Design of Partially H Shape Dual Band Micro strip Patch Antenna

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Abstract: *A single feed compact micro strip antenna for dual -band is presented in this paper. For the proposed antenna two resonant frequencies are obtained at 1.87GHz and 2.3 GHz respectively. The design and simulation of the proposed antenna is carried out using IE3D software. An extensive analysis of the return loss, Radiation pattern, gain, VSWR of the proposed antenna is presented. The simple configuration of the proposed antenna makes it suitable for the applications in much communication system. The return losses of this dual band antenna are -26dB at 1.95GHz, and -20dB at 3GHz. The proposed antenna offers 10.63% bandwidth at 1.87-2.08GHz and 26.41% bandwidth at 2.3- 3 GHz.*

Keywords: Dual band, Return losses, Gain, Vswr, IE3D Simulator

1. Introduction:

The micro strip 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 micro strip 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 low volume of antennas, integration and working band. Dual band antennas are of a relative interest since they can support multiple communication systems.

A large number of micro strip patches to be used in wireless applications have been developed [1-6].The rapid progress in wireless communications requires the development of lightweight, low profile, single feed antennas. Also it is highly desirable to integrate several RF modules for different frequencies into one piece of equipment. Hence, multiband antennas that can be used simultaneously in different standards have been in the focus points of many research projects.

The major limitation of micro strip antennas is their narrow bandwidth. Although different techniques are proposed to increase the bandwidth, practical implementation of many of these structures involves complex process that makes them uneconomical for mass production. Narrow bandwidth of micro strip patch antennas makes researchers think of dual-band antennas

The organization of this paper is as follows, section 2, the design for the proposed dual-band patch antenna is presented, in section 3; we present results and discussions for the performance of the proposed antenna. Section 4, contains conclusions, and at last Section 5 presents, references of proposed antenna.

2. Antenna Design :

The geometry of the proposed dual-band antenna is based on the micro strip antenna technique which is the most popular because of the ease of analysis and fabrication.

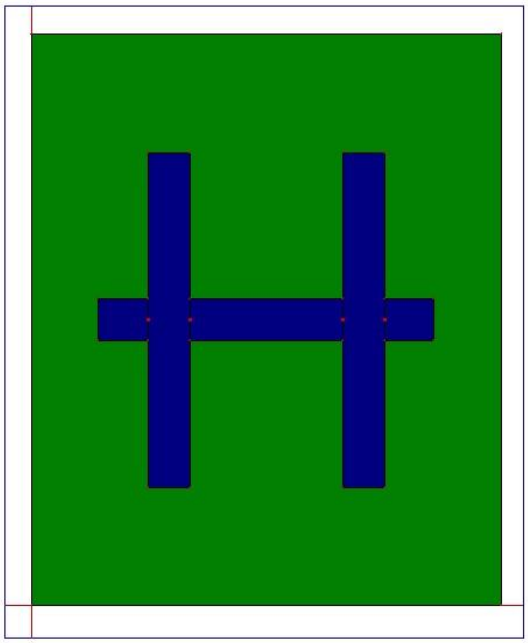

Figure 1: Design of Proposed Antenna

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.

The proposed structure of the antenna is printed on an epoxy substrate with dielectric constant of 4.2 and loss tangent of .001 .The operation is done at 3 GHz frequency and height of a substrate is 1.6mm. For the simulation we are used the IE3D v 9.0 software.

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

$$W = \frac{c}{2f_r\sqrt{\frac{2}{\epsilon_r+1}}}$$

(2) Effective dielectric constant is given as

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

(3) The length extension can be finding by

$$\Delta L = 0.412h\frac{(\epsilon_r+0.3)(\frac{W}{h}+0.264)}{(\epsilon_r-0.3)\left(\frac{W}{h}+0.8\right)}$$

(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

Table 1: Design Parameters Of Proposed Antenna	
Antenna Parameters	Dimension in mm
h	1.6
W_g	40.85
L_g	33.76
W_p	23.96
L_p	23.96
K_1 & K_2	8.445
L_1	3
W_1	3
I_1	4.8

