

ABSTRACT

Mobile cognitive radio base station (MCRBS) is an alternative for cellular network, since base transceiver station (BTS) is in outage in the disaster area. MCRBS is mainly functioning to detect the position of all victims who have an active cell-phone. The problem arises when MCRBS is unable to go forward in area having substantial obstacles. MCRBS should deploy high altitude platform station (HAPS) as the relay communication to the victim. This thesis proposes reliable and secure communication between MCRBS and HAPS using Polar code as channel coding and security in physical layer.

This thesis considers Polar codes with low computational complexity of encoding and decoding. This thesis proposes unique construction of frozen and information bits of Polar codes for securing the transmission. The frozen bits containing random bit of 0 and 1 should be known at the receiver as the frozen key. The frozen key can protect and conceal the information bits from eavesdropper. This thesis proposes 2 techniques to protect information bits, i.e., (i) Fixed frozen sequence, and (ii) Dynamic frozen sequence, of which is the pattern of frozen key is decided from the header. The proposed security techniques evaluate security performance with mathematical simulation in additive white Gaussian noise (AWGN), Fading, HAPS, and additive mod-2 Gaussian noise (AMGN) channels and experiment in real-field using universal software radio peripheral (USRP).

The results show that the communication between MCRBS and HAPS using Polar codes are found to be secure based on a series of computer simulation. The performances of legitimate receiver is kept good, while the performances of eavesdropper is made bad in all channels. With the proposed secure Polar codes, the eavesdropper is unable to decode the information causing bad performance with error-floor for both BER and FER performance. This result is expected to provide contribution to the development on robust and secure communications between MCRBS and HAPS.

Keywords: Polar codes, HAPS Communications, Disaster Recovery Networks.