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T-plated Microstrip Antenna For dual band WLAN and WiMAX applications

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***Abstract*---The article is all about the multiband microstrip patch antenna designed for WLAN and WiMAX applications. The proposed antenna consists of a T-shaped patch which gives dual band. The multiband characteristics are obtained by adding a T-shaped rectangular patches on a substrate of 0.8mm height. The designed antenna is a dual band antenna. The two bands lie in frequency range (2.36-2.71GHz)/2.49GHz and (5.26-5.52GHz)/5.39 GHz includes all the operating bands of WLAN and WiMAX applications as per IEEE 802.11a/b/g/n standards with 14% and 4.81% impedance bandwidth respectively.**

I. INTRODUCTION

Any communication is only possible when there is a transmitter, receiver and a communication channel in between. Hence the antennas are the backbone of any communication system . Today it's not only the concern of communication but the modern world is characterised by the development of wireless communication and compact systems. Hence such system require an antenna which are compact in size and are be applicable for wireless communication .Such a need of antenna is fulfilled by the microstrip patch antenna which are conformal and hence can be mounted directly on devices but this is not only the advantage of using microstrip antennas the other merits are there low cost , ease of manufacturing them in bulk as well as low power consumption. All the advantagesmentioned above make microstrip patch antennas highly suitable for applications like WLAN, WiMAX, satellite communication and many more .Due to this patch antennas occupy a special place in satellites ,mobile phones etc and almost in every other wireless device we are using in our daily life .

According to IEEE standards 802.11 a/b/g/n WLAN operates at frequency bands 2.4 GHz (2.40–2.484 GHz), 5.2 GHz (5.15–5.35 GHz), 5.8 GHz (3.585– 5.825 GHz) and WiMAX operates at 2.4

GHz (2.5–2.8 GHz), 3.5 GHz (3.2–3.8 GHz) and 5.5 GHz (5.2–5.8 GHz).So there is need of antenna which can be operated on multiple frequencies.

Comparison of proposed design with various antenna designs for WLAN and WiMAX applications like split ring slot [1], L slotted microstrip fed monopole antenna[2] indicates that the antenna proposed in this paper is relatively compact and simple in design, which would prove to be beneficial in manufacturing the antenna.

In this paper, a T shaped patched antenna is presented which covers the WLAN 2.4 GHz and WiMAX 2.4 GHz frequency bands. The maximum % impedance bandwidth covered by the antenna is 14%.A simple and compact antenna with good radiation pattern is proposed in this paper.

II. ANTENNA GEOMETRY

The geometrical figure of antenna with its dimensions is given in fig :1. The proposed antenna consist of a substrate of dimensions WsubX Lsub(30X30 mm^2).

The dimensions of the antenna are calculated with the help of given formula.

$Wp = c/2fr\ (2/\epsilon r + 1)^{½}$

$\varepsilon reff = (\epsilon reff + 1)/2 + (\epsilon reff - 1)/2[1+12h/wp]^{-1/2}$

$Leff = c/2fr(\epsilon reff)^{-1/2}$

$\Delta L = 0.412\ h[(\epsilon reff+0.3)(wp/h+0.264)]/[(\epsilon reff - 0.258)(wp/h +0.8)]$

$Lp = Leff - 2\Delta L$

Where, c (= 3×10^8 m/s) is the speed of light.

The overall dimensions of ground are Wg X L_g(30 X 2 mm^2). The antenna consists of rectangular patches of T shape which are designed so to obtain the multiband characteristics. FR4_epoxy substrate of thickness h (0.8 mm) is used to fabricate the antenna and it is fed by a 50 ohm microstrip line of dimensions W_f X L_f (4X12 mm^2) . All the dimensions of the proposed design are given in the design itself (All dimensions are in mm.). Fig 1 and Fig 2

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shows the front view and bottom view of proposed antenna.

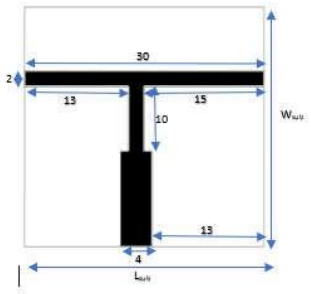

Fig 1:Front view of antenna

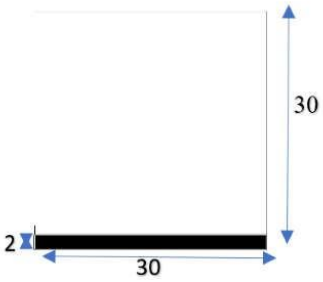

Fig 2: Bottom view of antenna

III. RESULTS AND DISCUSSION

The antenna proposed in the article is designed, simulated using HFSS13.0 software and it's characteristics are studied on the basis of s11 parameters current distribution and radiation pattern of antenna. Here there is a brief overview of simulated results at different stages of antenna .return loss curve of proposed antenna is shown in fig3 .the proposed antenna is a dual band with frequency bands of (2.36- 2.71GHz)/2.49Ghz and (5.26-5.52GHz)/5.39GHz that covers the frequency band of WLAN and WiMAX with the different return loss curves are observed at different length, the modification in length of ground surface (Lg) is done to obtain a better dual band return loss curve which can be clearly observed in the final return loss curve in the proposed antenna .

