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| **Radiocommunication Assembly (RA-15)Geneva, 26-30 October 2015** |  |
| **INTERNATIONAL TELECOMMUNICATION UNION** |  |
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|  | **Document 3/1001-E** |
| **9 September 2015** |
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| Chairman, Radiocommunication Study Group 3 |
| chairman’s report |
| radiowave propagation |
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# 1 Introduction

ITU-R Study Group 3 is conducting radio-wave propagation studies for system design and service planning as spelled out in Resolution ITU-R 23.

During the 2012-2015 study period, Study Group 3 had two meetings (both in Geneva, 27‑28 June 2013 and 30 April – 1 May 2015). In addition, four Working Party block meetings have been held in Geneva (18-27 June 2012, 17-26 June 2013, 2-10 September 2014 and 20-29 April 2015).

A major part of the work was dedicated to the production and revision of Recommendations (P‑series). During the 2012-2015 study period, Study Group 3 generated two new ITU-R Recommendations, revised 47 existing ITU-R Recommendations and suppressed one ITU-R Recommendation.

According to Resolution ITU-R 5-6, 23 Questions are assigned to ITU-R SG 3. Study Group 3 proposed the suppression of two Questions in the 2012-2015 study period.

This Report summarizes the progress of Study Group 3 since the last Radiocommunication Assembly in 2012. The Chairman would like to acknowledge the work of the Chairmen of the Working Parties during this period, as well as the help he received from the Vice-Chairmen and from the counsellor.

In addition to this Chairman’s Report, Study Group 3 is presenting four other contributions to the Radiocommunication Assembly:

• a list of P-series ITU-R Recommendations (Document 3/1002);

• a list of ITU-R Questions assigned to Study Group 3 (Document 3/1003);

• a list of ITU-R Resolutions of specific interest to Study Group 3 (Document 3/1004)

• revision to ITU-R Recommendation P.834-6 for the consideration of RA-15 (Document 3/1005).

# 2 Organization of Study Group 3

The 2012 the Radiocommunication Assembly re-appointed the Chairman and four Vice-Chairmen. It also appointed four new Vice-Chairmen.

While it is without doubt a necessity to have one or two Vice Chairmen in each Study Group (and perhaps three or four can be justified), it remains unclear whether the appointment of eight Vice‑Chairmen of the Study Group is useful, efficient or desirable. Especially Vice-Chairmen who do not attend the meetings of Working Parties will not have sufficient insight into the ongoing issues and priorities to effectively lead the Study Group, should the need arise. Possibly Resolution ITU-R 15, Annex 3 could be strengthened to provide more guidance on the optimum number of Vice‑Chairmen.

Study Group 3 officers, appointed by the 2012 Radiocommunication Assembly (see Resolution ITU‑R 4-6) were:

*Chairman:* Mr B. ARBESSER-RASTBURG (ESA)

*Vice-Chairmen:* Mr S. AL-MASABI (United Arab Emirates)

 Mr F.Y.N. DAUDU (Nigeria)

 Mr S. KONE (Côte d’Ivoire)

 Mr L. OLSON (United States)

 Ms M. PONTES (Brazil)

 Dr S.I. STARCHENKO (Russian Federation)

 Ms C.D. WILSON (Australia)

 Mr H. ZHU (China)

The Working Party organization established for the study period was:

WP 3J: Propagation fundamentals: Chairman: Prof M. Pontes (Brazil)

WP 3K: Point-to-area propagation: Chairman: Dr P. McKenna (USA)

WP 3L: Ionospheric propagation and radio noise: Chairman: Prof L. Barclay (UK)

WP 3M: Point-to-point and Earth-space propagation: Chairman: Ms C. Wilson (Australia)

At the Study Group 3 meeting in April 2015, the following new appointments were made:

WP 3J: Chairman Prof C. Riva (Italy),
Vice Chairman Dr L. Castanet (France)

WP 3L: Vice Chairman Dr C. Behm (USA)

WP 3M: Vice Chairman Mr G. Feldhake (USA)

# 3 Activities of Working Parties

## 3.1 WP 3J: Propagation fundamentals

This Working Party is concerned with the fundamental aspects of radio wave propagation upon which the other SG 3 Working Parties develop propagation methods and applications.

During the study period 2012-2015 Working Party 3J held four meetings under the chairmanship of Prof Marlene Pontes (The last meeting was chaired by Prof C. Riva since Prof Pontes had been kept from attending by a health issue). All meetings were held in Geneva, (18-27 June 2012, 17‑26 June 2013, 2-10 September 2014 and 20-29 April 2015).

