A New Dual Side Cut Corner circularly polarized Rectenna 2.45 GHz with DGS

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Abstract- *This paper introduces a new dual side cut corner circular polarized (CP) high efficiency rectifying antenna (Rectenna) array. The Rectenna consist of a truncated square patch antenna and a rectifying circuit. The Rectenna use a micro-strip patch antenna as a frequency 2.45GHz and gain of 31.29 dB. The Rectenna circuit has a low pass filter (LPF) the maximum RF to DC conversion efficiency of the Rectenna is 68%.*

Keywords- CST Software, A dual circular polarization,rectenna, Return loss, rectifying Circuit, Defected Ground Structure (DGS).

I. INTRODUCTION

In the 1960's, Raytheon developed a rectifying antenna or Rectenna which converted RF to DC power at 2.45 GHz ISM frequency. The Rectenna consisted of a half-wave dipole antenna with a balanced bridge or single diode placed above a reflecting plane as well as resistive load .The rectenna conversion efficiency also referred to as the percentage of power converted from RF to DC increased throughout the 1960's and 1970's. The highest conversion efficiency ever recorded was achieved by Brown at Raytheon in 1977 (1). Brown used a GaAs-Pt Shottky barrier diode and aluminum bar dipole and transmission lines to achieve 90.6 % conversion efficiency at an input microwave power level of 8 W. Later, Brown developed a printed thin-film version at 2.45 GHz with a 85 % conversion efficiency [2]. through free space without wire connections or a battery, thus rectenna plays a key role for wireless power transfer applications and a truncated corner square patch antenna [3].was usually adopted for microwave power reception. Afterward, many function were added to enhance the performance of the rectenna array, such as arbitrary polarization [4].The rectifying antenna is one of the main components for above considered techniques, which has great potential to convey, collect and convert radio frequency (RF) energy into useful direct current (DC) power for be nearby electronic device or to recharge batteries through free space without using the physical transmission line [5] . a dual-rhombic-loop antenna[6].or wireless sensors. the used in rectenna design. However, rectennas with circular polarization features [8]. This information then must be sent to an suitable destination. Traditionally, a mobile test unit (UMT) will perform the function of the interrogator. We propose that in addition to data telemetry the MTU will also deliver microwave power to the embedded wireless sensor. The power will be received and converted to dc using an on-board rectenna [9]-[10].

II. RECTENNA DESIGN SPECIFICATIONS

The Design of circularly polarized rectenna at 2.45 GHz is shown in fig.(2). And Fig 1. Displays the Geometry of purpose truncated Square shape microstrip patch antenna. This geometry in fig (2). For the purpose of rectenna, this paper shows the cut of antenna in front side. Its physical dimensions are Length L=140mm, Width W=140mm, Feed Length=20mm. FR4 (lossy) has been taken as substrate whose dielectric constant and thickness are respectively 4.4 and 1.6 mm.

