EUROPEAN MICROWAVE WEEK 2018
IFEMA - FERIA DE MADRID, MADRID, SPAIN
23RD - 28TH SEPTEMBER 2018

CONFERENCE PROGRAMME
EUROPE'S PREMIER MICROWAVE, RF, WIRELESS AND RADAR EVENT

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*European Microwave Week Future Events*

*EuMW 2019 - Paris*

*EuMW 2020 - Utrecht*

*Details in this booklet were correct at the time of going to press. They are subject to change. For up-to-date information visit our website: www.eumweek.com*
Welcome to the 21st European Microwave Week

Welcome to Madrid, the economic and cultural centre of Spain and the third largest city in the European Union! It is our great pleasure to welcome you to the 21st European Microwave Week (EuMW) to be held at IFEMA Feria de Madrid from Sunday 23rd to Friday 28th September 2018. After the very successful edition in Nuremberg (2017) the EuMW comes to the lively, cosmopolitan and friendly city of Madrid. This conference event, which was started by the European Microwave Association (EuMA) in 1998, is comprised of the 48th European Microwave Conference (EuMC) to be held from 25th to 27th September, the 13th European Microwave Integrated Circuits Conference (EuMIC) which will take place from 24th to 25th September, and the 15th European Radar Conference (EuRAD) which will run from 26th to 28th September. The three conferences are accompanied by the traditional 3-day trade show on microwaves and RF, which attracts about 300 exhibitors and is the largest of its kind in Europe.

Based on the invaluable commitment of over 430 reviewers, the 110 members of the Technical Programme Committee constituted an excellent programme comprising 521 presentations. The programme also includes six Special Sessions. We are proud to host in particular the Special Session celebrating the 20th anniversary of EuMW, which encompasses presentations by our esteemed colleagues who launched this successful event as envisioned by, at-the-time, a recently established EuMA. Two other Special Sessions highlight the research activities in Latin America and 5G Technology in the Asia Pacific Region. Two more Special Sessions present the latest research on Additive Manufacturing and High Frequency Flexible Bendable Electronics for Wireless Communication Systems. Finally, a Special Session is devoted to Radar Projects at the European Defence Agency.

The regular programme is organised in 87 oral sessions and five interactive sessions. The programme is complemented by 33 Workshops and eight Short Courses covering the most relevant topics ranging from Millimetre-Wave Circuits to 5G, from Power Amplifiers to Automotive Radar, and from THz Technology to Satellite Communications.

This year’s Defence, Security and Space Forum (DSS), a well-established and highly appreciated event at the EuMW, is devoted to ‘Integrating Unmanned Aerial Vehicles (UAVs) into Defence and Security Scenarios’. The popularity of UAVs is growing due to a reduction in costs and the increasing capabilities and benefits provided by such systems. Currently, the estimated number of existing UAVs is believed to be a few million with that figure estimated to grow exponentially in coming years. The DSS Forum organisers have succeeded in attracting high-level speakers to discuss the need from a Defence and Security perspective of integrating UAVs into current air traffic control and air defence systems, together with related technological challenges and solutions.

Internationally renowned speakers will discuss the latest trends and developments in their keynotes at the conferences Plenary Sessions. At the Opening Session of the EuMW Enrique Blanco, Telefónica Global CTO, will outline how the 5G technologies will impact future communication networks. The EuMIC opens with presentations by Chuck Campbell, Engineering Senior Fellow with the Infrastructure and Defense Products Division of Qorvo, USA, and Sebastián Gómez-Díaz from University of California, Davis, USA, on the progress and problems of Gallium Nitride MMIC design and by Bill DeAl, Distinguished Engineer in the RF and Mixed Signal Department of Northrop Grumman, USA, has accepted the invitation to close the EuMIC with a review on Terahertz transistors and their applications. During the EuRAD Opening, which is held in conjunction with the DSS Forum, M. Carmen Barbero, Head of Naval Radar Programmes, Indra Sistemas, Spain, will present the new radar generation for the F-110 frigate integrated masts, and Stefano Pirandola, from York Centre for Quantum Technologies, UK, will discuss Quantum Radar. Domingo Castro, Rafael Casado and Jacobo Martínez-Villa, from Indra Sistemas, Spain, will present the S3T Spanish ESA (European Space Agency) Radar facility for space debris at the EuRAD Closing Session. The EuMW will close with a presentation by Giuliano Gatti, Space Segment Manager of ESA Galileo Satellite Navigation Program.

Following the format introduced in EuMW 2017 of Session Keynotes to boost industrial participation and intensify the interaction between industry and academia, this year’s programme again includes fifteen industrial keynotes by internationally recognized experts from industry who will open selected sessions with presentations on challenges and state-of-the-art achievements in their field.

The traditional Women in Microwave Engineering (WiM) event, co-sponsored by the IEEE MTT-Society, will focus on communications technology for space exploration, and both women and men are welcome. Attendees will visit one of the following two centres located near Madrid: the NASA-MDSCC (Madrid Deep Space Communications Complex) or the ESA-ESAC (European Space Astronomy Centre). Besides visiting the centre, presentations will be given by scientists working at MDSCC or ESAC. As initiated during EuMW 2017, the WiM attendees will have the opportunity to interact with high school students who are invited to participate in this event. Early registration is encouraged, since the number of participants is limited.

The EuMW 2018 will host several events especially for the younger generation. These include the very stimulating and successful Student Challenge, which will have the same format as in previous years. The Student Design Competition comprises two tasks to be prepared in advance. It will also feature a design task to be carried out on-site. This will take place in the frame of a hands-on design experience event. The latter is also part of the Student and the Doctoral School, which start with a high-level, one day and one and a half day lecture programme. The Career Platform will continue the successful format of previous years. Finally, two sessions devoted to Young Professionals are offered.

The ‘Week’ wouldn’t be the ‘Week’ without its traditional social events. These include Monday’s EuMIC Get-Together, which this year will be held at a beautiful restaurant located in the heart of Madrid’s modern down-town, Tuesday’s Welcome Reception sponsored by Keysight Technologies, which will also be held off-site at the Palacio del Negralejo, and the EuRAD lunch on Friday. In addition, a private visit to the Thyssen-Bornemisza Museum, one of Madrid’s Golden Triangle of Art, together with the Prado and the Reina Sofia national galleries, followed by a cocktail dinner, has been organised for Wednesday evening.

The week’s programme will let you enjoy Europe’s Microwave event in 2018 and will give you plenty of opportunities to satisfy your personal PASSION FOR MICROWAVES. Don’t forget to explore the friendly city of Madrid where everyone feels at home. Madrid’s rich artistic and natural heritage, cutting edge transport network, quality accommodation, fine cuisine and the passion locals show when enjoying their city’s day and night life make it one of the most attractive cities in the world. If time permits we invite you to visit some of the many nearby landmarks, from Alcalá de Henares, where Miguel de Cervantes, the well-known author of Don Quijote de la Mancha, was born 471 years ago, to Segovia, Toledo, and more...
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Join the EuMA Community
Welcome to Madrid on behalf of the European Microwave Association (EuMA)! Our mission as EuMA is to promote microwaves in Europe and to foster networking between microwave scientists and engineers in Europe. We are pursuing this in various ways but our key event is the European Microwave Week.

For those who are not familiar with EuMA: We are open to membership for all working in the field of microwaves, particularly from Europe, but also from around the world. The General Assembly, the highest governing body of the Association, gathers representatives from European countries, from North America, from the Asia-Pacific region, and from North Africa and Middle East. If you are not a EuMA member yet, I encourage you to join. Among other benefits, you will enjoy reduced fees for attending the Week and other EuMA-sponsored conferences and workshops as well as the IEEE International Microwave Symposium. Moreover, you will have access to the internal part of our website, which provides an archive of publications, the on-line version of the International Journal on Microwave and Wireless Technologies and further networking opportunities.

The European Microwave Week (EuMW) is the premier microwave conference and exhibition event in Europe. Its centrepiece is the European Microwave Conference (EuMC), the largest of the 3 conferences composing the Week. It is complemented by the European Microwave Integrated Circuits Conference (EuMIC) focusing on semiconductor device and circuit technologies, and the European Radar Conference (EuRAD), targeting the field of radar, from components to applications. The success of EuMW is also a result of the collaboration with the IEEE MTT Society (technical co-sponsor of the Week) and the GAAS Association (co-sponsor of EuMIC). But the Week is not only conferences, the Exhibition organised by our long-standing partner Horizon House forms an integral part of it.

As everybody knows, preparing and hosting the EuMW is a major effort, from paper submission and review to on-site organisation at the venue, and this is accomplished by a team of volunteers year by year. Therefore, my special and sincere thanks go to Magdalena Salazar Palma and José Ignacio Alonso Montes, 2018 General Chair and Co-chair, to Almudena Suárez Rodríguez, General TPC Chair, to José Carlos Pedro, Workshops and Short Courses Chair, and to Daniel Segovia Vargas, Treasurer, as well as to Vicente Boria Esbert and Ferran Martín, EuMC Chair and TPC Chair, to Teresa Martín Guerrero and José Ángel García García, EuMIC Chair and TPC Chair, and to Mateo Burgos García and Manuel Rosa Zurera, EuRAD Chair and TPC Chair - just to name a few on behalf of the entire team. Thank you!

It is the first time we are holding the European Microwave Week in Spain, in the beautiful city of Madrid with its many attractions. All members of the team have been working hard to set up an outstanding technical and scientific programme for you and I am sure they will make your stay in Madrid exciting, enjoyable, and a rewarding experience of Spanish hospitality.

With this, I would like to cordially invite you to EuMW 2018. I hope you will not only gain new insights from presentations and posters but also find enough time to meet with colleagues and friends. Join us and see you in Madrid!

Wolfgang Heinrich
President
European Microwave Association
In its 48th anniversary, the European Microwave Conference (EuMC) comes again to Spain, after 25 years. The last Spanish edition of the EuMC was held in Madrid in 1993, and in that time the flagship conference of the current European Microwave Week (EuMW) was not associated to the European Radar Conference (EuRAD) and to the European Microwave Integrated Circuits Conference (EuMIC). In its present format, the EuMC is able to reach a wider audience, since its traditional and widespread set of covered topics (mainly focused on microwave and wireless components, systems and technologies) is enriched with radar technologies and microwave integrated circuits (in this edition through 4 joint sessions with EuMIC and 9 with EuRAD). Thus, the simultaneous celebration of the three conferences during the same week, plus the high number of technical workshops, short courses, associated events, as well as the Industry Exhibition, will contribute to the continuous success that EuMW and particularly EuMC experiences yearly.

We, the entire Team of the EuMW 2018, and particularly the EuMC 2018 Team, with the help of the TPC members and paper reviewers, have done our best to generate an exciting, coherent, balanced, and complete program for this year's conference, with special emphasis on the latest trends in microwave, millimeter-wave, THz and wireless technologies. In summary, 355 papers grouped in 51 technical sessions or presented in the 4 interactive forums, 9 industrial session keynotes, 28 workshops and 8 short courses have been accepted in the present edition of EuMC. Moreover, 5 special sessions will be held in the following selected domains: “20th Anniversary of the European Microwave Week”, “Microwave Research in Latin America”, “5G Technology in Asia Pacific”, “Additive Manufacturing”, and “High Frequency Flexible Bendable Electronics for Wireless Communication Systems”.

Conference delegates are also warmly encouraged to attend the opening and closing sessions of EuMC (which are also the main plenary sessions of the whole EuMW) on Tuesday and Thursday, respectively, where prominent speakers have been invited. Particularly, Enrique Blanco, Global CTIO of Telefónica, Spain will give a plenary talk on Tuesday 25th September on 5G networks and communication systems; and Giuliano Gatti, Galileo Space Segment Manager at European Space Agency (ESA), will contribute with a presentation about the Galileo global satellite navigation system during the closing session to be held on Thursday 27th September. The EuMC 2018 will be closed with the traditional awards ceremony, when the best paper prizes will be announced.

