

ISSN: 1553-0396
Place of Publication: USA

Date
ISSN
Impact Factor.



CPW Fed Dual Band Dual Sense Circularly Polarized Asymmetrical Y- Shaped Microstrip Patch Antenna for Wireless Applications

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Abstract- This paper presents, coplanar waveguide (CPW) fed novel dual asymmetrical Y- shaped microstrip patch antenna with wide impedance bandwidth for wireless communication applications. The antenna offers wide impedance bandwidth of ($S_{11} < -10$ dB) 2.88 GHz with dual band dual sense circularly polarized response at 3.5 GHz and 4.9 GHz. The simulated 3 dB axial ratio bandwidth of dual band antenna is 4.57% and 4.27% for 3.5 GHz and 4.9 GHz respectively. The proposed antenna radiates in left hand circular polarization for lower frequency (3.5 GHz) and right hand circular polarization for higher frequency (4.9 GHz) with peak gain of 1.47 dBi and 1.33 dBi respectively. The antenna is fabricated using FR4 substrate having size of 30 mm × 30 mm. The parametric analysis of the design parameters has been carried out to optimize the performance of antenna. The fabricated prototype is tested and measured impedance bandwidth is around 60%. The measured and simulated results are found in close agreement with each other. The novelty of this research work is the transmission line equivalent circuit of proposed CPW fed antenna structure is presented and discussed.

Index Terms- Broadband, circularly polarized, dual sense, Y-shaped.

I. INTRODUCTION

In the last couple of years, circularly polarized (CP) planar microstrip antennas have grabbed vantage attention. In modern dynamic wireless communication technology, low cost, compact antennas with broad bandwidth is desired. Microstrip patch antennas (MPAs) with advantages of low profile, planar structure, ease of fabrication and comfortableness in polarization design are found suitable for wireless applications. CP MPAs are gaining popularity as they are resistant to multi-path fading effect and orientation of antennas [1]. Planar MPAs are found good candidate for modern wireless

communications as they can radiate in both directions. Recently, many investigations have been carried out to design dual band and dual band-dual sense CP MPAs with wide impedance and axial ratio bandwidth [2-13].

An array of hexagonal patch antennas along with annular feed network has been presented to realized dual sense CP [2]. In recent, authors have reported dual band CP printed monopole with L-shaped slot in ground and parasitically coupled diagonally square slot cut square shaped microstrip patch antenna for WLAN and vehicular communication applications [3]. An offset fed wideband inverted L -shaped strip loaded square slot antenna has been reported in [4]. To realize dual band dual sense CP, CPW fed square slot antenna with two parasitic patches [5], a semicircular patch with circular curved slot [6], swastika shaped aperture coupled dielectric resonator antenna [7], asymmetric square shaped ring along with dielectric resonator antenna [9], CPW fed monopole with two parasitically coupled rectangular radiators and I-shaped stub loaded antenna [10], asymmetrical square slot loaded L-shaped [11], U-shaped slot and stub loaded modified ground antenna are reported [13] in literature.

In the proposed research work, a new coplanar waveguide (CPW) fed dual asymmetric Y- shaped microstrip patch antenna for dual band dual sense CP operation with wide impedance bandwidth of 2.8 GHz (3- 5.8 GHz) covering WLAN and Wi-MAX wireless applications is proposed. The antenna consists of dual asymmetric Y- shaped patches to realized dual band dual sense CP. By proper tuning of length of ground plane, broad impedance bandwidth has been realized. The antenna has been fabricated using economical FR4 substrate having thickness $h = 1.6$ mm, $\epsilon_r = 4.3$, and $\tan \delta = 0.02$ with overall size of 30 × 30 mm². The