

Exercise 6

7.5

An earth station receive antenna, located at a latitude of 55° , with 3 dB beamwidth of 0.1° at 10 GHz is pointed directly at the Moon with an elevation angle of 45° . Assuming a rainfall rate of 28 mm/h and feeder loss of 3 dB, calculate the system noise temperature.

7.6

Assuming that the variation of the electron density N with height r is given by $N(r) = N_0 e^{k(1-r)}$, where $N_0 = 10^{12}$ and $k = 10^{-5} \text{ m}^{-1}$, calculate the following parameters for a zenith path: total electron content, Faraday rotation, propagation delay and dispersion for a 30 GHz wave.

7.add

In the Oslo region the average rainfall rate exceeded at 0.01% of a year is 26 mm/h. Calculate the percentage of the year rain attenuation is exceeded for three 5 km paths operating at 10 GHz, 20 GHz, and 40 GHz, all horizontal polarisation. Choose percentages between 0.001% and 1%. Present the result in a semi-logarithmic plot showing percentage of time (ordinate) the link is attenuated (abscissa) due to rainfall. The ordinate is the logarithmic axis and shall be limited to the range 0.001 % to 1 %. [Help: Use the lecture notes or the book. In the latter case, note that the path-length reduction factor, in Equation 7.15, is in error, it should be $\cos\theta$ and not $\sin\theta$. The book has based the satellite path method on ITU-R Recommendation P.618-5 (1997).]

3.add

A jogger lost his smartphone into a fresh water pond. Fortunately, the phone is water proof and an app is running telling exactly where it is located. Furthermore, there is a base station located on a small hill around 100 m away and at 50 m height above the pond. The receiver sensitivity threshold is -105 dBm and the base station transmits 20 dBm EIRP. Assume free space transmission loss between the the base station and surface of the water. At what depth can the mobile be found for radio systems operating at 0.9 GHz and 1.8 GHz?