



## Review of Spectrum Occupancy Measurements in the Context of Cognitive Radio

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### Abstract

Presently, there is a progressive growth in the proportion of internet users as well as deployment of data intensive applications which has led to higher demand for bandwidth on the usable spectrum space for the unlicensed and licensed frequency bands. Spectrum is a scarce and limited resource, inefficiencies in the management of spectrum has resulted to a recent and unique communication standard for exploiting the current licensed spectrum in an opportunistic manner. Cognitive Radio (CR) has proved to be the solution to this seeming highly demanded spectrum. Several studies have been conducted on spectrum occupancy across the world in order to observe and determine the bands that have been underutilized so as to make room for the new technological emergences such as CR. This review shows that from previous works done, there is a research gap in the spectrum measurement work for TV band and specifically the VHF band in Nigeria.

**Keywords:** Cognitive Radio, Primary Users (PU), Secondary Users (SU), IoT.

### 1. Introduction

Cognitive Radio has attracted so much attention because the spectrum is perceived to have been over crowded. Of late, there is an upsurge in the need for spectrum, due to the emergence of recent communication technologies and services such as (Internet of Things) IoT and 5G technologies (Li *et al.*, 2019; Hamdaoui *et al.*, 2018; Sharma *et al.*, 2018). The static allocation of frequency spectrum to network users is the reason for this. It is important to ensure spectrum access in these recent technologies and networks including device-to-device and drones enabled systems (Marota *et al.*, 2018; Shen *et al.*, 2019).

In the current policy on radio spectrum allocation, users are assigned licenses for a particular communication services and technologies. Only licensed users have permission to occupy a particular spectrum allocated to them. Unlicensed users are strictly prevented from accessing the spectrum even when they are unoccupied or vacant by the primary users (Saladhine *et al.*, 2017)

Federal Communication Commission (FCC) is the regulatory body in the USA while Nigerian Communication Commission (NCC) is responsible for communication rules and policies and also controls the usage of the limited radio resource spectrum. In the USA, previous studies revealed that spectrum occupancy is between 15 to 85% in the static allocation policy (Saladhine, 2017). According to Manesh *et al.*, (2017), measurements by FCC revealed that, while some channels are heavily used others have low usage.

Cognitive Radio is a radio that is cognizant of its spectral environment and can change operating parameters to enable seamless communication. Such radios are able to function in a wide frequency band range. When a licensed Primary User (PU) is absent, cognitive radio can opportunistically use its frequency and immediately vacate at the emergence of the licensed primary user. In this manner, the cognitive radio does not cause interference with the PU.