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A Leaf Shaped Microstrip Patch Antenna

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Abstract **- This paper describes a new microstrip patch antenna which is presented by using a IE3D software .These antenna is named as *"A Leaf Shaped microstrip patch antenna"* .Simulation results has been obtained which states that the microstrip patch antenna possess predictable multi band characteristics. The result shows that the designed antenna can operated in 3 different frequency bands with bandwidth of 3.49%,2.37% and 1.86% the resonating behavior makes this antenna suitable for different type of applications.**

Index Terms **— Patch Antenna , Microstrip antenna, Multiband band.**

I. INTRODUCTION

The Microstrip Patch Antenna (MPA) has attracted wide interest due to its important characteristics, such as light weight, low profile and low cost, mechanically robust, simple to manufacture , easy to integrated with RF devices allow multi frequency operation to be achieved .[1] [2] In some cases where 2D antennas are needed these antennas can't be used due to their bulky size and 3D structures ,this is a case which leads to the requirement of 2D planar antenna and microstrip patch antenna is the most important type of planar antenna structure. There are several patch shapes which provides good bandwidth and gain for various applications.

[3] A patch antenna is a popular type of microstrip antenna which is also known as a flat panel antenna .it derives its name from the fact that it is formed by suspending a single metal patch over another larger metallic plate with a dielectric sheet in between two pieces,The increased production and use of portable electronic equipment has increased the need for a reliable and compact antenna .

Patch type microstrip antennas have met this need , and are now built in to cellular phones, palm electronic devices as well as laptop computers and wireless local area network (LAN) equipment . A Patch antenna assembly is commonly enclosed in a protective white or black plastic case , called a radome , in order to shield the antenna from inclement weather and make it easier to mount. Patch antennas are thin, lightweight and relatively simple to construct, modify or customize. These antennas are commonly fabricated into rectangular, square, elliptical,or circular shapes.

II. LITERATURE REVIEW

(i) Microstrip patch antenna (MPA) is generally used in modern communication devices , and a large part of day –to – day communication is done through it study of literature of past few year shows that , the leading work on MPA is focused on designing compact sized microstrip antenna.

(ii)[4]The printed research in printed antenna technology points to development of antennas in compact with efficient radiation characteristics.

(iii) Microstrip antenna are often referred as patch antenna because the radiating element is normally a patch. It comes in different shapes such as square , rectangular, circular etc.

(iv)[5]Microstrip Patch Antenna (MPA) have many advantages over conventional antennas which makes them suitable for a wide variety of applications. However, a major drawback of these antenna is low bandwidth . various techniques have been proposed by researchers to enhance its bandwidth.

(v)In the recent years , the electromagnetic bandgap(EBG) structures have been attracted much attention in the microwave community for their unique properties.

III. PROPOSED WORK

The antenna is designed by *IE3D* structure simulator engine by zeland software . the geometry of an antenna is substitute on a finite rectangular ground plane of dimensions (30mm × 40mm) ,the patch element has been printed on the top of substrate (ztop = 1.6, $E_{r=}$ 4.4, loss of tangent =0.02) , the feed point has been given on the lower of the rectangular surface .

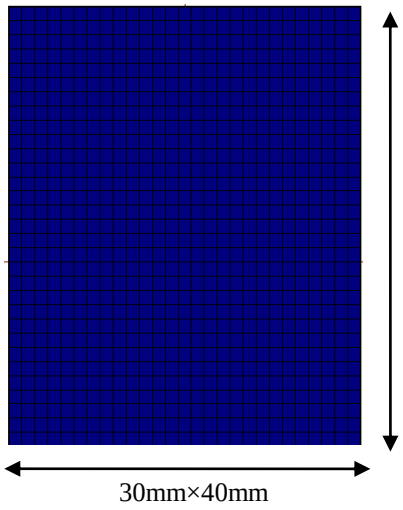

Fig-1 Base Shape

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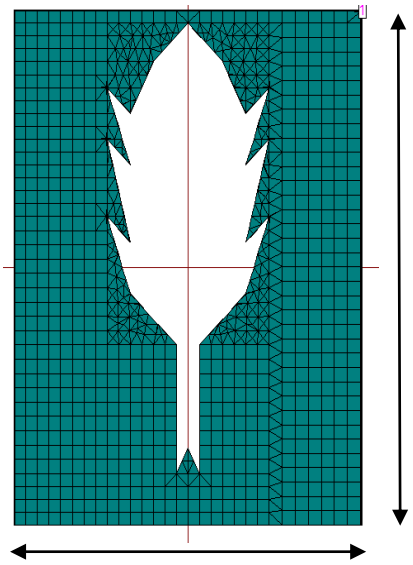

30mm×40mm
Fig-2 Final Leaf Shaped

The patch is printed on the ground plane substrate of relative permittivity E_r =4.4. (fig-1) is the base shape which is of rectangular shape and (fig-2) is the final patch shape which of shield shaped. The various parameters that have been optimized are length and position of the aperature , length of the open circuited microstrip stub ,and the air gap between the substrates.

