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Design of Compact Printed Antenna for UMTS & WiMAX Applications

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Abstract:- In telecommunications, there are several types of microstrip antennas, the most common of which is microstrip patch antenna. Patch antennas are also relatively inexpensive to manufacture and design because of simple 2D physical geometry. In this paper Two L slits are introduced at the both edge of the patch to reduce the resonant frequency. The proposed antenna is developed to operate in the WiMax frequency ranges of 2.5-2.69 GHz & 3.2-3.8 GHz. The size of the antenna has been reduced by 73 % when compared to a conventional microstrip patch.

Keywords:- Conventional,patch,slit.

I. INTRODUCTION

Microstrip patch antennas [1] are popular in wireless communication [7-8], because they have some advantages due to their conformal and simple planar structure. They allow all the advantages of printed-circuit technology. There are varieties of patch structures available but the rectangular, circular and triangular shapes [2] are most frequently used. WiMax [3-6] stands for Worldwide Interoperability for Microwave access and it has been established by the IEEE 802.16 working group. It has three operating bands, the low band (2.5-2.69 GHz), the middle band (3.2-3.8 GHz) and the upper band (5.2-5.8 GHz). The work to be presented in this paper is also a compact microstrip antenna design obtained by cutting L slits on the both edge of the patch. Our aim is to reduce the size of the antenna as well as increase the operating bandwidth. In this paper resonating frequencies are obtained at 2.03 at -16.37 dB, 2.65 at -14.56 dB & 3.42 at -21.06 dB with bandwidth of 15.02, 12.72 , 42.36 MHz respectively.

II. ANTENNA DESIGN

The configuration of the proposed antenna is shown in the fig 1. The antenna is a 24 mm x 18 mm rectangular patch. The dielectric material selected for this design is an FR4 epoxy with dielectric constant (ε_r) =4.4 and substrate height (h) =1.5875 mm.

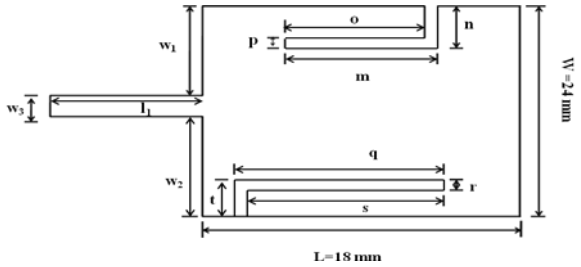


Fig. 1: Antenna Configuration

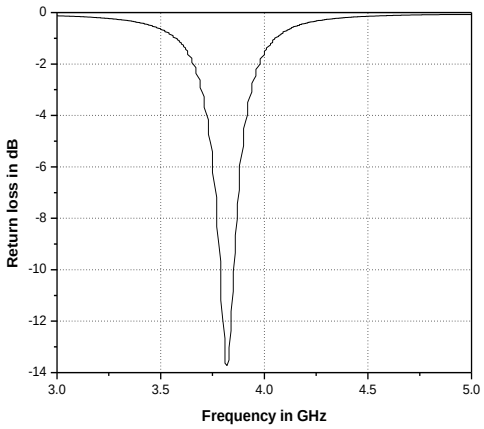
The optical parameter values of the antenna are listed in the table :

Table :

Parameters	m	n	o	p	w_2	l_1	q	r	s	t	w_1	w_3
Values (mm)	12.25	3.25	11.75	.5	11.8	6.3	13.15	.5	12.65	4.25	11.5	.7

III. SIMULATED RESULTS AND DISCUSSION

The simulated return loss of the conventional antenna (antenna 1) and the proposed antenna (antenna 2) is shown in Fig. 2 which is done by IE3D [11] software.



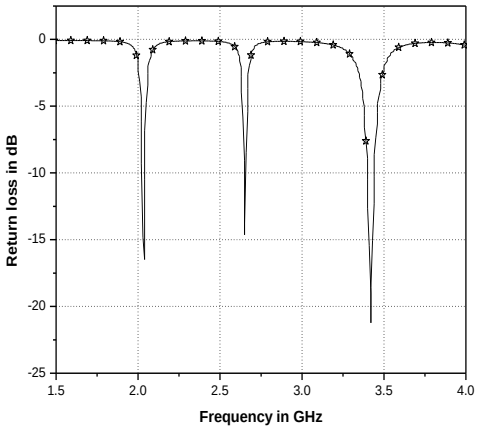


Fig. 2 : (a) Return loss of the conventional antenna **Fig. 2 :** (b) Return loss of the proposed antenna

In conventional antenna return loss found of about -13.72 dB at 3.82 GHz and corresponding bandwidth is 63.31 MHz. For antenna 2 return losses -16.37 dB is obtained at 2.03 GHz, -14.56 dB at 2.65 GHz & -21.06 dB at 3.42 GHZ and corresponding 10 dB bandwidth is 15.02 MHz, 12.72 & 42.36 MHz respectively.

