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A 2.4 GHz Microstrip Patch Antenna with a Single Slot for WLAN Application

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ABSTRACT- A newly design technique for enhancing Bandwidth that improves the performance of a conventional microstrip patch antenna is proposed. This paper presents a novel wideband slot antenna. The design adopts contemporary techniques; A single slot patch antenna structure. The effect of these techniques and by introducing the novel single shaped patch, offer a low profile, broadband, high gain, and compact antenna element. The result showed satisfactory performance with maximum achievable return loss -37.5db and a fractional impedance bandwidth of 2.3GHZ-2.6GHZ. The design is suitable for mobile communication, satellite communication & WPAN.

I. INTRODUCTION

Microstrip patch antennas have several well-known advantages, such as low profile, low cost, light weight, ease of fabrication and conformity. However, the microstrip antenna inherently has a low gain and a narrow bandwidth. To overcome its inherent limitation of narrow impedance bandwidth and low gain, many techniques have been suggested e.g., for single slot, microstrip patch antennas on electrically thick substrate, slotted patch antenna have been proposed and investigated. In general, the impedance bandwidth of a patch antenna is proportional to the antenna volume, measured in wavelengths. However, by using single slot patch with the walls at the substrate, one can obtain enhanced impedance band width. A simple patch antenna with basic rectangular patch operates in a single frequency band. A patch antenna intended to operate at a center resonance frequency fr mounted on a substrate having dielectric constant εr would have length L and width W of the patch as found from the following equations neglecting the fringing effect.

$$L_{eff} = \frac{c}{2 f_0 \sqrt{\varepsilon_{reff}}}$$

$$W = \frac{\lambda o}{2}\left[\frac{\xi r+1}{2}\right]^{-\frac{1}{2}}$$

and

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

II. ANTENNA GEOMETRY AND DESIGN

A low-profile microstrip slot patch antenna is proposed as shown in Fig. 1. Rectangular geometries were simulated to optimize the performance, starting with a rectangular patch antenna on a rectangular ground plane and ending up with an slot shape, for both the radiator and the ground plane. The conventional shape of slot patch antenna shown in Fig. 1 has a substrate 124.4mm*93.3mm. Slot length of 62.2 mm, width 3.11mm and fr is 2.4GHZ.

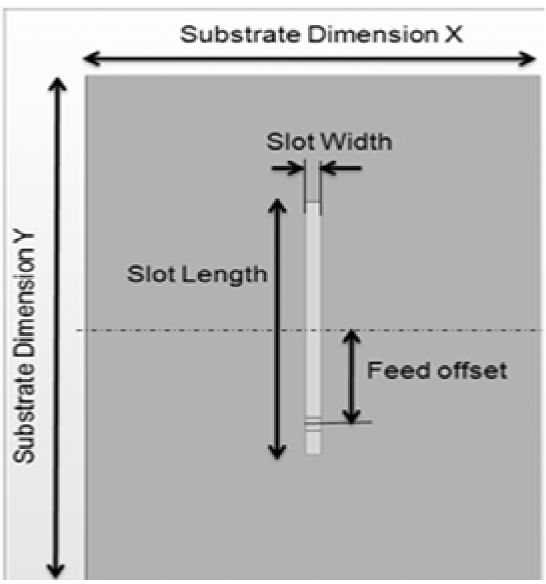

Fig.1: Slot Antenna (Top view)

III. SIMULATION AND EXPERIMENTAL RESULTS

The antenna performance was investigated numerically and experimentally. The simulation was done using the commercial simulator HFSS ver. 13, When the parameters of the proposed antenna are selected as indicated in Figs. 1. Fig. 3 shows the gain of a slot antenna. Gain of the antenna reaches 5dB with an operating frequency 2.4 GHZ.

The overall impedance bandwidth (retum loss reaches -37.5 dB). The measurement results agree well with the predicted ones. The central frequency over the frequency range of interest is 2.4 GHz. The overall antenna thickness is about 62mil. results of the return loss and input impedance behaviour of the proposed single-patch slot antenna frequencies is obtained. Fig. 2 shows the simulated and measured return loss with a single band whose measured bandwidth is 2.3GHZ – 2.6GHZ at -10dB.

