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S-Patch Rectangular Microstrip Antenna for Navigation

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***Abstract*—In this paper, a rectangular microstrip antenna for ultra high frequency applications with S-slotted patch has been described. Antenna is printed on a dielectric substrate (RT Duroid) and fed by a 50 ohm microstrip line. The antenna is design and simulated using HFSS (High Frequency Structure Simulator) version 11 software. The proposed design offers low profile, high bandwidth and compact antenna element. This design structure offers the gain and directivity of antenna which is applied for high efficiency antenna. The bandwidth from 1.30 GHz to 1.6 GHz for many application e.g. navigation and satellite, etc. The voltage standing wave ratio(VSWR) is less than 2.**

Keywords: Ultra high frequency band (UHB), HFSS software, microstrip line-fed.

I. INTRODUCTION

Microstrip patch antenna is a key element in wireless communication and Global Positioning system since it was first demonstrate in 1886 by Heinrich Hertz and its practical application by Guglielmo Marconi in 1901. Future trend in communication design is towards compact devices. Microstrip patch antenna have been well known for its advantages such as light weight, low fabrication cost, mechanically robust when mounted on rigid surfaces and capability of dual and triple frequency operations all these features, attract many researchers to investigate the performance of parch antenna in various ways.

This single patch antenna operates at voltage standing wave ratio of less than 2 (VSWR < 2). Theoretical simulation and optimization are performed using HFSS (High Frequency Structure Simulator) version 11 software.

Ultra highband (UHB) antennas have commanded increased interest in the last few years, due to the rapid development of navigation and satellite communication systems. UHB technology has received an impetus and attracted academia and industrial attention in the navigation and satellite[1]. An UHB system has many advantages because of their wide bandwidth and economics advantages have been used in television broadcasting and cellular phones.
In this paper, an antenna with S-slotted patch for UHB applications. Multi-band characteristics with desired bandwidth are obtained by simulating a S-slotted -shaped radiating patch on one side of the substrate and a rectangular shape ground plane on other side of the substrate as shown in fig 1. The shapes of the ground planes are carefully designed in order to increase both gain and bandwidth for a UHB.

ANTENNA STRUCTURE

The geometry of the proposed antenna is shown in Fig.1 (b). The antenna is made of a single patch on top, one layers of dielectric and fed by a 50 ohm microstrip line and fabricated on a 0.254 mm thick substrate with W= 100 mm and L=75 mm surface area. The relative permittivity and loss tangent of the substrate is 3.4 and 0.008 respectively. A 50-Ohm microstrip feeding line (width 3.8 mm and length is 41 mm) is connected to the S-shaped rectangular patch.

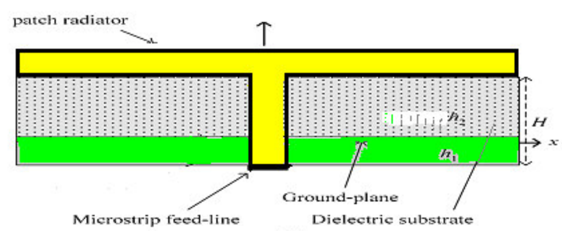

Figure 1(a)

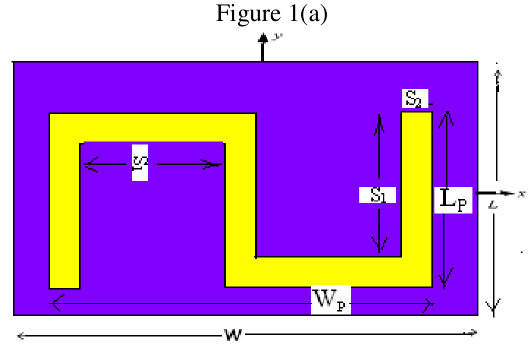

Figure 1(b): Design geometry of S- patch antenna

II. SIMULATED RESULTS

To getting a low return loss, high gain, directivity and enhanced radiation patterns of a planar antenna for the frequency range between 1.3GHz to 1.6 GHz. The numerical simulation is performed using the HFSS software [14], which utilizes the finite element method for electromagnetic computation, in order to find a good tradeoff between these requirements.

A. Return loss

Fig 2 indicates that it is double band antenna in the range 1.3GHz to 1.6GHz. Fig. 2 also shows the input reflection coefficient of the antenna obtained from Ansoft HFSS [14]. Good agreement is observed, thus verifying the design process. The return loss is better than 10dB between 1.3 GHz and 1.6 GHz

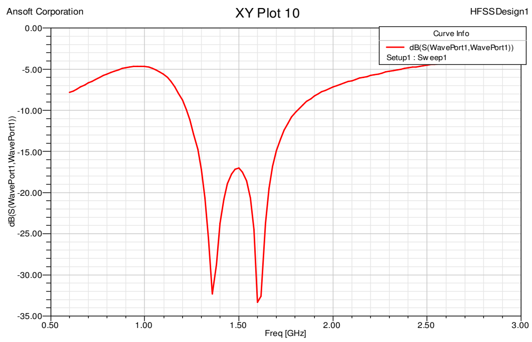

Fig. 2: Return Loss

B. V.S.W.R

Voltage Standing Wave ratio, that means the ratio between transmitted signal from source to the reflected signal from thee load (antenna), ideal case is VSWR=1, but of course it's not exists in the real life so the good ratio swinging between 1.0 to 1.2, over 1.5 is bad. As signal amplitude (voltage) is a proportion of impedance so VSWR equal to ratio between load impedance and transmit media, any difference will cause high VSWR. Here (VSWR) < 2 is from 1.3GHz to 1.6GHz. as shown in fig. 3.

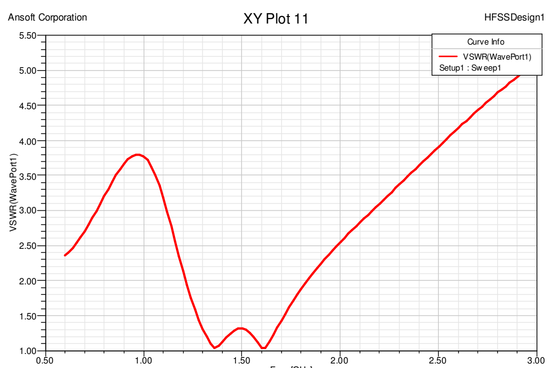

Fig.3: V.S.W.R

C. Peak Gain

The simulated gain of the proposed patch antenna at various frequencies is shown in Fig. 4. As shown in the fig 4, the maximum achievable peak gain is 82.45%

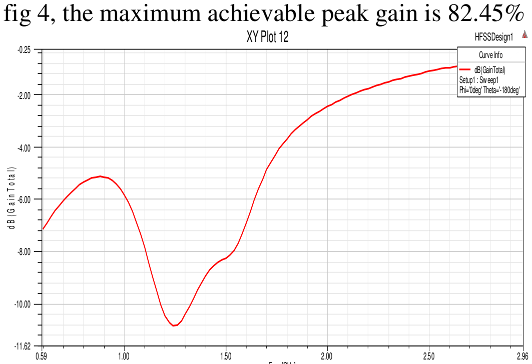

Fig. 4: Gain

E. Conclusion:

In this paper we have presented the effect of rectangular shaped ground plane, investigated and compared the effect of the small reflectors plan for circular CPW and the proposed antenna. Finite ground plane can increase the gain and directivity of antenna and it gives the multi band characteristic also. The impendence bandwidth is in between 1.3GHz to less than 2GHz is suitable for VSWR <2 and the antenna gain is 8.19 dB.

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