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Design of a Triangular Patch Antenna For S Band Applications

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Abstract

S-band communication antennas have application in the Weather, traffic control, tracking, microwave oven. There are many traffic controls & tracking organization requiring multiband capabilities. So this paper presents the dual band triangular microstrip patch antenna design for s band application. Triangular patch antenna is designed with RT/Duroid 5880 substrateand microstrip feeding. The design is simulated with Advance Design System 2011-10. Simulated results for main parameters such as return loss, impedance bandwidth, Directivity, radiation patterns and gains are also discussed herein. The study showed maximum achievable gain of about 4.77 dBi with simplicity in designing and feeding.
Keywords: Microstrip Patch Antenna, Probe Fed & Resonant Frequencies.

I. INTRODUCTION

The S band is a name given to certain portions of the electromagnetic spectrum, including wavelengths of microwaves that are used for long-distance radio telecommunications. Current advancement in printed antenna technologies have resulted in variety of different techniques for designing low profile, cost effective and high efficient wideband antennas. [2] Most of techniques deals with marginal improvement in no. of Band on which antenna can operate, such as patch with slot lines.[3] However, not much attention has been paid for improving the no. of Band. The design presented in this paper is a corner cut triangular patch antenna. Studies of a triangular patch antenna shows only single resonant frequency in S band.

II. ANTENNA DESIGN

The proposed structure of the antenna is shown in Fig. (1).The antenna is simulated on RT/duroid 5880 substrate with a dielectric constant of 2.2 and a loss tangent of 0.0009. The thickness of the substrate is 0.8mm. The height of triangular patch antenna is 32mm and base is 36.5mm.

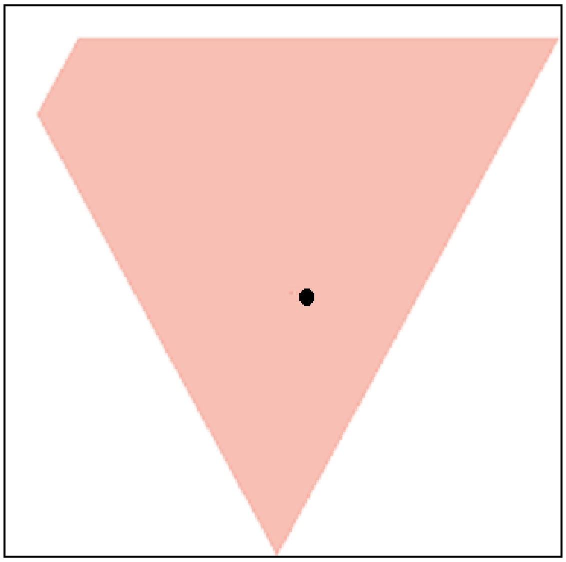

Fig. 1: Design of Triangular Patch Antenna

III. THEORY

The procedure of analysis of fed and unfed patch antennas using the cavity model is well known. For the equilateral triangular patch, however, the resultant expressions are rather lengthy. For reference purposes the formulas for resonant frequency is given in this section**.** Their derivations are omitted. Formula for the resonant frequency is obtained by the Cavity model with perfect magnetic walls [1] is given

$$f_{mn} = \frac{2c}{3a\mathcal{E}_r^{\frac{1}{2}}}(m^2 + mn + n^2)^{\frac{1}{2}} \qquad (1)$$

Where subscript *mn* refers to TMmn TMmn modes, a is the side length, c is the velocity of light and εr is the Dielectric constant. [6]

IV. RESULT

The resonant properties of the proposed antenna have been predicted and optimized using a frequency domain Analysis. Fig. 2 shows the simulated result of the return loss of the proposed triangular patch antenna. There are two closely excited resonant frequencies at 3.141 GHz and at 3.318 GHz. The S-parameter shows clearly two bands, whose values are -26.34dB and -17.95dB. The Gain, directivity and power radiated for different frequencies is shown in table1.

Table - 1

Frequency	*Gain*	*Directivity*	*Power*
3.14 GHz	*4.59dB*	*6.75dB*	*1.1mw*
3.31 GHz	*4.77dB*	*6.75dB*	*1.4mw*

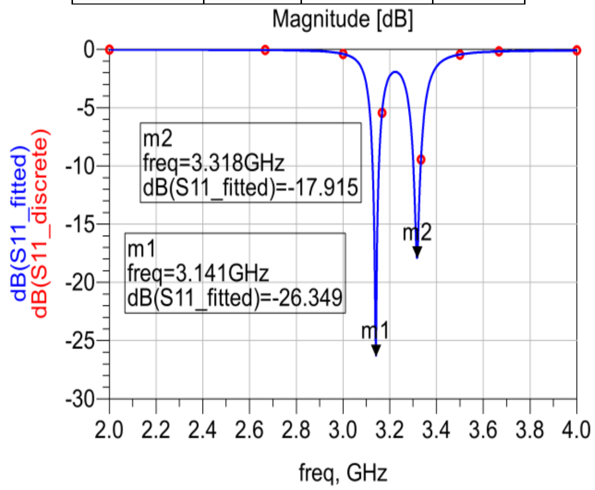

Fig. 2: S- parameter (Return Loss)

