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Design and Analysis of Planar Inverted F-Antenna

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Abstract: The proposed planar inverted F antenna is very simple structure. Planar inverted F antenna is designed which is popular for mobile devices. It can be easily placed in small space present inside the mobile phones. This paper concentrates on design and development of compact antenna used for mobile phones. PIFA design uses the quarter wavelength operation also. Details of antenna design and experimental results are demonstrated in this paper.

Keywords: Antenna designing, PIFA, low profile antenna, DGS.

1. INTRODUCTION

PIFA antenna structure has emerged as one of the most essential antenna in the category of low profile antennas used in handheld devices. PIFA has simple construction, high radiation efficiency, small volume, low-loss impedance matching. PIFA and microstrip antenna (MSA) have been popularly used for wireless devices due to their low profile geometry. The special feature of the PIFA is that its resonant frequency depends on not only the length of the shorts patch but also other dimensions such as the width and height of the patch and the distance between the feeding and shorting plates. The quarter-wavelength whip antenna was very popular, mostly because it is simple and convenient [1].

In this paper, a planar inverted F antenna (PIFA) for mobile communication applications is presented. One has to make some kind compromise among volume impedance bandwidth and radiation characteristics of an antenna while making the smallest possible antenna.

PIFA is also referred to as short-circuited microstrip antenna due to the fact that its structure resembles to short-circuit MSA. However, the conventional microstrip patch is not a good candidate for the portable devices as their designs are based on half-wavelength of operation [2], [3] and not meet the strict small space requirement of these devices. Therefore, PIFA is used for reduced size. Technique like use of reduced ground plane can to be employed to further increase the bandwidth [4], [5]. Multi -frequency capability with the antenna structure can be achieved by exciting various resonant modes using branched structure, created by cutting slots in the radiating element [6]-[9]. By varying the size of the ground plane, the bandwidth of a PIFA can be adjusted and optimized. The proposed antenna is designed with the help of sonnet software in which box size is (20×20) cell size (0.25×0.25) and number of cells is (80,80) , we can increase the cells for better result.

