

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 6, Issue 11, November 2017

## Study on Electromagnetic Field Radiation Emission from Mobile Towers in Kota City

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**ABSTRACT:** There has been an unprecedented growth in the global communication industry in recent years which has resulted in a remarkable increase in the number of wireless devices. Mobile industry is one of the fastest growing industries in the world. Electromagnetic radiation resulting from cell phones and towers is a form of environmental pollution which may hurt human. Mobile phone masts which are located in residential areas are disturbing humans continuously with noise and radiation that could suffer long-term effects, like reduction of their natural defenses, deterioration of their health and problem in reproduction etc. It has been tried to study the magnitude of electromagnetic radiation from mobile towers in Kota city and probable health effects on human beings. The study has been carried out for a year long period and it has been found that electromagnetic radiation emitted from mobile towers is beyond the permissible limits at certain locations in the city.

**KEYWORDS:** Mobile phones, mobile towers, electromagnetic radiation, environmental impacts, health impacts

### I. INTRODUCTION

Cell phone technology has several advantages and has grown rapidly in the last decade. In India, there are nearly 80 crore cell phone subscribers and around 4.5 lakh cell phone towers. Numbers of cell phones and cell towers are increasing without considering its disadvantages. People have been debating all over the world about related health risks due to electromagnetic radiation from cell phones and cell towers. There are several reports in the media and scientific literature, which are conflicting in nature. In Rajasthan, cell towers are mushrooming all over the places. People have been complaining to Rajasthan Pollution Control Board and other agencies regarding electromagnetic radiation from cell towers, structural stability, noise and air pollution from Diesel Generators (DG), etc. The effect of mobile phone radiation on human health is a subject of interest and study worldwide.

According to the telephone regulatory authority of India (TRAI), the composition of telephone subscribers using wireless form of communication in urban area is approximately 63.27% and in rural area, it is 33.20%. This has led to mushrooming of supporting infrastructure in the form of cell towers which provide the link to and from the mobile phones. With no regulation on the placement of cell towers, they are being placed haphazardly closer to schools, crèches, public playgrounds, college campuses, and traces of densely populated urban residential areas. Hence, the public is being exposed to continuous, low intensity radiation from these towers. Since the electromagnetic radiation, also known as electro smog cannot be seen; smelt or felt, one would not realize their potential harm over long periods. Many studies and researches have reported the ill-effects of radio-frequency electromagnetic field (RF-EMF) on birds and animals like bees, fruit flies, frogs, bats and humans, but the long-term studies of such exposures are uncertain and insufficient, and almost non-existent in India.

The main aim of the study is to assess the amplitude and impacts of mobile tower radiation on human health in Kota. Radiation due to towers has been assessed using a radiation counter at various most problematic locations.

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## II. RELATED WORK

Researchers have been doing work on mobile radiation for more than one decade in different parts of the world and publishing their studies in journals. A Swedish scientific team at the Karolinska Institute conducted an epidemiological study (2004) that suggested that regular use of a mobile phone over a decade or more was associated with an increased risk of acoustic neuronal, a type of benign brain tumor.

The INTERPHONE study group from Japan published the results of a study of brain tumor risk and mobile phone use. They used a new approach: determining the SAR inside a tumor by calculating the radio frequency field absorption in the exact tumor location. Cases examined included glioma, meningioma, and pituitary adenoma. They reported that the overall odds ratio (OR) was not increased and that there was no significant trend towards an increasing OR in relation to exposure, as measured by SAR.

Usha Kiran Building in Mumbai has reported 6 cancer cases in sequential floors as they were in the main beam of the transmitting tower antenna in the opposite building. In Andheri, 15 cancer cases have been reported due to heavy cluster of cell towers. Mr. Bhagwant Deshpande of Solapur has reported 9 deaths due to cancer living within 91m from the two towers.

## III. STUDY AREA

The whole city of Kota has been selected for study point of view in which different areas or zones have been earmarked for observation. We divided the city into four zones and in each zone, total 10 sampling locations have been identified. So, overall 40 mobile towers have been studied from all the zones. The following zones have been taken up:

1. Residential area (Zone-A)
2. Commercial area (Zone-B)
3. Agriculture and rural area (Zone-C)
4. Highway and far flung area (Zone-D)

The Government of India has adopted and implemented ICNIRP (International Commission on Non-Ionizing Radiation Protection) standards for the telecom sector in the country. These standards are considered to be among the best in the world and have been adopted by over 90 percent countries worldwide.

