

# Triangular Shaped Broadband High Gain Microstrip Antenna

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**ABSTRACT:** In this research work triangular shaped broadband patch antenna with high gain is proposed. The proposed is designed by a triangular shaped radiating patch with modified ground plane. The covered frequency ranges from 4.7 GHz to 9 GHz with peak gain 3.47 dBi. Two resonant frequencies at 5.1 GHz and 7.8 GHz with minimum reflection coefficient of -26dB and -33.9 dB are achieved. The simulated design antenna is offered broadband with percentage bandwidth of 62%. The designed antenna is simulated using Ansoft designer software.

**KEYWORDS:** Radiating patch, broadband and microstrip antennas.

## I. INTRODUCTION

The conventional patch antenna consists of radiation patch, dielectric substrate and ground plane. The dielectric substrate is sandwich in between radiating patch and ground plane. In general the radiating patch shapes may be rectangular, circular, and square. Other shapes can be design by modifying conventional shape. The microstrip patch antennas have some inherent properties like low profile, lightweight, planer surface, non planer surface, flexible, easy to fabrication, versatile application and easily available. For these advantageous properties, it is frequently used in different wireless communication system and medical application [1-5]. With the advantage of microstrip patch antenna, some drawbacks have existed. The drawbacks are narrow bandwidth with low gain. The drawbacks have been overcome by using several techniques [6-8]. In general the conventional microstrip patch antenna carry 2% frequency band and very low antenna gain and sometimes it may be negative. The -10dB frequency band may be enhanced by introducing slot on the both planes of the antenna [8-12]. In this research article a broadband with high gain microstrip patch antenna is presented by introducing triangular shaped radiating patch with modified ground plane. Maximum percentage bandwidth of 62% with maximum peak gain 3.47 dBi is found. The proposed antenna is simulated using Ansoft designer software.

## II. ANTENNA DESIGN

The dimensions of Antenna – I and Antenna – II are 17 mm X 15 mm and 15 mm X 17 mm. The geometrical view of the designed antenna is shown in Fig. 1. The dimension of the ground plane is 15 mm X 15 mm with small triangular shaped radiating patch. A rectangular shape slot is loaded on the back side of dimension 12 mm X 11 mm. The feeding point is located 1.5 mm from bottom edge and 7.5 mm from right edge of the antenna structure. The dielectric substrate is RogersRT/duroid 5880(tm) with relative permittivity 2.2, relative permeability 1 and loss tangent 0.0009. All the dimension of the proposed antenna is given in Table 1. Only simulated results of the designed antenna are presented in this paper by MOM base Ansoft designer software.

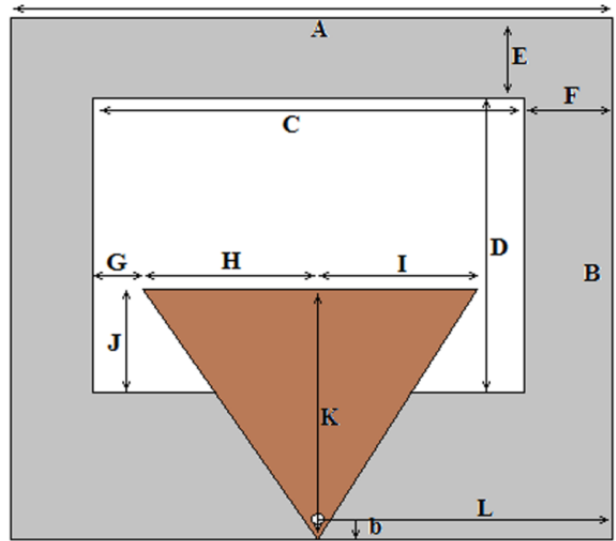


Figure 1 Proposed microstrip patch antenna.

