Compact Wideband Patch Antenna for 5 and 6 GHz WLAN Applications

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Abstract

A wideband rectangular and circular mistostrip patch antenna for 5 and 6 GHz WLAN applications is presented. The rectangular and the circular patches are fed by microstrip line. All the structure is placed on the same layer with a very simple structure. The impedance bandwidth for the antenna presented 22.41 % ranging from 5.15 GHz to 6.45 GHz. The radiation pattern including E-plane and H-plane is satisfactory within this bandwidth.

1-Introduction

With the great development of the wireless communication, there is an increase demand for wide bandwidth antennas that can be easily integrated with the communication system. the advantage of microstrip patch antenna make them popular in many applications requiring a low profile and lightweight antenna, microstrip patch antennas have very narrow bandwidth normally 1% to 3 %. However, many researches have investigated the design of wide bandwidth for 5 and 6 GHz bands. For example, a wideband patch antenna for HiperLAN2 has been presented [1] with a bandwidth of 8.1%. Also, a multi U-slot Patch antenna has been reported recently for 5 GHz WLAN [2] with 14% bandwidth. U-slot array antenna for 5 and 6 GHz applications with 18% impedance bandwidth has been presented [3]. In addition, wideband Y-shape and V-slot with 21% impedance bandwidth has been reported [4].

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[5,6].

This Paper demonstrate rectangular and circular patch antenna using microstrip feeding line for the 5 GHz and 6GHz WLAN applications. The simulated results show an impedance bandwidth (VSWR<2) of 22.41% ranging from 5.15 GHz to 6.45 GHz, results based on a commercially available Finite Element package HFSS, on the return loss, and E, H plane radiation pattern are provided and discussed.

2- Antenna structure

The geometry and detailed dimensions of the rectangular and circular antenna are shown in table 1 and fig 1. The dielectric substrate is with a relative permittivity (εr =4.4) and a thickness h of 1mm. residing on the surface of a PCB martial which is FR4.

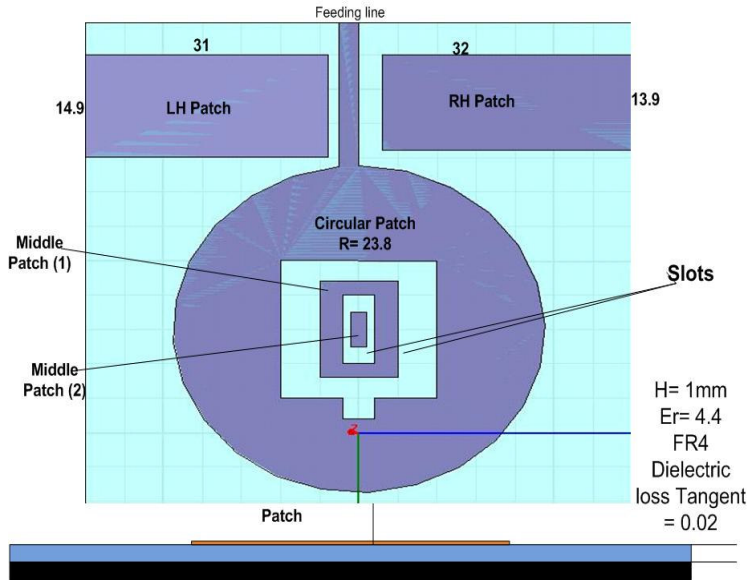


Fig. 1 the structure and detailed diminutions of the proposed antenna (Unit: mm).

	W	L	R
RH side Patch	14.9	31	--
LH side Patch	13.9	32	--
Circular Patch	--	--	32.8
Slot	20	20	--
Middle Patch (1)	14	10	--
Middle Patch (2)	5	2	--
Feeding Line	2.5	20.79	--

Table 1. Dimensions of the proposed Antenna. (Unit: mm).

3. Simulation Results

All the simulation preformed by Ansoft HFSS. Fig. 2 shows the simulated return loss, the simulated band for -10 dB return loss ranges from 5.15 to 6.45 GHz (impedance bandwidth 22.41%). Simulated radiation pattern for 5.15, 5.8 and 6.15GHz are shown in fig. 3.

The simulation in fig. 3 indicate that for H-Plane radiation pattern, the results present a cross polarize radiation below -9 dB for the 5.15 GHz band, whereas at 5.8 and 6.1 GHz below -11 dB. For E-plane, the simulation results present a cross polarizes radiation always below -30 dB in all bands 5.1, 5.8 and 6.1 GHz.

