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Analysis and Design of L-strip Ultra wideband Antenna

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Abstract:- An L-strip proximity coupled circular micro strip antenna is proposed. The structure is investigated using circuit theoretic approach and simulated using IE3D simulation software**.** The patch is designed on at hick substrate of thickness 11mm for a center frequency of 8.9GHz and provides ultra wide band operation. The parametric study is carried out for horizon tall length of L-strip deviation of patch, and antenna dimensions and return loss radiation pattern, antenna efficiency, radiation efficiency and gain are obtained. It is observed that the band width of the antenna depends on L-strip feed dimensions along with deviation of patch. An ultra bandwidth of 4.35GHz is achieved with consistent ideate on characteristics.

Keywords:- Semi Circular micro strip antenna, Band width, L-strip, micro strip antenna, proximity, wideband, radiation pattern, antenna gain, radiation efficiency, return loss, directivity.

I. INTRODUCTION

Due to its inherent properties of light weight low cost, integrate ability, low profile etc. micro strip antenna has be ensued in transmission and reception of electromagnetic signals for wireless communication, aviation, mobile, and astronautics etc. However, it shows very small bandwidth that restricts the use of these antennas for wideband/broad band applications. Hence, many methods to enhance bandwidth have been developed [1-4] such as using gap coupled patched to the radiating and non-radiating edges [5-10], T-probe feed on thick substrate [11], impedance matching network [6], and. Antennas using thick substrate suffer from low efficiency due to dielectric loss and the reactance of longer probe restricts the bandwidth. An L-shaped micro strip feed has given consider able bandwidth in thick substrates with better coupling [13]. Recently the L-strip has become a popular feeding technique to design ultra wide band antenna [14, 15].

In this paper, an ultra-wideband proximity coupled L- strip fed semi-circular micro strip antenna (SCMSA) has been proposed. Fig.1shows the proposed antenna, in which a foam layer of thickness11mm is used as a substrate, and Shaped structure is used for feed. The antenna is simulated with MOM based IE3D software.

Further, parametric study of antenna for antenna efficiency, radiation efficiency, radiation pattern, gain

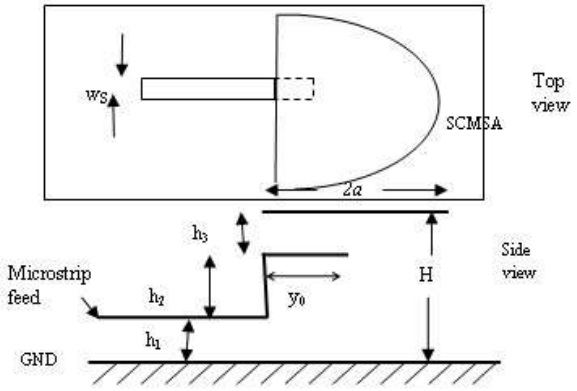


Fig. 1: Structure of proposed antenna and directivity is carried out.
The details of entire investigations are present in the following sections.

II. ANTENNADESIGN

The proposed L-strip feed semi circular micro strip antenna, showninfig.1, is designed on thick substrate of foam material with dielectric constant very close to unity (1.07).Total height of the antenna is 11mm which is divided into three parts. The lower part with height of 1.6mm (h1) is used for micro strip feed design with characteristic impedance of 50ohms.The width of the feed line (was) is 5mm.The middle layer of the substrate consists of vertical part of L-strip feed with same width as of micro strip line on bottom layer. The

thickness of middle layer (h2) is 7.8mm. At the top of this layer a horizontal l line is made which is responsible for the power coupling to patch. The length of this line is2.5mm. On the top of to player with thickness of1.6mm (h3) a semi- circular patch is designed with radius of 17mm (a) which has an offset to f0mm (D) from the feed line. The vertical part of L-strip provides inductance which is compensated by the capacitance created by horizontal apart of L-strip along with is distance. These form a series combination of resistance, inductance and capacitance i.e. a series resonant circuit. This in turn comes in series with parallel reason circuit of patch [14, 15].

III. RESULTSAND DISCUSSION

The proposed antenna is simulated on Mom based full wave electromagnetic simulation software IE3D.The behavior of antenna on various antenna parameters is studied. The length of horizontal part of L-strip feed is varied while keeping all other parameters fixed and the result is shown in fig.2.

