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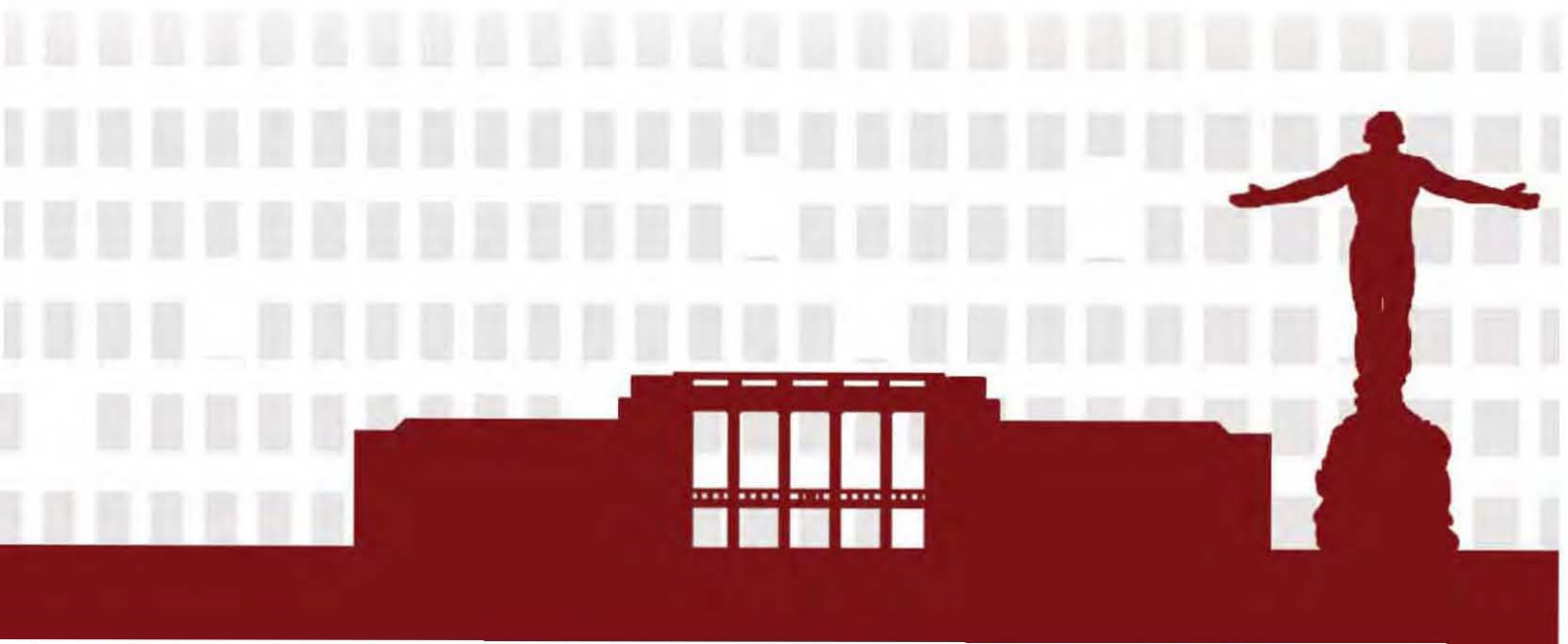

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DEVELOPMENT OF AN OFDM-BASED HANDSHAKE SYSTEM FOR TVWS APPLICATION

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ABSTRACT

The electromagnetic spectrum is a valuable resource in the field of communication technology. Thus, the idea of utilizing the unused frequencies under the Ultra high frequency (UHF: 300 MHz - 3 GHz) and Very High Frequency (VHF: 30 - 300 MHz) band, particularly known as the *TV white spaces*, has gained a considerable attention in the past few years. TV white spaces (TVWS) are frequency bands allotted but are not utilized for television broadcasting. These were either remaining channels or were guard bands purposely left unutilized in between adjacent channels to prevent interference. The aim of this project is to develop a connection-request response or handshake system with TV white spaces as channels. This handshake system was developed to operate on OFDM signal that produces a cyclic time domain sequence in order to be able to adapt a simple detection algorithm [1] that was proven to produce good performance in hardware application.