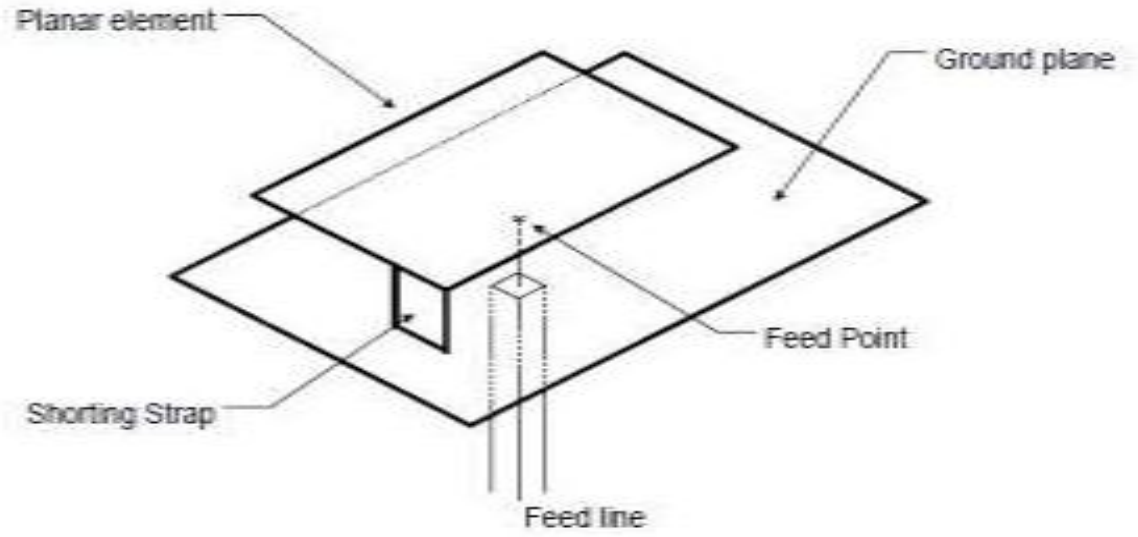

Fig -1: Basic layout of the planar inverted-F antenna

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2. ANTENNA DESIGN

The development and characterization of several low-profile and integrated antennas with enhanced bandwidth for wireless communication systems [10]. The configuration of the proposed antenna is shown in fig.(2).The size of the box is (20×20)mm² considered as the circuit board. Ground plane exists on the front surface of a FR-4 with the substrate height or dielectric thickness is 1.8. The thickness of the first layer should be ten times larger than the substrate height i.e. 19.

In this paper we take lossless material over a ground plane, there is used a S type DGS which has dimension (2.35×1.227×0.268). S type cutting is used at the ground plane. DGS is used to improve the performance of antenna. The dimension of three slots is given as follows:
I slot- 14×0.302 mm²
II slot- 6×0.25 mm²
III slot- 6×0.25 mm²
And the spacing between two slot is 1.9mm.
The basic 2-d view and 3-d view of the proposed antenna is shown in fig (2) and fig (3) respectively

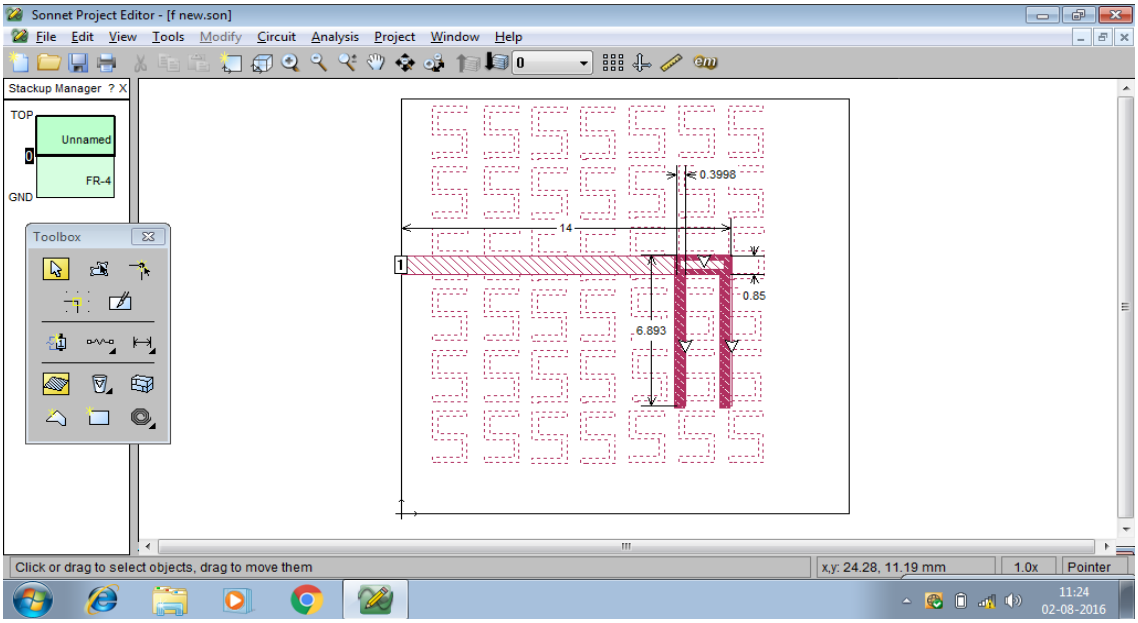

Fig- 2: Basic F-Antenna with 2-D view.

