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Design of CPW fed antenna for satellite and radar applications

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Abstract

Objectives: In a recent wireless communication and worldwide interoperability applications a CPW fed antenna is proposed for satellite and missile applications.
Methods/Statistical analysis: The proposed antenna can be designed by using IE3D simulator. The antenna was fabricated using FR4 substrate. The simulated results shows lower return loss value at 5.8GHz. The proposed antenna shows maximum gain of 3 dBi.
Findings: The proposed antenna is fed by coplanar waveguide method for high frequency response. It shows the lower return loss, good impedance matching and high gain compared to other antennas.
Application: The proposed antenna design methodology can be applied to optimize antenna for several wireless scenarios and satellite applications.

Keywords: CPW, Wi-Max, WLAN, FR4, MIMO.

1. Introduction

Antenna is the most visible part in satellite communication system. The antenna is used to broadcast communication and get the modulated carrier signal for satellite communication, the frequencies stand for microwaves with wavelength on the sort of one meter downward to less than one centimeter. Antennas having levelheaded size for profitable use because High frequencies and corresponding small wavelengths [1].

Satellite plays an important role in interface between the various satellite subsystems and earth during operations. Antennas broadcast to downlink signal and get the uplink signal. It gives signal connection for the satellite elementary. The condition of satellite antenna is to cover the required area [2].

Satellites are good-looking since they need smaller savings, lower launch costs, and mass manufacture while offering better consistency, small price and better launch agility. Their make use involves a solitary or a group of satellites, communication and learning applications [3]-[4]. Printed antennas are one of the main applicants, particularly of their lightweight characteristics. Small satellite antenna generally need a condensed size, modest directivity and amplified gain performances. It covers a little main documented request like directly wide cast satellite TV downlink [5]-[6]. Satellite communication requires round separation to easiness any way linked issue of the receiving base station antennas. In satellite applications, the monopole antenna is unsuitable [7].

Today, microstrip patch antennas establish their request in satellite space communication, bio medical and etc. They insist of small volume, low cost, small shape, and planar construction for the antenna to be implemented on the consumer terminals [8]. Compact Microstrip Patch Antennas have increased the interest in mobile satellite communiqué systems. CPW-fed antennas have features like easy integration for monolithic integrated circuit, low dispersion, and low radiation loss [9]. For 3G and 4G MIMO inside applications Two-Port prototype variety Antenna can be used. The antenna is a single mixture of a modest mono cone structure with coupled-feeding. The two antennas are incorporated with small trouble for each other because it reuses part of the antenna structure.

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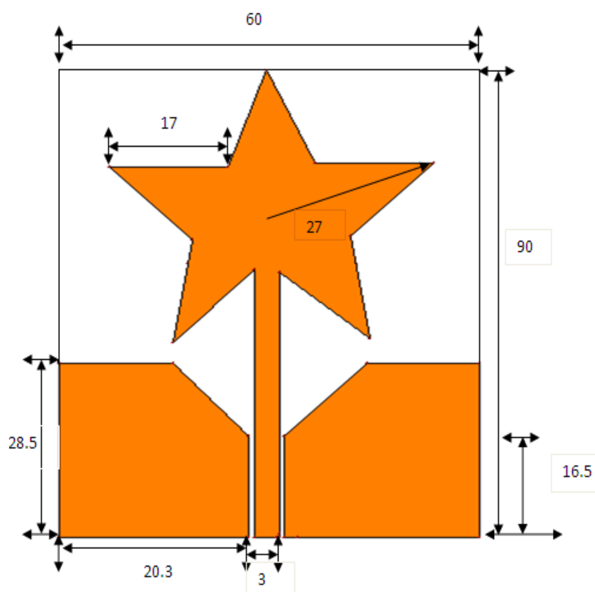
2. Antenna design

A dielectric constant value of our proposed antenna shows ε_r=4.4 and thickness h=0.8mm are used. The antenna size is 90mm x 60 mm. The proposed antenna has incredibly high conventional antenna parameters in the necessary bandwidth.

