 ISSN: 2250–3676

[IJESAT] INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE & ADVANCED TECHNOLOGY Volume-2, Issue-4, 840 – 845

A COMPACT PRINTED ANTENNA FOR MOBILE COMMUNICATION

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Abstract

In recent years, great interest was focused on microstrip antennas for their small volumes, low profiles, good integration, low costs and good performance. With the continuous growth of wireless communication service and the constant miniaturization of communication equipment, there are higher and higher demands for the volume of antennas, integration and working band. A single feed single layer compact rectangular microstrip antenna application is proposed in this paper. Two L slits are introduced at the right edge of the patch to reduce the resonant frequency. An extensive analysis of the return loss, radiation pattern and efficiency of the proposed antenna is shown in this paper. The resonant frequencies are obtained at .9 GHz, 1.41GHz, 1.94 GHz, 3.32GHz, 5.44 GHz and 5.8 GHz with bandwidth of 10 MHz, 12 MHz, 14 MHz, 41MHz, 88MHz & 96 MHZ & return loss of –16.06, -16, -14.12, -12,-23 & -14.7 dB respectively. The size of the antenna has been reduced by 80 % when compared to a conventional microstrip patch. The characteristics of the designed structure are investigated by using MOM based electromagnetic solver, IE3D. The simple configuration and low profile nature of the proposed antenna make it suitable for the applications in mobile communication system.

Index Terms: *Conventional, Compact, patch, slit.*

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1. INTRODUCTION

The use of microstrip antennas[6-8] in various mobile communication[1-2] systems are increasing day by day as it meets many requirements for practical applications such as low profile, easy to mount, light weight, easy to integrate with monolithic microwave integrated circuits. Our aim is to reduce the size of the antenna as well as increase the operating bandwidth. The size of the antenna is effectively reduced by cutting two L slit on the patch. The simulation has been carried out by IE3D [9] software which uses the MOM method Due to the Small size, low cost and low weight this antenna is a good candidate for the application of GSM,WLAN and WiMax[3-5] technology.

2. ANTENNA DESIGN

The configuration of the proposed antenna is shown in Figure 1.The antenna is a 58 mm x 48 mm rectangular patch. The dielectric material selected for this design with ε_r=2.4 and substrate height =1.6 mm. A 50Ω inset microstrip line feed is attached to the patch & has a width w_3 (4 mm) and length l_1 (28.5 mm)

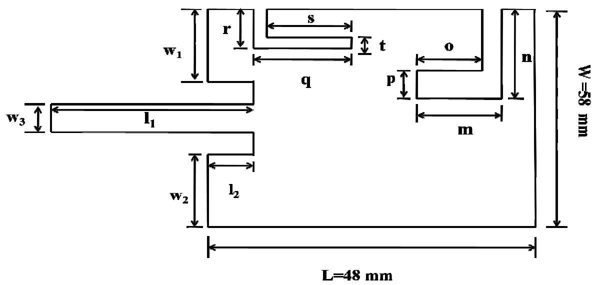

Fig-1: Antenna 2 Configuration

The optimal parameter values of the antenna are listed in Table1 & 2.

Table-1:

Parameters	m	n	o	p	w_1
Values(mm)	17.5	28.5	15.4	6	24

Table-2:

Parameters	q	r	s	t	l_2	w_2
Values(mm)	9	13.8	7	1.8	12.5	22

3. SIMULATED RESULTS & DISCUSSION

Simulated (using IE3D [10]) results of return loss of the Conventional & proposed antenna are shown in Figure 2 & 3. A significant improvement of frequency reduction is achieved in with respect to a conventional microstrip antenna.