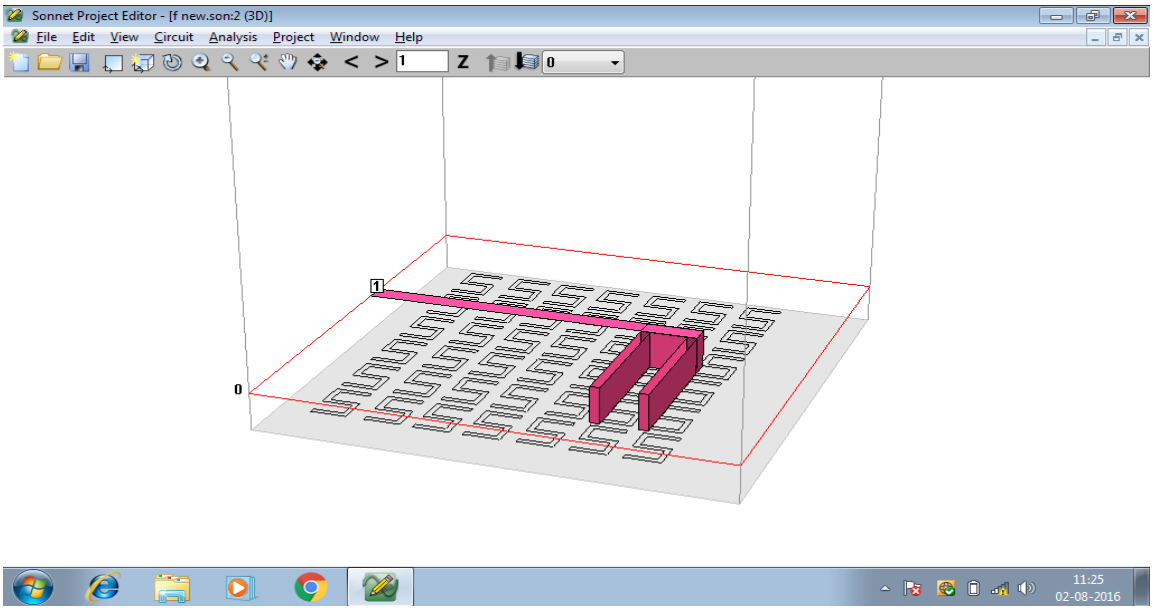

Fig- 3: F- Antenna with 3-D view

3. RESULTS

The analysis of the proposed antenna design is done with sonnet. The proposed structure is covering uplink satellite communication band and downlink. This design is having one band. Fig (4) shows the VSWR. Return loss is shown by fig (5).

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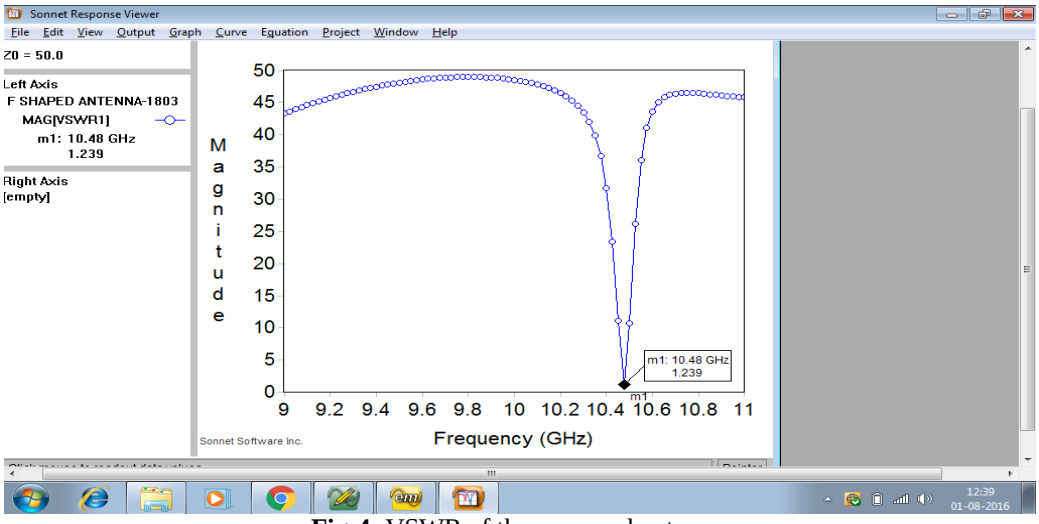

