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## Biological Effects On Radio Frequency Smog.

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### ABSTRACT

There is no possibility of sinking the tremendous requirements of wireless cellular communication. A suitable solution is to mitigate the RF pollution or smog from base station installation in hot spot areas. On the basis of mitigating the RF frequencies, much amendment has to be made on the design of base station, decreasing of signals between the entities and considering distance also. Heterogeneous networks security will increase the signaling transmission for getting user authentication. Many techniques were implemented to reduce signaling transmission, on the basis of authentication, fast authentication and re authentication. This paper mainly concentrates on the reduction of communication signal transmission between the entities. Before the data transmission, the entities have to get the mutual negotiation. The authentication protocols used by the cellular networks often result low frequency pulsing of the carrier signal. The radio frequency effect is reinterpreted as the normal cellular response to an increase in temperature. The effects are attributed to the induced electromagnetic effects inside the biological cells of the body which is possibly more harmful. People who are frequently exposed to stumpy level radio frequency emissions and base station consume reported sensation several undefined symptoms throughout and after its use, reaching from burning and tingling impression in the skin of the head, fatigue, sleep disturbance, dizziness, lack of concentration, ringing in the ears, reaction time, loss of memory, headache, disturbance in digestive system and heart palpitation etc. Nearby remain intelligences indicating hostile health effects of base station which release electro-magnetic radiation, with a supreme value of their energy being placed when apprehended close to the suburban area. In order to protect the population living around base stations and low message transfer between cellular communication between users, BS and the core network to access internet. . Low power, confining radiation pattern, distance factor and signal transmission are the factors reducing base stations will result in reduction of interference and R. F. pollution substantially. The main idea of this paper is to exposure limit for RF field interference in small cell base station (SCBS).As well as a standard limitation is provided in the RF interference range.

**Keywords:** Smog, radio frequency, SCBS

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## INTRODUCTION

In India base station R. F. effluence has been recognized as health exposure, a lot of opposition came from people. In view of WHO recommendation, the government announced limitation of frequencies against base station installation. Many suitable solution has to be developed for meeting demand of heterogeneous wireless communication.. This paper deals with the effects of RF interference small cell base stations in hot spot areas in view of biological effects of human health exposure.

Mobile networks are specifically designed to use the lowest possible power from base stations and mobile phones necessary to quality voice or data services. The network automatically adjusts the base station transmitter power according to how far away the mobile phone users are. With the optimal network design, base stations are located close to mobile phone users and produce the lowest possible EMF. The further away base stations are located from mobile phone users, the higher the power required resulting in higher EMF levels. Today's society relies on mobile phones working everywhere including at home, at school and at work. When base stations are located close to users, the transmitter power required by the mobile phone and the base station to communicate is relatively low. If base stations were located further away, the power required is generally higher, and this means a higher EMF. Therefore to provide good reception and minimise EMF, base stations need to be located close to users and where we live.

Base stations operate at low power. Independent surveys demonstrate that the background EMF level in the community from base stations is very low, and similar to environmental EMF levels from broadcast radio and television.

Low power base stations will result in reduction of interference and R. F. pollution substantially. This has been proved beyond doubt through simulations and practically too by researchers [16] – [18]. Proposed small cell base station (SCBS) network is not only spectrum efficient but also it will reduce power consumption and R. F. pollution drastically. This will help in achieving our goal of spectral efficiency and reduction of R.F. pollution which is the dire need of hour in the prevailing circumstances.

## RADIATION EFFECTS AND EMF EMISSIONS

Radiation is electromagnetic in nature and are exposed to both natural and man-made radiation. Every second of our life, we are exposed to all forms of radiation such as ultraviolet light from the sun and radio waves from radio and television broadcasts. Non-ionizing radiation (NIR) does not have sufficient energy to cause ionization in living matter. It causes some heating effect, but usually not enough to cause any kind of long-term damage to tissues. Radiofrequency energy, visible light and microwave radiation are considered non-ionizing.

RF fields below 10 GHz to 1 MHz, penetrate exposed tissues and produce heating due to energy absorption. The depth of penetration depends on the frequency of the field and is greater for lower frequencies. Absorption of RF fields in tissues is measured as a Specific Absorption Rate (SAR) within a given tissue mass. The unit of SAR is watts per kilogram (W/kg). SAR is the quantity used to measure the "dose" of RF fields between about 1 MHz and 10 GHz. An SAR of at least 4 W/kg is needed to produce known adverse health effects in people exposed to RF fields in this frequency range. RF fields above 10 GHz are absorbed at the skin surface, with very little of the energy penetrating into the underlying tissues. The basic dosimetric quantity for RF fields above 10 GHz is the intensity of the field measured as power density in watts per square metre (W/m<sup>2</sup>) or for weak fields in milliwatts per square metre (mW/m<sup>2</sup>) or microwatts per square metre ( $\mu$ W/m<sup>2</sup>). Exposure to RF fields above 10 GHz at power densities over 1000 W/m<sup>2</sup> are known to produce adverse health effects, such as eye cataracts and skin burns.

