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A Design of H-Shape Microstrip Patch Antenna for WLAN Applications

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ABSTRACT: *A new high gain, wideband H-shape slot loaded microstrip patch antenna is presented in this paper. The antenna is printed on a dielectric substrate, backed by a metal board, and directly fed from a 50 Ω coaxial cable. Using ADS software package according to the set size, the antenna is simulated. The composite effect of integrating these techniques and by introducing the novel slotted patch offers a low profile, wide bandwidth, high gain and compact antenna element. The computer simulation results show that the antenna can realize wide band characters. With adjusted parameters, it exhibits a broad impedance bandwidth at a frequency of 2.42 GHz.*

KEYWORDS — *Microstrip antenna, wideband, H-shape slot, coaxial probe, ADS*

I. INTRODUCTION

The rapid development of wireless communication systems has increased the demand for compact microstrip antennas with high gain and wideband operating frequencies. Microstrip patch antenna has advantages such as low profile, conformal, light weight, simple realization process and low manufacturing cost. However, the general microstrip patch antennas have some disadvantages such as narrow bandwidth etc. Enhancement of the performance to cover the demanding bandwidth is necessary. There are numerous and well-known methods to increase the bandwidth of antennas, including increase of the substrate thickness, the use of a low dielectric substrate, the use of various impedance matching and feeding techniques, and the use of multiple resonators

In this paper a printed wide-band antenna fed by a coaxial probe is presented. The antenna is simulated using Advanced Design System (ADS) Agilent technologies. The results show the impedance bandwidth has achieved a good match.

II. ANTENNA DESIGN

The dielectric constant of the substrate is closely related to the size and the bandwidth of the microstrip antenna. Low dielectric constant of the substrate produces larger bandwidth, while the high dielectric constant of the substrate results in smaller size of antenna. A trade-off relationship exists between antenna size and bandwidth.

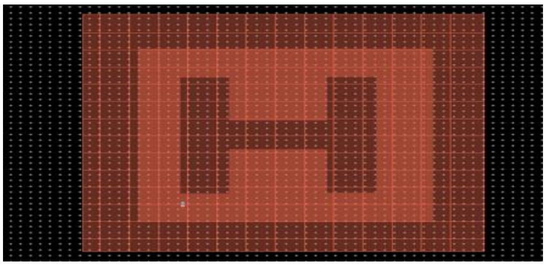


Figure 1: antenna layout in ADS

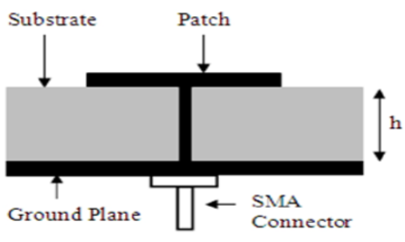


Figure 2b: Side view of the patch

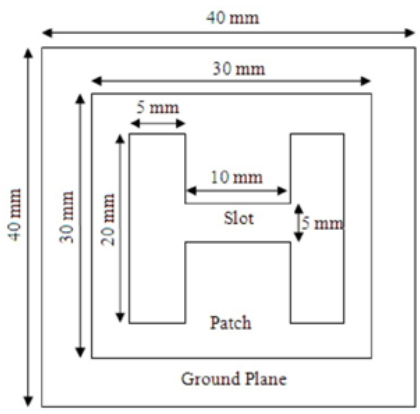


Figure 3: dimensions of the antenna

III. MICROSTRIP PATCH

The following drawing shows a patch antenna in its basic form: a flat plate over a ground plane (usually a PC board). The center conductor of a coax serves as the feed probe to couple electromagnetic energy in and/or out of the patch. The electric field distribution of a rectangular patch excited in its fundamental mode is also indicated.

The electric field is zero at the center of the patch, maximum (positive) at one side, and minimum (negative) on the opposite side. It should be mentioned that the minimum and maximum continuously change side according to the instantaneous phase of the applied signal. The electric field does not stop abruptly at the patch's periphery as in a cavity; Rather, the fields extend the outer periphery to some degree.

