IMPLEMENTATION OF MODULATIOR/DEMODULATOR USING 16QAM CONSTELLATION

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215-41-017
ECE-641
Spring-2011

INTRODUCTION

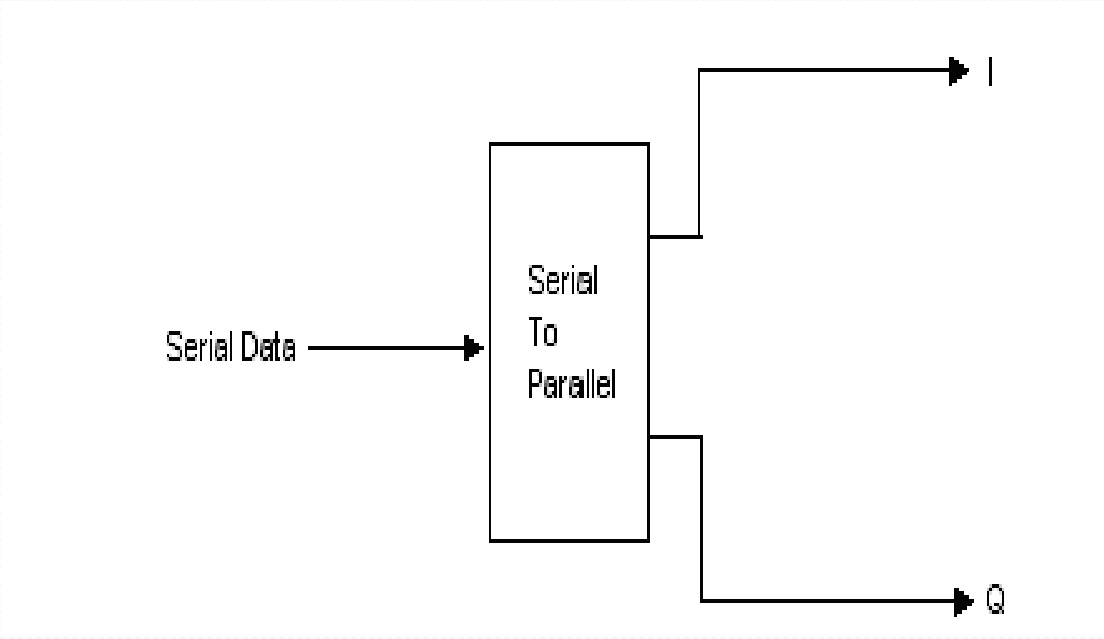
- In the project Modulator and Demodulator with modulation scheme 16 QAM constellation on platform of FPGA is implemented.
- FPGA kit of Altera is used as a Logic Design Environment.
- The Altera- Quartus-II simulator is used for synthesis, implementation and simulation.
- Programming is done in VHDL.

16 QAM

- QAM-Quadrature Amplitude Modulation
- In 16-state Quadrature Amplitude Modulation (16QAM), there are four I values and four Q values.
- It is more efficient than BPSK, QPSK, or 8PSK.

