

## **Commission A Triennial Report (2014-2017)**

### **1. Terms of Reference**

The current Terms of Reference for the Commission A (Electromagnetic Metrology) is the result of the revision made at the commission Business Meeting during the URSI GASS2011. The Terms of Reference is intended to include broader areas related to the science of measurements for various electromagnetic fields of research. It was reviewed again at the commission business meeting during the URSI GASS2014, where it was concluded that no changes were necessary. The following is the current Terms of Reference.

The commission promotes research and development of the field of measurement standards and physical constants, calibration and measurement methodologies, improved quantification of accuracy, traceability, and uncertainty, and the inter-comparison of such. Areas of emphasis are:

1. the development and refinement of new measurement techniques and calibration standards, including antenna measurement techniques
2. primary standards, including those based on quantum phenomena, and the realization and dissemination of time and frequency standards
3. characterization of electromagnetic properties of materials, physical constants, and properties of engineered materials, including nanotechnology
4. methodology of space metrology and electromagnetic dosimetry/measurements for health diagnostics, applications, and biotechnology, including bio-sensing
5. measurements in advanced communication systems and other applications

The commission fosters accurate and consistent measurements needed to support research, development, and exploitation of electromagnetic technologies across the spectrum and for all commissions.

### **2. Opinion on the redefinition of UTC requested by ITU**

At the commission business meeting during the URSI GASS2014, there was a discussion about the redefinition of Coordinated Universal Time (UTC). URSI was formally requested by International Telecommunication Union (ITU) to provide an opinion on this matter. As a result, the following document was agreed to as a resolution of the business meeting of URSI Commission A.

URSI Commission A

considering that

in 1971, the ITU-R (formerly CCIR, International Consultative Committee for Radiocommunications) proposed the present form of UTC (Universal Time Coordinated), which is based upon the SI second but remains linked to the variable rotation of the Earth through the introduction of leap seconds in such a manner that UT1-UTC will always less than 1 second,

this proposal was accepted after discussions with BIH (Bureau International de l'Heure), URSI, IAU, IUGG, and other bodies active in positioning and navigation, this system has worked well for most purposes, at the time of introduction, the future implementation of satellite and other systems which cannot easily incorporate the leap second was not foreseeable,

a proposal on the redefinition of UTC is under consideration by ITU,

the CCTF (Consultative Committee for Time and Frequency) of CIPM has endorsed the suggestion that no additional leap second should be inserted into UTC,

the Commission A of URSI expressed its opinion in 1999 as in the appendix,

fully supports

the action to consult on this subject with the appropriate Unions, the IERS (International Earth Rotation and Reference Systems Service) and other bodies interested in the use of time scales,

and is of the opinion that

no further leap seconds should be inserted, and UTC should become a unique and continuous reference time scale,

and requests that

URSI endorse and forward this opinion to ITU.

This document was then submitted to the URSI Council and it was decided to forward the document to the Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science (IUCAF) for comments and further action. After some discussion between the representatives of IUCAF and URSI, the document was submitted to ITU-R as an input document for the discussions towards the ITU World Radiocommunication Conference in 2015 (WRC-15) which took place in November 2015.

The ITU discussed the future of UTC at the WRC-15 and decided to call for further studies regarding current and potential future reference time-scales, including their impact and applications. The redefinition will be considered by the ITU at the World Radiocommunication Conference in 2023 (WRC-23). In preparation for WRC-23, the ITU has requested international organizations such as the International Maritime Organization (IMO), the International Civil Aviation Organization (ICAO), the General Conference on Weights and Measures (CGPM), the International Committee for Weights and Measures (CIPM), the International Bureau of Weights and Measures (BIPM), the International Earth Rotation and Reference Systems Service (IERS), the International Union of Geodesy and Geophysics (IUGG), the International Union of Radio Science (URSI), the International Organization for Standardization (ISO), the World Meteorological Organization (WMO), and the International Astronomical Union (IAU) for feedback and opinions.

### **3. Technical Advisory Committee**

At the URSI Coordinating Committee Meeting which took place at the AT-RASC in 2015, it was suggested to form Technical Advisory Committee under each Commission. This idea was discussed at the Business Meeting of the Commission A and was supported by the participants. A solicitation to become or to nominate a member of the committee was sent to the national members of the Commission A after the AT-RASC2015. As the results the Technical Advisory Committee was created under the Commission A with the members listed below.