TABLE 1  
GEOMETRICAL DIMENSION OF THE PROPOSED ANTENNA. (ALL DIMENSIONS ARE IN MM)

Parameters	Dimensions	Parameters	Dimensions
A	15	H	5
B	15	I	5
C	12	J	4
D	11	K	6.5
E	1.5	L	7.5
F	1.5	b	1.5
G	1	-	-

### III. ANTENNA RESULTS AND DISCUSSION

The entire results reflection coefficient versus frequency response, 2D antenna gain, VSWR, 3D antenna gain and surface current distribution of the proposed antenna are presented from Fig. 2 to Fig. 6. Antenna – I and Antenna – II is obtained by the variation of length (A in mm) and width (B in mm) and finally proposed antenna is obtained. The gain and bandwidth of the antenna is enhanced by the introduction a rectangular slot on the ground plane with dimension 12 mm X 11 mm.

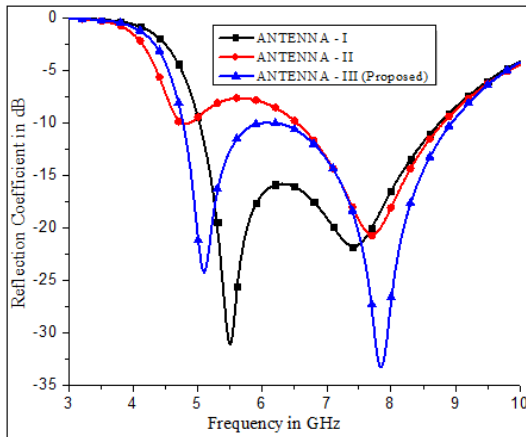


Fig. 2 Reflection coefficient of the antenna.

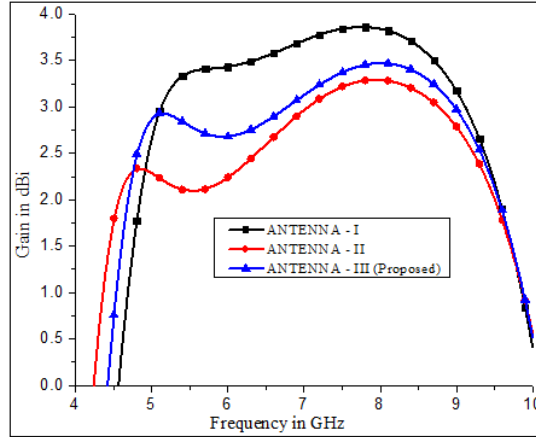


Fig. 3 Gain of the antennas.

Table 2 Simulated results of the antennas.

Antenna	Bandwidth (in GHz)	Resonance frequency (in GHz)	Reflection coefficient (in dB)	Maximum Gain (in dBi)
Antenna - I	5 – 8.8	5.5, 7.4	-33.63 and -21.87	3.8
Antenna - II	4.7 – 5 and 6.5 – 8.9	7.7	-20.8	3.3
Antenna – III (Proposed)	4.7 - 9	5.1 and 7.8	-26 and -34	3.5

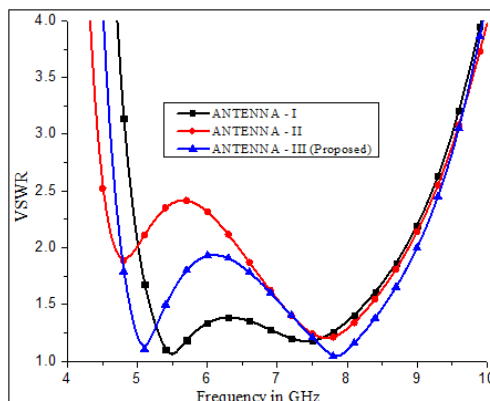


Fig. 4 VSWR of the antennas.

