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A Novel QWT Fed Penta- Band Microstrip Patch Antenna for Various Wireless Applications

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Abstract

A conventional patch antenna is initially designed with edge fed feeding. The four edges of patch are chamfered to make it octagon shaped. Further four slots two in horizontal and two oriented vertically are etched on the patch. A H shaped Slot is created on Ground. The result is a multi-resonant antenna for SATCOM and RADAR applications. The use of flexible substrate is to suit the chosen wireless applications. The optimized antenna model with its vital parameters are presented in this paper.

Keywords: *Microstrip Patch Antenna, Linear Polarization, Wireless Applications, H Shaped Slot, Radar, SATCOM Applications*

INTRODUCTION

There are different methods to feed a microstrip patch antennas like Inset feed, Coaxial feed, Edge feed, Em coupling, Aperture coupling [1]. The antenna because of its merits like light weight, ease of integration, cheapness because of Photolithographic fabrication finds tremendous application in Satellites, Radars, Mobiles, Wireless applications, Defence etc [2]. Microstrip patch antenna design has underwent drastic change eversince its proposed [3]. An Antenna designer needs the chosen frequency bands and the criteria for designing any antenna for that band, for which one may refer [4]. A triple band antenna is seen in [5]. Several advancements including metamaterial approach are seen in [6–10]. In this paper, a multiresonant antenna with rectangular and H shaped slots with QWT feeding is presented. The antenna is simulated using a versatile EM simulator.

DESIGN OF PROPOSED ANTENNA

The antenna design is carried out with an aim to create multiresonances covering Radar and Satcom spectras. Four rectangular slots are created over patch. Two are positioned vertically while two are in horizontal directions. The antenna is modelled using Rogers Duroid substrate with ε_r of 2.2 with a thickness of 62 mils.

The antenna is chamfered on all the four sides of patch to make is like an octagon. Further a slot in th shape of alphabet H is etched on its ground. This antenna model is shown in Figures 1-2 this includes both top and its ground view. The optimized dimension to induce required resonances are shown in Table 1.

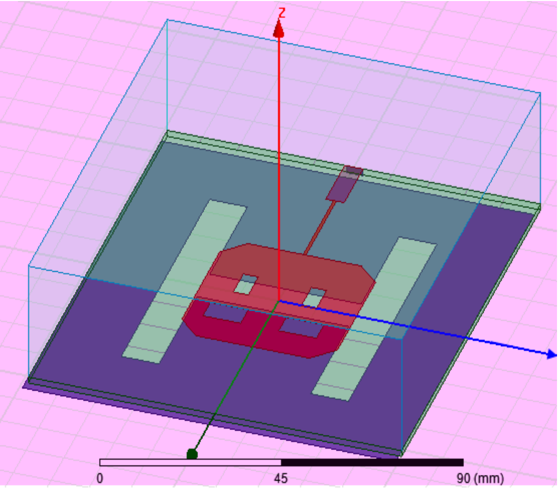

Fig. 1: *Top View of the Proposed Antenna.*

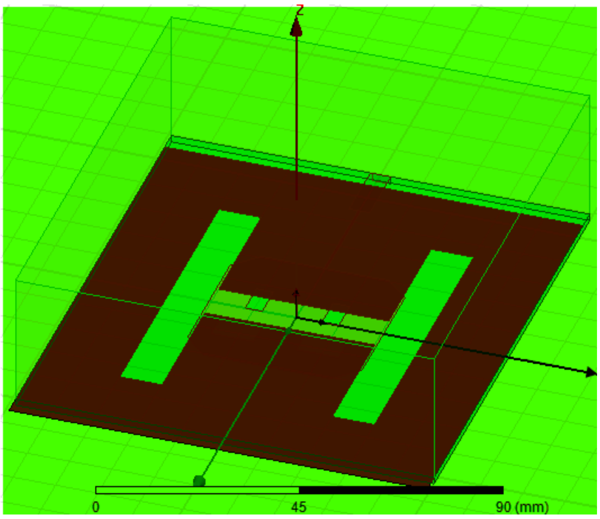

Fig. 2: *Ground Layer of the Proposed Antenna.*

Table 1: *Dimension of the Proposed Antenna.*

Parameters	**Size**
Substrate	62 mils
Ground	98.5 X 98.5 mm
Four rectangles on Patch	32 mm^2,60mm^2
One H shaped slot of area	1800 mm^2

ANALYSIS OF THE PROPOSED ANTENNA

The QWT fed antenna is modelled and optimized for inducing resonances at five frequencies they are 2.3, 3.2, 4.4, 5.2, 5.6 GHz and its return loss characteristics are shown in Figure 3.

