

Wireless Charging of Mobile Phone Using Microwaves or Radio Frequency Signals

Neeraj Singla

Pursuing- M.Tech, Punjab, India

Abstract

Battery life of mobile phone is always been a problem for manufacturers. People are complaining about their mobile's battery life, that they don't have long battery life and they have to charge their phone several times. Portable electronic devices are very popular nowadays. As the usage of these portable electronic devices is increasing, the demands for longer battery life are also increasing. These batteries need to be recharged or replaced periodically. It is a hassle to charge or change the battery after a while, especially when there is no power outlet around. This wireless battery charger is expected to eliminate all the hassles with today's battery technology. The advantage of this device is that it can wirelessly charge up the batteries which can save time and money in a long run for the general public. prototype device that converts microwave signals to DC power. Once the prototype has been proved to be working, it is possible to implement this prototype into other applications such as in television remote control, fire alarm, clock, and places that are far to reach to change battery.

Keywords

Electromagnetic Spectrum, Telecommunication, Microwave Generator, Retina, Sensor Circuitry

I. Introduction

Microwaves are radio waves (a form of electromagnetic radiation) with wavelengths ranging from as long as one meter to as short as one millimeter. The prefix "micro-" in "microwave" is not meant to suggest a wavelength in the micrometer range. It indicates that microwaves are "small" compared to waves used in typical radio broadcasting, in that they have shorter wavelengths.



Fig. 1: A Microwave Telecommunications Tower on Wrights Hill in Wellington, New Zealand

Microwave technology is extensively used for point-to-point telecommunications (i.e., non-broadcast uses). Microwaves are especially suitable for this use since they are more easily focused into narrow beams than radio waves, allowing frequency reuse; their comparatively higher frequencies allow broad bandwidth and high data transmission rates, and antenna sizes are smaller than at lower frequencies because antenna size is inversely

proportional to transmitted frequency. Microwaves are used in spacecraft communication, and much of the world's data, TV, and telephone communications are transmitted long distances by microwaves between ground stations and communications satellites. Microwaves are also employed in microwave ovens and in radar technology. With mobile phones becoming a basic part of life, the recharging of mobile phone batteries has always been a problem. The mobile phones vary in their talk time and battery standby according to their manufacturer and batteries. All these phones irrespective of their manufacturer and batteries have to be put to recharge after the battery has drained out. The main objective of this current proposal is to make the recharging of the mobile phones independent of their manufacturer and battery make. In this paper a new proposal has been made so as to make the recharging of the mobile phones is done automatically as you talk in your mobile phone! This is done by use of microwaves. The microwave signal is transmitted from the transmitter along with the message signal using special kind of antennas called slotted wave guide antenna at a frequency is 2.45 GHz.

II. Wireless Power Transmission

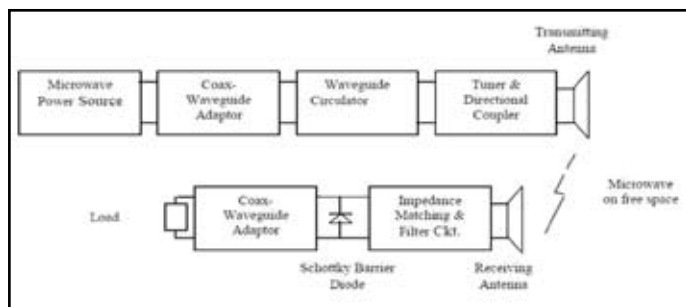
Nikolas Tesla first transmitted electricity without wire and known as the father of wireless electricity transmission. Wireless power transmission works on the principle of Magnetic induction. As we put one coil carrying current through it, it creates a magnetic field near to it. And if we put other coil over there than it is induce by the first coil and it carry current from it. This is the principle of magnetic induction.

A. Wireless Power Transmission System

William C. Brown gives the principle that how the power can be transfer through space using microwaves. This principle of wireless power is shown by the block diagram below: The block diagram shown above in fig. 1 consist of two parts One is transmitting part and the other is the Receiving part. At the transmitting end there is one microwave power source which is actually producing microwaves.