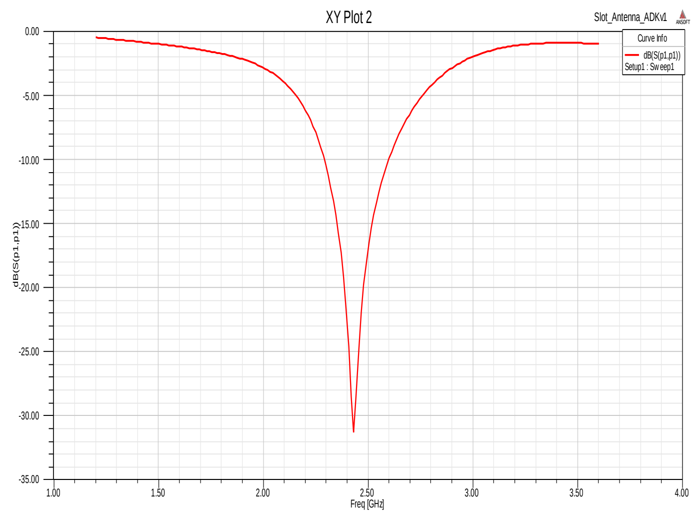

Fig.2: Measured return loss

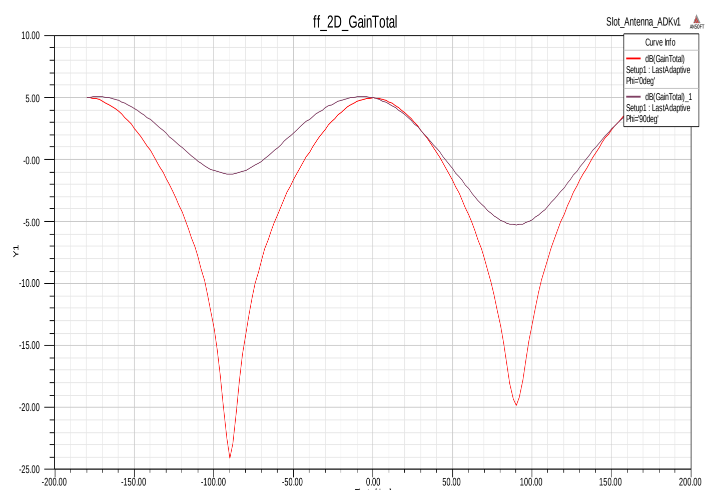

Fig.3:Gain of the Antenna

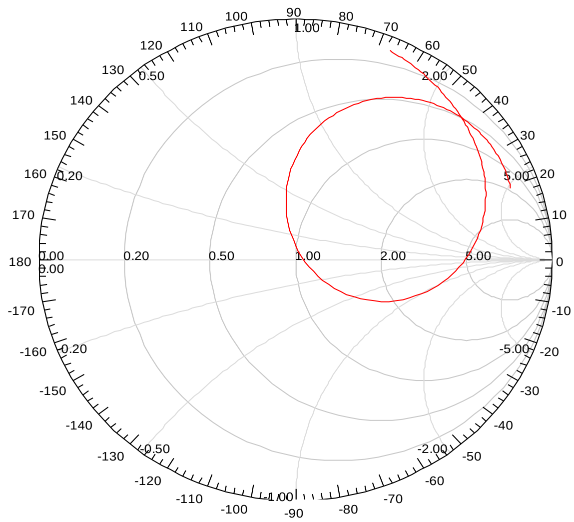

Fig.4 :Smith Chart Radiation pattern

Fig.4 show the smith chart of a slot antenna (radiation pattern), which shows the direction of the radiation from the antenna.which is above 80% in the positive side in the chart that is to good result of the antenna**.**

IV.CONCLUSION

In this paper a novel slot antenna with single-Sub structure, single slot and single frequency operation has been presented. A wide-band multiple slotted stacked patch antenna has been designed for high gain. A novel technique for enhancing bandwidth and gain of microstrip patch antenna is successfully designed in this paper. The proposed microstrip patch antenna achieves a fractional bandwidth of (2.3 to 2.6 GHz) at 10 dB return loss . The maximum achievable gain of the antenna is 5 dBi. By carefully displacing one feed from the principal axes of the single patch delicately, it is possible to realise resonant modes and achieve a wide impedance bandwidth (return loss < - 10dB) over the frequency range from 2.3 GHz to 2.6 GHz.Cause of the good bandwidth and its range it is very suitable for the WPAN and satellite communication applications. The measured and simulated results are in good agreement

V. REFERENCES

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