Digital Modulation (ASK)

Analog Modulation

$V_m(t) = 0$ or 1

$V_c(t) = V_c \cos \omega_c t$

$V_m(t) = V_m \cos \omega_m t$

$V_c(t) = V_c \cos \omega_c t$

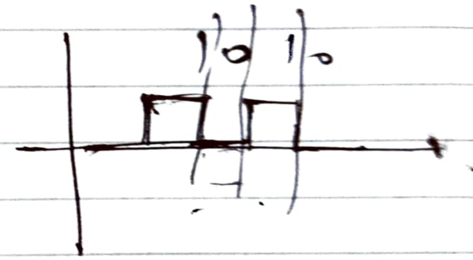
$V_c \cos(\omega_c t + \Phi)$

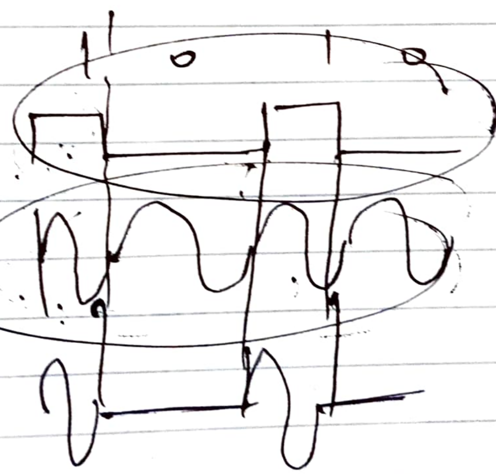
Digital

Analog mod → AM FM PM

Digital mod. ASK FSK PSK

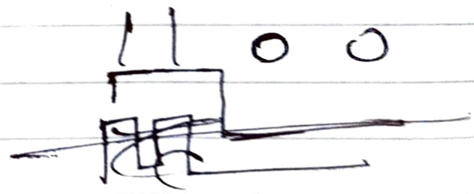
V ⟨ ARL / RL

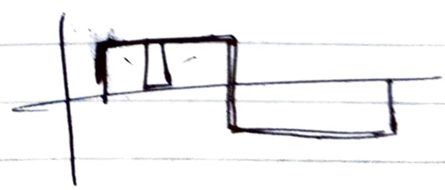


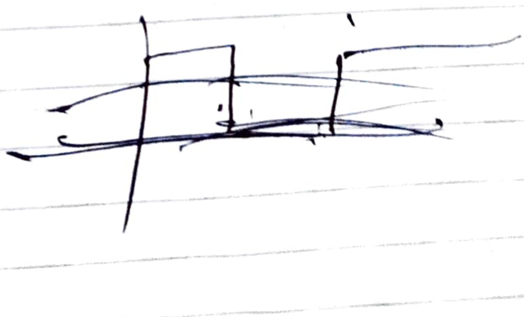


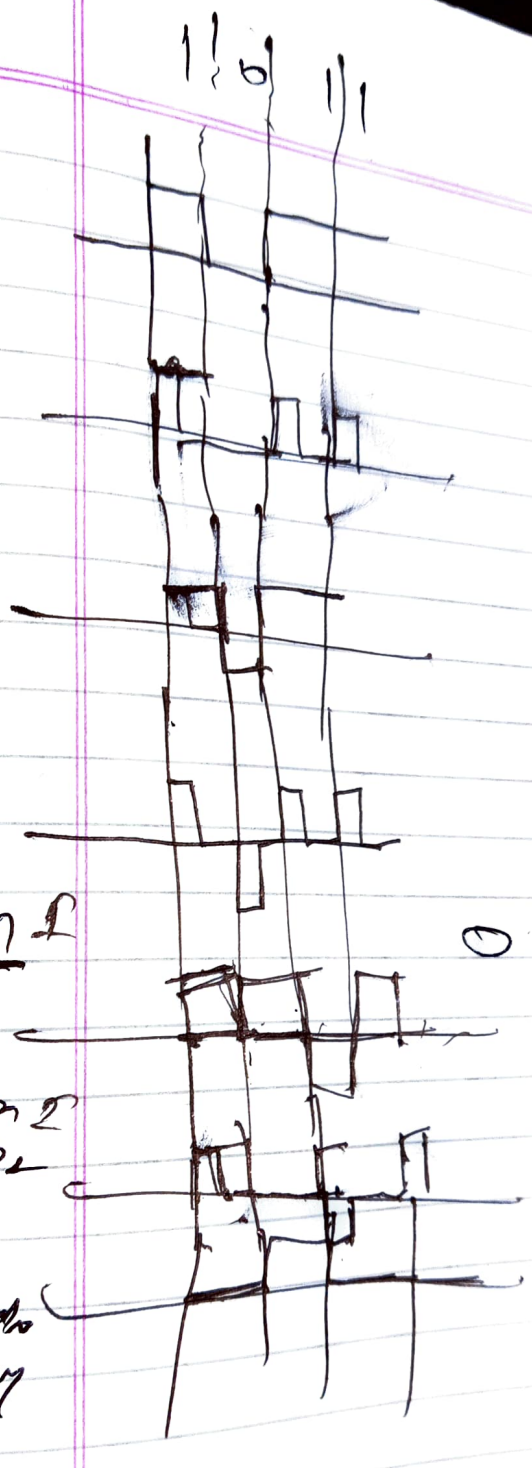
ASK

ASK ON-OFF KEYING








Am 1
Am 2
RL

Objective:
Study of Time Division Multiplexing/ Pulse Code Modulation

Equipment Required:

1. 2153 and 2154 with power supply cord

c/1

Experiment 6

Objective:

1. Study of Amplitude Shift Keying Modulation and Demodulation .

