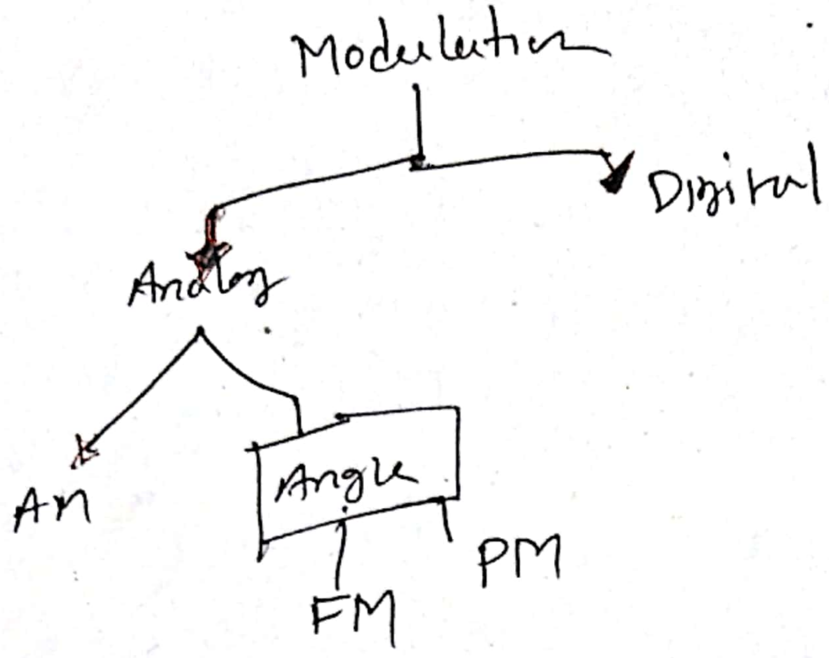


information / message / modulating / baseband signal

cutoff Fe

$fm < Fc < fs - fm$ LOS

antenna is shortened, Signal ↑ is reduced

adjusment of bandwidth,

multiplexing

$$AM \Rightarrow \quad Y = A_c(1 + B \cos(2\pi f_m t)) \cdot \cos(2\pi f_c t)$$

$B = \frac{A_m}{A_c} \,/\, \frac{V_m}{V_c} \Rightarrow$ Modulation Index / Modulation Depth

$B = 1 \Rightarrow$ 100% modulation / modulated wave

$B < 1 \Rightarrow$ Under modulation / n

$B > 1 \Rightarrow$ Over modulation / modulated wave

~~$B = 0 < 1$~~

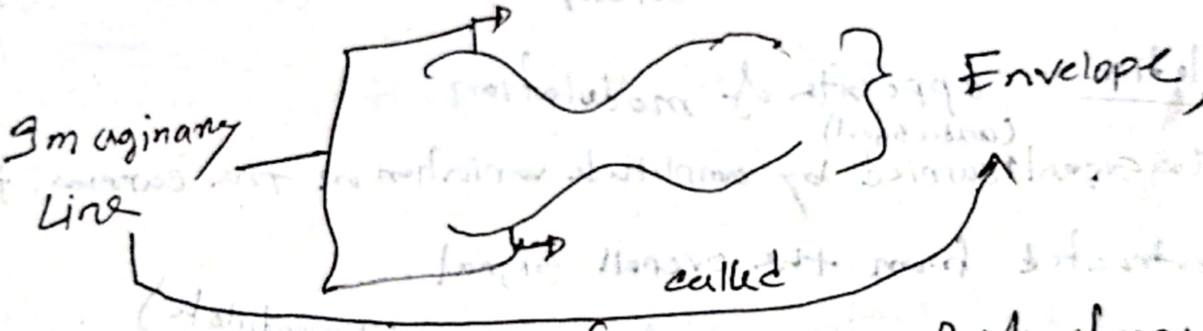
$\boxed{0 \le B \le 1}$

→ [illegible]

Information / signal distortion

$A_m > V_c \Rightarrow$ Signal Distortion

$B = \frac{V_m}{V_c}$ or $B = \frac{A_{max} - A_{min}}{A_{max} + A_{min}}$



$f_c > f_m \Rightarrow$ carrier frequency is high frequency.

low frequency

$$B_{Am} = 2B$$

Am Demodulation: ↳ Extracted from receive signal

↳ Circuit / software defined radio.

used for → Recover the information content from.

used: Broadcast receivers, Professional radio communication equipment, walkie talkies.

