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# Enhancement in Design and Analysis of H-Shaped Patch Antenna using HFSS

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**Abstract:** Patch antenna is an most essential component in radio broadcasting such as television, radio, radar, mobile phones etc., Patch Antenna has very low profile which can suitable in the surface of consumer products aircraft and missiles. The demand is increasing for small size antenna for both commercial and personal applications. H-shaped patch antenna consists of rectangular patch on the top of the dielectric substrate FR\_4, the H- shaped slot has been made to reduce the size of the antenna. The H-shaped patch antenna has the capability of wide bandwidth and for dual band applications. By reducing the size of the antenna, it results in improved gain and decreases the antenna's return loss and increases the bandwidth of the antenna. In the proposed method, patch antenna operates at frequency of 8.5GHz and 4.5GHz which has more loss and less gain , patch antenna operates at frequency of 10GHz which results better H- shaped patch antenna than existing method.

**Keywords:** H-shaped slot patch antenna; High- frequency structural simulator; Bandwidth enhancement; Dual band; multiple frequencies;

## I. INTRODUCTION

The patch antenna is significant in the wireless communication systems for varied systems and standards with the properties like gain, bandwidth, multiband operations and smart size. Little patch antenna can be applicable for diverse applications. High gain, wide system of measurement, come loss, graph and improved efficiency are needed in patch antenna. The graph of Associate in nursing antenna can be a diagram of intensity or extra usually the ability of the intensity. Ground plane and also the antenna has necessity of separation between system, all the antenna style ought to attain smart radiation potency. With slim information measure, twin and tri band application antenna is employed for patch antennas. H shaped antenna is employed For the high speed mobile communication and beside the delivery of high speed knowledge, microwave systems like WLANs, satellite communication is to be additionally developed. Variety of antenna styles like H formed, E shaped, L Shaped, I Shaped, T formed and monopole antennas are bestowed For Wi-Fi and wireless local area network applications. For wireless communication patch antenna are most well-liked for wireless communication. For presidency and industrial applications to transfer the data from one place to a different the patch antenna. Substrate divergent patches and ground are essentially included in antenna. Often, the microstrip antennas are also called as patch antennas. All-time low of the substrate is placed at the bottom of the plane and also the two divergent patches and also the feed lines are typically photo etched on the stuff substrate. Patch antennas are needed for good options like low profile, light weight, low cost, high potency. The 2 rectangular patches are most generally used configurations because of suffer from the slim information measure. Isolation improvement in the antenna array posses sophisticated end in the antenna community. At an equivalent frequency to a standard substrate, multiple antenna parts operated to style. in order that mutual coupling happens and antenna gain, information measure and radiation potency is additionally increased. An excessive amount of attention is taken by the formed slot small strip patch antenna in numerous applications like wireless, WLAN, Satellite communication. The information measure of straight forward small strip antennas is increased by the formed slot small strip patch antenna. It can be designed for applications having a twin and triple band in it. It's Applicable for the antenna which have less and wide unfold quantitative relation of frequency. The formed slot small patch antenna has the power to reconfigure frequency of 10GHz.

## II. EXISTING METHOD

Microstrip antennas were widely used in several areas because of low profile, and easy fabrication. Some applications were desired to have a twin band or multiband characteristics. These characteristics are obtained by coupling multiple divergent parts or by victimization standardization devices like varactor diodes. However, these ways make antenna a lot of difficult. the straightforward method to obtain the twin band characteristic in a microstrip antenna is embedding a find time for the patch which the divergent patch includes a combine of step-slots. In microstrip patch antennas, embedded slots also can be accustomed enhance the resistivity information measure of one band antenna.

The motive of this work is to design and to develop a U formed microstrip , which might work under the frequencies of four.9 gig cycle per second and seven.5 gig cycle per second applicable for Wi-Fi and WLAN applications.. In a multiple tuned antenna, the bottom loss is reduced. the U formed patch antenna has been completed victimization HFSS software. Micro strip antennas have low bandwidth and gain. The U- shaped slot is acquainted with in the micro strip antenna which radically increase the bandwidth and gain of it. The antenna is designed by using the substrate FR4\_epoxy is dual band and also works on two multiple frequencies. It also gives different and directivity at different frequency of 10GHz which it is premeditated to work. The radiation pattern of u shaped antenna is analyzed as well as return loss is measured as -31dB which conveys how much power is transmitted by the antenna. The parameters were analyzed by using high frequency structural simulator (HFSS) which is Ansys software This also can be installed in mobiles, satellite communication. It is also used as WLAN & Wireless.

