ULTRA WIDE BAND CPW FED ANTENNA FOR WIRELESS APPLICATION

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Abstract: An ultra wide band CPW fed antenna for wireless communication proposes a very promising solution. These antennas consist of a polygon microstrip antenna. We studied the performance of a patch antenna made on FR4 epoxy substrate. The antenna size is 26×22×0.5mm^2. The CPW fed antenna is used for wireless application. Performance parameters such as total active reflection coefficient, S-parameter, total gain, and radiation pattern have been measured. The proposed antenna is reduced in size. In other hand, monopole like radiation pattern with acceptable gains make it a good candidate as an internal antenna for wireless application. This antenna covers three bands (c-band, s-band, x-band). All simulations are done by using HFSS ver.13 software.

***Index Terms* - CPW fed antenna, Ultra wide band, Radiation pattern,**

I. INTRODUCTION

PRESENTLY with the increase in demands for communication systems, small antenna's research with different radiating elements, polarizations and various feeding designs has attracted immense attentions. Circularly polarized antennas is earning favored due to its various supremacy of good mobility and weather penetration in communication system as compared to linearly polarized antennas. In present days, many of researches because of broad bandwidth and low profile designed wide slot circularly polarized antenna and circularly polarized wide slot wide slot antenna can also integrated with MMIC i.e. microwave monolithic integrated circuits. Circularly polarized antennas operates on the principle of exciting two modes has equal amplitudes and orthogonal to each other. Various techniques for exciting circular polarization mode have been executed and mostly based on modification of the ground plane and antenna resonator [1], [6]. With the help of slot structures [7-10] and through array configurations [11], [12]. CPW antenna can also be obtained through compact monopole antenna [13].

Although these designs of antenna are very complicated that they induce difficulties in designs and fabrications of antenna. In the present paper, an elementary and compact wideband CPW microstrip antenna has been proposed. Proposed antenna has a microstrip feed-line, rectangular slot at the ground and circle-shape protruding stub from the ground plane towards the center of the slot. This proposed antenna has 133.74% (2.42-12.30GHz) wide impedance bandwidth for S- band (airport surveillance radar for air traffic control, weather radar, surface ship radar, and some communications satellites), C-band (satellite communication, weather radar systems, WiFi and ISM Band applications) and X-band (radar applications including continuous-wave, pulsed, single-polarization, dual-polarization, synthetic aperture radar, and phased arrays) in wireless communication.

II. ANTENNA DESIGN

A. Antenna model and Configuration

Configuration of the CPW wide slot antenna of size 26mm X 22 mm has been depicted in fig.1.

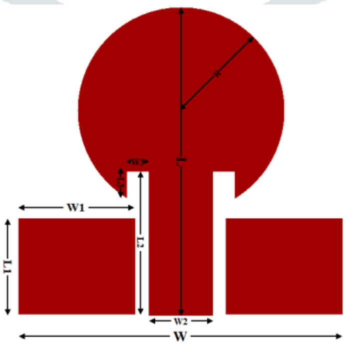

Fig.1 Geometry of Proposed Antenna

The presented antenna has ground (GND) plane at lower side of substrate, wide square slot i.e. WSS at the GND plane, O-shape protruded stub from the ground plane is printed towards the center of the slot. Presented antenna is fed by 50Ω offset microstrip feedline above the FR4 dielectric. FR4 dielectric is used with ε_r =4.4, and height hsub=0.5mm. Width of the microstrip feedline is about 3mm. To create CPW, microstrip feedline is positioned at the right fringe of antenna underneath the extended stub. Parameter of the presented antenna is depicted in Table 1.

