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Design of a Monopole Fractal Antenna for UWB Wireless Communication Networks

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***Abstract*— In this paper a compact monopole antenna for ultra wideband application is proposed with microstrip feed technique. Some slots are introduced in the patch of 10 X 10 mm. The antenna proposed is designed on an FR4 Epoxy substrate of dielectric constant 4.4 and thickness of 1 mm. Theoretical investigations done by Ansoft Designer demonstrate that the frequency of operation is from 4.63 to 6.72 GHz with a resonant frequency of 5.27 GHz.**

Keywords—Microstrip Patch, Slot, Ultra Wide band, Return Loss, Microstrip Feed, Fractal Patch

I. INTRODUCTION

The basic structure of a patch antenna consists of a ground plane in the underside with a dielectric region separating the ground and the radiating patch. The electromagnetic waves fringes from the radiating patch into the substrate and are reflected by the ground plane into air.

Microstrip patch antennas have various attractive features such as light weight, low profile, planar configuration, low cost, high efficiency, simple to fabricate and easy to integrate [1]. Ultra Wideband antennas have found a lot of important applications in military and commercial systems. For example the UWB antenna is widely used in radar systems due to its high speed data rate and immunity to multi-path interference [2]. Therefore these antennas find applications in wireless sensor networks and personal communication systems [3-5]. Antenna size can be reduced considerably by incorporating slots properly which allows the mending of the current paths [6]. Slots are introduced to tune the resonant frequency of antennas [7]. The slot loading technique is a simple and effective way to increase the bandwidth of microstrip patch antennas.

In this paper a slot loaded ultra wideband fractal patch antenna [3] design has been proposed which overcomes the limitations of the conventional rectangular patch and which can be used for high speed data transfer in WLAN/PCS applications [5].

II. ANTENNA DESIGN

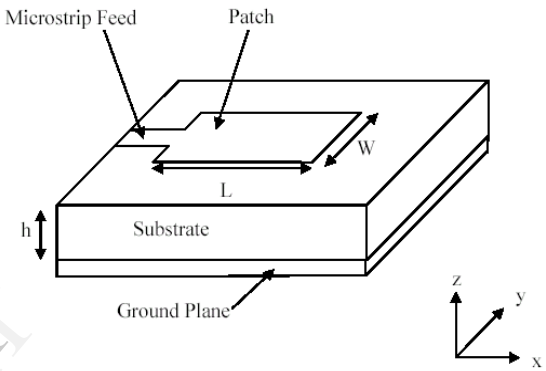

Fig 1: Microstrip line feed Patch Antenna

The proposed antenna was designed on an inexpensive FR4 Epoxy substrate of dielectric constant 4.4 and thickness of 1 mm which seperates the ground plane and the metallic patch. The microstrip line feed technique is used to feed the input signal [8]. Slots of various dimensions are used in the ground plane of 40 X 40 mm as well as the patch of 10 X 10 mm. In addition fractures at the ends of the patch were incorporated which is a space filling size reduction technique [3] that improves the performance of the antenna.

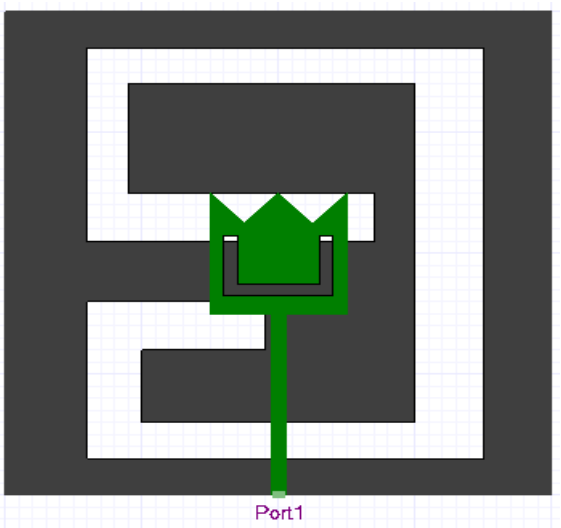

Fig2: Proposed Patch Antenna

The ground plane and the patch dimensions are labelled separately as shown in Fig. 3 and 4 respectively.

