SYSTEM NOISE TEMPERATURE ,C/N AND G/T RATIO

- Thermal noise in its pre amplifier
- PN=KTsB
- SYSTEM NOISE TEMPERATURE IS ALSO CALLED EFFECTIVE INPUT NOISE TEMPERATURE OF THE RECEIVER.
- IT IS DEFINED AS THE NOISE TEMPERATURE OF A NOISE SOURCE LOCATED AT THE INPUT OF A NOISELESS RECEIVER WHICH WILL PRODUCE THE SAME CONTRIBUTION TO THE RECIEVER OUT PUT NOISE AS THE INTERNAL NOISE OF THE ACTUAL SYSTEM ITSELF

SYSTEM NOISE TEMPERATURE ,C/N AND G/T RATIO

- T_s is located at the input to the receiver.
- RF amplifier
- IF amplifier
- Demodulator
- Over all gain at the receiver G
- Narrowest bandwidth is B
- Noise power at the demodulator input is

$$P_n = KT_S BG$$

Noise temp contt---

Pr is the signal power at the input of the RF section of the receiver

signal power at the demodulator input will be PrG

$$\frac{C}{N} = \frac{P_r G}{K T_S B G} = \frac{P_r}{K T_s B}$$

$$P_n = G_{If} K T_{If} B + G_{If} G_m K T_m B + G_{If} G_m G_{RF} K B (T_{RF} + T_{in})$$

$$P_n = G_{If} G_M G_{Rf} \left[\frac{K T_{If} B}{G_{If} G_m} + \frac{K T_m B}{G_{Rf}} + K B (T_{RF} + T_{in}) \right]$$

$$P_n = G_{If} G_M G_{Rf} KB \left[T_{Rf} + T_{in} + \frac{T_{if}}{G_m G_{Rf}} + \frac{T_m}{G_{RF}} \right]$$

$$P_n = G_{If} G_M G_{Rf} KBT_s$$

from above equation

$$\mathrm{KT_s} B = KB \left[T_{Rf} + T_{in} + \frac{T_{if}}{G_m G_{Rf}} + \frac{T_m}{G_{RF}} \right]$$

$$T_s = \left[T_{Rf} + T_{in} + \frac{T_{if}}{G_m G_{Rf}} + \frac{T_m}{G_{RF}} \right]$$

Noise temp cont---

- G/T ratio is 40.7 db k^{-1} at 4 GHz and 5^0 elevation
- Gr varies with frequency f^2
- Ts depends upon the sky noise temperature

Noise temp cont---

$$\frac{C}{N} = \frac{P_T G_T G_R \left(\frac{\lambda}{4\pi d}\right)^2}{K T_S B L_A}$$

$$N_0 = \frac{N}{B}$$

EIRP

$$\left(\frac{C}{N}\right)_{dBHz} = 10\log P_T G_T - 20Log\left(\frac{4\pi d}{\lambda}\right) + 10\log\frac{G_R}{T_S} - 10LogL_A$$

$$-10LogK$$

Gr/Ts -- ratio is called figure of merit

Atmospheric and ionospheric effect on link design

- Absorption
- refraction
- Diffusion(diffraction)
- Rotation of polarization of plane

depend on path length more pronounced at small elevation angles

Absorption and diffusion--- lower layers

---- increase in noise power at receiving antenna

Atmospheric and ionospheric effect on link design –cont-

- Upper layer of atmosphere cause refraction and depolarization
- De polarization is produced when radio waves traverse through the ionosphere layer.
- Below 10 GHz atmospheric attenuation is of no importance
- atmosphere has a small effect on the link quality at frequency between 2GHz and 10 GHz for higher elevation angles

Atmospheric and ionospheric effect on link design – contt---

- Rain attenuation
- Frequency, rainfall rate, diameter and distribution of rain drops

$$A_{rain} = \gamma_r L_e$$

- γ_r specific rain attenuation
- L_e effective path length

Few decibels at very heavy rainfall