### III. PROPOSAL METHOD

The microstrip patch antenna is to design H-shaped Patch antenna and to analyze the radiation diagram, come back loss, gain and directionality. Length and breadth of the antenna are changed by the planning equation. Microstrip antenna is simulated by HFSS software system that has its operative frequency vary (5-12) GHz. As in modern communication were bothered in size reduction and movability, miniaturization and sensible price to quality quantitative relation are the most things in our project. The H-shaped slot patch antenna comprised of the radiating patch, coaxial connector, dielectric substrate, and ground plane. The radiating patch were present on the upper side of the dielectric substrate while ground plane is present on the down side of it. The upper side of the patch antenna is fed with the feed line. Radiating patch were obtained by using conducting materials like copper and gold . The antenna is designed by using The dielectric substrate FR4\_epoxy is used to design an antenna that have an relative permittivity of 4.4 and a dielectric loss tangent of -31.00. The substrate dimensions are based on the frequency of 10GHz using probe feed. It comprised of H-shaped slot patch on an FR4\_epoxy substrate material. The patch is probe feed. The probe feed consists of two cylinders which are made up of pec material. The full substrate is placed inside the air box which each side, except side at z=0, has been assigned radiation boundaries.

### IV. LAYOUT DIAGRAM

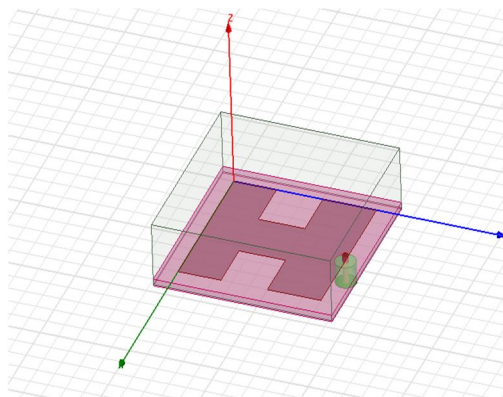


Fig 1: H- shaped slot micro strip antenna

### V. DESCRIPTION

The diverse patch concentrated instrumentality, the stuff components and ground line are incorporate to develop slot tiny strip patch antenna. The gift in the bottom side was ground plane to the stuff substrate. The patch which place gift in the face was fed to the feed probe or feed patch.

Regulating materials square gold or Copper Square used for calculation for developing diverse patch. The stuff materials FR4\_epoxy which contains relative permittivity of 4 and it has stuff low tangent of -31.00. the scale of substrate square was calculated by he wavelength of 10GHz victimization probe feed. The substrate contains a developed slot patch coupled to Nursing FR4\_epoxy substrate material. The patch was considered as probe feed. The probe feed contains two cylinders and the square calculates allotted pec substrates. The entire substrata was situated within air box either side, except at z=0, which has been allotted to radiation boundaries.

## VI. SPECIFICATION AND PROCEDURE

- A. The size of the patch is 40mmx40mm.
- B. The slots size is 13mmx13mm which make the H shape.
- C. By using the subtract, the patch is cut into the H shaped.
- D. The dimension of ground is -50mm in x axis and y axis.
- E. The dimension of substrate is -50mm in x axis and y axis, 1.6mm in z axis.
- F. The radius of ground is cut it out around 2.9mm.
- G. The ground and ground cutout are cut by using the subtract option.
- H. By using cylinder option draw a probe which is made up of pec material consist of radius 0.81mm and height is 1.6mm.
- I. By using cylinder, option draw a pin which is made up of pec material consist of radius 0.81mm and height is -5mm.
- J. Again by using cylinder option draw a coax which is made up of vacuum material consist of radius 2.9mm and height is -5mm.
- K. Draw a circle which is named as source consist of radius 2.9mm .
- L. Assign boundary for ground.
- M. Assign boundary for patch and assign excitation as wave port.
- N. Draw a cube which is named as radiation box consist of -50mm in x axis and y axis, 15mm in z axis.
- O. Selecting the face and assign the radiation.
- P. And then generate the graph for antenna gain and radiation pattern.
- Q. Generate 3d model for the radiation pattern.

