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Design and Analysis of Different Types of Modern Methods Using Line Feed of Microstrip Antenna Using CST Software

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Abstract- Small size wideband microstrip patch antenna with horizontal slot and vertical slot in patch stacked patch and multiple patch is fed through microstrip line is presented. By inserting slot on patch, stacked patch supported by wall and the multiple patch, the bandwidth can improve significantly without significant change in the frequency. The bandwidth before adding the slot and the stacked patch was 5%, whereas after adding the slot and the stacked patch the bandwidth increased ranging from 2.42 to 2.50 GHz. The radiation pattern has acceptable response at both E-plane and H-plane. The ground plane size is 56 mm by 74 mm, the antenna designed is based on FR4 substrate with dielectric constant 4.4.For all that, the design of a microstrip antenna is not always an easy problem and the antenna designer is faced with difficulties coming from a) the inherent disadvantages of a printed resonant antenna element, for example the narrow impedance bandwidth, and b)the various requirements of the specific applications, which concern the operation of the radiating element, and cannot be satisfied by a printed scheme with an ordinary configuration[3]. Moreover, the rapid development in the field of Land Mobile Telephony as well as in the field of Wireless Local Area Networks (WLANs) demands devices capable to operate in more than one frequency bands [4].

Keywords: *Bandwidth, gain, offset, stacking Broadband microstrip antenna.*

I. INTRODUCTION

With the rapid growth of the wireless mobile communication technology, the future technologies need a very small antenna and also the need of wide band antenna is increased to avoid using two antennas and to allow video, voice and data information to be transmitted. Microstrip patch antenna is promising to be a good candidate for the future technology.

Microstrip patch antenna consists of a dielectric substrate, with a ground plane on the other side. Due to its advantages such as low weight, low profile planar configuration, low fabrication costs and capability to integrate with microwave integrated circuits technology, the microstrip patch antenna is very well suited for applications such as wireless communications system, cellular phones, pagers, Radar systems and satellite communications systems [1, 2, 3].

Several designs have been investigated and reported to decrease the size of the antenna [4] and to improve the bandwidth of the antenna [5, 6]. Handset antenna has been reported with wide bandwidth [7]. Half U-slot patch antenna with shorting wall reported in [8] with 28% impedance bandwidth. Double U-Slot patch antenna has been reported recently [9] for WiMAX applications. In this paper, compact size wideband patch antenna with slot in ground plane and stacked patch is proposed. The bandwidth has improved by adding stacked patch and adding a slot in the ground plane. The paper is divided as:
section two, presents the dimensions of the proposed antenna followed by the result of the simulated antenna. Finally, section three provides the conclusion. Results are based on a commercially available CST Microwave studio.

II. ANTENNA STRUCTURE AND RESULTS

The antenna has a very simple structure fed by 50 ohm microstrip line. Fig. 1 demonstrate the dimensions of the antenna. Generally the overall dimensions of the Ground plane of antenna is 56 mm by 74 mm, and the patch dimensions is 28 mm by 37 mm, the selected substrate for this structure is FR4 with dielectric constant 4.4 with height 1.6 mm. In order to improve the

impedance bandwidth performance for the antenna, a 4mm by 2mm slot has been placed on the patch with horizontal and vertical slots and a stacked patch supported with a foam substrate whose dielectric constant 1.01 with height 1.6 mm, which resulted in improving the bandwidth of the antenna, gain polar plot and Smith Chart variation is presented in this paper.

