Design of Dual-Polarized Broadband Dipole Antenna for Base Station Applications

[#]Ying Liu, Wen Jiang, Sha Cui, Shu-xi Gong
Xidian University
Xi'an Shaanxi China, liuying@mail.xidian.edu.cn
jw13@vip.qq.com
cuisha2372@sina.com
shxgong@xidian.edu.cn

Abstract

This paper presents a base station dipole antenna operating in 1.8-2.7 GHz which covers multi-systems and applied for IMT-Advanced System. The dipole antenna is $\pm 45^{\circ}$ polarized to increase the base station antenna sensitivity and the user capacity of a base station. A U-shaped base plate is used as a reflector to obtain desired radiation pattern and an 8 dB gain. The dipole antenna can be used in the smart antenna array.

Keywords : Antennas Base station Dual-polarization Broadband

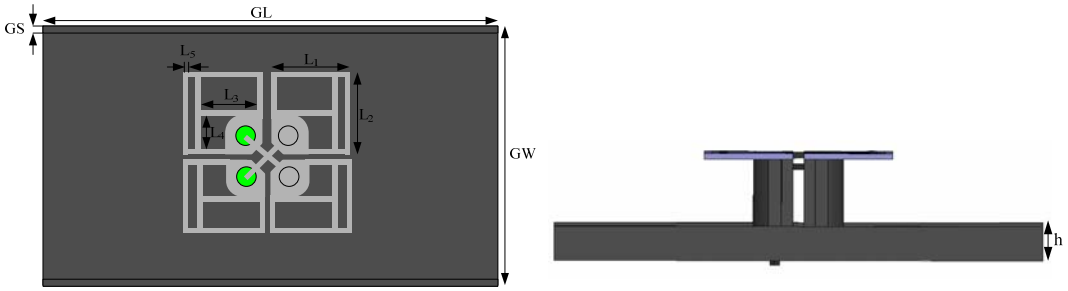
1. Introduction

The fast development of mobile communication demands broadband base station antennas. The dipole antenna is more favorable for base station system because of its simple design, low fabrication cost and good radiation pattern [1]. And arrays of crossed dipoles are commonly used as base station antennas for mobile communications [2]. Base station antennas of mobile communications are demanded to achieve two orthogonal polarizations. Based on measurements, it has shown that the diversity gain of a $\pm 45^{\circ}$ slanted polarization scheme in different environments is almost the same as the horizontal space diversity scheme and slightly better than the H/V polarization scheme [3].

In this paper, a broadband base station dipole antenna is proposed. The dipole antenna is $\pm 45^{\circ}$ polarized, which operates in 1.8-2.7GHz. It meets the requirement of IMT-Advanced System. The base station antenna has a voltage standing wave ratio (VSWR) below 2 and horizontal beamwidth of 108 degree. The isolation between the two dipoles is below 26.7 dB during the whole operating band. A U-shaped base plate is used as a reflector to achieve desired radiation pattern and a high gain of 8 dB. The dipole antenna is used to form smart antenna and detailed results of array how to improve the array performance and optimize the radiation patterns will be presented at the symposium.

2. Antenna Design

The geometry of the proposed base station antenna is shown in Figure 1. The base station antenna is $\pm 45^{\circ}$ polarized. The parameters L_1 and L_2 mainly affect the operating frequency and VSWR. L_3 and L_4 mainly change the isolation between the two antennas. A U-shaped base plate is used to obtain desired radiation pattern and high gain. The width of the base plate plays an important role in changing the horizontal beamwidth of the antenna. The beamwidth can be controlled by adjusting the height and the width of the base plate. Final value of the detailed parameters is given in table 1.



(a) Top view (b)Side view

Figure 1: A Dual-Polarized Dipole Antenna.

Table 1: Final Value of the Detailed Parameters (unit: mm)

GW	GL	GS	L_1	L_2
75	130	2	23.5	23.5
L_3	L_4	L_5	h	
15.5	8.5	2	12	

3. Antenna Performance

The simulation of proposed antenna was carried out by using the simulator HFSS_V11 by Ansoft based on the Finite Element Method (FEM)[4]. Figure 2 shows the simulated VSWR of the proposed antenna. It can be observed that both ports of the dual-polarized dipole antenna achieve VSWR below 2 in 1.8-2.7 GHz band. Figure 3 shows the port isolation of the dual-polarized dipole antenna, from which we can see that the isolation during the whole operating band is below 26.7 dB. Figure 4 shows the radiation patterns of the proposed antenna at 1.88 GHz, 2.01 GHz and 2.35 GHz. It is observed that the antenna has horizontal beamwidth of 108 degree.

