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U-Slot Loaded Square Monopole Microstrip Antenna for Wide Band Operation

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Abstract: ***This paper presents the design and development of simple U- slot loaded square monopole microstrip antenna for wide band operation. The proposed antenna is excited through microstripline feed arrangement. The low cost glass epoxy substrate material is used to fabricate the antenna. The antenna operates between 3.16 GHz to 9.96 GHz giving linearly polarized broadside radiation characteristics with impedance band width of 74.4% and a peak gain of 4.2 dB. The proposed antenna may find applications in X band systems..***
Keywords: slot, microstrip antenna, triple band, gain.

I. INTRODUCTION

In recent era the microstrip antennas are becoming increasingly popular because of their small size, lightweight, low cost, easy to fabricate and compatible to microwave integrated circuits [1-2]. However, the modern communication systems such as wireless local area networks (WLAN) often require antennas possessing single wide band to cover larger frequency spectrum ,which can avoid the use of multiple antennas. In this paper a U- slot loaded on square monopole microstrip antenna is presented for wide band operation giving better radiation characteristics. This kind of study is found to be rare in the literature.

II. DESIGNING OF ANTENNA

The conventional rectangular microstrip antenna (CRMSA) is fabricated on low cost glass epoxy substrate material of thickness h = 1.6 mm, loss tangent 0.02 and dielectric constant ε_r = 4.2. The artwork of is developed using computer software AUTO CAD to achieve better accuracy. The antennas are etched by photolithography process. The bottom surface of the substrate consists of a tight ground plane copper shielding.

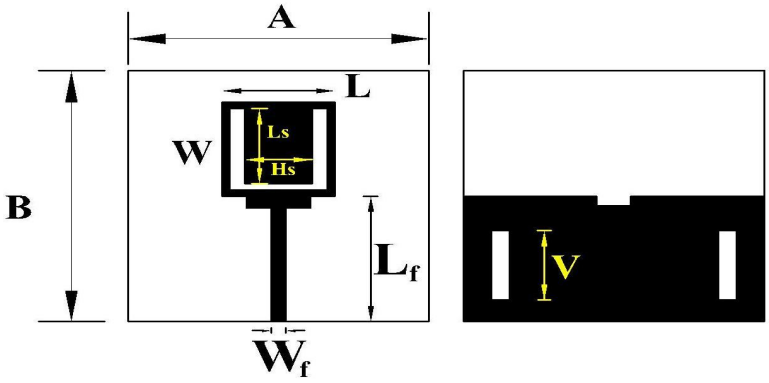

Fig. 1 Geometry of USCTSMSA

Figure 1 shows the geometry of U Slot corner truncated Square microstrip antenna (USCTSMSA) This antenna is designed for the resonant frequency of 3.0 GHz using the equations available in the literature for the design of rectangular microstrip antenna on the substrate area A x B. This antenna consists of a radiating patch of length L and width W. The microstripline feed of length L_f and width W_f is used to feed the microwave energy to the antenna. A 50 **Ω** semi miniature-A (SMA) connector is used at the tip of the microstripline feed. The corners of the antenna are truncated by 4 mm and 6 mm in X and Y axes respectively. The U -slot of width H_S and length L_S is placed on the patch of the antenna. The vertical slot of width 2 mm and length V is placed on the ground plane of the antenna. Figure 2 shows the Photograph of the antenna. The designed parameters are tabulated in Table No 1.

Fig. 2 Photograph of USCTSMSA

Table No 1

Antenna	Parameters(cm)								
	A	B	W	L	L_f	W_f	L_S	H_S	V
USCTSMSA	8	8	3.1	2.4	1.26	0.32	1.26	0.8	1.6

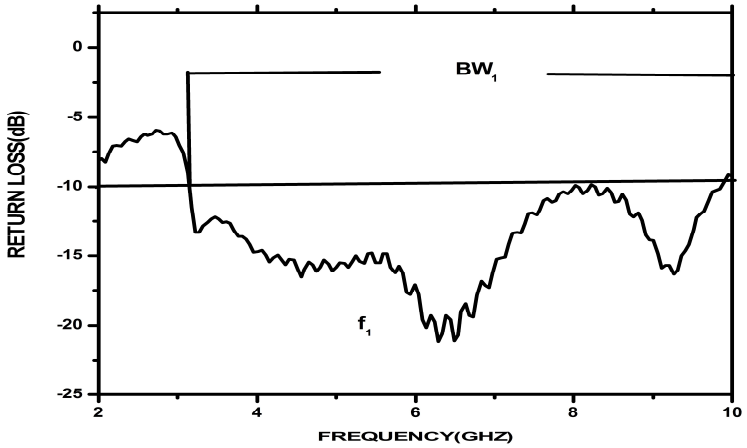

Fig. 3 Variation of return loss versus frequency of USCTSMSA

Figure 3 shows the variation of return loss versus frequency of VSRMMSA when the slot is on left side of the central line of the patch. It is seen from this figure that the antenna resonates for single wide band f_1 of bandwidth BW_1= (9.96 GHz-3.16 GHz) The BW_1 is due to fundamental resonance of the patch.

