INTERNATIONAL TELECOMMUNICATION UNION

Radiocommunication Bureau
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Administrative Circular
CACE/496

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To Administrations of Member States of the ITU, Radiocommunication Sector Members, ITU-R Associates participating in the work of Radiocommunication Study Group 3 and the Special Committee on Regulatory/Procedural Matters

Subject: **Radiocommunication Study Group 3**

– Approval of 11 revised ITU-R Questions

By Administrative Circular CAR/281 of 21 July 2009, 11 draft revised ITU-R Questions were submitted for approval by correspondence in accordance with Resolution ITU-R 1-5 (§ 3.4).

The conditions governing these procedures were met on 21 October 2009.

The texts of the approved Questions are attached for your reference (Annexes 1 to 11) and will be published in Addendum 1 to Document 3/1 which contains the ITU-R Questions approved by the 2007 Radiocommunication Assembly and assigned to Radiocommunication Study Group 3.

Valery Timofeev
Director, Radiocommunication Bureau

Annexes: 11

Distribution:

- Administrations of Member States and Radiocommunication Sector Members
- ITU-R Associates in the work of Radiocommunication Study Group 3
- Chairmen and Vice-Chairmen of Radiocommunication Study Groups and Special Committee on Regulatory/Procedural Matters
- Chairman and Vice-Chairmen of the Conference Preparatory Meeting
- Members of the Radio Regulations Board
- Secretary-General of the ITU, Director of the Telecommunication Standardization Bureau, Director of the Telecommunication Development Bureau

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Annex 1

QUESTION ITU-R 203-4/3

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

(1990-1993-1995-2000-2002-2009)

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,

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;

– 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

1 that the available information should be prepared as a new Recommendation.

Category: S1

Annex 2

QUESTION ITU-R 212-2/3

Ionospheric properties

(1978-1982-1990-1997-2009)

The ITU Radiocommunication Assembly,

considering

a) that ionized media affect the propagation of radiowaves;

b) that a large number of digitized measurements are now available which cover all levels of solar activity for 3-4 eleven-year solar cycles,

decides that the following Questions should be studied

1 What additional information concerning the properties of the terrestrial ionosphere and ionized regions beyond would facilitate the study of aspects of propagation that are important to radio systems?

2 What physical properties and what variations in the structure of the ionosphere, in particular at or near the magnetic equator and at high latitudes, have an influence on radiocommunications?

3 What improvements may be made to the mapping of ionospheric characteristics on both a global and regional basis using data and analysis techniques now available?

further decides

1 that appropriate information shall be included in a Recommendation;

2 that the above studies should be completed by 2013.

Category: S3

Annex 3

QUESTION ITU-R 221-1/3

Propagation by way of sporadic E and other ionization

(1990-2009)

The ITU Radiocommunication Assembly,

considering

a) that the available information on terrestrial propagation by sporadic E and other ionization is insufficient to provide statistical data of the type needed by telecommunication engineers, especially at low and high latitudes;

b) that ionospheric irregularities including meteor ionization in the E region and the F region can affect the performance of radio systems;

c) that suitable methods for estimating sky-wave field strength and signal dispersion are required by:

– administrations, in connection with the establishment and operation of radio systems;

– the Radiocommunication Bureau, for further refinement of its technical standards contained within the Rules of Procedure;

– the Radiocommunication Sector, in connection with future Radiocommunication Conferences,

decides that the following Questions should be studied

1 What are the characteristics of sporadic-E (E_s) ionization and how do these affect oblique incidence propagation in the HF and VHF bands?

2 What are the mechanisms for VHF and UHF propagation by the ionosphere and how can the statistics of the propagation characteristics be predicted?

further decides

1 that the available information should be prepared as new Recommendations, or as revisions to existing Recommendations;

2 that the above studies should be completed by 2013.

NOTE 1 – See Recommendations ITU-R P.534 and ITU-R P.843.

Category: S3

Annex 4

QUESTION ITU-R 229-1/3

Prediction of sky-wave propagation conditions, signal intensity, circuit performance and reliability at frequencies between about 1.6 and 30 MHz, in particular for systems using digital modulation techniques

(2002-2009)

