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Design of Multislot Dual Band Patch Antenna for Satellite Communications

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Abstract

This paper gives configuration and analysis of dual band slotted patch antenna. For resonance purpose antenna is loaded with rectangular slots. Microstrip feed line is used to feed the antenna. Antenna characteristics were simulated using full-wave electromagnetic simulator (IE3D). According to simulations, the proposed antenna can provide two separated impedance bandwidths of 1.05 GHz (about 12.96% centered at 8.1 GHz) and 1.55 GHz (about 16.45% centered at 9.422 GHz), satisfying VSWR, and stable radiation patterns for satellite communications.

Keywords: ***Microstrip Antenna, Return Loss, VSWR***

1. Introduction

Due to the rapid development in the field of satellite and wireless communication there has been a great demand for low cost minimal weight, compact low profile antennas that are capable of maintaining high performance over a large spectrum of frequencies. Through the years, microstrip antenna structures are the most common option used to realize millimeter wave monolithic integrated circuits for microwave, radar and communication purposes. Using the Dual Band Microstrip Antenna concept in this thesis dual band rectangular Microstrip antenna is designed simulated and tested. There are a few softwares available which allow the optimization of the antenna. IE3D is one of the most imperial electromagnetic software which allows to solving for radio and microwave application.

A Microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side. Micro strip antennas are planar resonant cavities that leak from their edges and radiate. Printed circuit techniques can be used to etch the antennas on soft substrates to produce low-cost and repeatable antennas in a low profile.

2. Proposed Antenna Design &Optimizations

The Performance of the micro strip antenna depends on its dimension. Depending on the dimension the operating frequency, return loss and other related parameters are also influenced.

2.1 Design specifications:

Frequency of operation:

1. 7.84-8.81 GHz centered at 8.11GHz
2. 9.18-10.10GHz centered at 9.42 GHZ

Height of dielectric substrate: 1.588mm

Dielectric constant: 4.4

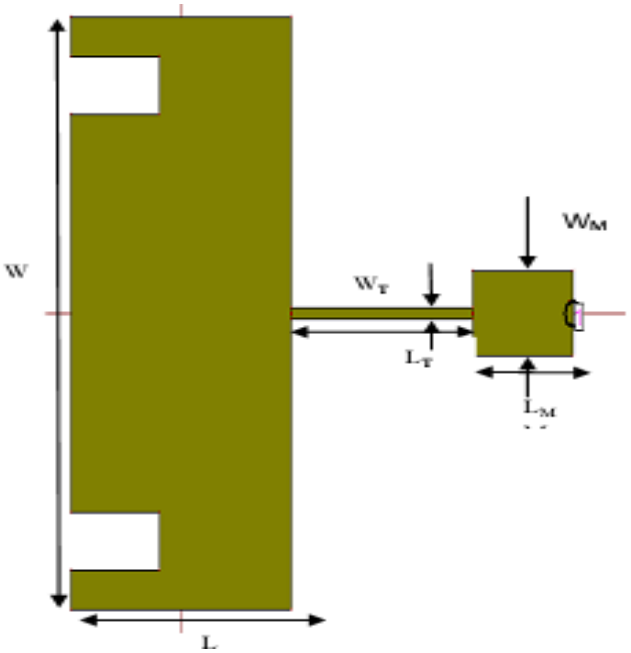

Fig. 1. Proposed antenna.

Parameter	Dimension (mm)	Optimized Dimension (mm)
L	6.58	6.5
W	11.25	11.2
L_T	5.6	5.6
W_T	0.3	0.3
L_M	3	3
W_M	1.623	1.6
L_S	2.632	2.6
W_S	0.98	0.9

3. Results

The software used to model and simulate the Micro strip patch antenna is Zealand Inc's IE3D. IE3D is a full-wave electromagnetic simulator based on the method of moments. It can be used to calculate and Return loss plot, VSWR, radiation patterns etc.

3.1 Return Loss:

The center frequencies are selected as the one at which the return loss is minimum. Return loss values obtained at 8.12GHz and 9.422GHz are -17dB and -44dB respectively.