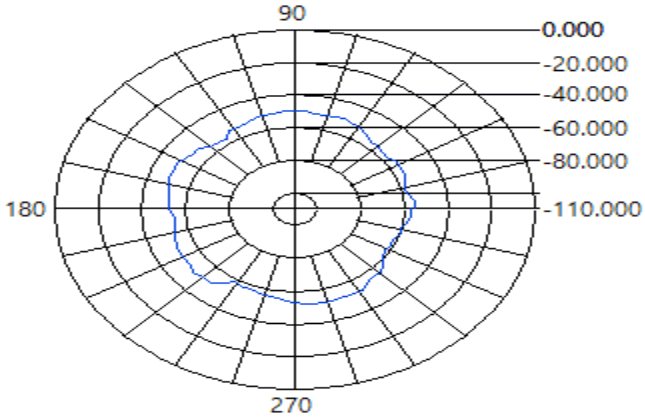

Fig. 4 radiation pattern of USCTSMSA

Figure 4 shows the radiation pattern USCTSMSA it is seen from these figure that the pattern is linear and broad sided. The gain of the proposed antenna is measured by absolute gain method. The power transmitted 'P_t' by pyramidal horn antenna and power received 'P_r' by antenna under test (AUT) are measured independently. With the help of these experimental data, the gain (G) dB of AUT is calculated by using the equation,

$$(G)\ dB = 10 \log\left(\frac{P_r}{P_t}\right) - (G_t)\ dB - 20\log\left(\frac{\lambda_0}{4\pi R}\right) dB$$

where, G_t is the gain of the pyramidal horn antenna and R is the distance between the transmitting antenna and the AUT. The maximum gain USCTSMSA measured in its operating bands is found to be 4.2 dB.

III. CONCLUSION

From the detailed study, it is concluded that, the USCTSMSA can be made to operate single wide band between 3.16 GHz to 9.96 GHz by loading U slot on the radiating patch. The maximum bandwidth of 74.4 % is achieved with linear broad side radiation pattern. The peak gain of 4.2 dB is achieved by the USCTSMSA. The proposed antenna is simple in its geometry and can be fabricated using low cost glass epoxy substrate material. This antenna may find applications in x band systems

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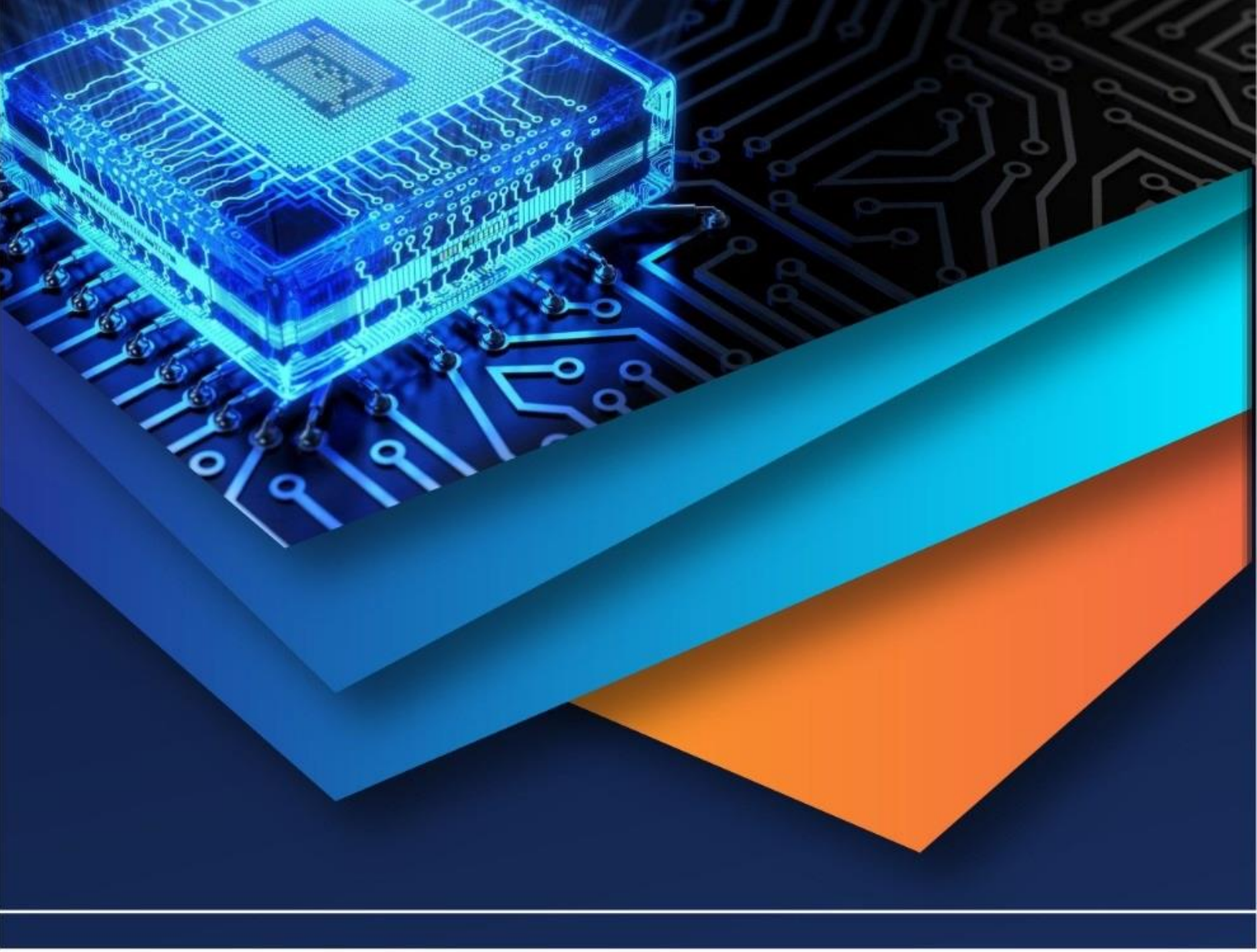

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