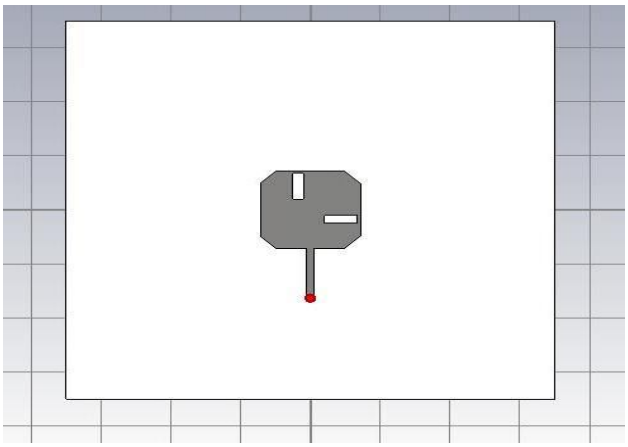

Fig 1.Top view of truncated-corner square patch antenna

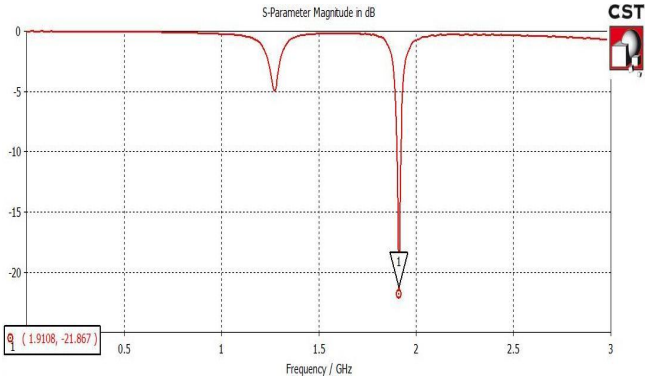

Fig 2. Return loss Vs. frequency without DGS

The circularly Polarized rectenna is shown in fig.1. And its simulation result in which Return loss Vs. frequency curve is shown in fig.2. The defected ground structure is shown in fig.3 the cut in rectangular slot, size in slot 20x5 mm.

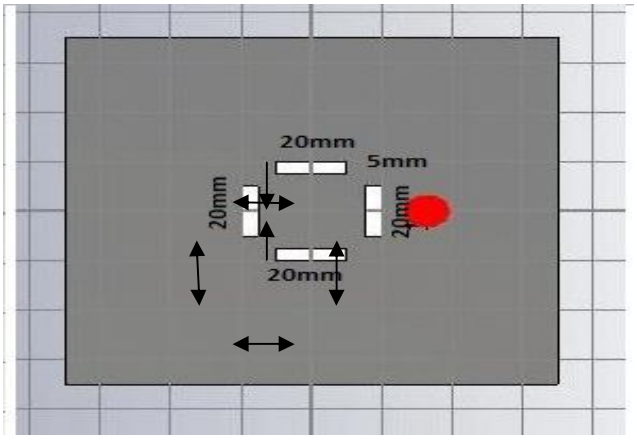

Fig 3. Defected ground structure of bottom view

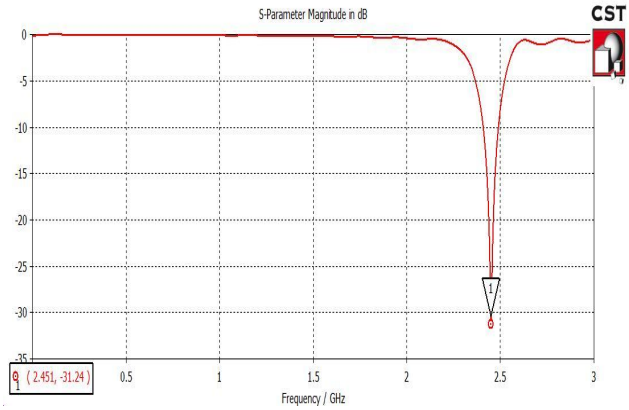

Fig 4. Return loss Vs. frequency with DGS

The return loss of cut coroner microstrip patch antenna with DGS is shown in fig.4 The increase in return loss 29dB to 31dB.

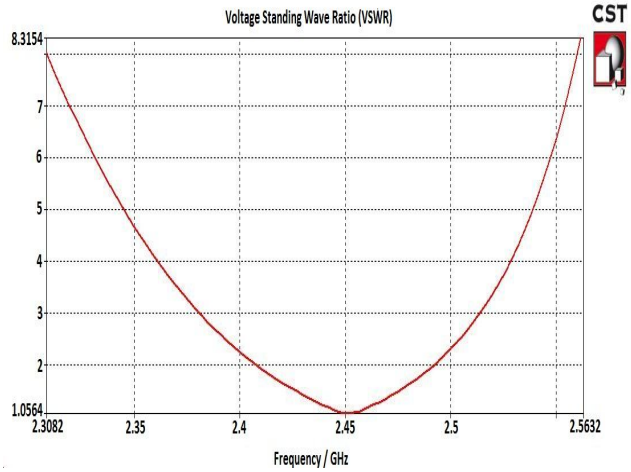

Fig 5. VSWR(Voltage standing wave ratio)

A rectangular slot of size 10mm×20mm is made on the back side of this circular polarized rectenna Which is shown in fig (4). This is Defected Ground Structure type Circularly rectenna. And the simulation result is shown in fig (5) VSWR to varies in under 2.42 to 2.48 and less than 2 and Bandwidth is respectively 94MHz.

