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Analysis and Performance Evaluation of Microstrip Patch Antenna for X- Band Applications

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Abstract— **In this paper, a design of Microstrip Patch Antenna for X- Band applications is proposed. The input impedance of the antenna is 50Ω. The Proposed antenna resonates at 10.62 GHz having return loss value of -20.36dB. The total bandwidth of the proposed patch antenna is1.88GHz. The antenna is fed by a micro strip feed. The Rogers RT/ Duroid 5880 (tm) is used as a substrate, and antenna dimensions of 30mm x 25mm in X and Y directions and having a thickness of 1.6mm. The results are simulated by using Ansoft HFSS software. Also gain, directivity and bandwidth of the proposed antenna are studied.**

Index Terms— **Microstrip, Bandwidth, Gain, X- Band.**

I. INTRODUCTION

Modern wireless communication systems requires antennas having wider bandwidth, resonates at multiple frequency bands and should have low profile for variety of applications. An antenna is an important element of the wireless system. Antenna which is an electrical device transmits the electromagnetic waves into the space by converting the electric power given at the input into the radio waves at the transmitter side and at the receiver side, the receiving antenna intercepts these radio waves and converts them back into the electrical power. Antenna is an essential part of so many systems such as remote controlled television, cellular phones, satellite communications, spacecraft, radars, wireless phones and wireless computer networks. With the advancement in the technology used in satellite communication and in the aircraft and spacecraft has also increased the demand of a low profile antenna that can provide reliable communication [1-5].The proposed antenna in this paper resonates at the frequency of 10.62 GHz and the total bandwidth achieved is 1.88 GHz. Also the radiation properties of the proposed antenna are analyzed.

II. ANTENNA DESIGN

In this proposed design of antenna the substrate is of Rogers RT/ Duroid 5880 (tm) whose relative permittivity is 2.2.The dimensions of the antenna is 30mm x 25mm x 1.6mm, the microstrip feed is used . The input impedance of the antenna is 50Ω. two rectangular slots are cut in order to get better results. The proposed design is simulated using Ansoft HFSS Software. Fig.1 and Fig.2 (a) - (b) represents the structure of the proposed antenna and top and side view of the proposed antenna.

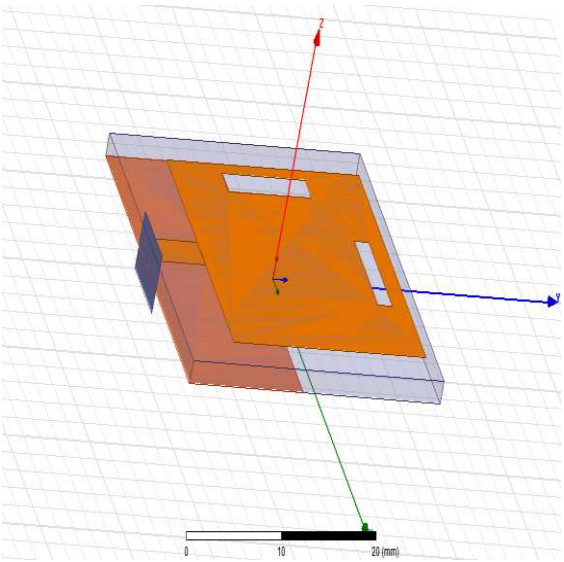

Fig.1: Structure of Proposed Antenna

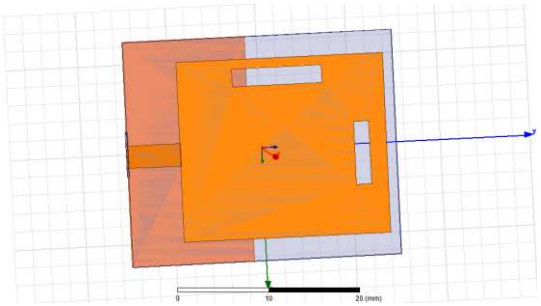

Fig.2 (a): Top view of Proposed Antenna

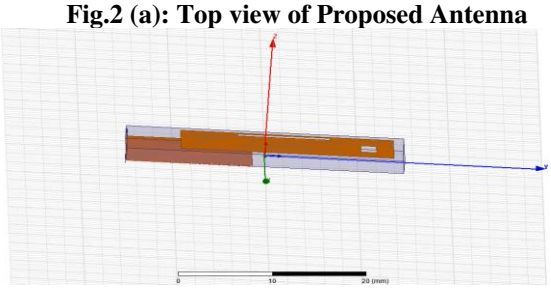

Fig.2 (b): Side view of Proposed Antenna

III. SIMULATED RESULTS AND DISCUSSION

The simulated results of the proposed antenna are presented as figures given below:

A. Return Loss and Antenna Bandwidth

Fig.3shows S_{11} parameter (return loss) for the proposed antenna that resonates at 10.62 GHz having value of -20.36dB.The bandwidth of antenna can be calculated from return loss versus frequency plot. The total bandwidth of the proposed patch antenna is 1.88GHz.

