

UWB Direct Sequences Chaotic Communications System

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ABSTRACT

Ultra wideband communications based on chaotic signal is considered for low data rate and multi user system. The proposed direct chaotic system is introduced and implementation results are shown. The PHY layer including transceiver and modem is designed and implemented to realize a communication with low hardware complexity, low cost, efficient power management, robustness in multi-path and flexible pulse length.

I. Introduction

UWB (Ultra-Wideband) radio became popular in quite recent years finding huge possibilities in high data rate communications within short ranges. In 2002, FCC unleashed new frequency bands (3.1 ~ 10.6 GHz) at the noise floor igniting excitements and worldwide efforts through industry and academic circles [1]. UWB is a fast emerging technology with uniquely attractive features such as simplicity, low cost, large processing gain, robust operation, high security and high time definition. All those features make UWB applicable to various wireless communications, networking and ranging systems [2]. Initially, high data rate application attracted attentions in the market and some standard works in WPAN (Wireless Personal Area Network) area have been done as IEEE standards.

In this paper, the advantages of the Direct Sequences (DS) Chaotic system are introduced and shown the simulation results. The radio architectures of the DS Chaotic communications are represented in Section II. And the simulation results applied channel model to obtain BER and PER performances are shown in Section III. For the implementation, platform of DS chaotic system and PER curves of proposed platform are shown in Section IV.

II. Radio Architecture

A. Direct Chaotic Communications

Chaotic signal has two distinguishing characteristics: 1)

irregular phase variation and 2) wide bandwidth. When signals are overlapped in conventional communications, the signal is distorted or cancelled out due to phase overlapping chaotic signals can be kept as they are since chaotic signals are noise-like in phase characteristics. Moreover, the wide spectrum has the merit of power and spectral efficiency. Hence, when modulated as OOK(On Off Keying), a simple transmitter with low power consumption can be built as shown in Fig. 1 without any need for PLL or frequency converter. When chaotic signals are directly switched to produce on and off modulation, the switch is controlled by Rx/Tx_Cont from Modem system block. In the receiver, the OOK signals coming from the antenna are amplified into the detector diode. The detected envelope is sampled and fed into A/D. Overall system architecture is extremely simple enabling small form factor as well as low power/low cost implementation.

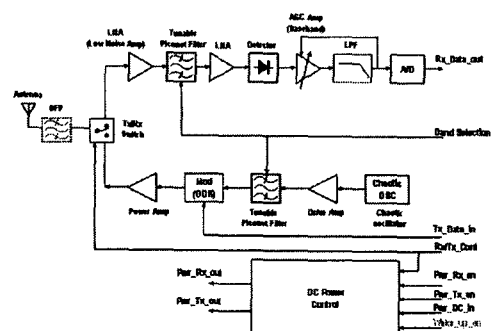


Fig. 1. Radio Architecture