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Step loaded Square monopole microstrip antenna for dual band operation

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Abstract: In this communication the design and development of step loaded square monopole microstrip antenna for dual 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 1.7 GHz to 7.14 GHz giving linearly polarized broadside radiation characteristics with impedance band width of 60.2% and a peak gain of 4.3 dB. The proposed antenna may find applications in WLAN.

Key words: slot, microstrip antenna, dual band, gain.

1. INTRODUCTION

In modern 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 wider bands to cover maximum communication frequency spectrum. In this paper step slot loaded on square monopole microstrip antenna is presented for dual band operation giving better radiation characteristics. This kind of study is found to be rare in the literature.

2. 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.

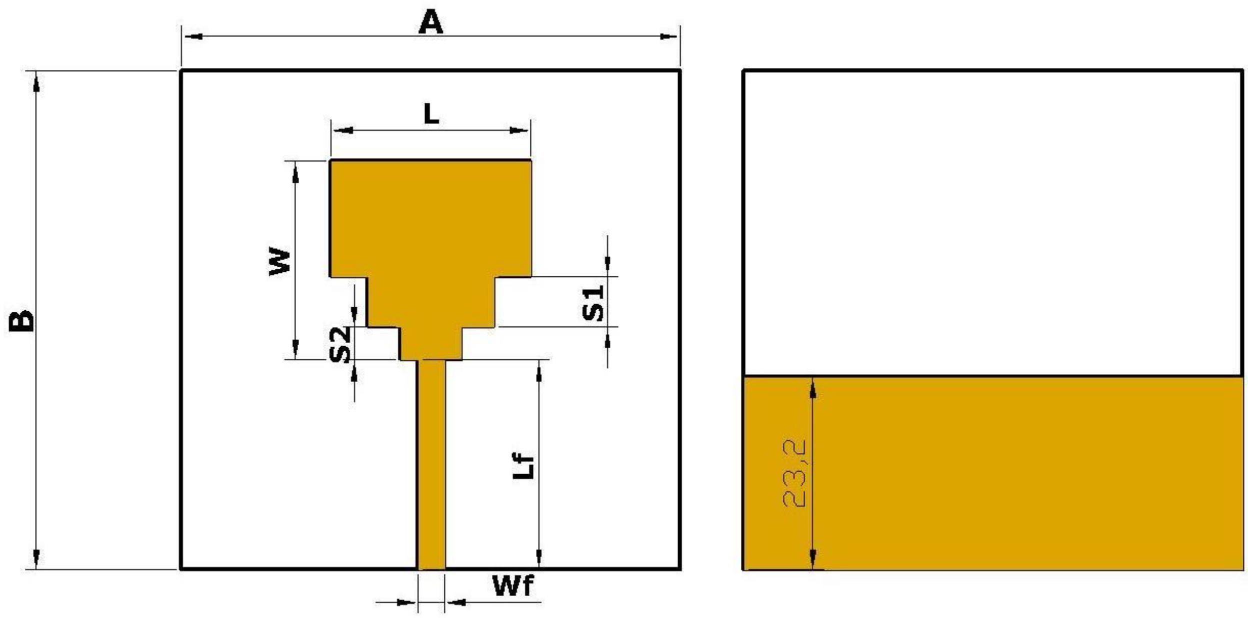

Fig. 1 Geometry of SSMSA

Figure 1 shows the geometry step loaded Square microstrip antenna (SSMSA) 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 use steps S_1 = 4 mm and 6 mm in while S_2 = 4 mm x 4 mm in X and Y axes respectively. Figure 2 shows the Photograph of the antenna. The designed parameters are tabulated in Table No 1.