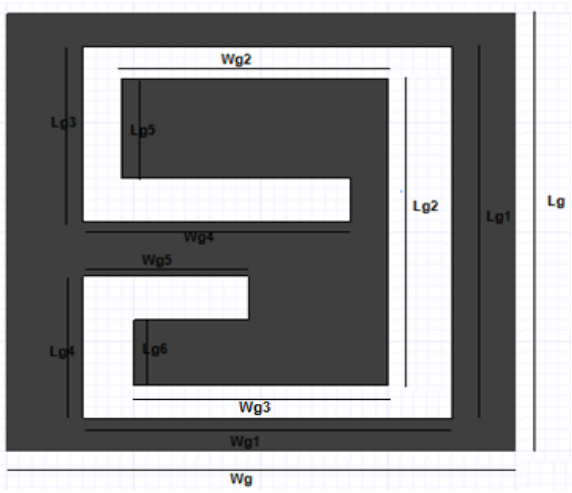

Fig3: Ground Plane dimensions

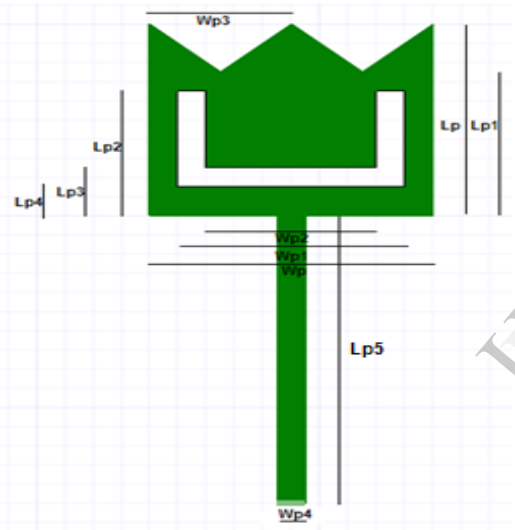

Fig4: Patch Antenna dimensions

TABLE I: Dimensions of the Ground Plane and Patch

Sl. No.	Ground Plane Dimensions	Length (mm)	Patch Dimensions	Length (mm)
1	Wg	40	Wp	10
2	Wg1	29	Wp1	8
3	Wg2	21	Wp2	6
4	Wg3	20	Wp3	5
5	Wg4	21	Wp4	1
6	Wg5	13	Lp	10
7	Lg	40	Lp1	7.5
8	Lg1	34	Lp2	6.5
9	Lg2	28	Lp3	2.5
10	Lg3	16	Lp4	1.5
11	Lg4	13	Lp5	15
12	Lg5	9		
13	Lg6	6		

III. RESULTS

Return Loss vs. Frequency, VSWR, the Radiation Pattern and the 3D Gain Plots of the proposed antenna are shown. The proposed antenna has an upper cut off frequency (-10 dB frequency) at 6.72 GHz and a lower cut off frequency (-10 dB frequency) at 4.63 GHz with a resonant frequency of 5.27 GHz. Thus a wide bandwidth of 2.09 GHz is attained using this simple structure which is useful for ultra wideband applications.

