RECOMMENDATION ITU-R P.838-1

SPECIFIC ATTENUATION MODEL FOR RAIN FOR USE IN PREDICTION METHODS

(Question ITU-R 201/3)

(1992-1999)

The ITU Radiocommunication Assembly,

considering

a) that there is a need to calculate the attenuation due to rain from a knowledge of rain rates,

recommends

1 that the following procedure be used.

Specific attenuation γ_R (dB/km) is obtained from the rain rate R (mm/h) using the power-law relationship:

$$\gamma_R = k R^{\alpha} \tag{1}$$

The frequency-dependent coefficients k and α are given in Table 1 for linear polarizations (horizontal: H, vertical: V) and horizontal paths. Values of k and α at frequencies other than those in Table 1 can be obtained by interpolation using a logarithmic scale for frequency, a logarithmic scale for k and a linear scale for α.

The values in Table 1 have been tested and found to be sufficiently accurate for attenuation prediction up to frequencies of 55 GHz.

For linear and circular polarization, and for all path geometries, the coefficients in equation (1) can be calculated from the values in Table 1 using the following equations:

$$k = \left[k_H + k_V + (k_H - k_V)\cos^2\theta \cos 2\tau\right]/2 \tag{2}$$

$$\alpha = \left[k_H \alpha_H + k_V \alpha_V + (k_H \alpha_H - k_V \alpha_V)\cos^2\theta \cos 2\tau\right]/2k \tag{3}$$

where θ is the path elevation angle and τ is the polarization tilt angle relative to the horizontal ($\tau = 45°$ for circular polarization).

TABLE 1

Regression coefficients for estimating specific attenuation in equation (1)

Frequency (GHz)	k_H	k_V	α_H	α_V
1	0.0000387	0.0000352	0.912	0.880
2	0.000154	0.000138	0.963	0.923
4	0.000650	0.000591	1.121	1.075
6	0.00175	0.00155	1.308	1.265
7	0.00301	0.00265	1.332	1.312
8	0.00454	0.00395	1.327	1.310
10	0.0101	0.00887	1.276	1.264
12	0.0188	0.0168	1.217	1.200
15	0.0367	0.0335	1.154	1.128
20	0.0751	0.0691	1.099	1.065
25	0.124	0.113	1.061	1.030
30	0.187	0.167	1.021	1.000
35	0.263	0.233	0.979	0.963
40	0.350	0.310	0.939	0.929
45	0.442	0.393	0.903	0.897
50	0.536	0.479	0.873	0.868
60	0.707	0.642	0.826	0.824
70	0.851	0.784	0.793	0.793
80	0.975	0.906	0.769	0.769
90	1.06	0.999	0.753	0.754
100	1.12	1.06	0.743	0.744
120	1.18	1.13	0.731	0.732
150	1.31	1.27	0.710	0.711
200	1.45	1.42	0.689	0.690
300	1.36	1.35	0.688	0.689
400	1.32	1.31	0.683	0.684