A multi-radio, multi-hop ad-hoc radio communication network for Communications-Based Train Control (CBTC) with optimized frequency separation

Communications-Based Train Control (CBTC) is a modern signalling system that uses radio communication to transfer train control information between train and wayside. The trackside networks in these systems are mostly based on conventional infrastructure Wi-Fi (IEEE802.11). It means a train has to continuously associate (i.e. perform handshake) with the trackside Wi-Fi Access Points (AP) as it moves, which incurs communication delays. Additionally, these APs are connected to the wayside infrastructure via optical fiber cables that incur huge installation costs. Our earlier work presented a novel design in which trackside nodes function in ad-hoc Wi-Fi mode, which means no handshake has to be performed with them prior to transmitting. A node upon receiving packets from a train forwards these packets to the next node, forming a chain of nodes. Following this chain, packets reach the destination. To make the design resilient against interference between the nodes, transmissions are separated on multiple frequencies, ensuring a certain separation between the transmissions. Nonetheless, the results show that despite this separation, a significant amount of interference is experienced along the chain due to the interference range being greater than the frequency separation distance. This paper proposes an extension to the design in which additional frequencies are employed in an interleaving fashion to optimize the frequency separation distance and presents the results from an extensive simulation study.