German Jordanian University

Department of Communication Engineering

Digital Communication Systems Lab

CME 313-Lab

Experiment 6

Modeling Digital Communication System

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Experiment 5

Amplitude-shift keying (ASK)

Objectives:

By the end of this experiment, the student should be able to:

1. Generate and demodulate an amplitude shift keyed (ASK) signal

Introduction

Amplitude-shift keying (ASK) is a form of amplitude modulation that represents digital data as variations in the amplitude of a carrier wave. In an ASK system, the binary symbol 1 is represented by transmitting a fixed-amplitude carrier wave and fixed frequency for a bit duration of T seconds. If the signal value is 1 then the carrier signal will be transmitted; otherwise, a signal value of 0 will be transmitted.

Figure 1 illustrates a binary ASK signal (lower), together with the binary sequence which initiated it (upper).

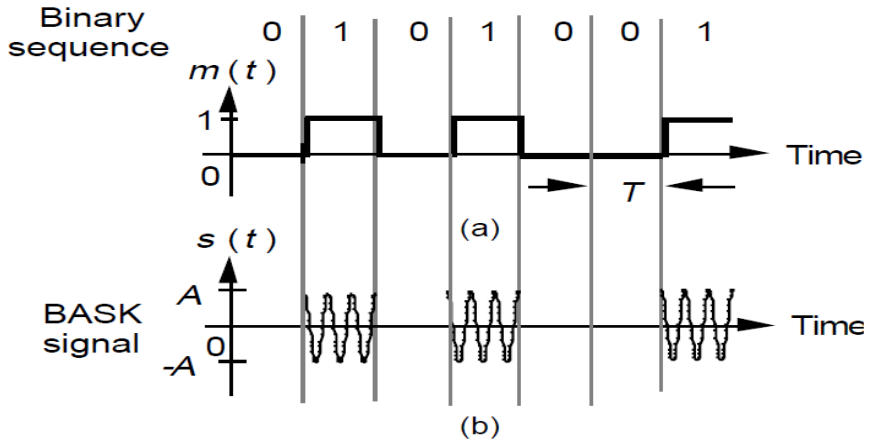

Figure.1 Binary modulating signal and (b) BASK signal.

ASK Generation

A block diagram of a basic ASK modulator is shown in Fig.2. The multiplier can be modeled by analog multiplier or by analog switch

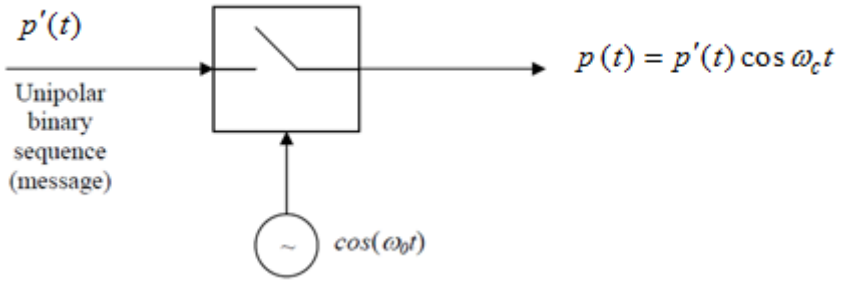

Figure.2 Amplitude Shift Keying Modulator

Demodulation methods

It is apparent from Figures 1 that the ASK signal has a well defined envelope. Thus it is amenable to demodulation by an envelope detector.

A synchronous demodulator would also be appropriate.

Note that:

- Envelope detection circuitry is simple.
- Synchronous demodulation requires a phase-Iocked local carrier and therefore carrier acquisition circuitry .

With band limiting of the transmitted ASK neither of these demodulation methods would recover the original binary sequence; instead, their outputs would be a band limited version. Thus further processing - by some sort of decision-making circuitry for example - would be necessary.

Thus demodulation is a two-stage process:

- Recovery of the bandlimited bit stream
- Regeneration of the binary bit stream

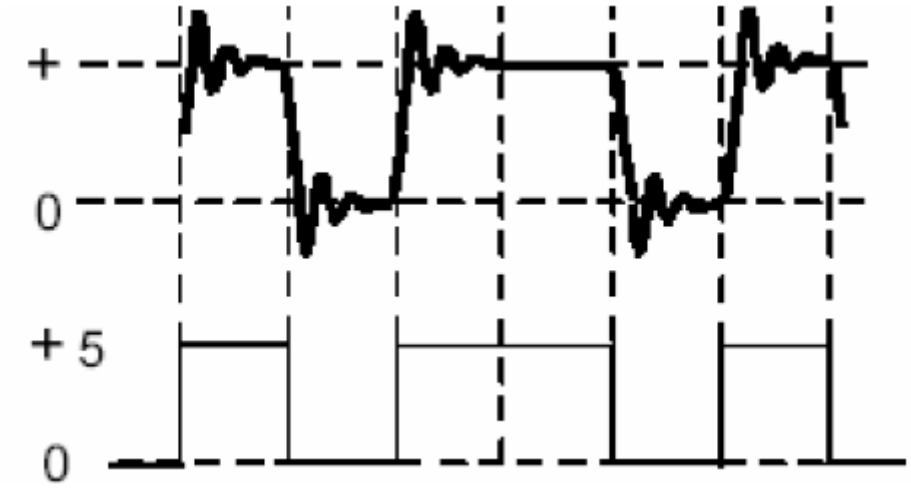

Figure.3 The two stages of the demodulation process

Envelope Detection

It is apparent from Fig. 5.1 that the ASK signal has a well defined envelope. Thus, it is amenable to demodulation by an envelope detector. Envelope detection is used if Signal to Noise Ratio (SNR) is high. The envelope detector is a rectifier and low pass filter circuit. The circuit rejects the carrier frequency components and produces a dc output that corresponds to the original binary data.

The output from the detector will be a distorted binary signal. A threshold device, such as comparator or decision maker, can be used to 'clean up' the recovered envelope detector output waveform. Figure.4 shows the block diagram for such system.

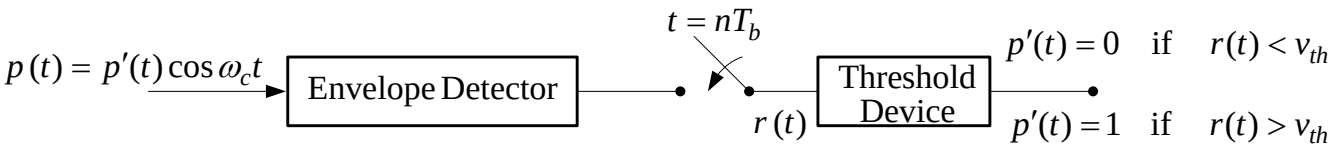

Figure.4 Amplitude Shift Keying Envelope Detection

Procedure:

***Part l:* Generation of ASK Signal Using Analog Switch**

1- Construct the TIMS model of the ASK modulator as shown in below **Figure 5.**
2- Before plugging the SEQUENCE GENERATOR module in locate the on-board switch SW2 and set both toggles UP.
3- Connect the circuit shown in Fig. 5.6. Set the frequency of the AUDIO OSCILLATOR close to 8.333 kHz.

- **What does the signal at CONTROL 2 of the DUAL ANALOG SWITCH represent? What does that at IN2 represent?**
- **Save the signals at CONTROL 2 of the DUAL ANALOG SWITCH and that at its output**
- **What does the signal at the output of the DUAL ANALOG SWITCH represent?**
- **Measure the bit period (T_b) and calculate the bit rate (R_b).**