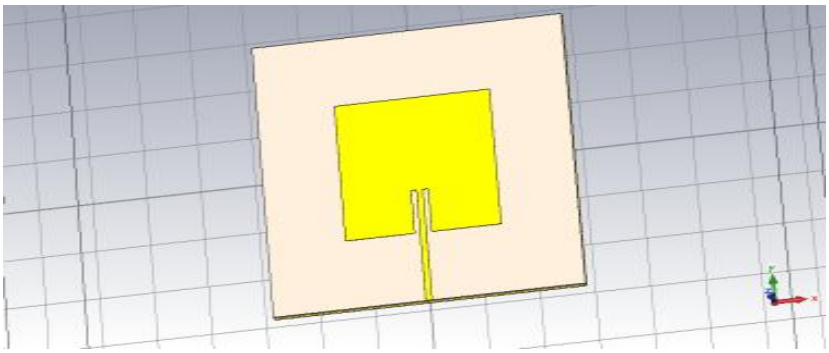

Fig 1:Schematic diagram of patch antenna

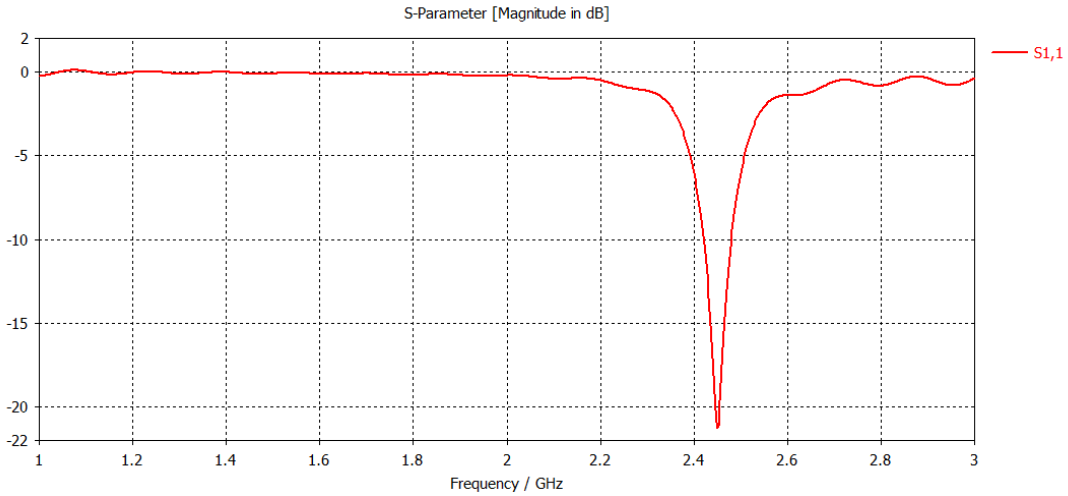

Fig 2:Diagram of S_{11} vs Frequency of Patch Antenna

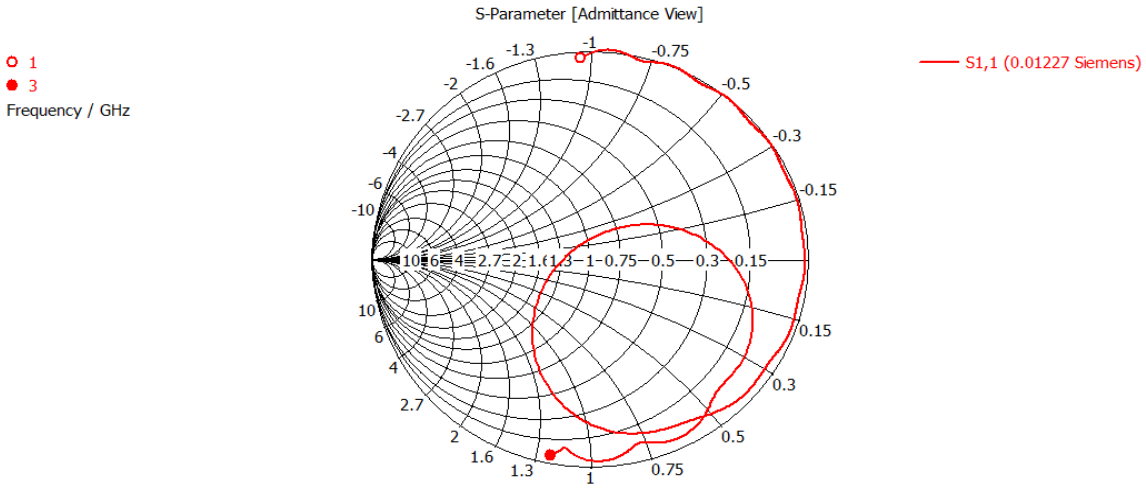

Fig 3:Schematic diagram of Smith of Patch antenna

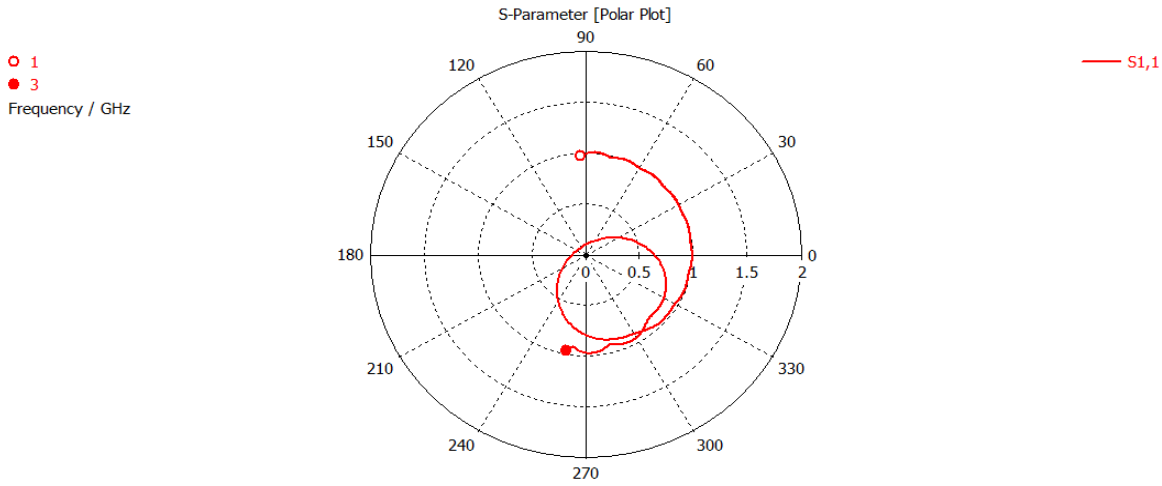

Fig 4:Schematic diagram of S parameter shown in polar plot

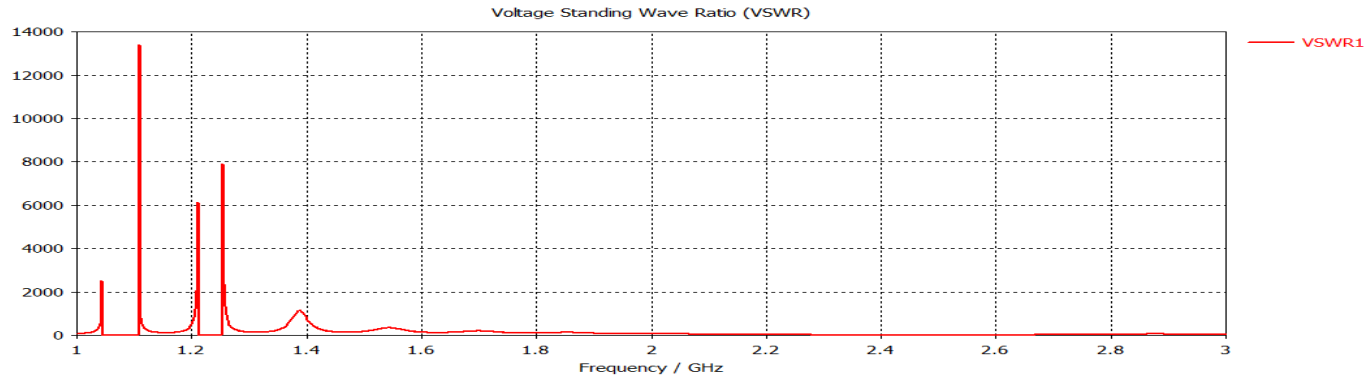

Fig 5:Schematic diagram of VSWR curve

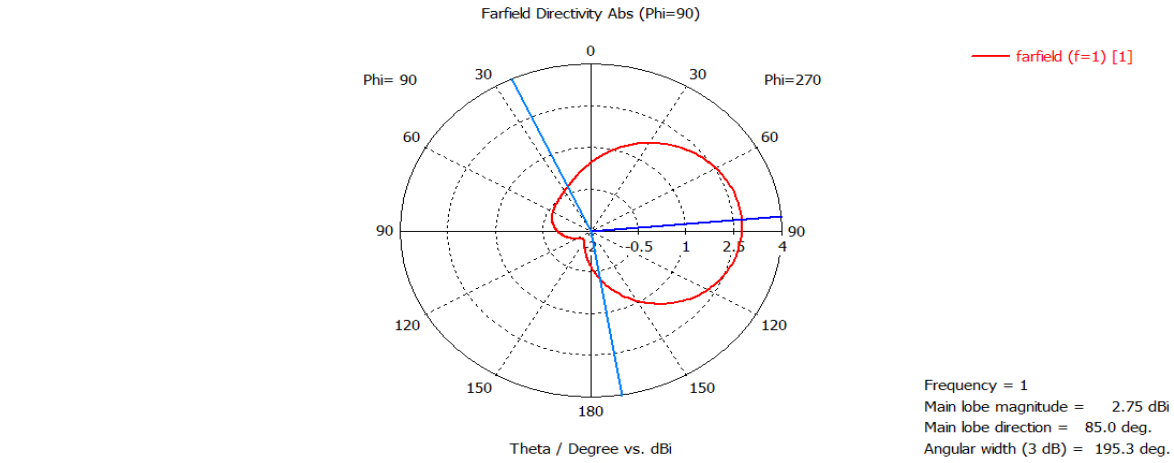

Fig 6: Schematic diagram of Polar plot Patch antenna

The simple rectangular patch shown in fig 1 is simulated using CST Microwave software and optimum results such as Return loss shown in fig 2 has a good depth up to -21dB at resonance frequency of 2.47 GHz and around 5% Bandwidth is achieved and corresponding VSWR shown in fig 5 is observed at frequency range of 2.4-2.52 GHz smith chart shown in fig 3 shows good match of impedance and Polar plot shown in fig 6 have some stability slightly in different direction .

On introducing the horizontal slot in same dimension on patch and simulate it we observe the S_{11} curve as shown in fig 8 shows a shifting on resonance frequency from 2.47 to 2.3 GHz in and corresponding VSWR as shown in fig 9 on same frequency. But Smith chart and Polar plot of S_{11} curve as shown in fig shows some good matching and stability in Boresight direction .If we use the vertical slot as shown in schematic Fig 12 instead of horizontal slot then again frequency resonate at frequency 2.45 GHz as shown in Return loss curve on Fig 13 , its VSWR shown in Fig 14 is less than 2 at same resonance frequency .Smith chart and polar plot of S_{11} shows good variation shown in fig 15 1nd fig 16. There is another method called stacked configuration shown in fig 17 here foam whose dielectric is approximately 1.01 is sandwich in between two layer of substrate whose dielectric value 4.4 of height 1.6mm and obtain a good agreement in between Return loss and impedance matching as shown in fig 18 and fig 21.So there is some stability in polar plot as shown in fig 20 and fig 19 shows the variation of VSWR vs frequency.

