

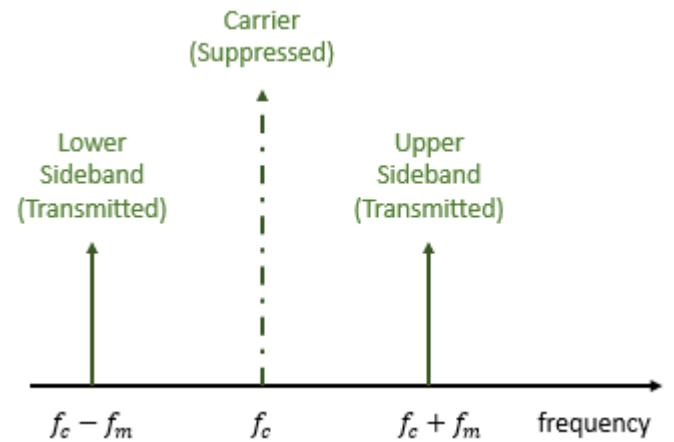
SUPPRESSED CARRIER AMPLITUDE MODULATION SCHEMES

EEEN 462 – ANALOGUE COMMUNICATION

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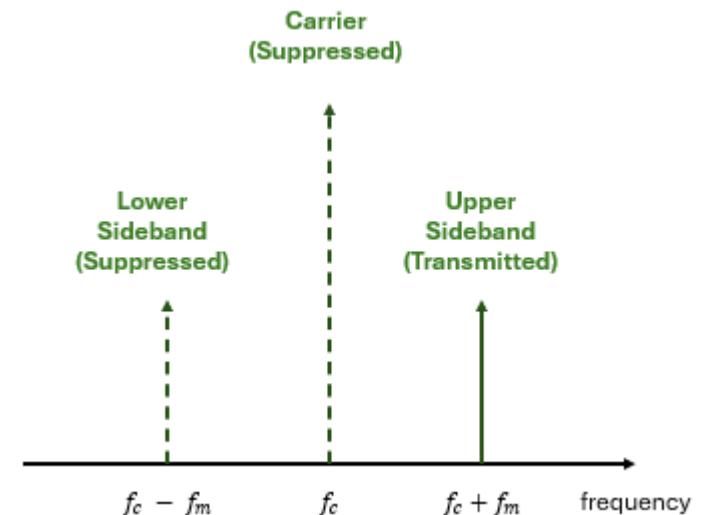
MOTIVATION FOR SUPPRESSED CARRIER IN AMPLITUDE MODULATION

- Conventional amplitude-modulated signals are wasteful of power and bandwidth because they contain a carrier signal and two identical sidebands.
- Suppressed carrier AM transmitters are generally designed to minimize the amplitude of the carrier signal.



WHAT IS SINGLE SIDEBAND AM MODULATION?

1. **Single sideband amplitude modulation (SSB-AM)** suppresses the carrier and a sideband and transmits only one sideband.
2. Suppressing a carrier and a sideband results in a more efficient system as **it uses less bandwidth and transmitter power compared with other AM techniques**



HISTORY OF SINGLE-SIDEBAND (SSB) AM

1915: First patent for SSB by John Carson.

1927: SSB used on long wave transatlantic public radiotelephone circuit between New York and London.

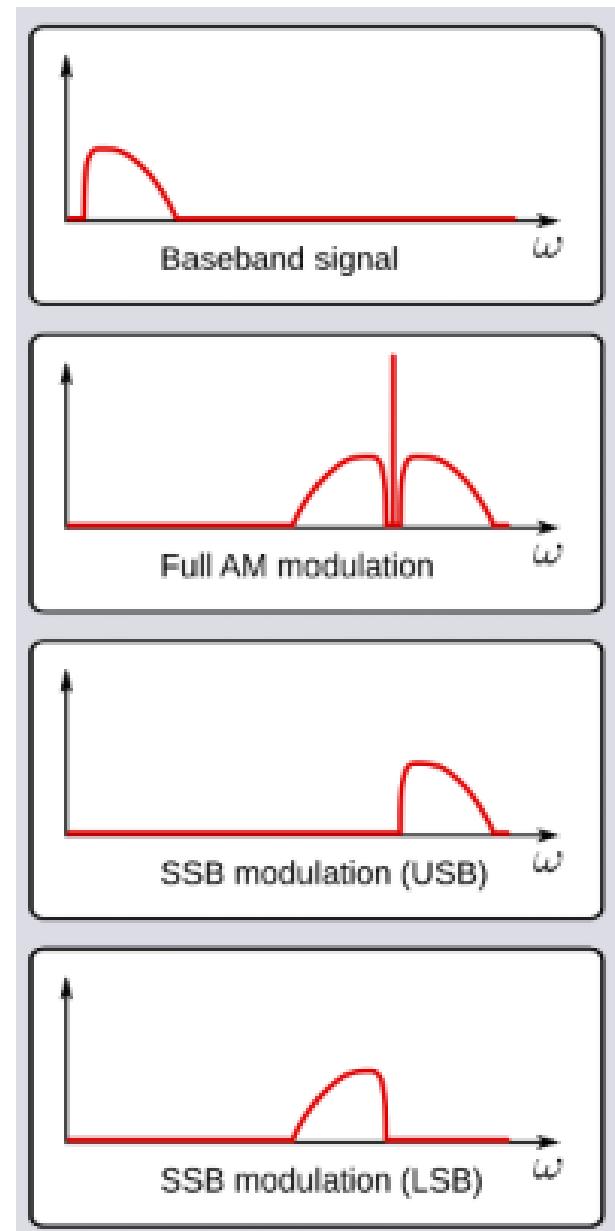
1930: SSB used on long distance telephone communication as frequency-division multiplexing (FDM).

