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Hexagonal Shaped Micro-strip Patch Antenna for Wi-Fi Application

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ABSTRACT: In recent years there is a need for more compact antennas due to rapid decrease in size of personal communication devices. This paper proposes the design of a compact antenna. The antenna structure consists of hexagonal patch which was given to the strip line feed. The antenna is operating at 2.45GHz with better values of return loss, VSWR and radiation characteristics.. The gain of the Proposed antenna is 4.68dB. The micro strip patch antenna was analyzed using Ansoft/Ansys HFSS.

KEYWORDS: Micro-strip patch antenna; Return loss; VSWR; Bandwidth; Wi-Fi

I. INTRODUCTION

Antennas (also just called patch antennas) are among the most common antenna types in use today, particularly in the popular frequency range of 1 to 6 GHz. This type of antenna had its first intense development in the 1970s, as communication systems became common at frequencies where its size and performance were very useful. At the same time, its flat profile and reduced weight, compared to parabolic reflectors and other antenna options, made it attractive for airborne and spacecraft applications. More recently, those same properties, with additional size reduction using high dielectric constant materials, have made patch antennas common in handsets, GPS receivers and other mass-produced wireless products. In high-performance aircraft, spacecraft, satellite, and missile applications, where size, weight, cost, performance, ease of installation, and aerodynamic profile are constraints, low-profile antennas may be required. Presently there are many other government and commercial applications, such as mobile radio and wireless communications, that have similar specifications. The microstrip patch antenna has elasticity of placing the feed in the micro-strip patch antenna anywhere inside patch in order to match the input impedance. The micro-strip patch antenna's fabrication process is tranquil. The antenna has additional advantage of low counterfeit radiation [1].

There are several ways to design micro strip patch antenna. A square shaped patch antenna with slots on the structure is used, in order to useful for S-band application [2]. An E-shaped antenna used strip line feed and it has an operating frequency of 2.6GHz [3], similarly a rectangular micro strip antenna used strip line feed and used air as a substrate to achieve the S-band characteristics [4]. A rectangular patch antenna is designed by using all types of feeding techniques [5]. A Probe feed is given to the slotted rectangular patch and E-shaped antenna in order to useful for wireless applications [6-7].

In view of above observations, a compact hexagonal shaped micro strip patch antenna is designed by using strip line feed. When compared with the previous design the dimensions of the antenna are very small and the proposed antenna is applicable for Wi-Fi applications.

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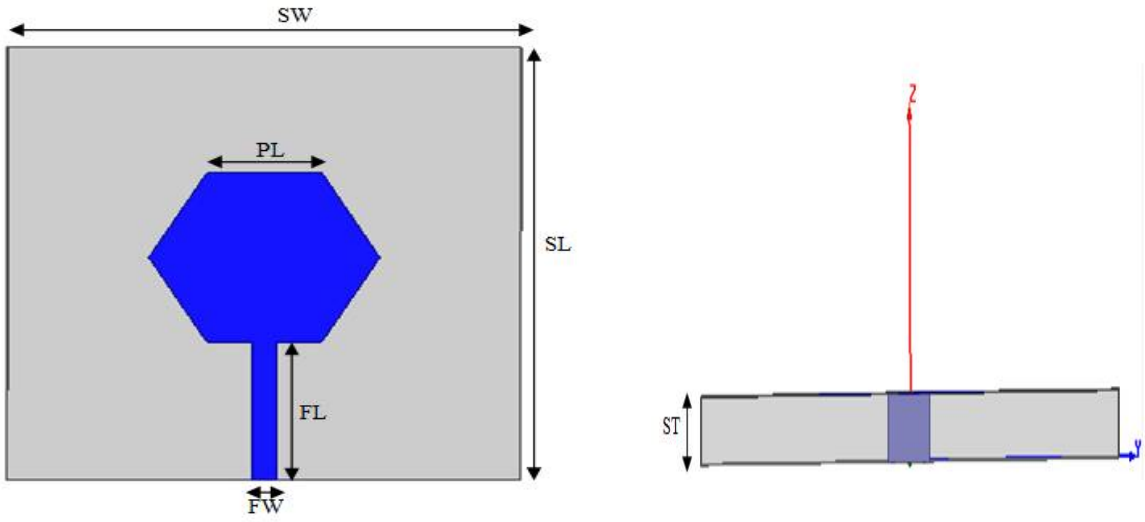
II. PROPOSED HEXAGONAL MICRO-STRIP PATCH ANTENNA

