

JOINT SESSIONS

Led by Commission A

Session	Title	Convener names & e-mails	Number of slots
AC1	Metrology Solutions for Radar Systems and Propagation	Pedro Miguel Cruz, Amir Zaghloul pedrocruz82@gmail.com, pedro.cruz4@pt.bosch.co, , amirz@vt.edu	6
<p>Description: This special session focuses on radar technologies, propagation aspects, impairments/interferences and over-the-air testing solutions. It also aims to provide a wide view of the methods, instruments and practical experience to test and functionally validate subsystems and radar systems in different operational fields (e.g. automotive, industrial, drones, shipborne, aircraft, etc.).</p> <p>Topics of relevance for the session are, but not limited to:</p> <p><i>RADAR Front-end, Propagation and Interference</i></p> <ul style="list-style-type: none"> • Passive, Bistatic and Multi-Static Radar • Forward Scattering Radar • MIMO Radar • UWB, Pseudo-noise and Swept-time Delay Cross-Correlation Radars • Antennas, Arrays and Beamforming • Propagation of Radar Signals • Radar and Clutter Modelling • RADAR OTA Testing Solutions <p><i>RADAR Detection, Tracking and Imaging</i></p> <ul style="list-style-type: none"> • Radar Remote Sensing • Automotive/Industrial/Maritime/etc. Radar • Localization and Tracking • Sensor Data Fusion • Multi-Channel and Array Processing • Adaptive Signal Processing / STAP 			

Session	Title	Convener names & e-mails	Number of slots
AC2	Metrology for 5G and emerging wireless technologies	Tian Hong Loh, Nuno Carvalho, Yves Louet tian.loh@npl.co.uk, nbcarvalho@ua.pt, Yves.Louet@centralesupelec.fr	6
<p>Description: This session will focus on metrology for 5G and emerging wireless technologies. Characterization of emerging wireless systems become increasingly complex in today's wireless environment, we face unique challenges of verifying whether products meet desired performance parameters. Innovative test methods are required. For example measuring the performance of the device with adaptive antenna systems creates test challenges. The papers in this session would review these problems and outline possible solutions for how to effectively measure some of these system parameters.</p>			

Session	Title	Convener names & e-mails	Number of slots
AC 3	Channel Measurements, Characterization and Verification through Electromagnetic Metrology and Measurement Post Processing	Jeanne Quimby, jeanne.quimby@nist.gov Sana Salous, sana.salous@durham.ac.uk	5
<p>Description: The session will address development and refinement of channel measurements, characterization and verification through new and refined measurement techniques and calibrations; physical or statistical representation of the propagation channel; comparison of channel sounder systems to vector network analyzers, multiple channel sounders or standards; and measurement post processing for channel verification through new and novel techniques.</p>			

Session	Title	Convener names & e-mails	Number of slots
AD1	Optical Frequency Metrology	Hidekazu Hachisu, Hossein Ashgari, hachisu@nict.go.jp, Mohammadhossein.Asghari@Imu.edu	5
<p>Description: The development of frequency-stable lasers with sub-Hertz linewidth, of optical frequency standards with uncertainties in the low E-18 range based on laser cooled and trapped atoms or ions, of femtosecond lasers as optical frequency comb generators for the measurement of optical frequencies and frequency ratios, and the establishment of telecom fiber based optical carrier frequency transfer of high stability over long distances is opening new opportunities for the metrology of time and frequency and for various applications in basic and applied science. The session will solicit presentations that address the fascinating challenge to establish, improve and confirm the precision of frequency measurements in this new regime and to develop novel applications of optical frequency metrology in fields like navigation, geodesy, tests of fundamental physics, or other areas.</p>			

Session	Title	Convener names & e-mails	Number of slots
AE1	Mode-Stirred Chambers	Luk R. Arnaut, luk.arnaut@nottingham.ac.uk Tian Hong Loh, tian.loh@npl.co.uk	5
<p>Description: Electromagnetic reverberation chambers (RCs) (also known as mode-tuned or mode-stirred chambers) are now common RF test facilities used primarily for electromagnetic compatibility (EMC) measurements and evaluation of wireless communication performance. They are enclosed screen room typically equipped with mode stirrer(s). Ideal chambers have intrinsic properties of statistical isotropy and statistical homogeneity that provide several unique features for testing. To obtain statistically uniform electromagnetic fields and hence the desired information, the modes of the chamber are normally perturbed by either mechanical stirring or frequency stirring. Comparing with other types of RF testing facility, the cost of RC construction is relatively low and the test configurations inside RCs is relatively non-critical with regard to position and orientation. Nevertheless the relevant data analysis and interpretation is more complex. Recent advances in reverberation chamber metrology and statistical theory have added other electromagnetic investigations into the mix, particularly antenna efficiency measurements and multi-path propagation in high-mobility EM environments. Still some theoretical and metrological problems are open, as well as practical aspects in the lower frequency use. This session focuses on presenting the recent advances in the theory and the applications of RC technology, RC test facilities, measurement techniques, RC simulation and modeling, and EMC applications.</p>			

Led by Commission B

Session	Title	Convener names & e-mails	Number of slots
BD1	Symmetries in artificial materials: theory and applications	Guido Valerio, Simon Horsley guido.valerio@sorbonne-universite.fr, S.Horsley@exeter.ac.uk	6
<p>Description: Artificial materials have been widely studied and used in photonics and microwave in the last decades. Recent researches show that the introduction of specific higher symmetries in each cell of a periodic medium is an effective approach to obtain unprecedented exotic behaviour and overcome current limitations of these devices. Symmetries can be of purely spatial type (glide or twist transformations) or spatiotemporal (loss-gain). The presence of symmetries or their suitable breaking can define topological protected modes, exhibiting robustness to defects and perturbations and non-reciprocal behaviours, ultra-wideband behaviours for flat lenses, large stop bands for novel EBG materials...</p> <p>The interest in these applications is proved by the involvement of several research group and companies with very different background. The session will propose both theoretical and applied works with application from photonics to microwave, concerning the modelling of new materials, and the design of devices for the next generations of communications.</p>			

