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Square Shaped Multiband Patch Antenna for UMTS, WIMAX and WLAN Applications

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***Abstract*---The article introduces an omnidirectional antenna having dimensions as 20x20x0.8mm cube. It consists of square radiation patch, defected ground and operates at wireless local area network (WLAN) (4.3-5.9GHz),wide interoperability for microwave access band(WiMAX)(3.4-3.6GHz)and universal mobile telecommunications system (UMTS) (1920-2170MHz) band and hence is suitable for all general purpose communication features. The antenna is compact in size.**

***Keywords*---Multiband antenna, small size, wireless communication system, microstrip patch antenna.**

I. INTRODUCTION

Microstrip patch antenna has always been in demand because of its affordability and easy fabrication nature. And due the increasing growth in communication technology especially in the era of twenty first century the demand for antenna having better design to fulfil the need of modern man is almost reaching its peak. The evolution of the communication technology had the rapid rate since the entrance of human kind in technological age. The antenna introduced in the paper is decent in performance and simple in structure, also it is quite well in working for different bands of frequency ranging from WLAN to WiMAX and UMTS applications. Nevertheless, in designing the small size antenna having good results has always been difficult and many design technique were introduced and are introducing every day. In this article some of the methods are used to optimise the antenna as a result the antenna introduced in this paper is obtained.

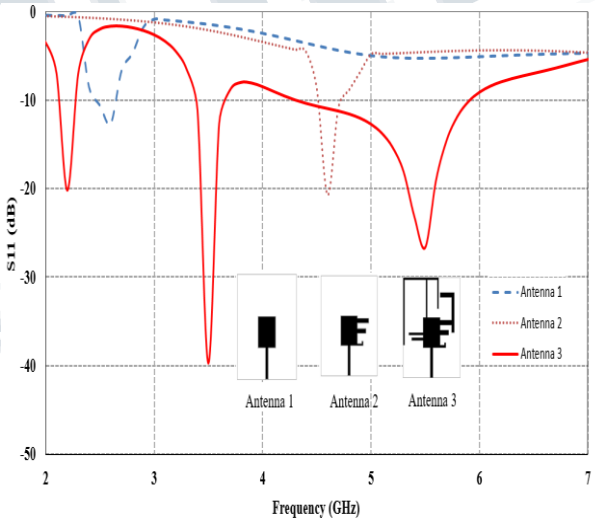

Fig 1; Configuration of proposed design

II. PROPOSED ANTENNA DESIGN AND STRUCTURE

The antenna uses a low cost FR4 substrate which has permittivity of 4.4 with the thickness of 0.8mm.Ground is defected, it uses a square radiation patch with 8 stubs and its overall dimension is 20x20x0.8mm cube. Two combined figures having a structure like E-shaped and a L-shaped are used to obtain the desired resonant bands ranging from (1920-2170)MHz, (3.4-3.6)GHz and(4.3-5.9)GHz having return loss of -20db,-40db ,-27.7db and resonant frequencies at 2.2GHz,3.5GHz and 5.4GHz

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respectively. The design uses 50ohm microstrip feed line.

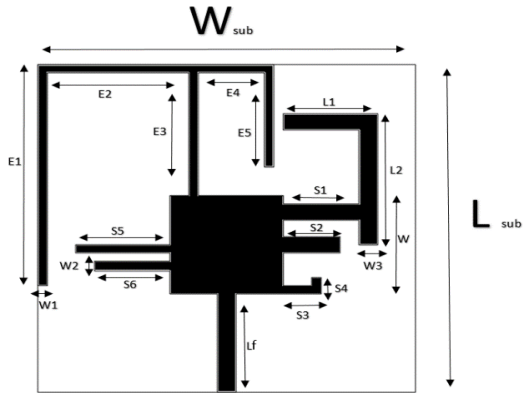

Fig: 2 Top View

Fig:3 Bottom View

Antenna	Size in mm sq.	Thickness in mm	Number of ba
MULTIBAND MONOPOLE U-SLOT PATCH ANTENNA WITH TRUNCATED GROUND PLANE [4]	72 X 52 X 1	1	Four
Dual feed U-slot antenna [2]	76.8 X 76.8 X 11.1	11.1	Two
Double U-slot patch Antenna [1]	70 X 70 X 1.57	1.57	Three
Proposed Antenna	20 X 20 X0.8	0.8	Three

