SUMMARY OF Ph.D. DISSERTATION

School	Student Identification Number	SURNAME, First name
Integrated Design Engineering		Anas Bin Muhamad Bostamam

Title

Adjacent Channel Interference Mitigation Schemes for Software Defined Radio Receiver

Abstract

Software defined radio (SDR) is a technology that allows a single terminal to support various kinds of wireless systems and services by changing software to reconfigure the wireless terminal. In order to realize a SDR receiver, flexible receiver architecture with wideband signal receiving capability is required. However, if the receiving bandwidth is wider, the received signal components may cause interference to each other. In this study, the signal processing methods to combat the adjacent channel interference (ACI) problems in the SDR receivers are investigated and discussed.

Chapter 1 introduces the background of the SDR and the motivation of the research.

Chapter 2 proposes and investigates a new ACI cancellation scheme for multi-channel reception with low-IF receivers. The multi-channel signal reception is utilized to realize high speed handover on wireless LAN. A high resolution ADCs should be employed to accommodate signals with a very large dynamic range. Moreover, the ACI component may directly overlap with the desired signal if the interference is much larger than the desired signal. In order to reduce the required resolution of the ADCs and reduce the interference, an analog-digital signal processing technique has been investigated. In the proposed analog-digital signal processing scheme, channel selection is made by analog complex band pass filter (BPF) to ease the dynamic range of ADCs, and the signal is reconstruct by Wiener filter in digital domain to eliminate the remaining interference effect.

Chapter 3 describes an ACI cancellation scheme with undersampling for the multi-channel reception. Undersampling technique is applied to the system which is described in Chapter 2 in order to lower the required sampling frequency and power consumption. However, the undersampling technique requires high performance BPFs to minimize any out-of-band signals; otherwise, the out-of-band signals will be aliased and translated to the desired band. The effects of the adjacent channel to the undersampling technique in this scheme is examined and discussed in the chapter. In the proposed scheme, the interference due to the undersampling is mitigated by using the Wiener filter.

Chapter 4 describes a new fractional sample rate conversion (SRC) scheme for the RF-sampling receiver architecture. The objective of the scheme is to realize a high-speed and high-performance SRC scheme with low-complexity and lower power consumption. High-speed SRC scheme for high sample rate data can be realized by a direct insertion/cancellation scheme. However, the direct insertion/cancellation scheme suffers from large aliasing and distortion as compared to the other SRC techniques. Moreover, the aliasing from the adjacent channel interferes the desired signal. In the proposed scheme, the distortion noise and aliasing are mitigated by applying multiple sets of inserters/deleters. This scheme mitigates the ACI, reduces the required complexity of an anti-aliasing filter structure, and improves the performance.

Chapter 5 summarizes the results of each chapter and concludes this thesis.