TABLE 1 PARAMETER OF PROPOSED ANTENNA

Different Parameters	Specification (in mm)	Different Parameters	Specification (in mm)
L	26	W	22
L1	-9	W1	9.2
L2	-9.3	W2	3
L3	2	W3	0.8
R	4	hsub	0.5

B. Progression of proposed design

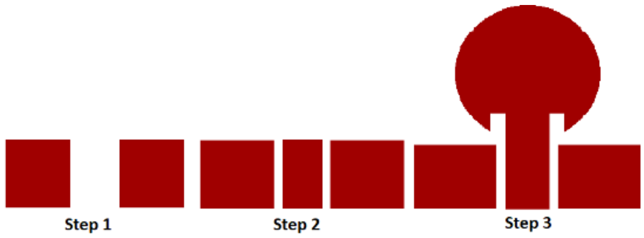

Fig.2 Evolution of Proposed antenna

Progression of the proposed antenna is shown in fig.2. Step 1 has two rectangular slot at the ground of length (L_1), width (W_1) and microstrip feed-line with length L_2 & width W_2 at the center generates primary resonance close to central frequency. Step 1 shows completely linear polarization (LP). In step 2 in range 5.94GHz-8.56GHz microstrip feedline is shifted towards the centre edges of the antenna with an offset distance. In step 3 in range 2.42GHz-12.30GHz there is circle-shape protruded stub to improve the bandwidth and axial ratio of the antenna.
Reflection coefficient of the Antenna's 1-3(Step1-3) is depicted in Fig.3 respectively. Description of the outcomes of Antennas 1-3 will be in III section.

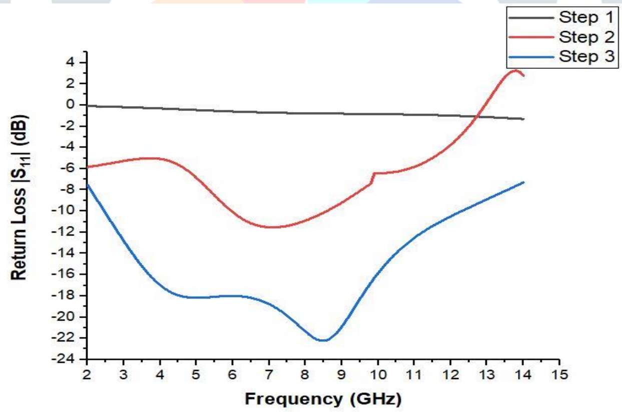

Fig.3 Reflection Coefficient of Step 1, Step 2, Step 3 of proposed antenna

III. RESULTS AND DISCUSSIONS

CPW wide slot antenna has been designed on the basis of measurements given in TABLE 1 and with the facilitate of ANSYS HFSS version 13 presented antennas have been simulated. Progress-performance of presented antennas have been clarified from Fig.3 which shows the comparison of impedance bandwidth of Antennas 1 – 3 (Step1-3) respectively. Two orthogonal E vectors $E_{Horizontal}$ i.e E_{Hor} (Horizontal planes complex voltage), and $E_{vertical}$ i.e Ever (Vertical planes complex voltage) of similar amplitude with 90˚phase difference, CPW is effectuated. When the microstrip feed-line is shifted with the same dimensions rectangular gap just below the feed-line towards the centre edge of the antenna shown as Antenna 2 (Step2) then CPW band is obtained from (5.94– 8.56GHz). Circle-shape protruded stub at the ground plane depicted in Antenna 3(Step 3) improves the impedance bandwidth.

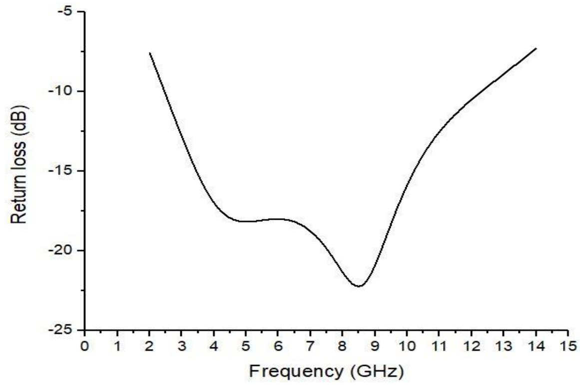

Fig.4 Return loss of Proposed antenna.

