

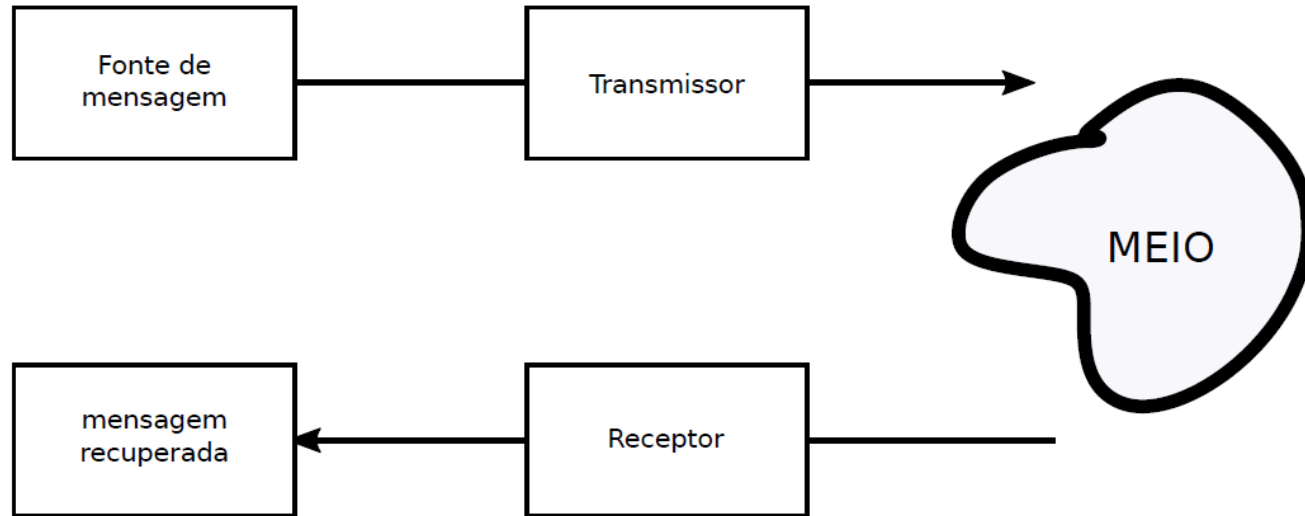
Camada Física da Computação

Projeto 8 - Modulacao AM

2018 – Engenharia da computação

Rodrigo Carareto

Várias fontes, vários receptores, bandas passantes...



O problema a ser enfrentado: vários emissores, vários receptores

UNITED STATES FREQUENCY ALLOCATIONS

[illegible]

