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A Review Paper on Growth and Utilization of White Space Technology

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Abstract—*In this paper we have discussed that how adaptable access of TV Band white spaces in VHF/UHF can be used in rural areas to provide internet at suitable cost. The document provides an overview for the present and future aspects of "White Space Technology". TVWS technology appealing for industry because it can travel longer distances and more easily through walls than the bands used by other wireless technologies like as Bluetooth and Wi-Fi. It is expected that the opening of white space technology will direct increase of spectrum utilization efficiency in highly attractive frequency bands. To avoid the interference between, the white space devices are designed to detect over the air digital TV signals. To avoid the channel interference Florida University developed a smart TV band white space identifier. This device is able to sense and avoid interference from white space devices to air DTV. The University of Strathclyde also used white space internet connection in place of Wi-Fi. In this paper we study the accessibility of TV white spaces in different countries and discuss the advantages of white space over the Wi-Fi and other generation techniques. The white space technology provides an alternative to cellular infrastructure or cable and we also discuss the limitations of this technology. The white-Fi Space reduces the time to detect transmission in variable channel width system by analyzing raw signals in the time domain. It also provides an insight into how this technology can be beneficial for India. But because of analog TV transmission this transmission is not yet used in India.*

Keywords*: White Space, Wi-Fi, UHF TV Band, TV Transmission, Cognitive radio*

1. INTRODUCTION

Different frequencies have been assigned by National and International bodies and in most of the cases they are having license to broadcast over these frequencies. A band plan is created by this frequency allocation process and to avoid interference white space are assigned between used band and channels. The existence of white spaces is natural between used channels, because if assignment of immediate transmissions is done to adjacent channel then destructive interference is caused as a result to both. An radio spectrum which has either never been used is also there and which will become free by some technical changes .e.g. as compared to analog, switching of digital transmission can be kept to adjacent channel [5]. In digital transmission, the band can be compressed into fewer channels, which will result in more transmission. White space radio link is an alternative for infrastructure which may be cellular or of wired medium like cables .The deserted TV frequencies are "White Spaces" in US, are the gaps in radio and TV links. Whitespace frequencies occupy the range mostly used by Analog TV in UHF range. In United States, this is 698-806 MHz and in UK it is 470-490 MHz [2].

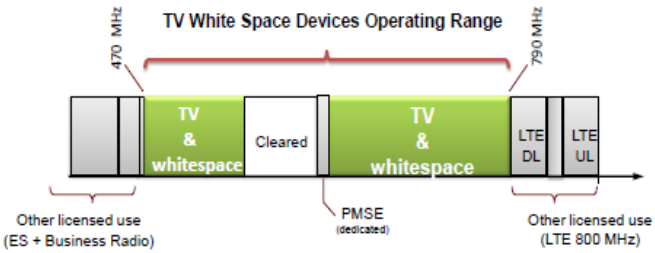

Fig. 1: Operating range for white space Devices [3]

1.1 DEVICES

Devices that intend to use white space channels for communication are said to be white space devices. White space devices will behave as cognitive radio devices. A transceiver that can detect used and unused channels and with this the busy channels can be shifted into vacant channels to avoid interference problem is Cognitive Radio Receiver. The usage of this device minimizes the use of available radio frequencies spectrum and reduces interference with other user. White space devices have some unique characteristics like they are needed to transmit small amount of data in "data gathering application". Those devices operate for a long time with requirement of low power. Proposals including IEEE 802.11AF (WLAN), IEEE802.22 (WRAN) and those for white space alliance have supported using white spaces by termination of analog TV to provide wireless broadband internet access[4].

2. COMPARISON BETWEEN WHITE SPACE TECHNOLOGY AND WI-FI

As compared to Wi-Fi, TVWS technology is pleasing more towards industry because of its easiness in travelling longer distances and through walls than the bands used by Wi-Fi. The main differences between white spaces ISM bands operated Wi-Fi device is that, in both bands variation is spatial in spectrum, but the effect of this variation is seen higher in white spaces as compared to Wi-Fi ISM bands. This difference is due to the FCC ruling which shows that there should be non-interference with wireless transmissions of incumbents (primary users). Secondly, since the primary users have the facility to operate in any portion of the white spaces, the network must be designed such that it can handle spectrum fragmentation, with different width of each of the fragment as a possibility. UHF channels are narrower and according to prior research aggregation of contiguous channels helps to improve throughput [1, 3]. Consequently, variable width channels must be supported by the network. Thirdly, there is a temporal variation in RF transmissions in white spaces; this is due to the reason that wireless microphones become active at any time without any type of warning. Researcher's experiments showed that even with a single packet transmission audible interference is caused during transmission of wireless microphone. Consequently, what happens; both the AP (Access point) and its clients must disconnect at that time and again reconnect themselves by using a different channel that is available at that time.

3. ADVANTAGES

White space devices are expected to have range in Miles. They can travel through obstacles like walls, trees, etc. and it is expected that their network speed is comparable to 3G and 4G technologies .White space can be accessed by users other than the licensed one which will result in increase of overall spectrum efficiency [2]. It also innovates new services and protection of the licenses those are mandatory. This application shows cost effectiveness as it uses machine to machine services (M2M) [4].

4. APPLICATION AND FUTURE SCOPE

White space can be used in broadband connectivity in rural area. It also provides services like remote health care etc. TV white space provides a wireless broadband connection to rural areas [2] .Various technologies are emerging which will enable the radio spectrum to be used more efficiently for long time. Multiple frequency bands can be operated through this technology in an increased manner.

5. SCENARIO OF TV WHITE SPACE IN INDIA

In India for analog TV transmission, allocated band spectrum is 470-585 MHz the portion of this spectrum which is being unutilized is 100 MHz [4]. In India there is only one terrestrial broadcaster e.g. Doordarshan and Digitalization of broadcasting services is under progress. This will free up whole spectrum for Wi-Fi and other related application. It is found in research that for providing UHF TV band that previously exists in India, four TV band channels (or 32MHz) are sufficient. After having motivation by the underutilization of UHF TV band spectrum, a proposal for spatial reuse based channel allocation algorithm came into existence for the existing TV transmitters in India operating in the range of 470 to 590 MHz band. Least number of TV band channels are used by Algorithm with gaurantee that no (significant) interference between transmitters will take place operating in the same channel. It has been observed that by this technique at least 70% UHF TV band channels can be freed.

6. LIMITATIONS

White space spectrum has certain limitations. The primarily limitation arises from the need that interference should be avoided with existing broadcast services and with very complex and dynamic process [2]. White-space technology can extend Wi-Fi coverage area to new places with portions being exploited and which are being unused in the TV and Radio broadcast spectrum. The aim behind white space usage is that empty lanes can receive Internet transmissions. The very first step that is followed by white-space devices is to identify the radio and TV traffic location and which lanes are open; there is something that changes frequently. If the devices fail to perform this, signals in the traffic will be caught simply.

7. CONCLUSION

In this paper we have studied the implementation of white space. White space can be used in broadband connectivity to rural area. Anyone can deploy a network without a need of a nationwide contract. Few companies enable customers to operate their own white space network that delivers up to 16Mb/s over 10Km range.

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