LINK DESIGN WITH AND WITHOUT FREQUENCY

In satellite communication systems, there are two types of power calculations. Those are transmitting power and receiving power calculations. In general, these calculations are called as Link budget calculations.

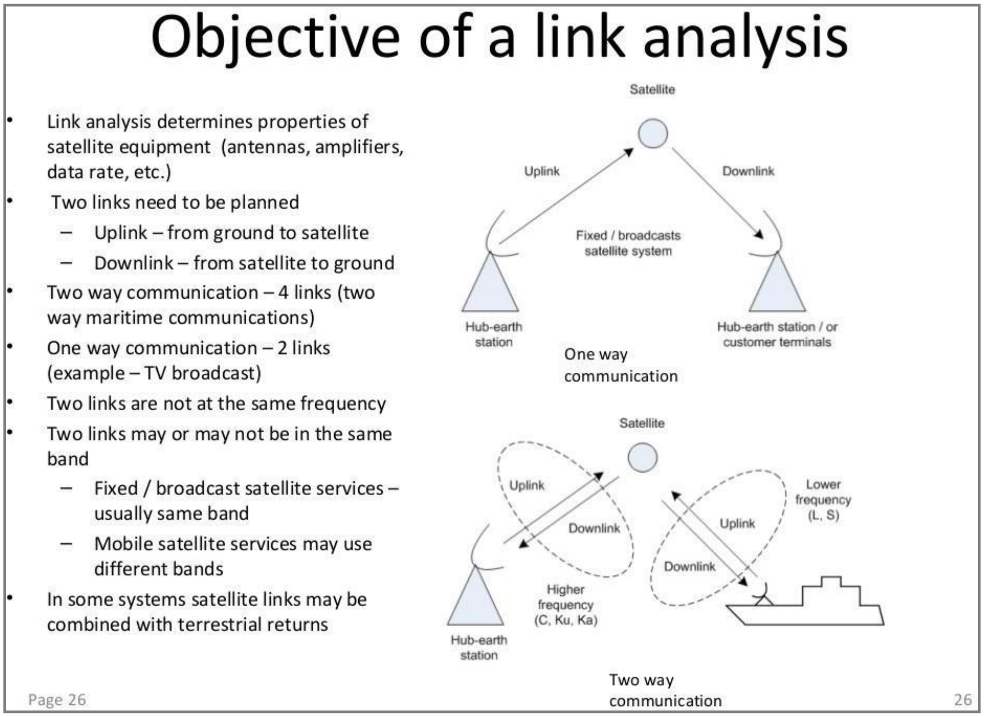
The unit of power is decibel.out

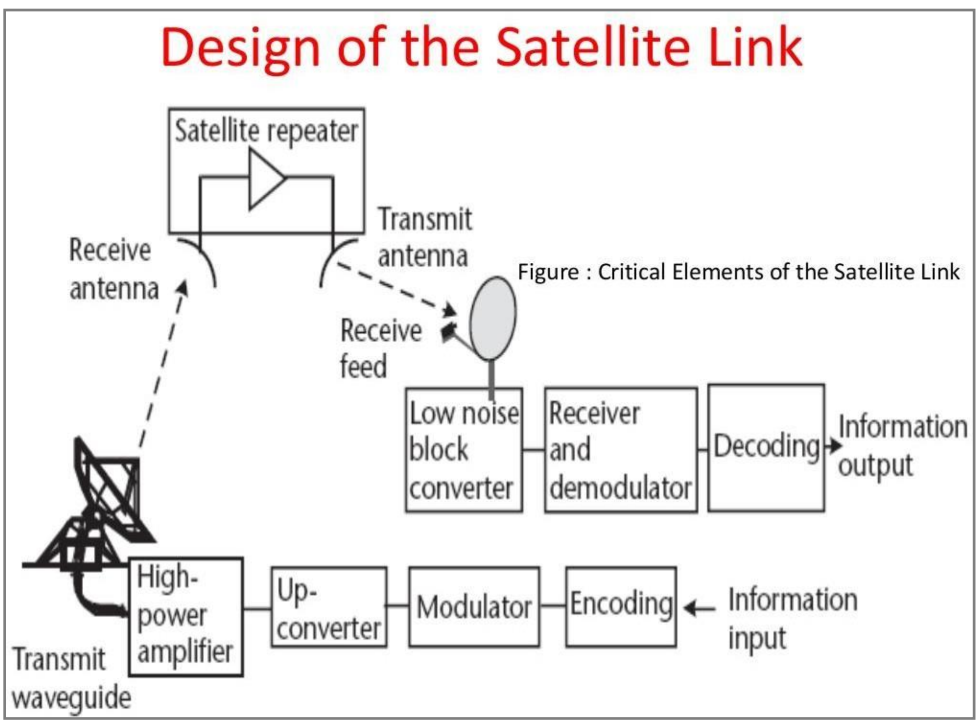
Satellite Link Design

The four factors related to satellite system design:

1. The weight of satellite
2. The choice frequency band
3. Atmospheric propagation effects
4. Multiple access technique

- ❖ The major frequency bands are 6/4 GHz, 14/11 GHz and 30/20 GHz (Uplink/Downlink)
- ❖ At geostationary orbit there is already satellites using both 6/4 and 14/11 GHz every 2º (minimum space to avoid interference from uplink earth stations)





First, let us discuss the basic terminology used in Link Budget and then we will move onto explain Link Budget calculations.

3.11.1 Basic Terminology

An isotropic radiator (antenna) radiates equally in all directions. But, it doesn't exist practically. It is just a theoretical antenna. We can compare the performance of all real (practical) antennas with respect to this antenna.

3.11.1.1 Power flux density

Assume an isotropic radiator is situated at the center of the sphere having radius, r. We know that power flux density is the ratio of power flow and unit area.

Power flux density, $\Psi_i\Psi_i$ of an isotropic radiator is

$$\Psi_i=p_s4\pi r2\Psi i=ps4\pi r2$$

Where, P_sP_s is the power flow. In general, the power flux density of a practical antenna varies with direction. But, it's maximum value will be in one particular direction only.

