ISSN XXXX XXXX © 2018 IJESC

Research Article Volume 8 Issue No.3

Rectangular Microstrip Antenna with Siva Linga Shaped Slotted for X-Band Applications

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Abstract:
A small printed rectangular shaped microstrip antenna with Siva Linga shaped sloted antenna for x-band applications obtain frequency range from 8GHz to 9.5GHz. The proposed antenna consist numerical number seven shaped slot on radiating patch. It consist partially semi ground size 13mm×6mm.size of antenna is 13mm×15mm×1.6mm using FR4 material as a substrate using in HFSS. It gives VSWR<2 and simulated antenna gain is 2.59 dB 8 GHZ. radiating patch size 10mm×8mm proposed antenna consist line feeding used rectangle shaped feed size of feed is 2mm×7mm proposed antenna simulated on HFSS.

Keywords: Siva Linga shaped slot, X band applications, HFSS.

I. INTRODUCTION

In the fast expansion of now a days Wireless Communication Technology, microstrip antennas are used many researchers [9]. The printed antennas i.e Microstrip are having a feature of simple geometry, simple to manufacture and little expensive, they suffer from drawbacks of low gain and narrow bandwidth [1]. C band is used for long distance radio telecommunication satellite communication[10]. X band are used in radar applications like single,dual polarization, phased arrays,synthetic aperture radar and X band radar's frequency sub-bands are used in military, civil and government organizations for air traffic control, weather monitoring, defence tracking, maritime vessel traffic control, and vehicle speed revealing for law enforcement.

Many techniques are there in the literature to provide X band microstrip antennas which include bow tie antenna [1], using circular patch [2], using nine element quasi yagi antenna [3], using dielectric resonator [4], having two slots on the ground plane [5], using fractal patterned iris loaded cross dipole slot [6], having two dielectric resonators coupled to an S-shaped slot [7] and extended stepped side inverted U slot [11]. The intend of this paper is to suggest a rectangular microstrip antenna with siva linga shaped sloted simulating with HFSS software [8]. to cover applications of communication engineering ranging from 8 to 9.5 GHz for X band, radar applications from 8 to 12 GHz in X band, and to cover X band uplink frequency band from 8 to 8.4 GHz as assigned by the International Telecommunications Union (ITU). The Microstrip antenna that we suggest is little shape and covering X band applications

II. THE PROPOSED ANTENNA GEOMETRY AND MODEL

The schematic diagram of the suggested microstrip antenna is exposed in Fig. 1. Antenna is fabricated on FR4 the substrate of dielectric permittivity having ε_r=4.4, and its thickness h=1.6 mm the dimensions of 12x16x1.6 mm^3. A rectangular patch of dimensions 10x8 mm^2 is printed on one of the side and the partial ground on other side. Numerical number seven shaped slot on the patch. Microstrip line feed is used with proportions of width 2 mm and length 7mm to reach 50Ω impedance. Proportions of slots and the ground were optimized at preliminary stage to get a broad bandwidth using HFSS software simulation.

A Defected Ground Structure (DGS) with stepped slots is feature on the base surface of the FR4 substrate. Length of the ground Lg is 5 mm and width is similar as of the substrate (13mm). The composition is simulated in FEM (Finite Element Method) based HFSS.

This type of feed is microstrip line feed as it is one of the simple methods to fabricate and can be consider as an extension of patch. The location of the strip is normally at half of the width of patch in X axis directions.

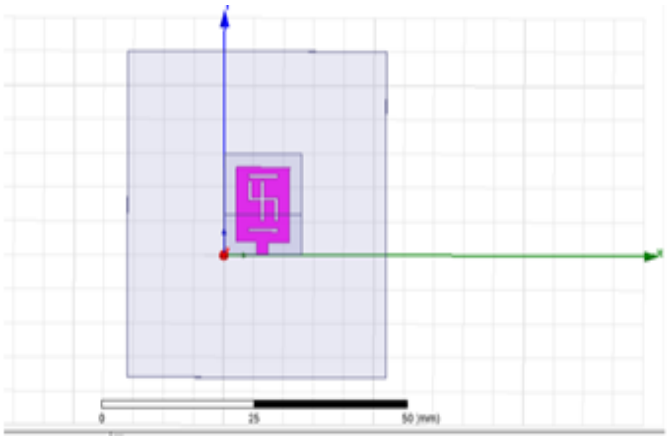

Figure.1. Schematic diagram of suggested antenna

The width & length of the patch are calculated at fr = 8 GHz. primarily we optimize the dimension of patch. slot and partial ground to obtain enhanced wide band character.

Design process of the suggested antenna is shown in Fig. 2.

