Design of Compact Rectangular Slot Micro strip Antenna for Mobile Communication

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***Abstract*-This paper presents novel coaxial feed compact rectangular slot microstrip antenna for linear polarization. A narrow C shaped microstrip antenna is fed at the corner using a coaxial feed to obtain a LP operation. The compactness of the antenna is easily obtained by inserting a slot. Wide LP radiation is achieved simply by making the C-shaped slot symmetrical. The simple rectangular and compact C shaped microstrip antenna is simulated with IE3D and MATLAB and their corresponding result is compared.**

Keywords-Rectangular, C shaped microstrip antenna.

I. INTRODUCTION

Microstrip patch antennas (MPAs) have attracted widespread interest due to their small size, light weight, low profile and low cost as well as to the fact that they are simple to manufacture, suited to planar and non planar surfaces, mechanically robust, easily integrated with circuits, allow multifrequency operation to be achieved [1] Linearly polarized microstrip antennas (LPMAs) are widely used in many wireless communication applications. The classification of the LPMAs is based upon the single-feed or dual-feed types. Single-feed wideband LPMAs are currently receiving much attention. Recently in [2], another design was proposed. In this design, LP operation was accomplished by using the U-slot of unequal lengths for a square microstrip antenna using a coaxial feed. The symmetrical U-slot cut microstrip antenna structure can generate two orthogonal modes for LP radiation; therefore no extra stubs, notches or chamfering at corners of the rectangular patch are necessary. The patch radiator was fabricated from the copper sheet and mounted on a duroid substrate. However, the patch radiator on the duroid substrate is mechanically unstable. Moreover, the coaxial feed in this antenna makes it unsuitable for a low-cost antenna array design. A LPMA with combining slots and patch has been proposed for dual-band operation [3]. They had used a power divider to excite the four slots for LP operation. In this paper, we propose a new compact, coaxial feed, linear polarized, C-shaped microstrip antenna. The antenna consists of a C-shaped patch radiator and a coaxial feeding structure. By cutting a slot in the patch radiator, the excited surface current of the fundamental TM_{10} mode on the patch is significantly lengthened to make the fundamental resonance frequency lower. The C-shaped dimensions are optimized to radiate wide linearly polarized waves. The results are compared with the results obtained by EM simulator software, IE3D.

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II. ANALYSIS OF PROPOSED ANTENNA

In the first step we had analyzed the rectangular microstrip patch antenna by most popular method transmission line model and then analysed proposed antenna as same model "equation.1-11". The side view of rectangular antenna geometry is shown in "Fig.1", the patch is feed by coaxial probe. The feed position is calculated by using by modal expansion cavity model theory [4] for a 50Ω co-axial cable. The shaped has been cut along the patch width in such a way that it lies at a symmetrical distance from both length edges of the path. According to the cavity modal theory [5], a normal microstrip patch antenna can be modeled as parallel RLC circuit. The current flows from the feeding point to the top and bottom edges of the patch. Values of L and C are determined by the currents path length: The patch width, effective dielectric constant, the length extension and also patch length are given by

$$W = \frac{c}{2f\sqrt{\varepsilon_r}} \tag{1}$$

where **c** is the velocity of light, ε_r is the dielectric constant of substrate, f is the antenna working frequency, W is the patch nonresonant width, and the effective dielectric constant is ε_{eff} given as,

$$\varepsilon_{eff} = \frac{(\varepsilon_r+1)}{2} + \frac{(\varepsilon_r+1)}{2}\left[1+10\frac{H}{W}\right]^{-\frac{1}{2}} \tag{2}$$

The extension length Δ is calculates as,

$$\frac{\Delta}{H} = \frac{(\varepsilon_{eff}+0.300)\left(\frac{W}{H}+0.262\right)}{(\varepsilon_{eff}-0.258)\left(\frac{W}{H}+0.813\right)} \tag{3}$$

