

Some faculty members at IITs and IISc in the area of Communications (listed below), concerned about the reports of adverse impact of Radio-Frequency Radiation from Cellular Towers on human health, have been discussing the issue amongst ourselves over the last few months. Having examined the issue in some detail, we have prepared a statement on the issue. On behalf of these faculty members I am sending you the statement. We will be willing to assist you in all possible ways to ensure that while telecom industry continue to expand to serve our people, the issue of any adverse impact on health is also addressed.

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On behalf of

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# A Statement on the Health Effects of Electromagnetic Radiation from Cellular Base Stations

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1. All of us are aware of the great role that wireless communications has played in bringing telephony and communications to the Indian people. Back in 1994, we had about 8 million telephones and were adding less than a million telephone lines a year. Typical wait period for getting a telephone line in cities like Chennai was 8 years. Wireless telephony changed all this and telephony started reaching even the poorest in India. Later, wireless started playing a role in bringing Internet to us; even though Internet speeds are nowhere near what one gets in the West today, wireless Internet through GPRS/3G/4G/WiFi is just about keeping our heads above water. This is especially important as India lacks the wired-infrastructure that many other parts of the world have.
2. A side-effect of the spread of wireless communications technology is an increased level of RF (Radio-Frequency) radiation through cell towers, cell phones, WiFi access points, WiFi and blue-tooth enabled laptops, blue-tooth headsets, cordless phones, tablets and various UHF and VHF transmitters. This adds to the EM (Electro-Magnetic) radiation from microwave ovens, AM and FM radio broadcasting, TV broadcasting, microwave towers and satellite communications amongst others. We consider here the potential effects of radiation from cellphone towers on the health of the general public.
3. These radio-frequency radiations are in the frequency range from a few KHz to several GHz and are all non-ionising electromagnetic radiations. Unlike ionizing radiation such as X-rays or gamma rays, non-ionising radiation cannot break chemical bonds nor cause ionization in the human body<sup>1</sup>.

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<sup>1</sup> The capability to break molecular bonds or to ionise depends on the energy per photon. It takes about 12eV to ionize water. EM radiation with photonic energy of more than 10 eV is generally considered ionizing. As we move up the frequency scale in the electromagnetic spectrum, energy per photon increases. The energy per photon of RF and microwave radiations are few microeV, visible light has about 2 eV while Gamma rays have MegaeV. Thus radio waves, microwaves, visible light with much less photonic energy are all non-ionizing while ultra-violet, x-rays, gamma rays are all ionizing. (Kwan-Hoong Ng, "Non-Ionizing Radiations-Sources, Biological Effects, Emissions and Exposures", *Proc. of the Int'l Conf. on Non-Ionizing Radiation, Oct 2003*). Thus ultra-violet, x-rays and gamma rays are known to cause cancers. Some research has suggested that if 2 low frequency photons simultaneously strike a molecule, they could break a bond through two-photon absorption ([http://en.wikipedia.org/wiki/Two-photon\\_absorption](http://en.wikipedia.org/wiki/Two-photon_absorption)). However, 2-photon absorption has been experimentally observed only with lasers, the probability of it occurring with RF radiation is practically zero.

4. There have been a number of reports of people complaining about a variety of symptoms due to exposure to low-level wireless antenna emissions (such as fatigue, sleep disturbance, loss of memory, disturbance in digestion). There have been arguments that RF radiation has the potential to mutate DNA and cause cancer. There have also been reports of harmful impact on birds, bees and the like. As described above, RF radiation cannot cause cancer through mutations.

The other potentially harmful effect of radio-frequency radiation is dielectric heating due to absorption of EM radiation. If the temperature increase is small, the brain blood circulation is capable of disposing the excess heat by increasing the local blood flow. This is the normal cellular response to an increase in temperature<sup>2</sup>.

Vasant Natarajan considers both issues in a recent article published<sup>3</sup> in *PHYSICS Journal*:

“..... that the cell-phone photons ... do not have enough energy to cause a mutation in your DNA. Period. No matter what their power is— increasing their power will increase the number of photons, but they will all be below the threshold for causing cancer. They do not have enough energy to break a bond and cause a mutation. If you live next to a cell-phone transmission tower, the power levels will be higher than if you just used a cell phone, but you can be sure that all the photons are harmless. And yes, if you give enough photons of sub-threshold frequency, you can heat a substance, i.e. increase their vibration energy. This is why you feel hot when you go out into the sun. The visible and infrared photons cannot cause cancer but can heat up your body. But this happens because the power density from the sun received on the earth (called the “insolation”) is typically 1000 W/m<sup>2</sup>, while that at the base of a cell phone tower is ten thousand times smaller at about 0.1 W/m<sup>2</sup>. No wonder you do not feel hot when you stand next to a cell phone tower”.

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<sup>2</sup> Report of the Inter-ministerial Committee on EM Radiation, Government of India, Ministry of Communications & Information Technology, Department of Telecommunications, 2011.

<sup>3</sup>The myth of cell phone radiation”, Vasant Natarajan, Physics.Gen-PH, 22 Nov2012. He further argues, “Despite the knowledge that cell phone radiation is harmless, organizations like the WHO want to play it safe and want to base their recommendations on “epidemiological studies”—studies that compare the prevalence of cancer or other health indicators between cell phone users and nonusers. This is because there are scare-mongers who play on the fears of gullible poorly-informed people and claim that there is scientifically documented proof of such harmful effects.”