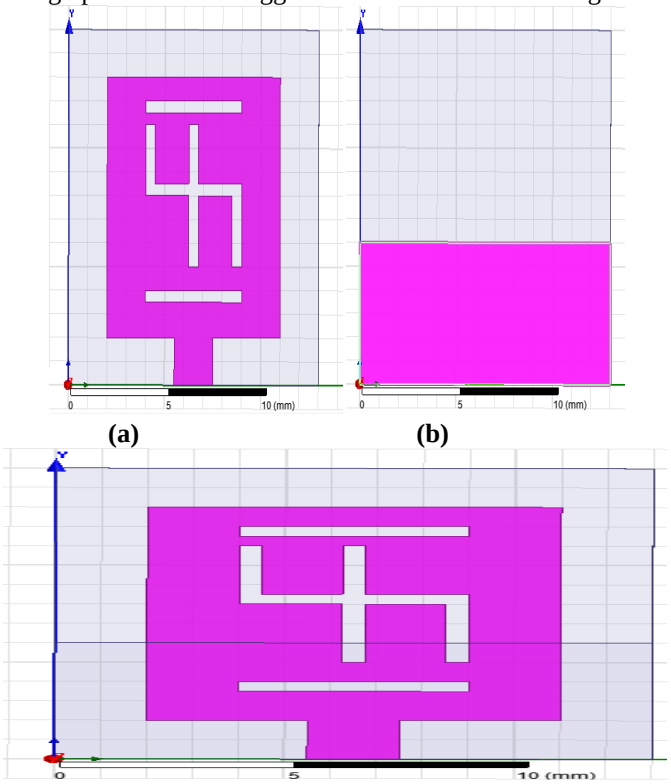

Figure.2. Design evolution of suggested antenna

First design patch as per theoretical calculations which are available equations in literature survey using those equations to calculate patch width and length.

Choosing the consideration of w/h>1

Width,

$$W = \frac{c}{2fr}\frac{1}{\sqrt{\left(\frac{\in r+1}{2}\right)}}$$

Effective dielectric constant,

$$\in eff = \frac{\in r+1}{2} + \frac{\in r-1}{2}\left(1+\frac{12h}{w}\right)^{\frac{-1}{2}}$$

Length ,

$$L = \frac{C}{2fr\sqrt{\in r}} - 2\Delta l$$

Where Δl is

$$\Delta l = 0.412h\left(\frac{\in eff + 0.3}{\in eff - 0.258}\right)\left(\frac{\frac{w}{h}+0.264}{\frac{w}{h}+0.8}\right)$$

Using this equations calculate length and width of patch. From figure 2(a) observe patch and feed of antenna. In literature survey have many feeding techniques in that line feeding technique choose has a feed of propose antenna. from figure 2(b) make a partially ground and size 13mm×6mm.at this stage did not found any frequency response at 8 GHz. when ever make a numerical number seven as a slot on the radiating patch then we found operating frequency range 8 GHz to 9.5 GHz at mid frequency 8 GHz. The specifications of the slot siva linga have length 8mm and width 0.5mm .

III. RESULTS AND DISCUSSIONS

The Below Fig.4 shows the simulated reflection coefficient of this antenna according to the frequency. Ths result shows that the antenna has a bandwidth measured at -10dB ranges from 8 – 9.5 GHz for X- band applications Your Conference Paper must follow these overall formatting specifications:

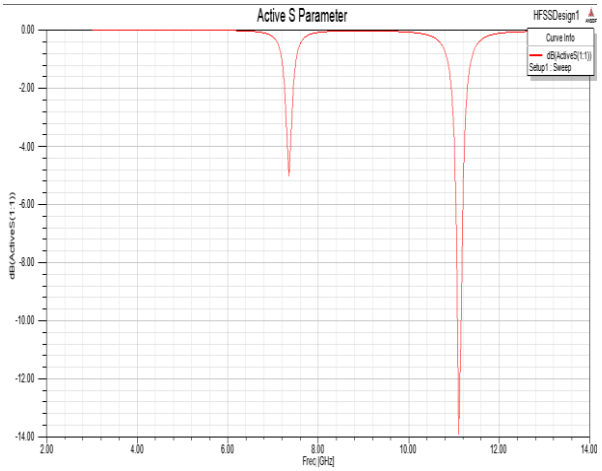

Figure.4. Simulated reflection coefficient S_{11} against frequency

Fig. 5 shows the simulated voltage standing wave ratio of the antenna according to the frequency. We observe that the value of VSWR in the band is less than the value 2, which is sufficient to cover the band allocated by the FCC

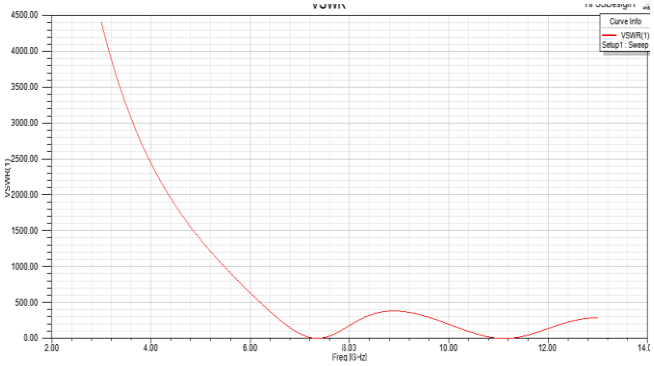

Figure.5. Simulated variation of VSWR

Fig.6 shows the return loss performance of different configurations for Fig.2 (b) to 3(c), with and without slots. The simulated Gain Total(dB) of the antenna is characterize by the disparity of the radiation intensity at large distance in the unlike directions of space. The dB (Gain Total) at 6 GHz is shown in Fig. 6 as 2.59dB.

