A Compact Multiband Dual U-Shape Monopole Antenna for Wireless Application

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Abstract
The paper presents a multiband dual U-shape monopole antenna for WiMAX and Wireless LAN applications. The antenna is designed by using a double U-shaped strip as well as a defected ground plane with a rectangular ring. All simulations are done by using HFSS software.

Keywords: Monopole antenna, WLAN, WiMAX, rectangular ring, U-Shaped antenna monopole

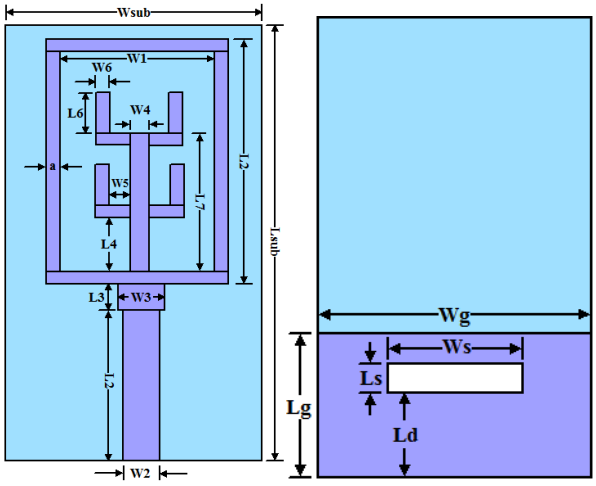
I. Introduction

The wireless communication system has become very popular due to the wireless area network (2.4-2.484GHz and 5.15-5.35GHz and 5.75-5.825 GHz). The reason for the viral communication system and development has become popular due to the worldwide evaporation technology. Its reach (2.5-2.69GHz, 3.4-3.69GHz and 5.25-5.85GHz) [1]. We have a compact size flame profile in Monopole antenna, lightweight, low cost, less delicate and easily constructed and compact size [2-3]. WLAN and WiMAX application These dual and multiband antenna are different types of applications. Antenna design has been done in order to meet the WLAN requirement. WLAN and WiMAX applications.These dual and multi-band antennae are different types of transit. The antenna design has been done in this for the WLAN requirement that can be fulfilled.

In the proposed antenna, firstly ring strip of rectangular shape is designed and then a defected ground with U-shaped strip is added [6-12]. A significant four band is obtained, and it satisfies both WiMAX and WLAN applications. Parameters of the proposed antenna design, VSWR, group delay, input impedance, $|S_{1\,1}|$ plot, and the gain of the antenna are also presented and discussed.

II. Proposed antenna design

The structure and geometry of the proposed antenna are given in Fig. 1. All design parameters of the proposed antenna are shown in Table 1. A dielectric substrate of FR4 epoxy having length Lsub=34mm and width Wsub=18mm with a defected ground is used. To obtain better performances, there is fixed W2 at 3mm and the thickness of the substrate height h=1.6mm. The relative permittivity for the substrate is 4.4. Fig. 2 presents the design process steps of the final proposed multiband antenna. The proposed antenna I is of the shape of rectangular ring micro-strip resonant antenna, having micro-strip under the rectangular ring.



(a) Top View (b) Back view

Fig.1. Proposed antenna (Top & Back view)

Table1: Proposed antenna design parameters

Different Parameters	Specification (in mm)	Different Parameters	Specification (in mm)
W Sub	18	L sub	34
W1	15.5	L1	17
W2	3	L2	12.4
W3	4	L3	3
W4	1.4	L4	4.4

W5	1.8	L5	1.2
W6	1	L6	2
Wg	18	L7	9
Ws	8.2	Lg	8.7
a	1	Ls	1.2
h	1.6	Ld	6.3

WLAN and WiMAX application used for data communication. WiMAX covers greater distance (about 50 Km) compare to the WLAN (about 30 m).