- Felicitas Arias, BIPM, France
- Nuno Borges Carvalho, Instituto de Telecomunicacoes, Universidade de Aveiro, Portugal
- Yang Chuntao, Beijing Institute of Radio Metrology & Measurement, China
- Frédérique de Fornel, CNRS, France
- Jacob Halevy-Politch, Representative Commission A, Israel
- Ryszard J. Katulski, Gdansk University of Technology, Poland
- Chen Kunfeng, The 41st Institute of CETC, China

- Andon Lazarov, Burgas Free University, Bulgaria
- Tian Hong Loh, National Physical Laboratory, UK
- Demetrios Matsakis, United States Naval Observatory, USA
- Liu Min, Beijing Orient Institute of Measurement and Test, China
- Amitava Sen Gupta, The NorthCap University, India
- Noshewan Shoaib, Politecnico di Torino, Italy
- Emmanuel Van Lil, KU Leuven, Netherlands
- Steven Weiss, Army Research Lab, USA
- Liu Xinmeng, National Institute of Metrology, China
- Li Yalu, Beijing Orient Institute of Measurement and Test, China
- William A. Davis, Professor Emeritus, Virginia Tech, USA (Immediate Past Chair)
- Pedro Miguel Cruz, CONTROLAR, Portugal (ECR)
- Patrizia Tavella, INRIM, Italy (Vice Chair)
- Yasuhiro Koyama, NICT, Japan (Chair)

The committee was consulted for coordination of Commission A's sessions for AP-RASC2016 and GASS2017. Various ideas were proposed by the committee members, some of whom volunteered to become conveners of AP-RASC2016 and GASS2017.

#### **4. Working Group for Education and Training**

At the time of commission business meeting during the GASS2014, it was proposed to establish a new working group focusing on the education and training for Electromagnetic Metrology. There are many institutes providing such education and training, and it was thought to be very helpful if we could share valuable materials and resources. Since the formal establishment of the new working group will require detailed Terms of Reference and a list of membership, it was proposed to start from ad-hoc group with the task of collecting the information on training organized by the various institutes and sharing the information. Dr. Demetrios Matsakis of United States Naval Observatory volunteered to become the Chair of the WG and the initial members have been defined as the list below.

- Ashish Agarwal, National Physical Laboratory, India
- Charles F. Bunting, Oklahoma State University, USA
- William A. Davis, Professor Emeritus, Virginia Tech, USA
- Yashiro Koyama, NICT, Japan
- Tian Hong Loh, National Physical Laboratory, UK
- Demetrios Matsakis (WG Chair)
- Alireza Motevasselian, LEAX Arkivator Telecom, Sweden
- Patrizia Tavella, INRIM, Italy
- Congsi Wang, Key Laboratory of Electronic Equipment Structure, China

There will be a dedicated session for the Education and Training in Electromagnetic Metrology at the GASS2017 and information about available resources and experiences will be shared among the community of Commission A.

## 5. Sponsored meetings

During the triennial from GASS2014 to GASS2017, the following meetings and conferences have been technically supported by Commission A.

- CEM'17 (Computing and Electromagnetics International Workshop), Barcelona, Spain
- 3rd URSI – RCRS (URSI Regional Conference on Radio Science 2017), Tirupati, Andhra Pradesh, India
- URSI-France 2017 Workshop dedicated to “Radio Science for Humanity”, Sophia Antipolis, France
- USNC-URSI NRSM 2017 (US National Committee-URSI National Radio Science Meeting), Boulder, CO, USA
- 34th National Radio Science Conference (NRSC2017), March 2017, Alexandria, Egypt
- SCOSTEP/ISWI (International School on Space Science), Sangli, India
- RADIO 2016, IEEE Radio and Antenna Days of the Indian Ocean 2016, Réunion Island
- ICEAA 2016 (Eighteenth edition of the International Conference on Electromagnetics in Advanced Applications), Cairns, Australia
- HF13 (Nordic HF Conference with Longwave Symposium LW 13), Faro, Sweden
- COSPAR 2016 (41st Scientific Assembly of the Committee on Space Research and Associated Events), Istanbul, Turkey
- ISPRS-URSI Joint Special Session SpS15 : "Disaster and Risk Management", Prague, Czech Republic
- MMET 2016 (16th International Conference on Mathematical Methods in Electromagnetic Theory), Lviv, Ukraine
- MetroAeroSpace 2016, 3rd IEEE International Workshop on Metrology for Aerospace, Firenze, Italy
- NRSM 2016 (2016 National Radio Science Meeting), Boulder, CO, USA
- 33rd National Radio Science Conference (NRSC2016), February 2016 Aswan, Egypt
- ICMARS 2015 (11th International Conference on Microwaves Antenna Propagation & Remote Sensing), Jodhpur, Rajasthan, India
- URSI-RCRS 2015 (2nd URSI Regional Conference on Radio Science), New Delhi, India
- COSPAR 2015 (2nd Symposium of the Committee on Space Research), Water and Life in the Universe, Foz do Iguacu, Brazil
- IEEE Radio 2015 (IEEE Radio and Antenna Days of the Indian Ocean 2015), Mauritius
- URSI-JRSM 2015 (2015 URSI-Japan Radio Science Meeting), Tokyo, Japan
- CEM'15 (Computational Electromagnetics International Workshop), Izmir, Turkey
- Metamaterials 2015, The 9th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, Oxford, U.K.
- 32nd National Radio Science Conference (NRSC2015), March 2015, Cairo, Egypt
- ISRSSP 2014 (The Fourth International Symposium on Radio Systems and Space Plasma), Ruse, Bulgaria