Equipment Required:

1. ST2156 and ST2157 with power supply cord
2. CRO with connecting probe
3. Connecting cords

Theory

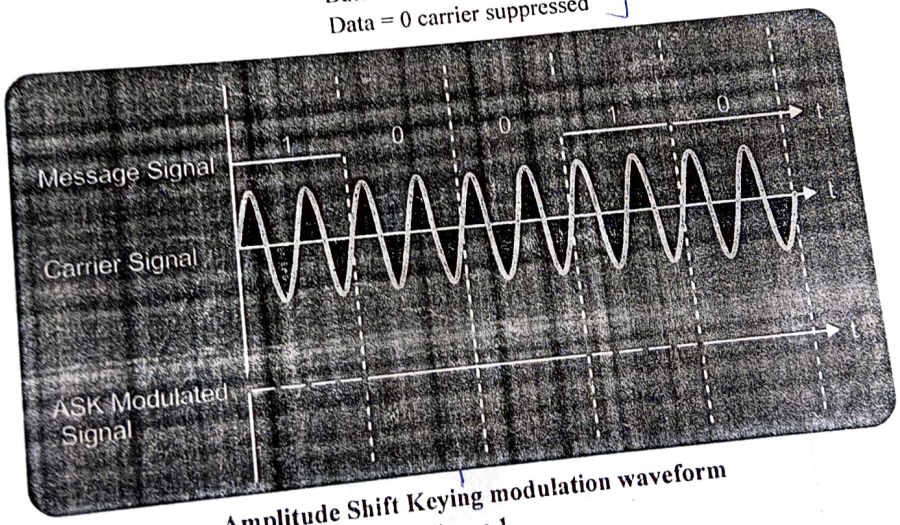
Amplitude Shift Keying (ASK) Technique:

The simplest method of modulating a carrier with a data stream is to change the amplitude of the carrier wave every time the data changes. This modulation technique is known as Amplitude Shift Keying.

The simplest way of achieving amplitude shift keying is by switching 'ON' the carrier whenever the data bit is '1' & switching it 'OFF' whenever the data bit is '0' i.e. the transmitter outputs the carrier for a' 1 ' & totally suppresses the carrier for a '0'. This technique is also known as ON-OFF keying. Figure 12 illustrates the amplitude shift keying for the given data stream.

