



**SNS COLLEGE OF TECHNOLOGY**  
**An Autonomous Institution**  
**Coimbatore-35**



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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**

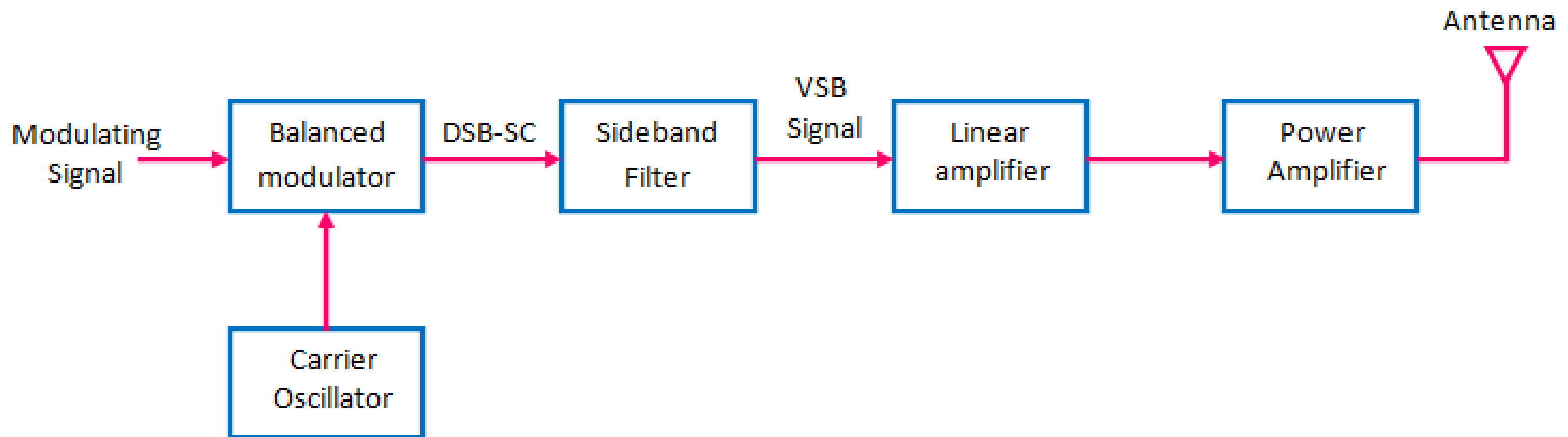
**TOPIC – VSB RECEIVER**



## VSB TRANSMISSION

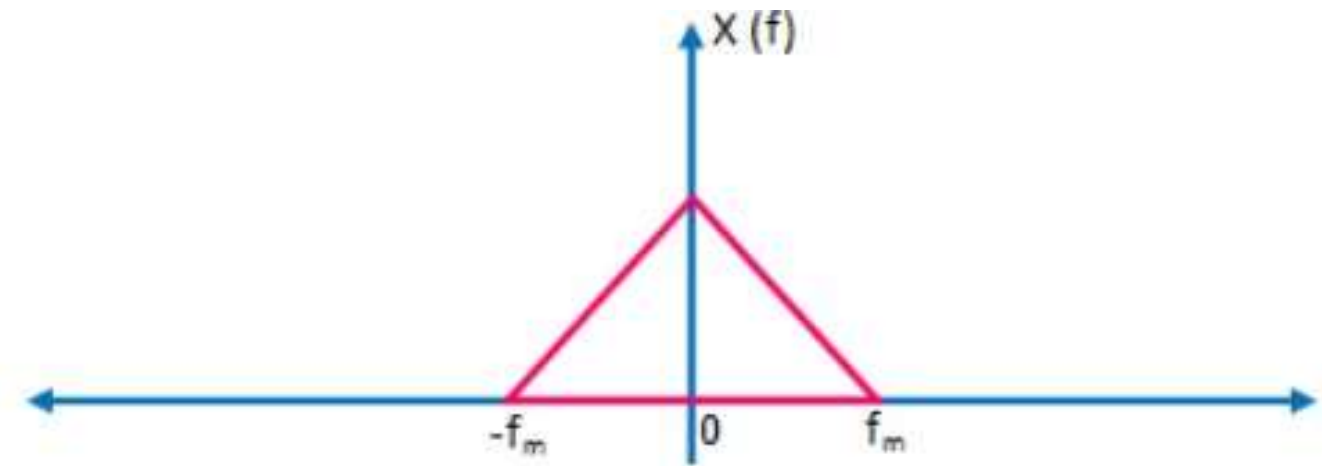


