



Radiocommunication Bureau (BR)

Administrative Circular
CACE/988

27 July 2021

**To Administrations of Member States of the ITU, Radiocommunication Sector Members,
ITU-R Associates participating in the work of Radiocommunication Study Group 3
and ITU Academia**

Subject: **Radiocommunication Study Group 3 (Radiowave propagation)**

- **Proposed adoption of 18 draft revised ITU-R Recommendations and their simultaneous approval by correspondence in accordance with § A2.6.2.4 of Resolution ITU-R 1-8 (Procedure for the simultaneous adoption and approval by correspondence)**

At the meeting of Radiocommunication Study Group 3, held on 2 July 2021, the Study Group decided to seek adoption of 18 draft revised ITU-R Recommendations by correspondence (§ A2.6.2 of Resolution ITU-R 1-8) and further decided to apply the procedure for simultaneous adoption and approval by correspondence (PSAA, § A2.6.2.4 of Resolution ITU-R 1-8). The titles and summaries of the draft Recommendations are given in the Annex to this letter. Any Member State which objects to the adoption of a draft Recommendation is requested to inform the Director and the Chairman of the Study Group of the reasons for the objection.

The consideration period shall extend for 2 months ending on 27 September 2021. If within this period no objections are received from Member States, the draft Recommendations shall be considered to be adopted by Study Group 3. Furthermore, since the PSAA procedure has been followed, the draft Recommendations shall also be considered as approved.

After the above-mentioned deadline, the results of the above procedures will be announced in an Administrative Circular and the approved Recommendations will be published as soon as practicable (see <http://www.itu.int/pub/R-REC>).

Any ITU member organization aware of a patent held by itself or others which may fully or partly cover elements of the draft Recommendations mentioned in this letter is requested to disclose such information to the Secretariat as soon as possible. The Common Patent Policy for ITU-T/ITU-R/ISO/IEC is available at <http://www.itu.int/en/ITU-T/ipr/Pages/policy.aspx>.

Mario Maniewicz
Director

Annex: Titles and summaries of the draft Recommendations

Documents: Documents 3/28, 3/29, 3/30, 3/31, 3/33(Rev.1), 3/34, 3/35, 3/38(Rev.1), 3/39, 3/40, 3/41, 3/42(Rev.2), 3/45, 3/46, 3/47(Rev.1), 3/48(Rev.1), 3/49(Rev.1) and 3/51(Rev.1)

These documents are available in electronic format at: <https://www.itu.int/md/R19-SG03-C/en>

Annex

Titles and summaries of the draft ITU-R Recommendations

Draft revision of Recommendation ITU-R P.2040-1

Doc. 3/28

Effects of building materials and structures on radiowave propagation above about 100 MHz

This draft revision provides material properties parameters with improved measurement accuracy for concrete, brick, plasterboard, ceiling board and glass, and parameters for plywood and marble, that are not provided in the current Recommendation.

In addition, measured material properties for building materials in the 220 to 450 GHz range, are now provided for glass and ceiling board.

Draft revision of Recommendation ITU-R P.527-5

Doc. 3/29

Electrical characteristics of the surface of the Earth

This draft revision of Recommendation ITU-R P.527-5 proposes to replace the existing model for the prediction of the complex permittivity of wet snow. It also provides prediction models for the complex relative permittivity of:

- Sea ice brine
- Sea ice (first year ice FYI and multiyear ice MYI), and
- Sea foam.

Furthermore, the study corrects the mixing between pure ice and dry ice/snow, and hence it provides the proper models for predicting their complex relative permittivity. In addition, the applicability domains for the complex permittivity prediction models of pure water and sea water are not reported in Recommendation ITU-R P.527-5. Those domains are provided in Section 5.1.1 and Section 5.1.2 respectively. Moreover, getting global maps of soil texture required as input to the complex relative permittivity of soil is provided above Table 1.

NOTE – The revision to Recommendation ITU-R P.527 supports dependencies required by developments in preliminary draft new Recommendation ITU-R P.[BISTATIC_SCATTERING].

Multipath propagation and parameterization of its characteristics

This draft revision of Recommendation ITU-R P.1407-7 consists of a time series generator based on the Sum of Sinusoid principle. In order to be consistent with the current version of Recommendation ITU-R P.1407-7, a small section is added in order to introduce narrow band channel modelling.

A new annex is added on the estimation of Rice factor for fading models.

Attenuation in vegetation

This draft revision of Recommendation ITU-R P.833-9 proposes to add to Section 2.2 of the Recommendation a new model for vegetation attenuation on slant paths, taking seasonal variation into account.

A new Section 3.2.3 is also proposed, considering seasonal variation. This provides models for the cumulative distributions of loss and scattering angle through trees of various species at 60.5 GHz, fitted to measurements.

