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CPW fed circular slot microstrip patch antenna for Wideband application

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Abstract: In this paper, a CPW-fed circular slot antenna for wideband application was designed and simulated [1]. The Proposed research work encompasses design & parametric analysis of new antenna in order to improve the performance parameters of the existing and future wireless communication systems**.** In order to examine the performances of this antenna, a prototype was designed at frequency 2.4 GHz and simulated with various radius of circular slot antenna for input impedances matching and simulated by HFSS version 13.0 [2]. The simulation result of bandwidth is 0.9 GHz (1.97 Ghz to 2.87Ghz) which covers the standard frequency of IEEE 802.11 b/g (2.4 - 2.4835GHz). With these performances, the proposed antenna can be used in wideband applications.

Keywords: circular slot, wideband, prototype, impedance, IEEE 802.11 b/g

I. INTRODUCTION

Microstrip antenna is one type of antennas which can be used for transmitting and receiving signals. Microstrip is low profile, small size, light weight and widely used in wireless and mobile communications, as well as radar applications[8]. Microstrip antennas can be divided into two basic types by structure, namely microstrip patch antenna and microstrip slot antenna [3]. The slot antennas can be fed by microstrip line, slot line and CPW. The CPW is the feeding which side-plane conductor is ground and center strip carries the signal [2]. The advantage of CPW fed circular slot antenna is wideband antenna which many research introduce the several shape of slot antenna for use in WLAN applications. In this paper, we proposed the circular slot antenna fed by CPW at a designed frequency of 2.4 GHz and coverage frequency range from 1.97 Ghz to 2.87Ghz.at 10 dB bandwidth [7].

II. ANTENNA GEOMETRY AND PARAMETRIC STUDY

The CPW fed slot antenna is designed at 2.4 GHz with the structure, as shown in figure 1[6] .The proposed design is based on transmission line model analysis and it has rectangular patch antenna with upper pentagonal end cut along with a circular cut on the ground [10]. In the designing of antenna three basic parameters are required such as thickness of substrate, relative permittivity and dielectric substrate. Thickness of Substrate reduces the size of antenna and surface radiations and low dielectric constant is preferred because the antenna gives better efficiency, low losses and higher bandwidth. This antenna is designed on FR4 epoxy, the substrate with thickness (*h*) of 1.6mm and dielectric constant of 4.4. The coplanar waveguide (CPW) is designed to be 50 ohms in order to match the characteristic impedance of transmission line. The antenna parameter is varied to study the effect of variation on the antenna performance.

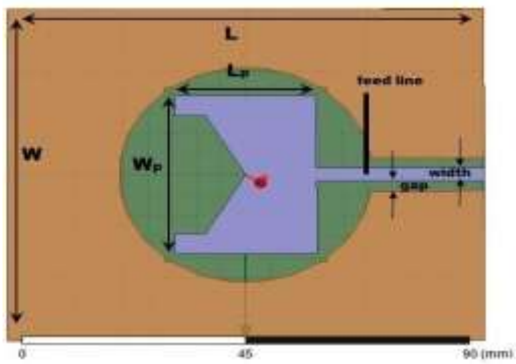

Figure 1: CPW-fed circular slot antenna

Table 1: Dimensions of the designed antenna

Input Parameter	Value
Length of patch (L_p)	30mm
Width of patch (W_p)	40mm
Length of substrate (L)	97.5mm
Width of substrate (W)	80mm

Length of feed line	34.5mm
Width of feed line	3.045mm
Dielectric constant	4.4
Operating frequency	2.4GHz
Height of substrate	1.6mm
Radius of circle	26mm
Length of air boundary	127.48mm
Width of air boundary	110mm
Height of air boundary	23.2mm
Length of lumped port	4mm
Width of lumped port	13mm

