

MUHANNAD YOUSIF MUHSIN. DESIGN AND IMPLEMENTATION OF SELECTABLE MODEMS FOR WIMAX SYSTEM USING FPGA.UNIVERSITY OF TECHNOLOGY.

Department of Electrical Engineering. M.Sc. Supervisor : Asst.Prof.Dr. Hadi T. Ziboon
2012. 102p.

Abstract

The Software Defined Radio (SDR) is a wireless system implemented by software routines so that various wireless radios can be supported by the same hardware based on software changes. Thus, the use of SDR allows vehicle manufacturers to adapt communication technologies supported by vehicles to fit on the standards of the respected country presented in the object oriented program, which means that each unit is dealt with separately and then called according to the process.

The main objective of this work is to design, simulate and implementation of a proposed system of six bandpass modems (modulation/demodulation) schemes with selectable technique between them based on Software Defined Radio (SDR). These modems satisfy the WIMAX standard. These modems are BPSK, QPSK, 8QAM, 16QAM, 32QAM and 64QAM. The design is to be created by using MATLAB-Simulink tool as well as M-files presented for each modem. "Simulink HDL Coder" is used to convert all files to VHDL Codes for hardware implementation using FPGA Altera-Cyclone II Family DE2 board.

Simulink HDL Coder proves the capability to generate Hardware Description Language (HDL) code to MATLAB model (Simulink and M-file) for complex units of proposed system. The following are complex units which are designed, implemented and verified (Digital Low Pass Filter with length (50), multimode soft decision circuit, division of input data by the variable factor according to the number of bit per symbol, symbol mapping (baseband modulators) and Generation bandpass signal for six modems in order to set the IF signal required by SDR systems. Moreover the generation of the bandpass signal has optimal utilized area in FPGA with satisfied the required sampling rate).

The experimental results show that there is coincidence between transmitted and received data with time delay of (0.3-0.4 μ sec) for different data rate (0.5-3Mbps). However, the combination of MATLAB (Simulink and M-file) and Simulink HDL Coder provides flexible capabilities for analysis, design, simulation, implementation and verification. However all these capabilities are one system to reduce the time spent on fine tuning and to reduce the algorithms and models through rapid prototyping and experimentation and less time on HDL coding.

Keywords: Software Defined Radio (SDR), Worldwide Interoperability for Microwave Access (WIMAX), Simulink HDL Coder, Very High Speed Integration Circuit Hardware Description Language (VHDL), Field Programmable Gate Array (FPGA)