16 QAM Modem

Junchao Ge

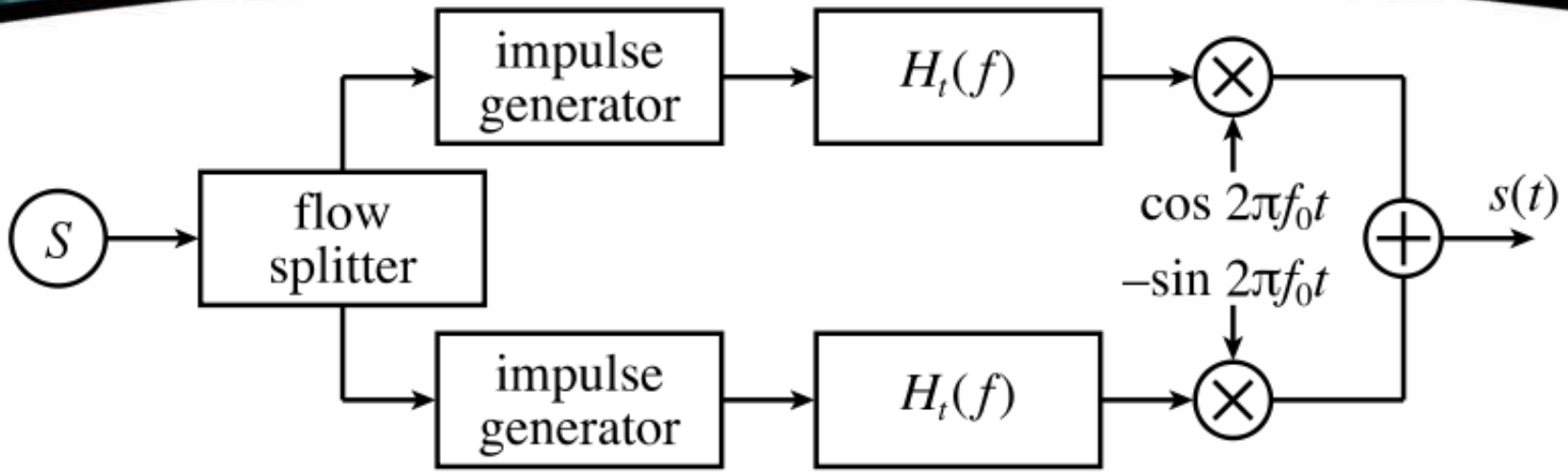
16 QAM Modem

QAM means :
Quadrature Amplitude Modulation

It's both an analog and a digital modulation scheme. It conveys two analog message signals by changing (modulating) the amplitudes of two carrier waves, using the amplitude modulation (AM) analog modulation scheme.

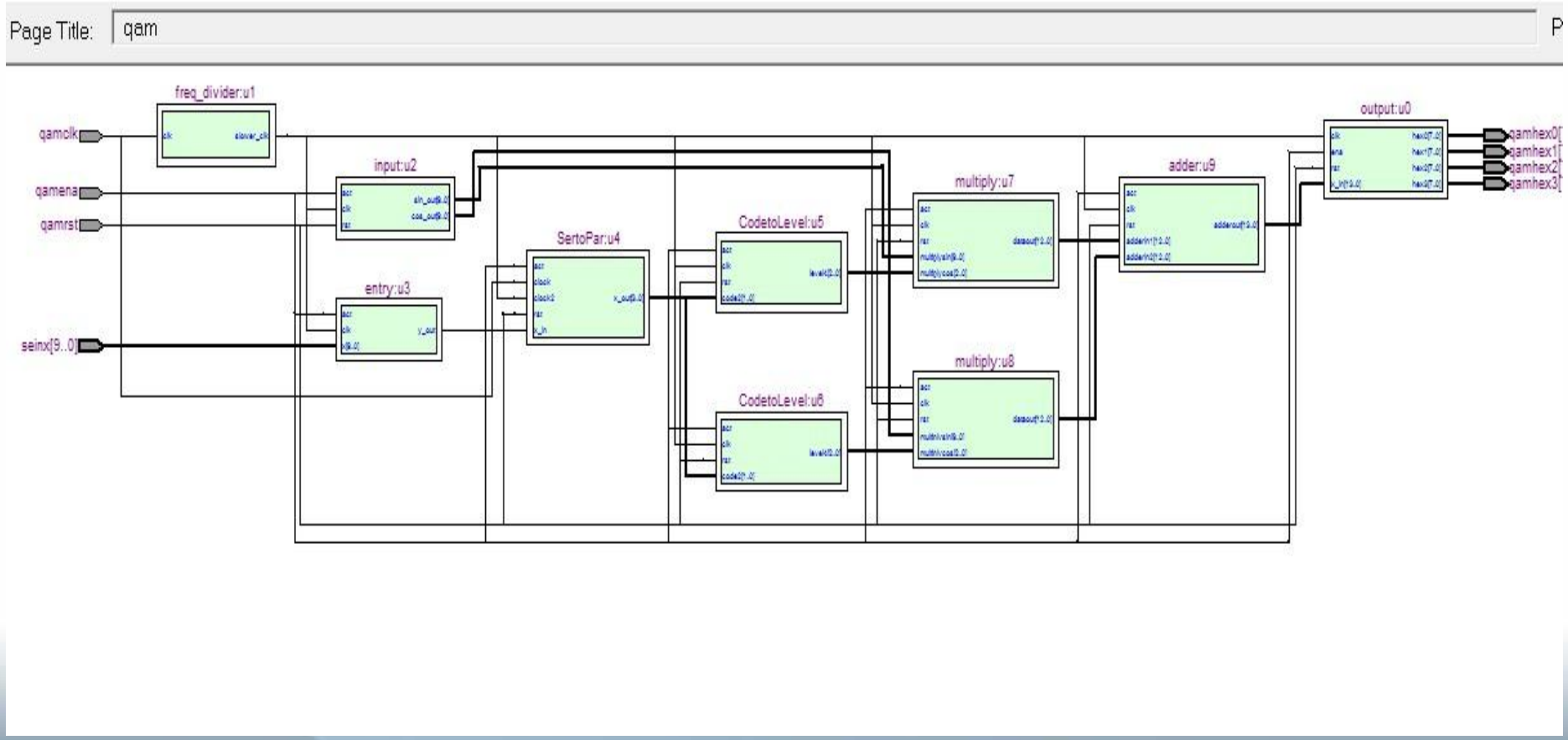
When transmitting two signals by modulating them with QAM, the transmitted signal will be of the form:

