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A New Multi-Resonant Frequency Microstrip Antenna with U-Shaped Patch for Wireless Communication

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Abstract

This paper presents the investigation of a new square patch antenna. In the designed antenna a U-shaped square patch has been constructed, and nelco material substrate is used in the designed antenna for multiple resonances. It is a light weight, low profile, low volume, easily mounted and low fabrication cost antenna. In this proposed antenna, we have achieved 4 resonances of -50.40db, -42db, -27.92db and -21.83db at a frequency of 5.21Ghz, 5.98Ghz, 5.55Ghz and 4.36Ghz respectively. The maximum achieved gain of the designed antenna is 7.

Keywords— **U-Shaped Patch, Resonant Frequency, Dielectric constant.**

I. INTRODUCTION

A U-Shaped microstrip patch antenna is a type of antenna which provides a low profile i.e. thin and easy manufacturability, using modern fabrication techniques; it can be easily etched on dielectric substrate [1]. The metallic strip between ground and atmosphere is used to guide radio frequency or signals. The main disadvantage of patch antenna is narrow bandwidth, low gain, extra radiation occurs from its feed and junction etc. [2].

A U-shaped patch antenna is easily designed by cutting a square slot patch on square patch. We obtained an antenna which is operated on more than two resonant frequencies. In the newly designed patch antenna the U-shaped patch is mounted on the dielectric substrate which is excited with the help of the simple electromagnetic couple probe. In [1], a U-shaped antenna is proposed in which RF-35, dual layer of substrate is used.

II. ANTENNA STRUCTURE

The configuration of the proposed antenna is shown in Fig.1. A nelco substrate having relative permittivity in between 2.2 to 12 is used in this newly designed antenna. The substrate thickness is 1.6 mm and the ground plane is of 30mm × 30 mm × 0.1mm dimensions. A 3-dimensional view of this designed antenna is shown in Fig.2.In this designed antenna the radiating element is U-shaped square patch. The probe feeding technique is used in this proposed antenna [3]. For obtaining all resonant frequencies, optimum values of the structural parameters of the designed antenna are as follows: w = 20mm, L = 20mm, ls = 5mm.

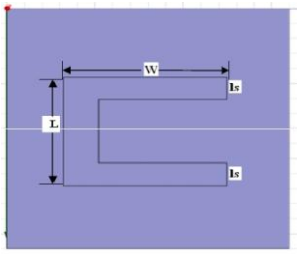

Figure 1

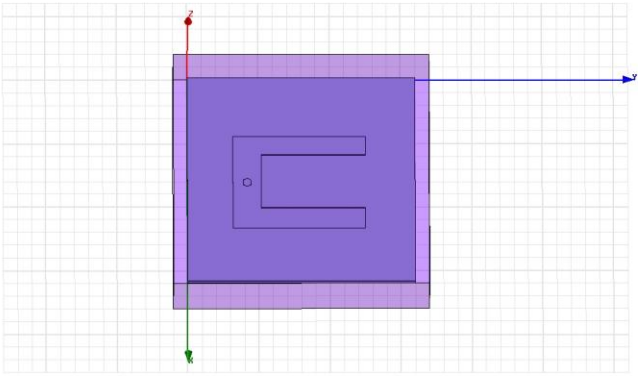

Figure 2

III. PARAMETRIC STUDY

In the parametric study, we will discuss about the optimization of different parameters of the proposed antenna. In this paper we will optimize the size and return loss of the proposed U-shaped microstrip antenna and observe the various optimized

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parameters of designed antenna. The diameter and the length of the probe also play an important role to optimize the performance parameters of antenna.

IV. SIMULATED RESULTS

1. In this paper we will use the HFSS software version 11.1 for the simulation and analysis of the proposed

antenna. In this analysis we would optimize parameters such as return loss, vswr, gain etc.

1.1 If we select the size of the substrate equal to the size of the U-shaped patch as shown in fig.3, then we achieve two resonances having return loss of -27.20db and -31.90db at 7.1GHz & 9.1GHz respectively as shown in fig.4.

