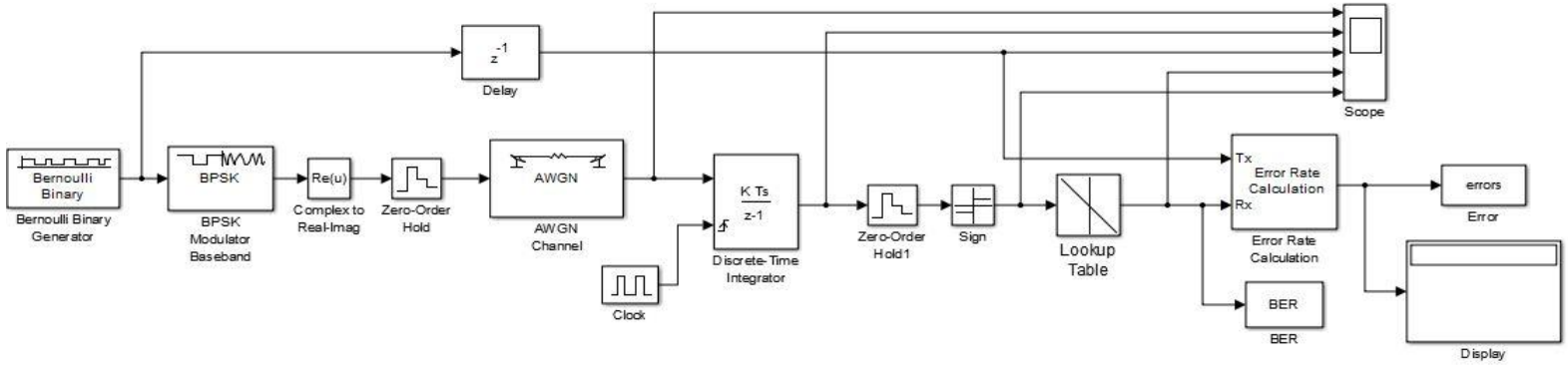
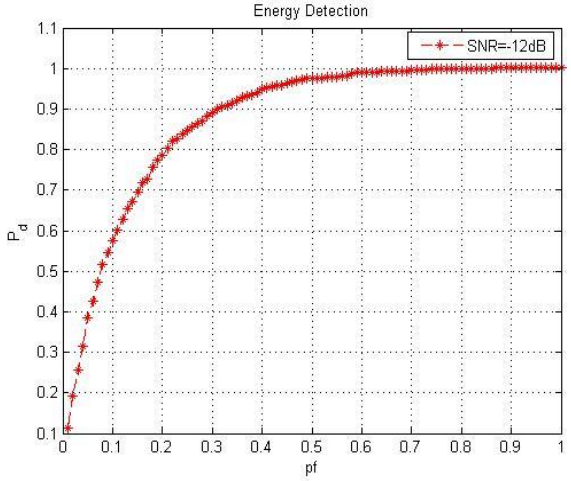


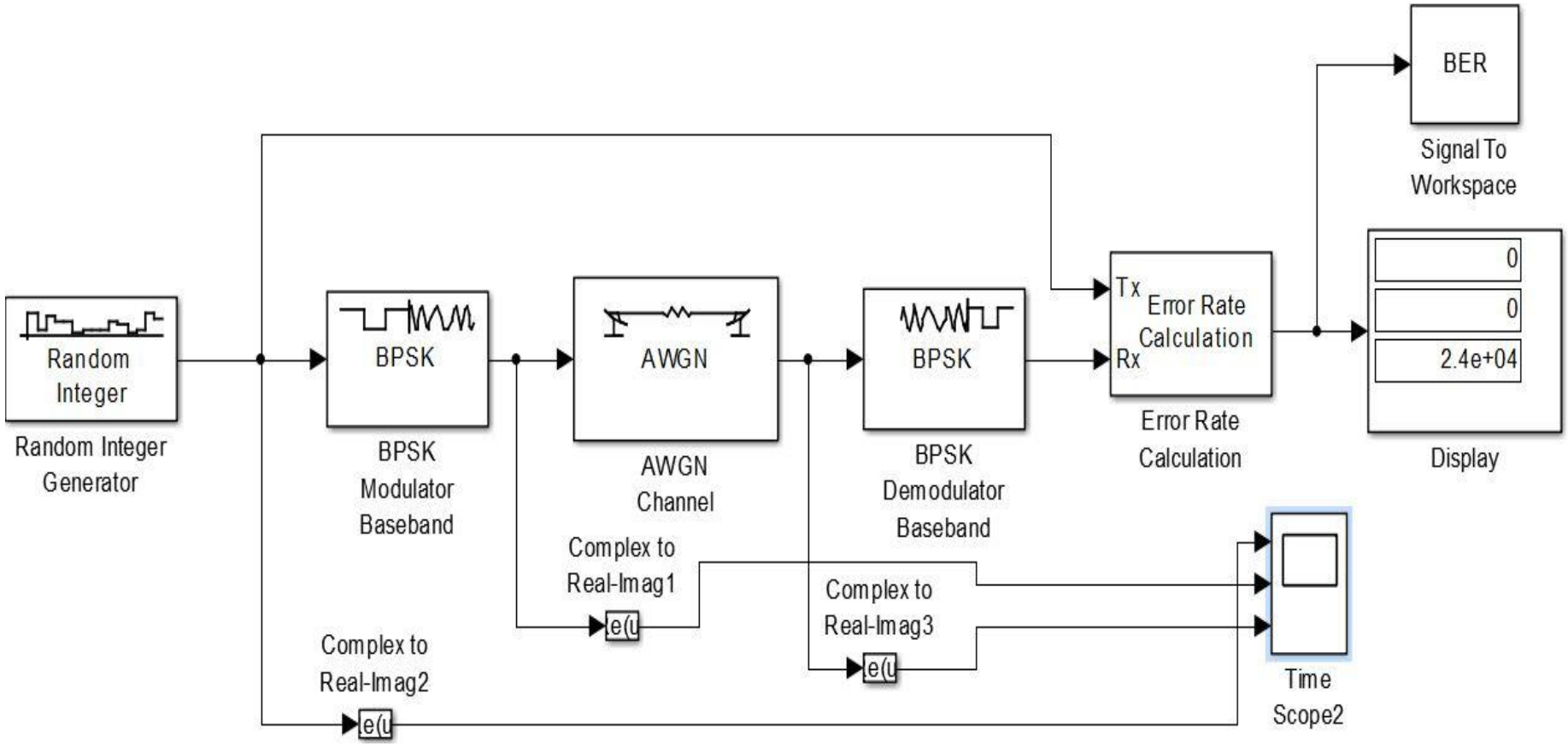
Simulink Models (BER and ROC Curves)



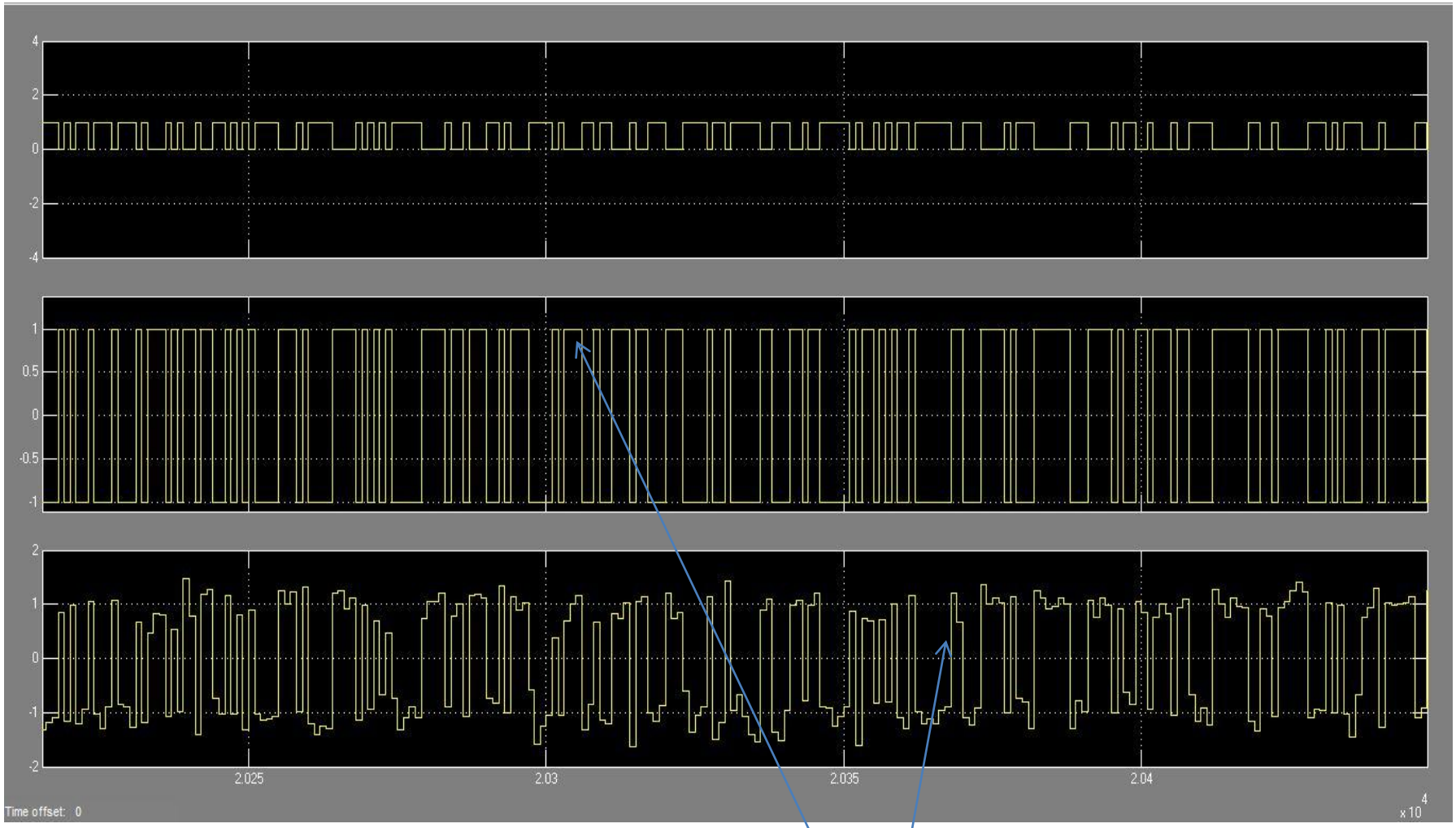
Index

- BER Curve for BPSK in AWGN 1st model
- BER curve for BPSK in AWGN 2nd model
- BER Curve for BPSK in AWGN 3st model (using Integrator while demodulation)
- BER curve BPSK in Rayleigh fading channel and output
- BER curve for BPSK in Recian fading channel and output (for different K)
- Energy Detection (Matlab script file and its output)
- Energy Detection From Simulink Model .
- ROC characteristics curve from Simulink Model at different SNR
- Including Low Pass Filter
- Next tasks :

