CPW Fed Microstrip Antenna with U-Shaped Cut-off and Circular Slot for Wireless Application

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Abstract— In this paper we have designed a CPW feed microstrip antenna with circular slot and U-shaped cut on the rectangular patch to operate at resonant frequency of 1.9 GHz. These types of antennas are of high performance, robust in design and easy to fabricate. Due to their attractive features like the transferring of the data by wireless method, its versatility and it can also be designed to any geometrical shapes and compact sizes have increased their demand very high as these are used now a days. The Patch elements used here are placed on the FR4 epoxy substrate of relative permittivity value 4.4 is kept at a height of 1.6mm from the ground. Results of simulation are the results presented by the using of HFSS version 13.0. The return loss measures -24 dB, antenna gives the impedance bandwidth of 45%, VSWR observed is 1.15 and the gain proposed is 1.55dB at centre frequency of 1.9GHz.

Key words: Microstrip Antenna, CPW Feed, HFSS 13.0, 1.9 GHZ, FR4 Epoxy

I. INTRODUCTION

In early period of 1970's the first ever practical antenna was designed and also fabricated by Howel & Munson and so on the microstrip antennas became popular during the 1970's period and also they had very special space borne applications uses. With the start of the use of the physical medium the conventional medium for the long range i.e distant range of communication was impossible as it would cost very high and also impractical so the wireless mode i.e without the use of physical medium, has started a new era which has enabled its use for the long range or distant range of communication with the new and the advancement of technology better and also quicker and faster modes of communication and communication devices are invented that covers much larger and huge apart distances.

Antennas today play a very vital role in the communication systems for the transmitting and receiving of the signals. They are also versatile in taking any geometrical dimensions i.e can be designed to any shape and can also be implemented very easily. They are also very useful as they are quite low profile also has low power handling capacity, also low weight, also simple and cheap in price [3]. Due to their various attractive and distinctive features like the high rate of transfer of the data wirelessly and are also compact in size and also have increased their demand highly and they have various applications. The microstrip type of antennas are of very high performance in nature, robust in design and easy to fabricate[1].

There are many problems that are to overcome such as the surface wave excitation problem and narrow bandwidth problem are overcomed by the use of the various methods such as the cutting slot method, increasing thickness methods, etc. CPW fed antennas are used in the designing of the antennas which has quite low weight and to obtain low transmission losses and also this method was introduced first by C.P. Wen in 1969 [4]. CPW-Fed antenna method is quite a cheap and also the line impedance and the phase velocity is very less dependent on the substrate of the height and then on slot width [5]. The further details of this paper present the design of the antenna, the geometry and the results of the designed antenna.

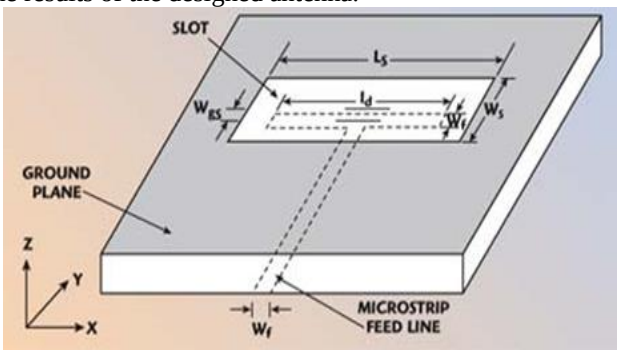

Fig. 1: Microstrip Antenna Model Diagram

II. ANTENNA DESIGN

The design is based on the transmission line model method analysis and also it has rectangular patch with U-shaped cut on the rectangular patch of the antenna with a circular slot cut on the ground on the base. On the design of the antenna three basic parameters are required to study such as the thickness of the substrate, the relative permittivity and also the dielectric substrate. Thickness of the substrate reduces efficiently the size of the antenna and also surface radiations occurring and also low dielectric constant of the antenna is preferred as because the antenna gives better efficiency with low losses and also gives higher bandwidth and so, patch elements are placed on the FR4 epoxy substrate used with relative permittivity of 4.4(low) is kept at 1.6mm height. The feed line width of the antenna is such that the impedance used is 50Ω [2]. The shown antenna is designed at a centre frequency of 2.4GHz.

Parameter	Value
Length of patch (L_P)	29mm
Width of patch (W_P)	38mm
Substrate length (L)	97.48mm
Substrate Width(W)	80mm
Feed line length	34.24mm
Width of feed line	2.2mm
Height of substrate	1.6mm
Radius of circle	26mm

Table 1: The Dimensions of the Proposed Design Antenna

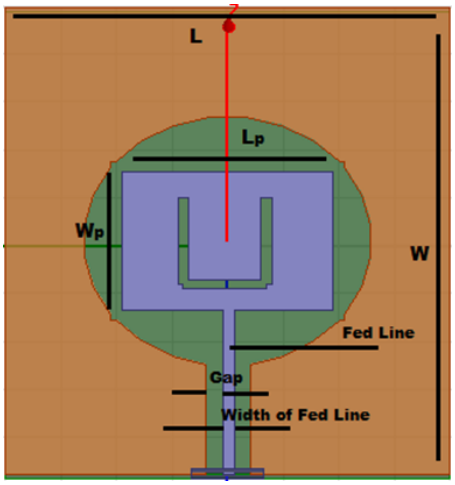

Fig. 2: Design of the antenna using HFSS 13.0

III. SIMULATION OF ANTENNA AND ITS MEASURED RESULTS

Simulated results are obtained by using the Ansoft HFSS version 13.0 software. The results achieved after simulation of antenna are discussed in this section.