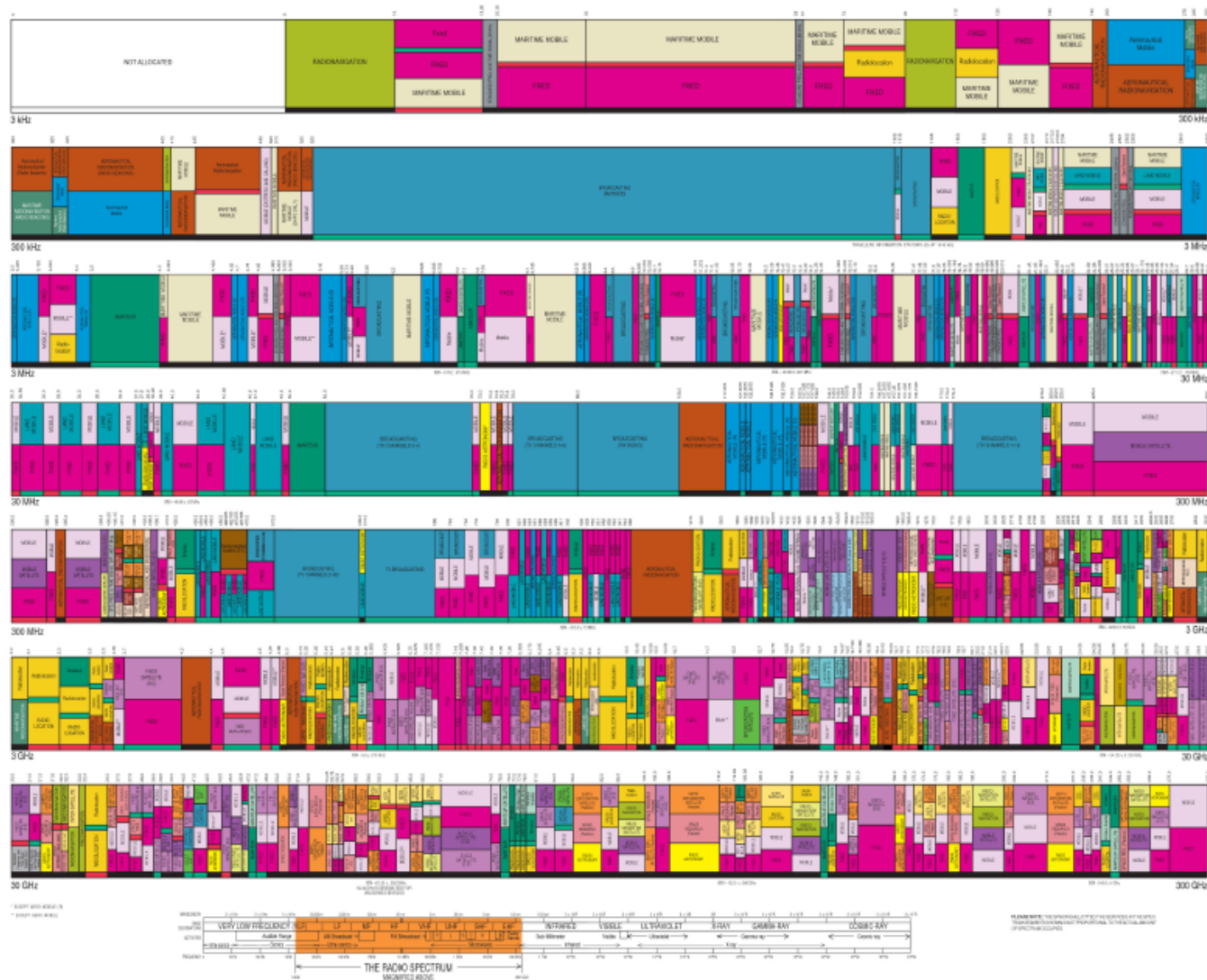
 GOVERNMENT DISCLOSE GOVERNMENT/NON-GOVERNMENT SHARED
 NON-GOVERNMENT DISCLOSE

SERVICE	EXAMPLE	DESCRIPTION
Primary	Fixed	Capital Letters
Secondary	Blank	1st Capital with lower case letter