Fig-4: VSWR of the proposed antenna

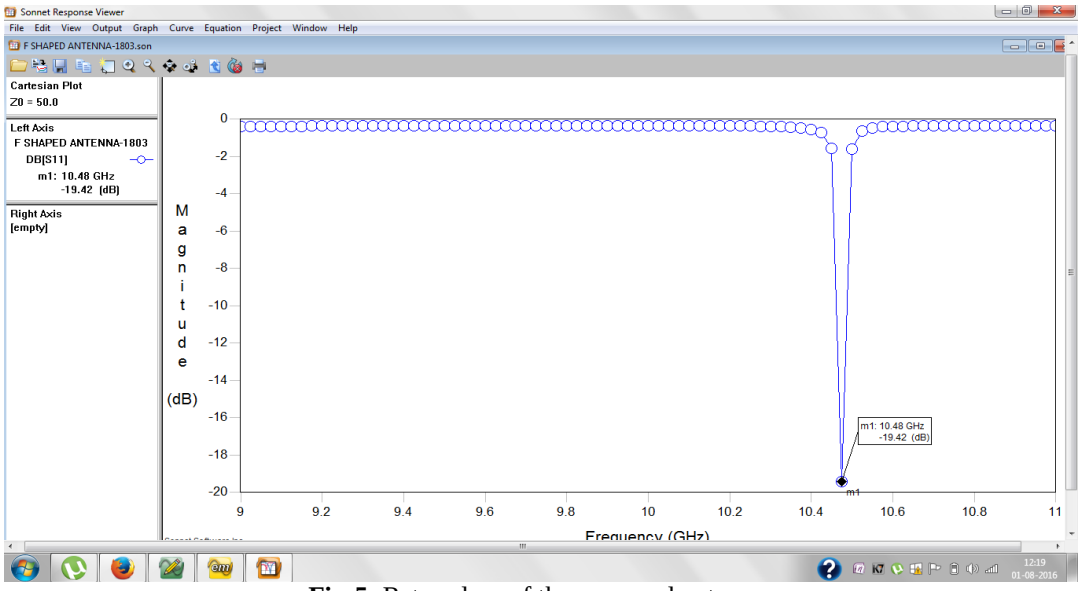

Fig-5: Return loss of the proposed antenna

The smith chart of the proposed antenna is shown in fig (6).

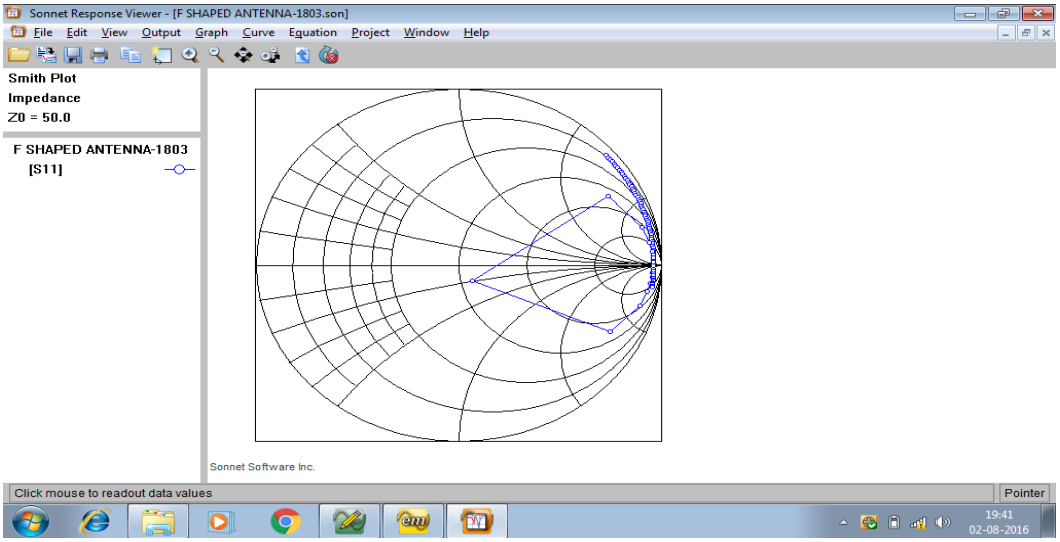

Fig-6: Smith chart of the proposed antenna.