BPSK BER vs EbNo 1st model



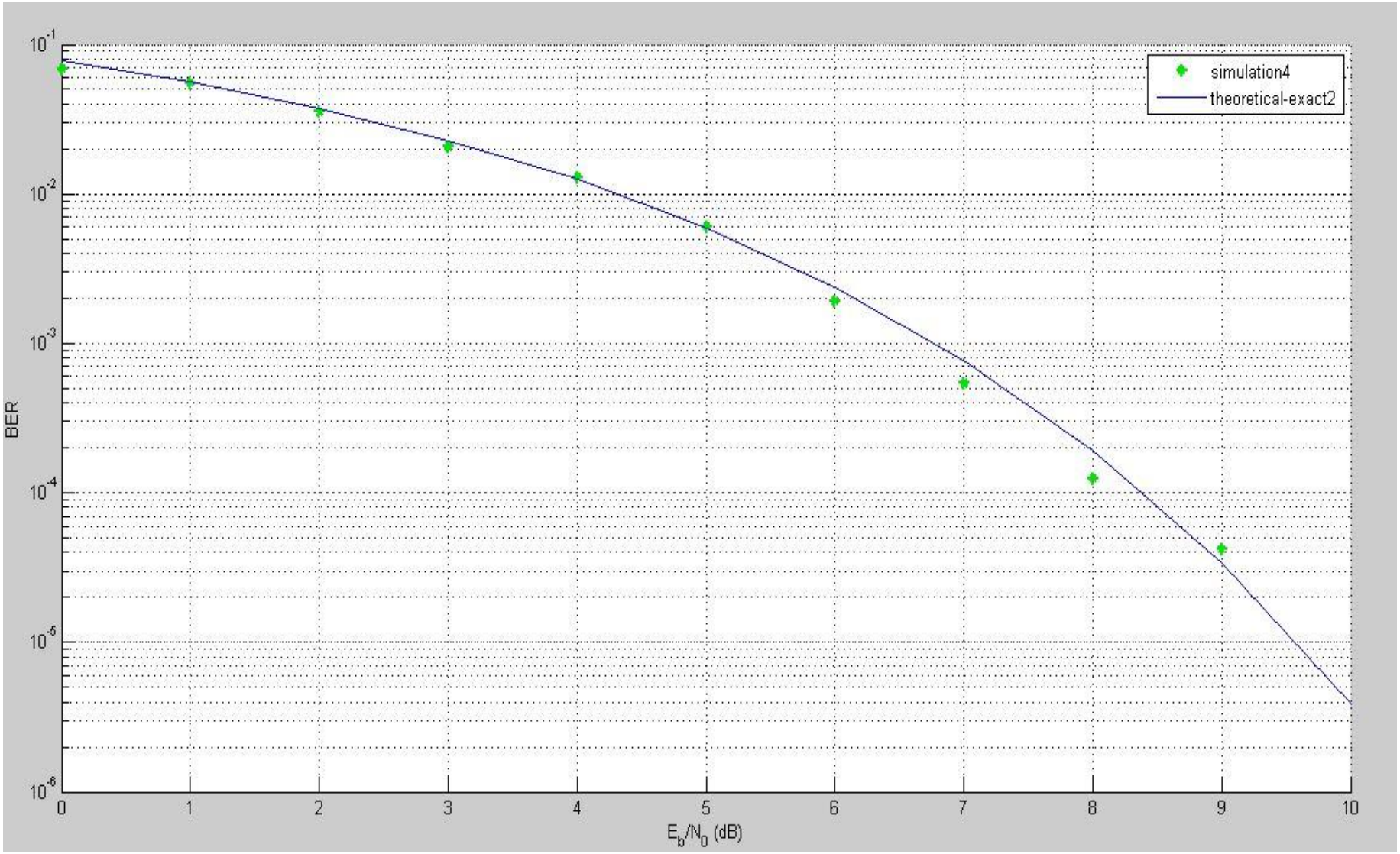
Waveforms



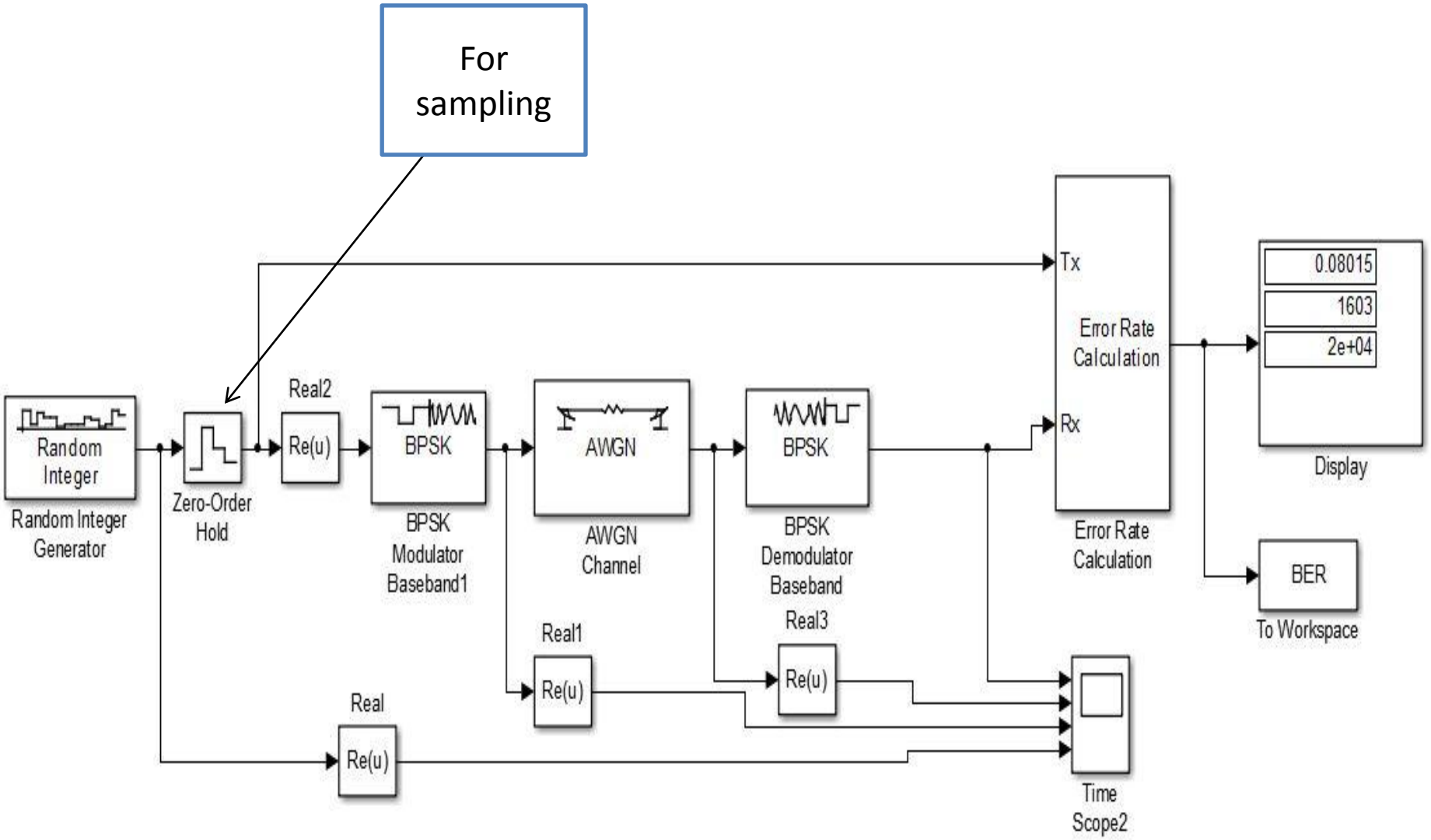
Sampling Problem

Output

Problem? Sampling is not done on each bit that we are sending

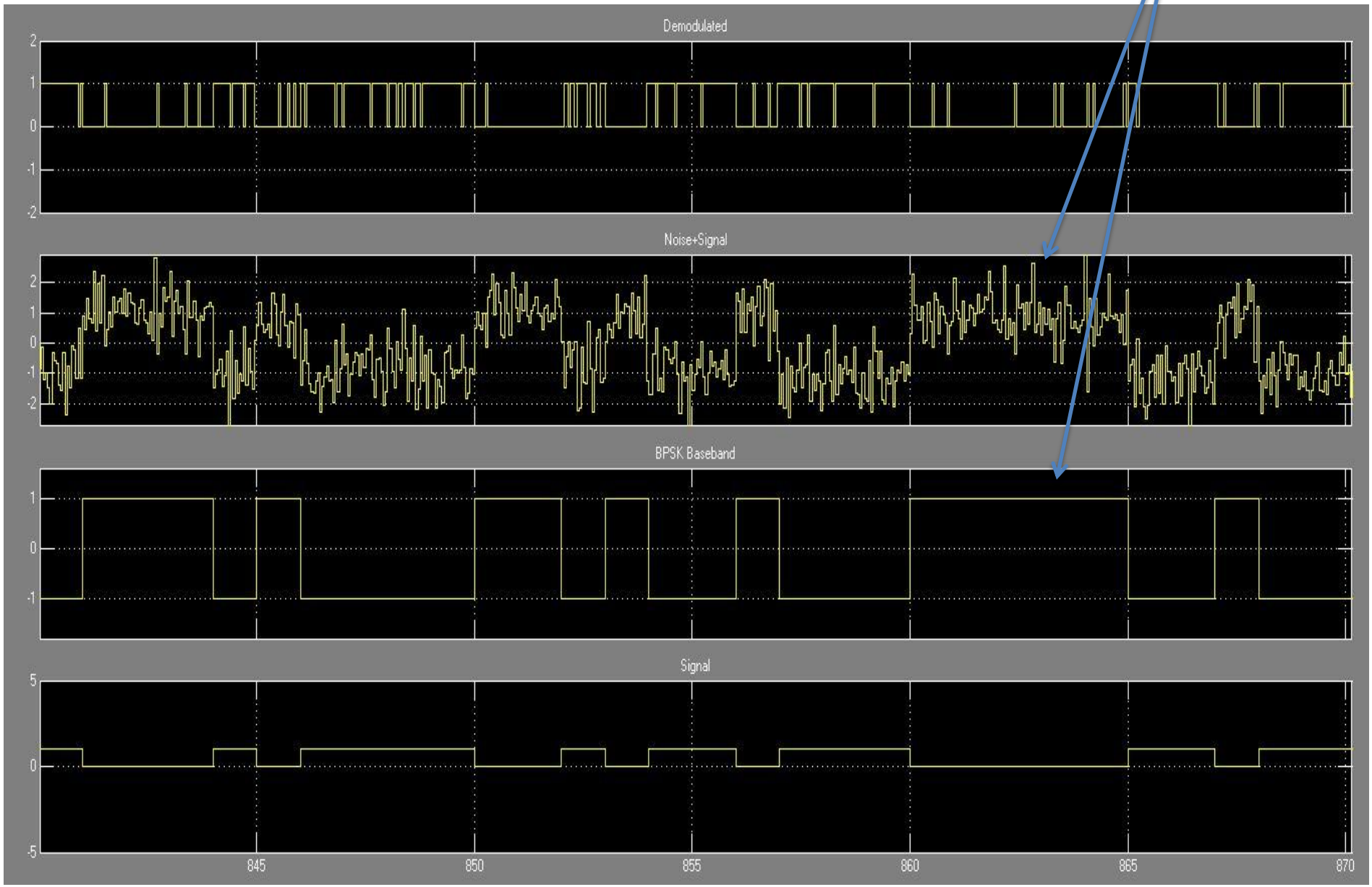


BPSK BER vs EbNo 2nd Model