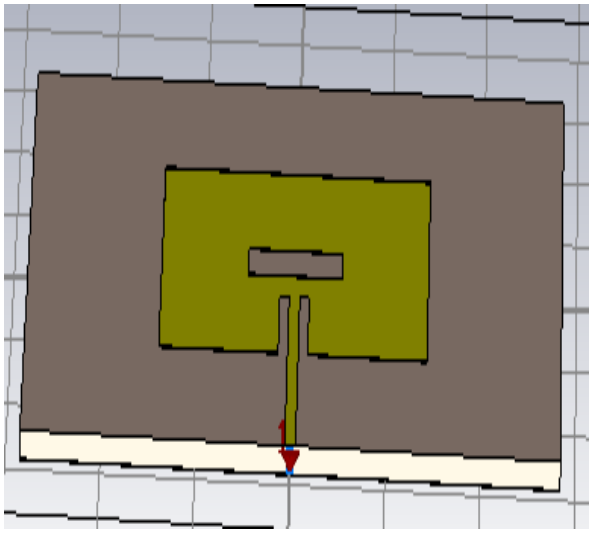

Fig 7: Schematic diagram of Patch antenna with Horizontal slot

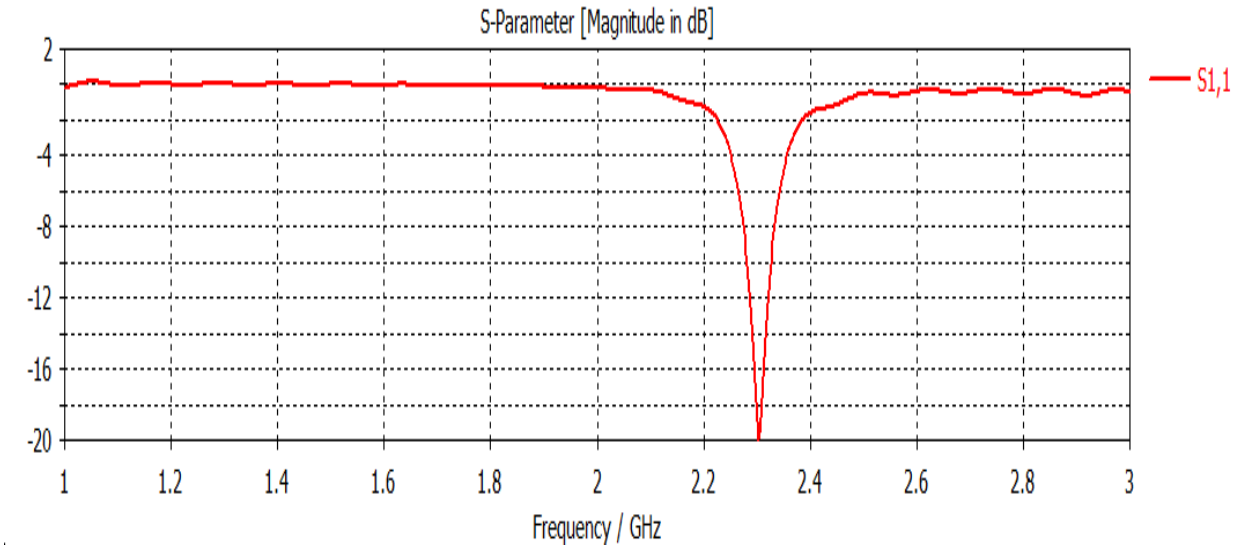

Fig 8:Schematic diagram of Patch antenna with Horizontal slot S_{11} parameter vs Frequency

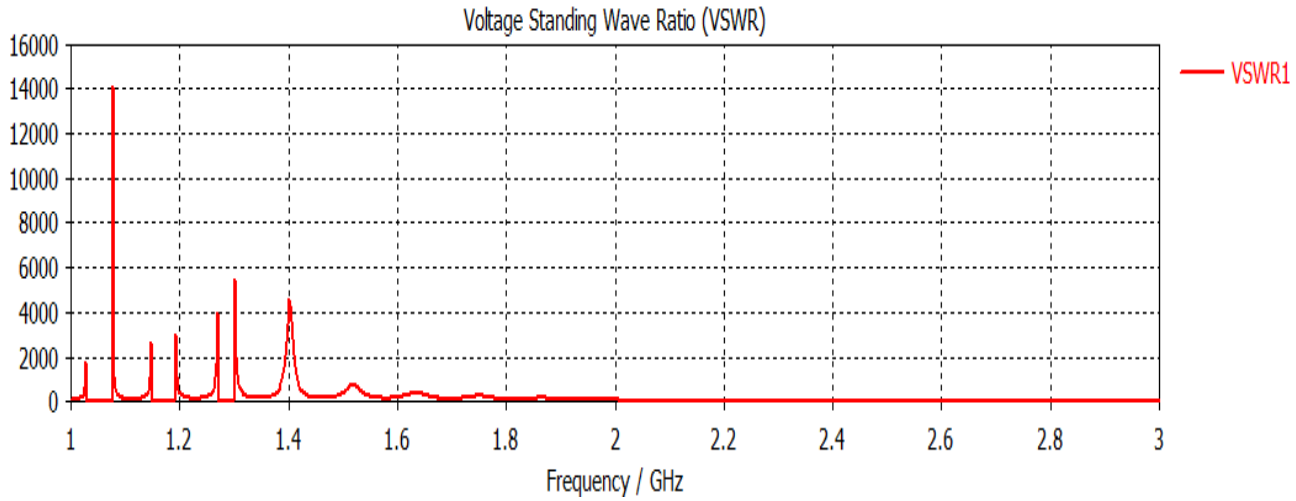

Fig 9:Schematic diagram of Patch antenna with Horizontal slot VSWR vs Frequency

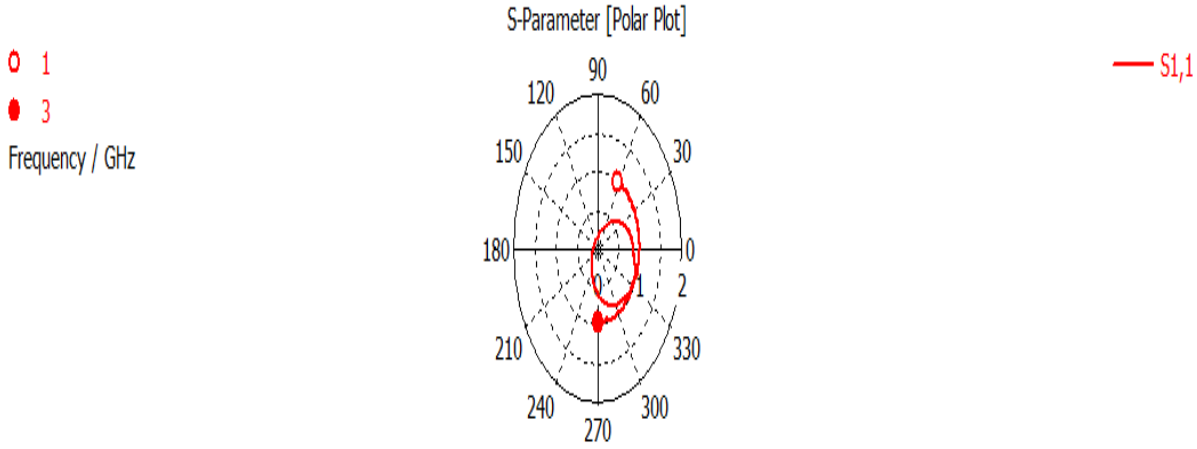

Fig 10: Schematic diagram of Patch antenna with Horizontal slot on S_{11} Polar plot.

