Hexagonal Shaped Slotted Microstrip Patch Antenna
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Abstract:
In this paper author propose a design of L shaped slotted Hexagonal microstrip patch antenna. The unslotted hexagonal patch antenna is analyzed and it was found that it is a single band antenna. By making slot in the patch, dual band response of antenna is achieved and performance of antenna also improved. Parametric study of antenna is done by varying the horizontal length of L shaped slot. The slotted hexagonal antenna is optimized with horizontal length of L slot at which antenna had highest negative value of return loss (S11 in dB). The optimized slotted hexagonal patch antenna resonant at frequencies 4.94 GHz and 8.02 GHz with -10 dB bandwidth of 100 MHz and 400 MHz respectively.

Keywords: Hexagonal shaped, microstrip patch antenna, L shaped slot.

1. INTRODUCTION

In the field of wireless communications, antennas play very significant role. Various types of antennas are popular having certain properties and usages. Out of those microstrip patch antenna is most suitable candidate for wireless communication because of its low profile, light weight, conformability and easy fabrication properties. In microstrip patch antenna, rectangular and circular shaped patch antennas are most commonly used. Inset feed, coaxial feed, aperture coupled, proximity coupled feed are most common method to feed the microstrip patch antenna. Slots are cuts in the patch or in the ground to enhance the performance of microstrip patch antenna.

In this paper, design of L shaped slotted Hexagonal microstrip patch antenna is presented. First unslotted hexagonal shaped microstrip patch antenna is analyzed and then L shaped slot is cut in the hexagonal microstrip patch antenna. Parametric analysis is also performed by varying the horizontal length of L shaped slot. Optimization of Slotted Hexagonal microstrip patch antenna is also done. The antenna structure is designed and simulated by using finite element based electro-magnetic mode solver Ansoft HFSS simulator software.

The paper is divided in four sections. Section 2 explains the design and configuration of the proposed antenna. In section 3, parametric analysis and optimization of the antenna is done and simulation results are also discussed. Section 4 gives the conclusion of this work.

2. DESIGN & CONFIGURATION

Figure 1 shows the structure of proposed hexagonal shaped slotted microstrip patch antenna. The antenna is printed on a substrate (Rogers RT / duroid 5880) of thickness = 0.2 cm with relative permittivity of 2.2.

The dimensions of the slotted hexagonal microstrip patch are shown in Figure 1. Probe feeding is used to feed the antenna. L shaped slot is cut in the patch antenna. Vertical length of the L shaped slot is 2.73 cm and the horizontal length of the L shaped slot is varied for parametric analysis while the width of the slot is 0.2 cm.

3. ANALYSIS

First unslotted hexagonal shaped microstrip patch antenna is analyzed. The unslotted hexagonal patch antenna resonant at 6.10 GHz with a -10dB bandwidth of 320 MHz. Return loss of unslotted hexagonal patch antenna is shown in figure 2 and the patch antenna had a gain of 7.3227 dB at resonating frequency (figure3).
L shaped slot is cut in the hexagonal microstrip patch antenna and the horizontal length of the L shaped slot is varied from 1.6 cm to 2.0 cm. Dual band response of slotted hexagonal microstrip patch antenna is obtained. Return loss for different values of horizontal length of L shaped slot is shown in figure 4 (figure 4a, 4b is zoom of figure 4). It can be seen that as the horizontal length of L slot increases, the resonant frequencies of slotted hexagonal patch antenna decreases because of increase in path length.
The slotted hexagonal patch antenna is then optimized with horizontal length of the L shaped slot = 1.9 cm at which the negative value of S11 is highest. Dual band response of optimized slotted hexagonal patch antenna is shown in figure 5. The optimized slotted hexagonal patch antenna resonant at 4.94 GHz and 8.02 GHz frequencies with -10dB B.W. of 100 MHz and 400 MHz respectively. The gains of slotted hexagonal patch antenna at resonating frequencies are 7.2509 dB and 8.4272 dB respectively (figure 6a,6b).

![Figure 5: Return Loss of Optimized Slotted Hexagonal Patch Antenna.](image)

![Figure 6a: Gain of Optimized Slotted Hexagonal Patch Antenna.](image)

![Figure 6a: Gain of Optimized Slotted Hexagonal Patch Antenna at 4.94 GHz.](image)

4. CONCLUSION

Design of L shaped slotted Hexagonal microstrip patch antenna is presented in this paper. The unslotted hexagonal patch antenna is single band antenna and resonant at 6.10 GHz frequency with a -10dB B.W. of 320 MHz. By making slot in the patch, dual band response of antenna is achieved and performance of antenna also improved. Parametric study of antenna is done by varying the horizontal length of L shaped slot. It can be seen that as the horizontal length of L slot increases the resonant frequencies of patch antenna decreases because of increase in path length. The slotted hexagonal antenna is optimized with horizontal length of L slot = 1.9 cm at which antenna had highest negative S11 value. The optimized slotted hexagonal patch antenna resonant at frequencies 4.94 GHz and 8.02 GHz with -10 dB B.W of 100 MHz and 400 MHz respectively.

REFERENCES


