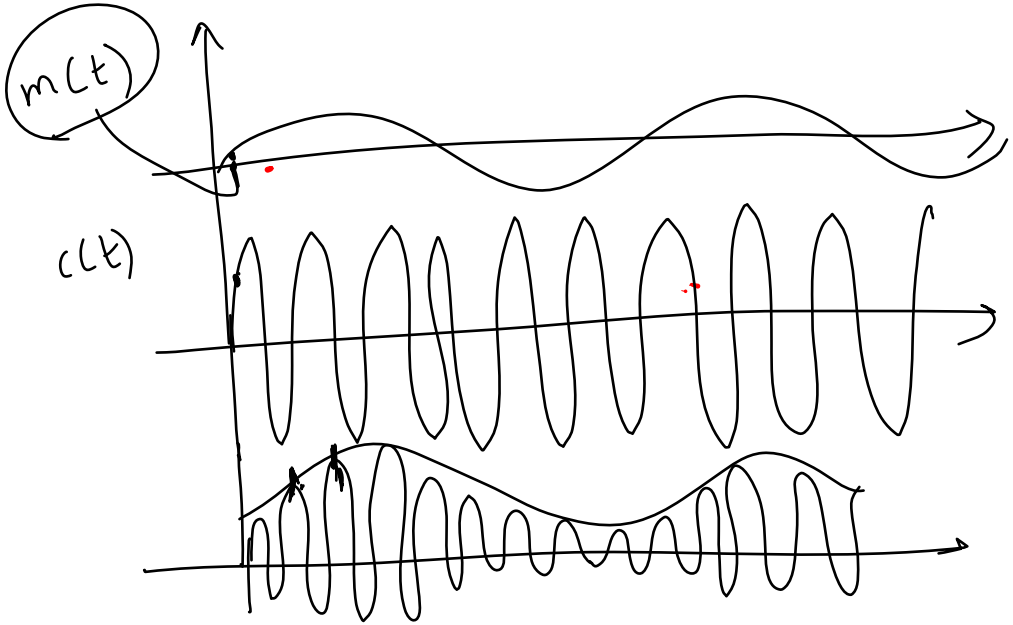
Amplitude Modulation :

In amplitude Modulation, the amplitude of carrier is varied in accordance with the information signal.



$c(t) = A_c \sin \omega_c t$

$m(t) = A_m \sin \omega_m t$

$C_m(t) = (A_c + A_m \sin \omega t) \sin \omega_c t$

Amplitude of Modulated.

$A_c + A_m$

$A_c - A_m$

$\omega t = 0, 2\pi$

$\omega t = \pi$

$$\Rightarrow A_c\left(1+\frac{A_m}{A_c}\sin\omega_m t\right)\sin\omega_c t.$$

$\frac{A_m}{A_c}$ = 'μ' [Modulation Index]

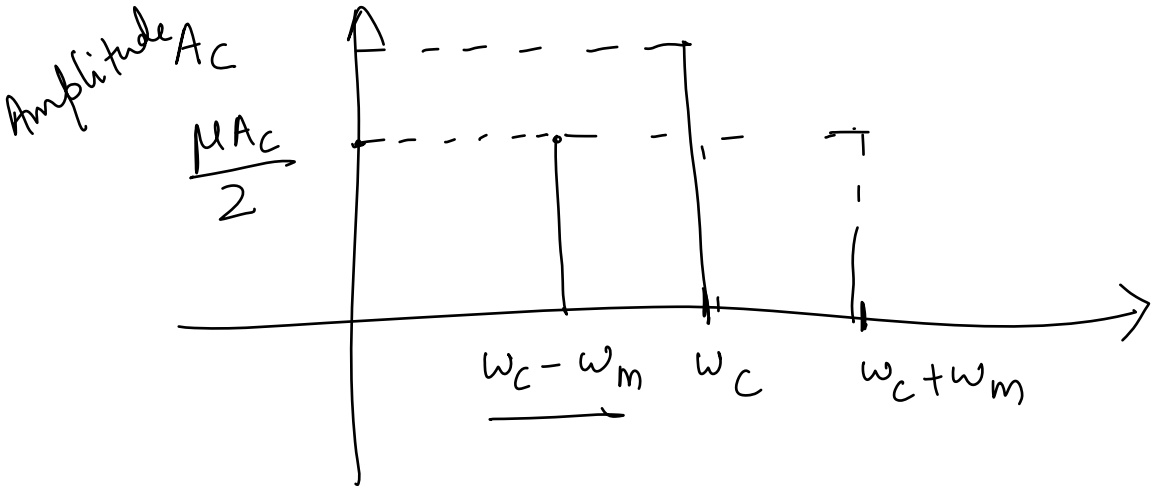
$$c_m(t) = A_c\sin\omega_c t + \mu\cdot A_c \sin\omega_m t \sin\omega_c t.$$

$$\sin A\sin B = \frac{1}{2}\left[\cos(A+B) - \cos(A-B)\right]$$

$$= A_c\sin\omega_c t + \frac{\mu A_c}{2}\left[\cos(\omega_m+\omega_c)t - \cos(\omega_m-\omega_c)t\right]$$

$$= A_c \sin \omega_c t + \frac{\mu A_c}{2} \cos(\omega_c - \omega_m)t - \frac{\mu A_c}{2} \cos(\omega_c + \omega_m)$$