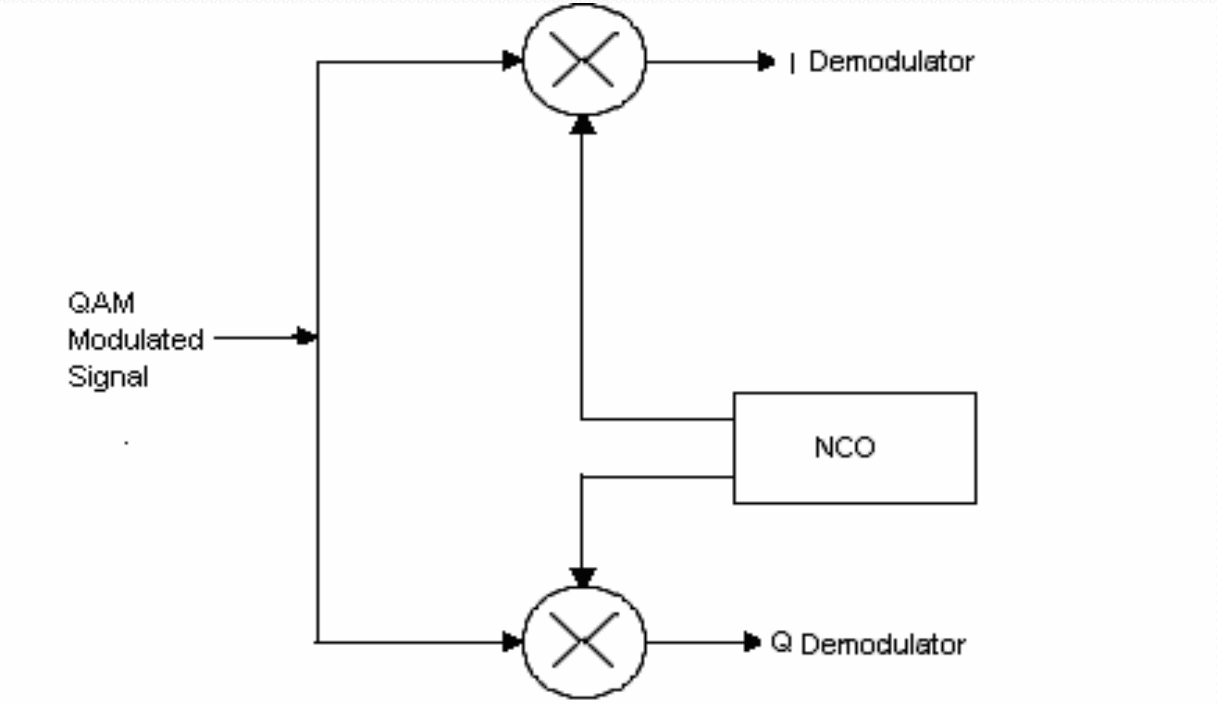
Modulation/Demodulation

- MODULATION

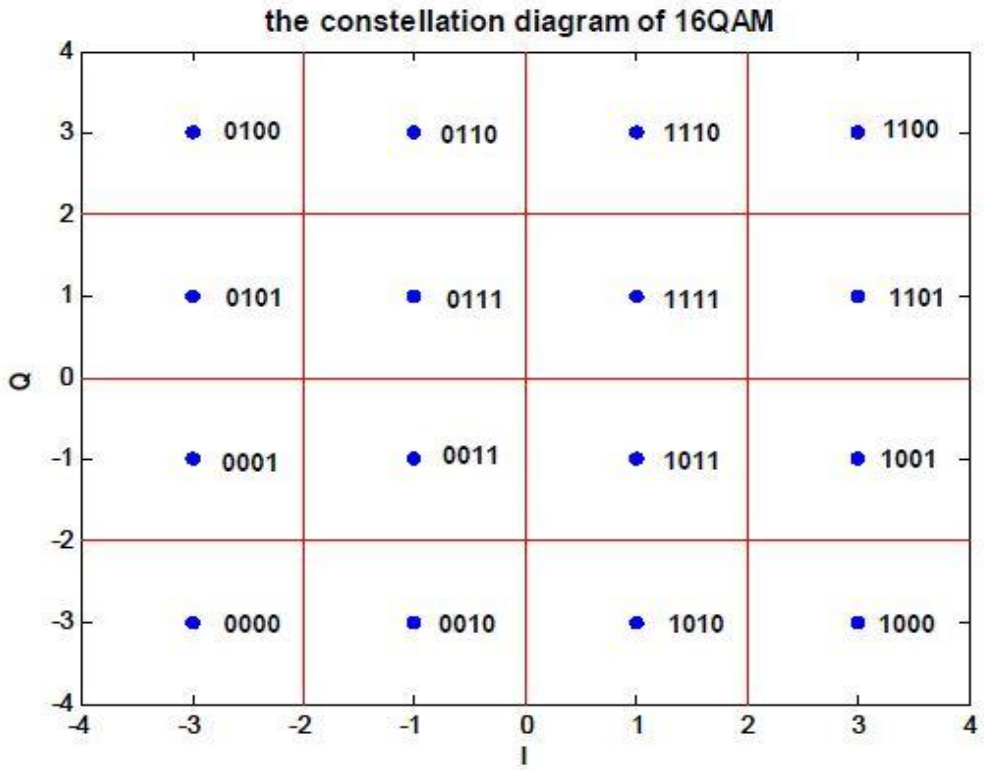


Modulation/Demodulation

- DEMODULATION

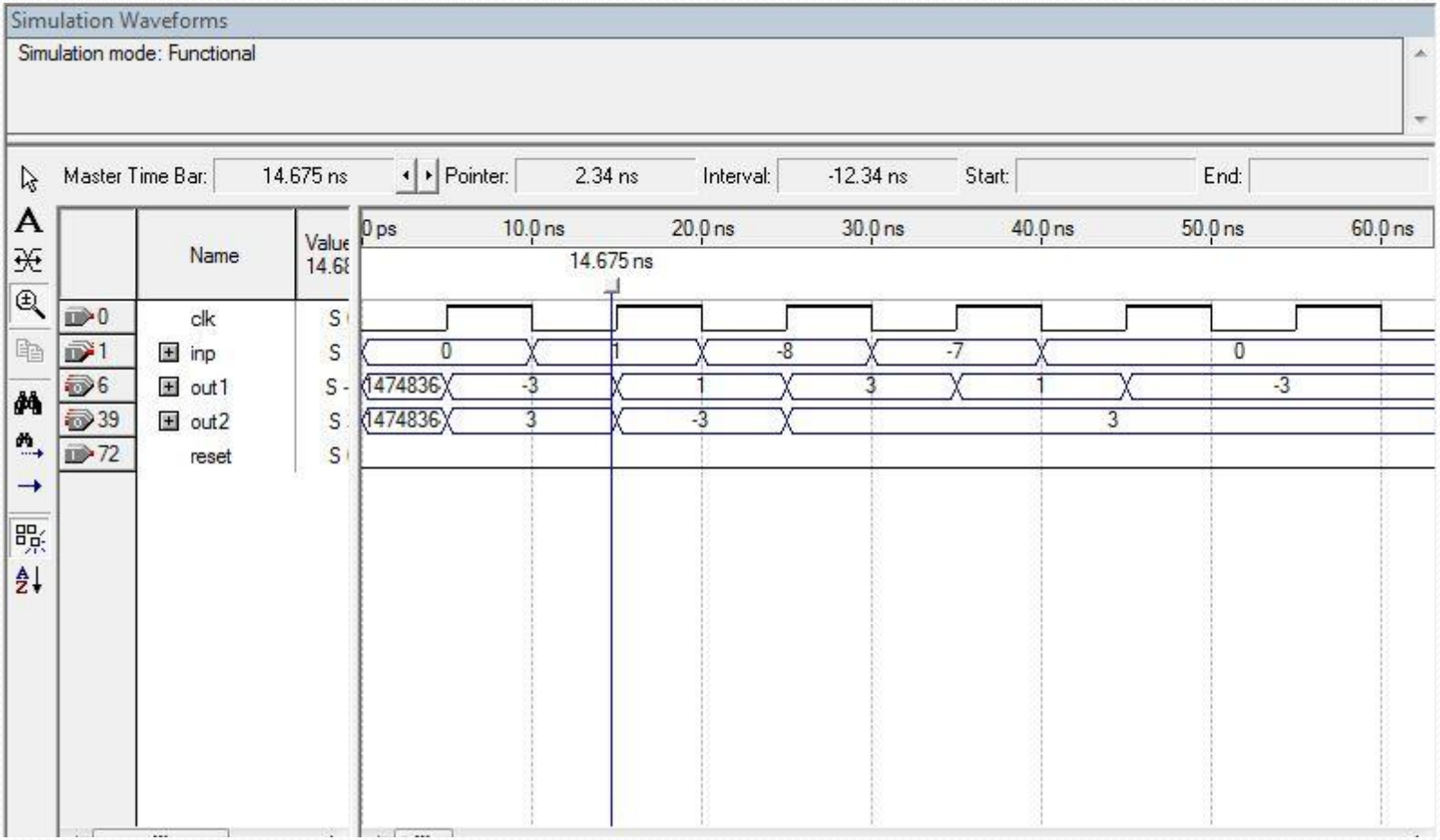


16 QAM CONSTELLATION

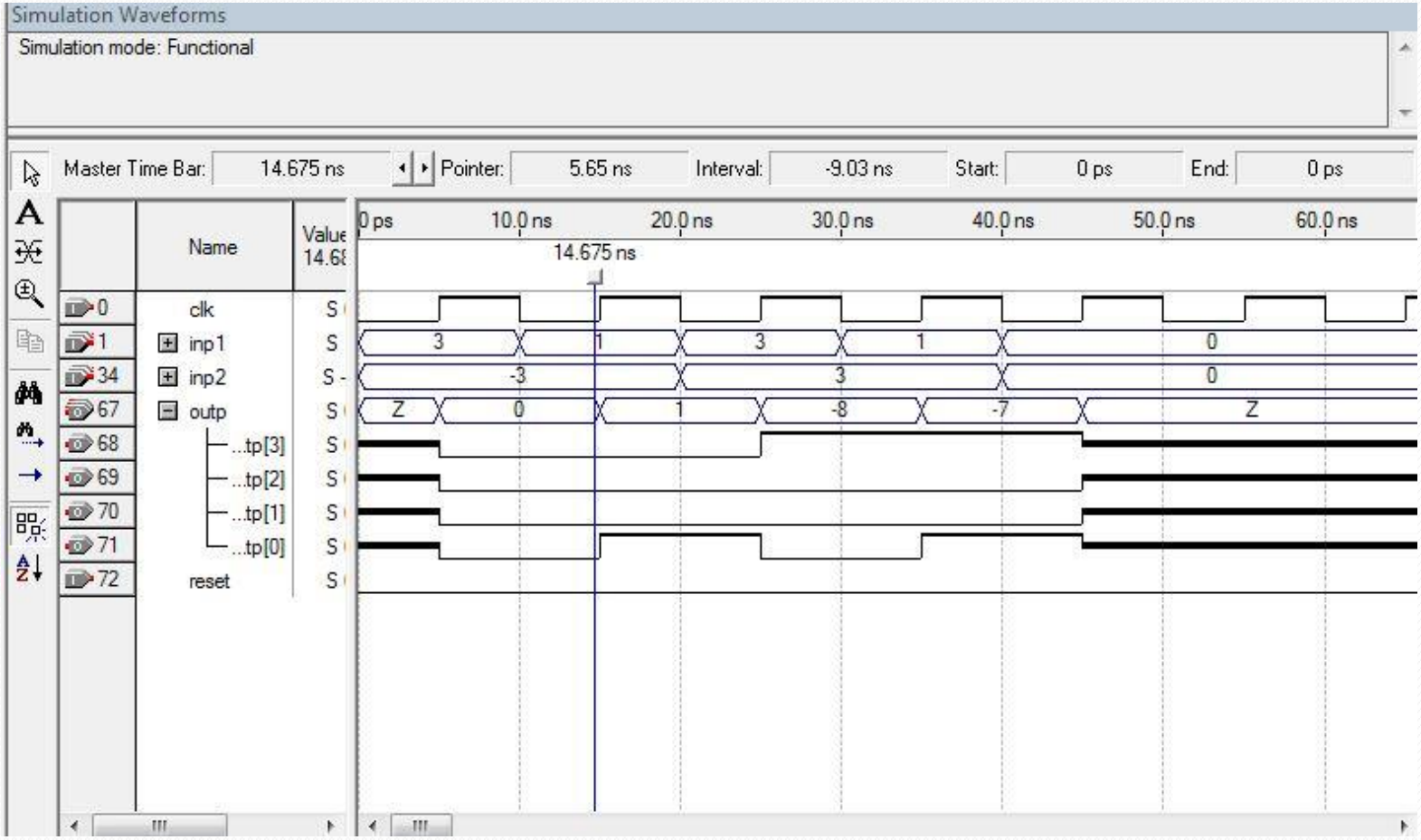


Each symbol contains 4 bits, the values in real and imaginary are 3，-1，1，3. The bits 1,3 corresponds to real part, the bits 2,4 corresponds to the imaginary part.

Simulation