This work is a preliminary step to a bigger project that has the goal of implementing communication in TVWS through a radio with spectrum managing and spectrum sensing capabilities. A network of this kind of radio, utilizing the TVWS, should then be able to communicate with each other effectively. The challenge in using the TVWS is that reinitialization is required more often since channel transfer in TVWS operation is required as often whenever the primary user needs to use the operating channel. This reinitialization part is the focus of this current project. The connection-request response system being developed should be fast and reliable for this application. This project also focuses on using LabVIEW to simulate the system and test its performance. The transmitter, receiver and channel model are developed using LabVIEW. In the transmitter block, a training sequence is generated then sent as an OFDM signal. The training sequence used was the Short Training Sequence (STS) adopted from the IEEE 802.11a Preamble. By utilizing LabVIEW's Inverse Fast Fourier Transform VI, the cyclic time domain sequence of the normalized sequence is produced. This repetitive nature of the STS is to be exploited in the handshake system being developed for the implementation of a simple detection algorithm developed by Chia Horng-Liu in [1]. This detection algorithm correlates the received samples to predefined constants and compares the value to a threshold to decide whether the received sequence is the expected. Upon receipt of the expected sequence, the same sequence can be sent over the same channel to the other end to serve as acknowledgement to end the handshake process.

Final testing includes testing of correctness and latency of the system. The detection algorithm used was proven on LabVIEW simulation to be effective up until a -5 dB signal-to-noise ratio. This was the general response of the system as tested for different center frequencies under the UHF band. The latency of the detection was about 0.15 ms and 0.7 ms for the two-way process though this measurement can be improved with actual hardware testing. From these results, the connection-request response system can be considered viable though testing of this system on actual hardware would be needed to verify the response especially on working at the UHF - VHF band.

Keywords: Connection-request response, Handshake, TVWS

Acknowledgment
The authors would like to express appreciation for the support of everyone in the Electrical and Electronics Engineering Institute of UP Diliman in completing this project.