The work of Working Party 3J was carried out in four subgroups:

3J-1: Effects of the clear atmosphere

3J-2: Effects of clouds and precipitation

3J-3: Global mapping and statistical aspects

3J-4: Vegetation and obstacle diffraction

In addition, WP 3J participated in the work of Joint Subgroup 3JKM: “Building entry loss for all services from 30 MHz to about 100 GHz”.

The main tasks of the Working Party were:

– considering requests for information and proposals contained in liaison statements
from other Working Parties;

– considering proposals for revision of existing Recommendations;

– considering new inputs to the databanks;

– working on the development of texts towards the creation of new Recommendations and Questions;

– considering Opinions and Resolutions related to the Working Party work;

– considering Questions addressed to the Working Party.

Questions ITU-R 201-5/3, 202-4/3, 209-2/3, and 214-5/3 are assigned to WP 3J. Questions ITU‑R 202 and 209 have been revised in the 2012-2015 study period.

Currently there are 25 Recommendations under the purview of Working Party 3J.

There is one Opinion, ITU-R 101-0 (Worldwide land cover data bases) assigned to this Working Party. This Opinion shall be maintained unchanged.

Working Party 3J has Report ITU-R P.2090-0 “Measuring the input parameters for the radiative energy transfer model of vegetation attenuation” under its purview. A new Report ITU-R P.2346-0 on the collection of experimental building entry loss data has also been established.

One of the most successful endeavours of WP 3J in the last study period was the introduction of digital maps for a variety of propagation-relevant factors, reaching from digital elevation maps to maps of water vapour. In many cases such digital maps have been incorporated into recommendations as integral part of the Recommendation (see Resolution ITU-R 25-3 and Resolution ITU-R 40-3).

Another important development was the creation of Rec. ITU-R P. 2040 on the “Effects of building materials and structures on radiowave propagation above about 100 MHz”, which forms a basis for the activities in the field of Building Entry Loss.

## 3.2 WP 3K: Point-to-area propagation

This Working Party is concerned with radio propagation aspects for terrestrial mobile and broadcasting services.

During the study period, 2012-2015 Working Part 3K held four meetings under the chairmanship of Dr Paul McKenna. These meetings were all held in Geneva (18-27 June 2012, 17-26 June 2013, 2‑10 September 2014 and 20-29 April 2015).

The work of Working Party 3K was conducted in five subgroups:

3K-1 Path specific prediction methods for terrestrial services from 30 MHz to 3 GHz

3K-2 Path general prediction methods for terrestrial services from 30 MHz to 3 GHz

3K-3 Short-range propagation for personal communications and wireless LANs in the frequency range 300 MHz to 100 GHz

3K-4 Prediction methods for terrestrial broadband radio access systems from 3 GHz to 60 GHz

Working Party 3K also took the lead in the Joint Subgroup 3JKM: Building entry loss for all services from 30 MHz to about 100 GHz.

The main tasks of the Working Party were:

• to consider questions and proposals contained in liaison statements from other Working Parties;

• to consider revision of Questions and Resolutions;

• to consider proposals for revision of existing Recommendations;

• the development of texts towards the creation of new Recommendations;

• to consider new inputs to the databanks.

The two ITU-R Questions assigned to Working Party 3K are as follows:

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| ITU-R 203-6/3:  | Propagation prediction methods for terrestrial broadcasting fixed (broadband access) and mobile services at frequencies above 30 MHz |
| ITU-R 211-3/3:  | 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  |

Working Party 3K proposed a revision to Question ITU-R 211.

Currently there are 11 Recommendations under the purview of Working Party 3K.

Working Party 3K currently has the following Reports under its responsibility:

Report ITU-R P.227-3: General methods of measuring the field strength and related parameters

Report ITU-R P.228-3: Measurement of field strength for VHF (metric) and UHF (decimetric) broadcast services, including television

Report ITU-R P.239-7: Propagation statistics required for broadcasting services using the frequency range 30 MHz to 1 000 MHz

These Reports will remain in force unchanged.

A new Report ITU-R P.2345 on “Defining the propagation method for Recommendation ITU‑R P.528” has been established. This report provides the background on the ITS – FAA 1977 (IF‑77) computer program used to produce the basic transmission loss curves in Recommendation ITU-R P.528.

The following list summarizes the most important activities of WP 3K:

• Correspondence Group 3K-3 studied possible improvements to the mixed path methods in both temperate and non-temperate climates. It also studied propagation models for Ultra Wideband (UWB) devices.

• Recommendation ITU-R P.1812 underwent further testing against measured data, as well as with other models. At the 2013 meeting of SG 3 a revised version with several improvements has been adopted.

