Radiocommunication Bureau (BR)

Administrative Circular   19 June 2023
CACE/1064

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

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

–   Proposed approval of 1 draft new and 3 draft revised ITU-R Questions

At the meeting of Radiocommunication Study Group 3 held from on 2 June 2023, 1 draft new and 3 draft revised ITU-R Questions were adopted according to Resolution ITU-R 1-8 (§ A2.5.2.2) and it was agreed to apply the procedure of Resolution ITU-R 1-8 (see § A2.5.2.3) for approval of Questions in the interval between Radiocommunication Assemblies. The texts of the draft ITU-R Questions are attached for your reference in Annexes 1 to 4. Any Member State raising an objection to the approval of a draft Question is requested to inform the Director and the Chairman of the Study Group of the reasons for the objection.

Having regard to the provisions of § A2.5.2.3 of Resolution ITU-R 1-8, Member States are requested to inform the Secretariat (brsgd@itu.int) by 19 August 2023, whether they approve or do not approve the proposals above.

After the above-mentioned deadline, the results of this consultation will be announced in an Administrative Circular and the approved Questions will be published as soon as practicable (see: http://www.itu.int/ITU-R/go/que-rsg3/en).

Mario Maniewicz
Director

Annexes: 4

–   1 draft new and 3 draft revised ITU-R Questions

Annex 1

(Document 3/128(Rev.1))

DRAFT NEW QUESTION ITU-R XXX/3

Use of machine learning methods for radiowave propagation studies

(2023)

The ITU Radiocommunication Assembly,

considering

a) that the assessment and the modelling of the characteristics of the propagation radio channel require the identification of several key propagation parameters;

b) that in a number of cases the key parameter of the propagation radio channel is difficult to observe directly and must be inferred indirectly (i.e. retrieved) by measuring other observables;

c) that the number of observables can be large and the relationship between observables and the parameters of the propagation radio channel can be non-linear and not one-to-one;

d) that the uncertainty and the errors of methods used to measure the observables can significantly affect the accuracy of the process used to retrieve the key propagation parameters;

e) that in several cases propagation models are required to provide the statistical characterisation of the propagation parameter over a large probability range and for this scope it is required to collect and process large numbers of samples;

f) that in a number of cases propagation models use joint statistical distributions of many input parameters;

g) that the development of machine learning algorithms and dedicated hardware platforms may provide researchers the possibility to process large amounts of data from very different sources to extract information from measurements;

h) that the criteria for applicability of these tools to propagation models need to be studied;

i) that to develop propagation models which are statistically representative of all possible conditions of the physical process, the data used for model development and for model testing are required to be different;

j) that machine learning algorithms can be used as one of the methods for now-casting, short-term forecasting and prediction of parameters affecting the temporal evolution of the radio propagation channel;

k) that machine learning algorithms have been used for many years in developing radiowave propagation prediction methods and with the advances in computer technology there are many machine learning frameworks being made widely available,

decides that the following Questions should be studied

1   How to use machine learning techniques as an algorithm for developing radiowave propagation prediction methods?

2   How can state-of-the-art machine learning algorithms and frameworks be utilized for the development and the improvement of radiowave propagation models able to cope with complex scenarios and environments?

3   What are the procedures to ensure that a propagation model developed using machine learning algorithms is representative of all the possible conditions, in particular those not considered in the data set used to develop the model?

4   What are the characteristics of quality of input data to be assessed for the use in machine learning algorithms, in the analysis of measurements?

5   Which machine learning frameworks could be applied for radiowave propagation, with particular regard to the analysis of measurements?

6   Are there already examples of machine learning tools being used for radiowave propagation predictions? Which use cases have been dealt with so far?

further decides

1   that the results of the above studies (in particular for methods and data) should be included in ITU-R Reports, Recommendations and Handbooks, as appropriate;

2   that the above studies should be completed by 2027.