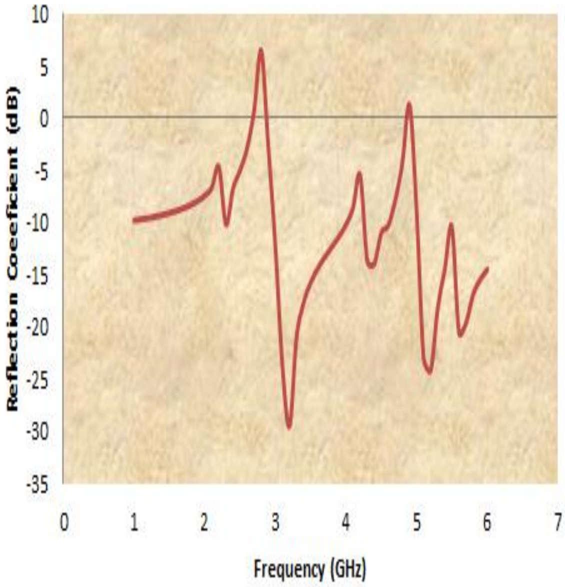

Fig. 3: *Reflection Coefficient of the Proposed Antenna.*

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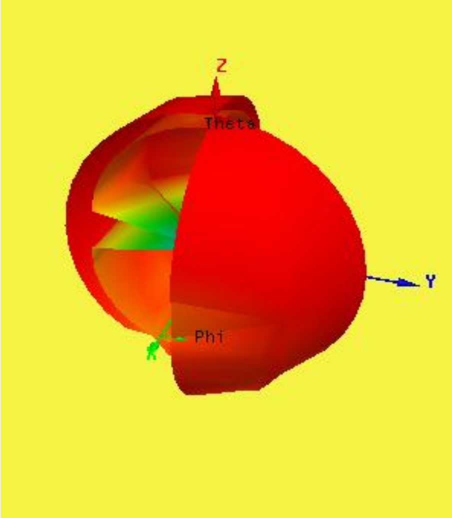

Fig. 4: *Polar Plot (Gain) of the Proposed Antenna.*

The Polar Plot of the Proposed Antenna at its five discrete frequencies of resonances is noted in Figures 4–8. The Magnitude of its VSWR is seen in Figure 9.

