An Improved Slotted Patch Antenna for RFID Application

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Abstract- **This paper proposed a radio frequency identification (RFID) Reader Antenna which operates on ISM band with frequency range from 902 to 928 MHz and bandwidth of the antenna is 58MHz. Antenna consist of rectangular patches on Rogers RO4360 substrate with microstrip feed line. Return loss of the antenna comes out to be about -39.98 dB on behalf of the frequency 907MHz. Gain of the proposed antenna is 5.21dB. This antenna is simulated on CST Microwave Studio and the results are thoroughly discussed in the paper.**

Index Terms- **ultra high frequency (UHF); radio frequency identification (RFID); microstrip feed line**

I. INTRODUCTION

Radio frequency identification (RFID) has various applications, which includes identification and tracking of humans as well as animals, this can be done by tagging the antenna to the objects. Vehicular access control, hospitality, library, sports and healthcare are major applications of this RFID technique [1]. RFID is providing a replacement of the barcode with high reliability and more accuracy. Due to low cost and simplified design process patch antennas are popular and researchers are doing their work in this field [2, 3]. Return loss of the proposed antenna is much better than the general reference which is normally taken as -10dB. Voltage Standing Wave Ratio (VSWR) of the antenna is ≤ 2 and is 1.02 and gain of the antenna is 5.21dB, which is acceptable for Radio frequency identification application. Resonant frequency of the proposed antenna is 907MHz and is covering range from 879 to 937 MHz, thus bandwidth of the antenna is 58MHz [4, 5]. The total area covered by the proposed antenna is 100x75 mm^2. This Paper shows a simple patch antenna with waveguide feeding mechanism for 907 MHz radio frequency identification application.

II. RELATED WORK

In [1], a planer RFID reader antenna is proposed for UHF communication, this antenna is used to produce strong magnetic field with uniform field distribution. RFID applications are become popular because of their tracking and monitoring behaviour. RFID has shown their potentials in improving healthcare quality and reducing the medical errors in hospitals [2]. A miniature RFID antenna is proposed in [3], which is used for metal object detection. This antenna can detect the presence of metal within range of 1.5 meter and by using single-layer substrate; we can minimize the cost of RFID reader antenna. RFID tags are used by the suppliers to put on their packages shipped to warehouse centers. Packages have a reader and four antennas which are placed on top, bottom and two sides [4] [5]. A monopole tag antenna for RFID application is proposed in [6] and is capable of providing a maximum readable range of 5.6 meter along with isotropic radiated power of 4W. Antenna design given in [6] is very compact as compared to other tag designs and can easily integrate with other portable devices. In spite of small size of antenna, it is providing a good coverage and radiation performance. It has many advantages like fast and convenient operation, tolerance in different environment and identification of various fast moving objects[7]-[8]. [9-18] has shown optimized performance for antenna.

III. ANTENNA STRUCTURE

Fig. 1 shows the design of simple patch antenna for RFID Application, and corresponding dimensions are given in Table-1. The antenna is composed of rectangular patch and a microstrip feed line with waveguide port.