The ITU Radiocommunication Assembly,

considering

a) that accurate, quantitative predictions of ionospheric propagation are important for planning optimum spectrum utilization;

b) that the methods for prediction of basic and operational MUFs and ray paths (see Recommendation ITU-R P.1240) are required for predicting HF sky-wave propagation characteristics and merit further improvement;

c) that a method for predicting HF sky-wave propagation characteristics is given in Recommendation ITU-R P.533, and that this now includes procedures for digital systems in the Equatorial region;

d) that Recommendation ITU-R P.842 provides a method for the computation of reliability and compatibility of HF radio systems;

e) that radio system performance is influenced by variations of the amplitude and dispersion of the wanted signals, and of the background noise and interference, and this influence varies with the type of emission, particularly between analogue and digital;

f) that the available prediction methods are intended primarily for use for narrow-band or analogue systems;

g) that many HF systems use digital modulation techniques, including those which utilize fast signalling speeds or which require phase or frequency stability;

h) that a method needs to be developed for other parts of the world, particularly at high latitudes, to estimate the performance of digital broadcasting,

decides that the following Questions should be studied

1 What improvement may be made to the methods given in Recommendation ITU-R P.1240 for the long-term prediction of basic and operational MUFs and ray paths, and their variability, from predicted ionospheric characteristics?

2 What improvements may be made to the method for the long-term estimation of sky-wave propagation conditions, signal intensity, circuit performance and reliability using predicted ionospheric characteristics?

3 What are the characteristics of time delay spread, frequency spread (multipath and Doppler shifts) and frequency correlation of HF sky-wave signals, including fading characteristics?

4 What values of a time-delay and frequency power profiles are characteristic of the ionosphere at different locations and times, and how may the prediction of these characteristics be included within a comprehensive method?

further decides

1 that the available information should be prepared as new Recommendations, or as revisions to existing Recommendations;

2 that the methods described in the Recommendations should be available as a software package for use within the Radiocommunication Bureau and by those concerned with the planning and operation of HF systems and networks;

3 that the above studies should be completed by 2011.

Category: S1

Annex 5

QUESTION ITU-R 218-4/3

Ionospheric influences on space systems

(1990-1992-1995-1997-2007-2009)

The ITU Radiocommunication Assembly,

considering

a) that, in the case of some high-performance space systems involving satellites, ionospheric effects should be considered up to the highest frequencies in use;

b) that various satellite systems, including mobile- and navigational-satellite services, are employing non-geostationary-satellite networks,

decides that the following Questions should be studied

1 How can trans-ionospheric propagation models be improved, especially to account for ionospheric changes in the short-term, and at high and low latitudes, in regard to:

– scintillation effects on phase, angle of arrival, amplitude and polarization;

– Doppler and dispersion effects;

– refraction affecting in particular the direction of arrival and also the phase and group delays;

– Faraday effect, particularly with regard to polarization discrimination;

– attenuation effects?

2 What propagation prediction methods can be derived to assist in coordination and sharing among concerned services?

3 What propagation prediction method can be derived to assist in the determination of performance characteristics of satellite services employing non-geostationary-satellite networks?

4 What are the methods to simulate realistic time-series for system simulation including rapidly varying propagation effects?

further decides

1 that the available information should be prepared as new Recommendations, or as revisions to existing Recommendations;

2 that Recommendation ITU-R P.531 will be revised before 2010.

NOTE 1 – Priority will be given to studies relating to § 1.

3 that the above studies should be completed by 2012.

Category: S2

Annex 6

QUESTION ITU-R 222-2/3

Measurements and data banks of ionospheric characteristics and noise

(1990-1993-2000-2000-2009)

The ITU Radiocommunication Assembly,

considering

a) that measurements of signal characteristics and of the ionosphere as a propagation medium are essential for the further improvement of methods of radiowave propagation prediction;

b) that various organisations and agencies maintain databanks of measurements of ionospheric characteristics;

c) that measurements of signal characteristics, useful for the evaluation of prediction procedures, etc., may not be consistently collected in databanks elsewhere,

decides that the following Questions should be studied

1 What characteristics of the ionosphere, of signal propagation through or via the ionosphere and of noise are appropriate for inclusion in databanks maintained and developed by ITU-R Study Group 3?

2 What data collection, analysis, standardization, compilation and dissemination procedures are best suited for ITU-R purposes?

further decides

1 that Radiocommunication Study Group 3 should develop and maintain databanks of measurements of ionospheric propagation, of ionospheric characteristics and of noise identified in answering this Question;

2 that the above studies should be completed by 2012.

Category: S2

Annex 7

QUESTION ITU-R 204-4/3

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

(1990-1993-1995-1997-2000-2009)

The ITU Radiocommunication Assembly,

considering

a) that a better knowledge of the characteristics of propagation contributes greatly to the design of economic line-of-sight systems and to the improvement of system performance and in particular:

– that the design of digital systems is largely controlled by the performance and the availability required (as related to propagation) and that periods of adverse propagation are significant to the design of digital systems;

– that amplitude and group-delay distortions across a microwave radio channel have a profound effect on the bit error ratio of digital systems,

decides that the following Questions should be studied

1 What is the distribution of the value of transmission loss additional to free space resulting from multipath propagation, diffraction, precipitation and absorption, etc., for frequency bands above about 300 MHz for each month of the year, including its diurnal variation averaged over each month?

