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A study on inverted Tshaped micro strip antenna at different frequencies

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Abstract- This is the era of communication, where any information can be globalised in very short time around the world. Today we are having a lot of advanced technology where any information can be convey in just a click and this all things are possible due to compact size of the devices, and microstrip patch antenna play a very important role to reduce the size of communicating devices. In this paper we are study about the bandwidth and return loss at frequency 4GHz, 5GHz and 6GHz. In here we are taking a inverted T shaped [1] patch and find the results at different frequency but the important point on this paper is,the feed point location is approximately is same for each frequency.

Keyword- BandWidth , Return Loss Dual Band,

Introduction:

The microstrip patch antenna is one of the most preferred antenna structures for low cost and compact design for wireless system and RF application. In recent years great interest was focused on microstrip antennas for their small volumes, low profiles, good integration low costs and good performance [2,3]. With the continuous growth of wireless communication service and the constant miniaturization of communication equipment, there are higher and higher demands for the low volume of antennas, integration and working band [4]. In the last few years the Global System for Mobile communications (GSM) ,the Universal Mobile Telecommunications System (UMTS) bands and one of the ISM bands is at 2.45 GHz which is also the same band for the Wireless Local Area Network (WLAN) system and Bluetooth applications have been presented in the published papers [LIU 07] [LEE 97] [MAL 03].In the literature, several antennas have been used in a variety of applications for which new and more restrictive requirements in the design of the antenna have been introduced. In particular, for high precision GSM, UMTS and ISM/WLAN applications, few solutions have been proposed by [CHA 02] [TUN 02] [CIA 03]. Unfortunately, these solutions, it may easily provide the desired electric characteristics, but it becomes impractical due to the operational requirements on size and weight. The complicated geometry of these various antennas presents the problem at the levels of the realization, which require very sophisticated equipments and a higher cost for the designer [5],

In this paper we are taken a patch fig.1where we calculate the various results at 4GHz, 5GHz and 6 GHz frequency. For each frequency the length and width are calculated because when operating frequency is changed W and L are also changed. The importance of this paper is, when we are changing our operating frequency the results are changed and feed point location also should be changed but in this paper we are showing after changing our frequency and changing our W and L the location of feed point are not changed.

Antenna Design:

The geometry of a proposed microstrip patch antenna, glass epoxy dielectric material (ε_r = 4.2) with dielectric loss tangent of 0.02 is selected as the substrate with 1.6 mm height. The design parameters are given in Table1.for each frequency. But in here we are referring only patch at 5 GHz. For its simple structure, the proposed antenna can be easily simulated by IE3D simulator. Some useful guidelines for the antenna design will be discussed as follows

For the simulation we are used the IE3D v 9.0 software.

(1) The width of the rectangular MSA is given by

$$W = \frac{c}{2\, f_r \sqrt{\frac{\varepsilon r+1}{2}}}$$

(2) The effects of the medium and the fringing fields at each end of the patch are accounted by the effective relative dielectric constant, ε_{eff}, and the edge extension, ΔL, being the effective length to which the fields fringe at each end of the patch. The following effective dielectric constant formula proposed is used in equation

$$\epsilon_{reff} = \frac{\epsilon_r + 1}{2} + \frac{\frac{\epsilon_r - 1}{2}}{\sqrt{\left[1+12\frac{h}{w}\right]}}$$

(3)The length extension can be finding by

$$\Delta L = 0.412h\frac{(\varepsilon_{reff} + 0.3)(\frac{W}{h}+0.264)}{(\varepsilon_{reff} - 0.258)(\frac{W}{h}+0.8)}$$

(4)The actual length is given by

$$L = \frac{c}{2f_r\sqrt{\epsilon_{reff}}} - 2\Delta L$$

(5)Width of the ground plane can find out by

$$W_g = 6h+W$$

(6) And the length of the ground plane find by equation

$$L_g = 6h+l$$

Where C = Velocity of Light, ε_e= Dielectric constant of a substrate ,f_r = Antenna frequency

From the above formula we can calculate the W and L of the patch for different frequencies, table .1 are given below for the W and L.

	4Ghz	**5Ghz**	**6Ghz**
W_g (mm)	32.856	28.205	25.104
L_g (mm)	27.404	23.686	21.197
W_e(mm)	23.256	18.605	15.504
L_e(mm)	17.804	14.085	11.597

Table.1

In this work we are having the three same type of patch, but for each patch W and L are change because frequency for each patch are change. But in here we are only reefer's patch at 5GHz.