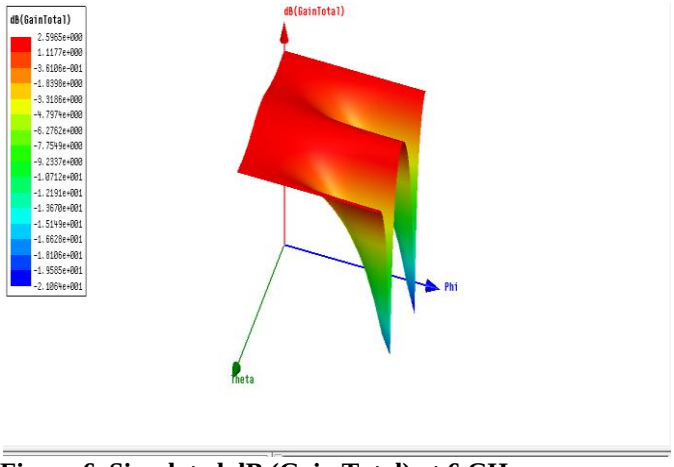

Figure 6. Simulated dB (Gain Total) at 6 GHz

E-plane is the x-z plane (elevation plane) with some particular azimuth angle and the primary sweep will be theta. H-plane is the x-y plane (azimuth plane) with some particular elevation angle and the primary sweep will be Phi. Fig. 7 and Fig. 8 show the simulated two dimensional radiation patterns (E-plane, H-plane) of the antenna at 8 GHz. In the E-plane, the value of azimuth angle (Phi angle) φ of 0° and 90° with all

theta values. In the H-plane, the value of elevation angle θ of 0° and 90° are taken into consideration.

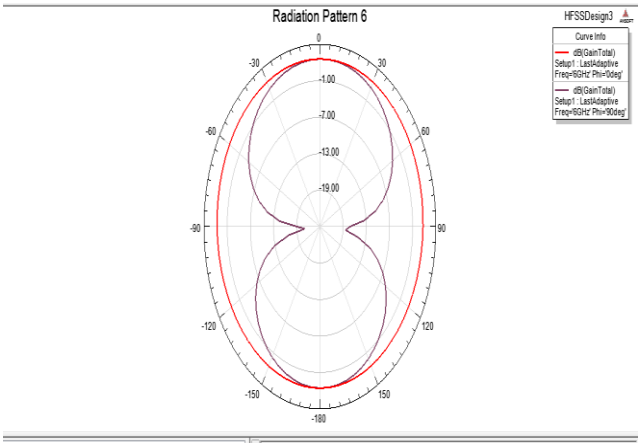

Figure.7. Simulated E- plane radiation patterns at 6 GHz

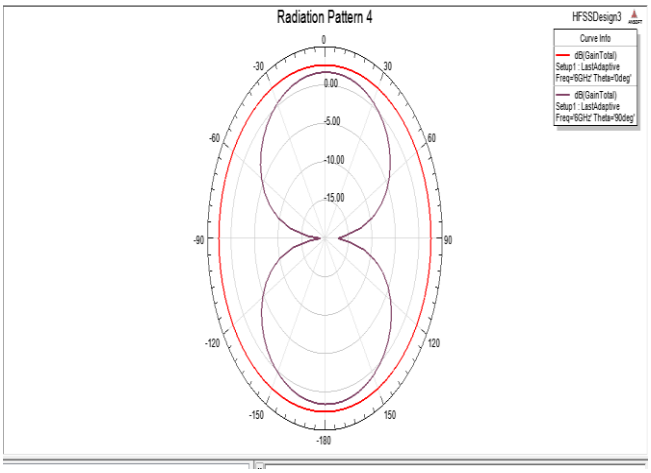

Figure.8. Simulated E- plane radiation patterns at 6 GHz

IV. CONCULSION

In this paper, we proposed a rectangular printed UWB microstrip antenna having operating frequency range in X-band from 8 to 9.5 GHz below -10dB. The suggested antenna is simulated by using HFSS with good performance for the allocated X-band. We have shown in this paper that how the frequency parameters are changed with the numerical number seven shaped slot and also with the partially ground. The radiation pattern of this antenna was analyzed. It has good stability over the entire frequency band required and that in the two principal planes E and H. The simulated gain is found to be a maximum of 2.59 dB at 8 GHz.

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