



Radiocommunication Bureau (BR)

Administrative Circular
CACE/643

26 November 2013

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

Subject: **Radiocommunication Study Group 3 (Radiowave propagation)**
– **Approval of 2 revised ITU-R Questions**

By Administrative Circular CACE/630 of 20 September 2013, 2 draft revised ITU-R Questions were submitted for approval by correspondence in accordance with Resolution ITU-R 1-6 (§ 3.1.2).

The conditions governing this procedure were met on 20 November 2013.

The texts of the approved Questions are attached for your reference in Annexes 1 and 2 and will be published in Revision 2 to [Document 3/1](#) which contains the ITU-R Questions approved by the 2012 Radiocommunication Assembly and assigned to Radiocommunication Study Group 3.

François Rancy
Director

Annexes: 2

Distribution:

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

Annex 1

QUESTION ITU-R 204-5/3

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

(1990-1993-1995-1997-2000-2009-2013)

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);
 - diversity reception and dual polarised systems;
 - 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 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;

2 that the above studies should be completed by 2015.

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

Category: S2

Annex 2

QUESTION ITU-R 208-4/3

Propagation factors in frequency sharing issues affecting space radiocommunication services and terrestrial services

(1990-1993-1995-2002-2005-2013)

The ITU Radiocommunication Assembly,

considering

- a)* that propagation data for radio paths are required when planning the sharing of frequency channels in radiocommunication systems;
- b)* that, in accordance with the Radio Regulations (RR), a coordination distance or coordination area should be determined for earth stations in the frequency bands shared between space radiocommunication services and terrestrial services;
- c)* that in the calculation of coordination distances, all pertinent propagation mechanisms and system factors should be taken into account;
- d)* that in the calculation of interference between systems, more detailed consideration of the contributing propagation mechanisms is required;
- e)* that the World Radiocommunication Conference (WRC-2000) approved a revision of Appendix 7 (subsequently modified by WRC-03 and WRC-07) based on material in Recommendation ITU-R SM.1448 which in turn is based on material in Recommendation ITU-R P.620 covering the frequency range 100 MHz to 105 GHz;
- f)* that Resolution **74 (Rev.WRC-03)** describes a process to keep the technical bases of Appendix 7 current,

decides that the following Questions should be studied

- 1 What is the distribution of signal level variations (both fading and enhancement) and their duration due to:
 - diffraction;
 - atmospheric mechanisms such as ducting, precipitation scatter, troposcatter and reflecting atmospheric layers;
 - reflections from the ground and man-made structures;
 - combinations of these mechanisms?
- 2 What is the dependence of these effects on location, time, path length and frequency, taking into consideration the following points:
 - the percentage range of greatest interest is from 0.001% to 50%;
 - the reference periods of interest are worst month and average year;

- path lengths of greatest interest are those up to 1 000 km; however, in areas where ducting is prevalent (e.g. oceans in tropical and equatorial regions) much greater distances should also be considered;
 - the frequency range of interest is approximately 100 MHz to 500 GHz?
- 3 How may improved models and prediction procedures be developed for precipitation scatter to determine the practical significance of this mode, and how does it depend on rainfall rate and structure and on system geometry?
 - 4 What precipitation parameters, in addition to rainfall intensity and height of the 0°C isotherm, can be applied to precipitation-related prediction methods to take account of different climates?
 - 5 What refractivity parameters can be applied to clear-air prediction methods to take account of different climates?
 - 6 How can scatter from irregular terrain be quantified (including the effect of vegetation and man-made structures such as buildings)?
 - 7 How can interaction between an antenna and the propagation medium be taken into account when considering modes of anomalous propagation (e.g. coupling into and out of ducts and the impact of use of omnidirectional, sector and high-gain antennas)?
 - 8 How may site shielding be evaluated, with special emphasis on a practical procedure for calculating its magnitude in particular situations (e.g. small earth stations in urban areas)?
 - 9 What is the correlation of fading and enhancements of the signal on separate radio links, and its influence on the statistics of interference?
 - 10 What method best describes the differential rain attenuation statistics between a wanted path and an unwanted path?
 - 11 What is a suitable method by which the total effect of the above-mentioned mechanisms can be taken into account when evaluating interference between terrestrial and Earth-space systems; in particular, what improvements can be recommended to the interference prediction methods contained in Recommendation ITU-R P.452 and to the propagation prediction procedures for determining coordination distance contained in Recommendation ITU-R P.620, including the alignment of these two methods in order to obtain consistency between the determination of coordination area and detailed evaluation of interference in individual cases?
 - 12 Which are the most effective clear-air and hydrometeor-scatter propagation models to allow effective frequency coordination and interference potential evaluation between earth stations for geostationary-satellite systems and those for non-geostationary satellite systems sharing the same frequencies on a “bidirectional working” basis?

further decides

that the above studies should be completed by 2015.

NOTE – Priority will be given to studies relating to §§ 2, 5, 6, 8, 9 and 10.

Category: S2
