TABLE 4 (*end*)

Parameter	Definition	Limits
R_1 (m)	Representative clutter height (around transmitter)	None
R_2 (m)	Representative clutter height (around receiver)	None
θ_{tca} (degrees)	Terrain clearance angle	0.55° to 40°
θ_{eff} θ_{eff1} θ_{eff2} (degrees)	Transmitter/base effective terrain clearance angles. Annex 5, § 9	Must be positive

If the required horizontal distance is 0.04 km or less, start at Step 17. If the required horizontal distance is greater than 0.04 km and less than 1 km, steps 1 to 16 should be followed with *d* set to 1 km, after which the remaining steps should be followed with *d* set to the required value. Otherwise all steps should be followed with *d* set to the required value.

Step 1: Determine the type of the propagation path as land, cold sea or warm sea. If the path is mixed then determine two path types which are regarded as first and second propagation types. If the path can be represented by a single type then this is regarded as the first propagation type and the mixed-path method given in Step 11 is not required.

Step 2: For any given percentage of time (in the range 1% to 50% time) determine two nominal time percentages as follows:

– wanted time percentage > 1 and < 10, the lower and higher nominal percentages are 1 and 10, respectively;

– wanted time percentage > 10 and < 50, the lower and higher nominal percentages are 10 and 50, respectively.

If the required percentage of time is equal to 1% or 10% or 50%, this value should be regarded as the lower nominal percentage time and the interpolation process of Step 10 is not required.

Step 3: For any wanted frequency (in the range 30 to 4 000 MHz) determine two nominal frequencies as follows:

– where the wanted frequency < 600 MHz, the lower and higher nominal frequencies are 100 and 600 MHz, respectively;

– where the wanted frequency > 600 MHz, the lower and higher nominal frequencies are 600 and 2 000 MHz, respectively.

If the wanted frequency equals 100 or 600 or 2 000 MHz, this value should be regarded as the lower nominal frequency and the interpolation/extrapolation process of Step 9 is not required.

Step 4: Determine the lower and higher nominal distances from Table 1 closest to the required distance. If the required distance coincides with a value in Table 1, this should be regarded as the lower nominal distance and the interpolation process of Step 8.1.5 is not required.

Step 5: For the first propagation type follow Steps 6 to 11. 8 - 11

Step 6: For the lower nominal percentage time follow Steps 7 to 10. 8 -10

Step 7: For the lower nominal frequency follow Steps 8 and 9. 9 - 9

Step 8: Obtain the field strength exceeded at 50% locations for a receiving/mobile antenna at the height of representative clutter, R_2, above ground for the required distance and transmitting/base antenna height as follows:

Step 8.1: For a transmitting/base antenna height h_1 equal to or greater than 10 m follow Steps 8.1.1 to 8.1.6:

Step 8.1.1: Determine the lower and higher nominal h_1 values using the method given in Annex 5, § 4.1. If h_1 coincides with one of the nominal values 10, 20, 37.5, 75, 150, 300, 600 or 1 200 m, this should be regarded as the lower nominal value of h_1 and the interpolation process of Step 8.1.6 is not required.

Step 8.1.2: For the lower nominal value of h_1 follow Steps 8.1.3 to 8.1.5.

Step 8.1.3: For the lower nominal value of distance follow Step 8.1.4.

Step 8.1.4: Obtain the field strength exceeded at 50% locations for a receiving/mobile antenna at the height of representative clutter, R_2, for the required values of distance, d, and transmitting/base antenna height, h_1.

Step 8.1.5: If the required distance does not coincide with the lower nominal distance, repeat Step 8.1.4 for the higher nominal distance and interpolate the two field strengths for distance using the method given in Annex 5, § 5.

Step 8.1.6: If the required transmitting/base antenna height, h_1, does not coincide with one of the nominal values, repeat Steps 8.1.3 to 8.1.5 and interpolate/extrapolate for h_1 using the method given in Annex 5, § 4.1. If necessary limit the result to the maximum given in Annex 5, § 2.

Step 8.2: For a transmitting/base antenna height h_1 less than 10 m determine the field strength for the required height and distance using the method given in Annex 5, § 4.2. If h_1 is less than zero, the method given in Annex 5, § 4.3 should also be used.