B. Components of Wireless Power Transmission System

There are three important components of this system are Microwave generator, Transmitting antenna, and the receiving antenna.



1. Microwave Generator

The Microwave Generator is the one which generates the microwave of preferred frequency. It generates the Microwave by the interaction of steam of elections and the magnetic field.

2. Transmitting Antenna

Transmitting antenna are use to transfer the signal from free space to the device. There are many kind of slotted wave guide antenna available. Like parabolic dish antenna, microstrip patch an-tennas are the popular type of transmitting antenna.

3. Rectenna

Its elements are usually arranged in rectenna. The current included by the microwaves in the rectenna is rectified by the diode which powers a load connected across the diode. Scotty diodes are used because they have low voltage drop and high speed so that they have low power loss. rectenna are highly efficient at converting microwave energy above 90% have been observed with regularity. The basic addition to the mobile phone is going to be the rectenna. A rectenna is a rectifying antenna, a special type of antenna that is used to directly convert microwave energy into DC electricity. Its elements are usually arranged in a mesh pattern, giving it a distinct appearance from most antennae. A simple rectenna can be constructed from a Schottky diode placed between antenna dipoles. The diode rectifies the current induced in the antenna by the microwaves.

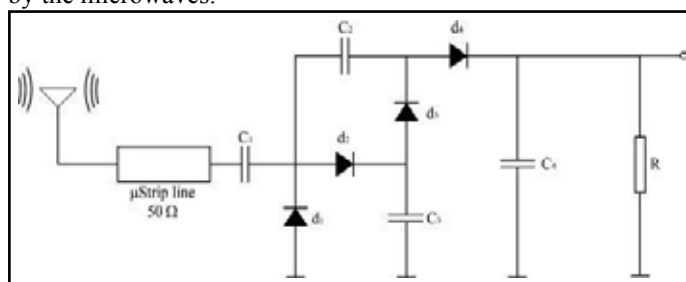
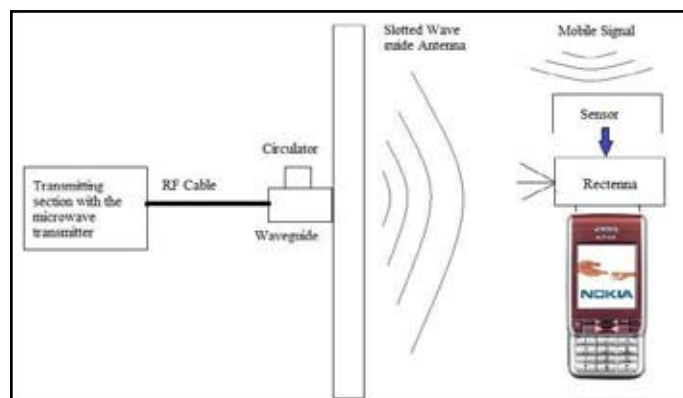


Fig. 2: Block Diagram of a Rectenna

It has been theorized that similar devices, scaled down to the proportions used in nanotechnology, could be used to convert light into electricity at much greater efficiencies than what is currently possible with solar cells. This type of device is called an optical rectenna. Theoretically, high efficiencies can be maintained as the device shrinks, but experiments funded by the United States National Renewable energy Laboratory have so far only obtained roughly 1% efficiency while using infrared light. Another important part of our receiver circuitry is a simple sensor.



III. System Design

The system designing of wireless charging of mobile phone using microwaves mainly consist of four parts as transmitter design, receiver design, the Process of Rectification, sensor Circuitry.

A. Transmitter Design

A magnetron is a diode vacuum tube with filament in which filament act as the cathode shown in fig 3. Magnetron is actually behaved as an oscillator to produce microwaves. It can be done by putting magnet between the resonating chambers which is the center of the oscillator. These resonating chambers are named as anode in the magnetron. When electrons come out from the cathode and go direct towards the Anode, it passes through the magnetic field. It starts circulating in the resonating cavity and start producing waves according to its frequency. And the generated RF signal by this flow outside of the chamber.

