

# Dual Band Circularly Polarized Square Microstrip Patch Antenna for WLAN and Wi-MAX

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**Abstract**— This paper presents a dual band single feed circularly polarized square microstrip patch antenna (SMPA) for WLAN (2.4 – 2.48 GHz) and WiMAX (5.25 - 5.85 GHz) wireless communication applications. A square and L-shaped slot is etched inside the radiating patch to achieve dual-band and circular polarization respectively. The electrical size of proposed microstrip patch antenna is  $0.22\lambda \times 0.22\lambda$ . The antenna is fabricated using FR4 substrate with size of  $40 \times 40 \text{ mm}^2$ . The antenna resonates at 2.45 GHz and 5.5 GHz with bandwidth of 66 MHz and 121 MHz respectively. The proposed antenna has been fabricated, tested and measured results are presented in this paper.

**Keywords**- Circular Polarization; slotting; WLAN; WiMAX

## I. INTRODUCTION

The development of RF and mobile handheld communication system and devices is growing day by day. This communication system needs compact, multi-band antennas with broad bandwidth and high gain. Circularly polarized antenna has been intensively preferred in such types of communication systems as they are immune to multipath propagation effects caused by surrounding walls, structures and ground. Microstrip patch antennas can be a suitable candidate for wireless communication systems due to their low profile, low weight, polarization agile and easy to fabricate [1-3]. The objective of this paper is to design, fabricate and test dual band circularly polarized microstrip patch antenna using simple slotting technique.

## II. ANTENNA DESIGN

Figure 1 and 2 shows the geometrical structure and fabricated prototype of square and 'L' shaped slotted square microstrip patch antenna. Initially, square microstrip patch antenna of length  $L_p$  is designed to resonate at frequency of 2.45 GHz using transmission line model [1-2]. This antenna resonates at fundamental mode of  $TM_{10}$ . A square shaped slot is etched diagonally to achieve dual-band operation. The dimensions of slot have been taken as  $7 \text{ mm} \times 7 \text{ mm}$ . By etching the square shaped slot, the antenna resonates at 5.5 GHz,  $TM_{20}$  mode. Thus, dual band operation has been achieved. However, to make antenna circularly polarized the 'L' shaped slot is again etched downside of square slot of

length  $L_2$  and  $L_3$  equals to 3 mm respectively with width of 0.5 mm each. The proposed antenna has been designed using FR4 substrate with thickness  $h = 1.6 \text{ mm}$  and dielectric constant ( $\epsilon_r$ ) = 4.4. The antenna is co-axially fed at location  $x = 7 \text{ mm}$ . MoM based CAD Feko EM simulator is used to simulate this antenna.

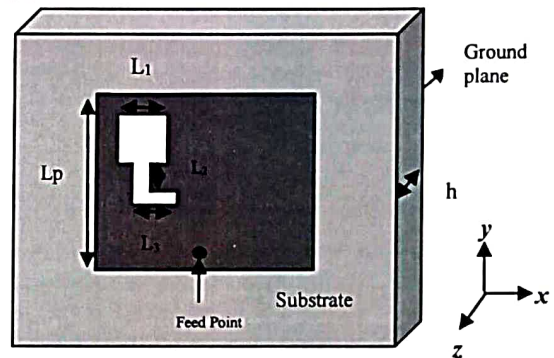


Fig. 1. Geometrical structure of Square and 'L' shaped slotted square microstrip patch antenna



Fig.2 Photographs of fabricated dual band microstrip patch antenna

## III. RESULTS AND DISCUSSION

Figure 3 depicts simulated reflection coefficient ( $S_{11}$ ) of proposed antenna with L slot position compared at center, right and left. The antenna resonates at 2.45 GHz and 5.57 GHz dual band operation with impedance bandwidth of 66 MHz and 121 MHz respectively.

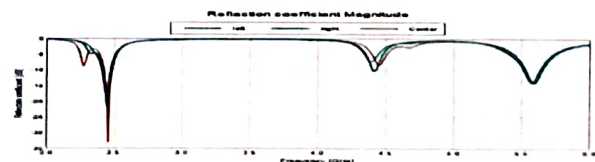


Fig. 3. Simulated return loss ( $S_{11}$ ) characteristics