

# A Review Paper on Wireless charging of mobile phones

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## Abstract

*Nowadays Mobile communication not only restricted for voice transmission but also used for various multimedia applications like transfer of text, images, videos, playing games etc. Continuous use of mobile phones needs charging of the batteries again and again. Imagine a system where your cellular phone battery is always charged, You don't have to worry if you forget the charger. In this paper two methods are studied first is wireless charging of mobile phones using microwaves which eliminates the need of separate charger for mobiles .In this method the charging of mobile phones is done using microwaves when we talk on that particular mobile .The microwave frequency used is 2.45Ghz.The second method is charging of mobile phones using Bluetooth.*

**Keywords—** Mobile communication, microwave, wireless charging

## 1. Introduction

There is an abundance of energy around us at all times. Radio and television towers, the cellular phone antennas, and even satellites orbiting earth are constantly transmitting energy. It will be very useful if we gather the energy and store it and use it as a source of power for other circuits. In the case of the cellular phone, this power could be used to recharge a battery that is constantly being depleted. The first step is to capture the energy from air and second step needs an efficient antenna which will convert AC to DC. [1]

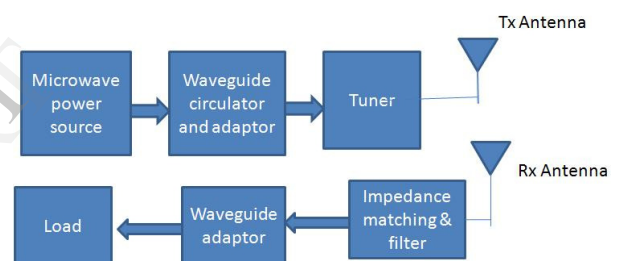
### 1.1Wireless charging of mobile phones using microwaves [2]

Microwaves are a form of electromagnetic radiation with wavelengths ranging from as long as one meter to as short as one millimetre, or equivalently, with

frequencies between 300 MHz (0.3 GHz) and 300 GHz. There are various advantages of microwave over low frequencies such as –

- Directivity: As frequency increases the directivity increase and beam width reduces.
- More bandwidth at higher frequencies.
- Microwave signals travel by line of sight and are capable of freely propagating through snow, clouds and smoke therefore used for communication. [3]

### 1.2Wireless power transmission



**Figure 1. Block diagram of Wireless power transmission**

The block diagram consists of microwave generator which actually produces microwave and microwave convertor which will convert microwave energy into dc power

#### 1.2.1 Microwave generator.

Magnetron is used to generate microwave at preferred frequency; basically the magnetron is a high-powered vacuum tube that works as self-excited microwave oscillator. To produce high power output crossed electronic and magnetic fields are used.

A circulator is a passive device which has three or four ports in which a radiofrequency or microwave

signal entering any port is transmitted to the next port in rotation. A port in this context is a point where an external transmission line or waveguide connects to the device. For a circulator which has four ports, a signal applied to port 1 only comes out of port 2; a signal applied to port 2 only comes out of port 3; a signal applied to port 3 only comes out of port 1.

Tuner is used for impedance matching with transmitting antenna. The transmitting antenna can be a patch antenna and is fabricated from copper plating that is soldered to a feed wire and has a ground plane. We can use slotted waveguide antenna for the same purpose.

1.2.2 Microwave convertor:

Rectenna is used to convert microwave energy into dc power. A simple rectenna element consists of a dipole antenna with an RF diode connected across the dipole elements. The diode rectifies the AC current induced in the antenna by the microwaves. Schottky diodes are used for production of DC power, which powers a load connected across the diode. Schottky diodes are usually used because they have the lowest voltage drop, highest speed and low noise index which is important for communication receivers. “Rectenna” is key component in wireless power transmission because the capacity of the utility power at the receiving site depends on the rectenna performance.