Session	Title	Convener names & e-mails	Number of slots
BE1	Near-field coupling in wireless communications	Andrea Michel, Gabriele Gradoni, Paolo Nepa andrea.michel@unipi.it, Gabriele.Gradoni@nottingham.ac.uk, paolo.nepa@unipi.i	10
<p>Description: When talking about antenna design and propagation analysis, people usually think to wireless links between devices that are far apart, and this is actually the case in most of wireless applications. Nonetheless, there is a large number of wireless links where the antennas operate in their near-field region, either reactive or radiative. In such cases, conventional far-field coupling models based on plane-wave incidence approximation are not effective and more complex numerical and analytical models must be used. This special session aims to collect a number of wireless applications where accurate electromagnetic models are required to account for both radiative and reactive near-field coupling phenomena, including: wireless power transfer, microwave sensing with targets located in the antenna near-field region, chip-to-chip as well as device-to-device wireless links, near-field antenna measurements and characterization, near-field effects in Massive MIMO antenna arrays, near-field communications, near-field MIMO, near-field radio frequency identification, near-field focusing. In the context of wireless communications, channel models including near-field interactions will benefit from accurate electromagnetic models and can include statistical approaches that capture channel variability on sub-wavelength scales.</p>			

Session	Title	Convener names & e-mails	Number of slots
BE2	Reconfigurable Intelligent Surfaces for Wireless Communication and Sensing	Philipp del Hougne, Gabriele Gradoni, philipp.delhougne@gmail.com, Gabriele.Gradoni@nottingham.ac.u	6
<p>Description: The session will provide an overview of recent advances on the use of Reconfigurable Intelligent Surfaces (RIS), covering the entire spectrum of researchers interested in RIS. This includes the communities of signal processing and wireless communication, the metamaterial community (since programmable metasurfaces are the hardware behind the RIS paradigm) and the wave chaos community (multi-path reverberant propagation environments). Contributions are expected to cover the entire spectrum from analytical via numerical to experimental work, on topics from programmable metasurface designs via RIS-enabled wireless communication paradigms to RIS-based sensing (geo-localization, object recognition). Many RIS-related research tracks are currently somewhat detached from each other and different communities are not aware of the advances of other communities on very related topics. We hope to bring key actors of all relevant communities together in this session to enhance dissemination of recent results, increase awareness of related work and stimulate the emergence of collaborations across communities.</p>			

Session	Title	Convener names & e-mails	Number of slots
BG1	High-frequency wave propagation in highly disturbed ionosphere	Nikolay Zernov, Vadim Gherm, Charles Carrano n.zernov@spbu.ru, v.germ@spbu.ru, Charles.Carrano@bc.edu	10
<p>Description: The session is aimed to discuss the analytic and numerical methods for treating the problems of the high-frequency wave propagation in the conditions of highly disturbed ionosphere. In particular, this includes the effects of meso-scale ionospheric structures as in the high-latitude, or equatorial ionosphere, which may be additionally associated with the effects of the field strong scintillation due to fluctuations of the electron density of the ionosphere. Adjacent problems of the high-frequency ionospheric propagation are also welcome.</p>			

Session	Title	Convener names & e-mails	Number of slots
BK1	Innovative methods and devices for microwave medical applications	Lorenzo Crocco, Francesca Vipiana, Panagiotis Kosmas crocco.l@irea.cnr.it, francesca.vipiana@polito.it, panagiotis.kosmas@kcl.ac.uk	10
<p>Description: Medical applications of microwave technologies are becoming increasingly relevant in the clinical practice and include minimally invasive treatments, such as hyperthermia and thermal ablation, as well as safe and effective diagnostic modalities for early stage management of critical diseases, such as breast cancer and brain stroke. Furthermore, the joint exploitation of the unique abilities of microwaves opens the way to a completely novel scenario in which all the stages of the clinical practice (diagnosis, treatment, follow-up) are joined together in a multi-purpose theranostic system. The session aims at presenting to the GASS audience the state of the art of this vital area of research, inviting scholars worldwide to present their most recent results concerned with system design and development, controlled experiments, clinical studies, as well as with any other aspect related to the development and the translation into clinics of microwave medical technologies</p>			

Led by Commission C

Session	Title:	Conveners	Number
CB1	Functional Metasurfaces for Communication and Radar Systems	Amir Zaghoul, Enrica Martini amirz@vt.edu, martini@dii.unisi.it	5

Description: Metasurfaces have the potential of encompassing several functions for communication and radar systems beyond acting as optimized radiators. The shapes and polarization properties in the metasurface pixels can be dynamically adjusted to satisfy certain functions in the system. These functions may include modulation, multiplexing, spectrum control, phase deception, beam shaping, reconfigurability and others. Possible designs, commands and controls of the metasurface parameters to achieve such functions can be accomplished in hardware and software/algorithm.

Session	Title:	Conveners	Number
CD1	Micro to Nano-Scale Wearable and Implantable Sensing and Communication (MSC)	Qammer H. Abbasi, Akram Alomainy, Arnaud Vena Qammer.Abbasi@glasgow.ac.uk, a.alomainy@qmul.ac.uk, arnaud.vena@umontpellier.fr	8

Description: With the evolution of nano-technology, the future electronics and sensing systems will be implantable and wearable with applications not limited to healthcare monitoring systems, entertainment, tracking and soft robotics. The field has started to see interesting developments in the areas of circuits and systems, antenna and propagation and connectivity of sensors with various paradigm including EM, ultrasonic etc. This special issue will be focus on future wearable and implantable systems, from sensing and communications prospective from macro to nano-scale. The topics of interest include, but are not limited to:

- Wearable and implantable sensing technologies;
- Channel modelling for wearables and implants;
- Body sensor networks; wearable and mobile health monitoring;
- Antennas and propagation for wearables and wireless implants;
- Energy efficiency in wearable and implantable sensing systems.