Table 2 Comparison of proposed antenna with the previously presented antennas

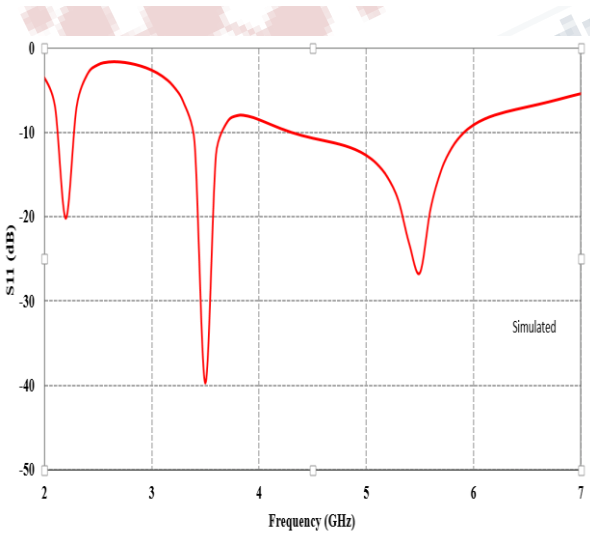

Fig: 4 Return Loss

TABLE 1 Dimensions of Proposed Antenna (All Dimensions are in mm)

W sub	L sub	W	W1	W2	L g	S1	S2	S3	S4	S5	S6	Lf	E1	E2	E3	E4	E5	L1	L2
20	20	6	0.5	0.6	3.5	4	3	1.5	1	5	4	6	13.5	7.5	7.5	2	5.5	6	6.5

III. RESULT AND DISCUSSION

The antenna is simulated using High frequency Structural Simulator Version 13.The antenna provides 3 bands that are UMTS, WiMAX and WLAN and the resonance frequencies are 2.2, 3.5 and 5.4 GHz respectively. Fig:1 shows the evolution of design with their observed results and according to which , first the square patch of size 6X6mm sq. is created which provides the low frequency band. In the next step three stubs with the intention to get wlan band were inserted but the observed result was some high frequency band. In the last step an E-shaped and a L-shaped structure were introduced in the design and as a result three bands were observed having the capability of operating the antenna in UMTS, WiMAX and WLAN Bands. The fig: 4 shows the final return loss of proposed antenna it shows that return loss of respective bands are -20dB, -40dB and -27.7dB which are quite impressive. Fig: 5 show the far field radiation pattern of the design which clearly conveys that the antenna is omnidirection in nature.

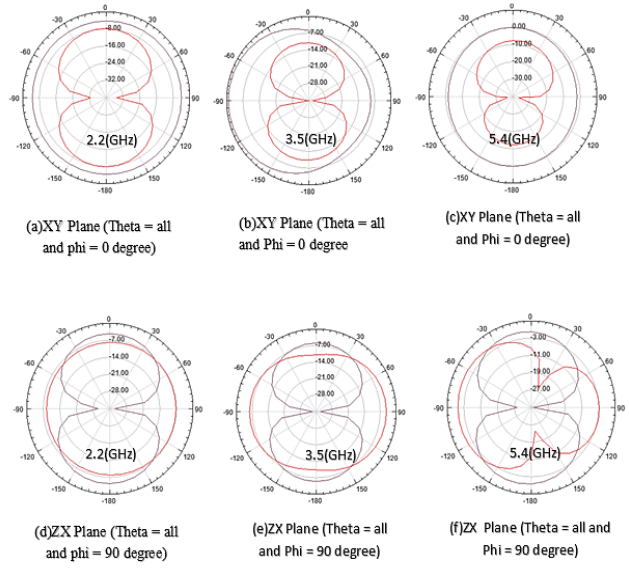

Fig: 5 Radiation pattern at different frequencies

IV. CONCLUSION

The proposed antenna is multiband in nature. It has resonant frequency at 2.2GHz 3.4GHz and 5.4Ghz and hence occupying the UMTS, WiMAX and WLAN bands and the results are in good agreement according IEEE standards. The design has compact size , good radiation pattern , high gain and good impedence bandwidth . The gain of antenna is about 2.5dBi in UMTS, 3dBi in WiMAX and 4dBi in WLAN. Overall the design is simple and cost effective and good for multiband wireless applications.

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