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GREEN HETEROGENEOUS FEMTO-CELL NETWORKS FOR REDUCING THE CO_2 AND ELECTROMAGNETIC POLLUTION OF MOBILE COMMUNICATIONS

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ABSTRACT

Small cell networks are discussed as a standard part of the future heterogeneous networks. In this paper, we consider heterogeneous network which promises energy savings by deploying the femto cellular network and thereby reducing CO2 emissions and mainly concentrating on implementing directional antenna instead of omnidirectional antenna which radiates equally in all direction increases the electromagnetic pollution. The main aim of the paper is to use of horn antenna for femto cellular network which is used to reduce the unwanted radiation and it increases the efficiency of the communication.

Keywords— co2 emission; small cell; gain; directivity; femto cell.

1. INTRODUCTION

Wireless communications are considered as the major worldwide cause of energy consumption within a few years, with a devastating impact in terms of pollution and energy consumption. The high power needed for operating base station causes huge CO_2 emissions in the atmosphere, while the portion of energy actually traveling on the communication media is one or two orders of magnitude lesser than the energy consumed by the overall system. Jointly with the environmental impact of new towers and base station sites, the highly inefficient use of power might become a serious menace for the environment. In particular, base stations cause more than 80 percent of the operator's power consumption, which makes the design of base stations are key element for determining both the environmental impact of wireless networking and the operational expenditure. To grant an idea of the actual energy and pollution cost induced by a base station, consider that most of the operating base stations continuously consume at least 2 kW, mainly generated by means of fossil fuels, and hence produce as much CO_2 as a few automobiles in their average utilization cycle. Thus wireless industries not only consume much energy but also cause a more electromagnetic pollution, impacting on the global environment. Researchers have already to explore "Green communication" [1]–[3] to reduce electromagnetic pollution. The main aims of green communication are to improve energy efficient technology, to reduce wireless pollution and to improve performance metrics [4]. The green radio program is to identify appropriate wireless network architecture, which enables power reduction and also improves energy metrics [5]. Heterogeneous networks emerges as a remarkable solution to the challenging demands such as high spectral and power effectiveness, improved cell coverage and cell edge performance of the future wireless networks. In this regard, recently

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planned heterogeneous small cell network (HetSNet) deployment strategies are gaining significant popularity. HetSNets are envisioned to enhance next-generation wireless Networks by offloading traffic from the macrocell network, providing higher data rates and devoted capacity to residential areas and hot spots. HetSNets consist of small cells each having variable capabilities and functions. A key current trend in this regard is the use of directional antenna in femtocells which radiates only in desired direction. In those directional antennas, we are using horn antenna which has high directivity and gain. Increase in directivity improves efficiency of the communication and reduces unwanted radiation which future reduces electromagnetic pollution of mobile communication.

2. EXISTING SYSTEM

In existing system, low power low cost user deployed base stations complement the existing macrocell infrastructure. They proposes an energy-efficient deployment of the cells where the small cell base stations are arranged around the edge of the reference macrocell, and the deployment is referred to as cell-on-edge (COE) deployment. By arranging small cells in edges of the macro cell it reduces the distance between the base station and edge users. Reduction in distance achieves decrease in maximum transmission power to serve cell edge users. There is direct relationship between transmission power and energy consumption, there by reduction in transmission decreases energy consumption. Due to the limited battery power constraint and PC mechanisms, mobile users located close to the serving BS are able to reach their desired targets while minimizing their transmit power. However, cell edge users are highly likely to starve and transmit at their maximum powers. In this context, COE deployment allows significant reduction in the transmit power of cell edge users while maintaining their target rates.

