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Bandwidth Enhancement of Triple-Band Printed Monopole Antenna used for WLAN/WiMAX Applications using EBG

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Abstract: ***In this paper, a design of triple-band printed monopole Antenna applied for both WLAN and WiMAX systems is presented. The triple-band monopole antenna has a compact size of 34mm x 18 mm. This microstrip fed antenna mainly involves a fork-shaped strip that is etched on a modified rectangular ring and a rectangular defected ground plane.***
Keywords: triple-band, monopole antenna, defected ground, EBG.

I. INTRODUCTION

In modern days there is a rapid development of wireless communication systems. The most widely used two wireless technologies are WLAN and WiMAX systems. The characteristics of a monopole antenna are compact size, low cost, lightweight, being less fragile, low profile, and easy fabrication. There are many dual and multi-band designs for WLAN and WiMAX applications such as G-shaped antenna, inverted L-shaped strip antenna, and 9-shaped antenna besides these antennas have a relatively large size. In this paper, a new microstrip fed modified rectangular ring antenna with an EBG is proposed for both WiMAX and WLAN applications. The triple band can be achieved by introducing a modified rectangular strip, a fork-shaped strip, and defected ground which can satisfy WLAN and WiMAX systems. The EBG is responsible for achieving greater Bandwidth.

II. DESIGN OF ANTENNA

We used ANSYS HFSS software that permits calculation of finite-sized phased-array antennas with all electromagnetic effects that has element-to-element coupling and also critical array edge effects. The traditional approach for simulating large phased-array antennas is to approximate antenna behaviour by assuming an infinitely large array. In this technique, one or more antenna elements are placed within a unit cell with a periodic boundary condition on the surrounding walls that mirror the fields and allows you to create infinite number of images in two directions.

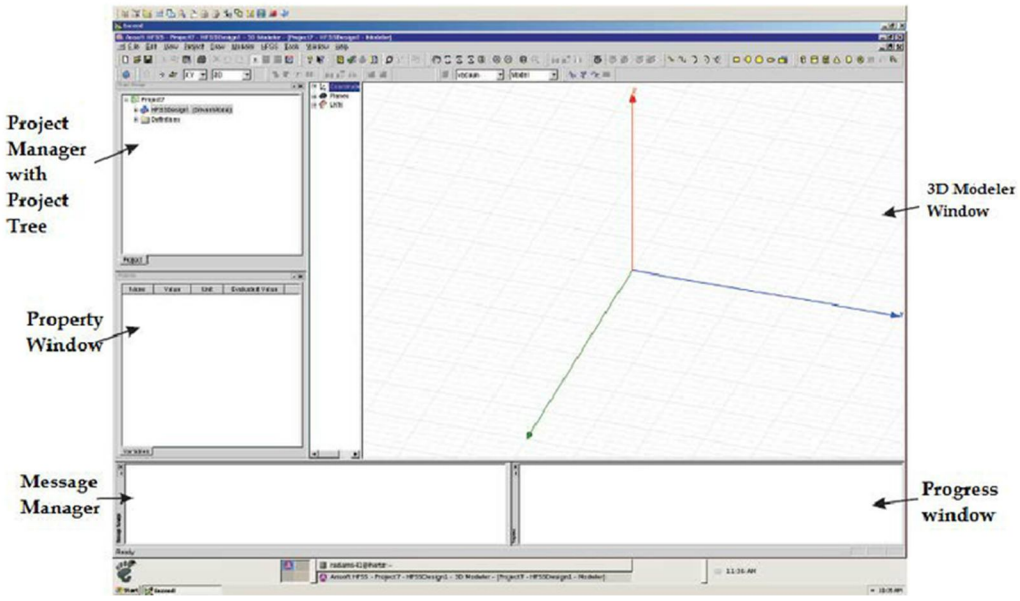


Fig1: ANSYS HFSS

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III.DESIGNED ANTENNA

A radiator with a 50-ohm microstrip line and is composed of a modified rectangular ring and a fork-shaped strip.
The proposed the antenna is designed on an FR4 substrate with length 34mm and width 18mm.
To achieve better antenna performance, W2 is fixed at 0.3 mm as the thickness of the substrate is fixed at 1.6mm moreover the relative permittivity of the substrate is 4.4.
To obtain the antenna to achieve better impedance matching at a higher band, a rectangular slot is etched on the ground plane.
Designed antenna can achieve three resonant bands of 2.40– 2.71, 3.31–3.79, and 5.13–5.91 GHz, which can cover almost all WLAN and WiMAX bands.

