Satellife Signal Strength

- power IVI. of electromagnetic signal received at ground Station.
- Primary metric of strength: received power
- Unit: Watts OR decibels milliwatt (dBm)

- Free-space path loss (FSPL)

- Reduction in signal power as it travels through space due to spreading

Assumption: unobstructed line-of-sight path blu receiver & transmitter

FSPL=(4Tdf)2 OR FSPL= 20logod + 20logof + 20logo(47)

With Cle Cotion

d → distance b/w Satellite and receiver f → freq. of signal c → speed of light(3x108m/sec)

Eg Geostationary Satellite at distance 36,000km and a Signal frequency of 129Hz. FSPL?

FSPL = 20 log, (3.6x17m) + 20 log, (12x10 Hz) + 20 log, (4TT)

link Brdget - 911 gains & losses in communication link, to find receive Signal power. [Ps = Pt + Gt + Gr - FSAL - Latin - Lother atmospheric transmitted pones receiver 1055 transmitter Antenna antenna gain gain D Antenna Gain (G) - How well antenna focuses energy in particular direction for parabolic dish antenna Antenna gain G= 20/09(2) + 20/09(D) + 20/09(F) + 20/09(T) 1-> Antenna Efficiency (0.55-0.7 typically) D→ Antenna Diameter. -> Carrier-to-noise Ratio (C/N) oly to pools to - Signal quality wit background noise ·N -> Noise Power (dBm or dBW) S=Po-N K→Boltzmann's constant (1.38×10-23 J/K) N = 10 logio (KTB) T- System noise (K) B -> receiver (HZ)
Bandwith (HZ) High Ch lation Better signal quality

* Factors affecting signal Strength

(1) Atmospheric Attenuation:

to Rain absorbs & Scatters Signals, especially at higher frequencies; Attenuation depends on rain tate (mm/hr)

12-18442 26-40 GHZ

of frequency of 22 GHz.

D Interference: From other safellifes/tercestral sources teduces signal quality.

- [carrier-to-interference = Pr-Pi] y Pi=power of interfering signal.

 (3) Antennat misalignment: loss-due to pointing error (0) Lipointing = 2 (D) 2 & O3dB -> contenns 3dB Bandwidth.
- Satellite uses linear or circular polarization (4) Polatization: mismatch blw transmitter or teceiver can cause loss of 3 dB (for linear-circular mismatch) or upto 200B (for orthogonal polarization)

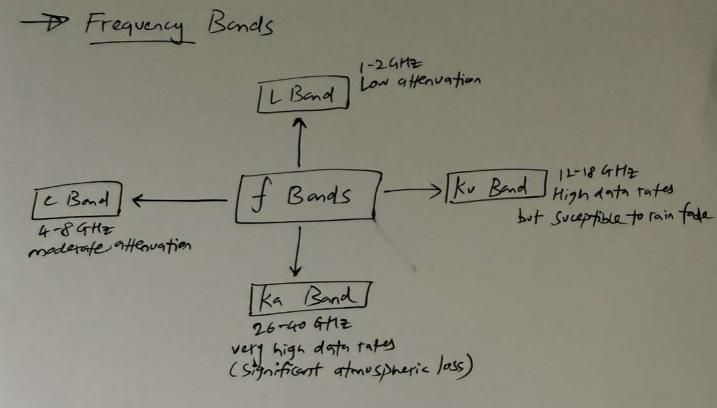
- (5) Distance 1 GEO Satellites - higher path loss but stable position LEO Safellity -> lower path loss but needs tracking.
 - Mathematical modeling of Signal Strength.
 - 1) Friss Transmission Eqn.

 [$P_8 = P_4 G_4 G_8 \left(\frac{\lambda}{4 \text{Trd}}\right)^2$] $\frac{1}{3}\lambda = \frac{\zeta}{4}$ OR [Pr = Pt abm + B GtdBm + Gran - FSPLaB]
 - 2) Noise Figure & system temperature quantifies degradation Tsys = Tantenna + Traccing of signal-to-noise ratio by receiver at frequency of 120%. FaB = 10/09,0(F)
 - 3 Bit Error Rate (BER) Energy per bit.

 to noise power spectral

 density Ratio $\frac{E_b}{N_0} = \frac{c / N}{R_b / B}$ $\int R_b \rightarrow bit$ Rate George & (Egg) 2 1 EMB - sufferen

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- Receiver Sens; tivity

- Minimum detectible Signal (MDS)

MDS = -174 + 10g

MDS = -174 + 10logio(B) + NF) NF>noise figure