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DESIGN AND ANALYSIS OF PARASITIC HEXAGONAL PATCH ANTENNA BOUNDED BY SIMILAR SHAPED SLOT FOR BANDWIDTH ENHANCEMENT

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ABSTRACT
This paper introduces the hexagonal shaped microstrip patch antenna for improving the bandwidth of the antenna. The overall size of the antenna 25mm×25mm×1.6mm. It covers the impedance bandwidth of 5910MHz (4.04-9.95GHz).The combination of hexagonal shaped parasitic element and I-shaped monopole antenna can be used to achieve wider bandwidth. The proposed antenna offers (2.29dB and 3.72dB) gain and (2.62dB and 4.06dB) directivity for the frequencies 4.96GHz and 8.47GHz. Bidirectional pattern is inferred in E-plane (θ=90˚) and omnidirectional is inferred in H-plane ((θ =0˚).
KEYWORD: Microstrip patch; Wider Bandwidth; Gain; Radiation pattern; Directivity; Parasitic element.

1. INTRODUCTION
An antenna is the major contribution for transmitting the signal for wireless applications. Advanced wireless communication requires higher bandwidth, low profile and compact size [1]. ELC based metamaterial offers unusual electromagnetic property which is used to enhance the bandwidth of the antenna [2]. A microstrip patch antenna is a metal strip or patch mounted on a dielectric layer (substrate) over a ground plane which is useful for high performance in extreme applications: aircraft, satellite, missiles, cell phones and electronic devices [3]. Patch antennas are low cost, have a low profile and are easily fabricated [4]. Substrate integrated waveguide (SIW) technology provides wider bandwidth and high gain antenna design. The same SIW concept can be utilized for designing power divider [5] and Frequency selective surface (FSS) [6]. Meta material based radiating element can be used to design RF ID antenna [7] and band pass filter [8]. Since the recent wireless system focuses on ISM band [9] and millimeter wave range [10], most of the researchers are contributing towards it. In this paper, parasitic element is introduced on the bottom of the ground plane to enhance the bandwidth for WLAN applications.

2. PROPOSED ANTENNA DESIGN
The key objective of work is to investigate the possibility of bandwidth enhancement by varying the width of the parasitic element. The proposed antenna has a compact size of 25mm×25mm×1.6mm. Here I shaped monopole is used in the ground and a hexagonal parasitic element is introduced to the surface of the substrate. The height of the I- shaped monopole is 10mm. On varying the width of the parasitic element the bandwidth of the antenna varied considerably. At a certain width (6mm) wider bandwidth is achieved. The structure of the proposed antenna is shown in Figure 1.

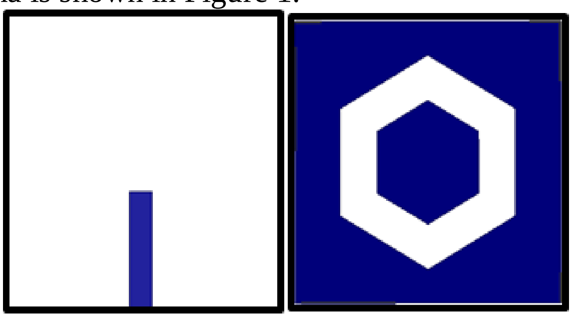

(a) (b)

Figure 1 Proposed antenna (a) Top view (b) Bottom view.

Figure 2 depicts that, the return loss characteristics of conventional antenna and proposed parasitic loaded monopole antenna. It clearly shows that the proposed antenna covers a wider impedance bandwidth of 5910MHz (4.04-9.95GHz).

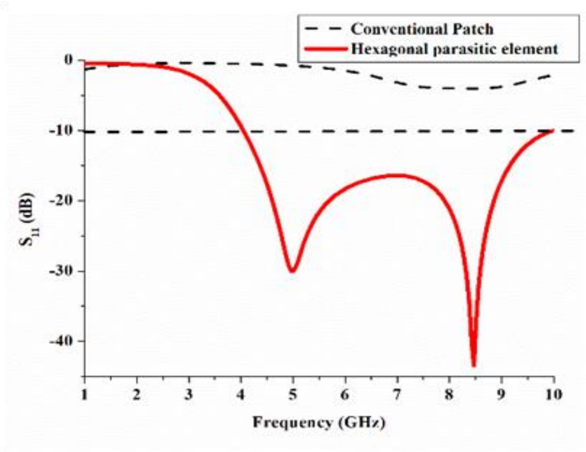


Figure 2 Simulated return loss characteristics of conventional and proposed antenna.