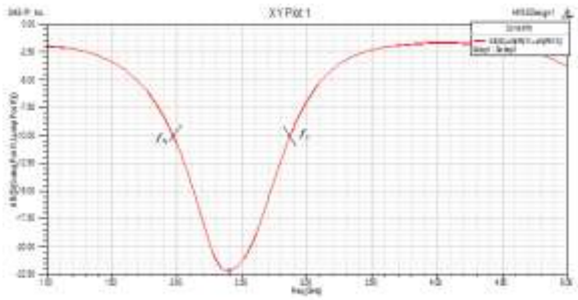

Figure 2: Return Loss and bandwidth graph

The important point for return loss is any antenna the return loss should be less than -10dB and this is necessary for proper functioning of antenna and for its effective radiation characteristics. In the design of our proposed antenna we have got the return loss of at the resonant frequency. The proposed antenna provides impedance bandwidth of 37.5% at the resonant frequency of 2.4 GHz.

A. Effect on impedance bandwidth

From the graph it has been conclude that, as the radius of circle increases, the bandwidth decreases and so larger the radius of circle smaller the bandwidth. radius of circle and bandwidth are indirectly comparative to each other.

B. Effects on return loss

Here, as the radius of circle increases, the return loss increases, hence larger the radius, larger the return loss. Radius and return losses are directly comparative to each other.

C.Effect on VSWR

From the graph it has been conclude that, as the radius of circle increases then the VSWR also increases, and so wider the radius, higher the VSWR. Radius and VSWR are directly comparative to each other.

C. Effect on the resonant frequency

Here we can say that, as the radius of circle increases then the resonant frequency increases, so larger the radius larger the resonant frequency. Radius and resonant frequency are directly proportional to each other.

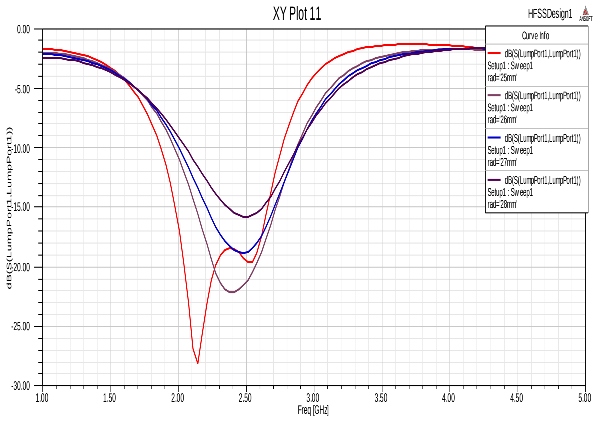

Figure 3: Return loss graph on changing the radius of the circle

Table: 2. Result Summary

Effect on Parameter	Result Analysis
Impedance bandwidth	Inversely Proportional
Return loss	Directly Proportional
Resonant frequency	Inversely Proportional
VSWR	Inversely Proportional

III. CONCLUSION

The design of circular slot antenna fed by CPW is considered on the basic structure. The proposed design is based on transmission line model analysis and it has rectangular patch antenna with upper pentagonal end cut along with a circular cut on the ground [4] [10]. It is proved by varying the slot radius for achieving the wideband for use in WLAN applications [7]. This paper shows the maximum bandwidth of 0.9 GHz at design frequency of 2.4 GHz [5]. The simulation result of bandwidth is 0.9 GHz (1.97 Ghz to 2.87Ghz) which covers the standard frequency of IEEE 802.11 b/g (2.4 - 2.4835 GHz).The antenna has 37.5% impedance bandwidth, 4.5 dB gain and acceptable radiation characteristics that make this class of antennas a good candidate for a variety of communication applications. In future this antenna can be converting into ultra wideband by alteration in geometry. The bandwidth can be increase by adding some slots in patch

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Paresh Jain joined Suresh Gyan Vihar University in july 2008 in Department of Electronics and Communication Engineering. As a Assistant Professor. He has completed their M.Tech from RTU Kota in 2013 .Paresh Jain has a long experience of almost 13 years of teaching students at B.Tech ,M.Tech level. His main areas of interest are antenna, Mobile and Cellular communication. He has good number publications to their credit. Some of their research papers have appeared in certain leading journals.

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