

TV white space opportunity for cognitive radio networks

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INTRODUCTION

In wireless communication networks, radio frequency spectrum is the most important and very expensive resource. The TV digital switchover (DSO) will leave a large portion of the TV frequency bands unused, known as TV white space (TVWS). In order to benefit from the digital dividend brought about by the DSO, regulators from the developed countries are promoting license-exempt cognitive radio (CR) access to TVWS. However, there is a need to understand how much TVWS is available in South Africa, and also to study the feasibility of TVWS for CR technology. In this work we present the ongoing research work on TVWS and CR technology within the Wireless Computing and Networking (WCN) research group at the CSIR Meraka.

MERAKA COGNITIVE RADIO PLATFORM

The WCN group developed a CR platform consisting of four nodes as shown in **Figure 1**. The platform is used for the experimentation of TVWS, CR and dynamic spectrum access. The platform is also opened for use by other researchers and students from other universities and within the CSIR.

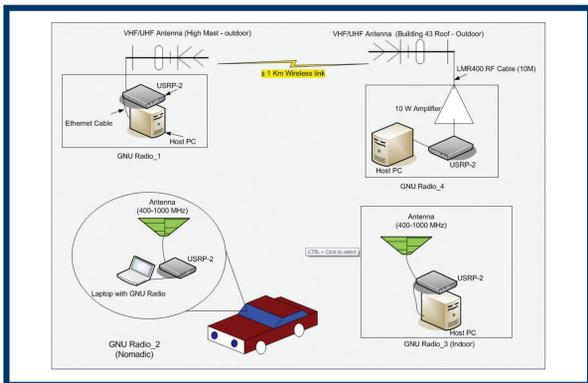


Figure 1: Meraka Cognitive Radio Platform

A single node is built up of three major hardware components: a high speed computer (powered by 2.60 GHz Dual Core Intel Pentium Processor, 2 GB memory and 500 GB harddrive), version two of the Universal Software Radio Peripheral or USRP-2 package (with a single WBX daughter-board) and high gain VHF/UHF antenna.

TV WHITE SPACE MEASUREMENTS

The aim of our measurements was to scan the frequency range from 50 MHz to 1 GHz. We conducted the frequency scan in three different locations in southern Africa (Pretoria, Philipstown and Macha, Zambia). The averaged spectrum occupancy plots are depicted in **Figures 2** through to **Figure 4**.

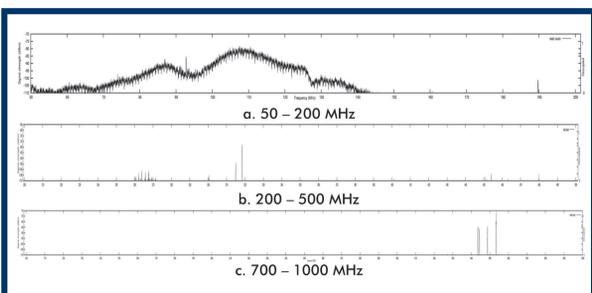


Figure 2: TV spectrum occupancy in Philipstown

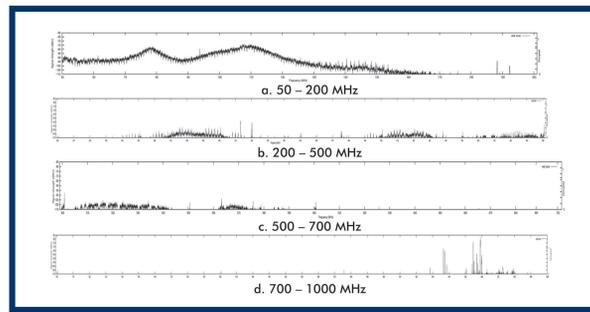


Figure 3: TV spectrum occupancy in Macha (Zambia)

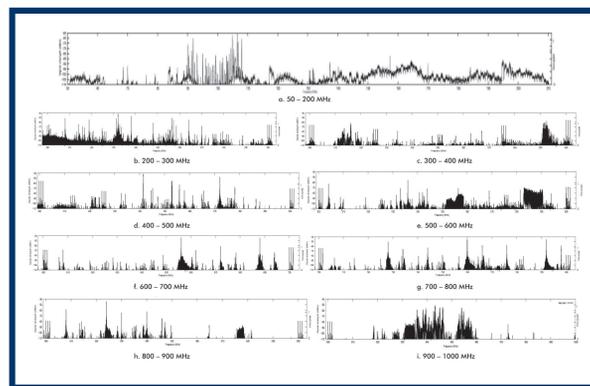


Figure 4: TV spectrum occupancy in Pretoria

TV WHITE SPACE TRIALS

The Wireless Computing and Networking (WCN) research group within the CSIR Meraka is in the process of piloting TVWS technology in South Africa. The aim of the pilot is to demonstrate that unlicensed TVWS devices can operate on TV frequencies without causing harmful interference to the primary users (i.e. TV sets). The sequence of actions/steps needed to validate the spectrum emissions produced by operation of cognitive radio (CR) devices is shown in **Figure 5**.

The trials are planned to take place in two different provinces of South Africa: the Western Cape and Limpopo.

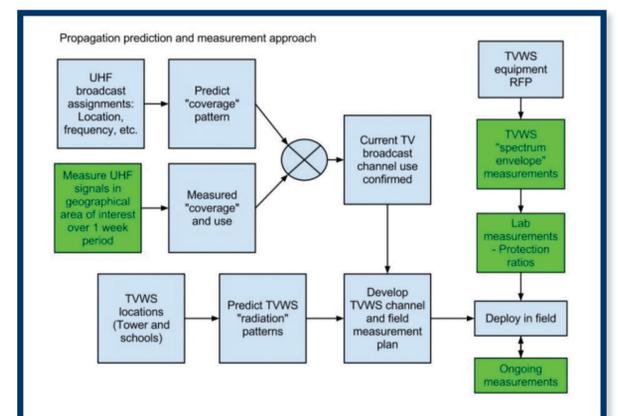


Figure 5: Steps in the planning and validating the trial

CONCLUSION

We present progress made in achieving some of the objectives listed above. The measurement results indicate that there is substantial TV white space available in both rural and urban areas in southern Africa. This makes research in TVWS technology a promising and interesting area for wireless broadband provision in rural and urban areas. Future work includes the development of a dynamic geo-location database and energy efficient spectrum decision models. The TVWS trials will begin in the near future.

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