OFDM 통신 시스템에서의 주파수 오차 보상 방안

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Frequency Offset Correction Scheme for an OFDM-Based Mobile Communication System

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Abstract

Frame synchronization is an critical factor for an effective operation of OFDM (orthogonal frequency division multiplexing) based communication systems. In this paper, we present and analyze an efficient frame synchronization method based on m-sequence for OFDM-based mobile multimedia communication systems. The cyclic extension preceding OFDM frames is of decisive importance for this method. The m-sequence is added directly to cyclic extension signal in the time domain. By utilizing the autocorrelation characteristics of m-sequence, efficient frame synchronization can be achieved. And we also consider frequency offset estimation simultaneously. The proposed frame synchronization method can be applied to the OFDM-based mobile multimedia communication systems.

I. INTRODUCTION

Frame synchronization is required to detect proper time instant to start sampling a new frame in order to transmit OFDM signal blocks. The OFDM system is extremely sensitive to possible uncompensated these frequency offsets, which distort orthogonality between subcarrier. As a result, intercarrier interference (ICI) occurs. To avoid severe system performance degradation, it is required in fact that the uncompensated frequency offset does not exceed a small fraction of the subcarrier signaling rate, which is N times smaller than the overall signaling rate. This paper proposes the new frame synchronization and frequency offset estimation method which is applying the PN sequences on the cyclic extension signal. At the receiver, correlation detection is used to estimate the start position of the new frame. The m-sequence does not affect the normal operation of OFDM system since we can make the power of m-sequence low enough or compensate for the spectrum of the m-sequence at the receiver. Simulation results show that the proposed method performs well over the multipath channel.

II. SYSTEM MODEL

As shown in figure 1, an m-sequence is added in the start position of a new frame of $x(N)$. If we observe $2N_c'+1$ consecutive samples of $r(n)$ in which an m-sequence is contained. The start position is unknown to the receiver.

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However we know that the start position of m-sequence, which is also the start position of OFDM frame.

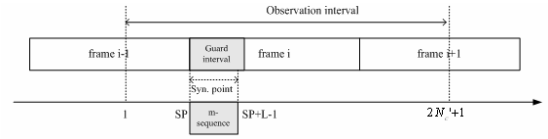

Fig.1. Synchronization scheme using m-sequence in the guard interval

Ⅲ. SIMULATION RESULTS

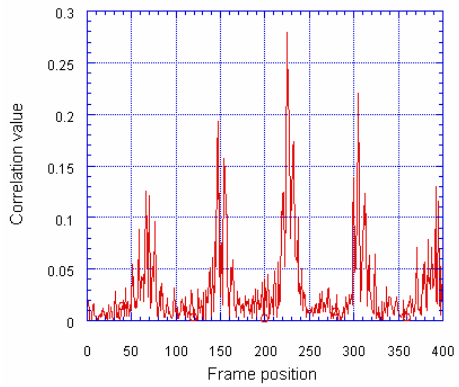

Fig.2. PN sequence synchronization in 2-ray Rayleigh channel. SNR=15dB

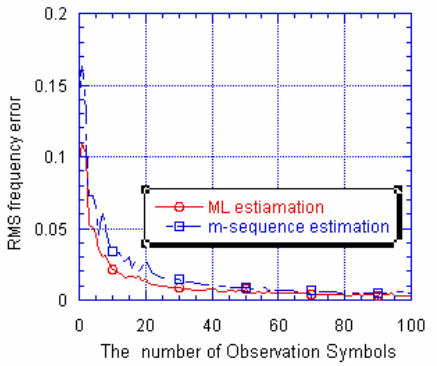

Fig.3.RMS frequency error versus the number of symbols in 2-ray Rayleigh channel. SNR=15dB

IV. DISCUSSIONS

In this paper, we have proposed an efficient synchronization method and frequency offset estimation method based on m-sequence for OFDM scheme in the multipath channel.

Although the GIB optimum ML estimation method is optimal, it may not be appropriate for use in the practical system due to its high complexity, and severe degradation of performance in the multipath channel and interfered by the impulsive noise. From the synchronization point of view, the simulation result shows that the performance of proposed algorithm improves than optimum ML estimation in the multipath channel. In the RMS frequency error aspect, although the optimum ML estimation is improved a little in the beginning of samples than m-sequence estimation method, the performance of m-sequence estimation is closed to ML estimation after a few samples.

ACKNOWLEDGEMENT

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