Conformal microstrip circularly polarization Antenna array

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***Abstract*- In this paper, the conical conformal antenna array is proposed, which employs a feeding network and three double feed square circularly polarization patches. Good agreement between the theoretical and experimental results is obtained .Its measured 3dB axial ratio bandwidth is about 270MHz , covering 1.37GHz-1.64GHz.The measured radiation pattern of antenna is also presented, which is almost onmidirectional.**

I. INTRODUCTION

As the major part of wireless detection system, the design of antenna is essential to the performance of detection system. One of the most important innovations in technology of modern antenna lies in the introduction of the conformal antenna design to many applied areas ,such as radar, data links, mobile cellular base station ,communicative terminals and so on[1].

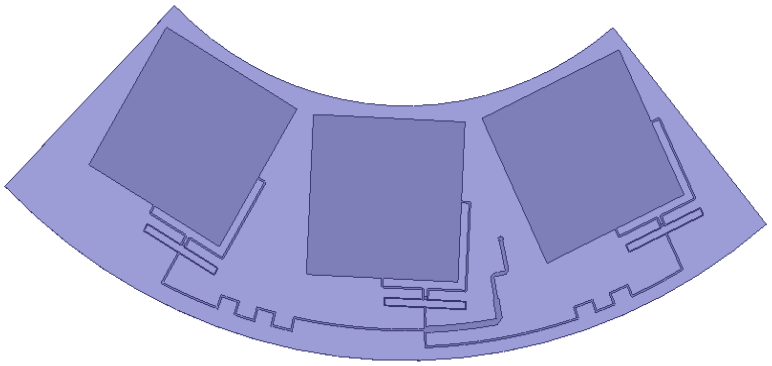
The conformal antenna usually use the microstrip antenna or slot antenna because of their low profile structure .The microstrip antennas are well known for the characters of lightweight ,low-profile ,low cost advantages and their efficiency is increased by using arrays. Moreover, in the case of using on small vehicles, and considering the aerodynamics character of a flying high-speed aircraft ,microstip conformal arrays are widely used.

There are several papers that contribute to conformal microstrip antenna [2,3,4], but most of them are based on cylinder surface,sometimes a long cone with a small apex angle approximates to a cylinder .Compare to cylinder conformal antennas, the conical conformal ones are much more complex to analyze, design, and produce . On the other hand ,most conformal antenna was studied in the field of narrow circular polarization antenna which adopt single feed in the middle side of patch and two cut corners .

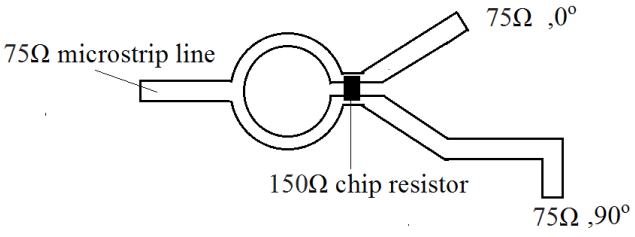
In this paper, a conical conformal circularly polarization array is presented, which is made up of feeding network and 3 square patches with two feed points symmetrically on the two main axis . The simulated and measured radiation patterns at center frequency are both presented. Its structure and experimental results are presented as follow.

II. DESCRIPTION OF THE ARRAY

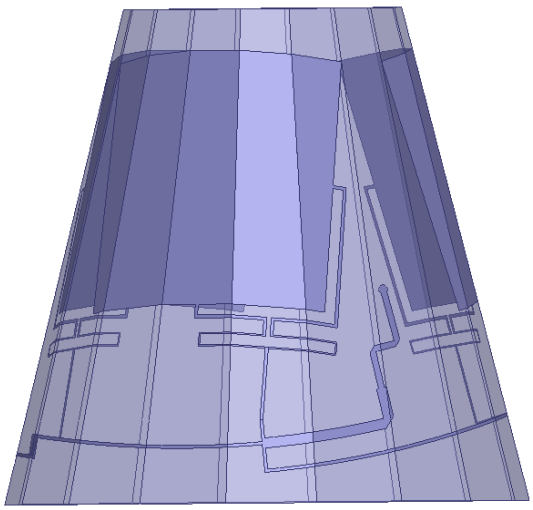
As shown in Fig.1(a), the circular polarization antenna array has been realized by feeding network of three equal way and three square patches, which are fed by two points symmetrically on the two main axis . To maintain the amplitude and phase relationship between the two points, every patch employ a Wilkinson power divider ,with its output feedlines having a length difference of a quarter-wavelength to produce a 90º phase shift as shown in Fig1(b).A 150Ω chip resistor is added in power divider for achieving good isolation between the two feeds.



(a) Geometry of planar antenna array



(b)The wilkinson power divider



(c) Geometry of conformal antenna array

Figure 1. Structure of the proposed antenna

Considering the mass of antenna should be reduced and antenna should be curved for conformal of a finite length mental cone, the the thickness and the relative permittivity of substrate is chose to be 0.508mm and 2.33 respectively .The geometry of conformal antenna array is shown in Fig1(c).

After material and thickness of base for antenna is determined,the width of antenna is obtained by formula[6],which is emulated by Ansoft HFSS and modulated to be 61.72mm.

III. SIMULATED AND MEASURED RESULTS

The conical conformal antenna is simulated by using Ansoft HFSS ,the simulated results are shown in Fig.2and Fig.3 ,the central frequency is 1.575GHz,the simulated VSWR less than 2:1 is from 1.33GHz to 2.10GHz, the bandwidth of 3dB axial ratio is about 360MHz,axial ratio is about 1.25dB at f =1.575GHz ,and gain of the antenna array is about 0dB at maximum radiation direction, as shown in Fig.4.

