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Implementation of Efficient Channelizer for software defined radio

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Abstract : The main aim of Software Defined Radio (SDR) system is to support a multiple wireless communication services in a single system design. In SDR, the use of channelizers is to extract the expected channels from received RF frequency band and perform baseband processing. This journal explains the process of channelizer applied on low power and high efficient application as it selects the bandwidth based on application of target. The design consists of schematic entry and RTL descriptions in Verilog.
Keywords: **Software Defined Radio, Channelizer, wireless communication, Baseband processing, modulation techniques.**

I. INTRODUCTION

In 1897 Gugliemo Marconi was first discovered the possibility of establishing a continuous communication stream with the ship in English channel by means of radio waves. Communication means transfer of information from source to destination. In traditional telephony, the source and the recipient are connected by means of conducting wires, and it would carry information in the form electrical signals. But today ,it is fabricated by RF circuit fabrication and digital switching techniques, affordable high speed communication. The transfer of information between the points that has no physical connection, like wire or cable connection , would be wireless communication for example space radio communication.

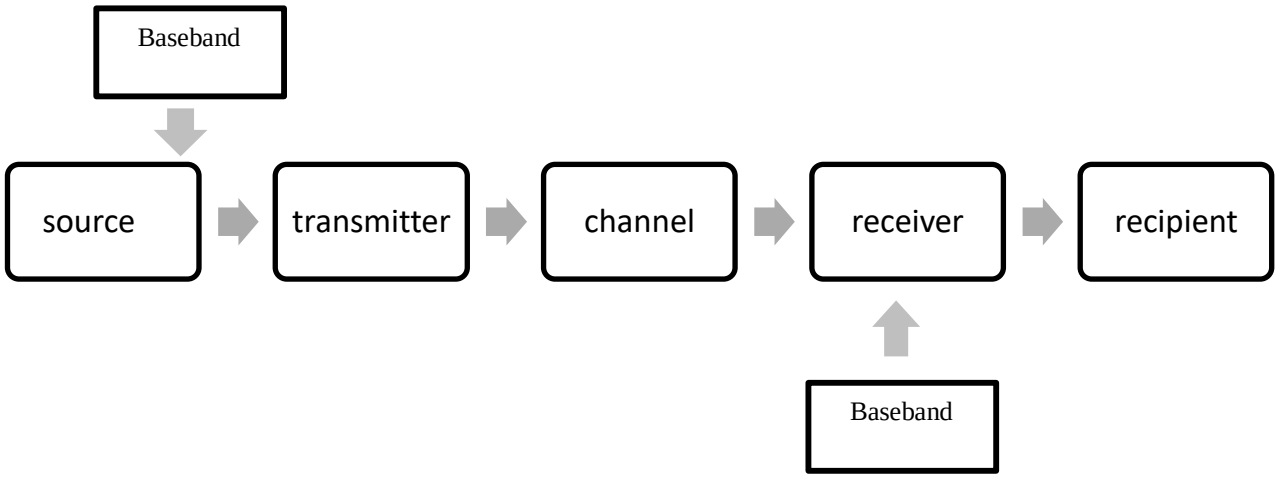

Fig 1: Communication System

The information to be transferred is originated from the source. This information could be in the form of either either , voice, text ,picture or a packet data. It is encoded upon a carrier or a medium called baseband signal .Before reaching the transmitter, the information to be sent is added to the baseband signal. The transmitter then sends the message into the communication channel. The channel is the medium to connect sender and receiver. This in the wired system could be a generally waves like IR or radio. At the receiver, the information is extracted from the incoming received signal, by subtracting the baseband signal from it.

Software-Defined Radio (SDR) is a rapidly evolving technology that is receiving enormous recognition and generating widespread interest in the telecommunication industry. SDR consists of software as well as hardware technologies. This technology facilitates implementation of some of the functional modules in a radio system such as modulation/demodulation, signal generation, coding and link-layer protocols in software.It helps in building reconfigurable software radio systems where dynamic selection of parameters for each of the above-mentioned functional modules is possible.