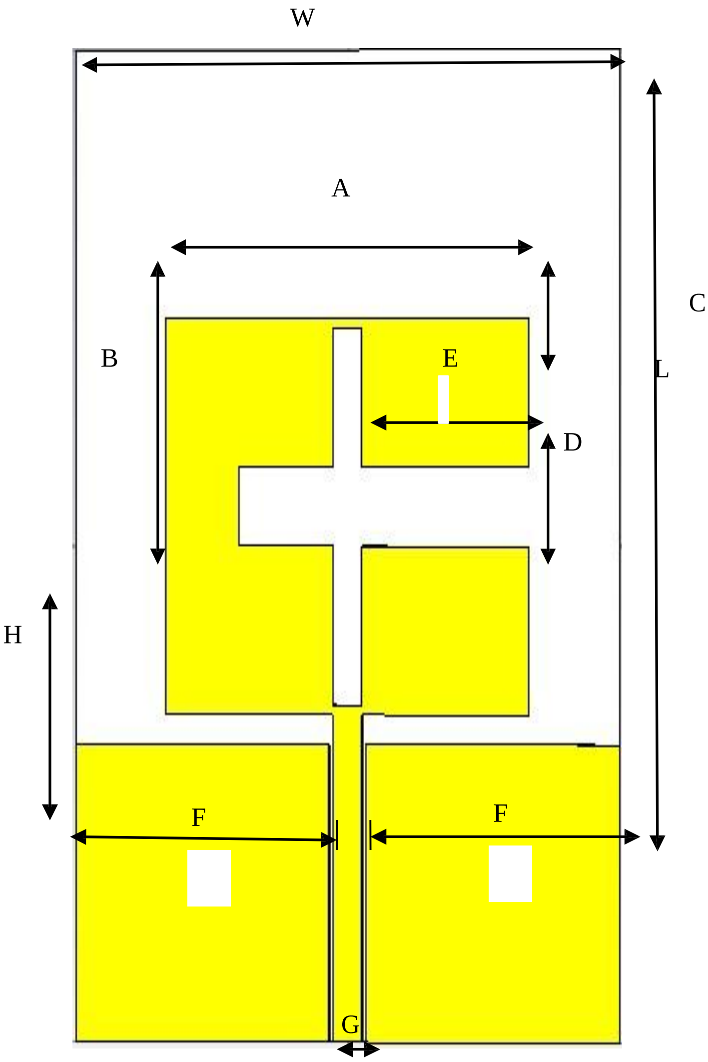

Fig 1. Configuration of Anticipated Antenna

IV. DESIGN SPECIFICATIONS

The anticipated antenna has been simulated on transient solver in CST Microwave Studio simulation software tool. This Antenna design simulator CST is installed on windows 7 very easily. List of considerations used in the design of antenna are specified further down in table 1.

Considerations of Proposed Antenna

Parameter	Value (mm)
W	75
L	100
A	50
B	40
C	12
D	20
E	23
F	22.5
G	4
H	30

This antenna was instigated on Rogers RO4360 substrate using thickness 0.5 mm and comparative dielectric permittivity is taken to be about 6.15.

V. RESULTS AND DISCUSSION

Simulation of the proposed antenna is done on CST Microwave Studio and results are described below. Fig. 2 displays return loss contrasted with frequency for the projected antenna and Fig. 3 describes gain of the antenna and Fig. 4 shows E-field and H-field, Voltage Standing Wave Ratio (VSWR) of the antenna is 1.02 and is shown in Fig. 5.Voltage Standing Wave Ratio (VSWR) of the antenna is ≤ 2 and is 1.02.

A. RETURN LOSS

Fig. 2 diagrams return loss contrasted with frequency for the planned antenna -10 dB return loss along with frequency of the proposed antenna ranges between 879 to 937 MHz, hence achieved bandwidth of the antenna is 58 MHz, which comes under ISM band range, so it can be used for the RFID applications [6, 7]. It has been observed that changing the dimensions of the patch of the antenna affect both return loss and frequency.

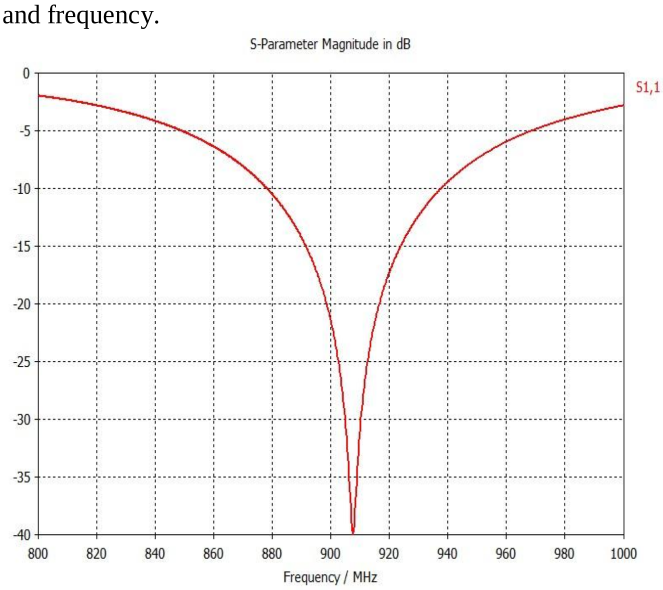

Fig. 2 Displays return loss contrasted with frequency

B. RADIATION PATTERN

The gain of an antenna is described as the intensity of radiation of the antenna in a particular direction, which relates the concept of directivity and electrical efficiency of antenna. [19]Radiation pattern is the representation of obtained gain, including direction as a function. [20-23] Gain of the proposed antenna is 5.21dB at the resonant frequency 900 MHz, which is shown in Fig. 3.