We do hope that you find the conference of interest and fruitful from a scientific and technical viewpoint. We do also expect that you get in touch with our culture and traditions during the conference week. Finally, we will be very happy if, after the week, you experience a higher motivation and passion for microwaves. Enjoy the event!
Welcome to the 13th European Microwave Integrated Circuits Conference, EuMIC 2018

It is a great pleasure and an honor to welcome you all to the 13th European Microwave Integrated Circuits Conference, EuMIC 2018. EuMIC arrives to Spain after a long journey that started in Rome in 1990 organised by the GAAS® Association and continued, after 2004, in the framework of the European Microwave Week. The city of Madrid is proud to receive the visit of the Passionate European Microwave Community.

This conference is the result of huge efforts made by the panel of reviewers and TPC members. We would like to thank all of them. We also want to thank all authors, workshop and short-course organisers for their submissions and proposals, which has allowed the organisers to guarantee that this event will have great interest and high quality levels. We would especially like to acknowledge the extremely generous help received from previous EuMIC teams.

The scientific panel is composed of 12 regular EuMIC sessions and 3 EuMC/EuMIC joint sessions covering topics from device to system level. Millimetre-wave technologies have gained an important presence in this edition, reflecting their role in paving the way for 5G and beyond. Device modelling is also present with 4 regular sessions, showing how a classic topic remains a challenge for our community. The 5 sessions on amplifiers will focus on system level issues. The interactive poster session has been organised jointly with the EuMC and will be held on Tuesday, enjoying the lively atmosphere of the Exhibition. No less interesting is the offer of Short Courses and Workshops: EuMIC delegates will find a not to be missed appealing offer on Sunday. Finally, it is worth mentioning that EuMIC has included 3 relevant Industrial Keynotes thanks to the kind participation of prominent speakers from Cree, Globalfoundries and Televés. Invited manufacturers will take the floor during the traditional ‘Foundry Session’ hosted by the GAAs® Association.

The EuMIC Opening and Closing plenary sessions will feature three invited speakers, world-class in their fields. During the Opening ceremony Charles F. Campbell, Engineering Senior Fellow with the Infrastructure and Defense Products Division of Qorvo, USA, will present a realistic perspective of the present challenges that GaN monolithic designs faces. In addition, J. Sebastián Gómez-Díaz, Assistant Professor in the Electrical and Computer Engineering Department of the University of California, Davis, USA, will address the use of graphene and other 2D materials as a powerful, reconfigurable, CMOS compatible, and miniaturized on-chip platform for THz device fabrication. During the Closing session William R. Deal, Distinguished Engineer in Northrop Grumman’s RF and Mixed Signal Department, USA, will talk about the status of transistor-based electronics operating above 100 GHz and will describe recent progress in communications and sensors at these frequencies. Also during the Closing ceremony, the best contributed paper to EuMIC 2018 and the Young Engineer Prize will be awarded by the EuMIC Technical Program Committee and the EuMW Steering Committee. Three GAAS® Association PhD student fellowships will also be celebrated.

The members of the Organising Committee of this EuMIC 2018 have done our utmost to make this event possible. EuMIC 2018 is from now on mostly in your hands and we hope you will enjoy days of fruitful discussion, knowledge exchange and networking.

We are looking forward to welcoming you in Madrid.
It is a pleasure for me, on behalf of the EURAD 2018 organisation team, to welcome you to this important event for radar professionals, scientists and researchers in Europe. The European Radar Conference reaches this year its 15th edition, after walking a path of continuous growing, both in absolute terms and in terms of its weight and significance within the European Microwave Week. This year we are proud to host the EuRAD in Madrid from 26th to 28th September at IFEMA Feria de Madrid. During these days, top professionals will present their latest research and development, and discuss about the present status and future trends in the fields of radar technology, system design and performance, radar components, radar propagation and target modelling, advanced signal processing techniques, as well as the most innovative radar architectures, concepts and applications.

In the opening session on Wednesday, we will enjoy the presence of two excellent keynote Speakers. First, Mrs M. Carmen Barbero, from Indra Sistemas will present their radar global concept for the next generation of F110 frigates for the Spanish Navy, in which advanced concepts such as full digital implementation using software defined radio concepts, and multiple function front-end sharing are included. Later on, Dr. Stefano Pirandola from the University of York, will present a more long-term vision of our technologies, exploring the capabilities of the quantum radar concept. For the closing session our keynote speakers, Domingo Castro, Rafael Casado and Jacobo Martínez-Villa, from Indra Sistemas, Spain, will describe the new impressive radar facility for space debris surveillance that is starting to be installed in Spain.

This year, 156 papers were submitted to the conference, and after a rigorous selection process, the 93 accepted papers were organised into 22 oral sessions and two interactive sessions, some of them shared with EuMC. Prominent industrial keynotes speakers will open four of these sessions, showing the latest industry approaches to the addressed technologies. A Special Session about radar projects in the European Defense Agency (EDA) has been organized by Dr. Roland Krebs (Project Officer RF Sensor Technologies at EDA) to present the framework of R&T collaboration at EDA. The most relevant outcomes of recent projects in the frame of the RF Sensor Technologies CapTech will be presented by top level speakers, representing the European cooperation in this domain. An attractive topical workshops program will be running alongside the conference programme.

Finally, we would like to express our gratitude to all the reviewers and the TPC members for undertaking their task in a professional and timely manner, and for their contribution to the success of the conference. We look forward to meeting you in our nice city, at the EuRAD 2018 conference, and wish you a very pleasant stay in Madrid.

Welcome to the 15th European Radar Conference, EuRAD 2018
Welcome from the General TPC Chairs

This year the European Microwave Week is held in Madrid for the first time and we are thrilled about this excellent opportunity for the microwave community to meet, share advances and interact. As General Technical Programme Committee Chairs, we are grateful for the excellent scientific revision and management of the submitted manuscripts by the reviewers and TPC members, meeting all the required deadlines. The total number of contributions submitted was over 900. The reviews were performed by 110 TPC members and more than 430 reviewers, listed in the programme book. The TPC meeting was held in April 7th in Madrid, where an intense scientific activity took place in a friendly atmosphere. The TPC members and reviewers are fundamental to preserve the high scientific standards of the EuMW and we strongly recognize their dedication, which guarantees a thorough and fair decision, typically based on six reviews per paper. Eventually, a total of 521 regular papers were accepted, arranged in 87 oral sessions and 5 interactive sessions. In addition to the regular papers, and following an initiative started in the past EuMW, there are 15 invited industrial keynotes, which will open some of the technical sessions of the three conferences.

It has been a unique opportunity for both of us to chair the TPC, both scientifically and personally. Going through all the submitted papers for the initial review setup, we have been able to appreciate the high global quality of the contributions and the significant advances in the broad diversity of topics covered by EuMW. At a personal level, we have had the pleasure to fruitfully interact with TPC members and reviewers for an optimum execution of the revision procedure.

We are grateful to the previous TPC chairs and EuMW teams for their precious help and availability, especially to Prof. Thomas Zwick for his timely answers to numerous questions and the valuable documents he provided us. We would also like to acknowledge Prof. Lorentz-Peter Schmidt for organising and chairing the hand-over meetings, as well as the members of the EuMA BoD for their useful comments and suggestions.

For the second year, the TPC has been managed with the CONVERIA software. We want to thank Matthias Rudolph, Marc van Heijningen, Cristina Andrei and the staff from CONVERIA, who have actively supported us during the whole review process and TPC meeting. Their help has been invaluable. We are also very grateful to the three conference and TPC Chairs, the Chairs of the Workshops and Short courses, the Chairs of the Special and Focus Sessions, and the whole EuMW 2018 team who have been extremely responsive during the whole process.

We wholeheartedly hope that you will enjoy the technical programme of EuMW 2018 and the lively city of Madrid, with its renowned museums and historic neighborhoods and landmarks.

Our warmest welcome to EuMW 2018 in Madrid, Spain!

Almudena Suárez Rodríguez
General TPC Chair

Juan-Mari Collantes
General TPC Co-Chair

SPECIAL ISSUE

International Journal of Microwave and Wireless Technologies: EuMW 2018 Special Issue

The International Journal of Microwave and Wireless Technologies was created in 2009 by the European Microwave Association (EuMA) and Cambridge University Press for the benefit of the microwave research community in Europe and overseas.

The journal is published ten times a year. It allows academic and industrial researchers to promote their work and stay connected with the most recent developments in microwave and RF technology. The journal is referenced in databases such as Scopus and Google Scholar and is indexed in the Thomson Reuters Web of Science. Following the success of previous microwave weeks, the journal will again publish a special issue dedicated to European Microwave Week 2018.

The authors of a number of highly ranked papers presented at the conferences will be invited to submit an extended version for publication in the journal. The special issue will be guest edited by Vicente Boria Esbert, chair of EuMC 2018, Teresa Martín Guerrero, chair of EuMIC 2018, and Mateo Burgos García, chair of EuRAD 2018.

Accepted papers will be published online at http://journals.cambridge.org/MRF and can be referenced using their DOI (Digital Object Identifier). Once all submissions are received, the articles will be collated into the Special Issue and published in print, which is expected to appear in June 2019.

Vicente Boria Esbert
EuMC 2018 Chair

Teresa Martín Guerrero
EuMIC 2018 Chair

Mateo Burgos García
EuRAD 2018 Chair
EuMW PRIZES

2017 European Microwave Week in Nuremberg
Best Paper Prizes

EuMC Microwave Prize (sponsored by EuMA)
Sub-THZ Micromachined Waveguides for Wafer Level Integration of MMICs
P. Pursula, A. Lamminen, M. Kantanen, J. Saarilahti, V. Ermolov
VTT Technical Research Centre of Finland

EuMC Young Engineer Prizes
(sponsored by Thales Deutschland GmbH)
High Precision Realtime RF-Measurement System for Imaging of Stroke
S. Poltschak¹, M. Freilinger¹, R. Feger¹, A. Stelzer¹, A. Hamidipour², T. Henriksson², M. Hopfer², R. Planas², and S. Semenov²
¹Johannes Kepler University Linz, ²EMTensor GmbH

EuRAD Young Engineer Prize
(sponsored by Hensoldt)
Range Sidelobes Attenuation of Pseudorandom Waveforms for Civil Radars
F. De Palo, G. Galati
University of Rome Tor Vergata

EuMIC Best Paper Prize (sponsored by Rohde & Schwarz)
80-GHz Impulse Radio Receiver with Quadrature PPM Demodulation in 55-nm CMOS Technology
H. Matsumura, Y. Yagishita, I. Soga, K. Oishi, Y. Kawano, Y. Nakasha, T. Iwai
Fujitsu Laboratories Ltd

EuMIC Young Engineer Prize
(sponsored by Rohde & Schwarz)
Global Modeling of GaN HEMT Resistive Current Including Charge Trapping and Self-Heating for Multi-Bias Multi-Class PA Performance Prediction
G.P. Gibiino, R. Cinani, A. Santarelli, F. Filicori
University of Bologna

EuRAD Best Paper Prize (sponsored by Thales Netherlands)
Automotive Radar Interference Mitigation Using a Sparse Sampling Approach
J. Bechter, F. Roos, M. Rahman, C. Waldschmidt
Ulm University
Vittorio Rizzoli received his degrees in Electronic Engineering from the University of Bologna, Italy, in 1971 and 1980. In 1972 he was appointed a Professional Engineer. In 1974 he joined the University of Bologna as an Assistant to the Chair of Electromagnetic Fields and Circuits. In November 1980, he joined the University of Bologna as a Full Professor of Electromagnetic Fields. His main research interests are in the areas of nonlinear microwave circuit simulation and design with emphasis on modern CAD techniques for large-size problems, electromagnetic design of microwave and millimetre-wave integrated circuits, and nonlinear/electromagnetic co-simulation of wireless systems including environmental aspects. He is author or co-author of over 220 technical papers, most of which have been published in English in refereed international journals or presented at selected international meetings (again in English). In these areas he participated in a large number of national and international research programs funded by national and international Institutions, in many cases as the principal investigator. From 1987 to 2002 he coordinated an applied research program in cooperation between the Department of Electronics and Computer Science of the University of Bologna and Compact Software Inc. (New Jersey, USA), aimed at the development of the first general-purpose software suite for nonlinear microwave circuit simulation and design. The resulting set of design tools was systematically used for many years by Industrial R&D labs worldwide.