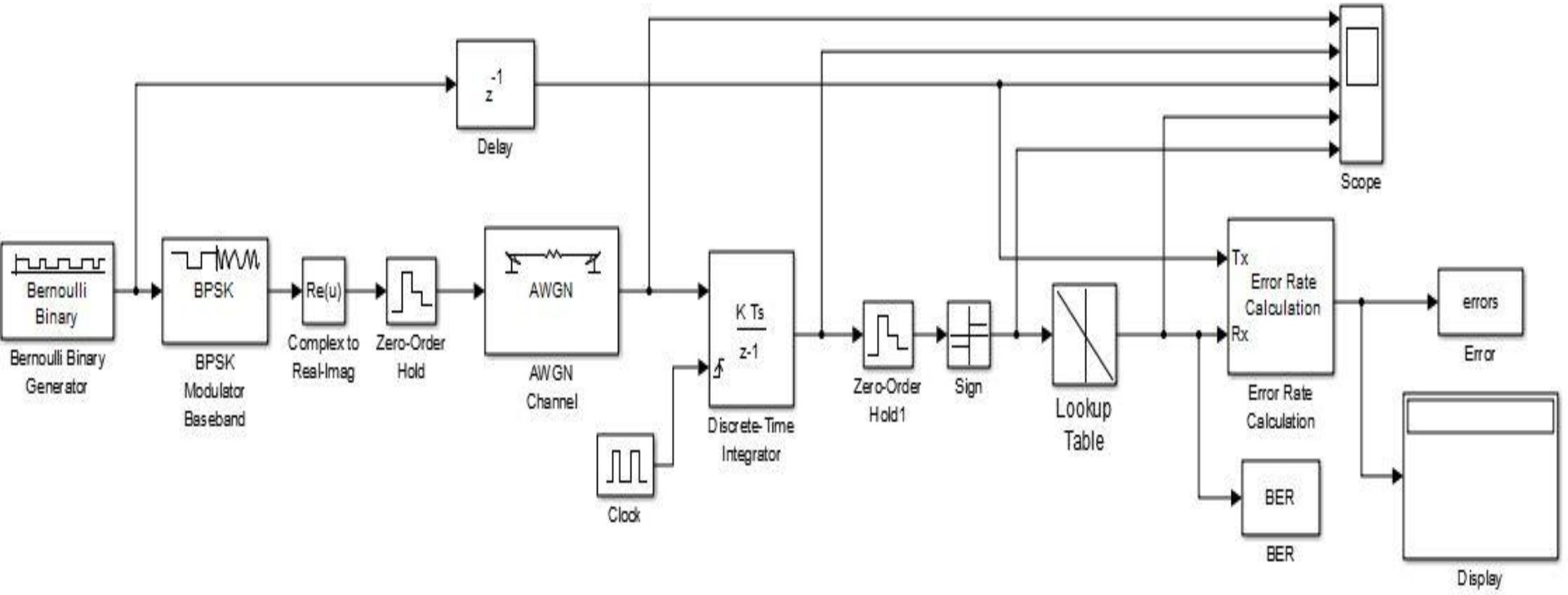


Waveforms

Sampling Per Bit

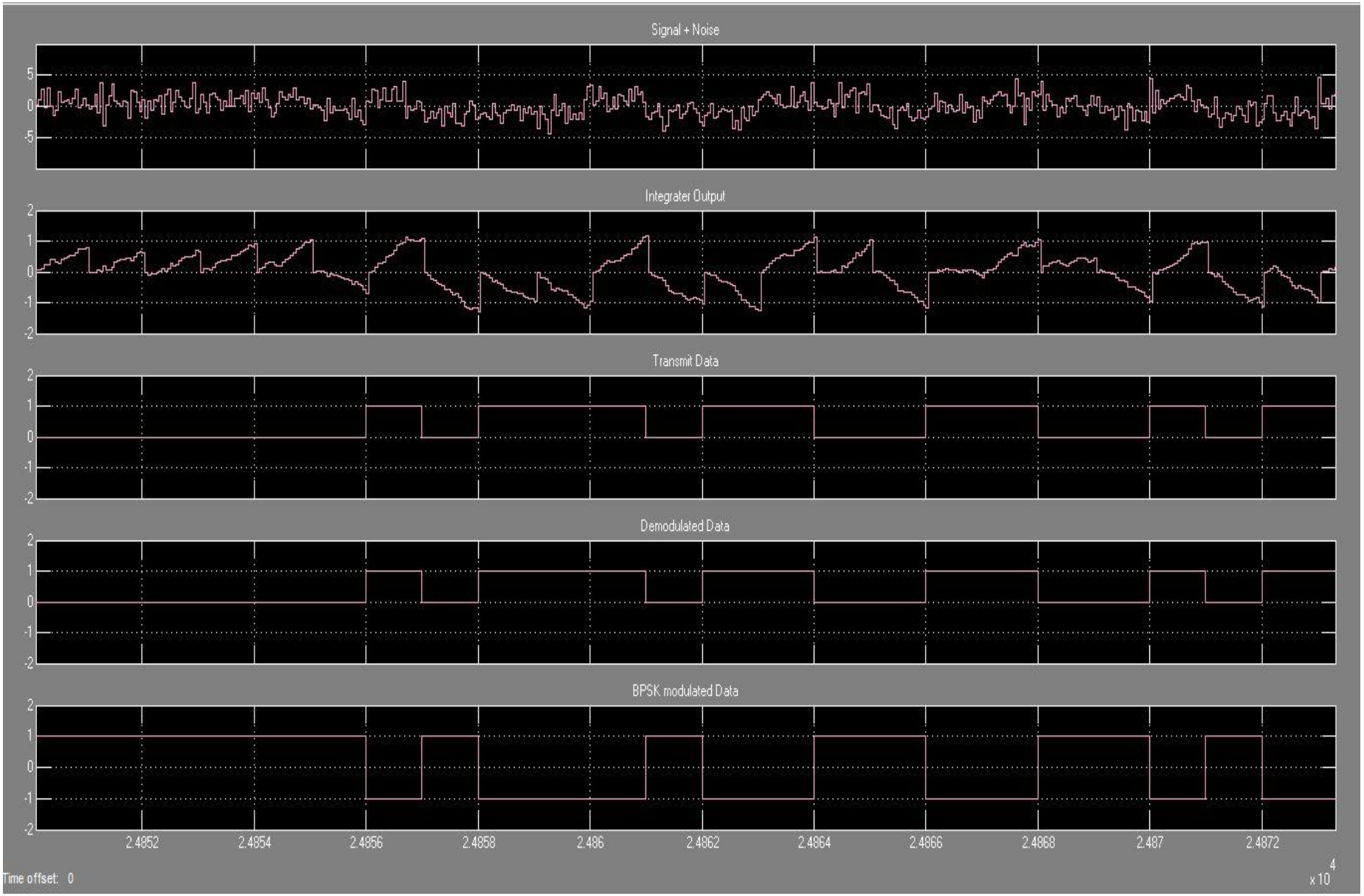


BPSK Baseband Eb/No vs BER Model 3rd using Integrator at receiver side

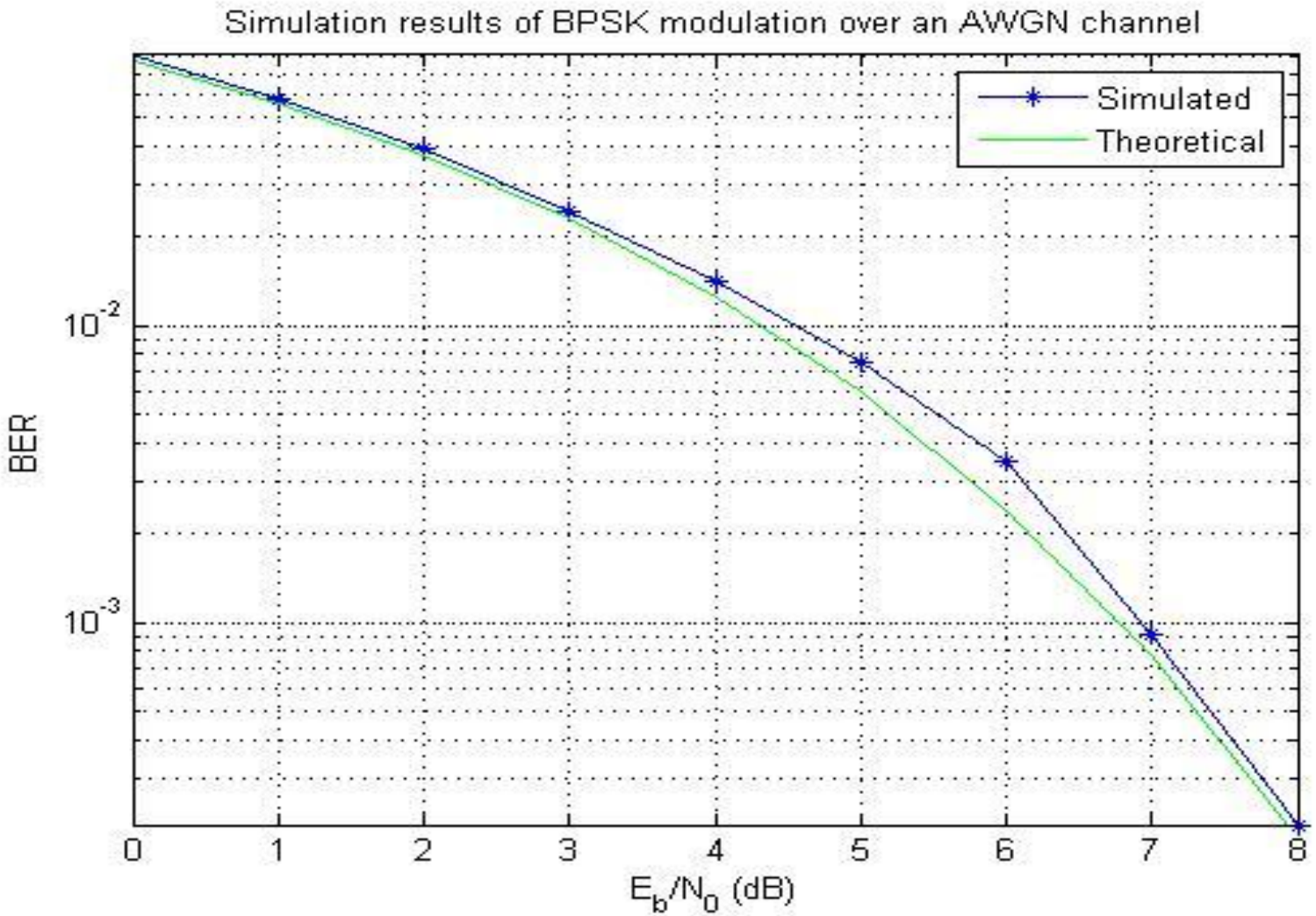


Model Run from Matlab script File and generate the output shown below