III. Results and discussion

Proposed antenna I have three bands of frequency in the range: 2.33-2.44 GHz, 2.85-3.41 GHz and 5.10-5.65 GHz with a simple structure. The frequency ranges of the proposed antenna II is in the range: 2.31-2.42 GHz, 2.84-3.57 GHz, 4.92-6.00 GHz, and 6.24-6.48 GHz. Use of U-shape slot on the ground plane makes the antenna to achieve matching better impedance at higher band. The $|S_{11}|$ curve which is shown in Fig. 3 and Fig. 4 show that the proposed antenna III is able to achieve four resonant bands in the frequency range: 2.32-2.44 GHz, 2.85-3.51 GHz, 4.95-5.78 GHz, and 6.41-6.56 GHz which cover the WiMAX and WLAN applications. The advantage of using a double U-shaped strip in the antenna is that there is another resonant mode which is excited, and this excitation results to achieve four frequency bands. Fig. 5 shows total gain and Fig. 6 shows the variation of the input impedance of the proposed antenna III with frequency. Fig. 7 shows the radiation efficiency with frequency while Fig. 8 shows the variation of group delay with the frequency of the proposed antenna III. In fig.5 antenna Gain is power which is present in strongest and it is divided by the power which would be transmitted with the help of isotropic antenna emitting the same total power. The antenna gain is expressed in terms of dBi. In fig.6 input impedance is the measurement of the opposition to current flow that is for both resistance (static) and reactance (dynamic), into the load network and it is extracted to the electrical source is known as the input impedance of network. In fig.7 VSWR which is stand for voltage standing wave ratio. It is taken from input impedance of antenna. It is shows that how far input impedance of antenna is from the nominal impedance. In fig.8 group, delay is defined as the ratio of change in transmission angle of phase to the frequency.

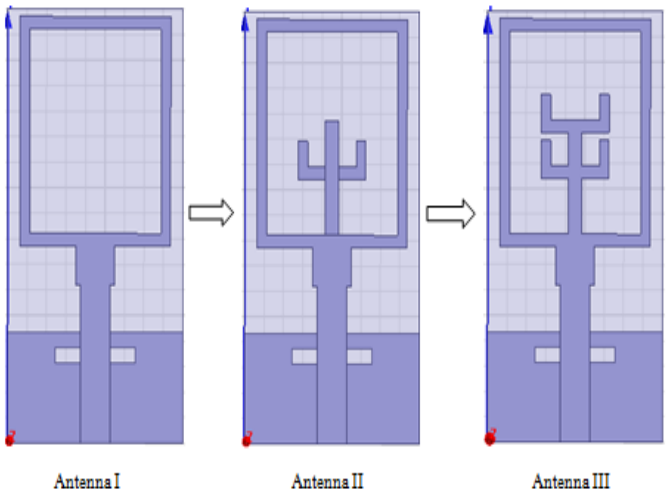


Fig.2. Design processes in designing the antenna (I, II and III)