TABLE I. Design Parameters Of The Proposed Printed Monopole Antenna

Parameters	L1	L2	L3	L4	L5	L6	L7
Unit(mm)	34	13.4	3	17	9	4.4	2
Parameters	L8	W1	W2	W3	W4	W5	W6
Unit(mm)	1.2	18	3	4	15.5	1.4	1.8
Parameters	W7	W8	h	a	Ld	Ls	G
Units(mm)	1	8.2	1.6	1	6.3	8.7	1

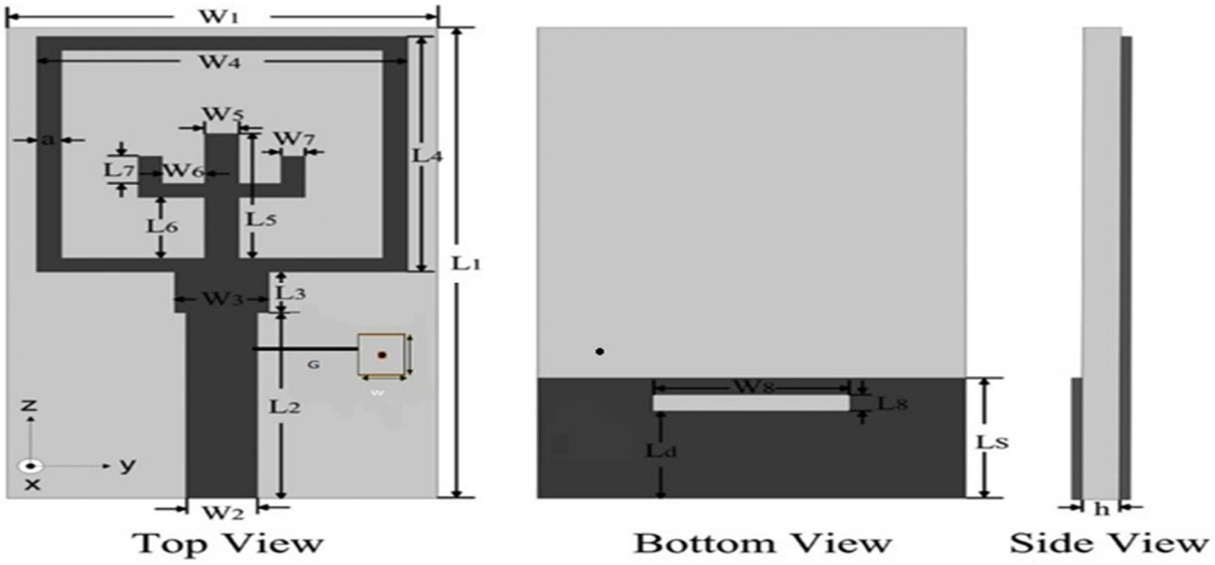


Fig 2 Geometry of Proposed antenna

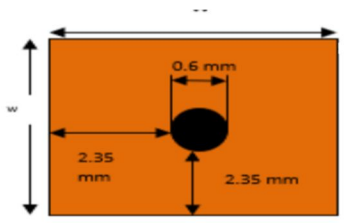


Fig 3 Geometry of Proposed EBG

The dimensions of the EBG are w=5.3mm and the centre located via with r=0.3mm and the gap between the EBG and the antenna is a gap of G=1mm.

