**The University of New Mexico**

**School of Engineering**

**Electrical and Computer Engineering Department**

**ECE 535 Satellite Communications**

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Module # 5: 4.3, 4.7, 4.8, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15

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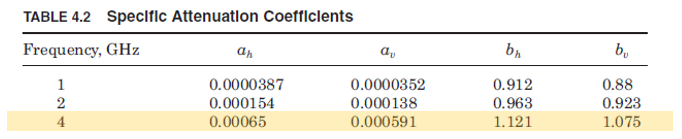
**4.3 Calculate the approximate value of atmospheric attenuation for a satellite transmission at 14GHz, for which the angle of elevation of the earth-station antenna is 15°.**

To approximate, we can assume an average rain rate of 8 mm/h is exceeded for a typical 0.001 percent of the year.

Thus:

**4.7 Compare the specific attenuations for vertical and horizontal polarization at a frequency of 4 GHz and a point rain rate of 8mm/h which is exceeded for 0.01 percent of the year.**

At 4 GHz…



**Horizontal Polarization**

**Vertical Polarization**

**4.10 For a satellite transmission path, the angle of elevation of the earth station antenna is 35°, and the earth station is situated at mean sea level. The signal is vertically polarized at a frequency of 18 GHz. The rain height is 1 km,** **and a rain rate of 10 mm/h is exceeded for 0.001 percent of the year. Calculate the rain attenuation under these conditions.**

**4.11 Repeat Prob. 4.10 when the rain rate of 10 mm/h is exceeded (a) 0.01 percent and (b) 0.1 percent of the year.**

**(a) At 0.01 percent:**

**(b) At 0.1 percent:**

**4.12 Given that for a satellite transmission EL = 22°, R0.01=15 mm/h, h0 = 600 m, hr = 1500 m, and horizontal polarization is used, calculate the rain attenuation for a signal frequency of 14GHz.**

**4.13 Determine the specific attenuation for a circularly polarized satellite signal at a frequency of 4GHz, where a point rain rate of 8mm/h is exceeded for 0.01 percent of the year.**

**4.14 A circularly polarized wave at a frequency of 12GHz is transmitted from a satellite. The point of rain rate for the region is R0.01=13mm/h. Calculate the specific attenuation.**

**4.15 Given that for Prob. 4.13 the earth station is situated at altitude 500m and the rain height is 2km, calculate the rain attenuation. The angle of elevation of the path is 35°.**