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Size miniaturization of microstrip patch antenna

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ABSTRACT

In this paper we discuss about size miniaturization of micro strip patch antenna using the miniaturisation techniques because the compact wireless devices has been in uses and there a need to reduce the size of micro strip patch antenna. This micro strip patch antenna has been designed and simulated using HFSS (High frequency structure simulation software) tool and getting good frequency and VSWR results within the UWB frequency range 3.1 to 10.6 GHz. Modified MPA by etching step slot in ground plane and etching the polygon slot in patch plane.

Keywords: *Micro strip patch antenna, duriod substrate, HFSS, Defected ground structures, Bandwidth.*

1. INTRODUCTION

In present time, the scope of the wireless communication technology becomes more interesting because wireless technology is one of the main research areas in the communication system. Today the micro strip antenna plays a significance role in the wireless communication system. In this paper we discuss the micro strip patch antenna and Micro strip antenna is one of the most widely types of printed antenna with its many advantages but it has the biggest disadvantage is its bandwidth. Bandwidth can be improved using different bandwidth enhancement techniques.

2. MICROSTRIP PATCH ANTENNA

(i). Antenna configuration:-

To design the micro strip patch antenna one of the most important point is selection of its substrate material. We can use the different types of substrate material but such type of the substrate material can be selected which provide the small size, high data transmission, higher accuracy, minimum losses, higher bandwidth and one of important point which consider at a purchasing time is its

Cost and must be in rang. The purpose of the substrate material is provide the mechanical support to the radiating patch and keep the spacing balance between two planes of MPA. The most uses types of the substrate material is duroid its dielectric constant Er. = 2.2 and height h = 1.4 mm. The micro strip patch antenna has the two faces at the one side radiating patch is printed of the substrate material and other side is ground plane. The configuration of the micro strip antenna is in different shape like as square, rectangular, circular, and triangular and size can selected using technique equations. The geometric of the radiating patch is shown in fig 1 and ground plane to be Ld × Wd = 25, 25 mm. The micro strip feeding is used to feed the located point of the radiating patch with the impedance of 50 Ω.

(ii). Design procedure:-

To design the compact micro strip patch antenna it is necessary to calculate the dimension of substrate material. The dimension calculated using the technical equation, the dielectric constant (Er) selected according to the purposed substrate material and frequency range selected according to the designer wish.

STEP 1:- Equation for Width Calculation (w)

$$w = \frac{c}{2fa\sqrt{(Er+1)/2}}$$

STEP 2:- Equation for calculation of Effective Dielectric Constant (Ereff)

$$Ereff = \frac{(Er+1)}{2} + \frac{(Er-1)}{2}\left[1 + 12\frac{h}{w}\right]$$

STEP 3:- Equation for calculation of the Effective Length (Leff)

$$Leff = \frac{c}{2fa\sqrt{Ereff}}$$

STEP 4:- Equation for calculation of Length Extension (ΔL)

$$\Delta L = \frac{0.412h(Ereff+0.3)(\frac{w}{h}+0.264)}{(Ereff-0.258)(\frac{w}{h}+0.8)}$$

STEP 5:- Equation for calculation of Actual Length (L) of Patch

$$L = Leff - 2\Delta L$$

3. SIMULATION AND RESULT

To simulate and design the micro strip patch antenna The High Frequency Structure Simulation (Ansoft HFSS) Software are used .The High Frequency Structure Simulation Software not only used to design and simulate the MPA but it also used to plotting and plot the directivity, radiation pattern, return losses, gain and find out best result between the numerical and experimental VSWR.

The simple micro strip patch antenna with the feed lines length is Lf × Wf = 1.5×6 mm^2.