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Maximum power transfer is shown in the proposed structure .As we can see in fig (7).

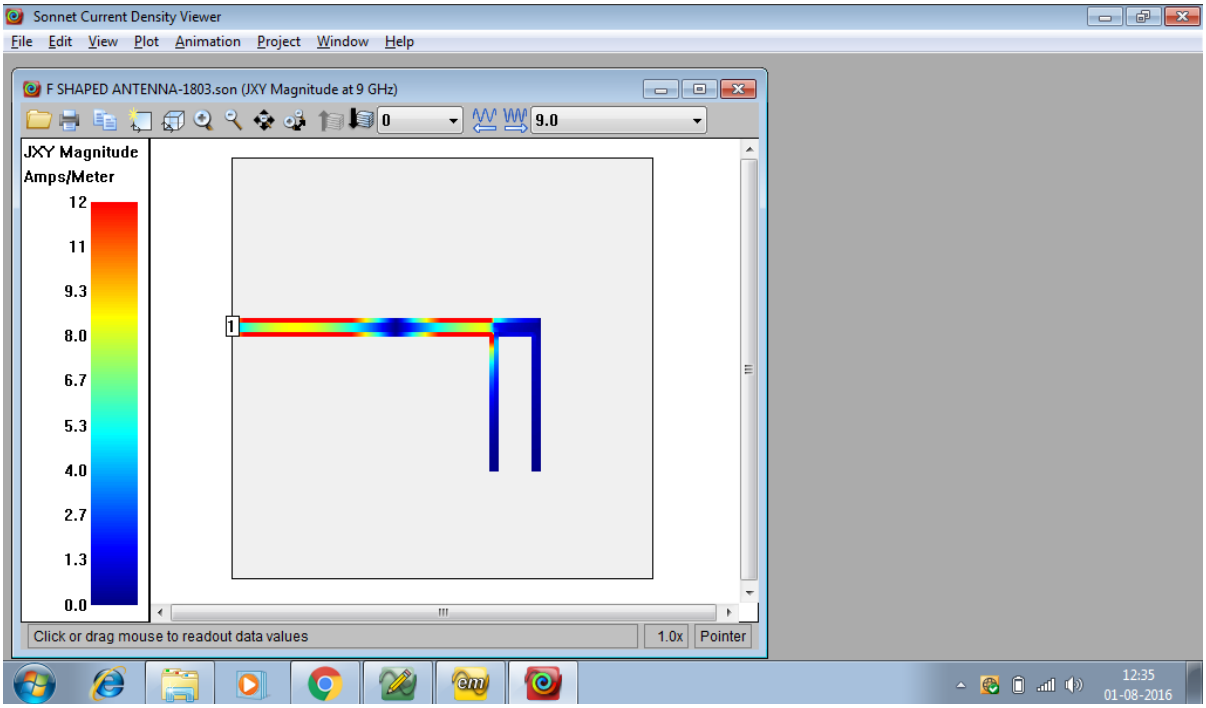

Fig-7: Maximum power transfer in the proposed design

4. CONCLUSION

The planar inverted F antenna is designed successfully. The analysis of the proposed antenna is done by the sonnet software. This antenna element can be easily placed in the mobile phones as there is less space in the mobile phones .The proposed design is having a VSWR less than 2 in the required bands. The radiation pattern is omnidirectional of the antenna.

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