"Design a Microstrip Patch Antenna, Shaped of Rectangle for Ultra Wideband (UWB) Applications"

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Abstract— Recently, the U-slot patch antenna established itself as a multi-features, low profile and cost effective antenna that can be fine- tuned for Ultra Wideband operations. And the main objective this thesis is a perform practical design procedure to design U-Slot antenna, can be fine- tuned for Ultra Wideband (UWB), and provide physical insight into the design using full wave analysis methods. This design has a good performance, like wide bandwidth, antenna size design is small, low cost. It can be accurately tuned to ultra-wide band operations, it also shows good performance, for a constant wave rate. And in this thesis the antenna is designed on micro-strip rectangular shape by using Ansoft's HFSS software package.

Keywords—"Design a Microstrip Patch Antenna, Shaped of Rectangle For Ultra Wideband (UWB) Applications"

I. INTRODUCTION

The Microstrip Patch antenna is a type of radio frequency antenna. Consists of flat rectangular sheet or patch of metal, mounted under a larger area of substrate called a ground plane [1-2]. The patch antenna has many names such as shorted patch antenna and printed antennas and microstrip patch antennas etc. And the Microstrip antenna shapes may be square or rectangular or circular or elliptical but any continuous shapes are possible. There are some of patch antennas, do not used a dielectric substrate, but consists of a metal patch mounted on the ground plane by using dielectric spacers, the resulting structure is less rugged and has feature of a wider bandwidth, this type of antennas has a low cost, low profile, and mechanically rugged and it also can be shaped as curve of a vehicle, and can be mounted on the surface of satellite, missile applications aircraft and spacecraft. And remarkable lots advancements in the designing of small sized microstrip antennas, and gain enhancements have been seen over the last few years [3-4-5]. Microstrip patch antennas have a conducting patch mounted on the top of a grounded dielectric substrate, and have low power consumption, light weight, ease of fabrication [6], and compatibility to mounting interface. Since, microstrip antennas have small frequency bandwidth comparatively, bandwidth improvement is usually required for practical applications [7]. Therefore, the purpose of this work to characterize the various microstrip patch antenna broad banding techniques with the purpose of developing design guidelines to aid the antenna design engineer in designing antenna structures with very wide bandwidth. In this design, the microstrip patch antenna constructed to demonstrate the Bandwidth-enhancement technique, with T-shape in patch and ground plane, the patch was Wp =15mm, Lp =4mm and feed line was Wf =2.75mm, Lf =-9 and material of substrate was "FR4_epoxy".

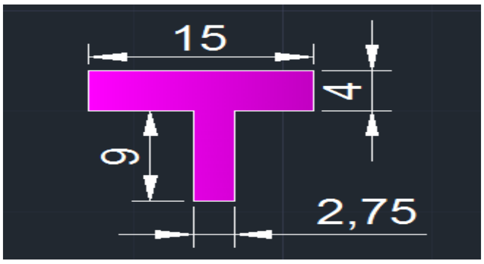


Figure-1: Designed Antenna

II. ANTENNA DESIGN

The rectangular microstrip patch antenna, is designed on FR4 substrate with (εr = 4.4 and tan δ = 0.02 and h=1.6mm). The antenna dimensions (in mm). The proposed rectangular Microstrip patch antenna shown in the Fig 2. The antenna dimensions (in mm), and described by the table 1.1.

Table 1.1 Dimension of Antenna

Parameters	Description	Size in (mm)
Lf Wf	Length of feed line Width of feed line	-9 2.75
Lr Wr	Length of Rectangle Width of Rectangle	2.75 -1.6
Lsub Wsub	Length of substrate Width of substrate	21 17
Lp Wp	Length of patch Width of patch	4 15

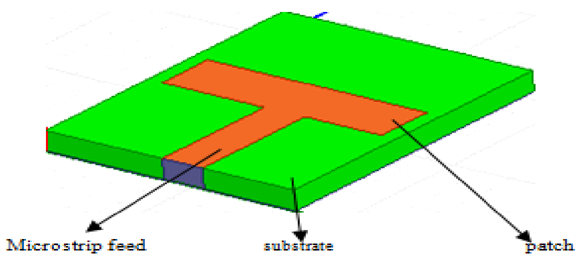
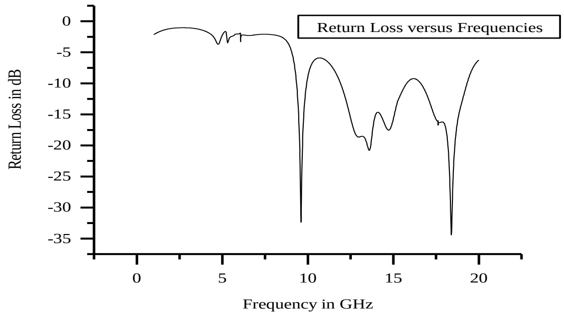
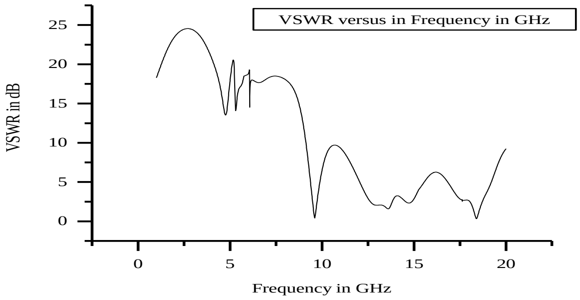


