



Commission Triennial Report

Commission A

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 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 GASS2017, 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. Proposals of resolutions to be considered at GASS

The International Telecommunication Union (ITU) has been discussing about the future of Coordinated Universal Time (UTC) for more than two decades and decided at its World Radio Conference (WRC) in 2015 to call for further studies regarding current and potential future reference time-scales, including their impact and applications. The redefinition of UTC is to be considered by the ITU again at the WRC in 2023 (WRC-23) and 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.



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To respond to the consultation from ITU, Commission A took the initiative to prepare official statements from URSI. At first, the first version of a draft resolution about the UTC issue was prepared by the experts of Commission A trying our best to reflect the position of URSI as an international organization of radio scientists not only representing the opinions of our commission but whole community of URSI. This version was distributed to all commissions in February 2020 and an ad-hoc drafting group was formed to revise the draft. As many as 19 experts volunteered to join the ad-hoc drafting group and after the rigorous discussions the final version of the draft resolution was proposed to the Secretariat of URSI for consideration by the Council.

Also, another draft resolution has been prepared jointly by our commission and the chair of commission G, Dr. Patricia Doherty. The intention of the second draft resolution is a proposal to rename the Auger effect to recognize contributions of Dr. Lisa Meitner.

3. Technical Advisory Committee

Technical Advisory Committee of Commission A was established in 2015 after the AT-RASC2015 meeting and the membership of the committee was refreshed after the GASS2017. Following is the list of members of the Technical Advisory Committee for the period from 2017 to 2021.

- Felicitas Arias, France
- Chen Kunfeng, The 41st Institute of CETC, China
- Demetrios Matsakis, USA
- Amitava Sen Gupta, The NorthCap University, India
- Emmanuel Van Lil, KU Leuven, Belgium
- Steven Weiss, The Johns Hopkins School for Professionals, USA
- Patrizia Tavella, BIPM, France
- Dominique Schreurs, KU Leuven, Belgium
- Tian Hong Loh, National Physical Laboratory, UK
- Rowayda A. Sadek, Helwan University, Egypt
- Parmeswar Banerjee, Amity University, India
- Noshawan Shoaib, National University of Sciences and Technology, Pakistan (ECR)
- Pedro Miguel Cruz, Bosch Security Systems SA, Portugal (ECR)
- Nuno Borges Carvalho, Instituto de Telecomunicacoes, Universidade de Aveiro, Portugal (Vice Chair)

The committee was consulted for coordination of Commission A's sessions for AT-RASC2018, AP-RASC2019, and GASS2021. Various ideas were proposed by the committee members, many of whom volunteered to become conveners of these flagship meetings.

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



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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, BIPM, France
- Congsi Wang, Key Laboratory of Electronic Equipment Structure, China
- Steven Weiss, The Johns Hopkins School for Professionals, USA
- Carlo F. M. Carobbi, University of Florence, Italy
- Razvan D. Tamas, Constanta Maritime University, Romania
- Amitava Sen Gupta, The NorthCap University, India

They have established a resource web page that is linked to from the official URSI Commission A pages. There will be a dedicated session for the Education and Training in Electromagnetic Metrology at the GASS2021 and information about available resources and experiences will be shared among the community of Commission A.

5. Sponsored meetings

During the period from GASS2017 to GASS2021, the following meetings and conferences have been technically supported by Commission A.

- IEEE Radio and Antenna Days of the Indian Ocean 2017, Cape Town, South Africa, 25-28 September 2017
- 2017 International Symposium on Antennas and Propagation, Phuket, Thailand, 30 October-2 November 2017
- The 12th International Congress on Artificial Materials for Novel Wave Phenomena, Espoo, Finland, 27-30 August 2018
- IEEE Radio and Antenna Days of the Indian Ocean 2018, Mauritius, 15-18 October 2018
- Asia-Pacific Microwave Conference 2018, Kyoto, Japan, 6-9 November 2018
- 2019 URSI-Japan Radio Science Meeting, Tokyo, Japan, 5-6 September 2019
- International Congress on Artificial Materials for Novel Wave Phenomena, Rome, Italy, 16-19 September 2019
- Radio and Antenna Days of the Indian Ocean 2019, Reunion Island, 23-26 September 2019
- 10th IEEE International Conference on RFID Technology and Applications, Pisa, Italy, 25-27 September 2019



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- 14th International Congress on Artificial Materials for Novel Wave Phenomena, New York, USA, 28 September - 1 October 2020 (in an online format)
- 2020 International Symposium on Antennas and Propagation, Osaka, Japan, 25-28 January 2021
- 15th International Congress on Artificial Materials for Novel Wave Phenomena, New York, NY, USA, 2-5 August 2021
- Microwave and Radio Electronics Week 2021, Brno, Czech Republic, 19-21 April 2021

6. AT-RASC2018

Atlantic Radio Science Conference 2018 (AT-RASC2018) was held at Expo Meloneras, Gran Canaria from 28 May to 1 June 2018. Commission A organized the following 8 sessions including 2 joint sessions with other commissions and 22 papers were presented in total.