$\omega_c - \omega_m$, $\omega_c + \omega_m$



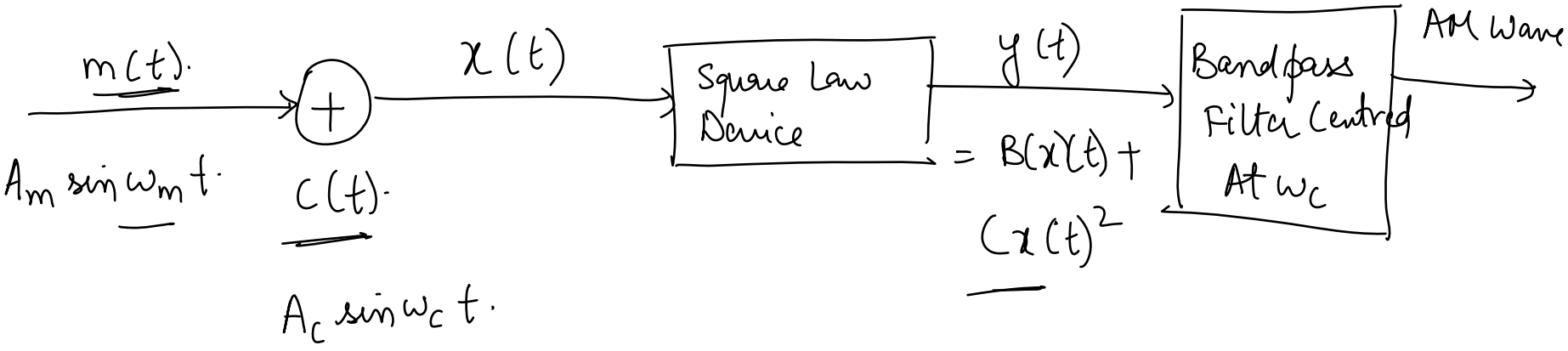
Combination of 3 waves, moving together with frequencies ω_c, $\omega_c - \omega_m$ & $\omega_c + \omega_m$.

Bandwidth = $(\omega_c + \omega_m) - (\omega_c - \omega_m) \Rightarrow 2\omega_m$.

Signals are located in side bands ($\omega_c - \omega_m$) & ($\omega_c + \omega_m$)

side bands.

Production of Amplitude Modulated Wave :



Band pass filter : It is a device that passes frequencies within a certain range and rejects frequencies outside that range.

$A_m \sin\omega_m t$ is added to carrier signal $A_c \sin\omega_c t$ $\longrightarrow$ $x(t)$.

The signal $x(t) = A_m \sin\omega_m t + A_c \sin\omega_c t$ is passed through a square law device $\longrightarrow$ output $= y(t) = B(x(t)) + C(x^2(t))$.

$(a+b)^2$

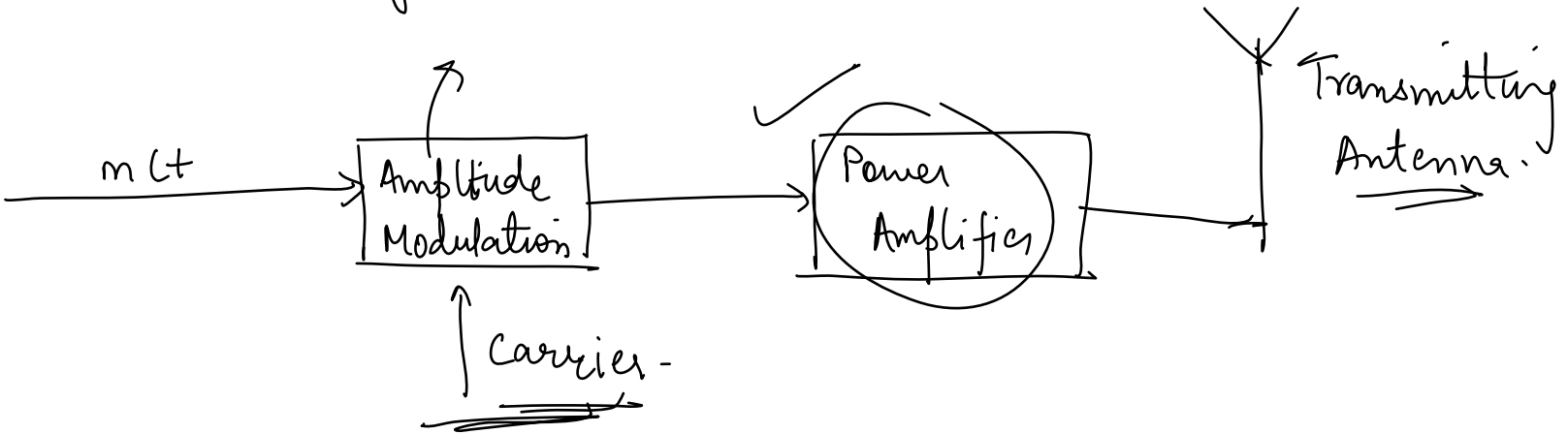
Output of square law device is non-linear..