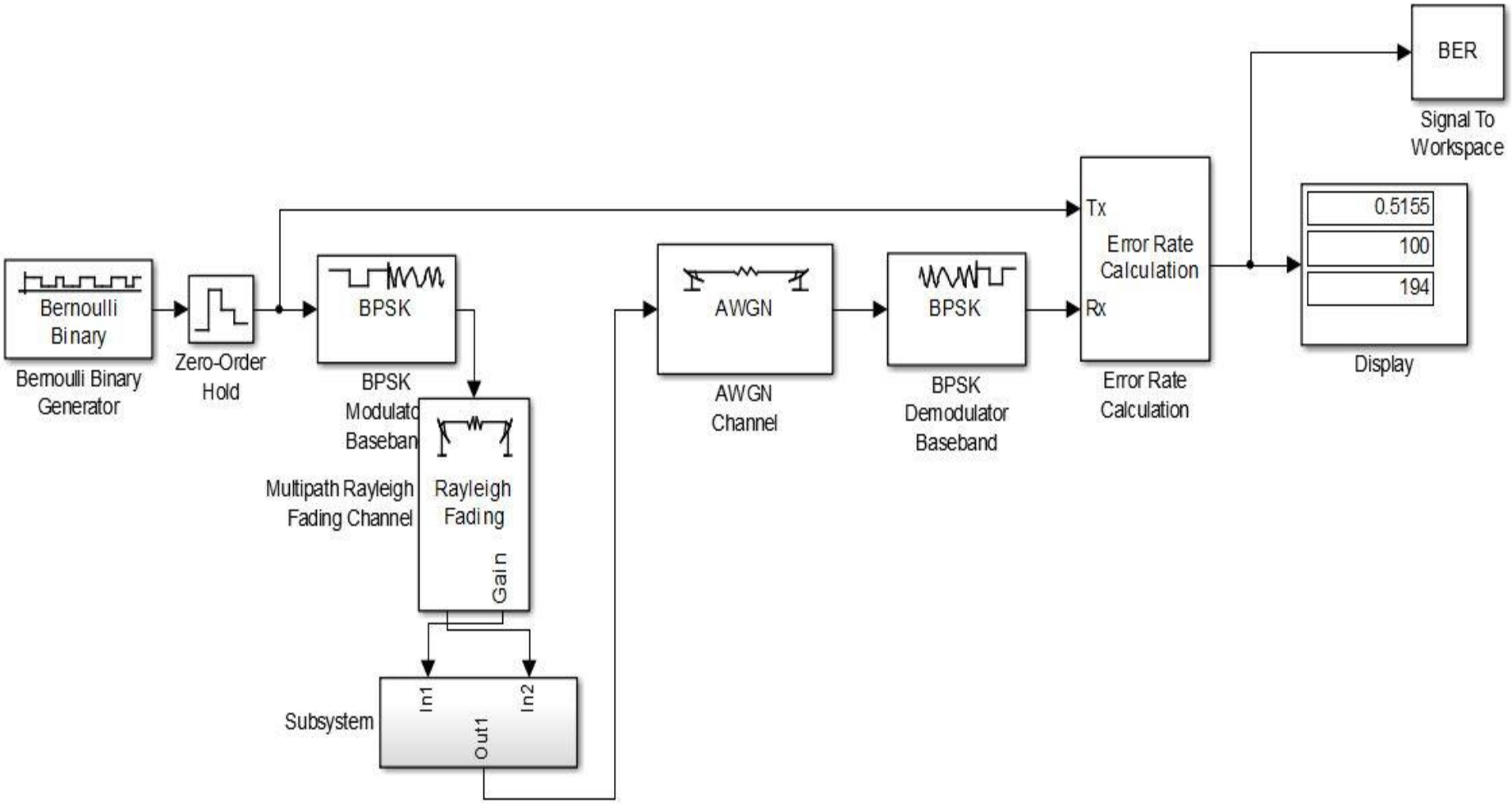
Waveform Output



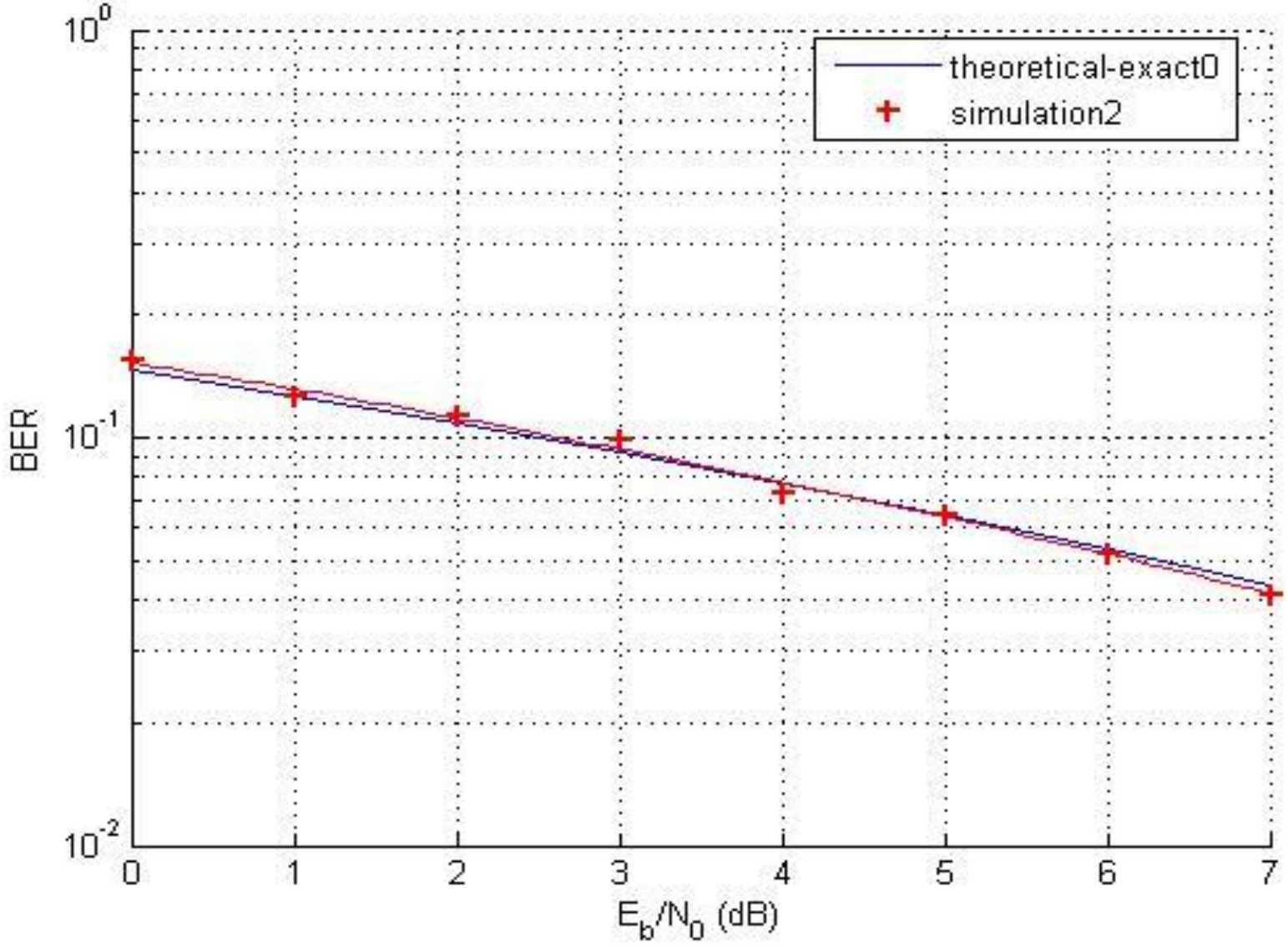
Output


Simulation results of BPSK modulation over an AWGN channel
Simulated
Theoretical
BER
10^{-2}
10^{-3}
0
1
2
3
4
5
6
7
8
E_b/N_0 (dB)

