AMERICAN INTERNATIONAL UNIVERSITY BANGLADESH

Faculty of Engineering

Laboratory Report Cover Sheet

Students must complete all details except the faculty use part.

Please submit all reports to your subject supervisor or the office of the concerned faculty.

Laboratory Title: **Message passing and receiving using modulator.**

Experiment Number: **08** Submission Date: **29 March 2023** Semester: **Spring**

Subject Code: COE 3201 Subject Name: **Data Communication** Section: k

Course Instructor: **DR. SHUVRA MONDAL** Degree Program: **B.Sc. CSE**

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Group Number: **01** ☐ Individual Submission ☐ Group Submission

No.	Student Name	Student ID	Contribution
1	ALANSAR, SADIAH	21-45612-3	Performance Task (a) & (b)
2	ULLAH, MD ISMAIL JOBI	21-44747-1	Introduction, Performance Task (c)
3	MULLICK, IFTEKHAR UDDIN	21-44649-1	Performance Task (b) & (d)
4	NISHAT, TARIKUL ISLAM	21-44632-1	Discussion, Conclusion, Performance Task (c)
5	AURTHY, MOST. LILUN NAHAR	20-43997-2	Abstract, Performance Task (a)
6	SHEAKH, MOHAMMAD BIN AB. JALIL SHEAKH	20-42132-1	

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Total Marks:________Marks Obtained: _________

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Title:
Message Passing and Receiving Using Modulator.

Abstract:
The purpose of the experiment is to understand the process of message encoding and decoding, as well as the concept of serial transmission and reception of messages. Furthermore, the experiment aims to develop a comprehensive understanding of the data transmission and reception process. This report provides an overview of the concepts underlying message encoding and decoding, serial transmission, and data transmission.

Introduction:
The experiment aims to provide a comprehensive understanding of the message passing process using modulation and demodulation techniques. The experiment involves encoding a text message, transmitting it through a communication channel, receiving the signal at the receiver, and decoding it to recover the original message. In this experiment, Quadrature Amplitude Shift Keying (QASK) modulation technique is used to modulate the binary data sequence onto an analog signal, which is transmitted through a communication channel. The analog signal is received and demodulated at the receiver to recover the binary data sequence, which is then decoded to recover the original text message.

Software:
MATLAB R2021b.

Performance Tasks:
Q (a) Transmit a text message 'Data Comm' as an analog signal using QASK. Show the binary data representing thetext, show the digital signal, and show the analog signal.

Ans:

Decimal to Serial Binary Conversion

In Matlab the following function (asc2bin) can be built to convert from a text string txt to a binary data sequence dn:

```
function dn = asc2bn(txt)
    dec = double(txt); % Text to ASCII (decimal)
    p2 = 2.^(0:-1:-7); % 2^0,2^-1,……………,2^-7
    B = mod(floor(p2'*dec),2); % Decimal to binary conversion
    % Columns of B are bits of chars
    dn = reshape(B,1,numel(B)); % Bytes to serial conversion
end
```

Binary information at Transmitter:

```
clc;
clear all;
close all;
Transmitted_Message= 'Data Comm'
%Converting Information Message to bit%
x = asc2bn(Transmitted_Message); % Binary Information
bp=.000001;
% bit period
disp(' Binary information at Trans mitter :');
disp(x);
```

Output:

```
Transmitted_Message =

Data Comm

 Binary information at Transmitter:
  Columns 1 through 38

    0 0 1 0 0 0 1 0 1 0 0 0 0 1 1 0 0 0 1 0 1 1 1 0 1 0 0 0 0 1 1 0 0 0 0 0 0 1

  Columns 39 through 72

    0 0 1 1 0 0 0 0 1 0 1 1 1 1 0 1 1 0 1 0 1 1 0 1 1 0 1 0 1 1 0 1 1 0
```

Representation of transmitting binary information as digital signal

```
% representation of transmitting binary information as digital signal XXX
bit=[];
for n=1:1:length(x)
    if x(n)==1;
        se=5*ones(1,100);
    else x(n)==0;
        se=zeros(1,100);
    end
    bit=[bit se];
end
t1=bp/100:bp/100:100*length(x)*(bp/100);
subplot(4,1,1);
plot(t1,bit,'lineWidth',2.5);grid on;
axis([ 0 bp*length(x) -.5 6]);
ylabel('amplitude(volt)');
xlabel(' time(sec)');
title('Transmitting information as digital signal (for the text "Data
Comm")');
```