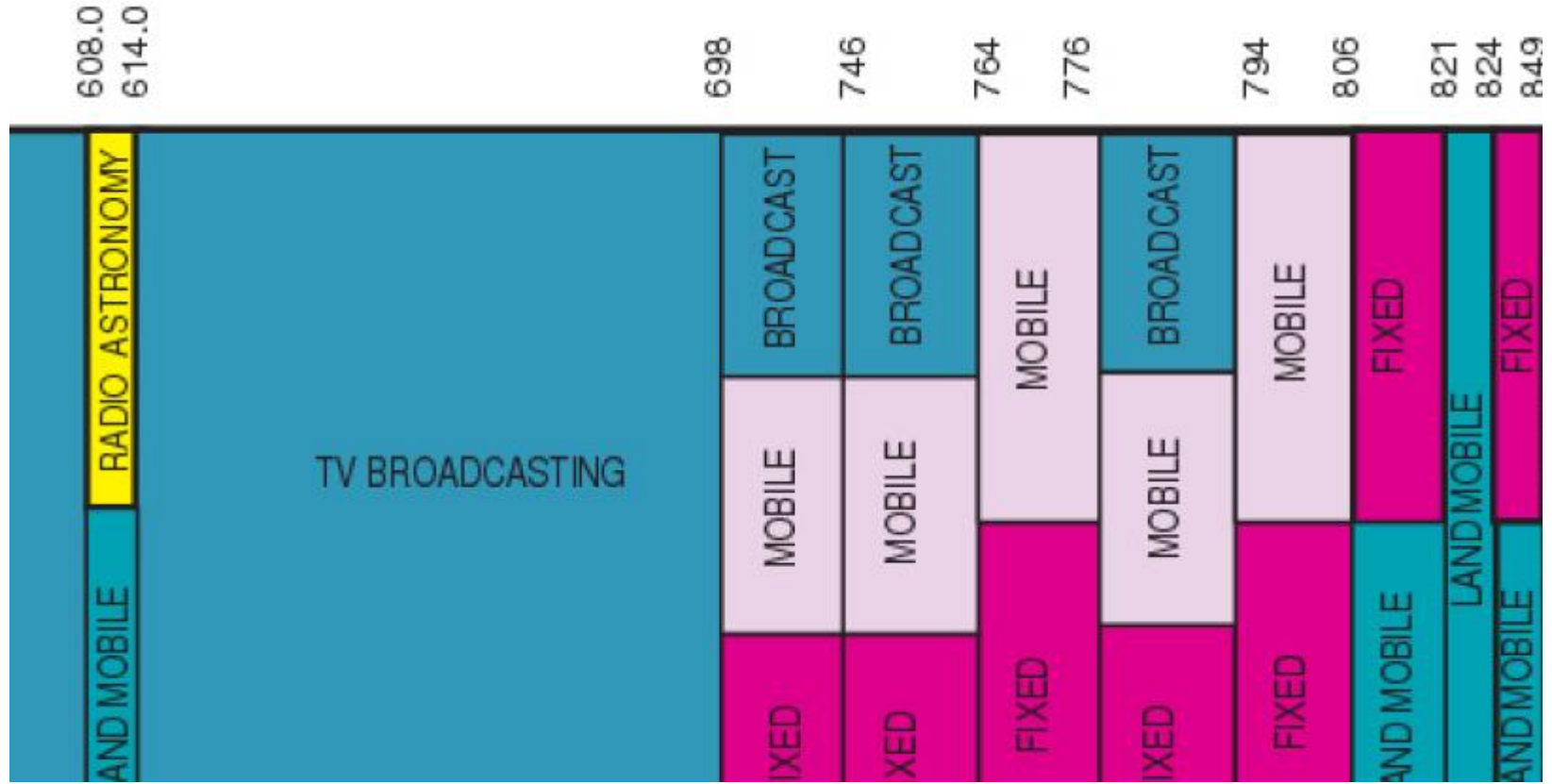
The chart is a graphic representation of the period of the table of Frequency-Associations used by the FCI and FCI-2. It does not completely reflect of updates, i.e. additions and recent changes made in the Table of Frequency-Associations. Therefore, for complete information, users should consult the



