

Rectenna Used for Energy Harvesting & Artificial Intelligence for Low Power Devices.

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ABSTRACT- *In the field of wireless power transmitting and receiving, we required the device which can have the ability to send or capture the power without wire. So the antenna has the ability of wireless power transmission and absorption. So this paper has the little bit contribution in the field of receive power without wire.*

KEYWORDS- *Energy Harvesting, Artificial Intelligence, Textile, Pspice Software, CST Software.*

1. INTRODUCTION

On the behalf of this paper we are focused on receiving the power for less energy consuming device and artificial intelligence. In the integration of transmission and receiving of power without wire this is the challenge for now days. The rectenna helps to operate the devices which are consuming very less amount of power. So the rectenna is the composition of rectifier and any kind of antenna which have the ability to transmit or receive the power at particular frequency. Then the rectifier circuit (made by using schottky diode and filter circuit) converts this power into direct current. The receiving power is in mille watt so it can operate some sensors which are used in artificial intelligence to send the information from one place to another or in control room.

2. RECTENNA DESIGN

2.1. Single band antenna

In this paper the textile antenna is designed by using micro strip technique and having the tortoise's structure. The antenna has the three layers. Middle layer is suggested as substrate, lower layer designed in particular manner act as ground and the upper layer which have the tortoise's structure named as patch it is nothing but the foil of copper tape having the suitable width. The simulation of this antenna is done by using CST Studio. This antenna connected to transmitting channel then the radio frequency is applied on it. If it connected to receiving end then it is connected to rectifier circuit. The structure of the patch and ground is shows in figure 1 and 2 respectively. The parameters of this antenna are shown in table 1.

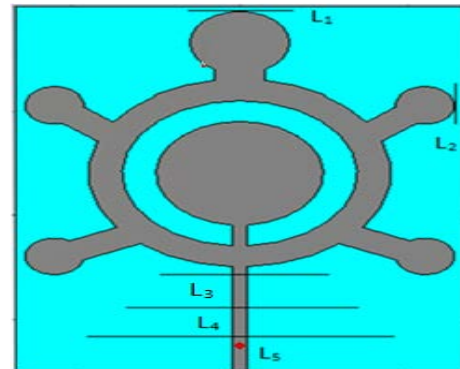


Fig. 1: Structure of antenna patch and geometry.

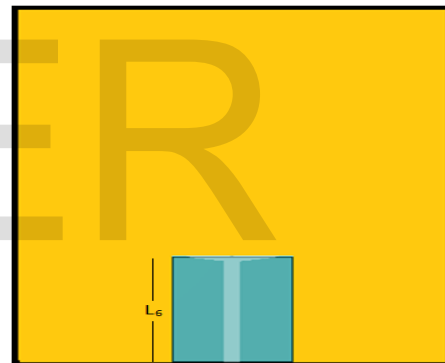


Fig. 2: Ground plane of proposed antenna geometry.

Table 1: Parameter of Designed textile antenna

S. No.	Antenna Parameter	Values
1.	Relative Permittivity (ϵ_r)	1.7
2.	Substrate Thickness (h)	1mm
3.	Ground Plane Dimension	15*20
4.	Upper circle diameter (L_1)	6mm
5.	Side circle diameter (L_2)	3.5mm
6.	Inner centre circle diameter (L_3)	8mm
7.	Middle circle inner diameter (L_4)	14mm
8.	Middle circle outer diameter (L_5)	18mm
9.	Ground length (L_6)	20mm

2.2. Rectifier circuit

The signal received by the rectenna, having small amount of energy and also alternating in nature so it is required to convert it into direct current. So rectifier with filter circuit is made by using schottky diode. Because it has minimum threshold value approx 140-150 mV.

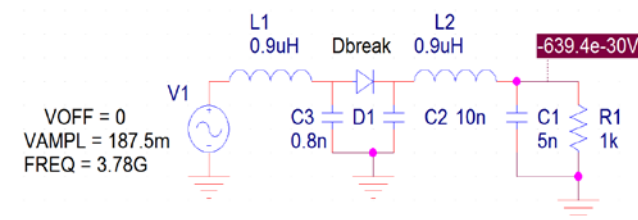


Fig. 3: Rectenna circuit with schottky circuit.

The input impedance of this type of diode is based on the radio frequency power. The designed rectenna circuit is shown in figure 3. L and C element are used in filter circuit having the value for 3.78 GHz are $L_1 = 0.9 \mu\text{H}$, $L_2 = 0.9 \mu\text{H}$, $C_1 = 5\text{nf}$, $C_2 = 10\text{nf}$, $C_3 = 0.8\text{nf}$ and $R_1 = 1\text{k}\Omega$.

