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Electronic Tracking for the Safe, Efficient and Reliable Transport of Radioactive Materials

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ABSTRACT

Governments and operators take their responsibility to transport nuclear and other radioactive materials seriously. Thousands of shipments are carried out every year, both safely and securely. However, because nuclear and other radioactive materials are potentially at their most vulnerable while they are being shipped from one location to another, the shipments need to be monitored carefully. One way of monitoring the shipments is to track them. To accomplish this mandate, organizations around the world use many different kinds of tracking methods. The most basic requires transport operators to contact their organizations at certain fixed time periods or checkpoints along the route. Electronic tracking systems can have many benefits, depending on the particulars of the shipment; if applied effectively, they could add an extra layer of security and functionality to materials transport. This paper is manly focused on electronic tracking for safe, efficient and reliable transport of radioactive materials.

INTRODUCTION

With the rapid increase in the use of radioactive material (RAM) in different fields, the quantum of transport of RAM from one place to another is also increasing. Even though there is a potential for radiation hazard in the transport of RAM, such hazard is controlled to an acceptable level by following the regulations for safe transport of radioactive material [1]. The "Regulations for Safe Transport of Radioactive Material" of the International Atomic Energy Agency (IAEA) is the backbone of the regulations in many countries. These regulations aim at providing an acceptable level of control of the radiation hazards to persons, property and the environment that are associated with the transport of radioactive material. The most modern satellite navigation and tracking equipment enables the ships position to be transmitted and each vessel maintains communications with the 24-hours report centre. This paper is designed and implement for modelling and simulation performance of image transmission based on Worldwide Interoperability for Microwave Access (Wi-MAX) using MATLAB/SIMULINK and hardware implementation via Xilinx Spartan - II based FPGA trainer model.

The IEEE Wi-MAX/ 802.16 is promising technology for broadband wireless-MAN network as it can provide high throughput over a long distances & can supports different Standards. In this paper we concentrate on wi-max physical layer protocol, its basic functional block diagram initially we analyze wi-max protocol with the help of matlab simulink & achieve satisfactory result. In second stage of over proposed work code is loaded into Spartan - II based FPGA trainer model in Xilinx.

Wi-max intends to combine the high data rate of WLAN and the range of 3G cellular networks to serve user with greater mobility at greater speed.

Wi-Fi devices operate in the unlicensed ISM band (Industrial Scientific and Medical Band) cantered at 2.4GHz. This frequency band is also used by other devices. Hence the Wi-Fi devices are allocated a maximum power limit by FCC which limits their range or coverage, Wi-MAX was designed keeping in mind a WMAN. It is allocated a licensed frequency band and hence interference from other devices is relatively less. Correspondingly the range for WiMAX is more.

The development will be divided into 2 steps:
1. The physical layer of 802.16/e design & simulated matlab/simulink platform and we are transmitted any image.
2. The hardware output will be captured digitally in the Spartan - II based FPGA trainer model in Xilinx. This platform validated with the simulation in SIMULINK. Validation in the analog domain with help of spectrum analyzer at the system output.

PROPOSE WI-MAX ARCHITECTURE AND SPECIFICATION

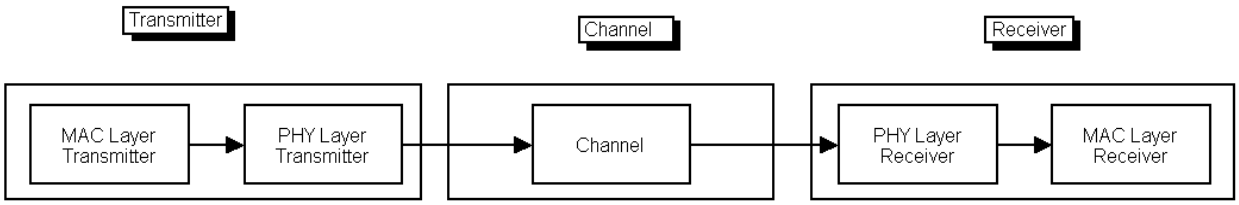
Physical layer set up the connection between the communicating devices and is responsible for transmitting the bit sequence. It also defines the type of modulation and demodulation as well as transmission power. WiMAX physical layer is based on the orthogonal frequency division multiplexing (OFDM). OFDM is a good choice of high speed data transmission, multimedia communication and digital video services. It even can maintain very fast data rate in a non line of sight condition and multipath environment. In the following subsection we provide a detailed description of Wi-MAX Physical layer.

Figure shows the high level architecture of Wi-MAX transmitter and receiver. At the transmitter end first Data, MAC PDU, Randomizer, Block Encoder, Convolution encoder, Interleaver, IQ map per, OFDM modulation, and these all above block is useful for data transmission in wireless medium. At receiver block exact opposite process done at the receiver end. Here as a channel we are using Additive White Gaussian Noise (AWGN).

Randomizer is done according to FEC (Forward Error correction) block for all data except for FCH (Frame control Header). Its main function is to maintain data integrity.

