

行政院國家科學委員會專題研究計畫 期中進度報告

子計畫五：超寬頻射頻收發電路之研製(1/3)

計畫類別：整合型計畫

計畫編號：NSC93-2219-E-002-024-

執行期間：93年08月01日至94年07月31日

執行單位：國立臺灣大學電信工程學研究所

計畫主持人：王暉

報告類型：完整報告

處理方式：本計畫可公開查詢

中 華 民 國 94年5月10日

九十三學年度研究計畫執行進度報告

計畫名稱：超寬頻射頻收發電路之研製 (1/3)

Research and Development of Ultra Wide Band Tranceiver Circuits(1/3)

計畫編號：NSC 93-2219-E-002-024

執行期限：93 年 8 月 1 日至 94 年 7 月 31 日

主持人：王 暉

執行單位：國立台灣大學電信工程學研究所

學 門：微波工程

二. 計畫摘要

本計畫的目標為：研發 40-48GHz 頻段超寬頻無線收發機中之升、降頻器微波積體電路，以提升國內微波單晶積體電路之技術。

本研究的內容包括：設計用等效電路模型的建立，電路之設計及實作，並以量測結果驗證設計理念，進而建立國內此項高頻電路之技術。

三. 預期完成之工作項目

本計畫擬於三年內，設計、研製、並分析數種升、降頻器微波電路，其分年之研究子題如下：

第一年 進行第一循環升、降頻器單晶微波積體電路之設計與製作，

第二年 進行量測第一年所製作之電路以及設計第二循環之晶片，

第三年 進行多功能晶片之整合設計。

而每一年度擬完成項目如下：

1. 高頻電路單晶片之設計及量測，
2. 元件模型之驗證及改進。

四. 第一年 (93.8.1-94.7.31) 研究項目執行進度

1. 設計第一循環之晶片 (已完成)
 - 1) 低雜訊放大器之設計 (已完成)
 - 2) 混頻器之設計 (已完成)
2. 元件等效電路之驗證及改進 (進行中)
3. 實驗系統建立與量測 (近完成階段)
4. 撰寫報告 (準備階段)

五. 具體成果

已完成下列論文

Journal paper:

- [1] Yu-Lung Tang, Po-Yu Chen, and Huei Wang, "A broadband PHEMT MMIC distributed doubler using high-pass drain line topology," *IEEE Microwave and Wireless Component Letters*, vol. 14, no. 5, pp. 201-203, May 2004. (ME 89-N-FA01-1-1, ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [2] Po-Yu Chen, Tian-Wei Huang, Huei Wang, Yu-Chi Wang, Pane-Chane Chao and Chung-Hsu Chen, "K-and HBT and HEMT monolithic active phase shifters using vector sum method," *IEEE Trans. on Microwave Theory and Tech.*, vol. 52, no. 5, pp. 1414-1424, May 2004. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)

- [3] Ren-Chieh Liu, Chin-Shen Lin, Kuo-Liang Deng, and Huei Wang, "Design and analysis of DC-to-14-GHz and 22-GHz CMOS cascode distributed amplifiers," *IEEE Journal of Solid State Circuits*, vol. 39, no. 8, pp. 1370-1374, August 2004. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [4] Ming-Da Tsai and Huei Wang, "A 0.3-25-GHz ultra-wideband mixer using commercial 0.18- μ m CMOS technology," *IEEE Microwave and Wireless Component Letters*, vol. 14, no. 11, pp. 522-524, Nov. 2004. (ME 89-N-FA01-1-1, ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [5] Ming-Da Tsai, Kuo-Liang Deng, Huei Wang, Chun-Hung Chen, Chih-Sheng Chang, and John G. J. Chern, "A miniature, 25-GHz 9-dB CMOS cascaded single-stage distributed amplifier," *IEEE Microwave and Wireless Component Letters*, vol. 14, no. 12, pp. 554-556, Dec. 2004. (ME 89-N-FA01-1-1, ME 89-E-FA06-2-4, NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [6] Kang-Wei Fan, Ching-Chih Weng, Zou-Min Tsai, Huei Wang and Shyh-Kang Jeng, "K-Band MMIC active band-pass filters," *IEEE Microwave and Wireless Component Letters*, vol. 15, no. 1, pp. 19-21, Jan. 2005. (NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)
- [7] Ming-Fong Lei and Huei Wang, "An analysis of miniaturized dual mode bandpass filter structure using shunt capacitance perturbation," *IEEE Trans. on Microwave Theory and Tech.*, vol. 53, no. 3, pp. 861-867, March, 2005. (NSC 89-2213-E-002-178, NSC 89-2219-E-002-042 and ME-89-E-FA06-2-4-6)
- [8] Ming-Da Tsai, Yi-Hsien Cho, and Huei Wang, "A 5-GHz low phase noise differential Colpitts CMOS VCO," to appear in *IEEE Microwave and Wireless Component Letters*. (NSC 90-2219-E-002-007, and NSC 89-2213-E-002-178)