2 What propagation data may be used for station site selection and for determining the height of antennas and their radiation characteristics, including the distribution of refractive-index gradient or *k*-factor during subrefractive conditions averaged over a specified path length?

3 What data may be obtained on clear-air propagation effects (both fading and enhancements), in particular:

– the number of atmospheric and ground reflected rays during multipath propagation, and the statistical distribution of their relative amplitudes and delays;

– statistics of single-frequency fading, flat fading, selective fading (including minimum and non-minimum phase fading, in-band power differences (IBPD), in-band amplitude dispersions (IBAD) and notch depths) and composite fading (flat plus selective), and diffraction fading;

– conditional probabilities of flat fading, selective fading, delays and notch depth to determine the inter-dependence of the principal multipath parameters;

– the dependence of all the items above on:
  – path and terrain characteristics, frequency, antenna patterns and geoclimatic factors;
  – diversity (angle, space and in-band and cross-band frequency);
– degree of correlation of multipath fading on different channels on the same path and different paths in a multi-hop link?

4 What models of the tropospheric channel transfer function can be used for the computation of system performance?

5 What data may be obtained on precipitation effects, in particular:
– concurrent long-term statistical distributions of rainfall attenuation and rainfall intensity, especially in tropical regions;
– the influence of sleet and wet snow;
– long-term number of precipitation attenuation events of duration shorter than 10 s and 10 s or longer for various attenuation levels, and the mean duration of precipitation events of duration 10 s or longer in combination with long-term statistical distributions of precipitation attenuation exceedances;
– the degree of correlation of precipitation effects on different paths of the same link?

6 What precipitation parameters, in addition to rainfall intensity, can be applied to precipitation-related prediction methods to take account of different climates?

7 What refractivity parameters, in addition to, or instead of, refractivity gradient statistics in the first 100 m of the atmosphere, can be applied to clear-air prediction methods to take account of different climates?

8 What is the variation, due to clear-air propagation effects, precipitation or any other cause, of the isolation between two orthogonal polarizations, including systems using diversity?

9 What is the set of conditions that must be met to identify the period of non-faded propagation?

10 What is the frequency of occurrence and duration of fades exceeding specified values and the rate of change of received signal in these fades, noting that the time resolution of measurements to obtain these statistics must be adequate to describe the rate of variation of the propagation effects. The duration statistics should also be apportioned between events shorter than 10 s and those 10 s or longer?

11 What is the improvement to be gained using diversity systems in the presence of rain or multipath?

12 What are the cumulative effects of all propagation factors, on the overall system performance of multi-hop links (including one or more satellite hops), and the dependence of these factors on hop characteristics?

13 How can the contributions from the various propagation effects be apportioned to performance and availability?

14 What are the relevant short-term propagation considerations for bringing a system into service?

15 How to simulate realistic time-series data for system testing taking into account all types of propagation effects?

further decides

1 that the available information should be prepared as new Recommendations, or as revisions to existing Recommendations;

NOTE 1 – Priority will be given to studies relating to § 5, 7, 11 and 13.

Category: S2

Annex 8

QUESTION ITU-R 207-4/3

Propagation data and prediction methods for satellite mobile and radiodetermination services above about 0.1 GHz

(1990-1993-1995-1997-2000-2009)

The ITU Radiocommunication Assembly,

considering

a) that there is a requirement for methods to estimate the field strength or the transmission loss when planning mobile and radiodetermination services using satellites;

b) that a number of administrations are studying satellite systems for aeronautical and maritime safety, radiodetermination, communication and control;

c) that there is considerable interest in providing communication services to handheld and vehicular terminals with mobile-satellite systems;

d) that for VHF, UHF and SHF systems involving satellites, both the ionosphere and troposphere may affect propagation, as well as reflections from the ground, sea and/or man-made structures;

e) that for land mobile-satellite systems, blockage and shadowing will affect propagation;

f) that there is a requirement for propagation data and modelling for all path elevation and azimuth angles, especially for systems employing constellations of non-geostationary satellites;

g) that knowledge of fade-duration and non-fade-duration distributions is of particular importance to satellite mobile and radiodetermination systems;

h) that a number of mobile-satellite systems sharing the same frequency band will be introduced;

j) that frequency-selective fading and delay spread are important aspects of the propagation channel which must be taken into account in the design of digital wideband mobile radiocommunication and navigation systems,

decides that the following Questions should be studied

1 To what extent does the field strength or transmission loss depend on the nature of terrain, the effects of vegetation and man-made structures, antenna location, frequency, polarization, angle of elevation and climate; and how do these factors affect the selection of frequencies and wave polarization for such systems?