Figure-2: Designed Antenna

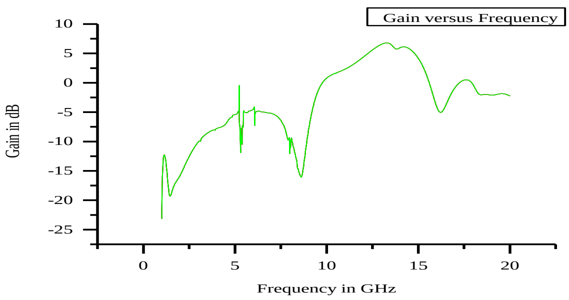
III. RESULTS AND DISCUSSIONS



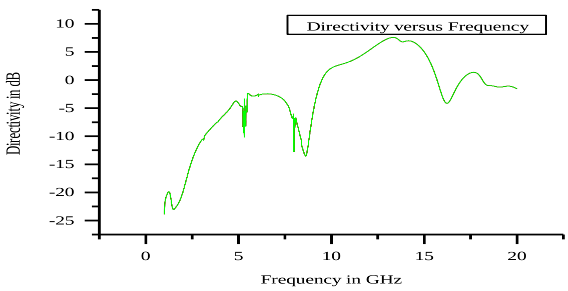
(a)



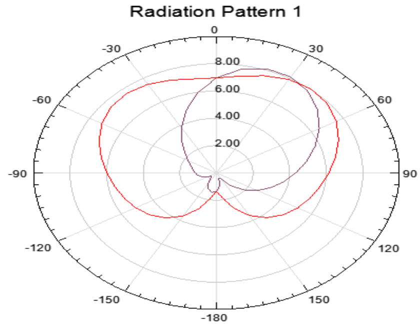
(b)



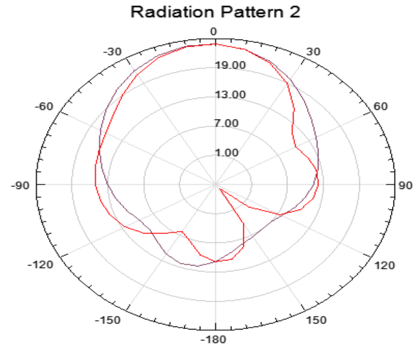
(c)



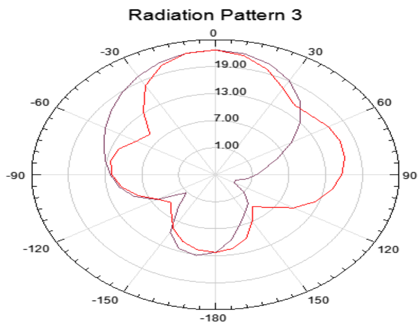
(d)



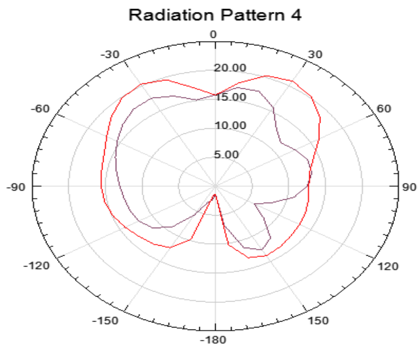
(e)



(f)



(g)



(h)

The designed antenna has return loss characteristic that is -32.3823dB, and -20.5835dB and -17.4034dB and -34.4152Db at resonant frequency 9.6000GHz and 13.6400GHz and 14.8000GHz and 18.4000GHz respectively. The return loss can further improvement by using different feeding techniques, shown in the Fig (a), and the (VSWR) graph of proposed antenna shows the (VSWR) value are 0.4177DB and 1.6291dB and 2.3568dB and 0.3305dB at resonant frequency 9.6000GHz and 13.6400GHz and 14.8000GHz and 18.4000GHz respectively. (VSWR) values implying the impedance matching between the source and the feed is good shown in the Fig (b).

The designed antenna has a good gain of -0.9233dB and 6.1265dB and 5.0006dB and -2.0414dB at a resonant frequency of 9.6000GHz and 13.6400GHz and 14.8000GHz and 18.4000GHz shown in the Fig (c). And the designed antenna has a good directivity of 0.7236dB and 7.1453dB and 5.8198dB and -0.9392dB at a resonant frequency of 9.6000GHz and 13.6400GHz and 14.8000GHz and 18.4000GHz, respectively shown in the Fig (d). Radiation pattern is the graphical representation of the radiation properties of the antenna as a function of space. Radiation pattern describes how the energy is radiated out into the space by the antenna or how it is received. For the resonant frequency 9.6000GHz and 13.6400GHz and 14.8000GHz and 18.4000GHz, the radiation pattern is nearly omnidirectional in the azimuthal and elevation plane, shown in figure (e), (f), (g) and (h) respectively.

Since this antenna is multiband so each frequency described their all characteistics of the antenna in table1.2.

Table1.2

Frequency GHz	RL dB	VSWR dB	Gain dB	Directivity dB	Bandwidth GHz
9.6000	-32.3823	0.4177	-0.9233	0.7236	1.7
13.6400	-20.5835	1.6291	6.1265	7.1453	0.05
14.8000	-17.4034	2.3568	5.0006	5.8198	2.35
18.4000	-34.4152	0.3305	-2.0414	-0.9392	0.15

IV. CONCLUSION

The antenna design, has a rectangular shape radiating element, with a partial ground plane and a microstrip line feed from the edge of the patch, antenna are able to resonate at frequencies 9.6000GHz, and 13.6400GHz and 14.8000GHz, and 18.4000GHz. The obtained return loss, directivity, gain, and VSWR is good and radiation characteristics are also appropriate, different feeding techniques may also be used for increasing the efficiency.

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