- 31st National Radio Science Conference (NRSC 2014), April 2014, Cairo, Egypt

## 6. AT-RASC2015

Atlantic Radio Science Conference 2015 (AT-RASC2015) was held at Expo Meloneras, Gran Canaria from 18 to 22 May 2015. Commission A organized the following four sessions and 22 papers were presented in total.

- Microwave to submillimeter measurements and standards
- Future of Coordinated Universal Time
- Antennas and wireless metrology
- Wireless Power Transmission and Energy Harvesting (Joint Session with Commission D and COST IC1301)

## 7. AP-RASC2016

Asia Pacific Radio Science Conference 2016 (AP-RASC2016) was held at the Grand Hilton Seoul Hotel in Seoul, Korea from 21 to 25 August, 2016. Commission A organized 4 regular sessions and 2 special sessions. Following is the list of sessions organized by Commission A. 34 papers were presented in total.

- Antenna (Session Chairs : Nozomu Ishii and Jin-Seob Kang)
- Time and Frequency (Session Chairs : Amitava Sen Gupta and Myoung-Sun Heo) (Asia-Pacific Workshop on Time and Frequency Joint Session)
- Material measurement & Network Analysis (Session Chairs : Kouji Shibata and Tah-Hsiung Chu)
- Communication Related Metrology (Session Chair : Qian Nan Lu)
- EM Basic Metrology (Session Organizers : Tae-Weon Kang and Shan Yueyan)
- Antenna Related Metrology (Session Organizers : Satoru Kurokawa and Ki-Chai Kim)

## 8. GASS2017

The 32nd URSI General Assembly and Scientific Symposium (GASS2017) will be held at the Palais des Congrès de Montréal, Canada from 19 to 26 August, 2017. Commission A is organizing 18 sessions including four joint sessions with other commissions.

- Measurements of Isotropic and Anisotropic Magnetodielectrics (Conveners : Steven Weiss and Amir I. Zaghoul)
- Linear and Nonlinear Measurements for Communications Systems (Conveners : Pedro Miguel Cruz and Nuno Borges Carvalho)
- Space Metrology (Conveners : Liu Min and Pedro Miguel Cruz)
- SI Units (Conveners : Felicitas Arias and Carl Williams)
- Metrology in the THz Region (Conveners : Chen Kunfeng and Masatoshi Kajita)
- Time and Frequency Standards (Conveners : Felicitas Arias and Masatoshi Kajita)

- Advanced Time and Frequency Transfer Techniques (Conveners : Felicitas Arias and Demetrios Matsakis)
- Education and Training in Electromagnetic Metrology (Conveners : Demetrios Matsakis, Patrizia Tavella and Parmeswar Banerjee)
- Advances in Sensor Development and Applications (Conveners : C. Zerrouki and Andon Lazarov)
- Metrological Analysis of Material Properties (Conveners : Noshewan Shoaib and Imran Shoaib)
- Metrology for Wireless Power Transmission Solutions (Conveners : Nuno Borges Carvalho and Ke Wu)
- Microwave Frequency Standards and Applications (Conveners : Amitava Sen Gupta and Fang Fang)
- Time Dissemination for Critical Applications (Conveners : Marina Gertsvolf and Leon Lobo)
- Open Session (Conveners : Yasuhiro Koyama and Patrizia Tavella)
- Mode-Stirred Chambers (Conveners : Luk R. Arnaut and Tian Hong Loh) (Joint Session with the Commission E)
- Channel Measurements, Characterization and Verification through Electromagnetic Metrology and Measurement Post Processing (Conveners : Jeanne Quimby and Sana Salous) (Joint Session with the Commission C)
- Optical Frequency Metrology (Conveners : Ekkehard Peik, Kazumoto Hosaka and Masami Yasuda) (Joint Session with the Commission D)
- Optical Methods for Microwave Metrology (Conveners: Mark Bieler and Yang Chuntao) (Joint Session with the Commission D)

In total, 108 papers have been accepted for presentations at the GASS2017. A tutorial lecture will be given by Dr. Judah Levine on “Distributing Time and Frequency Data: Requirements and Methods”.

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