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Dual Band Circular and Modified Circular Patch Microstrip Patch Antennas for Wlan Applications

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ABSTRACT
This paper presents an efficient design procedure for designing Dual band microstrip antennas (MSA) for WLAN applications using circular patch without any slot. Also this circular patch is modified to get different shapes of patch like hexagon, heptagon, octagon and many more to get the desired dual band MSA for WLAN applications. Computation used in designing is the transmission line method as it offers good physical insight.
The designs are simulated using "CST Microwave studio V10". The paper presents simulated results for return loss, bandwidth, VSWR & gain . The analysis of the simulated results confirms successful designs of Coaxial fed microstrip antennas for WLAN applications.

Keywords: Coaxial fed microstrip antenna, circular, hexagonal, heptagonal, octagonal, nonagonal & decagonal patches transmission line method.

1. INTRODUCTION

In this era of next generation networks we require high data rate and size of devices are getting smaller day by day. In this evolution two important standards are Wi-Fi (WLAN) and Wi-MAX. For success of all these wireless applications we need efficient and small antenna as wireless is getting more and more important in our life. This being the case, portable antenna technology has grown along with mobile and cellular technologies. Microstrip antennas (MSA) have characteristics like low cost and low profile which proves Microstrip antennas (MSA) to be well suited for WLAN/Wi-MAX application systems.
A microstrip antenna has a dielectric substrate having a radiating patch on one side and a ground plane on the other side. The EM waves firing off the top patch into the substrate and are radiated out into the air after reflecting off the ground plane. The feed of microstrip antenna can have many configurations like microstrip line, coaxial, aperture coupling and proximity coupling. But microstrip line and the coaxial feeds are relatively easier to fabricate. However, the microstrip line limits the bandwidth to 2 to 5% as spurious radiations increase with the increase in the substrate thickness. Therefore, we are using coaxial feed[2].
In paper [6] , three different shapes of patches are presented in which the antennas resonate at two different frequencies(2.45 GHz & 5.2 GHz) for WLAN applications. These antennas are having slots cut in the patch to have dual band operation. But in this paper we are presenting six antennas with different shapes of patches which are resonating at same two frequencies but without any slot cut in the patch. So the designs are very simple.

2. GEOMETRY OF THE DESIGNED ANTENNAS

(A) Circular Patch MSA for dual Band

Firstly we designed a simple circular patch antenna which is resonating at two different frequencies i.e. 2.5 GHz & 5.2 GHz [2]. The design is so simple to achieve multi resonance. The structural view of the designed antenna is shown in fig.1.
The dimensions of the designed antenna are shown below with the substrate thickness of 3.048 mm. [6]

Ground size	=55.78×64.4 mm
Substrate size	=55.78×64.4 mm
Circular Patch size of radius	=22 mm
Feed point location	=19.89,32.2
Dielectric constant	=2.2

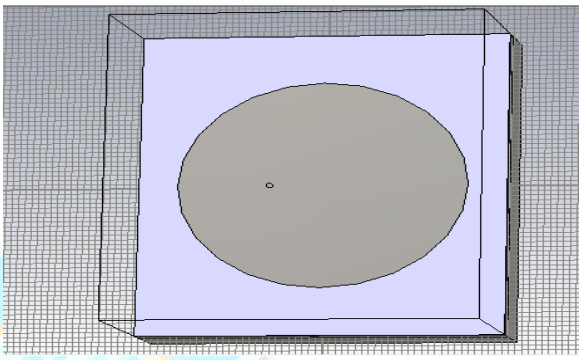


Fig 1 Structural view of the rectangular patch antenna

The results of the designed circular patch antenna are shown below in fig.2.