Fig (6)& (8) Shows Absolute radiation pattern and angular radiation pattern of circularly polarized rectenna respectively, and Axial ratio of the rectenna is shown in fig(7).

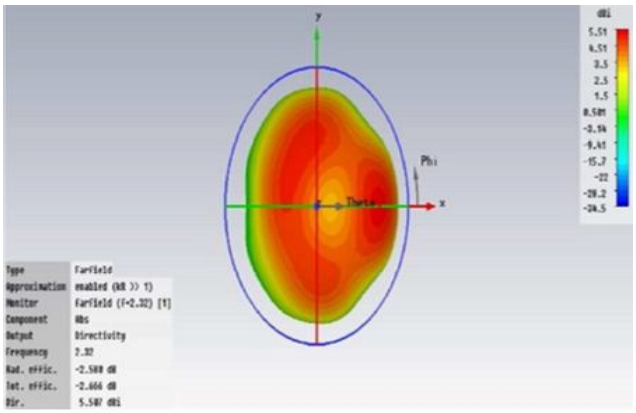

Fig 6. Absolute radiation pattern of CP Rectenna Fig

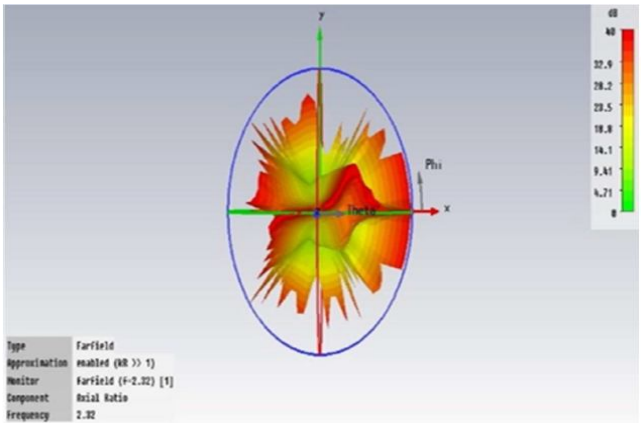

Fig 7. Axial Ratio of Circularly Polarized Rectenna

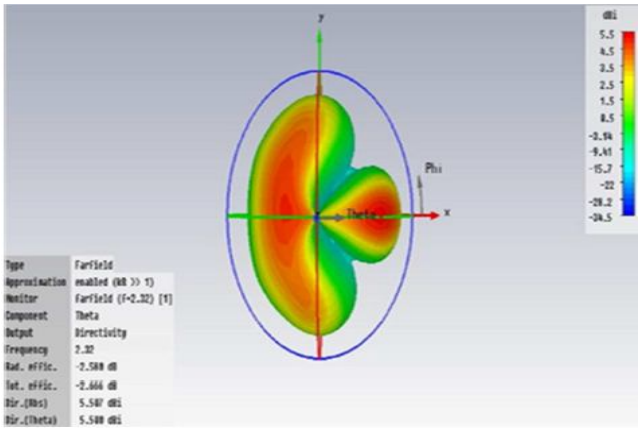

Fig 8. Angular radiation pattern of CP Rectenna

III. CONCLUSION

A Circularly Polarized Rectenna for microwave wireless power transmission at 2.45 GHz ISM Band. The proposed rectifying antenna should be useful as a virtual battery in application where the receiver is rotated relative to the transmitter. In this paper, we applied the concept of Defected Ground Structure. After applying DGS Gain and Bandwidth of Circularly Polarized Rectenna has increased. The gain is increased from 29 dB to 31.24 dB and bandwidth is increased from 92 MHz to 94 MHz.

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