Session	Title	Conveners	Number
CFH1	Radio Science Measurements from Spacecraft Telecommunications Signals	Sami Asmar, Daniele Durante, Takeshi Imamura, Joseph Lazio sami.asmar@jpl.nasa.gov, joseph.lazio@jpl.nasa.gov, daniele.durante@uniroma1.it, t_imamura@edu.k.u-tokyo.ac.jp	14-16
<p>Description: There is a long history of using precise tracking of spacecraft telecommunications signals to make science measurements, dating from the first interplanetary missions (Kliore et al. 1965, “Occultation Experiment: Results of the First Direct Measurement of Mars's Atmosphere and Ionosphere,” <i>Science</i>, 149, 1243–1248). The first measurements used the propagation of the spacecraft signals through planetary atmospheres and ionospheres for remote sensing, which helped set the stage for subsequent studies of Earth’s atmosphere by the radio occultation technique, such as radio occultations with Global Navigation Satellite Systems (GNSS) signals. Subsequent planetary science experiments have involved measuring the characteristics and masses of planetary ring systems, atmospheric dynamics, and the surface properties and interior structures of planetary bodies. In 2020, there will be at least three active missions for which precise tracking of spacecraft telecommunications is a key feature of the mission— NASA’s Juno mission will be measuring the interior structure of Jupiter, ESA’s BepiColumbo mission will be conducting tests of Einstein’s Theory of General Relativity, and NASA’s Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) will be probing the interior structure of Mars. Further, the stage is set for at least another decade of radio science from spacecraft telecommunications, with radio science measurements likely for NASA’s Europa Clipper mission and ESA’s Jupiter Icy Moons Explorer (JUICE), and possible for the Ice Giant Mission concept. The recent success of the Mars Cubesat One (MarCO) spacecraft has also highlighted how small spacecraft might be able to be used at other planets in a manner analogous to how small satellite constellations at Earth can conduct GNSS radio occultation experiments.</p> <p>Fundamental to all of these measurements has been the telecommunications system—both ground and space. We have contacted the chairs of Commissions C, F, and H and received preliminary indications that such a joint session would be relevant to their commissions. After reviewing papers and sessions from the 2017 URSI GASS, such a session would appear to be unique and new.</p>			

Session	Title	Conveners	Number
CK 1	Over-the-Air testing: State-of-the-Art and Future of Technology and Applications	Wim Kotterman, TU Ilmenau, Germany Pekka Kyösti, Keysight Technologies, Finland, University of Oulu, Finland	6-8
<p>Description: Over-the-Air testing has, with two accepted standards in 3GPP, proven to be provide valuable information on how antenna characteristics of the Device-under-Test interact with incoming time-variant spatio-temporal radio fields. But, the present state is still that UE for LTE, a system with great adaptation potential, will be tested in stationary environments without any temporal evolution of large-scale effects and with its adaptation mechanisms switched off. Besides, the time-variant transmission channels are abstract models in 2-D and the test set-up is that of a typical single-user, single-band, single system link in downlink only with cellular infrastructure that is interfered by just AWGN.</p> <p>For Over-the-Air testing of future equipment, some of it already arriving in the near future, new testing methodologies have to be developed. For instance in 5G, mobile communications will have multi-RAT, multi-band connectivity, some of those bands at mmWave frequencies with their own specifics and difficulties. Antennas will be integrated with RF and baseband circuitry, will be adaptive, eventually with a massive number of elements and channels may be highly dynamic. Systems with massive connectivity are foreseen, for instance in transportation or industrial environments, and very high reliability and low latency will be required for systems for cooperative automated driving that are organised as Vehicular Adhoc networks. All these characteristics are essential for the respective systems, but at the moment no thorough OTA testing concept has been presented for them.</p> <p>For this session, contributions are invited for OTA testing any type of radio system, not necessarily restricted to traditional cellular communications in 5G and beyond, but explicitly also serving applications like localisation, public transport, automated driving, industry 4.0, satellite comms and so on.</p>			

Led by Commission D

Session	Title:	Conveners	Number of slots
DA1	Measurement and Instrumentation Technologies for millimeter and THz waves	Shintaro Hisatake, Masatoshi Kajita hisatake@gifu-u.ac.jp	6
<p>Description: Despite the recent progress in measurement techniques and instrumentation related to millimeter wave systems, a number of challenges from a metrology perspective exist when we approach the THz region due to, for example, high noise levels, increased losses in waveguide structures and lack of sources with sufficient purity and power levels. On one side microwave electronics present high losses and face significant packaging challenges and on the other hand optical methods suffer from the large wavelengths corresponding to THz frequencies. The session focuses on recent advances in the electronics and photonics communities to tackle the forementioned challenges associated with metrology and instrumentation in millimeter wave and THz wave systems.</p>			

Session	Title:	Conveners	Number of slots
DB1	Metasurfaces-enabled polarisation control	Simone Zanotto, Andrey Miroshnichenko simone.zanotto@nano.cnr.it, andrey.miroshnichenko@unsw.edu.au	6
<p>Description: The ability to generate, manipulate, and detect polarized radiation is a task of extreme importance in several fields of science and technology. Metasurfaces, i.e. structured arrangements of subwavelength, specifically-shaped scattering elements, are emerging as a very promising tool to implement polarization manipulation in an extremely effective way. Metasurfaces and metalenses can exploit resonance effects to operate in multiband fashion, can be arranged to display spatial phase-gradient phenomena, or to implement computer-generated holograms. Other active fronts in the field are the search for specific target operations by inverse-design techniques and the investigation of reconfigurable and tunable metadevices.</p> <p>The aim of the present Session is to collect results concerning this field that lies at the crossing point among classical electromagnetism, physics of structured materials, radiofrequency technology, nanoscience, and photonics.</p>			

