Rectangular Microstrip Patch Antenna employing Polycarbonate substrate for Broadcasting and Inductive applications.

Amritpal Singh Grewal, Prabhdeepak Singh Sidhu, Simarjit Singh Saini

Abstract*— Reduced ground Microstrip Patch Antenna for Broadcasting and Inductive applications has been analyzed in this paper. The proposed microstrip antenna is a three layer antenna employimg copper material as a ground plane below the substrate and radiating patch above it. This paper does the analysis of Polycarbonate material as a substratre having dielectric constant of 2.1. The antenna parameters such as gain, directivity, reurn loss and bandwidth have been analyzed. The frequency range of the proposed antenna 7.3Ghz-7.85 with the centre frequency 7.576GHz. The proposed antenna has a directivity and gain of 5.65 dBi and 5.71 dB, respectively. The input impedance of the proposed antenna is 50.19 ohm which approximately matches with SMA connector (50 ohm) for maximum power transfer. The proposed antenna is designed and simulated using CST studio suite 2017.

***Index Terms*— Broadcasting, CST Studio Suite 2017, Directivity, Gain, Inductive, Polycarbonate, Return Loss, VSWR**

I. INTRODUCTION

Antenna is still emerging field of wireless & mobile communication. One of the major types of antenna is microstrip patch antenna. The rapid growth in communications has led to huge demand for microstrip antennas with low size, low profile, low cost of manufacture and ease of integration with feeding system. A microstrip patch antenna has various advantages such as compactness, light weight, and easiness to fabricate [1]. In 1953, Deschamp has reported first use of microstrip antennas. Further, Howell in the eighties worked and experimented on the microstrip antennas [2], [3]. The microstrip patch antennas consist of dielectric substrate, radiating patch, and ground plane. However, the microstrip antennas (MPA) suffer from low gain and low bandwidth the major drawbacks of the MPA. However, appropriate selection of substrate helps in improving the performance of antenna. Elimination of drawbacks, the low dielectric constant thick substrate or slotted patch can be employed [4]. The microstrip antenna size is dependent on the dielectric constant of a substrate. The size of antenna is inversely proportional to dielectric constant [5]. High dielectric constant substrate can be employed for a fixed frequency microstrip antenna [6]. Several techniques have been employed to improve the impedance bandwidth of microstrip patch antenna [7]. This includes meandering slots in the ground plane [8], and optimally designed impedance matching network [9] The slots on the ground or patch of microstrip antenna can be done, to improve the performance of the antenna [10]. The feeding technique employed in Microstrip Patch Antenna is microstrip feed line, its practical fabrication is not a complex process, therefore it is commonly employed in MPA [4]. The proposed work employs polycarbonate material as a substrate for broadcasting and Inductive application.

The paper has been divided into following sections.

In this paper, the antenna geometry has been deliberated in section II.

The simulated antenna results have been discussed in section.

The Section- III depicts the results and performance of the proposed antenna in terms of return loss (dB), directivity (dBi), bandwidth (GHz), gain (dB), VSWR and impedance (ohm).

Further, section IV concludes the proposed research work

II. ANTENNA DESIGN

In the proposed antenna design, the substrate of Polycarbonate material has been employed which have a relative permittivity (dielectric constant) of 2.1 with dimensions are 40mm x 30mm x 1.3mm.

The copper material is used for radiating patch and ground of prototype antenna.

The Figure 1(a), Figure 1(b) and Figure 1(c) demonstrates the geometry of the prototype microstrip antenna as shown in front view, bottom view and 3- dimensional view of the proposed antenna.

The ground of the proposed antenna has reduced which has been shown in Fig. 1 (c). The thickness of the copper brick has 0.35mm

The proposed microstrip antenna has a substrate of thickness 1.3 mm along with the patch and feedline of thickness of 0.35 mm.

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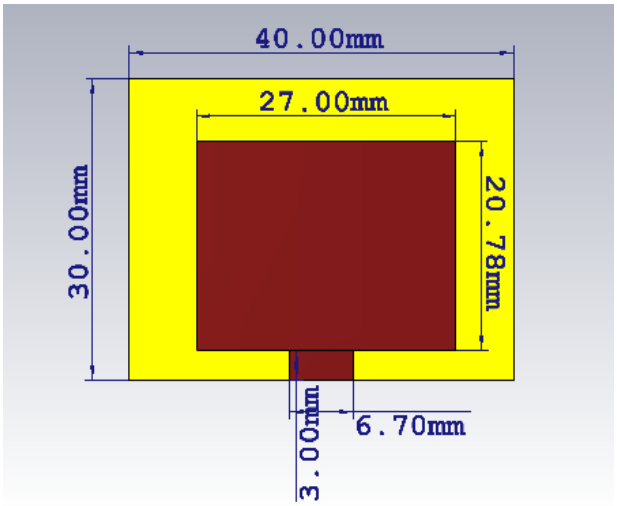