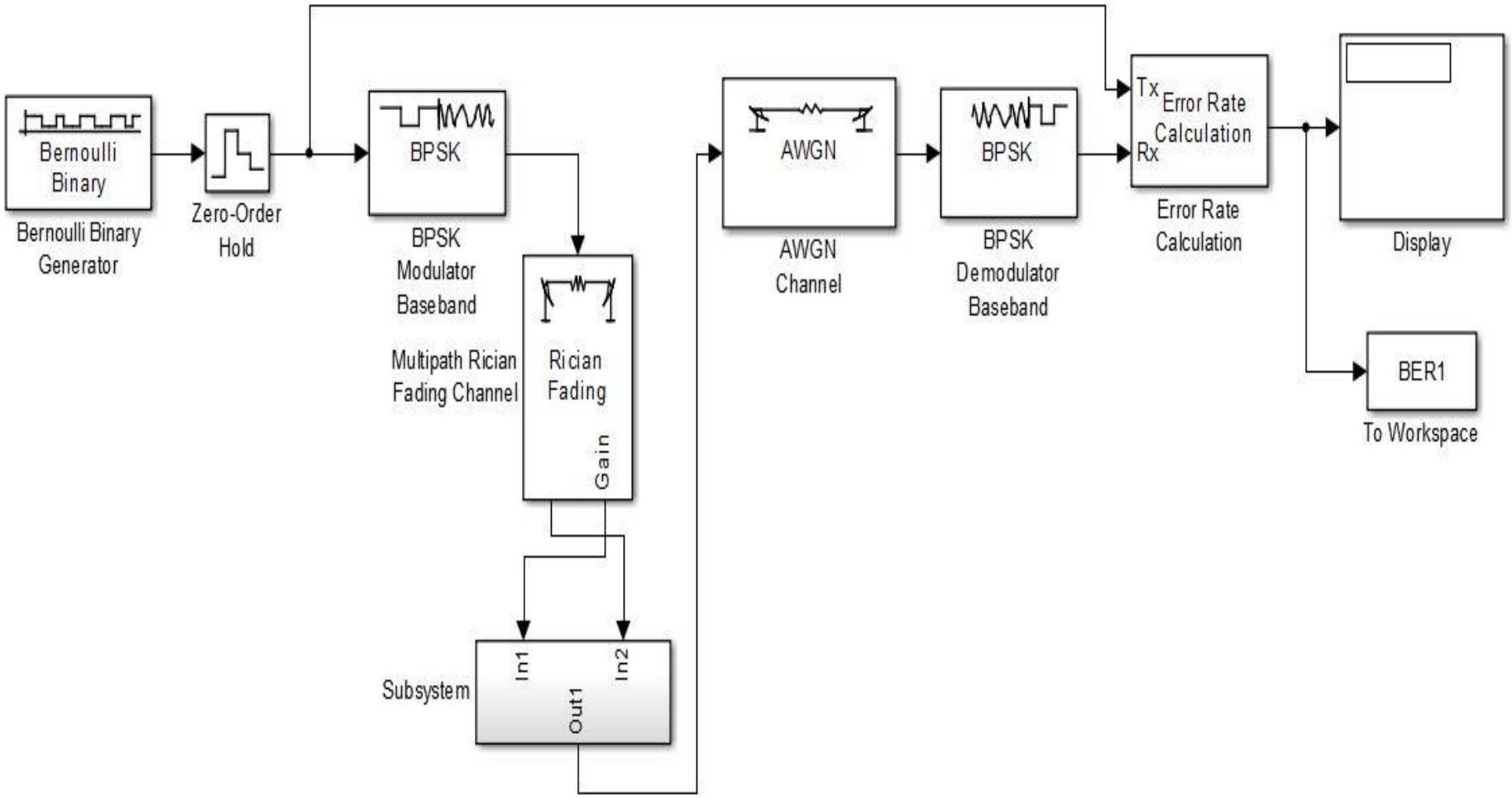
BER curve for BPSK under Rayleigh Channel



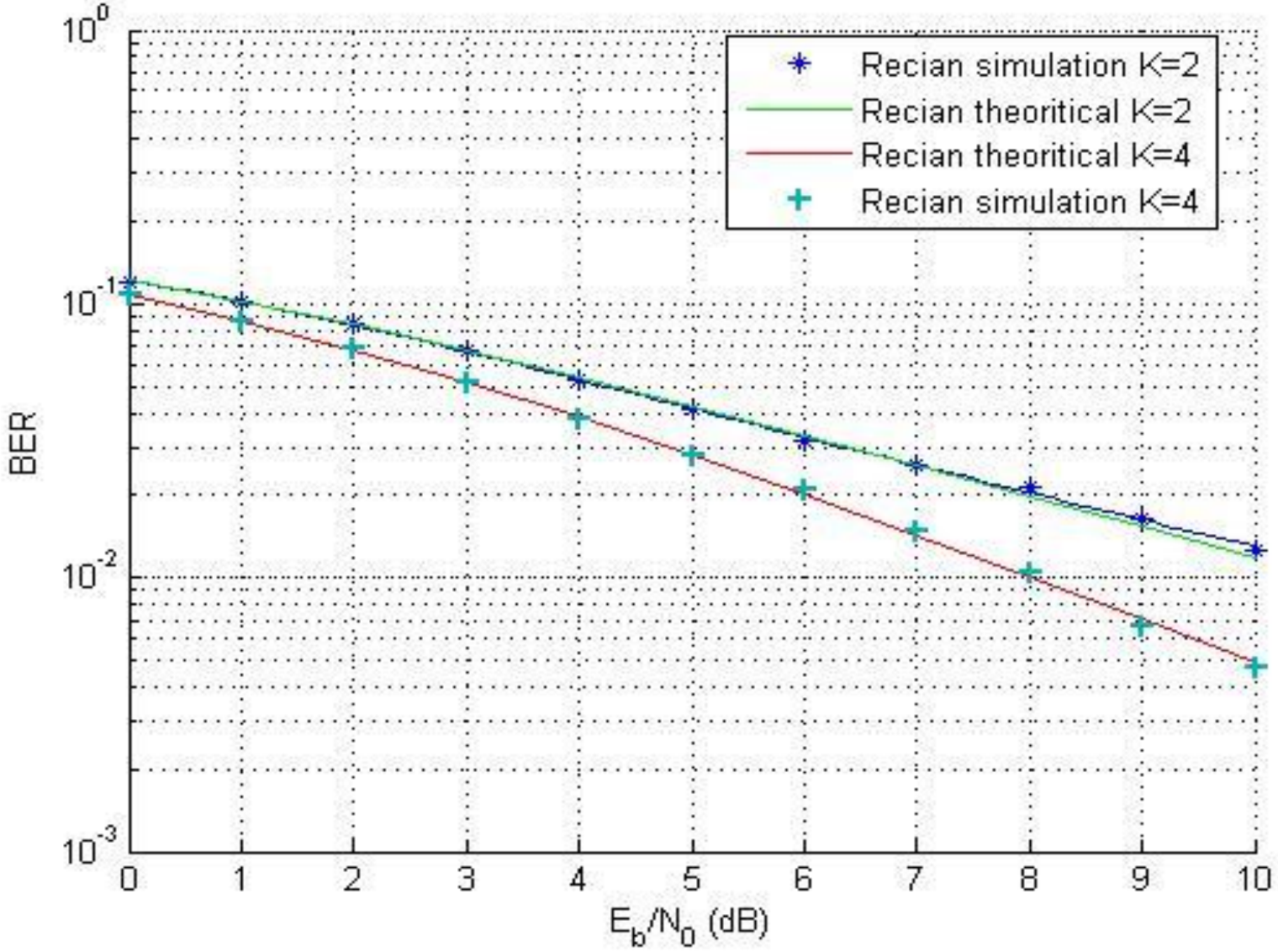
Output


theoretical-exact0
simulation2
BER
10^{0}
10^{-1}
10^{-2}
0
1
2
3
4
5
6
7
E_b/N_0 (dB)