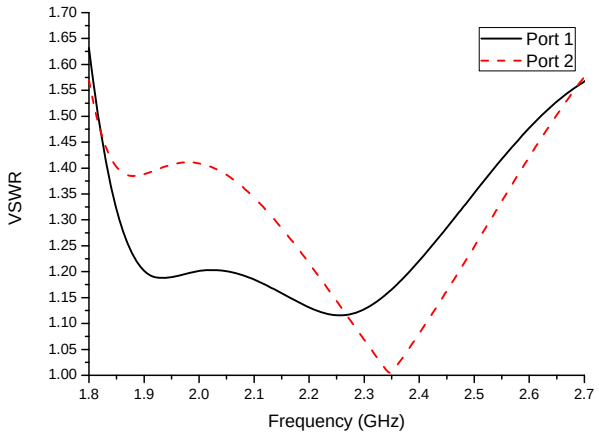


Figure 2: VSWR of the Proposed Dipole Antenna.

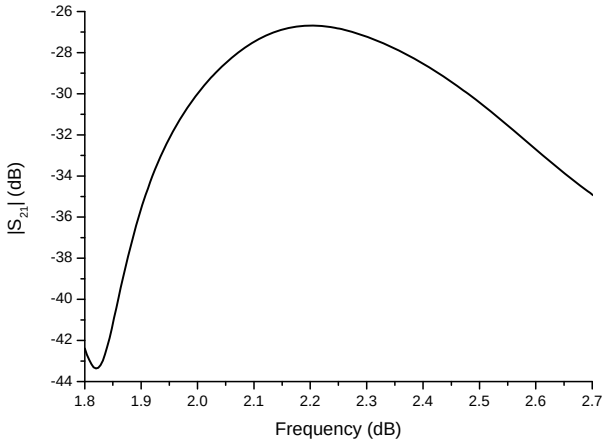
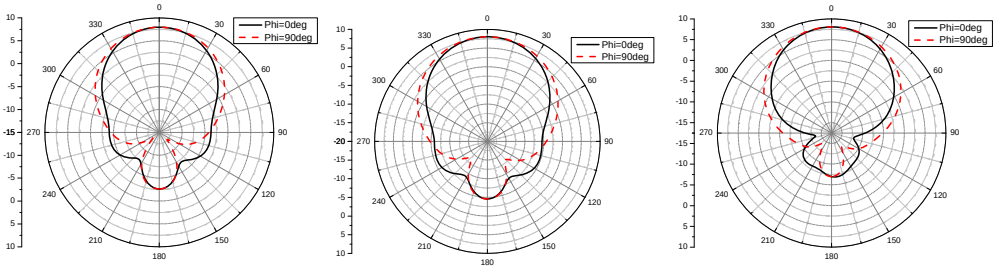


Figure 3: Isolation of the Proposed Dipole Antenna.



(a) 1.88GHz (b) 2.01GHz (c) 2.35GHz

Figure 4: Radiation Patterns of the Proposed Dipole Antenna (unit: dB).

4. Conclusion

A broadband base station antenna is presented. The antenna operates in 1.8-2.7 GHz with VSWR below 2 and horizontal beamwidth of 108 degree. The isolation between the dipoles is below 26.7 dB during the operating band. A U-shaped base plate is used as a reflector to achieve desired radiation pattern and a high gain of 8 dB. The dipole antenna is already used in smart antenna array for IMT-Advanced System.

Acknowledgments

This work was supported by **National Science and Technology Major Project of China**.

References

[1]Anas, Azhari Asrokin, Rizal Helmy Basri, Norman Jamlus, “Dual-polarized dipole array antenna for cdma 450 base station application,” IEEE Asia-Pacific Conference on Applied Electromagnetics, 2010.

[2]G. Deng, and B. Vassilakis, “A broad band dual polarized azimuth beamwidth adjustable antenna for wireless communications,” IEEE Microwave Conference, Asia Pacific, APMC 2008.

[3]J. J. A. Lempiainen, J. K. Laiho-Steffens, “The performance of polarization diversity schemes at a base station in small/micro cells at 1800 MHz,” IEEE Trans. Veh. Tech., Vol. 47, No. 3, 1087 – 1092, 1998.

[4]Ansoft HFSS ver. 11, 3D EM-field simulation for high performance electronic design, Ansoft Corp., Pittsburgh, PA, 2008.