Session	Title:	Conveners	Number of slots
DC1	TeraHertz communications	Yves Louet, Carlos Faouzi Bader, Akifumi Kasamatsu, Guillaume Ducournau, Cyril Renaud Yves.Louet@centralesupelec.fr, carlos.bader@isep.fr , kasa@nict.go.jp, guillaume.ducournau@iemn.univ-lille1.fr, c.renaud@ucl.ac.uk	4
<p>Description: The trend in the electronics consumer market is to transfer ever-increasing amount of information wirelessly. Wireless data traffic is growing by a factor of 100 every 10 years. As detailed in the Ericsson Mobility Report (Nov. 2017), it is expected that mobile communications will lead the increase of data traffic, with video accounting for 70% of global mobile data traffic by 2023. It is estimated that the demand for data rate in wireless networks increases by 40% up to 70% year upon year. This incredible growth implies that within the next 10-15 years, the wireless networks will need to deliver as much as several hundreds of times the capacity as compared to the current levels. To attain data rates of the order of 1 Tbps (or even some good fraction of it), a very broad bandwidth of several tens of GHz will be required. Moreover, it is well-known that the typical radio spectrum is currently widely overused and is considered as a precious resource. Over the past few years several approaches have been proposed towards improving the spectrum usage (e.g. cognitive radio, opportunistic or dynamic spectrum). Unfortunately, these approaches are not expected, by themselves alone, to be able to meet the aforementioned throughput demands. Therefore, to extend the capabilities of the future high-heterogeneous networks so as to accommodate Tbps data rates, we would need to considerably expand the available bandwidth by utilizing very large bands at frequencies as high as 90 GHz and above. This session intends to cover THz communications area under the signal processing and radio-communications umbrella with the following topics, to name a few : link budget, physical layers solutions, waveforms, coding, synchronisation, channel estimation, equalization, analog to digital conversion</p>			

Session	Title:	Conveners	Number of slots
DK1	Biological effects and electromagnetic interference of wireless power transfer	Takashi Hikage, Jerdvisanop Chakarothai, Valerio De Santis, hikage@wtmc.ist.hokudai.ac.jp, jerd@nict.go.jp, valerio.desantis@univaq.it	8
<p>Description: Wireless Power Transfer (WPT) technology has recently attracted attentions from many researchers and engineers in various fields of applications, such as automotive, medical, agricultural, etc., with the expectation to become a common technology of practical use. Both EM interferences and human safety should be investigated before their use in our daily lives. This session deals with EM interference of electromagnetic fields (EMFs) emitted from WPT systems to various electronic appliances and interaction with human bodies as well. Microwave WPT systems, which basically use the RF frequencies, are also considered in this session to share research activities in this intricate field.</p>			

Session	Title:	Conveners	Number of slots
DK2	Wearable and textile antenna for WBAN	Leena Ukkonen, Luciano Tarricone, Hendrik Rogier leena.ukkonen@tut.fi, luciano.tarricone@unisalento.it, Hendrik.Rogier@ugent.be)	5
<p>Description: The actual trends in electronics to miniaturize components, improve computing performances, and reduce power consumption opens the way to novel body centric applications. Among these, we can cite the health domain for the elderly, or in sportswear to record the performance of athletes. For a seamless integration of electronics and communications devices, antennas need to be integrated directly within the textile or applied as a thin patch on clothes. This session is focused on the study of lightweight and wearable antennas in the frequency range of commonly used wireless communications systems (NFC, LoRa, Bluetooth, Wifi, cell phone...). Challenges such as the realization method of antennas on flexible laminate, the specific absorption rate (SAR) or the antenna efficiency will be addressed.</p>			

Led by Commission E

Session	Title:	Conveners	Number of slots
EC1	EM Security of Cyber-physical systems and Wireless Technologies	Chaouki Kasmi, Virginie Deniau Chaouki.kasmi@darkmatter.ae, virginie.deniau@ifsttar.fr	5
<p>Description: During the last decades, many studies have shown how electromagnetic waves represent a non-negligible threat for critical infrastructures. From covert-communication to the denial-of-service attack of electronic systems, multiple papers have shown that the semantic aside many common interests have emerged. This session is organized to provide the audience a new way of analyzing the results of electromagnetic simulations and measurements of communication systems, wired and wireless technologies, risk management as well as EMC for functional safety. The session will cover side-channel attacks, Fault injections, covert-channels, jamming and IEMI against wireless technologies.</p>			

Session	Title:	Conveners	Number of slots
EBC1	Wave modelling of novel wireless systems	Gabriele Gradoni, Ari Sihvola, Sana Salous gabriele.gradoni@nottingham.ac.uk, Ari.Sihvola@aalto.fi, sana.salous@durham.ac.uk	5
<p>Description: Physics-based approaches are entering and complementing information theoretic formulations for wireless communications, assisting them in the description of non-thermal noise and describing propagation mechanisms in complex environments. Large scale, multiply connected indoor scenario are challenging to be tackled with conventional ray tracing algorithms at mmWave regimes, as they converge slowly and become inaccurate in presence of boundary roughness, diffraction and diffusion in the (very) high frequency limit. Statistical phase-space methods aim at compensating those drawbacks by borrowing concepts developed in semiclassical analysis and wave chaos. A wide range of applications can be described accurately, new collective phenomena exploited for an efficient energy transfer, path loss and clustering dynamics can be enriched and understood better. The session welcomes contributions that include – but are not limited to – channel modelling (full wave, asymptotics, statistical and mesh based) and characterization (channel sounding and software defined radio based) of MIMO and Massive MIMO systems, as well as reconfigurable channels through Large Intelligent Meta-surface and affine technologies.</p>			

Session	Title:	Conveners	Number of slots
ECJ1	Spectrum management	Jose Borrego, jose.borrego@anacom.pt, Tasso Tzioumis, Tasso.Tzioumis@csiro.au, Amir Zaghoul, amirz@vt.edu,	8

Description: The growth of commercial wireless broadband services, including smart phones, tablet and computers, the increase in scientific and governmental operations using radio frequency, and IoT wireless solutions have greatly boosted the demand for spectrum. At the same time, the economic value of spectrum has increased more than 25% in the last year. However, since the amount of spectrum is limited, there is concern about ensuring adequate access to an ever-increasing number of concurring services and applications. In this respect, the usage of high-frequency bands, such as the well-known mm-waves, shows a high potential and is envisaged to help meeting future spectrum needs in a timely manner, also enabling the full transition of mobile system to 5G.

