Lecture 8

PRINCIPLES OF SATELLITE COMMUNICATION

Relation between S/N &C/N

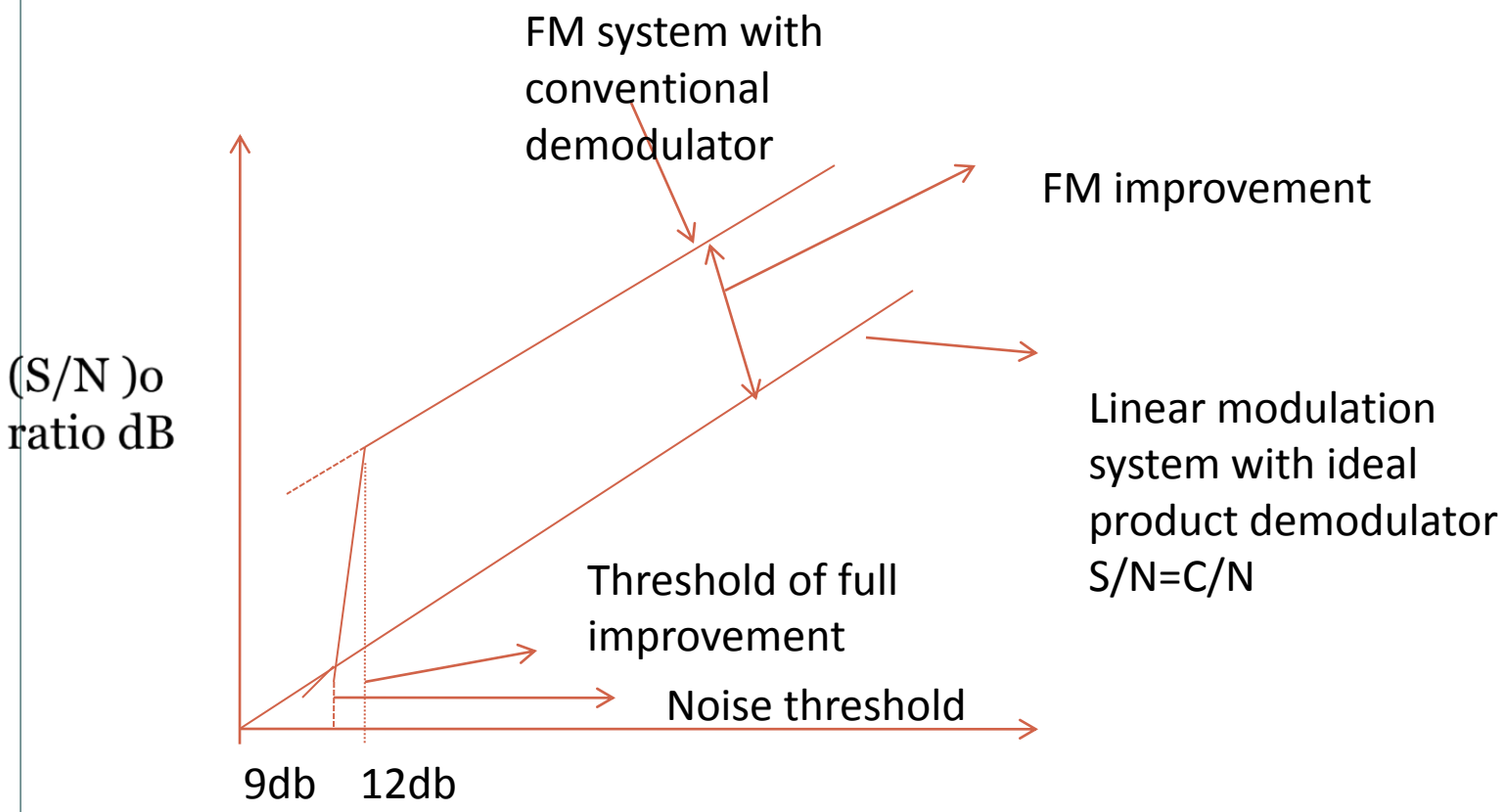
- Performance of FM receiver is judged on the basis of variation of output (S/N)o as function of (C/N) is measured at the input to the limiter.

$$\left(\frac{S}{N}\right)_o = \left(\frac{C}{N}\right)_i \frac{3}{2}m^2$$

- The second term on RHS gives improvement by FM in return for BW sacrifice

$$\left(\frac{S}{N}\right)_{odB} = \left(\frac{C}{N}\right)_{idB} + 10\log\frac{3}{2}m^2$$

- As (C/N)i decreases (S/N)o falls more sharply than (C/N)i as seen in the figure below.



Threshold (C/N)i for FM detector

Contt---

- With phase detector

$$\frac{\left(\frac{S}{N}\right)_O}{\left(\frac{C}{N}\right)_i} = (\Delta\phi)^2$$

- Δφ=peak phase deviation
- For non-sinusoidal modulating signal spectrum (0 to fmax Hz)

$$\left(\frac{S}{N}\right)_0 = \left(\frac{C}{N}\right)_i \frac{3B}{2f_{\max}} \left(\frac{\Delta f_{peak}}{f_{\max}}\right)^2$$

Contt---

$$B = 2 f_{\max} (1 + m)$$

$$m = \frac{\Delta f_{peak}}{f_{\max}}$$

$$\left(\frac{S}{N} \right)_0 = \left(\frac{C}{N} \right)_i * 3(1+m)m^2$$

- For large m,$3(1+m)m^2 \approx 3m^2$
- $m << 1, 3(1+m)m^2 \approx 3m^2$

S/N CAN BE IMPROVED

- The above eqn. shows that S/N can be improved by INCREASING THE CARRIER POWER (by increasing level of modulating baseband signal)
- Pre-emphasis at the transmitting system
- De-emphasis at the demodulating network

Power Spectral density

- In audio baseband signal power spectral density is relatively high in low frequency range and falls of rapidly at higher frequencies

- Thus in carrier modulated by audio signal , power spectral density of side bands near the carrier is highest and relatively small near the limits of allocated transmission band

SIGNAL IN SATELLITE LINK

- CHANNEL IS LOCATED AT THE HIGH FREQUENCY END OF THE MULTIPLEXED SIGNAL

$$\left(\frac{S}{N}\right)_{wc} = \left(\frac{C}{N}\right)_{i} * \left(\frac{B}{b}\right)\left(\frac{\Delta f_{rms}}{f_{\max}}\right)^{2}$$

- Where wc represents worst channel , b is voice channel BW (3100 Hz usually) , B is rf BW.