IV. SIMULATION AND RESULTS

The iterations of the microstrip patch antenna were examined by using the IE3D simulation software tool . the frequency lies between (1GHZ – 8GHZ) upto 100 number of frequencies. The simulation of this antenna structure provides good result and makes this antenna suitable to work in two to three different frequency bands. The most important parameter which is to be analyzed is the bandwidth of the antenna ,for analyzing the bandwidth of an antenna return loss curve is drawn and studied in Fig-3.

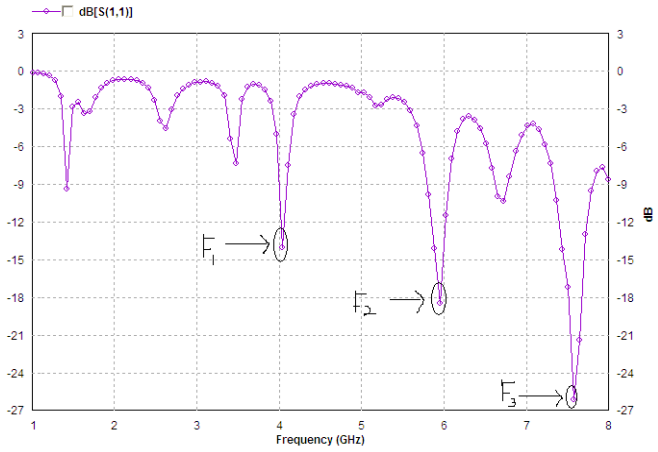

Fig-3 Return Loss Curve Of The Designed Antenna Structure

By analyzing the curve in the fig-3 . we can see three different frequency bands named F1, F2 , F3 respectively. after calculating we can see that the bandwidth of different frequency bands F1=3.49% at 4.04GHZ , F2=2.37% at 5.949GHZ and F3=1.86% at 7.576GHZ which makes the antenna structure suitable for three different types of applications.

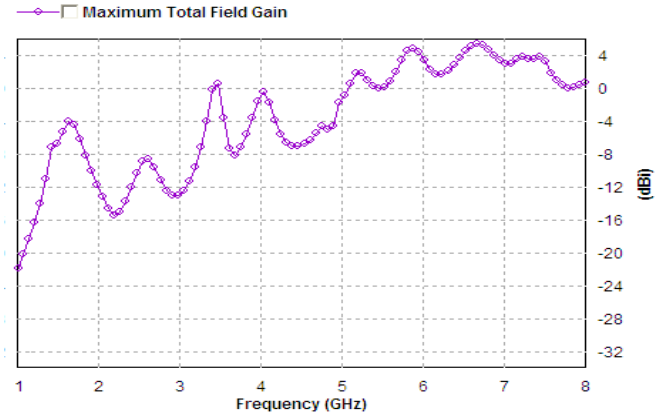

Fig-4 Total Field Gain VS Frequency

Another parameter is the gain of the antenna . The Gain VS Frequency Graph is illustrated in the Fig-4 is used to find gain of the antenna .the curve shows the Maximum gain of 5.335 at 6.66 GHZ.

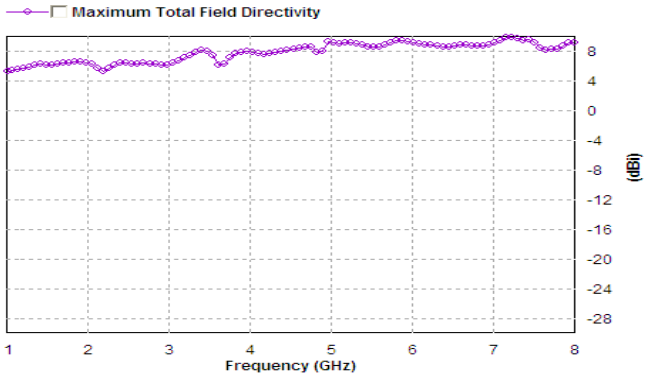

Fig-5 Total Field Directivity VS Frequency

Directivity is another important parameter of an antenna which is closely related to antenna gain. The Total Field Directivity VS Frequency curve is illustrated in Fig-5. The graph shows a directivity having a maximum value of 9.883dbi at 7.22 GHZ.

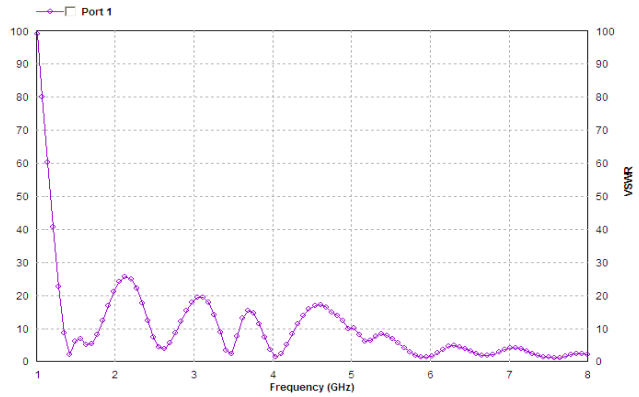

Fig-6 .VSWR curve

The VSWR curve is another important parameters it should

be less than 2 for an antenna to work properly.it is less than 2 in all three bands as shown in Fig-6.