DOUBLE SIDEBAND SUPPRESSED CARRIER AM (DSB-SC)

- **Double Sideband Suppressed Carrier (DSB-SC)** is an AM scheme where only sidebands are transmitted and the carrier is not transmitted as it gets suppressed.
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ADVANTAGES OF SINGLE SIDE-BAND AM

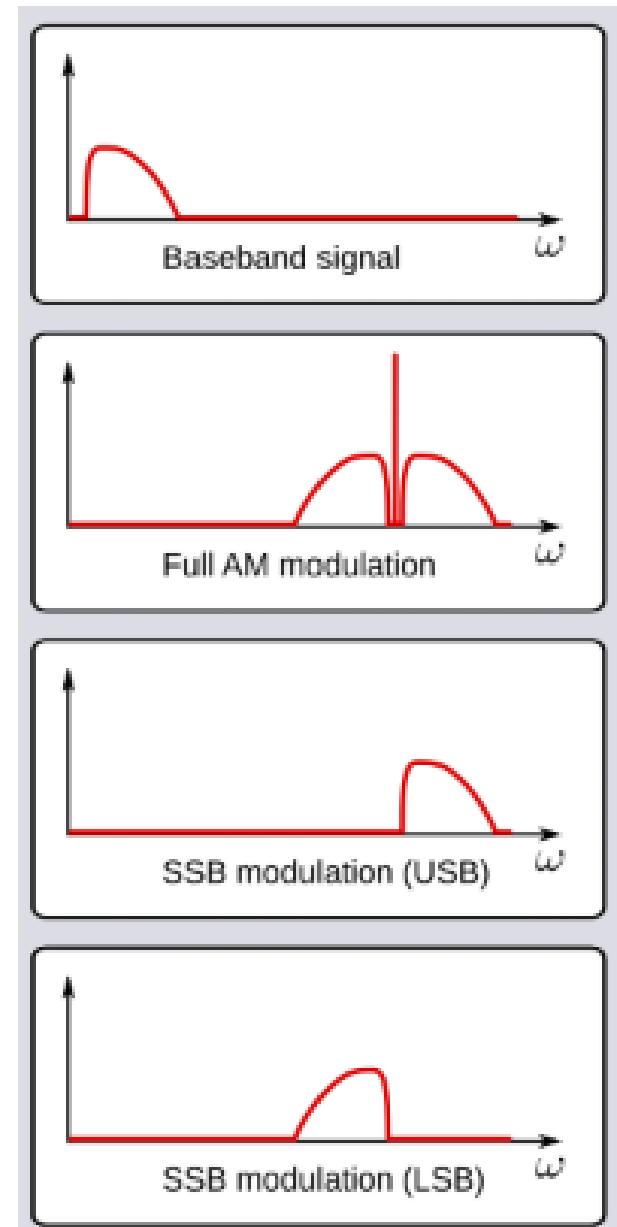
- 1. Less bandwidth required:** SSB signals occupy only half the spectrum space of AM and DSB signals, which allows more signals to be transmitted in the same frequency range.
- 2. Improved range and intelligibility:** SSB uses transmitter power more efficiently, which improves the range and intelligibility of radio communication. SSB uses quarter of power that of traditional AM and half that of DSB-SC.
- 3. Reduced interference:** SSB reduces interference between transmissions on nearby frequencies.
- 4. Reduced distortion:** SSB reduces distortion of the received signal caused by selective fading.
- 5. Reliable communication:** SSB provides a reliable means of communication, particularly in long-distance scenarios.