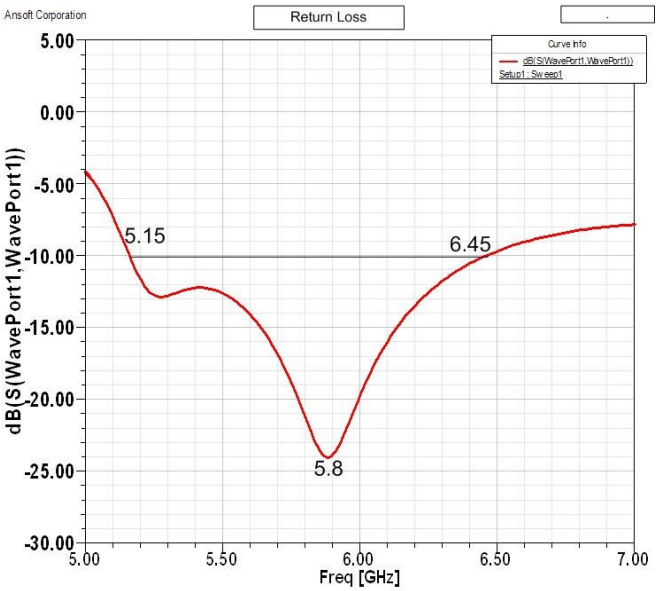
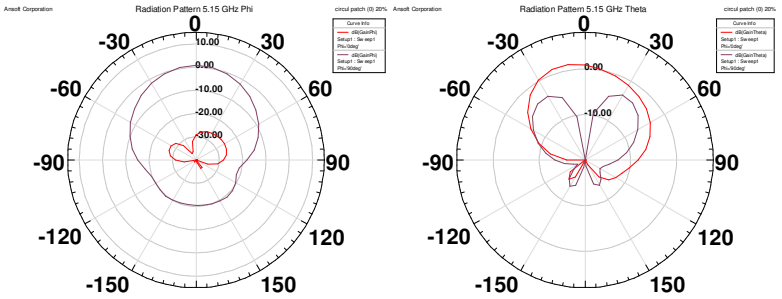
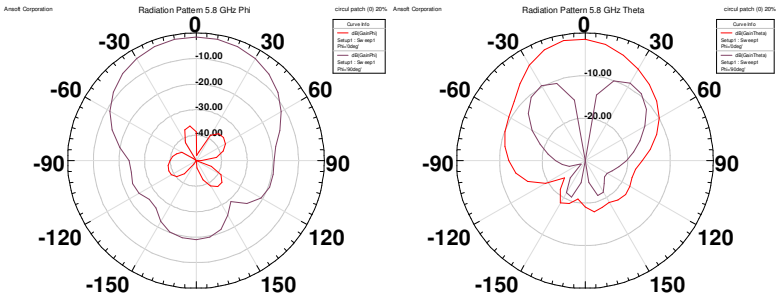


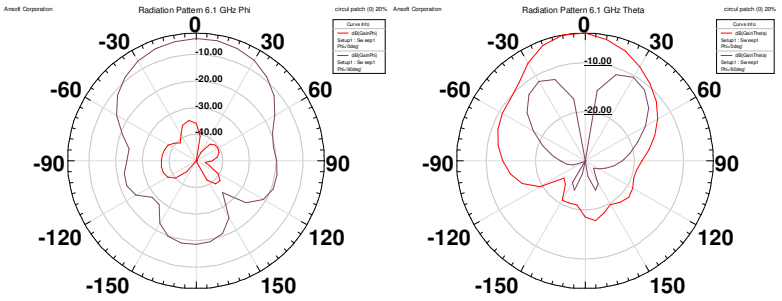
Fig. 2 Simulated return losses of the proposed antenna.



E-plane at 5.15GHz H-plane at 5.1GH



E-plane at 5.8GHz H-plane at 5.8GHz



E-plane at 6.45GHz H-plane at 6.45GHz

Fig. 3. The E-plane and H-plane simulated radiation pattern for 5.1, 5.8 and 6.1 GHz

3- Conclusion

A wideband microstrip patch antenna for 5 and 6 GHz WLAN applications using microstrip feed line is presented. This antenna has a wide bandwidth 22.41% and has very simple structure.

References

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