

EXPERIMENT NO-2

DSB-SC MODULATOR & DETECTOR

AIM: To study the working of the Balanced Modulator and demodulator.

APPARATUS:

1. Balanced modulator trainer kit
2. C.R.O (20MHz)
3. Connecting cords and probes
4. Function generator (1MHz)
5. PC with windows (95/98/XP/NT/2000)
6. MATLAB Software with communication toolbox

THEORY:

Balanced modulator circuit is used to generate only the two side bands DSB-SC. The balanced modulation system is a system of adding message to carrier wave frequency there by only the side bands are produced. It consists of two AM modulators arranged in a balanced configuration. The AM modulator is assumed to be identical. The carrier input to the two modulators is same.

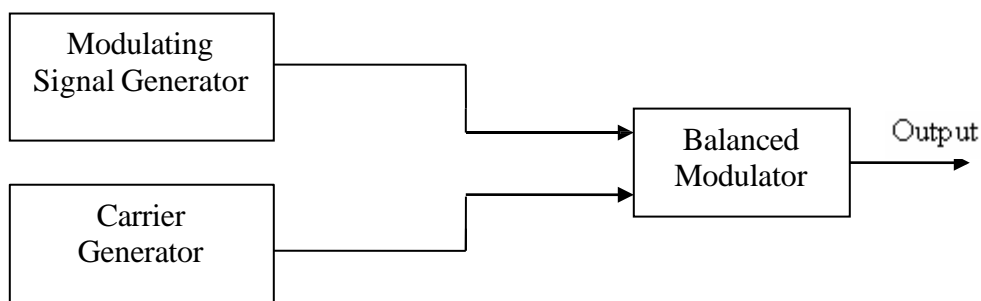
If we eliminate or suppress the carrier then the system becomes suppressed carrier DSB-SC. In this we need reinsert the carrier is complicated and costly. Hence the suppressed carrier DSB system may be used in point to point communication system.

Generation of suppressed carrier amplitude modulated volt balanced modulator may be of the following types.

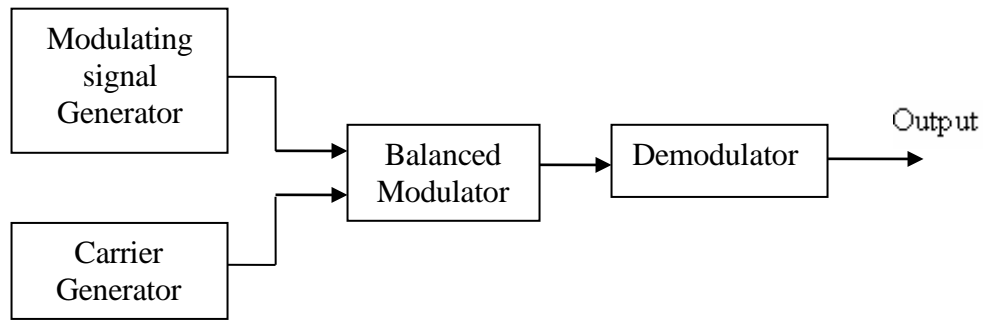
1. Using transistors or FET.
2. Using Diodes

BLOCK DIAGRAM:

Modulation



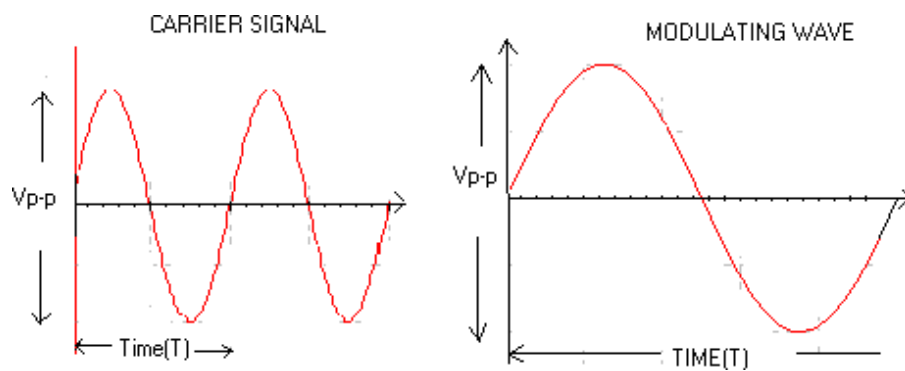
Demodulation

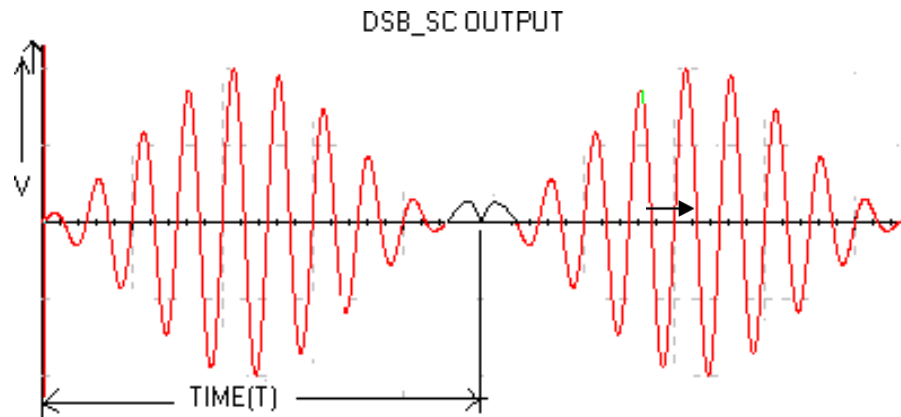


PROCEDURE:-

1. Connect the circuit as per the given circuit diagram.
2. Switch on the power to the trainer kit.
3. Apply a 100KHz, 0.1 peak sinusoidal to the carrier input and a 5KHz, 0.1 peak sinusoidal to the modulation input.
4. Measure the output signal frequency and amplitude by connecting the output to CRO.
5. And note down the output signals.

EXPECTED WAVEFORMS:-





OBSERVATIONS:

Carrier Signal		Message signal		Modulated signal		Demodulated Signal	
				output		output	
F _c (Hz)	V _c (volts)	F _m (Hz)	V _m (v)	F _o (Hz)	V _o (v)	F(Hz)	V(v)

RESULT:

QUESTIONS

1. What are the two ways of generating DSB_SC?
2. What are the applications of balanced modulator?
3. What are the advantages of suppressing the carrier?
4. What are the advantages of balanced modulator?
5. What are the advantages of Ring modulator?
6. Write the expression for the output voltage of a balanced modulator?
7. Explain the working of balanced modulator and Ring Modulator using diodes.

SSB-SC MODULATOR & DETECTOR (PHASE SHIFT METHOD)

AIM:- To generate SSB using phase method and detection of SSB signal using Synchronous detector.

APPARATUS:-

1. SSB trainer kit
2. C.R.O (20MHz)
3. Patch cards
4. CRO probes

THEORY:

AM and DSBSC modulation are wasteful of band width because they both require a transmission bandwidth which is equal to twice the message bandwidth. In SSB only one side band and the carrier is used. The other side band is suppressed at the transmitter, but no information is lost. Thus the communication channel needs to provide the same band width, when only one side band is transmitted. So the modulation system is referred to as SSB system.

The base band signal may not be recovered from a SSB signal by the use of a diode modulator. The base band signal can be recovered if the spectral component of the output i.e either the LSB or USB is multiplied by the carrier signal.