Recent studies and research, which rely also on trials and experiments across the world, including recent 5G pilots, have considerably progressed knowledge for the development of novel spectrum management paradigms. Innovative reference models have been set up to show how spectrum can be fully utilized and wireless networks can be rapidly and fruitfully deployed, maximizing spectrum efficiency, creating new opportunities for sharing and ensuring a higher degree of flexibility.

This session on spectrum management is focused on the improved utilization of the radio frequencies for protection of wireless communications service and radio science. The electromagnetic spectrum is treated as a limited natural resource, with a multitude of competing demands for access to it and use of it, which seeks innovative means and technologies for adequate coexistence of all of them, considering the need of protection of new and incumbent wireless and wired communication services, systems, and equipment, with special focus on science services and those that use passive technologies. It is expected that the communications, to be submitted to this session, cover relevant aspects within this wide range of topics. The session will, among others, focus on reference models to open up spectrum and successfully achieve the transition to 5G, derived from field trials, measurement campaigns, and simulations.

Session	Title	Convener names & e-mails	Number of slots
EFGH1	Natural Electromagnetic Noise and Radio Sensing Applications in Terrestrial and Planetary Environments	Yasuhide Hobara, Colin Price, Tomoo Ushio, Martin Fullekrug, hobara@ee.uec.ac.jp, cprice@flash.tau.ac.il, ushio@comm.eng.osaka-u.ac.jp, M.Fullekrug@bath.ac.uk	5/12

Description: This joint session aims at presenting recent works on electromagnetic noise and phenomena in the terrestrial and planetary atmosphere and upper atmosphere (ionosphere/magnetosphere). Different kinds of electromagnetic noises will be dealt with, including atmospheric noises originated in lightning discharges (ELF Schumann resonances, mesospheric optical emissions etc.), man-made noise and noise due to wave-particle and wave-wave interactions. Corresponding electromagnetic noise environments on other planets are also welcome. We are particularly interested in applications of natural EM observations in remote sensing such as monitoring, detecting and forecasting terrestrial environments and natural hazards, such as global climate change, thunderstorms, extreme weather, space weather and seismic events.

Led by Commission F

Session	Title	Convener names & e-mails	Number of talks
FC1	Opportunistic remote sensing of atmospheric parameters	Franz Teschl, franz.teschl@tugraz.at Matteo Colli, m.colli@artys.it	10
<p>Description: More than a decade ago, first researchers published rainfall estimates that have been retrieved from commercial cellular microwave links. Meanwhile in all parts of the world data from telecom companies are used for rainfall monitoring. Recently, also first publications on the use of satellite links for this purpose have been presented. Studying satellite links has the potential to retrieve also three dimensional structures of precipitation, the more so, when slant paths to various satellites are combined. This principle is also used to retrieve water vapour from global navigation satellite system signals (GNSS Tomography).</p> <p>The session aims to collect original or review contributions on related topics including:</p> <ul style="list-style-type: none"> • further improvement of retrieval, mapping and interpolation algorithms • handling of error sources (refraction, reflection, orbital effects, etc.) • merging terrestrial and slant path satellite link data • efforts to retrieve solid or melting precipitation • benefits for telecom and satellite data providers 			

Session	Title	Convener names & e-mails	Number of slots
FCD 1	Advanced passive RF-components for centimetre- and millimetre-wave frequencies	Reinhard Teschl, V.Chandrasekar, reinhard.teschl@tugraz.at , chandra@colostate.edu	6
<p>Description: Higher frequency bands will be utilized in next generation's wireless systems – both terrestrial and space based. The shift to higher frequencies presents challenges to passive RF-components such as filters and antennas. The requirements in terms of accuracy are rising, calling for new manufacturing technologies/techniques, and advanced designs. In addition, adaptability and reconfigurability of the RF components is a growing issue especially in view of countless wireless IoT devices communicating simultaneously, aiming for energy and resource efficient communication. The session therefore addresses contributions on recent advances in filter and antenna design, focusing either on: novel designs, refined materials, advanced manufacturing processes, integration of tuning mechanisms.</p>			

Session	Title	Convener names & e-mails	Number of slots
FCG1	Radio sciences and geosciences challenges: new approaches and trends in Disaster Management	Tullio Tanzi, Madhu Chandra tullio.tanzi@telecom-paris.fr chandra@colostate.edu	12
<p>Description: Risk has a multi-facet character. A disaster event must be managed in a transdisciplinary way even if we are confined to radio-science and remote sensing aspects. The contribution of geosciences to "classical" radio-sciences allows efficient cross-fertilization. The objective of this session is dedicated to the Disaster Management. In doing so, show the different new approaches coming from the traditional disciplines, such as remote sensing, RADAR, etc., but also Geosciences like Geographic Information System (GIS), spatial analysis, etc.</p>			

Session	Title	Convener names & e-mails	Number of slots
FCK1	COST CA15104 IRACON: Measurement & Modelling of Radio Waves Propagation in Body Area Networks	Slawomir J. Ambroziak, Kamran Sayrafian sj_ambroziak@eti.pg.gda.pl, kamran.sayrafian@nist.gov	5
<p>Body Area Networks consists of wearable (or implantable) physiological sensors (or actuators) that communicate health or relevant activity data to/from the human body. These networks and their applications are expected to be an important component of the fifth-generation radio communication systems in the future.</p> <p>The radio channels in BANs are inherently different from their counterpart in other traditional radio communication networks. This is mostly due to the direct placement of communicating nodes on the human body surface and the significant impact of movement and body posture. This results in multiple propagation scenarios and adds to the complexity of performing physical measurement to obtain sufficient data. As health and medical applications are expected to be the dominant use cases for BANs, thorough understanding and characterization of the channel will allow obtaining statistical models that accurately reflect the communication link. This, in turn, enables physical layer designers to achieve optimal transceivers that can compensates for potential channel impairments and obtain higher reliability in system operation.</p> <p>This session is meant to provide opportunities for researchers and engineers to present various methodologies to characterize radio waves propagation using novel simulation and physical measurements and discuss approaches to obtain practical channel models for future BAN applications within a 5G infrastructure.</p>			

Led by Commission G

Session	Title	Conveners names email	Number of slots
GH1	Meteors, collisional EMPs, and other Highly-Transient Space Plasma Events	J. L. Chau and M. M. Oppenheim; chau@iap-kborn.org meerso@bu.edu	12
<p>Description: This session includes meteoroid impacts, EMP generation on satellite and planetary surfaces as well other related transient atmospheric and ionospheric phenomena. Emphasis is on the radio and radar signatures of these events including observational, theoretical and modelling points in view. In the case of micrometeoroids, their presence (e.g. sputtering, fragmentation, ablation, ionization) and their effects on derived parameters, like winds, neutral temperatures, neutral density, meteor orbits, meteor masses, etc., are of special interest.</p>			

Session	Title	Conveners names emails	Number of slots
GH2	Plasma Instabilities in the Ionosphere	Rob Pfaff, Erhan Kudeki robert.f.pfaff@nasa.gov Erhan@illinois.edu	12
<p>Description: Plasma instabilities in the high, middle, and low latitude ionosphere play a key role in the development and evolution of structures in the Geospace environment, including processes in both the E and F regions. They often are associated with irregularities which can be experimentally observed using radar and radio techniques, as well as in-situ observations. Linear and non-linear theory is often used to predict instability thresholds, amplitudes, and velocities. Simulations have recently been quite successful in the detailed study of irregularity micro-structure, time evolution, and k-space behaviour. This session will encourage discussion of new developments in the theoretical, simulation, and experimental observations relevant to the study and understanding of ionospheric plasma instabilities. The effects of ionospheric instabilities on other Geospace phenomena will also be of interest. This includes coupling to the magnetosphere and impacts of the lower atmosphere on instability growth and development.</p>			

Session	Title	Conveners names email	Number of slots
GH3	Lesson's learned from ground based active ionospheric experiment	Alireza Mahmoudian, Mike Kosch a.mahmoudian@ut.ac.ir mkosch@sansa.org.za	12
<p>Description: The session will focus to share the knowledge learned in active space experiments especially in recent years and future path to follow specifically with the new facilities under development such as EISCAT 3D in Norway, bi-static HF imager at the Arecibo Observatory in Puerto Rico, as well as portable HF heaters under development at the University of Maryland. Field of active space experiments involves modification of the background ionospheric plasma by high-power HF radio waves (known as ionospheric heating) as well as dust/chemical cloud release using sounding rockets. Some of the topics of interest include: recent advances in numerical simulations of active space experiments, an overview of 4 decades active space experiment using sounding rockets and dust/aerosol release, a review of recent advances in ELF-VLF wave generation during HF pump heating of the ionosphere, the future of active space experiments at EISCAT 3D, and portable ionospheric heater facilities.</p>			

Session	Title	Conveners names email	Number of slots
GHE1	Seismo Electromagnetics (Lithosphere- Atmosphere-Ionosphere Coupling)	S. Pulinets, Mala Bagiya, Y. Hobara, H.Rothkaehl pulse1549@gmail.com, hobara@ee.uec.ac.jp, hrot@cbk.waw.pl bagiyamala@gmail.com	12
<p>Description: The results of electromagnetic and ionospheric monitoring do not leave the place to doubts on the electromagnetic and ionospheric anomalies existence and their connection with seismic activity. Quasi-stationary electric fields, electromagnetic emissions in wide band of electromagnetic spectrum, anomalies of radio wave propagation, ionospheric anomalies are now the hot spots at all conferences of geophysical thematic. But still we lack the physical substantiation of many of registered effects. Multi-parameter measurements in seismically active regions and cross validation of results obtained by different groups will help to understand the background physics of the observed anomalies and also to develop new insights in understanding the seismic imprints in near space environment. This session will accept papers demonstrating progress in understanding the ionospheric and electromagnetic effects preceding strong earthquakes and tsunami including experimental findings and theoretical papers on lithosphere-atmosphere-ionosphere coupling.</p>			

Session	Title (proposal)	Convener names & e-mails	Number of slots
GJ1	The polar environment and geospace	Lucilla Alfonsi, Nicolas Bergeot, Mark Clilverd, Stefan Lotz lucilla.alfonsi@ingv.it, nicolas.bergeot@oma.be, macl@bas.ac.uk, slotz@sansa.org.za	12
<p>Description: Remote Sensing techniques, either applied to ground based, airborne and satellite sensors, are able to provide measurements of a wide variety of geophysical parameters able to characterize the polar environment from the ground up into the magnetosphere. This session foresees the participation of scientists studying the polar atmosphere, from its lower to its upper regions, the thermosphere and the magnetosphere, as well as radio astronomers, geodesists, geophysicists, glaciologists, oceanographers, astrophysicists, etc., that need to mitigate the atmospheric effects on their remote sensing measurements. Contributed papers may address (but are not limited to) recent developments in monitoring methodologies, data analysis, measurement campaigns, modelling and international initiatives. Contributions based on observations that exploit the radio and optical spectrum are welcome. The session seeks also contributions addressed to short-term and long-term trends in the Earth's environment and the magnetosphere.</p>			