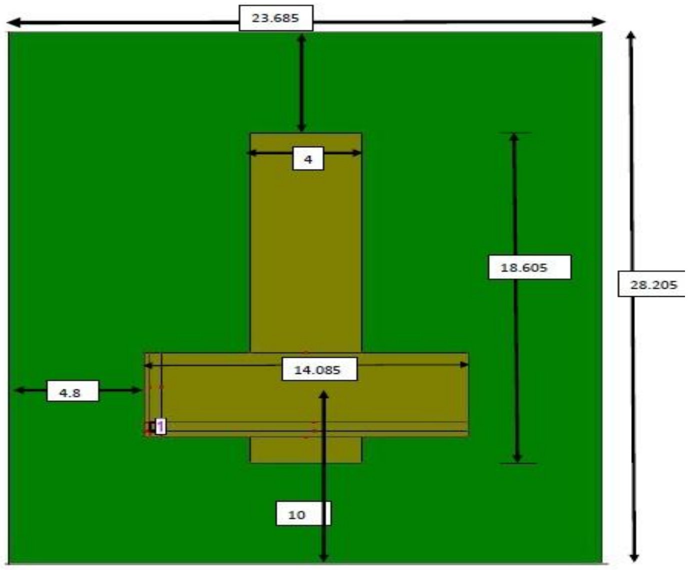

Figure.1 Proposed patch at 5GHz

Results and Discussion:

A proposed inverted T shapes patch is analyzed with a 4GHz, 5GHz, and 6GHz. This is found that by varying the operating frequency the size of patch changed [table.1] and a result is also changed [table.2]. At 4GHz, 5GHz, 6GHz frequencies antenna parameters return loss, bandwidth are measured and compared**.**

At 4GHz frequency we take a feed point at X= 5.425 and Y= 10.625, in here we are using a coaxial probe feed. From the results we conclude that the return loss is maximum at 4GHz And the minimum, return loss is at 6GHz.When we conclude the bandwidth of the patch then maximum bandwidth is 50%, obtained at 5GHz and minimum bandwidth is 42.42% at 4GHz (accept 1st band at 6GHz). The main important result in here is dual bandwidth is obtained at 6GHz, which can be used in various application Investigated results of return loss, and bandwidth for patch with different operating frequencies are shown in Table 2.

Specifications	4GHz	5GHz	6GHz
X(mm)	5.425	5.375	5.225
Y(mm)	10.625	8.65	6.5
Band	Single	Single	Dual
Band Width(%)	42.42	50	4.74 (1st Band)
			47 (2nd Band)
Return Loss	-32	-28	-19
			-20

Table.2

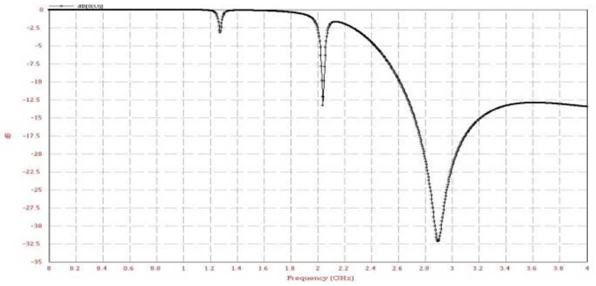

Fig.2 Results at 4GHz

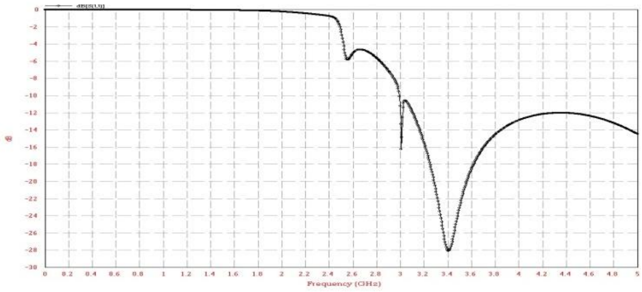

Fig.3 Results at 5GHz

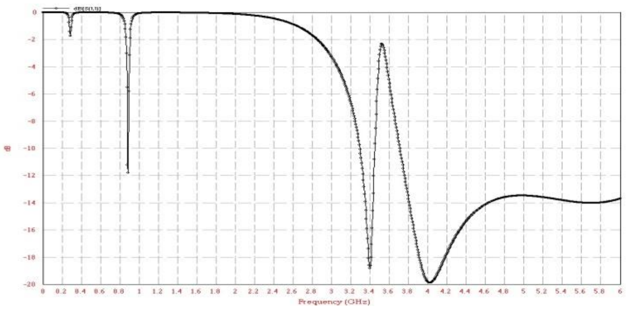

Fig.4 Results at 6GHz

Conclusion:

In the above work we have found that by changing the operating frequency and keeping feed point area constant, it is seen that as the value of return losses(S11 parameter) improves. It suggests that the microstrip antenna performance can be upgraded by using the proposed inverted T shaped patch antenna. The main focus is our work, that we are not changing the feed point area. By our work compactness of microstrip patch antenna can be achieved.

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