Broad band Cup Shaped Microstrip Patch Antenna for Modern Wireless Communication System

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***Abstract*—This article parades the novel design of microstrip feed modified microstrip patch antenna with eclectic slot. The overall size of this mono pole element is 40×40×1.59 mm^3. The simulator, which is used for optimization, is Computer Simulation Technology Microwave studio 2014. Projected antenna renders broadband extended between frequency range of 2.57- 6.57 GHz, with even gain (adjacent to 3-4 dBi) in the wanted frequency range. Planned microstrip patch antenna may be very valuable device for Wireless local area network and worldwide interoperability for microwave access.**

Keywords-Axial ratio; CST studio; defected ground; parasitic element.

1. INTRODUCTION

In recent radio communication system, Compact size and Broadband antennas play a decisive part [1-2]. Institute of Electrical and Electronics Engineers allocated 802.11 & 802.16 standards in 2.4/5.2/5.8 GHz for Wireless Local Area Network communication bands and 2.5/3.5/5.5-GHz for worldwide interoperability for microwave access band correspondingly. The above bands have extensive implementation in modern phones, hand grip CPUs and numerous radio transportable devices. Conniving of wideband antennas used for casing all these bands with features of small shape, compressed shape, omni-directional design is stimulating task for investigators in modern wireless communication system [3-5]. These antennas have the leverage of extensive bandwidth, calm impedance matching, and decent radiation efficiency. There are several conveyed antenna layouts for radio communication systems, but the utmost is narrow band or dual-bands structure [6]. Abdulkawi et al. reported a low-cost mono and dual patch antennas with four slots. The antenna is made to have low cost and reduced size for Wi-Max and WLAN application including IoT [7]. Ramasamy et al. reported a bloom-shaped patch antenna using FR4 substrate which gave at multiband frequencies between 1.6 GHz and 2.45 GHz [8].

In this communication, a modified cup shaped patch structure with wide slot monopole structure is discussed. This antenna is simulated in free space and its performance is reported in this paper.

2. ANTENNA LAYOUT AND OUTCOME ANALYSIS

The front and back views of planned planar antenna with geometrical details are presented in Figure 1. FR4 substrate with loss tangent 0.025, thickness 1.59mm and relative permittivity (ε_r) = 4.4 is utilized for the proposed design. The overall dimension of proposed structure is 40×40×1.59 mm^3. These dimensions were selected so that proposed antenna may resonate in the desired frequency band allocated for the WLAN/Wi-MAX communication system. For feeding this design, width W1= 1.9 mm is utilized. The augmented parameters of the reported structure are depicted in table 1 & 2. This proposed antenna is simulated by using CST studio suite 2014.

Table.1: Improvedsizes of Reported Patch Structure

Measurement of projected antenna design	Value (in mm)
Main axis of modified elliptical patch (A)	26
Side axis of modified elliptical patch (B)	12
Length of side slot cut in modified elliptical patch (b)	0.5
Width of side slot cut in modified elliptical patch (a)	6.9
Width of feed line (W1)	1.9
Length of feed line (L1)	11

Table.2:Optimized Dimensions of Ground for Antenna

Measurement of projected antenna design	Value (in mm)
Length of the Substrate/Ground (L)	40.0
Width of the Substrate/Ground (W)	40.0

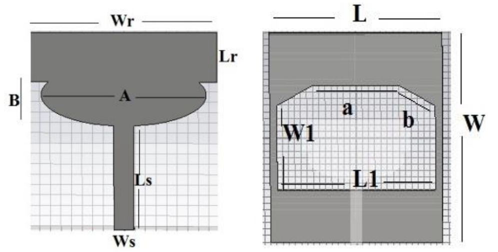

Figure 1. Forward-facing and posterior view of reported structure

The deviation of simulated reflection coefficient (S_{11}) values with frequency attained for modified ellipse designed patch antenna with defected ground plane is depicted in Figure 2. The simulation outcomes demonstration that the reported antenna resonates competently at trio diverse frequencies namely 3.02GHz, 4.82GHz and 5.85GHz. The simulated impedance bandwidth in the desired frequency range is around 87.5% (2.57GHz-6.57GHz) with respect to the central frequency.

