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BER Performance Analysis of UWB Impulse Radio Rake Receiver in Multipath Channel

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Abstract. We consider the RAKE receiver using maximum ratio combining (MRC) where detection threshold for receiver is set at the 0 value and investigate further the BER performances of binary pulse-position-modulation (PPM) and binary pulse-amplitude-modulation (PAM) in the deterministic discrete multipath model. The interpath interference of PPM leads to the unbalanced BER between transmitting "0" and "1" in multipath environment. The interpath interference impact to "0" is more than that to "1". Only the rake receiver with MRC ($L = M$), called IDEAL rake, can ensure the balance BER between transmitting "0" and "1". All rake combing techniques including IDEAL rake can't eliminate the interpath interference completely unless reasonable system design. For the BPM, however, the unbalanced BER for "-1"and for "1" are not raised and the interpath interference can be eliminated by choosing $|\tau_l - \tau_k| \geq T_p, \forall\, l \neq k$.
Keywords. UWB, PPM, RAKE receiver, multipath channel, performance analysis
AMS (MOS) subject classification: This is optional. But please supply them whenever possible.

1 Introduction

Ultra wideband (UWB) radio has recently been proposed for wireless communications systems [1]-[4]. The FCC Report and Order (R&O), issued in February 2002 [5], allocated 7,500MHz of spectrum for unlicensed use of UWB devices in the 3.1 to 10.6 GHz frequency band. More spectral allocation for unlicensed use is likely to follow in the next few years [6]. The FCC defines a radio signal as UWB if the –10dB bandwidth of the signal is greater than 500MHz in the 3.1 to 10.6 GHz band or the fractional bandwidth of the signal is greater than 20%. The UWB spectrum made available by the FCC can be utilized with impulse radio that have been developed to date. A new method emerging recently uses a multiband approach in which information is encoded in multiple RF subbands at the same time, each occupying 500MHz bandwidth [7].