Category: S2

Annex 2

(Document 3/130)

DRAFT REVISION OF QUESTION ITU-R 235-1/3

Impact of engineered electromagnetic surfaces on radiowave propagation

(2019-2023)

The ITU Radiocommunication Assembly,

considering

a) that engineered electromagnetic surfaces (EEMSs) have the ability to enhance or attenuate the transmission and reception of electromagnetic signals;

b) that EEMSs are being developed to extend the communications range, shape the coverage area, and mitigate the risk of interference;

c) that EEMSs are expected to be of great importance for future wireless systems and networks particularly international mobile telecommunications (IMT) and wireless local area networks (WLANs);

d) that EEMSs can be more cost and energy efficient than the deployment of additional access points or base stations;

e) that advances in EEMSs could reduce the demand for additional spectrum for future wireless systems and networks;

f) that EEMSs could be deployed predominantly as part of building materials and/or furnishing materials;

g) that the presence of EEMSs could modify, to a large extent, the propagation characteristics along the communications path;

h) that the electrical properties of surface materials as well as the orientation, design, and structure of the EEMS impact signal reflections and frequency selectivity;

i) that the modelling of signal reflections from EEMSs is of great significance for service coexistence and spectrum sharing between radiocommunication services and between service providers;

j) that the availability of EEMS databases will facilitate the development of appropriate site-specific propagation models,

noting

a) that Recommendation ITU-R P.526 provides guidance on calculation methods for obstacle diffraction effects, including those due to building materials and structures;

b) that Recommendation ITU-R P.530 provides propagation data and prediction methods required for the design of terrestrial line-of-sight systems;

c)   that Recommendation ITU-R P.1238 provides 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;

d)   that Recommendation ITU-R P.1407 provides information on various aspects of multi-path propagation;

e)   that Recommendation ITU-R P.1411 provides 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;

f)   that Recommendation ITU-R P.1812 provides a propagation prediction method for terrestrial point-to-area services in the frequency range 30 MHz to 6 GHz;

g)   that Recommendation ITU-R P.2040 provides guidance on the effects of building materials and structures on radiowave propagation above about 100 MHz;

h)   that Recommendation ITU-R P.2109 provides statistical models for building entry loss,

decides that the following Questions should be studied

1   What are suitable methods to describe the detailed characteristics of the EEMSs particularly reflectors and frequency selective structures?

2   Which deterministic and statistically-based methods can be used to model reflection of electromagnetic signals from EEMSs?

3   Which deterministic and statistically-based methods can be used to model propagation of electromagnetic signals through frequency selective EEMSs acting as band-stop or band-pass filters?

4   How do frequency selective EEMSs in buildings impact indoor-to-outdoor and outdoor-to-indoor transmissions and what is the effect on building entry/exit loss?

5   What is the influence of EEMSs such as reflectors and frequency selective surfaces on the transmission loss, diffraction loss, clutter loss, shadowing and polarization, including polarization mismatch loss, delay spread, and angular spread?

6   How can EEMS databases, together with other detailed information of the propagation path be applied to predict signal attenuation, time delay, scatter, diffraction, and other propagation characteristics?

7   In which way does the use of higher frequencies, particularly in the millimetre wave spectrum, impact the modelling of EEMSs (for key parameters such as surface roughness and conductivity)?

further decides

that the results of the above studies should be included in ITU-R Recommendations and/or Reports and that the above studies should be completed by 2027.

Category: S3

Annex 3

(Document 3/131)

DRAFT REVISION OF QUESTION ITU-R 203-9/3

Propagation prediction methods for terrestrial broadcasting, fixed (broadband access) and mobile services using frequencies above 30 MHz

(1990-1993-1995-2000-2002-2009-2012-2017-2019-2023)

The ITU Radiocommunication Assembly,

considering

a)   that there is a continuing need to improve and develop field strength prediction techniques for the planning or establishing of terrestrial broadcasting, fixed (broadband access) and mobile services using frequencies above 30 MHz;

b)   that for terrestrial broadcasting, fixed (broadband access) and mobile services, propagation studies involve consideration of point-to-area and multipoint-to-multipoint propagation paths;

c)   that present methods are based largely upon measurement data and there is a continuing need for measurements within this range of frequencies from all geographical regions, especially developing countries, to increase the accuracy of the prediction techniques;

d)   that the increasing use of frequencies above 10 GHz requires that prediction methods should be developed to meet these new requirements;

e)   that digital systems involving wideband transmission are being introduced to both broadcasting and mobile services;

f)   that reflected signals must be taken into account in the design of digital radio systems;

g)   that there are increasing demands for frequency sharing between these and other services;

h)   that the maximum speed of high speed transportation (using expressway, railway) is increasing up to 500 km/h,

decides that the following Questions should be studied

1   What field strength prediction methods can be used for terrestrial broadcasting, fixed (broadband access) and mobile services in the frequency range above 30 MHz?