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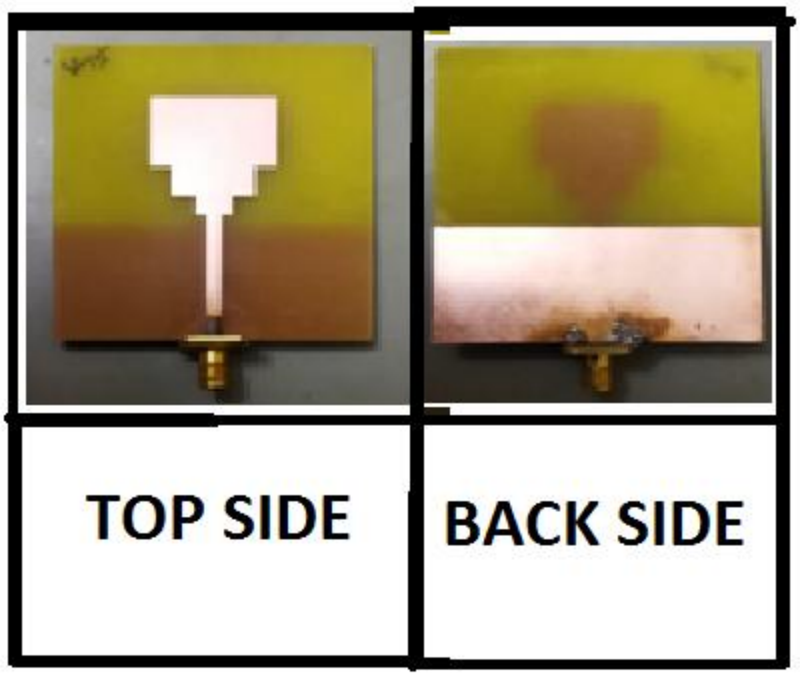

Fig. 2 Photograph of SSMSA

Table No 1

Antenna	Parameters(cm)					
	A	B	W	L	L_f	W_f
SSMSA	**6**	**6**	**2.39**	**2.39**	**1.26**	**0.32**

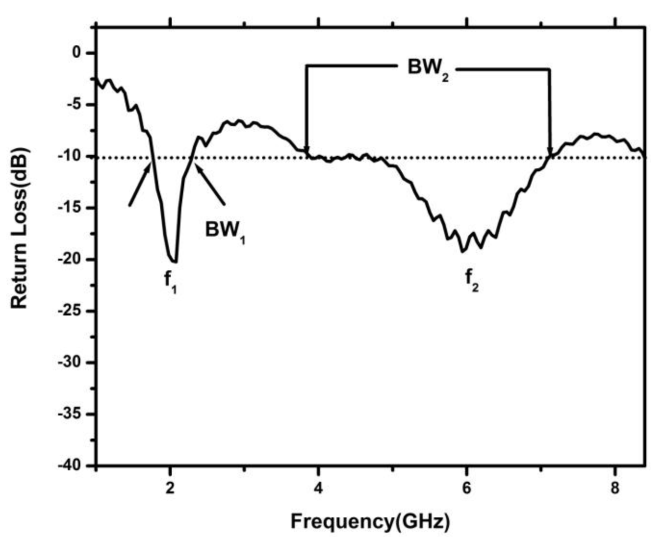

Fig. 3 Variation of return loss versus frequency of SSMSA

Figure 3 shows the variation of return loss versus frequency of SSMSA . It is seen from this figure that the antenna resonates for dual wide bands f_1 of bandwidth BW_1= 30% (2.3 GHz-1.73GHz) and f_2 of bandwidth BW_2= 60.2% (7.14GHz-3.85GHz). The frequency ratio f_2/f_1 is equal to 1.645 which shows the tuning property of the antenna..

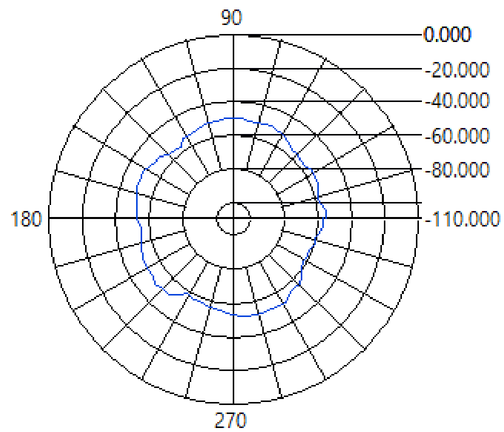

Fig. 4 radiation pattern of SSMSA

Figure 4 shows the radiation pattern SSMSA 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 SSMSA measured in its operating bands is found to be 4.3 dB.

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4. CONCLUSION

From the detailed study, it is concluded that, the SSMSA can be made to operate single wide band between 1.7 GHz to 7.14 GHz by steps on the on the radiating patch. The maximum bandwidth of 60.2% is achieved with linear broad side radiation pattern. The peak gain of 4.3 dB and frequency ratio of 1.645 is achieved by the SSMSA. The proposed antenna is simple in its geometry and can be fabricated using low cost glass epoxy substrate material. This antenna may find applications WLAN systems.

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