Wireless Power Transmission using Horn Antenna with 2.45 GHz Magnetron

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***Abstract*—** Wireless power transfer system using a microwave active phased array was developed to transmits of electrical energy from a power source to an electrical load without artificial interconnecting conductors. A microwave power beam consists of transmitting and receiving systems. In this paper, a synthesis horn antenna was design for high power microwave applications. The horn antenna was extended to increase the gain and power to focus the beam. A horn antenna operating at 2.45 GHz is designed and simulated. Measurements show that the horn has a high gain and suitable in the field of high power microwave applications.

Keywords*— *wireless power transmission; horn antenna; magnetrons.

I. INTRODUCTION

Wireless power transmission (WPT) technologies are being studied intensively around the world. Wireless power supply are conducted for short charging time, easier charging which can be anywhere, light battery capacity or resources and environment preservation. One method, Microwave beam radiation has been developed mainly with emphasis on use in the aerospace field, providing power transfer from a solar power satellite to the ground and from the ground to an aircraft flying through the stratosphere.

The advantages of wireless power transfer using microwaves over other methods are its use for longer distances with relatively higher efficiency and the technology is more mature. Highly efficient, super directive array configuration would have the potential of concentrated and directed microwave beam that can provide higher efficiency for longer distances [1].

WPT was assumed to be applied to power transfer to an unmanned microaerial vehicle (MAV) equipped with sensors. It is useful for charging its batteries [2].

A study was conducted to identify and design a suitable high power microwave transmission and antenna design with high gain (>20 dBi).

II. DEVELOPMENT OF MICROWAVE POWER TRANMISSION

The primary components of wireless power transmission are microwave generator. The microwave transmitting devices are classified as microwave vacuum tubes (magnetron, klystron). Magnetrons widely used for experimentation of WPT. The microwave transmission often uses 2.45 GHz or 5.8 GHz of ISM band. The highest schottky diode rectenna efficiency over 90% is achieved at 2.45 GHz among all the frequencies show in table 1[3].

TABLE I. RECTENNA EFFICIENCY FOR VARIOUS DIODES AT DIFFERENT FREQUENCY

Frequency (GHz)	***Rectenna: Schottky diode***	***Measured Efficiency (%)***	***Calculated Efficiency (%)***
2.45	GaAs-W	92.5	90.5
5.80	Si	82.0	78.3

We have used a 900 W microwave ovens magnetron as single high power microwave source. The irradiate microwave transparent piping by the waveguides show in figure 1 [4], and horn antenna considered as impedance match between the waveguide feeder and free space which has an impedance by having a tapered or having a flared end to the waveguide.

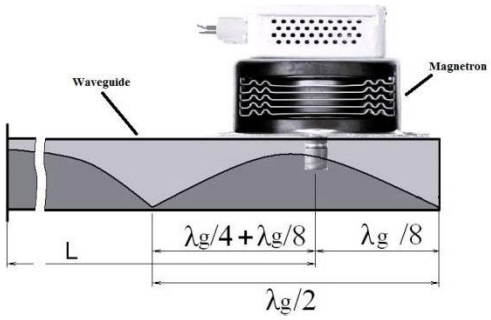

Fig. 1. *Magnetron placement on the waveguide*

High power antennas are needed for many applications. A basic horn antenna with patterns of the transmission antenna array was composed of one or two dimensional antenna array. An array of pyramidal horns with a slant polarization is proposed a simple relatively flat antenna, which is a compromise between a conventional horn antenna and a waveguide array which can be designed for high gain and high power.

In the case of single high power excitation a source must be high power, physical size is big and there are many challenges for fabrication. Therefore array horns need to be synthesized to obtain high gain by use of several sources [5]. The system has these issues which should be obtain electric power enough to drive the electric load which synchronized with the power transmission energy.

III. DESIGN AND SIMULATION

The microwave power from the magnetron is extracted into a standard rectangular waveguide and their appropriate frequency bands. We found WR-340 waveguides is suitable for