3.11.1. 2 Antenna Gain

The gain of practical antenna is defined as the ratio of maximum power flux density of practical antenna and power flux density of isotropic antenna.

Therefore, the Gain of Antenna or Antenna gain, G is

$$G=\Psi_m\Psi_{iG}=\Psi_m\Psi_i$$

Where, $\Psi_m\Psi_m$ is the maximum power flux density of practical antenna. And, $\Psi_i\Psi_i$ is the power flux density of isotropic radiator (antenna).

3.11.1.3 Equivalent Isotropic Radiated Power

Equivalent isotropic radiated power (EIRP) is the main parameter that is used in measurement of link budget.

Mathematically, it can be written as

$$EIRP=GPsEIRP=GPs$$

We can represent EIRP in decibels as

$$[EIRP]=[G]+[Ps]dBW[EIRP]=[G]+[Ps]dBW$$

Where, G is the Gain of Transmitting antenna and PsPs is the power of transmitter.

3.11.1.4 Transmission Losses

The difference between the power sent at one end and received at the receiving station is known as

Transmission losses. The losses can be categorized into 2 types.

- Constant losses
- Variable losses

The losses which are constant such as feeder losses are known as constant losses. No matter what precautions we might have taken, still these losses are bound to occur.

Another type of loses are variable loss. The sky and weather condition is an example of this type of loss. Means if the sky is not clear signal will not reach effectively to the satellite or vice versa.

Therefore, our procedure includes the calculation of losses due to clear weather or clear sky condition as 1st because these losses are constant. They will not change with time. Then in 2nd step, we can calculate the losses due to foul weather condition.