Prof. Rizzoli was a member of the Editorial Board of IEEE Microwave and Wireless Components Letters, IEEE Transactions on Microwave Theory and Techniques, and of John Wiley’s International Journal of RF and Microwave Computer Aided Engineering. He is also a member of the Paper Review Board of Electronics Letters. In the years 2005/2007 he served as Associate Editor of the IEEE Transactions on Microwave Theory and Techniques, with autonomous decision capabilities.

From 1987 to 1995, in 2002, and in 2009, he was on the Technical Program Committee of the European Microwave Conference. In 1995 he served as Chairman of the 25th European Microwave Conference that was held in Bologna, Italy, in conjunction with the Celebrations for the First Centenary of the Invention of the Radio. In 1995/96 he served as Chairman of the Management Committee of the European Microwave Conference. In 2001 he organised and chaired a Special Marconian Session devoted to the celebration of the first centenary of Marconi’s 1901 transatlantic radio transmission, that was held in London, UK, in conjunction with the 31st European Microwave Conference.

In 1990 Prof. Rizzoli was appointed by the IEEE “Distinguished Microwave Lecturer” of IEEE MTT-Society for Region 8. In this capacity, in 1990/1993 he presented 15 lectures at top scientific Institutions in Europe, U.S.A., and Middle East (Israel) on “Simulation and Design of Nonlinear Microwave Circuits”. In 1994 he was elected Fellow of the IEEE with the citation “For Contributions to the Simulation and Design of Nonlinear Microwave Integrated Circuits”. From 1999 to 2007 he was a member of the Technical Program Committee of the IEEE MTT-S International Microwave Symposium.

Since 1993 he has been a member of IEEE MTT-1, the Technical Committee of Computer-Aided Design whose institutional task is the promotion, development, and dissemination of CAD techniques among the members of the Scientific Community. In this capacity, he also cooperated in the organisation and presentation of several Workshops aimed at the illustration of key aspects of microwave CAD techniques to non-specialist audiences.

Robert Weigel was born in Ebermannstadt, Germany, in 1956. He received the Dr.-Ing. and the Dr.-Ing.habil. degrees, both in electrical engineering and computer science, from the Munich University of Technology in Germany where he respectively was a Research Engineer, a Senior Research Engineer, and a Professor for RF Circuits and Systems until 1996. During 1994 to 1995 he was a Guest Professor for SAW Technology at Vienna University of Technology in Austria. From 1996 to 2002, he was Director of the Institute for Communications and Information Engineering at the University of Linz, Austria where, in August 1999, he co-founded the company DICE, since split into an Infineon Technologies (DICE) and an Intel (DMCE) company with a total now of 450 staff members which are devoted to the design of RFICs for mobile radio and MMICs for vehicular radar applications. In 2000, he was appointed a Professor for RF Engineering at the Tongji University in Shanghai, China. Since 2002 he is the Head of the Institute for Electronics Engineering at the University of Erlangen-Nuremberg, Germany. Since 2017, he is Spokesman of the University’s Department of Electrical Engineering, in Erlangen, respectively in 2009, in 2012, and in 2015 he co-founded the companies easy-id, easy-ic and easy-innovation.

Prof. Weigel has been engaged in research and development of microwave theory and techniques, electronic circuits and systems, and communication and sensing systems. In these fields, he has published more than 900 papers. He received the 2002 VDE ITG-Award, the 2007 IEEE Microwave Applications Award, the 2016 IEEE MTT-S Distinguished Educator Award, and the 2018 IEEE Rudolf Henning Distinguished Mentoring Award.

Prof. Weigel is a Fellow of the IEEE, an Elected Member of the German National Academy of Science and Engineering (acatech), and an Elected Member of the Senate of the German Research Foundation (DFG). He is and has been serving on numerous advisory boards of government bodies, research institutes and companies in Europe and Asia. Furthermore, he is and has been serving on various editorial boards such as that of the Proceedings of the IEEE. He has been a member of numerous conference steering and technical program committees. He was General Chair of several conferences such as the 2004 URSI International Symposium on Signals, Systems and Electronics (ISSSE) in Linz, Austria and Technical Program Chair of several conferences such as the 2002 IEEE International Ultrasonics Symposium in Munich, Germany. He served in many roles for the IEEE MTT and UFFC Societies. He has been Founding Chair of the Austrian COM/MTT Joint Chapter, Region 8 MTT-S Coordinator, Distinguished Microwave Lecturer, MTT-S AdCom Member, and the 2014 MTT-S President.

Prof. Weigel also served in many roles for the European Microwave Association (EuMA). Since about 1990, he has served as a reviewer and, most of the years, also as a TPC member of one the EuMW conferences (EuMC, ECW Tr or EuMWC). He was General Chair of the EuMW 2013 and Honorary Chair of the EuMW 2017, both in Nuremberg, Germany. Prof. Weigel was the Founding Editor of the Proceedings of the European Microwave Association and served as Editor until 2009 when the Proceedings were transferred into the International EuMA Journal of Microwave and Wireless Technologies. He was TPC Chair of the ECWS 2003 and 2007 in Munich, Germany. For EuMW 2003 he served as the Treasurer. At the EuMW conferences he organised several workshops as well as special and focused sessions, submitted numerous papers of his research groups and contributed to and organised many special EuMW events such as the Bavarian State Receptions when EuMW has been held in Germany since 1999. At EuMW 2013, he initiated the 1st European Microwave Student School enabling students of European Universities to receive ECTS points for their curricula; and also at EuMW 2013, he initiated the 1st Graduate Student Industrial Career Platform for Ph.D., master and bachelor students. During his time as a Voting Member of the AdCom of the IEEE MTT-Society (2004 to 2017) he always served as a constructive bridge between EuMA and IEEE MTT-S through several functions and activities, e.g. as chair of MTT-S’S AdCom Subcommittee for International Liaison, and in particular when he was the MTT-President in 2014, when the EuMA President and he worked out the new EuMA/MTT-S agreement signed at the EuMW 2014 in Rome.
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Group 9 - Estonia, Latvia, Lithuania, Poland
Group 10 - Armenia, Azerbaijan, Georgia, Moldova, Ukraine
Group 11 - Albania, Bosnia and Herzegovina, Croatia, Cyprus, FYR Macedonia, Montenegro, Greece, Israel, Serbia, Slovenia, Turkey
Group 12 - Belarus, Russia
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Image courtesy of Shmuel Auster

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Welcome to EuMW 2018

European Microwave Week, being held in the effervescent and wildly exciting city of Madrid, comes to Spain for the first time ever. Bringing industry and academia together, European Microwave Week 2018 is a six-day event, including three cutting edge conferences and one exciting trade and technology exhibition featuring leading players from across the globe. EuMW 2018 provides access to the very latest products, research and initiatives in the microwave sector. It also offers you the opportunity for face-to-face interaction with those driving the future of microwave technology.

The 21st European Microwave Week combines:
- Three Major Conferences
- Associated Workshops
- Tailored Courses and Seminars for industrialists, academics and researchers
- Leading International Trade Show.

In addition, Exhibitor Workshops and Seminars will be provided by several top organisations with superior expertise in Microwave, RF, Wireless or Radar.

BADGES

Online registrants will automatically be e-mailed their badge barcode and an order confirmation receipt immediately after they pay. All those who have pre-registered should bring their badge barcode and confirmation with them to the conference where they can print out their badge by scanning their barcode at the Fast Track desk onsite. Once you have collected your badge, conference attendees can collect the proceedings which are on a USB stick and the delegate bag. Processing will be quick and easy but queues may form at busy times, so please arrange to collect your badge well in advance of your first conference session.

The registration area will be located at the lobby of IFEMA North Convention Centre, close to the North Entrance as signposted.

Those who have not pre-registered can do so on site. There will be onsite registration terminals located within the registration area, where delegates can enter their details and pay immediately by swiping their credit or debit cards through the card readers attached to the terminals.

Alternatively, you can pay at the Cashier desk if you require a printed receipt.

If you have any questions regarding registration procedures and payment, please email: eumwreg@itnint.com.

CONFERENCES

Choose from three separate but complementary conferences. Spanning the length of the week, starting from Sunday 23rd September, the conferences and workshops are scheduled as follows:

- European Microwave Integrated Circuits Conference (EuMIC) 24th-25th September 2018
- European Microwave Conference (EuMC) 25th-27th September 2018
- European Radar Conference (EuRAD) 26th-28th September 2018
- Plus Workshops and Short Courses (23rd - 28th September 2018)
- In addition, EuMW 2018 will include for the 9th year, the Defence, Security and Space Forum on 26th September 2018.

The conferences encompass a wide range of subject areas including:
- Microwave, Millimetre-wave and Submillimetre-wave Systems
- Antennas and Propagation
- Wireless Technologies
- Telecommunication (RF, Microwave and Optical)
- ICs, Semiconductor Materials and Packaging
- Radar Architectures, Systems and Subsystems
- Sensors and Remote Systems
- Test and Measurement

Online registration opens on 28th May 2018 and remains open up to and during the event until 28th September. During the event, you can also register onsite from Saturday 22nd September 2018 (16.00 - 19.00) and from 08.00 each morning from Sunday 23rd September 2018 to Friday 28th September 2018.

Conference rooms are located at the North Convention Centre. The conferences will be held in different rooms over the conference dates. Please refer to the Conference Matrix at the back of this booklet for a detailed overview. Delegates can register for one, two or all three of the conferences.

Registration at one conference does not allow any access to other conference sessions. Those who wish to register for two or more conferences will receive a discount on these registrations.

Fees and discounts are all explained in the Conference Registration Information section of this booklet.

PROCEDINGS ON USB STICK

All papers published for presentation at your chosen conference will be on a USB stick given out with the delegate bags. There will be one USB stick combining all three conferences. No hard copies of workshop slides will be provided. All workshop slides will be available on a USB stick for workshop participants.

INTERACTIVE SESSIONS

The interactive poster papers will be presented on electronic screens, which are located in the conference area on Monday and Friday, and in the exhibition as signposted on Tuesday, Wednesday and Thursday.

SPEAKER PREPARATION SPACE

A speaker preparation area is located in the conference area.

EXHIBITION HOURS

The exhibition area will be located in Hall 9 (North Entrance) as shown on the Floor Plan on page 109 of this booklet. As a registered delegate you will have full access to the exhibition area.

The exhibition opening hours are:
- Tuesday 25th September 9.30-18.00 (followed by the Welcome Reception)
- Wednesday 26th September 9.30-17.30
- Thursday 27th September 9.30-16.30

See the back cover for a full listing of the exhibitors (correct at the time of going to press).
EuMA MEMBERSHIP
One can apply for EuMA membership by ticking the appropriate box during registration for EuMW. In general, membership applications received after August 1, or through the EuMW registration form are intended for the next calendar year. However, the discount for the EuMW fees applies immediately.

EuMA membership fee is €25 for Professionals and €15 for Students.

EuMA offers a three-year free membership for people residing in NIS and some African countries.

EU MA KNOWLEDGE CENTRE
The EuMA website has its Knowledge Centre which presently contains over 20,000 papers published under the EuMA umbrella. Full texts are available to EuMA members only, who can make as many copies as they wish, at no extra-cost.

EUMA INTERNATIONAL JOURNAL
The ‘International Journal of Microwave and Wireless Technologies’ is published annually with 10 issues. EuMA members are entitled to free electronic access to the Journal. There is a special offer when subscribing to both Membership and printed Journal: €67 for Professionals, €57 for Students.

HOTELS AND TRAVEL
HOTEL RESERVATION
Horizon House has teamed up with Connex Hotels and Events, our official hotel booking supplier, to offer you the ability to book your accommodation for EuMW at the most competitive rates available. It is very easy to make an immediate hotel booking.

