單臂矩形螺旋型天線的研究

莊文豪、邱政男

E-mail: 9707887@mail.dyu.edu.tw

摘 要

本篇論文針對現代無線通訊系統，研究單臂矩形螺旋型天線(Single-arm Rectangular Spiral Antenna)的應用。首先分析螺旋型天線的特性，整理出產生寬頻效應的因素，並設計出一個符合DCS、PCS、IMT-2000/UMTS、WiFi、WiMAX等通訊系統的寬頻天線。而後，在接地面加上頻率選擇表面(Frequency selective surface, FSS)的結構，濾除在通訊系統不常用的頻帶，且造成高、低頻的最大輻射方向的角度約相互垂直，形成雙頻帶及雙指向性的矩形螺旋型天線。因此，此天線能同時應用於衛星通訊及地面通訊。論文中以全波數值模擬軟體(HFSS)分析，而得到最佳化設計，且經由實驗驗証。這二支天線在反射損耗、輻射場型、天線的增益及效率均有不錯的效能，適合應用在無線通訊產品之中。

關鍵詞 : 螺旋型天線 ; 寬頻天線 ; 頻率選擇表面

目錄

參考文獻

[1] 張盛富,載明鳳,“無線通信之射頻被動電路設計”,全華科技圖書股份有限公司，2003.

[2] M. S. Yap, L. Ng, and S. Aditya,“A Triple Band Antenna for GSM and GPS Application,”IEEE vol. 2, pp. 1119-1123, December 2003.

[3] H. Lee, H. Nam, Y. Lim,“A Design of Printed Square Loop Antenna for Omni-directional Radiation Patterns,”IEEE Radio and Wireless Conference, pp. 253-256, August 2003.

[4] Y. L. Kuo and K. L. Wong,“Printed Double-T Monopole Antenna for 2.4/5.2 GHz Dual-Band WLAN Operations,”IEEE Trans. Antennas Propagation, vol. 51, pp. 2187-2192, Sep. 2003.

[5] H. D. Chen, J. S. Chen, and Y. T. Cheng,“Modified Inverted-L Monopole Antenna for 2.4/5 GHz Dual-Band Operations,”Electron. Letter, vol. 39, pp. 1567-1568, 2003.

[6] R. Bawer, and J. J. Wolfe,“The Spiral Antenna,”IRE National Convention Record, vol. 5, pt. 1, pp. 298-306, May 1959.

[7] J. A. Kaisser,“The Archimedean Two-Wire Spiral Antenna,”IRE Trans. Antennas Propagation, vol. 8, pp. 312-323, May 1960.

[8] J. D. Dyson,“The Equiangular Spiral Antenna,”IRE Trans. Antennas Propagation, vol. AP-7, pp. 181-187, April 1959.

[9] C. W. Jung, B. A. Cetiner and F. D. Flaviis,“A Single-Arm Circular Spiral Antenna with Inner/Outer Feed Circuitry for Changing Polarization and Beam Characteristics.”IEEE Trans. Antennas Propagation, vol. 4, pp. 477-477 June 2002 [10] H. Nakano, K. Nogami, S. Arai, Mimaki, and J. Yamauchi,“A Spiral Antenna Backed by A Conducting Plane Reflector,”IEEE Trans. Antennas Propagation, vol. 34, pp. 791-796, June 1986.

[11] J. L. Volakis, M. W. Numberger, D. S. Fililpovic,“ A Broadband Cavity-Backed Slot Spiral Antenna”, IEEE Trans. Antennas Propagation, vol. 43, no. 6 pp. 15-26 December 2001.

[12] T. Ozdemir, M. W. Nurnberger, J. L. Volakis,“A Thin Cavity-Backed Archimedean Slot Spiral for 800-3000 MHz Band Coverage”IEEE

Trans. Antennas Propagation, vol. 4, pp. 2336-2339, June 1998.
[13] J. Thaysen, K. B. Jakobsen and J. Appel-Heanse, " A Wideband Balun – How Does it Work? " Applied Microwave and Wireless, vol. 12 no. 10, pp. 40-50, October 2000.
[14] V. H. Rumsey, " Frequency Independent Antenna, " IRE National Convention Record, vol. 5, pt. 1, pp. 114-118, 1957.
[15] W. L. Stutzman, G. A. Thiele, " Antenna Theory and Design, " pp. 245-257, John Wiley & Sons, 1998.
[16] C. A. Balanis, " Antenna Theory " pp. 64-72 John Wiley & Sons, 1997.
[17] T. N. Chang, " Dual-Band Circularly Polarized Antenna with A QUAD-EMC Structure, " Microwave Opt. Technology. Letter, Vol. 49, pp. 645-647, March, 2007.
[18] P. Minard, and A. Louzir, " A New Wide Frequency Band Feeding Technique of Annular Slot Antenna, " IEEE Antennas and Propagation Society International Symposium, Vol. 1, pp. 406-409, June, 2002.
[19] Ansoft HFSS Website.
[20] B. A. Munk, " Frequency Selective Surface Theory and Design, " Wiley, 2000.
[21] R. A. Pearson, B. Phillips, K. G. Mitchell, and M. Patel, " Application of Waveguide Simulators to FSS and Wideband Radome Design, " IEE Colloquium Advances in Electromagnetic Screens, Radomes and Materials, pp. 7/1 – 7/6, Oct. 1996.
[22] Y. Rahmat-Samii and A. N. Tulintseff, " Diffraction Analysis of Frequency Selective Reflector Antennas, " IEEE Trans. Antennas Propagation. Vol. 41, pp. 476 – 487, April 1993.
[23] M. Wahid and S. B. Morris, " Band Pass Radomes for Reduced RCS, " IEE Colloquium Antenna Radar Cross-Section, pp. 4/1 – 4/9, May 1991.
[24] B. A. Munk, D. S. Janning, J. B. Pryor, and R. J. Marhefka, " Scattering from Surface Waves on Finite FSS Antennas and Propagation, " IEEE Trans. Antennas Propagation, Vol. 49, pp. 1782 – 1793, Dec. 2001.
[25] A. Monorchio, G. Manara, U. Serra, G. Marola, and E. Pagana, " Design of Waveguide Filters by Using Genetically Optimized Frequency Selective Surfaces, " IEEE Microwave and Wireless Components Letters, Vol. 15, pp. 407 – 409, June 2005.
[26] E. Topsakal, J. L. Volakis, " Frequency Selective Volumes for Optical Spatial Filters, " Antennas and Wireless Propagation Letter. Vol. 3, pp. 236 – 238, 2004.