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V-slotted Triangular Microstrip Patch Antenna

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Abstract: This paper presents a design of triangular microstrip antenna with V-slot and experimentally studied. Triangular patch is designed on a FR4 substrate of thickness 0.6 mm and relative permittivity of 4.4 and mounted above the ground plane at a height of 6 mm. Bandwidth as high as 9.2% are achieved with stable pattern characteristics, such as gain and cross polarization, within its bandwidth. This design technology is achieved by embedding two narrow slots in V shape on the microstrip antenna and placing a single feed. Impedance bandwidth, antenna gain and return loss are observed for the proposed antenna. This antenna was designed on Ansoft Designer v-2.2.0 software. Details of the measured and simulated results are presented and discussed.

Keywords: Slotted Microstrip Antenna, Radiation Pattern, Returns Loss

1. INTRODUCTION

Microstrip patch antennas are widely implemented in many applications, especially in wireless communication. This is due to attractive features such as low profile, light weight, conformal shaping, low cost, high efficiency, simplicity of manufacture and easy integration to circuits. However the major disadvantage of the microstrip patch antenna is its inherently narrow impedance bandwidth. Much intensive research has been done in recent years to develop bandwidth enhancement techniques. These techniques includes the utilization of thick substrates with low dialectic constant [1], and slotted patch [2].The use of electronically thick substrate only result in limited success because a large inductance is introduce by the increased length of the probe feed, resulting few percentage of bandwidth at resonant frequency.

Now with the loading some specific slot in the radiating patch of microstrip antennas, compact or reduced size microstrip antennas can be obtained. The loading the slots in the radiating patch can cause meandering of the excited patch surface current paths and result in lowering of the antenna's fundamental resonant frequency, which corresponds to the reduced antenna size for such an antenna, compared to conventional microstrip antenna at same operating frequency.

In this paper, triangular microstrip antenna with V-slot on patch is proposed. The patch mounted on FR4 substrate (thickness=0.6mm) and above from ground plane at a height of 6mm. It is found that proposed design can also cause significant lowering of antennas fundamental resonant frequency due to increased length of the probe feed.

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2. ANTENNA DESIGN

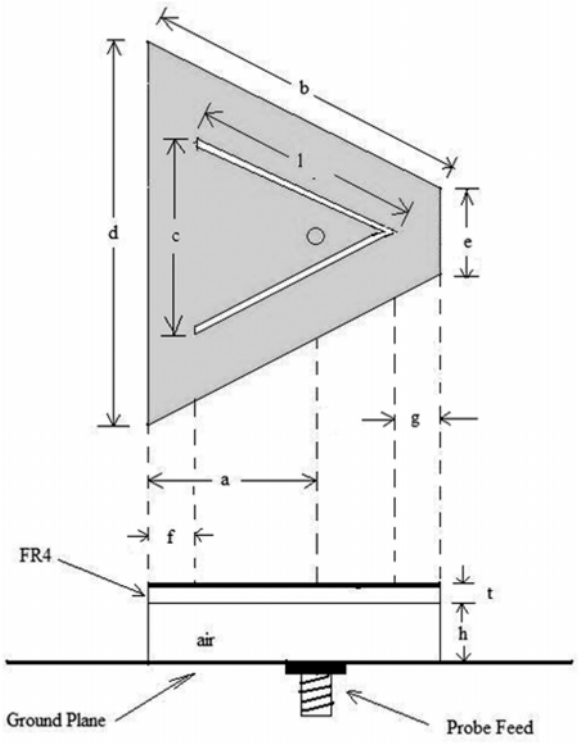

Figure 1: Geometry of Proposed *V*-slotted Triangular Microstrip Antenna with Dimensions a = 21mm, b = 41.23mm, c = 29.56mm, d = 50mm, e = 9.77mm, g = 5.67mm, f = 4.67mm h = 6mm, l = 29.56mm, t = 0.6mm.

Designing an antenna in the Wi-max band meant that the antenna dimension could be bulky which is un-welcomed. Owing to it objective is to design a reduced size wide band microstrip antenna; the design idea was taken from broadband antennas to make the antenna work in a large

band of frequencies of the many broadband antennas, triangular patch antenna was chosen. Hence the chosen shape of the patch was cut with a V-shaped slot, with an aim to achieve smaller size antenna.

The geometry of triangular microstrip patch antenna with V-slot is presented in fig.1 with front view and side view. This V-slotted equilateral triangular patch with a truncated tip is fabricated on a FR4 substrate of thickness 0.6 mm and relative permittivity of 4.4. It is mounted above the ground plane at height of 6 mm.

In this work, co-axial or probe feed technique is used as its main advantage is that, the feed can be placed at any place in the patch to match with its input impedance (usually 50 ohm). The software used to model and simulate the V-slot triangular patch antenna was Ansoft designer V-2.20, it can be used to calculate and plot return loss, VSWR, radiation pattern, smith chart and various other parameters.

