SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A+' Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECB301-ANALOG AND DIGITAL COMMUNICATION

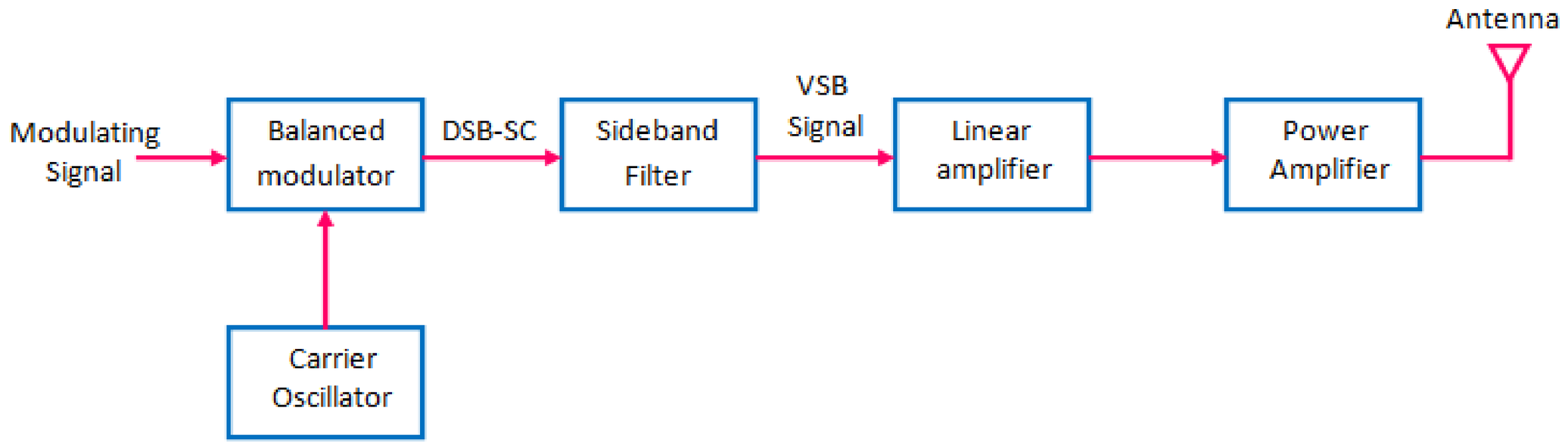
III YEAR/ V SEMESTER

UNIT 2 – RADIO TRANSMITTER & RECEIVER

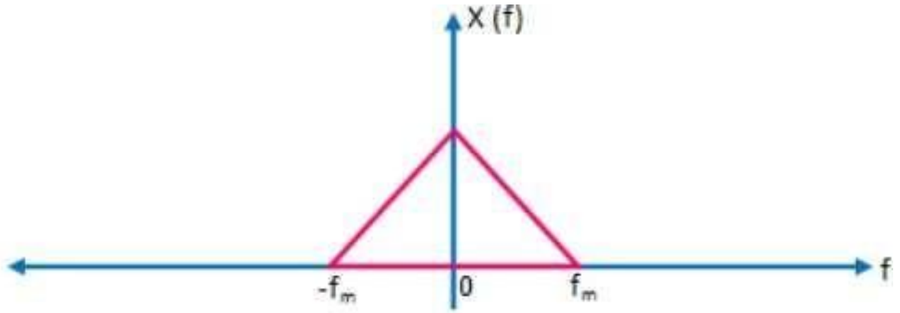
TOPIC – VSB RECEIVER

VSB TRANSMISSION

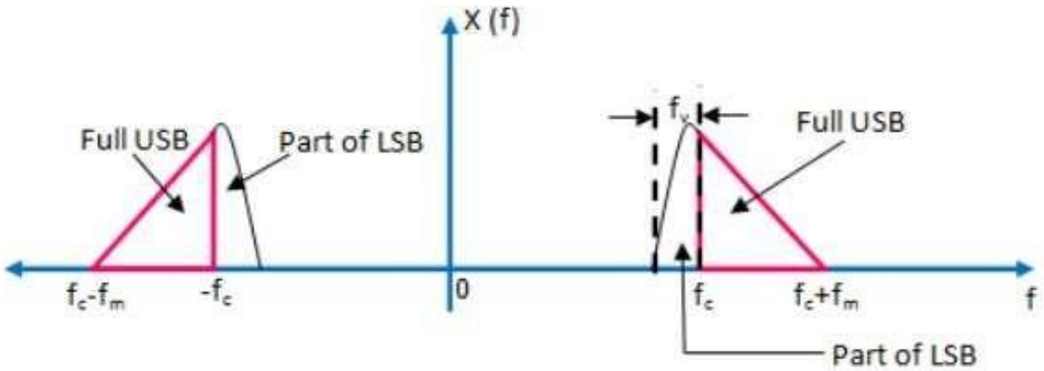
To generate a VSB signal, we have to first generate a DSB-SC signal and then pass it through a sideband filter. This filter will pass the wanted sideband as it is along with a part of unwanted sideband .