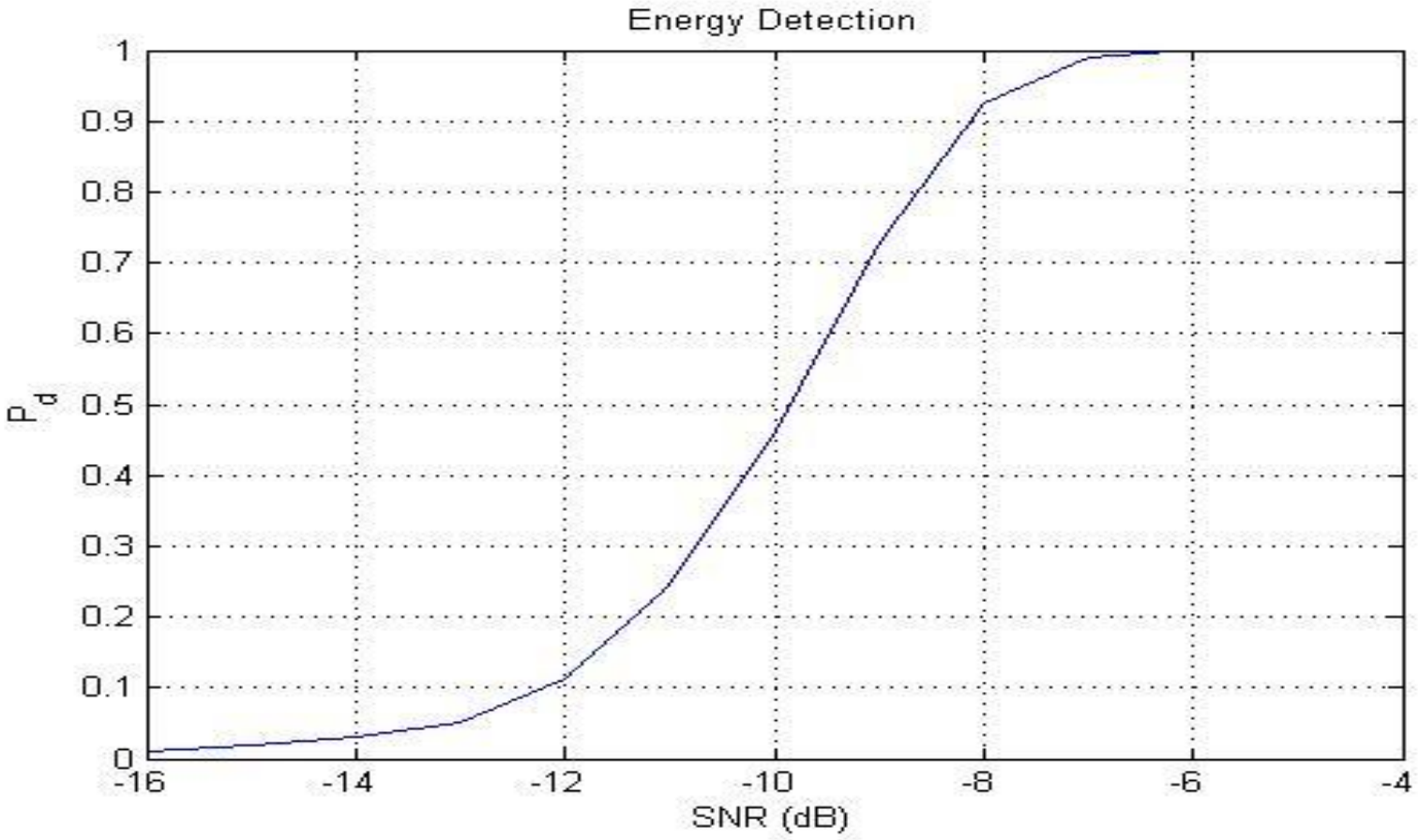
BER curve for BPSK under Recian Channel



Output

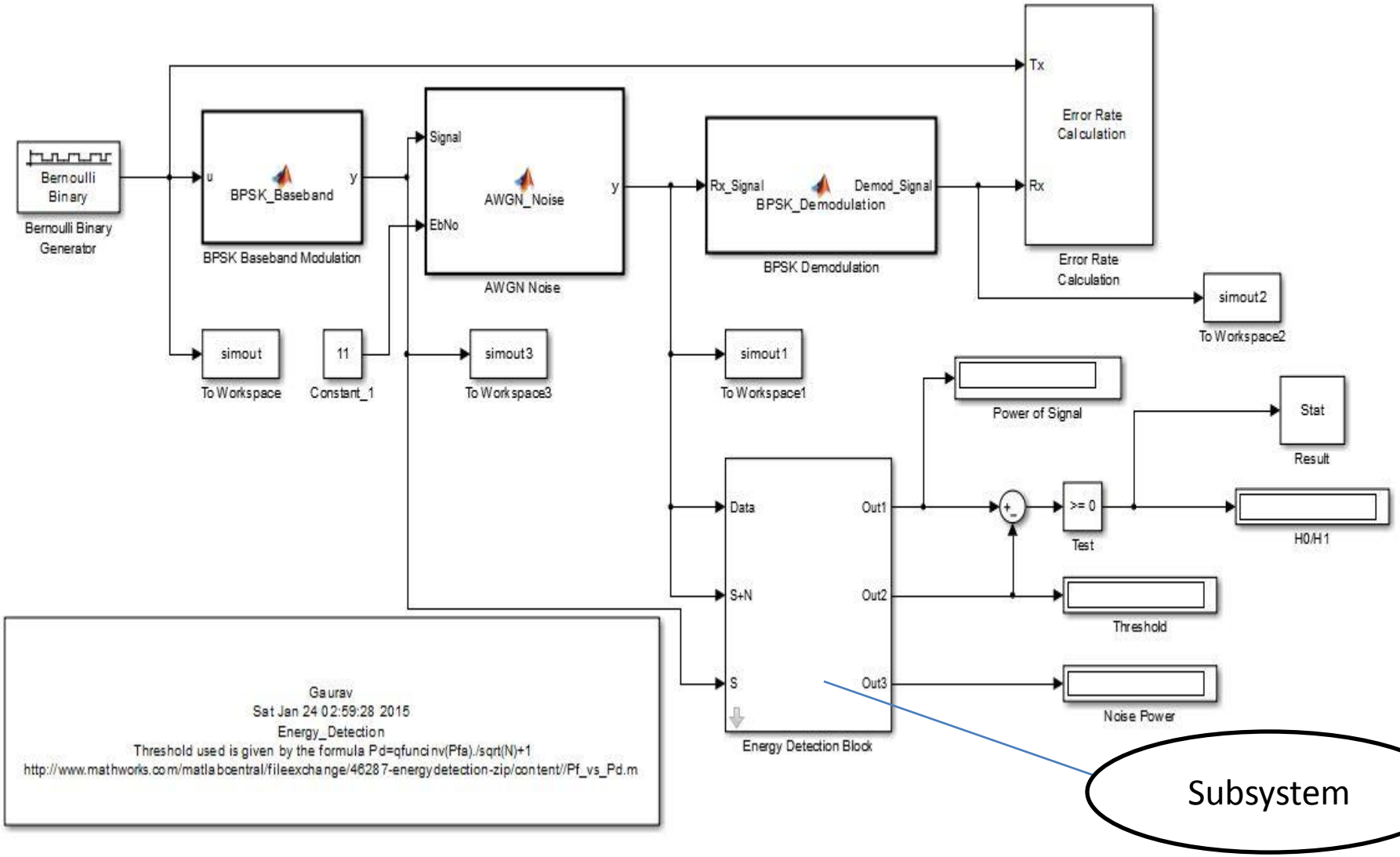

Recian simulation K=2
Recian theoritical K=2
Recian theoritical K=4
Recian simulation K=4
BER
10^{0}
10^{-1}
10^{-2}
10^{-3}
0
1
2
3
4
5
6
7
8
9
10
E_b/N_0 (dB)

Energy Detection (Matlab Script File Taking BPSK Baseband Signal

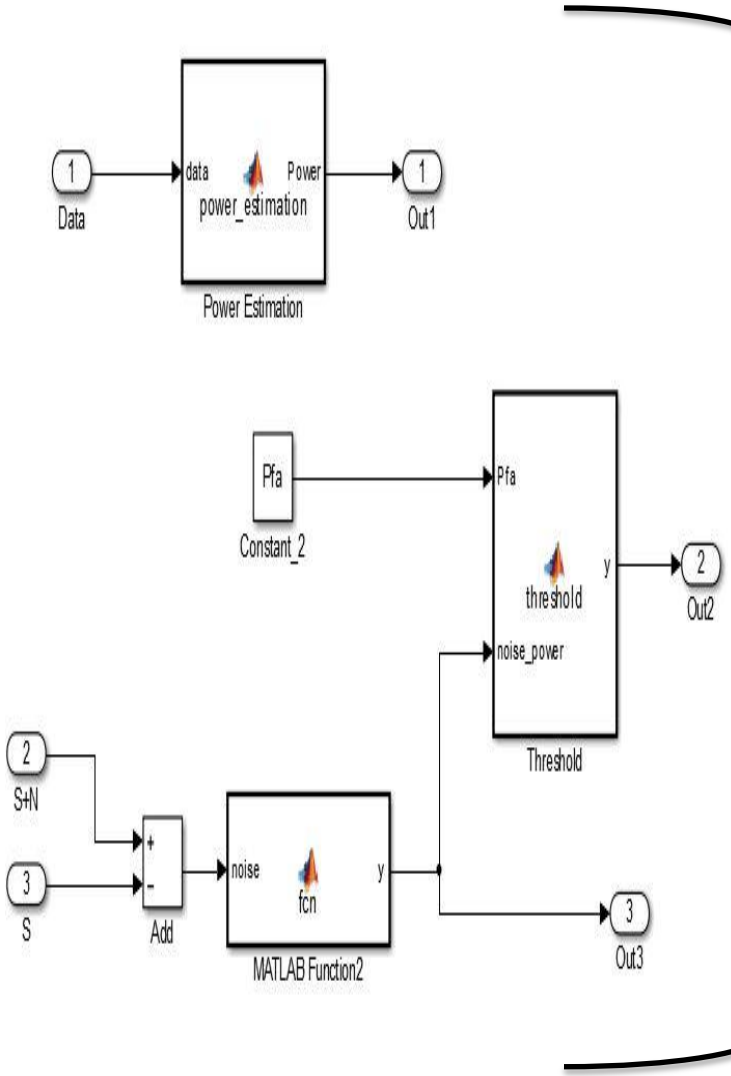


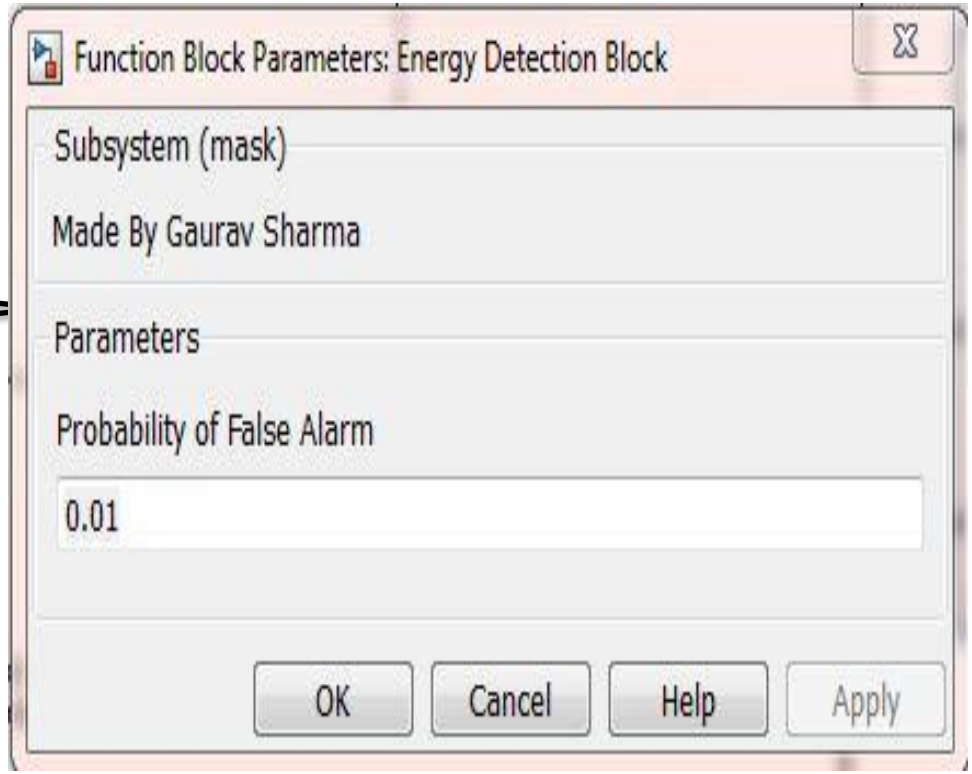
This figure shows simulation for energy detection method of signal detection in cognitive radio and its probability of detection for different SNR values with AWGN channel.

Energy Detection Simulink Model

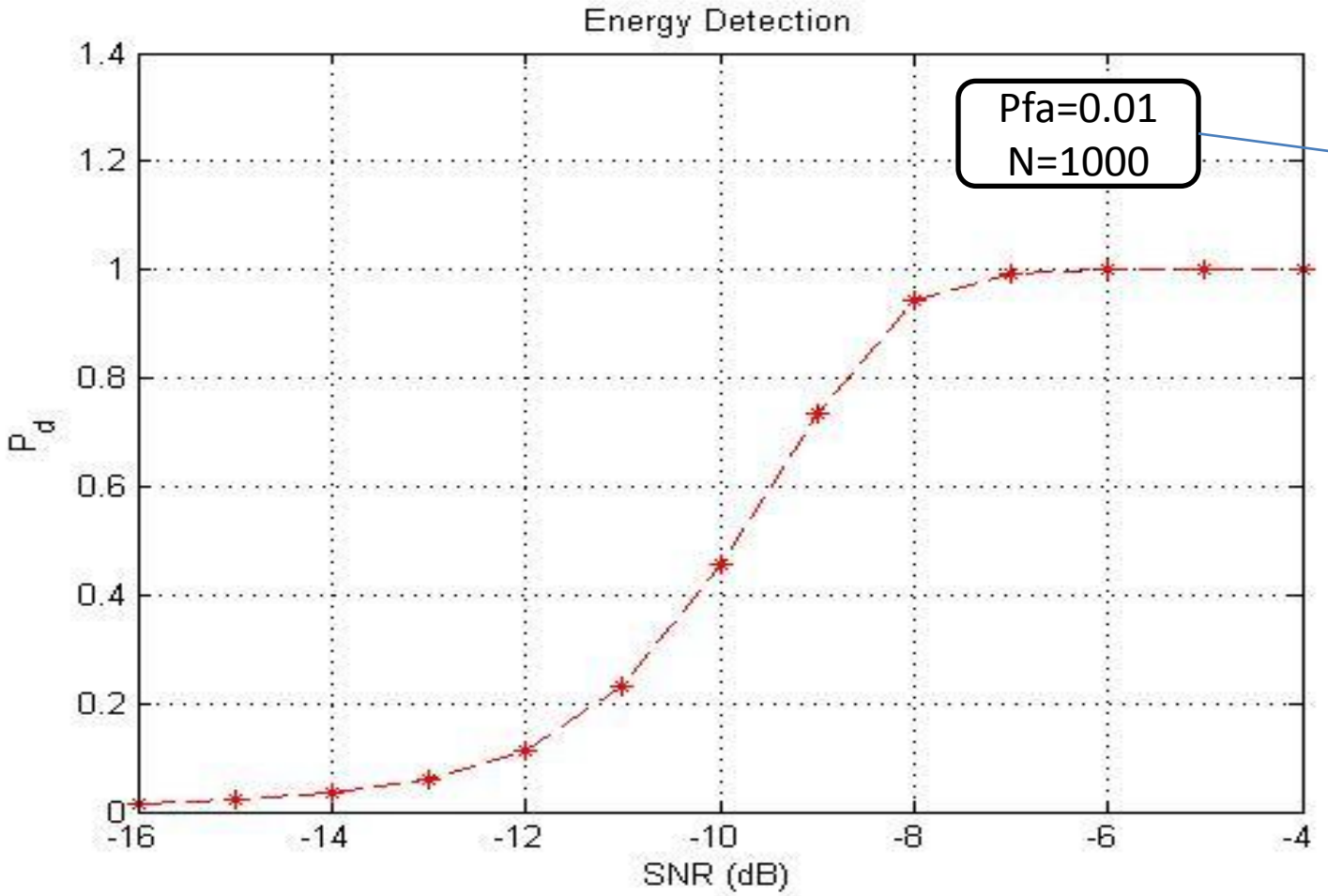


Subsystem


1
Data
data
power_estimation
Power
1
Out1
Power Estimation
Pfa
Constant_2
Pfa
threshold
y
2
Out2
noise_power
Threshold
2
S+N
3
S
Add
noise
fcn
y
MATLAB Function2
3
Out3


