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High Gain Rectangular Microstrip Patch Antenna Employing FR4 Substrate for Wi-MAX, LMDS and MMDS Applications

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ABSTRACT
This paper presents an antenna for WiMAX, LMDS and MMDS system applications. FR4 material has been used as substrate having dielectric constant of 4.4. The Patch, Ground and feedline are made of copper. The proposed antenna is rectangular in shape which resonate at 3.42 GHz with a bandwidth of 45MHz (3.40GHz-3.44GHz) and corresponding return loss of -32.39 dB. The performance of the antenna has been analyzed in terms of return loss (dB), gain (dB), directivity (dBi), VSWR and impedance (ohms). The proposed antenna has directivity and gain of 7.2 dBi and 7.28 dB respectively.
Keywords: directivity, gain, rectangular patch, VSWR, WiMAX.

I. INTRODUCTION

Communication systems are becoming compact in size and hence compact antennas with improved performance are required for these communication systems. Telecom Regulatory Authority of India (TRAI) recommended 3.3-3.4GHz range for WiMAX. The ministry of communication initially released approximately 12MHz of spectrum in the 3.3GHz-3.4GHz. [1][2][3][4]. These antennas can be fed either through a coaxial cable or through strip line etched on the surface of antenna. Size reduction enhancement are becoming major challenges these days. In order to achieve the broadband performance of the microstrip antenna, some researchers have proposed a variety of antenna structure, such as sector slots, notch or slits in patch etc. [5][6][7][8][9][10]. The defected ground planes may also control electromagnetic waves propagating through the substrate layer and effect the performance of antenna.

Section II focus on the geometry of the proposed antenna and section III focus on the performance analysis of the proposed microstrip patch antenna.

II. ANTENNA GEOMETRY

The proposed antenna is rectangular in shape. The Fig.1 (a) and Fig.1 (b) demonstrates the geometry of the proposed antenna. In the proposed antenna design substrate of thickness 1.57mm is used. The FR4 (Flame Retardant) has been employed as substrate with dielectric constant of 4.4. The geometry of proposed antenna is shown in Fig.1 (d).

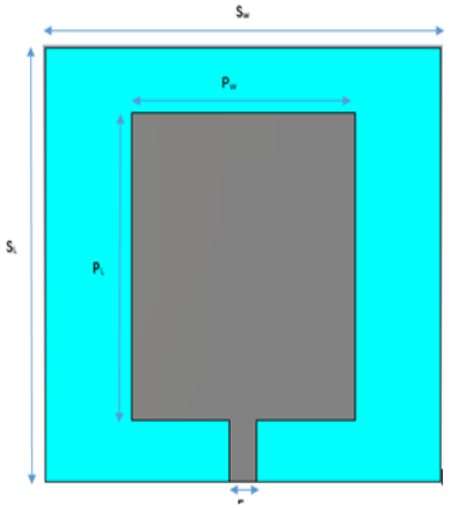

Fig. 1(A) Top View Of The Proposed Antenna

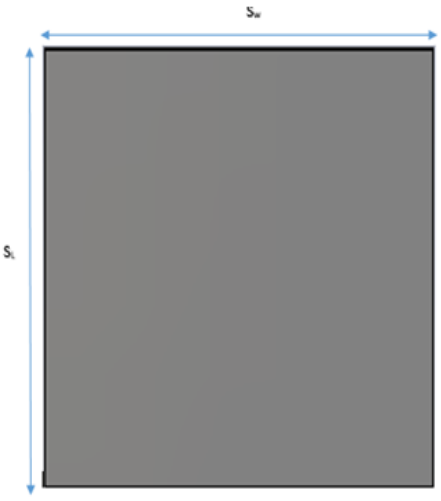

Fig. 1(B) Bottom View Of the Proposed Antenna

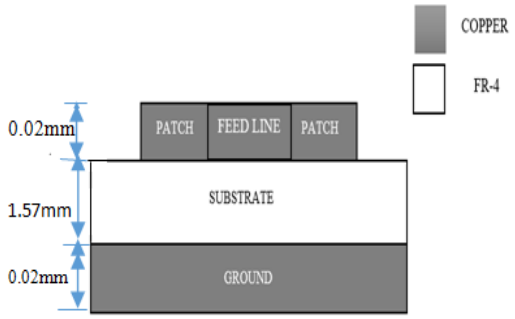

Fig. 1 (C) Front View of the Proposed Antenna

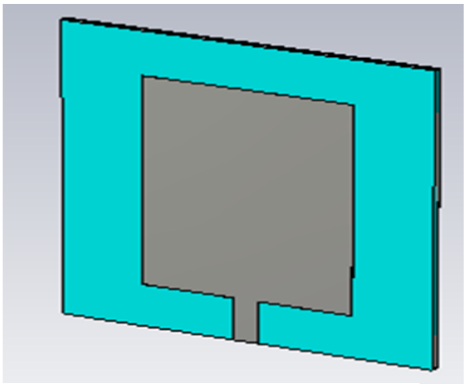

Fig. 1(D) 3-D View of the Proposed Antenna

Table 1 Antenna Dimensions

S.No	Parameters	Value(mm)
1.	Length of substrate, S_L	70
2.	Width of substrate, S_W	70
3.	Length of patch, P_L	39.67
4.	Width of patch, P_W	49.5
5.	Width of Feedline, F_w	4.8

III. RESULTS

The proposed system has been designed using CST Microwave Studio 2014 and the performance of the antenna has been analyzed in terms of return loss (dB), gain (dB), directivity (dBi), VSWR and impedance (ohms). The return loss plot illustrates that the antenna is resonant at 3.42GHz with the return loss of -32.39 dB as shown in Fig.2. The Smith chart plot of proposed antenna has been shown in Fig.3 which illustrates that the proposed antenna has impedance of 49.9 ohms. Fig. 4 and Fig.5 illustrates that proposed antenna has directivity and gain of 7.2 dBi and 7.28 dB respectively. The VSWR plot of the proposed antenna has been shown in Fig.6. The VSWR of the proposed antenna lies below the minimum accepted value i.e 2. The Fig.7 shows the power flow of the proposed antenna.