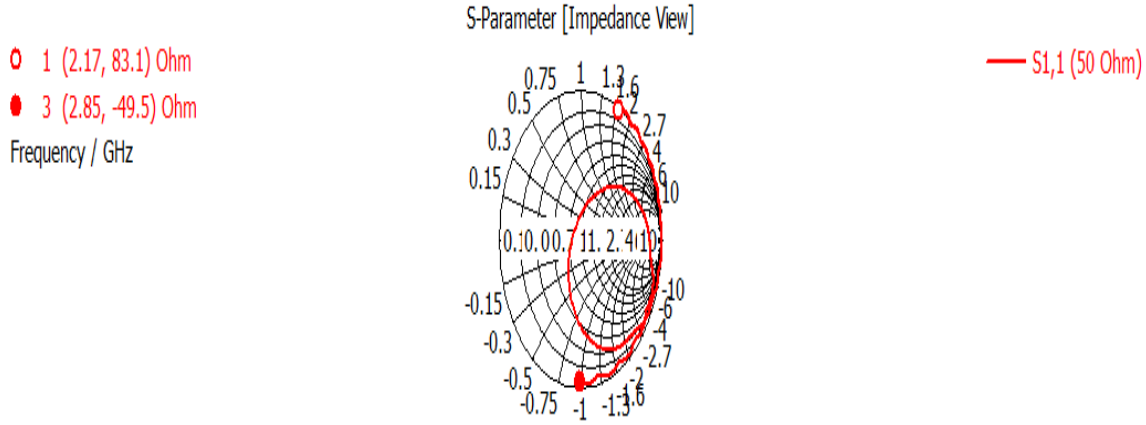

Fig 11:Schematic diagram of Smith Chart Patch antenna with Horizontal slot .

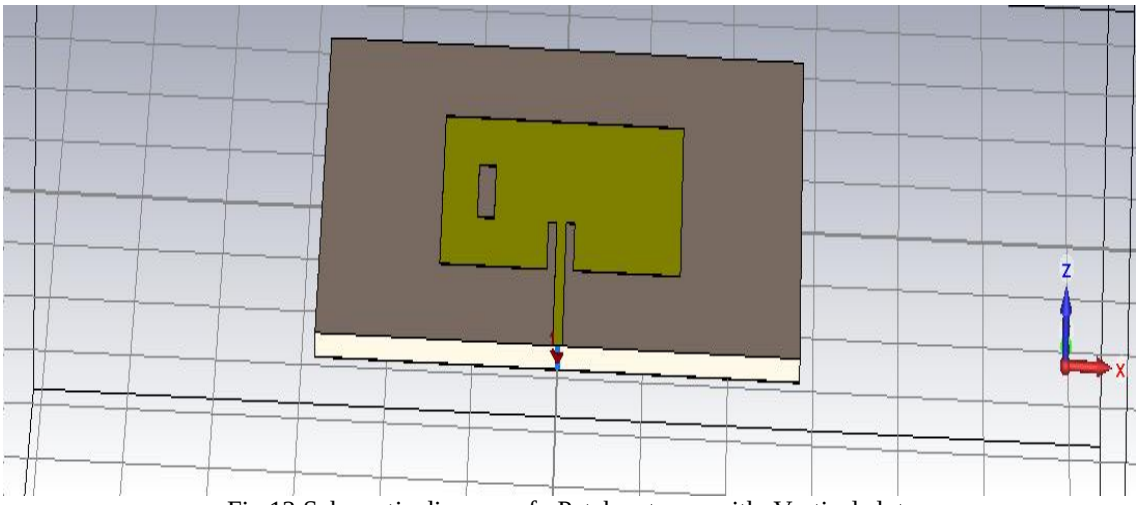

Fig 12:Schematic diagram of Patch antenna with Vertical slot.

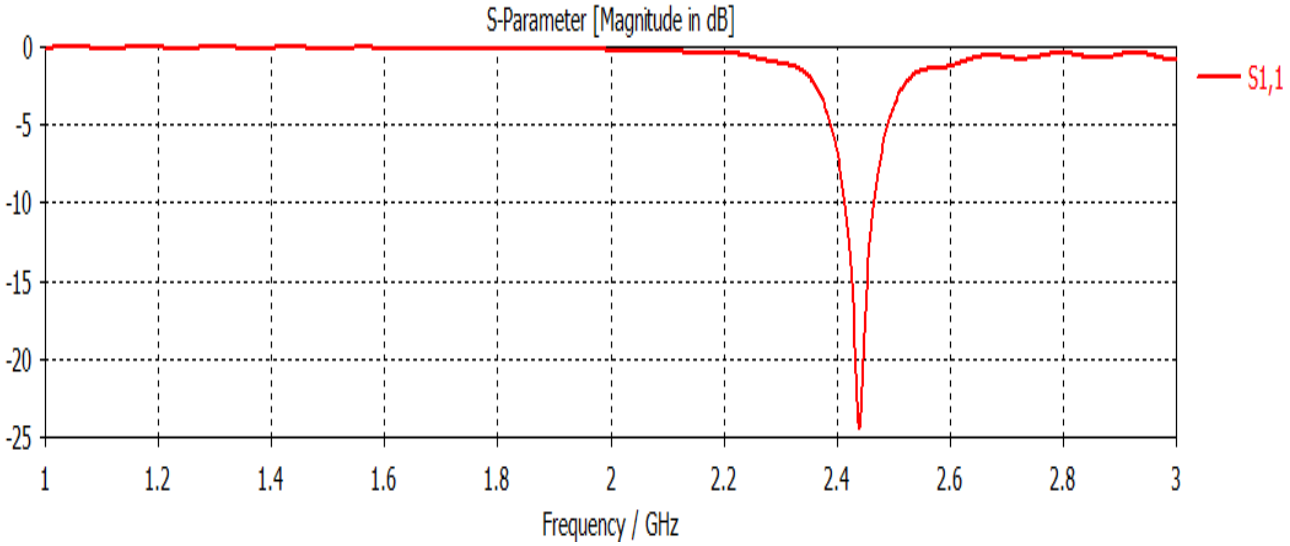

Fig 13: S_{11} parameter vs Frequency of Patch antenna with Vertical slot.