Consider the modulating signal

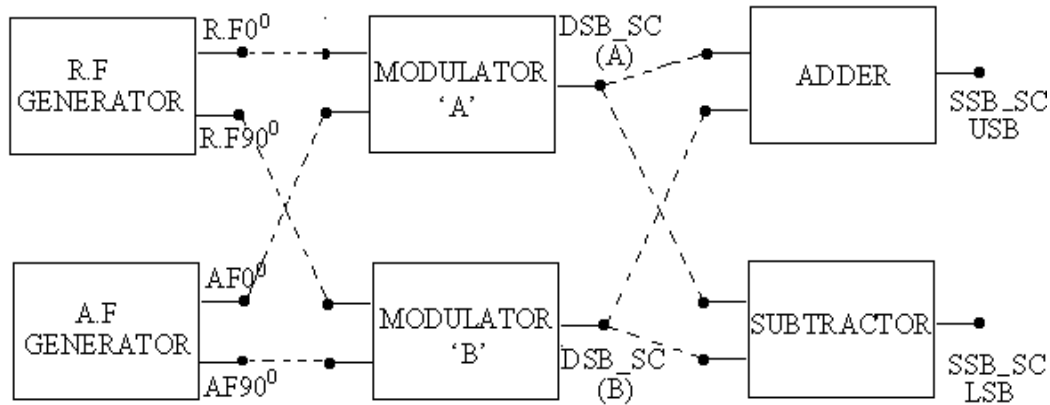
$$M(t) = A_m \cos \omega_m t$$
$$C(t) = A_c \cos \omega_c t$$

$$M(t)c(t) = A_c A_m \cos \omega_m t \cos \omega_c t$$

The above signal when passed through a filter, only one of the above components is obtained which is the SSB signal.

BLOCK DIAGRAM: -

SSB MODULATION



SSB DEMODULATION/SYNCHRONOUS DETECTOR



PROCEDURE:-

SSB MODULATION

1. Connect the Adaptor to the mains and the other side to the Experimental Trainer Switch 'ON' the power.
2. (a) Connect carrier $f_c 90^0$ to A_{in} of Balanced Modulator -A and adjust its amplitude to 0.1Vpp.
(b). Connect modulating signal $f_m 0^0$ 5Vpp to B_{in} of the Balanced Modulator-A.
3. Observe the DSB-A output on CRO.
4. Connect $f_c 0^0$ at 0.1 Vpp at C_{in} of Balanced Modulator B. Connect $f_m 90^0$ at 5 Vpp at D_{in} of Balanced Modulator B.

5. Connect the DSB-A output and DSB-B output to the summing amplifier. Observe the output (SSB output) on the spectrum analyzer. This gives single side band (upper) only while the lower side band is cancelled in the summing Amplifier.

