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Design and Simulation of Dual Band Rectangular Patch Antenna for WiMAX & IMT Band Application

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Abstract

The communication world patch antennas plays a main role due to its smaller dimensions. Today generation requires applications on a single device. In this paper dual band antenna is being presented. Currently multiband small microstrip antenna can be easily fitted into a device which can be used for various applications. Here first antenna is designed, slotted and simulations are carried out by using IE3D software [6]. Return loss, Gain, Antenna & radiating efficiency, Directivity are the various different properties observed after carrying out simulations. Here material with dielectric constant 2.2 is used.

1. Introduction

Microstrip patch antennas consist of a radiating patch, dielectric substrate and ground [1]. Selection of a substrate should be done very carefully because properties of an antenna vary with different substrate materials. Figure given below shows general two dimensional patch antenna

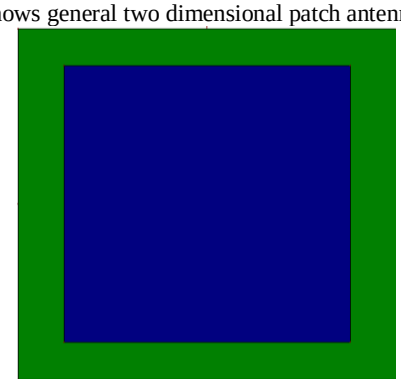

Fig: 1. Microstrip Rectangular Patch Antenna

2. Antenna Design

Various parameters taken for antenna design are shown in the table 1. Formulas [1], [6] for calculation are taken from transmission line model.

Table: 1. Design Parameters

S. No.	Parameter Name	Value
1	Patch length(L)	27.90 mm
2	Patch width(W)	33.88 mm
3	Ground length(L_g)	37.23 mm
4	Ground width(W_g)	43.02 mm
5	Frequency	3.5 GHz
6	Height of patch above ground(h)	1.524 mm

The designed slotted rectangular patch antenna is shown in figure 2. Here simulations were carried out on a IE3D software [6] and results were obtained. The best feed point was (5,-6).

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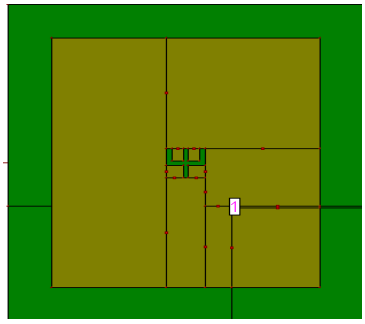

Fig: 2. Designed Slotted Rectangular Patch Antenna

3. Results & Discussions

First property that we are discussing is radiation pattern, when simulations were carried out then return losses of -15.85 dB and -21.7 dB were obtained at 2.86 GHz and 3.38 GHz respectively which shows that this is a dual band antenna. Figure below shows these return losses

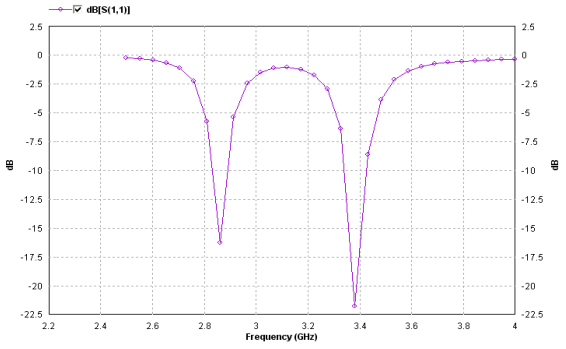

Fig: 3. Return loss graph

Second property is Directivity which measures the power density which the antenna radiates in the direction of its strongest emission, versus the power density radiated by an ideal isotropic radiator radiating the same total power.

The obtained directivity of 7.38 dBi at 3.38 GHz is excellent and shows that this antenna is very fruitful for the second band. Figure number 4 shows this directivity graph.