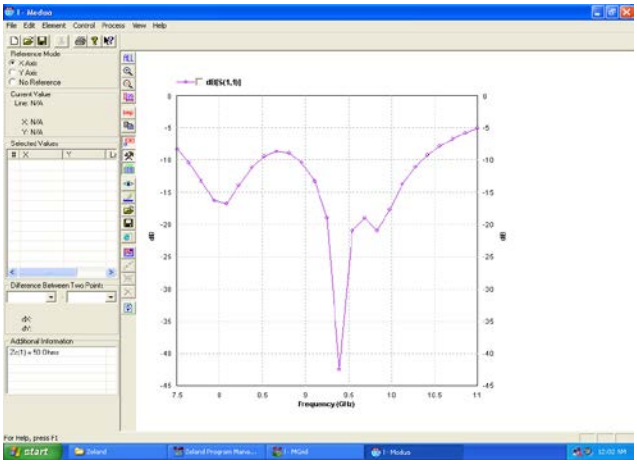

Fig. 2 Simulated results.

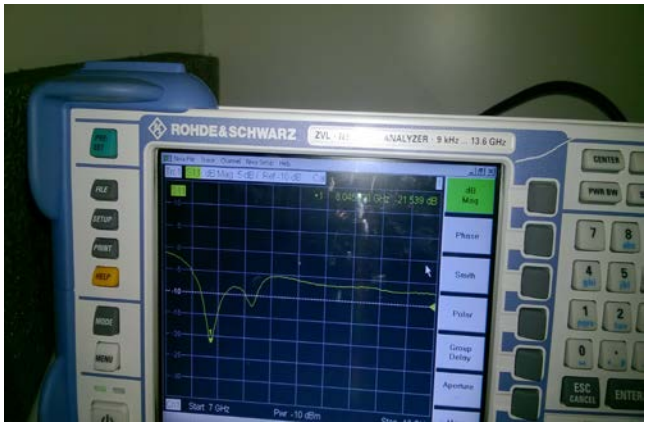

Fig. 2. Tested Hardware Results.

3.2 VSWR:

VSWR values are 1.26dB and 1.2 dB at 8.12GHz and 9.422GHZ respectively.

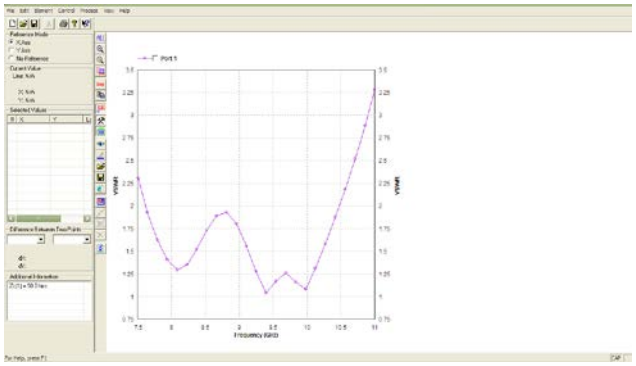

Fig. 3Simulated results

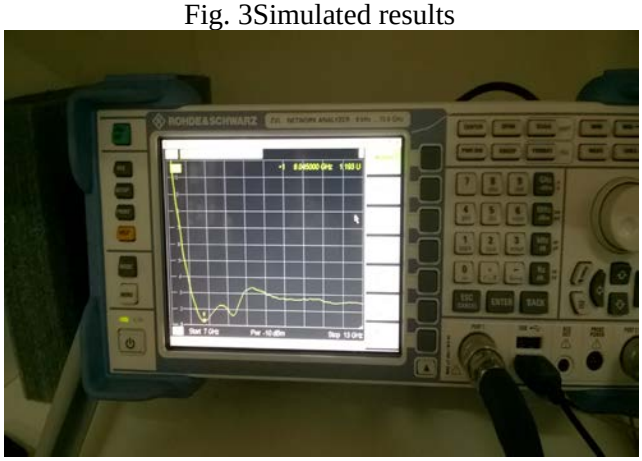

Fig. 4. Tested Hardware Results.

4. Conclusions

The antenna is designed and fabricated successfully with VSWR <2 and two bandwidths 12.96% (centered at 8.1 GHz) and 1.55 GHz (about 16.45% centered at 9.422 GHz).λ/4 transformer was successfully designed for matching purpose.

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