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Design of microstrip patch antenna for WLAN applications using Back to Back connection of Two E-Shapes.

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Abstract

In satellite communication, there are several types of micro-strip antennas, the most common of which is "Micro-strip patch antenna". Micro-strip patch antenna with slots placed parallel on the rectangular patch has developed and presented in this paper. Slots on the proposed patch can be used to increase the bandwidth of antenna. A constant radiation pattern with improved bandwidth, for an operating frequency of 4.5GHz can be easily achieved. Configuration of an antenna is easy to design. Different parameters like return loss which is -31.2492 at 4.7399GHz,gain along θ, Ø directions, radiation pattern in 2D & 3D where the 2-D gain is 8.0082 dB, E (9.3322e+002),H (1.3894e+000) field distributions and current distributions (2.2219e+000) are simulated using HFSS 13.0. This type of proposed patch can be used for various applications in S,C – bands.

Keywords: **Micro-strip patch antenna, Surface waves, Return loss , Gain , S,C-bands.**

I.INTRODUCTION

Micro-strip patch antennas have drawn the attention of researchers over the past decades. However, the antennas inherent narrow bandwidth and low gain is one of their major drawbacks. This is one of the problems that researchers around the world have been trying to overcome. The patch antenna has been rapidly used in various fields like space technology, aircrafts, missiles, mobile communication, GPS system, and broadcasting. Patch antennas are light in weight, small size, low cost, simplicity of manufacture and easy integration to circuits. More important is these can be made out into various shapes like rectangular, triangular, circular, square etc. Many techniques have been suggested for achieving the high bandwidth. These techniques includes: using parasitic elements either in same or other layer, utilization of thick substrates with low dielectric constant, and slotted patch. However, high bandwidth, small size, simplicity, and compatibility to the rest of the RF front-end are desirable factors of an antenna. Enormous effort has been invested on designing frequency independent or very wide band antennas. One of the major drawbacks of such antennas is their relatively large size which can potentially eliminate their use for mobile wireless applications. Commercial UWB systems require small low-cost antennas with Omni directional radiation patterns and large bandwidth. It is a well-known fact that slot antennas present really appealing physical features, such as simple structure, small size and low cost, micro-strip slot antennas are extremely attractive to be used in emerging UWB applications. The slots on the patch will assumed to have a narrow width. Increasing the width increases the bandwidth. The fractional bandwidth (FBW) for thin slots can be as low as 3-5%; wide slots can have a FBW on the order of 75%. Using a rectangular slot in the radiating patch increases the upper-edge frequency, and it is possible to control this frequency by adjusting the slot width. By cutting a modified slot of suitable dimensions at the radiating patch a new fed configuration can be constructed.

In this paper, a compact size micro-strip slot antenna is proposed with dielectric substrate as Rogers RT/duroid 5880(tm) with εr=4.4 and dimensions are base on resonant frequency. Various attempts are made to adjust the dimensions of the patch to improve the parameters like bandwidth, return loss, gain along **θ**, Ø directions, radiation pattern in 2-D and 3-D, E and H Field Distributions, Current Distributions using HFSS 13.0

II. DESIGN MODEL

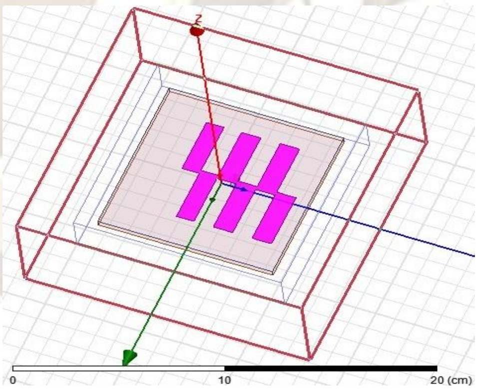

Fig:1 Ansoft HFSS generated model.

The proposed structure of the antenna is shown in Fig. (1). The antenna is simulated on an Rogers RT/duroid 5880(tm) substrate with a permittivity constant of 8.854 and a permeability of 1.2566. The thickness of the substrate is 0.36cm. The area of the antenna is 17.98cm*2cm, which is suitable for satellite communications transmissions, some Wi-Fi devices, some cordless telephones , and some weather radar systems. Some numerical results and experimental data are presented. Here, a rectangular patch can be fed with a probe with slots placed parallely on the patch considered through ground plane.The ease of insetting and low radiations is advantages of probe feeding as compared to rectangular micro-strip line feeding. The dimensions of shaped patch shown in Fig. (1) are L=2.64cm, W=2cm which are designed at operating frequency 4.5 GHz.

III. SIMULATION RESULTS

A. Return loss

Return loss is defined as the signal attenuation caused by impedance variations in the structure of a cable or associated connection parts.