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IV.SIMULATION

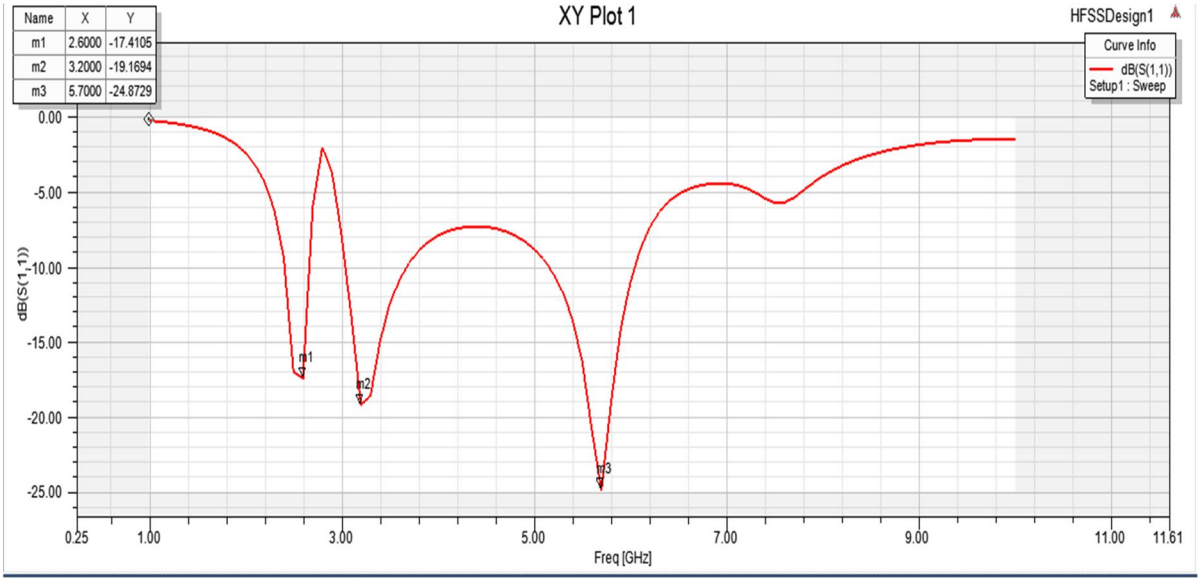


Fig 4 S11 of Proposed antenna.

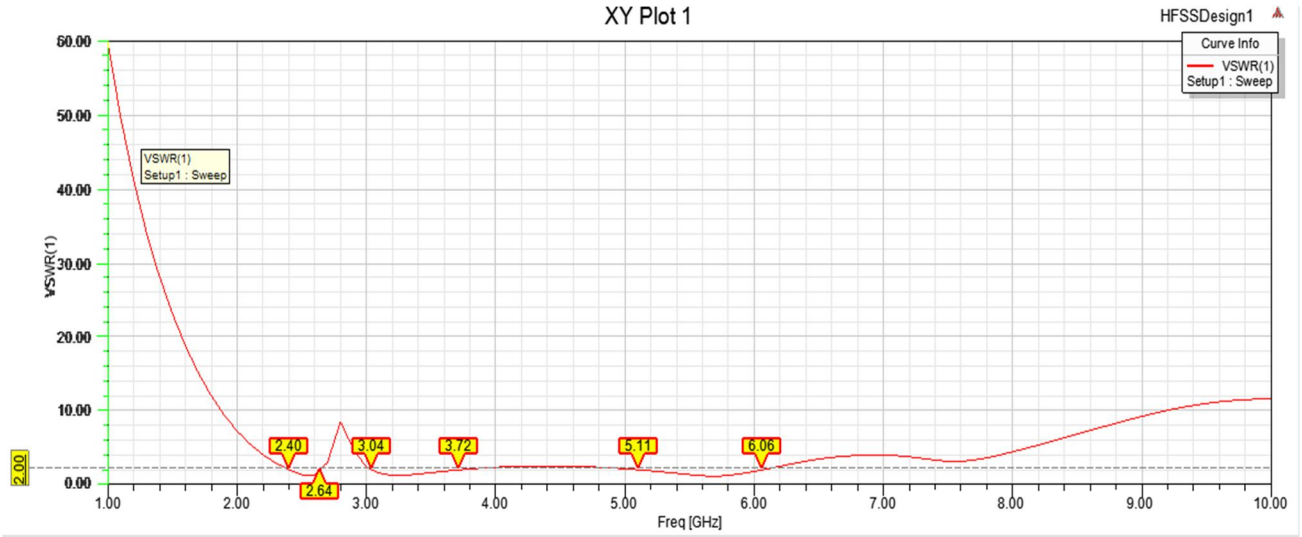


Fig 5 S11 & VSWR of rectangular UWB antenna (1) with 1.6mm FR4 from 2.40-6.06GH

V.GAIN AND RADIATION CHARACTERISTICS OF ANTENNA:

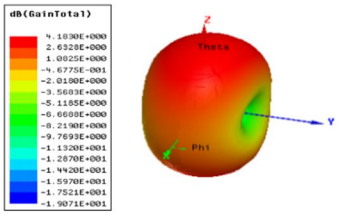


Fig 6: gain and distribution of antenna.

The gain of the antenna 1 and antenna 2 seems to be similar as shown in the figure and the radiation pattern is shown in the figure6

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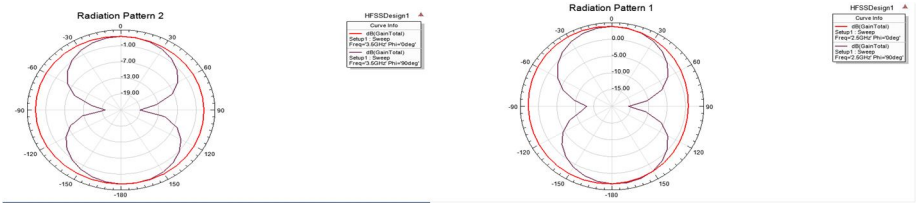


Fig 7**:** Radiation pattern of rectangular UWB antenna with 1.6mm FR4 for 2.5 &3.5 GHz

VI.FABRICATION

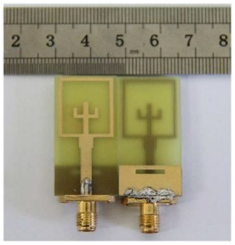


Fig 8: final fabricated antenna

The above figure shows the fabricated antenna with fr4 substrate with 1.6mm width and with relative permittivity 4.4
This fabricated antenna was simulated by using the antenna simulator.