A path-specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands

The draft revision of Recommendation ITU-R P.1812-5 includes the following changes:

- the path profile for the diffraction model is modified such that the first and last profile points are at the actual heights of the terminal antennas;
- the removal of clutter loss ('height-gain') term to address "double counting" of clutter loss;
- the valid frequency range extension to about 6 GHz;
- the free-space propagation modelling aligned with Recommendation ITU-R P.525-4;
- editorial change to the text related to ITU Digitized World Map (IDWM).

List of specific revisions:

- 1 A revision is proposed to the Title (extension to about 6 GHz).
- 2 A revision is proposed to the Scope (extension to about 6 GHz).
- 3 Revisions are proposed to the following sections of Rec. ITU-R P.1812-5, Annex 1:
 - a) §1 Introduction
 - b) § 2 Model elements of the propagation prediction method
 - c) § 3.2 Terrain profile
 - d) § 3.3 Radio-climatic zones
 - e) § 4.1 General
 - f) § 4.2 Line-of-sight propagation (including short-term effects)
 - g) § 4.3.2 Spherical-Earth diffraction loss (correction to text and clarification)
 - h) § 4.3.4 Complete “delta-Bullington” diffraction loss model (clarification)
 - i) § 4.5 Propagation by ducting/layer reflection (clarification)
 - j) § 4.6 Basic transmission loss not exceeded for p% time and 50% locations
 - k) § 4.7 Additional losses due to terminal surroundings (deletion)
 - l) Attachment 1 to Annex 1 Path profile analysis (clarifications)
 - m) Attachment 3 to Annex 1 Criteria for ground reflection and calculation of first reflection maximum (deletion).

Draft revision of Recommendation ITU-R P.1238-10

Doc. 3/34

**Propagation data and prediction methods for the planning of indoor
radiocommunication systems and radio local area networks
in the frequency range 300 MHz to 450 GHz**

This draft revision of the recommendation is intended to enrich the missing parts such as new frequencies of the tables and to improve its usability for deriving the basic transmission loss in Recommendation ITU-R P.1238 based on measurement data.

This document proposes a draft revision of Recommendation ITU-R P.1238 for the two items as follows:

Item 1 proposes a revision of the Recommendation ITU-R P.1238-10, based on the measurement results in indoor environments at representative frequencies of 340 and 410 GHz. It is proposed to add new transmission coefficients to Table 3 of Recommendation ITU-R P.1238.

Item 2 proposes to add a new indoor site-general basic transmission loss model, based on measurement results in indoor environments. Moreover, by proposing the new model, all parameter values for office, factory, and corridor environments below 100 GHz, except for directional antenna cases, are deleted from Tables 2, 3 and 4, and the current model and values for directional antenna cases are moved to the site-specific model section.

In addition, table and equation numbers have been renumbered due to the addition of new tables and equations.

Draft revision of Recommendation ITU-R P.1411-10

Doc. 3/35

Propagation data and prediction methods for the planning of short-range outdoor radiocommunication systems and radio local area networks in the frequency range 300 MHz to 100 GHz

This document proposes a draft revision of Recommendation ITU-R P.1411-10 for the five modifications as follows:

- 1) The modification of Table 4 in Section 4.1.1 to extend the applicable frequency range of the site-general basic transmission loss model for LoS and NLoS, respectively, up to 82 GHz based on measured results in urban areas.
- 2) The modification of Section 4.2.2 to extend the applicable frequency range of the site-specific basic transmission loss model for propagation over rooftops in urban areas from up to 5 GHz to up to 26 GHz.
- 3) The modification of Section 9.1 to add new measurement results at 28 GHz in high-speed trains scenarios such as a viaduct and a tunnel, including a description to explain clearly the high Doppler shifts in high-speed train scenarios in the section.
- 4) The modification of Section 9.2 to add new propagation characteristics such as the stationary distance, delay spread and K factor at 5.9 GHz, considering vehicle-to-vehicle (V2V) communication scenarios in an expressway environment.
- 5) A number of editorial corrections.

A propagation prediction method for aeronautical mobile and radionavigation services using the VHF, UHF, and SHF bands

The changes proposed in this draft revision of Recommendation ITU-R P.528-4 include the following:

- 1 Removal of the term *satellite* in the scope to avoid confusion due to the terminal height limit of 20 km.
- 2 Change of time variability from a probability to a percentage, p , to align with its representation in other P-series Recommendations.
- 3 Addition of support for vertical polarization.
- 4 Upgraded ray tracing methods as defined in Recommendation ITU-R P.676-12.
- 5 Replacement of the reference atmosphere with the mean annual global reference atmosphere as defined in Recommendation ITU-R P.835-6.
- 6 Replacement of the atmospheric absorption loss calculations to use the methods defined in Recommendation ITU-R P.676 with the updated reference atmosphere.
- 7 Inclusion of additional figures to provide additional clarity to the text.
- 8 Reduction in the lower frequency limit from 125 MHz to 100 MHz.
- 9 Increase in the upper frequency limit from 15.5 GHz to 30 GHz.
- 10 Renaming of certain mathematical parameters to provide consistency throughout the step-by-step method.
- 11 Inclusion of a method to convert from elevation angle to great-circle path distance, as great-circle distance is the input parameter to the step-by-step method.
- 12 Modification to the line-of-sight methods to rely on a binary search method to achieve convergence instead of the generation of a large look-up table through which linear interpolation is applied.
- 13 Renumbering of equations to reset for each section instead of being sequential throughout the entire text.
- 14 Removed the reference to *curves* in Annex 3, since they no longer are part of the Recommendation.
- 15 Updated integral data products, which include,
 - csv data tables
 - C++ source code implementing the step-by-step method
 - Integral digital products readme.

Method for calculating sporadic-E field strength

Global maps of foEs are integral (normative) to Recommendation ITU-R P.2001-2 and are cited in Section 4.3 of Recommendation ITU-R P.534-5; however, there is no reference or link to these maps. This draft revision incorporates digital maps of foEs exceeded for annual percentage times of 50%, 10%, 1%, and 0.1% from Recommendation ITU-R P.2001-2 in Recommendation ITU-R P.534-5 as integral (normative) data products and adds associated contour plots as convenient visual references.

Radio Noise

This draft revision of Recommendation ITU-R P.372-14 is an extensive revision intended to replace the entire Recommendation ITU-R P.372-14. A Table of Contents has been added to aid the user. General editorial revisions and technical corrections have been made throughout the document. The atmospheric noise Figures 13a to 36c have been updated with colour, enlarged, rotated and given their own page. The Figure titles have been updated to reflect the 3 month period they cover instead of labelling them by season which was not consistent between hemispheres. A reference to the software used to generate these figures was clarified in a footnote at the beginning of the document. This software has already been approved by the ITU-R. New sections 6 Man-made noise and 6.1 Outdoor Man-made noise have been added which cover man-made noise generally and additive white Gaussian noise particularly.

Prediction of clutter loss

This draft revision provides in the Attachment:

- a method to limit the clutter loss at the value of the long-range model to remove the non-monotonic behaviour of the model;
- correction to errors as follows:
 - In equation (3b) the σ_l and σ_s terms in the numerator should be squared.
 - Equation (5b) should define the standard deviation, σ_s , for the short-range clutter model.

Propagation data and prediction methods required for the design of terrestrial line-of-sight systems

This draft revision replaces the model for multipath fading in Section 2.3, that has been in force since 2009, with a new model fitted to a significantly increased amount of fading data, now including, for the first time, data from Turkmenistan, Kyrgyzstan, and Australia. The existing model is purely a worldwide regression model, while the new model uses universal kriging to obtain the best estimate based on both a worldwide regression model, and interpolation of measured geoclimatic factor from nearby links where available. The worldwide digital maps for the new model are included as part of this draft revision.

As well as the proposed revisions to Section 2.3, revisions to Attachment 1 to Annex 1 to suit, are provided.

In addition, a new equation, as an alternative to reading values from Figure 2, is provided for convenience of users of the Recommendation.

An amendment to rain attenuation path reduction factor, as a result of short path measurements is included in this draft revision.

A new Section 1.1 has been added describing integral digital products.

The digital maps are proposed to be part of the draft revised Recommendation.

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

Gaussian quadrature integration accurately approximates a definite integral if the integrand, $f(x)$, is well-approximated by a polynomial of degree $2n-1$ or less over the integration interval.

Recommendation ITU-R P.1144-10 contains the values of the Gaussian quadrature points and weights for 16, 32, 64, 128, and 256 points. This revision: 1) adds an algorithm to Recommendation ITU-R P.1144-10 that calculates the Gaussian quadrature points and weights for an arbitrary number of points; and 2) moves the five integral text files containing the values of the Gaussian quadrature points and weights from an integral data product to a supplemental data product.

Tables 1 and 2 are to be updated according to the approval of referenced recommendations as proposed at the Study Group 3 meeting of 2 July 2021.