The geometry of the proposed antenna is shown in the Fig.1. The Proposed antenna consists of hexagonal shaped micro strip patch which was placed on the FR4 epoxy substrate which has dielectric constant of 4.4 and thickness of 1.6mm. The strip line feed is used to design the antenna because of having its numerous advantages like easy to design, easy to fabricate and impedance matching. The antenna is designed and analysed by using HFSS software, after optimizing the dimensions of the hexagonal shaped microstrip patch antenna are tabulated in table1.



(a)Top View (b) Side View

Fig.1 The Proposed Hexagonal Shaped Micro strip Patch Antenna

Table.1: The Dimensions of the Proposed antenna

S.No.	Parameter	Description	Dimensions
1.	SL	Length Of The Substrate	20mm
2.	SW	Width Of The Substrate	20mm
3.	ST	Substrate Thickness	1.6mm
4.	PL	Length Of The Hexagonal Patch	4.5mm
5.	FL	Feed Length	7mm
6.	FW	Feed Width	1mm

III. SIMULATION RESULTS

The Fig.2 shows the frequency vs return loss plot, the proposed antenna is operating at 2.45GHz with a return loss of -34.8dB as this antenna is resonating at 2.45GHz so, it is useful for Wi-Fi application. This antenna has a bandwidth of 7.5GHz.

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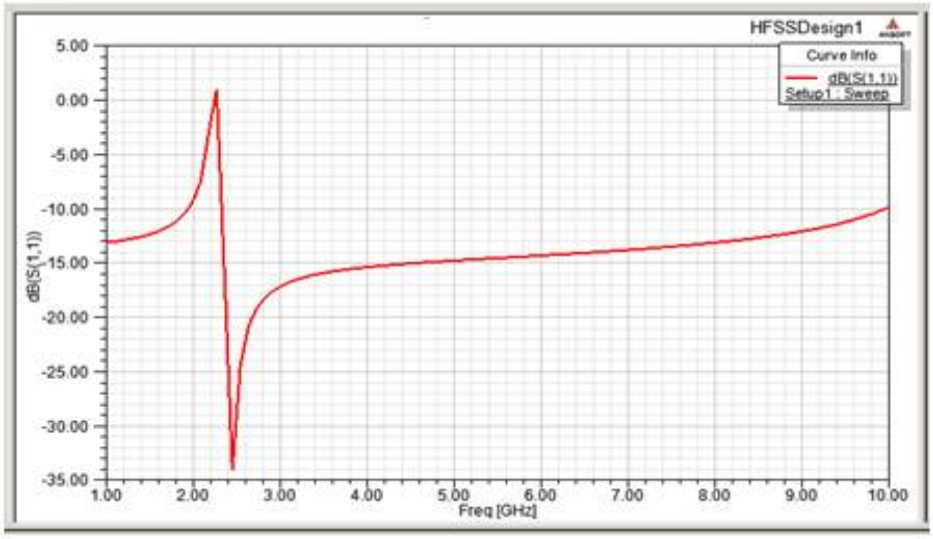

Fig.2.Frequency Vs Return loss Plot

VSWR (Voltage Standing Wave Ratio) is the ratio between the maximum voltage and minimum voltage in the transmission line. Better the antenna is matched to the transmission line and more power is delivered to the antenna. The Proposed antenna is having the VSWR of 1.05 and the frequency vs VSWR plot is shown in Fig.3

