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Co-Axial Feed 'O' Slot Circularly Polarized Corner Truncated Rectangular Micro-strip Patch Antenna

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ABSTRACT

In this paper a design of Co-axial feed 'O' slot circularly polarized corner truncated rectangular micro-strip patch antenna. Here micro-strip patch antenna is designed to improve the efficiency. The micro-strip patch antenna is very popular for its low profile, low cost, light weight, easy to feed, and their attractive application. The return loss is below -15.017 dB from 3.5 GHz to 3.75 GHz. A maximum gain achieved at 3.66 GHz frequency and VSWR < 2. The substrate material of RT-duriod-5880 with relative permittivity 2.2 and loss tangent of 0.009 is used in this proposed antenna. The input impedance and VSWR have been measured with the help of Network analyzer. The total simulation done on An soft HFSS software.

Keywords-**Co-axial feed, efficiency, corner truncated, micro-strip patch antenna, Patch length and width co-axial feed.**

I. INTRODUCTION

The demand of antenna is rapidly increasing recently due to varieties of wireless communication systems launched into the market; for instances, 2G/3G mobile services, marine or land vehicle navigations (GPS), wireless LANs access, remote sensors for monitoring systems, and many small devices embedded with Bluetooth, UWB, Zigbee, DVB etc. Among many types of antennas, they can be classified into two categories which are linearly-polarized and circularly-polarized antenna. For majorities of wireless applications, linearly polarized antenna is good enough for transmitting as well as for receiving RF signals. However, for satellite communication and high sensitivity systems like as GPS, satellite phone and the space-to-earth communication, then the circularly-polarized antenna must be used in order to maintain good capability of signal strength.

A micro-strip patch antenna, in simplest form, is just a single corner conductive plate that is placed above a ground plane. Frequently, the beam widths in the azimuth and elevation plane are similar, resulting in a fairly circular beam[2]. The radiation patterns exhibit typical patch antenna characteristics.

There is a single main lobe with fairly wide beam width with shallow nulls pointing up and down from the antenna [2] .The micro-strip slot antennas are attractive for their features such as low manufacturing cost, light weight, conformal, ease to feed. However general micro-strip antennas have disadvantages such as narrow band. There are multiple and well known methods to increase the BW, including increase of the substrate thickness, use of low dielectric substrate, the use of various feeding and matching techniques, and use of multiple resonators [5-10]. In this paper a wide band with high gain antenna fed to co-axial probe is presented. The height of the dielectric constant is kept constant1.5mm.

The micro strip center patch antenna is a very good characteristics antenna that has a number of advantages over the other antennas. A micro strip antenna consisting of conducting patch on a surface plane separated by a dielectric substrate. Low dielectric constant substrates are generally used for maximum radiation. The conducting patch can take any shape but here used a rectangular corner truncated shaped construction for our analysis. A micro strip patch antenna is characterized by its length, width, input impedance, gain, radiation patterns. The length of antenna is nearly half wavelength in the dielectric. For good antenna performance a thick dielectric substrate having low dielectric constant is desirable. Since this provide better efficiency, larger bandwidth and good radiation. With loading of some specific slot in the radiating patch of micro strip antennas can be obtained. The loading of the slots in the radiating patch can cause meandering of the excited patch surface current paths and result in lowering of the antennas fundamental resonant frequency, which corresponds to the reduced antenna size for such an antenna compared to conventional micro strip antenna at the same operating frequency.

II. DESIGN SPECIFICATION FOR PROPOSED ANTENNA:

In this paper several parameters have been investigated using Ansoft HFSS software. The geometry of the proposed a co-axial feed o-slotted circularly polarized corner truncated rectangular micro-strip patch antenna is shown in fig. 1. It is fabricated on RT-Duriod substrate with a dielectric constant of €= 2.2 and substrate thickness of t= 0.6mm. The antenna is fed by 50 ohm co-axial probe, through a quarter wavelength transformer for impedance matching. The proposed antenna has a simple configuration consisting of o-slot and parasitic patch. The radius of the slot determines the lower resonant frequency, with an increasing radius; the lower resonant frequency is shifted downward. The antenna has the following parameters R1=1.5cm; R2=2cm; L=4cm; er2.2. In order to obtain a stable symmetrical radiation pattern, the parasitic patch is embedded into the center of the slot. To simply the design, the width of the feed line is chosen to be 3mm. In here, the radius is the distance between the slot center and edge of the feed line. Based on the simulated results, the radius of the feed structure can be adjusted for good impedance matching. The proposed antenna has better bandwidth, better efficiency and much smaller size. Simulation is carried out using HFSS.

Table-1: Antenna Dimensions

Length of Rectangular patch	4 cm
Width of Rectangular patch	3cm
Thickness of the substrate	0.32cm
Relative Permittivity of the Substrate	2.2
Radius of inner circal (R1) (R2)	1.5cm and 2 cm

THEORETICAL CONSIDERATION

The feed position is calculated by using modal expansion cacity model theory, for 50 ohm co-axial cable. The notch has been cut along the patch width in such a way that it lies at a symmetrical distance from both length edges of the patch. According to the cavity model theory, a normal micro strip patch antenna can be modeled as parallel RLC circuit. The current flows from the feeding point to the top and bottom edges of the patch.