3. RESULTS AND DISCUSSION

The proposed antenna has been simulated using Ansoft Designer v-2.2.0 software[5]. Fig.2 shows the variation of return loss with frequency. Plot result shows resonant frequency 3.6 GHz. And total available impedance band width of 330 MHz that is 9.2% from the proposed antenna. Minimum -26.2 db return loss is available at resonant frequency which is significant. Fig.3 shows the input impedance loci using smith chart. Input impedance curve passing near to the 1 unit impedance circle that shows the perfect matching of input. Fig.4 shows the VSWR of the proposed antenna that is 1:1.11 at the resonant frequency 3.6 GHz. Good broadside radiation pattern obtain in fig.6

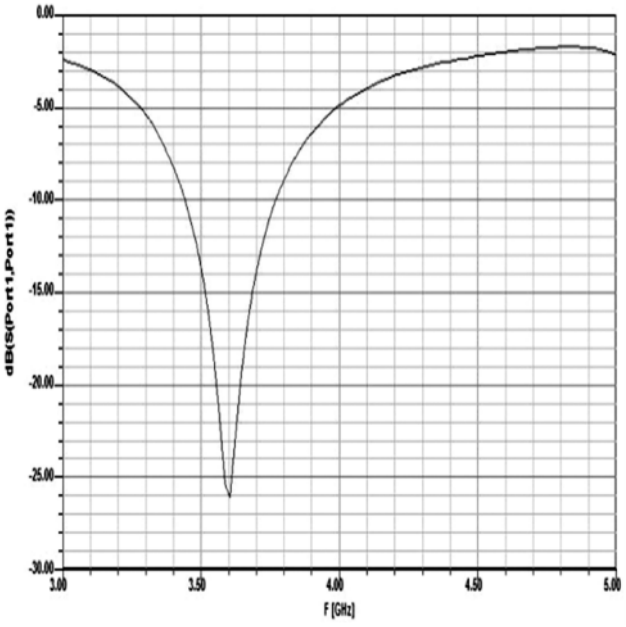

Figure 2: Return Loss vs. Frequency Curve for Proposed Antenna.

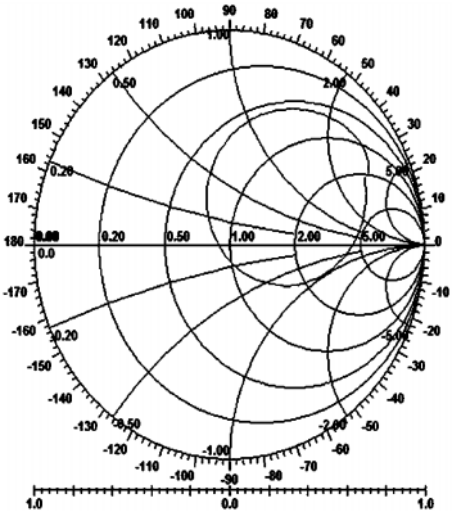

Figure 3: Input Impedance Loci using Smith Chart

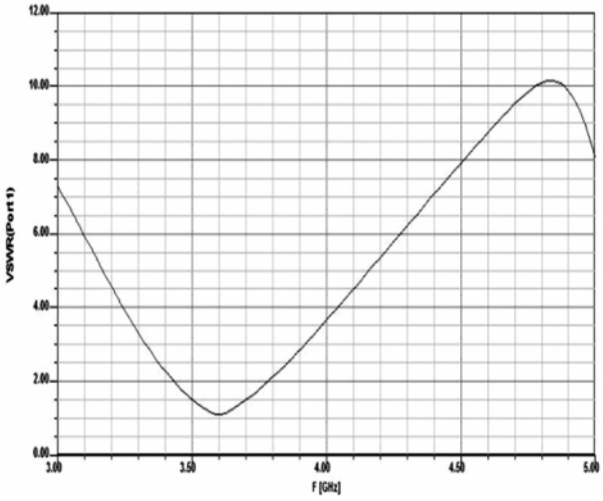

Figure 4: VSWR vs. Freq. Curve of Proposed Antenna

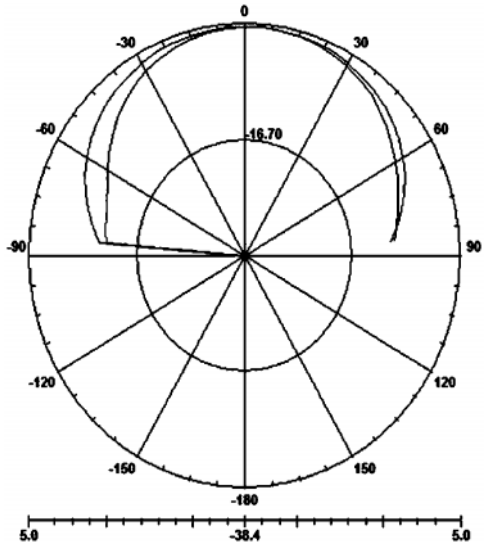

Figure 5: Radiation Pattern of proposed Antenna

4. CONCLUSIONS

The design has demonstrated that a single probe feed triangular patch with V-shaped slot on the patch can be used to form an antenna with impedance bandwidth of 9.2% working in Wi-max wireless communication system. These modern communication systems require antennas with broadband and/or multi-frequency operation modes. These goals have been accomplished employing slotted patch for the radiating element, with the aim to preserve compactness requirements and to maintain the overall layout as simply as possible and keeping the realization cost very low.

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