Conference paper

- [1] Tian-Wei Huang, Pei-Si Wu, Ren-Chieh Liu, Jeng-Han Tsai, Huei Wang, and Tzi-Dar Chiehuh, "Boundary scan for 5-GHz RF pins using LC isolation networks," *Proc. of 22nd IEEE VLSI Test Symposium*, Napa Valley, CA, USA, April 2004.
- [2] Chi-Hsueh Wang, Yo-Shen Lin, Huei Wang, and Chun-Hsiung Chen, "A Q-band miniaturized uniplanar MMIC HEMT mixer," *2004 IEEE MTT-S International Microwave Symposium Digest*, vol. 1, pp. 187-190, Dallas, Texas, June, 2004.
- [3] Ming-Da Tasi, Chin-Shen Lin, Chi-Hsueh Wang, Chun-Hsien Lien and Huei Wang, "A 0.1-23-GHz SiGe BiCMOS analog multiplier and mixer based on attenuation-compensation technique," *2004 IEEE RFIC Symposium Digest*, pp. 417-420, Dallas, Texas, June, 2004. (NSC 91-2219-E-002-014, NSC 91-2213-E-002-019 and ME 89-E-FA06-2-4-6)
- [4] Pei-Si Wu, Chao-Hsiung, Tseng, Ming-Fong Lei, Tian-Wei Huang, Huei Wang, and Philip Liao, "3-D X-band new transformer balun configuration using the multilayer ceramic technologies," *34th European Microwave Conference Proceedings*, vol. 1, pp. 385-388, Amsterdam, Netherlands, Oct., 2004. (NSC 93-2725-E-002-PAE, NSC 93-2219-E-002-016, NSC 93-2219-E-002-024 and NSC-2213-E-002-033)
- [5] Ming-Da Tsai, Huei Wang, Jui-Feng Kuan, and Chih-Ping Chao, "A miniature 4.3-7-GHz, 1-V CMOS LNA with helical inductors," *34th European Microwave Conference Proceedings*, vol. 1, pp. 29-32, Amsterdam, Netherlands, Oct., 2004. (NSC 92-2213-E-002-069 and NSC 93-2752-E-002-002-PAE)
- [6] Chin-Shen Lin, Ming-Da, Tsai, Huei Wang, Yu-Chi Wang, and Chung-Hsu Chen, "A monolithic HBT broadband Darlington amplifier using modified triple Darlington pair," *European GAAS Conference Proceedings*, pp. 331-334, Amsterdam, Netherlands, Oct., 2004. (NSC 93-2725-E-002-PAE, NSC 93-2219-E-002-016, NSC 93-2219-E-002-024 and NSC-2213-E-002-033)
- [7] Hong-Yeh Chang, Huei Wang, Yu-Chi Wang, Pane-Chane Chao, and Chung-Hsu Chen, "A 22-GHz ultra low phase noise push-push dielectric resonator oscillator using MMICs," *European GAAS Conference Proceedings*, pp. 33-36, Amsterdam, Netherlands, Oct., 2004. (NSC 93-2725-E-002-PAE, NSC 93-2219-E-002-016, NSC 93-2219-E-002-024 and NSC-2213-E-002-033)
- [8] Tsung-Liang Lin, Ren-Chieh Liu, Ming-Da Tsai, and Huei Wang, "A low-noise low-Power transimpedance amplifier for 10-G/s optical communications," *16th Asia Pacific Microwave Conference Technical Digest*, New Dehli, India, Dec., 2004.
- [9] To-Po Wang, Ming-Da Tsai, Ren-Chieh Liu and Huei Wang, "A high conversion gain and low LO power 5-6-GHz CMOS mixer," *16th Asia Pacific Microwave Conference Technical Digest*, New Dehli, India, Dec., 2004.
- [10] Mei-Chao Yeh, Zou-Min Tsai, and Huei Wang, "A miniature singly balanced mixer using seven-symmetric -coupled-line marchand balun," *16th Asia Pacific Microwave Conference Technical Digest*, New Dehli, India, Dec., 2004.
- [11] Chi-Hsueh Wang, Huei Wang, and Chun Hsiung Chen, "A miniaturized uniplanar MMIC diode mixer with multifunction transition," *16th Asia Pacific Microwave Conference Technical Digest*, New Dehli, India, Dec., 2004.

- [12]Jeng-Han Tsai, Hong-Yeh Chang, Pei-Si Wu, Tian-Wei Huang, and Huei Wang, "A 44-GHz high-linearity MMIC medium power amplifier with a low-loss built-in linearizer," *2005 IEEE MTT-S International Microwave Symposium Digest*, Long Beach, CA, June 2005.
- [13]Ming-Da Tsai, Kun-You Lin, and Huei Wang, "A 5.4-mW LNA using 0.35- μm SiGe BiCMOS technology for 3.1-10.6-GHz UWB wireless receivers," *2005 IEEE RFIC Symposium Digest*, Long Beach, CA, June 2005.
- [14]Shi-Chieh Shin, Szu-Fan Lai, Kun-You Lin, Ming-Da Tasi, Huei Wang and Chih-Sheng Chang, and Yung-Chih Tsai, "18-26 GHz low-noise amplifiers using 130- and 90-nm bulk CMOS technologies," *2005 IEEE RFIC Symposium Digest*, Long Beach, CA, June 2005.
- [15]Mei-Chao Yeh, Ren-Chieh Liu, Zuo-Min Tsai, and Huei Wang, "A miniature low-insertion-loss, high-power CMOS SPDT switch using floating-body technique for 2.4- and 5.8-GHz applications," *2005 IEEE RFIC Symposium Digest*, Long Beach, CA, June, 2005.