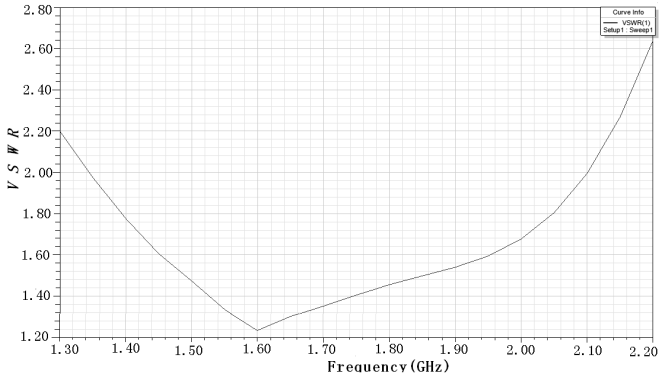


Figure 2 Simulated VSWR vs. frequency

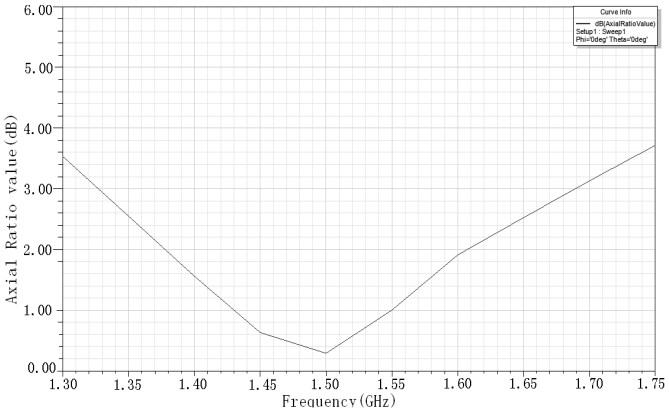


Figure 3 Simulated Axial ratio vs. frequency

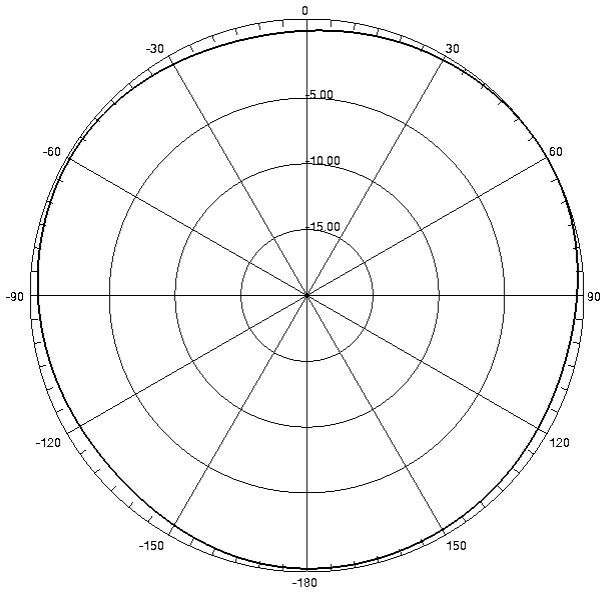


Figure 4 Simulated radiation pattern at f =1.575GHz

A test antenna was fabricated, the VSWR of the conformal microstrip antenna array is measured using the Agilent 8722ES Network Analyzer,the measured VSWR less than 2:1 is from 1.33GHz to 2.05GHz.Some discrepancy between the theory and experiment maybe due mainly to the effect of the SMA connector, which has not been considered in the simulation but inducts a reactance and therefore influences the positions of the resonant points.

The measured axial radio bandwidth became narrow, covering from 1.37 GHz to 1.64GHz.

The radiation patterns were measured in an anechoic chamber.The measured radiation pattern is nearly omnidirectional as shown in Fig.5 and the gain of maximum radiation direction reduce to -0.7dB at f =1.575GHz , and there is about 2dB discrepancy around the cone.

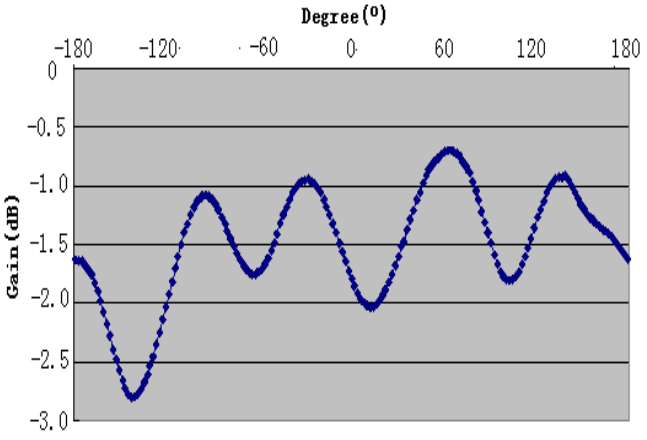


Figure 6 measured radiation pattern at f =1.575GHz

IV. CONCLUSION

This paper proposes a design of dual feed circularly polarized conical conformal antenna array .The performance of conformal antenna is studied and results are verified by experiment. The measured radiation pattern is almost omnidirectional as simulated one. The impedance bandwidth and the measured gain is almost similar with the simulated results. As the antenna structure is simple and its section plane is low, it can be widely used in curving surface and pneumatic structure.

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