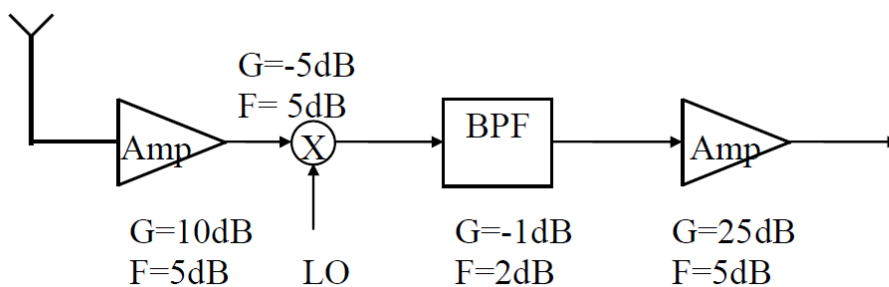


Assignment 1

1. A satellite a distance of 36000 km from earth transmits a signal with a power of 3 W at a carrier frequency of 10 GHz and with an antenna of gain 15 dBi. The earth station receiver has a parabolic antenna with diameter 10 m. (consider an ideal antenna)

- Compute the EIRP at the transmitter.
- Compute the physical area, effective area, and gain of the receiver antenna.
- Compute the power at the receiver antenna output.

2. In a system as shown the antenna picks up an input power of -113dBW and a noise spectral density of -205dBW/Hz. The gain and noise figures of the amplifiers, mixer and bandpass filter are as shown



The filter has a bandwidth of 10MHz. Compute:

- The noise temperature of the antenna.
- The equivalent gain, noise figure and temperature of the system
- The signal power, noise power and signal to noise ratio at input and output of the system.

3. Consider a satellite transmitting 30W at a frequency of 5 GHz via an antenna of 20dB gain. An earth station in the network uses an antenna of 10m diameter with an efficiency of 60%. Assuming the satellite-earth station range to be 40 000 km. Determine:

- The gain of the earth station antenna.
- The path loss (FSL).
- The flux density at the earth station.
- The power received at the output of the earth station antenna.

4. A spacecraft at distance of 100000 km from earth transmits data on a carrier frequency of 2GHz, has a power of 10W and an antenna gain of 10dB. The earth station receiver has a parabolic antenna with a diameter of 50m and a noise temperature of 300°K.

- Compute the power at receiver
- Compute the ratio of carrier power to noise power density.

5. A satellite system has the following parameters:

	Uplink	Downlink
EIRP (dBW)	55	35
G/T (dB/K)	1	18
Free Space Loss (dB)	200	198
Receive Feeder Loss (dB)	2	2
Atmospheric Atten. (dB)	0.5	1.5
Antenna Misalignment Loss (dB)	0.5	0.5

Determine the overall $\frac{C}{N_0}$ value for the satellite link.

6. One of the Mariner spacecraft transmitted to earth from a distance of 1.6×10^{11} m. The carrier frequency was 2.3 GHz, the power was 17 W and the antenna gain was 27dB. The earth station had a parabolic antenna with a diameter of 64m. The effective noise temperature of the receiver was 15°K and the temperature of the receiver antenna was 290°K. The required energy per bit is 6dB.

- What was the bit rate at this distance?
- At which distance was the bit rate half of that computed in a)?
- At which distance was the bit rate twice of that computed in a)?