The role of long-term revelation to high radio frequency radiation emitted either from mobile phones or from base stations and its relations with human's hormone profiles. This radiation effects on pituitary–adrenal axis represented in the reduction of ACTH, cortisol, thyroid hormones, prolactin in young females, and testosterone levels.

Pulsed microwave radiation used in base station of cellular device can non-thermally affect these various biological (electrical) activities and provoke adverse health reactions. Weak radiation can entail only

correspondingly weak effects, and vice versa. Ensuring non-thermal electromagnetic compatibility between mobile phone radiation and energized electronic equipment (in aircraft and hospitals, and with heart pacemakers) is accepted and generally respected, the same, unfortunately, does not yet obtain in the case of the alive human organism. Of particular relevance is the way in which this radiation affects brain function – specifically, its electrical activity (EEG), its electro-chemistry, and the blood/ brain barrier - and degrades the immune system. For these established influences are of a kind that are consistent with the nature of adverse health reactions reported both by some users of mobile phones and by some people (involuntarily) subject to long-term exposure to the radiation from Base-stations.

Furthermore, the fact that microwave radiation has been discovered to target the hippocampus region of the brain is consistent with reports of memory problems and, in some epileptic children, with an increase in the frequency of seizures. The latter finding is not at all unreasonable, given the known ability of a visible light (such as a stroboscope) flashing at a rate somewhere between 15-20 times per second to provoke seizures in the 5% minority of epileptics who are photosensitive.

**BIOELECTRO MAGNETISM**

It contracts with the biological articles and electromagnetic fields . Furthermost of the particles in the human physique interact feebly with electromagnetic fields in the radiofrequency or extremely low frequency groups. One such communication is preoccupation of energy as of the fields, which can reason tissue to increase temperature. This container main to biological belongings ranging from muscle lessening to injuries. Through effects of electromagnetism on human health consume been hard to prove and recognized life-threatening intrusions from electromagnetic fields are incomplete to medical devices such as pacemakers and additional electronic implants.

**HEALTH RISKS ASSOCIATED WITH BASE STATIONS**

This paper mainly concerns with the evaluation of radio frequency from mobiles base stations interference and its relations with humans. Radiofrequency (RF) fields emitted by base stations are results severe health problem fields have been causing carcinogenic to humans. There is no indication that environmental exposure to RF fields, such as from base stations, increases the risk of cancer or any other disease. The interference of base station EMW and some medical devices are reducing the risk in newer design of small cell coverage. Since the cellular base station successfully extenuating RF signal interference through thoughtful radio system knowledge with proper cell planning, frequency and bandwidth allocation.

**POTENTIAL BIOEFFECTS OF EXPOSURE TO MICROWAVE/RF RADIATION**

In general, most biological effects of exposure to microwave/RF radiation are related to the direct heating of tissues (thermal effects) or the flow of current through tissue (induced current effects). Non-thermal effects resulting in carcinogenesis, teratogenesis, etc. have been demonstrated in animals but have not been proven by epidemiological studies on humans. The following biological effects have been demonstrated in humans:

Base Station	WiFi (RF)exposure	Laptop	Cordless telephone	smart meter
Headaches, disrupted sleep	Brain problem	Spoil DNA	Heart problem	Nausea, anxiety, heart palpitations, tinnitus and ear pain

**BASE STATION MITIGATION EFFECTS ON RF**

The following factors are influencing the practical difficulties of RF interference.

Signal Transmission: As the user equipment to make calls, signals are transmitted back and forth to the base station. The RF waves produced at the base station are given off into the environment, where people can be exposed to them.

Mounting of the Antenna: Public exposure to radio waves from cell phone tower antennas is slight for several reasons. The power levels are relatively low, the antennas are mounted high above ground level, and the signals are transmitted intermittently, rather than constantly.

Reserve Factor: It is actual unlikely that a individual might be exposed to RF stages in additional of these bounds just by being nearby a cell phone tower. After a cellular antenna is straddling on a roof, it is conceivable that a individual on the roof might be exposed to RF levels greater than persons typically met on the milled.

Reducing exposure level of radiation: The level of RF energy inside buildings where a base station is mounted is typically much lower than the level outside, depending on the construction materials of the building. Wood or cement block reduces the exposure level of RF radiation by a factor of about 10.

Antenna Radiation pattern: The energy level behind an antenna is hundreds to thousands of times lower than in front. Therefore, if an antenna is mounted on the side of a building, the exposure level in the room directly behind the wall is typically well below the recommended exposure limits.

**SMALL CELL AND INTERFERENCE MITIGATION**

small cell are low-powered radio access nodes that operate in licensed and unlicensed spectrum that have a range of 10 meters to 1 or 2 kilometers. They are "small" compared to a mobile microcell, which may have a range of a few tens of kilometers. With mobile operators struggling to support the growth in mobile data traffic, many are using Mobile data offloading as a more efficient use of radio spectrum. Small cells are a vital element to 3G data offloading, and many mobile network operators see small cells as vital to managing LTE Advanced spectrum more efficiently compared to using just macro cells.

