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WIRELESS CHARGING OF MOBILE PHONE: A REVIEW

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ABSTRACT

Mobile phones and other electronic gadgets are part and parcel of our lives. But the problem with these electronic gadgets and gizmos is that they require frequent charging and one considers to replace their battery, if all of sudden they stop charging. The problem persists even more if someone is travelling where there is no facility of power outlet around. Different mobile phones having different standby time and battery specifications in market are competing with each other on the pretext of having longer battery duration .But the problem still persist in the long run. In the meantime, researchers have come out with new method of charging mobile without need of any charger with the help of microwaves. The new idea is that when user is talking on cell phone, microwave signal is generated at the frequency of 2.45 GHz along with the message signal by the transmitter situated at base transceiver station and is received by the slotted waveguide rectifying antenna mounted on handset which converts the RF signal into dc power and mobile gets charged. As we talk more on phone, the phone will charge more eliminating the need of charging adapters and battery standby time and other battery specifications from mobile specifications permanently.

Keywords: Electromagnetic Wave, S Band, Rectenna, Sensor, Filters, ISM, Magnetron.

I INTRODUCTION

Microwaves are electromagnetic waves with wavelength ranging from one metre to as small as one millimeter, with frequencies lying in the range of 300 MHz (100 cm) and 300 Ghz (0.1cm).The prefix ‘micro’ doesn't mean that wavelength is of the order of few microns. [1][2]What it means that wavelength is small as compared to wavelength used in radio broadcasting in that they have shorter wavelengths [3]. Moreover microwaves can penetrate through fog, haze, rain snow, obstacles very easily [3]. Microwave

technology is extremely useful for point to point communication purpose i.e. (non-broadcast users)[3] .This is due to the fact that microwaves are more easily focused into narrower beams than radio waves allowing frequency reuse for point-point communication[3]. Beside this microwave have certain advantages over radio waves such as high data transmission, broad bandwidths of the order of few GHz and antenna sizes are smaller than at lower frequencies because antenna height is inversely proportional to the wavelength of the signal [3]. Microwaves are valuable in spacecraft communication and much of the world's long lengthy or we can say big data and its broadcasting or telecommunication are transmitted long distances by microwaves between ground stations and communication satellites. Microwaves are also employed in oven and radar technology [3].

II WORKING

To make wireless charging of phones using microwaves possible, following components need to be added to existing circuitry of mobile phones.

2. 1 Rectenna: Rectenna is a special type of antenna that is used in receiving circuitry to convert electromagnetic wave into dc power. A simple rectenna element consists of dipole antenna with an RF diode connected across the dipole elements.[16]

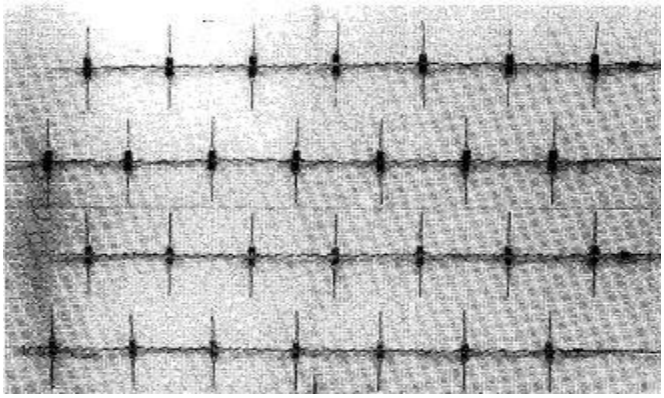

Figure 1- Rectenna [12]

It consists of 28 Half-wave dipoles antenna each terminated in a bridge rectifier made from 1N82G four point contact semiconductor diodes [12]. A power output of 7W with efficiency of 40% is achieved. The diode rectifies the AC current induced in the antenna by the microwaves, to produce DC power, which powers a load connected across the diode. Schottky diodes are preferred over normal diodes because they are fast in operation and have low voltage drop across them and produce high output power.

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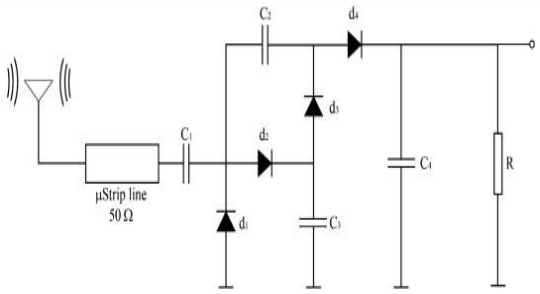

Figure 2 - Block Diagram of Rectenna.[10]