An Additive white Gaussian noise (AWGN) channel model is used with Rayleigh fading to resemble the real world scenario. The transmitter and receiver are assumed to be in fixed

positions and the channel coding is not used. The transmitted and received signals are considered to in perfect sync with each other in time and frequency. Losses from feeder cables, joints, connectors, jumpers are not taken in consideration. It is useful for data transmission in wireless medium. At receiver block exact opposite process done at the receiver end and Here as a channel we are using Additive White Gaussian Noise (AWGN).

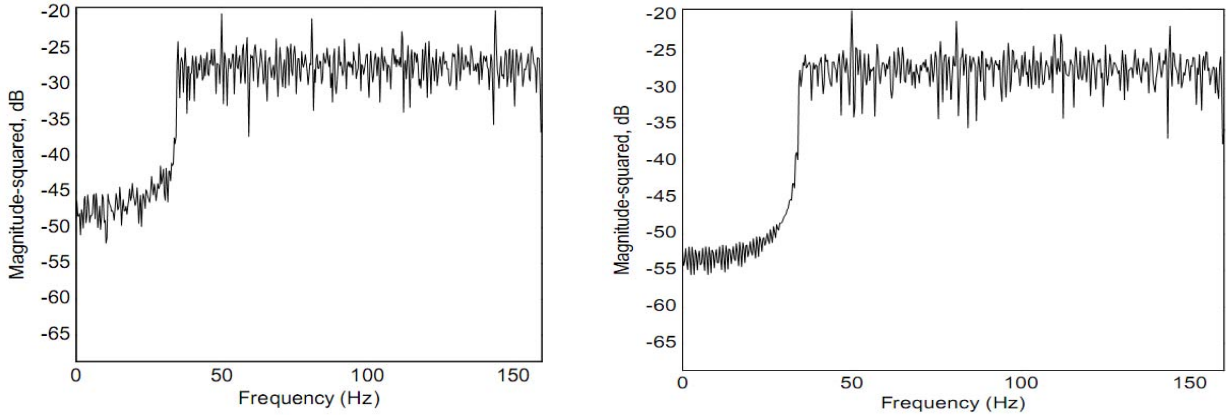


DSP/ FPGA HARDWARE SPECIFICATION AND LIMITATION OF DESIGN:

Our model is design using matlab simulink toolbox, so System Generator tool. it provides direct support for MATLAB through the MCode block. In this block you can directly applies input values to an M-function for evaluation using Xilinx's fixed-point data type. The evaluation is done once for each sample period. The block is capable of keeping internal states with the use of persistent state variables. The input ports of the block are determined by the input arguments of the specified M-function and the output ports of the block are determined by the output arguments of the M-function. The block provides a convenient way to build finite state machines, control logic, and computation Heavy systems.

Next step onward you must have installed Matlab simulink and search for Xilinx block. The significance is that the Xilinx blocks are the only blocks that can eventually be synthesized, placed and routed, and programmed into the FPGA. Xilinx blocks are essentially a Simulink version of all the cores in Xilinx Core Generator. With the help of System generator high level DSP algorithm design with FPGA implementation you can create internal core for simulink m-file so you can download m-file into the Xilinx Spartan – II FPGA model kit.

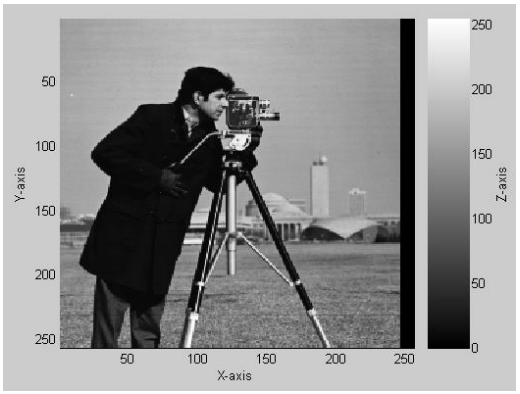
SIMULINK RESULTS:



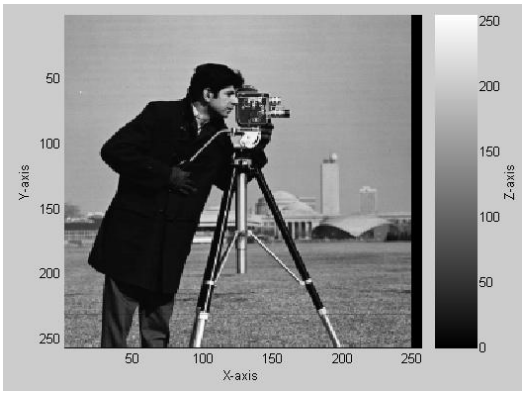
Implementing the specified design in SIMULINK, the output of the pulse shaping filter and the output of the transmitter are obtained.

The result of image transmission through Wi-max is given below.

(1) Input:



(2) Output:



CONCLUSION:

The MATLAB SIMULINK /SYSTEM GENERATOR ALSO XILINX ISE SUITE proves to be an easily modifiable platform for creating a WiMAX simulation model and transmit a data as image. first implementing in SIMULINK, install xilinx ISE suite then through system generator m-file loaded in the hard ware finally, verifying the hard-ware produce signal with the simulation, ensures that the plat-form is thoroughly tested and producing the correct result. It provides batter electronic tracking for safe, efficient and reliable transport of radioactive materials.

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