Design of Triple-S shaped Microstrip patch Antenna for Dual band Applications

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Abstract: This paper proposes the design of a Triple-S patch antenna for C band applications [1]. The designed antenna was fed by coaxial feeding technique. The proposed Triple-S patch antenna produces a wide band of frequencies for C-band applications [2]. The simulated results for various parameters like return loss, radiation pattern etc. have been presented. . This Triple-s patch antenna system produces dual band of frequencies with resonating frequencies at 5.4 GHz and 5.9 GHz, which can be used for Wireless applications.

Keywords: *Triple-S, Microstrip Patch, Co-axial feeding, Radiation Pattern.*

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1. Introduction: A microstrip or patch antenna is a low profile antenna that has a number of advantages over other antennas. Microstrip antenna found application in different fields due to its compact size [3]. Microstrip antenna is generally used for many wireless applications due to light weight and patch can be of any shape. Patch is generally made of material such as copper or gold. In radar and satellite communication, it is necessary to design antennas with very high directive characteristics to meet the demand of long distance communication. They have the capability to operate in dual and triple band frequency operations [4]. The patches are the basic and most commonly used Microstrip antennas. These patches are used for the simplest and the most demanding applications.

Akin to the two sides of a coin, a patch antenna also has some drawbacks. Bandwidth and Gain being the two most important factors of an antenna is low for patch antennas. There are many ways to solve this problem but each of them leads to another problem which requires further attention. The designed antenna was fed by coaxial feeding technique. Coaxial probe feeding is the method in which the inner conductor of the coaxial is attached to the radiation patch of the antenna while the outer conductor is connected to the ground plane [5].

In this paper we have designed Triple-S shaped Microstrip patch Antenna which produces dual band of frequencies resonating at 5.4 GHz and 5.9 GHz, which can be used for Wireless and mobile applications. This antenna is specifically designed for WiMAX and WLAN communication systems [6]. WiMAX belongs to IEEE 802.16 family of standards. The full form of WiMAX is Worldwide Interoperability for Microwave Access, it provides data rate of 30-40 Mbps, enabling us with interoperable implementations [7-9].

2. Antenna Design: In this design, Microstrip antenna is used due to its light weight, thin size and patch can be of any shape. The structure of Triple-S shaped Microstrip patch Antenna patch antenna is shown in Fig.1.

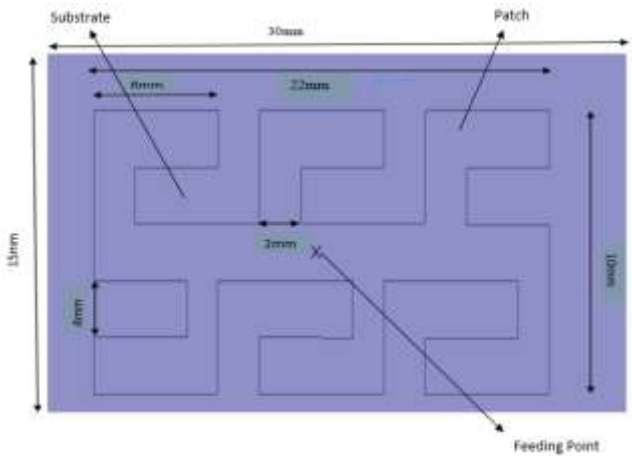

Figure 1: Triple-S shaped Microstrip patch Antenna

The antenna is etched on a "Rogers RO3210 (tm)" substrate which has a dimension of 15mm x 30mm with relative permittivity 10.2 and thickness of 2 mm. Rogers RO3210 in comparison has a higher dielectric constant which results in a smaller patch size. The geometry of the proposed antenna is shown in Fig.1.The ground plane is having 15mm x 30mm which is as same as substrate. For this proposed antenna we are using co-axial feeding which is simple in design.

The Return loss and VSWR results are presented in Fig.2 (a) & 2(b) respectively. From the observed results it is evident that the proposed antenna exhibits excellent isolation properties (*S*11) at the resonant frequencies of 5.4 GHz and 5.9 GHz with better return loss (*S*11) of -30 dB and -34 dB respectively, which gives good impedance matching for the antenna.

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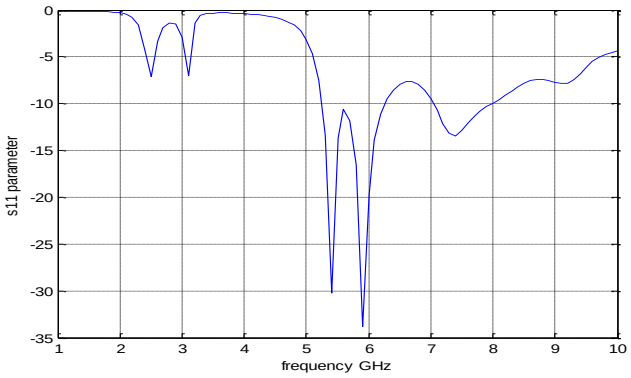

Figure 2(a): *S*11 Parameters of the Proposed

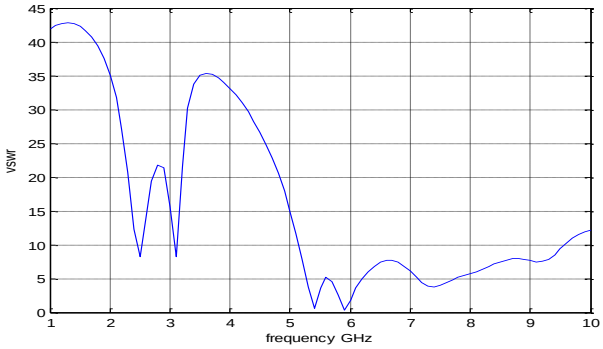

Figure 2(b): VSWR of the Proposed Antenna

The plot gives the desired values of VSWR at the resonant frequency which is less than 2. The less VSWR value is observed at the resonant frequencies 5.4GHz and 5.9GHz, indicating good matching conditions. The radiation pattern of the proposed antenna at the resonant frequencies is as shown in Fig.3 (a), 3(b), 3(c) & 3(d).