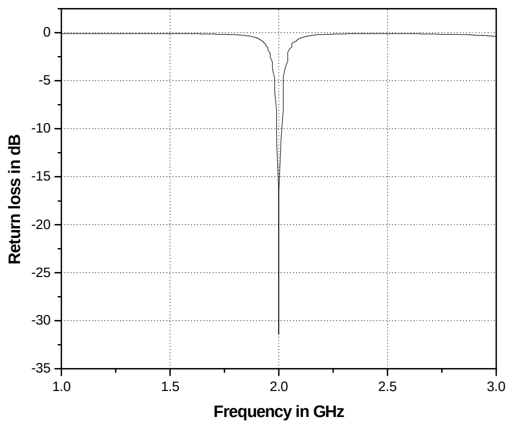

Fig-2: Return loss of the conventional antenna

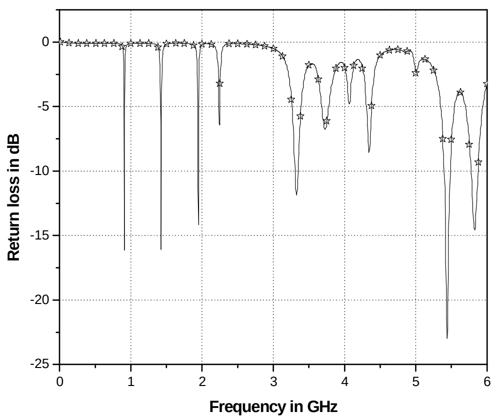

Fig-3: Return loss of the proposed antenna

In Conventional antenna only one frequency is obtained below -10 dB which is 2 GHz & return loss is found about -31.4 dB with 23.6 MHz bandwidth. For the proposed antenna resonant frequencies are .9 GHz, 1.41GHZ, 1.94 GHz, 3.32 GHz, 5.44 GHz, 5.8 GHz and their corresponding return losses are -16.06 dB, -16 dB , -14.12 dB, -12 dB, -23 dB & -14.7 dB respectively. Simulated 10 dB bandwidths are 10MHz, 12 MHz, 14 MHZ, 41 MHz, 88 MHZ & 96 MHz respectively.

3.1 Simulated radiation pattern

The simulated E & H plane radiation patterns for proposed antenna are shown in Figure 4-9.