B. Receiver Design

The basic addition to the mobile phone is going to be type of antenna that is used to directly convert microwave energy into DC electricity. Actually the size of rectenna can be reducing using the Nano technology. We also have to add a sensor at receiver side. As we know we are going to charge the phone while a person is talking. So here sensor is used to detect wither the phone is using microwaves or not.

C. The Process of Rectification

Microwave can easily travel through the media but it also loses some energy. So our key objective is to rectify the circuit and to rectify the waves at the low cost. And also we have to make the detection more sensitive. As we know that bridge rectification is more efficient than the single diode we use this for the better performance. We use the schottky diode to get the batter impedance.

D. Sensor Circuitry

The sensor circuitry is a any message signal. This is very important as the phone has to be charged as long as the user is talking. . Thus a simple frequency to voltage converter would serve our purpose. And this converter would act as switches to trigger the retina circuit to on. So when our phone is receiving microwave signal it make the recteen circuit on and charge the battery.

IV. Inductive Charging

Though some Handsets on the market currently provide wireless charging, the technology is not exactly same as mentioned here. For charging, phones are required to keep near the Charging Plate.

It uses inductively coupled Power Transfer System.

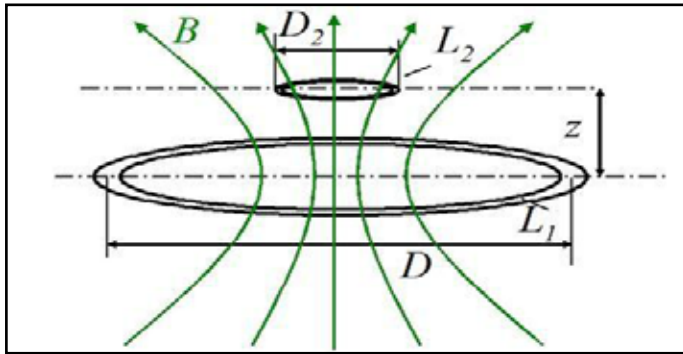


Fig. 4: Existing Power Transfer System



Nokia Lumia 920(AT&T) HTC Windows Phone AX Nokia Lumia 822(Verizon Wireless) Mobile Phones Using Power Transfer Charging System

A transmitter coil is positioned at the bottom (L_1) and the receiver coil (L_2) is situated at the top and these coils are embedded into different electrical devices. L_1 would be the Nokia Wireless Charging Plate and L_2 would be the Nokia Lumia 920, for example. In coming days, Microwave might fix various issues in the current system.

V. Conclusion

This paper successfully demonstrates a novel method of using the power of the microwave to charge the mobile phones without the use of wired chargers. The main advantage of this technique is this that the mobile phone users to carry their phones anywhere even if the place is devoid of facilities for charging.

References

- [1] Theoretical and experimental development of 10 and 35 GHz rectennas "IEEE Transactions on Microwave Theory and Techniques", vol. 40, no. 6, June 1992
- [2] Pozar, David M. "Microwave Engineering Addison-Wesley Publishing Company. ",2010.
- [3] Wireless Power Transmission "A Next Generation Power Transmission System, International Journal of Computer Applications" Volume 1 – No. 13,2010.
- [4] Lander, Cyril W "Rectifying Circuits". Power electronics (3rd ed. ed.),2011.
- [5] Espejel, J.D., "RF to DC power generation", University of Maryland, December 2003.
- [6] Hagerty, J.A., "Nonlinear Circuits and Antennas for Microwave Energy Conversion"2009,
- [7] Lin, G.H., "Topological generation of Voltage Multiplier Circuits", September 2003.
- [8] Pylarinos, L. and Roger, E. "Charge Pumps: An Overview", 2010.
- [9] Sedra, A.S. and Smith K.G, "Microelectronic Circuits", 5th Edition, 2004.
- [10] Stremmer, F.G., "Introduction to Communication Systems", 3rd Edition, 1990.

Biography



ER. NEERAJ SINGLA, pursuing M.Tech -CSE from CGC, Gharuan and done B.Tech. degree from Punjab technical university. He is the author of 8 international journals.