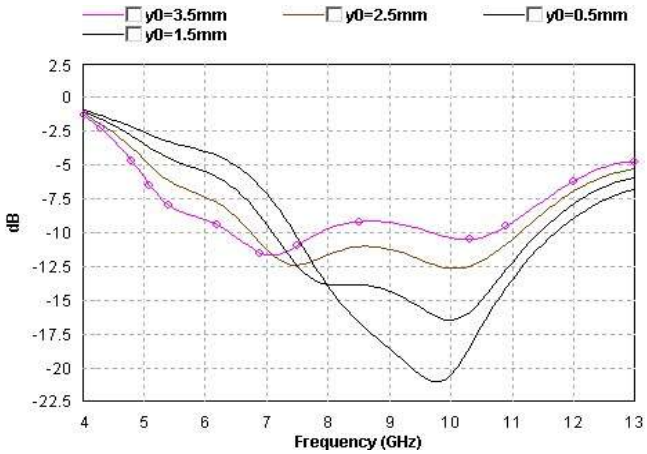


Fig. 2: Variation of Return loss with frequency for differenty0

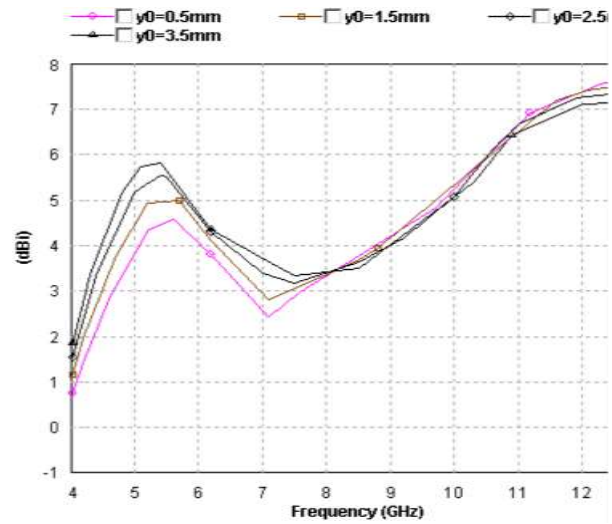


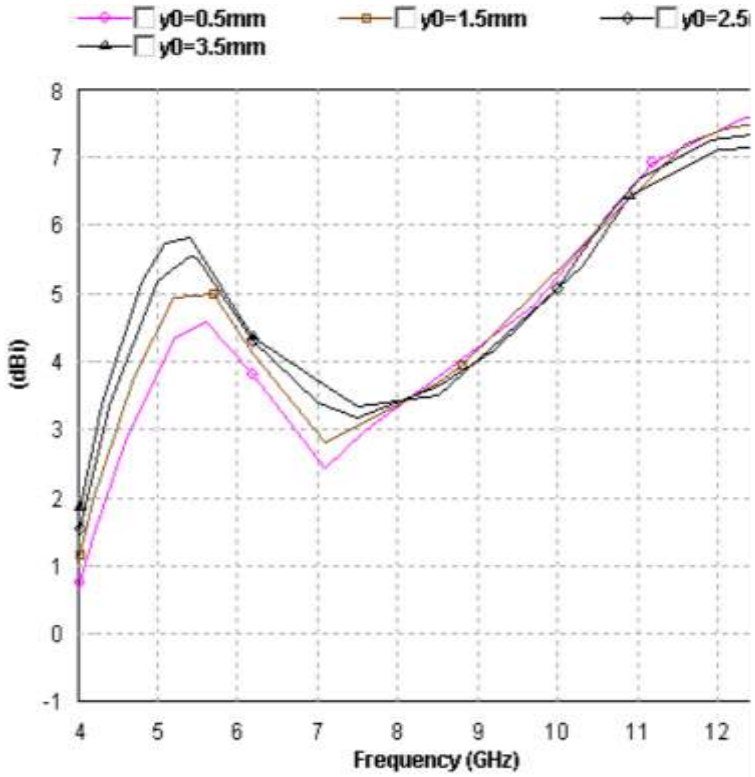
Fig. 3: Variation of gain with frequency at differenty0

From the figure it is clear that the nature of antenna is dependent on y0.There are two resonances in the structure. As we increase the length of feed line the lower resonance is visible but the antenna becomes dual band from UWB antenna. Moreover, the upper resonance shifts up ward with increase in length. The band of operation shift toward lower side of the spectrum. The bandwidth aty0=2.5mm is4.37GHz ranging from 6.75-11.12GHz.

Fig.3 shows the variation of gain of the antenna with frequency at different length of horizontal part of L-strip. It is clear from the figure that the gain of the antenna increases almost linearly with frequency for all lengths and that gain is similar for all.

Fig.7: Variation of return loss with frequency at different position of patch

The patch is shifted along x-axis and the behavior is studied.Fig.7shows variation of return loss with frequency at different off set of patch. The offset (D) is changed from



8: Radiation pattern at differenty0

-1mm (1mm towards left) to +1mm (1mm towards ht) with 1 mm gap. It may be observed that band width d matching improves as the structure is moved towards right. As patch is moved from towards right the band width increases as seen from table1.

Table1 Band width variation with off set

D	Lower cut off	Higher cut off	Bandwidth
-1mm	7.1GHz	11.37GHz	4.27GHz
0mm	7.1GHz	11.43GHz	4.33GHz
+1mm	7.15GHz	11.6GHz	4.45GHz

The radiation pattern of the antenna at different length of horizontal part of L-strip is shown infig.8.Thefigure shows radiation pattern is plotted in the respective band of operation. It is clear from the figure that the antenna radiates at-300 for all values of y0 except 3.5mm which radiates at 510.

IV. CONCLUSIONS

A novel ultra wide band L-strip fed doubles lot loaded semicircular micro strip antenna has been presented. The proposed slot loaded antenna has operating band width from 6.75GHz to11.12GHz. More over the antenna provides flexibility to design a dual band antenna with slot dimension variation. The gain of the antenna is linearly increasing with frequency and unchanged with slot dimensions. Ultra-wide band characteristics obtained due to the close proximity of resonant frequencies of L-strip ante patch. The radiation pattern is inclined and issue full for blind is coverage.

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