Simply visit their booking page http://www.connexhotelsandevents.com/eumw-2018-madrid.html and make your booking, or email sally@connexhotelsandevents.com. You will find a wide range of accommodation to suit every budget. Alternatively, see the hotel booking pages within this programme.

GETTING TO IFEMA - FERIA DE MADRID CONVENTION CENTRE
The city of Madrid is located in the geographic centre of Spain and it is well connected to the European motorway, rail and flight networks. IFEMA Feria de Madrid Convention Centre can be accessed through a variety of transportation means.

By Plane:
Adolfo Suárez Madrid-Barajas International Airport, or simply Madrid-Barajas Airport, is located only 10 minutes from the exhibition complex, and just 15 kilometres from the city centre, with which it is connected by Metro (Airport stations T-1, T-2, T-3 and T-4). A top international airport that guarantees daily direct connections from Feria de Madrid to most Spanish cities and to those throughout the world.

By Metro:
Access to Feria de Madrid is possible from anywhere in the city by means of Feria de Madrid station on Line 8, whose exit is at the South Entrance of the complex. Line 8 also connects the venue with the different terminals of Barajas International Airport.

By Bus:
A wide bus network provides access to Feria de Madrid from different points in the city:
Route 112-Feria de Madrid-8º Aeropuerto.
Route 122-Avenida de América-Feria de Madrid.
Route 828-Universidad Autónoma-ALcobendas-Callejeras-Feria de Madrid.

BY EUMW SHUTTLE BUSES
In order to facilitate the delegate transportation to (and from) IFEMA, a shuttle bus route has been organised from local hotels as well as from the South Entrance (metro) to the North (EuMW) Entrance.

For the complete time tables, please check the EuMW website.

By Taxi:
With ranks at each entrance to the exhibition complex, more than 15,000 taxis are available to visitors to Feria de Madrid.

By Car:
Feria de Madrid is linked by road to Madrid’s major access routes and ring roads: the M11 (Exits 5 and 7), the M40 (Exits 5, 6 and 7) and the A2 (Exit 7). There is direct access to the various parking areas.

OTHER USEFUL INFORMATION
PERSONAL INVITATION
A valid passport will be required for entry into the organising country, in this case Spain. Since EuMW events are held in the European Union, no visa is usually required for travellers with passports from a number of countries, like for instance: European Union, Australia, Brazil, Canada, Japan, Singapore, South Korea or the United States. At: http://www.exteriores.gob.es/Portal/en/ServiciosAlCiudadano/InformacionParaExtranjeros/Paginas/RequisitosDeEntrada.aspx you can find additional information to know whether you are required to apply for a visa for Spain. If you are registering as speaker, delegate or exhibitor and you need a visa, we recommend that you speak with the Spanish Consulate, in your own country. You should organise this at least 3 to 4 months prior to EuMW.

The organisers will be pleased to send a letter of invitation to any exhibitor, conference delegate or speaker requesting it.

For requesting this letter of invitation, please pre-fill the invitation letter at http://www.eumweek.com/visitors/passport-visa.html and return it to Prof. Dr. Luis Emilio García Castillo, Visa Chair EuMW 2018, Universidad Carlos III de Madrid, Leganés, Madrid via visa@eumw2018.com

INSURANCE
It is highly recommended that all participants carry the proper travel and health insurance, as the organiser cannot accept any liability for any accidents or injury that occur during or when travelling to the event. Please also insure that personal items are covered for loss, damage or theft either through a personal policy or by a corporate policy. We cannot accept any liability for personal items that are lost, damaged or stolen during or travelling to and from European Microwave Week 2018.

ELECTRICITY
Electricity is supplied at 230V, 50 Hz (socket type F (“Schuko plug”)).

SOCIAL EVENTS & PARTNER PROGRAMME
Full details of the social events & dinners that are taking place during EuMW 2018 can be found in the ‘Social Events & Partner Programme’ section of this programme.

CREDIT CARDS
All major hotels and most restaurants and shops will accept credit cards. It is advisable to carry other identification as well. Visa and MasterCard are the most widely accepted cards.

WIFI
WIFI is available in the exhibition hall and conference area. Login details can be found within your delegate bag.

SHOPPING & SIGHTSEEING
MADRID, its special dynamism as a business centre goes hand in hand with its vibrant vitality, tourist appeal and fervent cultural and recreational life. Come and discover its sites, iconic museums and spectacular range of hotels and restaurants; and enjoy its endless nightlife and the flood of designs, fashion and trends you will find in the shop windows of one of Europe’s leading capitals.

A great city that boasts a rich treasure of art, culture and natural environments, set in a region packed with history and modernity.

Visit https://www.esmadrld.com/en for information on top attractions and tips for your stay.

Alternatively, see the “Social Events & Partner Programme” section of this booklet for tours and excursions before, during and after EuMW 2018.
EuMIC Get-Together
Date: Monday 24th September 2018
Duration: from 20:00 until 22:00
Location: Larumbe, La Terraza, 4th floor, Centro Comercial ABC
Serrano, Serrano 61, 28006 Madrid
Cost: Free to EuMIC delegates

Following the tradition of the European Microwave Integrated Circuits Conference, delegates are invited to enjoy an informal dinner that will be offered by a first-class catering service in a unique location (Edificio ABC Serrano, a 19th century building) and located in the heart of Madrid, facing Serrano Street and Paseo de la Castellana. An unrivalled setting to have a good time with colleagues and friends and taste the excellent Spanish cuisine.

Welcome Reception
Date: Tuesday 25th September 2018
Duration: 18:30 until 21:30
Location: Palacio del Negralejo, Ctra. San Fernando a Mejorada., km 3, 28522 Rivas-Vaciamadrid, Madrid
Cost: Free to conference delegates & invited exhibitors

All registered conference delegates, as well as invited representatives from companies participating in the exhibition are invited to the EuMW 2018 Welcome Reception, sponsored by Keysight Technologies, Horizon House Publications and EuMA.

Delegates will need to bring their badge and exhibitors their invite along with them to gain entrance. The evening will begin with drinks at 18:30 followed by the General Chairs’ handover from EuMW 2018, Madrid to EuMW 2019, Paris as well as an address from the Platinum Sponsor, Keysight Technologies. The open-buffet dinner will be served from 19:00.

Bus transportation to and from Palacio del Negralejo will be provided.

Private Visit to the Thyssen-Bornemisza Museum and Cocktail Dinner
Date: Wednesday 26th September 2018
Duration: 19:30 until 21:00
Location: Museo Thyssen-Bornemisza, Paseo del Prado, 8, 28014 Madrid
Cost: € 45 for delegates, € 60 for exhibitors

A private visit to the Thyssen-Bornemisza Museum, one of Madrid’s Golden Triangle of Art together with the Prado and the Reina Sofia national galleries, has been organised, followed by a cocktail dinner, on Wednesday, 26th September 2018, starting at 19:30. With over 1,600 paintings and sculptures, the Thyssen-Bornemisza was the second largest private collection in the world after the British Royal Collection. The Museum houses now the core of the collection and fills the historical gaps in its counterparts’ collections. Guides will be available through the different rooms of this magnificent museum. This unique experience will be complemented with a cocktail dinner. Subsidised tickets at € 45 for delegates, and € 60 for exhibitors, are limited, so register as soon as possible.

Young Professionals Meet-Up
Date: Thursday 27th September 2018
Duration: 18:30 until 22:00
Location: A downtown Cafeteria to be announced
Cost: Free to all YPs

EuRAD Lunch
Date: Friday 28th September 2018
Duration: 12:30 until 13:50
Location: Restaurant Puerta de Alcala, IFEMA
Cost: Free to EuRAD delegates and Friday WS/SC delegates
CONFERENCE REGISTRATION INFORMATION

Fast Track Badge Retrieval
Register online and print out your badge in seconds onsite from the Fast Track Check In Desk

Register Online at www.eumweek.com
ONLINE registration is open from 28th May 2018 up to and during the event until 28th September 2018.
ONSITE registration is open from 16:00 on 22nd September 2018.
ADVANCE DISCOUNTED RATE (up to and including 23rd August) STANDARD RATE (from 24th August & Onsite).

CONFERENCE REGISTRATION FEES
There are TWO different rates available for the EuMW conferences:
• ADVANCE DISCOUNTED RATE – for all registrations made online up to and including 23rd August (these are approximately 40% cheaper than the Standard Rate).
• STANDARD RATE – for all registrations made online from 24th August and onsite.
Please see the Conference Registration Rates table on the following page for complete pricing information. All payments must be in € (Euros) – cards will be debited in € (Euros).

CONFERENCE REGISTRATION DETAILS

Online Registration
• All registrations should be made online at www.eumweek.com. Those completed up to and including 23rd August will be charged at the 'Advance Discounted Rate' and those from 24th August will be charged at the 'Standard Rate'.
• Online registration is open from 28th May 2018 up to and during the event until 28th September 2018. You can also register ONSITE from 16:00 on Saturday 22nd September 2018 and then at the times detailed below.

Onsite Registration
Onsite registration is available:
• Saturday 22nd September 16:00 - 19:00
• Sunday 23rd September 08:00 - 17:00
• Monday 24th September 08:00 - 17:00
• Tuesday 25th September 08:00 - 17:00
• Wednesday 26th September 08:00 - 17:00
• Thursday 27th September 08:00 - 17:00
• Friday 28th September 08:00 - 10:00

Onsite registration will be charged at the Standard Rates (see pricing table on the following page).

HOW TO REGISTER

Online
• All registrations should be made online at www.eumweek.com.
• Delegates can register for one, two or all three of the conferences, workshops and short courses.
• Discounts will be given to those registering for two or more conferences.
• Payment can be made online using Amex, Visa, Mastercard or Bank Transfer.
• Registrants paying by Credit Card will be sent an automatic email confirmation, with a receipt and badge barcode.
• Registrants choosing to pay by Bank Transfer will receive their confirmation, but their receipt and badge barcode will be sent only once payment has been received and cleared by Horizon House.

Onsite
• The registration area will be located at the entrance to the conference centre as signposted.
• There will be Self Service terminals in the registration area where delegates can enter their details and pay immediately by swiping their credit cards through the readers attached to the terminals.
• Delegates can also choose to ‘Pay at Cashier’ and then proceed to the Cashier Point and pay using credit cards or cash. Receipts will be given accordingly.

If you have any questions regarding registration procedures and payment, please contact: eumwreg@tinint.com.

BADGE COLLECTION AT FAST TRACK CHECK IN DESK
• All online registrants should bring a printed copy of their email registration receipt with the barcode and a photo ID. At the entry to the convention centre, they may scan the barcode at the Fast Track check-in desks and present their ID to obtain the badge.
• Online registrants without printed emails may also obtain their badges at the Self Service registration terminals (photo ID required).
• All onsite registrants using the Self Service terminals will receive their printed badge upon payment.
• Once you have collected your badge, you can collect the conference proceedings on USB stick and the delegate bag for the conferences from the specified delegate bag area by scanning your badge. Processing will be quick and easy but queues may form at busy times, so please arrange to collect your badge well in advance of your first conference session.

COFFEE BREAKS, EUOMIC GET-TOGETHER, WELCOME RECEPTION AND EURAD LUNCH
• Upon presentation of their badge conference delegates will be served free coffee during the coffee breaks.
• There will be two coffee breaks per day. On Friday, there will be only one coffee break in the morning.
• Monday’s EuMIC Get-Together, which will be held off-site at Larumbe, La Terraza, is free of cost for EuMIC delegates.
• Tuesday’s Welcome Reception, sponsored by Keysight Technologies, which will be held off-site at the Palacio del Negralejo, is free for delegates and invited exhibitors. Badges must be presented at the entrance.
• Friday’s EuRAD lunch, which will be held at restaurant Puerta de Alcala in IFEMA is free of cost for EuRAD delegates and Friday’s WS/SC delegates.