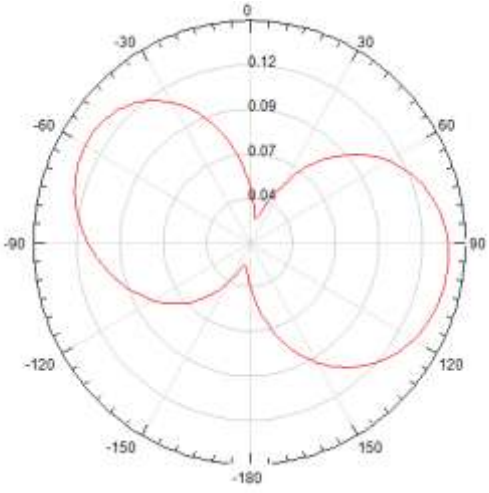

Figure 3(a): Radiation Pattern at 5.9 GHz for Φ=0^0

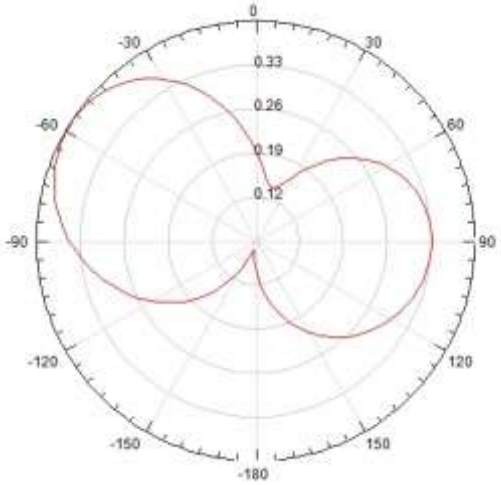

Figure 3(b): Radiation Pattern at 5.4 GHz for Φ=0^0

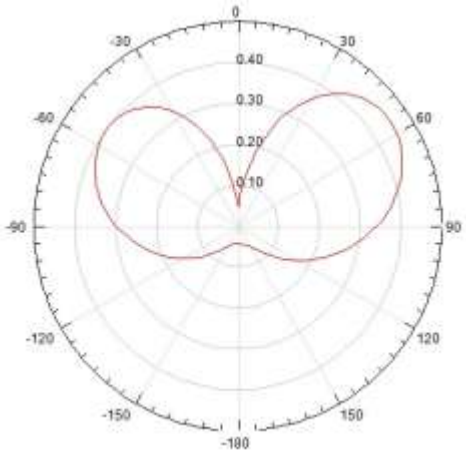

Figure 3(c): Radiation Pattern at 5.9 GHz for Φ=90^0

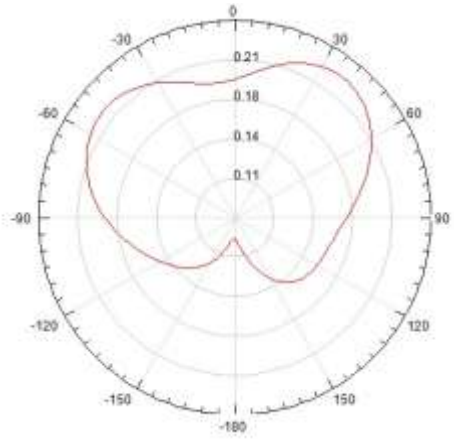

Figure 3(d): Radiation Pattern at 5.4 GHz for Φ=90^0

The 3D polar plot of proposed antenna is shown in figure 4.

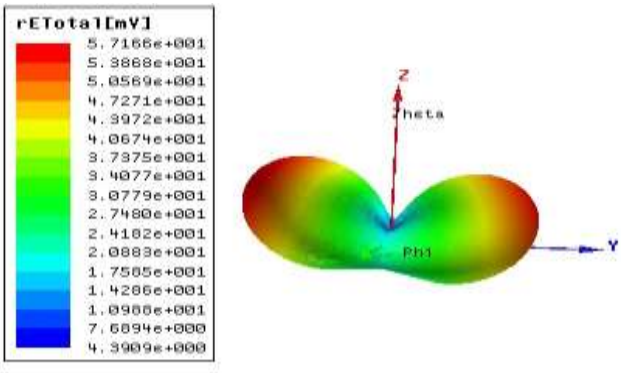

Figure 4: 3D Polar Plot of Proposed Antenna

3. Conclusion:

In this paper, we have proposed a Triple-S shaped microstrip patch antenna which produces dual band of frequencies resonates at 5.4 GHz and 5.9 GHz with excellent return loss of < -30dB. Hence from the above results we can conclude that, this antenna is well suited for wireless (WLAN, Wi-MAX, HIPERLAN, and NLOS) applications [10].

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