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# Half Ground Square Monopole Microstrip Antenna for Wide band operation

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**Abstract:** In this communication a square monopole microstrip antenna with half ground plane is presented for wide band operation. The antenna is housed in a volume of $60 \times 60 \times 16$ mm$^3$. The antenna is fabricated with low cost glass epoxy substrate material having 0.01 as loss tangent. The antenna shows a wide bandwidth with good radiation characteristics. The design parameters were presented and results of the antenna are discussed. This antenna may find its applications in the systems where wide bandwidth is a requisite.

**Key Words:** Microstrip antenna, Monopole, Wide band, Radiation.

## 1. INTRODUCTION

In the present era microstrip antennas are becoming popular because of their inherent advantages like low profile, light weight, low fabrication cost, robustness, integrability with MMICs and easy of installation [1]. Today's communication systems such as, WLAN, Wi-Max and SAR use antennas operating at definite frequency bands. But an antenna operating at single wideband is more attractive to use the device for the desired applications. In this study a simple square monopole microstrip antenna having good radiation characteristics and wide bandwidth is presented. This kind of study is found to be rare in the literature.

## 2. ANTENNA DESIGN

In this study the square microstrip antenna is considered as conventional antenna. The antenna is fabricated by using glass epoxy substrate mateirial of permitivitty 4.2 using the photolithography process. The microstripline of length $L_f$ and width $W_f$ is used to excite the antenna. A quarterwave transformer of length $L_t$ and wiodth $W_t$ is used to to match the impedamce between the microstripline and the patch. A 50Ω SMA connector is used to supply the microwave power. Figure 1 shows the Geometry of CSMSA.

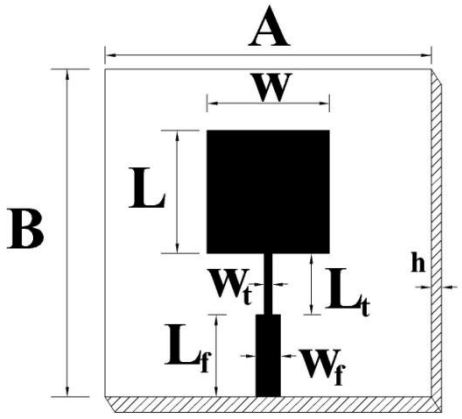


Figure-1 Conventional Square Microstrip antenna

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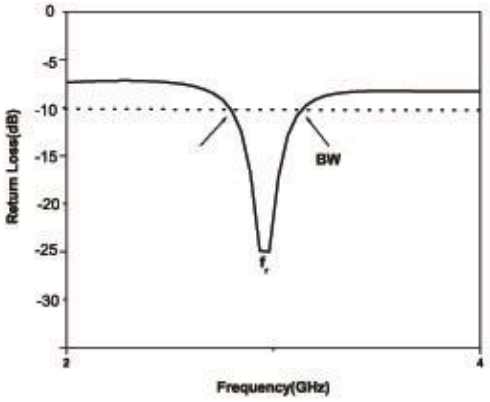


Figure-2 Return Loss versus frequency of the CSMSA

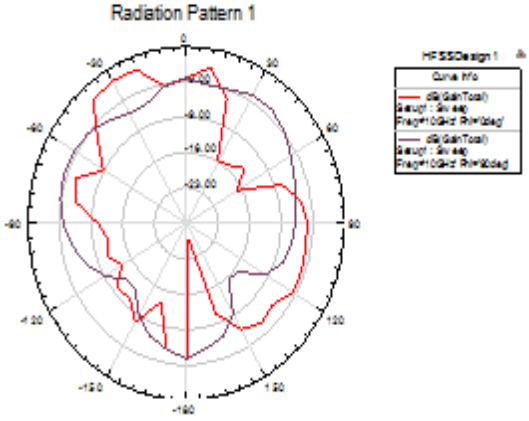


Figure-4 Smith Chart of CSMSA

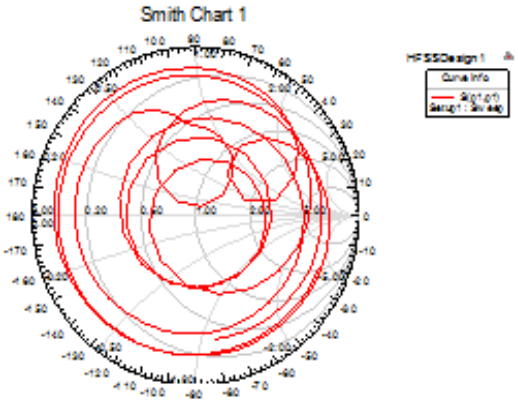


Figure-3 Typical Radiation Pattern of CSMSA

Figure 2 shows the return loss versus frequency of CSMSA, it is designed for 3 GHz frequency and it is resonated at 2.98 GHz of frequency which is very close to the designed value. Figure 3 and 4 show the radiation pattern and Smith Chart of the CSMSA. It can be noticed that the radiation is linear in nature and Smith chart shows good matching. Table-1 gives the design parameters of the antennas.