$$s(t) = a(t)\cos\omega_c t + b(t)\sin\omega_c t$$



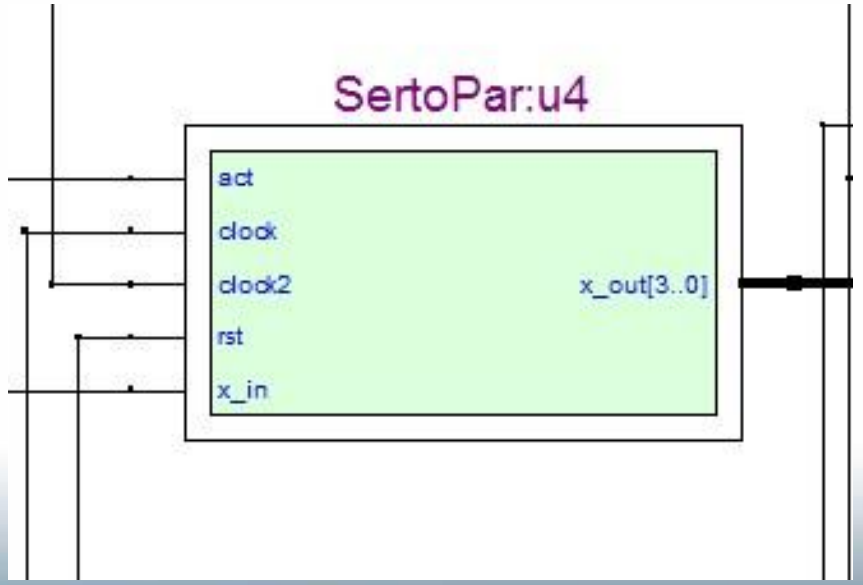
First the flow of bits to be transmitted is split into two equal parts: this process generates two independent signals to be transmitted. next to code to level switch. Then one channel is multiplied by a cosine, while the other channel is multiplied by a sine. This way there is a phase of 90° between them. They are simply added one to the other and sent through the real channel.

RTL Viewer


Page Title:
qam
freq_divider:u1
qamclk
qamena
qamrst
seinx[9..0]
input:u2
entry:u3
SertoPar:u4
CodetoLevel:u5
CodetoLevel:u6
multiply:u7
multiply:u8
adder:u9
output:u0
qamhex0[
qamhex1[
qamhex2[
qamhex3[