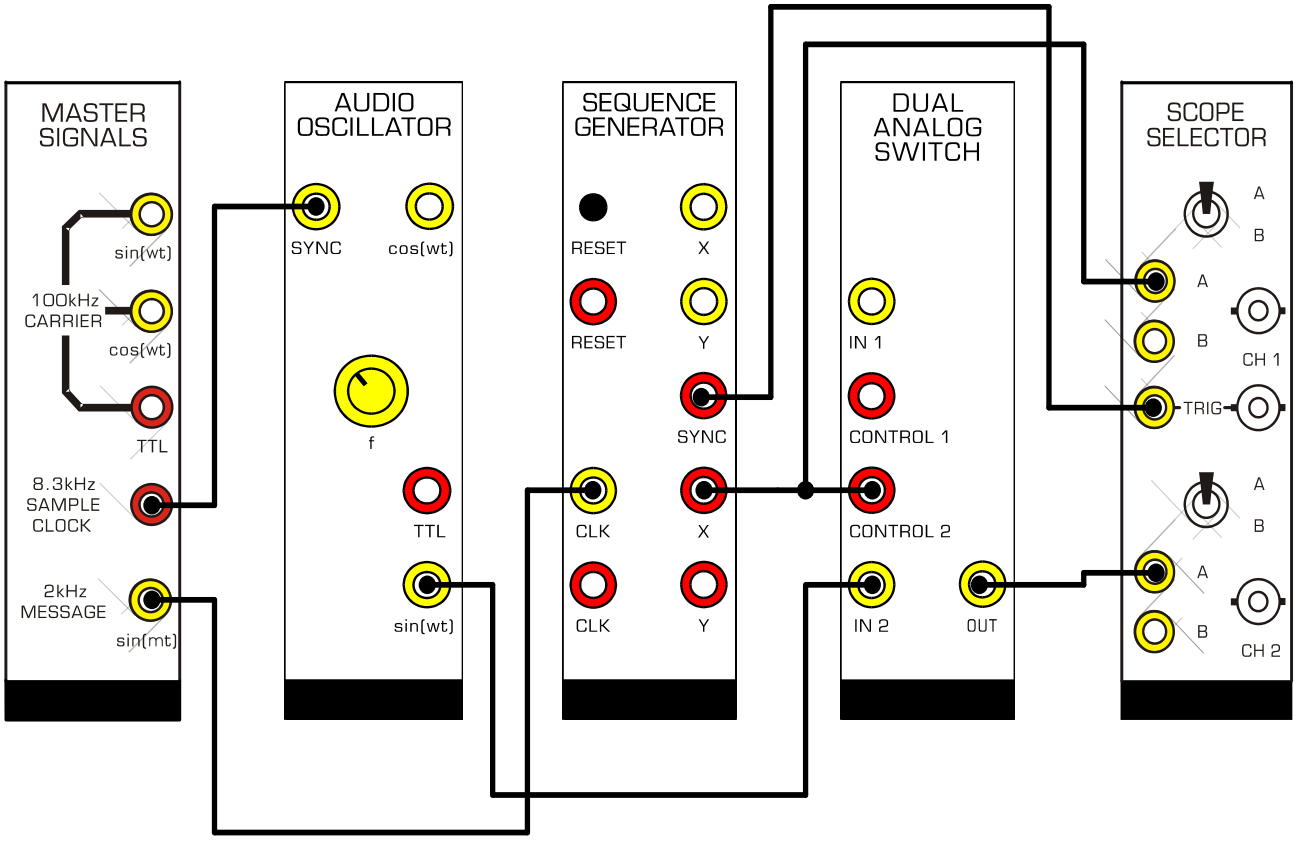

Figure.5 The TIMS model of ASK modulator.

Part II: Envelope Detection of ASK Signal

1- Construct the TIMS model of the ASK demodulator as shown in below **Figure 6.**

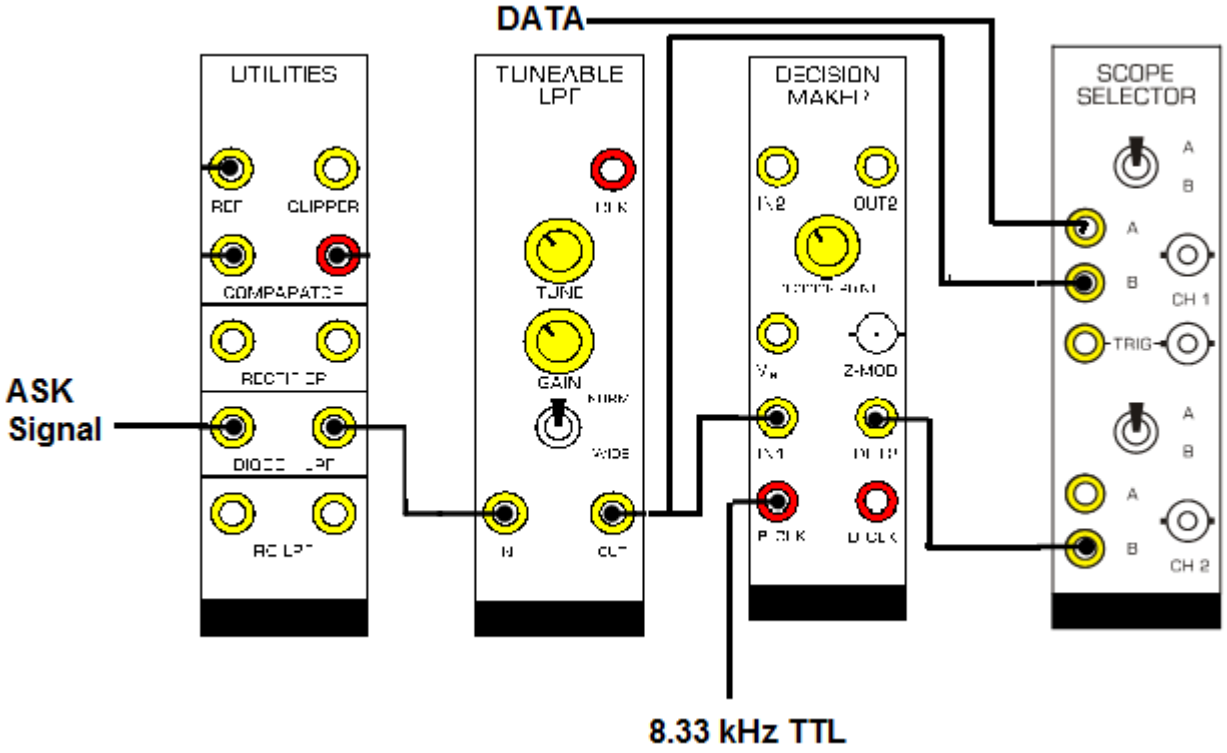

Figure.6 The TIMS model of ASK demodulator.

2. Before plugging in the DECISION MAKER:

   a) Switch the on-board switch SW2 to 'INT'.

   b) Select the NRZ-L line code with the on-board rotary switch SW1.

3. Adjust TUNE and GAIN controls of the TUNEABLE LPF such that the signal at CH1-B is the best approximation for the DATA at CH1-A.

- **Save signals at the input and output of the LPF.**
- **Save signals at the input and output of the DECISION MAKER**
- **Write complete comments about the above two signals**
- **Compare between the original data and Recovered data is there any difference?**