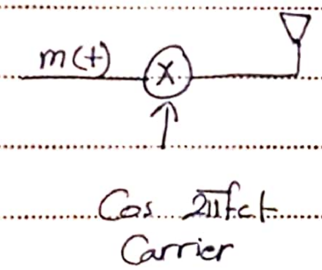
Double Side band (DSB) :- (26 _ 3 _ 2019)

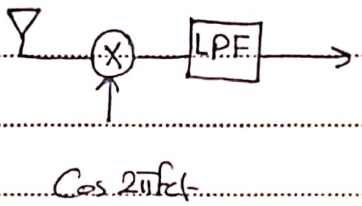
↳ DSB _ SC

↳ DSB _ LC

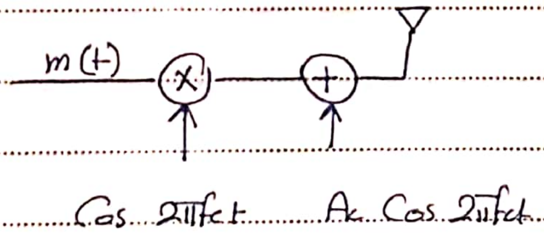
* DSB _ SC :-

Coherent demodulation , Synchronouse demodulation





* DSB _ LC :-

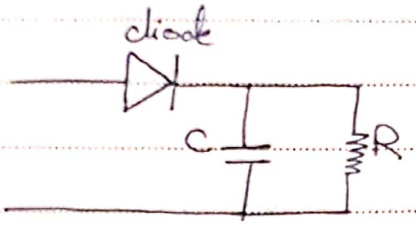


Dc value

ك حتى نستخدم non coherent demodulation

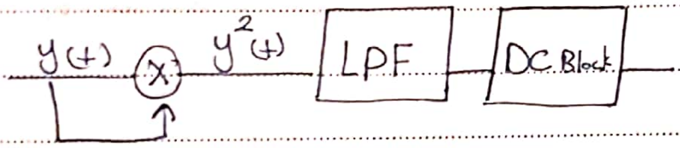
* non Coherent demodulation (asynchronouse) :-

Diode Detector :-

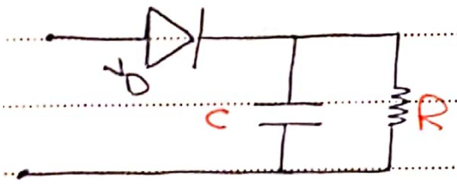


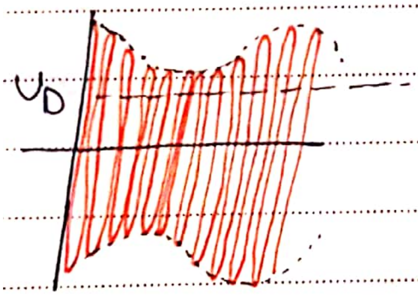
→ non Coherent demodulation.

Product demodulation :-

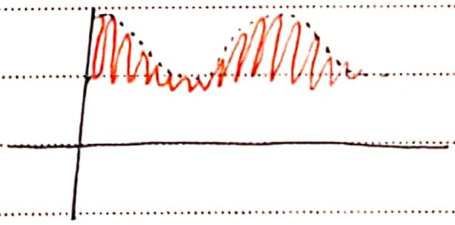


Diode Detector :-

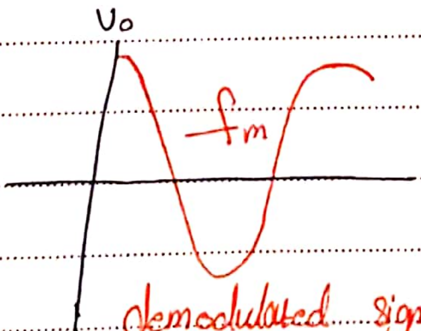




→



→ يلي رح يمرره الـ diode



demodulated signal.