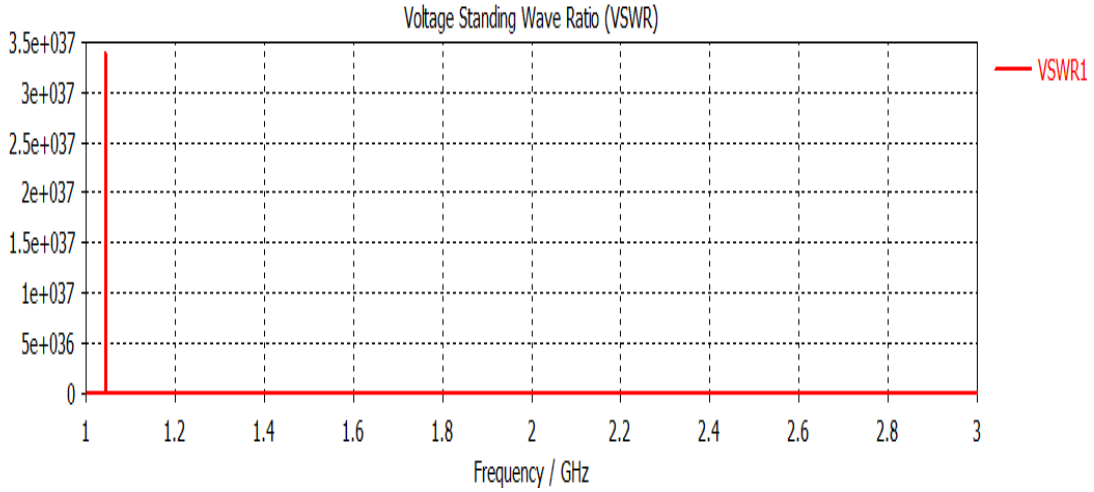

Fig 14: VSWR parameter vs Frequency of Patch antenna with Vertical slot.

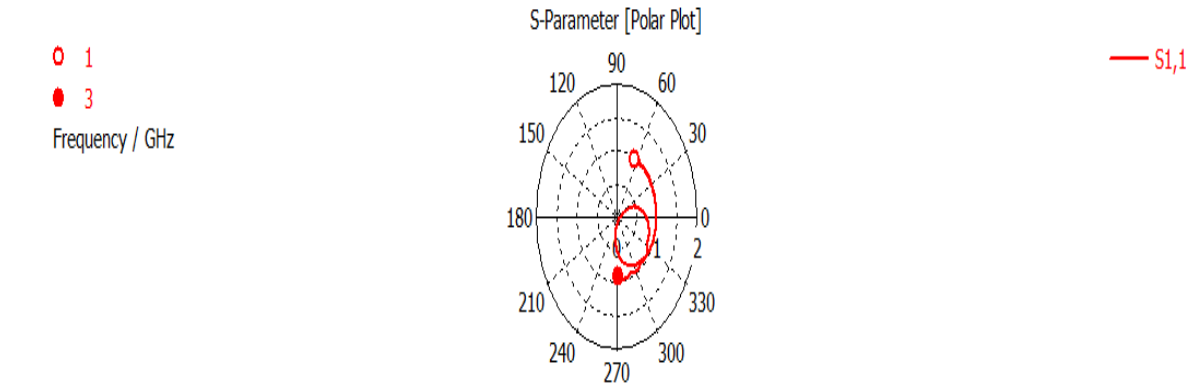

Fig 15: Polar Plot of Patch antenna with Vertical slot .

