DO. VWN

PCS-SSB-1

Module 1 - 3rd bit

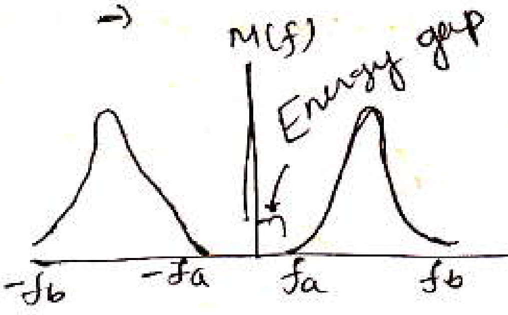
→ Generation is simple: First generate DSB-SC and Bandpass one of the SBs.

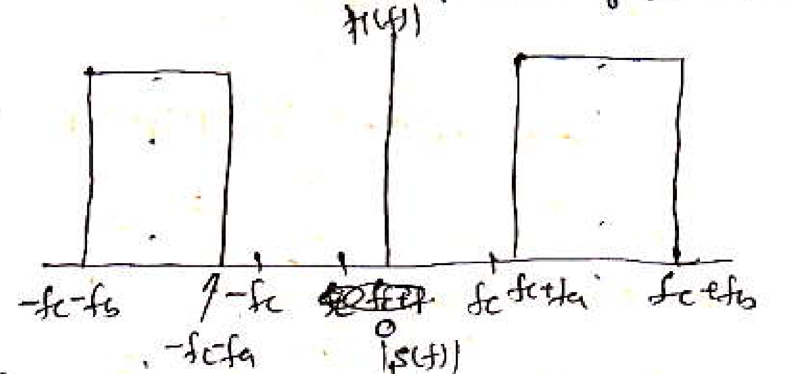
⇒ Filter must satisfy the following requirements:

→ The desired sideband lies inside the passband of the filter

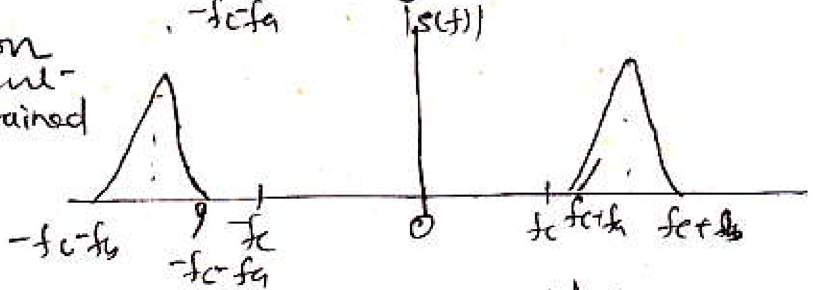
→ The unwanted sideband lies inside the stopband of the filter

→





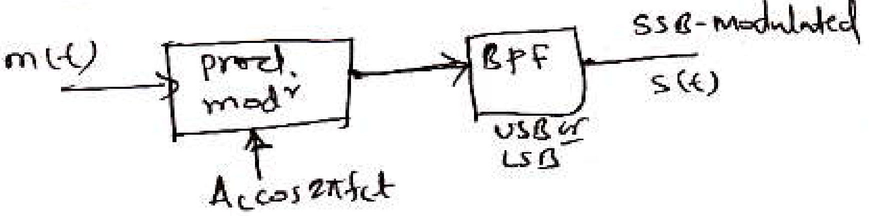
→ The synchronization information required to perform coherent demodulation is often obtained by one of two methods:



→ Transmitting a low power pilot carrier in addition to the selected sideband

→ Using highly stable oscillators in both the txr & rxr for generating the carrier frequency.

Genⁿ: Frequency-discrimination scheme



Theory: $m(t) = A_m \cos 2\pi f_m t$ —(1)

$c(t) = A_c \cos 2\pi f_c t$ —(2)

$s(t)_{DSB} = c(t) \cdot m(t)$

$= \frac{A_c A_m}{2} \cos(2\pi(f_c + f_m)t) + \frac{1}{2} A_c A_m \cos(2\pi(f_c - f_m)t)$ → (3)

$s(t)_{USB} = \frac{A_c A_m}{2} \cos(2\pi(f_c + f_m)t)$ → (4) USB

$= \frac{A_c A_m}{2} \cos 2\pi f_c t \cdot \cos 2\pi f_m t - \frac{A_c A_m}{2} \sin 2\pi f_c t \cdot \sin 2\pi f_m t$

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

Two cases: 1) Message signal periodic

2) " " nonperiodic

(4) consider m(t) is periodic

$\Rightarrow m(t) = \sum_n a_n \cos 2\pi f_n t$

Assuming c(t) is common to all components of m(t)

$S_{SSB} = \frac{1}{2} A_c \cos(2\pi f_c t) \sum_n a_n \cos 2\pi f_n t \mp \frac{1}{2} A_c \sin 2\pi f_c t \sum_n a_n \sin 2\pi f_n t$

let $\hat{m}(t) = \sum_n a_n \sin(2\pi f_n t)$

$\Rightarrow S_{SSB} = \frac{A_c m(t)}{2} \cos 2\pi f_c t \mp \frac{A_c \hat{m}(t)}{2} \sin 2\pi f_c t$

$\Rightarrow \hat{m}(t)$ is Hilbert transform of m(t)

$H(f) = -j\,\mathrm{sgn}(f)$ (H.T)

sgn(f) is signum fn

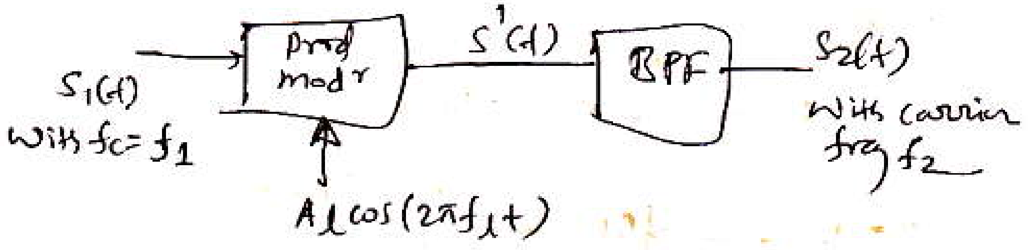
$\Rightarrow$ Magnitude response is unity for all freq

phase resp is +90° for −ve freq & −90° for +ve freq

$\therefore s(t) = \frac{A_c}{2} m(t) \cos(2\pi f_c t) \mp \frac{A_c}{2} \hat{m}(t) \sin(2\pi f_c t)$

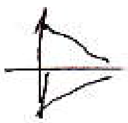
$\hat{m}$ −90° p.s version

<u>Frequency translation</u>



<u>B.D of mixer</u>

$\frac{V_{max} - V_{min}}{V_{max} + V_{min}} =$



<u>Eg</u>

<u>VSB</u>

Consider the message signal

$m(t) = 20 \cos(2\pi t)$ & $c(t) = 50 \cos(100\pi t)$

Sketch AM wave for 75%.

& power delivered across load 100Ω

(2) $m(t) = \frac{t}{1+t^2}$ Sketch AM wave for 50%, 100% & 125%.