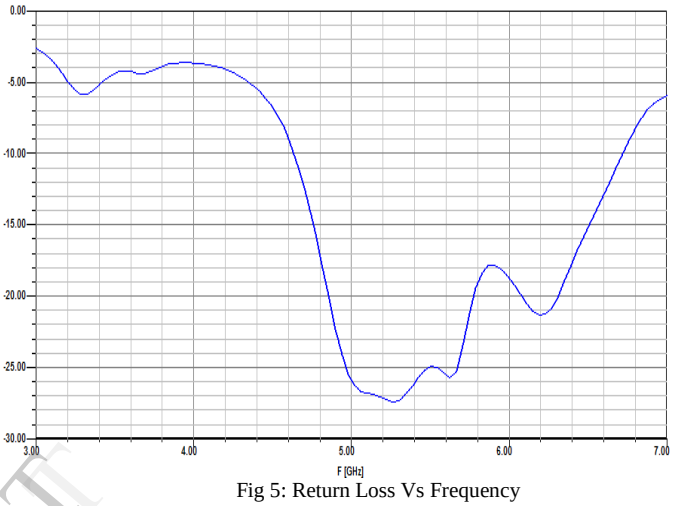

Fig 5: Return Loss Vs Frequency

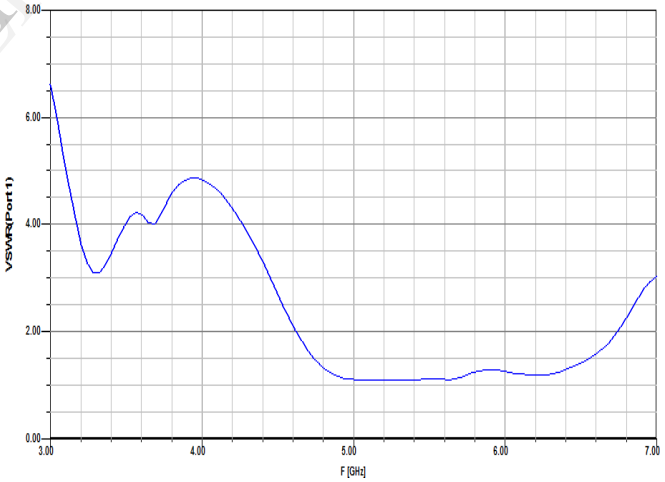

Fig 6: VSWR Vs Frequency

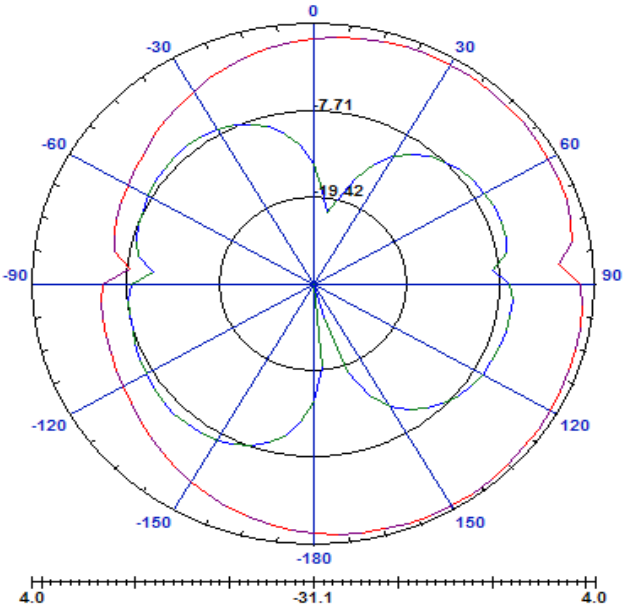

Fig 7: Radiation Pattern of the Antenna

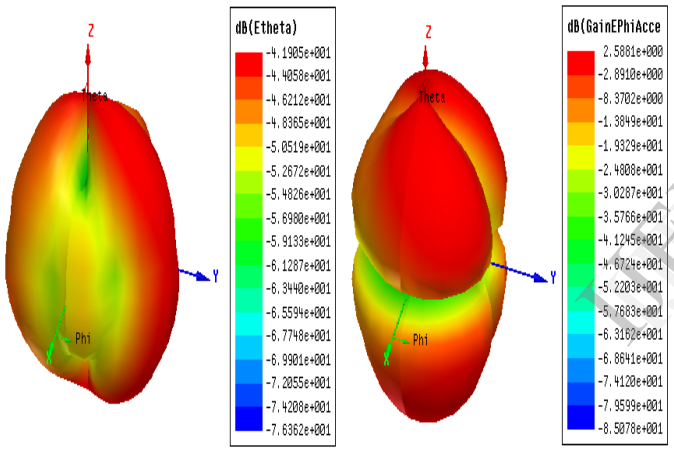

Fig 8: 3D Gain Plots of the Antenna

IV. CONCLUSION

In this paper a compact monopole patch antenna has been designed which can be used for Ultra wideband WLAN applications. Ansoft Designer was employed for simulating the results. A large bandwidth is obtained by introducing slots in the ground plane and the fractal patch. It is expected that this antenna will find applications for high speed data transfer for wireless communication networks.

ACKNOWLEDGMENT

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