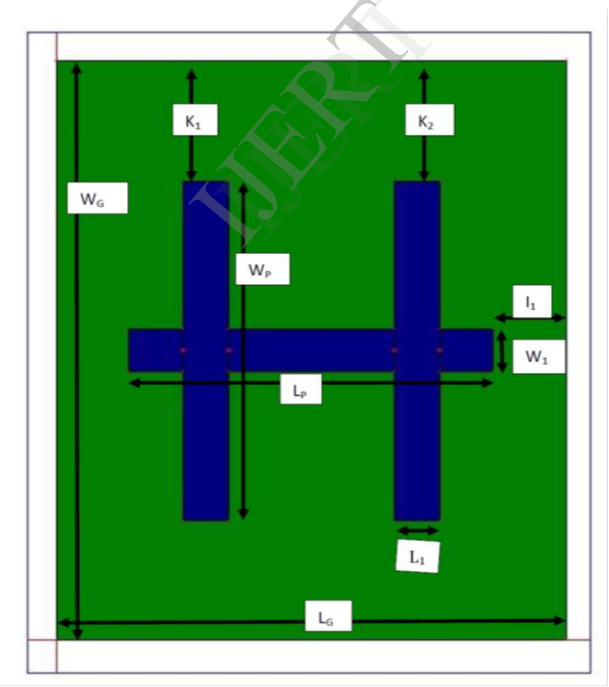

Figure 2: Dimensions Proposed Antenna

3. Results and Discussion:

A prototype of the antenna has been tested by IE3D simulator, with the above given geometrical dimensions of the patch. The simulation returns loss of
This antenna is presented in figure 3 for two different distances.

Return loss is a measure of the reflected energy from a transmitted signal which is commonly expressed in positive dB. The larger the value the lesser is the energy that is reflected.

From the figure 3 we can see that dual band width is obtained. The first Band at frequency between 1.87GHz -2.08GHz, and the maximum return loss at here is –26db.

From this band we can find out the 10.63% bandwidth by using fallowing equation

$$B(\%) = 100\frac{F_{\max} - F_{\inf}}{F_r}$$

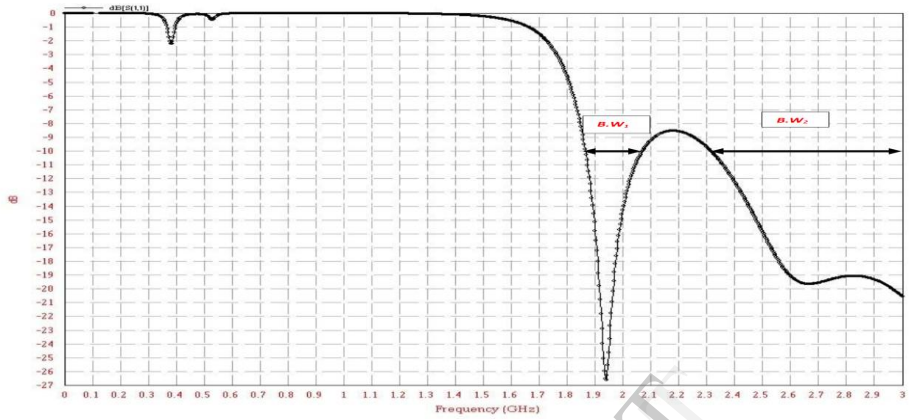

Figure 3: Simulated Return Loss [s11] of the Dual Band Rectangular patch antenna

Where F_{max} and F_{in} is higher and lower frequency of the first band
And F_r is cut of frequency which is average value of the higher and lower frequency of the band.
The second band of this micro strip antenna, we are obtain at frequency range 2.3GHz- 3.0GHz and maximum return loss is here -20db and the % bandwidth is 26.41%.
The return loss should be -10db is satisfactory for this patch to provide better results. From this frequency range we are