Its elements are usually arranged in mesh pattern, giving it distinct appearance from other antennas. [3]A simple rectenna can be constructed by placing schottky diode between antenna dipoles. [3] Rectenna are highly efficient at converting microwave energy into electricity. Rectenna provide efficiency above 90% with regularity in laboratory experiment.[3]With the advent of MEMS &Nanotechnology the size of these antennas can be brought down to molecular level. Large rectenna consists of large array of such dipole elements.[3] In future with the advent of nanotechnology, optical rectenna are utilized for converting light into dc power at much greater efficiencies than existing solar power cells.[3]

2.2 Sensors- These are other important components need to be added to existing circuitry. These are used to identify when the mobile user is talking, since our aim is to charge mobile phone when the user is talking. A simple F to V converter will be used in sensor circuitry. When the user is talking, thus convertor will act as switch to trigger the rectenna circuit on to charge mobile phone. When the user is not talking, it will switch off the circuit and mobile stops charging. A simple F to V converter will be LM2907 .it will serve our purpose since in India, the mobile usually operates in 900 and 1800 MHz frequency band. [4]

III SYSTEM DESIGN

The system design of wireless charging model consists of transmitter design, receiver design, the process of rectification and sensor circuitry.

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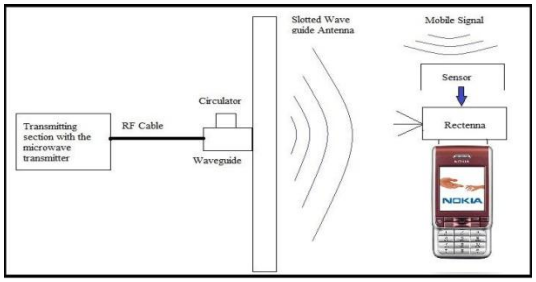

Figure 3- Block diagram of system design operation [10]

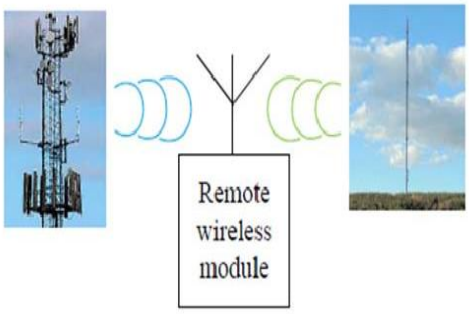

Figure 4 Transmitter Sections [14]

Receiver Section

After the RF frequency is radiated in free space it is received by receiving system. The receiving system comprises of rectenna, sensor, filters etc. The signal coming from free space is received by rectenna mounted on mobile handset. Rectenna is rectifying antenna .Dipole antennas mounted on substrate are responsible for inducing AC current which is converted into dc power by process of rectification.

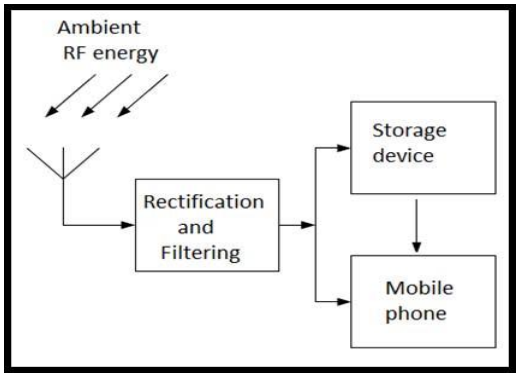

Figure 5- Receiver Section [14]

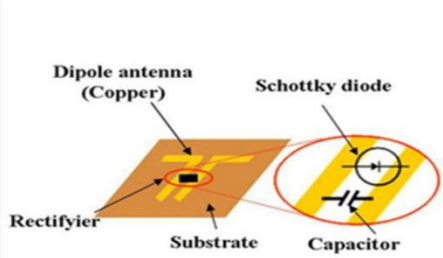

Figure 6- Receiver Circuitry [11]

IV PROCESS OF RECTIFICATION

Microwaves after travelling through media suffer some losses in environment. The process of rectification is to rectify the incoming microwave to the required Optimized level and to make detection more sensitive. Bridge rectifiers are preferred over single diode configuration because it is more efficient in rectification (conversion of ac into dc power).Sensors and filters are used in proximity with receiver circuitry to remove unwanted noise and to sense when the user is talking to make sure that its battery gets charged up.

V CONCLUSION

With Mobile phones and other electronic gadgets are flooding the market regularly with subsequent increase in number of users ,this prototype of wireless charging through microwaves if successful can bring a lot of revolution in telecommunication industry with the problem of charging will be eliminated completely at the cost of some financial loss to pocket of user. However so far it is not implemented practically as it is incomplete technology .But if this prototype has proved to be working, it is possible to implement this prototype in other applications such as fire alarm, clock and places that are far to reach to charge battery apart from wireless charging of phone through microwaves or radio frequency signals.

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