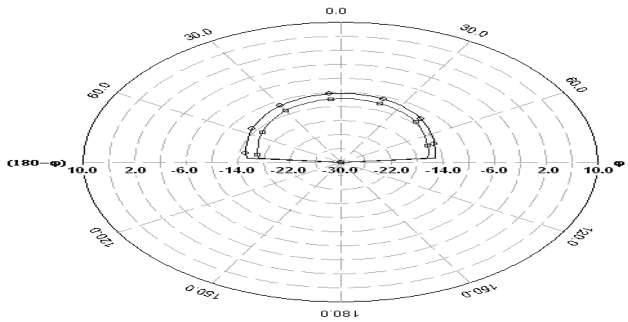

Fig -4: (a) E plane Radiation Pattern of the antenna 2 at .9 GHz

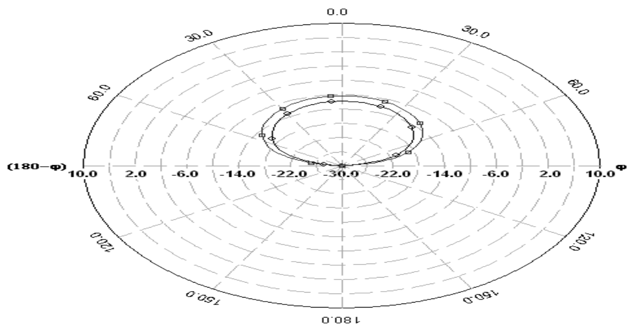

Fig -4: (b) H plane Radiation Pattern of the antenna 2 at .9 GHz

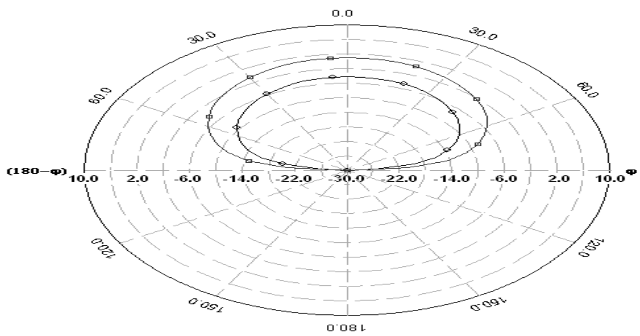

Fig -5: (a) E plane Radiation Pattern of the antenna 2 at 1.41 GHz

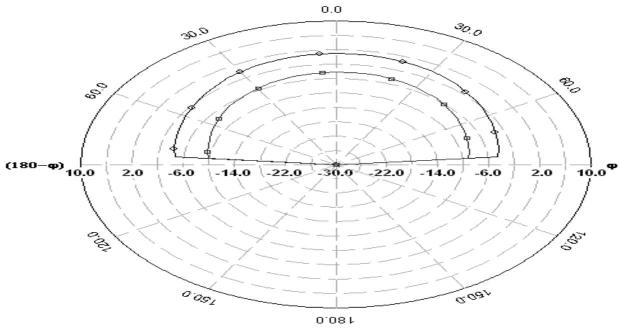

Fig -5: (b) H plane Radiation Pattern of the antenna 2 at 1.41 GHz

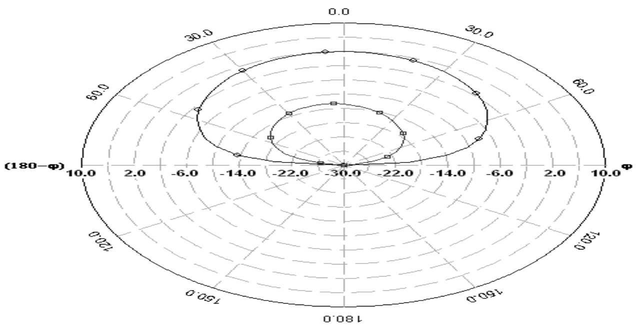

Fig -6: (a) E plane Radiation Pattern of the antenna 2 at 1.94 GHz

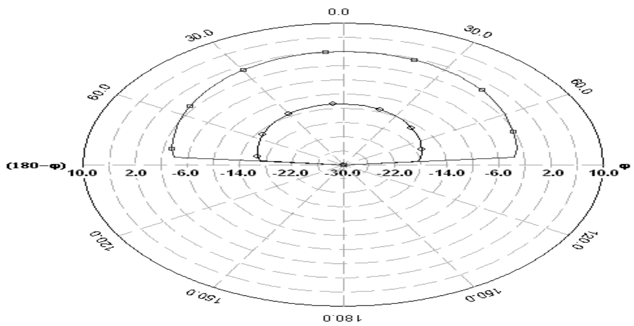

Fig -6: (b) H plane Radiation Pattern of the antenna 2 at 1.94 GHz

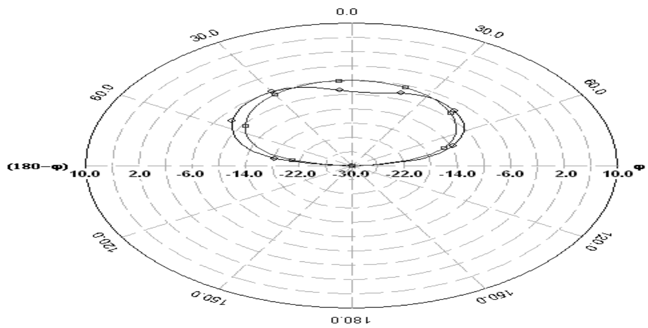

