AN ALGORITHM TO AVOID INTERFERENCE BETWEEN WLAN AND WPAN BASED ON COGNITIVE RADIO TECHNIQUE

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ABSTRACT

With the practical use of UWB, the concept of spectrum sharing has been established. Therefore, the necessity to use the frequency spectrum efficiently arises and the Cognitive Radio concept has been drawing much attention. In an environment where 5GHz-WLAN and UWB-WPAN coexist, the frequency spectrum can be shared efficiently by avoiding interference from WPAN to WLAN employing the Cognitive Radio concept, as it is shown in this paper. In particular, the proposed WLAN base station model, where both Cognitive Radio technique and UWB transmitter are implemented, made interference avoidance possible by an adaptive WPAN transmission power control depending on the amount of interference from WPAN.

1. INTRODUCTION

Recently, Ultra Wideband (UWB) wireless communication systems have attracted attention as a new system that enables low power consumption and high-speed communications. UWB wireless communication uses ultra wideband, up to 7.5GHz frequency band (3.1～10.6GHz) and is one type of WPAN (Wireless Personal Area Network). In Japan, the technical conditions about usage of UWB wireless system were set up by the Ministry of Internal Affairs and Communications on March 2006. In the conditions, UWB systems with the DAA (Detect And Avoid) technology implemented have to transmit on up to –41.3dBm/MHz of power and those without the implementation must transmit on up to –70dBm/MHz [1]. DAA is a technology to sense and avoid system interference. Therefore, instead of the traditional concept that frequency spectrums are assigned with each wireless system, spectrum sharing has become possible technologically. As a result, the need to use frequency efficiently has increased and the Cognitive Radio concept has been drawing attention. Cognitive Radio is a radio system that can sense the surrounding radio wave environment and use the radio resources efficiently by flexible reconfiguration of the system as a function of the environment changes [2][3]. It is said to be a concept that extended Software Defined Radio (SDR) in terms of system reconfiguration. This paper aims at the establishment of a method to apply Cognitive Radio commercially.

This paper assumes an environment where 5GHz-WLAN (Wireless Local Area Network) and UWB-WPAN coexist, and proposes a method to avoid interference from WPAN to WLAN so as these systems can coexist by using Cognitive Radio technique. In this scenario, since both 5GHz-WLAN and UWB-WPAN utilize a common frequency spectrum, the WPAN signal power affects the carrier-sensing of WLAN. As a result, the throughput of the latter degrades. This paper proposes to add both Cognitive Radio technique and UWB transmitter to the base station of WLAN. The base station controls the transmission power of WPAN terminals to avoid interference to WLAN when it recognizes the degradation of its throughput. In this paper, a method to calculate the transmission power of WPAN terminals is proposed and evaluated in terms of throughput and carrier-sense error rate.

This paper is organized as follows: Section 2 describes an interference problem in an environment where WLAN and WPAN coexist. Section 3 shows an algorithm for avoiding interference to WLAN with WPAN transmission power control. Section 4 presents a calculation method of WPAN transmission power. Section 5 evaluates the effectiveness of proposal method. Finally, in Section 6 we draw some conclusions.

2. INTERFERENCE FROM WPAN TO WLAN

In this section, an interference problem in an environment where WLAN and WPAN coexist is described.

2.1. Carrier-sense

Generally, WLAN uses carrier-sense as medium access control method [4][5]. In the carrier-sense, a terminal decides whether or not it sends data frames after sensing usage of the channel to avoid collision of frames with other