Simulated Radiation pattern

The simulated E –H plane radiation patterns for proposed antenna are shown in Figure 3-5.

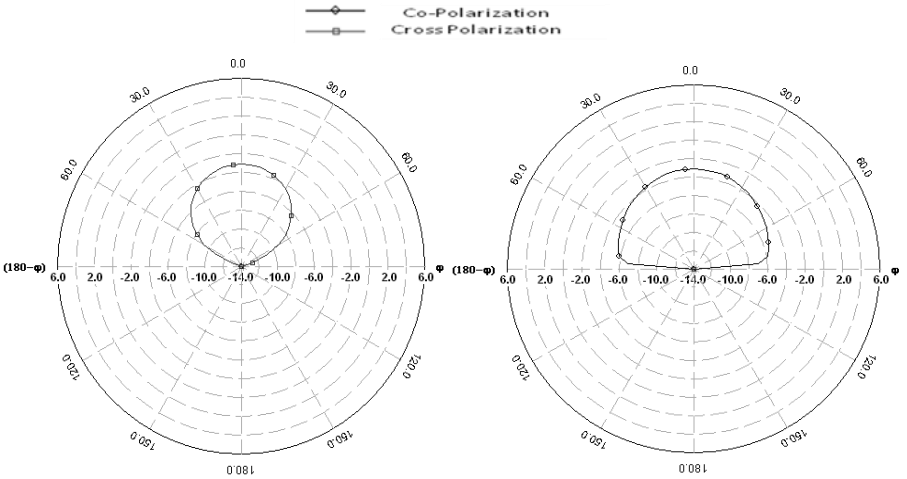


Fig. 3 : (a) E plane Radiation Pattern of the antenna for 2.03 GHz
(b) H plane Radiation Pattern of the antenna for 2.03 GHz

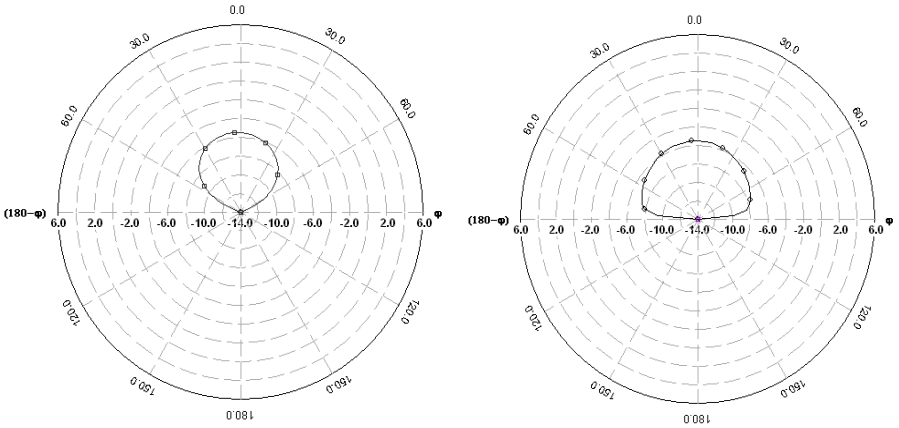


Fig. 4 : (a) E plane Radiation Pattern of the antenna for 2.65 GHz
(b) H plane Radiation Pattern of the antenna for 2.65 GHz

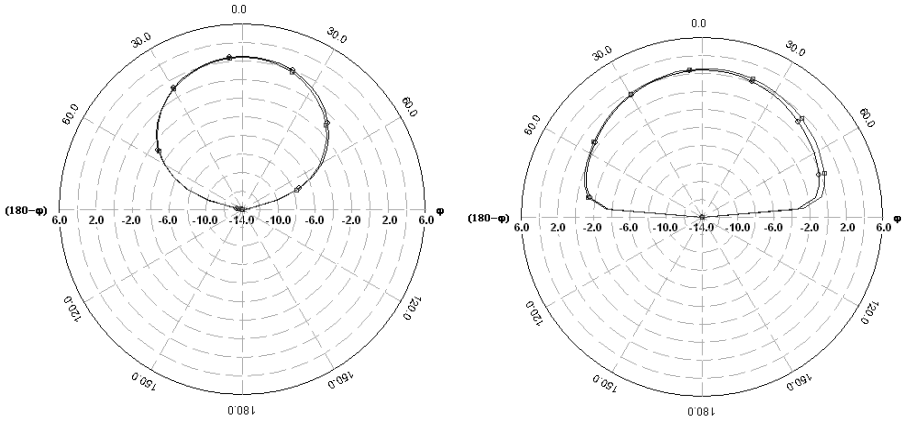


Fig. 5 : (a) E plane Radiation Pattern of the antenna for 3.42 GHz
(b) H plane Radiation Pattern of the antenna for 3.42 GHz