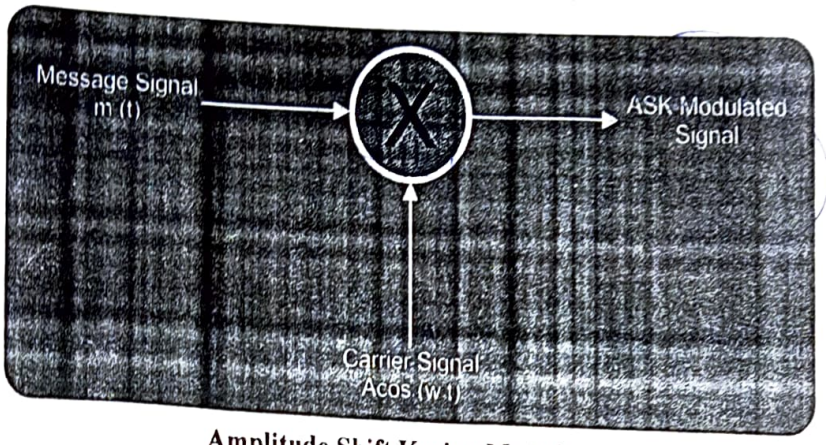
Thus,

Data = 1 carrier transmitted
Data = 0 carrier suppressed



Amplitude Shift Keying modulation waveform
Figure 1

The ASK waveform is generated by a balanced modulator circuit, also known as a linear multiplier as shown in the figure 13 given below. As the name suggests, the device multiplies the instantaneous signal at its two inputs. The output voltage being product of the two input voltages at any instance of time. One of the inputs is AC coupled 'carrier' wave of high frequency. Generally, the carrier wave is a sinusoidal signal since any other waveform would increase the bandwidth, without providing any advantages. The other input which is the information signal to be transmitted, is DC coupled. It is known as modulating signal.

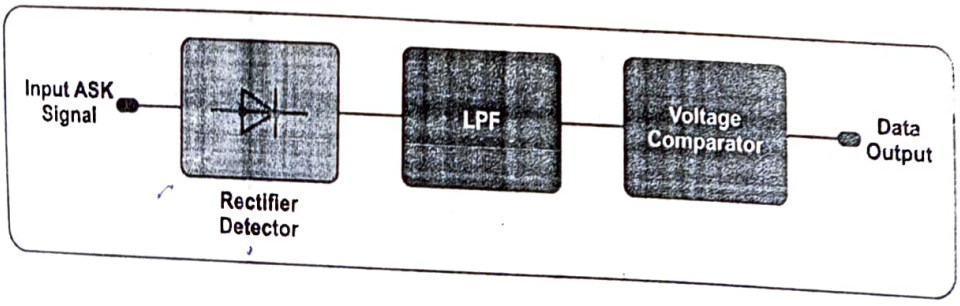


Amplitude Shift Keying Modulator

Figure 2

The data stream applied is unipolar i.e. 0 volts for logic '0' & + 5 Volts for logic '1'. The output of balanced modulator is a sine wave, unchanged in phase when a data bit 'I' is applied to it and is zero when the data bit '0' is applied.

The ASK modulation result in a great simplicity at the receiver. The method to demodulate the ASK waveform is to rectify it, pass it through the filter & 'shape up' the resulting waveform. The output is the original data stream. Figure 14 shows the functional blocks required in order to demodulate the ASK waveform at receiver.