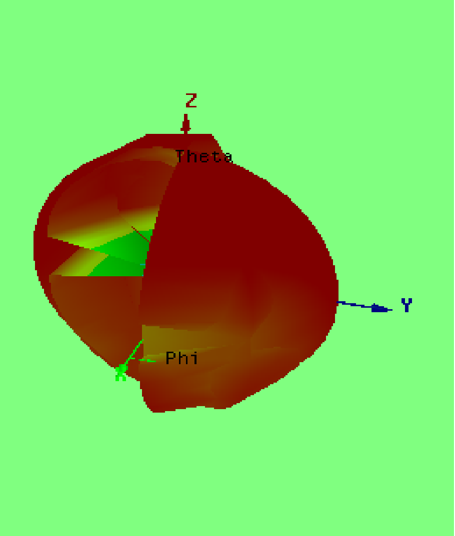

Fig. 5: *Polar Plot (Gain) of the Proposed Antenna.*

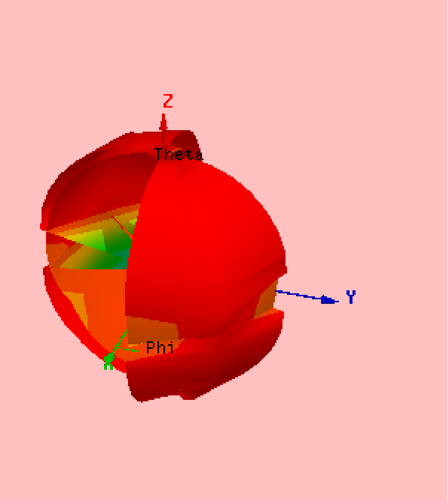

Fig. 6: *Polar Plot (Gain) of the Proposed Antenna.*

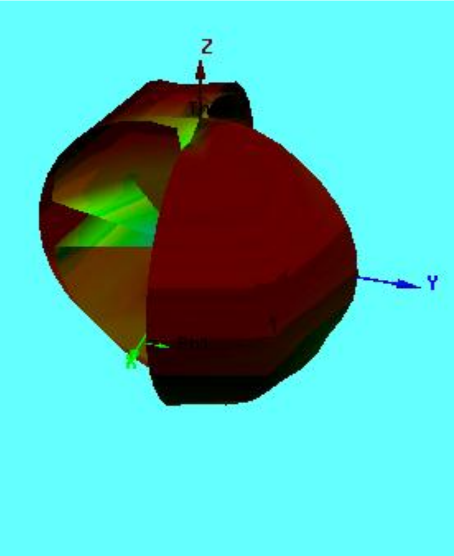

Fig. 7: *Polar Plot (Gain) of the Proposed Antenna.*

The antenna has a return loss of -10.2, -29.5, -14, -24, -20 dB's in its five resonant frequencies.

All the bands have very good radiating effieciency of more than 70%. May be the gain in certain spectra needs to be improved. The simulated antenna parameters are seen in Tables 2–6.

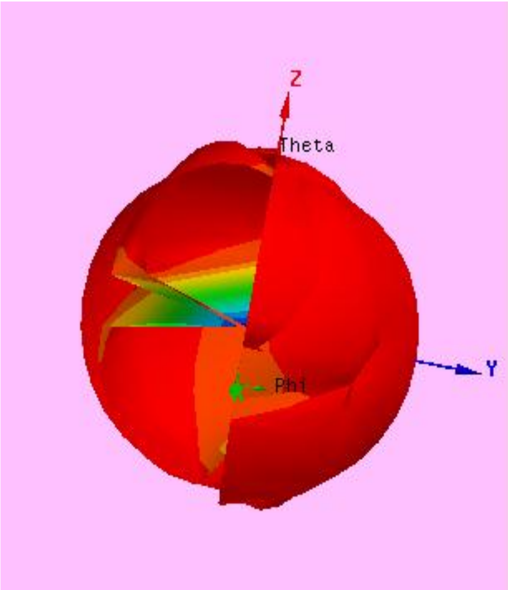

Fig. 8: *Polar Plot (Gain) of the Proposed Antenna.*

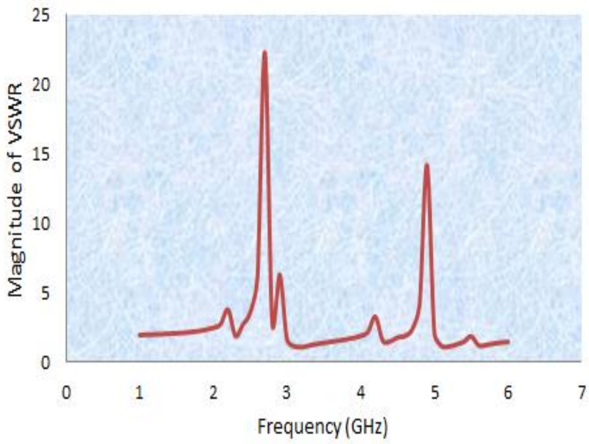

Fig. 9: *VSWR Characteristics of the Proposed Antenna.*

Table 2: *Antenna Parameters at 2.3 GHz.*

Quantity	**Value**
Directivity	4.7021
Gain (dB)	4.6018
Efficiency	97.998
VSWR	< 2

Table 3: *Antenna Parameters at 3.2 GHz.*

Quantity	**Value**
Directivity	1.557
Gain (dB)	1.139
Efficiency	73
VSWR	< 2

Table 4: *Antenna Parameters at 4.4 GHz.*

Quantity	**Value**
Directivity	4.9
Gain (dB)	4.5
Efficiency	91.9
VSWR	< 2

Table 5: *Antenna Parameters at 5.2 GHz.*

Quantity	**Value**
Directivity	2.57
Gain (dB)	2.12
Efficiency	82.5
VSWR	< 2

Table 6: *Antenna Parameters at 5.6 GHz.*

Quantity	**Value**
Directivity	5.2
Gain (dB)	4.56
Efficiency	87.9
VSWR	< 2

CONCLUSION

By introducing slots, the proposed antenna resonates at five different spectras covering Radar and satcom applications. The induced resonances have adequate return losss characteristics and efficiency. Further it is cost effective and the antenna is flexible due to use of Duroid substrate in its design. The antenna may be further modified to get circular polarization and adequacy in gain at certain induced frequency of resonances.

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