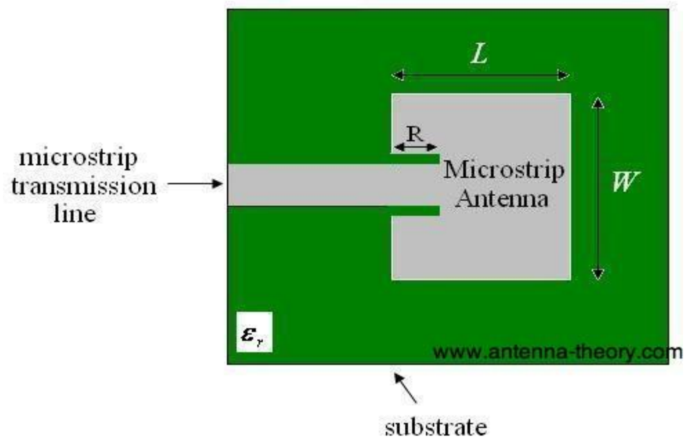


Figure 4: Typical microstrip patch antenna

IV. Design of H Shaped Microstrip Patch Antenna

$$f \cong \frac{c}{2L\sqrt{\varepsilon_r}} \quad (1)$$

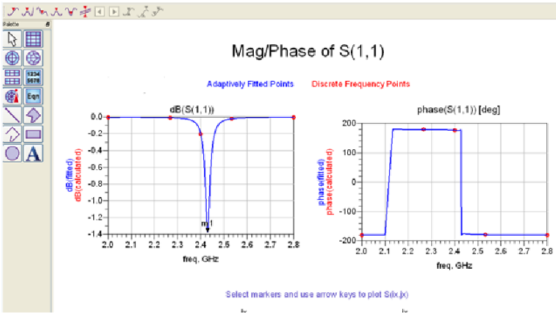
$$W = \frac{2}{f_r}\left(\frac{\varepsilon_r + 1}{2}\right)^{-\frac{1}{2}} \quad (2)$$

$$L = \frac{c}{2 f_r \sqrt{\varepsilon_r}} - 2\Delta l \quad (3)$$

Where f is the resonant frequency of the antenna, c is the free space velocity of the light, L is the actual length of the current, ε_r is the effective dielectric constant of the substrate and Δl is the length of equivalent radiation gap.

The geometries of the H-shaped slot antenna are shown in figure 1. The antenna is built on a glass epoxy substrate with dielectric constant 4.2 and height h of 1.6 mm. A substrate of low dielectric constant is selected to obtain a compact radiating structure that meets the demanding bandwidth specification. The geometry of the top view and side view of the proposed antenna is shown in figure 1 and 2 respectively. The dimensions of the slotted patch are shown in figure (c).

Reducing the size of the antenna is one of the key factors to miniaturize the wireless communication devices. However, reducing the antenna size will usually reduce its impedance bandwidth as well. Therefore designing a small antenna with a wide impedance bandwidth which satisfies future generation wireless application is a challenging work, especially having stable radiation patterns across the operating frequency band In this paper coaxial probe feeding, slot on the patch provide the wide bandwidth and gain enhancement.



V. RESULTS

Figure 5: Simulated output of the proposed antenna

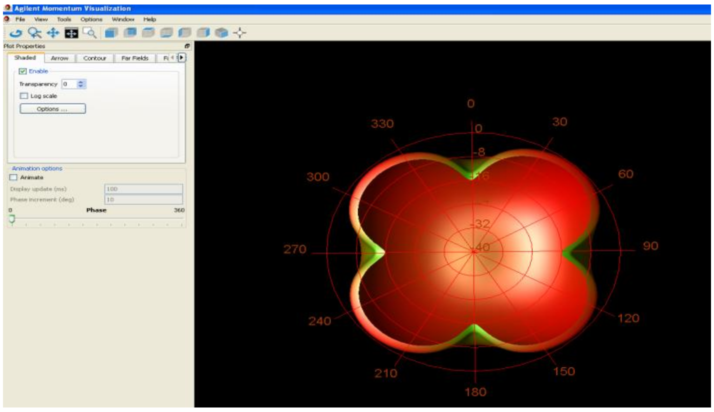


Figure 6: Radiation pattern of the proposed antenna

VI. CONCLUSION

Simulation results of a wideband microstrip patch antenna having 2.42 GHz frequency have been present. Good antenna performance and impedance matching can be realized by adjusting the probe position and the dimensions of the patch. It can be concluded from the results that the designed antenna has satisfactory performance and hence can be used for WLAN applications.

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