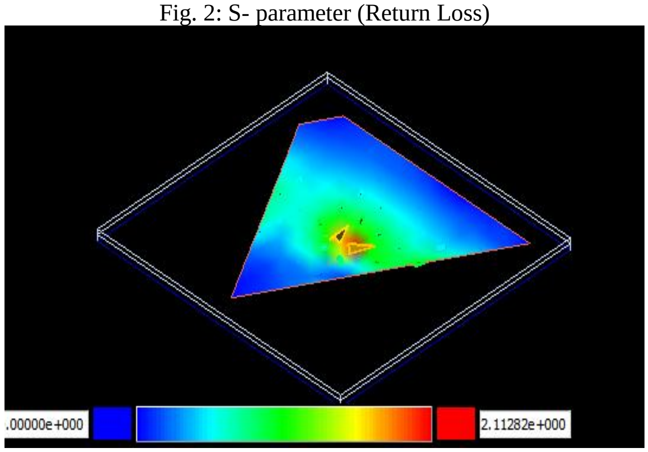

Fig. 3: Current Distribution

As fig. 3 shows the current distribution at feeding point.The current distribution is almost uniform in all directions.As it is shown in figure that maximum radiation takes place in opposite of corner cut of this antenna.

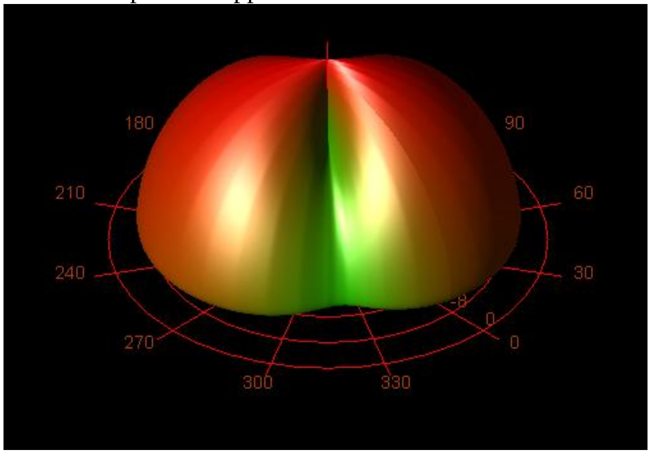

Fig. 4: 3D E theta

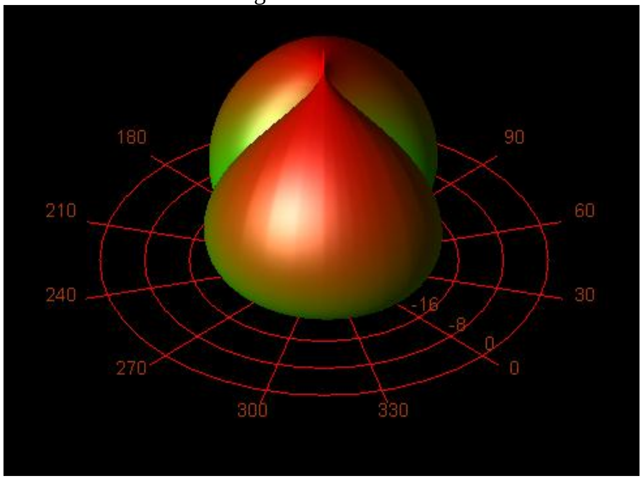

Fig. 5: 3 D E phi

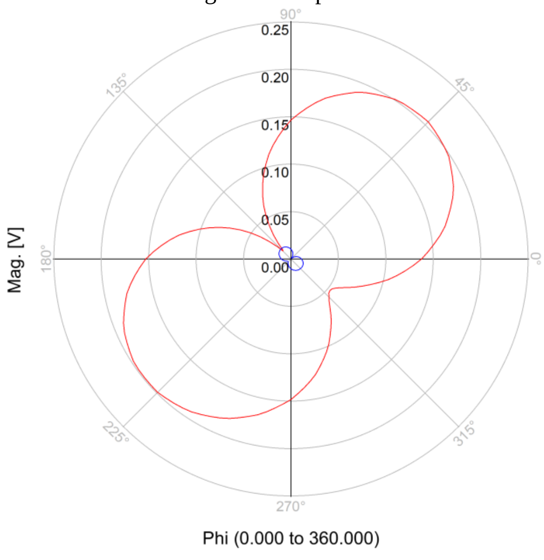

Fig. 6: E-Plain Radiation Pattern at Theta=0 & Phi =90

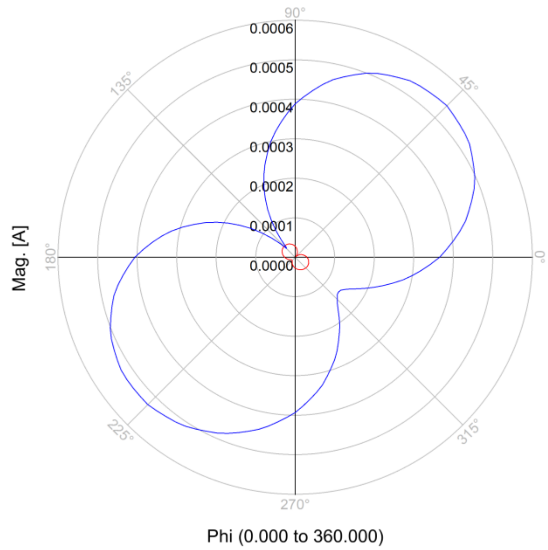

Fig. 7: E –Plain Radiation Pattern With Theta=0 & Phi=0

V. Conclusion

A new and simple technique for designing dual band antenna is presented. This technique is based on creating number of fictitious resonance along the triangular patch and using them to obtain dual band response with similar radiation pattern. Simplicity of the design process, consistent radiation and other parameter and excellent polarization purity make this technique very attractive for designing dual band antennas.

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