INTERNATIONAL TELECOMMUNICATION UNION

Radiocommunication Bureau
(Direct Fax N°. +41 22 730 57 85)

Administrative Circular
CAR/281

21 July 2009

To Administrations of Member States of the ITU

Subject: **Radiocommunication Study Group 3**

– Proposed approval of 11 draft revised ITU-R Questions

At the meeting of Radiocommunication Study Group 3 held on 11 and 12 June 2009, 11 draft revised ITU-R Questions were adopted and it was agreed to apply the procedure of Resolution ITU-R 1-5 (see § 3.4) for approval of Questions in the interval between Radiocommunication Assemblies.

Having regard to the provisions of § 3.4 of Resolution ITU-R 1-5, you are requested to inform the Secretariat (brsgd@itu.int) by 21 October 2009, whether your Administration approves or does not approve the proposals above.

After the above-mentioned deadline, the results of this consultation will be notified in an Administrative Circular. If the Questions are approved, they will have the same status as Questions approved at a Radiocommunication Assembly and will become official texts attributed to Radiocommunication Study Group 6 (see: http://www.itu.int/pub/R-QUE-SG03/en).

Valery Timofeev
Director, Radiocommunication Bureau

Annexes: 11

– 11 draft revised ITU-R Questions

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

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Annex 1

(Source: Document 3/16)

DRAFT REVISION TO QUESTION ITU-R 203-3/3

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

(1990-1993-1995-2000-2002)

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 ~~at~~ frequencies above ~~between~~ 30 MHz ~~and about 50 GHz~~;

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 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 ~~for terrestrial broadcasting and fixed (broadband access) services~~ 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

(Source: Document 3/19)

DRAFT REVISION OF QUESTION ITU-R 212-1/3

Ionospheric properties

(1978-1982-1990-1997)

The ITU Radiocommunication Assembly,

considering

a) that ionized media affect the propagation of radiowaves;

~~b) that the properties of the ionosphere and ionized regions beyond were described in former Reports of Study Group 3;~~

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

decides that the following Question<u>s</u> should be studied

1 What additional information concerning the properties of the terrestrial ionosphere and ionized regions beyond <u>would</u> facilitate~~s~~ 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<u>, in particular</u> at or near the magnetic equator <u>and at high latitudes,</u> 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 a revision of Recommendation ITU-R P.1239 should be proposed before 2005;~~

~~**2** that the available information should be prepared as a Handbook.~~

<u>**1** that appropriate information shall be included in a Recommendation;</u>

<u>**2** that the above studies should be completed by 2013.</u>

<u>Category: S3</u>

Annex 3

(Source: Document 3/21)

DRAFT REVISION OF QUESTION ITU-R 221/3

~~VHF and UHF p~~Propagation by way of sporadic E and other ionization

(1990)

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; ~~operating in the VHF and UHF portions of the spectrum;~~

c) that suitable methods for estimating ~~VHF~~ 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~~1~~ 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 – See Recommendations ITU-R P.534 and ITU-R P.843.

Category: S3

Annex 4

(Source: Document 3/22)

DRAFT REVISION OF QUESTION ITU-R 229/3

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)

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, ~~but that this method may need to be extended to meet new requirements;~~ 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) ~~in particular,~~ that a method needs to be developed for other parts of the world, particularly at high latitudes, ~~is urgently required~~ to estimate the performance of digital broadcasting, ~~and that additional requirements have been identified for the planning and operation of frequency agile adaptive HF systems,~~

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, ~~and~~ circuit performance and reliability using predicted ionospheric characteristics?

~~**3** What procedures should be applied for the estimation of the reliability of a radio system, considered in the presence of noise alone, and in the presence of noise and interference, including the effect of receiver noise factors?~~

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

45 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, taking account of the important needs for this method that the work should be undertaken urgently;~~

~~**4** that the results of the above should be communicated to Radiocommunication Study Groups 6 and 9.~~

3 that the above studies should be completed by 2011.

Category: S1

Annex 5

(Source: Document 3/25)

DRAFT REVISION OF QUESTION ITU-R 218-3/3

Ionospheric influences on space systems

(1990-1992-1995-1997-2007)

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

(Source: Document 3/26)

DRAFT REVISION OF QUESTION ITU-R 222-1/3

Measurements and data banks of ionospheric ~~parameters~~ characteristics and noise

(1990-1993-2000-2000)

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 techniques for the measurement of signals and for the collection of data are suitable for use in connection with the study of improvements in ionospheric prediction methods in all relevant frequency bands?~~ 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 techniques for HF field strength measurement and the compilation of data banks are suitable for use in connection with the study of improvements in HF prediction methods, taking into account the need for positive identification of signals and of the need to calibrate measuring systems and antennas?~~

~~**3** What routine measurement programmes including worldwide vertical sounding and TEC (total electron content) evaluation using global navigation satellites are necessary for ionospheric mapping and modelling purposes, and for studying ionospheric effects upon Earth-space propagation?~~

2~~4~~ What data collection, analysis, standardization, compilation and dissemination procedures are ~~needed for the creation and use of an international data bank of TEC values in the formulation of an ITU-R global TEC model?~~best suited for ITU-R purposes?

further decides

1 that Radiocommunication Study Group 3 should develop and maintain databanks of ~~ionospheric~~ measurements of ionospheric propagation, of ionospheric characteristics and of noise identified in answering this Question;~~obtained using the above techniques.~~

2 that the above studies should be completed by 2012.