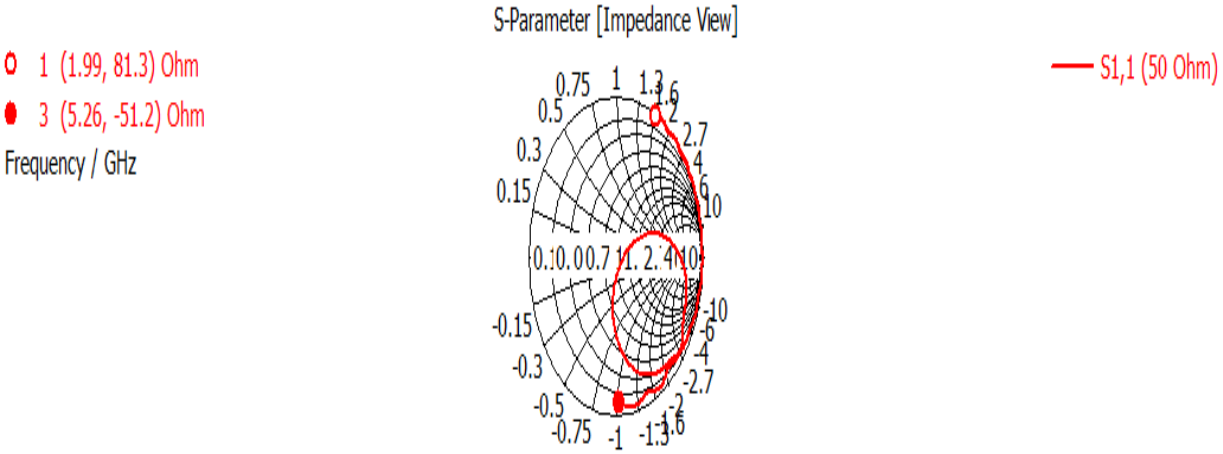

Fig 16: Smith Chart of Patch antenna with Vertical slot

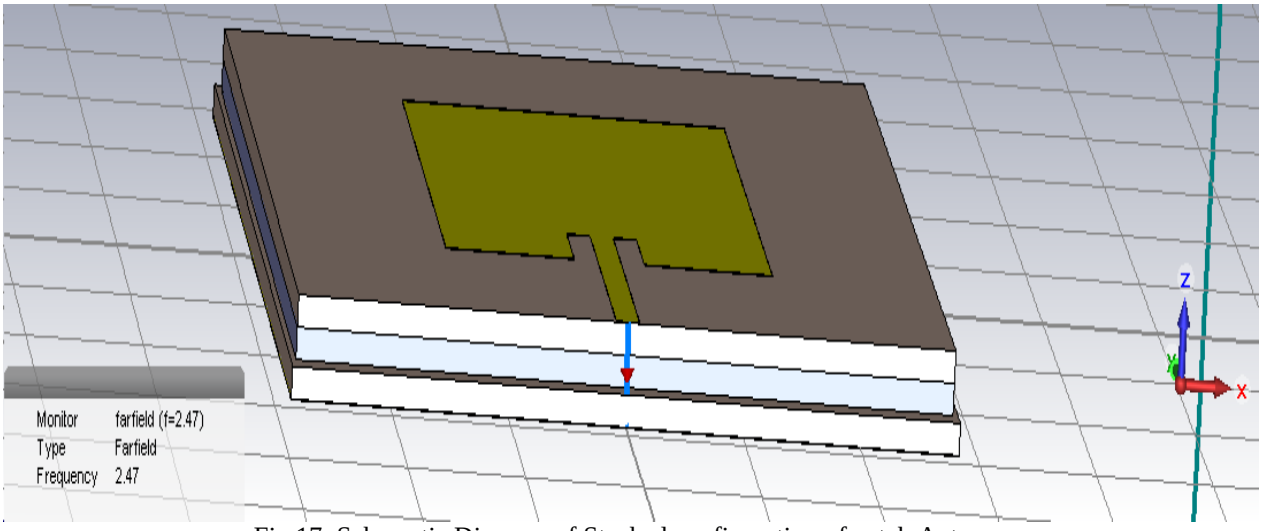

Fig 17: Schematic Diagram of Stacked configuration of patch Antenna

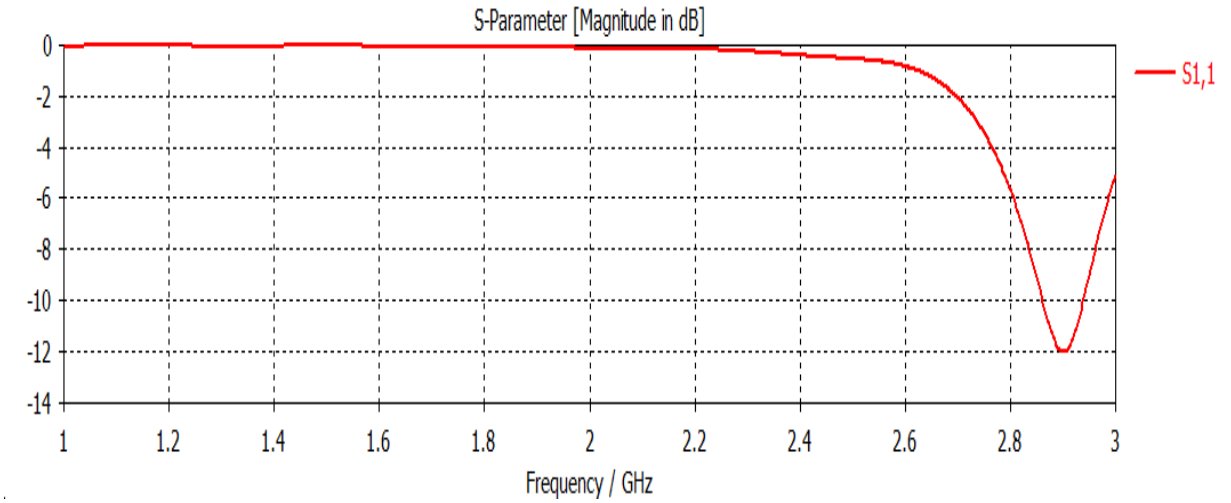

Fig 18: S_{11} parameter vs Frequency variation of Stacked configuration of patch Antenna

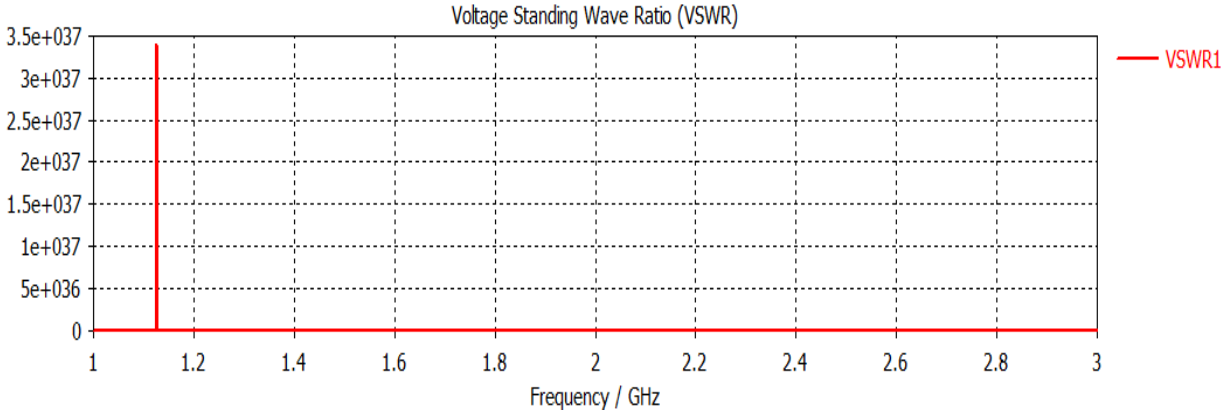

Fig 19: VSWR parameter vs Frequency variation of Stacked configuration of patch Antenna.

