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Design and simulation of dual band slotted microstrip rectangular patch antenna

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Abstract

Today in the communication world microstrip antennas plays a vital role due to its smaller dimensions. Today's generation require many properties of an antenna to lie under acceptable limit. Here dual band antenna is being presented. The multiband small microstrip antenna can be easily fitted in a device which can be used for various applications. Here first antenna is designed, slotted and simulations are carried out by using IE3D software [7]. Return loss, VSWR, Reflection coefficient are the various properties observed after carrying out simulations. Here Neltec NX 9240 epoxy [4] substrate material with dielectric constant 2.4 is used.

1. Introduction

Microstrip patch antennas have a radiating patch, dielectric substrate and ground. Selecting substrate is a key step in designing because a property of an antenna varies with a different substrate materials. Fig: 1. shows general two dimensional patch antenna.

Fig: 1. Microstrip rectangular patch antenna

2. Antenna Design

S.No.	Parameter Name	Value
1	Patch length(L)	36.03 mm
2	Patch width(W)	43.91 mm
3	Ground length(L_g)	48.03 mm
4	Ground width(W_g)	55.91 mm
5	Frequency	2.62 GHz
6	Height of patch above ground(h)	2 mm

Table: 1. Design parameters

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

The designed slotted rectangular patch antenna is shown in figure 2. Also feed point is (-6, 21).

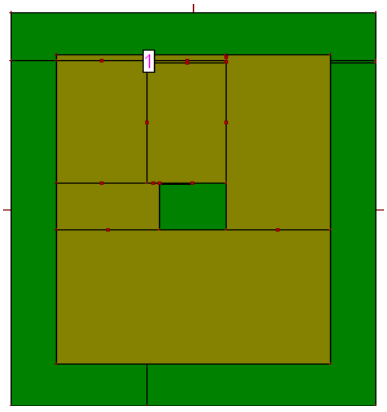

Fig: 2. Designed slotted rectangular patch antenna

3. Results & Discussions

First property that we are discussing is radiation pattern, when simulations was carried out then return losses of -18.06 dB and -38 dB were obtained at 2.47 GHz and 3.421 GHz, which proves that this is a dual band antenna. Figure below shows these return losses

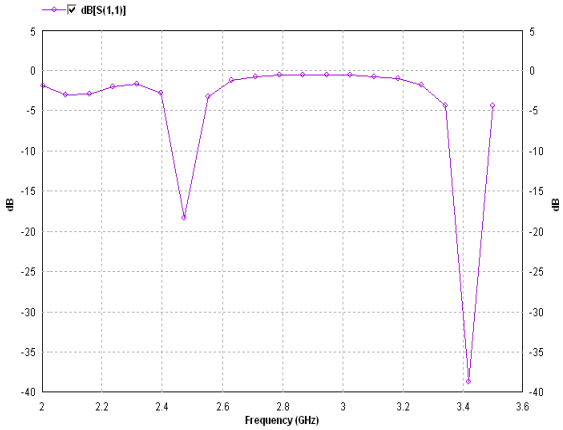

Fig: 3. Return loss graph

Second property is Voltage Standing Wave Ratio.

VSWR of 1.325 & 1.034 was obtained at 2.474 GHz & 3.421 GHz respectively. Figure 4 shows the VSWR graph.

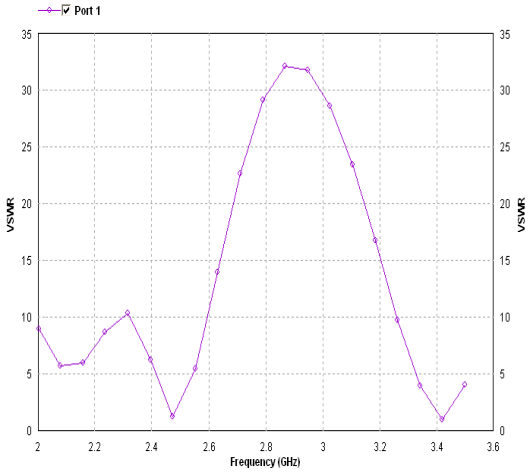

Fig: 4. VSWR graph

Next to discuss is reflection coefficient. Here reflection coefficient of 0.0984 and 0.011 was obtained at 2.478 GHz & 3.421 GHz respectively.