Propagation data and prediction methods for systems using high altitude platform stations and other elevated stations in the stratosphere at frequencies greater than about 1 GHz

The changes proposed in this draft revision of Recommendation ITU-R P.1409-1 include the following:

- 1 Modification to its title to clarify that the applicable frequency range of the Recommendation includes at about 0.7 GHz.
- 2 Addition of a sentence in the scope to clarify that this Recommendation provides prediction methods for interference assessment and for system design.
- 3 Addition of keywords.
- 4 Modify “at 47 GHz” to “up to 48.2 GHz” to be consistent with the Radio Regulations in *considering a*).
- 5 Delete “some of” in *considering b*).
- 6 A minor revision to *recommends* to make the order of the presentation of the prediction methods consistent with the order of the sections, and to clarify the meaning of the phrase “studies of sharing and compatibility.”
- 7 Addition of sentences in Section 1 “Introduction” in order to introduce the phrase “high-altitude station” so as to replace the phrase “high-altitude platform stations or other stations in the stratosphere” for brevity. The later phrase was replaced by the former phrase for the rest of the Recommendation.
- 8 Addition of the description of propagation paths and Figure 1 and deletion of propagation mechanisms and effects in Section 1 “Introduction.”
- 9 Deletion of Sections 2.1 and 2.2 which addressed the propagation paths that did not involve high-altitude stations. Subsequently, the sub-section headings in Section 2 were renumbered.
- 10 Modification to the titles of Section 2 and its subsections for clarification and brevity.
- 11 In new Section 2.1 “Between high-altitude stations and other terrestrial stations,” the propagation mechanisms and effects relevant to these propagation paths are listed.
- 12 Addition of information regarding tropospheric scintillation, clutter loss, building entry loss, and vegetation loss in new Section 2.1.

¹ The revision of Recommendation ITU-R P.1409-1 and certain limits of applicability of frequency ranges depend on the adoption and approval of the draft revision of Recommendation ITU-R P.528-4 (see Document 3/38(Rev.1)).

- 13 Addition of prediction methods and information regarding the free space basic transmission loss, cross-polarization discrimination due to Faraday rotation, and scintillation and absorption of radiowaves in the ionosphere in new Section 2.2 “Between high-altitude stations and space stations.”
- 14 Addition of section heading Section 2.2.4 “Back-scatter from the Earth’s surface” to the existing material.
- 15 Addition of Section 2.3 “Between high-altitude stations and stations in atmosphere.”
- 16 Modification of the title of Section 3 “The propagation prediction methods for the design of systems using high-altitude stations”.
- 17 Addition of human shielding loss model in Section 3.
- 18 Throughout the document, the phrase “high altitude” was replaced by “high-altitude.”

Draft revision of Recommendation ITU-R P.2001-3

Doc. 3/47(Rev.1)

A general purpose wide-range terrestrial propagation model in the frequency range 30 MHz to 50 GHz

The draft revision of Recommendation ITU-R P.2001-3 contains the following changes in Section 3.11 “Free-space basic transmission loss” aligning the free-space propagation modelling with Recommendation ITU-R P.525-4 “Calculation of free-space attenuation”:

- The first factor in equation (3.11.1) for the basic transmission loss is corrected to 92.4 dB (for the frequency expressed in GHz), which corresponds to the factor 32.4 dB in Recommendation ITU-R P.525-4 (for the frequency expressed in MHz).
- Slant-path distance between transmitter and receiver antennas is used instead of great-circle path distance.

Draft revision of Recommendation ITU-R P.452-16

Doc. 3/48(Rev.1)

Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz

- 1 The modification to Section 4.1 aims to align free-space modelling with Recommendation ITU-R P.525-4 and improves accuracy of basic transmission loss predictions for radio terminal distances less than approximately 3 km and where the altitude above sea level of each terminal is several hundred meters or more.
- 2 The modification to Section 4.3 corrects a reference to a figure (Fig. 6) which was not an accurate reference due do prior revisions of the recommendation.
- 3 Further modifications address some other minor editorial, cross-referencing, formatting and clarification issues.

Acquisition, presentation and analysis of data in studies of radiowave propagation

The objective of this draft revision of Recommendation ITU-R P.311-16 is to update Table XI-1 to provide additional experimental data for the case of radio noise indoor and of short-range path data. These data will be provided in new Tables IX-2 and XI-1.

Propagation data required for the evaluation of interference between stations in space and those on the surface of the Earth

The modifications in this draft revision of the recommendation include the following:

- The *notings* of the Recommendation was updated to reference other relevant ITU-R P-series Recommendations and Section 1.3 has minor text improvements;
 - There is a correction to an intermediate term in equation (8);
 - Section 2.4.2 on beam spreading loss uses the term “free space elevation angle” to make the text more concise;
 - Section 2.5.2 on tropospheric scintillation has a change of the minimum elevation angle;
 - Section 2.6 on ducting enhanced diffraction has significant amendments: a correction to the non-monotonic performance of equation (13), inclusion of a nominal surface ducting distance used in equations (13a), (13b), and (13f), implementation of diffraction loss due to a local obstruction now contains expanded guidance in equation (13f);
 - Several modifications to enhance the clarity and explanations of the methods in the recommendation.
-