Design of Beidou Circularly Polarized Terminal Antenna

Sijing Li[a], Yanzhong Yu[b], Yuting Zeng[c], Mengya Lin[d]

College of Physics & Information Engineering, Quanzhou Normal University, Quanzhou, China

[a]1141810671@qq.com, [b]yuyanzhong059368@163.com

[c]836193997@qq.com, [d]2448706525@qq.com

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Abstract：Beidou satellite navigation system is a Chinese self-developed global satellite navigation system. Now it has its place in mature satellite navigation system. In recent years, more and more people pay attention to it. The development of Beidou satellite navigation system has good prospects, so designing the Beidou terminal antenna is of important values both for research and applications. In this paper, a Beidou circularly polarized microstrip antenna is designed ,which is made by cutting an asymmetrical U-slot in a square radiating patch and diagonal corner cut method to achieve circular polarization and to reduce the size of the antenna. Finally the model of the antenna is made and analyzed by HFSS15.0 to get the optimum performance parameters.

Introduction

Recently, Satellite navigation systems have greatly facilitated human life. The demand for satellite navigation has also been increasing. It is precisely because of the ever-increasing demand of human beings that the development of satellite navigation technology has been promoted [1]. On the level of security and social development, China has developed an independent satellite navigation system, namely the Beidou satellite navigation system. The application of Beidou satellite navigation system is multi-faceted, not only in military applications, but also in our lives. With the popularity of the Beidou navigation system, its terminals are gradually characterized by lightness, thinness, shortness and smallness, and these characteristics require higher terminal antennas [2, 3]. The antenna is an indispensable part of the satellite navigation system. The quality of the antenna is closely related to whether the satellite navigation system can exert its capabilities well [4-6]. In recent years, the combination of antenna miniaturization and circular polarization is also becoming a trend.

Tag Antenna Design and Structure

The structure of the antenna is shown in Fig.1. The side length L of the radiating patch of the antenna is 43 mm, the side length L1 of the dielectric substrate is 59 mm, the thickness h of the dielectric substrate is 3 mm, and the left arm length of the asymmetric U-shaped groove is long. It is 9.9248mm, the right arm length is 10.6616mm, the base length is 6.0576mm, the groove width w of the asymmetric groove is 2.2mm, the distance from the feeding point to the center of the patch is 12mm, the isosceles of the radiation patch The side length a of the triangular chamfer is 6 mm. Fig.2 shows the main dimensions of the radiator sheet.

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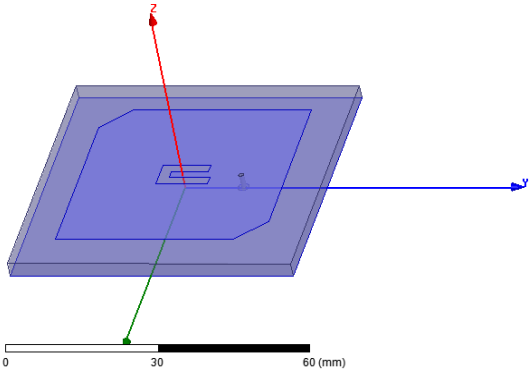


Fig.1. Structure of the antenna

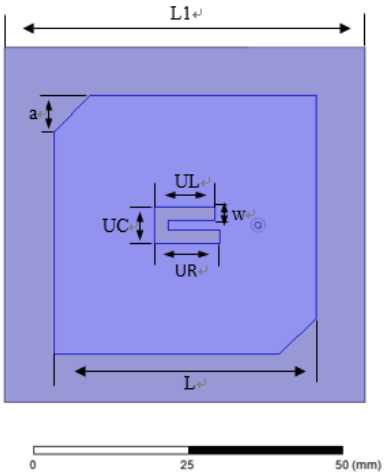


Fig.2. Antenna main size diagram

Simulation and Analysis

In the case where the other parameters are consistent, the resonant frequency of the antenna decreases as the side length of the radiating patch increases. And substantially independent of the dielectric substrate, it does not substantially change with the change in the side length L1 of the dielectric substrate. After a series of sweep analysis, the side length of the radiating substrate and the side length of the dielectric substrate are optimized. Fig.3 shows the result of S11 of the antenna. Finally, the bandwidth of S11 is calculated to be 86.7 MHz. As can be seen from the results report Fig.4, the normalized impedance at 1.561 GHz is 1.1356 + 0.4017i. It can be seen from the graph (a) of Fig.5 that when the antenna is operated at 1.561 GHz, the axial ratio of the antenna is 1.2921 dB, which is the target of less than 3 dB originally established; the antenna shaft can be seen from the figure (b). The two frequency points of the ratio of 3dB are 1.5473GHZ and 1.5680GHZ, respectively, so the bandwidth of the axial ratio is 20.7MHZ; as can be seen from the figure (c), when the frequency of the antenna is 1.561GHZ, θ is 0deg and φ is 0 deg, the axis ratio of the antenna is 1.2921 dB. From Fig.6, the total gain of the antenna is 1.9217 MHz.