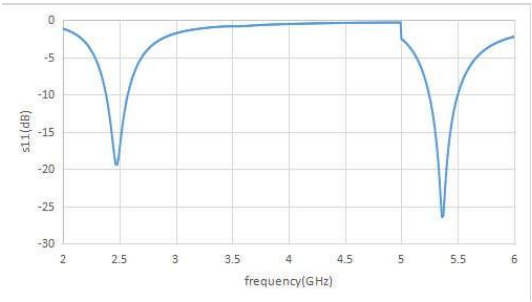

Fig:3-return loss curve of antenna

Fig 4 represents the design of proposed antenna at stage one with its dimensions whereas Fig 5 shows the return loss curve at this stage.

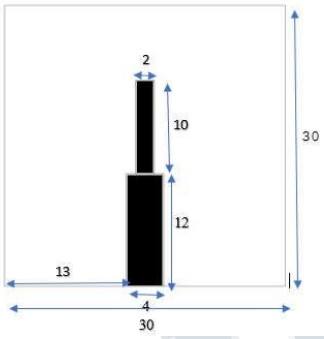

Fig 4- Stage 1 of proposed antenna

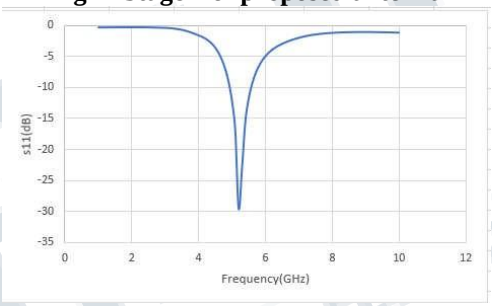

Fig 5-Return loss of stage 1

Further a rectangular patch is added to improve the return loss curve and obtain dual band characteristics. Fig 6 shows the stage 2 of proposed antenna with its return loss curve in fig 7.

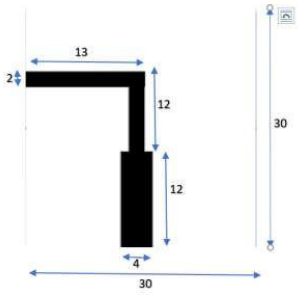

Fig-6 Stage 2 of antenna

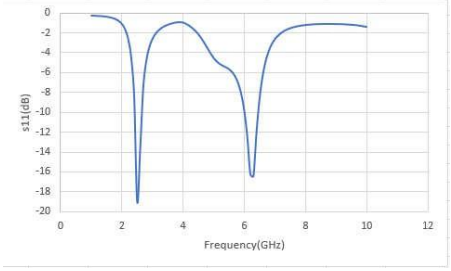

Fig 7-Return loss curve of stage 2

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To improve the s11 characteristics as per requirement the T-Shaped patch is proposed as shown above.

Figure 8 (a), Figure 8(b) shows the current distribution on surface of patch that defines the modification of field current at different frequencies.

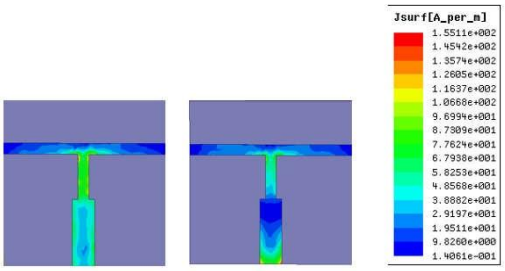

Fig-8(a),(b) - surface field current at different frequencies of antenna.

The gain verses frequency curve is shown in figure 9 maximum gain observed is 4.31 dB for band1 (2.36-2.71GHz)/2.49Ghz and 3.55 dB for band2 (5.26-5.52GHz)/5.39GHz.

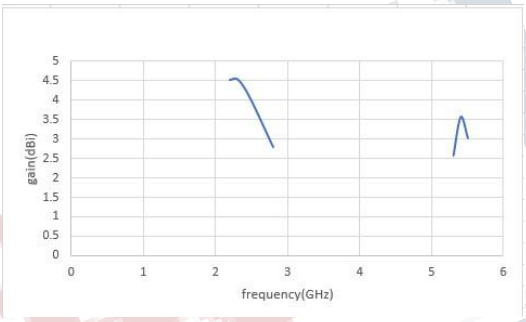

Fig.9-Gain vs freq curve

The 2D radiation pattern of discussed antenna at different frequencies is shown in Figure10-(a,b).

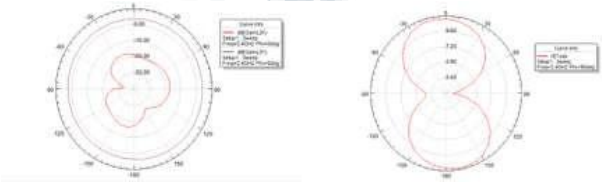

Fig10(a)-Radiation pattern at 2.4GHz

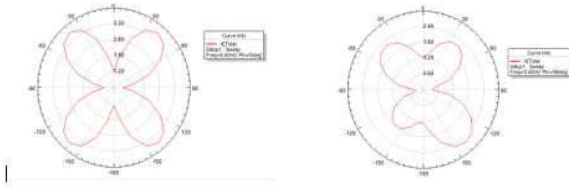

Fig.10(b)-Radiation pattern at 5.4GHz

IV. CONCLUSIONS-

A T patched rectangular antenna is successfully designed and sim ulated and its various characteristics are successfully studied and analysed .the proposed antenna can be operated at of (2.36- 2.71GHz)/2.49Ghz and (5.265.52GHz)/5.39GHz ,with a gain of 4.31dB and 3.55dB for respective bands. The proposed antenna is suitable for WLAN and WiMAX applications .Good radiation pattern with dual band return loss curve has been observed.

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