Figure 1. Proposed antenna structure (All dimensions are in mm)



The proposed antenna is shown in Figure 1. It is a kind of electrical transmission line and conveys micro wave frequency signals. The Guided Wave length can be computed using the following expression:

$$\lambda_g = \frac{c/f}{\sqrt{\varepsilon_{eff}}} = \frac{3\times10^8/5.9\times10^9}{\sqrt{1.25}} = 45.48mm \tag{1}$$

The propagation speed is,

$$v = \frac{c}{\sqrt{\varepsilon_{eff}}} = \frac{3\times10^8}{\sqrt{1.25}} = 2.68\times10^8 m/s \tag{2}$$

Resonant dipole length is,

$$r_d = 0.47\lambda = 0.47\frac{v}{f} \tag{3}$$

$r_d = 21.35mm$

3. Results and discussion

3.1. Return loss

Figure 2 shows Return loss characteristics of the proposed system. It shows precision results of bandwidth and vibrant frequency. Figure 3 exhibits the VSWR characteristics of proposed antenna and shows 1:2 ratio VSWR at 5.9GHz; Figure 4 and Figure 5 show maximum gain of 3dBi for both E plane and H plane.

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Figure 2. Return loss characteristics of proposed antenna

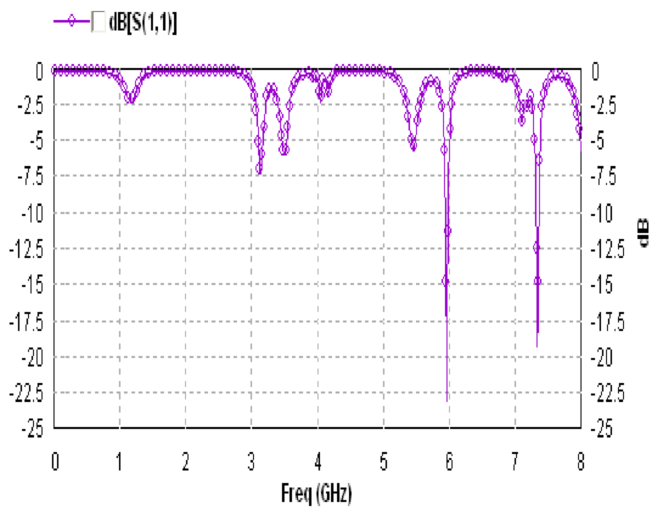


Figure 3. VSWR characteristics

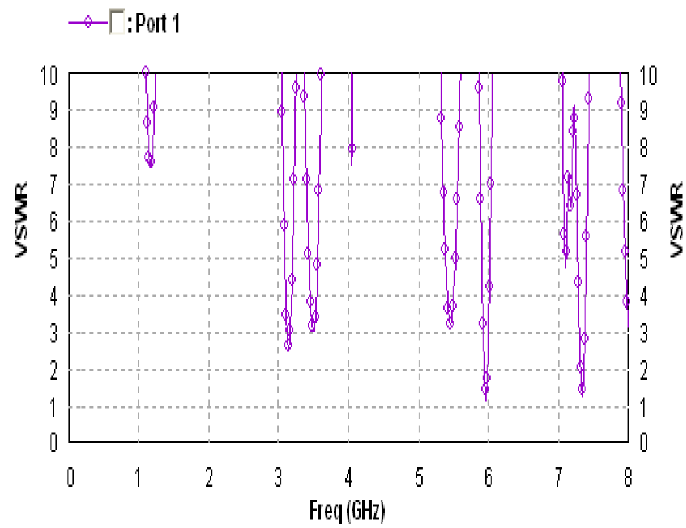


Figure 4. Elevation Pattern

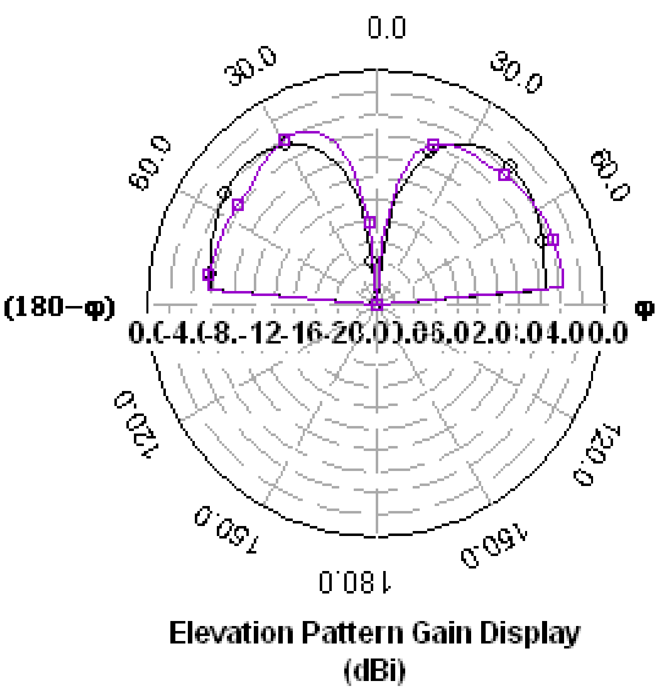
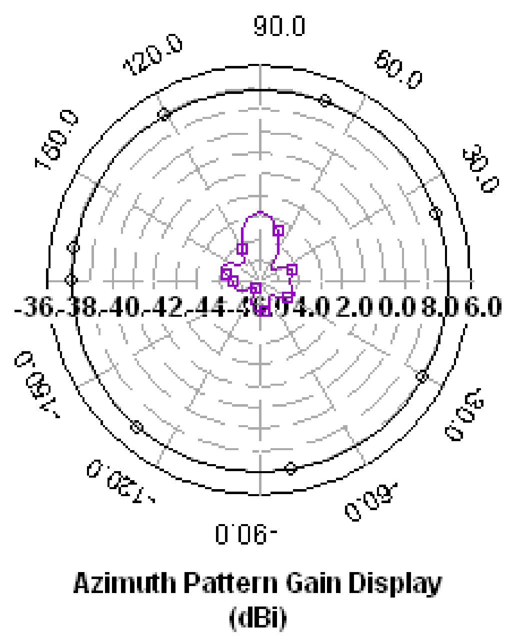


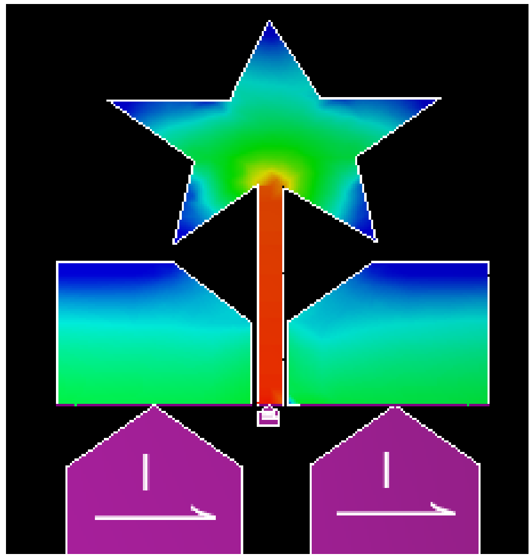
Figure 5. Azimuth Pattern



3.2 Current distribution

The antenna current distribution is shown in Figure 6. The green color area shows maximum current distribution at resonant frequency.

Figure 6. Current distribution



4. Conclusion

The antenna is intended to attain three targets needed for the system: dense size, broad band recital at the 5.9GHz band and unidirectional radiation pattern. The obtained results make possible to use microwave techniques for the satellite and Radar applications. The antenna attains a calculated gain of 3 dBi, and bandwidth is 400MHz. Hence, the antenna structure is appropriate for satellite applications.

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