## IV. METHODOLOGY

The zone wise distribution of mobile towers was carried out and the observations of radiations from mobile towers were made using a mobile app known as EMF detector and mobile tower radiation detector. The measurements were taken for a year long period from April 2016 to March 2017 throughout the Kota city in residential area, highways, far-flung agriculture area and commercial area. Total 40 observations have been recorded using detector and converting their values in international unit of measurement of radiation i.e. micro watt or watt/m<sup>2</sup>.

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Figure 1: EMF Measuring Device and Mobile app

## V. RESULTS AND DISCUSSION

In 2008, Department of Telecommunication (DoT), Govt. of India has adopted the ICNIRP Guidelines and prescribed limits/levels for antennas (Base Station Emissions) for general public exposure. However, from 2012, norms of mobile towers' EMF exposure limits have been revised to 1/10th of the existing prescribed limits of ICNIRP as a matter of abundant precaution, as shown in table 1 below:

Table1: Revised EMF Radiation Norms for Mobile Towers in India

Frequency in MHz	ICNIRP Radiation norms	Revised DoT Norms effective from 01.09.2012
900	4.5 watt/m <sup>2</sup>	0.45 watt/m <sup>2</sup>
1800	9 watt/m <sup>2</sup>	0.90 watt/m <sup>2</sup>
2100	10.5 watt/m <sup>2</sup>	1.05 watt/m <sup>2</sup>

Present limit for antennae (Base station) EMF emission for general public exposure are as per the table 2, given below:

Table 2: Permissible Limits for Cell Phone Antenna

Frequency Range	E- field strength (Volt/m)	H- field strength (Amp/m)	Power density (Watt/m <sup>2</sup> )
400 MHz - 2000MHz	$0.434f^{1/2}$	$0.0011f^{1/2}$	$f/2000$
2GHz - 300GHz	19.29	0.05	1

Where f is the frequency in MHz.

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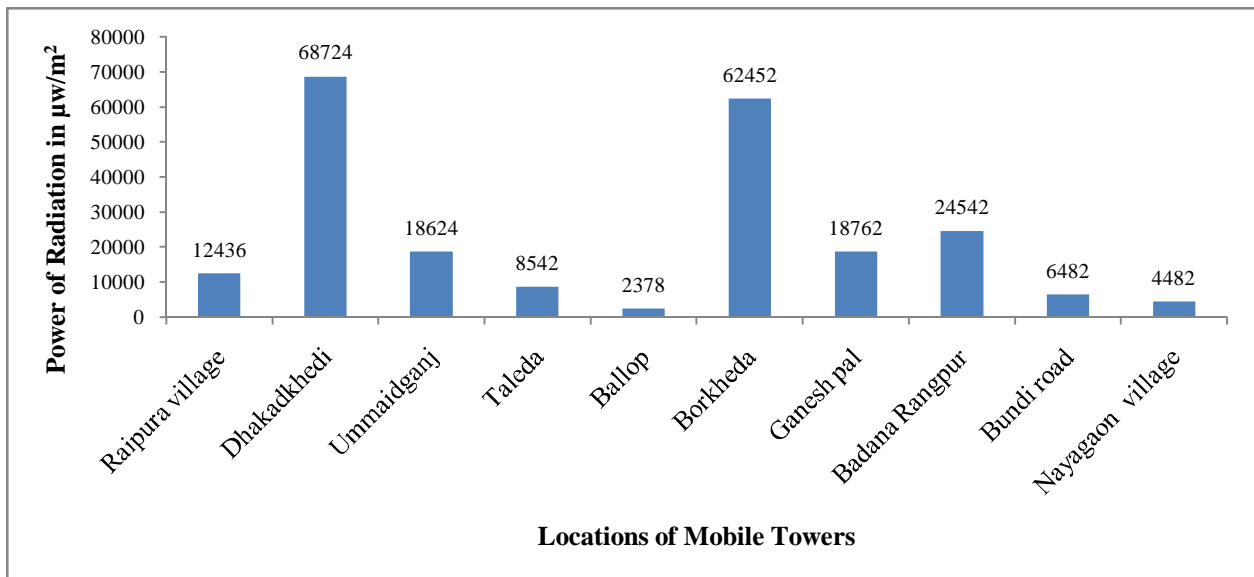
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The observations made for the measuring emf radiation from mobile towers in different zones of Kota city are presented as under:

Table 3: Observed Values of Mobile Tower Radiation using EMF Detector in Residential Areas of Kota City

Tower No.	Location or Area where Tower is situated in Kota City	Height of Tower	Power of radiation in $\mu\text{w}/\text{m}^2$	Power of radiation ( $\text{w}/\text{m}^2$ )	Risk Level
1	Srinathpuram	18m	77840	0.7784	High
2	Dadabari chhota chouraha	20m	8424	0.0084	Low
3	Talwandi	24m	6540	0.0065	Low
4	Mahaveer Nagar	18m	12430	0.0124	Medium
5	Model Town	18m	48658	0.4865	High
6	Rangabari	12m	16432	0.0164	Medium
7	Allen coaching	18m	5452	0.0054	Low
8	Shivpura	24m	8754	0.0087	Low
9	RAC ground	18m	15428	0.0154	Medium
10	Dhakadkhedi	30m	68436	0.6843	High



Graph 1: Observed Values of mobile tower radiation using EMF detector in Residential areas of Kota

The above results show that three mobile towers located at Srinathpuram, Model Town and Dhakadkhedi are emitting very high emf radiation as compared to the standard limits and hence pose the high risk. Similarly, in this zone of residential area, four mobile towers are under the category of medium risk level. This zone has the highest population density and hence the mobile towers pose a high risk to the residents of this zone.

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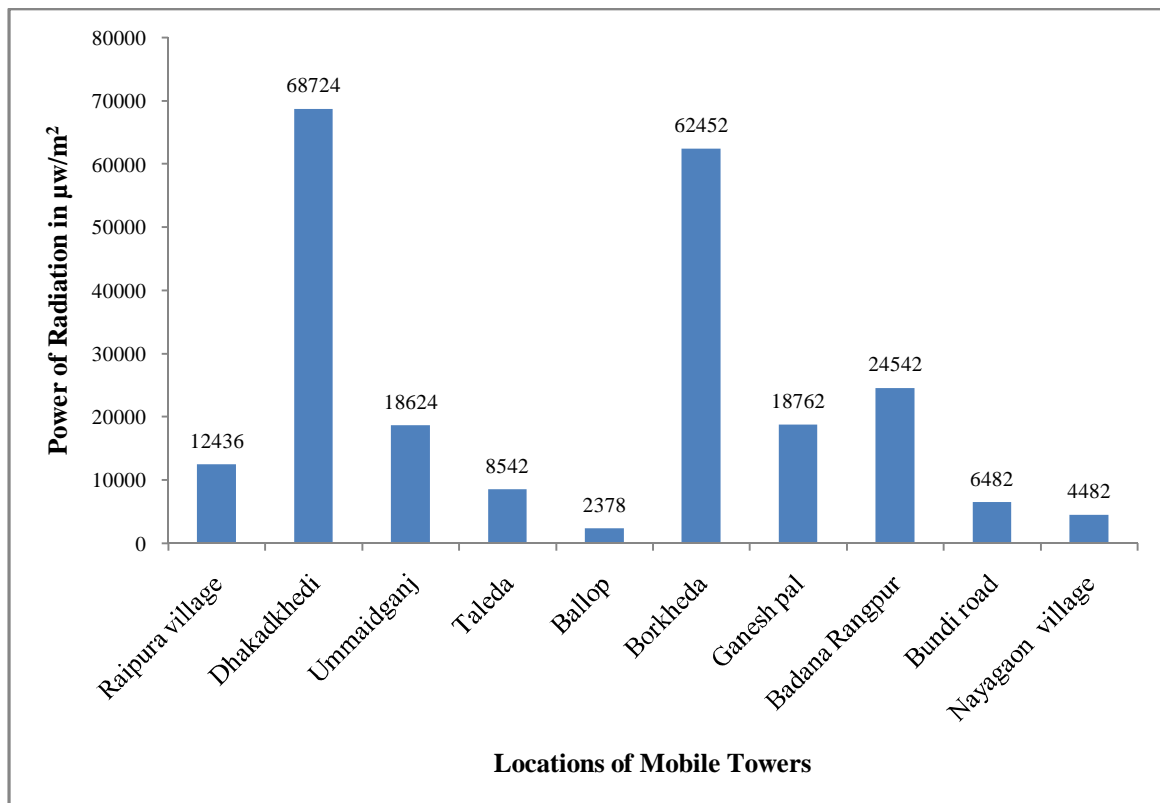
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Table 4: Observed Values of Mobile Tower Radiation using EMF Detector in Industrial and Commercial Areas of Kota City