Modulation of serial data stream to waveform

```
% Quadrature-ASK modulation %
A1=1.25; % Amplitude of carrier signal for information 00
A2=2.5; % Amplitude of carrier signal for information 01
A3=3.75; % Amplitude of carrier signal for information 10
A4=5.0; % Amplitude of carrier signal for information 11
br=1/bp;
% bit rate
f=br*10; % carrier frequency
t2=bp/99:bp/99:bp;
ss=length(t2);
m=[];
for (i=1:2:length(x))
    if (x(i)==0 && x(i+1)== 0)
        y=A1*cos(2*pi*f*t2);
    elseif (x(i)==0 && x(i+1) == 1)
        y=A2*cos(2*pi*f*t2);
    elseif (x(i)==1 && x(i+1) == 0)
        y=A3*cos(2*pi*f*t2);
    elseif (x(i)==1 && x(i+1)==1)
        y=A4*cos(2*pi*f*t2);
    end
    m=[m y];
end
t3=bp/99:(bp/99)*2:bp*length(x);
subplot(4,1,2);
plot(t3,m);
axis([ 0 bp*length(x) -6 6]);
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Modulated Signal at Transmitter');
```

Output:

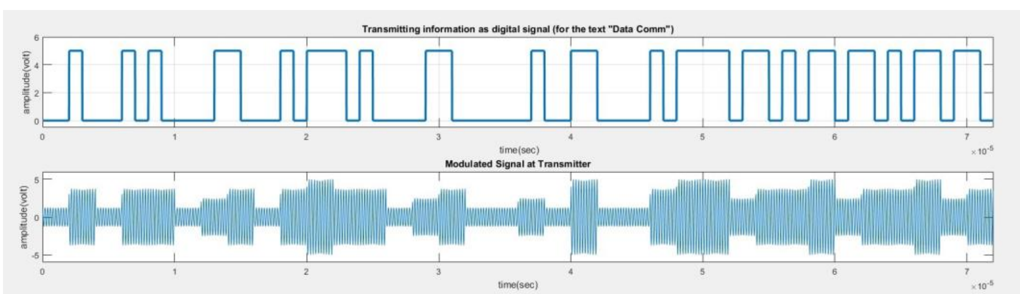

Figure 1.1: Digital signal and QASK modulated analog signal.

<u>**Q (b)**</u> Show the received analog signal assuming the communication channel has an SNR of 30 dB.
<u>**Ans:**</u>

Channel Noise

```
disp('**********')
disp(' Message transmitted through a Transmission medium');
disp('**********')
%Channel Noise%
t4=(bp/99):(bp/99)*2:bp*length(x);
Rec=awgn(m, 30); % Adding noise - set SNR to 30 according to the question
subplot(4,1,3);
plot(t4,Rec);
axis([ 0 bp*length(x) -6 6]);
xlabel('time(sec)');
ylabel('amplitude(volt)');
title('Received signal at Receiver (SNR 30)');
```

Output:

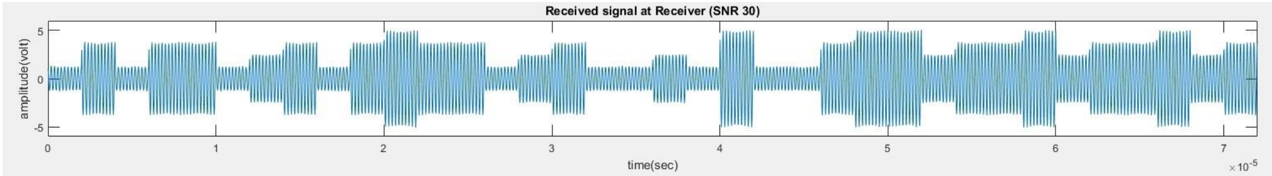

Figure 1.2: Received signal at the receiver (SNR 30)

Q (c) Recover the text 'Data Comm' from the received signal.