VSWR is Voltage Standing Wave Ratio is the parameter that numerically describes how well the antenna’s impedance is matched to the radio or transmission line is connected to. For the traditional antenna the VSWR value is 1 to 2. The obtained VSWR is 1.15 and it is shown in Figure 3.

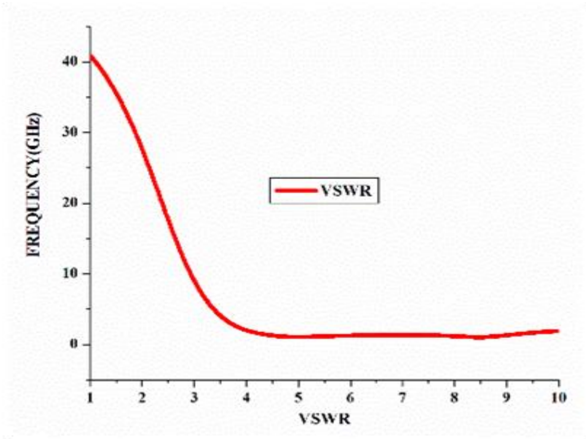


Figure 3 VSWR for the proposed antenna.

The radiation pattern is a graphical representation of distribution of radiation energy. The strength of radiation is usually measured in terms of field strength. The radiation pattern obtained in the E plane is bidirectional and the radiation pattern obtained in the H plane is omnidirectional, which is explained in Figure 4.

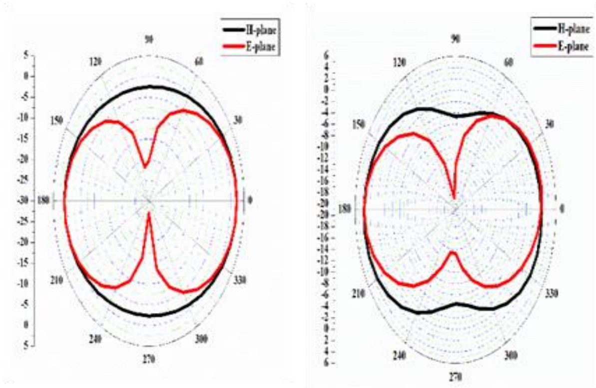


Figure 4 Radiation pattern of the proposed antenna.

An antenna power gain or gain is the key performance number which combines the antenna's directivity and electrical efficiency. The gain of the proposed antenna is shown in Figure.5. It depicts 2.29dB and 3.72dB gain for the frequencies 4.96GHz and 8.47GHz respectively.

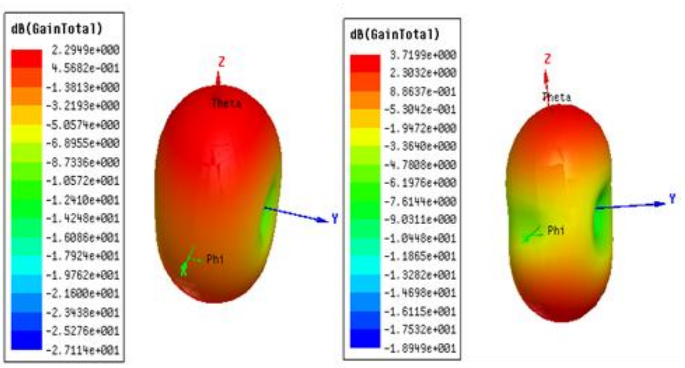
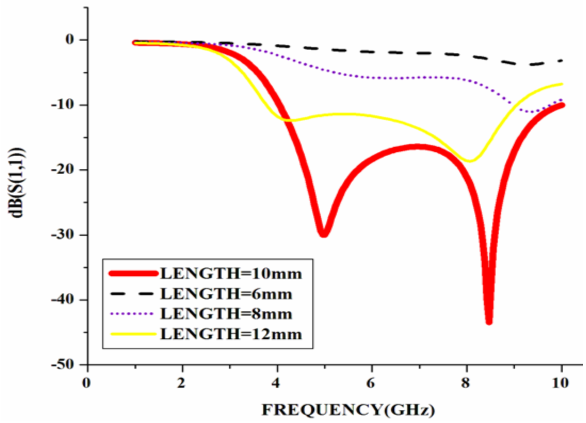


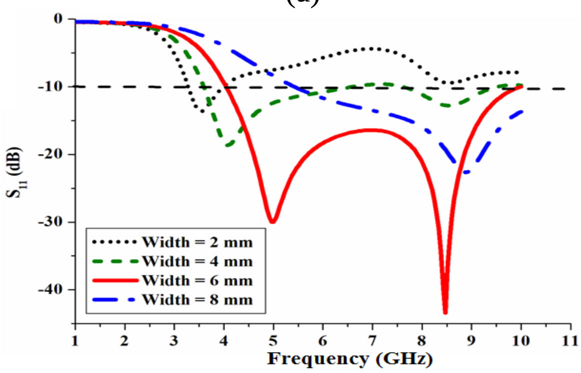
Figure 5 Gain of the proposed antenna.