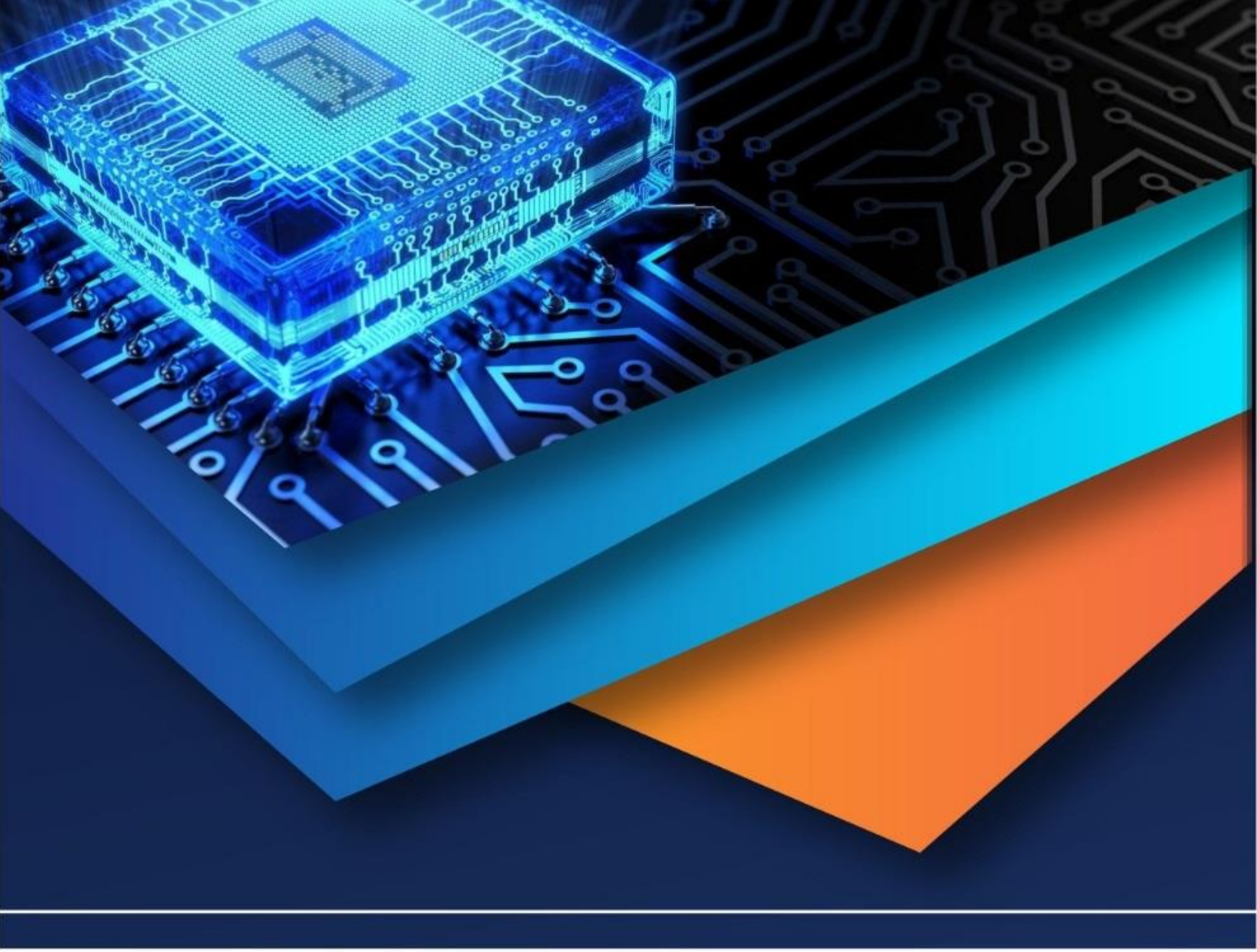
VII.CONCLUSION

A triple-band printed monopole antenna designed for WLAN and WiMAX system which has a higher bandwidth is presented. By etching a rectangular slot in the ground plane and adding a fork-shaped strip in a modified rectangular ring, the antenna can provide three resonant modes for desired applications. By adding EBG to the right corner of the antenna, it makes the antenna to obtain larger Bandwidth. Thus, this antenna facilitates Omnidirectional radiation patterns, reasonable gains, small size, and easy fabrication make the antenna suitable for WLAN/WiMAX applications.

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