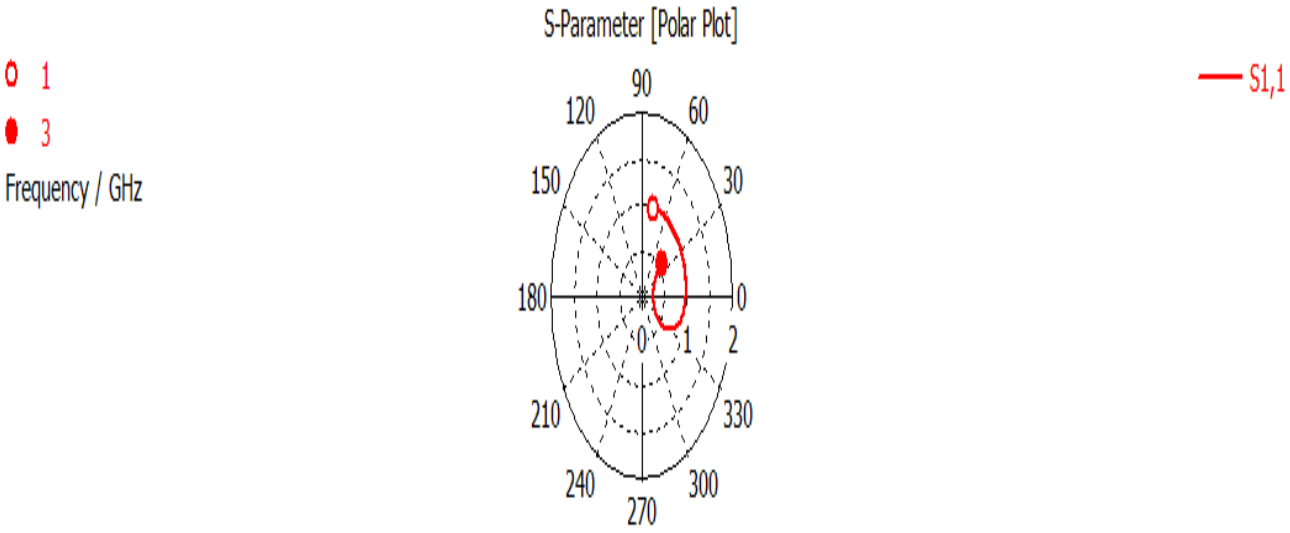

Fig 20: Polar Plot of Stacked configuration of patch Antenna

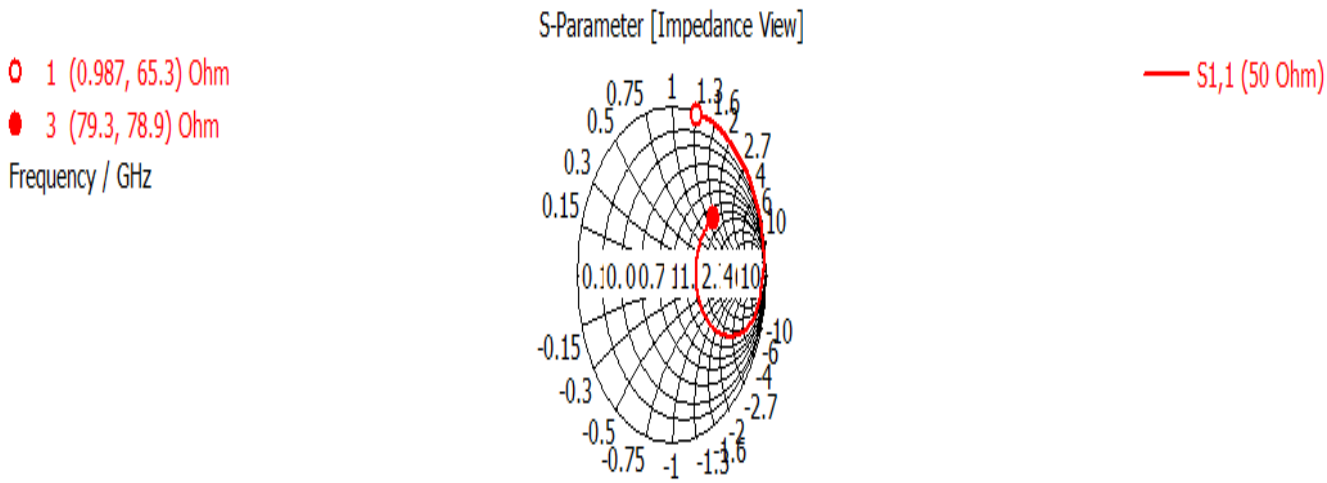

Fig 21: Smith chart of Stacked configuration of patch Antenna.

III. CONCLUSION

A small multi-band and wideband antenna has been introduced. Wideband has achieved by inserting horizontal slot ,vertical slot and stacked patch supported by foam substrate for wireless application band 2.4 GHz to 2.6 GHz. This antenna has a very simple structure printed on FR4 substrate. The total dimension of the ground plane is 56 X 74 mm. The antenna characteristic and radiation pattern are satisfactory for most of the wireless system.

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