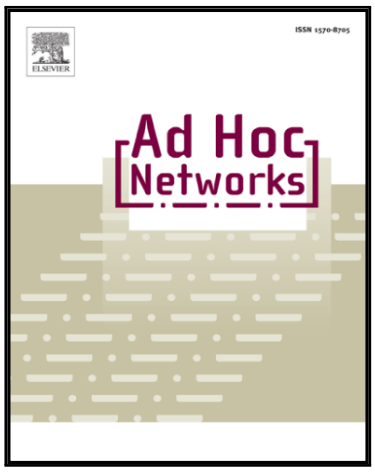

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Abstract

This paper considers a fully energy harvested two hop relay assisted cognitive radio (CR) system operated in an underlay mode. The frame structure of the CR network consists of three non-overlapping time slots. The first time slot is meant for energy harvesting (EH) at the relay node (from both the primary interference signal and the secondary transmitter signal), while during the second slot, the secondary user transmits its data to the relay (information transmission). During the third time slot, forwarding of data by the relay and EH at secondary transmitter (from the primary interference signal) are done simultaneously. An optimization problem is formulated that minimizes the outage probability under the constraints of maintaining the energy causality and interference threshold to the primary receiver due to both the secondary transmitter and the relay node. Closed form expressions for the optimal transmit power of the source and the relay node as well as the time slot for EH are derived. The convexity of the constrained objective function is proved mathematically and the analytical solutions are verified through a large set of simulation results. Simulation results also show that a gain $\sim 11.71\%$ and $\sim 12.7\%$ in outage probability minimization is achieved for the proposed scheme over the existing works.

Keywords: Cognitive radio, decode-and-forward, energy harvesting, outage probability, optimization.

1. Introduction

Recent advancements in Internet of Things (IoT) and machine-to-machine (M2M) communication demand wireless networking standards to operate in sub-1 GHz spectrum for providing a long range operation. The recent emergence

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