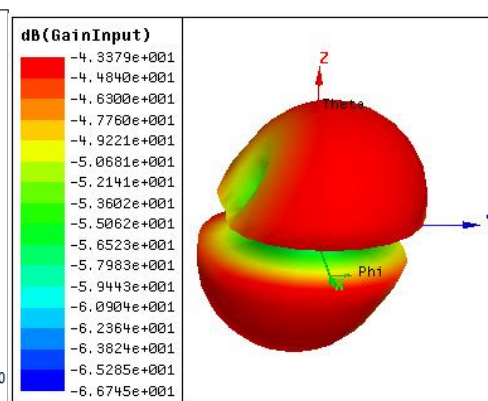


Fig. 5 3-D gain of the proposed antenna

The reflection coefficient of the antenna – I for the dimension 17 mm X 15 mm is -33.63 dB obtained with frequency band 5 – 8.8 GHz. Antenna – II offers frequency bands 4.7 – 5 GHz and 6.5 – 8.9 GHz with minimum reflection coefficient -20.8 dB. The bandwidth of the antenna is enhanced for the reduction of the length of parameter B from 17 mm to 15 mm. Finally the proposed antenna is designed with minimum dimension of 15 mm X 15 mm. The proposed antenna is offered maximum frequency band 4.7 – 9 GHz with minimum reflection coefficient -34 dB. With the enhanced bandwidth of the proposed antenna gain is little bit reduced from 3.8 dBi to 3.5 dBi. Similarly VSWR of the proposed antenna is varied in between the range of  $1.1 \leq \text{VSWR} \leq 1.9$ . The surface current distribution of the proposed antenna at the resonant frequencies 5.1 GHz and 7.8 GHz are presented in Fig. 6. Maximum simulated surface current

density of the proposed antenna 87 A/m at 5.1 is achieved. All the simulated results of the antennas are presented in Table 2 in details.

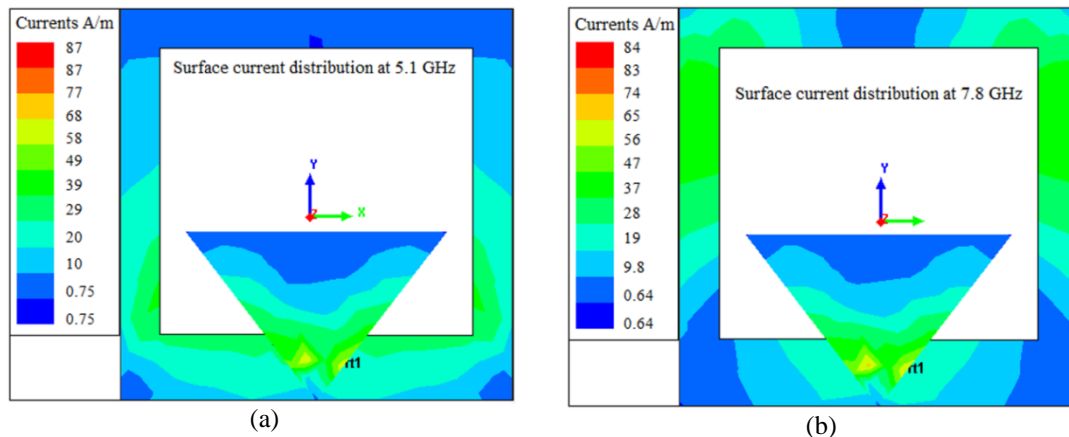


Fig. 6 Surface current distribution of the proposed antenna at (a) 5.1 GHz and (c) 7.8 GHz.

#### IV. CONCLUSION

After studies the simulated results of the antenna, it is found that the bandwidth of the antenna enhanced by the introduction of slot on the ground plane and it is farther enhanced for the variation of B parameter. The design antenna is very compact and it is offered maximum percentage bandwidth of 62% (4.7 – 9 GHz). The design antenna offers stable VSWR and gain of  $1.1 \leq \text{VSWR} \leq 1.9$  and 3.5 dBi which is very much applicable within the range of microstrip patch antenna. Also surface current distribution of the proposed antenna 87 A/m at 5.1 GHz is offered. This antenna may be applicable in wireless communication for small size and broadband with high gain.

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