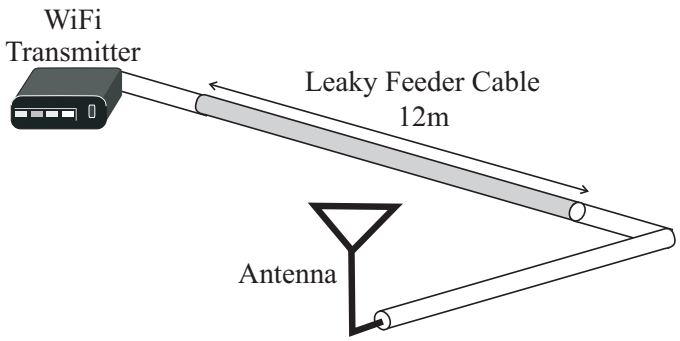
ECE 3025 Homework 6: Lossy Transmission Lines

1. When designing in-building wireless coverage, engineers often lay *leaky-feeder coaxial cable* that radiates a small portion of its modulated signal into the environment. The leaky-feeder cable can be modeled as a low-loss transmission line. You decide to deploy a wireless local area network that provides radio coverage to the 3rd floor of Van Leer. To ensure good coverage, you place one antenna on the corner of the building. This antenna is 30m away from the radio transmitter and is connected with a matched coaxial line that is run on top of the drop ceiling (above the tiles overhead). You decide to use a 12m segment of leaky-feeder coax in a section of cabling that passes by an area of poor radio coverage. You measure 30 dBm of power leaving the transmitter and 25 dBm of power entering the antenna. What is the attenuation constant, α, for this line? (5 points)



2. A twisted pair of 22 gauge copper wires insulated with polyethylene connects your house to the BellSouth office 3 miles away. According to the telephone company technical manual, the twisted pair has an inductance of 1 milliHenry/mile, a capacitance of 0.066 microFarads/mile, and series resistance of 50 ohms/mile. There is no shunt loss during dry weather and 10 milliSiemens/mile of shunt loss when the lines are wet. You decide to order DSL service. Thus, you connect a high-speed modem to this twisted pair of wires. The DSL modem selected for his service transmits frequencies from 100 kHz up to 1 MHz. Answer the following questions: (5 points each)

   (a) What is the transit time (in microseconds) and total attenuation (in dB) expected for transmission of data at the lowest frequency used by the modems in dry weather?

   (b) What is the transit time (in microseconds) and total attenuation (in dB) expected for transmission of data at the highest frequency used by the modems in dry weather?

(c) What is the transit time (in microseconds) and total attenuation (in dB) expected for transmission of data at the lowest frequency used by the modems in wet weather?

(d) What is the transit time (in microseconds) and total attenuation (in dB) expected for transmission of data at the highest frequency used by the modems in wet weather?