Minutes:

COST296 Seminar on ITU-R SG3L issues

4 to 5 July 2005 at IGAM, University of Graz

Original Agenda:

1) Review the current status of ITU-R SG3L documents;
2) Identify the areas where COST296 can really contribute;
3) Propose required work to be carried out in particular work packages;
4) Organize the active participation of European researchers at the ITU-R SG3L.

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Introduction - Les Barclay on ITU and ITU-R Study Groups

The Study Groups (SG) work with four types of documents (see Annex I)
– Recommendations
– Questions
– Resolutions and Opinions
– Reports

Depending on the situation some ITU member countries have there own study group meetings, e.g. the UK (UK SG 3 meeting on 11 September)

Study Group 3 (Radiowave Propagation) consists of 4 "Working Parties"

- Working Party 3J - Propagation fundamentals
- Working Party 3K - Point-to-area propagation
- Working Party 3L - Ionospheric propagation
- Working Party 3M - Point-to-point and Earth-space propagation

For information on the "Service Study Groups" see Annex II

For Questions compiled by Les Barclay see Annex III

Discussion remark on COST 251 ITU-R material: this Action had poor inputs.

NeQuick for ITU-R

Presently the official version is the version on the ITU-R Web site (= Version 1).
A revised product ("Revised NeQuick") has been distributed on request by e-mail from Graz and Trieste.

Leitinger/ Nava/ Martinecz report on NeQuick Version 2 which is in preparation
- new bottom side (already included in “revised version”)
- new topside (also used as option for the International Reference Ionosphere - IRI): still a semi-Epstein layer but new formulation for the topside thickness parameter and its increase with height
- replace dip latitude (grid file) by MODIP and allow for secular variation of MODIP by replacing the MODIP grid file in intervals of 5 years. These MODIP grid files are based on the geomagnetic field model IGRF “generation 9”.
- anchor point “peak of the F2 layer”: use maps for hmF2 instead of Dudeney formula (combination of M3000(F2), foF2 and foE) for peak height
- new simplified CCIR maps for hmF2 and foF2 reducing the influence of artifacts. The simplified CCIR maps are based on the classical maps but are (algorithmic) maps in MODIP and geographic longitude for constant Local Time. The classical CCIR maps use a combination of MODIP and geographic latitude and are formulated for constant Universal Time
- further improve the FORTRAN code.

Test results: Version 2 of NeQuick for ITU-R does improve low latitude behavior (less overestimation), and has no significant effect on high latitude behavior. Considerably improvement in the geographical distribution of equivalent slab thickness.
Sub-model for foE: Version 1 has used the model of John Titheridge which differs from the CCIR maps mainly by the nighttime base value and by the day-night and night-day transition. Sub-model for foF2: foF1=0 for nighttime and fixed ratio foF1/foE for daytime.
Version 2 uses modifications of the foF1/foE ratio (improved day/night transition) to ensure that foF1 cannot exceed foF2. Since both Titheridge’s original formulation and the variant are not based on CCIR maps it is suggested to avoid possible conflicts by change of variable names in the FORTRAN code.
Question: why is there a hard limit for solar activity (R12<=150)?
Answer: because of ITU-R document requirement.
There is agreement that the hard limit should be removed in version 2.

The “driver software” for NeQuick Version 2 will include a procedure for Faraday effect calculations along arbitrarily chosen ray paths based on Also have a procedure for Faraday
Also use an updated mag-field model on Modip maps based on IGRF.

GISM: Manual to be turned into Report. The NeQuick model description (now part of the software package) could also be the basis of a Report

Other matters discussed:

- Data banks
- New Maps for NmF2 and hmF2 derived
- Advantages and disadvantages of “grid point maps” to replace the “algorithmic maps”
- Submission plans

Question by Antonio Casimiro: how do we motivate people to work on ITU?