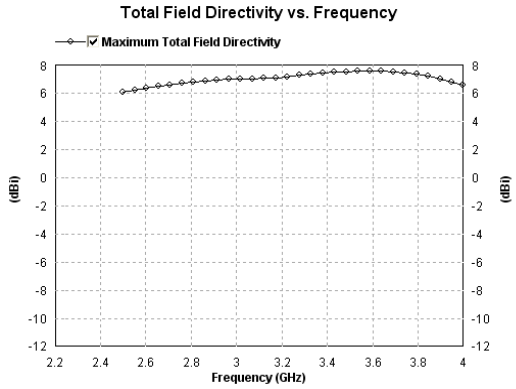

Fig: 4. Total field directivity

Next to discuss is radiation & antenna efficiency. A radiation efficiency of 88.16% & antenna efficiency 86.67% is obtained at 3.38GHz. Here radiation efficiency is more than 80% which is a very good result. Figure number 5 shows this radiation & antenna efficiency graph.

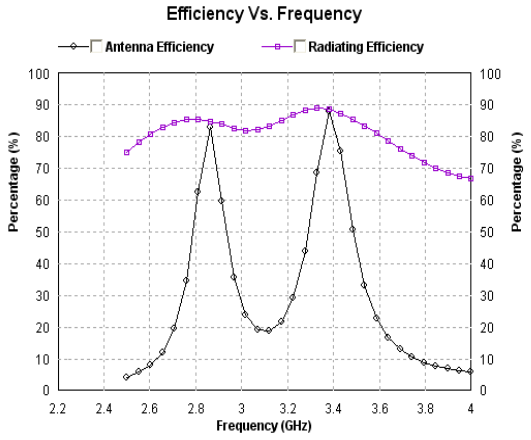

Fig: 5. Radiation & antenna efficiency graph

Also figure number 6 shows the radiation pattern of an antenna.

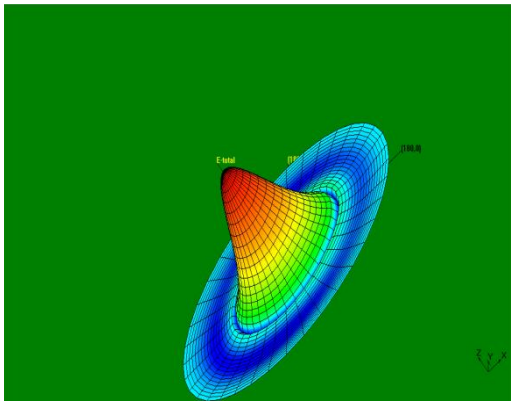

Fig: 6. Radiation pattern

The obtained gain of 6.76dBi at 3.38 GHz is excellent and shows that this antenna is very useful for the second band. Figure number 7 shows this gain graph.

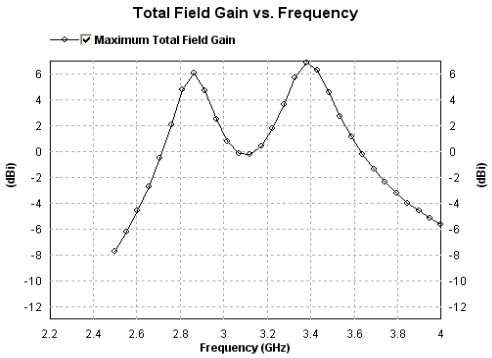

Fig: 7. Total field gain

The obtained VSWR of 1.18 at 3.38 GHz is very good and shows that this antenna is very useful for the second band. Figure number 8 shows its VSWR graph.

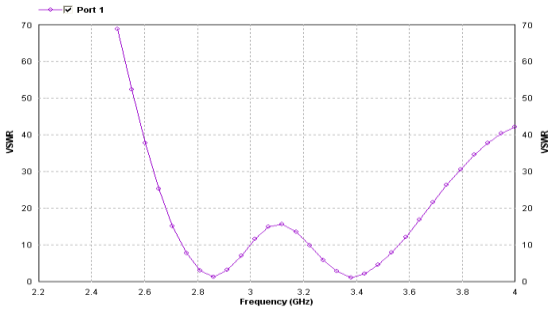

Fig: 8. VSWR

4. Conclusion

Obtained return losses of -15.85 dB and -21.7 dB are for the first and second bands respectively. The two bands show that this is a dual band antenna. Other properties like return loss, directivity, antenna & radiation efficiency, VSWR, gain were also very good.

The designed slotted rectangular patch antenna will be useful for various applications at 2.86 GHz(IMT band) and 3.38 GHz(WiMAX band).

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