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Triangular Srr Based Triple Band Amc Backed Antenna for High Gain Sub6ghz Application

M. S. Manohar[1], N. Manogna[2], K. Srinivasa Rao[3], V. Sasi Kiran[4], N. V. Pardhasaradhi[5]

[1,2,3]Assistant Professor, Department of Electronics and Communications Engineering, PACE Institute of Technology & Sciences, Ongole, Andhra Pradesh, India
[4,5] UG student, Department of Electronics and Communications Engineering, PACE Institute of Technology & Sciences, Ongole, Andhra Pradesh, India

Correspondence should be addressed to M. S. Manohar; manohar_m@pace.ac.in

ABSTRACT- This article describes a triple band monopole antenna. t has been assumed that the WiMAX band application is objective. In order to attain the required band, various iterations of the proposed antenna design are carried out. The proposed antenna in the shape of broken hearts operates in the frequency range of 3.2GHz to 4.1GHz. In the final iteration, the heart-shaped double slotted ring resonator (SRR) with two different radii is seen to improve the bandwidth (900MHz) and gain (3dB). In this design, additional parameters like VSWR (approximately 2 at the WiMAX band), impedance (real and imaginary), and efficiency (approximately 89%) have been observed. As a result, the proposed monopole antenna in the shape of a broken heart that operates in the WiMAX band exhibits high efficiency, reduced size, and moderate gain. which play a crucial role in the WIMAX application band.

KEYWORDS- Triple Band Antenna, Wimax, Slotted Ring Resonator (Srr), Vswr.

I. INTRODUCTION

In recent years, wireless devices for communication have exploded in popularity. Recently, WiMAX applications have been enhanced to offer higher speeds and multiple communication standards. The rapid improvement in communications has reduced the production of wideband and narrowband antennas. In [1] the author proposed a circular patch antenna, which should be designed using new techniques such as FDGS (Fractal Defective Ground Structure). In [2], the authors studied a new defective grounded structure described as a 'stretched arc', an asymmetric property that suppresses cross-polarized fields, but does not affect resonance or co-polarized radiation. In [3] the author proposed an antenna with his DGS with a triangular slot with a hexagonal annular patch for broadband applications. In [4], the authors proposed a coplanar waveguide model with DGS (defective ground structure) and octagonal patches for ultra-wideband applications. In [5], the author proposed an antenna with an imperfect ground structure with a square slot as the radiation point. This gives dual-band resonance in the ultra-wideband region. In [6], the author proposed a semi-defective ground structure model in which the T-shape serves as the radiation spot for his 5G MIMO application. [7] proposed an antenna with an ultra-wideband frequency response with a bandwidth of 3 to 12 GHz and a trident-shaped radiating spot. Conical pitch ground planes are used to improve the bandwidth performance of rectangular and elliptical asymmetric antennas [8]. The design of asymmetric CPW antennas based on the DGS structure has made it possible to reduce the size of the antenna [9-13]. An EBG structure used to increase the antenna bandwidth is proposed in [14-19]. Effects related to changing the dielectric constant of the substrate have been analyzed in [20–21]. Antennas with circular polarization-like radiation in [22], slot antennas with multiband characteristics in [23], and antenna arrays based on liquid crystal substrates are described in [24]. In this paper, a single-band antenna in the shape of a broken heart is constructed. Works with WiMAX applications. The proposed antenna was developed using ANSYS Electronics Desktop 18 software using Rogers RT/Droid 5880(tm) substrate material with a thickness of 0.8 mm. The design work of the proposed antenna and analysis of the results were performed in the next section of this paper.

II. ANTENNA DESIGN

The dimensions of the proposed antenna are 30 x 17.58 mm and it consists of a Rogers RT/droid 5880(tm) substrate with a substrate thickness of 0.8 mm. The antenna options offered are shown in Figure 1. Antenna design repeats from traditional elliptical patch and ground Defective ground structure (DGS) aircraft.