Function Block Parameters: Energy Detection Block
Subsystem (mask)
Made By Gaurav Sharma
Parameters
Probability of False Alarm
0.01
OK
Cancel
Help
Apply

Output From Simulink model

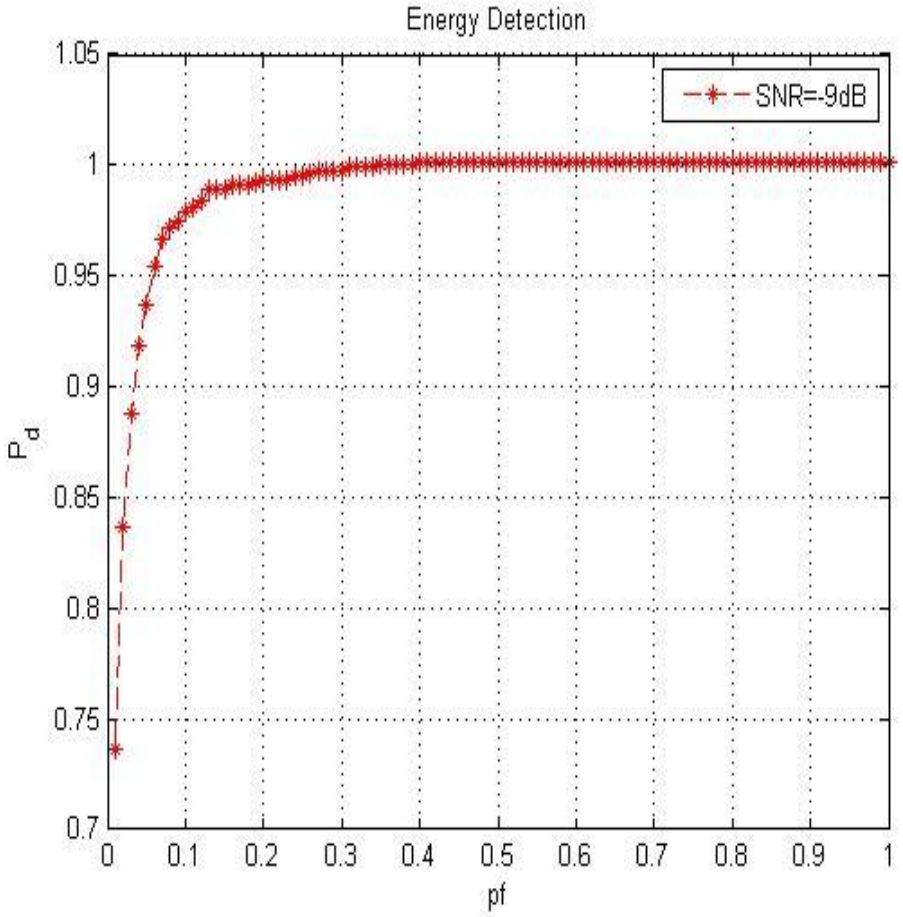


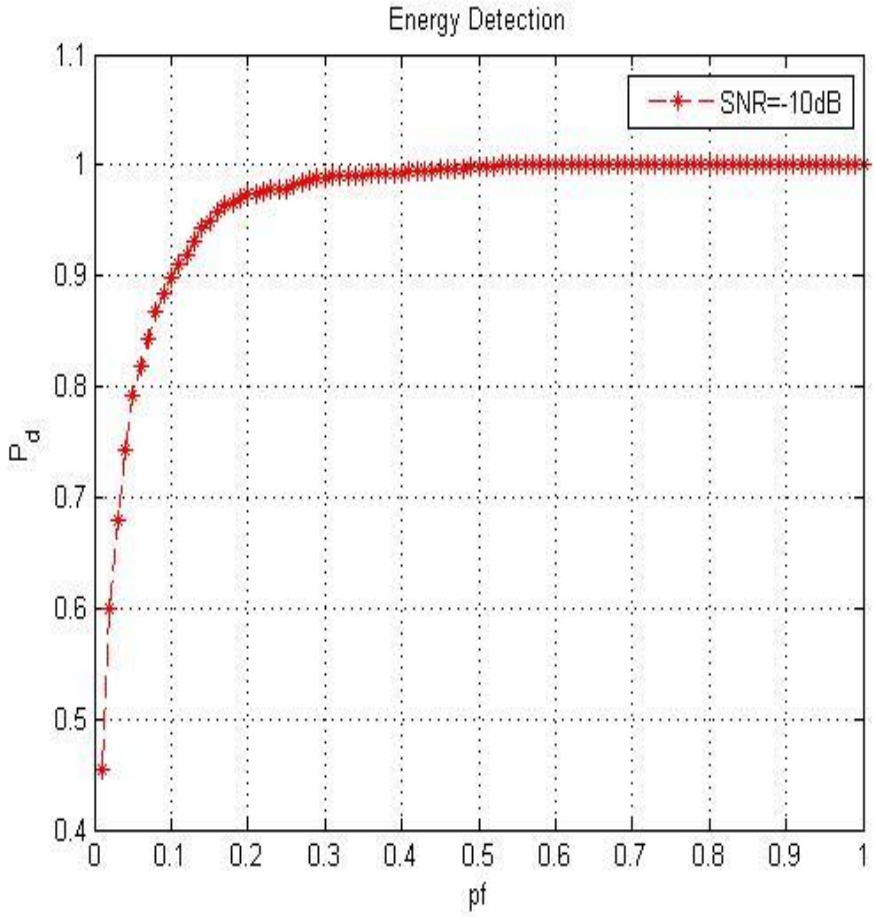
Note:
The parameter Pfa, N, SNR can be changed in simulink model, to obtain Pd vs Pfa or Pd vs SNR curves

Probability of detection for different SNR values with AWGN channel Graph from Simulink Model .The simulation parameter :
Pfa =0.01
No. of sample N=1000

