PERFORMANCE ANALYSIS OF LS CHANNEL ESTIMATION TECHNIQUE FOR IEEE 802.11P WAVE SYSTEM

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Abstract - IEEE 802.11p [1] based WAVE, which is a well-known wireless vehicular communication technology, is gaining worldwide attention as a medium/short range wireless communication system supporting public safety and personal communication between vehicles (V2V) and between vehicles and infrastructure (V2I) [2], [3]. However, accurate channel estimation is difficult under outdoor environments in the case of IEEE 802.11p based WAVE because data are transmitted in running vehicles. To overcome this difficulty, diverse studies on channel estimation are being carried out currently [4]-[8]. This study compared the symbol error rate (SER) performance between the perfect channel estimation method in an IEEE 802.11p based WAVE system and the LS channel estimation method using pilot signals.

Index Terms - IEEE 802.11p, Wave system, Channel estimation, LS Channel estimation.

I. INTRODUCTION

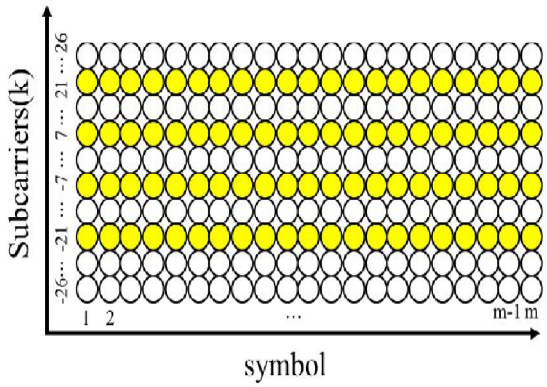


Figure 1. Structure of IEEE 802.11p frame

Recently, to resolve serious traffic problems that are on the rise worldwide, the Institute of Electrical and Electronics Engineers (IEEE) has presented a new standard called 802.11p. IEEE 802.11p [1] was created on the basis of the IEEE 802.11a wireless LAN and is designed to maintain almost every physical layer (PHY) function [9]. To stably transmit data to running vehicles using an IEEE 802p based WAVE communication system, accurate channel estimation is very important and many studies on channel estimation have been conducted globally. In this study, the performances of the perfect channel estimation method and the LS channel estimation method were measured in an urban environment [10] and the results were compared.

II. SYSTEM MODEL

Figure 1 shows the frame structure of IEEE 802.11p. IEEE 802.11p is based on orthogonal frequency division multiplexing (OFDM) and one symbol is comprised of 64 subcarriers in total. Among them, four pilot signals are allocated to the -21st, -7th, 7th and the 21st frequency indexes, and data, DC, and virtual subcarriers are allocated to the remaining frequency indexes. Table 1 shows the main parameters of the IEEE 802.11p physical layer.

Channel bandwidth	10MHz
Modulation Mode	BPSK, QPSK, 16QAM, 64QAM
Code rate	1/2, 2/3, 3/4
Number of data subcarriers	48
Number of pilot subcarriers	4
Number of subcarriers, total	64
FFT period	6.4 μs
Guard time	1.6 μs
Symbol duration	8.0μs

Table 1. Parameters of IEEE 802.11p PHY

III. SIMULATION RESULT

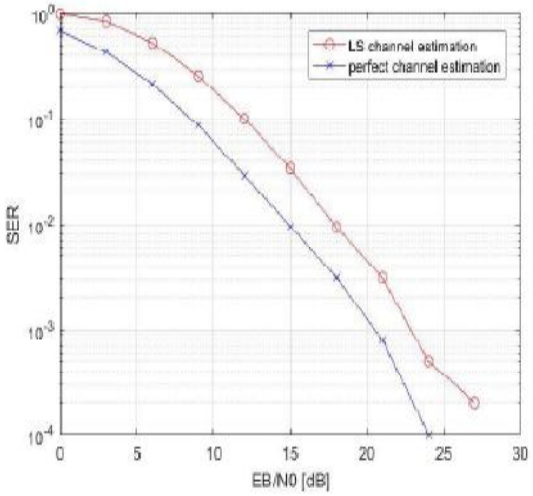


Figure 2 shows the SER performances of the perfect channel estimation method and the LS channel estimation method in an urban environment. The simulation results confirmed that when E_b/N_0 was 15 dB and QPSK was used, the SER of the perfect channel estimation method was 9.7×10^{-3} and that of the LS channel estimation method was 3.4×10^{-2}.

CONCLUSION

In this study, the SER performances of the perfect channel estimation method and the LS channel estimation method were measured under an urban environment through a simulation. The simulation results showed that the LS channel estimation method that uses only four pilot subcarriers may cause a delay in data transmission. Our future research task is to obtain a more robust channel estimation algorithm that can improve system performance without changing the IEEE 802.11p standard.

ACKNOWLEDGEMENT

This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIP; Ministry of Science, ICT & Future Planning) (No. NRF-2017R1C1B5017579).

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