Fig. 1(a) Front View of the proposed antenna

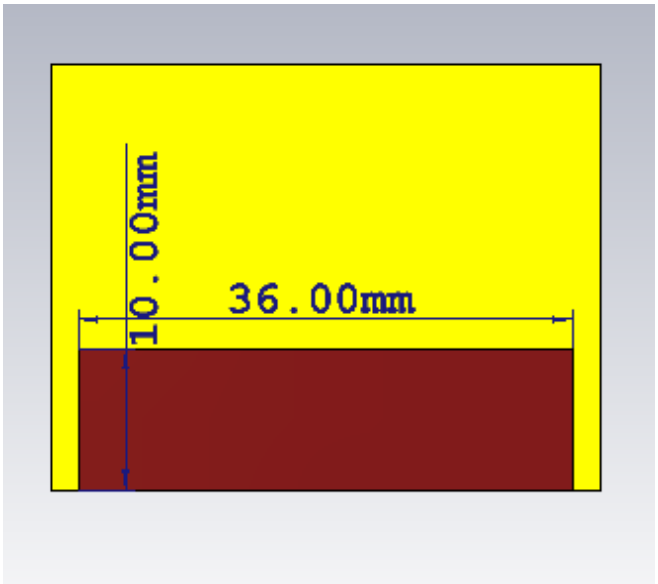

Fig. 1(b) Bottom view of the proposed antenna

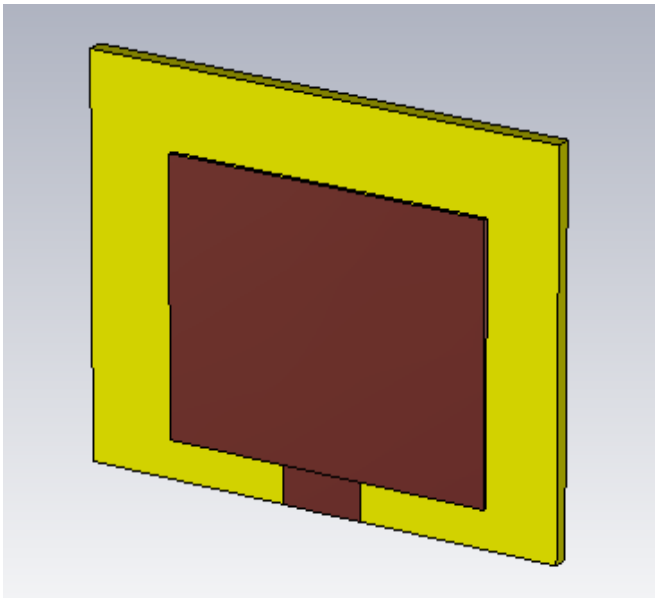

Fig. 1(c) 3-D view of the proposed

III. SMIULATED RESLUTS

The CST Studio Suite 2017 has been used to design and simulation of the proposed microstrip antenna and the performance has been analyzed in terms of return loss (dB), resonant frequency (GHz), directivity (dBi), gain (dB), impedance bandwidth (GHz), VSWR and impedance (ohms).

The return loss plot illustrating that the antenna is resonant at 7.57 GHz with a return loss of -54.51 dB has been shown in fig. 2.

The Smith Chart has been shown in fig. 3 which indicates that the proposed antenna has impedance of 50.19 ohm.

The directivity and gain of proposed textile antenna at 7.57 GHz is shown in Fig. 4 and Fig. 5.

The VSWR plot of the antenna has been shown in Fig. 6 which implies that the VSWR of the proposed antenna design lies below the minimum acceptable value of 2.

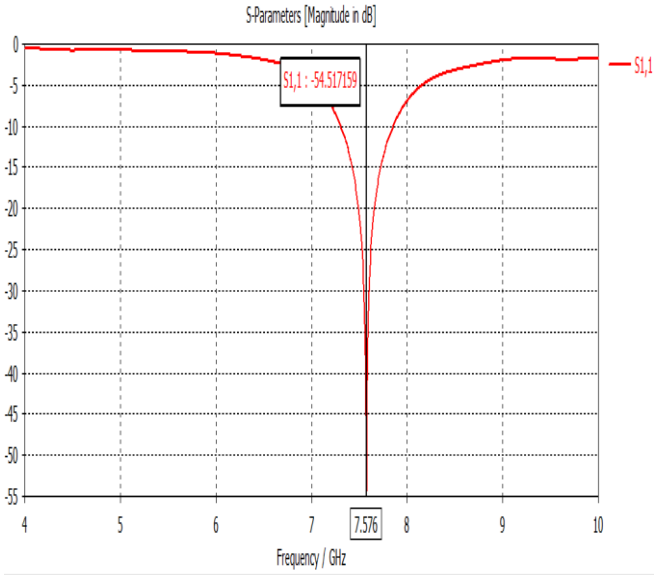

Fig. 2 Return Loss plot of the prototype antenna.

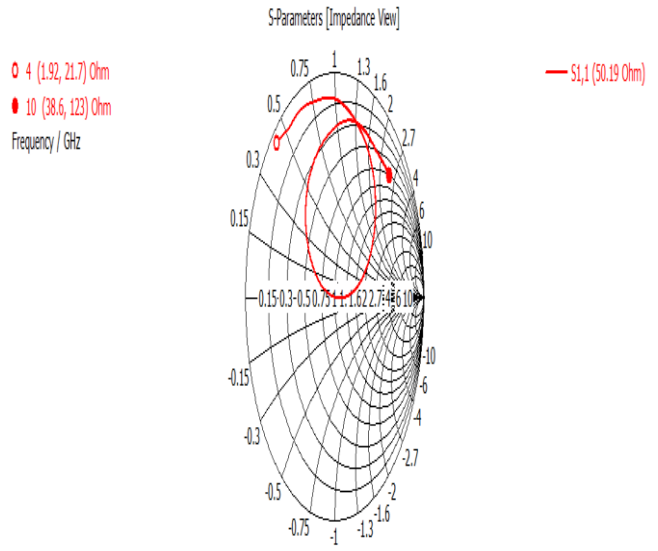

Fig. 3 Smith chart(Input impedance)of the proposed antenna.

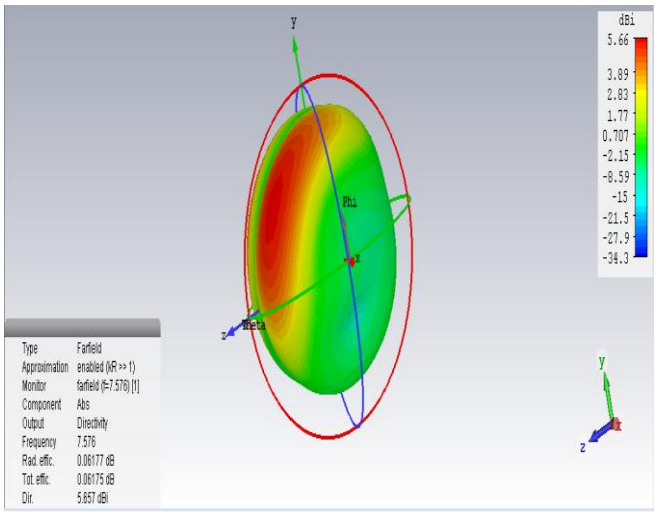

Fig. 4 Directivity of the proposed antenna.

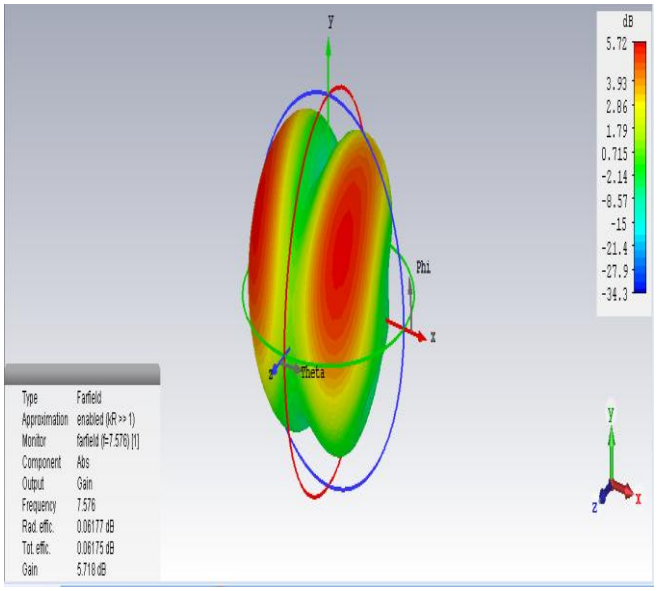

Fig. 5 Gain of the prototype microstrip antenna.

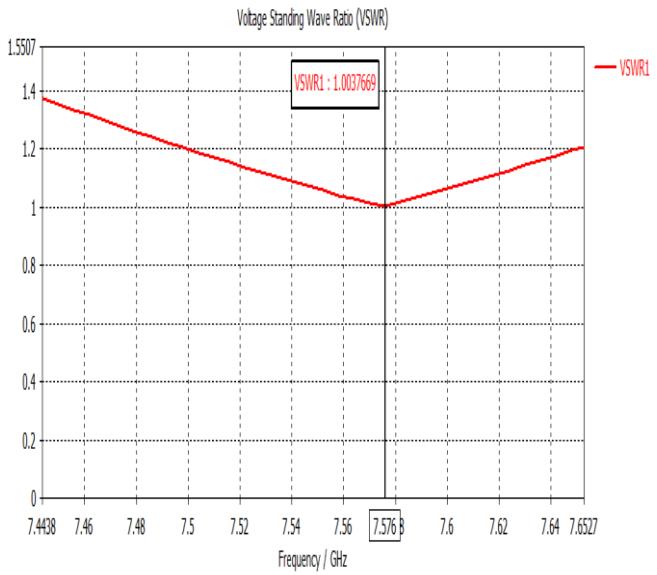

Fig. 6 Voltage Standing Wave Ratio (VSWR) of the proposed antenna.

IV. CONCLUSION

The proposed antenna employs Polycarbonate as substrate which covers the frequency from 7.30 GHz to 7.852 GHz making it suitable to be employed for the Broadcating and Inducative applications.

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