ROC Characteristics from Simulink Model

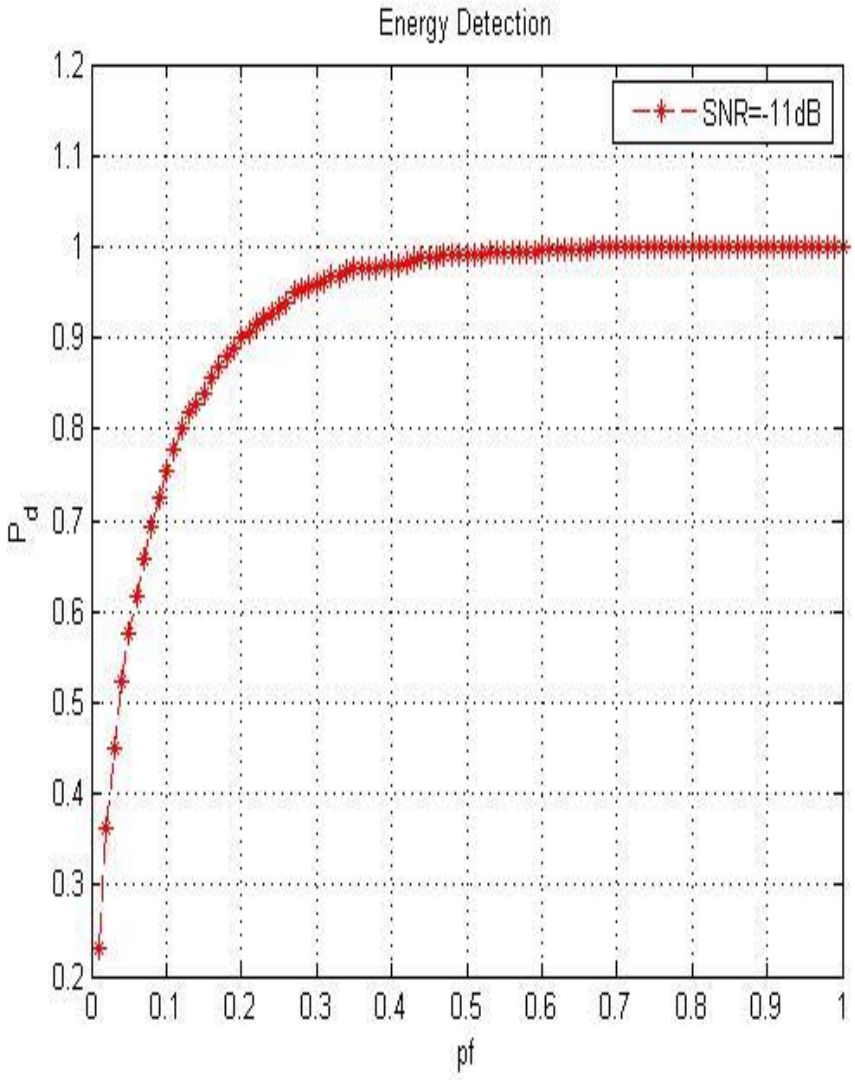
Pfa=0.01
N=1000

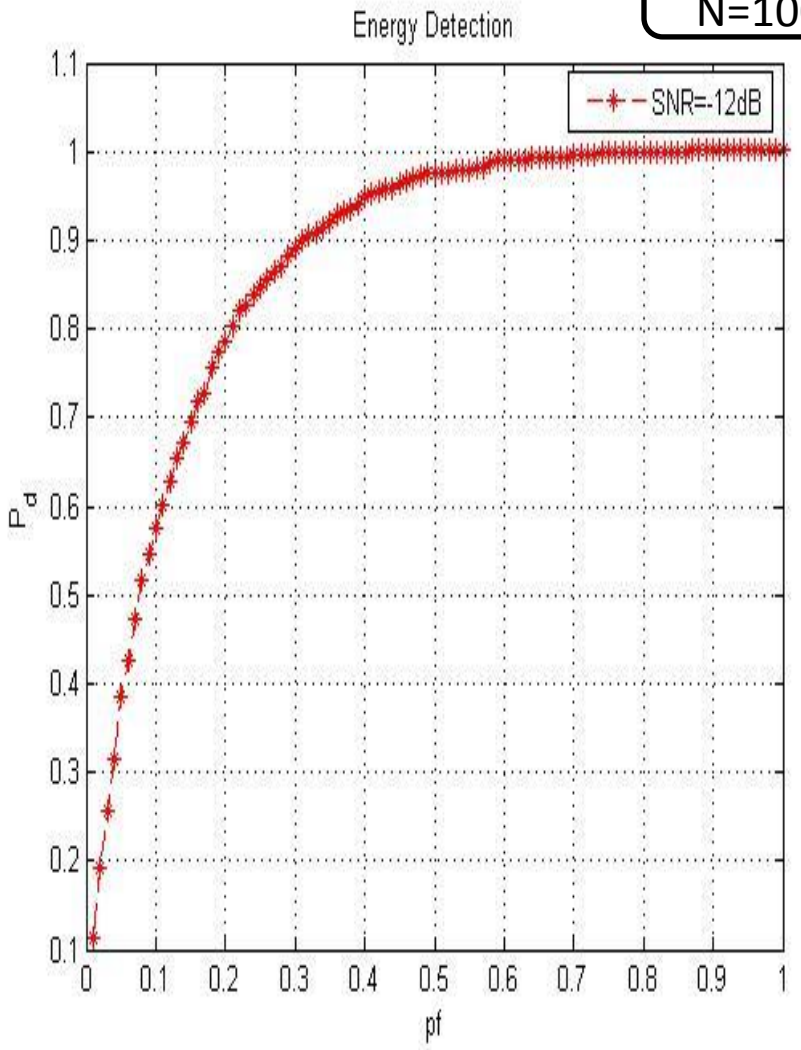




ROC curve Pd vs Pfa for SNR=-9dB (Left) and SNR=-10dB(Right)

Pfa=0.01
N=1000

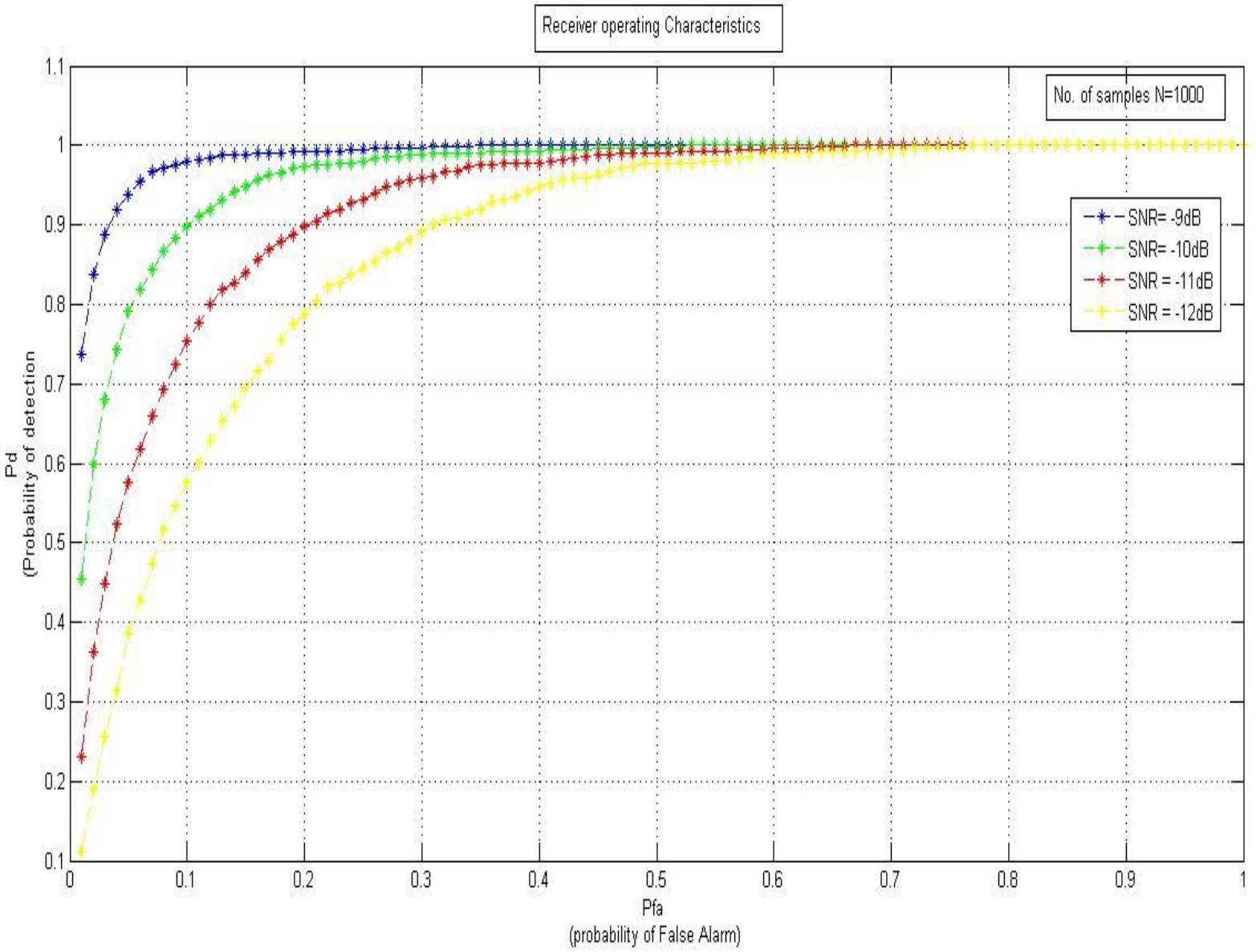




ROC curve for SNR=-11dB(left) and SNR= -12(Right)

Combined Figure

Pfa=0.01
N=1000

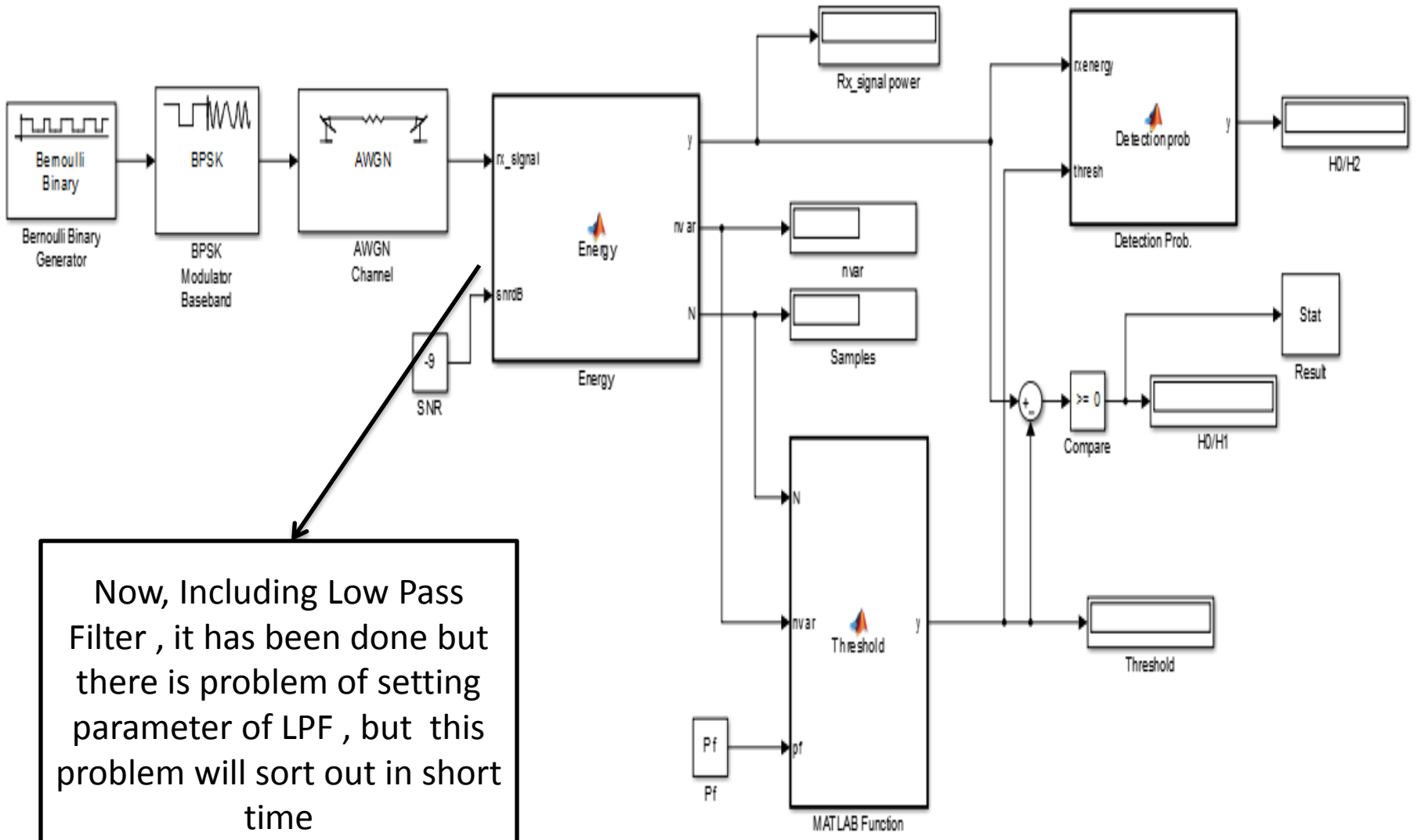


The Above all Curve Can be Obtained By running The Matlab Script File which calls our simulink model.One such code is as follow :-

```
clc;
pf = 0.01:0.01:1;
for i=1:length(pf)
Pf=pf(i);
model='SDR';
simout=sim(model);
[m,n]=size(Stat);
count=0;
for j=1:m
if Stat(j,1)==1
count=count+1;
end
end
pde(i)=count/1000;
end
% Plot result  (SNR Vs Pd)
figure()
plot(pf,pde,'--*r');
xlabel('pf');
ylabel('P_d');
title('Energy Detection');
g
```

Model name ‘SDR’ And Sim(‘model name’) is command to call the Model

Including Low Pass Filter



Now, Including Low Pass Filter , it has been done but there is problem of setting parameter of LPF , but this problem will sort out in short time

Next Tasks:
Simulink model for Fading Case Energy Detection On GNU Radio