

RECOMMENDATION ITU-R P.1144-2

**Guide to the application of the propagation methods
of Radiocommunication Study Group 3**

(1995-1999-2001)

The ITU Radiocommunication Assembly,

considering

a) that there is a need to assist users of the ITU-R Recommendations P Series (developed by Radiocommunication Study Group 3),

recommends

1 that the information contained in Table 1 be used for guidance on the application of the various propagation methods contained in the ITU-R Recommendations P Series (developed by Radiocommunication Study Group 3).

NOTE 1 – For each of the ITU-R Recommendations in Table 1, there are associated information columns to indicate:

Application: the service(s) or application for which the Recommendation is intended.

Type: the situation to which the Recommendation applies, such as point-to-point, point-to-area, line-of-sight, etc.

Output: the output parameter value produced by the method of the Recommendation, such as path loss.

Frequency: the applicable frequency range of the Recommendation.

Distance: the applicable distance range of the Recommendation.

% time: the applicable time percentage values or range of values of the Recommendation; % time is the percentage of time that the predicted signal is exceeded during an average year.

% location: the applicable per cent location range of the Recommendation; % location is the percentage of locations within, say, a square with 100 to 200 m sides that the predicted signal is exceeded.

Terminal height: the applicable terminal antenna height range of the Recommendation.

Input data: a list of parameters used by the method of the Recommendation; the list is ordered by the importance of the parameter and, in some instances, default values may be used.

The information, as shown in Table 1, is already provided in the Recommendations themselves; however, the Table allows users to quickly scan the capabilities (and limitations) of the Recommendations without the requirement to search through the text.

TABLE 1
ITU-R radiowave propagation prediction methods

Method	Application	Type	Output	Frequency	Distance	% time	% location	Terminal height	Input data
Rec. ITU-R P.368	All services	Point-to-point	Field strength	10 kHz to 30 MHz	1 to 10 000 km	Not applicable	Not applicable	Ground-based	Frequency Ground conductivity
Rec. ITU-R P.370	Broadcasting	Point-to-area	Field strength	30 to 1 000 MHz	10 to 1 000 km	1, 5, 10, 50	1 to 99	Tx: effective height from less than 0 m to greater than 1 200 m Rx: 1.5 to 40 m	Distance Tx antenna height Frequency Percentage time Rx antenna height Terrain clearance angle Terrain irregularity Percentage locations
Rec. ITU-R P.1147	Broadcasting	Point-to-area	Sky-wave field strength	0.15 to 1.7 MHz	50 to 12 000 km	10, 50	Not applicable	Not applicable	Latitude and longitude of Tx Latitude and longitude of Rx Distance Sunspot number Tx power Frequency
Rec. ITU-R P.452	Services employing stations on the surface of the Earth; interference	Point-to-point	Path loss	700 MHz to 30 GHz	Not specified but up to and beyond the radio horizon	0.001 to 50 Average year and worst month	Not applicable	No limits specified	Path profile data Frequency Percentage time Tx antenna height Rx antenna height Latitude and longitude of Tx Latitude and longitude of Rx Meteorological data

TABLE 1 (continued)

Method	Application	Type	Output	Frequency	Distance	% time	% location	Terminal height	Input data
Rec. ITU-R P.528	Aeronautical mobile	Point-to-area	Path loss	125 MHz to 15 GHz	0 to 1 800 km (for aeronautical applications 0 km horizontal distance does not mean 0 km path length)	5, 50, 95	Not applicable	H1: 15 m to 20 km H2: 1 to 20 km	Distance Tx height Frequency Rx height Percentage time
Rec. ITU-R P.1146	Land mobile Broadcasting	Point-to-area	Field strength	1 to 3 GHz	1 to 500 km	1 to 99	1 to 99	Tx \geq 1 m Rx: 1 to 30 m	Distance Frequency Tx antenna height Rx antenna height Percentage time Percentage location Terrain information
Rec. ITU-R P.529	Land mobile	Point-to-area	Field strength	30 MHz to 3 GHz (limited application above 1.5 GHz)	VHF: 10 to 600 km UHF: 1 to 100 km	VHF: 1, 10, 50 UHF: 50	Unspecified	Base: 20 m to 1 km Mobile: 1 to 10 m	Distance Base antenna height Frequency Mobile antenna height Percentage time Ground cover
Rec. ITU-R P.530	Line-of-sight Fixed links	Point-to-point Line-of-sight	Path loss Diversity improvement (clear air conditions) XPD Outage Error performance	Approximately 150 MHz to 40 GHz	Up to 200 km if line-of-sight	All percentages of time in clear-air conditions; 1 to 0.001 in precipitation conditions ⁽¹⁾	Not applicable	High enough to ensure specified path clearance	Distance Tx height Frequency Rx height Percentage time Path obstruction data Climate data

TABLE 1 (continued)