* for U > U.d :- the signal passes through the diode and it charge the Capacitor.

* for U < U.d :- the capacitor discharges through the resistor and the output is the recovered signal.

* The value of R and C should be carefully selected to perfectly demodulate the DSB - LC.

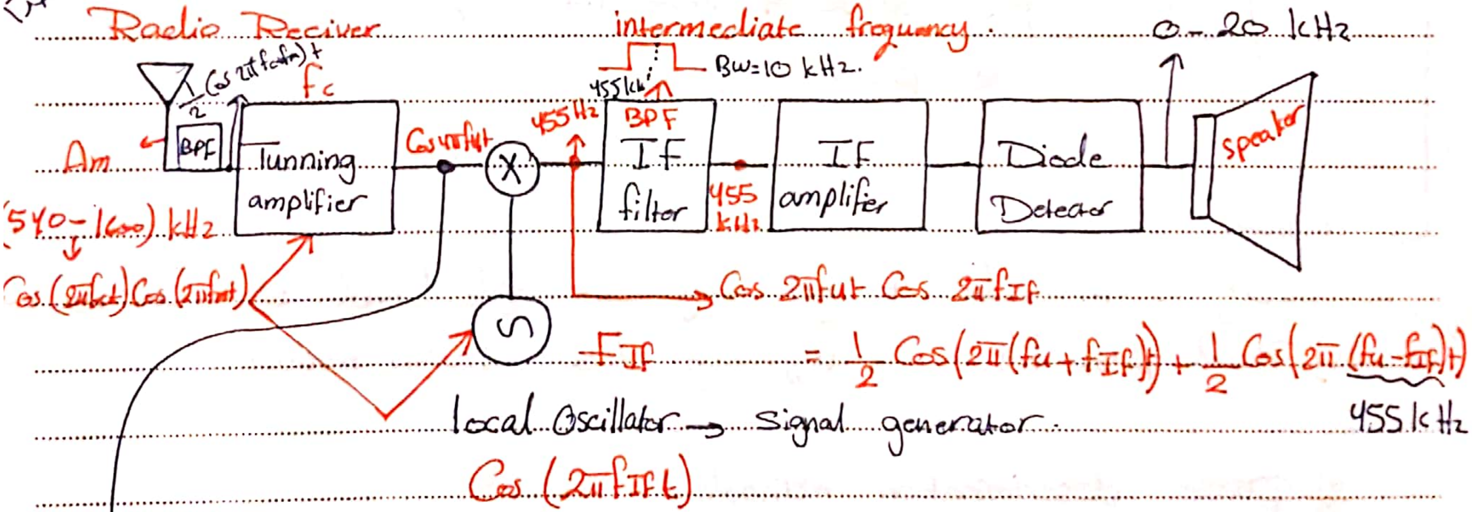
∴ non Coherent ⟹ DSB-LC.

∴ Coherent demodulation can be used to demodulate both DSB - SC , DSB - LC.

superhetrodyne Reciver :-

الكل يتغير بنفسه

Radio Reciver



$$= \frac{1}{2} Cos(2\pi(f_u + f_{IF})t) + \frac{1}{2} Cos(2\pi(f_u - f_{IF})t)$$

455 kHz

$$Cos(2\pi f_c t) + Cos(2\pi f_m t)$$

$$= \frac{1}{2}(Cos\ 2\pi(f_c + f_m)t) + \frac{1}{2}(Cos\ 2\pi(f_c - f_m)t).$$

after a BPF only one signal is selected.

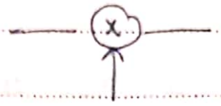
Subject : 28 / 3 / 2019 .

