6.3.3 Commercial FM transmission

* Commercial FM stations are broadcasting information on frequency ranges starting from 88 MHz – 108 MHz
* The Cararrier Spacing between adjacent channels is selected to be 200 kHz (0.2 MHz)
* The carrier spacing is equivalent to the bandwidth of each channel which is computed as shown below

$B.W = 2f_m(1+\beta)$ } Carson's rule }

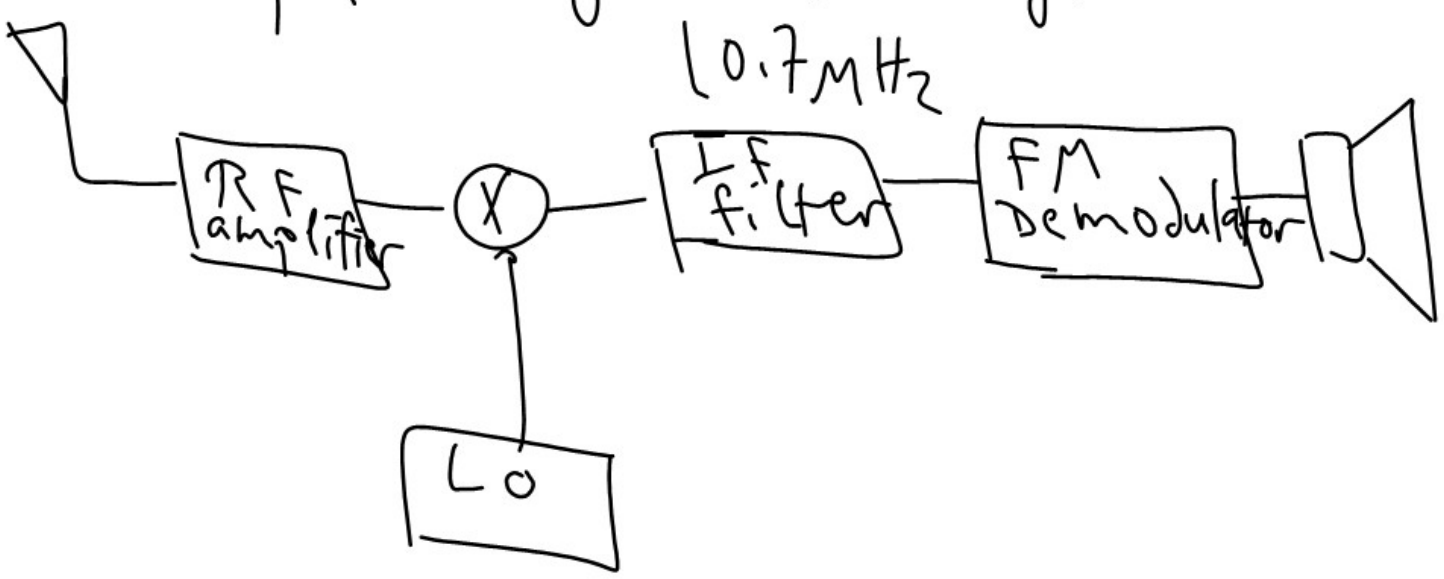
$= 2f_m + 2\Delta f$

$f_m = 15\,kHz$, $\Delta f = 75\,kHz$ as specified by the federal Communication Commity (FCC)

$\therefore BW = \underbrace{2(15)}_{20\,kHz} + 2(75) = 180\,kHz$

another (Guard) frequency to prevent interference between adjacent channels is added to each channel

* The total bandwidth is $= 180 + 20 = 200\,kHz$
* The FM receiver is composed from the following block diagram



6.4 Average power in Angle modulated signal

* The general expression for frequency modulated signal is given by

$$\phi_{WBFM}(t) = A\sum_{n=-\infty}^{\infty} J_n(\beta)\cos(\omega_c + n\omega_m)t$$

* $$\phi^2_{WBFM}(t) = \frac{A^2}{2}\sum_{n=-\infty}^{\infty} J_n^2(\beta)$$

Note that $\sum_{n=-\infty}^{\infty} J_n^2(\beta) = 1$ (a property of the Bessel function)

* $$\phi^2_{WBFM}(t) = \frac{A^2}{2}$$

Ex A given FM transmitter is modulated with a single sinusoidal signal. The output of no modulation is 100 watts into a 50 Ω resistive load. The peak frequency deviation of the transmitter is carefully increased from zero untill the first side amplitude in the output is zero

a) Determine the average power at carrier frequency
b) Determine the average power in the remaining side bands
c) Determine the average power in the second order side band

Solution

from:

$$\phi_{FM}(t) = A\cos(\omega_c t + \frac{a k_f}{\omega_m}\sin\omega_m t)$$