Channelizer is used to select appropriate channel according to received signal at the receiver and it supports multiple communication channel as per RF band. The channel co-efficient and decimation rates are unique to each channel. A main element of the SDR architecture is the channelization technique that is used to isolate the independent communication channels contained within the wideband signal. This paper will explores implementation channelizer in a software defined radio platform.

II. BLOCK DIAGRAM

2.1 Transmitter section

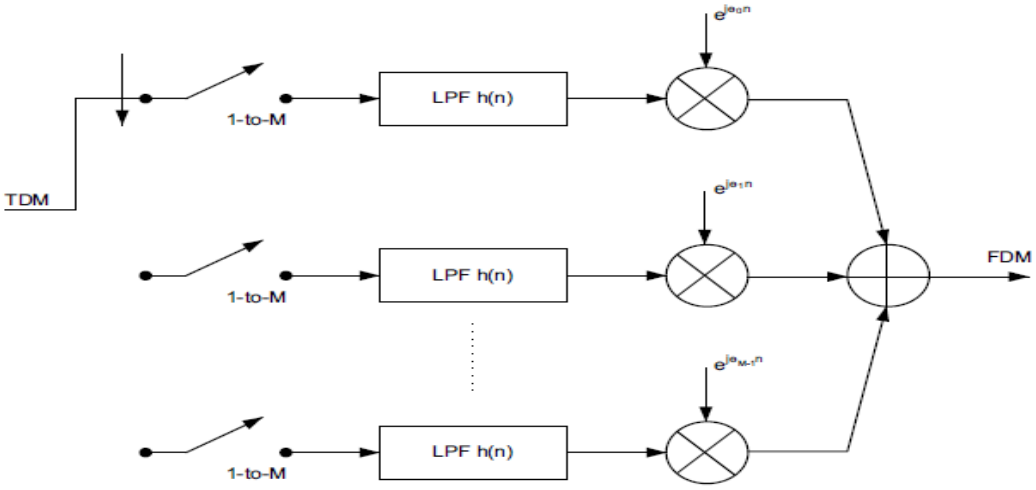

Fig 2: Transmitter

Transmitter first performs time division multiplexing.Time-division multiplexing is a method of transmitting and receiving independent signals over a common signal path by means of synchronized switches at each end of the transmission line so that each signal appears on the line only a fraction of time in an alternating pattern.The signal is then fed to low pass filter. It attenuates signals with frequncies higher than the cutoff frequencies.The signal is then fed to a multiplier.The last component performs frequency division multiplexing. Frequency-division multiplexing is a scheme in which numerous signals are combined for transmission on a single communications line or channel. Each signal is assigned a different frequency or a subchannel within the main channel. It is then transmitted.