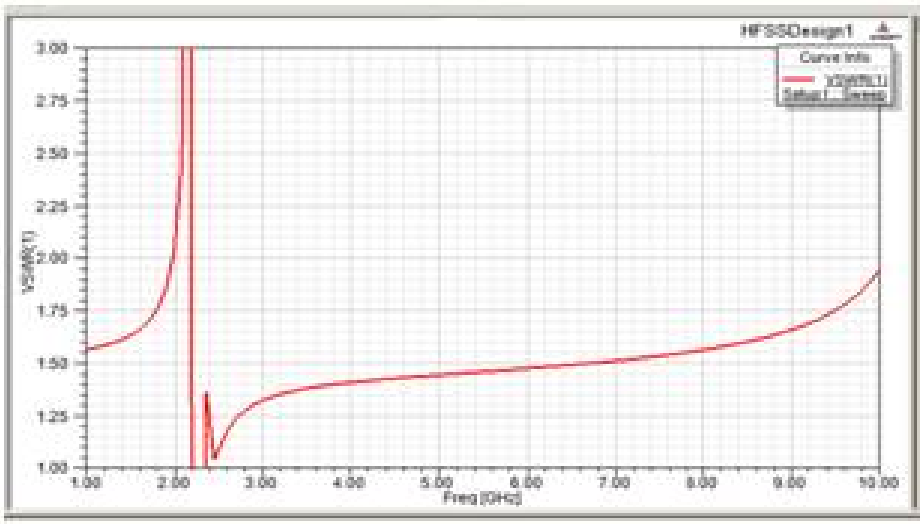

Fig.3.VSWR of proposed antenna

Radiation pattern gives the graphical representation of the radiation properties of the antenna as a function of a space coordinates here the radiation pattern is determined in the far field region. The radiation pattern plot of both E-plane and H-Plane is shown in Fig.4.

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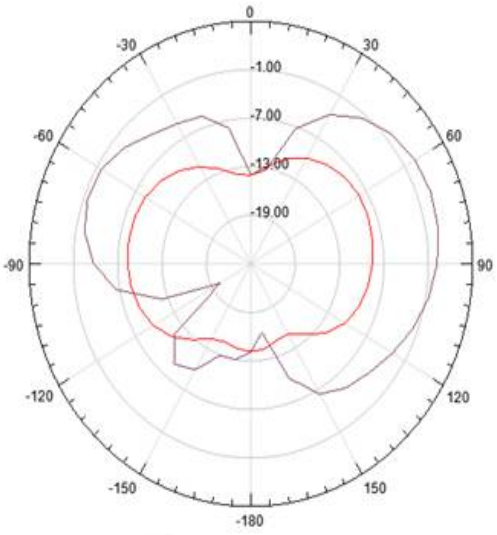

Fig.4 2D-Radiation Pattern Plot

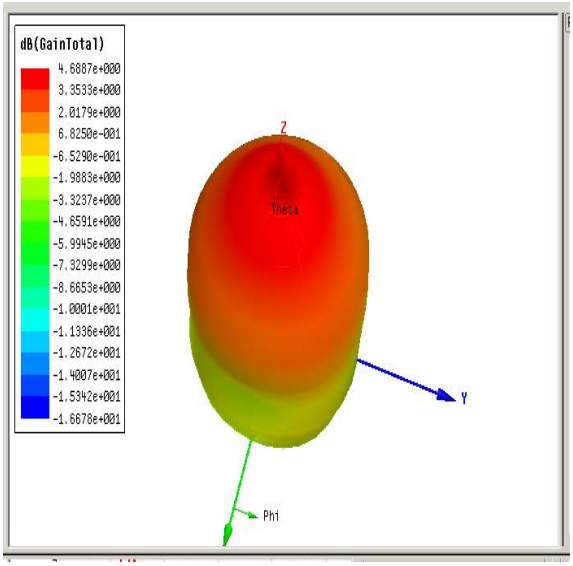

Fig.5. 3D Gain Plot

The Proposed Hexagonal Patch antenna is having gain of 4.68dB and the 3D gainplot is shown in Fig.5. The results are summarized in Table.2.

Table.2: Summary of the results

S.No.	Parameter	Value
1.	Return Loss	-34.8dB
2.	Band width	7.5GHz
3.	VSWR	1.05
4.	Gain	4.68dB

IV. CONCLUSION

The paper has designed a hexagonal micro-strip patch antenna operating at 2.46 GHz by using FR4-epoxy material as substrate. It has a return loss of -34.2 dB, VSWR of 1.05 and gain of 4.68dB.This antenna has a bandwidth of 7.5Ghz and it is useful for Wi-Fi application which in S-band.

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