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A Comparative Analysis of Variation Between Feed Patch and Parasitic Patch of a CPW Microstrip Antenna

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Abstract— ***A CPW fed microstrip antenna with triple band is presented. Two different radiating microstrip line are kept near the fed microstrip line structure. The new radiating antenna obtained has shifted frequencies bands at left side. The analysis of radiating structure by varying the gap fed patch and microstrip line is done. As well as comparisons of four antennas are given along with radiation pattern are presented. The simulation results have been done using software AWR Microwave office.***

Index Terms— ***Coplanar wave guide (CPW), Microstrip patch, triple band, dual band.***

I. INTRODUCTION

Nowadays microstrip antennas are the part of many electronic devices such as mobiles and other wireless devices.. A higher bandwidth is required for the efficient operation of the of such devices. A lot of antenna came into existence but particularly those antennas are of importance which draw low power, are smaller in size, and can be easily fabricated on printed circuit board, i.e., patch antenna. The microstrip patch antenna came into existence during 1950's, and after that much research has taken place in this field and antennas like planar inverted F shaped (PIFA), inset feed, proximity feed, aperture coupled are now in existence. In these antennas, several techniques have been used to enhance the bandwidth of patch antenna. The techniques like cutting notches, slots, stacking, aperture and proximity couple techniques are widely used[1-6]. The most efficient technique is CPW feed which provides a high bandwidth enhancement [7-8] to the microstrip patch antenna. Firstly, CPW fed was reported by Lee et al. in year 1992 [9] and later various scientist and researcher report have reported antennas such as back-to-back rectangular-patch [10],CPW-fed microstrip patch quasi-optical [11], single-layer CPW-fed active patch [12], compact CPW-based single-layer injection-locked active [13], monopole antenna for GSM and WLAN applications [14], and compact UWB microstrip antenna. In these reported papers a comparative study between different radiating structures have not been reported and also for complex design structures the design formulas and circuit diagrams are not presented.. In this paper, antenna is redesigned using AWR and the results obtained are compared with similar simulated radiating structure as reported in [15-16]. Complete analysis of different radiating structures along with results and conclusions are discussed in the next section.

II. ANTENNA DESIGN

Antenna designs are shown in Figure 1. Antenna1 is designed in such manner that it has two microstrips of dimension $L_m \times W_m$ and $L_n \times W_n$ attached in series after that a patch of dimension $L_p \times W_p$ is attached. Further, this antenna is modified by inserting two similar microstrips of dimensions $L_m \times W_m$ is kept on both sides of antenna 1(a) as shown in Figure 1 (b). The dimensions of the antenna 2 (shown in fig. 1(b)) are modified by adjusting the gap (g_m) between the feed patch (W_m) and the parasitic patch. The gap (g_m) between feed patch and the parasitic patch is varied, for antenna 3 g_m is at 2 mm whereas antenna 4 g_m is at 4 mm.

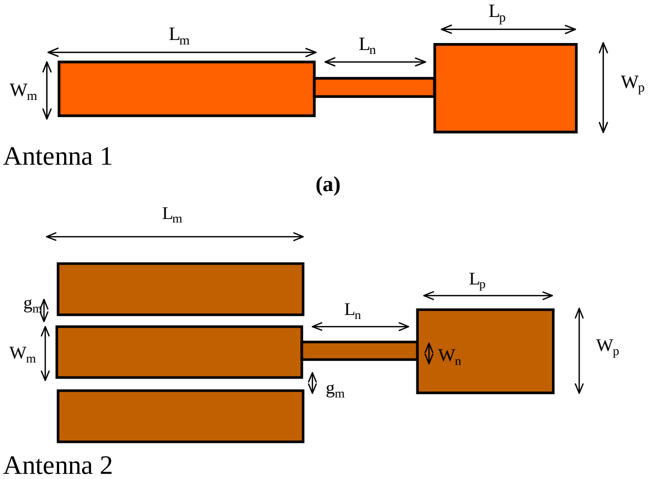

Figure1. Proposed antenna geometries.

