ECE 6390: Homework 4

Rain Attenuation

Prof. Durgin, Fall 2009, TTh 1:35pm

Individual Assignment

In class we learned the simplified ITU rainfall attenuation model based on regional climate models. On page 322 of your textbook, the full ITU rain attenuation model is explained in exhaustive detail. Write a spreadsheet or Matlab function for computing the rain attenuation given the following inputs: α, k, h_R', h_S, θ, and R. Write a brief discussion of the differences between the full model and the simplified model. Under what conditions do the two models diverge sufficiently? Make some graphs using your code to illustrate your conclusion. Include your code, where possible, as an appendix to your write-up.

Alternate Group Assignment

For Atlanta-based students, two or three people may collaborate and turn in an equivalent Homework 4 assignment (same number of total points). This assignment is identical to the individual assignment with the following additional requirements:

- A more-formal write-up in PDF form submitted to your instructor AND TA electronically.
- Use your formal code to answer the practical problem below (in your write-up).

If you are performing the group assignment, e-mail me a copy of your code in addition to placing it in the appendix of your PDF. Whether you choose the group or individual assignment, it will count the same # of total points in your course grade.

Practical Problem

When the standard 18" circular dish is installed at your home, a DirectTV™ satellite link has 8 dB of extra link power to protect against moderate rain fades. You are in Atlanta and mostly watch satellite C, which is geostationary at 101.0 degrees longitude. Satellite C transmits at 12 GHz with vertical polarization.

(a) On average, how many total minutes out of the year will your TV fail due to rain fade? Assume an earth station altitude of 0.320 km and a rain storm height of 3.500 km. Atlanta is at (+33.78 degrees lat, -84.40 degrees lon)

(b) You go online and discover several Florida companies that offer a special 18"-by-24" "rain-proof" oval dish that has 33% more aperture area than the standard 18" circular dish. After replacing your circular dish with the new oval dish, how many extra minutes of operation does this buy you in Atlanta?