



GAU
THE AMERICAN
UNIVERSITY
GIRNE CYPRUS

PAUL AUDU TONGA
100212116
MOBILE COMMUNICATION
HOMEWORK 4

Question

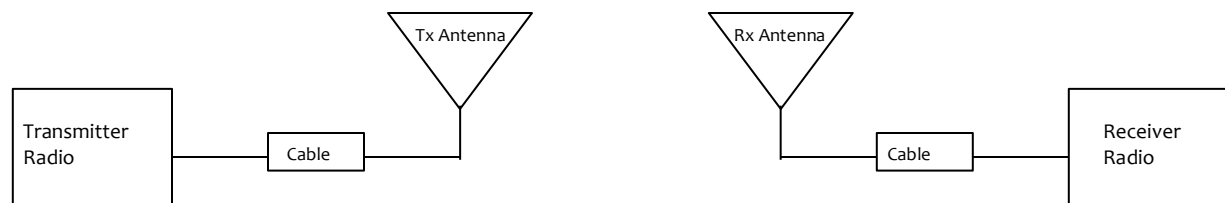
Estimate the feasibility of a 5km link, with one access point and one client radio. The access point is connected to antenna with 10dBi gain with transmitting power of 20dBm and a receiving sensitivity of -89dBm

The client is connected to an antenna with 14dBi gain with transmitting power of 15dBm and receiving sensitivity of -82dBm

The cables in both cases have loss of 2dB at each side of 2.4GHz frequency of operation.

- Draw the block diagram representation of the link
- Calculate the path loss for 5km distance. State any assumptions made.
- Calculate the uplink (from station to client)
- Calculate the downlink (from client to base station)
- Using the parameters provided, is it possible to transmit using the power to reach the distance (5km)
- Do the reverse; from client to base station

Solution



Block Diagram

Base station to Client Transmission

Considering transmission from station to client, first we calculate total gain:

$$\text{Total Gain} = 20\text{dBm} + 10\text{dBi} - 2\text{dB} + 14\text{dBi} - 2\text{dB} = 40\text{dB}$$

Next, the path loss from station to client along 5km distance

$$40 + 20 \log 5000 = 113\text{dB}$$

Subtracting total gain from path loss:

$$40\text{dB} - 113\text{dB} = -73\text{dB}$$

$$\text{EIRP} = P_t \times G_t = 10 \times 20 = 200\text{dB}$$

Analysis: since the signal of -73dB is higher than the minimum sensitivity of the client antenna which is -82dBm, the client's radio will have good reception. There is a 9dB gap, which is enough for transmission. But in extreme weather conditions, the signal may be distorted.

Client to Base Station Transmission

First, we add up all the gains and subtract the losses:

$$20dBm + 10dBi - 2dB + 10dBi - 2dB = 35dB$$

The path loss remains the same as 113dB. The effective signal is:

$$35dB - 113dB = -78dB$$

$$EIRP = P_t \times G_t = 15 \times 14 = 210dB$$

Analysis: The signal strength is higher than the -89dBi sensitivity level of the antenna, with a fading margin of 11dB. This will provide clear signal reception. An increase in the size of the antenna dish could boost the signal strength.