2. RECTENNA FOR ARTIFITIAL INTELLIGENCE

Rectenna circuit used in artificial intelligence to operate small sensors to send the secrete information from one place to another. If this flexible antenna is fitted in the solders cloth then it receives the small amount of energy at particular frequency then by using this power we operate the sensor for gathering some information.

Another application as the purpose of artificial intelligence is that if we are designed the antenna which is not shows as genuine antenna like tortoise, missile ship cartoon etc to gather the energy then another person confused that it is antenna or not . and by using different well designed antenna we gathered energy to operate the sensors. So it is just the concept of the rectenna circuit used in artificial intelligence.

3. RESULT AND DISCUSSION

This antenna having resonant frequency is 3.78 GHz and the return losses at that frequency are very less as -55dB. Figure 5 shows the return losses versus frequency graph where 3.78GHz is resonant frequency. This rectenna circuit converts the radio frequency power into DC output by using the equation which is given below

$$P_D = (P_t * G_t) / 4 * 3.14 * R^2 .$$

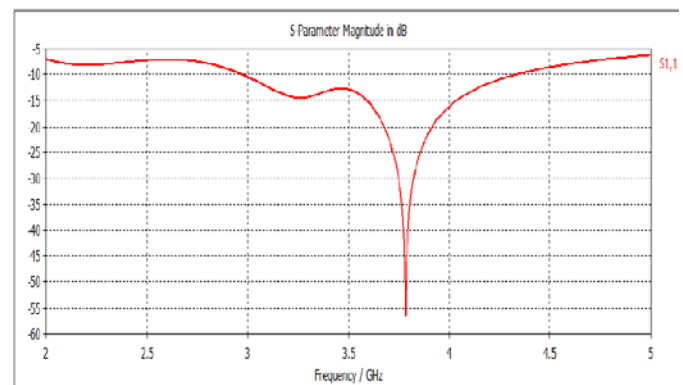


Fig. 4: Return loss Vs Frequency plot of designed antenna.

Figure 5 and 6 gathered the information about the estimated result by using Pspice software in which the output current and voltage across the load resistance of 1kΩ.

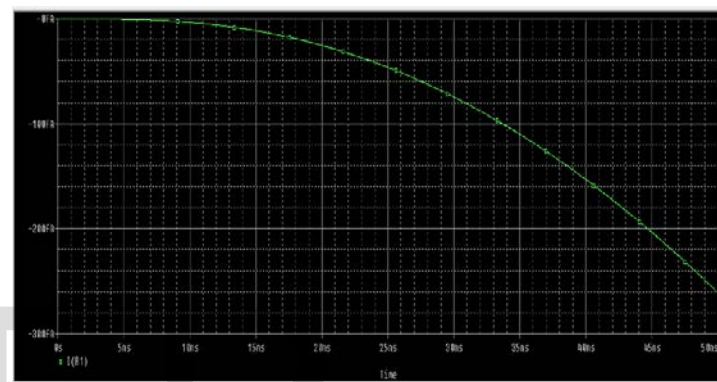


Fig. 5: output current at 1 kΩ load.

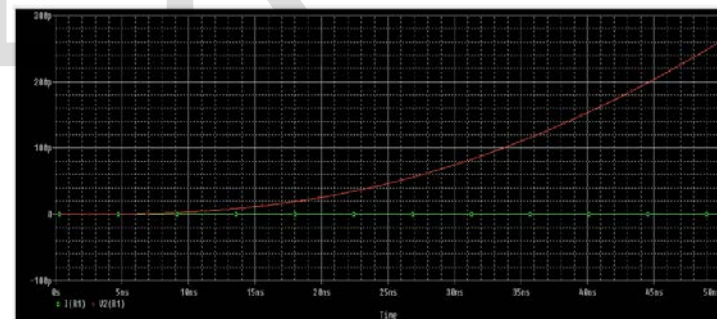


Fig. 6: output voltage at 1 kΩ load.

The overall efficiency (η_r) of rectenna can be calculated by

$$\eta_r = P_{\text{outDC}} / P_{\text{RX}} = (V_{\text{outDC}}^2 / R_L) / P_{\text{RX}} .$$

4. CONCLUSION

The rectenna circuit is designed by using CST Software for harvesting the energy at 3.78 GHz. This rectenna circuit is also used for artificial intelligence.

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