Yet, the antenna is scarcely circularly polarized and still has not wide band CP characteristics. In order to improve impedance bandwidth a rectangular stub is loaded at microstrip feedline, obtained impedance bandwidth is about 133.74% (2.42-12.30GHz). Simulated reflection coefficient of CPW wide slot microstrip fed antenna is shown in Fig.4 and respectively. Surface current distribution of presented compact CPW wideband antenna is shown in Fig.6 at 8.5 GHz and it can be clearly seen that resonance at 8.5 GHz is generated due to density of current near the protruded stub and resonance is created due to presence of large amount of current at the feedline.

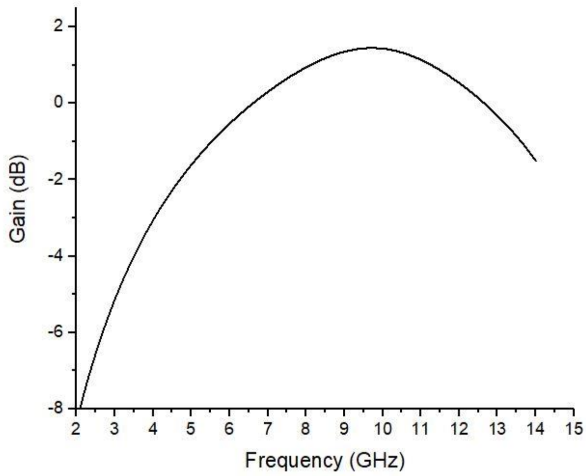

Fig.5 Simulated gain of proposed antenna

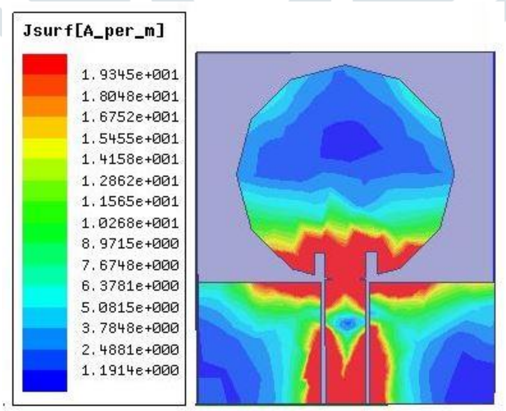

Fig.6 Simulated surface current distribution of proposed antenna at 8.5 GHz

Obtained simulated peak gain of antenna is about 3.44dB at 9.7GHz shown in Fig.5. Radiation pattern of presented compact CPW wideband antenna is shown in fig.7 and it can be clearly seen that H-plane and E-plane of antenna are mirror image of each other at 8.5GHz. Hence, presented CPW wide slot microstrip fed antenna is circularly polarized.

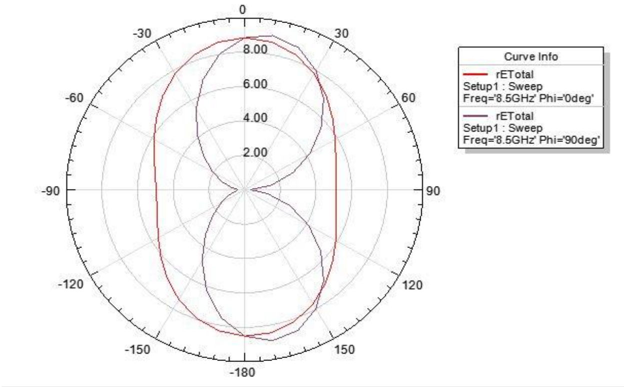

Fig.7 Simulated radiation pattern of proposed antenna at 8.5GHz frequency in H-Plane at phi=90 deg. And E-Plane at phi =0 deg.

IV. CONCLUSION

This work presented a Ultra Wide Band CPW Fed Antenna for Wireless Application. The proposed antenna is easily accomplished like other wide slit antenna. Simulated results shows accomplished impedance bandwidth of presented antenna is 133.74% (2.42-12.30GHz) obtained. Proposed CPW wide slot microstrip fed antenna may be used for S- band (airport surveillance radar for air traffic control, weather radar, surface ship radar, and some communications satellites), C-band (satellite communication, weather radar systems, WiFi and ISM Band applications) and X-band (radar applications including continuous-wave, pulsed, single-polarization, dual-polarization, synthetic aperture radar, and phased arrays) in wireless communication.

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