2.2 Receiver section

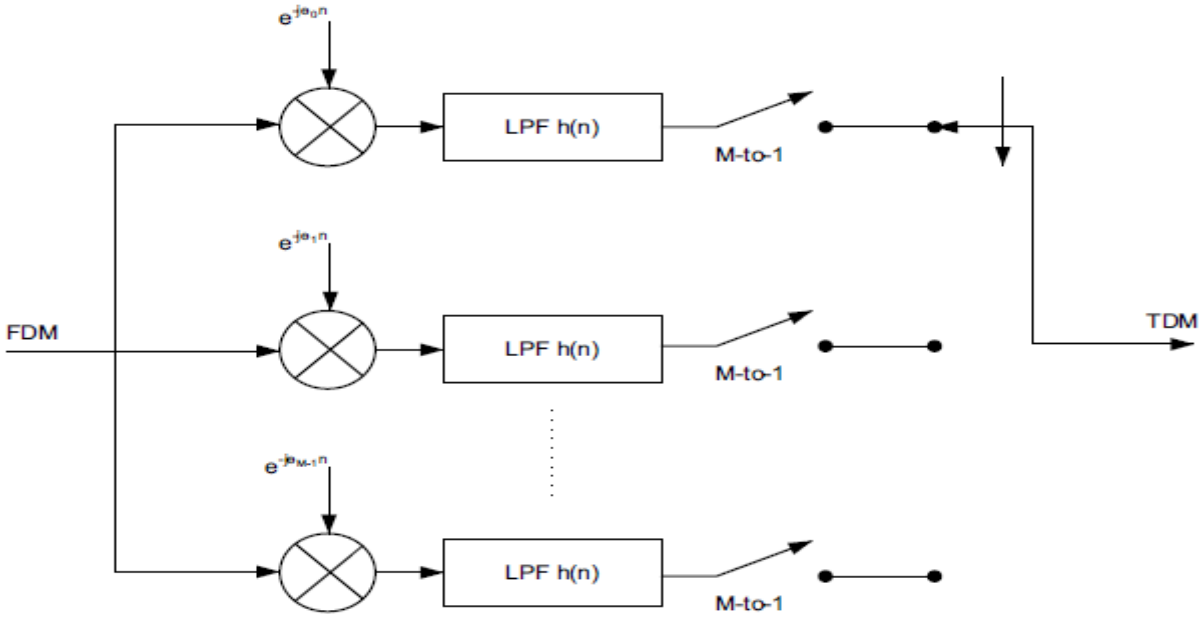

Fig 3: Receiver

At the receiver, it first performs frequency division multiplexing inorder to obtain the sub-channels that is transmitted from the transmitter portion.It is given to a multiplier whose output is given to a low pass filter inorder to attenuate signals with frequncies higher than the cutoff frequencies.The LPF output performs time division multiplexing to receive independent signals over a common signal path by means of synchronized switches at each end of the transmission line.

III. RESULT

This project is done on XIlinx ISE Design suite. From this project, we were able to observe the channelization technique done in a software-defined radio.

The input and output of each blocks of our project is as shown below:

3.1 Encoder
Input=i[15:0]
Output=o[15:0]

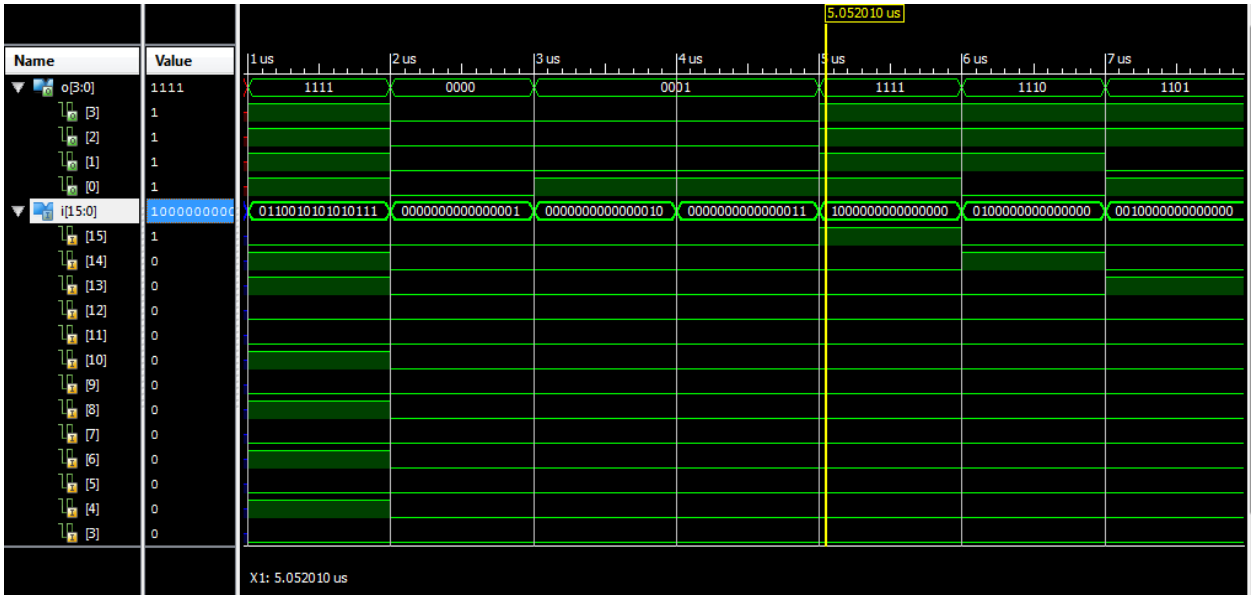

Fig 4: Simulation Result of Encoder

2.2 BPSK Modulator
Input=clk,din,vin,rst
Output=vout,dout,r[15:0],dout i[15:0]

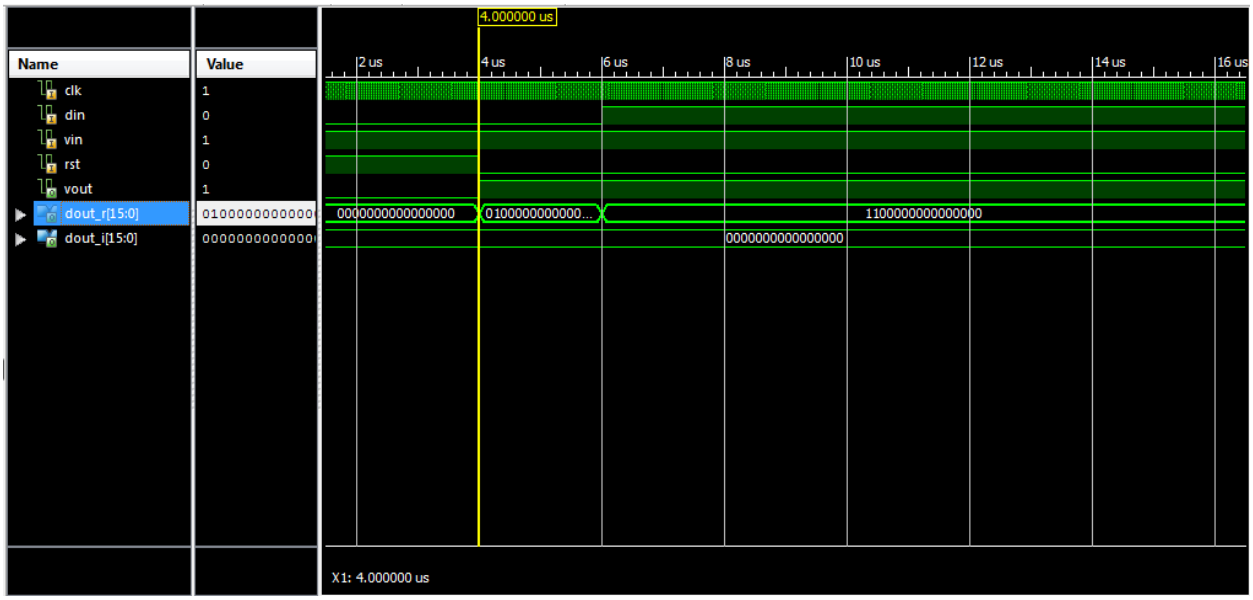

Fig 5: Simulation Result of BPSK modulator

2.3 FFT
Input=a1[31:0], b1[31:0], a2[31:0], b2[31:0], wr[31:0], wi[31:0],clk
Output= z1r[31:0], z2r[31:0], z1i[31:0], z2i[31:0]

