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Refinement and Validation of a Real-time Airborne System for Remotely Sensing Ocean Surface using Communication Satellite Signals

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ABSTRACT

The ability to remotely sense ocean wave heights and wind speed by measuring the reflected Radio Frequency (RF) signals from the ocean's surface has been demonstrated in previous research projects. The recording systems for these research projects collected and stored unmodified RF signals and then analyzed the data through post-processing. Several disadvantages to this approach include large requirements for data storage and lengthy post-processing time. To assist in the creation of a suitable platform for an airplane-based application, a new system was designed which features real-time processing of the RF signals. This system captures two RF signals in the 2.4 GHz regions (direct and reflected), calculates the cross-correlation between the two signals and then outputs the result to a PC.

Due to the time-consuming nature of the cross-correlation algorithm, a FPGA based implementation of the system was chosen to conform to the real-time constraints of the system. In this project, previously created Verilog source code for the system was debugged, improved and verified. This project also developed a method to test the system by using several 110-foot sections of RG6 Coaxial Cables. These cables induced a physical delay in the reflected channel, simulating the application's conditions, in order to cause a shift in the correlation peak. The results are discussed as well as suggestions for future improvements.

KEYWORDS
Signals of Opportunity, Remote Sensing, XM Radio, Validation, Field Programmable Gate Array, FPGA, Universal Software Radio Peripheral (USRP).