2   How are the predicted field strengths, multipath and their temporal and spatial statistics influenced by:

–   frequency, bandwidth and polarization;

–   length and properties of the propagation path;

–   terrain features, including the possibility of long delayed reflections from off-great circle hillsides;

–   ground cover, buildings and other man-made structures;

–   atmospheric constituents;

–   height and surrounding environment of the terminating antennas;

– directivity and diversity of the antennas;

– mobile reception, including Doppler effects;

– the general nature of the propagation path, e.g., paths over deserts, seas, coastal areas or mountains and, in particular, in areas subject to super-refractive conditions?

3 To what extent are propagation statistics correlated over different paths and frequencies?

4 What methods and parameters best describe the coverage reliability of these analogue and digital services and what information beyond field strength data is necessary for these purposes, e.g. the "intelligence" incorporated in a frequency agile system?

5 What methods and parameters best describe the propagation channel's impulse response?

further decides

that the available information should be prepared as revisions to relevant Recommendations or as new Recommendations and that the above studies should be completed by 2027.

Category: S2

Annex 4

(Document 3/132)

DRAFT REVISION OF QUESTION ITU-R 211-8/3

Propagation data and propagation models in the frequency range 300 MHz to 450 GHz for the design of short-range wireless radiocommunication systems and wireless local area networks (WLAN)

(1993-2000-2002-2005-2007-2009-2015-2019-2023)

The ITU Radiocommunication Assembly,

considering

a) that many new short-range personal communication systems are being developed which will operate indoors as well as outdoors;

b) that future mobile systems (e.g. IMT) will provide personal communications, indoors (office or residential) as well as outdoors;

c) that there is a high demand for wireless local area networks (WLANs) and wireless private business exchanges (WPBXs), as demonstrated by existing products and intense research activities;

d) that it is desirable to establish WLAN standards which are compatible with both wireless and wired telecommunications;

e) that short-range systems using very low power have many advantages for providing services in the mobile and personal environment;

f) that ultra-wideband (UWB) is an important wireless technology and may have impact on radiocommunication services;

g) that there is a requirement for propagation data and propagation models when planning new short-range land-mobile and fixed service, including WLANs in the frequency range from 300 MHz to 450 GHz with caution and necessary, and sufficient measurements to be provided;

h) that knowledge of the propagation characteristics within buildings and the interference arising from multiple users in the same area is critical to the efficient design of systems;

i) that while multipath propagation may cause impairments, it may also be used to advantage in a mobile or indoor environment;

j) that there are only limited propagation measurements available in some of the frequency bands being considered for short-range systems;

k) that information regarding indoor and indoor-to-outdoor propagation may also be of interest to other services,

decides that the following Questions should be studied

1 What propagation models should be used for the design of short-range systems operating indoors, outdoors, and indoor-to-outdoors (operating range less than 1 km) including wireless communication and access systems and WLANs?

2   What propagation characteristics of a channel are most appropriate to describe its quality for different services, such as:

–   voice communications;

–   facsimile services;

–   data transfer services (both high bit rate and low bit rate);

–   paging and messaging services;

–   video services?

3   What are the characteristics of the impulse response of the channel?

4   What effect does the choice of polarization have on the propagation characteristics?

5   What effect does the performance of the base station and terminal antennas (e.g. directivity, beam-steering) have on the propagation characteristics?

6   What are the effects of various diversity schemes?

7   What are the effects of the siting of the transmitter and receiver?

8   In the indoor environment, what is the effect of different building and furnishing materials as regards shadowing, diffraction, and reflection?

9   In the outdoor environment, what is the effect of building structures and vegetation as regards shadowing, diffraction, and reflection?

10   What effect does the movement of persons and objects within the room, possibly including the movement of one or both ends of the radio link, have on the propagation characteristics?

11   What variables are necessary in the model to account for different types of buildings (e.g. open-plan, single-storey, multi-storey) in which one or both of the terminals are situated?

12   How may building entry loss be characterized for system design, and what is its effect on indoor-to-outdoor transmission?

13   What factors can be used for frequency scaling, and over what ranges are they appropriate?

14   What are the best ways of presenting the required data?

15   What propagation models are most appropriate to evaluate the effect for system design such as Multiple Input Multiple Output (MIMO) technology?

16   What effect do modes of high speed transport (using expressway, railway) have on propagation characteristics?

17   What are the effects of human body shadowing?

18   What are the elements required to estimate Line-of-Sight probabilities for use in sharing and compatibility studies?

further decides

1   that necessary and sufficient measurements should be the basis of the developed prediction methods, as described in *considering g)*;

2   that the results of the above studies should be included in one or more Recommendations and/or Reports and that the above studies should be completed by 2027.

Category: S3

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