

# 寬頻廣角天線之研製及其雷達截面積研究

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## 摘要

在本篇論文中，將設計製作一適合於VAN AT T A 廣角回波系統之寬頻廣角微帶天線，並將其簡單製作為VAN AT T A 形式後量測其雷達截面積以做研究。文中以降低基板介電常數、增加寄生元件方法增加微帶天線之寬頻性及廣角性，並以模擬軟體IE3D 進行分析與設計，而後製成成品以近場量測系統進行量測。在使用回波系統時，天線的雷達截面積於各角度之響應有其重要性，因此針對所設計的天線，以VAN AT T A 的形式，分析其傳輸線長度以及天線陣列方式可能對天線之雷達截面積的影響，皆將於本論文中加以探討。

關鍵詞：無

## 目錄

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## 參考文獻

- [ 1 ] NICHOLAS C. CURRIE, RADAR REFLECTIVITY MEASUREMENT: TECHNIQUES AND APPLICATIONS, PP. 29-33, 1989.
- [ 2 ] C. A. BALANIS, ANTENNA THEORY ANALYSIS AND DESIGN, 2 ND ED. NEW YORK: WILEY, 1982.
- [ 3 ] L. C. VAN ATTA, "ELECTROMAGNETIC REFLECTOR," U. S. PATENT 2 908 002, OCT. 6, 1959.
- [ 4 ] E. D. SHARP AND M. A. DIAB, "VAN ATTA REFLECTOR ARRAY," IRE TRANS. ANTENNAS PROPAGAT. , VOL. AP-8, PP. 436-438, JUNE 1960.
- [ 5 ] S. N. ANDRE AND D. J. LEONARD, "AN ACTIVE RETRODIRECTIVE ARRAY FOR SATELLITE COMMUNIC -TIONS," IEEE TRANS. ANTENNAS PROPAGAT , VOL. AP-12, PP.181-186, MAR. 1964.
- [ 6 ] S. L. KARODE AND VINCENT F. FUSCO, "SELF-TRACKING DUPLEX COMMUNICATION LINK USING PLA -NAR RETRODIRECTIVE ANTENNAS" IEEE TRANS. ANTENNAS PROPAGAT. , VOL. 47, PP. 993-1000, JUNE. 1999.
- [ 7 ] 湯慶仲!AK 頻段共面波導饋入式雙頻微帶天線之設計，碩士論文，臺灣大學電信工程研究所，中華民國八十八年六月。
- [ 8 ] G. A. DESCHAMPS, "MICROSTRIP MICROWAVE ANTENNAS," PRESENTED AT THE THIRD USAF SYMPSIU -M ON ANTENNAS, 1953.
- [ 9 ] R. E. MUSON, "CONFORMAL MICROSTRIP ANTENNAS AND MICROSTRIP PHASED ARRAYS," IEEE TRANS . ANTENNAS PROPAGAT. , VOL. AP-22, NO. 1, PP.74-78, JANUARY 1974.
- [ 10 ] J. W. HOWELL, "MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT. , VOL. AP-23, NO. 1, PP.90-93, JANUARY 1975.
- [ 11 ] 顏仕傑，中華衛星一號個人通信實驗地面發射 / 接收天線之雜 形研製，碩士論文，臺灣大學電機 工程研究所，中華民國八十六年六月。
- [ 12 ] C.H.HUANG AND P.HSU, "EFFECT OF FEED MODELING ON THE EVALUATION OF INPUT IMPEDANCE OF MICROSTRIP ANTENNA," IEEE TRANS. MAGNETICS, VOL.25, PP.3058-3060, JULY 1989.
- [ 13 ] T.C.CHENG,DESIGN OF CPW-FEED BACK TO BACK PATCH ANTENNA FOR WIRELESS LAN, MASTER THESIS, DEPARTMENT OF ELECTRICAL ENGINEERING, NATIONAL TAIWAN UNIVERSITY, JUN 1998.
- [ 14 ] D.M..POZER, "A MICROSTRIP ANTENNA APERTURE-COUPLED TO MICROSTRIP LINE," ELECTRONIC LE -TTERS., VOL.21, PP.49-50, JAN.1985.

