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Research Article

Analysis Of Dual Layer Patch Antenna for WLAN Applications

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ABSTRACT
This research is based on developing a dual-layer microstrip patch antenna for WLAN applications. The target frequency for the desired antenna is 5.2GHz. The overall dimension of the antenna is 36×32×3.2 mm^3.To obtain broad bandwidth and gains, several attempts have been undertaken, such as using different heights of the substrate with the same FR-4 material. The results of the simulations were obtained using the CSTMW software 2018.The antenna's benefits include a simple construction, wideband performance, minimal return loss, and increased gains above conventional designs. Throughout this analysis dielectric Fr-4 substrate was used. Finally, it was found from the analysis compared to the single layer the return loss having-17dB with gain 2.94dB and double layer substrate with equal heights (1.6mm+1.6mm) achieved -36.5dB and having gain 4.48dB. From the analysis this proposed antenna well suited for WLAN applications.

Keywords: Analysis, Dual, Antenna, Application

Introduction

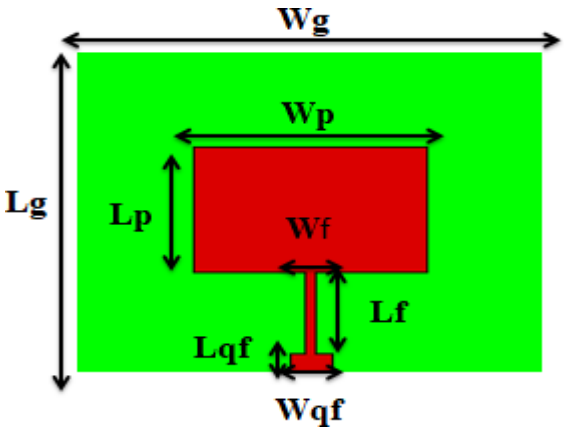
The MPA includes a patch (metallic) element with an intermediary dielectric layer and a ground plane layer. The patch excites an antenna at its resonant frequency, creating considerable radiation, and therefore serves as a resonant cavity. Mobile communication base stations, space borne satellite systems, handheld mobile communication terminals, SAR, WLAN applications, and medical applications all use microstrip patch antennas because of their lightweight nature, compact design, low fabrication cost, and excellent performance. Additionally, they are easily integrated with microwave integrated circuits and can operate in the dual and triple frequency bands. The solution also enables linear and circular polarization to be used, plus it's physically stable when placed on a hard surface and has a reasonably easy impedance matching for its flat surfaces. The drawbacks of its have included reduced gain, limited bandwidth, and surface wave losses due of the high quality factor [1]. In [2] A double- layer rectangular patch microstrip antenna suitable for Bluetooth applications was designed. The air gap between the patch and the ground plane increases the impedance bandwidth and can be used to tune the resonant frequency. In [3] designed a Single and Double Layer microstrip patch antennas for ultra-wideband applications. The design consists of a square patch with a partial ground plane, fed by a50ΩΩ microstrip line. In [4], a triple-layer double U-slot patch antenna with several bands and a small bandwidth was planned. in [5] An edge feed is utilized to feed the intended antenna, and a double layer dielectric substrate is used to improve bandwidth. In[6] designed a triple band multi-layer patch antenna band width. Different dielectric substrates are used and output is analyzed. In [7], a triple-layer double U- slot patch antenna with several bands and a small bandwidth was planned. In [8] This patch antenna was designed to resonate at 2.45 GHz, in a low-profile, unidirectional, dual layer, and narrow bandwidth design. In [19] low-profile dual layer patch antennas with RHCP and LHCP were constructed using single-fed probe structures. A rectangular, dual- layer patch antenna for wireless networking networks is being suggested in this article. The current study focuses on the design and simulation of a dual band dual -layer patch antenna with operating frequencies of 5.2GHz. Two FR 4 dielectric substrates are used.in this dual layer configuration, and their results are also investigated.

Single layer Design Analysis-1

In this section the proposed monopole antenna resonant at 5.4GHz frequency, with substrate one height is 1.6mm, low return loss -29.5dB and with required voltage standing wave ratio (VSWR) is achieved. Fig 1 shows the basic monopole antenna design and b&c depicted the S-parameter results and VSWR results. The surface current distribution at 5.4GHz is shown in Fig .1(d) and radiation pattern shows in Fig. 1(e). The gain 2.94dB is obtained, which is shown in Fig. 1(f). Table.1 shows the dimensions of the antenna

Table 1: Dimensions of the proposed antenna

S. No	Parameters	Dimensions(mm)
1	Wg	36
2	Lg	32
3	Wp	17
4	Lp	11.65
5	Wf	0.725
6	Lf	7.9
7	Wqf	3.1
8	Lqf	2



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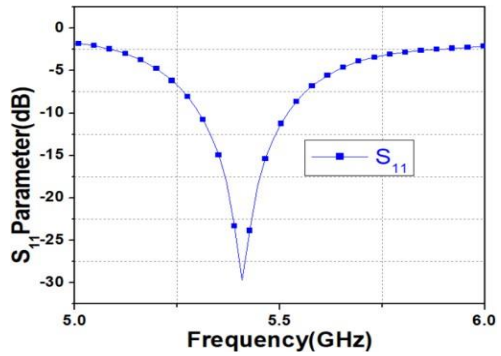