Table-1 Design Parameters

| **Parameter** | A | B | L=W | $L_f$ | $W_f$ | $L_t$ | $W_t$ | G | h |
|---|---|---|---|---|---|---|---|---|---|
| **Dimension(cm)** | 8 | 8 | 2.39 | 1.27 | 0.32 | 1.26 | 0.08 | 4 | 0.16 |

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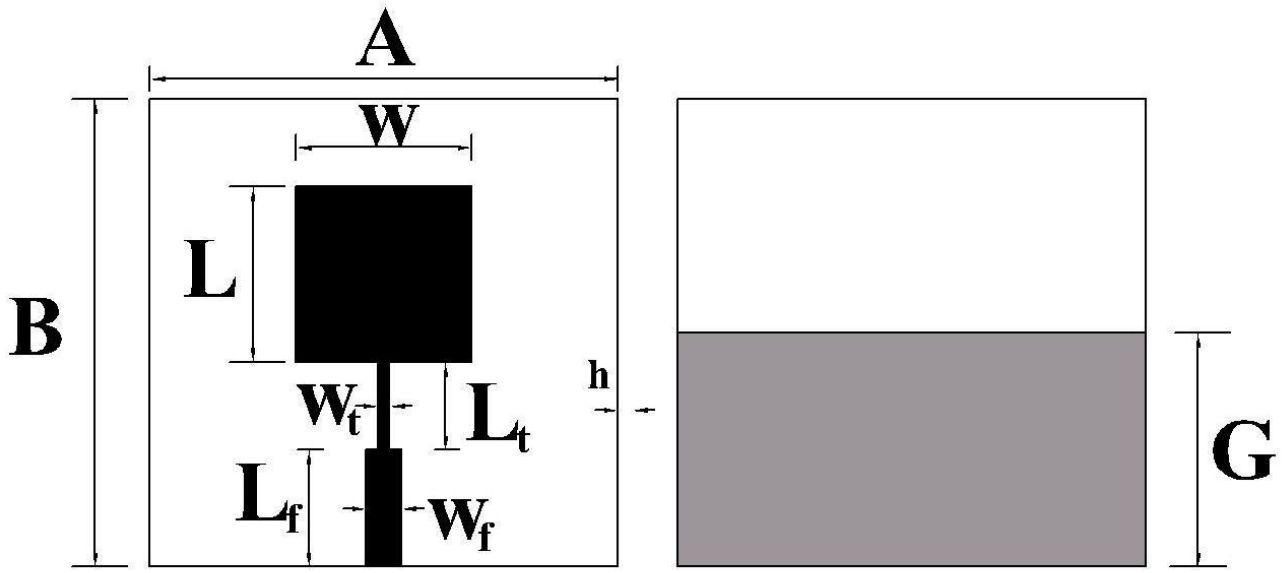


Figure-5 Half grounded Square Monopole Microstrip antenna

Figure 5 shows the Square monopole microstrip antenna (HGSMMSA). The full ground plane of CSMSA is reduced to half to near the monopole property. All other dimensions of the CSMSA are kept same for HGSMMSA also.

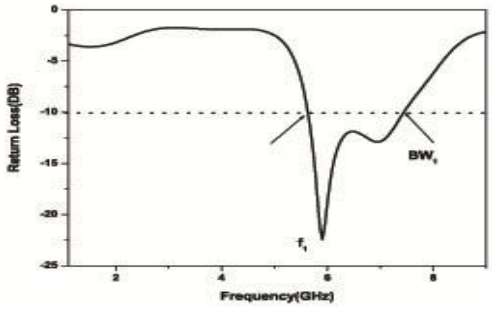


Figure 6 Return loss of HGSMMSA with half ground

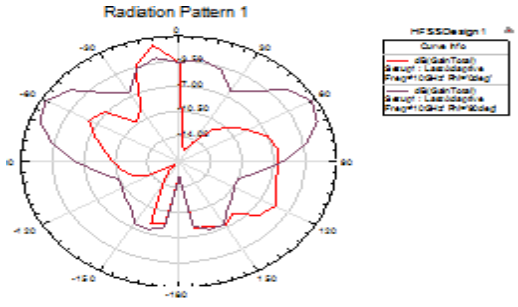


Figure-7 Typical radiation pattern of HGSMMSA

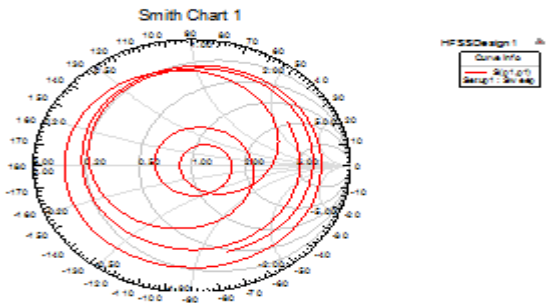


Figure-8 Smith Chart of CSMSA

Figure 6 ,7 and 8 show the return loss , radiation pattern and Smith chart of the HGSMMSA it can be noticed that when the ground plane is reduced to half when compared to the ground plane of the CSMSA, the single wide band having the band width of 1.8GHz and impedance bandwidth = 27.67% (7.4GHz-5.6GHz) is obtained with center frequency of 6.5GHz. The radiation pattern is broadside and Smith chart shows the good matching concept. Figure 9 shows the Photograph of HGSMMSA fabricated using the modified glass epoxy substrate material.

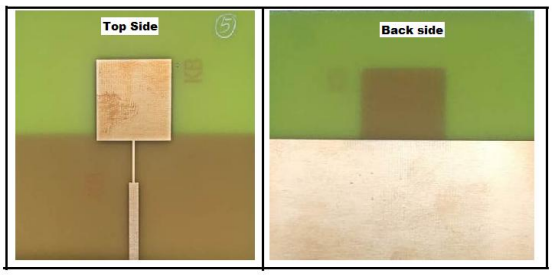


Figure-9: Photograph of the HGSMMSA

## 3. CONCLUSION

The proposed antenna meets all the needs of the modern communication systems. The single wideband with impedance bandwidth of 27.67% having maximum gain up to 6 dB can be achieved from HGSMMSA. This antenna possess half ground plane at the bottom of its structure which can reduce the spurious radiation and gives good radiation characteristics.

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