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# Design of Ultra Wideband Antenna

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***Abstract*: *In this paper, A coplanar waveguide (CPW) ultra-wideband(UWB) antenna is designed, analyzed and simulated by computer simulation technology(CST). The proposed antenna is fabricated on FR-4 dielectric substrate. A microstrip feed line is used to excite the antenna.The ground plane is slotted to improve the impedance bandwidth (BW). Here, a rectangular patch is used as radiator and two corners out of four are truncated to improve impedance matching and UWB characterization.This antenna satisfies UWB characteristics like VSWR<2, Return loss(S11)<-10 dB,Gain<5dB and the antenna is operating within the frequency range of 1.59 to 11.87 GHz range which covers whole ultra wideband i.e. 3.1 to 10.6 GHz range.***

***Keywords* : *CPW; ultra wideband ; microstrip feed line; impedance bandwidth; rectangular patch.***

## I. INTRODUCTION

The term "UWB" was traditionally been joined the terms like non-sinusoidal, baseband, super wideband, mono-pulse, short-pulse, fast frequency chirp and large relative bandwidth radio etc. [1]. In recent history, UWB was altered drastically. Ultra-wideband has been used, in the last 20 years, for military, sensing and Radar applications. In Feb. 2002, the Federal Communications Commission (FCC) has been declared that the usage of unlicensed band of UWB for indoor and short-range radio communications. The greatest advantages of UWB are high data rates (From 100 Mbps to many Gbps), low power, larger bandwidth (7.5 GHz), small size and low cost[2]. The fundamental feature of this ultra-wideband is that it occupies larger BW i.e. 3.1-10.6 GHz compared to conventional radios, because of using the impulse signals. Such UWB systems have unique design challenges for antennas. Antennas are the main integral components in any wireless communications. Recently, UWB technology has been attracted by many researchers and engineers because of wider bandwidth, higher speed data rate, low power consumption and avoidance of multi-path interference[12]. The main challenge in UWB system is to design a suitable antenna to operate over entire BW that is 3.1 to 10.6 GHz. The design procedure of microstrip patch antenna is easy but has less bandwidth[13]. To improve the performance of BW of antenna, there are some techniques available[14]. These techniques for enhancing the bandwidth are using partial ground plane, cutting slits at the radiating edges, etching slots in patch, miniaturization of antenna size and increasing the substrate height (h) etc.

A. Kr Gautam, et al., proposed a novel antenna which is fed by coplanar waveguide to increase the bandwidth and impedance matching properties by adding inverted shape of L-strip on the radiating patch and used a different slotted ground plane [3]. A.K. Gautam, et al. also tried to enhance the bandwidth and to produce multiple resonances, the antenna size is reduced and the ground plane is slotted [4]. In paper [5] by Nasser Ojaroundi has presented a new antenna design having partial ground in which two rotated slots which are in L-shaped are cut to enhance the matching characteristics and BW. In [6], S. Kumar Mishra, et al. proposed a fork shaped antenna which has a rectangular plane of ground for Bluetooth and UWB characteristics.

Anjaneyulu katuru and A.Sudhakar are trying to improve the matching characteristics and to enhance the -10 dB bandwidth, which consists of UWB frequency range, by using a matching transformer placed between the microstrip feed line and octagonal patch and a ground structure which is defected is used in the rare side of the patch [7]. In [8], Anjaneyulu Katuru and Sudhakar alapati is presenting a new design which provides UWB characteristics by modifying the circular patch with a defected ground structure. A compact CPW fed single layer rectangular microstrip patch antenna has a shape of half elliptical slot and two identical stubs on either ends of the ground are enlarged to obtain ultra wideband and impedance matching properties [9]. In this article, a rectangular slotted ground patch antenna is designed and two corners of the patch are truncated[10] to improve the antenna efficiency[15].

## II. ANTENNA STRUCTURE

The proposed antenna has the following structural parameters with dimensions .L=Length of the substrate=50 mm, W=Width of the substrate=50 mm h=Height of the substrate=1.6 mm,lp=Length of the patch=9.4 mm, wp=Width of the patch=13.9 mm, tp=Thickness of the patch=0.1 mm,lf=Length of the feed=4.5 mm, wf=Width of the feed=1.9 mm, lg=length of t5he ground=50 mm, wg=width of the ground=50 mm, ls=Slot length=27.1 mm, ws=slot width=40.1 mm, d=vertical corner value=3.5 mm, p=horizontal corner dimension=3.1 mm.

## III. ANTENNA SIMULATION RESULTS

The basic antenna structure is shown in fig. 1 and the proposed antenna is depicted in fig. 3.

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The corresponding simulated results such as return loss, voltage standing wave ratio and radiation patterns are shown in figures 2&4 of basic and proposed antennas[11].