Step 9: If the required frequency does not coincide with the lower nominal frequency, repeat Step 8 for the higher nominal frequency and interpolate or extrapolate the two field strengths using the method given in Annex 5, § 6. If necessary limit the result to the maximum field strength as given in Annex 5, § 2.

Step 10: If the required percentage time does not coincide with the lower nominal percentage time, repeat Steps 7 to 9 for the higher nominal percentage time and interpolate the two field strengths using the method given in Annex 5, § 7.

Step 11: If the prediction is for a mixed path, follow the step-by-step procedure given in Annex 5, § 8. This requires use of Steps 6 to 10 for paths of each propagation type. Note that if different sections of the path exist classified as both cold and warm sea, all sea sections should be classified as warm sea.

Step 12: If information on the terrain clearance angle at a receiving/mobile antenna adjacent to land is available, correct the field strength for terrain clearance angle at the receiver/mobile using the method given in Annex 5, § 11.

Step 13: Calculate the estimated field strength due to tropospheric scattering using the method given in Annex 5 § 13, and take the maximum of E and E_{ts}.

Step 14: Correct the field strength for receiving/mobile antenna height h_2 using the method given in Annex 5, § 9.

Step 15: If there is clutter around the transmitting/base terminal, even if at a lower height above ground than the antenna, correct for its effect using the method given in Annex 5, § 10.

Step 16: Apply the slope-path correction given in Annex 5, § 14.

Step *17*: Annex 5, § 15, gives the method for paths less than 1 km. As noted immediately before Step 1 above, it may first be necessary to follow Steps 1 to 16 for d = 1 km.

Step 18: If the field strength at a receiving/mobile antenna adjacent to land exceeded at percentage locations other than 50% is required, correct the field strength for the required percentage of locations using the method given in Annex 5, § 12.

Step 19: If necessary, limit the resulting field strength to the maximum given in Annex 5, § 2. If a mixed path calculation has been made for a percentage time less than 50% it will be necessary to calculate the maximum field strength by linear interpolation between the all-land and all-sea values. This is given by:

$$E_{max} = E_{fs} + d_s E_{se} / d_{total} \qquad \text{dB}(\mu\text{V/m}) \qquad (42)$$

where:

- E_{fs}: free-space field strength given by equation (2) in Annex 5, § 2
- E_{se}: enhancement at small time percentages for a sea path given by equation (3) in Annex 5, § 2
- d_s: the total sea distance (km)
- d_{total}: the total path distance (km).

Step 20: If required, convert field strength to equivalent basic transmission loss for the path using the method given in Annex 5, § 17.

Annex 7

Adjustment for different climatic regions

The curves given in Annexes 2, 3 and 4 are based on measurements in temperate climates. Field strengths in regions of the world where the vertical atmospheric refractivity gradient is significantly different will not, in general, be so accurately predicted.

The following method may be used to apply vertical refractivity gradient information from Recommendation ITU-R P.453 to correct the curves in Annexes 2, 3 and 4 for use anywhere in the world. The Recommendation ITU-R P.453 data files give refractivity gradients in *N*-units/km in the lowest 65 m of the atmosphere as negative values.

For the purpose of this adjustment the curves in Annexes 2, 3 and 4 are considered to represent reference values of gradient dN_0 given by:

For fields exceeded for 50% time: $dN_0 = -43.3$ N-units/km (43a)

For fields exceeded for 10% time: $dN_0 = -141.9$ N-units/km (43b)

For fields exceeded for 1% time: $dN_0 = -301.3$ N-units/km (43c)

To adjust a family of field-strength curves for a different radio-climatic region of the world, calculate the difference in gradient ΔN given by:

$$\Delta N = dN_0 - dN \qquad (44)$$

where:

- dN: gradient exceeded for the time percentage of the curves to be adjusted obtained from the Recommendation ITU-R P.453 data files DNDZ_50.TXT, DNDZ_10.TXT, DNDZ_01.TXT for 50%, 10% and 1% time, respectively
- dN_0: reference gradient for the percentage time of the curve to be adjusted given by equations (43).