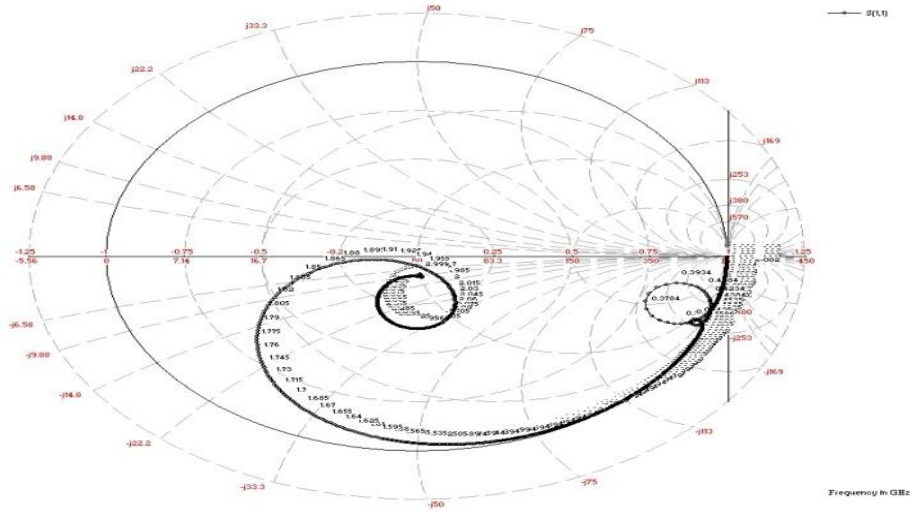

Fig.4. Smith Chart of the proposed antenna

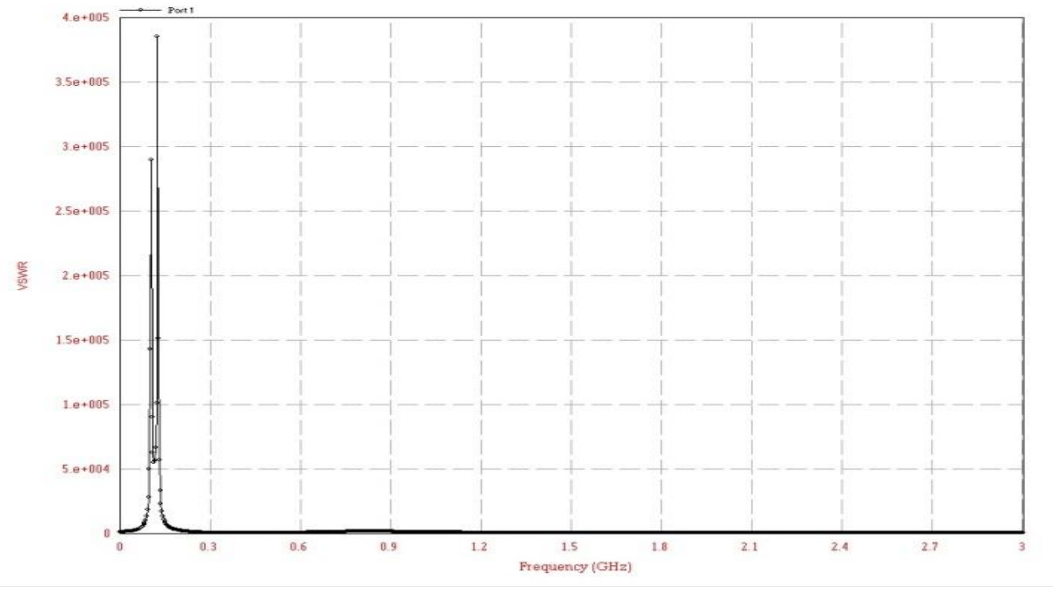

Fig.5. VSWR Vs Frequency of the proposed antenna

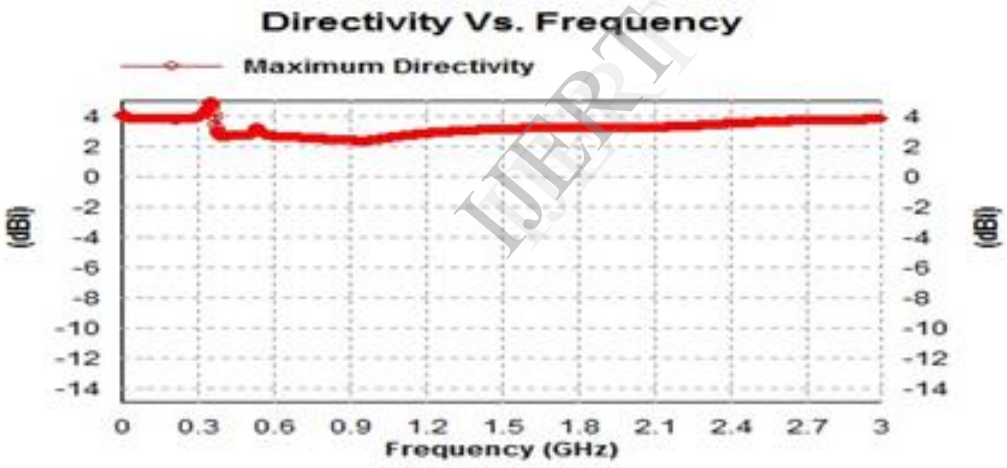

Fig.6. Directivity Vs Frequency of the proposed antenna

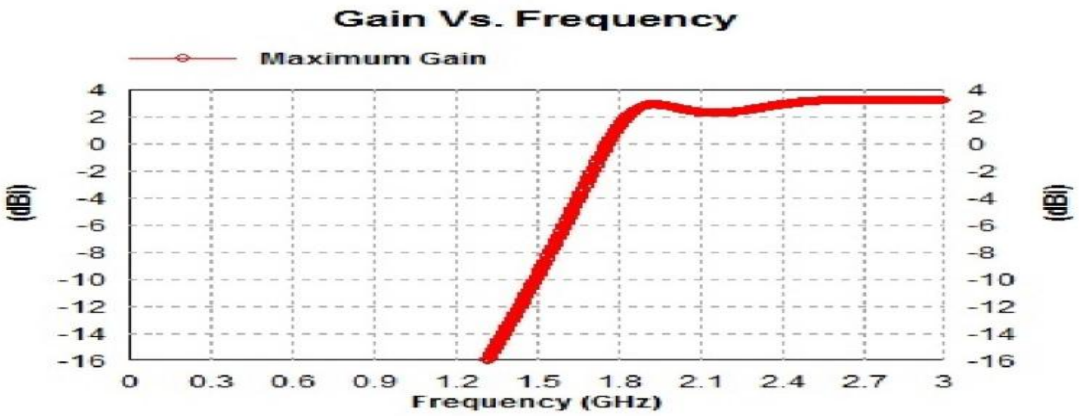

Fig.7. Gain Vs Frequency of the proposed antenna