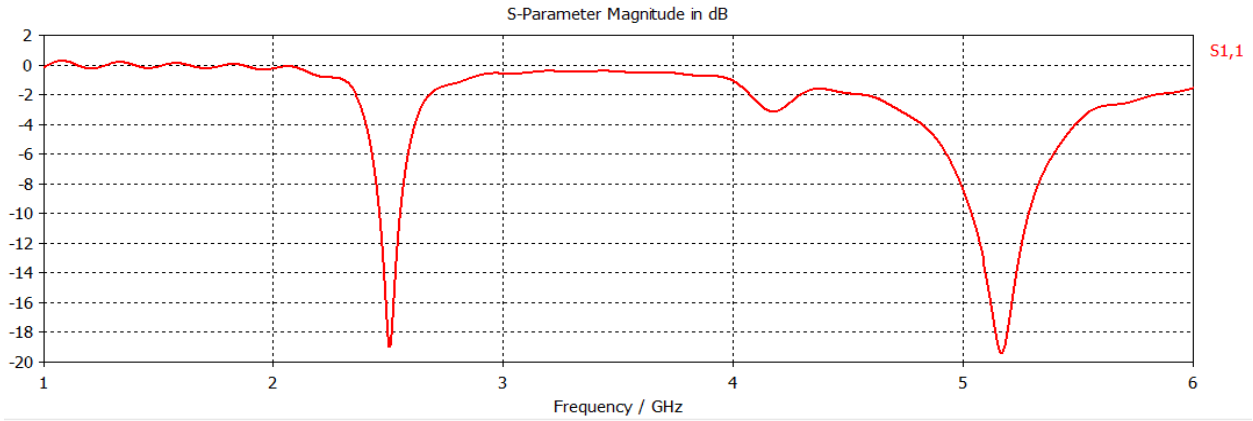


FIG. 2 (A) Simulated Return Loss[s11] of the Dual Band Circular patch antenna

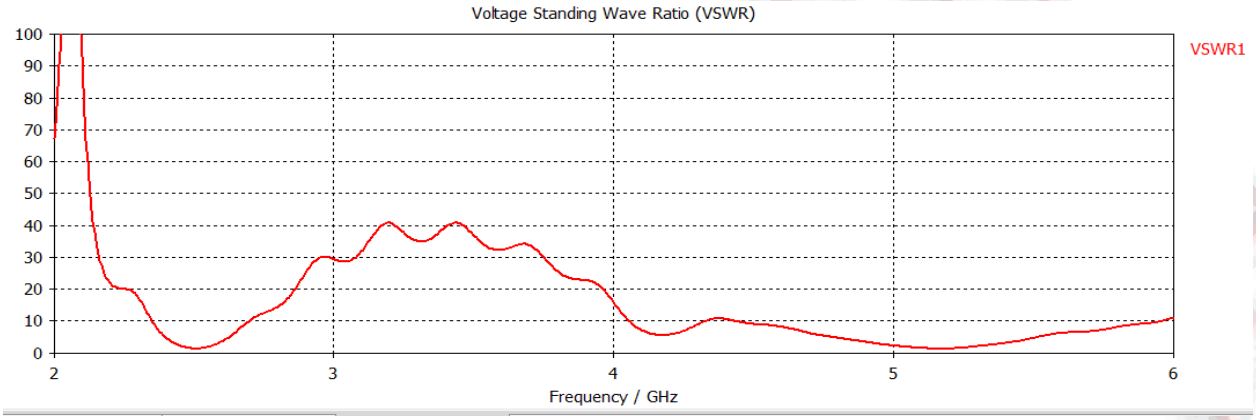
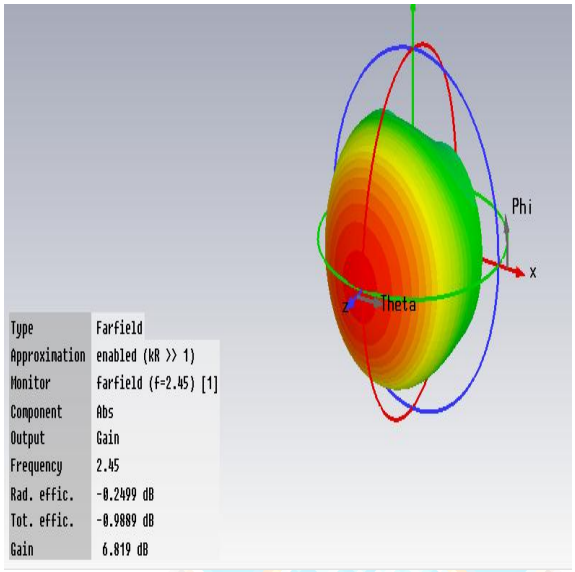


