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Potential Sharing in TV Band using Cognitive Wireless Networks

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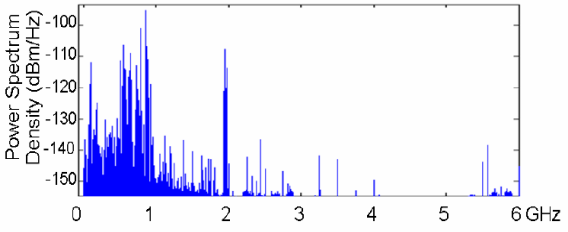
***Abstract*— Cognitive wireless networks (CWNs) are advanced wireless systems where network nodes are equipped via smart engines, enabling them to exhibit intelligent behavior across the entire network. This advancement holds promise for improving commercial data services and facilitating the establishment of new emergency and surveillance and military communication services. An illustration of this is the exploration of sharing between licensed TV bands (primary user) and unlicensed WiMax (secondary user). Despite the allocation of a significant portion of the radio frequency spectrum to TV bands, much of it remains unused. This underutilization makes TV spectrum an attractive candidate for dynamic spectrum access (DSA). However, further investigation is necessary to ascertain the suitability of this spectrum for supporting secondary transmissions. Dynamic Frequency Selection (DFS) empowers radios to select bands by minimal interference, while Power Control (PC) facilitates communication at the lowest feasible power transmit. Time Agility (TA) allows radios to adjust according to the traffic patterns of one another, This helps reduce disruption in challenging channel situations. These techniques were evaluated through simulations conducted using the network simulator NS2. The proposed network is TV Based station as primary user and many WiMax connected together as mesh network. The result proves that WiMax transmitting data within TV Channels when TV channels not transmitting and WiMax within same geographical coverage of TV Base Station.**

Keywords—Cognitive Radio, sharing, TV Channels, Wireless Mesh Network

I. INTRODUCTION

The soaring demand for faster wireless communication, driven by an array of applications, has hit a bottleneck due to dwindling spectral resources. Available frequency bands for new systems, particularly within the widely utilized 0-6 GHz range, are severely limited, as evidenced by the FCC spectrum inventory table [1]. This scarcity has fostered a misconception of a spectrum availability crisis.

However, this perception overlooks an alternative viewpoint: rather than viewing the spectrum as a fixed allocation of frequencies distributed among systems, consider it from a temporal perspective within the matching bandwidth from 0 GHZ until 6 GHz, illustrated in Figure 1. Empirical measurements in urban areas, documented in [2], [14], reveal that band utilization varies widely, ranging from under 1% to just over 50%. Utilization rates are even lower in suburban and rural areas. This suggests a substantial spectrum opportunity for next-generation wireless systems, provided they possess the capability to dynamically perceive and capitalize on these opportunities beyond traditional frequency dimensions.



Freq (GHz)	0~1	1~2	2~3	3~4	4~5	5~6
Utilization(%)	54.4	35.1	7.6	0.25	0.128	4.6

Figure 1 Measured spectrum utilization (0-6 GHz) in downtown Berkeley, USA [2].

Indeed, while there exists a scarcity of spectrum in the frequency domain, other dimensions like time and space offer an abundance of frequency resources. However, existing communication technologies lack the capability to identify and leverage such spectrum opportunities. Hence, a new communication breed of spectrum mindful technology introduce known as "cognitive radios CR," was introduced in [3].

A CR represents an intelligent device that integrates advanced methods drawn from artificial intelligence, numerical signal processing, heterogonies band antenna methods, game theory, information theory, and more. This