Tower No.	Location or Area where Tower is situated in Kota City	Height of Tower	Power of radiation in $\mu\text{w}/\text{m}^2$	Power of radiation ( $\text{w}/\text{m}^2$ )	Risk Level
1	Poultry estate	18m	54623	0.5462	High
2	Chhawani circle	24m	17862	0.0178	Medium
3	Ranpur industrial area	20m	5463	0.0054	Low
4	Annantpura industrial area	20m	11243	0.0112	Medium
5	Railway station	24m	68769	0.6876	High
6	Dakania station	20m	12868	0.0128	Medium
7	Bajrangnagar market	24m	18764	0.0187	Medium
8	Basant vihar market	20m	5642	0.0056	Low
9	Indraprastha industrial area	30m	2386	0.0023	Low
10	Talwandi market	20m	56786	0.5678	High



Graph 2: Observed values of mobile tower radiation using EMF detector in industrial and commercial areas

The above results show that three mobile towers located at poultry estate, railway station and Talwandi market are emitting very high emf radiation as compared to the standard limits and hence pose the high risk. Similarly, in this zone of industrial and commercial area, four mobile towers are under the category of medium risk level. This zone has also high population density and hence the mobile towers pose a high risk to the people of this zone.

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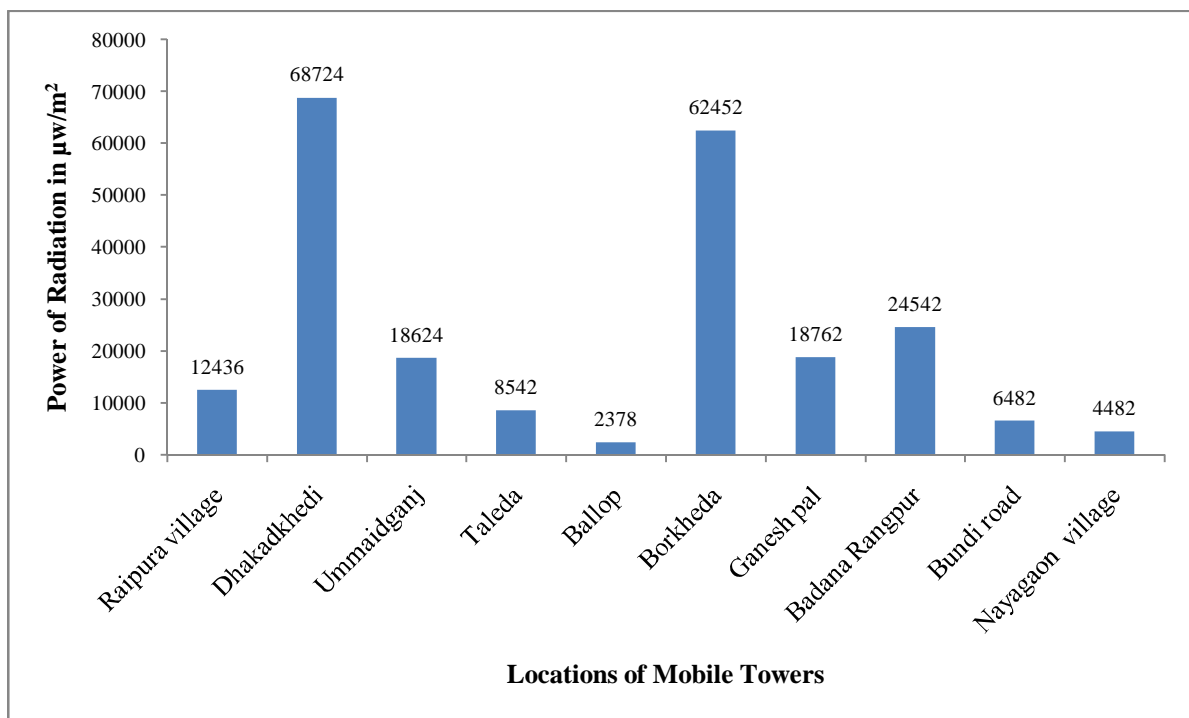
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Table 5: Observed Values of Mobile Tower Radiation using EMF Detector in Agricultural Areas of Kota City