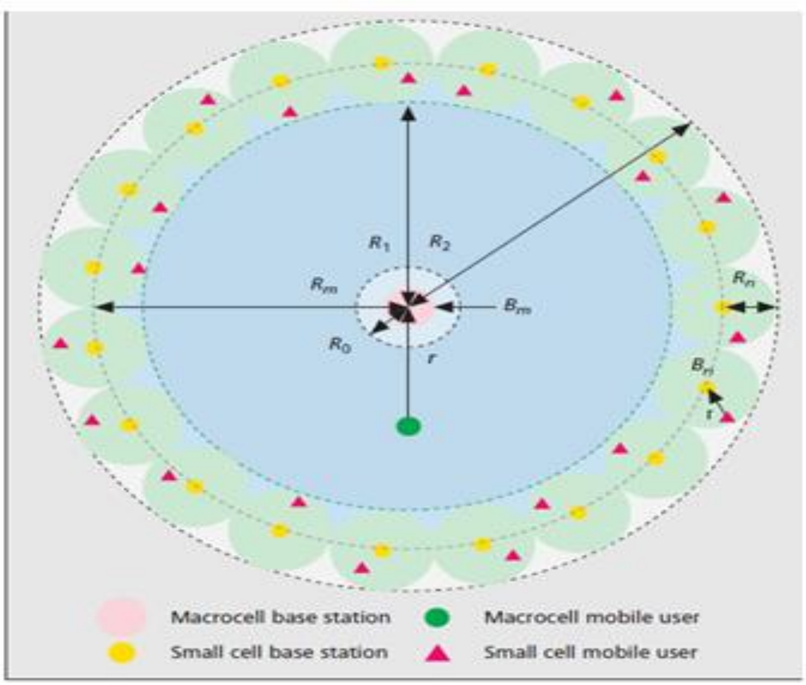

Fig.1. Graphical illustration of heterogeneous network where a Macrocell is surrounded by *N* small cells around the edge

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3. HORN ANTENNA

A horn antenna is nothing more than a flared wave-guide as shown in Figure 1. The horn exhibits gain and directivity, however its performance is improved more by using it in combination with a parabolic reflector. An open-ended wave-guide is an inefficient radiator of energy due to the impedance mismatch at the mouth; it can be improved by simply flaring the end of the waveguide. Horns are widely used as antennas Used at UHF and microwave frequencies. The coverage area of this antenna is 120^0. Horn antennas have excellent gain and directivity.

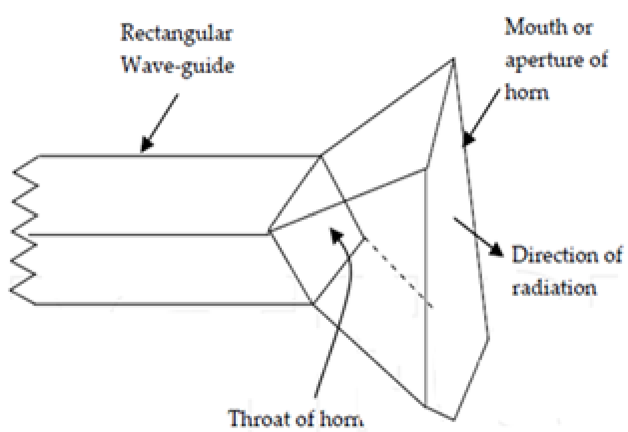

Fig.2. Horn antenna

The longer the horn, the greater its gain and directivity. Different kinds of horn antennas can be created by flaring the end of the Wave-guide in different ways for example flaring in one dimension creates a sectoral horn Pyramidal horn e.g. horns flared in both E and H planes. The important dimensions of the horn antenna are Horn length, Aperture area and Flare angle. The length of a typical horn is usually 2 to 15 wavelengths at the operating frequency. The longer horns though more difficult to mount and work with provide higher gain and better Directivity. The aperture area is the area of the rectangle formed by the opening of the horn and is simply the product of the height and width of the horn. The greater this area, the higher the gain and directivity.

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4. PROPOSED SYSTEM

We propose FOE deployment in which the femto BSs are arranged around the edge of the reference macrocell. The deployment is referred to as Femto-on-edge (FOE) and has been shown in fig.1 to produce significant reduction in co2 emission and electromagnetic pollution by using directional antenna. The first tier of the considered heterogeneous network comprises of circular macrocell each of radius *Rm* [m] with a BS *Bm* deployed at the center and equipped with directional antenna. Each macrocell is assumed to have *H* mobile users uniformly distributed over the region bounded by *R*0 and *Rm*, where *R*0 denotes the minimum distance between the macrocell mobile user and its serving BS. The second tier of the heterogeneous network comprises of *N* circular femtocells each of radius *Rn* [m] with low power low-cost user deployed femto BSs *Bn* located at the center.