Category: S2

Annex 7

(Source: Document 3/27)

DRAFT REVISION QUESTION ITU-R 204-3/3

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

(1990-1993-1995-1997-2000)

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 is the improvement to be gained using diversity systems in the presence of multipath?~~

~~**13**~~**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?

~~14~~**13** How can the contributions from the various propagation effects be apportioned to performance and availability?

~~15~~**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 § ~~3~~5, ~~4,~~ 7, ~~12~~11 and ~~14~~13.

Category: S2

Annex 8

(Source: Document 3/29)

DRAFT REVISION OF QUESTION ITU-R 207-3/3

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

(1990-1993-1995-1997-2000)

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 ~~wideband~~ 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 ~~frequency~~ 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

(Source: Document 3/38)

DRAFT REVISION OF QUESTION ITU-R 213-1/3

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

(1978-1990-1993-2000-2000)

The ITU Radiocommunication Assembly,

considering

a) that accurate, quantitative short-term predictions of ionospheric variations a few hours or days in advance would ~~permit more efficient utilization of radio frequencies and~~ increase the reliability of radiocommunication and aeronautical radionavigation--satellite services including safety-related applications;

b) that, in addition to the widespread disturbances associated with major geophysical or solar events that affect the ~~maximum plasma frequency and~~ 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)~~) whose effects on:~~,

~~1) operational characteristics of HF radio systems, such as operational MUF;~~

~~2) operational characteristics of VHF/UHF radio systems, such as TEC;~~

~~3) those characteristics associated with attenuation, background noise, fading, multipath interference, group path delay, scattering, polarization rotation, dispersion, angular deviation and scintillation;~~

~~cannot be predicted by well-established techniques,~~

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 ~~or days~~ in advance) of operational parameters for ~~ionospheric and~~ trans-ionospheric radiocommunications and radionaviagtion services?

2 How useful are the established techniques of ground based and space-based space weather monitoring~~ionospheric sounding, TEC determination~~ for short-term prediction of trans-ionospheric propagation conditions? ~~from global navigation satellite systems and channel evaluation measurements as aids in the real-time estimation of potential circuit performance and in the operational frequency management of radio circuits?~~

further decides

1 that appropriate information shall be ~~prepared as~~included in a Recommendation or~~and as~~ a Handbook.

2 that the above studies should be completed by 2013.

Category: S3

Annex 10

(Source: Document 3/39)

DRAFT REVISION OF QUESTION ITU-R 230/3*

Prediction methods and models applicable to power line telecommunications systems

(2005)

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 in PLT systems that cause radio frequency energy to be radiated?~~

~~**2** Which modelling techniques may be best used to estimate radiated energy from a generic portion of a complete network?~~

~~**3** What are the effects of the position of the ground plane and other structures relative to the line on radiated energy and its spatial distribution?~~

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~~4~~ What techniques are most appropriate in aggregating the total radiated energy in space from such a system or multitude of systems?

3~~5~~ Which signal level propagation models are most appropriate in the determination of interference?

4~~6~~ What advice may be given to enable practical measurement of radiating fields at short distances (within the near field)?

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

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~~CATEGORY~~: S2~~1~~

Annex 11

(Source: Document 3/42)

DRAFT REVISION OF QUESTION ITU-R 211-4/3

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

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)

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. ~~beyond~~ IMT~~-2000~~) 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 ~~rapidly emerging~~ 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 frequencies proposed for the systems described in § a), b) and c) range from about 300 MHz to 100 GHz;~~

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

~~l~~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 models should be used for assessing impact of UWB devices on other recognized radiocommunication services?~~

~~3~~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?

~~4~~3 What are the characteristics of the impulse response of the channel?

~~5~~4 What effect does the choice of polarization have on the propagation characteristics?

~~6~~5 What effect does the performance of the base station and terminal antennas (e.g. directivity, beam-steering) have on the propagation characteristics?

~~7~~6 What are the effects of various diversity schemes?

~~8~~7 What are the effects of the siting of the transmitter and receiver?

~~9~~8 In the indoor environment, what is the effect of different building and furnishing materials as regards shadowing, diffraction, and reflection?

~~10~~9 In the outdoor environment, what is the effect of building structures and vegetation as regards shadowing, diffraction, and reflection?

~~11~~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?

~~12~~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?

~~13~~12 How may building entry loss be characterized for system design, and what is its effect on indoor-to-outdoor transmission?

~~14~~13 What factors can be used for frequency scaling, and over what ranges are they appropriate?

~~15~~14 What are the best ways of presenting the required data?

~~16~~15 ~~How may propagation channels using multiple transmitters and multiple receivers be characterised for system design?~~ 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 20~~09~~13.

Category: S~~1~~3