Communication technologies are evolving drastically in recent years. However, the scarcity of spectrum began to appear with the accelerating usage of various communication technologies, as well as the preservation of traditional channel access methods. Cognitive Radio (CR) is an innovative solution for spectrum scarcity. Spectrum sensing is a key task of the CR life-cycle that gains significance as spectrum holes can be detected during this task. This paper studies and compares the performance of the KMeans-based spectrum sensing technique with the non-cooperative spectrum sensing technique , the And-based spectrum sensing technique , and the Or-based spectrum sensing technique in stationary and mobile CR networks (CRNs). The effect of the fading channel type has also been considered. Small-scale CRNs were simulated using the third version of the network simulator. In this context, two models have been developed. The first was built based on the well-known κ−μ general fading model to simulate the fading effects. The latter is the noise model to simulate different noise conditions. The results reveal that spectrum sensing techniques provide better performance in stationary networks as compared to mobile networks. Further, our experimental results show that at least three secondary users and about 1500 samples are needed to reach acceptable performance. In addition, the results show that the KMeans-based technique slightly outperforms the Or-based technique , especially in highly noisy environments and under severe fading channels.