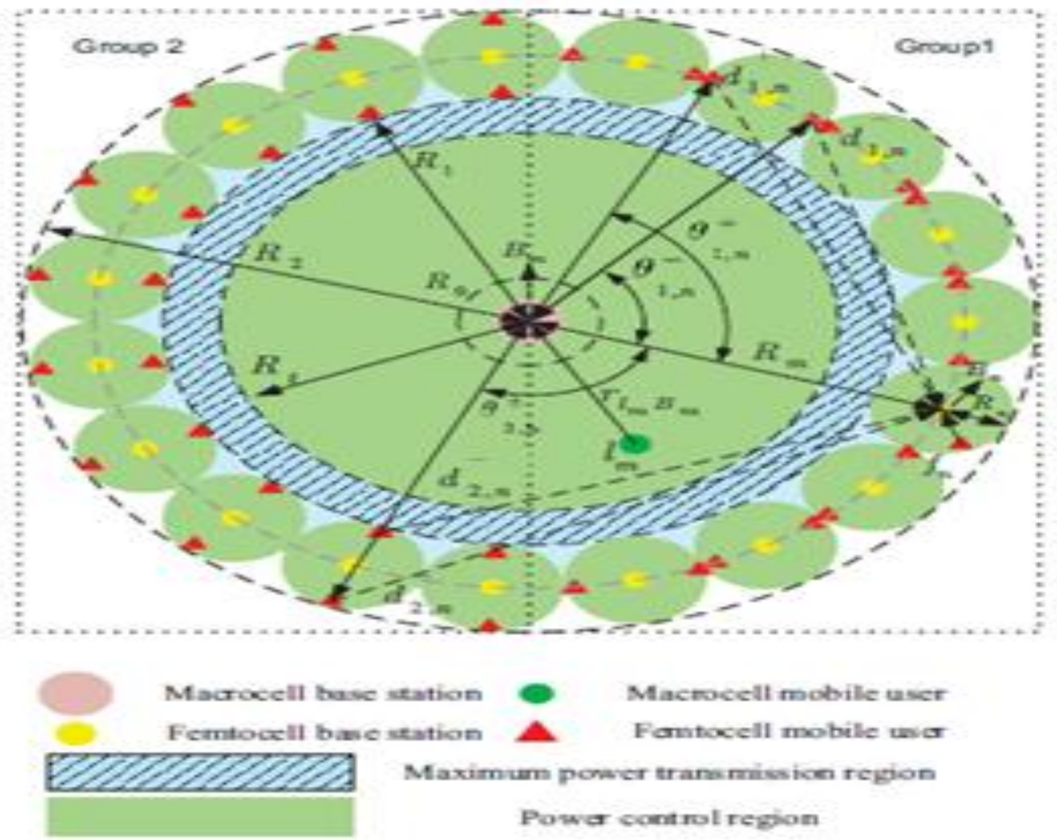

Fig.3. Graphical illustration of heterogeneous network where a macrocell is surrounded by *N* femtocells around the edge.

The main purpose of our paper is to design a horn antenna this is one of the directional antenna which has high gain and directivity and radiates only in desired direction to reduce unwanted radiation in all direction. Femto cell base stations are used within building the coverage area of this cell is the order of 10 meters. The use femto cell benefits both the mobile operator and consumer. For a mobile operator, a femto cell improves both coverage, capacity and achieves higher data rates using less power thus battery life is longer.

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5. RESULT AND ANAYLYSIS

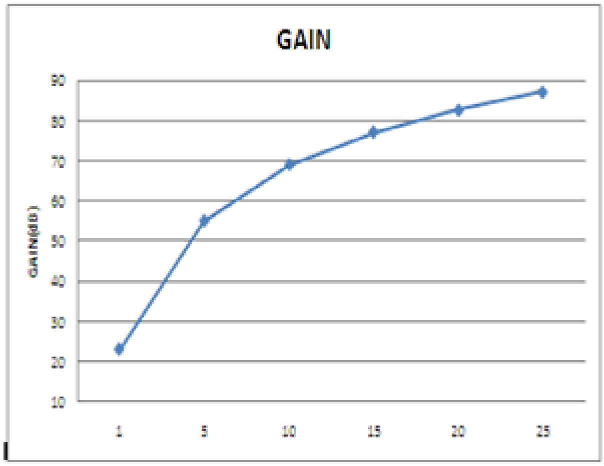

Fig.4. the variation of gain when the aperture diameter changes from that the gain of the horn antenna increases when the aperture diameter increases

Gain and directivity of a horn antenna is determined by adjusting the aperture diameter of front end of the horn antenna. From that efficient gain and directivity is calculated and also efficient diameter which most suitable for femto cell is determined by taking average of gains and directivity. Aperturediameter determines the cone angle of a bundle of electromagnetic rays that come through a waveguide. Figure 4 shows the variation of directivity when the aperture diameter of the horn antenna changes. The directivity of the horn antenna increases when the aperture diameter of front end of the horn antenna increases. Here x-axis indicates the values of directivity and y-axis indicates the values of aperture diameter.

CONCLUSION

Green networking is the practice of selecting energy-efficient networking technology for reducing co_2 emission and electromagnetic pollution. We proposed a methodology called heterogeneous networks using femto cell to overcome the disadvantages of current mobile communication. Successfully directivity antenna is designed using Matlab to get efficient aperture diameter. By using that we have achieved the increase in gain and directivity. In future the designed directivity antenna will be used in femto cell network for reducing electromagnetic pollution and Co_2 emission.

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