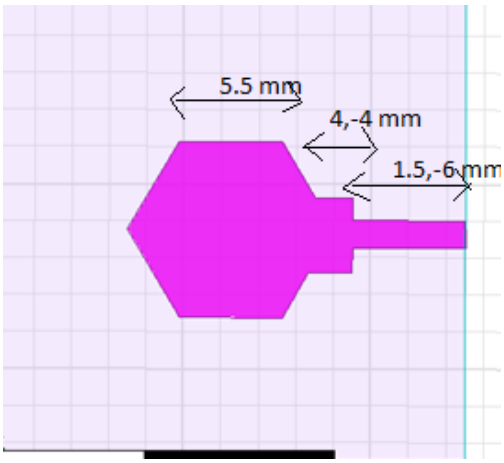

Fig. 1 Simple micro strip patch antenna

Microstrip Patch Antenna with Modified Patch and Ground Planes

To modify the micro strip patch antenna etching the slot on the ground and patch planes with the equal size of slot width is 2mm. This proposed structure is designed to enhance the bandwidth. The micro strip patch antenna with modified ground plane is show in fig 2.1 & 2.2.

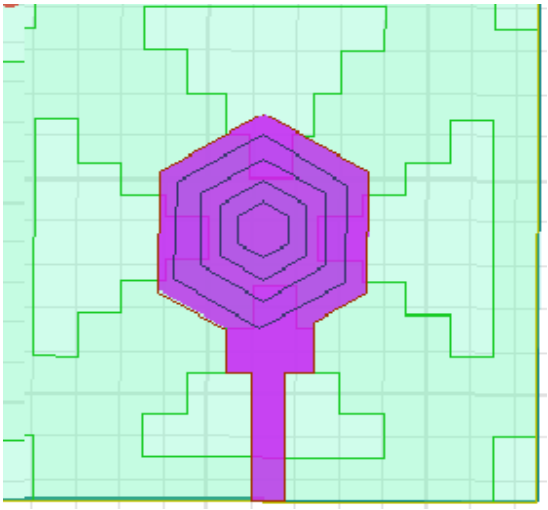

Fig. 2.1 Modified ground planes top view