METHODS OF GENERATING SSB AM

There are THREE basic methods of generating SSB AM signals, i.e

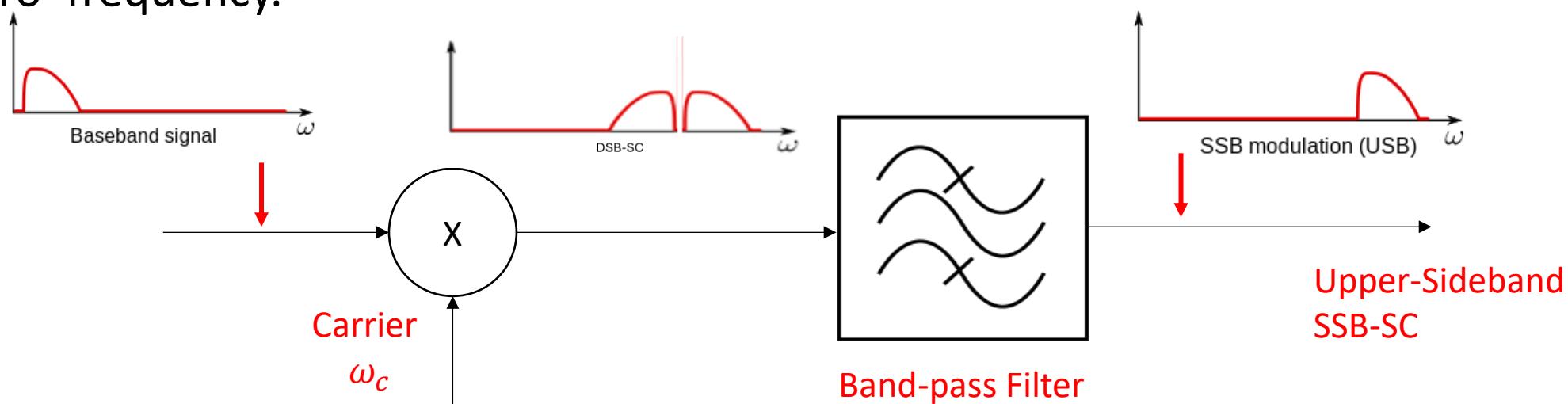
1. **Filter method:** A balanced modulator is used to create a double sideband (DSB) signal, which is then filtered to extract the desired sideband. This is the most common method for generating SSB signals.
2. **Phase shift method** uses two balanced modulators, with the carrier signal phase shifted by 90° between them. This causes one sideband to cancel out when combined.
3. **Weaver's method** uses a simpler RC phase shift network instead of filters or complex phase shifting networks with four balanced modulators, two audio filters, and two 90° phase shifters.



GENERATION OF SSB: FILTER METHOD

Filter method (also called frequency discrimination method) of SSB generation is based on suppressing one of the sidebands from the double-side-band suppressed carrier (DSB-SC) modulated waveform.

The **band pass filter** should have sharp cut-off, which is a difficult constraint for practical implementation, especially when the message signal has significant components near the 'zero' frequency.