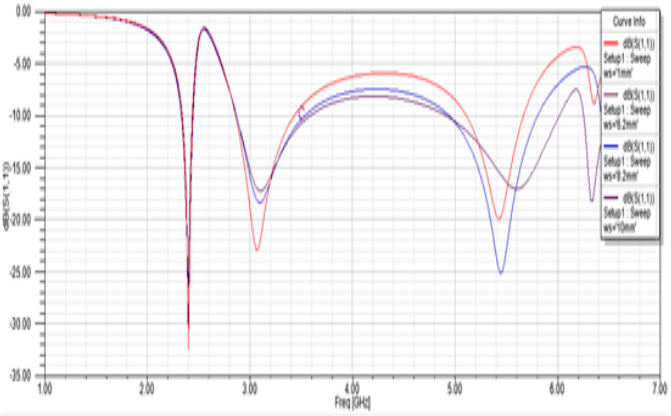


Fig.3. |S11| plot of the proposed antenna I, II, and III

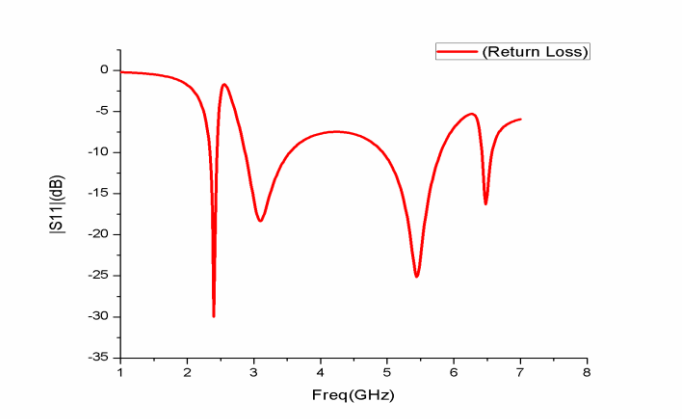


Fig.4. $|S_{11}|$ of antenna III

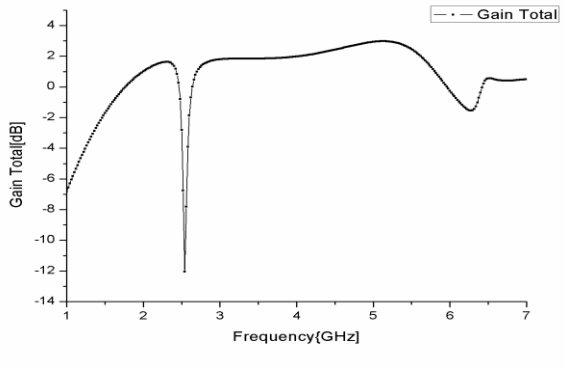


Fig.5. Total Gain

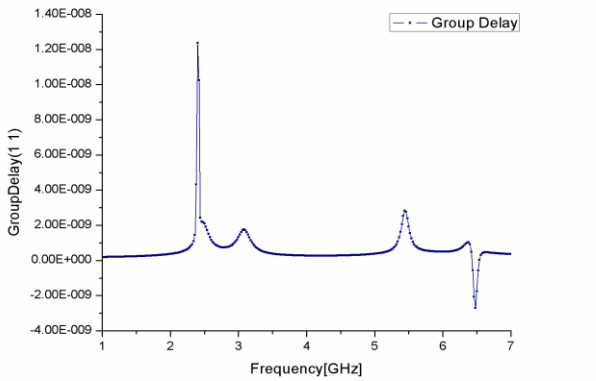


Fig.8. Group delay

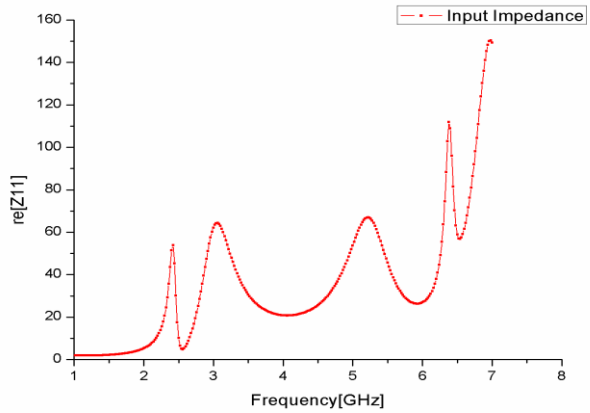


Fig.6. Input impedance

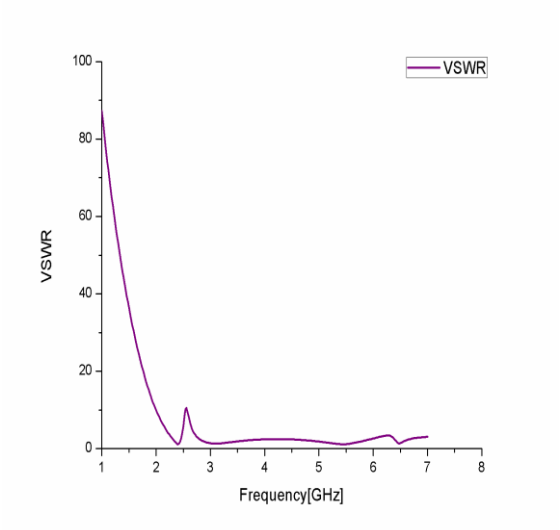


Fig.7. VSWR

IV. Conclusion

In this work, we offer a compact multiband for a wireless application and U-shaped monopole antenna. Looking at the proposed antenna, we recur four times for WLAN and WiMAX applications. We can easily digest the antenna and the small antenna and the larger the bandwidth occurs in the antenna.

V. Reference

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