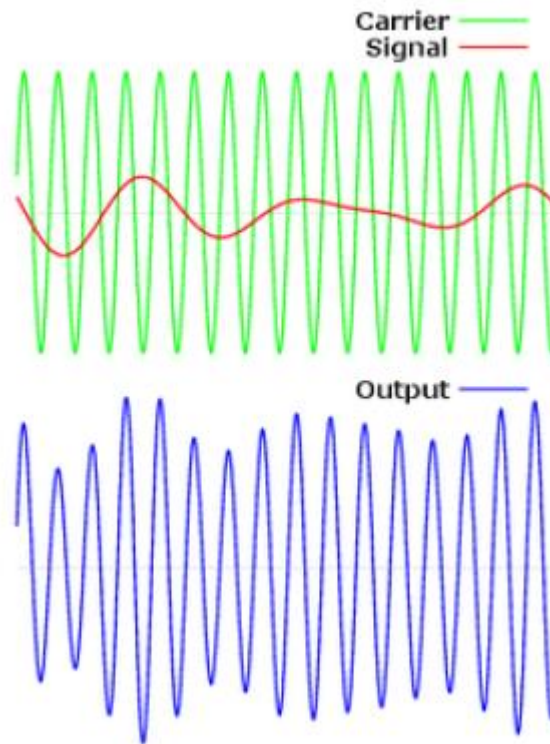
U.S. DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Office of Spectrum Management
October 2020