Amplitude Shift Keying Demodulator

Figure 3

Connection diagram:

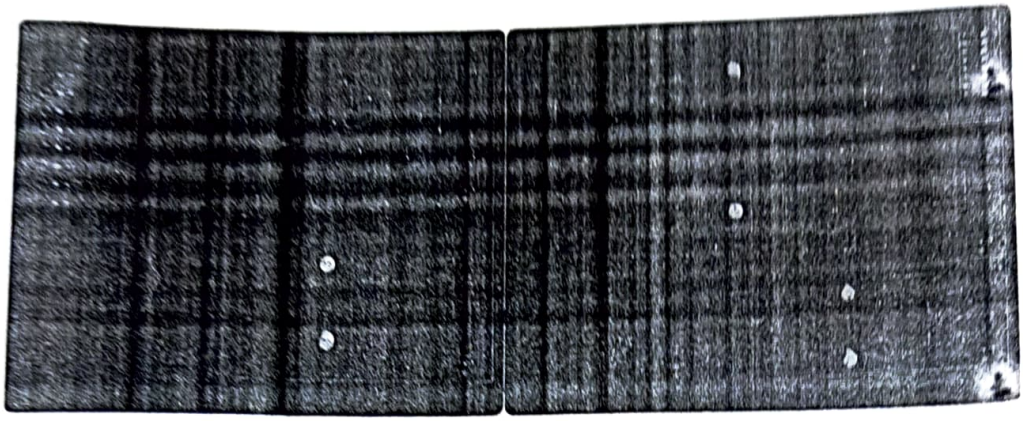


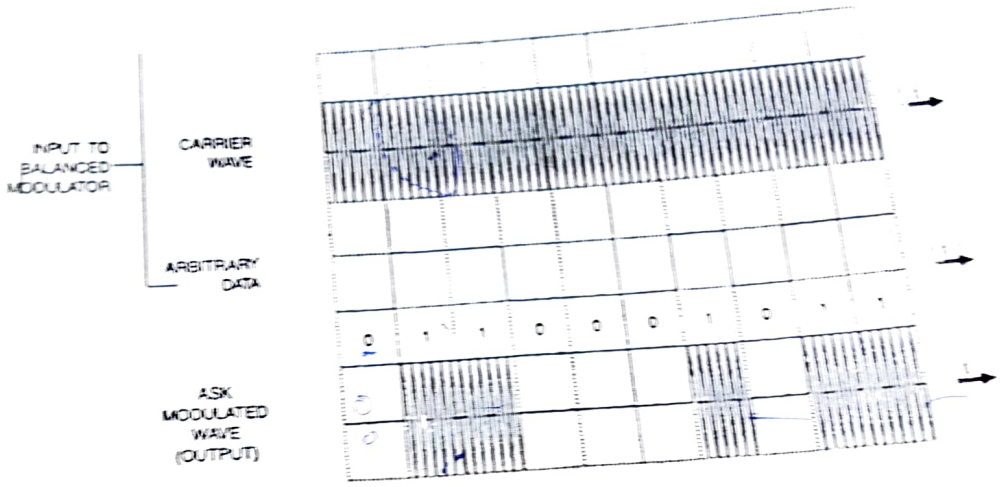
Figure 4

Procedure:

1. Connect the power supplies of Scientech 2156 and Scientech 2157 but do not turn on the power supplies until connections are made for this experiment.
2. Make the connections as shown in the figure 4.
3. Switch 'ON' the power.
4. On Scientech 2156, connect oscilloscope CH1 to 'Clock In' and CH2 to 'Data In' and observe the waveforms.
5. On Scientech 2156, connect oscilloscope CH1 to 'NRZ (L)' and CH2 to 'Output' of modulator Circuit (l) on Scientech 2156 and observe the waveforms.
6. Vary the gain potentiometer of modulator circuit (l) on Scientech 2156 to adjust the amplitude of ASK Waveform.
7. On Scientech 2156, connect oscilloscope CH1 to 'NRZ (L)' and CH2 to 'Output' of comparator on Scientech 2157 and observe the waveforms.