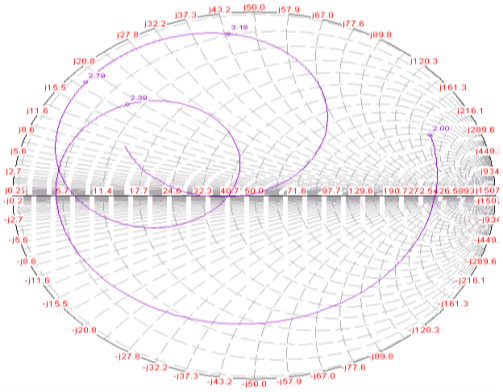

Fig: 5. Smith chart

Fig: 5. shows the smith chart from where the reflection coefficients are being observed.

Next figure no. 6 shows the total field directivity of a slotted antenna which is looking good for the first band.

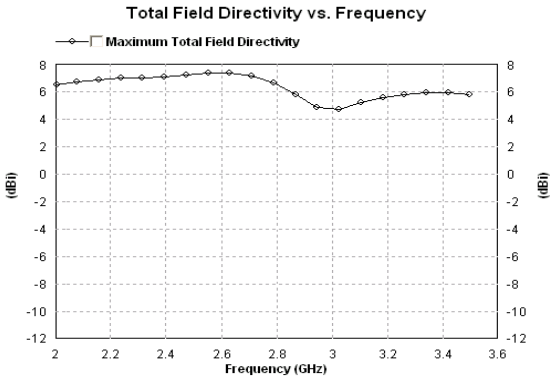

Fig: 6. Total field directivity

Finally figures 7 & 8 shows the 3D radiation patterns of an antenna at frequencies 2.47368 GHz and 3.42105 GHz respectively.

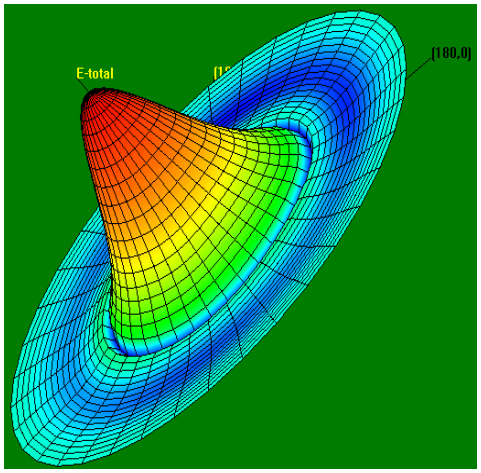

Fig: 7. Radiation pattern at 2.47368 GHz

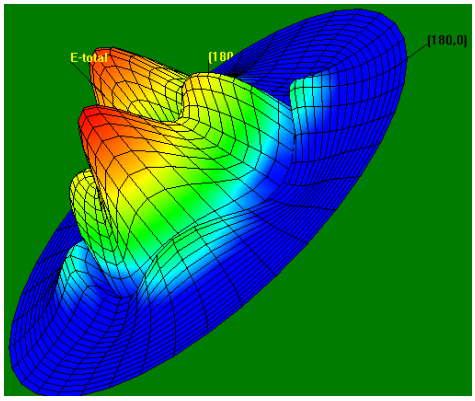

Fig: 8. Radiation pattern at 3.42105 GHz

4. Conclusion

Obtained return losses of -18 dB and -38.62 dB are for the first and second bands respectively. Especially the return loss of second band is excellent. Other properties like VSWR and reflection coefficients were also very good.

The designed slotted rectangular patch antenna is a dual band antenna which will be useful for IEEE 802.16e operating radio frequency range (2.5 GHz-2.7 GHz)[5], moreover second band may be utilized for middle band WiMAX applications[2].

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[7] IE3D zeland software.