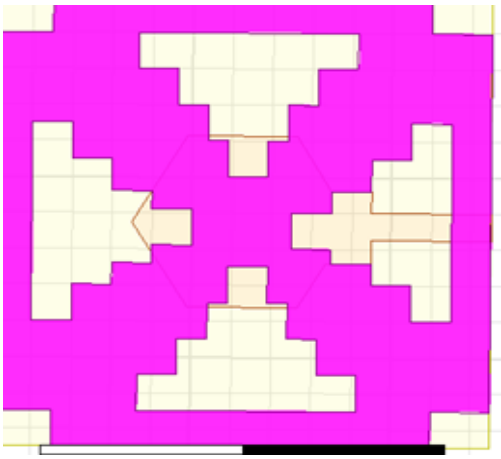

Fig. 2.2 Modified ground planes bottom view

Simple Polygon Microstrip Patch Antenna

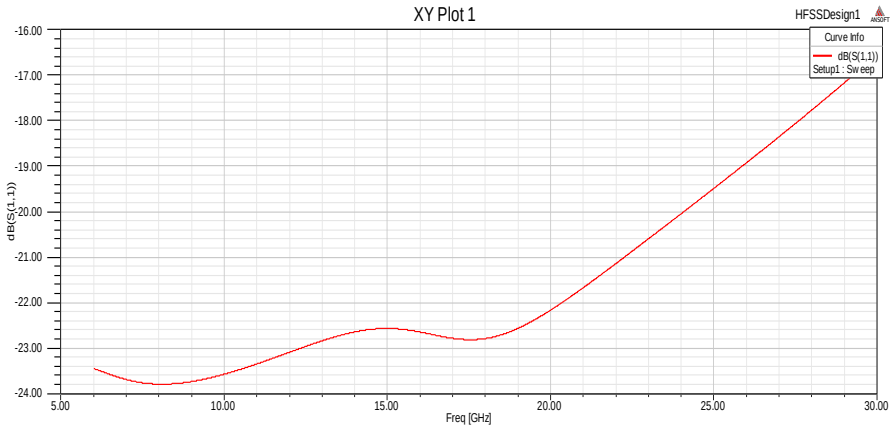

Fig. 3 Simple polygon micro strip patch antenna

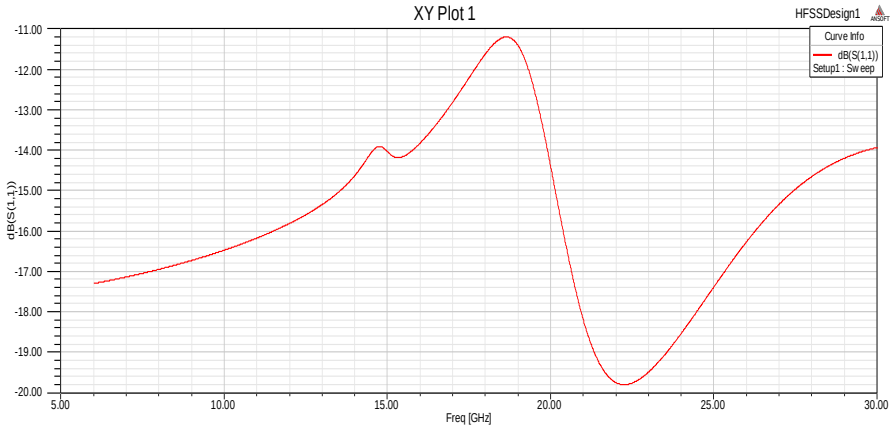

Fig. 4 Micro strip patch antenna with modified ground plane

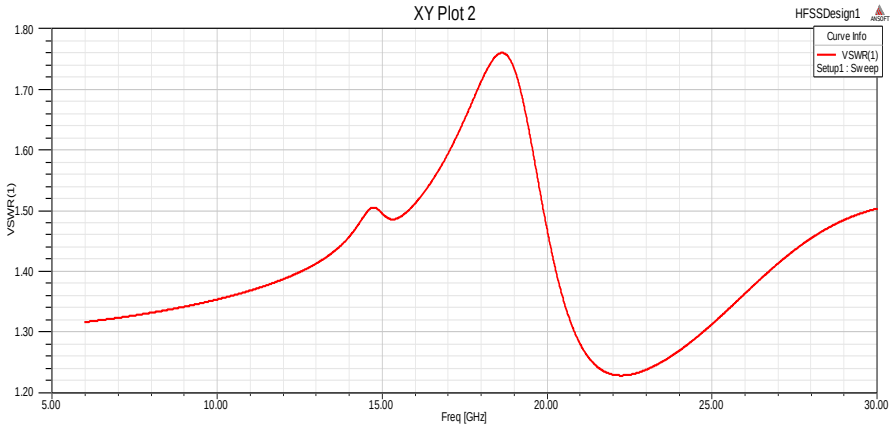

Fig. 5 Graph between VSWR and Freq.

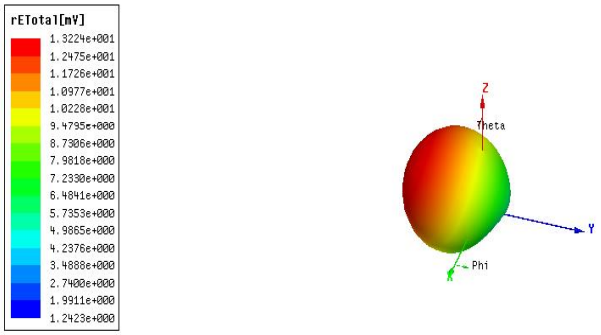

Fig. 6 far field 3d polar plot of micro strip patch antenna with modified ground plane

