Experiment No.: 2

Title: Experimental study of ASK modulation and demodulation.

Roll No.: _________ Batch: __________
Date of Performance: _________________
Date of Assessment: ___________________

Particulars	Marks
Attendance (05)	
Journal (05)	
Performance (05)	
Understanding (05)	
Total (20)	
Signature of Staff Member	

Experiment No: 2

Title: Experimental study of ASK modulation and demodulation.

Aim: To study and implement Amplitude Shift Keying (ASK) modulation and demodulation technique.

Prerequisites:

- Basic knowledge of digital communication (modulation & demodulation concepts).
- Understanding of Amplitude Shift Keying (ASK) principle.
- Familiarity with carrier and message signals (frequency, amplitude, and waveform).
- Knowledge of basic electronics (resistors, diodes, transistors, capacitors).
- Ability to use lab instruments like function generator, CRO/DSO, and power supply.
- Understanding of the ASK trainer kit.
- Skill to observe and interpret waveforms (modulated and demodulated signals).

Objectives:

1. To understand the working principle of ASK modulation and demodulation.
2. To analyze how digital data can be transmitted using amplitude variations of a carrier signal.
3. To observe the effect of binary input data on the amplitude of the modulated waveform.
4. To verify the retrieval of original data through demodulation.

Theory:

Amplitude Shift Keying (ASK) is a digital modulation technique in which the amplitude of a sinusoidal carrier signal is varied according to the binary data signal. The **frequency and phase remain constant**, while only the amplitude changes.

In ASK:

- A carrier of **amplitude A** is transmitted for binary **'1'**.
- **Zero or no carrier** is transmitted for binary **'0'**.

The ASK modulated signal can be expressed as:

$$x_c(t) = \begin{cases} 0, & \text{symbol "0"} \\ A\cos(\omega_c t), & \text{symbol "1"} \end{cases}$$

ASK modulation results in bursts of sinusoidal signals. Figure 1 (below) illustrates the **binary input message signal (top)** and the corresponding **ASK signal (bottom)**.

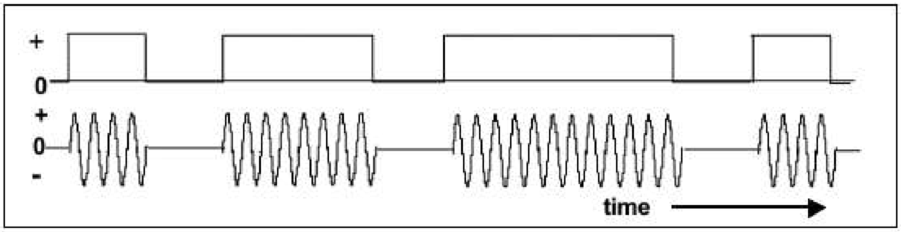


Figure 1: an ASK signal (below) and the message (above)

The transition points between '0' and '1' in ASK cause sharp discontinuities, resulting in a signal with high bandwidth. In practical systems, **band-limiting** is often introduced to avoid spectral spreading. This is done either by smoothing the binary signal before modulation or applying filters to the output signal.

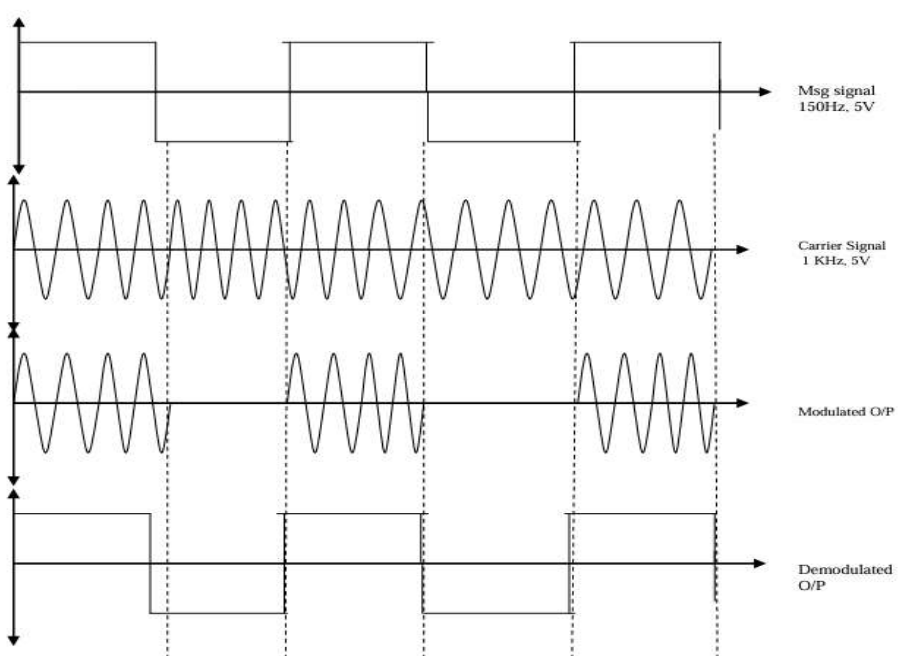
ASK demodulation is typically performed using an **envelope detector** followed by a **comparator** to reconstruct the original binary stream.

Procedure:

1. **Power ON** the trainer kit and verify that all LEDs are working.
2. **Check NRZ and $\overline{\boldsymbol{NRZ}}$ Outputs:**
   a. Use the DSO to observe the NRZ and its complement ($\overline{\boldsymbol{NRZ}}$) from the Digital Data Generator block.
3. **Check Carrier Signal:**
   a. Probe the sine wave output from the Carrier Generator block using the DSO.
4. **Connect NRZ to Modulator:**
   a. Connect **NRZ** and $\overline{\boldsymbol{NRZ}}$ to the inputs of **Balanced Modulator 1**.
5. **Feed Carrier Signal:**
   a. Connect the sine wave from the Carrier Generator to the carrier input of Balanced Modulator 1.
6. **Observe ASK Output:**
   a. Connect DSO Channel 1 to the output of Balanced Modulator 1.
   b. Connect the ground probe to the kit's GND terminal.

c. Observe the ASK waveform.

Waveforms:



Conclusion: