Commission A

Session	Number of slots
A01	3-5
SI Units	
Conveners: Felicitas Arias, Carl Williams, felicitas.time@gmail.com, carl.williams@nist.gov	
Description: SI units are fundamental to all scientific measurements and to metrology. Various electromagnetic measurement methods are essential for the definition and realization of SI units, and various SI units are used in all electromagnetic measurements. The SI is evolving towards new definitions of units based on physical constants. This session solicits papers regarding the definition, realization, and improvements of SI units in connection with Electromagnetic Metrology.	

Session	Number of slots
A02	3-5
Time and Frequency Standards	
Conveners: Felicitas Arias, Masatoshi Kajita, felicitas.time@gmail.com, kajita@nict.go.jp	
Description: In this session, we discuss recent progress on the development of Time and Frequency standards. Papers on experimental results of precise measurement of transition frequencies of atoms, molecules, and ions in all frequency area (microwave, optical, infrared, THz) are expected. Also theoretical papers giving new sights on precise measurements are welcome.	

Session	Number of slots
A03	3-5
Advanced Time and Frequency Transfer Techniques	
Conveners: Felicitas Arias, Demetrios Matsakis, felicitas.time@gmail.com, demetrios.matsakis@usno.navy.mil, dnmyiasou@yahoo.com	
Description: Ever-improving frequency standards and the technological growth of our civilization is generating and sustaining a need for more precise, accurate, robust, and secure time and frequency transfer than currently available locally, globally, and extra-terrestrially. Improvements to existing operational technologies such as GNSS, two way satellite time and frequency transfer, NTP, and PTP can help solve the problem, as can development of newer technologies involving optical fibers, optical transmissions from ground or space, VLBI observations of radio sources, and differential observations of pulsars and x-ray sources. Papers are solicited in all these fields, as well as any other areas that involve time and frequency transfer.	

Session	Number of slots
A04	
Time Dissemination for Critical Applications	
Conveners: Marina Gertsvolf, Leon Lobo Marina.Gertsvolf@nrc-cnrc.gc.ca, leon.lobo@npl.co.uk	
Description: In the past few years the need for traceable and accurate time dissemination at sub-millisecond and sub-microsecond levels has been fast growing. New technologies drive tight technical time synchronization demand followed by new regulations. In this session the papers will be focused on high accuracy time dissemination methods for the power industry (e.g. smart grids), wireless communications (e.g. LTE), financial sector and scientific applications (e.g. VLBI). The papers will address different dissemination methods (e.g. fibre, GNSS, MW) and solutions.	

Session	Number of slots
A05	3-5
Microwave Frequency Standards and Applications	
Conveners: Amitava Sen Gupta, Fang Fang, sengupta53@yahoo.com, fangf@nim.ac.cn	
Description: This session will focus on research on topics related to the following: (a) Microwave Atomic Frequency Standards, (b) Atomic Clocks for Space Applications, (c) Vapor-cell Atomic Clocks (d) cell-based Sensors and Instruments, (e) Atomic Interferometers, (f) Fundamental Physics Tests with Clocks, and Other Applications.	

Session	Number of slots
A06	3-5
Metrology for Wireless Power Transmission Solutions	
Conveners: Nuno Borges Carvalho, Alessandra Costanzo, nbcarvalho@av.it.pt, alessandra.costanzo@unibo.it	
Description: In this session the main issues to be addressed are measurements and instrumentation for wireless power transmission and electromagnetic energy harvesting, including IoT and RFID devices. Papers should focus on these themes spanning from material characterization to antenna measurements and nonlinear active device components.	

Session	Number of slots
A07	3-5
Advances in Sensor Development and Applications	
Conveners: Chouki Zerrouki, Rowayda Sadek, chouki.zerrouki@cnam.fr, rowayda_sadek@yahoo.com	
Description: The session will focus on a broad range of sensors, technologies and applications. These can be categorized by the sensing material, frequency of the electromagnetic waves, principles, technique and technology of development, and the sensor network protocols and application domain. The session will include papers on all of these subjects. In particular: 1, methods for sensor deployment; instrumentation and models for deployment of sensors networks; sensor architecture; micro and nano devices; biosensors; optical sensors; smart sensors; acoustic sensors; microwave sensors, synthetic aperture radars; sensor prototypes; sensor node components; sensor interfaces; actuators; independent component analysis; design of cost effective and economical sensors; smart material applications to design sensors; integration of sensors into engineered systems; hardware platforms; test-beds incorporating multiple sensors; operating system and middleware support. 2. Wireless Sensor Communications; Network connectivity & longevity; tracking objects; geo-location problems; network coverage; algorithms for sensor localization and tracking; detection, classification and estimation; physical layer impact on higher level protocols; directional and smart antennas for sensor networks; coverage maintenance; transceiver and antenna design; ubiquitous wireless connectivity. 3. Applications and demonstrations of sensor networks; software platforms development tools; architectural design and optimization tools for sensor nodes; computation and programming models of sensor networks; languages and operating systems of sensors; programming and interfacing; programming abstraction; programming models for sensors; programming methodology for sensor environments; intelligent sensor theory and applications; machine learning applications to sensor networks; wireless sensor applications; applications for sensor network management; software tools for chip programming; application requirements; application evaluation and comparison; demos and prototype testing.	

Session	Number of slots
A08	3-5
Metrological Analysis of Material Properties	
Conveners: Nosherwan Shoaib, Imran Shoaib nosherwan.shoaib@seecs.edu.pk, nosherwan@live.com, imran.shoaib@ieee.org	
Description: This session will focus on the material measurements and the associated uncertainty evaluation using the time and frequency domain measurement systems. The traceability of uncertainty analysis to the International System of Units (SI) is important to establish in order to evaluate the validity of the results obtained using different measurement systems. The papers for this session should analyze the permittivity measurements and associated uncertainty for magnetic or non-magnetic materials over the frequencies ranging from few MHz up to the THz. The comparisons between the results obtained from different measurement systems are highly encouraged.	

Session	Number of slots
A09	3-5
Space Metrology	
Conveners: Liu Min, Pedro Miguel Cruz liumin@cast514.com, pedrocruz82@gmail.com, pedro.cruz@controlar.pt	
Description: Space metrology is required to assure unified and accurate measurements of space equipment and systems. There are three themes for Space Metrology. The first is in-orbit, embedded and automatic calibration of the spacecraft platform. The second applies to the space measurement instruments (the payload). These need be calibrated and include solar observation instruments, electromagnetic field measurements etc. The third addresses basic metrology theory that necessitates the reconsideration of the application of SI units in the space environment. According to general relativity, gravity affects the frequency of atomic clock, and then influences length, voltage and mass at scales of 1/c2. Timekeeping in space is a new topic and is an important issue in navigation and astronomical observations. This session will focus on in-orbit calibration of equipment in space, calibration of space environment simulations, space metrology theory in the context of general relativity etc.	

Session	Number of slots
A10	3-5
Education and Training in Electromagnetic Metrology	
Conveners: Demetrios Matsakis, Patrizia Tavella, demetrios.matsakis@usno.navy.mil, dnmyiasou@yahoo.com, patrizia.tavella@bipm.org	
Description: Education and training play an important role in the dissemination of the metrology culture and in forming skilled metrologists. URSI Commission A recognizes the high potential of electromagnetic metrology in different fields of application and the need for appropriately educated young scientists is deemed fundamental. Many countries run university courses in metrology and/or electromagnetic measurements, including masters courses, PhD programs, and specialized summer schools. This session seeks to promote the discussion and sharing of information and teaching material, and to support similar initiatives in education and training in different countries with possible teaching cooperation.	

Session	Number of slots
A11	3-5
Measurements of Isotropic and Anisotropic Magnetodielectrics	
Conveners: Steven Weiss, Amir I. Zaghloul, steven.j.weiss14.civ@mail.mil, swieee@aol.com, amirz@vt.edu	
Description: The use of magnetodielectric materials with prescribed or tunable values of permittivity and permeability is becoming an important enabling technology for device enhancements (e.g., low-profile antennas). This session addresses measurement techniques to evaluate various properties of magnetodielectric materials that are isotropic or anisotropic in construction.	

Session	Number of slots
A12	3-5
GaN based Power Amplifiers for satellite systems	
Conveners: Vittorio Camarchia, Paolo Colantonio, vittorio.camarchia@polito.it, paolo.colantonio@uniroma2.it	
Description: The progress in the development of Gallium Nitride technology is becoming really appealing and challenging for the application in the space systems. In particular, the realization of solid state power amplifiers for satellite system is beoming a solution for both navigation and communication applications. This session will focus on the solutions developed for the design of power amplifiers based on GaN technology for space systems.	

Session	Number of slots
A13	3-5
Metrology for Internet of Things	
Conveners: Nuno Borges Carvalho, Luca Roselli nbcarvalho@av.it.pt, luca.roselli@unipg.it	
Description: In this session the main issues to be addressed are measurements and instrumentation for IoT applications, specially sensitivity of very low power solutions and low duty cycle approaches as also measurements ana characterization of cross section solutions in backscatter devices. Papers should focus on these themes spanning from time domain to frequency domain approaches as also antenna measurements in integrated components for future IoT applications.	

Session	Number of slots
A14	3-5
Micro and Nanotechnology in Instrumentation and Measurement	
Conveners: Nosherwan Shoaib, Imran Shoaib nosherwan@live.com, nosherwan.shoaib@seecs.edu.pk, imran.shoaib@ieee.org	
Description: In the domain of micro and nanotechnology, the instrumentation and measurement techniques have particular specifications and requirements which make the fabrication and testing of micro- and nano-devices a very challenging task. This session will focus on the instrumentation and measurement techniques related to the design, fabrication and testing of micro- and nano-devices and systems. Simulations and measurements results for micro- and nano-devices and systems are also welcome. In addition, papers dealing with different instrumentation and measurement aspects of micro- and nanotechnology are highly encouraged. The comparisons between the results obtained from different measurement systems are also recommended.	

Session	Number of slots
A15	3-5
Characterization and Modelling of Microwave Transistors	
Conveners: Antonio Raffo, Patrick Roblin antonio.raffo@unife.it, roblin.1@osu.edu	
Description: Microwave transistors are driving the development of last-generation communication systems, such as 5G. As a consequence, they are one of the most important enabling technologies for the birth of the new fully-connected world, encompassing IoT and cyber-physical systems. Operating frequencies, power-handling capabilities, linearity, efficiency of the adopted transistors define the maximum achievable performance of a communication system. In this perspective, microwave measurements are of paramount importance for correctly assessing the performance achievable by an investigated technology and represent the starting point for extracting linear and nonlinear models suitable for CAD environment. Model accuracy is inherently related to measurement uncertainty and, also for this reason, the correct evaluation of uncertainty has gained more and more attention in the last years. The different talks in this session will be focused on both advanced measurement and modelling techniques oriented to state-of-the-art microwave transistors.	

Session	Number of slots
A16	3-5
Advanced Techniques of Positioning and Timing	
Conveners: Parameswar Banerjee, Gerard Petit, Pascale Defraigne pbanerjee150@gmail.com, gpetit@bipm.org, Pascale.Defraigne@oma.be	
Description: Precision and accuracy of time and frequency transfer have been improving with evolution of advanced techniques and technologies. There have been extensive efforts to optimally utilize GNSS, two way satellite time and frequency transfer leading to cater the need for more advanced techniques. Precise positioning is an emerging area that needs to be addressed to cope with the demanding social requirements. Papers that will address these issues including advanced time transfer techniques and related challenges and precise positioning methods, are solicited.	

Session	Number of slots
A17	3-5
Open Session	
Conveners: Yasuhiro Koyama, Nuno Borges Carvalho koyama@nict.go.jp, nbcarvalho@av.it.pt	
Description: This session is open for all papers related to the following list of topics of interests. - Interaction between EM field and living tissue Bioeffects, Biological affects, Medical applications - EM Fields EM-field metrology, EMC and EM pollution, Impulse radar, Interconnect and packaging - Materials Material characterization, Metrology of material - Measurements and calibration Propagation, Microwave to submillimeter measurements/standards, millimeter-wave and sub-mm wave communications, Noise, Noise measurement standards, Planar structures and microstrip circuits, Quantum metrology and fundamental concepts, RFID, Scattering calibration and references, Signal enhancement for EM metrology, Space plasma characterization, Time and frequency, Time domain metrology, Techniques for remote sensing - Statistical measurement Turbulent media, Rough Surfaces, Stratified media	