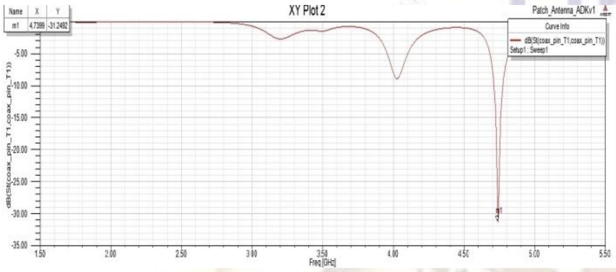

Fig. 2. Return Loss

Figure 3 shows the return loss plotted at 4.5GHz. The return loss obtained at 4.7399GHz is -31.2492.

B. 3D Gain and 2D Gain

It is defined as the ratio of the radiation intensity in the peak intensity direction to the intensity that would be obtained if the power accepted by the antenna were radiated isotropic ally.

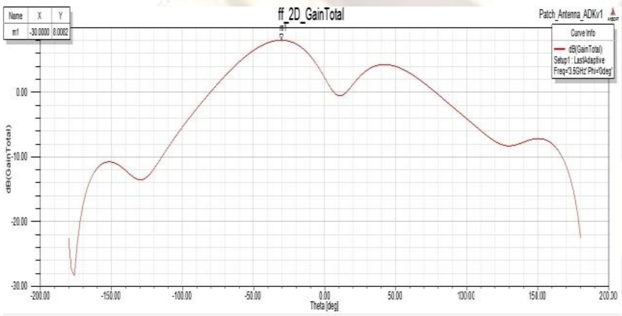

Fig.3. 2D Gain total

Figure 4 shows the 2D gain total plotted at 4.5GHz. The gain that obtains 8.0082dB at 0 degrees.

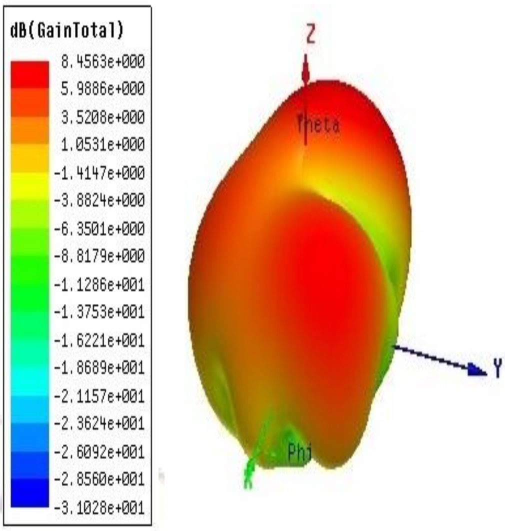

Fig.4. 3D Gain total

Figure 5 shows the 3D gain plotted at 4.5 GHz. The gain that obtains 8.4563e+000.

C. Radiation Patterns

The term radiation pattern refers to the directional (angular) dependence of the strength of the radio waves from the antenna or other source.

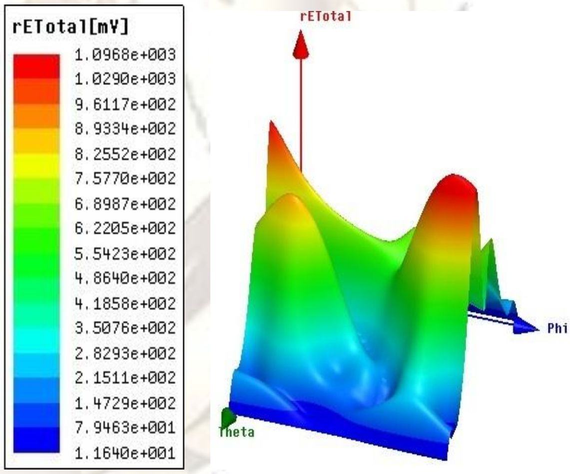

Fig.5. Radiation pattern Total

Figure 6 shows the radiation pattern total(E total) plotted at 4.5GHz. The E total obtains 1.0968e+003.

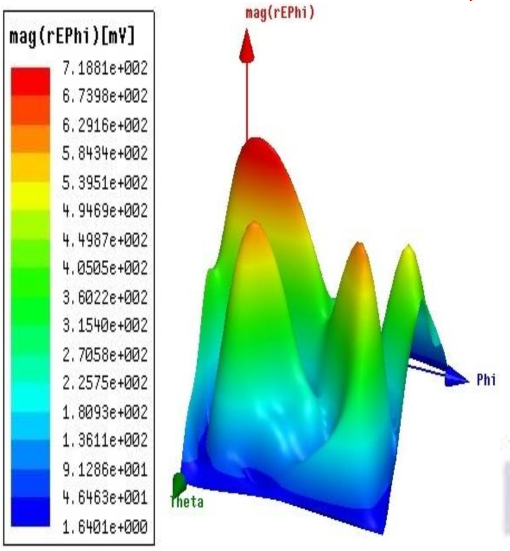

Fig.6. Radiation Pattern Phi

Figure 7 shows the radiation pattern phi(E Phi) plotted at 4.5GHz. The E total obtains is 7.1881e+002.

