



Stub loaded dual band circularly polarized microstrip antenna for GPS application

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Abstract — A single-feed low-profile and easy to fabricate circularly polarized microstrip patch antenna has been developed for GPS applications. For dual frequency operation, four slots are etched near edges of the patch and a crossed slot etched in the center for generating circular polarization. In order to reducing the frequency ratio of two frequency bands of the antenna, the patch is loaded by four short circuit microstrip stubs. Using stub loading, the frequency ratio of two bands of the antenna can be, even, reduced.

Keywords- Microstrip Antenna, stub, Circular polarization, Axial Ratio, Bandwidth

I. INTRODUCTION

Many studies and research efforts have been reported in the literature directed towards obtaining circularly polarized micro strip antennas. In general, single-feed single-layer structures yield the smallest axial-ratio (AR) bandwidth, defined at the 3 dB level. Recently, the U-slot and E-shaped patches have gained a lot of popularity. This is because compared to other methods, they do not require a complex matching network or stacked configuration. More recently, the E-slot and L-probe feed techniques have been applied to single-layer single-feed circularly polarized antennas [7-10]. These techniques enable the use of thick substrates, and yield axial-ratio bandwidths as large as 13%. It was demonstrated that U-slot patch antennas with linear polarization have good electrical characteristics including wide bandwidth, high gain, and quite stable gain across the operating frequencies. Recently, it was found that U-slot patch antennas can also be operated with circular polarization (CP). The asymmetrical structure of the U-slot provides two different current paths for the two orthogonal modes required for circular polarization. In this, the well-known technique of an E-shaped patch used for a broad impedance bandwidth is modified to generate circularly polarized radiation. This leads to a new alternative method of acquiring circular polarization, using a single-layer probe-fed patch antenna with a relatively wideband axial ratio, without the necessity of it being square or corner-trimmed.

In this paper, an analysis to study the effects of slot to generate circular polarization on the rectangular microstrip antenna and its variations is presented. The stub loaded microstrip antenna gives dual band CP radiation for GPS applications. The idea employed in this paper is to use a single feed slotted patch structure and load it reactively so as to reduce the frequency ratio of two bands. The single feed makes the antenna a cost effective for mass production.

II. STUB LOADED MICROSTRIP PATCH ANTENNA

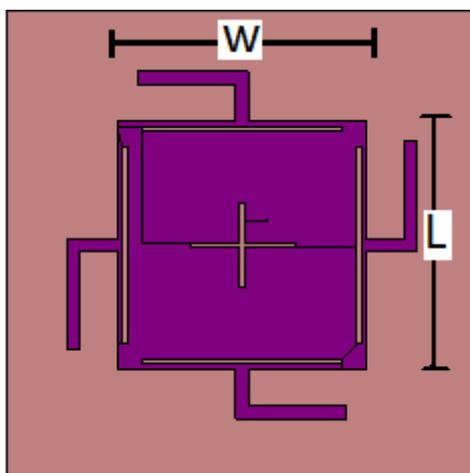


Fig.1 Dual band stub loaded MSA

A dual band circularly stub loaded micro strip antenna is as shown in figure1. Initially the square MSA is designed to operate at 1.4 Ghz frequency on glass epoxy of thickness 1.6mm. As the substrate is lossy the gain is below 0dB. So in order to increase the gain of the antenna the same structure is designed in suspended configuration. Where the antenna is suspended at above air layer of 4mm thickness and the dimensions are obtained to be 99mm. In MSA the circular polarization can be achieved by keeping two resonating frequency of the antenna close to each other giving frequency ratio in between 1.01 to 1.1. in single feed MSA CP can be obtained by perturbing the antenna surface this can be done by creating slots in the patch. so here the square patch contains four slot at the edges and the cross slot at the centre. with cross slot antenna will have 45° polarization. The cross slot excited two orthogonal modes with same amplitude but 90° out of phase yielding CP(circular polarized) radiation.

The horizontal slot have length and width 74mm*2mm. The vertical slot have the length=79mm and width=2mm. The slots on the opposite edges have same dimensions. The centre CS (crossslot) has the dimension as follow, vertical CS=33.6mm*1mm and the horizontal CS= 1mm*41.6mm. The four stubs are used in antenna with total length of 69mm and width of 5mm. the feed is given at (10, 10). The SMA connector of diameter 1.2cm is used to feed the antenna. The antenna is tested on Vector network analyzer and the results are presented.

III. RESULT

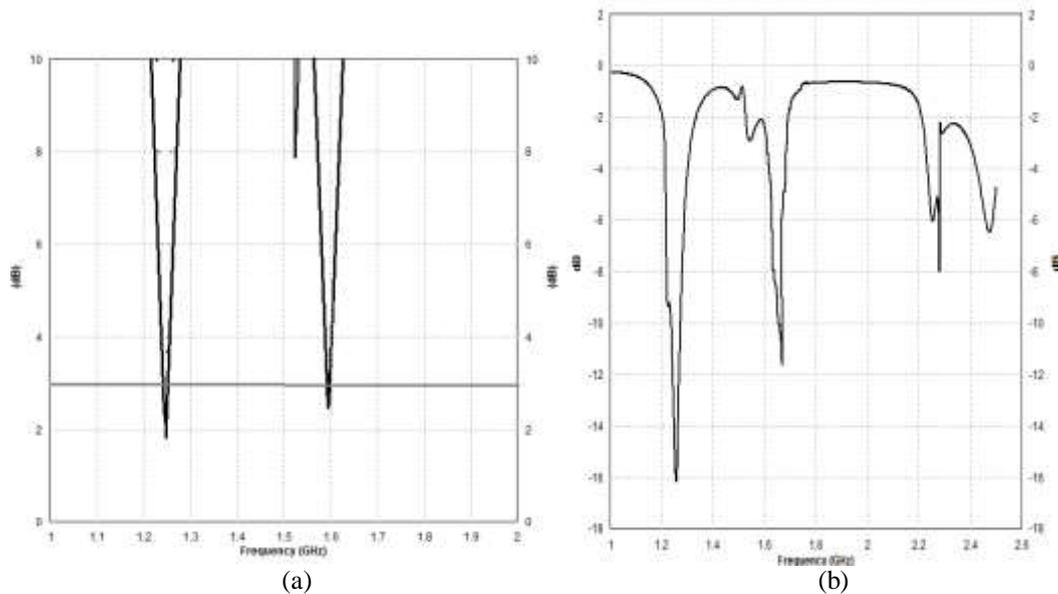


Figure 2: (a) axial ratio and (b) return loss plot for stub loaded MSA

The axial ratio is parameter to indicate circularly polarized response of the antenna. The figure:2 shows the axial ratio of the proposed antenna. It shows that the axial ratio is below 3 db for two frequency bands useful for GPS operation. The return loss of circularly polarized antenna it shows that the return loss at the same two frequency i.e. 1.2 and 1.6 Ghz is below -10db .

IV. CONCLUSION

Dual band circularly polarized microstrip patch antenna has been designed on rectangular microstrip antenna by creating different slots at the edges and the centre of the patch. The antenna gives circularly polarized response at 1.2 GHz and 1.6 GHz . It's a low profile low cost antenna which can be implemented for GPS applications.

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