• Correspondence Group 3K-6 has studied the impact of higher frequencies (from 6 GHz to 100 GHz) on propagation models covered in Recommendations ITU-R P.1411 and P.1238.

• Prediction methods for terrestrial broadband radio access systems have been studied to improve the prediction models for the frequency range 3-20 GHz concerning various issues, such as long links and short links, penetration through vegetation and building material. Future work towards revisions of Recommendation ITU-R P.1410 may make use 3D building databases.

• The Joint Correspondence Group 3J-3K-3M-8 studies the issues related to building entry loss. The focus will be on models for the frequency range 0.5 to 60 GHz for service prediction (high attenuation range) and for sharing studies (low attenuation range).

• Recommendation ITU-R P.1816 on the prediction of the delay profile for broadband land mobile services using UHF and SHF bands has seen some effort, extending the application range to greater distances.

## 3.3 WP 3L: Ionospheric propagation and radio noise

Working Party 3L is concerned with the propagation effects of the ionosphere and with radio noise.

During the study period, 2012-2015 Working Part 3K held four meetings under the chairmanship of Prof L. Barclay. These meetings were all held in Geneva (20-27 June 2012, 19-26 June 2013, 4‑10 September 2014 and 22-29 April 2015).

The work is divided into five subgroups:

3L-1 MF and LF propagation

3L-2 HF propagation

3L-3 Trans-Ionospheric propagation

3L-4 Radio Noise

3L-5 Handbook

Currently there are 10 Questions assigned to Working Party 3L by Study Group 3. It was agreed to transfer the responsibility of Question ITU-R 230 to WP 3J.

Currently there are 23 Recommendations under the purview of Working Party 3L.

There are four ITU-R Opinions assigned to WP 3L, namely:

Op ITU-R 22-7: Routine ionospheric sounding

Op ITU-R 23-6: Observations needed to provide basic indices for ionospheric propagation

Op ITU-R 68-2: Data bank of HF sky-wave intensity

Op ITU-R 91-2: World atlas of ground conductivities.

No changes are proposed to these Opinions.

Working Party 3L currently has the following four Reports under its responsibility:

Report ITU-R P.2011-1: Propagation of frequencies above basic MUF

Report ITU-R P.2089-0: The analysis of radio noise data

Report ITU-R P.2097-0: Trans-ionospheric radio propagation − The Global Ionospheric Scintillation Model.

Report ITU-R P.2297-0: Electron density models and data for transionospheric radio

These Reports will remain in force unchanged.

WP 3L has completed a Handbook on Ground-wave propagation. The update of the Handbook on “Ionosphere and its effects on propagation” is in the process of being compiled.

The following list summarizes the most important activities of WP 3L:

• a new HF Prediction method, called ITURHFPROP has been tested and made available;

• continued work on collection data on radio noise;

• revision of Recommendation ITU-R P.1147;

• updating the Handbook on “Ionosphere and its effects on propagation”.

## 3.4 WP 3M: Point-to-point and Earth-space propagation

Working Party 3M is concerned with the propagation aspects of the fixed services, except HF, and all satellite services.

During the study period, 2012-2015 Working Part 3K held four meetings under the chairmanship of Ms C. Wilson. These meetings were all held in Geneva (18-27 June 2012, 17-26 June 2013, 2‑10 September 2014 and 20‑29 April 2015).

The Working Party is conducting the work in four subgroups, namely:

3M-1 Terrestrial paths

3M-2 Earth-space paths

3M-3 Interference and coordination

3M-4 Software and digital products (for the whole Study group)

In addition, WP 3M participated in the work of Joint Subgroup 3JKM: “Building entry loss for all services from 30 MHz to about 100 GHz”.

Questions assigned to WP 3M are ITU-R 204-6/3, 205-2/3, 206-4/3, 207-5/3, 208-5/3, 228-2/3 and 233-1/3. Changes to Question 207 have been proposed.

Currently there are 23 Recommendations under the purview of Working Party 3M.

Working Party 3M currently has one Report under its responsibility:

Report ITU-R P.2145-1: Model parameters for an urban environment for the physical-statistical wideband LMSS model in Recommendation ITU R P.681-6

Topics under active study include prediction methods for terrestrial paths, prediction methods for Earth-space paths, interference and co-ordination, clear-air propagation effects and related parameters, precipitation effects, especially in tropical areas, prediction methods for broadcasting and mobile-satellite services, and maintaining the data banks.