Tower No.	Location or Area where Tower is situated in Kota City	Height of Tower	Power of radiation in $\mu\text{w}/\text{m}^2$	Power of radiation ( $\text{w}/\text{m}^2$ )	Risk Level
1	Raipura village	24m	12436	0.0124	Medium
2	Dhakadkhedi	20m	68724	0.6872	High
3	Ummaidganj	24m	18624	0.0186	Medium
4	Taleda	30m	8542	0.0085	Low
5	Ballop	30m	2378	0.0023	Low
6	Borkheda	20m	62452	0.6245	High
7	Ganesh pal	24m	18762	0.0187	Medium
8	Badana Rangpur	30m	24542	0.0245	Medium
9	Bundi road	30m	6482	0.0064	Low
10	Nayagaon village	30m	4482	0.0044	Low



Graph 3: Observed values of mobile tower radiation using EMF detector in Agricultural Areas of Kota

The above results show that two mobile towers located at Dhakadkhedi and Borkheda are emitting very high emf radiation as compared to the standard limits and hence pose the high risk. Similarly, in this zone of agricultural area, four mobile towers are under the category of medium risk level. This zone is the outer skirt area of the city and has also high population density and hence the mobile towers pose a high risk to the people of this zone.

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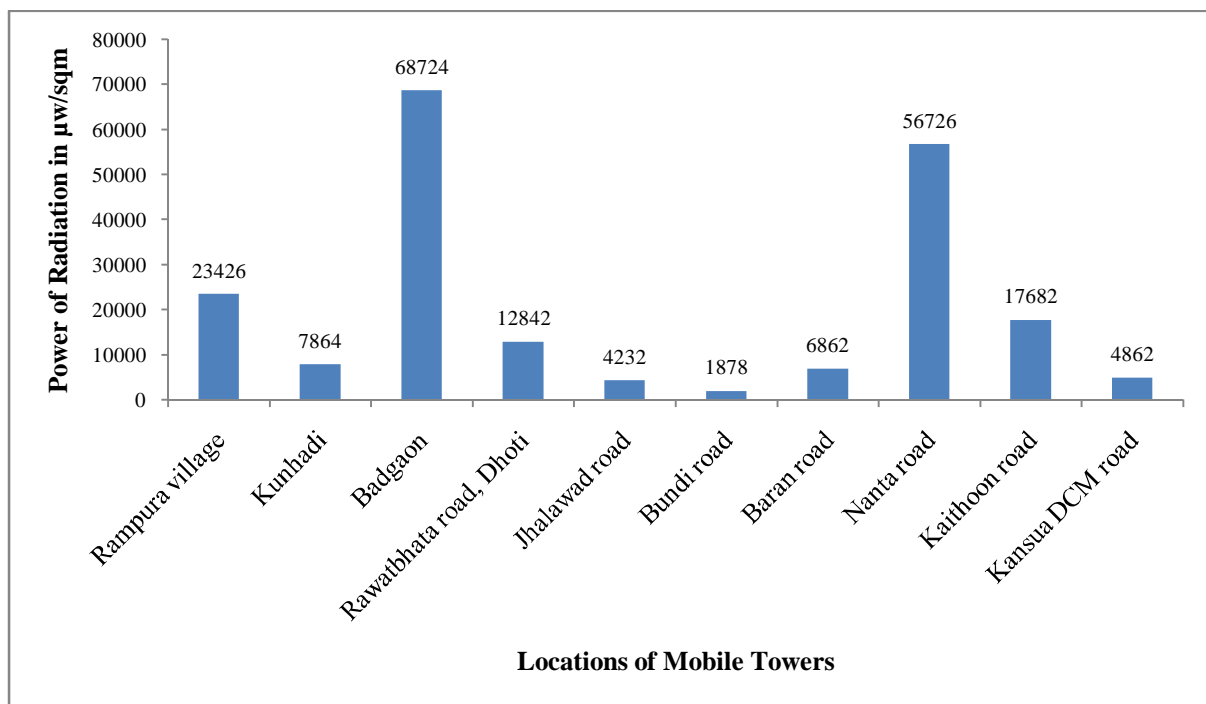
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Table 6: Observed Values of Mobile Tower Radiation using EMF Detector in far flung Rural Areas on Highways, Kota