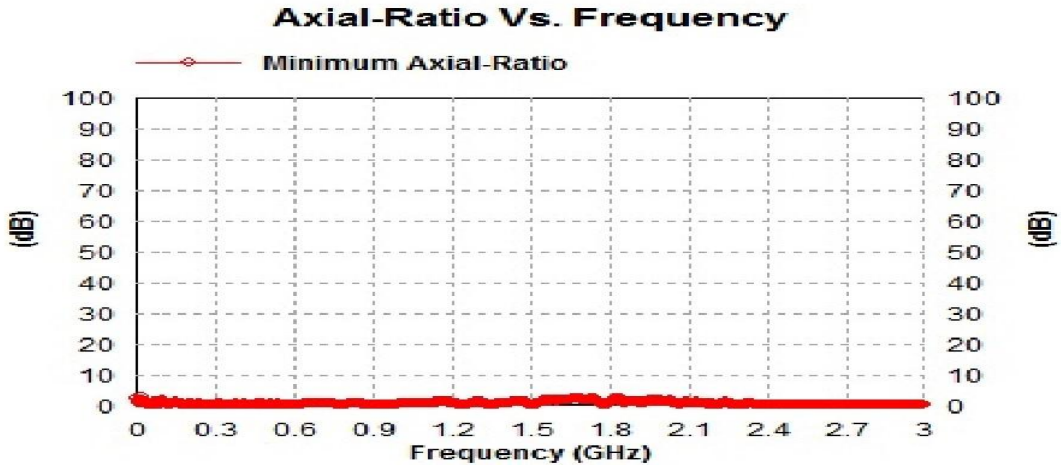

Fig.8. Axial Ratio Vs Frequency of the proposed antenna

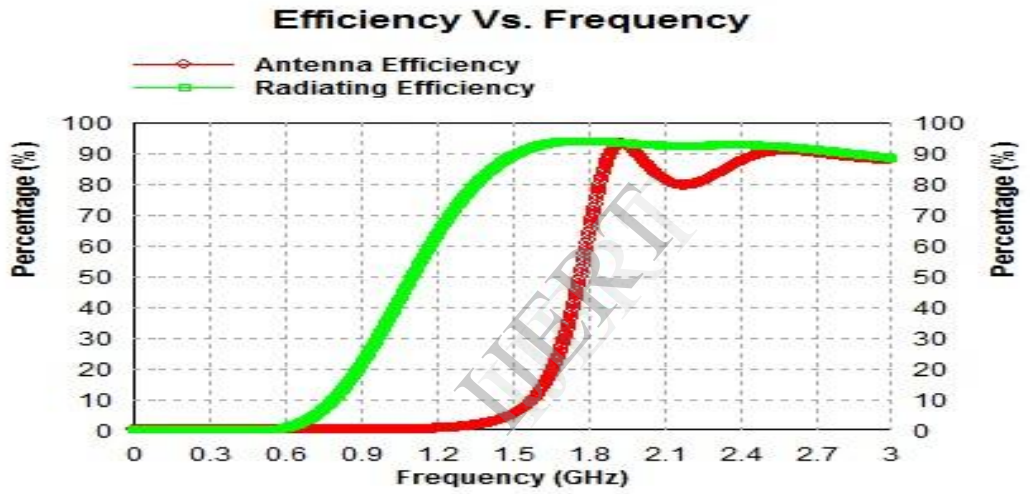

Fig.9. Efficiency Vs Frequency of the proposed antenna

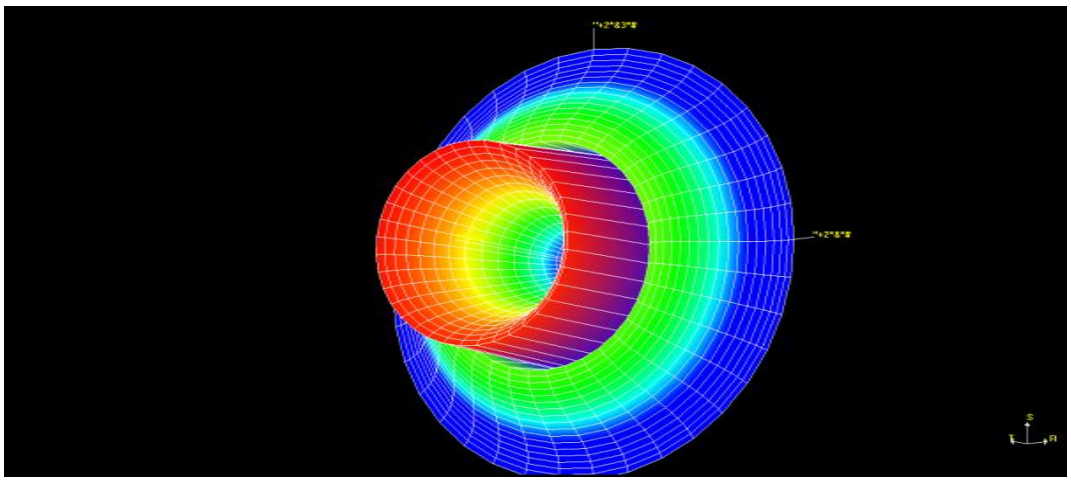

Fig.10. 3-D radiation pattern of proposed anten

4. Conclusions:

Hence, the proposed patch antenna is a low cost, moderate gain antenna solution The main quality of the partially H shaped proposed antenna is that it allows an effective design maintaining all the advantages of micro strip antennas in terms of size, weight and easy manufacturing. From the figure we can analyze that all the results simulated by IE3D v 9.0 is good and can be used in different communication field.

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