Envelope ⇒ The envelope of a signal is created by the low frequency signal.

If modulating signal = sinusoidal then envelope of the modulated RF signal = sinusoidal

Demodulation: opposite of modulation

↳ The signal (audio signal) carried by amplitude variation on the carrier. that is extracted from the overall signal

Envelope Detector: ↳ used to detect (Demodulate) high level amplitude modulation wave.

↳ Demodulation by squaring of modulated signal $s(t)$ then ~~Filter~~ low pass filter used then high frequency is removed

$$M(t) = \frac{A_c}{4}(1 + Bm(t))$$

↳ amdemod (y, f_c, f_s)

↳ f_s = sampling $= 2f_m$ { 1. ± ধরে maximum f_m ; 2. ± ধরে $2(f_{m_1} + f_{m_2})$ }

FM ⇒ Frequency increased when Amplitude of message signal increases

no ~~varies the~~ .

Instantaneous frequency, $f_i = f_c + k_f\, m(t)$

$\hookrightarrow$ proportionality constant

$s(t) = A_c \cos(2\pi f_c t + \beta \sin(2\pi f_m t))$ $\hookrightarrow$ cos এর হবে

$s(t) = A_c \sin(2\pi f_c t + \beta \sin(2\pi f_m t))$ $\rightarrow$ ~~sine~~ এর sin

$\beta = \dfrac{f_d}{f_m}$ $\rightarrow$ frequency deviation

$= \dfrac{\cancel{k_f A_m}}{\cancel{\omega_m}}$ $\quad f_d = k_f A_m$

$$\omega_i = \frac{d\,\theta_i(t)}{dt}$$

$\theta_i t = 2\pi \int f_i\, dt$ $\rightarrow$ integration হবে.

Amplitude বাড়লে Frequency বাড়ে কমলে কমে

(+) peak point এ সর্বোচ্চ হবে.

$\hookrightarrow$ Carrier ~~er~~ Frequency থেকে বেশি Frequency হবে.

$B_{\cancel{FM}} = 2(1+\beta)\,B$

$\hookrightarrow 4$

Signal $\rightarrow$ $\boxed{VCO}$ $\leftarrow$ output

F. Demodulation:

↳ FM detection.

used in older circuit and technology.

↳ is a key process in the reception of F. modulated signal

↳ signal has been received, filtered, Amplified.

↳ Found in any receiver. (broadcast receiver, walkie-talkies)

↳ demod.(y, fc, fs, 'fm');

↳ FM এর diff আছে.

PM: $y(t) = A_c * \cos(2\pi f_c t + s_m .* f_s)$

$s_m = A_m * \cos(2 * pi * f_m * t)$

Amplitude বাড়লে Frequency বাড়ে কমলে কমে

Amplitude বাড়লে lag করে কমলে lead করে

Signal → $\boxed{\frac{d}{dt}}$ → $\boxed{VCO}$ → output

↳ opposite of FM.

$B_{pm} = 2(1+\beta)B$
↳ 2

Pre-Emphasis:

Pre-emphasis ~~refer করে~~ higher frequency (2 to 15) KHz বাড়ার জন্য modulating voltage এর Amplitude কে boosting ~~করার জন্য~~ refer করে

↳ is done at the transmitter.

↳ is to improve the ~~S to~~ signal to Noise ratio.

if time constn 75 μs then $f_c = \frac{1}{2\pi RC}$ cutoff Frequency

↳ High pass filter.

$$= \frac{1}{2\pi \times 75 \times 10^{-6}}$$

$$= 2122$$

$$= \frac{S}{N}$$

= ~~ক~~ Ratio বড় হওয়া লাগে

↳ The output amplitude increase with frequency.

↳ Pre-emphasis circuit increases the energy content of the higher frequency signal so that they will be stronger than high frequency noise components.

↳ increase intelligibility and fidelity.

↳ The pre-emphasis circuit also has upper break frequency where signal flattens out.

$\cancel{f_u = R_1 + R_2} / 2\pi$

De-emphasis: used at the receiver.

↳ Simple low-pass filter

↳ providing normal frequency response

Hence ⇒ combined effect of pre and de-emphasis is to increases the high-frequency component during transmission so that they will be stronger and not masked by noise

pre-emphasis:

SNR ⇒ increment

↳ modulation Index increase

$$B = \frac{f_d}{f_m}$$

f_d can increase and, Am increase

$f_d = k\,Am$