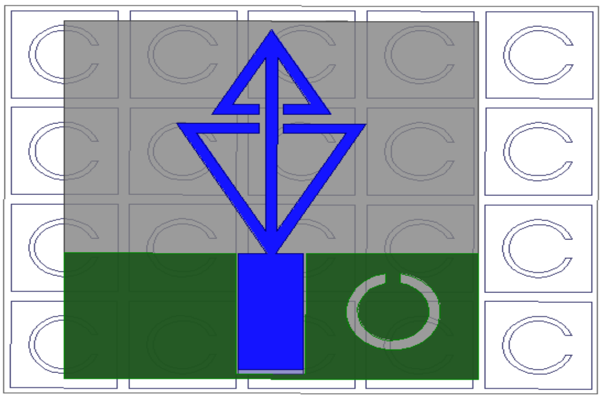

Figure 1: Proposed Antenna Dimensions

The ground of the proposed antenna creates a faulty ground structure by etching two rectangles of 12 mm × 16.5 mm and 2 mm × 5 mm, respectively, as shown in the figure 2. The shape and dimensions of the proposed antenna are given in the table: I.

Table 1: Parameters of the proposed Antenna

Parameters	Unit (mm)	Parameters	Unit (mm)
LS	36.00	WS	20
LP	10	WP	8.70
Lf	9	Wf	1.50
Lg1	12.00	Wgs1	17
Lg2	4	Wgs2	5.00
a	10.00	b	0.3
c	5.75		

III. EXPERIMENT RESULTS AND DISCUSSION

Figure 3 the reflectivity of the indicated antennas is indicated. Simulation results show -10 dB return loss over the 3.2 to 4.1 GHz bandwidth using FEM-based HFSS. The diagram shows that in the first iteration, the antenna operates in the range 3.5 to 4 GHz, associated with the "elliptical" shape of the spot, as shown in figure 2. In the second iteration, the antenna he resonates at frequencies between 3.6 and 4.6 GHz. This is related to the change from an "elliptical" shape to a "dumbbell-like" shape. In the third iteration, the antenna operates at frequencies between 3.7 and 4.5 GHz. This is related to the change from a "dumbbell" shape to a "heart" shape. In the fourth iteration, the antenna operates at frequencies from 3.2 to 4.1 GHz. This is related to changing the heart-shaped patch to a "heart-shaped closed ring resonator/heart-shaped ring slot". In the fifth iteration, the antenna operates at frequencies from 3.2 to 4.1 GHz. This is because the "heart-shaped closed ring resonator" shape patch was changed to a "split-shaped ring resonator".

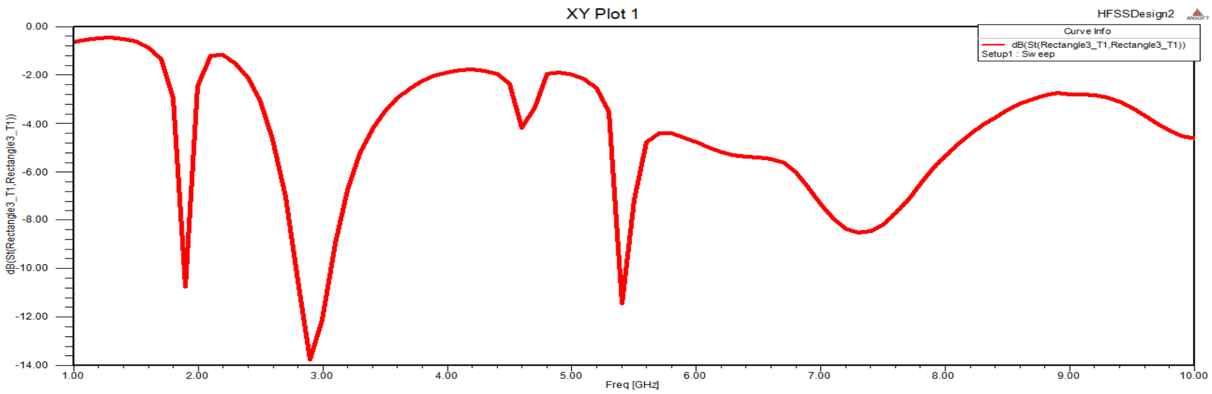

Figure 2: Simulated Reflection Coefficients of Antenna Iterations

In the sixth iteration, the antenna operated at frequencies from 3.2 to 4.1 GHz, embedded a heart-shaped ring slot in a broken heart-shaped ring slot, and turned it upside down to reduce its size as a "closed-ring resonator." insert the heart. In the seventh iteration, the antenna operates between 3.2 and 4.1 GHz by embedding a broken heart ring slot into a broken heart ring slot by inserting an inverted 'heart-shaped slot ring resonator' of reduced size.

