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Bandwidth Enhancement of Stacked Microstrip Patch Antenna for WLAN Applications

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Abstract— This research is mainly focus on a stacked microstrip patch antenna by considering different dielectric materials with different substrate heights with quarter wave feed and proximity feed coupling is used for WLAN applications. The quarter-wave-length feeding method is used to provide improved impedance matching the design is simulated using CSTMW 2018.In this proposed designs three different analysis carried out and observed the each parameter. From the findings the antenna are simple structure, wideband performance 5GHz-5.5GHz and low return loss -47dB, with enhanced gains 5.82dB. Finally, it was found from the analysis compared to the single layer with stacked layer substrate with equal heights 1.6mm and 1.6mm achieved low return loss and high gain as compared with substrate 0.8mm and 1.6mm heights. The FR-4 dielectric constant of 4.3, dielectric material was utilized throughout this analysis from the results this antenna is recommended to be used in WLAN applications

Keywords: ***Bandwidth, Dual layer, Gain, patch antenna. Return loss, stacked Layer***

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I. INTRODUCTION

All manuscripts must be in English. These guidelines an antenna is a device that allows electromagnetic waves to be transmitted and received. Radio waves are a term used to describe electromagnetic waves [1]. Antenna design and development to improve communication system performance, particularly for S-band frequencies, which are commonly used for cellular networks and radar surveillance [2].Because of their small physical size, low profile, and ease of production, microstrip antennas are the subject of many studies nowadays [3]. One disadvantage of such an antenna, in addition to its many benefits, is its limited band width [4]. Adding a parasitic radiator to a microstrip antenna will have a significant impact on these concerns. The addition of a parasitic radiator to a microstrip antenna will provide significant improvement with a simple design technique to overcome these issues [5]. The layer staking method of radiating elements is used for parasitic additions. However, because the research has only focused on Adding parasitic radiators to one side of the layer, it's fascinating to observe what happens when you add two sides of the parasitic radiator layer [6]. For this reason, we observe the effect of adding a double layer to increase antenna gain and bandwidth performance [7]. Besides observing this effect, we will also observe the effect of the magnitude of a gap between the parasitic radiator layer and the radiating element [8]. Setting the gap between these layers will increase the gain and bandwidth [9].The present work deals with the design and Simulation of a dual-layer patch antenna to get different bandwidths and dielectric substrates [10].

II. SINGLE LAYER DESIGN ANALYSIS-1

In this section the proposed monopole antenna resonant at 5GHz frequency, with FR4 substrate height is 0.8mm ,which this proposed design , return loss is -17.5dB and with Required voltage standing wave ratio (VSWR) is achieved.Figure1.1 shows the basic monopole antenna design and Figure 1.2 represented the S-parameter results and VSWR results. The surface current distribution at 5.34GHz is shown in Figure 1.3 and radiation pattern shows in Figure 1.4. The gain 2.94dB is obtained, which is shown in Figure1.5.