DELEGATE LUNCHBOXES
• Subsidised lunchboxes for delegates, WS/SC, doctoral and student school attendees are being offered by EuMW at the reduced cost of € 5 per lunchbox (one per day). In order to guarantee availability, it is required to order the lunchboxes at the time of registration. We recommend the selection of a lunch box for Tuesday, if you plan to attend the WiM event. Visit www.eumweek.com for more information.

PRIVATE VISIT AND COCKTAIL DINNER AT THE THYSSEN-BORNEMISZA MUSEUM – 26TH SEPTEMBER 2018
A private visit to the Thyssen-Bornemisza Museum, one of Madrid’s Golden Triangle of Art together with the Prado and the Reina Sofia national galleries, has been organised, followed by a cocktail dinner, on Wednesday, 26th September 2018, starting at 19:30. With over 1,600 paintings and sculptures, the Thyssen-Bornemisza was the second largest private collection in the world after the British Royal Collection. The Museum houses now the core of the collection and fills the historical gaps in its competitors’ collections. Guides will be available through the different rooms of this magnificent museum. This unique experience will be complemented with a cocktail dinner. Subsidised tickets at € 45 for delegates, € 60 for exhibitors are limited, so register as soon as possible.

CONFERENCE LOCATION
The conferences will be held in different rooms over the conference dates. Please refer to the Conference Matrix. Registration at one conference does not allow access to the sessions of the other conferences.
Reduced rates are offered if you have society membership to any of the following*: EuMA, GAAS, IET, EurAAP or IEEE. EuMA membership fees: Professional € 25/year, Student € 15/year.

If you register for membership through the EuMW registration system, you will automatically be entitled to discounted member rates.

Reduced Rates for the conferences are also offered if you are a Student/Senior (Full-time students 30 years or younger and Seniors 65 or older as of 28th September 2018).

The fees shown below are invoiced in the name and on behalf of the European Microwave Association. EuMA’s supplies of attendance fees in respect of the European Microwave Week 2018 are exempted from Spanish VAT.

**CONFERENCE REGISTRATION INFORMATION**

**EUROPEAN MICROWAVE WEEK 2018, 23rd - 28th September, Madrid, Spain**

Register Online at www.eumweek.com

ONLINE registration is open from 28th May 2018 up to and during the event until 28th September 2018.

ONSITE registration is open from 16:00 on 22nd September 2018.

**ADVANCE DISCOUNTED RATE (up to and including 23rd August) STANDARD RATE (from 24th August & Onsite).**

Reduced rates are offered if you have society membership to any of the following*:

- EuMA
- GAAS
- IET
- EurAAP
- IEEE

The fees shown below are invoiced in the name and on behalf of the European Microwave Association. EuMA’s supplies of attendance fees in respect of the European Microwave Week 2018 are exempted from Spanish VAT.

### ADVANCE REGISTRATION CONFERENCE FEES

**EUROPEAN MICROWAVE WEEK 2018**

<table>
<thead>
<tr>
<th>CONFERENCE FEES</th>
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### STANDARD REGISTRATION CONFERENCE FEES

**EUROPEAN MICROWAVE WEEK 2018**

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### WORKSHOP AND SHORT COURSE FEES

**EUROPEAN MICROWAVE WEEK 2018**

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<th>FEES</th>
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**PRIVATE VISIT TO THE THYSSEN-BORNEMISZA MUSEUM & COCKTAIL DINNER – 26TH SEPTEMBER 2018**

Tickets for the private visit and cocktail dinner at the Thyssen-Bornemisza Museum are offered at the price of € 45 for delegates, € 60 for exhibitors.

Tickets are limited and available on a first-come, first-served basis.

### PROCEEDINGS ON USB STICK

All papers published for presentation at the conferences will be on a USB stick, given out FREE with the delegate bags to those attending conferences. The cost for an additional USB stick is € 50.

### INTERNATIONAL JOURNAL OF MICROWAVE AND WIRELESS TECHNOLOGIES (8 ISSUES PER YEAR)

International Journal combined with EuMA membership: € 67 for Professionals or € 57 for Students.

### PARTNER PROGRAMME AND SOCIAL EVENTS

Full details and contacts for the Partner Programme and other Social Events can be obtained via the EuMW website www.eumweek.com.

**EUROPEAN MICROWAVE WEEK WORKSHOPS & SHORT COURSES**

**SUNDAY 23rd September**

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<thead>
<tr>
<th>TIME</th>
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<tr>
<td>Full Day WS-01</td>
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<tr>
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<td>EuMC</td>
</tr>
<tr>
<td>Half Day WS-05</td>
<td>EuMC</td>
</tr>
<tr>
<td>Full Day WS-06</td>
<td>EuMC/EuMIC</td>
</tr>
<tr>
<td>Full Day WS-07</td>
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**TUESDAY 25th September**

<table>
<thead>
<tr>
<th>TIME</th>
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<tbody>
<tr>
<td>Full Day PM WW-01</td>
<td>EuMC/EuRAD</td>
</tr>
<tr>
<td>Full Day WW-02</td>
<td>EuRAD</td>
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**WEDNESDAY 26th September**

<table>
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<th>TIME</th>
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<tbody>
<tr>
<td>Full Day PM WW-03</td>
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</tr>
<tr>
<td>Full Day PM WW-04</td>
<td>EuMC/EuRAD</td>
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<tr>
<td>Full Day PM WW-05</td>
<td>EuMC</td>
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<tr>
<td>Full Day PM WW-06</td>
<td>EuMC</td>
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<tr>
<td>Half Day PM WW-07</td>
<td>EuMC/EuRAD</td>
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**THURSDAY 27th September**

<table>
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<tr>
<th>TIME</th>
<th>FEES</th>
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</thead>
<tbody>
<tr>
<td>Full Day AM WW-08</td>
<td>EuMC/EuMIC</td>
</tr>
<tr>
<td>Full Day AM WW-09</td>
<td>EuMC/EuMIC</td>
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<tr>
<td>Full Day AM WW-10</td>
<td>EuMC</td>
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<tr>
<td>Full Day AM WW-11</td>
<td>EuMC/EuMIC</td>
</tr>
<tr>
<td>Full Day AM WW-12</td>
<td>EuMC/EuMIC</td>
</tr>
<tr>
<td>Half Day PM SS-01</td>
<td>EuMC/EuMIC</td>
</tr>
<tr>
<td>Full Day SS-02</td>
<td>EuMC/EuMIC</td>
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<td>EuMC/EuMIC</td>
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**FRIDAY 28th September**

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<tr>
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<tr>
<td>Full Day AM WM-01</td>
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<tr>
<td>Full Day AM WM-02</td>
<td>EuMC</td>
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<tr>
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<td>EuMC</td>
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<tr>
<td>Full Day AM WM-04</td>
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<td>Full Day AM WM-05</td>
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<td>Full Day AM WM-06</td>
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<tr>
<td>Half Day AM SM-01</td>
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<td>EuMC</td>
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**SPECIAL FORUMS & SESSIONS**

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<tr>
<th>DATE</th>
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<tr>
<td>Wednesday 26th September</td>
<td>10:50 - 17:50</td>
<td>Defence, Security &amp; Space Forum</td>
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<tr>
<td>Monday 24th - Wednesday 26th September</td>
<td>08:30 - 17:50</td>
<td>European Microwave Student School</td>
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<tr>
<td>Monday 24th - Wednesday 26th September</td>
<td>08:30 - 17:50</td>
<td>European Microwave Doctoral School</td>
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# EUROPEAN MICROWAVE WEEK WORKSHOPS AND SHORT COURSES

## SUNDAY 23rd September

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<thead>
<tr>
<th>Time</th>
<th>Type</th>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>Full Day</td>
<td>WS-01</td>
<td>EuMC</td>
<td>GaN HEMT Characterization and Modeling for micro- and mm-Wave Power Amplifier Applications</td>
</tr>
<tr>
<td>Half Day AM</td>
<td>WS-02</td>
<td>EuMC</td>
<td>High Efficiency mm-Wave Power Amplifiers for 5G</td>
</tr>
<tr>
<td>Half Day PM</td>
<td>WS-03</td>
<td>EuMC</td>
<td>Current Trends in Broadband, Efficient and Linear PAs for 5G Wireless Applications</td>
</tr>
<tr>
<td>Half Day AM</td>
<td>WS-04</td>
<td>EuMC</td>
<td>RF Techniques for Cellular Carrier Aggregation and Beyond</td>
</tr>
<tr>
<td>Half Day PM</td>
<td>WS-05</td>
<td>EuMC</td>
<td>5G Systems &amp; Millimeter Wave Communications in Smart Public Transport</td>
</tr>
<tr>
<td>Full Day</td>
<td>WS-06</td>
<td>EuMC/EuMIC</td>
<td>Terahertz Technologies from Fundamentals to Implementations: A Device and Application Prospective</td>
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<tr>
<td>Half Day AM</td>
<td>WS-07</td>
<td>EuMC</td>
<td>Broadband Power Amplifiers for Wireless Applications</td>
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<tr>
<td>Full Day</td>
<td>WS-08</td>
<td>EuMC/EuMIC</td>
<td>Transmitter Modules for Smart Antennas and MIMO Systems</td>
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<tr>
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<td>WS-09</td>
<td>EuMC/EuMIC</td>
<td>Metamaterials, Metasurfaces and Applications</td>
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<tr>
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<td>WS-10</td>
<td>EuMC</td>
<td>Radioastronomy Instrumentation</td>
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<tr>
<td>Full Day</td>
<td>WS-11</td>
<td>EuMC/EuMIC</td>
<td>Highly Integrated RF Transceiver Systems</td>
</tr>
<tr>
<td>Full Day</td>
<td>WS-12</td>
<td>EuMC/EuMIC</td>
<td>Wideband Supply Modulated RF Power Amplifiers for Energy Efficient Wireless Communication Infrastructure</td>
</tr>
<tr>
<td>Half Day PM</td>
<td>SS-01</td>
<td>EuMC/EuMIC</td>
<td>Introduction to SSPA Design and Considerations for Spaceborne Applications</td>
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<tr>
<td>Full Day</td>
<td>SS-02</td>
<td>EuMC/EuMIC</td>
<td>Fundamentals of Microwave PA Design</td>
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<tr>
<td>Full Day</td>
<td>SS-03</td>
<td>EuMC/EuMIC</td>
<td>Additive Manufacturing of Radio-Frequency Components</td>
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## MONDAY 24th September

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<th>Type</th>
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<td>Full Day</td>
<td>WM-01</td>
<td>EuMC</td>
<td>Digital Calibration and Nonlinear Compensation Techniques for MIMO Wireless Transmitters in 5G and Beyond</td>
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<tr>
<td>Full Day</td>
<td>WM-02</td>
<td>EuMC</td>
<td>High Power RF Breakdown and PIM in Space Applications</td>
</tr>
<tr>
<td>Full Day</td>
<td>WM-03</td>
<td>EuMC</td>
<td>Recent Advances in RF/Microwave Filters for Space Application</td>
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<tr>
<td>Full Day</td>
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<td>EuMC</td>
<td>Substrate Integration Technologies and Applications</td>
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<td>Full Day</td>
<td>SM-01</td>
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<td>Microwaves for Quantum Information Technology</td>
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<tr>
<td>Full Day</td>
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<td>EuMC</td>
<td>Classical and Novel Synthesis Methods for Filters and Multiplexers</td>
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<tr>
<td>Full Day</td>
<td>SM-03</td>
<td>EuMC</td>
<td>Coupling-Matrix-Based Design of RF/Microwave Filters</td>
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<tr>
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<td>High-Speed Interconnects and Signal Integrity</td>
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## TUESDAY 25th September

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## WEDNESDAY 26th September

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<tr>
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<td>WW-01</td>
<td>EuMC/EuRAD</td>
<td>Relevance of Electromagnetics in Communication System Design</td>
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<tr>
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<td>WW-02</td>
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<td>Automotive Radar and HAD</td>
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## THURSDAY 27th September

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<td>Full Day</td>
<td>WTh-01</td>
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<td>THz Applications: Present and Future</td>
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<td>Half Day AM</td>
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<td>EuMC</td>
<td>Wearable and Smart Electronics: Design, Materials and Applications</td>
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<tr>
<td>Half Day PM</td>
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<td>EuRAD</td>
<td>Millimeter-wave Radar for Industrial and Consumer Applications</td>
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<td>THz Electronics for Communication and Remote Sensing Systems</td>
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<td>New Generations of Microwave Measurements and the Impact of Uncertainty/Sensitivity</td>
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<td>Half Day AM</td>
<td>WTh-06</td>
<td>EuMC</td>
<td>Doherty Legacy: from Invention to Revival</td>
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<td>Half Day PM</td>
<td>WTh-07</td>
<td>EuRAD</td>
<td>Coexistence in the Crowded Spectrum between 1 and 100 GHz</td>
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## FRIDAY 28th September

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<td>WF-01</td>
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The Defence, Security and Space (DSS) Forum is jointly organised by the European Microwave Association (EuMA) and Microwave Journal, to complement European Microwave Week’s activity in the defence, security and space sector. This year, local input has been welcomed from: Fundación Círculo (Circle of Technologies for Defence and Security Foundation), TEDAE (Spanish Association of Technological Defence, Aeronautics and Space Companies) and UPM (Universidad Politécnica de Madrid).