FIG. 2 (B) Simulated VSWR of the Dual Band Circular patch antenna



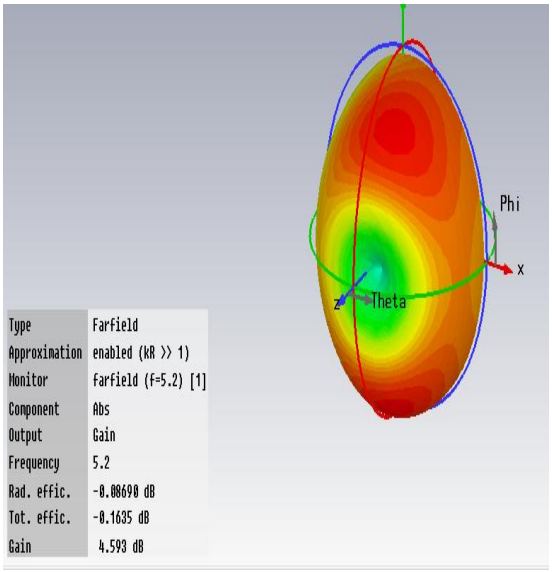
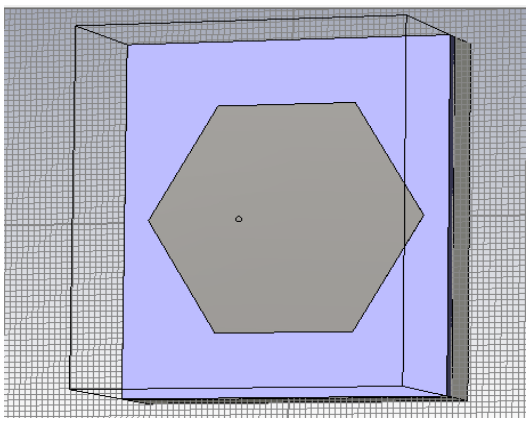


FIG. 2 (C) Simulated Gain at 2.45 GHz **FIG. 2 (D) Simulated Gain at 5.2 GHz**

The fig 2 shows that the designed antenna is resonating at two different frequencies-2.45GHz & 5.2 GHz with return loss -18.96dB & -19.18dB ,Bandwidth 104.8MHz & 277.78MHz , VSWR 1.25 & 1.24 , Gain 6.819 dB & 4.593 dB respectively .

(B) Modified Circular Patch MSA for dual Band

The design shown above is the simple Dual band circular patch MSA for WLAN application . Further we can get the different shapes of patches with some little modifications in the above design. This can be achieved by simply cutting the circular patch in different equal segments. In this paper we have presented five shapes of patches viz hexagonal, heptagonal ,octagonal ,nonagonal & decagonal by selecting the segments of the circular patch as six, seven, eight, nine & ten respectively. Also we have to slightly change the radius of the circle of the above-said shapes to have the resonance at the desired two frequencies that are 2.45 GHz & 5.2 GHz. These are shown in figures 3,4,5,6 & 7.