serial to parallel converter

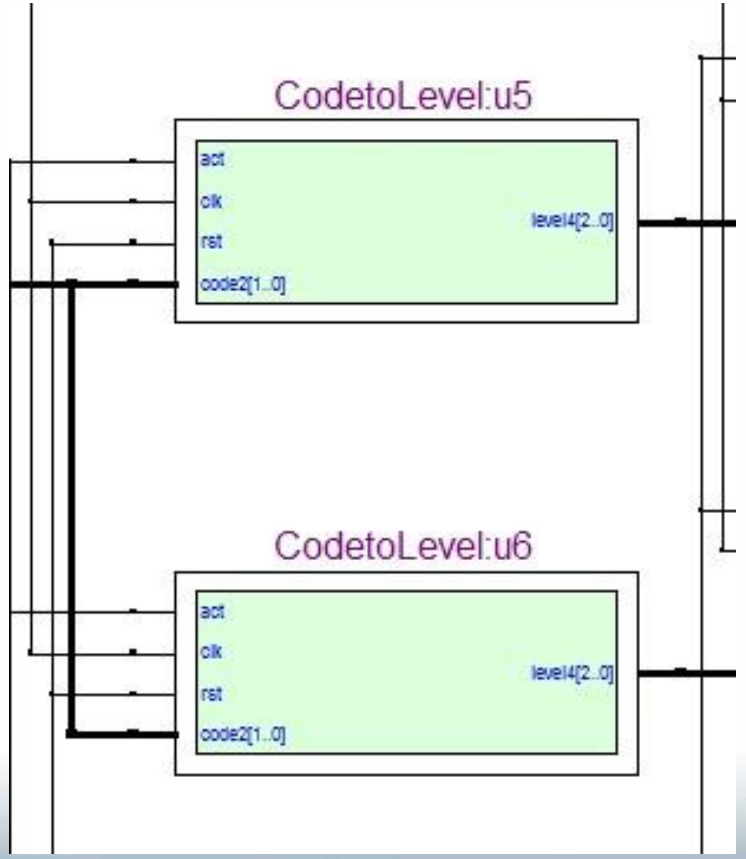
The original modulation signal is a flow of binary code , this component split Serial data input to two parallel Independence signals 00010100101111



Level Switch

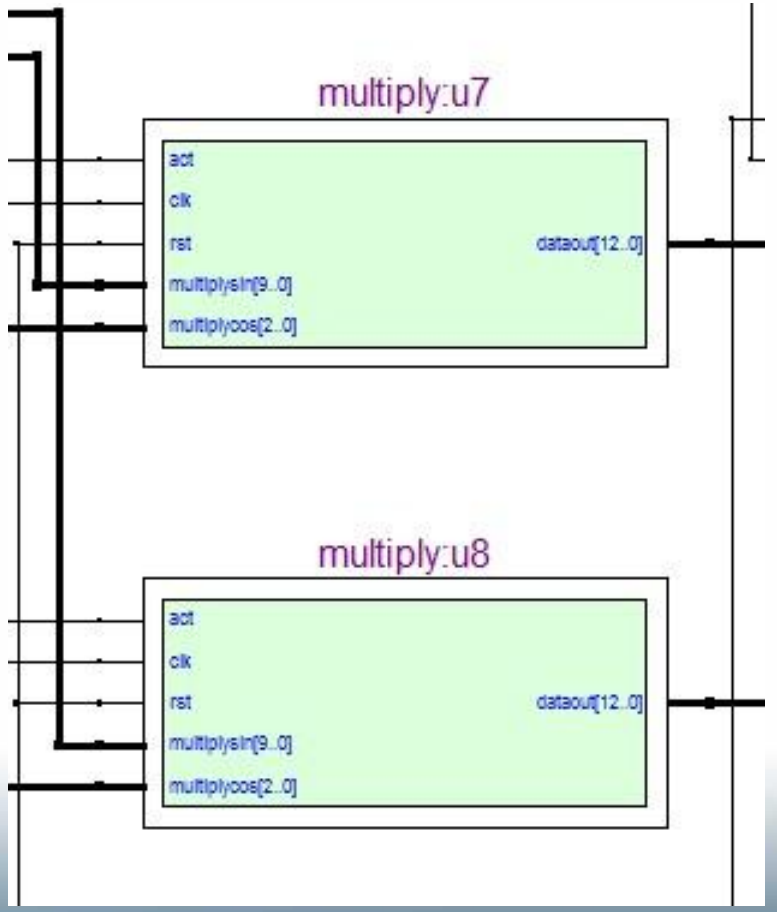
Mapping Table

Input data	Output level
00	-1A
01	-3A
10	1A
11	3A



Sin & Cos


input:u2
act
clk
rst
sin_out[9..0]
cos_out[9..0]


multiply:u7
act
clk
rst
multiplysin[9..0]
multiplycos[2..0]
dataout[12..0]
multiply:u8
act
clk
rst
multiplysin[9..0]
multiplycos[2..0]
dataout[12..0]

Sin & Cos input



Adder Part

add two signals which multiply by sin and cos seperately
then output to the print part to FPGA



Thank You