Each year the DSS Forum focuses on a hot topic that is engaging industry, academia and organisations/agencies to develop, test and implement leading edge technology. In 2018 the topic is: Integrating Unmanned Aerial Vehicles (UAVs) into Defence and Security Scenarios.

The popularity of Unmanned Aerial Vehicles is growing due to a reduction in costs and the increasing capabilities and benefits provided by such systems. Currently, the estimated number of existing UAVs is believed to be a few million, with that figure estimated to grow exponentially in coming years. From a Defence and Security perspective, there is the need to provide UAVs with innovative technologies enhancing performances for safe and secure systems, and to defend against threats posed by terrorists and insurgents utilising UAVs to achieve their own objectives.

Microwave technologies are essential to meet these challenges by providing UAVs with new and more advanced sensors and communications equipment. However, going forward the development of such systems also anticipates the use of new technologies such as Big Data and Artificial Intelligence which will result in a high level of autonomy that, using the data obtained by the sensors, will provide the ability to learn from the environment and their own errors, eventually facilitating autonomous decision making in a constantly evolving environment.

Keynote speakers will consider the state of the art of leading technologies and systems for unmanned operations, the estimated evolution of technologies and trends and consider expected capabilities and functionalities to address future conflicts. The efforts made by the main players in the sector will be analysed and their views on new trends and technological developments will be offered.

The industry session will reflect the effort and investment that is being made to innovate, develop and bring UAV technologies to market. Specific areas of activity include radar systems being developed for UAV security – detection, identification and denial and obstacle detection for autonomous flying and crash avoidance. From an industry perspective, the emphasis will be on development at system and sub-system level, with particular focus on sub-system integration, not forgetting the significant role that test and measurement has to play in moving the sector forward.

The Executive Forum will present the points of view of the different established and regulatory bodies that allow coexistence between the different aerial platforms and describe the activity of the different players already established and emerging in the field.

Programme

08:30 - 10:10 EuRAD Opening Session
10:10 - 10:50 Coffee Break
10:50 - 12:30 New Concepts, Technologies and Systems for UAV Integration and Their Role in Future Hybrid Scenarios. Moderator: Alfonso Farina, IEEE Fellow, Italy
- Technological Demonstrator of Enhanced Situation Awareness in Naval Environment with the Use of Unmanned Systems – Dr. Tony Arecchi, Ocean 2020 Project Coordinator, Leonardo S.p.A. Italy.

Offering an economic perspective, the session will address the questions that will be faced when expanding the ‘UAS Mission Envelope’ including: What will be the challenges for suppliers of systems and subsystems across radar, EW, communications and EO-IR sensors? How will AI and Big Data be leveraged? Also, as the expansion of commercial UAS use brings to the fore disruptive potential, intentional or otherwise, as well their implementation in the asymmetric threat arsenal, is the threat being recognized, and more importantly budgeted for?

13:50 - 15:30 Microwave Journal Industry Session
This session offers a perspective on the endeavour, innovation and investment that industry is committing to the development of Unmanned Aerial Vehicles in the defence and security sector. Speakers will offer an insight into such areas of activity as microwave sensors/sub-systems, the test and measurement challenges that are being addressed and the issue of UAV identification and detection.

15:30 - 16:10 Coffee Break
16:10 - 17:50 Round table: Efforts & Investment Needs to Drive UAV Technologies to Market
High level speakers from key governmental agencies and commercial companies involved in the development of UAV Systems and Technologies and their implementation and integration into security and defence markets will offer their opinions and outline the opportunities and challenges that can be expected in the coming years. Speakers will also focus on the research needs and technological trends that will define the architectures and technical characteristics of future unmanned systems. Among others, the following topics will be analysed: Emerging technologies, operational and military visions, architectures and regulatory aspects together with the threat of hostile drones. Moderator: Ignacio Montiel Sánchez, Project Officer Information Technologies. European Defence Agency (EDA). Belgium

Speakers:
- Paolo Salieri, Principal Scientific and Policy Officer in the Directorate General for Enterprise and Industry of the European Commission. Belgium
- Fernando Mijares, Head of Future Projects of AIRBUS Defence & Space. Germany
- Juan Besada, Professor, Information Processing and Telecom Center, Universidad Politécnica de Madrid (IPTC-UPM). Member of SESAR Scientific Committee. Spain
- Fernando Arias, Senior Expert, ISDEFE. Spain

17:50 - 18:30 Cocktail Reception
The opportunity to network and discuss informally the issues raised throughout the Forum.

Registration and Programme Updates
Registration fee is €20 for those who registered for a conference and €60 for those not registered for a conference. The Conference Special Events section of the EuMW website will give further details and updates.
EuMW 2018 Student Challenge

When: Wednesday 26th September, 2018
Location: Exhibition Hall

Eligible students are invited to take part in the Student Challenge during EuMW 2018. The Student Challenge is an opportunity for Bachelor, Master, and Doctoral students from all over the world with a variety of academic backgrounds, to work together on a specific topic in the wide and challenging field of microwaves. The aim is to promote innovative thinking, teamwork and pro-active behaviour; skills future employers will highly value. Kick-off will take place during the first break on Monday 24th at both the student and the doctoral school.

Teams
Each team is composed of a maximum of four members, preferably from different institutions and with a variety of backgrounds. All teams will present, explain, and defend a fresh, visionary, application oriented concept by a short presentation (ePoster). The presentation must be based on at least two papers presented at the EuMW 2018, of which only one paper may be authored by a member of the team. Eventually, each team will give an elevator pitch of the innovative concepts they have devised. Hurry up, register promptly, the number of participants is limited!

Evaluation Criteria
• Novelty of the idea
• Relevance of the solution/vision proposed
• Feasibility of the idea
• Clarity of the poster
• Clarity of the oral presentation and discussion

Registration
To register, please send an e-mail to student_contests@eumw2018.com and attach a copy of your student identity card or a confirmation, signed by your responsible professor. The deadline for registration is 7th September 2018. Updated information can be found at the EUMW 2018 web site.

Programme
Monday 24th September
10:10-10:50 Kick-off meeting: Theme disclosure, instructions, team formation (room N108)

Wednesday 26th September
13:50-17:50 Poster presentation to jury and audience (exhibition hall)

EuMW 2018 Student Design Competitions

When: Tuesday 25th September and Wednesday 26th September, 2018
Location: Exhibition Hall (Tuesday)
N109 (Wednesday)

Organisers: Prof. Roberto Gómez García (Universidad de Alcalá, Spain) & Prof. Miguel Ángel Sánchez Soriano (Universidad de Alicante, Spain)

The Student Design Competitions involve master and doctoral students designing and measuring a microwave device developed prior to and also at the conference.

This year, three competitions will be offered:

Thrust 1: Transceiver Design
Thrust 1 is made to learn designing and measuring a transceiver as a result of the European Microwave Student/Doctoral Schools and the actual competition will be held at the end of the school on Wednesday in room N109. Registration at the school is required. This thrust is supervised by Prof. David S. Ricketts (North Carolina State University, USA).

Thrust 2: Video Bandwidth Enhancement for High Power Amplifiers (sponsored by Ampleon)
Thrust 2 is dedicated to the development of a power amplifier (transistors are provided by the sponsor) with enhanced video bandwidth performance at 3.6 GHz before the conference. This thrust is supervised by Dr. Osman Ceylan and Dr. Lázaro Marco-Platón. Winners will be awarded €1500 (1st place) and €1000 (2nd place). Promising designs will also be awarded €500. The competition will be held on Tuesday in the exhibition hall. Please refer to the students activities web site for design rules and specifications.

Thrust 3: Planar Filter Design at C-Band (sponsored by Ansys)
Thrust 3 is meant to develop a planar filter design at C-band prior to the conference. This thrust is supervised by Prof. Roberto Gómez García and Prof. Miguel Ángel Sánchez Soriano. The winner will be awarded an ANSYS Research HF licence for six months (worth €2400). The competition will be held on Tuesday in the exhibition hall. Please refer to the students activities web site for design rules and specifications.

www.eumweek.com | 25
3rd European Microwave Student School
‘Microwave Circuits in Planar Technologies’

When: Monday 24th September until Wednesday 26th September, 2018
Location: N107 (Monday and Tuesday)
N109 (Wednesday)
Organisers: Ernesto Ávila & Germán Torregrosa (Miguel Hernández University of Elche, Elche, Spain)

About the European Microwave Student School
This year’s European Microwave Week features the third European Microwave Student School for bachelor and master students from all over Europe. This year’s topic is “Microwave Circuits in Planar Technologies”, spanning from fundamentals of microwave circuits design to new designing techniques, technologies and implementations of microwave planar circuits. The programme features experts from academia and industry and it will enable a theoretical and practical understanding of microwave circuits in planar technologies. The course will be formed by an intensive full day of lectures accompanied by a hands-on design experience event on the second and third days. Together with the Doctoral School, students will build a modern digital transceiver. The best concepts will enter the Student Design Competition. The School is also open to interested PhD students.

Earning Credit Points
The European Microwave Student School will offer certificates to all attendees for earning credit points within the European Credit Transfer System (ECTS). If you need to have a written or oral exam, please contact your professor well in advance for arranging the details of the examination process. By request of your professor via email to studentsschool@eumw2018.com we will provide an exam sheet for oral or written examination by the beginning of October 2018.

Registration
The registration fee for this event is €40. For the registration, bachelor and master students will need a valid student ID of an accredited university. ADS and HFSS temporary licenses will be available during the school. Students are prompted to bring their own laptops. For registration, please go to the registration site and select EuMW Student School. Students may also register for lunchboxes. For further information please visit: www.eumweek.com.

Registration closes 7th September 2018. Space is limited, so purchase your ticket well in advance.