Simulation Waveforms
Simulation mode: Functional
Master Time Bar: 14.675 ns
Pointer: 2.34 ns
Interval: -12.34 ns
Start:
End:
Name
Value
14.68
0 ps
10.0 ns
20.0 ns
30.0 ns
40.0 ns
50.0 ns
60.0 ns
14.675 ns
0 clk
1 inp
6 out1
39 out2
72 reset
0
1
-8
-7
0
1474836
-3
1
3
1
-3
1474836
3
-3
3

Simulation


Simulation Waveforms
Simulation mode: Functional
Master Time Bar: 14.675 ns
Pointer: 5.65 ns
Interval: -9.03 ns
Start: 0 ps
End: 0 ps
Name
Value
14.68
0 ps
10.0 ns
20.0 ns
30.0 ns
40.0 ns
50.0 ns
60.0 ns
14.675 ns
0 clk
1 inp1
34 inp2
67 outp
68 ...tp[3]
69 ...tp[2]
70 ...tp[1]
71 ...tp[0]
72 reset
3
1
3
1
0
-3
3
0
Z
0
1
-8
-7
Z

References

- Ref. # J. G. Proakis, Digital Communications, 3rd Edition, McGraw-Hill, 1994.
- http://en.wikipedia.org/wiki/Quadrature amplitude modulation.
- http://www.doulos.com/knowhow/vhdl_designers_guide/an_example_design_entity

THANK Q..!!