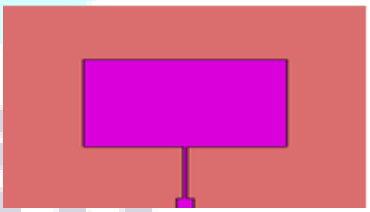

Figure:1.1 proposed antenna results with 0.8mm height Proposed antenna

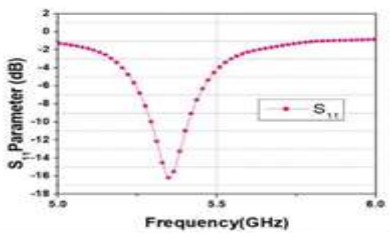

Figure:1.2 S11

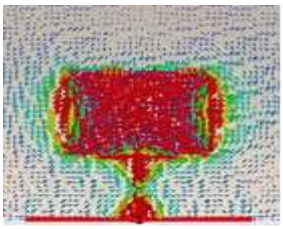

Figure:1.3Current distribution

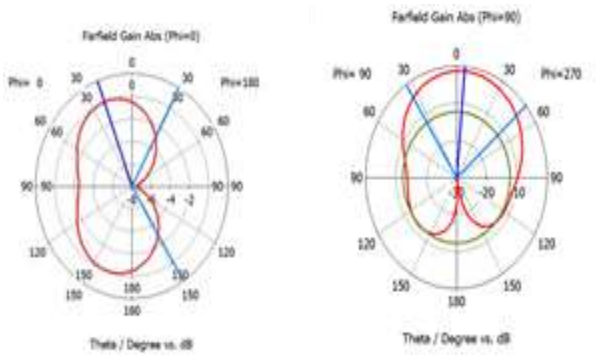

Figure:1.4 Polar plot

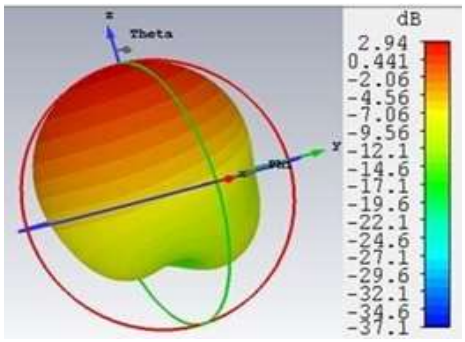

Figure: 1.5:Gain

III. SINGLE LAYER DESIGN ANALYSIS -2

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. Figure 2 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 Figure 2 (d) and radiation pattern shows in Figure 2 (e). The gain 3.48dB is obtained, which is shown in Figure 2 (f).

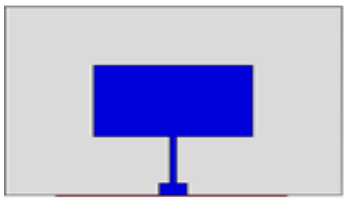

Figure:2.1 proposed antenna results with 1.6mm height proposed antenna

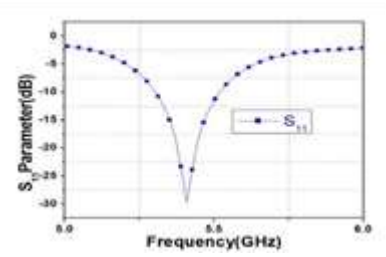

Figure:2.2 S11

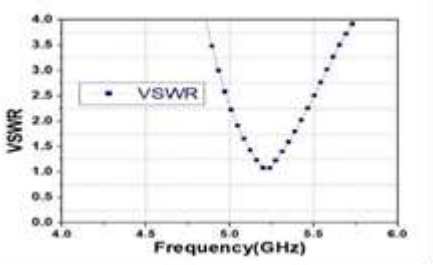

Figure:2.3 VSWR

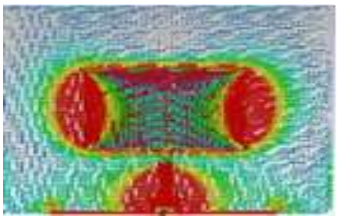

Figure:2.4 Current distribution

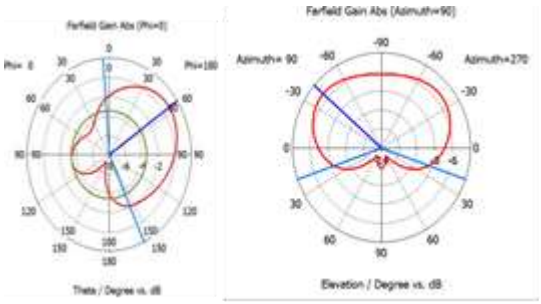

Figure:2.5 Polar plot

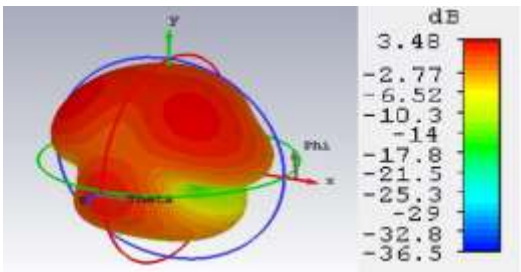

Figure:2.6 Gain

IV. STACKED LAYER WITH DIFFERENT SUBSTRATE HEIGHTS

This section discuss about the stacked monopole antenna resonates at 5.25GHz ,where the RT 5880 is used as a first substrate with height 1.6mm and FR4 layer is used as second substrate with height is 1.6mm.The proximity feeding is used to enhance the operating bandwidth. With this proposed

design return loss -47dB is achieved. Figure 3(a) shows the side view of the stacked layer monopole antenna. Figure 3b and c represented the S-parameter results and VSWR results. The gain 5.82dB is obtained, which is shown in Figure 3 (d). Figure 3e shows the surface distribution of the stacked layer antenna.Table-1 shows the analysis of the proposed designs.