By using above equation we can find the value of actual length of the patch as,

$$L = \frac{c}{2f\sqrt{\varepsilon_{eff}}} - 2\Delta \tag{4}$$

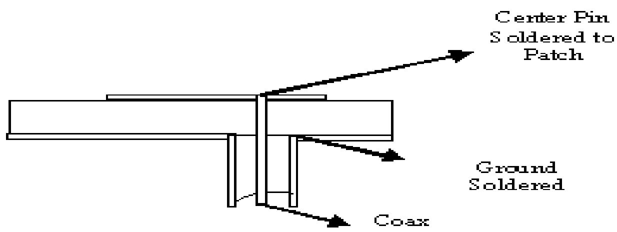

Figure 1. Side view of rectangular microstrip antenna

III. PROPOSED ANTENNA GEOMETRY AND DESIGN

The cross-section of the proposed coaxial feed, linearly polarized,C-shaped microstrip antenna with dielectric cover is shown in "Fig. 2". W is the width and L is the length and h is the thickness of rectangular microstrip patch antenna. The rectangular Microstrip patch with a C-shaped has a side length l_s and width w_s and thickness is s of the proposed antenna. The co-axial feed is located at the corner of the C-shaped rectangular microstrip antenna. A parametric analysis is conducted to optimize the proposed antenna for good LP operation. Now we have taken small value of substrate thickness is 1.6 mm then after calculation we got width and length of the patch are 62.02 and 48.40 at 1.5 GHz operating frequency of proposed antenna.

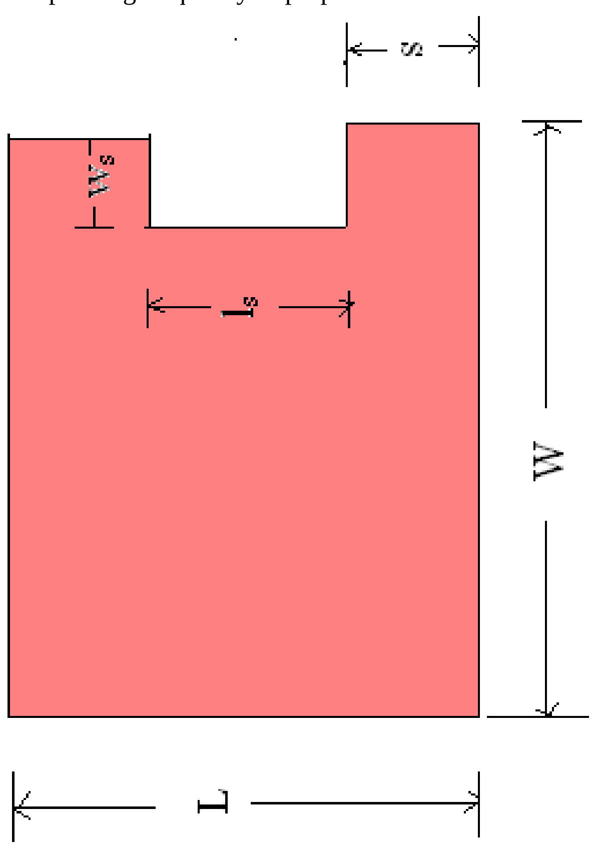

Figure 2. Geometry of c shaped rectangular microstrip antenna

IV. ANTENNA FABRICATION AND RESULTS

The C shaped microstrip patch antenna designed on EM simulator software IE3D and after simulation reflection coefficient S_{11} is obtained. It is mounted on a RT duroid substrate of dielectric constant 4.2. We have operating frequency at 1.5 GHz but after simulation resonance frequency shifted at 1.44GHz which is shown in "Fig.4,5&6".