Small cells encompass femto cells, pico cells, and microcells. Small-cell networks can also be realized by means of distributed radio technology consisting of centralized baseband units and remote radio heads. Beamforming technology (focusing a radio signal on a very specific area) can be utilized to further enhance or focus small cell coverage. A common factor in all these approaches to small cells is that they are centrally managed by mobile network operators.

**ENERGY DISTRIBUTION – BASE STATION**

For the growth of wireless communication, networks are evolving towards small cell base stations closer to the mobile users. Energy consumption of base-stations will give different opportunities for future heterogeneous networks  
Radio equipment is the one who mainly dominated power consumption of a SCBS.

It must guarantee a continuous flow of information while providing sufficient quality-of-service. To reduce the power consumption of the radio equipment efficiently, it is essential to quantify the power consumption over the different radio equipment components and to focus on the main consumers.

Coverage of Cell	Power consumption of RF components
Pico Cell	>12%
Femto cell	>12%
Power Amplifier	30%
Base band component	30%

Energy adaptation opportunities

Normally, base-stations are designed for maximal traffic load and high variations in the power saving parameter. There are many parameters were included in the performance of utilizing base station traffic load. From the figure, the variation of BS depends heavy traffic period, medium traffic, heterogeneous interference period and sleep mode period.

#### Small cell base station interference reduction:

Small cells base station (SCAP) provides flexibility and increased QoS capabilities at an attractive cost. Implementing a small cell infrastructure is also more environmentally friendly as it will reduce the number of cell towers (maybe even eventually eliminate them) and it provides a cleaner signal with less power. The small cell base station becomes the key to deploy either of these systems. A typical base station has several transceivers allowing operation in several different frequencies (UHF/VHF) and different technologies CDMA, GSM, 3G, 4G, and futuristic 5G directions of the cell in the system.

Finally another issue to be taken into account is the public opinion worrying about the multiplication of radio transmitters in the neighborhood and inside living areas. People are more and more complaining about the multiplication of cellular transmitters near their home. In many countries, a mood of suspicion about radio waves is noticeable, and more and more lawsuit is brought against the installation of base station.

Because of the narrow beam pattern, RF fields are much weaker outside of the main beam than within it. The RF exposure a person receives from a base station thus depends on both the distance from the antenna, and on the angle below the direction of the main beam. At ground level, the signal is relatively weak near the base of an antenna tower (since the main beam is passing directly overhead). For most base stations, the signal strength at ground level increases gradually with distance from the tower, reaches a maximum between 50 - 200 meters from the base of the tower, and then decreases at still greater distances. At all places on the ground, however, these signal levels are very low compared with regulatory guidelines.

Population exposure of radiation pattern in small cell base station generally depends on the power, antenna type and distance. Special type of antenna is used for indoor SCBS. Since the antenna position; angle elevation and the directivity are deciding the radiation energy. Therefore, exposure to residents inside a building a small base station antenna is invariably very low.

These type of base station antennas are normally designed to radiate energy in the effective direction away from unused areas, and they radiate very little energy into the unused areas

Maximum permissible exposure limit is provided for co-channel base station interferences in wireless communication. RF linked with conventional wireless base station areas of uncontrolled public access will exceed optional exposure guidelines, in some cases, e.g., where there may be a variety of antennas for different services, a detailed safety analysis may be required to evaluate compliance. The purpose of the RF exposure standards is to prevent exposures on biological effects of electromagnetic fields. To reduce the impact level for which realistic confirmation exists for any reproducible adverse effect that can be related to human health. studies have involved short-term exposures to animals, sometimes at high power levels, although a limited number of long-term animal and human (epidemiological). A variety of radio frequency induced biological effects have been reported, most of which are related with too much of heating problem. A variety of exposure guidelines incorporate safety factors to keep exposures below levels that are considered to be potentially hazardous, even under worse-case exposure conditions.

#### Signal Transmission Reduction:

To reduce the message transaction between wireless communications, results less interference from radio frequency. There are two types of handovers inter cell and intra cell communication. Once the small cell base station is placed inside the area of the required environment, the not required or unused areas are unaffected from the harmfulness. If the authentication message transaction is more, then the RF interference impact is also high in the public areas. So the number of authentication transaction is being reduced in the fourth coming wireless communication. On the basis of distance, coverage area, fast mobility of the User equipment may split the control and user plane of the radio link into scalable dense small cells. The centralized control management enables fast information exchange with less interference from radiation

Before transmitting of data, reducing the signal load (message) between the entities is a major challenge in the field of mobile cellular communication. Local exchange of information and far distance message exchange will cover different cell area, which consequences various radio wave interference in the

required users and not required users. Authenticating the small cell base station is a most important process in the field of security. It has to get authenticated from user equipment as well as from the access network.

### CONCLUSION

A goal of this paper is to focus attention on the human health hazards from radio frequency interference aspects of deploying small cell base station heterogeneous networks. Additionally, networks are increasingly using small cells and base stations deployed indoors or below. There may be some risk to human resources with heart pacemakers, implanted defibrillators, or other body-mounted medical electronic devices when they are close (within a meter or so) and in the main beam of an operating base station antenna. Therefore, they can root organs disappointment and generalized glitches to organism. So as to diminution these difficulties it is significant diminish the description especially on high-risk workforces.

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