

**Article Info**

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**Design & Simulation of Dual Band Rectangular Patch Antenna for Various Applications at 3.2 GHz & 4.0GHz**

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**ABSTRACT**

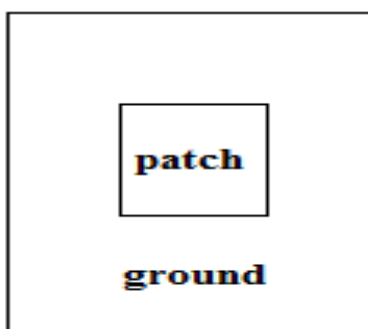
*In the communication world microstrip patch antennas plays a great role due to its various advantages. Today we require many applications on a single device. The multiband antenna can be easily fitted in the electronic device, which can be used for various applications. Here we have designed the microstrip rectangular patch antenna using IE3D software [7] and its various properties have been studied.*

**Keywords:** Rectangular Patch Antenna; Voltage Standing Wave Ratio; Total field directivity; Radiation Pattern; Return loss.

**1.0 Introduction**

Microstrip patch antenna consists of a radiating patch, dielectric substrate and ground. At bottom there is a ground and patch lies on the top. We can make a slot in patch and any shape can be given. The figure given below shows a microstrip rectangular patch antenna [5].

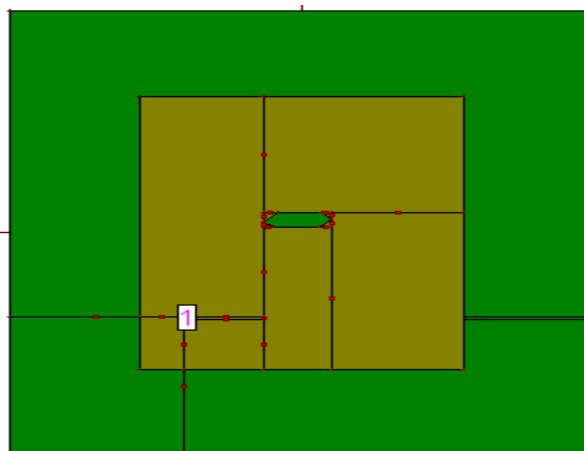
**Fig: 1. Microstrip Rectangular Patch Antenna**



**2.0 Antenna Design**

The designed rectangular patch antenna is shown in figure 2. The antenna is being designed by using IE3D software [7] and then a patch was slotted as shown in figure.

**Fig 2: Designed Rectangular Patch Antenna**



The various design parameters of this rectangular patch antenna are shown in table number 1. The  $f_0$  taken for calculation [4] of parameters is 4 GHz. In this figure the ground is represented by green color and slotted patch is shown at top.

**3.0 Results and discussion**

Results are being obtained after carrying out simulations on IE3D software [7]. First to discuss is the return loss, the return losses of -12.62 & -14.99

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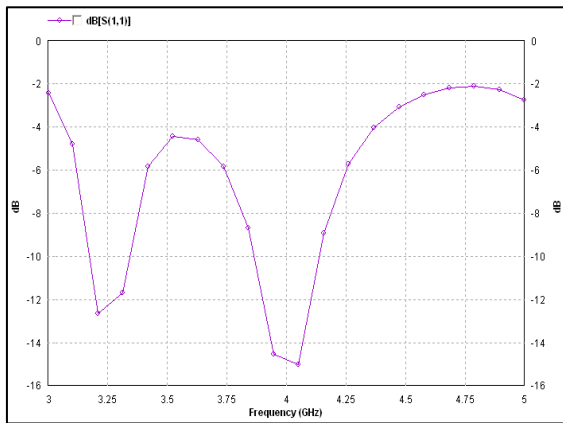
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dB at 3.21 and 4.05 GHz respectively have been obtained. The figure 3 shows these results.

**Table 1: Various Design Parameters**

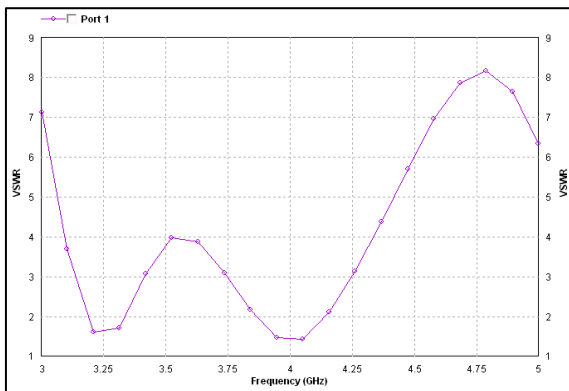
| S.No. | Parameter             | Value    |
|-------|-----------------------|----------|
| 1     | Height (h)            | 3 mm     |
| 2     | Width of patch(W)     | 28.76 mm |
| 3     | Width of ground( Wg)  | 46.76 m  |
| 4     | Length of patch(L)    | 22.44 mm |
| 5     | Length of ground( Lg) | 40.44 mm |
| 6     | $\epsilon_r$          | 2.4      |

**Fig 3: Return Losses Graph**



Next to discuss is the Voltage standing wave ratio (VSWR). A VSWRs of 1.61 & 1.43 at 3.21 GHz and 4.05 GHz respectively have been obtained. Figure 4 shows these results.