Led by Commission H

Session	Title	Convener names & e-mails	Number of slots
HG1	Active experiments and radio sounding,	V. Sonwalkar, R. Moore, N. Jackson-Booth, T. Pedersen vssonwalkar@alaska.edu, moore@ece.ufl.edu, todd.pedersen@us.af.mil, njbooth@qinetiq.com , Natasha.jackson-booth@qinetiq.com	20
<p>Description: This session will cover recent advances in active space experiments, including ionospheric perturbations, disturbances or other effects on the space environment actively produced by high-power RF waves, chemical releases, rocket exhaust, ion engine propulsion systems or other means. In addition to presentations of observations and measurements from recent or novel experiments, theoretical and modeling developments that advance theory beyond the prevailing qualitative and descriptive state toward quantitative and predictive capabilities will also be welcomed. Topics of interest include wave generation stimulated by or propagation modified by artificial effects. Presentations on technologies, such as RF sources or chemical reactions, which may enable new or improved applications in active space experimentation, are also sought. This session will also cover the latest technical and scientific results on and concepts of space-borne radio sounding in terrestrial and extra-terrestrial ionospheres and magnetospheres including previous, current, and planned spaceborne sounders. The basic physics of plasma-wave propagation and of active or passive antennas, in magnetoplasmas in laboratory or space, are important related topics. Investigations of geospace plasma density structures using injected whistler-mode and Z-mode waves are also solicited, as are reviews of earlier radio-sounding accomplishments highlighting outstanding questions yet to be addressed by radio sounders. There is a close connection between active experiments and space-borne sounding: near-field interactions with antennas in a plasma are very similar to high-power radio wave heating and stimulate a variety of resonances which need to be understood to optimize system function and which can also be used for diagnostic purposes. Contributions on such overlapping research areas are especially welcome.</p>			

Session	Title	Convener names & e-mails	Number of slots
HGE1	Atmospheric, Ionospheric, Magnetospheric and High Energy Effects of Lightning Discharges	S. Celestin, N. Liu and M Fullekrug sebastien.celestin@cnsr-orleans.fr, Ningyu.Liu@unh.edu, M.Fullekrug@bath.ac.uk	25
<p>Description: The recent discovery that lightning discharges can cause energetic radiation, relativistic particles, and transient luminous events has marked a profound progress in our understanding of the Earth's atmospheric electrodynamic behavior. This session explores these novel processes and their impact on the atmosphere and the near-Earth environment. The session solicits contributions that advance knowledge in the areas of the global atmospheric electric circuit, lightning physics, transient luminous events, energetic radiation, relativistic particles, and their impact on the Earth's atmosphere, ionosphere and magnetosphere. One key focus of the session will be novel observations from space platforms, such as the lightning imagers on board geostationary satellites, the TARANIS satellite, the ASIM payload on the International Space Station, and related ground based observations and their modeling. Interdisciplinary studies that emphasize the connection between atmospheric layers and the relation between atmospheric electricity and climate change are particularly welcome.</p>			

Session	Title	Convener names & e-mails	Number of slots
HJ1	Solar, Planetary, and Heliospheric Radio Emissions	P. Galopeau, G. Mann, H. O. Rucker, Y. Yan patrick.galopeau@latmos.ipsl.fr, Gmann@aip.d, rucker@oeaw.ac.at, yyh@nao.cas.cn	30
<p>Description: The Sun, the magnetized planets in the solar system, and the heliosphere are sources of intense non thermal radio emission. New instruments, as e.g. the novel radio interferometers LOFAR, LOIS, LWA1, MWA, and VLA as well as the Ukrainian radio telescopes UTR-2, URAN, and GURT, and the radio spectrometers aboard Stereo spacecraft, provide new possibilities to measure this radio radiation in an unprecedented way. Thus, a new window was opened for a better understanding of the radio emission processes in space. These processes can be used as diagnostic tools, for example, for extrasolar planets, since these processes are basic plasma processes in space. The study of radio emission in space is therefore of general astrophysical interest, where radio waves provide information on cosmic objects (e. g. supernovae remnants, active galactic nuclei). Observations and analyses from ground-based and spaceborne experiments (e.g. Juno, Cassini, Galileo, Ulysses, Wind...) are highly welcome including laboratory and experimental studies, and of course theoretical investigations devoted to the generation mechanisms and particle acceleration processes. Preparational studies of forthcoming space missions (like Bepi-Colombo, Juice, Solar Orbiter, Solar Probe, SunRISE, Taranis) are explicitly encouraged, too.</p>			

Led by Commission J

Session	Title	Convener names & e-mails	Number of slots
JG1	Mutual benefit between radio astronomy and ionospheric science.	Maaijke Mevius, Claudio Cesaroni Claudio.cesaroni@ingv.it, mevius@astron.nl	

Description: The ionized atmosphere significantly affects radio waves propagation and this can lead to misinterpretations of data of radio astronomical observations. Astronomical science studies using radio waves acquired at ground, especially at the lowest frequencies (e.g. LOFAR/MWA, and in the future the SKA), should therefore definitely take up-to-date atmospheric parameters into account. On other hand, radio signals disturbances can be used to retrieve information about the morphology and dynamics of the ionosphere. Typically, radio astronomical observations are sensitive to small scale disturbances in the ionosphere, with spatial scales from hundreds of meters to hundreds of kilometers and from seconds to minute timescales.

To pose a solid bridge between the ionospheric and radio astronomical scientific communities, this session solicits contributions to facilitate exchange of information on their respective states of the art as well as on their future needs.

Contributions are welcome from both communities: Scientists studying the ionosphere presenting climatology studies, small scale disturbances like TIDs and scintillation and abnormal behaviors of the ionosphere during extreme events. Scientists dealing with radio astronomy that need to remove or mitigate the ionospheric contribution from their measurements or that can contribute to the understanding the ionospheric physics with their studies.

