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On the Secrecy Analysis of Cognitive Radio Networks

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On the Secrecy Analysis of Cognitive Radio Networks

Abstract: The increasing number of connected devices represents a major challenge for broadband wireless networks that would require a paradigm shift towards the development of key enabling technologies for the fifth-generation wireless networks. One of the key challenges towards realizing the next-generation wireless networks, however, is the scarcity of spectrum, owing to the unprecedented broadband penetration rate in recent years. Cognitive radio has emerged as a promising solution to the current spectrum crunch. Assuming a spectrum sharing scenario, the unlicensed users, also known as secondary users, opportunistically access the spectrum of primary (licensed) users under the constraint of not causing harmful interference to them.

Similarly to traditional wireless networks, cognitive radio networks (CRNs) could be vulnerable to several attacks that could disrupt their operation. Eavesdropping attack is one of the security threats that can occur at the physical layer. Therein, unauthorized users try to over- hear the communication between legitimate users. Since the SUs have to continuously adapt their transmit power to avoid causing harmful interference to the PUs, ensuring the security at the physical layer becomes a challenging task. Although several research works have investigated physical layer security (PLS) of wireless communication networks, secrecy analysis of CRNs is among the hottest research topics that are in their infancy. Therefore, in this thesis, the PLS of several cognitive radio-based wireless communication systems has been investigated and some main techniques such as friendly jammer, space diversity, and energy harvesting have been considered for security enhancement purposes.

Keywords: Cognitive radio networks, dual-hop based satellite communication, eavesdrop- ping, energy harvesting, fading channels, friendly jammer, intercept probability, maximum tolerated interference power, physical layer security, power-splitting, secrecy capacity, secrecy outage probability, time-switching.