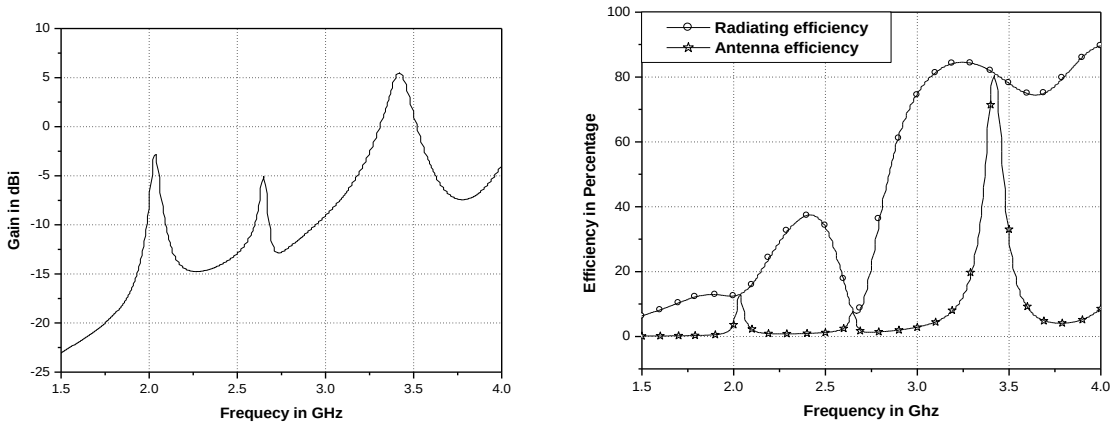


Fig. 6 : Gain versus frequency plot for the antenna 2.
Fig. 7 : Antenna efficiency versus frequency plot for the proposed antenna.

Figure 6 shows the Gain versus frequency plot for the antenna 2.It is observed that maximum gain is about 5.42 dBi for 3.42 GHz. Efficiency of the antenna 2 with the variation of frequency is shown in figure 7. It is found that maximum antenna efficiency is about 80 % for 3.42 GHz.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

Comparisons between the measured return losses with the simulated ones are shown in Fig. 8 and 9. All the measurements are carried out using Vector Network Analyser (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.

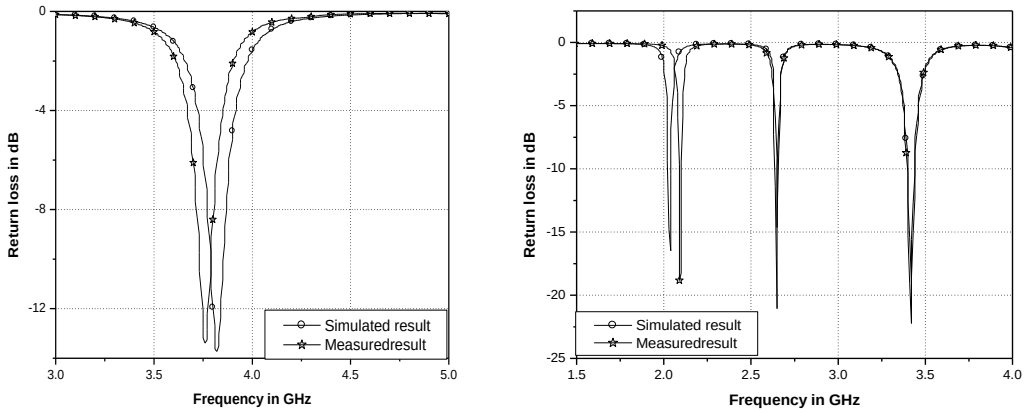


Fig. 8 : Comparison between measured and simulated return losses for conventional antenna.
Fig. 9 : Comparison between measured and simulated return losses for proposed antenna.

V. CONCLUSIONS

A single feed single layer two L slits microstrip antenna has been proposed in this paper. It is shown that the proposed antenna can operate in three frequency bands. The slits reduced the size of the antenna by 73 % for the resonant frequency 2.03 GHz and increase the bandwidth up to 42.36 MHz with a return loss of -21.06 dB. An optimization between size reductions with multiband operation is maintained in this work.

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