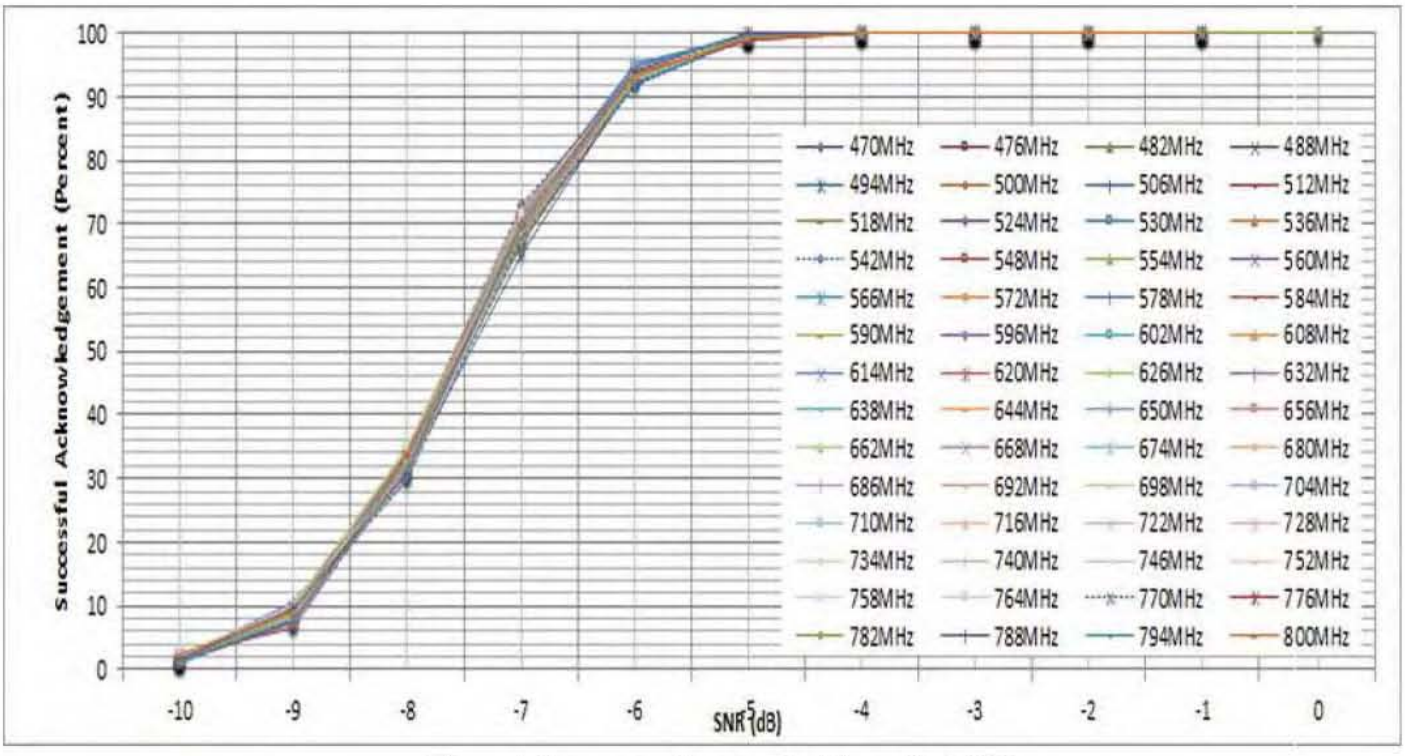

Figure 1. Percentage Success of trials vs. SNR (dB)

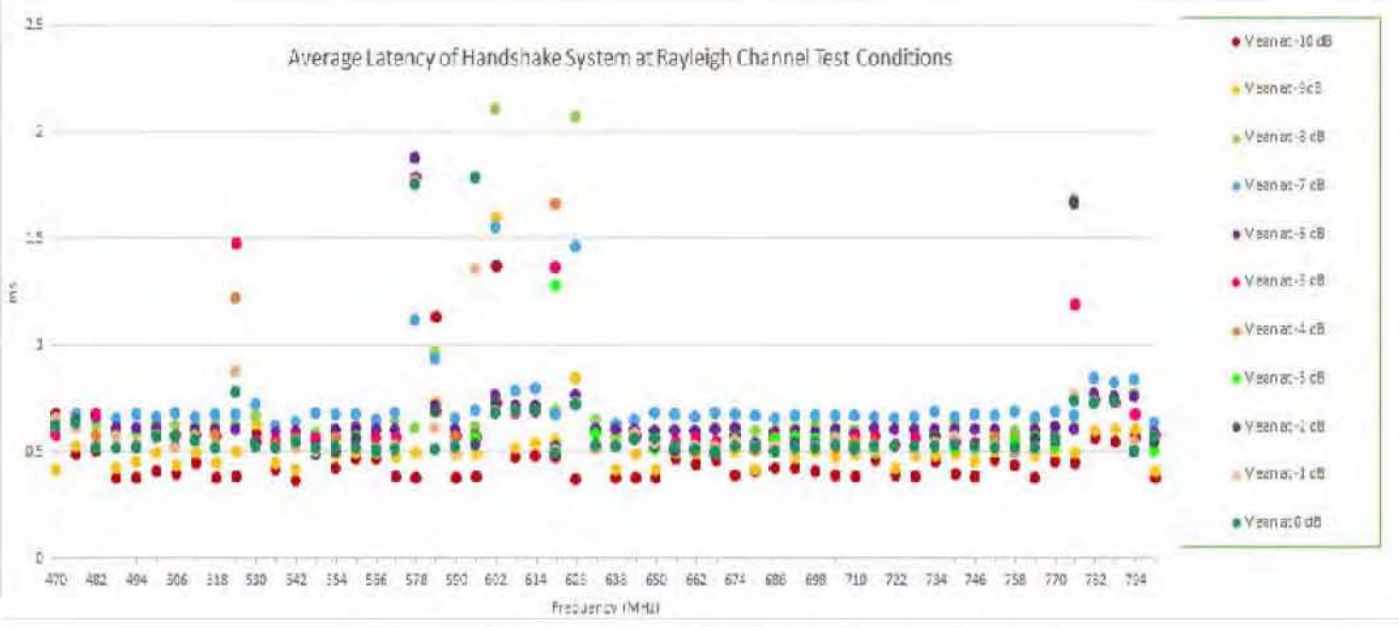

Figure 2. Average Latency of Handshake System vs. Frequency

Reference

[1] C. Liu, "On the Design of OFDM Signal Detection Algoritms for Hardware Implementation", *IEEE*, Vol. 2, pp. 596-599, 2003.