Proposals:

1. Preparation:

Distribute last WP3L Chairman's report

Review ITU-R Questions assigned to SG-3, SG-7 & SG-9 (see handout and Presentation by Les)
(Review 2005 liaison statements directed to WP3L)

Review ITU-R Recs. P. 313, 371, 373, 525, 531, 532, 533, 534, 684, 842, 843, 844, 845, 846, 1059, 1060, 1144, 1147, 1148, 1239, 1240, 1321.
Rec F.1487

Review software on:
http://www.itu.int/ITU-R/software/study-groups/rsg3/databanks/ionosph/index.html

2. Generation of input:

Nr	TITLE	Resp.	Date
1	Update NeQuick to V2 (include Faraday calc?) [Rec P.531]	**R.L.**	**2005**
2	Update GISM to V 2 [Rec P.531]	**Y.B.**	**2005**
3	Produce report on the models (based on NeQuick and GISM)	**R.L.&Y.B.**	**2005**
4	New Maps: NmF2, hmF2, MODIP	**R.L.**	**2005**
5	Ionospheric properties for HF- Skywave [Rec P.533]	**L.B.**	**2006**
6	HF Channel simulator [Rec F.1487]	**L.B.**	**2006**
7	Model of Ionospheric Trough for HF propagation.	**R.L. & L.C.**	**2006**
8	Model of ionospheric dynamics (based on slab thickness) [Rec P.531]	**S.K.**	**2006**
9	Short term forecasting	**L.C. & L.B.**	**2005**
10			

2005 means Beginning of September (preparations for next SG3 meeting in Cleveland/Ohio).

Draft minutes by Bertram Arbesser-Rastburg, Graz, 5 July 2005,
this form by Reinhart Leitinger, finalised 9 November 2005

Annex I
Info by Les Barclay

EXTRACT FROM THE ITU-R DOCUMENT GIVING STATUS OF ITU-R STUDY GROUP 3 TEXTS

The Annexes attached show the status of ITU-R SG 3 texts, which may have relevance for ionospheric studies, at 09 May 2005.

Annex 1 – Recommendations

All Recommendations currently in force are published on CD-ROM ("ITU-R Recommendations and Reports") and they are also available from the ITU-R Webpage at: http://www.itu.int/rec/recommendation.asp?type=products&lang=e&parent=R-REC-P.
For each Recommendation listed in Annex 1, the source is indicated as follows:

V texts published in the Volume 2000 P series, Parts 1 and 2;

S texts published in Supplement 1 to Volume 2000 P series;

W texts available from website and from CD-ROM ("ITU-R Recommendations and Reports").

Annex 2 – Questions

The texts of the Questions can be found in Document 3/1 (at: http://www.itu.int/md/meetingdoc.asp?type=sitems&lang=e&parent=R03-SG03-C-0001) as well as on the ITU-R webpage at: http://www.itu.int/ITU-R/publications/download.asp?product=que03&lang=e.

Annex 3 – Resolutions and Opinions

The texts of the ITU-R Resolutions (Radiocommunication Assembly 2003) can be found on the ITU-R Webpage at: http://www.itu.int/publications/productslist.aspx?lang=e&menu=categories&CategoryID=R-RES&selection=5&sector=1.
Opinions appear on the ITU-R Webpage at: http://www.itu.int/publications/productslist.aspx?lang=e&menu=categories&CategoryID=R-OP&selection=6&sector=1.

Annex 4 – Reports

These are published on CD-ROM ("ITU-R Recommendations and Reports") and ITU-R Reports are also available from the ITU-R Webpage at: http://www.itu.int/publications/productslist.aspx?lang=e&CategoryID=R-REP&series=P.

Annex II

Extract from Les Barclay's "Introduciton" presentation

- The ITU is concerned with the international regulation, spectrum and satellite orbit regulation and spectrum management for international purposes.
- It is interested in managing interference and in quantifying system performance
- The ITU regulatory work is supplemented and supported by a number of study groups which continually maintain and update a large number of Recommendations
- All of the service study groups have an interest in ionospheric propagation:
-
  - as mechanism for wanted propagation
  -
  - as a mechanism for unwanted interference propagation
  - *or*
  - as a source of channel distortion

- **SG4: fixed satellite service**
  - trans-ionospheric scintillation, polarisation rotation, etc
- **SG6: broadcasting**
  - satellite bc: trans-ionospheric scintillation, polarisation rotation, etc
  - HF & MF bc: coverage prediction
  - HF & MF bc: digital channel characteristics
- **SG7: science services-remote sensing, etc**
  - trans-ionospheric scintillation, polarisation rotation, etc
- **SG8: mobile services, navigation, etc**
  - satellite applications: trans-ionospheric scintillation, polarisation rotation, etc
  - HF – LF applications: coverage predictions, channel distortion
- **SG9: fixed service**
  - HF services: coverage predictions, channel distortion, simulator design
- **SG1: spectrum management, monitoring**
  - General considerations