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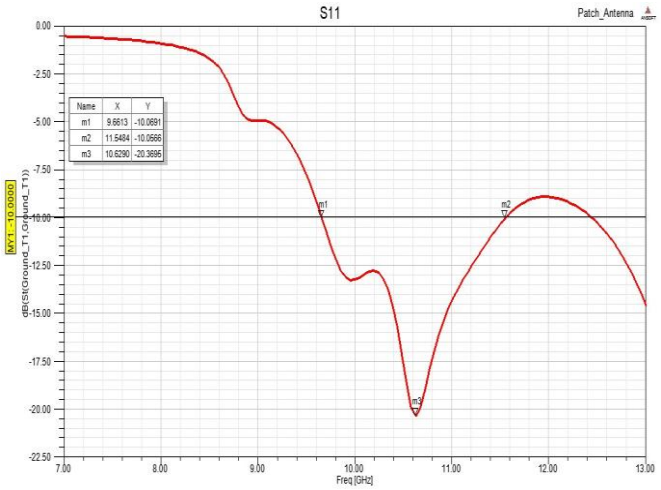

Fig.3: Simulated ReturnLoss S_{11} (in dB)

B. Voltage Standing Wave Ratio (VSWR)

Fig.4 indicates the voltage standing wave ratio (VSWR) of the proposed X-band antenna.

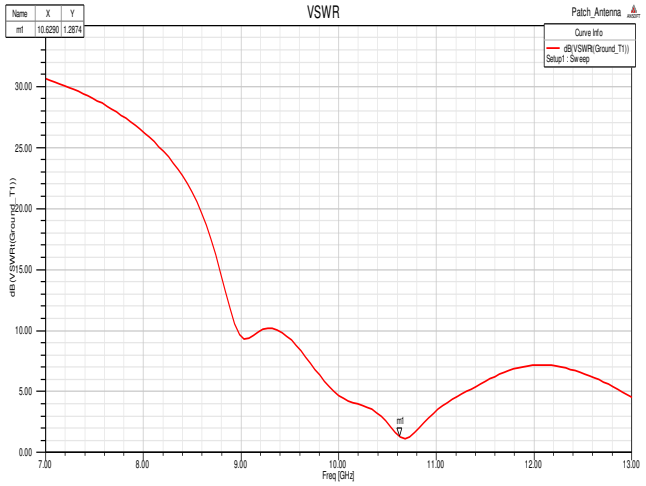

Fig.4: Simulated VSWR Plot

C. Gain

The Gain plot (Fig.5) gives the average peak gain=5.03dB.The gain of the antenna in a particular direction is more as compared to isotropic antenna radiating in all directions which is very useful for various applications in X-Band providing a better performance.

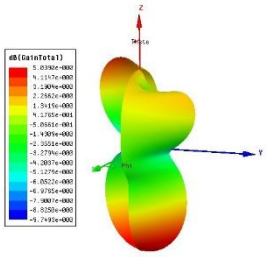

Fig.5: Overall Gain of the Proposed Antenna (3Dview)

D. Radiation Pattern

From polar plot view of radiation pattern as shown in Fig.6, itcanbe seen that at resonant frequencies radiation pattern obtained is Omni directional.

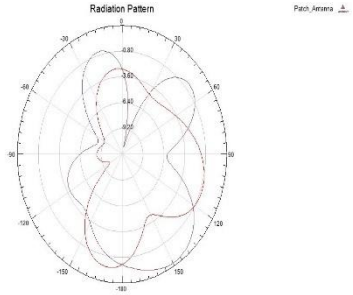

Fig. 6:Radiation Pattern of the designed Antenna (2D view) for phi= 0^0 & 90^0

IV. CONCLUSION AND FUTURE SCOPE

Microstrip patch antennas are being used in several applications since last few decades and they have been very popular due to their features like low profile, less weight, conformal design, low cost, ease of fabrication and ease of integration into communication systems. In this paper a Micro strip patch antenna is designed for X- band applications. The design of the antenna is properly analyzed and its different parameters like gain, radiation pattern, VSWR and return loss are studied. The proposed antenna can be used for multiple frequencies, the number of frequency bands can be increased by proper slotting and adjusting the design parameters.

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