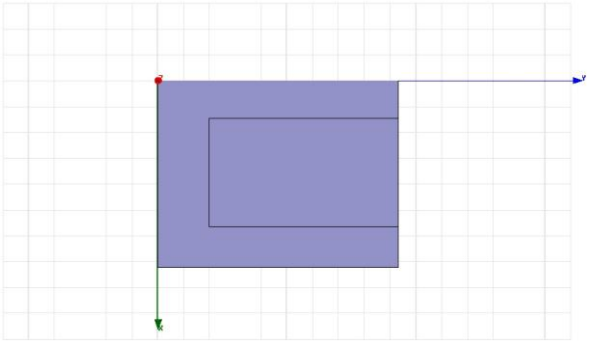

Figure 3

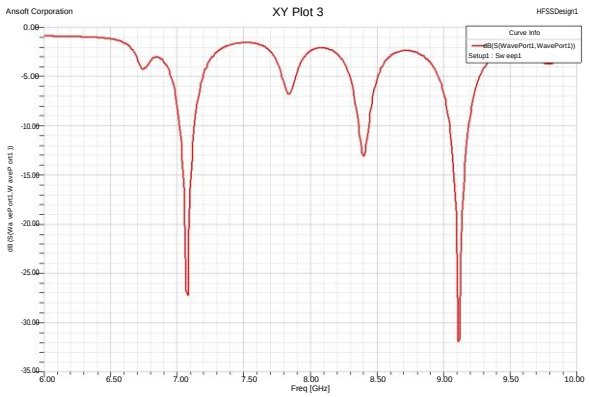

Figure 4

1.2 Now we increase the size of the substrate to 50mm×50mm and dielectric constant also, then we get number of resonances as shown in fig.6.

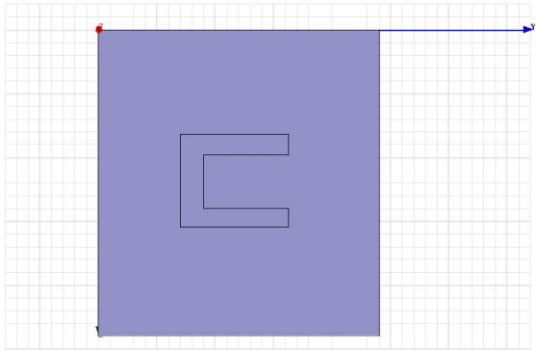

Figure 5

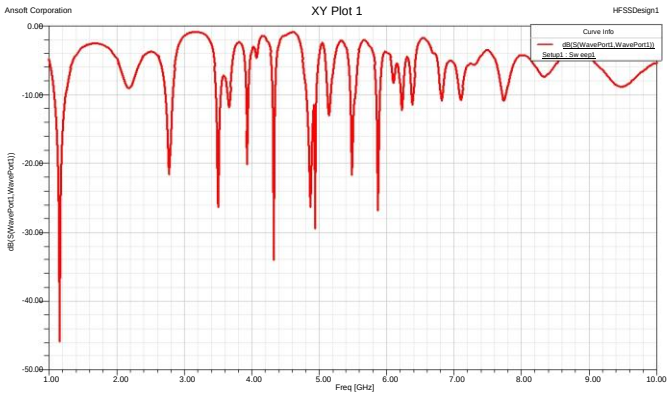

Figure 6

1.3 If we reduce the size of the substrate up to 60% of the earlier structure then

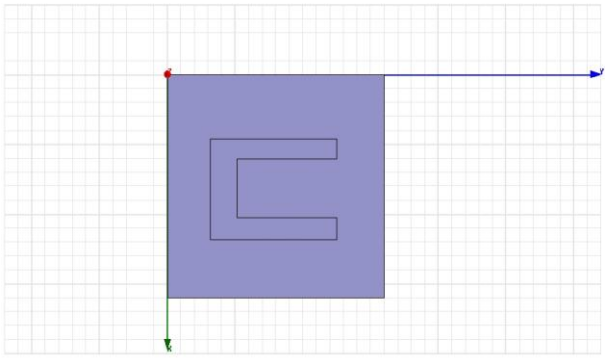

Figure 7

we find the four resonances of -50.40db, -42db, - 27.92db and –21.83db at 4.36 GHz, 5.21GHz, 5.98GHz and 5.55GHz respectively as shown in fig.8.