Fig -7: (a) E plane Radiation Pattern of the antenna 2 at 3.22 GHz

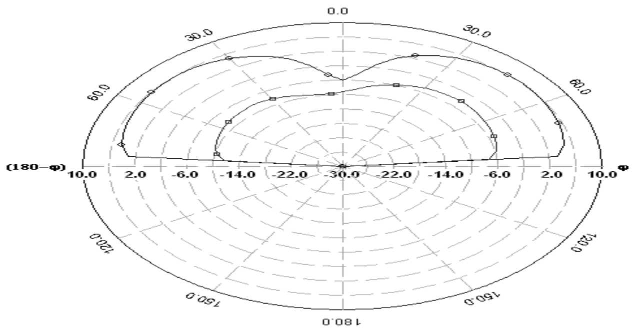

Fig -7: (b) H plane Radiation Pattern of the antenna 2 at 3.22 GHz

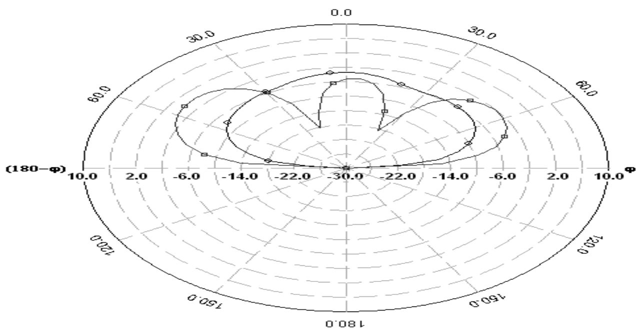

Fig -8: (a) E plane Radiation Pattern of the antenna 2 at 5.44 GHz

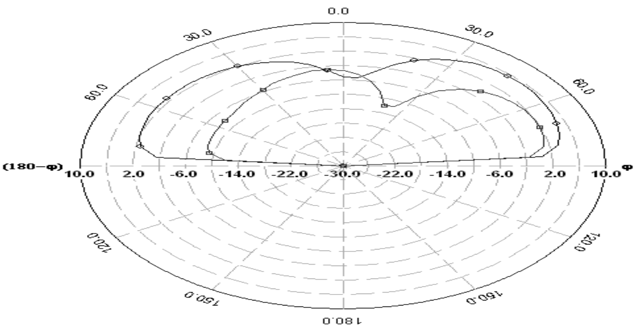

Fig -8: (b) H plane Radiation Pattern of the antenna 2 at 5.44 GHz

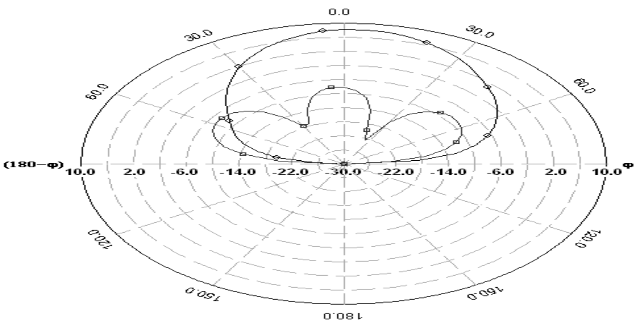

Fig -9: (a) E plane Radiation Pattern of the antenna 2 at 5.8 GHz

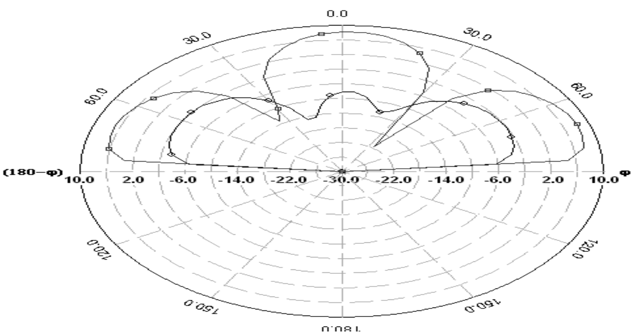

Fig -9: (b) H plane Radiation Pattern of the antenna 2 at 5.8 GHz

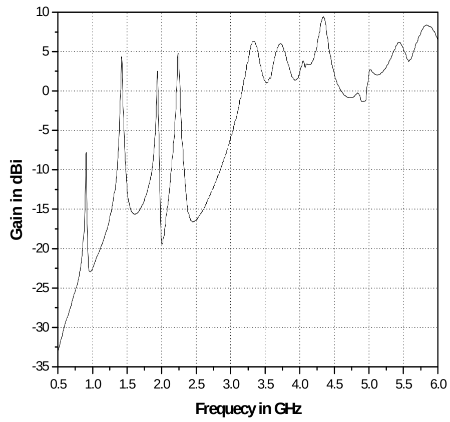

Fig -10: Gain versus frequency plot of the antenna 2.