The following list summarizes the most important activities of WP 3M:

• use improved radio-meteorological data provided as global maps from WP 3J, particularly for Recommendations ITU-R P.452 and ITU-R P.620 for frequencies up to 105 GHz;

• develop physical prediction methods for rain attenuation, which use the complete rainfall rate distribution in order to reflect more accurately the characteristics of different climates and the spatial correlation properties of rain attenuation;

• improve prediction methods for short, diffractive and reflective terrestrial paths, e.g., for point-to point radio links in cities;

• extend current methods for terrestrial LOS links and Earth-space links up to 105 GHz, both with respect to precipitation and clear air effects;

• develop methods for predicting spatial and temporal influences on various diversity techniques;

• develop prediction methods suitable to estimate outage intensity on digital terrestrial links.

# 4 Recommendations

Study Group 3 has currently 77 Recommendations, of which 76 are to be maintained unchanged. During the 2012-2015 study period Study Group 3 proposed the suppression of two recommendations and the addition of two new recommendations. For a complete list of P-Series Recommendations in force, see Document 3/1002.

A recent revision to Recommendation ITU-R P.834-6 had been sent to Administrations for adoption (see Administrative Circular CACE/728), but accidentally some text and equations had been mixed up and this had gone undetected. Thanks to the diligence of one administration the error was detected and the administration objected to the proposed adoption of the revision (see Annex 1). Resolution ITU-R 1-6, § 10.2.1.2.b makes provision to bring the Recommendation to the attention of RA-15 for consideration noting that there were no other meetings of SG 3 prior to RA-15 and subsequent to receiving the objection. All the parties involved have been consulted and Document 3/1005 now provides a revision which attempts to resolve the reason for the objection due purely to an oversight. RA 15 is invited to consider the corrected revised Recommendation in Document 3/1005 for adoption.

# 5 Questions

The Study Group currently has 23 Questions assigned to it, of which all are to be maintained. The Questions, together with their respective categories are listed in Document 3/1003.

# 6 Handbooks

Study Group 3 has produced the Handbooks with the following titles:

• Radiometeorology

• Radiowave propagation information for predictions for Earth-to-space path communication

• Terrestrial land mobile radiowave propagation in the VHF/UHF bands

• Curves for radiowave propagation over the surface of the Earth

• The ionosphere and its effects on radiowave propagation

• Radiowave propagation information for designing terrestrial point-to-point links

• The selection and use of radio propagation models for interference prediction and ITU sharing studies

• Handbook on ground-wave propagation.

A new [Decision 1](http://www.itu.int/oth/R0A0400006D/en) on eHandbooks was drafted during the June 2012 block meetings of Working Parties 3J, 3K, 3L and 3M and adopted by the subsequent meeting of Study Group 3. This new Decision 1 allows to supplement published handbooks with electronic versions of individual handbooks’ chapters. Updates of the electronic versions of these individual chapters will be available on a much more regular and timely basis.

# 7 Reports and Opinions

The Study Group has 11 Reports under its purview:

Report ITU-R P.227-3: General methods of measuring the field strength and related parameters

Report ITU-R P.228-3: Measurement of field strength for VHF (metric) and UHF (decimetric) broadcast services, including television

Report ITU-R P.239-7: Propagation statistics required for broadcasting services using the frequency range 30 MHz to 1 000 MHz

Report ITU-R P.2011-1: Propagation at frequencies above the basic MUF

Report ITU-R P.2089-0: The analysis of radio noise data

Report ITU-R P.2090-0: Measuring the input parameters for the radiative energy transfer model of vegetation attenuation

Report ITU-R P.2097-0: Trans-ionospheric radio propagation – The Global Ionospheric Scintillation Model (GISM)

Report ITU-R P.2145-1: Model parameters for an urban environment for the physical-statistical wideband LMSS model in Recommendation ITU R P.681-6

Report ITU-R P.2297-0: Electron density models and data for transionospheric radio

Report ITU-R P.2345-0: Defining propagation model for Recommendation ITU-R P.528-3

Report ITU-R P.2346-0: Compilation of measurement data relating to building entry loss

# 8 Resolutions

Resolutions ITU-R 8, ITU-R 25, ITU-R 37 and ITU-R 40 are particularly relevant to SG 3 (see also Document 3/1004). The Study Group reviews relevant Resolutions as part of its normal schedule to ensure that they are relevant and useful. The Study Group has reviewed the ITU-R Resolutions relevant to its scope and has found no need for any revisions.

# 9 Measurement campaigns and data banks

The Study Group manages data banks for the construction and testing of propagation prediction methods. The acquisition and quality control of data banks are important elements in validating software developed from the Recommendations. The Study Group has therefore assigned each data table to a Table Keeper who is an expert in the specific field. The data banks are available from the ITU-R [website](http://www.itu.int/ITU-R/index.asp?category=study-groups&rlink=rsg3-software-ionospheric&lang=en) thereby minimizing the cost and administrative effort of participants in the work and the Radiocommunication Bureau.