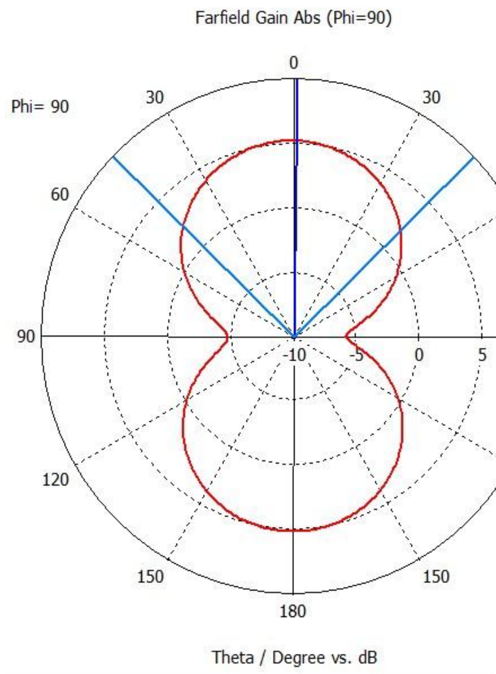

Fig. 3 Gain of proposed Antenna

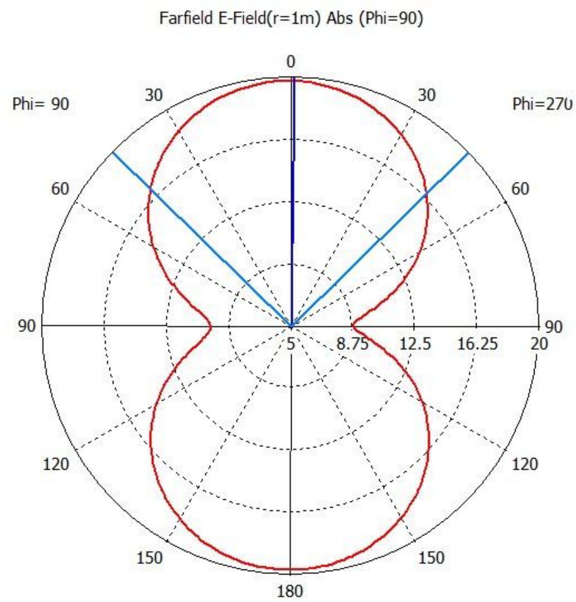

Fig 4(a). E-Field of Proposed Antenna

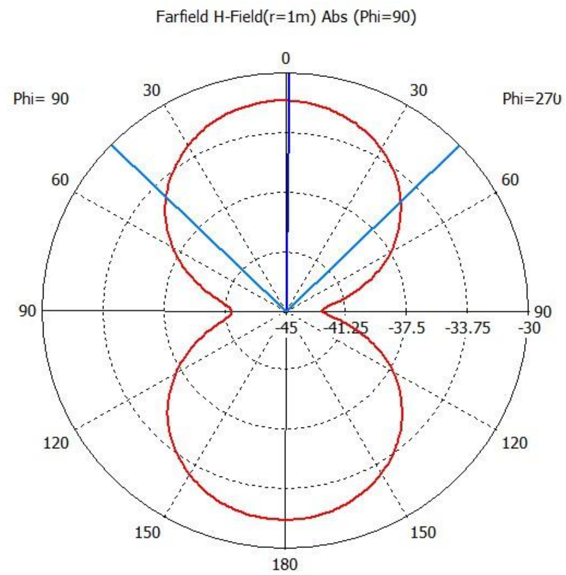

Fig. 4(b). H-field of proposed antenna

C. VOLTAGE STANDING WAVE RATIO (VSWR)

VSWR of the ideal antenna is 1, and is of proposed antenna 1.02, which is very close to ideal antenna for whole bandwidth of 58 MHz, which is shown in Fig. 5.

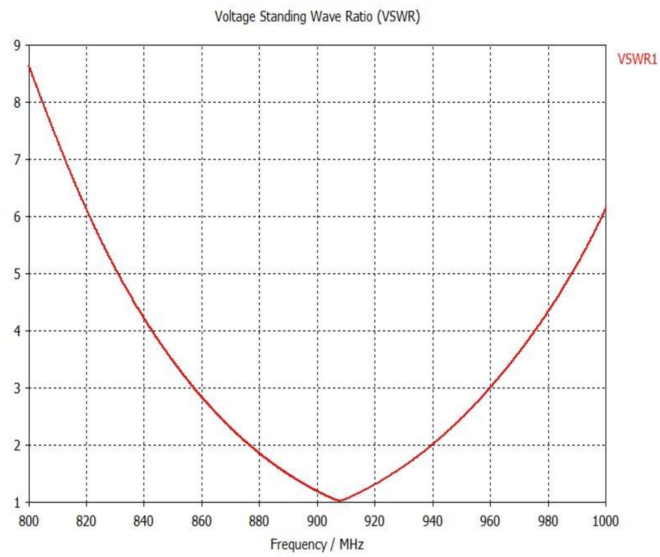

Fig. 5 VSWR of Proposed Antenna

IV. CONCLUSION

In this paper, simple patch antenna for RFID application has been proposed, which operates in frequency range 879 to 937 MHz Data rate of the RFID application in frequency range 902 to 928 MHz is moderate to high and covering range of antenna is 1 to 12 meter. The proposed antenna has shown good results in terms of return loss and VSWR. This antenna can be used in various RFID applications, like vehicular access control, Hospitals & healthcare, human identification, museum and sports. This antenna design fulfills the requirements of RFID applications but can also be used in other fields of wireless applications.

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