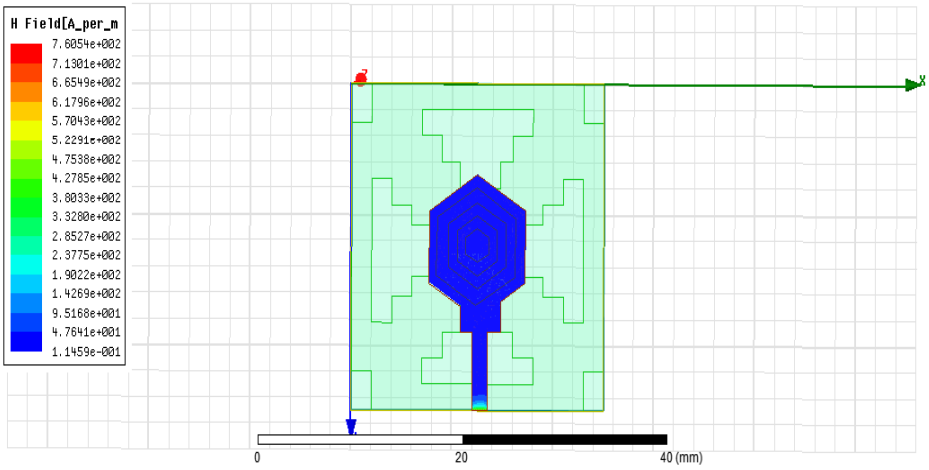

Fig. 7 H field current distribution

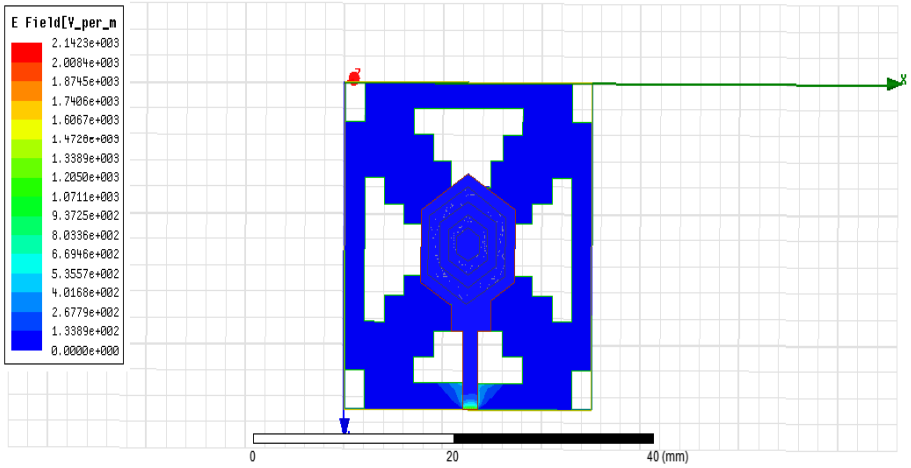

Fig. 8 E field current distribution

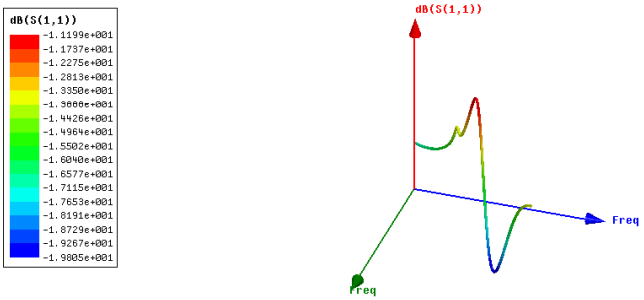

Fig. 9 3d rectangular plot

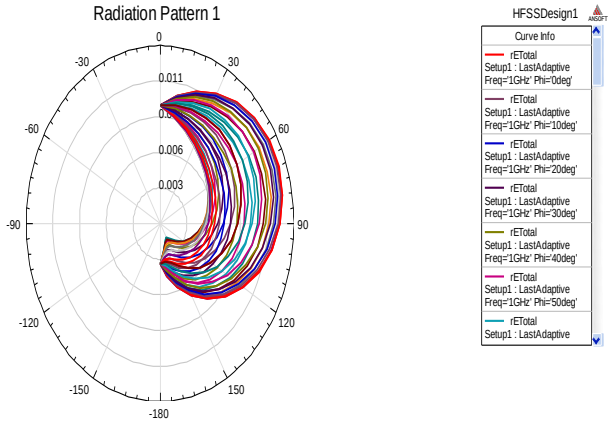

Fig. 10 Radiation pattern

4. CONCLUSION

We have constructed size miniaturization of micro strip patch antenna and experimental study show fig 5 the excellent agreement between the VSWR and frequency response. We also found the excellent radiation pattern, size miniaturization, bandwidth enhancement, desired directivity and gain etc.

5. REFERENCE

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