Programme

Monday 24th September
8:30-8:40  Student School presentation
8:40-9:30  Co-simulation and optimization of microwave planar circuits
Lluís Pradell, Universidad Politécnica de Cataluña, Barcelona, Spain
9:30-10:10 Integrated electromagnetic modeling and simulation to do more efficient microwave design
Keysight, Spain
10:10-10:50 Break
10:50-11:40 Addressing Microwave Beamforming challenges in design and test
Markus Lörner, Rohde & Schwarz
11:40-12:30 Wideband matching networks
Càndid Reig Escrivà, Universidad de Valencia, Valencia, Spain
12:30-13:50 Lunch
13:50-14:40 Antenna feeding technologies
Sergio Llorente Romano, Universidad Carlos III de Madrid, Leganés, Spain
14:40-15:30 Low profile planar antennas: fundamentals and applications
José Luis Masa Campos, Universidad Autónoma de Madrid, Madrid, Spain
15:30-16:10 Break
16:10-17:00 Design of coupled-line bandpass filters by using an energetic coupling approach
Miguel Ángel Sánchez Soriano, Universidad de Alicante, Alicante, Spain
17:00-17:50 Power amplifier design
Osman Ceylan, Ampelion, Nijmegen, The Netherlands

Tuesday 25th September
8:30-12:30 Hands on activity - Building a modern digital transceiver in one day
David S. Ricketts, North Carolina State University, Raleigh, USA
12:30-13:50 Lunch

Wednesday 11th October
8:30-12:30 Student Design Competition. Hands on activity.
David S. Ricketts, North Carolina State University, Raleigh, USA
12:30-13:50 Lunch
3rd European Microwave Doctoral School
‘Emerging Technologies in Microwave Engineering’

When: Monday 24th September until Wednesday 26th September, 2018
Location: N108 (Monday and Tuesday)
          N109 (Wednesday)
Organisers: Enrique Bronchalo, Germán Torregrosa (Miguel Hernández University of Elche, Elche, Spain)

About the European Microwave Doctoral School
Following the success of the previous editions, this year’s European Microwave Week features the third European Microwave Doctoral School. The aim of the Doctoral School is to offer to PhD students, beyond the normal conference programme, an overview of various emerging technologies in Microwave Engineering. The School gathers several speakers that develop their research in different topics of the microwave field. The talks of the School are longer (50 min) than typical conference presentations. Additionally, the School includes a Hands-on Design Experience on Wednesday.

Registration
The School is dedicated (but not limited) to PhD students in the microwave field. The registration fee for this event is €80. For the registration, PhD students will need a valid student ID of an accredited university. ADS and HFSS temporary licenses will be available during the school. Students are prompted to bring their own laptops. For registration, please go to the registration site and select EuMW Doctoral School. Students may also register for lunchboxes. Registration is open until 7th September 2018. Space is limited, so secure your ticket well in advance.

Programme

Monday 24th September
8:30-8:40  Doctoral School presentation
8:40-9:20  ANSYS HFSS solvers for accurate and large scale RF and antenna design
          David Prestaux, Lead HF application engineer, Ansys Europe.
9:20-10:10 Metamaterial-inspired resonators and applications
           Ferran Martín, Universidad Autónoma de Barcelona, Barcelona, Spain
10:10-10:50 Break
           Almudena Suárez, Universidad de Cantabria, Santander, Spain
11:40-12:30 Metasurfaces at THz: sensing and communication devices
           Miguel Beruete, Universidad Pública de Navarra, Pamplona, Spain

Tuesday 25th September
8:30-9:20  Novel design techniques with sharp/smooth filter profiles
           Israel Arnedo, Universidad Pública de Navarra, Pamplona, Spain
           Iván Arregui, Universidad Pública de Navarra, Pamplona, Spain
9:20-10:10 High power harming effects in space hardware
           Carlos Vicente, Aurorasat, Valencia, Spain
10:10-10:50 Break
           Maurizio Bozzi, University of Pavia, Pavia, Italy
11:40-12:30 Radio astronomy receivers development in Yebes Observatory
           José A. López-Pérez, Observatorio de Yebes, Instituto Geográfico Nacional, Spain
12:00-12:30 Hands on activity presentation
           David S. Ricketts, North Carolina State University, Raleigh, USA
13:00-13:50 Lunch

Wednesday 26th September
8:30-12:30  Student Design Competition. Hands on activity.
           David S. Ricketts, North Carolina State University, Raleigh, USA
12:30-13:50 Lunch

For updates to the programme, visit www.eumweek.com/students/doctoralschool.html
Young Professionals in Microwave Engineering at the European Microwave Week

Following last year initiative, EuMW 2018 has arranged two sessions devoted to Young Professionals (YPs) in Microwave Engineering. As a group of young scientists and engineers at an early career stage, YPs in the field would like to share their knowledge, enthusiasm and collaboration around the globe. Multidisciplinarity and diversity in perspectives are some of the YPs’ tools for pushing new technologies. The session on Tuesday, 25th September, from 13:50 to 15:30, is dedicated to “Career Opportunities in Microwave Engineering”, while the session on Thursday, 27th September, from 16:10 to 17:50, will present successful stories of “Microwave Engineering in Humanitarian Projects” and existing volunteering opportunities for advancing technology for the benefit of humanity. Finally, all Young Professionals are invited to a “Young Professionals Meet-Up” within the casual atmosphere of one of Madrid’s downtown cafeterias on Thursday, 27th September, starting at 18:30.

EuMW 2018 Career Platform

The Career Platform is a two-day event (25th and 26th September) within the European Microwave Week 2018 and it is part of the student activities organised by the EuMW 2018 team. The Career Platform is an opportunity for young European graduates to get in touch with those companies making an impact in today’s high-frequency business and to know their main activities, application fields, and market indicators, and for the companies to recruit young talent in the areas of microwave/ millimetre-wave, radar, wireless and integrated circuits engineering. The main aim of the EuMW 2018 Career Platform initiative is to foster relationships between the young engineers and the job market. To this end, a special session will be held on “Professional Opportunities in the European Microwave Industry” on Tuesday, 25th September. The Career Platform will also include a speed-recruiting lounge where companies and institutions will show their current job/internship offers. All this will be complemented by an active presence in the social networks (Facebook, LinkedIn, Xing) during the conference and the maintenance of the European RF and Microwave job portal http://www.rf-and-microwave-jobs-in-europe.eu which is the virtual marketplace for students and companies to meet at and in-between European Microwave Weeks. Further information can be found at www.eumweek.com/docs/Career_platform.html. Please feel free to contact the Career Platform Chair with any questions you may have or to obtain additional details.

Career Platform Special Session

Professional Opportunities in the European Microwave Industry

Date: Tuesday 25th September
Time: 08:30 – 10:10
Room: N118
Registration: Free (including visitors)

Programme

The following talks have been confirmed:

1. The European Space Programs: Opportunities & Challenges
   Dr. Javier Ventura-Traveset, Head of Galileo Navigation Science Office, European Space Agency.
2. Millimeter Waves Today - Automotive Radar and 5G as Driving Forces - Career Opportunities,
   Holger H. Meinel, Independent Consultant, formerly with Daimler Corporate Research
3. The Defense Market
   INDRA’s perspective on the Defense Market.
   Speaker to be confirmed
4. Space Sector: Your first work at a SME in the space sector
   David Diez, Vice President in charge of Space, Microwave and Datalink Systems Business Units, Erzia, Spain

Additional talks will be confirmed before the event, through social networks and in the EuMW website.

Career Platform Lounge

Date: Tuesday 25th and Wednesday 26th September
Time: 13:20 - 17:50
Room: First Floor, West Entrance Hall
Registration: Free (including visitors)

The Career Platform will be an excellent opportunity for companies to meet students and young engineers looking for a career in the areas of high frequency, microwave, millimetre-wave engineering and Radar.
EM simulation based modelling of antennas and systems - Podium discussion on the occasion of the 80th birthday of Ingo Wolff

On the occasion of the 80th birthday of Prof. Ingo Wolff, a podium discussion on EM simulation based modelling of antennas and microwave systems is being held on Thursday 27th in Room N117 from 12:40-13:40.

Over the last 30 years EM simulation techniques for application in microwave system design have been largely improved; today they are indispensable tools in the design of microwave circuits, antennas and systems. Based mainly on the finite difference time domain (FDTD) and the finite element (FE) technique, the software implementations have reached high performance. They can be used flexibly for varying structures and materials, they can produce highly accurate results, and, using e.g. parallelization techniques, they work with unprecedented high speed and numerical efficiency. Techniques for analyzing noisy electromagnetic fields are under development and a first connection to virtual reality has been demonstrated.

All these techniques, however, are basically analysis methods, i.e., one has to define a microwave component or system and can then analyze its behavior. First approaches for the opposite direction, i.e., synthesizing techniques based on an EM simulation, are available for simple components and also partly installed in the simulation tools. A method called "Inverse Local Imaging" which allows you to calculate the current sources from a given electromagnetic field is still in its infancy and far from an application to synthesize complex microwave antenna and circuit systems. The question is whether upcoming "Artificial Intelligence" processes are able to perform this task together with fast analysis tools in the background.

In the podium discussion, this idea and alternative strategies will be presented and discussed, using an antenna or circuit design task as an example.
Welcome to Madrid!
No city on earth is more alive than Madrid, a beguiling place whose sheer energy carries a simple message: this city really knows how to live.

Few cities boast an artistic pedigree quite as pure as Madrid’s: many art lovers return here again and again. For centuries, Spanish royals showered praise and riches upon the finest artists of the day, from home-grown talents such as Goya and Velázquez to Flemish and Italian greats. Masterpieces by these and other Spanish painters such as Picasso, Dalí and Miró now adorn the walls of the city’s world-class galleries. Three in particular are giants – the Museo del Prado, Centro de Arte Reina Sofía and Museo Thyssen-Bornemisza – but in Madrid these are merely good places to start.

If you would like any other information, please contact Sally Garland on sally@connexhotelsandevents.com

Madrid City Tour

Madrid City Tour is one of the easiest and most comfortable ways of discovering the city. All you have to do is buy your one or two-day ticket, hop on the bus, put on your earphones, listen to the recorded commentaries and enjoy the streets, monuments and places of interest you pass by. You can hop off wherever you want, as many times as you like.

If on the same day you want to visit the Santiago Bernabéu stadium, the Prado Museum and the Royal Palace, with Madrid City Tour, you can get to them all quickly and easily, without having to know the local bus routes or change lines on the underground. The buses are equipped with audio guides in 14 languages (Spanish, English, French, German, Italian, Portuguese, Russian, Japanese, Dutch, Chinese, Arabic, Catalan, Basque and Galician).

ROUTE 1: HISTORICAL MADRID

The first route starts off from Calle Felipe IV, next to the Prado Museum, and the Royal Palace, with Madrid City Tour, you can get to them all quickly and easily, without having to know the local bus routes or change lines on the underground. The buses are equipped with audio guides in 14 languages (Spanish, English, French, German, Italian, Portuguese, Russian, Japanese, Dutch, Chinese, Arabic, Catalan, Basque and Galician).

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ROUTE 2: MODERN MADRID

The second route offered by Madrid City Tour also starts off next to the Prado Museum, but then continues along some of the city’s main thoroughfares, such as Castellana, Prado and Recoletos, and their side streets. The route sets out from Plaza de Neuftuno and continues to Plaza de Cibeles, where you can see Cibeles Palace, the current seat of the City Council. It’s one of the most spectacular buildings along the route, which also offers views of the Palace of the Marquis of Salamanca, the Nuevos Ministerios government buildings, the AZCA business complex and the Santiago Bernabéu Stadium. The bus also passes through Barrio de Salamanca, with its luxury brand shops and museums like the Lázaro Galdiano Museum. Towards the end of the route we pass the Puerta de Alcalá gate and Puerta del Sol, before ending up in Plaza de las Cortes.

The extended version of this route is also available twice a day (at 12.15pm and 4.05pm), going all the way to the new high-rise Cuatro Torres Business Area and Las Ventas Bullring.

Times: March to October: 9am to 10pm
(passing by every 8-9 minutes)

Prices:
Adults: €21 (one day) and €25 (two consecutive days).
Kids (ages 7-15) and over-65s: €9 (one day) and €12 (two consecutive days).
Families (two adults and two kids): €53 (one day).
Children (under 6): free.

With a ticket valid for either one or two consecutive days, you can hop on the bus at any stop, provided that there are free seats.

The Madrid Top 10 places to Visit!

Paseo del Arte

This area, known in English as the Art Walk, boasts art and beauty as you’ll see nowhere else in the world. Along a stretch of just over one kilometre, you’ll find the Prado Museum, the Thyssen-Bornemisza Museum and the Reina Sofia Museum, as well as a number of other institutions and buildings well worth visiting.

The Essential Art Walk app

The Essential Art Walk App will help you discover 24 great masterpieces, eight in each museum, in a simple and entertaining way. A complete tour of the History of Western Art in the heart of Madrid.