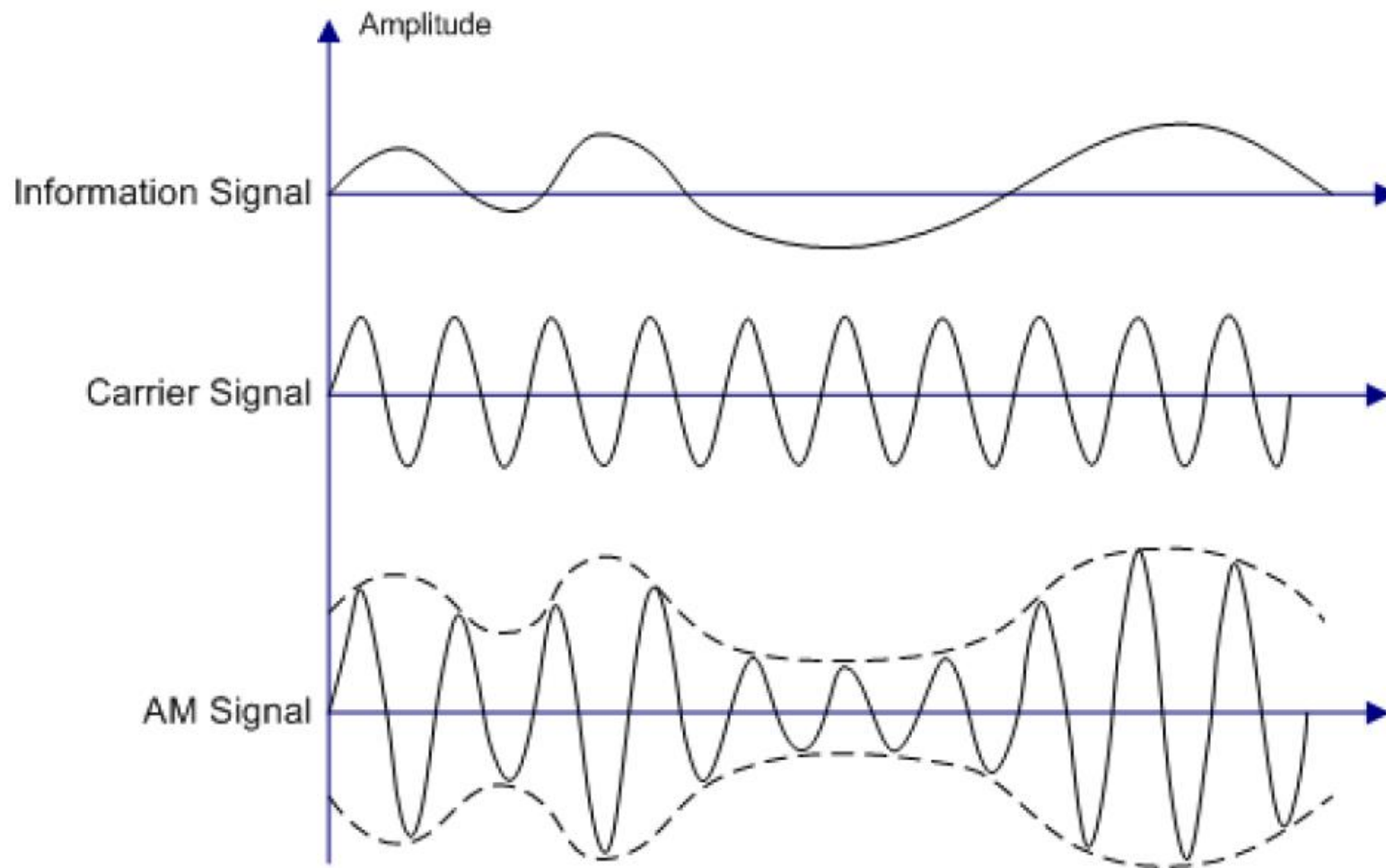
Bandas americanas



Como colocar informação em uma frequência única de recepção?



Modulação AM

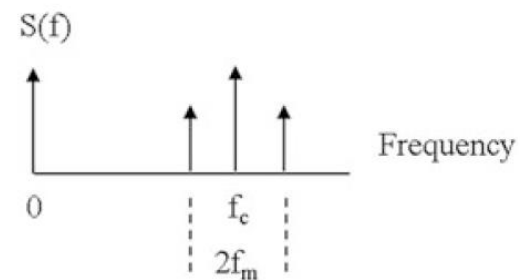
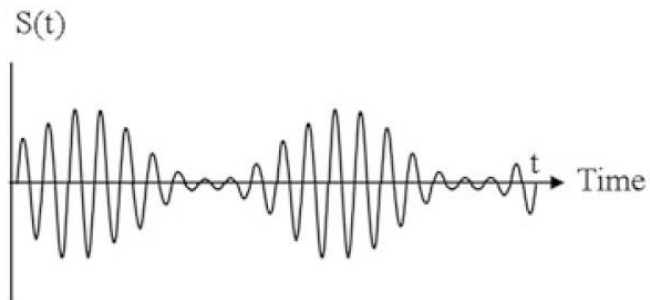
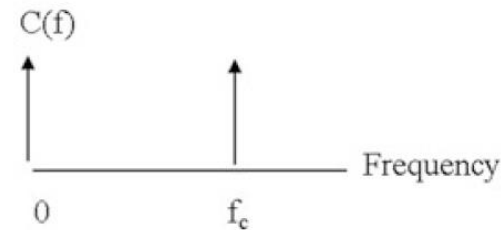
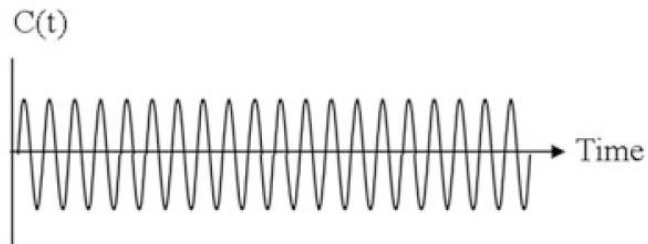
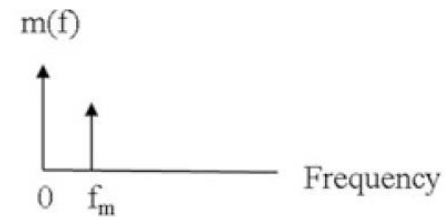
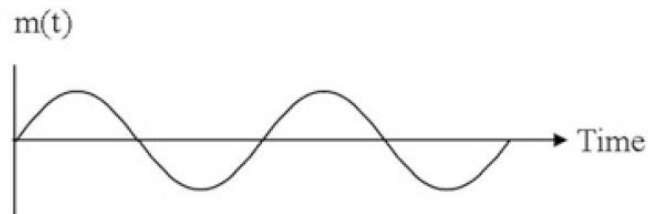


