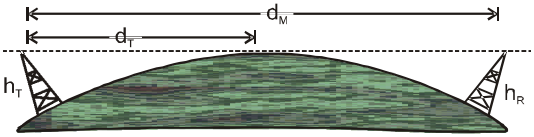
Transmission from tower of height h



- the distance to the horizon $d_T = \sqrt{2Rh_T}$
- $d_M = \sqrt{2Rh_T} + \sqrt{2Rh_R}$

Amplitude Modulation

- The modulated signal $c_m(t)$ can be written as

$$c_m(t) = A_c \sin \omega_c t + \frac{\mu A_c}{2} \cos(\omega_C - \omega_m) t - \frac{\mu A_c}{2} \cos(\omega_C + \omega_m)$$

- Modulation index $m_a = \dfrac{\text{Change in amplitude of carrier wave}}{\text{Amplitude of original carrier wave}} = \dfrac{kA_m}{A_c}$

where k = A factor which determines the maximum change in the amplitude for a given amplitude E_m of the modulating. If k = 1 then

$$m_a = \frac{A_m}{A_c} = \frac{A_{max} - A_{min}}{A_{max} - A_{min}}$$

- If a carrier wave is modulated by several sine waves the total modulated index m_t is given by $m_t = \sqrt{m_1^2 + m_2^2 + m_3^2 + ...}$
- Side band frequencies

$(f_c + f_m)$ = Upper side band (USB) frequency

$(f_c - f_m)$ = Lower side band (LBS) frequency

- Band width $= (f_c + f_m) - (f_c - f_m) = 2f_m$
- Power in AM waves : $P = \dfrac{V_{rms}^2}{R}$

(i) carrier power $P_c = \dfrac{\left(\frac{A_c}{\sqrt{2}}\right)^2}{R} = \dfrac{A_c^2}{2R}$

(ii) Total power of side bands $P_{sb} = \frac{\left(\frac{m_a A_c}{2\sqrt{2}}\right)^2}{R} = \frac{\left(\frac{m_a A_c}{2\sqrt{2}}\right)}{2R} = \frac{m_a^2 A_c^2}{4R}$

(iii) Total power of AM wave $P_{Total} = P_c + P_{ab} = \frac{A_c^2}{2R}\left(1+\frac{m_a^2}{2}\right)$

(iv) $\frac{P_t}{P_c} = \left(1+\frac{m_a^2}{2}\right)$ and $\frac{P_{sb}}{P_t} = \frac{m_a^2/2}{\left(1+\frac{m_a^2}{2}\right)}$

(v) Maximum power in the AM (without distortion) will occur when $m_a = 1$ i.e., $P_t = 1.5\ P = 3P_{ab}$

(vi) If I_c = Unmodulated current and I_t = total or modulated current

$$\Rightarrow \frac{P_t}{P_c} = \frac{I_t^2}{I_c^2} \Rightarrow \frac{I_t}{I_c} = \sqrt{\left(1+\frac{m_a^2}{2}\right)}$$

Frequency Modulation

- Frequency deviation δ = = $(f_{max} - f_c) = f_c - f_{min} = k_f \cdot \frac{E_m}{2\pi}$
- Carrier swing (CS) = CS = $2 \times \Delta f$
- Frequency modulation index (m_f)

=. $m_f = \frac{\delta}{f_m} = \frac{f_{max} - f_c}{f_m} = \frac{f_c - f_{min}}{f_m} = \frac{k_f \ \ E_m}{f_m}$

- Frequency spectrum = FM side band modulated signal consist of infinite number of side bands whose frequencies are $(f_c \pm f_m)$, $(f_c \pm 2f_m)$, $(f_c \pm 3f_m)$.....
- Deviation ratio = $\frac{(\Delta f)_{max}}{(f_m)_{max}}$
- Percent modulation , m = $\frac{(\Delta f)_{actual}}{(\Delta f)_{max}}$