$y(t) = B(A_m \sin\omega_m t + A_c \sin\omega_c t) + C(A_m^2 \sin^2\omega_m t + A_c^2 \sin^2\omega_c t + 2A_m A_c \sin\omega_m t \sin\omega_c t)$

$\sin^2\theta \Rightarrow \frac{1-\cos 2\theta}{2}$

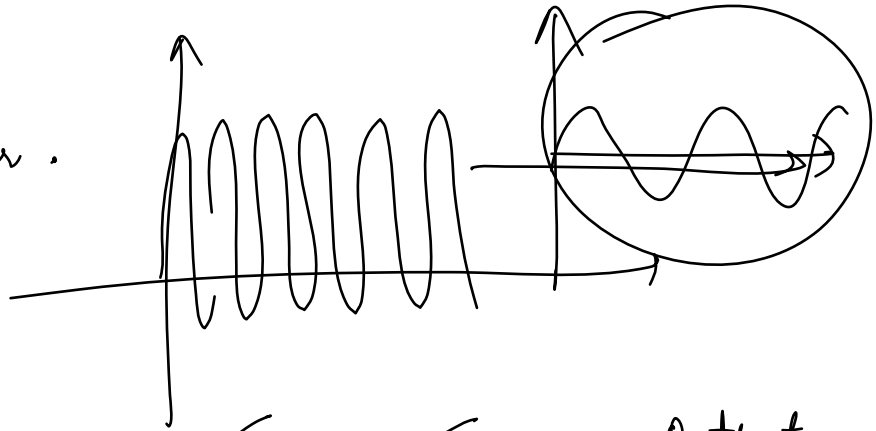
ω_c , $\omega_c - \omega_m$, $\omega_c + \omega_m$ ⟶ These are the frequencies which retained and rejects the other one-

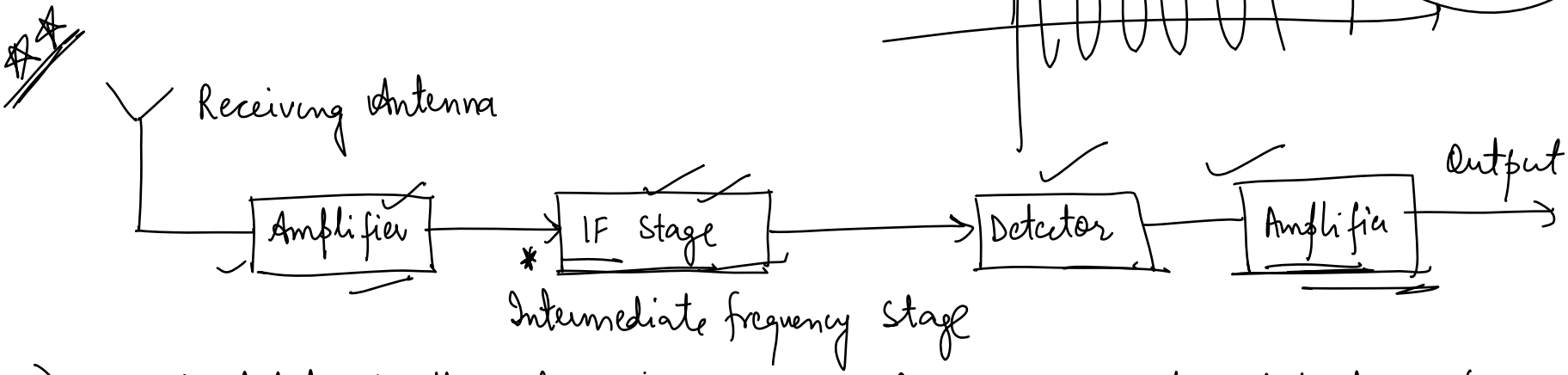
Modulated signal does not possess enough power to get transmitted



Detection of Amplitude Modulated Wave:

1) Receiving Antenna is attached by amplifier.





Intermediate frequency Stage

2) To facilitate further processing, carrier frequency is changed to lower frequency by [IF Stage].

Detection is the process of recovering the message signal from the modulated carrier wave.

Modulated wave contains frequencies ω_c, $\omega_c + \omega_m$, $\omega_c - \omega_m$.

In order to obtain message signal of frequency ω_m, modulated signal is passed through Rectifier to obtain output. In order to get $m(t)$, the signal is passed through envelope detector, which consists of RC circuit.