From these results the basic antenna has return loss (S11)=-23.5 dB, VSWR=1.14, gain(G)=4.52 dBi and -10 db BW=4.89 GHz (1.59-5.48 GHz).The basic structure did not satisfy the UWB characteristics in the bandwidth point of view. The simulated results of the proposed antenna are S11=-44.19 dB, VSWR=1.01, Gain=4.57 dBi and -10 dB bandwidth=10.28 GHz(1.59-11.87 GHz).

This antenna covered the entire UWB range and satisfied the ultra-wideband characteristics[16].

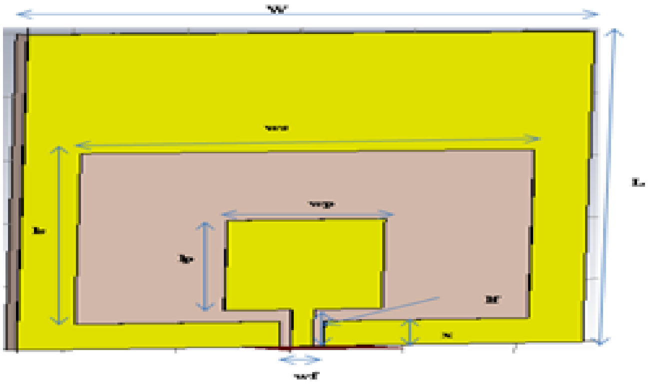
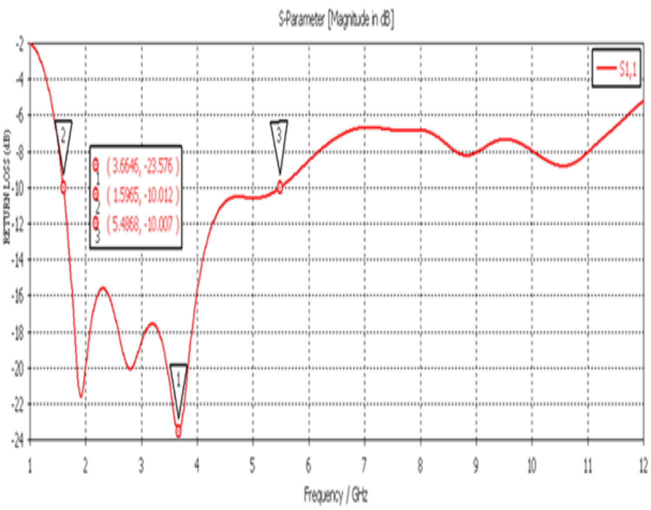
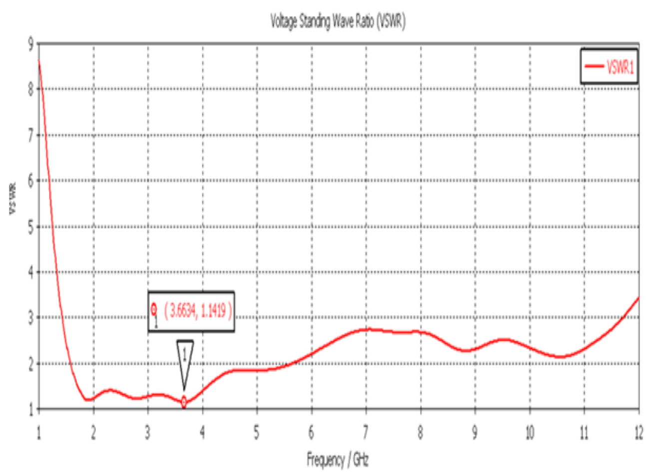