figure 3 (a) and (b) show the surface current distribution and antenna current amplitude at 3.6 GHz, respectively. As can be seen, both the left and right sides of the ring patch antenna with the heart-shaped slot and the damaged ground plane effectively radiate and play an important role in achieving resonance at 3.6 GHz. Therefore, the proposed antenna can be considered suitable for wireless applications such as WiMAX.

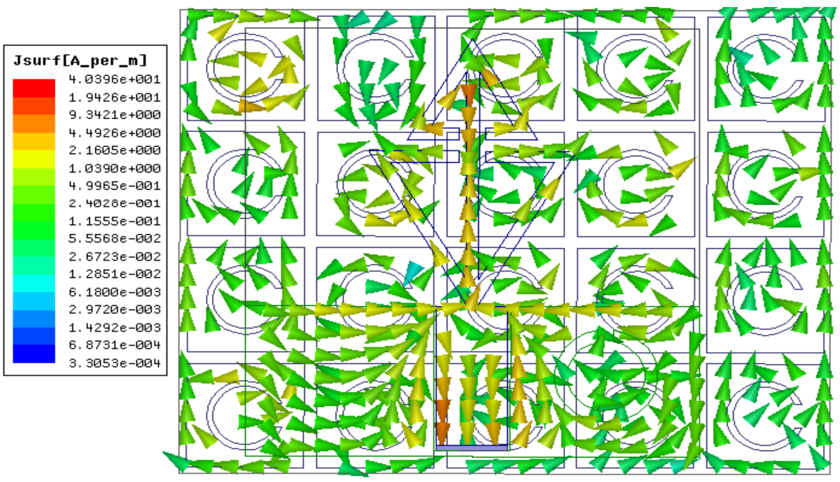

Figure 3: (a) Antenna Current Distribution (b) Antenna Current Magnitudes

Table 2: Bandwidth, Return Loss and Gain comparison of Antenna Iterations

	Band Coverage (GHz)	RL (GHz)	Imp BW (%)	Peak Gain (dBi)	Avg Gain (dBi)
Iteration_1	3.5-4.0	3.7	13.51	2.734	2.714
Iteration_2	3.6-4.6	4.1	24.39	2.784	2.735
Iteration_3	3.7-4.5	4.1	19.51	2.788	2.778
Iteration_4	3.2-4.1	3.7	24.32	2.829	2.889
Iteration_5	3.2-4.1	3.6	25	2.855	2.896
Iteration_6	3.2-4.1	3.6	25	3.015	2.973
Iteration_7	3.2-4.1	3.6	25	3.117	2.98

The power line of the proposed patch antenna plays an important role in current flow. The proposed antenna achieves a reflectivity of less than -10 dB in the frequency band from 3.2 GHz to 4.1 GHz and reaches 0.9 GHz. This is because both the ring patch antenna with the heart-shaped slot and the ground plane maintain surface currents. A harmonious flow of commands.

Figure 5 shows the simulated gain comparison of antenna iterations. From the figure we can observe that the gain for the proposed antenna varies from 2.7 – 3.1dB in 3.2 – 4.1GHz and the average gain is 2.98dB.

