A Conformal antenna with Proper Shape and Good Electrical Properties

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Abstract. A conformal antenna based on Teflon with proper shape to get more space is presented. It is accomplished by using three-dimensional simulation design software HFSS to achieve the best method. A special kind of Teflon has been chosen to meet the requirement for light weight and ease of installation. A series of antennas is designed and optimized and the best result shows that the conformal antenna could achieve 80\% relative impedance bandwidth and peak gain>3dBi at 4GHz. The far-field patterns of antenna are also analyzed and have an acceptable performance. All the results show that this kind of antenna can work well for engineering applications with high cost.

1. Introduction

These Antennas working over the frequency range from 2.5GHz to 6GHz are widely used for modern wireless communications[1-3]. Furthermore, many antennas design techniques have been studied and used to satisfy the demand for various wireless communication[4-9].

The low-profile antennas are used for small size and good electrical properties. However, the low-profile antennas could not work over wide bandwidth with good radiation characteristics. The dielectric antenna with various structures are also studied to miniaturize antennas with good performance and many antennas with smaller size, special structure, high efficiency and broad bandwidth have been reported[10-15]. However, up to now, few studies have studied the antennas with shape and common material for low cost, consequential weight reduction, easy installation and suitable properties in microwave band.

In this paper, we present an antennas made by teflon with right shape to address the goal for light weight and convenience of installation. Furthermore, the influence of the structure on the antenna is analyzed and the high efficiency and broad bandwidth were obtained.

2. Models of Antenna

The structure of the telegraph pole and the position for the installation of the antenna is shown in figure 1.
To ensure the room for other usage, the antenna for wireless communication should be made as cylinder which could be fitted on cylinder shaft of the telegraph pole and the material of the antenna should be flexible and low cost for easy installation and mass manufacture. The electrical properties of the antenna needed are as follows: the -10dB bandwidth can reach up to 80% and the peak gain>3dBi at 4GHz.

Here: the height of the cylinder is H1, the external diameter of the cylinder is R1, the internal diameter of the cylinder is R2, the distance of the feed to the edge of the antenna is L1 and the height of the feed is H2, respectively.

3. Simulation and Discussion
For the engineering and installation requirements, the internal diameter and external diameter of the antenna is fixed and other parameters of the structure could be changed for good electrical properties.
To calculate the electrical properties of the antenna exactly, HFSS is used and the optimization course is shown in figure 2.

It can be seen that the working frequency is determined by the height of the antenna. The -10dB bandwidth is affected by changing the height of the coaxial feed and height of the antenna. By adjusting the parameters, the -10dB bandwidth of the antenna can be obtained.

The radiation patterns of the antenna at 4GHz are shown in figure 3.
Figure 3. The radiation patterns of the antennas.

It is found that the radiation patterns of the antenna in x-z plane is very different from the patterns in y-z plane. The radiation patterns of the antenna in x-z plane have a ultra wide beam width and the half-power beam width could reach up to 120 degrees. On the other hand, the radiation patterns of antenna have a narrower beam width in y-z plane.

The reason for the result could be concluded that the position of the feed has a great affect on the far-field pattern of the antenna and the strength of RF fields is greater with distance from the feed. It also could be seen that the radiation pattern of the antenna is basically not be influenced by the height of the feed.

4. Conclusions
A conformal antenna is designed for more space and proper electrical properties. The cylinder structure and cheap material as Teflon are used for adapting to the environment, easy installation and mass manufacture. The conformal antenna could achieve 80% relative impedance bandwidth and peak gain>3dBi at 4GHz and the radiation patterns of the antenna in x-z plane could obtain a ultra wide beam width and the half-power beam width could reach up to 120 degrees. These results show that the conformal antenna is a potential choice for wireless communications in city.

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