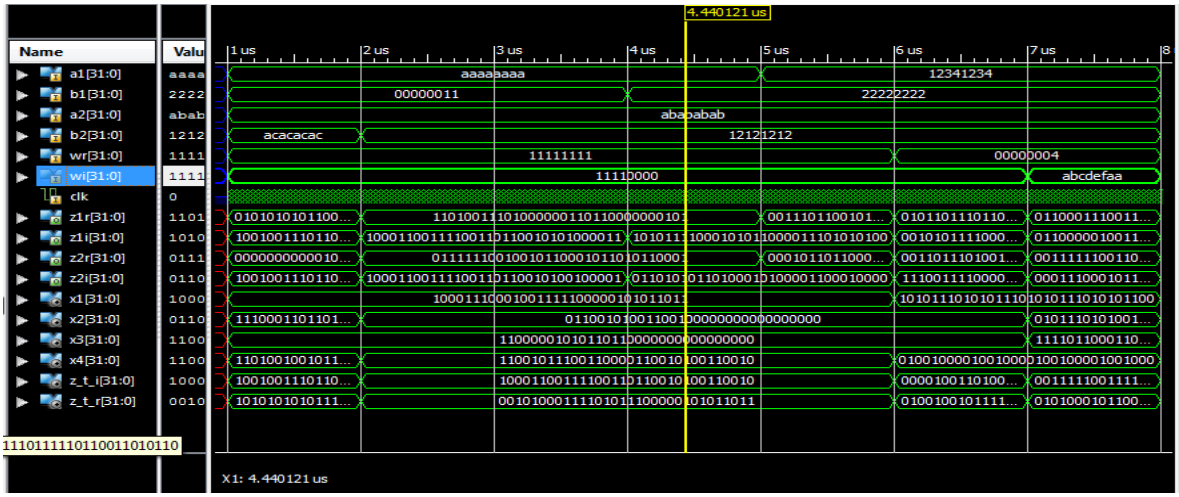

Fig 6: Simulation Result of FFT

2.4 Multiplier

Input=inp1[31:0],inp2[3:0]

Output=Product[7:0]