Single Side band (SSB) Modulation :-

in DSB :-

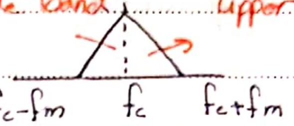
f_m

0 → 4kHz



Cos $2\pi f_c t$

lower side band (LSB) ; upper side band (USB)

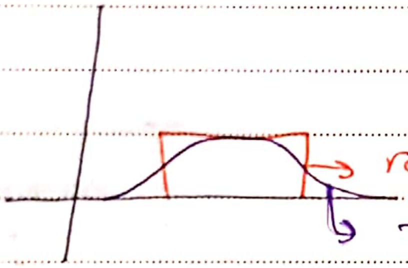


BW = $2f_m$

* LSB has a full ~~Cosky~~ Copy of the message m(t) , also USB has another Copy of the message m(t) .

* it is enough to transmit either the LSB or USB .

How to get only one side band ?!

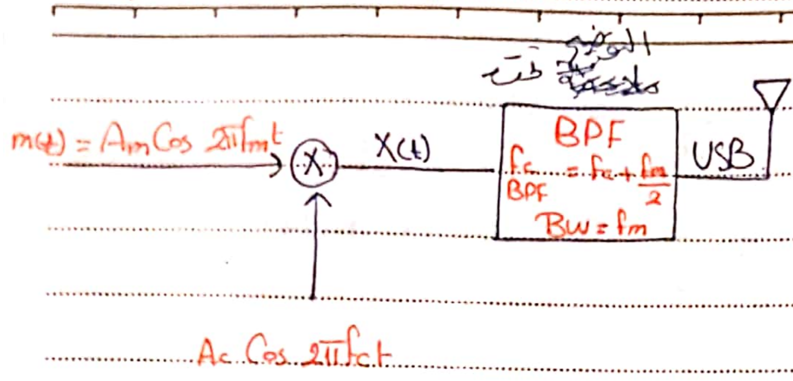


answer :-

in Theory : in order to get only one side band we may use :

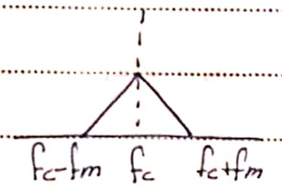
1) Band pass filter (frequency descrimination method).

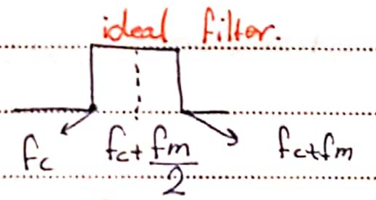
2) phase descrimination methode



$$X(t) = A_m \cos 2\pi f_m t \cdot A_c \cos 2\pi f_c t$$

$$= \frac{A_m A_c}{2} \underbrace{\cos\left(2\pi(f_c+f_m)t\right)}_{\text{upper side band}} + \frac{A_m A_c}{2} \underbrace{\cos\left(2\pi(f_c-f_m)t\right)}_{\text{lower side band}}$$





Center of the BPF.

$$* \; S_{USB}(t) = \frac{A_m A_c}{2} \cos\left(2\pi(f_c+f_m)t\right).$$

$$= \frac{A_m A_c}{2} \cos(2\pi f_c t) \cos(2\pi f_m t) - \frac{A_c A_m}{2} \overset{\sin}{\cancel{\cos}}(2\pi f_c t)\, \overset{\sin}{\cancel{\cos}}(2\pi f_m t)$$

$$* \; S_{LSB}(t) = \frac{A_m A_c}{2} \cos\left(2\pi(f_c-f_m)t\right)$$

$$= \frac{A_m A_c}{2} \cos(2\pi f_c t) \cos(2\pi f_m t) + \frac{A_m A_c}{2} \sin(2\pi f_c t) \sin(2\pi f_m t).$$

Subject : 28 / 3 / 2014.

$\therefore S_{USB}(t) = \frac{A_c}{2} \cos(2\pi f_c t)\, m(t) - \frac{A_c}{2} \sin(2\pi f_c t)\, \underbrace{\hat{m}(t)}_{\text{hilbert transform}}$.