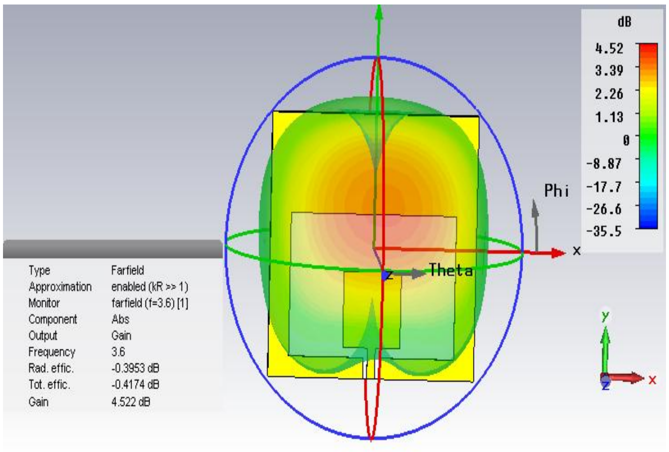
**Figure 1: Basic antenna.**




**(a)**




**(b)**




**(c)**

**Figure 2: (a ) S11 (b) VSWR and (c) Gain pattern**

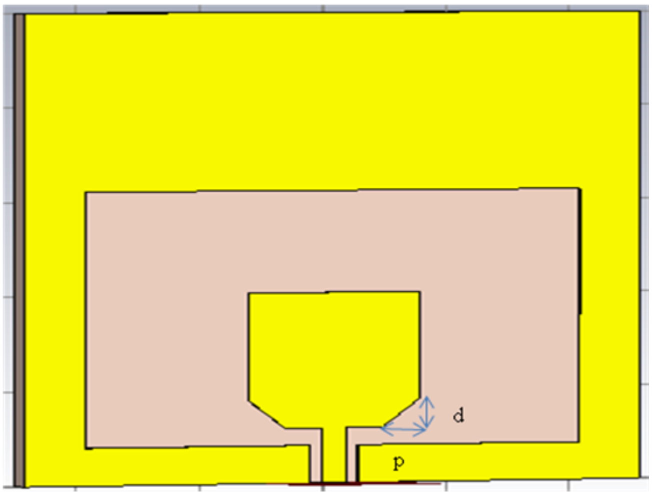
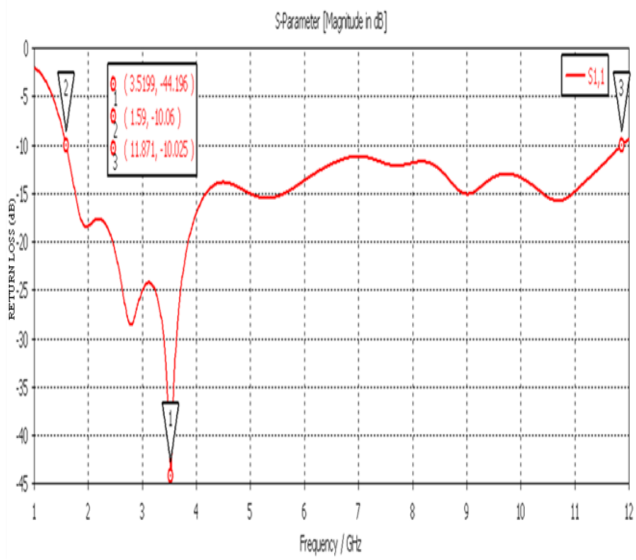
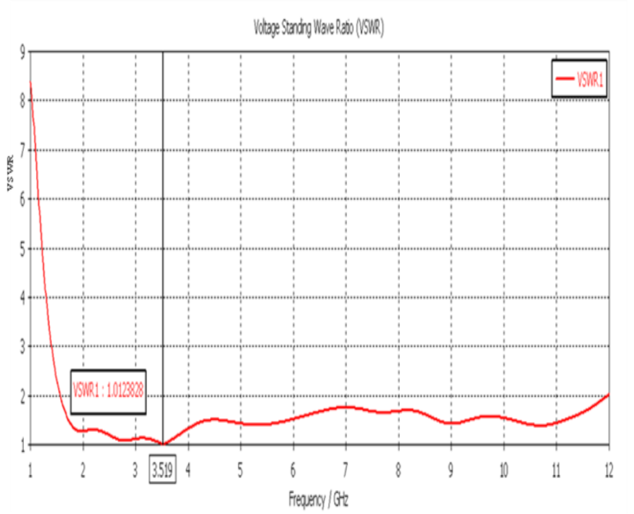


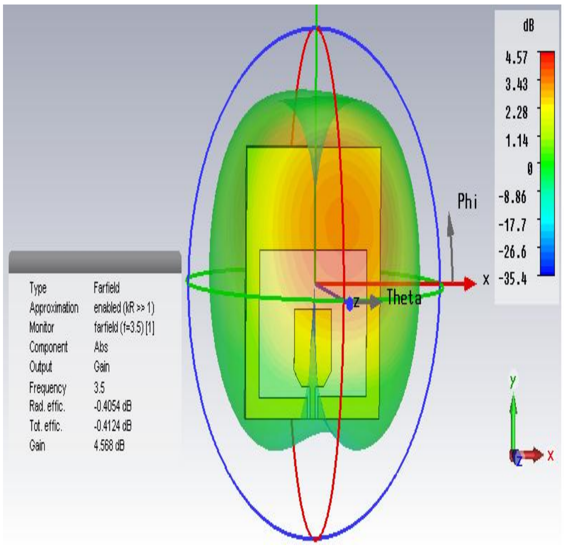

**Figure 3: Proposed Antenna**




**(a)**




(b)




(c)

**Figure 4: S11, VSWR and antenna gain pattern shown in (a), (b), and (c).**

## IV. CONCLUSION

A coplanar waveguide fed rectangular slotted patch antenna is designed and simulated by CST. The desired antenna has given the best results in the ultra wideband range in the form of return loss, VSWR, gain and bandwidth point of view due to truncation of the corners and etched the aperture in the ground plane. This is the best antenna for UWB applications.

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