Method	Application	Type	Output	Frequency	Distance	% time	% location	Terminal height	Input data
Rec. ITU-R P.533	Broadcasting Fixed Mobile	Point-to-point	Basic MUF Sky-wave field strength Available receiver power Signal-to-noise ratio LUF Circuit reliability	2 to 30 MHz	0 to 40 000 km	All percentages	Not applicable	Not applicable	Latitude and longitude of Tx Latitude and longitude of Rx Sunspot number Month Time(s) of day Frequencies Tx power Tx antenna type Rx antenna type
Rec. ITU-R P.534	Fixed Mobile Broadcasting	Point-to-point via sporadic E	Field strength	30 to 100 MHz	0 to 4 000 km	0 to 50	Not applicable	Not applicable	Distance Frequency
Rec. ITU-R P.616	Maritime mobile	As for Recommendation ITU-R P.370							
Rec. ITU-R P.617	Trans-horizon fixed links	Point-to-point	Path loss	> 30 MHz	100 to 1 000 km	20, 50, 90, 99, and 99.9	Not applicable	No limits specified	Frequency Tx antenna gain Rx antenna gain Path geometry
Rec. ITU-R P.618	Fixed satellite	Point-to-point	Path loss Diversity gain and (for precipitation condition) XPD	1 to 55 GHz	Any practical orbit height	0.001-5 for attenuation; 0.001-1 for XPD	Not applicable	No limit	Meteorological data Frequency Elevation angle Height of earth station Separation and angle between earth station sites (for diversity gain) Antenna diameter and efficiency (for scintillation) Polarization angle (for XPD)

TABLE 1 (continued)

Method	Application	Type	Output	Frequency	Distance	% time	% location	Terminal height	Input data
Rec. ITU-R P.620	Earth station frequency coordination	Coordination distance	Distance of which the required propagation loss is achieved	100 MHz to 105 GHz	Up to 1 200 km	0.001 to 50	Not applicable	No limits specified	Minimum basic transmission loss Frequency Percentage of time Earth-station elevation angle
Rec. ITU-R P.680	Maritime mobile satellite	Point-to-point	Sea-surface fading Fade duration Interference (adjacent satellite)	0.8-8 GHz	Any practical orbit height	To 0.001% via Rice-Nakagami distribution Limit of 0.01% for interference ⁽¹⁾	Not applicable	No limit	Frequency Elevation angle Maximum antenna boresight gain
Rec. ITU-R P.681	Land mobile satellite	Point-to-point	Path fading Fade duration Non-fade duration	0.8 to 20 GHz	Any practical orbit height	Not applicable Percentage of distance travelled 1 to 80% ⁽¹⁾	Not applicable	No limit	Frequency Elevation angle Percentage of distance travelled Approximate level of optical shadowing
Rec. ITU-R P.682	Aeronautical mobile satellite	Point-to-point	Sea-surface fading	1 to 2 GHz	Any practical orbit height	To 0.001% via Rice-Nakagami distribution ⁽¹⁾	Not applicable	No limit	Frequency Elevation angle Polarization Maximum antenna boresight gain Antenna height
Rec. ITU-R P.684	Fixed Mobile	Point-to-point Point-to-area	Sky-wave field strength	30 to 150 kHz	0 to 40 000 km	50	Not applicable	Not applicable	Latitude and longitude of Tx Latitude and longitude of Rx Distance Tx power Frequency Ground constants Season Sunspot number Hour of day

TABLE 1 (end)

Method	Application	Type	Output	Frequency	Distance	% time	% location	Terminal height	Input data
Rec. ITU-R P.843	Fixed Mobile Broadcasting	Point-to-point via meteor-burst	Received power Burst rate	30 to 100 MHz	100 to 1 000 km	0 to 5	Not applicable	Not applicable	Frequency Distance Tx power Antenna gains
Rec. ITU-R P.1238	Mobile RLAN	In-building propagation methods	Path loss Delay spread	900 MHz to 100 GHz	Within buildings	Not applicable	Not applicable	Base: about 2-3 m Mobile: about 0.5-3 m	Frequency Distance Floor and wall factors
Rec. ITU-R P.1411	Mobile	Short-path propagation methods	Path loss Delay spread	300 MHz to 100 GHz	< 1 km	Not applicable	Not applicable	Base: about 4-50 m Mobile: about 0.5-3 m	Frequency Distance Street dimensions Structure heights
Rec. ITU-R P.1410	Broadband radio access	Point-to-area	Coverage Temporal coverage reduction due to rain	20 to 50 GHz	0-5 km	0.001 to 1 (for calculating reduction in coverage due to rain)	Up to 100	No limit; 0-300 m (typical)	Frequency Cell size Terminal heights Building height statistical parameters Area-averaged rainfall rate

(1) Time percentage of outage; for service availability, subtract value from 100.