To generate a VSB signal, we have to first generate a DSB-SC signal and then pass it through a sideband filter. This filter will pass the wanted sideband as it is along with a part of unwanted sideband .

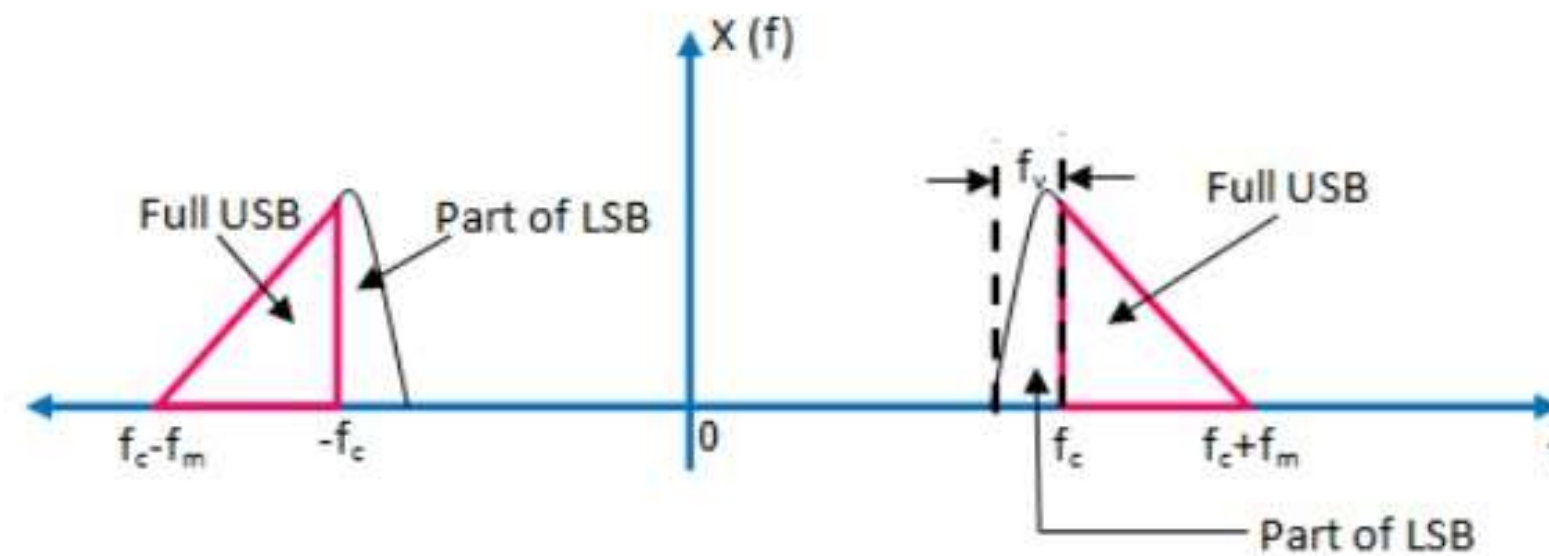




# VSB FREQUENCY SPECTRUM



(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  $f_m$  = Message bandwidth

$f_v$  = 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 .

