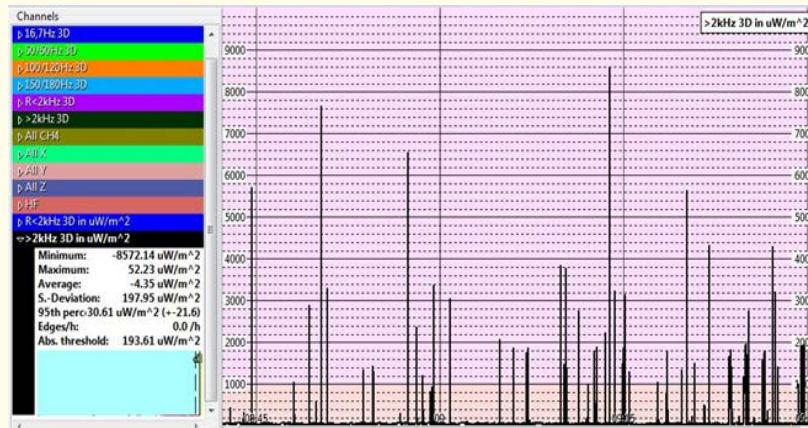


Figure 11: Radiation levels from Minerva Circle to City Railway station (>2 KHz).

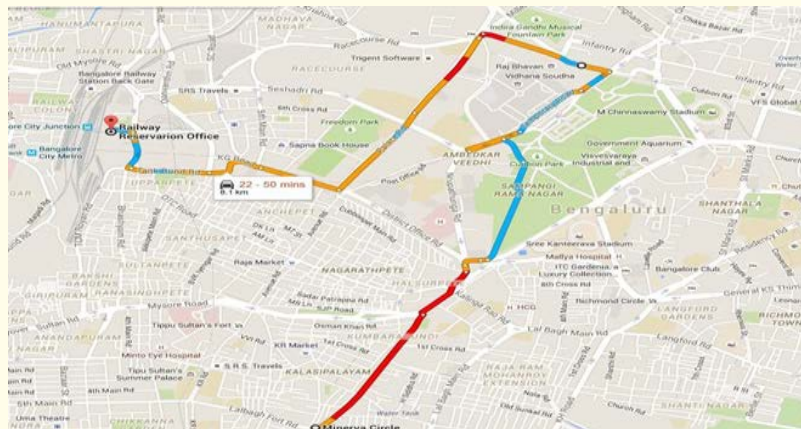


Figure 12: GPS route from Minerva Circle to City Railway station.

How to avoid ill effects

1. Avoid the installation of mobile towers on school buildings, hospitals and residential houses in close vicinity and facing such premises [6].
2. Reduce output power by decreasing the radius of coverage while installing more towers.

Conclusions

From the measurements of radiation intensity levels at different points of Bangalore it can be noticed that majority of the location are subject to levels above tolerable limits as observed. It is recommended to have safe areas must be 400m far from microwave towers considering whether single or multiple towers are installed at the location.

Future Scope of Investigation

More intensive survey of radiation together with a survey of associated health problems in such areas in cooperation with medical institutions is urgently needed to know the of current state of hazardous level.

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