A. Return Loss

It is the loss measurement of the antenna which shows that how the antenna designed is utmost effective in delivering the power from the source to the antenna. Return loss measured here is -24dB.

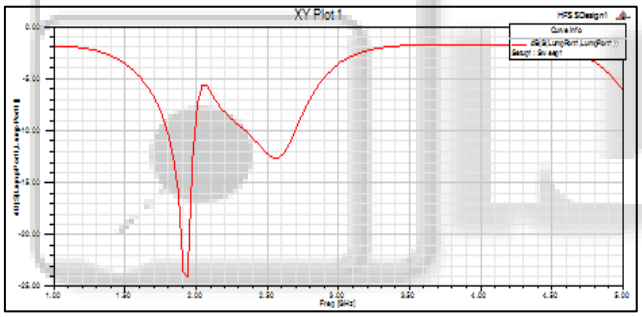

Fig. 3: Return Loss

B. Bandwidth

S-parameter can be used in calculating the bandwidth of the antenna. The antenna gives the 10dBi impedance bandwidth of 45%. The frequency ranges from 1.79GHz to 2.00 GHz.

C. Radiation Pattern

The pattern of radiation shows the directions in which the power is directed and is also the measure which shows the radiation distribution and the power distribution in the particular direction. Radiation pattern at centre frequency 1.9 GHz figure follows.

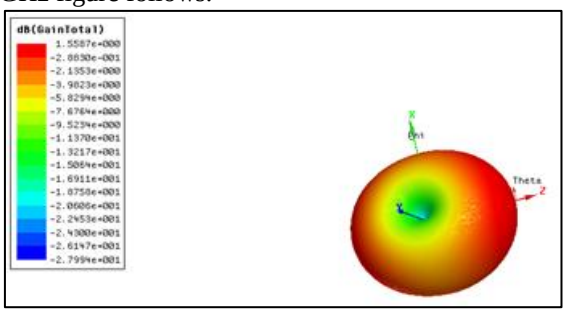

Fig. 4: Design antenna Radiation Pattern

D. VSWR

The VSWR is the application of the maximum and the minimum voltages at the feed line of the antenna and their ratio is the VSWR showed by the antenna. The value of the VSWR which is determined for perfect and correct functioning of the designed antenna is that it needs to be kept at value less than 2. The value obtained by simulation should be in the ratio of 1:1 for the perfect matching and the antenna to perform effectively and efficiently. The plot shows that the VSWR observed by the design is as 1.15 at 1.9GHz.

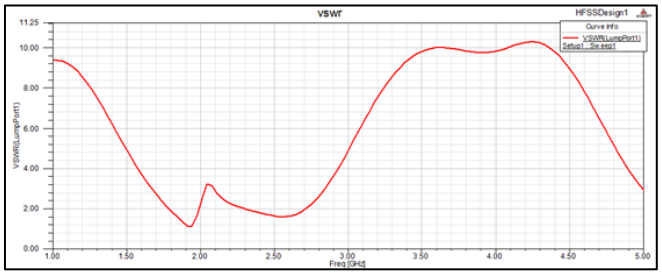

Fig. 5: VSWR

E. Gain

Value of the gain antenna shows the amount of the power transmitted by design antenna in the maximum radiation and in direction in which the isotropic source of design antenna is taken. The gain measured should not be less than 0dB or not equal to 0dB otherwise the antenna will not radiating. Here we can also get the gain of the design antenna by the divisioning of the radiation intensity of designed antenna and peak intensity of the antenna. We have got the maximum gain as 1.55 dBat our taken frequency.

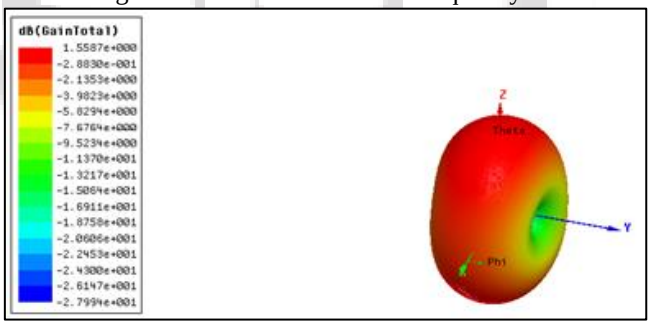

Fig. 6: Gain

IV. CONCLUSION

The designing of the antenna shown above is made with the CPW-Fed method and also the study of the result shows utmost gain calculated is 1.55dB and the return loss calculated is -24dB, VSWR calculated is 1.15 and the impedance bandwidth calculated is 45% in the proposed design antenna. Simulation of antenna and the design part of the microstrip patch antenna designed here is done on a substrate of the dielectric constant 4.4 at a resonant frequency of 1.9GHz which ranges from 1.79GHz to 2.00 GHz is successfully done on HFSS. Several many more designs of such antenna can be simulated using various design parameters gaining better results and higher efficiency finding its place in the important field of wireless communication with newly invented ideas and also their main applications are in GSM 1800/1900.

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