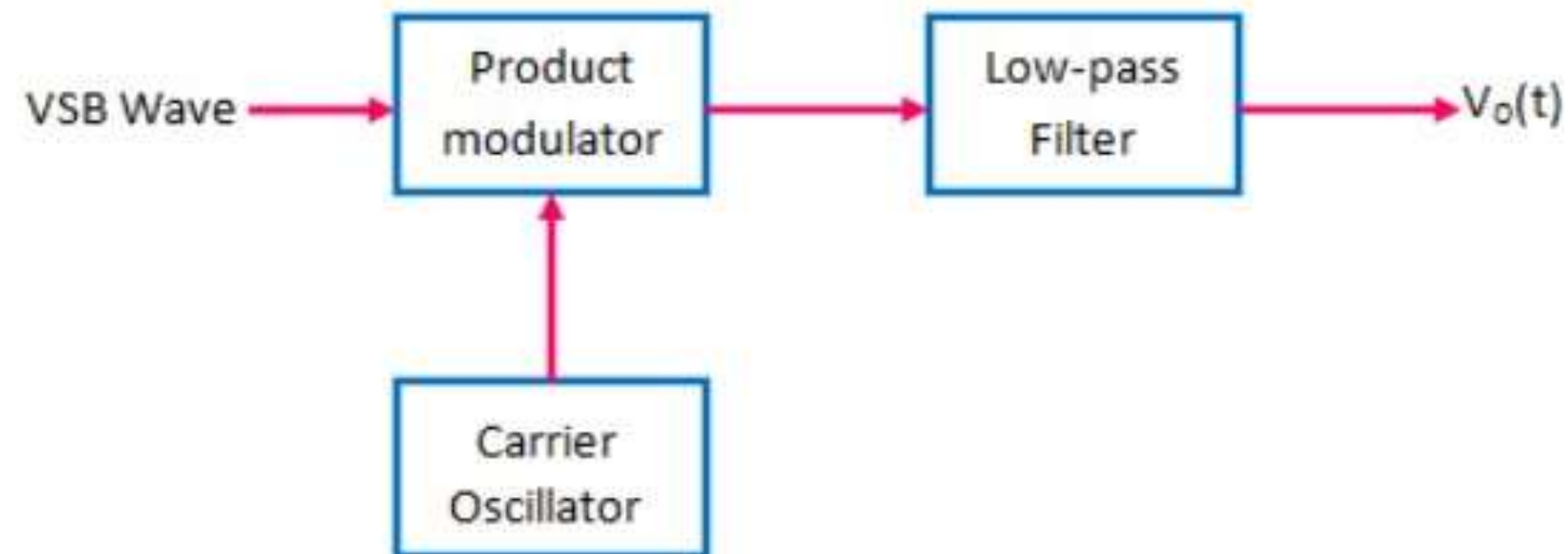


# VSB RECEIVER



## 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  $2f_c$ . This term will be eliminated by the filter to produce output  $v_o(t)$ .

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



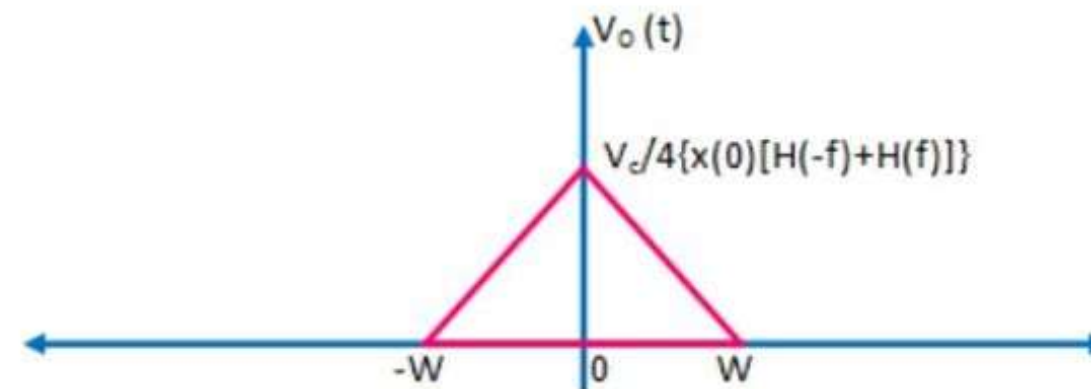


## VSB RECEIVER WORKING OPERATION



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,  $V_o(f)$  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**