5. The World Health Organization (WHO)<sup>4</sup> reports that “considering the very low exposure levels and research results collected, there is no convincing scientific evidence that the weak RF signals from cell phone towers and wireless networks cause adverse health effects”. However, a number of studies have continued to report some link between exposure to radio frequency radiation and occurrence of a variety of health disorders. As of now, these studies and observations have not been considered conclusive<sup>5</sup>.
6. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent international scientific organization that provides guidance and advice on the health hazards of non-ionizing radiation exposure. ICNIRP has published guidelines for limiting exposure to time varying electromagnetic fields in the frequency range up to 300 GHz. The guidelines are based on the thermal impact of EM radiation. It notes<sup>6</sup> that at 4W of received EM radiation per kg, the body temperature rise is limited to a fraction of a degree Celsius, which does not adversely affect health. Notwithstanding this, as a precautionary approach, ICNIRP has specified that the exposure level should be limited to 0.08 W/kg for the general public, which is a 50 times reduction factor of safety. This factor, according to them, is sufficient to protect all people including children, adults with low BMI, obese individuals and those people who, through frailty or illness, have bodies that are less able to control core temperature. The ICNIRP guidelines are recommended by the World Health Organization (WHO)<sup>7</sup> and the International Telecommunications Union (ITU).
7. The exposure limits that are applicable to both public and occupational exposure from RF and ELF (Extremely Low Frequency) fields form the basis for national regulations in most of the countries around the World. In 2008, the Department of Telecommunications (DoT) adopted the ICNIRP guidelines for RF exposure.
8. Wireless technologies have evolved from second generation (2G) to fourth generation (4G) with increasing emphasis on energy efficiency. Energy efficiency is important from radiation point of view.

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<sup>4</sup><http://www.who.int/mediacentre/factsheets/fs193/en/>

<sup>5</sup>The US National Cancer Institute has considered a wide range of studies and has concluded that there is no danger of cellphone radiation causing cancer. [www.cancer.gov/cancertopics/factsheet/Risk/cellphones](http://www.cancer.gov/cancertopics/factsheet/Risk/cellphones)

<sup>6</sup>[http://www.who.int/peh-emf/publications/en/malaysia\\_mobphone\\_basestations\\_and\\_health.pdf](http://www.who.int/peh-emf/publications/en/malaysia_mobphone_basestations_and_health.pdf)

<sup>7</sup>WHO, Electromagnetic Fields & Public Health. [www.who.int/docstore/peh-emf/publications/fact-press/efactefs193.html](http://www.who.int/docstore/peh-emf/publications/fact-press/efactefs193.html) (Earlier references 2000, 2004, 2007).

However as wireless communications (both cellular and shorter-range WiFi and Bluetooth) continue to grow, there has been some concern that these may affect health in the long run, even though nothing may be known today. An Inter-Ministerial Committee (of Government of India) examined this issue and submitted recommendations to follow a policy of abundant precaution. Based on this, the department of Telecommunications on September 1, 2012, implemented reduction of emission levels from mobile towers in the country to 1/10<sup>th</sup> of the ICNIRP standards. They also recommended that the exposure is applicable not only at ground level, but also at all points at a given radius (so that, for example, some high-rise building balcony does not receive radiation higher than permitted). India thus became one of the 10% of the countries<sup>8</sup> having the most stringent norms for EM exposure. Most of the countries in the world at present have higher EM emission limits than India.

## Conclusions

9. We consider the recommendations of DoT, Government of India, to be sensible and based on the international best practices at this point in time. They should be implemented strictly, including ensuring radiation norms are met at windows, balconies and roof-tops near cell-towers. At this stage, there is no further knowledge available that warrants a change in the recommendations. Results of new research, as well as complaints from citizens, should be carefully examined on a continuous basis, and the recommendations modified as found appropriate. However, caution should be exercised to avoid ad-hoc decisions regarding restrictions on tower locations as long as they meet the stringent guidelines, and to avoid unnecessary panic and fear among the citizens.
10. We further would like to see the following:
  - a) Creation of a public database, where all study reports (pro and con) on the health implication of EM radiation should be placed. Also, all arguments in favour and against putting higher restrictions on radiation should be placed. The site should become a public repository for all information, so that it can be analysed on a continuous basis. This should be supervised by a committee of academicians.
  - b) As the bit-rates required on Internet increases and usage of Internet in India increases, there will be more and more usage of wireless (especially in the absence of adequate wired infrastructure in India). Further higher bit-rates

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<sup>8</sup> Some countries in the West like USA, UK, Germany etc. continue to use the ICNIRP standards, which is ten times less stringent than current Indian standards. However, a few cities in these countries may have adopted more stringent norms.

imply higher RF energy transmitted if energy per bit remains the same. India needs to evolve a focused scientific program to develop technological solutions to reduce transmitted energy per bit required by a factor of ten in the next five years and by a factor of hundred in the next ten years. Difficult though these goals may appear today, focused scientific research should get us there.

- c) There is a need to conduct on a continuous basis multiple scientific studies on the subject of short-term, mid-term and long-term health implications of EM radiations. The studies should be reviewed and thereafter published. DST, DBT, ICMR etc may fund such studies.

*Disclosure: All of us have been working on R&D in telecom for 5 to 35 years. From time to time, some of our work has been funded by various government agencies and by telecom operators (mostly through Telecom Centers of Excellence at IITs). Some of us have been consultants to telecom manufacturing and operations companies and have also been independent board members of these companies. We sign the statement solely in our professional capacity and as responsible citizens.*