2 What are the effects of the local environment for handheld and vehicular terminals and personal communication systems?

3 What are the effects due to multipath propagation and Doppler spread changes, and how do these depend on the parameters listed in § 1?

4 What is the most suitable form of prediction method, for each radio service, for use in the preparation of national and international frequency plans?

5 What are the characteristics and effects of land- or sea-reflection and multipath fading on radiocommunication or radiodetermination signals transmitted by satellites, both geostationary and otherwise, for the use of land vehicles, aircraft and ships?

6 What propagation data may be collected for modelling, statistical characterization and mitigation of tropospheric and multipath-induced impairments, especially for low elevation angle slant paths, as a function of sea or land surface state (wave height or terrain irregularity), satellite elevation angle, antenna radiation pattern, local site clearance and environment, including terrain and vegetation blockage and shadowing and frequency?

7 What is the method for estimating signal-to-interference ratio where both wanted and unwanted signals are affected by multipath fading?

8 What are the advantages of physical-statistical propagation models for the characterization of the radio channel in multiple environments for land mobile satellite systems?

9 What are the methods to model the propagation channel and evaluate performance improvement due to diversity (satellite, polarization, antenna) and multiple-input-multiple-output (MIMO) techniques for mitigation of propagation impairment models in satellite mobile radiocommunications?

further decides

1 that the available information should be prepared as a new Recommendation;

2 that the above studies should be completed by 2013.

NOTE 1 – Priority will be given to studies relating to § 1 and 2.

Category: S2

Annex 9

QUESTION ITU-R 213-2/3

The short-term forecasting of operational parameters for trans-ionospheric radiocommunication and aeronautical radionavigation services

(1978-1990-1993-2000-2000-2009)

The ITU Radiocommunication Assembly,

considering

a) that accurate, quantitative short-term predictions of ionospheric variations a few hours or days in advance would increase the reliability of radiocommunication and aeronautical radionavigation-satellite services including safetyrelated applications;

b) that, in addition to the widespread disturbances associated with major geophysical or solar events that affect the total electron content (TEC), the spatial and temporal gradients of TEC and the occurrence of ionospheric scintillations, there are other hour-to-hour and day-to-day ionospheric variations (which may be local in influence),

decides that the following Questions should be studied

1 What are the needs and techniques for the short-term prediction (up to a few hours in advance) of operational parameters for trans-ionospheric radiocommunications and radionaviagtion services?

2 How useful are the established techniques of ground based and space-based space weather monitoring for short-term prediction of trans-ionospheric propagation conditions?

further decides

1 that appropriate information shall be included in a Recommendation or a Handbook;

2 that the above studies should be completed by 2013.

Category: S3

Annex 10

QUESTION ITU-R 230-1/3*

Prediction methods and models applicable to power line telecommunications systems

(2005-2009)

The ITU Radiocommunication Assembly,

considering

a) that power line telecommunications systems (PLT) and other wired telecommunication systems may use base-band frequencies up to 80 MHz, and that a wide variety of PLT architectures and components will be present, even in one administrative jurisdiction;

b) that radio-frequency energy will be radiated by a number of mechanisms and in several modes, particularly from unbalanced, variable impedance and poorly terminated lines,

decides that the following Questions should be studied

1 What are the mechanisms that cause radio-frequency radiation from PLT systems and how can they be modelled? What are the salient features of the topology (ground plane location, spatial distribution, etc.) that are most important for accurate estimation of emissions?

2 What techniques are most appropriate in aggregating the total radiated energy in space from such a system or multitude of systems?

3 Which signal level propagation models are most appropriate in the determination of interference?

4 What advice may be given to enable practical measurement of radiating fields at short distances (within the near field)?

further decides

1 that appropriate information shall be included in a Recommendation or a Handbook;

2 that the above studies should be completed by 2012.

Category: S2

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* This Question should be brought to the attention of Radiocommunication Study Group 1 (Working Party 1A).

Annex 11

QUESTION ITU-R 211-5/3

Propagation data and propagation models in the frequency range 300 MHz to 100 GHz for the design of short-range wireless radiocommunication systems and wireless local area networks (WLAN)

(1993-2000-2002-2005-2007-2009)

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 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;

h) 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?

further decides

1 that the results of the above studies should be included in one ore more Recommendations and/or Reports;

2 that the above studies should be completed by 2013.

Category: S3