The Performance of Frequency Offset Estimation in DVB-C2 Receiver

Jae-Ho Lee*, Dong-Joon Choi*, Nam-Ho Hur*, Whan-Woo Kim**

* Smart Cable Broadcasting Research Division, ETRI, South Korea
** Chungnam National University, South Korea
jaeholee@etri.re.kr, djchoi@etri.re.kr, namho@etri.re.kr, wwkim@cnu.ac.kr

Abstract—In this paper, we show the performance of frequency offset (FO) estimation in Digital Video Broadcasting for Cable version 2 (DVB-C2) receiver which uses orthogonal frequency-division multiplexing (OFDM). In OFDM system, inter-carrier interference (ICI) occurs due to FO which is caused by an oscillator of a transmitter and receiver, and degrades the performance of a receiver. Thus, FO should be estimated and compensated to improve the performance of a receiver. FO can be normalized to subcarrier spacing in OFDM system, and consists of fractional frequency offset (FFO) and integer frequency offset (IFO) accordingly. FFO is estimated in time domain using cyclic prefix (CP), and IFO is estimated in frequency domain with unique synchronization sequence (USS) of preamble due to the structure of DVB-C2 frame. Because the estimation of FO is influenced by CP length and echo channels shown in the DVB-C2 specification, we simulate the mean square error (MSE) of FO estimation w.r.t CP length and echo channels. The results of simulation show that MSE is reduced as CP length is longer. In addition, MSE is improved as Eb/N0 increases. However, MSE of the estimated FO tends to saturate at high Eb/N0 when echo channels are used. In addition, it increases when the maximum delay spread between echo channels is longer.

Keyword—DVB-C2 receiver, Frequency offset, mean square error, unique synchronization sequence

Jae-Ho Lee was born in Namwon, Korea, in 1972. He received the B.S. and M.S. degree in electronics engineering from the Chonbuk National University, Korea, in 1997 and 1999, respectively. He has enrolled in a doctoral course at Chungnam National University in 2010. He joined in ETRI (Electronics and Telecommunications Research Institute) in 1999. Since 1999, he has participated in developing IEEE 802.11a system and the related data services. His current interest includes cable broadcasting, and OFDM system.

He received the B.S. and M.S. degree in electronics engineering from the Pohang University of science and technology, Korea, in 1991 and 1993, respectively. He joined in ETRI (Electronics and Telecommunications Research Institute) in 1993. Since 1993, he has participated in developing wireless MAC system and the related data services. His current interest includes cable broadcasting, DOCSIS, and OFDM system.

He received the BS, MS, and PhD degrees in electrical and electronic engineering from Pohang University of Science and Technology (POSTECH), Pohang, Korea, in 1992, 1994, and 2000. He is currently with the Digital Broadcasting Research Division, Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea. As a research scientist, he spent a year with Communications Research Centre Canada (CRC) from 2003 to 2004. His main research interests are ac motor drives, control theory and its application to power electronics, high-performance power converter/inverter systems, three dimensional television (3DTV) broadcasting systems, and perceptual requirements of stereoscopic multiview video systems.

He received the B.S. degree in electronics engineering from Seoul University, Korea, in 1977 and the M.S. and Ph.D. degrees from KAIST and University of Utah, Korea and USA in 1979 and 1988, respectively.