Session	Title	Convener names & e-mails	Number of slots
J-IAU	Next generation radio astronomy science and technologies	Anthony Beasley, Carole Jackson, Gabriele Giovannini, Melissa Soriano tbeasley@nrao.edu, jackson@astron.nl, ggiovann@ira.inaf.it, melissa.a.soriano@jpl.nasa.gov	6

Description: In this session we bring together URSI and IAU Commission B4 (radio astronomy) to explore how frontier astronomy is pushing radio astronomy technologies. This astronomy will exploit the major instruments of the next decade and beyond i.e. SKA, ALMA2030, ngVLA and many others. This session will be wide-ranging, looking to major trends in photonics, computing and multi-messenger physics, but also the raw reality of increasing billion-dollar telescopes. How will these mega-instruments keep pace, how early do they need to foresight revolutions in technologies, and how does science drive these to fruition?

Led by Commission K

Session	Title	Convener names & e-mails	Number of slots
KB1	Electromagnetic biomedical imaging and inversion	Puyan Mojabi, Tommaso Isernia, Shouhei Kidera Puyan.Mojabi@umanitoba.ca, tommaso.isernia@unirc.it, kidera@ee.uec.ac.jp	12
<p>Description: This session is devoted to non-ionizing electromagnetic (and hybrid-electromagnetic) systems for bio-imaging imaging and inversion. Several application areas, which span a wide range of frequencies from a few hertz to optical frequencies, utilize electromagnetic inversion algorithms and techniques to reconstruct the properties of interest, such as complex permittivity profiles of biological tissues. Much progress has been made on the development of such systems ranging from very low frequencies all the way up to optical frequencies. Examples include electrical impedance tomography, microwave imaging, near-infrared tomography, and THz imaging. This session is focused on bringing together recent advances in quantitative electromagnetic inverse scattering and inverse source algorithms/techniques in biomedical imaging and will address various applications such as tissues characterization or detection/identification of tumors.</p>			

Session	Title	Convener names & e-mails	Number of slots
KB2	Theranostic applications of microwaves	Iman Farhat, Julian Bonello iman.farhat@um.edu.mt, julian.bonello@um.edu.mt	6
<p>Description: In recent years, microwave theranostic applications in medicine have been developed as a promising approach for diagnostics and therapy. Their main advantages are their non-ionizing nature and their penetration into biological tissues. The motivation for this session is to shed light on the most recent developments of such techniques as well as their implementation. It also seeks to emphasize the potential of such methods to various applications, such as;</p> <ul style="list-style-type: none"> • Microwave thermometry and near field resonance tomography. • Non-invasive therapies using the magnetic nanoparticles. • Minimally invasive systems. 			

Session	Title	Convener names & e-mails	Number of slots
KD1	Smart Body Area IoT (BAIoT) in the era of Beyond 5G/6G	John Farserotu, Hirokazu Tanaka, Daisuke Anzai john.farserotu@csem.ch, hi.tanaka@m.ieice.org, anzai@nitech.ac.jp	6
<p>Description: The emergence of Smart Body Area IoT (BAIoT) including Wireless Body Area Networks (WBANs) including applications in healthcare and medical monitoring, emergency response, search and rescue, military, etc. have triggered an extensive research effort to establish reliable communications systems in the era of Beyond 5G/6G. However, the communication performance is expected to be strongly affected by the presence of a human body. To ensure stable communication in Smart BAIoT, we need to optimize a communication system from various kinds of aspects: antenna structure, operating frequency, modulation and demodulation, communication protocol including PHY/MAC, wireless network topology, security, privacy, trustworthiness and interoperability, for instance. The objective of this session is to present state-of-the-art research related to Smart BAIoT systems and applications in the era of Beyond 5G/6G. The session covers communications as well as sensing in the Smart BAIoT domain. This topic is already of increasing importance, which also fits the focus areas of the URSI Commission K (Electromagnetics in Biology and Medicine).</p>			

Session	Title	Convener names & e-mails	Number of slots
KE1	EMF Exposure Assessment and EMC for Implanted and Wearable BAN Devices	Jianqing Wang, Dirk Plettemeier, Qiong Wang, Concepcion Garcia-Pardo wang@nitech.ac.jp, dirk.plettemeier@tu-dresden.de, qiong.wang@tu-dresden.de, cgpardo@iteam.upv.es	6
<p>Description: Wireless body area networks (BAN) applications in healthcare and medicine are growing rapidly in daily life. The electromagnetic (EM) energy generated by such wireless BAN devices is absorbed by human tissues, raising safety concerns for the human body. EM field (EMF) exposure assessment is therefore an important issue for these devices that are either implant or wearable. Another important issue is electromagnetic compatibility (EMC). Environmental EM fields can cause significant interference with the wireless BAN devices, and their safe use without malfunction is particularly essential for healthcare and medical applications. The purpose of this convened session is to present state-of-the art research related to EMF exposure assessment and EMC of the wireless BAN devices.</p>			

Session	Title	Convener names & e-mails	Number of slots
KBE1	Stochastic methods and machine learning applied in electromagnetism (antenna design, exposure assessment, EMC and dosimetry)	J. Wiart, K. Kobayashi, G Gradoni, P. Ravazzani Joe.wiart@telecom-paris.fr, kazuya_k@sea.plala.or.jp, gabriele.gradoni@nottingham.ac.uk, paolo.ravazzani@ieiit.cnr.it	6
<p>Description: This session will discuss recent developments in surrogate modeling, stochastic Methods and Machine Learning applied in electromagnetism, antenna design, Exposure assessment, EMC. Keywords: Surrogate modeling, Uncertainty Quantification, Stochastic approaches Artificial Neural network in EM, Sensitivity analysis, Application in dosimetry , Artificial Neural network, Influence of the variable environment on antenna performance, Application in dosimetry, EMC and antenna design</p>			