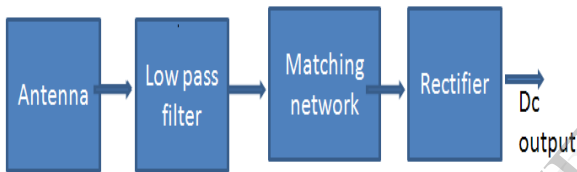


Figure 2. Block diagram of convertor system

Antenna shown here is rectangular microstrip patch antenna (RMPA).Rectification process converts ac to dc. Low pass filter is used to remove the harmonics which are generated during rectification process it is necessary to remove the harmonics as they are radiated back through antenna thus resulting in significant loss of energy. To suppress re-radiation and to maximize the power conversion, Low pass filter is placed between antenna and rectifier setup. The cut-off frequency for Low Pass Filter has been selected such that second harmonic signals are rejected. [4].The use of matching network is impedance matching of input impedance of low pass filter and antenna so that maximum power will be transmitted. After this match circuit the rectifying diode is placed for rectification followed by

DC pass filter which consists of smoothing capacitor for reducing ripples also followed by load. The conversion efficiency depends on this DC pass filter set up i.e. value and position of dc pass filter setup.

1.2.3 Frequency to voltage convertor. A signal is sent when user is talking this is very important as phone has to be charged as long as user is talking. The frequency to voltage convertor would act as switch to turn rectenna circuit ON when user starts his conversation signal is sent to sensor circuit. LM 2907 can be used as a sensor to convert frequency to voltage. Thus on reception of the signal sensor circuit switches rectenna circuit ON and mobile phone begins to charge.

2. Advantages.

The charging of mobile phones is done wirelessly so eliminates the need to use separate charger and plugs. The time required to charge the mobiles can be saved. Wastage of power is less.

Limitations:

- Radiation problem may accure.
- Network traffic may cause problem in charging.
- Rectenna circuit makes device bulky.
- Wireless charging increases heat in device as compare to wired method.

3. Charging of mobile phones using Bluetooth [5].

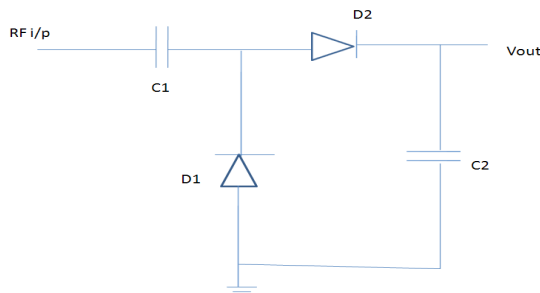
Bluetooth is a wireless technology standard for exchanging data over short distance using short wavelength microwave transmission in the ism band from (2400-2800) MHz, from fixed and mobile devices. The table shows different classes of Bluetooth based on maximum power it can transmit.

Class	Maximum power	Range
Class1	100mw	100 meters
Class 2	2.5 mw	10 meters
Class 3	1 mw	1 meter

Table 1 Different classes of Bluetooth

Bluetooth can act as transmitter as well as receiver. Thus Bluetooth device can be used for wireless charging of mobiles. Transmitter is one Bluetooth device which will transmit RF signals of different power depending upon its class. Receiver will be another Bluetooth device and from received signal

maximum energy will be extracted using following voltage doubler circuit.



**Figure 3 Voltage doubler circuit**

A voltage doubler is an electronic circuit which charges capacitors from the input voltage and switches these charges in such a way that, in the ideal case, exactly twice the voltage is produced at the output as at its input. The simplest of these circuits are a form of rectifier which take an AC voltage as input and output a doubled DC voltage. The output of this circuit is used to charge the mobile batteries.

#### **Application:**

This method can be use to charge the mobile phones in case of emergency, as the circuit size is small it can be easily implemented inside the mobile phones.

#### **Conclusion:**

In this paper two methods for wireless charging of mobile phones are studied. Charging of mobile phones can be done using microwaves and Bluetooth. These methods eliminate need of separate charger thus making the use of mobiles possible in case of emergency even if charger is not available. These methods also results in harvesting of energy.

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