# 10 Software and digital products

Software and digital data products (such as digital maps) related to the Recommendations of Study Group 3 have been checked, verified and updated. Work continues to ensure that the software is up-to-date, clearly documented and maintained on the website in a manner that assists users to access the relevant digital products.

# 11 Future work programme

The Study Group is planning to hold Working Party meetings in June 2016 and in June 2017.

Study Group meetings will be scheduled according to progress made. If there is substantial material for a new recommendation on Building Entry Loss, a one-day meeting will be set up in June of 2016.

In 2017 a two-day meeting is scheduled right after the Working Party block meetings.

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| Dates | Meeting | Remarks |
| 20 June 2016 | 29 June 2016 | WPs 3J, 3K, 3M |  |
| 22 June 2016 | 29 June 2016 | WP 3L |  |
| 30 June 2016 | 30 June 2016 | SG 3 | if required |
| 19 June 2017 | 28 June 2017 | WPs 3J, 3K, 3M |  |
| 21 June 2017 | 28 June 2017 | WP 3L |  |
| 29 June 2017 | 30 June 2017 | SG 3 | normal schedule |

# 12 Conclusion

Study Group 3 has achieved its goals in the 2012-2015 study period and has contributed to the overall objectives of ITU-R. The structure of the Study Group has been maintained to ensure efficient use of the available expertise and the number of meetings was considered adequate to deal with the work at hand. The participation in Working Party meetings and Study Group meetings has been fairly constant over the years. It was observed that some of the traditionally strongly represented western countries have seen a reduction in participation whereas participation from the countries in Region 3 has increased.

# 13 Acknowledgement

The progress of SG 3 was only possible thanks to the dedication of delegates who prepared the input documents to meetings and who participated in the meetings of the Working Parties in a highly collaborative spirit.

Thanks are due to the Working Party Chairmen for their excellent efforts over the period. The work would not have been carried through without their leadership and the active and constructive participation of the Study Group membership.

Particular thanks are due to the Counsellor, Mr David Botha for his support and good advice and to the staff of the Bureau for their dedication in the preparation of meetings and processing of documents.

ANNEX 1

Objection from the Administration of the United States of America
to the approval of the Revision to Recommendation ITU-R P.834-6

27 July, 2015

In regard to: Administrative Circular CACE/728

Mr. Francois Rancy,
Director, Radiocommunication Bureau, ITU

Dear Mr. Rancy,

ITU-R circular letter CACE/728, dated 29 May, 2015, states that the meeting of Study Group 3, held on 30 April 2015, sought the adoption of the Draft Revision of Recommendation ITU-R P.834‑6 and further decided to apply the procedure for simultaneous adoption and approval by correspondence (PSAA) (§ 10.3 of Resolution ITU‑R 1.6). The Administration of the United States of America respectfully wishes to object to the adoption of the Draft Revision of Recommendation ITU-R P.834-6, based on an error in the equation for α, the lapse rate of air temperature, that appears in an unnumbered equation between equations (24c) and (25) of the revision.

The input document from the European Space Agency, 3J/119 contained the correct equation:

 $α≅0.5\left[\frac{(λ+1)⋅g}{R'\_{d}}-\sqrt{\frac{\left(λ+1\right)⋅g}{R'\_{d}}}\left[\frac{\left(λ+1\right)⋅g}{R'\_{d}}-4α\_{m}\right]\right]$ (K/km).

However, the output document from the Working Party 3J Drafting group, 3J/TEMP/67(Rev. 1), and the input document from Working Party 3J to Study Group 3, Document 3/92(Rev. 1), contained the following equation:

 $α≅0.5\left.\frac{(λ+1)g}{R'\_{d}}\left[1-\sqrt{\frac{\left(λ+1\right)g}{R'\_{d}}}\left[\frac{\left(λ+1\right)g}{R'\_{d}}-4α\_{m}\right]\right]\right.$ (K/km),

which is in error. Due to this error, the recommended method to predict the excess radio path length is not usable.

Therefore, the United States of America proposes that the Draft Revision to Recommendation ITU‑R P.834-6 be: a) returned to ITU-R Working Party 3J for further modification, correction and clarification and then b) subsequently resubmitted to the next meeting of ITU-R Study Group 3 for adoption and approval. The United States of America intends to collaborate with the European Space Agency to submit a detailed revision of the method to predict the excess radio path length to the next meeting of ITU-R Working Party 3J.

With Kind Regards,

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