

# Beam Steering Implementation by Phase Correction Algorithm for Phased Array

周國良、張道治

E-mail: 9419764@mail.dyu.edu.tw

## ABSTRACT

The one dimensional PAA (phased array antenna) is under developed at WCRC (wireless communication research laboratory) of DYU (Da Yeh University). There are eight antenna elements. The phase shifters of each antenna element are used the SP8T (single pole eight through) matrix switch to form the signal path. The quantized phase error is about 22.5 degrees. The operating frequency band for the PAA is from 1.7 to 2.2 GHz. The antenna array is eight elements of Bow-Tie type Antenna. Besides, the SP8T switch matrix is CYTEC Company production. The switching speed of the switch matrix is less than 15 ms. In this paper, we emphasize the program software development to exploited the PAA beam steering, phase compensation for each frequency, and interface between computer and matrix switch using RS232 to instead human operating mode to control the Matrix Switch, just for the purpose of saving a lot of parameters setting and reviewing data setting time, and achieving automatic control by computer. Finally, there is a function in the developed program that to call PCAAD (Personal Computer Aided Antenna Design) package to show the antenna pattern which is the result of all phases by computer operated, and the measured data at WCRC to verify the result of experiment.

Keywords : PAA、Phase Shifters、Switch Matrix

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## REFERENCES

- [1] 謝德榮 “ Microsoft Excel 應用系列資料與數值分析 ” , 五南(Wu Nan)圖書出版公司。
- [2] 洪國勝、江國軍等 , “ C++ Builder 6 ” , 旗標出版股份有限公司。
- [3] R. C. HANSEN, “ PHASED ARRAY ANTENNAS ” , Revised Edition, 1998, page 7, 17, 106.
- [4] BYRON EDDE. “ RADAR PRINCIPLES, TECHNOLOGY, APPLICATIONS ” , page 457, 458.
- [5] David Adamy, “ E101, A First Course in Electronic Warfare ” ,2000, page.158-162.
- [6] Richard C. Johnson. “ ANTENNA ENGINEERING HANDBOOK ” , Third Edition, page 20-4,20-5,20-6.
- [7] John D.Karus Ronald J. Marhefka. “ ANTENNAS For All Application ” Third Edition, 2002. Page52-521.
- [8] 鄭明哲 “ 工程數值方法 ” , 全華(Chan Wang)科技圖書公司。第273頁, 第 275頁至277頁止。