$\therefore S_{LSB}(t) = \frac{A_c}{2} \cos(2\pi f_c t)\, m(t) + \frac{A_c}{2} \sin(2\pi f_c t)\, \hat{m}(t)$.

$m(t) \rightarrow$ [Fourier Transform] $\rightarrow M(f)$

90° = shift phase يغير

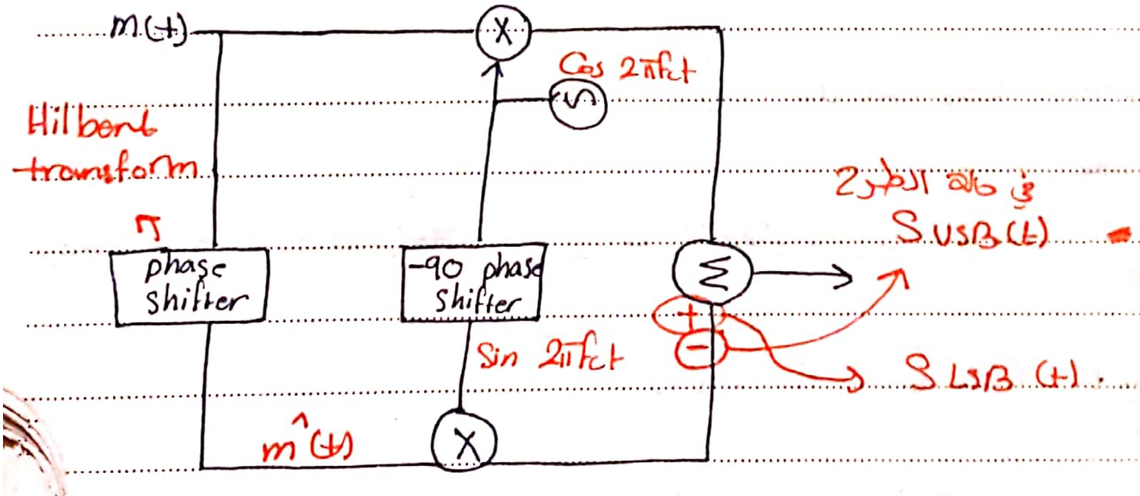
$m(t) \rightarrow$ [Hilbert transform] $\rightarrow$ ~~M(f)~~ $-j\,\mathrm{sgn}(f)\, M(f) \rightarrow \begin{cases} 1 & f > 0 \\ -1 & f < 0 \end{cases}$

* Hilbert transform doesn't change the magnitude of M(f), it only change the phase

* وظيفة Hilbert transform هي تغيير الزاوية الى 90°

(2) phase Discrimination method :-

\# Block digram of the SSB modulator.



Scanned by CamScanner

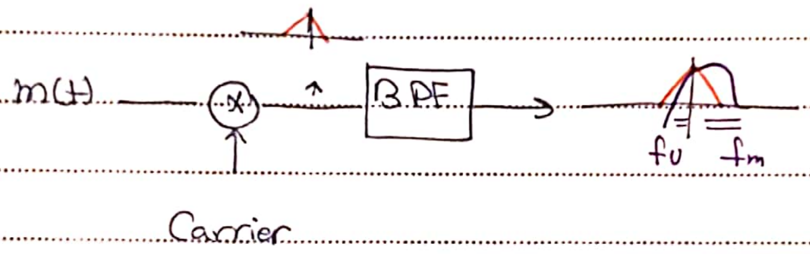
H.W :-

Demodulate the Signal $S_{USB}(t) = \frac{A_c A_m}{2} \cos\left(2\pi(f_c+f_m)t\right)$

by using a Coherent Demodulator and the right filter.

* * *

in practical Communication, We use practical filter to obtain one side band :-



S_{USB}

↳ Vistigial side band

* in Vestigial Side band, I got one Side band in full and a Practical Part of the other Side.

$$BW = f_m + \underline{\underline{f_v}}$$

due to practical filter.

* * *