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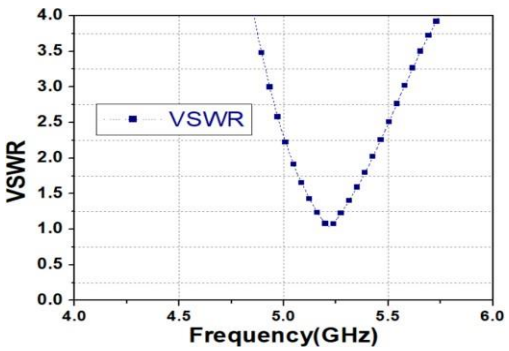

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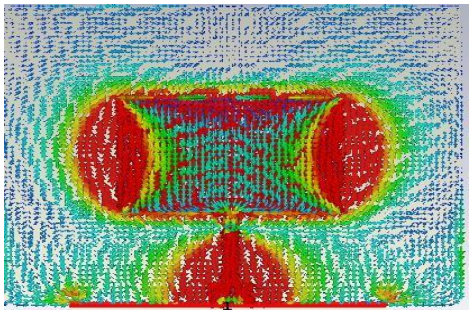

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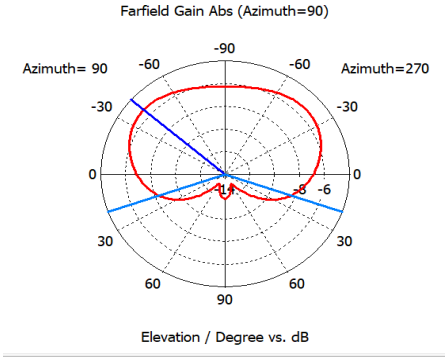

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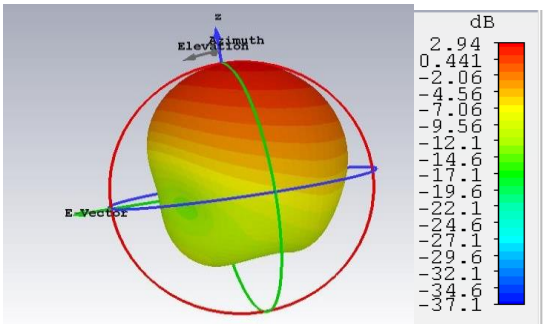
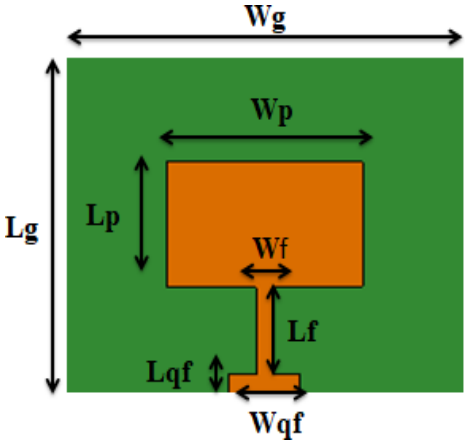


(f)

Fig.1: proposed antenna results with 1.6mm height(a)Single antenna(b) S-Parameters(c) VSWR(d)Surface current at 5.2GHz(e)Radiation pattern(f) Gain

Dual layer analysis with same substrate heights Analysis-2

In this section dual layer monopole antenna is designed at resonates 5.2GHz layer -1 substrate height is 1.6mm and layer two substrate height is also 1.6 mm and feed dimensions changed, with this proposed design return loss -36.5dB is achieved. Fig 2(a, &b) shows the dual layer monopole antenna design Front view, back view and side view. Fig.2(c&d) represented the S-parameter results and VSWR results. The surface current distribution at 5.2GHz is shown in Fig .2(e) and radiation pattern shows in Fig.2(f). The gain 4.08 dB is obtained, which is shown in Fig.2(g). By comparing single layer with the double layer with 1.6mm same two substrate heights exhibits good result shown Fig.2(c-g)



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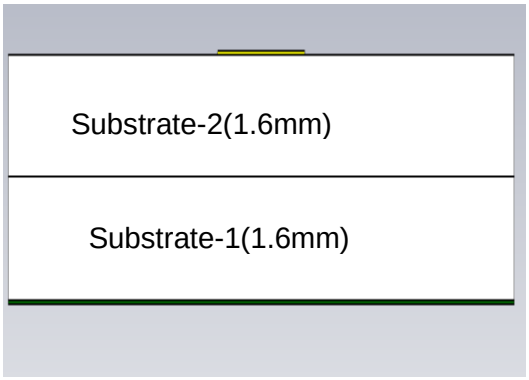