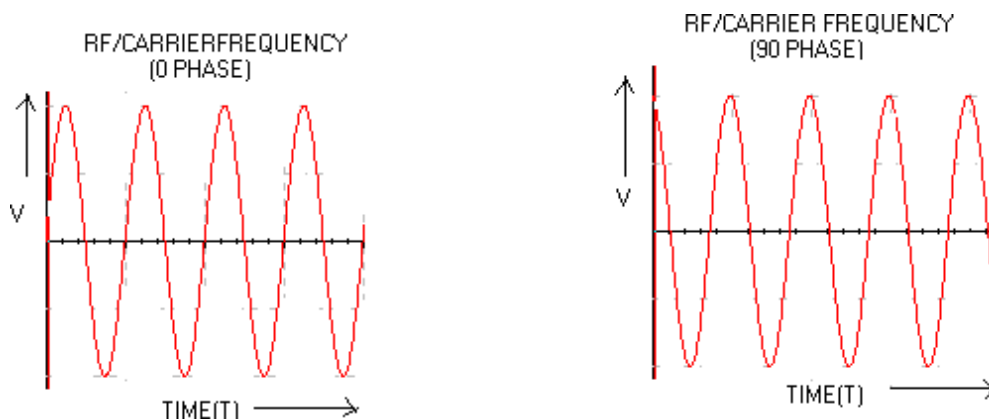
SSB DEMODULATION

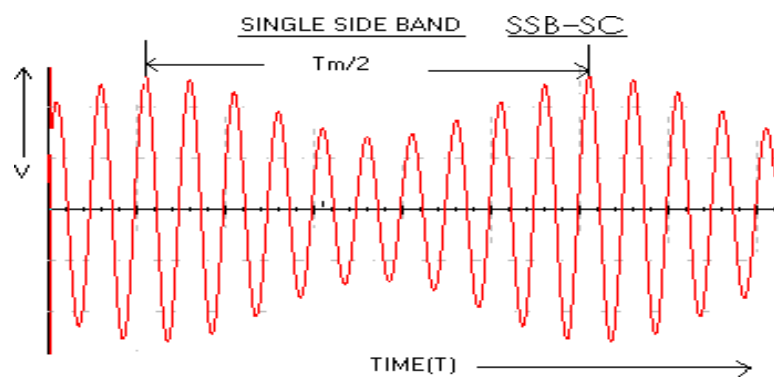
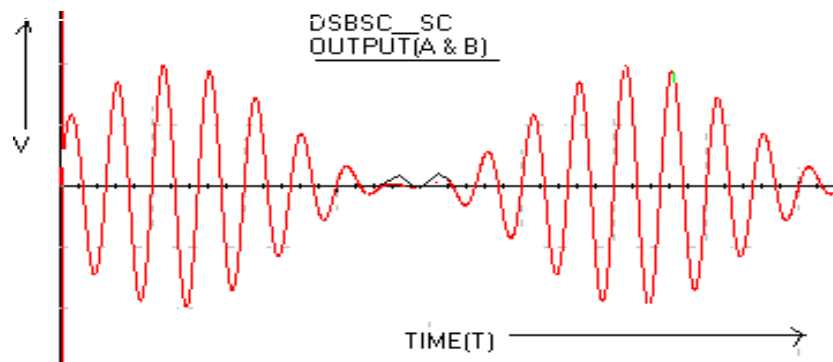
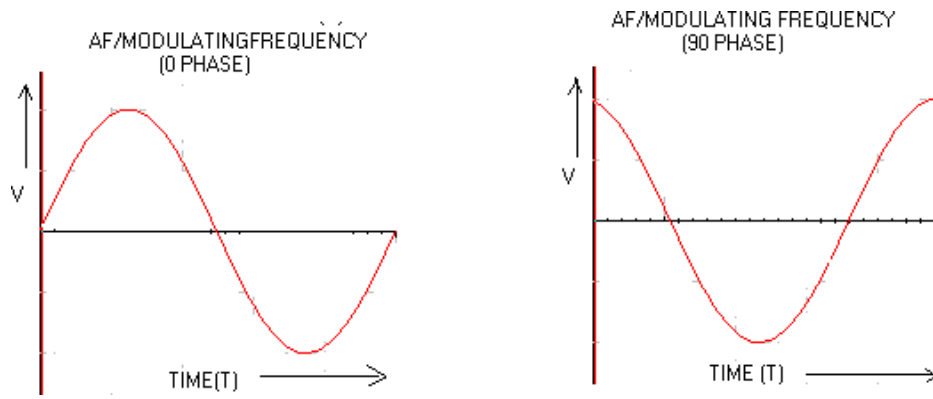
1. Connect the carrier f_c and SSB output to the synchronous detector.
2. Connect the demodulator output on the oscilloscope which is the recovered modulating signal.

OBSERVATIONS:

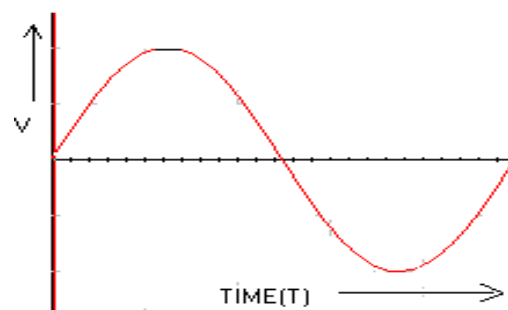
Carrier signal		Modulating signal		Balanced modulator -A		Balanced modulator -B		Adder/Subtractor Output		Synchronous detector	
Fc	Vc	Fm	Vm	Vmax	Vmin	Vmax	Vmin	Vmax	Vmin	Fd	Vd

EXPECTED WAVE FORMS: -





SSB DEMODULATED OUTPUT



-

RESULT:

QUESTIONS:

1. **What are the different methods to generate SSB-SC signal?**
2. What is the advantage of SSB-SC over DSB-SC?
3. Explain Phase Shift method for SSB generation.
4. Why SSB is not used for broadcasting?

SSB DETECTION

5. Give the circuit for synchronous detector?
6. What are the uses of synchronous or coherent detector?
7. Give the block diagram of synchronous detector?
8. Why the name synchronous detector.