Modulação AM

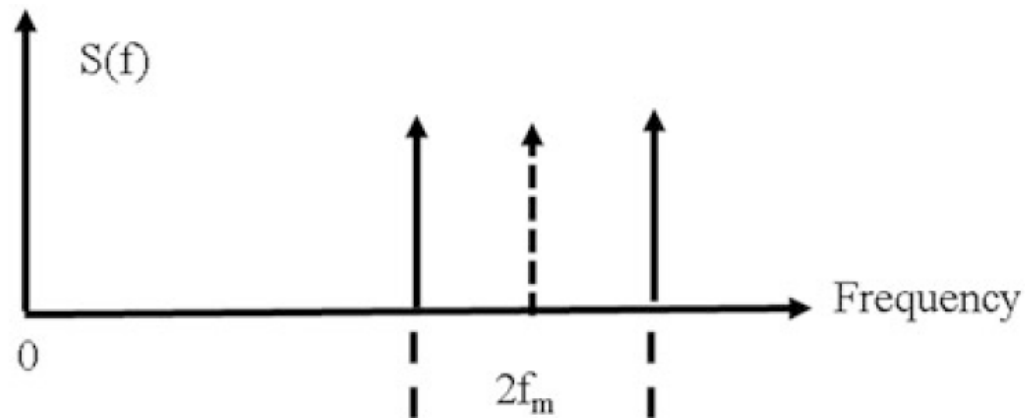
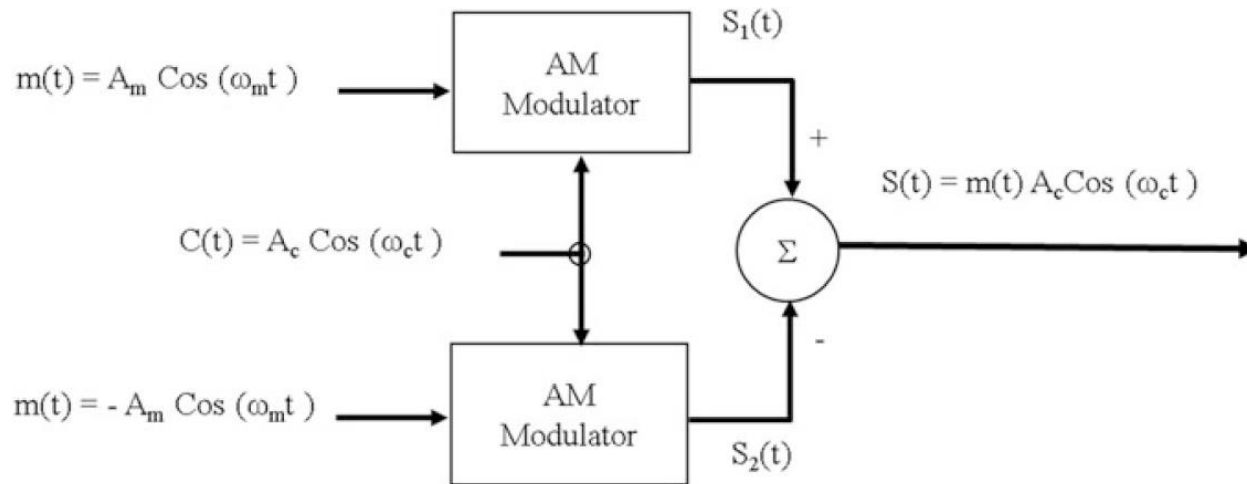
- $m(t) = A_m \cos(2\pi f_m t)$
- $C(t) = A_c \cos(2\pi f_c t) f_c \gg f_m$
- $S(t) = [1 + m(t)]C(t)$
 $= C(t) + m(t)C(t)$

Modulação AM

- $m(t) = A_m \cos(2\pi f_m t)$
- $C(t) = A_c \cos(2\pi f_c t)$ $f_c \gg f_m$
- $S(t) = [1 + m(t)]C(t)$
 $= C(t) + m(t)C(t)$