ITU-R SG3: radiowave propagation

- WP3L: ionospheric propagation

- Current main enquiries from:
  - SG6 (digital HF/MF broadcasting- prediction method including service quality)

  - SG9 (frequency adaptive technology- prediction method for planning and operation; high speed modems and simulators– representative channel characteristics;)

- Underlying enquiries: scintillations, TEC

Documentation process

Technical input document prepared

- proposal for a modification of an existing Recommendation
- proposal for part of a new recommendation
- information papers

- all should have a justification: need, validation, application

Submitted (electronically) by an administration to the working party

Considered by working party;

- modified if necessary
- adopted as new text

or

- carried forward for further consideration

or

- noted

Adopted text considered by study group;
sent for approval by Member States

Approved and Published

SG3 ionospheric Questions: priority categories

- C: Conference oriented Questions associated with work related to specific preparations for, and decisions of, world and regional radiocommunication conferences:
- S: Questions which are intended to respond to:
  - topics from RA, PP, WRC, Council or RRB
  - advances in radiocommunication technology or
  - spectrum management;
  - changes in radio usage or operation:

S1: urgent studies, intended to be completed within 2 years;
S2: important studies, necessary for the development of radiocommunications;
S3: required studies, expected to facilitate the development of radiocommunications.

Questions – ionospheric SG3

212-1/3	S3	Ionospheric properties
213-1/3	S3	short-term forecasting of operational parameters for ionospheric & trans-ionospheric radiocommunications
214-1/3	S2	Radio noise
218-2/3	S2	Ionospheric influences on space systems
221/3	S3	VHF and UHF propagation by way of sporadic E & other ionization
222-1/3	S2	Measurements & data banks of ionospheric parameters
225-3/3	S1	prediction of propagation factors affecting systems at LF & MF including use of digital modulation techniques
226-2/3	S2	Ionospheric and tropospheric characteristics along satellite-to-satellite paths
227-1/3	S1	HF channel simulation
229/3	S1	Prediction of sky-wave propagation conditions, signal intensity, circuit performance & reliability at

		frequencies between about 1.6 & 30 MHz, in particular for systems using digital modulation techniques
230/3	C1	prediction methods and models applicable to power line telecommunication systems

Annex III
Questions compiled by Les Barclay

QUESTIONS ASSIGNED TO RADIOCOMMUNICATION STUDY GROUP 3

WITH RELEVANCE TO IONOSPHERIC RADIOWAVE PROPAGATION

Attached please find the list of Questions assigned to Radiocommunication Study Group 3. The following extract from Resolution ITU-R 5 gives the definition of categories of Questions:

C: Conference oriented Questions associated with work related to specific preparations for, and decisions of, world and regional radiocommunication conferences:

C1: very urgent and priority studies, required for the World Radiocommunication Conference to be held within the next two-year period;

C2: urgent studies, expected to be required for other Radiocommunication Conferences.

S: Questions which are intended to respond to:

– matters referred to the Radiocommunication Assembly by the Plenipotentiary Conference, any other conference, the Council, the Radio Regulations Board (see Note 1);

– advances in radiocommunication technology or spectrum management;

– changes in radio usage or operation:

S1: urgent studies which are intended to be completed within two years;

S2: important studies, necessary for the development of radiocommunications;

S3: required studies, expected to facilitate the development of radiocommunications.

/AP: Alternative approval procedure.

NOTE 1 – Where appropriate, Questions maintained (but unmodified) have been editorially updated. In such cases, the version number and date of the Question have remained unchanged.