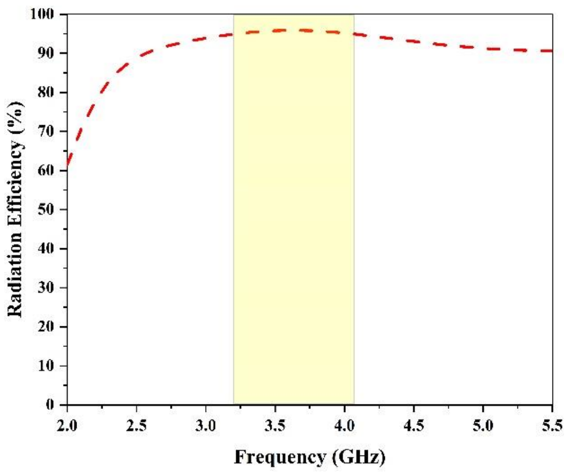

Figure 4: Simulated Efficiency Vs Frequency of Proposed Antenna

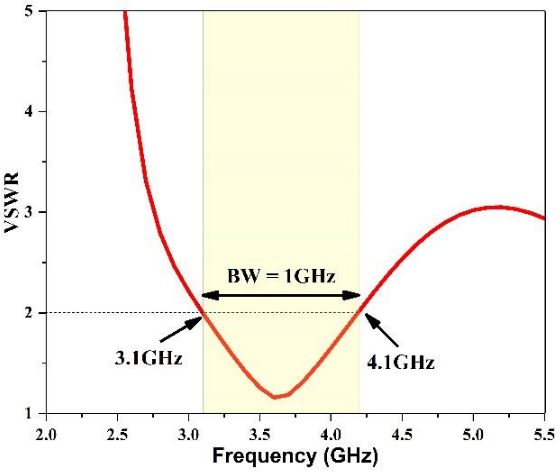

Figure 5: VSWR of the Proposed antenna

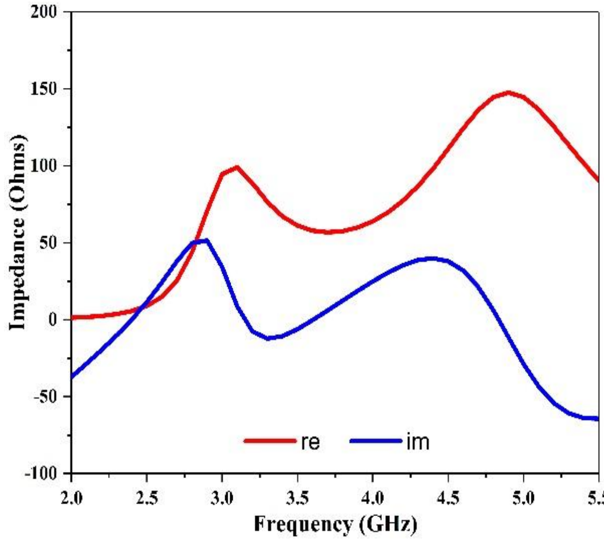

Figure 6: Impedance characteristics of the proposed antenna

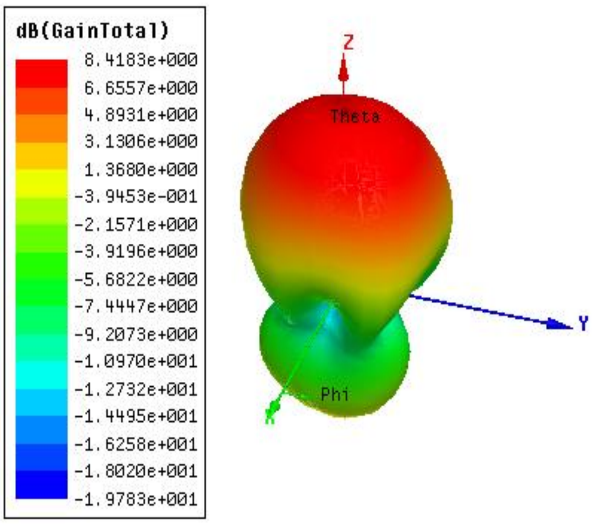

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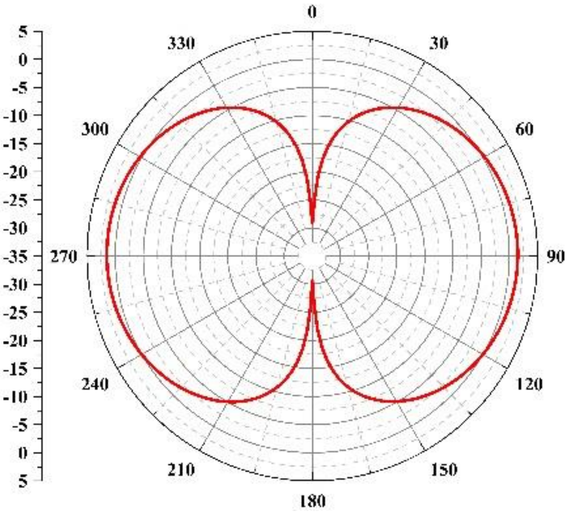
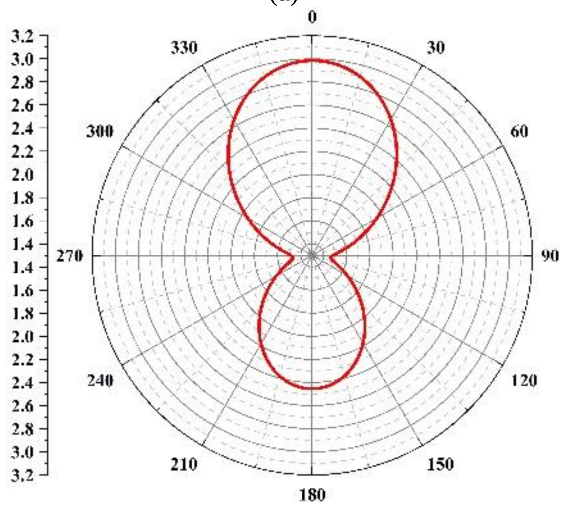
Figure 7: Show the simulated efficiency of the proposed antenna.

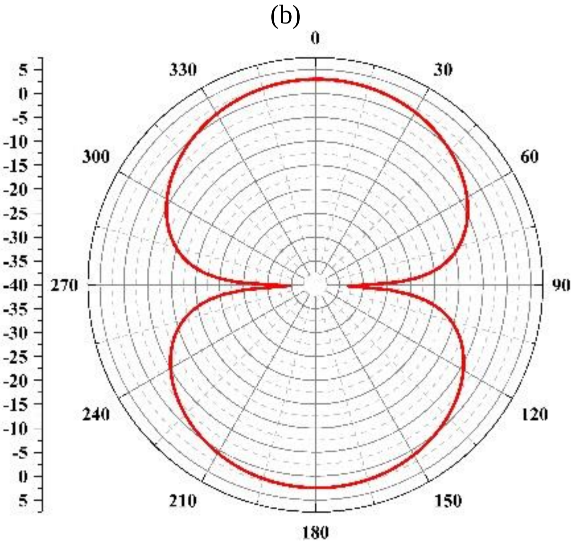
Figure 7 shows that the efficiency of the proposed antenna varies from 94 to 96% over the range of 3.2 to 4.1 GHz, with an average gain of 95%. In the figure: 7 VSWR watch the proposed antenna. According to the figure 5, we can understand that VSWR in the work time (3.1 GHz - 4.1 GHz) has an appropriate comparison of the impedance. In figure 8 shows the actual and impedance characteristics of the proposed antenna. It can be seen from the figure that in the operating band, the actual impedance value fluctuates between 50 and 60 ohms, which implies a perfect impedance match in the figure. Figure 9 shows the simulated radiation pattern of the proposed antenna. All these values are summarized in the table 2.



(a)



(b)



(c)

Figure 8: Simulated Radiation Pattern
(a) XY-Plane (b) YZ-Plane (c) ZX-Plane

IV. CONCLUSION

In this article, we designed and analyzed a refractive spike monopole antenna with ANSYS Electronic Desktop-18. The proposed antenna operates in the WiMAX application band. Several replicates were analyzed to obtain the required bands. The proposed Broken Heart antenna has an average gain of 3 dB with a bandwidth of 900 MHz from 3.2 GHz to 4.1 GHz and an efficiency of 87%, meaning it is a good candidate for modern WiMAX wireless applications. Regarding antenna analysis, this article discusses other parameters such as impedance, current distribution, electric field distribution, SWR, radiation pattern, etc., which are very similar to the characteristics of WiMAX applications.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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