Figure 10 shows the Gain versus frequency plot for the antenna 2.It is observed that maximum gain is about 8.35 dBi for 5.8 GHz.

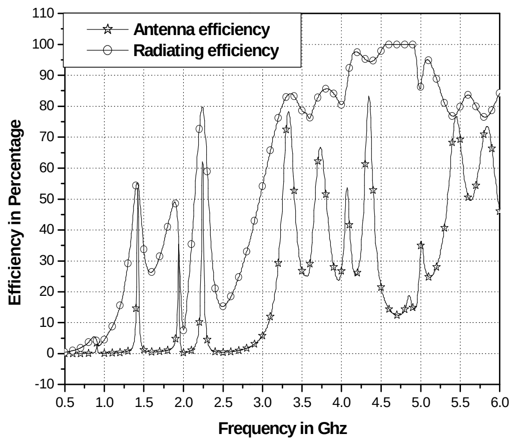

Fig -11: Antenna efficiency versus frequency plot for the antenna 2.

Efficiency of the antenna with the variation of frequency is shown in figure 11. It is found that maximum antenna efficiency is about 78% for 3.32 GHz.

4. EXPERIMENTAL RESULTS

Comparisons between the measured return losses with the simulated ones are shown in Fig.12 and 13. All the measurements are carried out using Vector Network Analyzer

(VNA) Agilent N5 230A.The agreement between the simulated and measured data is reasonably good. The discrepancy between the measured and simulated results is due to the effect of improper soldering of SMA connector or fabrication tolerance.

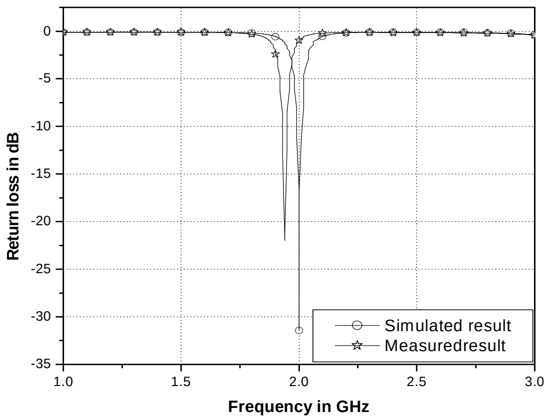

Fig-12: Comparison between measured and simulated return losses for antenna1

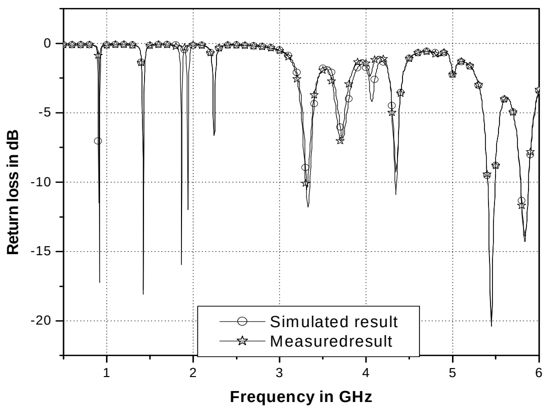

Fig-13: Comparison between measured and simulated return losses for antenna2

5. CONCLUSION

A single feed compact L slits microstrip patch antenna has been proposed in this paper. It is shown that the proposed antenna can operate in six frequency bands. Due to slits maximum bandwidth of the antenna is 96 MHz with a return loss of -14.7 dB and absolute gain about 8.35dBi. Size of the antenna has been reduced by 80% when compared to a conventional microstrip patch. Change of the parameter values of the slit may reduce the size of the patch area more than 80 % but an optimization between size reduction and gain-bandwidth performance is maintained in this work.

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BIOGRAPHIES

Barun Mazumdar was born in India, W.B, in 1985. He received the B.Tech, M.Tech degrees from West Bengal University, India in 2008and 2011 respectively. From 2009-2011 he worked as lecturer and from 2011 to till date he is working as Assistant professor in Electronics Engineering. He has published 10 papers in International journals & 8 papers in national & international conferences. His research of interests includes antennas & microwave.