QUESTIONS ASSIGNED TO RADIOCOMMUNICATION STUDY GROUP 3

Question ITU-R	Title	Category
201-2/3	Radiometeorological data required for the planning of terrestrial and space communication systems and space research application	S2
202-1/3	Methods for predicting propagation over the surface of the Earth	S2
203-3/3	Propagation prediction methods for terrestrial broadcasting, fixed (broadband access) and mobile services at frequencies above 30 MHz	S1
204-3/3	Propagation data and prediction methods required for terrestrial line-of-sight systems	S2
205-1/3	Propagation data and prediction methods required for trans-horizon systems	S2
206-3/3	Propagation data and prediction methods for fixed- and broadcasting-satellite services	S2
207-3/3	Propagation data and prediction methods for satellite mobile and radiodetermination services above about 0.1 GHz	S2
208-2/3	Propagation factors in frequency sharing issues affecting fixed-satellite services and terrestrial services	S2
209/3	Variability and risk parameters in system performance analysis	S2
211-2/3	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	S1
212-1/3	Ionospheric properties	S3
213-1/3	The short-term forecasting of operational parameters for ionospheric and trans-ionospheric radiocommunications	S3
214-1/3	Radio noise	S2
218-2/3	Ionospheric influences on space systems	S2
221/3	VHF and UHF propagation by way of sporadic E and other ionization	S3
222-1/3	Measurements and data banks of ionospheric parameters	S2
225-3/3	The prediction of propagation factors affecting systems at LF and MF including the use of digital modulation techniques	S1
226-2/3	Ionospheric and tropospheric characteristics along satellite-to-satellite paths	S2
227-1/3	HF channel simulation	S3
228/3	Propagation data required for the planning of space radiocommunication systems and space science service systems operating above 275 GHz	S1
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	S1
230/3	Prediction methods and models applicable to power line telecommunications systems	S1

QUESTION ITU-R 208-3/3

Propagation factors in frequency sharing issues affecting fixed-satellite services and terrestrial services

(1990-1993-1995-2002-2005)

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) 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 Question 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?

NOTE 1 – Priority will be given to studies relating to §§ 2, 5, 6, 8, 9 and 10.

Category: S2

QUESTION ITU-R 209/3

Variability and risk parameters in system performance analysis

(1993)

The ITU Radiocommunication Assembly,

considering

a) that for the proper planning of terrestrial and Earth-space links it is necessary to have appropriate parameters for the formulation of performance criteria of radiocommunication systems;

b) that the “average annual worst month” has been defined as the long-term statistic relevant to performance criteria referring to “any month”;

c) that due to the stochastic nature of propagation effects in radiocommunication systems there is a need for information on variability of these effects, with respect to the long-term statistic, for various periods of reference;

d) that there is a need for an unambiguous formulation of variability parameters to allow proper cost and performance trade-offs to be made in the analysis of system reliability, availability and quality,

decides that the following Question should be studied

1 What is the variation of propagation effects with respect to the long-term cumulative statistic for various periods of reference?

2 What are the periods of reference to be specified for the formulation of risk parameters associated with the variation of propagation statistics?

3 What are the parameters most suited to the formulation of confidence limits and risks associated with the specification and estimation of system performance?

4 What are the procedures for the calculation of the parameters defining statistical variation of propagation effects in radiocommunication systems?

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;

c) 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 should be studied

1 What additional information concerning the properties of the terrestrial ionosphere and ionized regions beyond facilitates 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 at or near the magnetic equator 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.

QUESTION ITU-R 213-1/3

The short-term forecasting of operational parameters for ionospheric and trans-ionospheric radiocommunications

(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 services;

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), 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 Question should be studied

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

2 How useful are the techniques of ionospheric sounding, TEC determination 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 a Recommendation and as a Handbook.

QUESTION ITU-R 214-1/3

Radio noise

(1978-1982-1990-1993-2000-2000)

The ITU Radiocommunication Assembly,

considering

a) that radio noise of natural or man-made origin often determines the practical limit of performance for radio systems and thus is an important factor in planning efficient use of the spectrum;

b) that much has been learned about the origin, statistical characteristics, and general intensities of both natural and man-made noise, but that additional information is needed, particularly for parts of the world not previously studied, for the planning of telecommunications systems;

c) that for system design, determination of system performance and spectrum utilization factors, it is essential to determine the noise parameters appropriate in considering various modulation methods, including as a minimum, the noise parameters described in Recommendation ITU-R P.372,

decides that the following Question should be studied

1 What are the intensities and the values of other parameters, the temporal and geographical variations, the directions of arrival, and the relationship to changes in geophysical phenomena, such as solar activity, of natural and man-made noise from local and distant sources, and how should measurements be made?

further decides

1 that appropriate information concerning radio noise resulting from studies within the ITU-R shall be contained in a single Recommendation.

QUESTION ITU-R 218-2/3

Ionospheric influences on space systems

(1990-1992-1995-1997)

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 Question should be studied

1 What methods exist for predicting:

– 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 prediction methods can be derived to assist in the determination of the relevant coordination area?