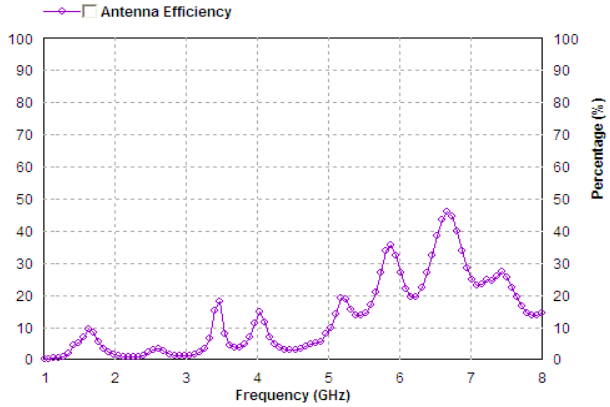

Fig -7 Antenna Efficiency

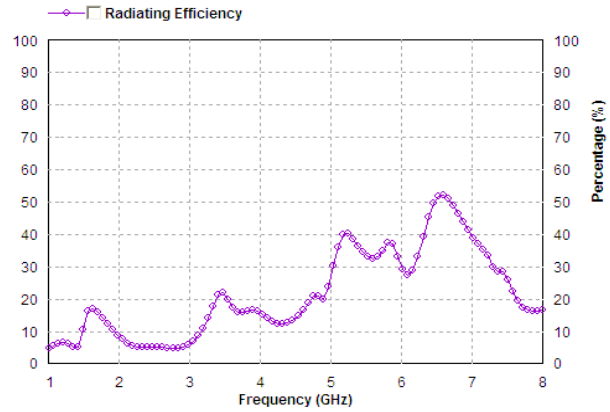

Fig-8 Radiation Efficiency

Antenna efficiency and radiation efficiency are very important terms,which is used to analyze whether the antenna is efficient or not, and whether the antenna is radiating properly or not . the curve's is described in Fig-7&Fig-8.

By Analyzing the curve we can see that the observed antenna structure design provides an antenna efficiency of 45.75% at 6.66GHZ and the radiation efficiency of 51.98% at 6.59GHZ.

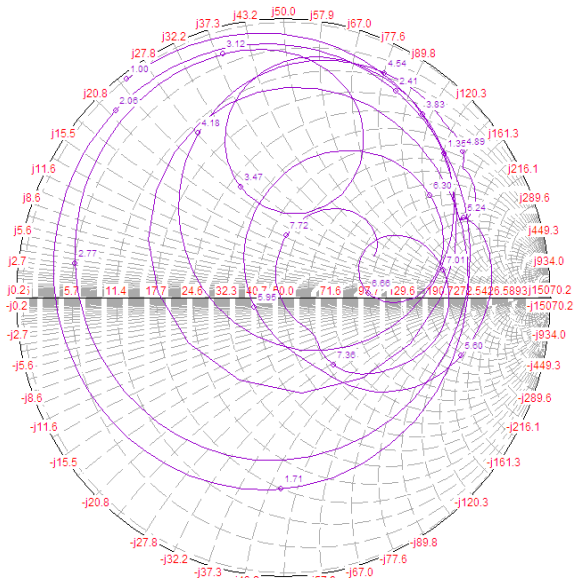

Fig-9 Smith chart

S.NO	RESONANT FREQ(GHZ)	RETURN LOSS	BW	VSWR
1	F1-4.04	-14.08	3.49%	1.49
2	F2-5.949	-18.48	2.37%	1.27
3	F3-7.576	-26.16	1.86%	1.103

TABLE-1 EXPERIMENTAL RESULT OF LEAF SHAPED

V. CONCLUSION

A Leaf shaped microstrip patch antenna with Multi-Band characteristics has been successfully demonstrated .this antenna works in three different frequency bands as shown in the return loss curve. The antenna structure also provides a good amount of gain i.e. 5.335 at 6.66 GHZ and directivity i.e. 9.883dbi at 7.22 GHZ. The antenna efficiency is about 45.75% and radiation efficiency is about 51.98% which is quiet good enough. It's frequency lies between (4-8) GHZ and it can be used in ISM bands devices cordless telephones , wireless computer network, Bluetooth devices etc ,and it can also be used in various military and wireless applications.
Analyzing this type of structures we can further provide increment in the gain and bandwidth of the antenna.

VI. ACKNOWLEDGEMENT

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