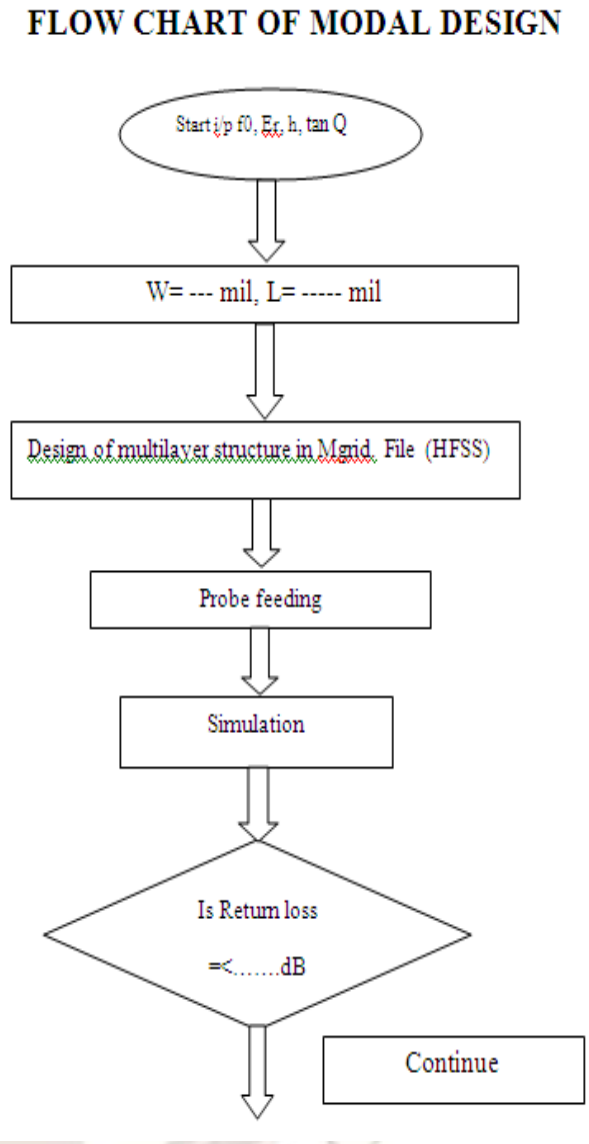

Figure 1: Flow chart for model designing

ANTENNA DESIGN

The construction of proposed micro strip antenna is design in fig 2. The proposed antenna has a rectangular corner truncated and circular 'o' slot with circle patch connected to the micro strip feed line on the center of the substrate. The width of the design micro strip feed line is fixed at 1.9mm to achieve 50 ohm impedance. On the other side of substrate, a conducting surface plane of width and length is printed.

By designing the edges of the radiating patch in the form of circle shape slot, additional resonances is generated and the impedance BW of the micro strip antenna is improved[11],[12]. The quality between the width of patch and width of the surface plane is also important parameter to getting the suitable required radiation characteristics [13].

III. DESIGN OF PROPOSED ANTENNA

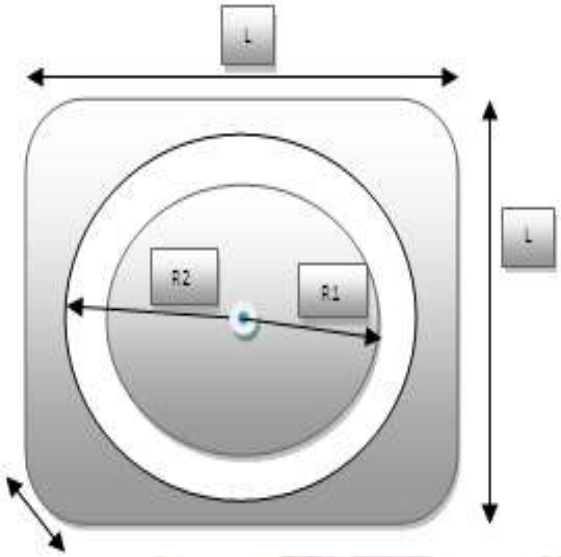

Figure 2: Coaxial feed 'o' slot circularly polarized corner truncated micro-strip antenna.

AVAILABLE METHODS

Compact and Designed antenna is a favorite case. Some techniques are used to compact antenna and some technique s are used to enhance the efficiency of antenna.

Based on recent designs slotted micro strip antennas have been proposed. For example increasing relative permittivity results in size reduction. Because resonant frequency can be obtained from previous relation, in fixed length with increasing ε_r, frequency is lowered .With increasing ε_r, frequency is lowered (broad band appl.). With increasing ε_r, we can have a compact antenna, when resonant frequency fixed.

FREQUENCY CHANGING METHODS

In micro strip antenna, resonant frequency can be approximately obtained from following relation [13]:

$$f \cong c/2L\sqrt{Er}$$

This means that with fixed relative permittivity (fixed substrate), directly lower frequency, larger size is obtained, and vice versa. In mobile and wireless communications, size and frequency interval have great importance. So, size and frequency, both are important variables in patch antenna design. And lengthening the size is no good solution.

FUTURESCOPE

This work will be helpful to designing the micro strip antenna with the reduce in return loss, high bandwidth and more efficiency

CONCLUSION:

This paper proposed a co-axial feed 'o' slot circularly polarized corner truncated micro-strip patch antenna for wireless communication systems. Various parameters of antenna design are optimized. In this paper, we measure the result of return loss, Radiation pattern and efficiency of the proposed antenna design and which ensures that this antenna gives very good performance in wireless communication applications.

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