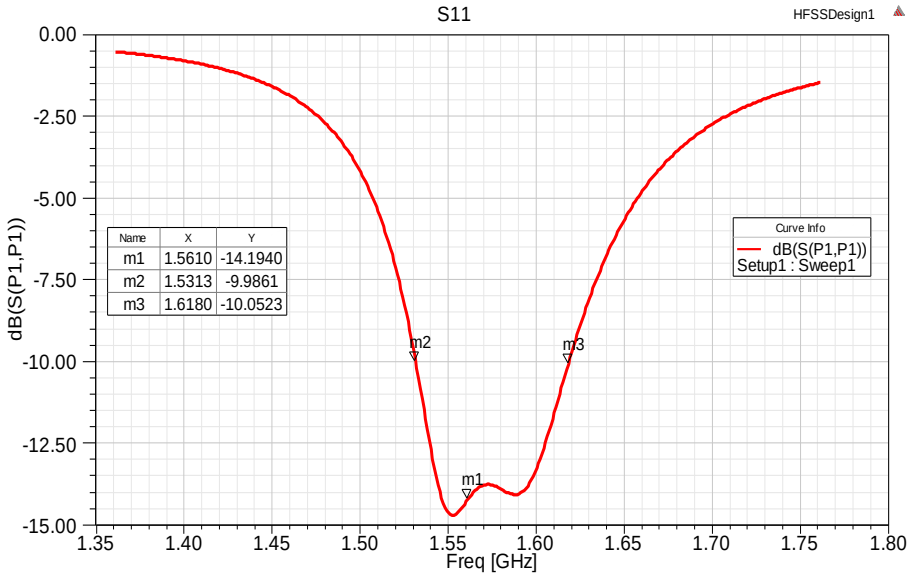


Fig.3. S11

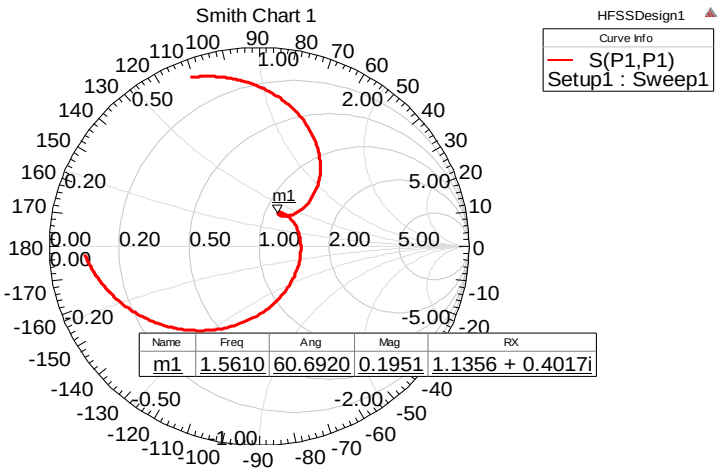
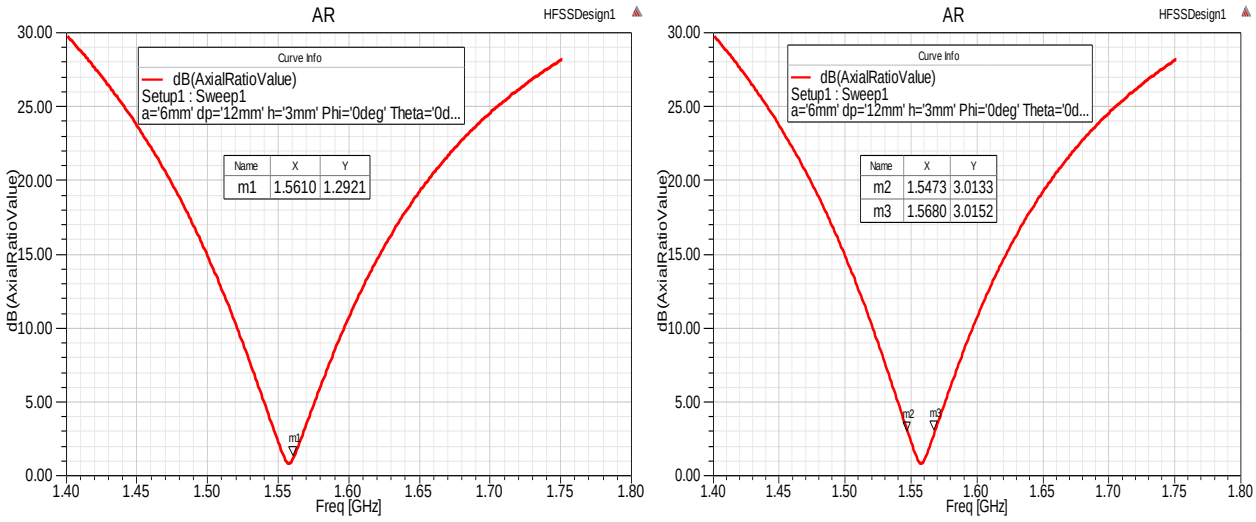
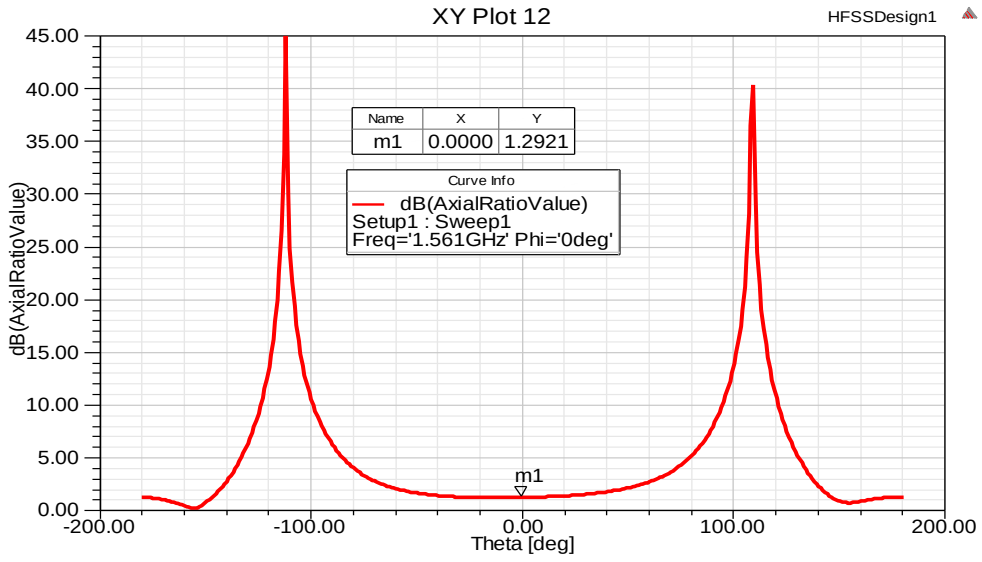


Fig.4. Smith chart of S11



(a) (b)



(c)

Fig.5. Axial ratio sweep analysis chart

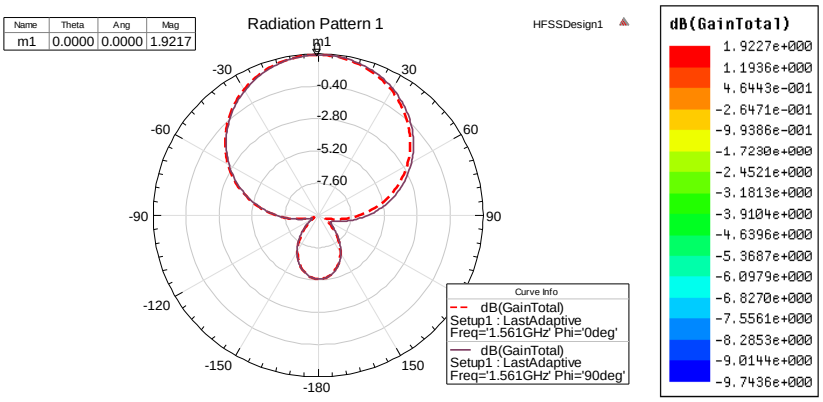


Fig.6. Total antenna gain

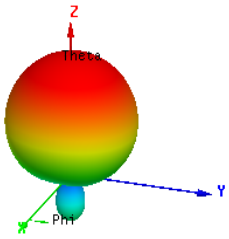


Fig.7. 3D gain

Conclusions

Based on the actual situation and using the knowledge of microstrip antenna, this paper presents a circularly polarized microstrip antenna model working in the B1 frequency band of Beidou II. The innovation of this design is to use asymmetric U-shaped groove, which can not only realize Good circular polarization can also properly reduce the size of the antenna.

Acknowledgements

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