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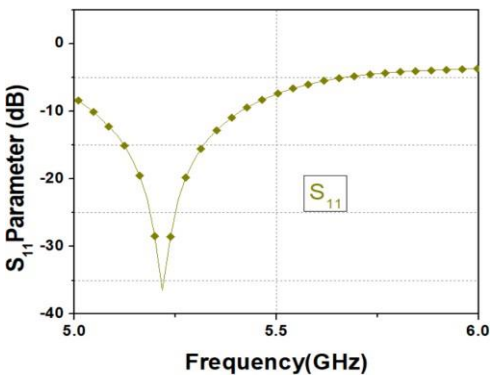

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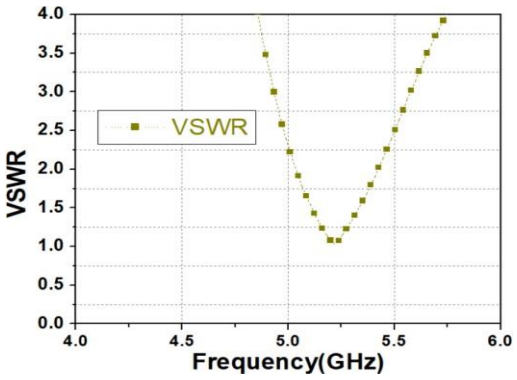

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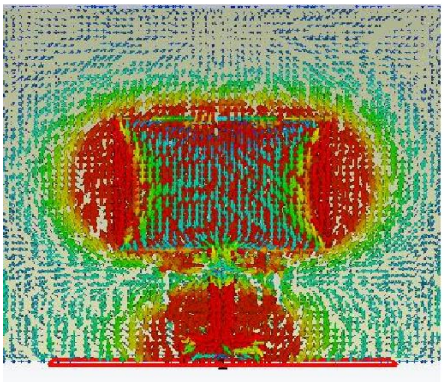

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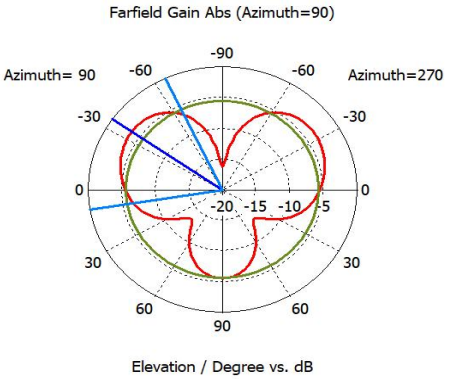
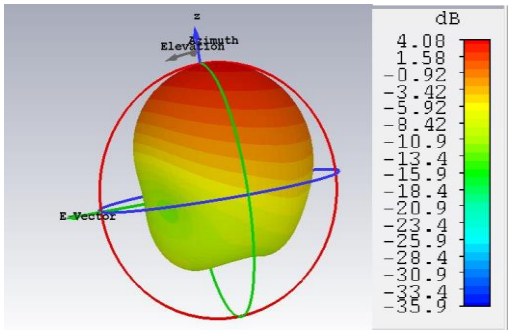


(f)



(g)

Table 2 : Dimensions of the dual layer

S.N 0	Parameters	Dimensions in (mm)
1	Wg	36
2	Lg	32
3	Wp	17
4	Lp	11.65
5	Wf	1.45
6	Lf	8.17
7	Wqf	6.2
8	Lqf	2

(h) Dual layer dimensions

Fig.2: proposed dual layer antenna results with height 1.6mm and 1.6mm Fig.1 proposed antenna results with 1.6mm height(a)Dual layer antenna antenna(b)Bottom view (c) S- Parameters(d) VSWR(e)Surface current at 5.2GHz(f)Radiation pattern(g) Gain(h) Dimensions of the dual layer

Results and discussion

By the observation single layer 1.6mm substrate height satisfies good results as compared to the substrate height 1.6mm.in the analysis of the dual layer two same substrate heights satisfies all the results but as compared to the single layer with 1.6 heights. The comparison table shows analysis of the proposed with single and dual layer.Fig.3 Shows the single layer fabricated antenna and measurement setup. Fig.3 Shows the dual layer fabricated antenna and measurement setup.

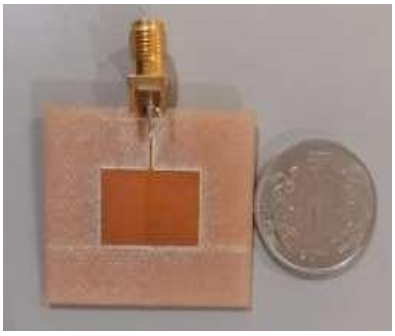


Fig.3: Prototype and measurement setup for single layer

Fig.4: Prototype and measurement setup for dual layer

Comparison table

S.no	Height of the substrate(mm)	Resonant frequency (MHz)	S-11 Parameters(dB)	Bandwidth (MHz)	Gain(dB)
1.	1.6(single layer)	5.2	-29.6	216	2.94
2	1.6+1.6(dual layer)	5.2	-36.5	365	4.48

Conclusion

In this research double layer with same 1.6 mm substrate height antenna achieved good result.so that the proposed dual layer antenna can be used for WLAN applications.

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