Table-Design specifications of antenna 1-4

L_m	W_m	L_n	W_n	L_p	W_p	g_m	h	ε_r
28	4.86	5.34	1.42	11.85	8.77	1	1.57	2.2

III. RESULTS AND DISCUSSIONS

The return loss of the antenna 1 is shown in figure 2. It is found that antenna 1 resonates at three resonating frequencies from 1 to 11 GHz, i.e., at 1 GHz, 3.9 GHz, and 7.9 GHz. These entire frequency bands are of physical importance in wireless communication.

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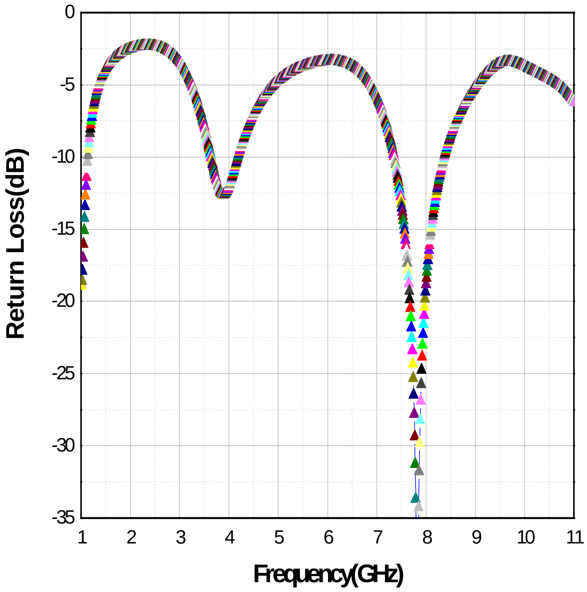

Figure 2 Return loss versus frequency for antenna1.

Figure 3 shows the plot of return loss versus frequency for antenna 2 (g_m =1mm). It is observed that after inserting the microstrip (acting ground plane) near the fed microstrip, the higher order band that was obtained at 7.9 GHz has been shifted towards right side and it starts begining at 6.9 GHz. Similarly, second order band is shifted towards lower side and it is obtained at 3.4 GHz. Here, gap between the fed patch and the parasitic patch acts as a ground plane.

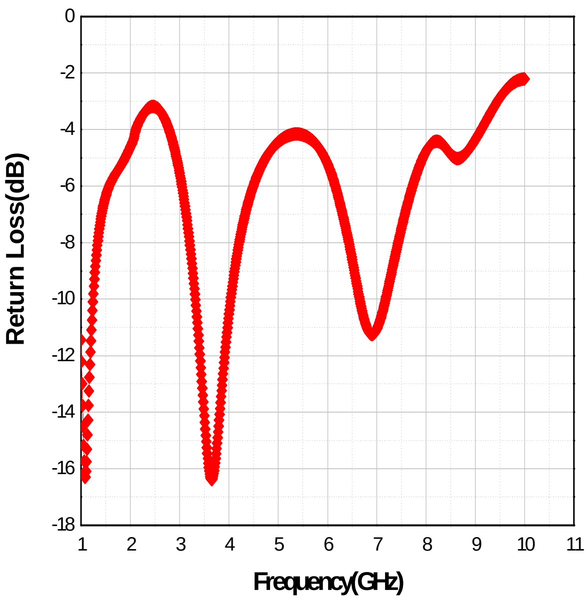

Figure 3 Return loss versus frequency for antenna 2.

The return loss of the antenna 3 (which is obtained by varying its gap between parasitic patch and feed patch; g_m =2mm) is shown in figure 4. It is observed that antenna 3 also resonates at three resonating frequencies from 1 to 11 GHz, i.e., at 1 GHz, 3.4 GHz, and 7.0 GHz.

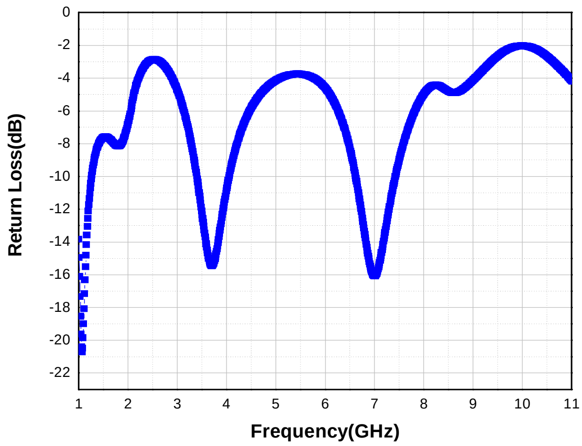

Figure 4 Return loss versus frequency for antenna 3.