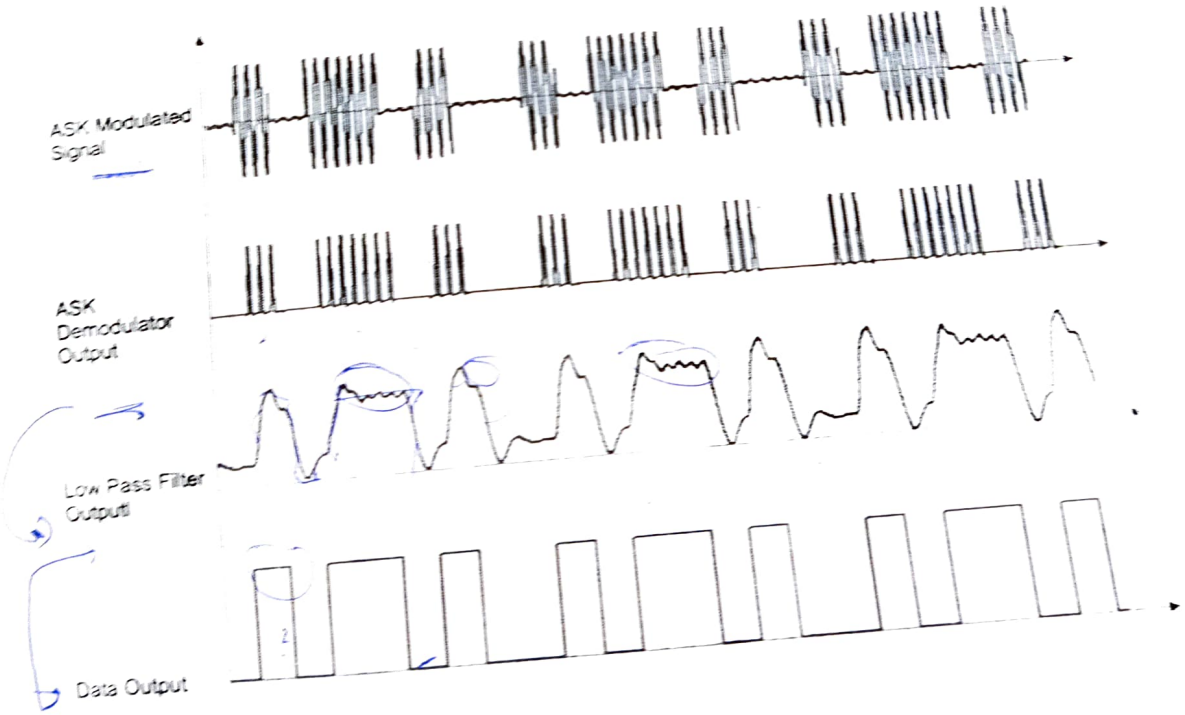
Observations:

1. The output at 'Data In' is repeating sequence of bits generated by Data Source.
2. The output at Modulator Circuit (l) is the ASK waveform which contains carrier transmitted for Data '1' and carrier suppressed Data '0'.
3. The output at comparator on Scientech 2157 is the same as 'Data In' on Scientech 2156.



Waveforms Of ASK Modulation

Figure 5



Waveforms Of ASK Demodulation

Figure 6

Conclusions:

1. Amplitude shift keying is fairly simple to implement in practice, but it is less efficient, because the noise inherent in the transmission channel can deteriorate the signal so much that the amplitude changes in the modulated carrier wave due to noise addition, may lead to the incorrect decoding at the receiver.
2. The technique is not widely used is practice. Application wise, it is however used in diverse areas and old as emergency radio transmissions and fiber-optic communications.

Experiment 2

Objective:
Study of Time Division Multiplexing/ Pulse Code Modulation and Demodulation

Equipment Required:
2 and 2154 with power supply cord
ecting probe

FREQUENTLY ASKED QUESTIONS

1. What are the types of Digital Modulation techniques?
Ans. Digital Modulation techniques is classified into coherent or non-coherent techniques depending on whether the receiver is quipped with a phase recovery circuit or not.

1.Define Coherent Digital Modulation technique ?
Ans. Coherent Digital Modulation technique employs Coherent detection technique in which local carrier generated at the receiver is phase locked with the carrier which is used in transmitter section. It is a Synchronous detection method.

3 State the bandwidth requirement in ASK System ?
Ans. Maximum Bandwidth is $2f_b$ Hz in ASK System.