- [15] A. G. DERNERYD, "LINEARLY POLARIZED MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP-24, NO. 6, PP.846-851, NOVEMBER 1976.
- [16] E. H. NEWMAN AND P. TULYATHAN, "ANALYSIS OF MICROSTRIP ANTENNAS USING MOMENT METHODS," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP-29, NO. 1, PP. 47-53, JANUARY 1981.
- [17] W. F. RICHARDS, Y. T. LO, AND APPLICATIONS," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP- 29, NO. 1, PP. 38-46, JANUARY 1981.
- [18] Y. T. LO, D. SOLOMON, AND W. F. RICHARDS, "THEORY AND EXPERIMENT ON MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP- 27, NO. 2, PP. 137-145, MARCH 1979.
- [19] M. C. BAILEY AND M. D. DESHPANDE, "INTEGRAL EQUATION FORMULATION OF MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP-30, NO. 4, PP. 651-656, JULY 1982.
- [20] J. R. MOSIG AND F. E. GARDIOL, "GENERAL INTEGRAL EQUATION FORMULATION OF MICROSTRIP ANTENNAS AND SCATTERERS," PROC. INST. ELECT. ENG., PT. H, VOL. 132, PP. 424-432, 1985.
- [21] D. M. POZAR AND S. M. VODA, "RIGOROUS ANALYSIS OF A MICROSTRIP FED PATCH ANTENNA," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP-35, PP. 1343-1350, 1987.
- [22] L. VEGNI, R. CICHETTI, AND P. CAPECE, "SPECTRAL DYADIC GREEN'S FUNCTION FOR PLANAR INTEGRATED STRUCTURES," IEEE TRANS. ANTENNAS PROPAGAT., VOL. AP-36, NO. 8, PP. 1057- 1065, AUGUST 1988.
- [23] L. GIAUFFRET AND J. M. LAHEURTE, "THEORETICAL AND EXPERIMENTAL CHARACTERISATION OF CPW-FED MICROSTRIP ANTENNAS," IEE PROC. MICROW. ANTENNAS PROPAG., VOL. 143, NO.1, FEBRUARY 1996.
- [24] D. M. POZAR, "CONSIDERATION FOR MILLIMETER WAVE PRINTED ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL.31, PP. 740-747, SEP. 1983.
- [25] E. CHANG, S. A. LONG AND W. F. RICHARDS, "AN EXPERIMENTAL INVESTIGATION OF ELECTRICALLY THICK RECTANGULAR MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL.34, PP. 767-772, JUNE. 1986.
- [26] D. H. SCHAUBERT, D. M. POZAR AND A. ADRIAN, "EFFECT OF THEORIES ANTENNA SUBSTRATE THICKNESS AND PERMITTIVITY: COMPARISON OF THEORIES WITH EXPERIMENT," IEEE TRANS. ANTENNAS PROPAGAT., VOL.37, PP. 677-682, JUNE. 1989.
- [27] G. KUMAR, K. C. GUPTA, "BROAD-BAND MICROSTRIP ANTENNA USING ADDITIONAL RESONATORS GAP-COUPLE TO THE RADIATING EDGES," IEEE TRANS. ANTENNAS PROPAGAT., VOL.32, PP. 1375-1379, DEC. 1984.
- [28] G. KUMAR, K. C. GUPTA, "NONRADIATING EDGES AND FOUR EDGES GAP-COUPLED MULTIPLE RESONATOR BROAD-BAND MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL.33, PP. 173-178, FEB. 1985.
- [29] G. KUMAR, K. C. GUPTA, "DIRECTLY COUPLED MULTIPLE RESONATOR WIDE-BAND MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT. VOL.33, PP. 588-593, JUNE. 1985.
- [30] S. A. LONG AND M. D. WALTON, "A DUAL-FREQUENCY STACKED CIRCUIT-DISC ANTENNA," IEEE TRANS. ANTENNAS PROPAGAT., VOL.27, PP. 270-273, MAR. 1979.
- [31] A. SABBAN, "A NEWBROADBAND STACKED TWO-LAYER MICROSTRIP ANTENNA,"IEEE AP-S INT. SYMP. DIG., PP. 63-66, JUNE.
- [32] R. Q. LEE, K. F. LEE AND J. BOBINCHAK, "CHARACTERISTICS OF TWO-LAYER ELECTROMAGNETICALLY COUPLED RECTANGULAR PATCH ANTENNA," ELECTRON. LETT., VOL. 23, PP. 1070-1073, SEP. 1987.
- [33] A. N. TULINTSEFF AND R. M. SORBELLO, "CURRENT AND RADIATION FIELDS OF ELECTROMAGNETICALLY COUPLED MICROSTRIP ANTENNAS," IEEE AP-S INT. SYMP. DIG., VOL.2, PP. 928-931, JUNE 1987.
- [34] A. N. TULINTSEFF, S. M. ALI AND J. A. KONG, "INPUT IMPEDANCE OF A PROBE-FED STACKED CIRCUIT MICROSTRIP ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL.39, PP. 381-390, MAR. 1991.
- [35] C. A. BALANIS, "ANTENNA THEORY ANALYSIS AND DESIGN" 2ND ED., PP727-731, 1996.
- [36] A. D. YAGHJIAN, "SIMPLIFIED APPROACH TO PROBE-CORRECTED SPHERICAL NEAR-FIELD SCANNING," ELECTRON. LETT., VOL. 20, PP. 195-196, MAR. 1984.
- [37] R. C. WITTMANN, "PROBE CORRECTION IN SPHERICAL NEAR-FIELD SCANNING, VIEWED AS AN IDEAL PROBE MEASURING AN EFFECTIVE FIELD," IEEE AP-S INT. SYMP. DIG., BOSTON, PP. 674-677, MA, JUNE 1984.
- [38] A. D. YAGHJIAN AND R. C. WITTMANN, "THE RECEIVING ANTENNA AS A LINEAR DIFFERENTIAL OPERATOR: APPLICATION TO SPHERICAL NEAR-FIELD SCANNING," IEEE TRANS. ANTENNAS PROPAGAT., VOL.33, PP. 1175-1185, NOV. 1985.
- [39] A. D. YAGHJIAN, "EQUIVALENCE OF SURFACE CURRENT AND APERTURE FIELD INTEGRATION FOR REFLECTOR ANTENNAS," IEEE TRANS. ANTENNAS PROPAGAT., VOL.32, PP. 1355-1358, DEC. 1984.
- [40] ANTCOM NEAR-FIELD SCANNER TEST SYSTEM TECHNICAL MANUAL,1999.
- [41]邱永年!A被動式汽車短距離通訊微波答詢器之研發，碩士論文，交通大學電信工程研究所，中華民國八十八年六月。

