Chapter 19
The Use of Convolutional Code for Narrowband Interference Suppression in OFDM-DVBT System

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Abstract The problem of mitigating narrowband interference (NBI) due to coexistence between Digital Video Broadcasting-Terrestrial (DVB-T) and International Mobile Telecommunication-Advanced (IMT-A) system is considered. It is assumed that a spectrum of IMT-A system between 790 and 862 MHz interfere the spectrum of the OFDM signal in DVB-T band. Two types of convolutional code (CC) which are non-systematic convolutional code (NSCC) and recursive systematic convolutional code (RSCC) are proposed to mitigate NBI. The performance of the two techniques is compared under additive white Gaussian noise (AWGN) channel. It is observed that NSCC has a better bit error rate (BER) performance than RSCC. The result showed good performance for low SNR ($\leq$5 dB).

Keywords OFDM · Convolutional code · Narrowband interference · DVB-T

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19.1 Introduction

Orthogonal Frequency Division Multiplexing (OFDM) is a popular multiplexing scheme used for transmission of high data rates in various communication standards such as DVB-T, WLANS, WMANs and WiMAX [1, 2]. For certain standards such as WLANs and WMANs, an OFDM system has the ability to operate in unlicensed frequency bands. As a result, there is a possibility that they have to share the same frequency band with other communication systems such as cordless telephones, garage door openers and baby monitors. This leads to narrowband interference (NBI) in the systems [3]. Another example of systems sharing the same frequency band is WiMAX and UWB systems. According to [4], UWB system is required to modify its spectrum to avoid interference with WiMAX. In WRC-07 conference, ITU-R has allocated the 790–862 MHz frequency for IMT-A system. This also suggests that the DVB-T system which operates between 470 and 862 MHz have to share its upper frequency band with the IMT-A system [5].

There are several techniques proposed to mitigate NBI such as using orthogonal codes, frequency domain cancellation, receiver windowing and excision filtering [3, 4]. Although orthogonal codes is found to give better performance compared to error control code (ECC), this method does not comply with the current OFDM standard such as DVB-T and IEEE [3]. On the other hand, frequency domain cancellation technique is not suitable to be implemented in broadcasting because the channel and interference information from the receiver needed to be fed back to the transmitter periodically for update. A limitation of receiver windowing method is that it is suitable to be used together with frequency domain cancellation to reduce the effect of sinc shape side lobes from spreading to adjacent channel while excision filtering method provides less benefit with quadrature amplitude modulation (QAM) [4].

ECC is a suitable candidate to mitigate NBI as it is able to protect the data using a specific code. The data which is corrupted during transmission in the noisy channel will be recovered by the specific decoding method. Theoretically, ECC has the capability to lower the bit error rate of an uncoded system by a certain coding rate [6]. In brief, there are three types of ECC known as block, convolutional and modern codes. In this work, convolutional code (CC) is proposed as it is suitable to be used in broadcasting, deep space communication, digital speech and also for Gaussian channel condition [7, 8]. Two types of convolutional code proposed to mitigate NBI in DVB-T system are non-systematic convolutional code (NSCC) and recursive systematic convolutional code (RSCC).

Section 19.2 describes the OFDM system and NBI model used. Section 19.3 explains about the proposed ECC techniques. Section 19.4 provides the simulation results and discussion while Sect. 19.5 concludes this paper.