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

further decides

1 that Recommendation ITU-R P.531 will be revised before 2005.

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

QUESTION ITU-R 221/3

VHF and UHF 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 Question should be studied

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

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

QUESTION ITU-R 222-1/3

Measurements and data banks of ionospheric parameters

(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,

decides that the following Question 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?

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?

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?

further decides

1 that Radiocommunication Study Group 3 should develop and maintain databanks of ionospheric measurements obtained using the above techniques.

QUESTION ITU-R 225-4/3

The prediction of propagation factors affecting systems at LF and MF including the use of digital modulation techniques

(1995-1997-2000-2000-2005)

The ITU Radiocommunication Assembly,

considering

a) that Recommendation ITU-R P.368 presents ground-wave propagation curves for frequencies between 10 kHz and 30 MHz and that Recommendation ITU-R P.684 and Recommendation ITU-R P.1147 describe procedures for predicting sky-wave propagation at frequencies below about 150 kHz and at frequencies between about 150 and 1 700 kHz, respectively;

b) that most of these and other available prediction methods are intended primarily for narrow-band or analogue systems;

c) that under certain conditions, ground-wave and sky-wave signals of the same source may be comparable in amplitude;

d) that there is an increasing use of digital modulation techniques, including those that use fast signalling speeds or which require good phase or frequency stability;

e) that Recommendation ITU-R P.1321 summarizes some results of studies on propagation factors affecting systems using digital techniques at LF and MF;

f) that, for digital systems, information will be required of the signal level and its variation as well as of time and frequency spreads within the channel,

decides that the following Question should be studied

1 What improvements may be made to the methods of predicting the sky-wave field strength and circuit performance at frequencies below about 1.7 MHz?

2 Are there significant variations in ground-wave field strength with location or with time?

3 How does the coexistence of ground-wave and sky-wave signals affect digital systems at LF and MF?

4 What are the amplitude and phase characteristics of time and frequency spreads (multipath and Doppler) of the LF/MF sky-wave signals?

5 What are the appropriate parameters for these signal characteristics for incorporation into a measurement data bank?

6 How do the sky-wave parameters vary with time, frequency, path length and other factors?

7 What are the appropriate methods for predicting these parameters and to what extent should different prediction models be used, dependent on the modulation methods employed for the signal?

8 What service reliability results from the above parameters?

Category: S1

QUESTION ITU-R 226-2/3

Ionospheric and tropospheric characteristics along satellite-to-satellite paths

(1997-2000-2000)

The ITU Radiocommunication Assembly,

considering

a) that techniques exist for monitoring tropospheric and ionospheric characteristics by means of low orbiting satellites observing GPS satellites near the Earth's limb;

b) that ionospheric effects along these paths may dominate over tropospheric effects in some situations and, for extrapolation to other scenarios, separation of these two components is necessary;

c) that intersatellite links and compatibility may be affected by the ionosphere and the troposphere,

decides that the following Question should be studied

1 How does the ionospheric content along satellite-to-satellite radio paths vary with slant path, location, height, time and solar activity?

2 How are intersatellite links affected by the ionosphere and troposphere?

3 How can the ionospheric and tropospheric effects be separated in the results of measurements on such circuits?

QUESTION ITU-R 227-1/3*

HF channel simulation

(2000-2002)

The ITU Radiocommunication Assembly,

considering

a) that the testing and evaluation of HF modems is more cost effective when carried out under simulated representative ionospheric conditions;

b) that detailed characteristics of the ionospheric effects on an HF channel are required in order to simulate an HF channel accurately;

c) that both narrow-band and wideband HF systems need to be tested under simulated ionospheric conditions,

decides that the following Question should be studied

1 What ionospheric situations have significant effects on an HF channel?

2 What are the characteristics relevant for the simulation of a narrow-band HF channel?

3 What are the characteristics relevant for the simulation of a wideband (e.g. 100 kHz) HF channel?

4 What values of the channel transfer function, notably the delay power profile, are characteristic of the ionosphere at different locations and times?

further decides

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

* This Question should be brought to the attention of Radiocommunications Working Party 9C.

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;

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 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 Question 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 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?

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

5 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.

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 communication 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 Question 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?

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

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

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

Category: S1

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