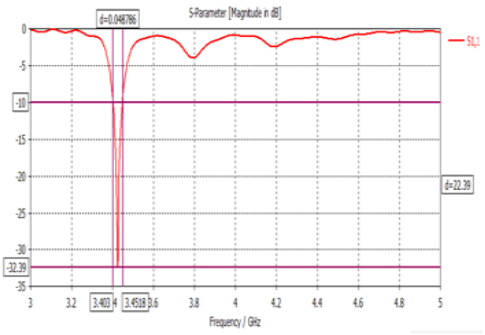

Fig. 2 Return Loss Plot Of The Proposed Antenna

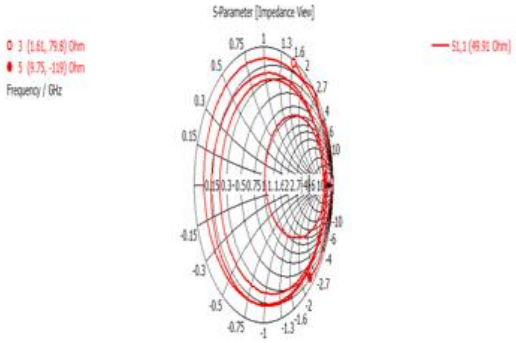

Fig. 3 Smith Chart Plot Of The Proposed System

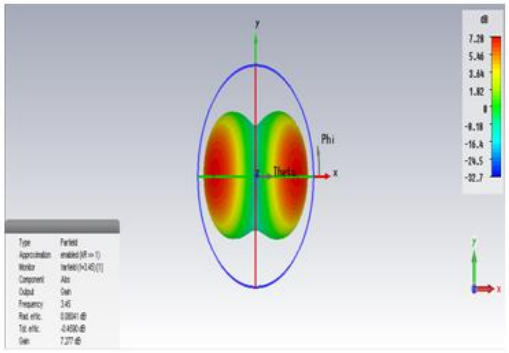

Fig. 4 Gain Of The Proposed Antenna

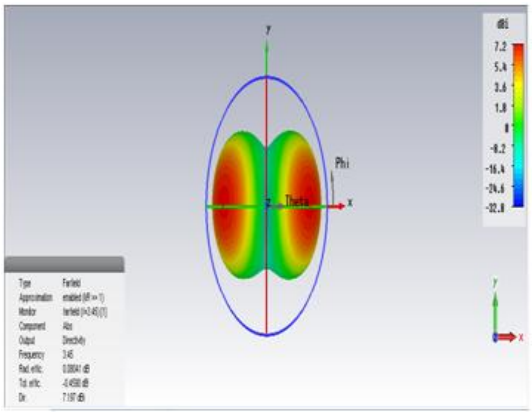

Fig. 5 Directivity Of The Proposed Antenna

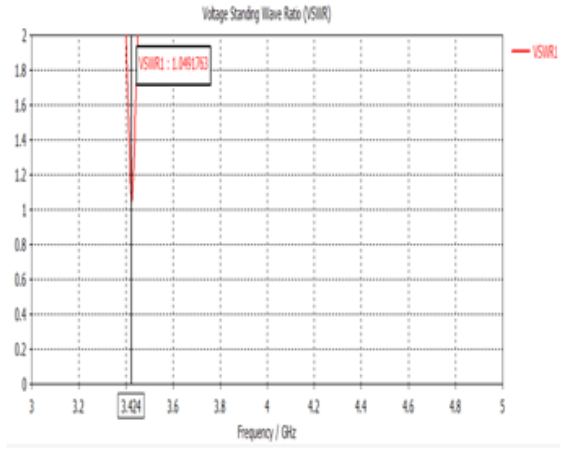

Fig. 6 VSWR Plot Of The Proposed Antenna

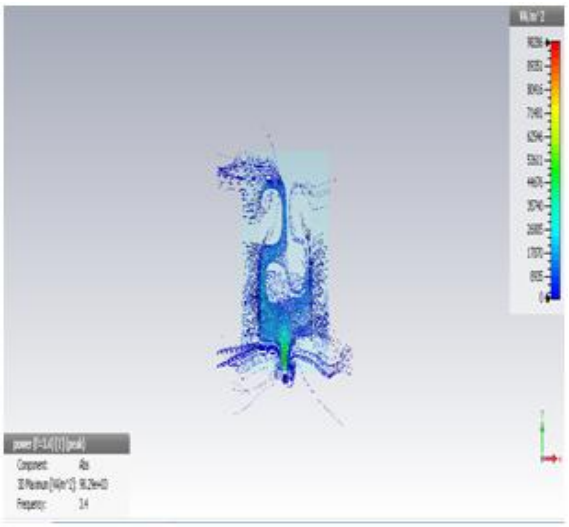

Fig. 7 Power Flow Pattern of the Proposed Antenna

IV. CONCLUSION

In this paper, the microstrip patch antenna with a resonant frequency of 3.42GHz has been designed and proposed. The proposed antenna has been designed and simulated using CST Microwave Studio 2014. This paper presents an antenna having high gain of 7.28 dB and directivity of 7.2 dB with impedance bandwidth of 45MHz (3.40GHz - 3.44GHz). The proposed antenna can be suitably employed for WiMAX, LMDS and MMDS system applications.

V. ACKNOWLEDGEMENT

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