Figure 6 shows the plot of return loss versus frequency for antenna 4 (which is obtained by varying its gap between parasitic patch and feed patch; g_m =4 mm). In this case the higher order band (third band) that was obtained at 7.9 GHz for antenna 1 has been shifted towards right side and it begins at 7.2 GHz which is now acting as fourth band for antenna 4. Similarly, third order band is shifted towards lower side and it is obtained at 3.4 GHz.

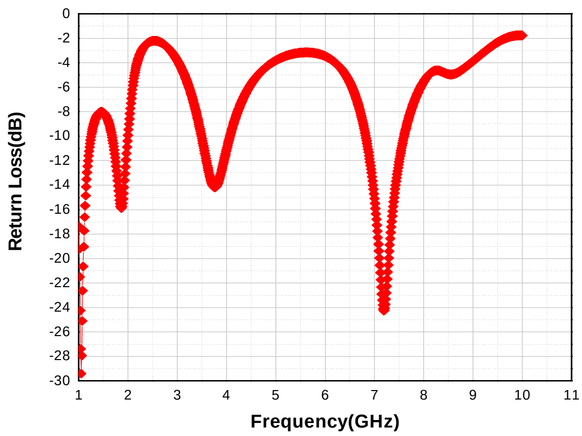

Figure 5 Return loss versus frequency for antenna 4.

Figure 6 shows the radiation for the antenna 4 for centre frequency (3.4 GHz). Antenna 4 shows broadside radiation pattern and it has been plotted for LHCP, RHCP, and PPC.

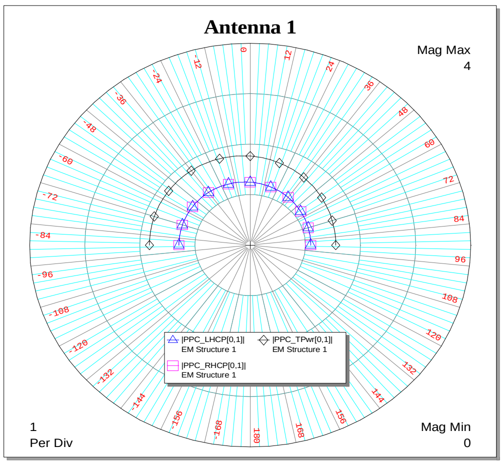

Figure 6 Radiation pattern of proposed antenna 4.

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Figure 7 depicts a comparison of plots between antennas 1-4. It has been observed that when the g_m is 1 mm the band is shifted towards left side whereas when the gap is increased from 1mm to 4mm the band shifts towards right side.

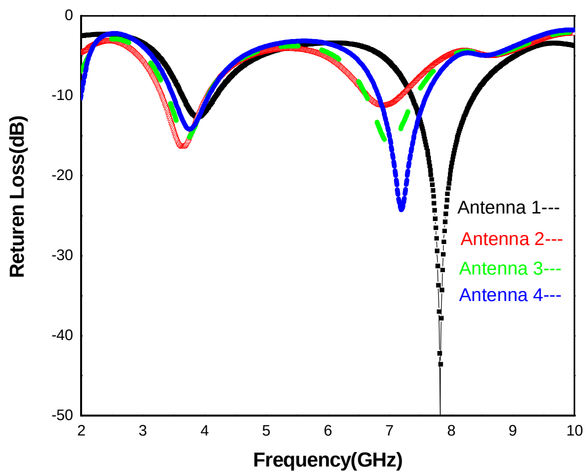

Figure 7 Return loss versus frequency for antennas 1-4.

IV. CONCLUSIONS

Simulations of the proposed antenna structures are performed using Microwave Office and the results are presented. It has been observed that variations in gap between feed patch and micro-strip line tends to shift the resonance frequencies making it useful for antenna applications in C and S bands. Comparative return loss results are presented for immediate comparison of different structures. The investigated antennas are good candidate for many wireless communications.

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Bibliography

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