Experimental study of sensing performance metrics for cognitive radio network using software defined radio platform

Abstract

Cognitive Radio (CR) is a promising technology in wireless communication for an enhanced utilization of limited spectral resources. It allows unlicensed or cognitive users (CUs) to sense the spectral environment and access a channel exhibiting negligible activity of licensed or primary users (PUs). Hence, spectrum sensing is a crucial task for a CU to perform in an opportunistic spectrum access (OSA) based CR network to avoid harmful interference to PU. Two main performances metrics that are crucial in the design of spectrum sensing are the probability of false alarm (P fa) and the probability of detection (P d). These metrics are used to define the CR system quality of service (QoS). The threshold to decide on the presence of PU and the sensing time needed for the CR system are also determined based on these metrics. This paper presents the design of measurement methods to experimentally acquire the P fa and P d curves based on locally captured data to determine the value of the threshold and sensing time. The implementation, experimentation and measurement are done using GNU Radio and universal software defined radio peripheral (USRP) software defined radio (SDR) platform as the cognitive radio testbed. Spectrum sensing was done based on energy detection. Each of the energy based detection measurement is repeated 1000 times to obtain an accurate estimation of P fa and P d . The findings show that the target Quality of Sevice (QoS) of P fa of 5% and P d of 90% can be derived from the estimated sensing threshold of -39 dB and achieves a sensing time of 31.59 ms.