3. PARAMETRIC ANALYSIS

Parametric analysis of for various lengths of I-shaped monopole and width of the parasitic element are shown in Figure 6 (a) and (b). Increasing the length of the 'I' shaped monopole and width of the parasitic element offers better impedance matching and broad bandwidth. Similarly, the return loss characteristics of with parasitic element and without parasitic element are depicted in Figure 7. It describes the parasitic element creates important role in obtaining broad bandwidth due to coupling between parasitic element and metallic portion.



(a)



(b)

Figure 6 Parametric analysis for (a) various length of I shaped monopole (b) Various width of the parasitic element.

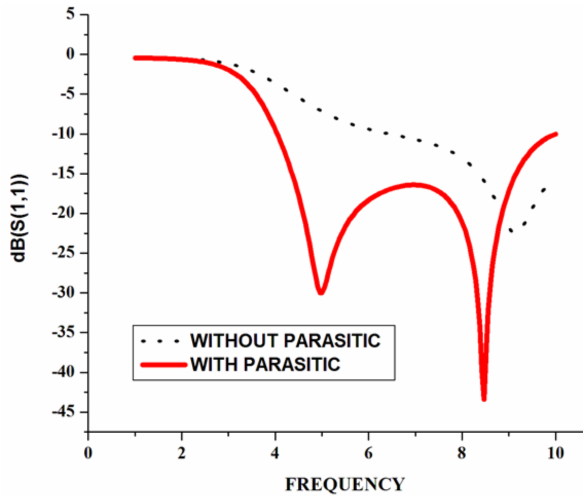


Figure 7 Return loss characteristics of with parasitic element and without parasitic element.

4. EXPERIMENTAL RESULTS

The photograph of fabricated antenna is shown in Figure 8. A low cost FR-4 substrate is utilized for fabrication having a dimension of 25 mm× 25 mm ×1.6mm. The relationship between simulated and measured return loss characteristics is displayed in Figure 9. Measured result matches with simulated results to cover wider impedance bandwidth for WLAN applications.

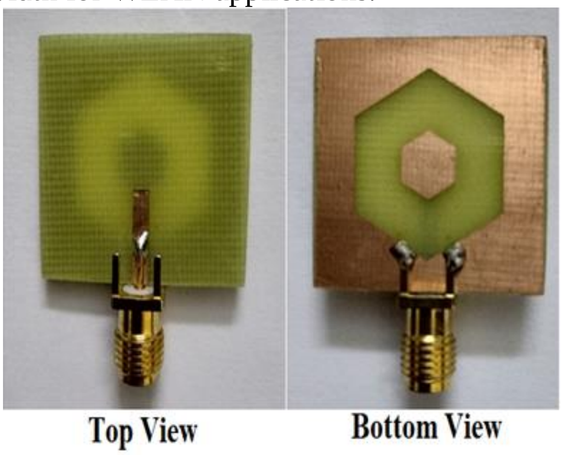


Figure 8 Fabricated antenna.

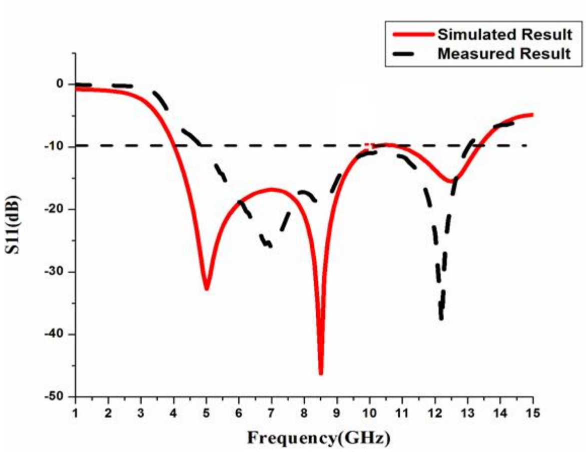


Figure 9 simulated and measured return loss characteristics of the proposed antenna.

5. CONCLUSION

The proposed antenna has a compact size of 25mm×25mm×1.6mm. It covers an impedance bandwidth of 5910MHz (4.04-9.95GHz).The parasitic element changes the current distribution and offers wider bandwidth. The optimum dimensions of the proposed antenna are obtained by parasitic analysis.

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