Tower No.	Location or Area where Tower is situated in Kota City	Height of Tower	Power of radiation in $\mu\text{w}/\text{m}^2$	Power of radiation ( $\text{w}/\text{m}^2$ )	Risk Level
1	Rampura village	30m	23426	0.0234	Medium
2	Kunhadi	24m	7864	0.0078	Medium
3	Badgaon	18m	68724	0.687	High
4	Rawatbhata road, Dhoti	24m	12842	0.0128	Medium
5	Jhalawad road	24m	4232	0.00423	Low
6	Bundi road	30m	1878	0.00187	Low
7	Baran road	30m	6862	0.0068	Low
8	Nanta road	24m	56726	0.567	High
9	Kaithoon road	30m	17682	0.0176	Medium
10	Kansua DCM road	30m	4862	0.0048	Low



Graph 4: Observed values of mobile tower radiation using EMF detector in far flung rural area on highways, Kota

The above results show that two mobile towers located at Badgaon and Nanta Road are emitting very high emf radiation as compared to the standard limits and hence pose the high risk. Similarly, in this zone of industrial and commercial area, four mobile towers are under the category of medium risk level. This zone is consisting of rural villages nearby the city and located on highways, so it has also high population density and hence the mobile towers pose a high risk to the people of this zone.

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## VI. CONCLUSIONS

It has been found that out of the total observed mobile towers, more than 20% are in the category of high risk level, 40% in medium risk and remaining 40% are under the low risk category. This is an alarming situation that almost 60% mobile towers emitting radiation beyond the permissible limits and common man is not aware of this fact. In fact, in short term duration, the ill-effects of radiation are not known properly or sometimes people do not take them seriously. But in long-terms, the harmful environmental and health issues may prove to be very critical and therefore, it is the right time to take precautionary measures.

## VII. RECOMMENDATIONS AND SUGGESTIONS

1. The current guidelines adopted in India are 2012 WHO approved ICNIRP norms, which allow 0.45 Watt/sq.m (900 MHz) to 0.92 watt/sq.m (1840 MHz). However, many countries of the world, both developing and developed, have adopted much stricter guidelines. It is pertinent to note that in China, the corresponding guideline is only 0.10 Watt/sq.m.
2. Transmitted power from each cell tower must be immediately reduced to maximum 1 to 2W, which will protect health of the people from harmful effects of cell tower radiation. It will also protect birds, animals, plants, trees and environment.
3. The reduced transmitted power may create signal problem to the people living near the edge of the circle in the beginning, so public announcement must be made that this is being done to protect the health of the people. People must be educated about adverse health effects of cell phone and cell tower radiations.
4. Towers both ground based and roof based should not be installed within 50 meters from schools or hospitals. New towers should be located 50 meters away from school and hospital buildings. Existing towers should be relocated within a year if they are located within 50 meters from the schools or hospital buildings.
5. Installation towers in the residential areas will be allowed only in consultation with the concerned resident welfare association and not left to bilateral negotiations between telecom companies and individual residents.
6. Antennas should be mounted on or above 30 meters from the ground where the power of transmitting antenna is 10 watts or above. Micro and Pico cell antennas mounted inside the building should not exceed 0.1 watt.
7. Warning sign boards must be installed near cell towers to warn people of the danger of radiation.

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