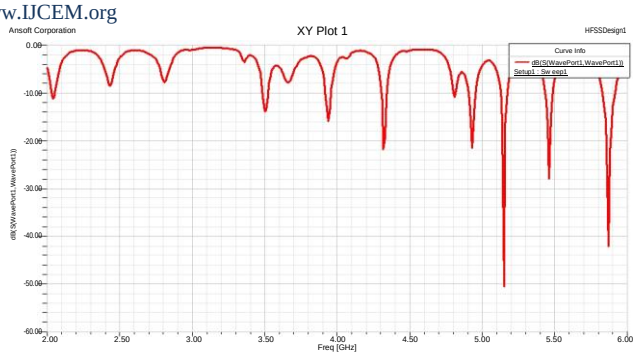

Figure 8

Minimum value of VSWR of the designed antenna is 1.029 as shown in fig.10.

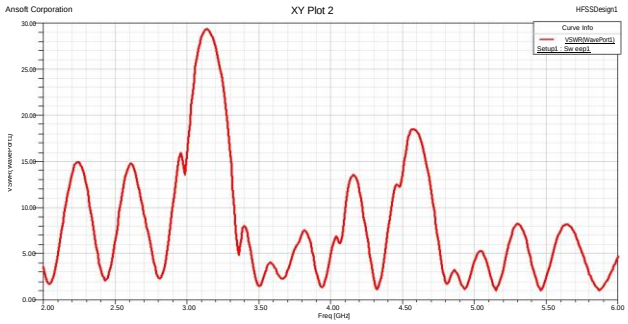

Figure 9

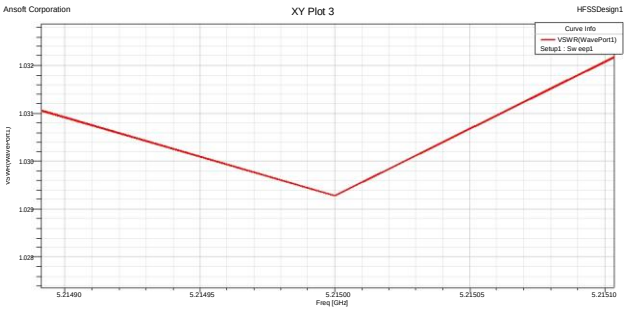

Figure 10

2. The maximum achieved gain of the U-Shaped microstrip antenna is 7 as shown in fig. 11.

3. A 3D view of radiation pattern of newly designed antenna is shown in fig.12. As we see in the figure.12, all power of proposed antenna is radiated in upward direction.

4.

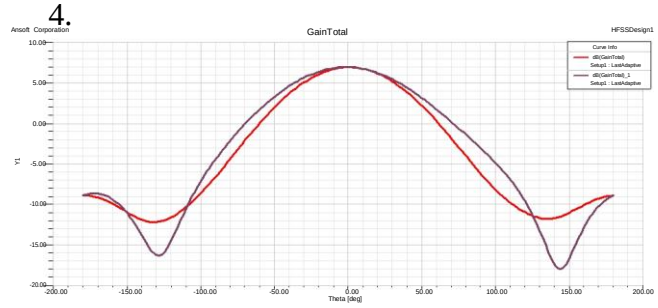

Figure 11

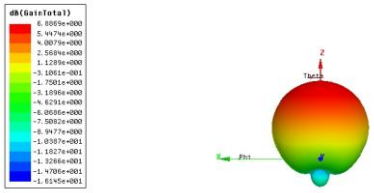

Figure 12

V. CONCLUSIONS

In this paper we have designed a square U-shaped microstrip antenna and varied the size and dielectric constant of substrate. We observed the effects of these variations on various parameters. We have achieved multiple resonances of -50.40db, -42db, -27.92db and –21.83db at 5.21GHz, 5.98GHz, 5.55GHz and 4.36GHz frequencies respectively. The maximum achieved gain of the designed antenna is 7. The VSWR of this proposed U-shaped antenna is 1.029 at 5.215GHz frequency. This antenna finds applications in wireless communication.

VI. REFERENCES

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