## VII. RESULT

The dielectric materials are used to design the patch antenna is FR4\_epoxy which includes relative permittivity of 4.4 and dielectric low tangent of -31. Depends on the wavelength of 10GHz , the dimension of materials are calculated. The FR4\_epoxy materials contains H- shaped slot patch in it. The patch was used as probe feed. The probe feed contains two cylinders which allocate to pec material. The entire was situated inside the air box each sides, except at z=0 side, which is allocated to radiation boundaries. The side probe feed cylinder was assigned to wave port excitation on the higher level was parallel to the patch.

### A. Radiation Pattern

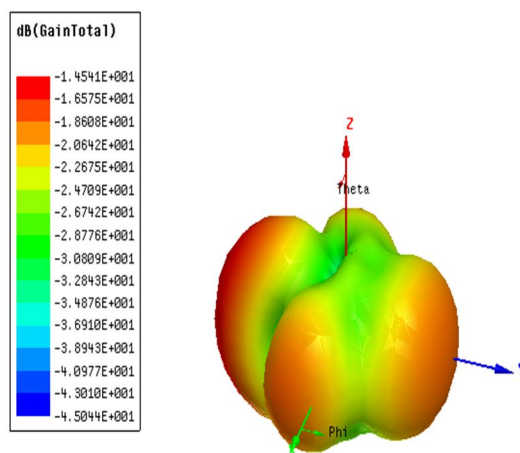


Fig 2: Radiation pattern for polar plot

The direction mediated to the maximum radiation develops antenna was gives information about the directivity. The maximum directivity in the solution wavelength 10 GHz was 7dB. The maximum back loss in the solution wavelength was 10GHz to -31dB. The directivity was revealed in figure 2.

**B. Antenna Gain**

The attain H-shaped microstrip slot antenna reveals in fig 3. The attain value are higher in 7dB.

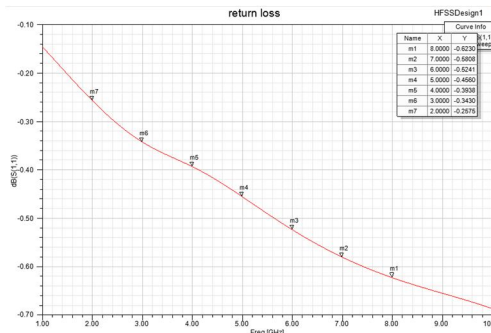


Fig 3: Gain of H shaped microstrip patch antenna

**C. Power Reflected**

Voltage Standing Wave Ratio (VSWR) of H shaped slot microstrip patch antenna was revealed in figure 4. Results conclude that the value of power transmitted and reflected from antenna. The minimum return loss at the solution frequency of 10GHz is -31dB.

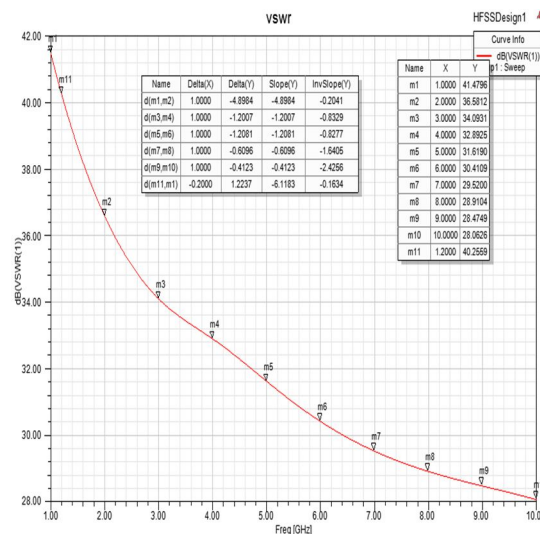


Fig 4: Power reflected from the U-shaped slot micro strip patch antenna

**VIII. CONCLUSION**

The altering frequency of antenna, shows the entire results are scrutinized and enhanced to HFSS has accuracy. The dimension of dielectric materials, radiating patch, and slot was altered. The entire process of reduction size increases the attaining process, and the decreases return loss of the dielectric materials. When the slot size increases the patch size was decreased. In conclusion, the mono band antenna operating frequency of 10GHz, including respective dimensions.

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