Time-Frequency-Multiplex Preamble Design for Joint I/Q Imbalance, CFO and Channel Estimation in OFDM Systems

Juinn-Horng Deng* and Kuo-Tai Feng **†

* Department of Communications Engineering Yuan Ze University, 135 Yuan-Tung Road, Chung-Li, Taiwan
** Department of Communications Engineering Yuan Ze University, 135 Yuan-Tung Road, Chung-Li, Taiwan
E-mails: jh.deng@saturn.yzu.edu.tw, s1004812@mail.yzu.edu.tw

Abstract— In this paper, a novel time-frequency-multiplex preamble design is proposed to estimate the in-phase and quadrature-phase (I/Q) imbalance, carrier frequency offset (CFO) and channel impulse response parameters for the zero-IF receiver of orthogonal frequency-division multiplexing (OFDM) systems. First, the contiguous time-multiplex preamble is designed to estimate CFO. Then, the two CFO compensators of the positive and negative subcarriers are proposed to separate and estimate I/Q imbalance and channel parameters. Finally, the image signal cancellation via the estimated parameters is designed to enhance the receiver performance. The advantage of the proposed time-frequency-multiplex preamble design is low computational complexity and robust performance. Simulation results confirm that the proposed estimator can provide reliable performance over the severe I/Q imbalance, CFO, and multipath fading channel environment.

Keywords—OFDM, CFO, I/Q imbalance, channel estimation, equalization.

Juinn-Horng Deng received the Ph.D. degree in Commun. Engineering from National Chiao Tung University, Taiwan, R.O.C, in 2003. From 2003 to 2008, he was in the Electronic System Research Department at Chung Shan Institute of Science Technology, Taiwan, R.O.C. In 2008, he joined the Faculty of Yuan Ze University, Chungli City, Taiwan, where he currently is an Assistant Professor in the Department of Communication Engineering. His research interests include advanced signal processing and MIMO techniques for wireless communication.

Kuo-Tai Feng received the B.S. degree in Department of Electrical Engineering at Fu Jen Catholic University, in 2011. He is working on his Master’s degree at Yuan Ze University, Taiwan, R.O.C. His research interests include advanced signal processing, wireless communication and software defined radios.