應用於 77 GHz 之次諧波混頻器與倍頻器

研究生：吳俊毅　　指導教授：張志揚 博士

國立交通大學電信工程學系

摘要

本篇論文提出應用於 77 GHz 的次諧波混頻器與倍頻器。次諧波混頻器的設計中，分別使用反並聯式配對二極體 (antiparallel diode pair)與超寬頻岔路環 (ultra-broadband rat race ring)來達成混頻的效果。兩種混頻器皆採用混成微波積體電路製成，以共平面波導結構製作完成。在不同的架構的混頻器量測結果顯示，最小的轉頻損耗為 12.8 dB，RF 頻率為 95GHz。

倍頻器電路分別利用二極體與 HEMT 電晶體非線性的特性達成倍頻效果。二極體倍頻器利用共平面波導，混成式積體電路製成，而 HEMT 倍頻器則使用微帶線結構，單石微波積體電路製成製作完成。量測結果顯示，二極體倍頻器最佳的轉頻損耗為 12.8dB，輸出頻率 75GHz，而 HEMT 倍頻器最佳轉頻損耗為 5.96dB，輸出頻率 77GHz。

Subharmonic Mixers and Frequency Doublers for 77GHz Application

Student: Chun-Yi Wu Advisor: Dr. Chi-Yang Chang

Institute of Electrical Communication Engineering
National Chiao-Tung University

Abstract

Subharmonic mixers and frequency doublers for 77 GHz application are presented in this thesis. Subharmonic mixers incorporating an antiparallel diode pair and an ulra-broadband rat race ring are designed using coplanar waveguide (CPW) technology on a ceramic substrate. The mixers are designed to operate mainly at an RF of 77 GHz and a fixed IF of 500 MHz. Of several mixer configurations measured, the best results reveal a minimum conversion loss of 12.8 dB at an RF of 95 GHz.

Frequency doublers using single diode and HEMT are fabricated by hybrid MIC in CPW and MMIC in microstrip process respectively. The frequency doublers are designed to operate at an input of 38.5 GHz and an output of 77 GHz. The single diode doubler exhibits a minimum conversion loss of 12.8 dB at 75 GHz, while HEMT frequency doubler exhibits a minimum conversion loss of 5.96 dB at 77 GHz and a maximum output power of 6.04 dBm at 77GHz.