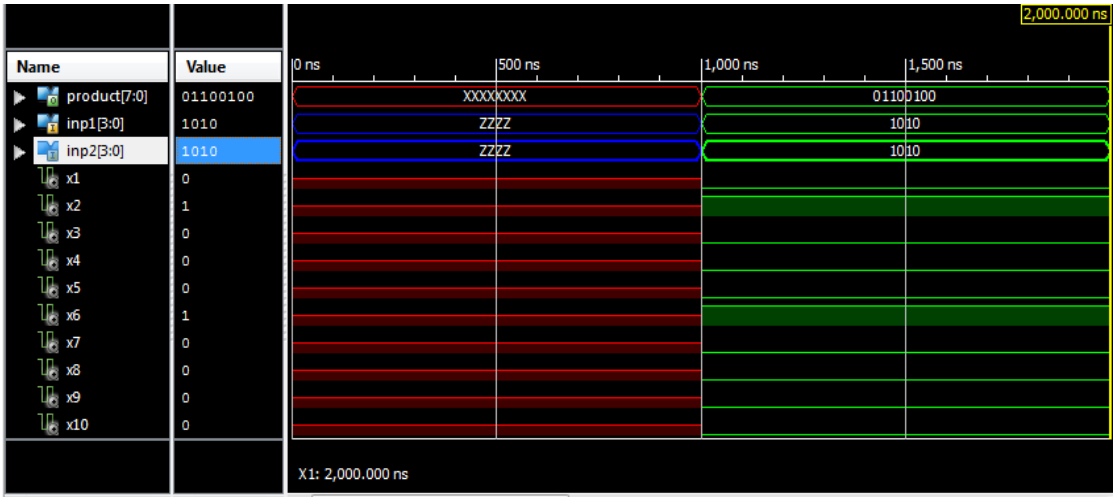

Fig 7: Simulation Result of Multiplier

2.5 Channelizer

Input=clk, rst n, in data[31:0], in nd, in m[0:0], in msg[31:0], in msg

Output= out data[31:0], out nd,out m[0:0], out msg[31:0], error

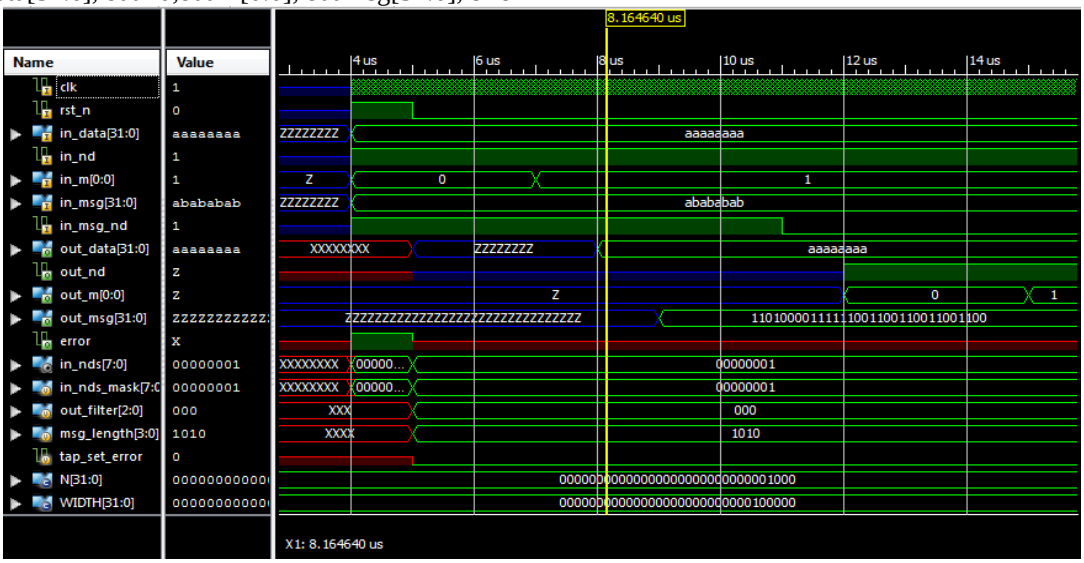

Fig 8: Simulation Result of Channelizer

2.6 Channelizer buffer output:

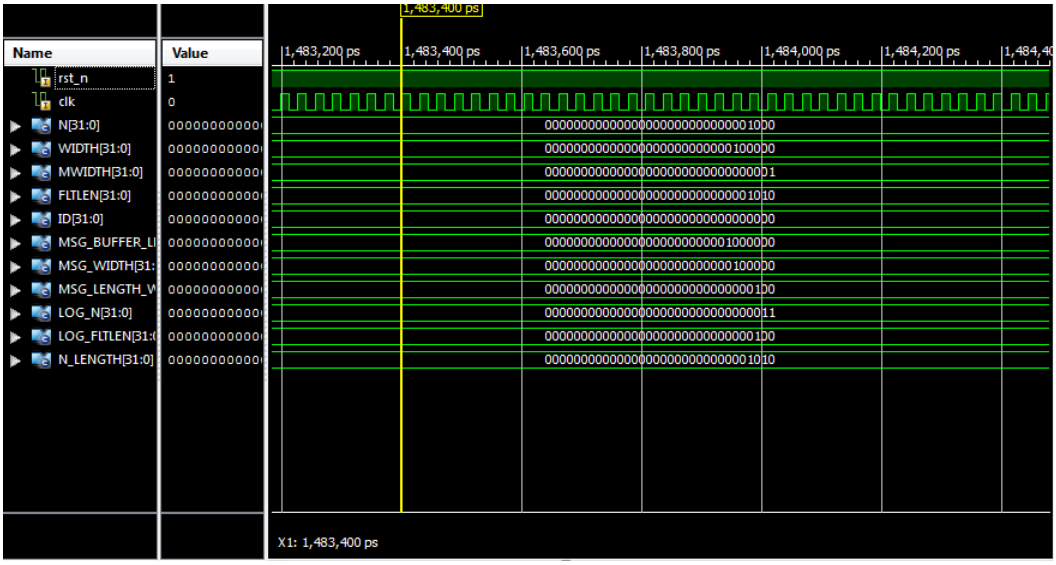

Fig 9: Simulation Result of Buffer

IV. Conclusion

This journal explained the process of channelizer applied on low power and high efficient application as it selects the bandwidth based on application of target. The design consists of schematic entry and RTL descriptions in Verilog. Architecture optimized with respect to efficiency and those made in the polyphase FFT and implementation aspects leads to

- Smaller Area
- Low Power Consumption
- Low Cost Seem Very Promising
- For Further Processing Architecture Optimization Is Achieved.

Summarizing, SDR is a promising technology that facilitates development of multi-band, multi-service, multi-standard, multi-feature consumer handsets and future-proof network infrastructure equipment.

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