RECOMMENDATION ITU-R P.1322

RADIOMETRIC ESTIMATION OF ATMOSPHERIC ATTENUATION

(Question ITU-R 201/3)

(1997)

The ITU Radiocommunication Assembly,

considering

a) the necessity of estimating the atmospheric attenuation on Earth-satellite paths for particular locations where general climatological information is insufficient;

b) that radiometric measurements may be employed to obtain an estimate of slant path attenuation,

recommends

that the following algorithms be used in estimating atmospheric attenuation from radiometric measurements of sky brightness temperature.

1 Path attenuation

To convert radiometrically measured brightness temperature T_b (K) into path attenuation A (dB), the following equation should be used:

$$A = 10 \log_{10} \frac{(T_{mr} - T_0)}{(T_{mr} - T_b)} \quad (1)$$

where:

T_{mr}: atmospheric effective or mean radiating temperature (K)

T_0: cosmic background temperature, usually chosen as 2.7 K.

Equation (1) is derived from the radiative transfer equation under the assumption of low atmospheric absorption and in the absence of scattering. In general, T_{mr} depends upon frequency and attenuation through the physical processes that produce the attenuation. For attenuation values less than 6 dB and frequencies below 50 GHz, T_{mr} can be approximated, with a weak dependence on frequency. Its value can be chosen as 265 K in the 10-15 GHz range and as 270 K in the 20-30 GHz range. When surface temperature is known, however, a first estimate of T_{mr} can be also obtained by multiplying the surface temperature by 0.95 in the 20 GHz band and by 0.94 for the 30 GHz window.