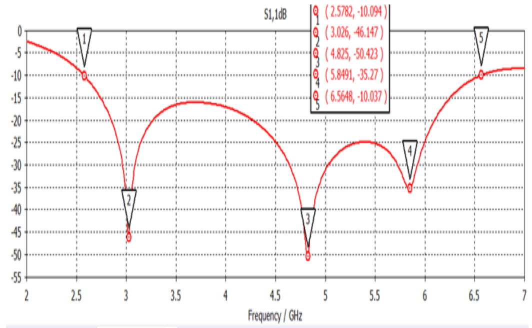

Figure 2. Variations of reflection coefficient with frequency

The variation of VSWR at dissimilar frequencies is depicted in Figure 3. It is detected that VSWR values between the bandwidth range remains less than threshold value i.e. 2.

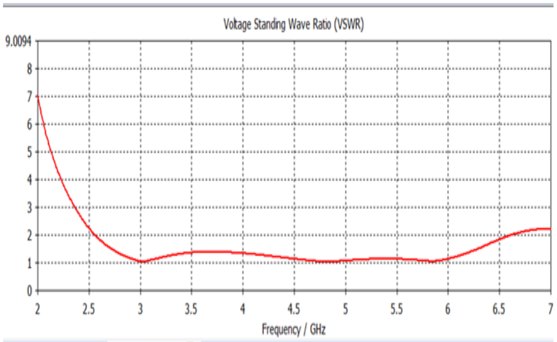

Figure 3 VSWR with frequency

The replicated gain values of the reported patch antenna with frequency are shown in figure 4. It has been observed that gain of antenna remains constant (nearly 3.5 dBi) in the entire bandwidth range i.e. 2.57GHz-6.57GHz.

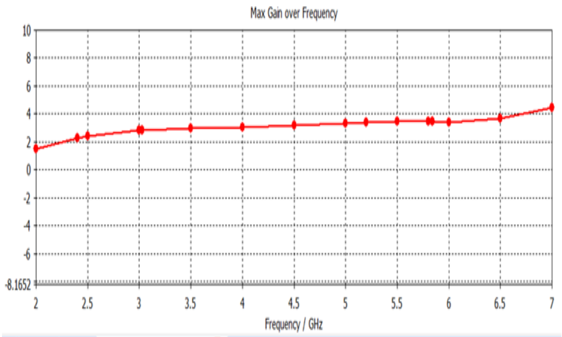

Figure 4. Variations of Antenna gain with frequency

The deuce dimensional determined H-and E-plane radiation patterns of reported antenna attained at trio resonance frequencies 2.44 GHz, 3.87 GHz and 5.90 GHz are revealed in Figure 5. The reported pattern of E-plane at these trio frequencies are nearly omni-directional and look like with the radiation pattern of a monopole antenna.

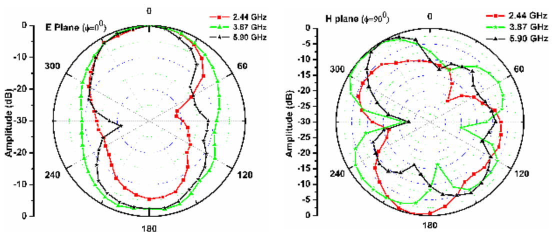

Figure 5. Simulated radiation patterns at different frequencies

3. CONCLUSIONS

Reported article parades the novel design of microstrip feed modified microstrip patch antenna with eclectic slot. By modifying conventional elliptical patch antenna with wide slot monopole antenna, we achieved three resonance frequencies 3.02GHz, 4.82GHz and 5.85GHzwith very much improved impedance bandwidth around 87.5% in the frequency range 2.57GHz-6.57GHz. This reported antenna is useful in current wideband radio communication and covers different frequency bands allocated for the WLAN/Wi-MAX communication system such as Wi-MAX (3.4-3.6 3.7-4.2 GHz) Local Area Network (5.47-5.725 GHz) Wireless Fidelity band 802.11y (3.6-3.7GHz) and Wireless Local Area Network communication 802.11b/g/a (5.31-6.32 GHz). The Gain of antenna is nearly 3.5 dBi in the entire bandwidth range which is reasonable high. Antenna size is also very compact due to modification in patch and ground plane. These features make the reported antenna very much appropriate for current radio communication systems.

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