- Realization and Calibration of Standards (Conveners : Amitava Sen Gupta, Marina Gertsvolf)
- Redefinition of SI electromagnetic units (Conveners : Felicitas Arias, Carl Williams)
- Precision geolocation, navigation and timing (Conveners ; Demetrios Matsakis, Pedro Miguel Cruz)
- Characterization and measurements for 5G and beyond (Conveners : Nuno Borges Carvalho, Tian Hong Loh)
- Antenna and wireless system measurements (Conveners : Steven Weiss, Congsi Wang)
- Education and training in electromagnetic metrology (Conveners : Steven Weiss, Demetrios Matsakis)
- Radio Channel Sounding and Channel Modeling (Conveners : Tian Hong Loh, Jeanne Quimby)
- Mode stirred chambers (Conveners : Luk Arnaut, Tian Hong Loh)

7. AP-RASC2019

Asia Pacific Radio Science Conference 2019 (AP-RASC2019) was held at the India Habitat Centre in New Delhi, India from 9 to 15 March, 2019. A keynote lecture "Linking the International System of Units to Fundamental Constants" was given by Dr. J. Ullrich from Commission A. Commission A organized 4 regular sessions listed below and 45 papers were presented in total.

- Precision Metrology - Practice, Education, and Prospects (Conveners : Y. Koyama, G. Petit, E. Peik, D. Matsakis, S. Weiss)
- Microwave and Optical Frequency Standards (Conveners : A. Sen Gupta, M. Gertsvolf, F. Fang)
- Advanced Time & Frequency Transfer Techniques and Precision Geolocation (Conveners : P. Banerjee, H. Lin, F. Arias)
- Metrology in Telecommunication Systems (Conveners : N. Shoaib, I. Shoaib, S. Dubey, N. Carvalho, T. Loh, S. Weiss, S. Ananthkrishnan)



8. GASS 2021

The 34th URSI General Assembly and Scientific Symposium (GASS2021) will be held at the Faculty of Civil and Industrial Engineering, Sapienza University of Rome, Italy from 28 August to 4 September, 2021. Commission A is organizing 19 sessions including 5 joint sessions with other commissions.

- SI Units and time and frequency standards (Convenors : F. Arias, C. Williams, and M. Kajita)
- Advanced Time and Frequency Transfer Techniques (Convenors : F. Arias, D. Matsakis)
- Time Dissemination for Critical Applications (Convenors : M. Gertsvolf, L. Lobo)
- Metrology for Wireless Power Transmission Solutions (Convenors : N. Carvalho, A. Costanzo)
- Advances in Sensor Development and Applications (Convenors : C. Zerrouki, R. Sadek)
- Metrological Analysis of Material Properties (Convenors : N. Shoaib, I. Shoaib)
- Space Metrology (Convenors : L. Min, P. Cruz)
- Education and Training in Electromagnetic Metrology (Convenors : D. Matsakis, P. Tavella)
- Measurements of Isotropic and Anisotropic Magnetodielectrics (Convenors : S. Weiss, A. Zaghoul)
- GaN based Power Amplifiers for satellite systems (Convenors : V. Camarchia, P. Colantonio)
- Micro and Nanotechnology in Instrumentation and Measurement (Convenors : N. Shoaib, I. Shoaib)
- Characterization and Modelling of Microwave Transistors (Convenors : A. Raffo, P. Roblin)
- Advanced Techniques of Positioning and Timing (Convenors : P. Banerjee, G. Petit)
- Open Session (Convenors : Y. Koyama, N. Carvalho)
- Metrology Solutions for Radar Systems and Propagation (Convenors : P. Cruz, A. Zaghoul)
- Metrology for 5G and Emerging Wireless Technologies (Convenors : T. Loh, N. Carvalho, Y. Louet)
- Channel Meas. Charact. and Verification through EM Metrology and Post Proc. (Convenors : J. Quimby, S. Salous)
- Optical Frequency Metrology (Convenors : H. Hachisu, H. Ashgari)
- Mode-Stirred Chambers (Convenors : L. Arnaut, T.H. Loh)

In total, 88 papers have been accepted for presentations at the GASS2021. A tutorial lecture will be given by Dr. Noshawan Shoaib on RF Energy Harvesting for IoT Applications.

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