Ans:

Demodulation of the received waveform at the output of the waveform channel to obtain the received serial data stream.

```
% Quadrature-ASK demodulation %
mn=[];
for n=ss:ss:length(Rec)
    t=bp/99:bp/99:bp;
    y=cos(2*pi*f*t); % carrier signal
    mm=y.*Rec((n-(ss-1)):n);
    t5=bp/99:bp/99:bp;
    z=trapz(t5,mm);
    % intregation
    zz=round((2*z/bp));
        if(zz>0.625 && zz<1.875)
            % logic level = (A1+A2)/2=7.5
            a=0;
            b=0;
        elseif(zz>1.875 && zz<3.125)
            a=0;
            b=1;
        elseif(zz>3.125 && zz<4.375)
            a=1;
            b=0;
        elseif(zz>4.375 && zz<5.625)
            a=1;
            b=1;
        end
    mn=[mn a b];
end
disp(' Binary information at Receiver :');
disp(mn);

% Representation of binary information as digital signal which achieved after
ASK demodulation %
bit=[];
for n=1:length(mn)
    if mn(n)==1
        se=5*ones(1,100);
    else
        mn(n) == 0;
        se=zeros(1,100);
    end
    bit=[bit se];
end
t5=bp/100:bp/100:100*length(mn)*(bp/100);
subplot(4,1,4)
plot(t5,bit,'LineWidth',2.5);
grid on;
axis([ 0 bp*length(mn) -.5 6]);
ylabel('amplitude(volt)');
xlabel(' time(sec)');
title('Demodulated signal at receiver');
```

Output:

```
Binary information at Receiver :
  Columns 1 through 38

    0 0 1 0 0 0 1 0 1 0 0 0 0 1 1 0 0 0 1 0 1 1 1 0 1 0 0 0 0 1 1 0 0 0 0 0 0 1

  Columns 39 through 72

    0 0 1 1 0 0 0 0 1 0 1 1 1 1 0 1 1 0 1 0 1 1 0 1 1 0 1 0 1 1 0 1 1 0
```

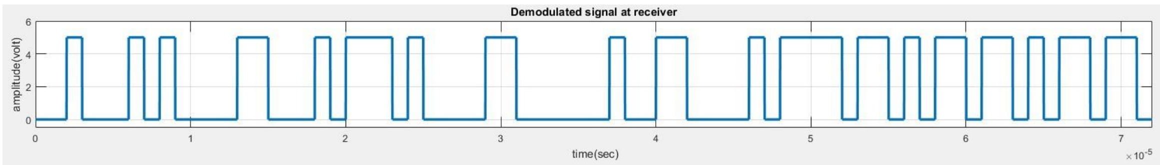

Fig 1.3: Demodulated signal at the receiver

Conversion from Serial Binary to Text

A complete function, called bin2asc that converts a binary data string A back to a text string txt is shown below

```
function txt = bin2asc(dn)
    L=length(dn); %Length of input string
    L8=8*floor(L/8); %Multiple of 8 Length
    B=reshape(dn(1:L8),8,L8/8); %Cols of B are bits of chars
    p2=2.^(0:7); %power of 2
    dec=p2*B; %Binary to decimal conversion
    txt=char(dec); %ASCII (decimal) to txt
end
```

Thus, using bin2asc with asc2bin(txt) as input should return the text in txt as demonstrated below:

```
%Converting Information bit to Message%
Received_Message = bin2asc(mn)
```

Output:

```
Received_Message =

Data Comm
```

Discussion& Conclusion:

The results of the experiment demonstrate the importance of message encoding and decoding techniques in data communication. The conversion of the text message 'Data Comm' to a binary data sequence using the asc2bin function allows for easy and efficient transmission of the message through the communication channel. The digital and analog signals generated from the binary data sequence illustrate the process of message modulation and transmission.

The received signal at the receiver is affected by channel noise, which can lead to errors in the demodulation and decoding process. The results show that a Signal-to-Noise Ratio (SNR) of 30 dB is sufficient for the successful transmission and recovery of the text message. The demodulated signal at the receiver demonstrates the importance of the demodulation process in recovering the original binary data sequence from the received analog signal.

References:

- Prakash C. Gupta, “Data communications”, Prentice Hall India Pvt.
- William Stallings, "Data and Computer Communications”, Pearson
- Forouzan, B. A. "Data Communication and Networking. Tata McGraw." (2005).
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