Figure 3.. Geometry of c shaped of proposed antenna on IE3D

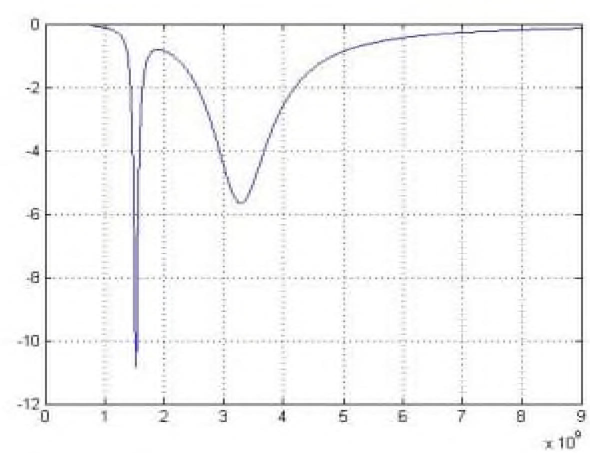

Figure 4. Return loss Vs frequency plot of c shaped on MATLAB.

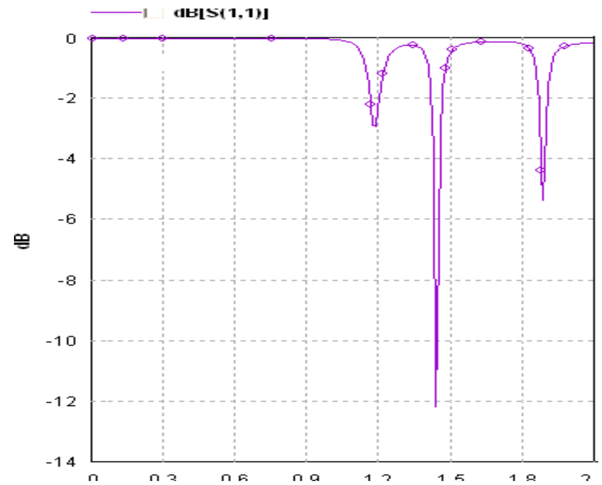

Figure 6. Return lossVs frequency plot of c-shaped on IE3D.

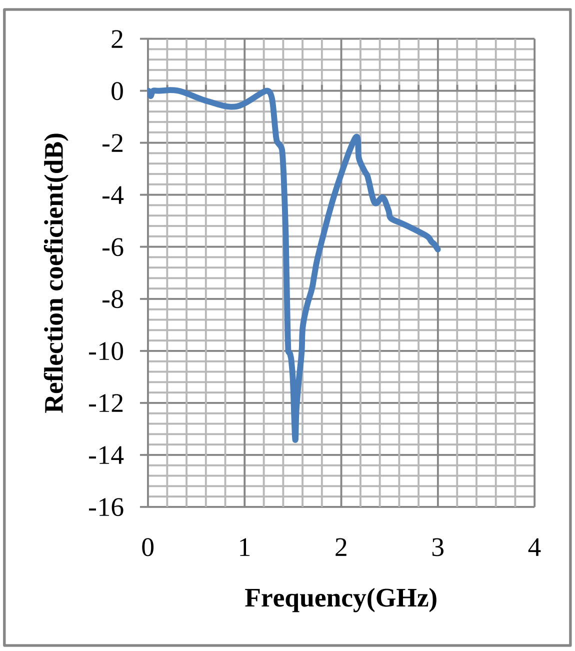

Figure 7. Experimental return loss Vs frequency plot of c-shaped

V. Conclusions

A compact, coaxial feed, linear polarized, compact rectangular microstrip antenna has been designed, and simulated using IE3d and matlab. After comparison the proposed antenna gives better results as compared normal rectangular microstrip antenna. The proposed shaped microstrip antenna is suitable for implementing it in mobile communication compact arrays, thus achieving even higher gain and good LP over a large bandwidth. The performances of antenna is investigated for the application in wireless local area network and mobile communication using IE3Dand matlab software and the computed results are verified by measurement. Results show that the antennas have moderate gain and may be used as small, compact antennas mobile communication.

VI. Refrences

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