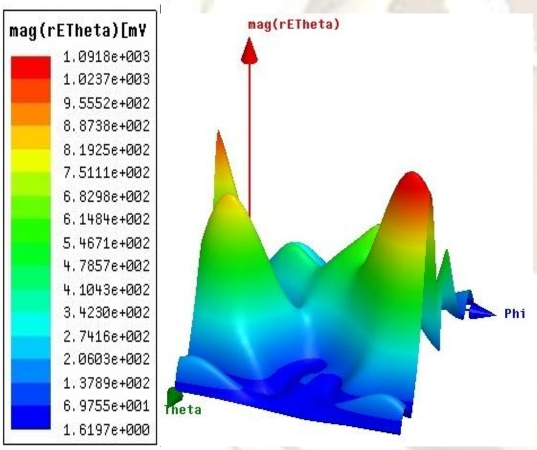

Fig.7. Radiation pattern Theta

Figure 8 shows the radiation pattern theta (E Theta) plotted at 4.5GHz. The E Theta obtains 1.0918e+003.

D. E-Field distribution

E-field is an effect produced by an electric charge that exerts a force on charged objects in its vicinity Electric fields themselves result directly from other electric charges or from changing magnetic fields.

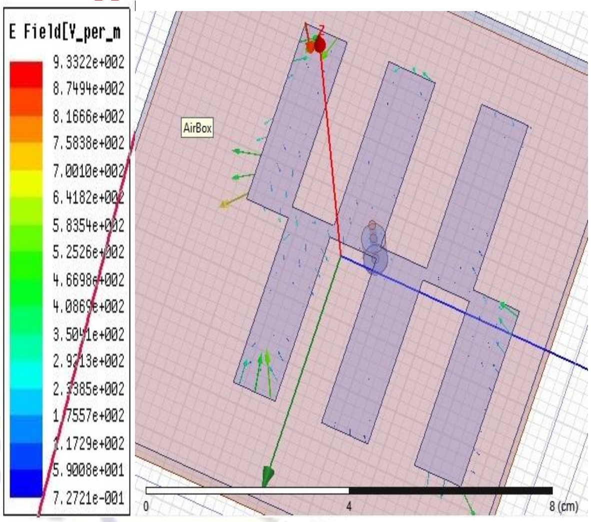

Fig.8. Electric Field

Figure 9 shows the electric field distribution(mag E) plotted at 4.5GHz. The mag E obtains 9.3322e+002.

E. H-Field distribution

It is defined as the measured intensity of a magnetic field at a specific point. Usually expressed in amperes/meter.

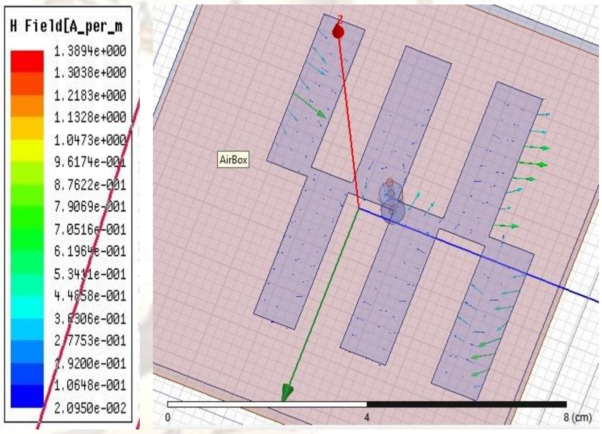

Fig.9. Magnetic Field

Figure 10 shows the magnetic field distribution (mag H) plotted at 4.5GHz. The mag H obtains 1.3894e+000.

F. Current distribution

It is defined as the distribution which establishes itself when the influence of over potential is negligible.

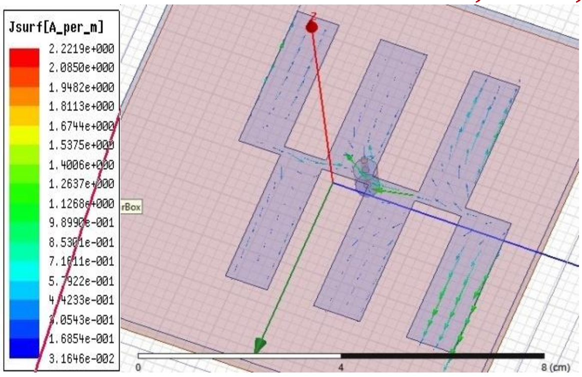

Fig.10. Current distribution

Figure 11 shows the current distribution (mag Jsurf) plotted at 4.5GHz. The mag Jsurf obtains 2.2219e+000.

IV. CONCLUSION

In this paper, a micro-strip patch antenna having slots placed parallely on the rectangular patch with wide bandwidth capability for UWB applications is proposed. In this design, the proposed antenna can operate at 4.5GHz with Return Loss < 10 dB and the proposed antenna displays a good Omni-directional radiation pattern even at higher frequencies. Good return loss and radiation pattern characteristics are obtained in the frequency band of interest. Simulated and experimental results show that the proposed antenna could be a good antenna and can be used in the s, c-bands.

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