Circularly Polarized Dual Frequency Square Microstrip Patch Antenna

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***Abstract*—A single feed, dual frequency corner cut Square Microstrip Patch Antenna (SMPA) with L-shaped slot is proposed. The antenna resonates at 2.45 GHz and 4.81 GHz with bandwidth of 103 MHz and 100 MHz respectively. The L-shaped slot is cut inside the radiating patch to achieve circular polarization at higher resonating mode. The electrical size of square microstrip patch antenna is 0.23λ × 0.23λ. The antenna is fabricated using FR4 substrate. The simulated and measured results are compared and presented in this paper.**

Keywords—slotting, circular polarization, higher order mode

I. INTRODUCTION

The demand of compact, multiband antennas in present wireless communication system is increasing day by day. Microstrip Patch Antennas (MPA) are found suitable to cater the requirement of today's wireless communication system. These antennas offer attractive features such as low profile, light weight, easy integration with RF circuitry etc. Single feed circularly polarized (CP) microstrip patch antennas gaining much attentions as they are immune to multipath propagation and fading effect. Various techniques to design dual band and circularly polarized microstrip patch antenna has been reported [1-5]. Dual band circular polarization has been realized by loading parasitic patch in rotation with respect to radiating patch [1], multi layered configuration of corner truncated patches [2], by inserting the slits at edges of patch [3] or by loading stubs to single feed nearly square MPAs [4]. Use of slotting techniques can make antenna compact and suitable for dual frequency operation. It has been observed that, by cutting slot at appropriate location inside the radiating patch, modifies the higher order resonating modes and realizes dual band response [6-7]. To design and fabricate compact, multiband single feed circularly polarized microstrip patch antennas is challenging task for antenna researchers. The objective of this research work, is to realize single feed dual frequency circularly polarized microstrip patch antenna. It has been observed that, by cutting the slot inside the radiating patch at proper location, it further modifies and reduces the higher order resonating frequency. The antenna is first designed and then simulated using Altair's CAD FEKO simulator, further the simulated antenna is fabricated and tested. The measured results show slight shift in resonating frequencies to lower side with simulated results. The paper is organized as follows. Section II explains the design of single feed dual frequency circularly polarized microstrip antenna, the results are discussed and presented in III and finally the paper is concluded in IV.

II. ANTENNA DESIGN

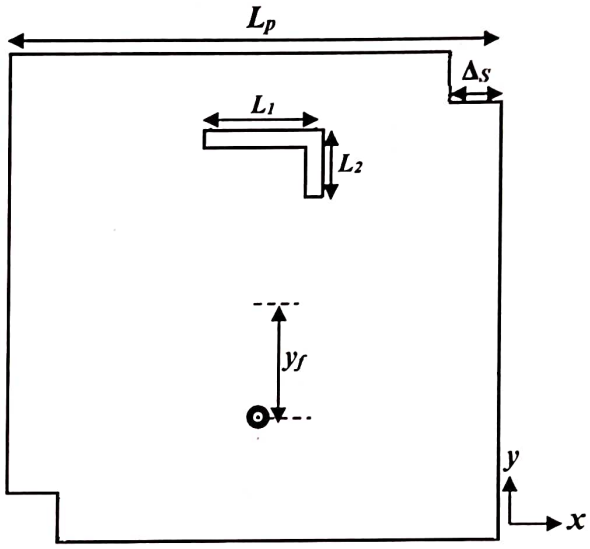

Fig. 1 Geometry of corner cut L-shaped slotted microstrip patch antenna

Fig.1 shows the geometry of diagonally corner cut and L-shaped slotted square microstrip patch antenna. At first, the side length L_p of square microstrip patch antenna is calculated for 2.45 GHz using (1) [8].

$$L_p = \frac{c}{2f_r\sqrt{\varepsilon_r}} - 2\Delta l \tag{1}$$

where, f_r is desired resonant frequency, Δl is extension in path length, c is velocity of light 3×10^8 m/s, ε_r is dielectric constant of substrate used. The Δl can be expressed and is given in (2), (3) [8].

$$\Delta l = 0.412h\frac{(\varepsilon_e + 0.3)(\frac{W}{h} + 0.264)}{(\varepsilon_e - 0.258)(\frac{W}{h} + 0.813)} \tag{2}$$

$$\varepsilon_e = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2\sqrt{1 + 12\frac{h}{W}}} \tag{3}$$

In (2) and (3), h is thickness of substrate, W is width of patch and ε_e is the effective dielectric constant of substrate. The calculated side length of the proposed square microstrip

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