VSB FREQUENCY SPECTRUM



(a) Spectrum of message signal



(b) Spectrum of VSB Signal

VSB FREQUENCY SPECTRUM

Transmission Bandwidth

From fig. 2 (b), it is evident that the transmission bandwidth of the VSB modulated wave is given by :

$$B = (f_m + f_v)Hz$$

Where fm = Message bandwidth

fv = Width of the vestigial sideband

VSB-ADVANTAGES & APPLICATIONS

Advantages of VSB

1. The main advantage of VSB modulation is the reduction in bandwidth. It is almost as efficient as the SSB .
2. Due to allowance of transmitting a part of lower sideband, the constraint on the filter have been relaxed . So practically, easy to design filters can be used .
3. It possesses good phase characteristics and makes the transmission of low frequency components possible .

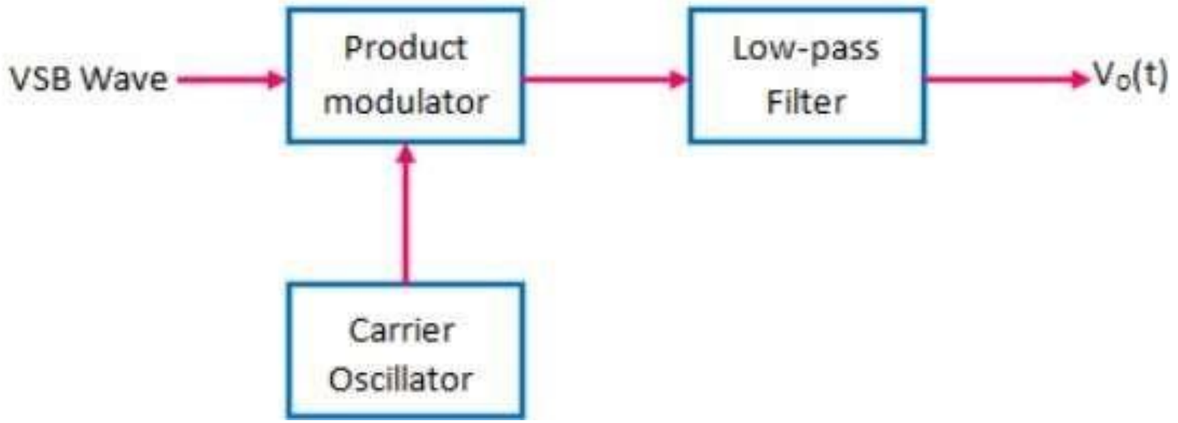
Application of VSB

VSB modulation has become standard for the transmission of television signal . Because the video signal need a large transmission bandwidth if transmitted using DSB-FC or DSB-SC techniques .

VSB RECEIVER

Demodulation of VSB Wave

The block diagram of the VSB demodulator



VSB RECEIVER WORKING OPERATION

The VSB modulated wave is passed through a product modulator where it is multiplied with the locally generated synchronous carrier .

Hence, the output of the product modulator is given by :

$$m(t) = s(t) \times c(t) = s(t)V_c \cos(2\pi f_c t)$$

Taking the Fourier transform of both sides, we get

$$M(f) = S(f) \times \left[\frac{1}{2}\delta(f + f_c) + \frac{1}{2}\delta(f - f_c)\right] = \frac{1}{2}S(f + f_c) + \frac{1}{2}S(f - f_c)$$

VSB RECEIVER WORKING OPERATION

But

$$S(f) = \frac{V_c}{2}[X(f - f_c) + X(f + f_c)]H(f)$$

Hence, we have

$$M(f) = \frac{V_c}{2}[X(f - 2f_c)H(f - f_c) + X((f + 2f_c)H(f + f_c)] + \frac{V_c}{4}[X(f)[H(f - f_c) + H(f + f_c)]$$

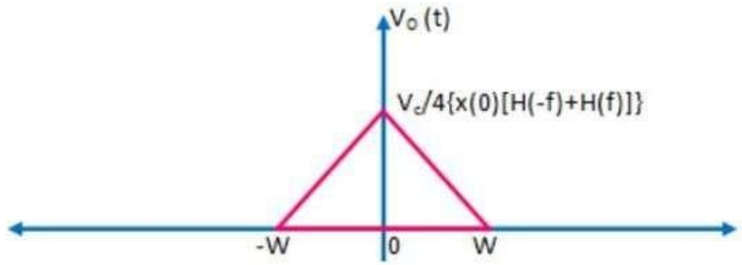
The first term in the above expression represents the VSB modulated wave, corresponding to a carrier frequency of 2fc .This term will be eliminated by the filter to produce output vo(t) .

The second term in the above expression for M(f) represents the spectrum of demodulated VSB output .

VSB RECEIVER WORKING OPERATION

Therefore ,

$$V_o(f) = \frac{V_c}{4}[X(f)[H(f-f_c) + H(f+f_c)]$$



Spectrum of VSB Demodulator

In order to obtain the undistorted message signal x(t) at the output of the demodulator, Vo(f) should be a scaled version of X(f) .

For this the transfer function H(f) should satisfy the following conditions :

$$H(f-f_c) + H(f+f_c) = 2H(f+f_c)$$

THANK YOU