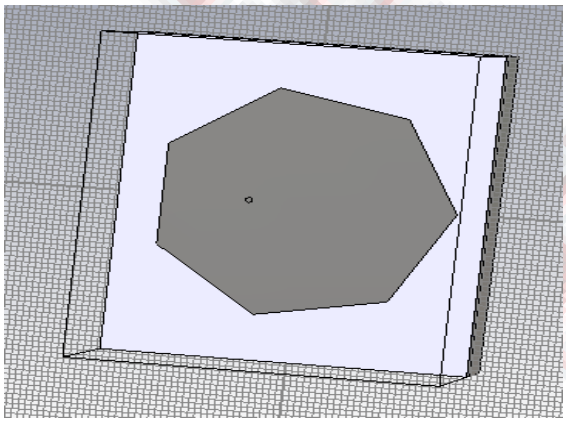


Fig 3 hexagonal patch antenna **Fig 4 Heptagonal patch antenna**

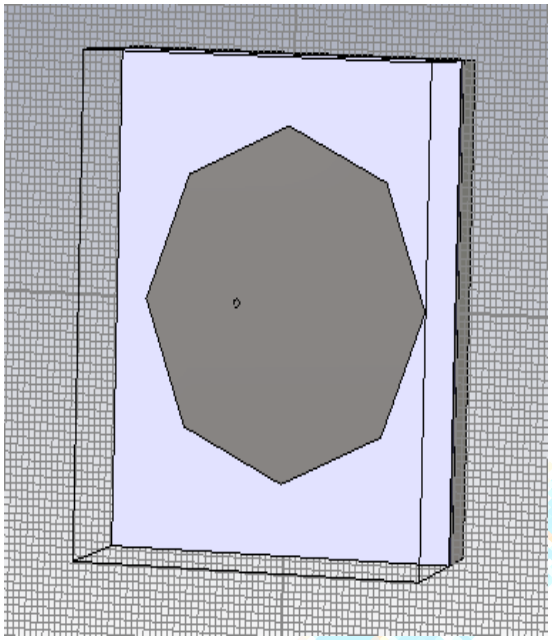


Fig 5 Octagonal patch antenna

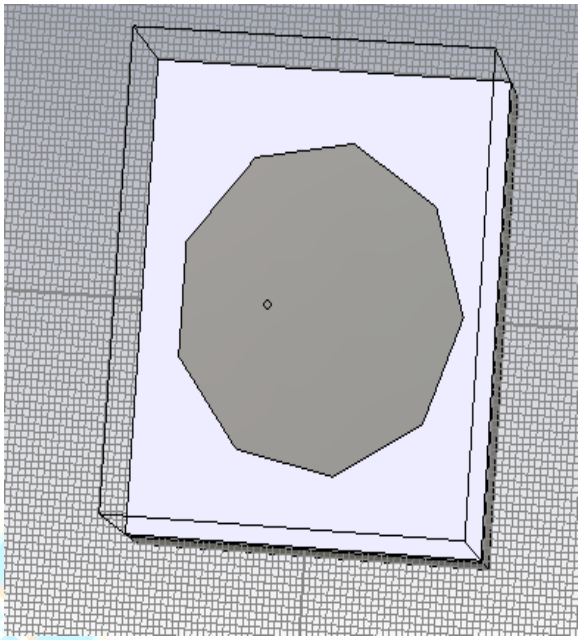


Fig 6. Nonagonal patch antenna

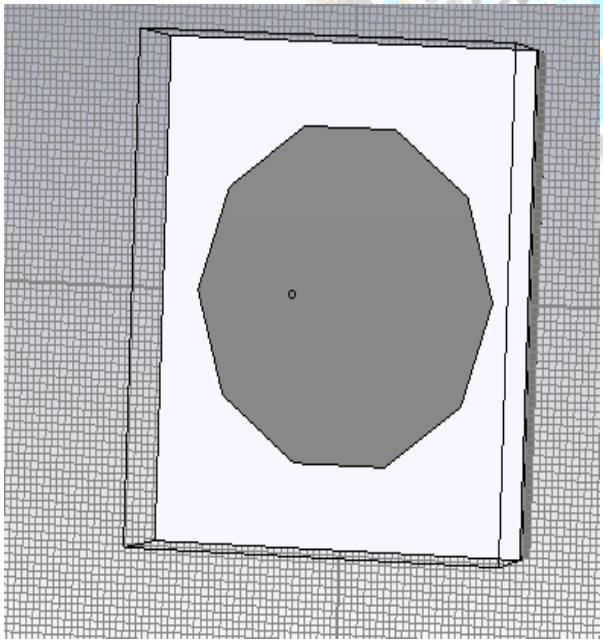


Fig 7. Decagonal patch antenna

3. RESULTS OF DESIGNED ANTENNAS

The designed antennas are simulated using CST Microwave Studio .The simulated results for return loss, bandwidth, VSWR and gain are shown in table 1.

SHAPE OF PATCH	RADIUS OF CIRCLE (IN mm)	FREQUENCY (IN GHz)	RETURN LOSS (IN dB)	BANDWIDTH (IN MHz)	VSWR	GAIN (IN dB)
CIRCULAR	22	2.45	-18.96	104.8	1.25	6.819
		5.2	-19.18	277.78	1.24	4.593
HEXAGONAL	23.7	2.45	-17	95	1.3	6.898
		5.2	-17.5	295.98	1.3	4.828
HEPTAGONAL	23.5	2.45	-17.56	94.34	1.3	6.861
		5.2	-18	262.05	1.2	4.489
OCTAGONAL	23	2.45	-18.30	99.58	1.276	6.864
		5.2	-18.53	267.3	1.268	4.524
NONAGONAL	22.8	2.45	-18.4	104.8	1.27	6.863
		5.2	-17.98	277.78	1.28	4.538
DECAGONAL	22.5	2.45	-18.07	104.8	1.285	6.891
		5.2	-18.69	272	1.26	4.458

Table 1. Results Of The Designed Antennas

4. CONCLUSION

The results are successfully simulated and the designed antennas fulfill the bandwidth requirements for WLAN Applications.

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