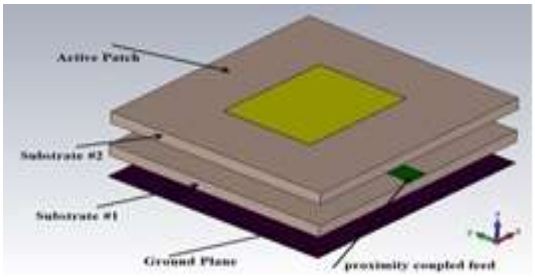

Figure:3.1 proposed antenna results with 3.2mm height

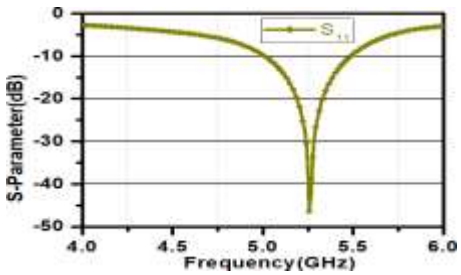

Figure:3.2 S11

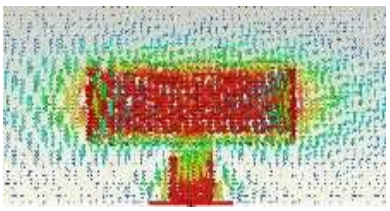

Figure:3.3 current Distribution

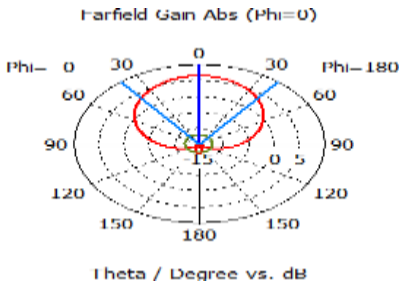

Figure:3.4 E-Plane

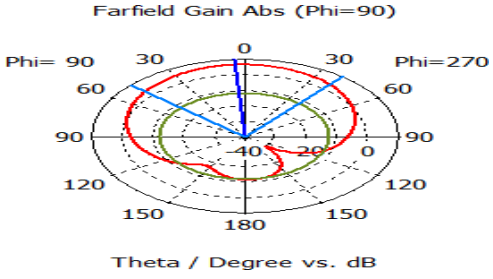

Figure:3.5 H-Plane

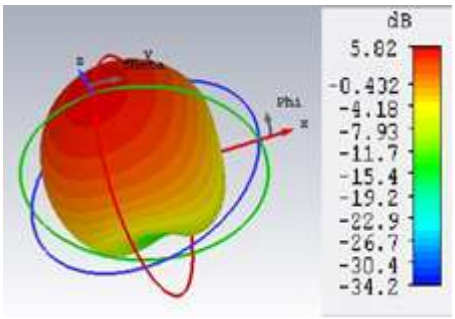

Figure: 3.6 Gain

Table-1 Analysis of the proposed antenna

S.NO	Name of the Parameter	Design-1	Design-2	Design-3
1	Frequency	5.34	5.4	5.25
2	Substrate	FR4	FR4	RT5880& FR4
3	Height	0.8	1.6	1.6and 1.6
4	S_{11}(dB)	-17.5	-29.5	-47
5	Bandwidth(GHz)	5.25- 5.3	5.25-5.5	5.-5.45
6	Gain(dB)	2.94	3.48	5.82

V. CONCLUSION

In this work initially single layer micro strip patch antenna with 0.8mm substrate height is designed and observed that all the required parameters of the antenna was observed than after that dual layer antenna with 1.6mm substrate is used from that results of the two proposed designs it was found that

The bandwidth is extended from 5.2GHz-5.5GHz.For further improvement stacked layer with proximity coupling is proposed ,with two different substrate heights and substrate materials, with this proposed design very low return loss and extended bandwidth is obtained from 5GHz-5.45GHz.So that the design can be used for WLAN applications at 5.25GHz frequency.

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