Outage Probability Bound and Diversity Gain for Ultra-Wideband Multiple-Access Relay Channels with Correlated Noises

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Abstract—In this paper, Ultra-wideband (UWB) multiple access relay channel with correlated noises at the relay and receiver is investigated. We obtain outer and inner bounds for the IEEE 802.15.3a UWB multiple access relay channel, and also, a diversity gain bound. Finally, we evaluate some results numerically and show that noise correlation coefficients play important role in determining relay position.

Index Terms—Ultra wideband, multiple access relay channel, diversity gain, outage probability.

I. INTRODUCTION

Information theoretic performance analysis of UWB communication systems is of practically importance, due to UWB extremely high data rates and diversity, coexistence capability with other wireless networks, accurate position location and ranging, no significant multipath fading, multiple access, covert communications and possible easier material penetration. Possibly extension of discrete alphabet channels results to continuous alphabet versions has been of practically and theoretically importance. For example in addition to widely used Gaussian Shannon channel, there are many works such as Costa theorem [1] as the Gaussian version of discrete alphabet Gelfand-Pinsker theorem [2] and many other works related to fading or Gaussian version of discrete alphabet relay channels. In [3], the discrete alphabet degraded relay channel has been extended to Gaussian version. In [5] and [6], the previous results for discrete alphabets and memory less relay channel have been extended to UWB relay channel. In [5], authors derive bounds on the expected capacity and outage capacity of a three-node relay network with independent noises for UWB communications. In [6], a general achievable rate, two special capacity results and the max-flow min-cut outer bound for the UWB relay channel with correlated noises at the relay and destination are obtained.