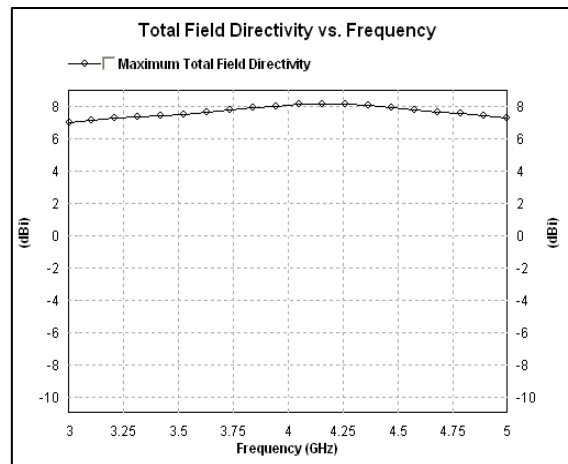
**Fig 4: VSWR Graph**



Next to discuss is the total field directivity.

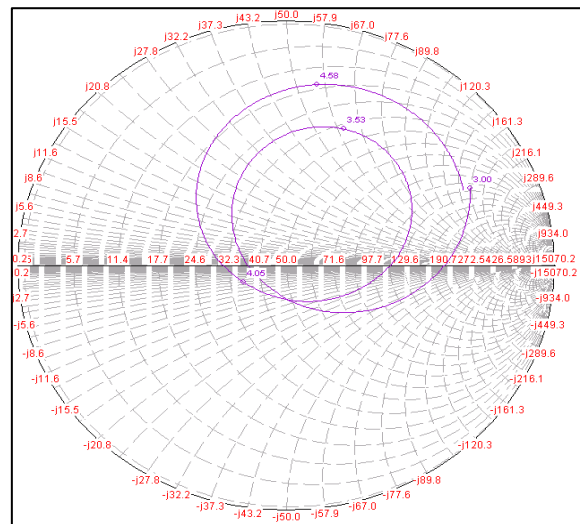
The excellent total field directivities of 7.22 & 8.07 dBi at 3.21 and 4.05 GHz respectively have been obtained. The figure 5 shows the total field directivities.

**Fig 5: Total Field Directivity Graph**



**Figure 6: shows the smith chart.**

**Fig 6: Smith chart**

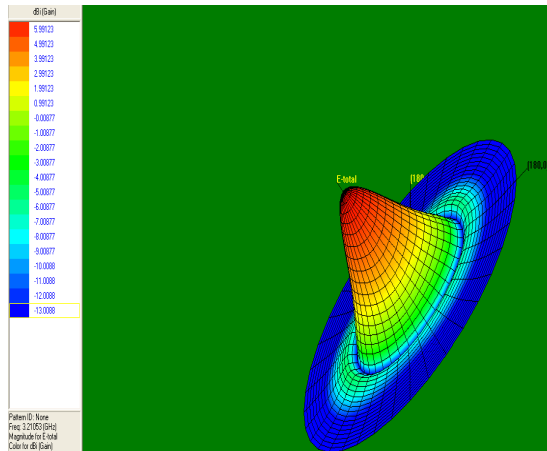


The reflection coefficients obtained from smith chart are shown in table

**Table 2: Results Obtained from Smith Chart**

| Frequency  | Magnitude | Angle    |
|------------|-----------|----------|
| 3.2556 GHz | 0.1135    | -127.466 |
| 4.0 GHz    | 0.1374    | -107.5   |

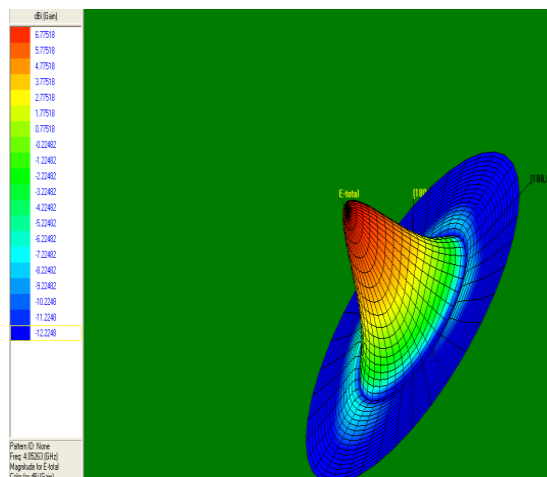
**Fig 7: Radiation Pattern at 3.21 GHz.**



**4.0 Conclusion**

The obtained return losses of -12.62 & -14.99 dB band antenna. The designed antenna can be useful for various at 3.2 GHz and 4.0 GHz

**Fig 8: Radiation Pattern at 4.05 GHz.**



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