Chapter 1

Introduction

In recent years, wireless communications such as pagers, cordless phones, cellular phones and wireless local area networks (WLAN) have been indispensable commodity in most modern people's lives. The tremendous growth of the wireless communication market has driven standard bodies, industries and academies ranging from system specification to IC manufacturing in response to the demands on higher data rate, lower power dissipation and lower cost of wireless devices. Many wireless system specifications had been proposed to meet the need for wireless connectivity such as PHS, W-CDMA, Bluetooth,and WLAN. Among these wireless systems, the unlicensed WLAN presents to be the most flexibility and degree of freedom for wireless data access, which triggered enormous academic research activities.

1.1 Motivation

As the successful market of wireless LAN, the standard evolves to adopt more complex modulation techniques in order to increase data rate. As a result, the requirements for radio receivers become more stringent in terms of noise and linearity performance. The research goal of the work is to explore the techniques for implementing a direct conversion receiver in low-cost complimentary metal-oxide

semiconductor (CMOS) technology while provide sufficient performance. Since direct conversion has been the most attractive receiver architecture for wideband wireless receivers, the design issue of reducing flicker noise is one of the interests of the work. Moreover, integration of wireless systems also drives the demands for co-verification of baseband and radio receivers to ensure a robust performance of the receiver prior manufacturing. Although the work focuses mainly on wireless LAN, the techniques developed also apply to other wireless systems.

1.2 Organization

The organization of the dissertation is overviewed as follows:

Chapter 2 begins with a review of radio specifications of various wireless LAN standards. Based on the specifications, the specifications for a 2.4/5-GHz dual-band WLAN radio receiver are established. The direct conversion receiver architecture as well as the receiver link budget plan are also discussed in the chapter.

To meet the need for operation at both upper and lower band of 5-GHz WLAN frequency band, Chapter 3 presents a experimental dual-band switchable low noise amplifier implemented in a 0.25-μm CMOS technology. The experimental results demonstrate the ability of switchable frequency band with a dual-band load design.

The flicker noise of a direct conversion receiver mainly comes from the down-conversion mixer. The design obstacle is addressed in Chapter 4. A low flicker noise current-folded mixer topology has been proposed to alleviate the problem and shows superior performance compared to conventional Gilbert-cell mixers.

Chapter 5 presents the RF/baseband co-verification and co-design method used in the implementation of a 2.4-GHz CMOS direct conversion receiver front-end. The experimental result shows agreement with the RF/baseband co-simulation result.

With the proposed current-folded mixer topology and the RF/baseband co-verification method, a 2.4-GHz CMOS direct conversion receiver front-end had

been implemented in a 0.25-μm CMOS technology and is discussed in Chapter 6. For the completeness of the dissertation, an experimental version of 2.4-GHz low noise amplifier implemented in 0.25-μm CMOS technology is included in Appendix B.

Chapter 7 concludes with a summary of contributions and some suggestions for further work.