Modulação AM DSBSC



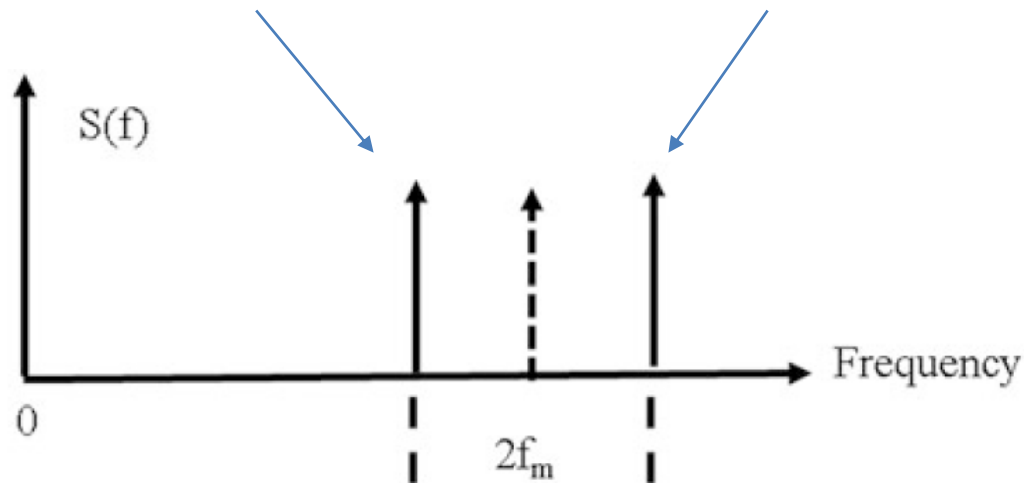
Modulação AM DSBSC

$$S(t) = M \cos(2\pi f_m) \cdot C \cos(2\pi f_c)$$

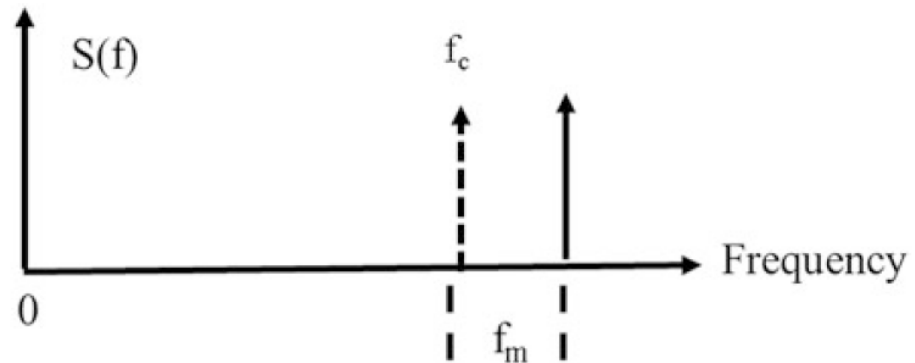
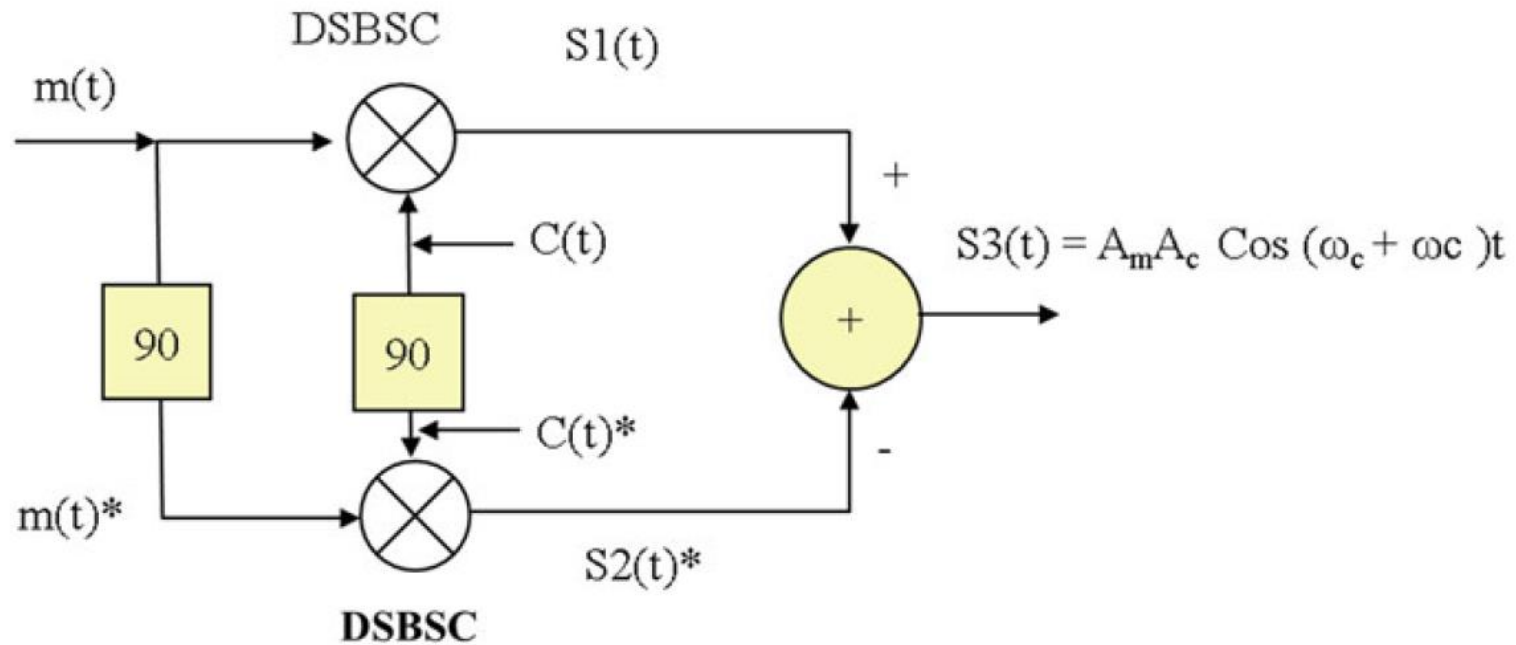
$$S(t) = M \sin(2\pi f_m + \phi) \cdot C \sin(2\pi f_c + \phi)$$

$$\sin(a)\cos(b) = \frac{1}{2} (\sin(a + b) + \sin(a - b))$$

$$S(t) = \frac{MC}{2} \sin(2\pi(f_c - f_m)t - \phi) + \frac{MC}{2} \sin(2\pi(f_c + f_m)t + \phi)$$



Modulação AM SSB



Demodulação

$$S(t) = \frac{MC}{2} \sin(2\pi(f_c - f_m)t - \phi) + \frac{MC}{2} \sin(2\pi(f_c + f_m)t + \phi)$$

Multiplica-se o sinal pela portadora novamente

$$S(t) = \left[\frac{MC}{2} \sin(2\pi(f_c - f_m)t - \phi) + \frac{MC}{2} \sin(2\pi(f_c + f_m)t + \phi) \right] C \sin(2\pi f_c t)$$

Como

$$\sin(a)\cos(b) = \frac{1}{2} (\sin(a + b) + \sin(a - b))$$

$$S'(t) = \frac{1}{4} [\underbrace{\cos(2\pi f_m t) - \cos(2\pi(2f_c + f_m)t)}_{\text{Alta freq}}] + \frac{1}{4} [\underbrace{\cos(-2\pi f_m t) - \cos(2\pi(-2f_c + f_m)t)}_{\text{Alta freq}}]$$

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