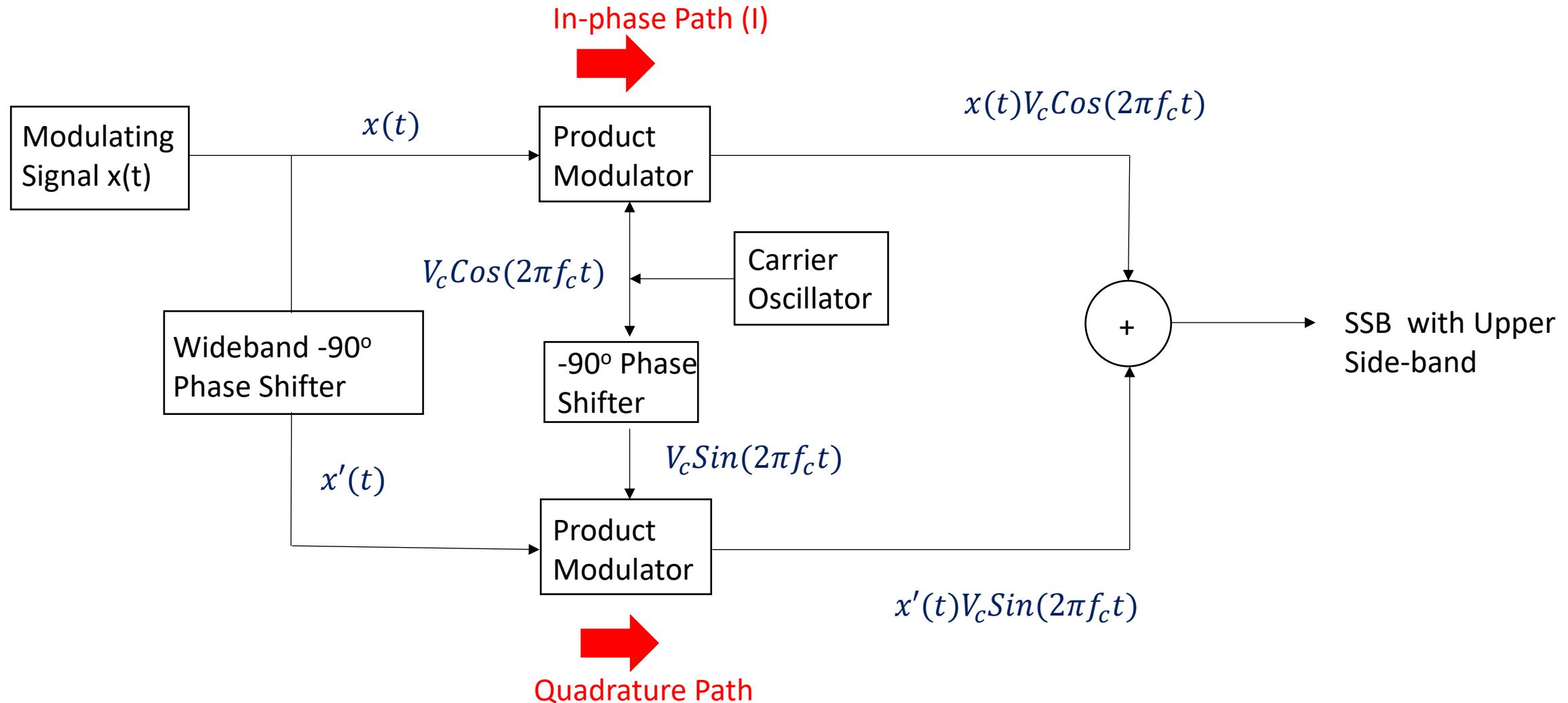


Limitations:

1. The baseband signal must have a guardband. This is easy to provide for voice but difficult for certain signals, e.g. video
2. The baseband signal must be appropriately related to the carrier.

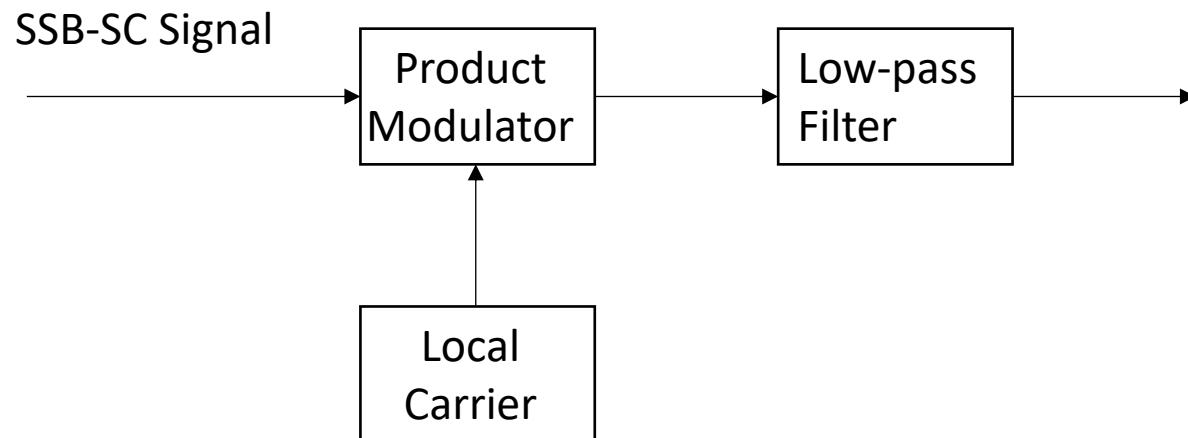
PHASE SHIFT METHOD OF GENERATING SSB

In SSB modulation with phase discrimination method, the suppressed carrier is multiplied with message signal in one channel and multiplied with -90° phase shifted message signal in the other channel and the product signal from the two channel are combined to produce the SSB signal.



DEMODULATING SSB SIGNALS

- SSB demodulation employs a locally generated coherent carrier as shown.



DEMODULATION OF VSB SIGNALS

VSB signals are demodulated by using multiplying the VSB signal with a locally generated carrier