Download via iTunes or Google Play
Royal Palace

Home to the Kings of Spain from Charles III to Alfonso XIII, Madrid’s Royal Palace takes us on a journey through the history of Spain. Though it is no longer the royal family’s home, it continues to be their official residence. It comprises over 3000 rooms, including: the Main Staircase, designed by Sabatini with over 70 steps; the Throne Hall featuring a ceiling painted by Tiepolo; the Hall of Halberdiers, which Charles III turned into the Guards Room; the Gasparini Room, with its grand 18th century decoration on a floral theme; the Royal Chemist’s with natural medicine cabinets, ceramic pots made by the La Granja factory, and even prescriptions given to members of the royal family; and the Royal Chapel, which is home to a collection of string instruments made by the legendary Antonio Stradivari.

Puerta del Sol

Central and bustling, Puerta del Sol is one of Madrid’s best known squares. Several busy historical streets, such as Calle Mayor, Calle Arenal, Calle Alcalá and Calle Preciados, converge here and it contains several of the city’s best known landmarks.

Plaza Mayor

This portico lined square is situated at the heart of Hapsburg Madrid, the old part of the city and one of the capital’s most charming districts. Before Madrid became a capital city, with its wide avenues and boulevards, its footprint consisted of narrow streets, alleys and passageways, which today take us back to the times of swashbuckling swordsmen and medieval rogues.

Puerta de Alcalá

The gate was built by Sabatini in 1778 as part of the city decoration restorations promoted by Charles III. It is made of granite and is an excellent example of proportion, harmony, and elegance. The King commissioned the work to Sabatini in order to commemorate his arrival at the capital in 1759. The gate was located at the entrance of the city, next to the Alcalá de Henares road, from which it received its name.

Cibeles Fountain

The Cibeles Fountain, created in 1782 and situated in its current location since 1895, has ended up lending its name to one of the most emblematic squares of Madrid. It has also become a symbol of the capital. The Fountain depicts the Roman goddess of the same name (Cybele in English), symbol of the Earth, agriculture, and fertility, atop a chariot drawn by lions.

Santiago Bernabéu Stadium

Real Madrid is one of our city’s three professional football teams, together with Atlético de Madrid and Rayo Vallecano. Holder of multiple European and international titles, the club opens its doors 363 days a year for football and sports fans to explore its historic stadium, an absolute must on your trip to Madrid. Named after the club’s legendary president who headed Real Madrid between 1943 and 1978, the Santiago Bernabéu stadium was opened in 1947.

Las Ventas Bullring

Based on a project by José Espelius, who died during its construction, it was completed by Manuel Muñoz Monasterio in 1931 and opened in the same year. Las Ventas holds 23,798 fans and, at 196 feet in diameter, the arena is one of the largest in the world.

El Retiro Park

This green oasis in the centre of Madrid has 125 hectares and is home to over 15,000 trees. From a botanical point of view, the park includes some very important gardens: the Jardín de Vivaces, the Jardines de Cecilio Rodríguez (classical gardens of an Andalusian style), the Jardines del Arquitecto Herrero Palacios, the Rose Garden, and the Parterre Francés with the oldest tree in Madrid, a bald cypress that is believed to be 400 years old.

The Rastro

Always full of locals and visitors, it is an attraction no one should miss if they visit the city on a Sunday or a public holiday. Set in the La Latina district, around Ribera de Curtidores, with Plaza de Cascorro as its nerve centre, the market takes in a large, almost triangular block bounded by Toledo, Embajadores and Ronda de Toledo and takes in other streets such as San Cayetano, Fray Ceferino González, Carlos Arniches and Mira el Río, as well as Plaza de General Vara del Rey and Plaza Campillo del Mundo Nuevo.

Hidden Gems

- **Temple of Debod**
  A second-century Egyptian temple donated to Spain during the construction of the great Aswan Dam.

- **Sorolla Museum**
  Museum dedicated to Joaquin Sorolla, the painter of Mediterranean light, set in his former family home.

- **National Archaeological Museum**
  This 19th Century Neo-Classical building houses one of the world’s most important antique collections.

- **Matadero Madrid**
  The city’s old slaughterhouse, at Madrid Rio, has been transformed into a cultural megacomplex.

- **Platform 0. Chamberí Station**
  Built in 1919, Chamberí is a “ghost station” which has been fully restored with authentic period features.

- **Museum of the Americas**
  Situated in the Princesa area, it boasts a collection of pre-Columbine, ethnographic and colonial pieces.
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<td><strong>EuMIC01</strong></td>
<td>Millimeter-Wave GaN Devices and MMICs and Thermal Reliability Considerations</td>
<td>Chair: Dimitris Pavlidis Co-Chair: Didier Floriot&lt;br&gt;¹Boston University, ²United Monolithic Semiconductors SAS</td>
<td>³Infineon Technologies AG</td>
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<td><strong>EuMIC02</strong></td>
<td>Millimeter-Wave Amplifiers and Detectors</td>
<td>Chair: Herbert Zirath Co-Chair: Ingmar Kalfass&lt;br&gt;¹Chalmers University of Technology, ²University of Stuttgart</td>
<td>³Infineon Technologies AG</td>
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<td><strong>EuMIC03</strong></td>
<td>mm-Wave Systems-on-Chip</td>
<td>Chair: Frank van Vliet Co-Chair: Elias Cipriani&lt;br&gt;¹TNÖ, University of Roma Tor Vergata</td>
<td>³Infineon Technologies AG</td>
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<td><strong>EuMIC04</strong></td>
<td>Large-Signal Modelling</td>
<td>Chair: Joaquin Portilla Co-Chair: Monica Fernández Barciela&lt;br&gt;¹UPV/EHU, ²University of Vigo</td>
<td>³Infineon Technologies AG</td>
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**MONDAY**
10:50 - 11:00
Welcome Address

Opening of the European Microwave Integrated Circuits Conference 2018
Teresa M. Martín-Guerrero, EuMIC 2018 Chair
José Ángel García-García, EuMIC 2018 TPC Chair

11:00 - 11:45
Gallium Nitride MMIC Design – Progress and Problems
Dr. Charles F. Campbell, Qorvo Inc.

GaN based transistor technology’s characteristics of very high current density combined with high voltage operation have held the promise to vastly improve many microwave circuit applications that once utilized GaAs devices. Today, GaN transistors are capable of high voltage operation while simultaneously demonstrating FT & FMAX characteristics more typical of lower voltage GaAs PHEMT devices.

The potential benefits of GaN device characteristics combined with MMIC technology are many. Highly efficient switched modes of power amplifier operation should be possible at higher output power levels and frequency. High output impedance typical of transistors operated at high voltage should facilitate lower loss matching networks and reduced transformation ratios. The higher output power density of GaN devices should lead to greatly reduced die size for GaN implementations of existing power amplifier functions.

The improved heat flow realized by the high thermal conductivity SiC substrate material should allow for acceptable junction temperatures even with the much higher power dissipation. Very high power switches could be designed by using large control voltages and taking advantage of the high current capability of GaN.

The RF voltage swings present in GaN MMICs under large signal operation present opportunities to develop circuit functions that self-actuating, reconfigure and re-bias based on power level. While the advantages are manifest, many of the features that make GaN transistors attractive can be shown to create significant issues that are typically not encountered with lower voltage devices.

In this talk, MMIC design examples and scenarios are discussed highlighting the benefits and problems associated to GaN MMIC technology.

11:45 - 12:30
Terahertz Nanoplasmonics with 2D Materials
Prof. J. Sebastián Gómez-Díaz, University of California, Davis

The THz spectrum offers unique opportunities to transform our society through advanced and exciting applications, including wireless communications with terabit-per-second data rates, molecular recognition, ultra-high resolution imaging and screening systems, and real-time spectroscopy, among many others. These applications are not currently being exploited due to the immature state of THz technology in terms of antennas, detectors, sources, and basic components. In fact, this frequency region is known as the “THz gap”, as it occupies a technology gap between the well-developed areas of electronics and photonics.

This talk overviews the use of graphene and other 2D materials as a powerful, reconfigurable, CMOS-compatible, and miniaturized on-chip platform for terahertz nanoplasmonics, addressing some of the shortcomings of current THz technology by compressing electromagnetic waves to deeply subwavelength volumes. This platform offers intriguing opportunities to develop tunable components such as modulators, waveguides, lenses, and antennas, as well as magnetless nonreciprocal devices based on the spatiotemporal modulation of graphene’s conductivity. The talk will conclude attempting to identify and explore current research trends as well as mid- and long-term prospects and challenges.
EuMIC 2018

**EuMIC06**

**Power Amplifier ICs**

Chair: Frank van den Bogart*, Co-Chair: Christophe Gaquiere*
1 TNO, 2 EUNIN

**EuMIC07**

**Millimeter-Wave Signal Generation**

Chair: Jonas Hansryd*, Co-Chair: Yinggang Li*
1 Ericsson AB

**EuMIC08**

**MMIC Components**

Chair: Asher Madjar*, Co-Chair: Nuno Borges Carvalho*
1 EUMA Founder Member, Institute of Telecommunications - Univ. Aveiro

**EuMIC09**

**Small-Signal & Noise Modelling**

Chair: Alberto Sandretto*, Co-Chair: Jean-Christophe Nataliambly*
1 University of Bologna, 2 LIM Research Institute - UMR CNRS 7522

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**EuMIC06-1**

**Industrial Keynote: Using GaN and LDMOS to Enable Faster 4G and the Transition to 5G**

Garthard Wolf
Wolf-speed - CREE

**EuMIC06-2**

**Three Stage 5-18.5 GHz High Gain and High Power Amplifier Based on 0.15 μm GaN Technology**

1 United Monolithics Semiconductors SAS, 2 United Monolithics Semiconductors SAS, 3 United Monolithics Semiconductors SAS, 4 United Monolithics Semiconductors SAS

**EuMIC06-3**

**A 6-18 GHz GaN on SiC High Power Amplifier MMIC for Electronic Warfare**

1 University of the Basque Country, 2 University of Granada, 3 University of Sharjah, 4 Technische Universität Braunschweig, 5 Universidad de Málaga

**EuMIC06-4**

**Design and Implementation of an Encapsulated GaN X-band Power Amplifier Family**

Chun Mengni*, Aper Karakula*, Adrian Gundel*, Faith Koger*, Odeen Auny Cut*  
1 Middle East Technical University, 2 Analog Devices, Inc.

**EuMIC06-5**

**A Low-Cost 30-W Class X-band GaN-on-Si MMIC Power Amplifier With a GaAs MMIC Output**

Matching Circuit
1 Mitsubishi Electric Corporation

**EuMIC06-6**

**Industrial Keynote: Using GaN and LDMOS to Enable Faster 4G and the Transition to 5G**

Marc van Heijningen*, Jaap Essing*, Frank van Vliet*  
1 TNO, 2 IEMN, 3 IRCICA

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**EuMIC07-1**

**A Hetero-Integrated W-Band Transmitter Module in InP-on-BiCMOS Technology**

1 Ferdinand-Braun-Institut (FBH) Letzlingen-Institut, 2 Forschungszentrum Hasselt, 3 Innovationsforschung für Hochfrequenztechnik (IFHT), 4 University of Duisburg-Essen

**EuMIC07-2**

**110–135 GHz SiGe BiCMOS Frequency Quadrupler Based on a Single Gilbert Cell**


**EuMIC07-3**

**A 110–147 GHz Frequency Sixtupler in a 130 nm SiGe BiCMOS Technology**

Mingquan Bao*, Zhongxia Simon He*, Thanh Ngoc Tran*, Herbert Zirath*  
1 IHP Microelectronics, 2 Michigan State University, 3 University of Duisburg-Essen

**EuMIC07-4**

**Broadband and Highly Accurate X-Band Vector-Sum Phase Shifter Using LC-Type Power Splitter**

Kata-Aki Fujimura*, Mitshio Shimozawa*  
1 Mitsubishi Electric Corporation

**EuMIC07-5**

**A 239 – 315 GHz CMOS Frequency Doubler Designed by Using a Small-Signal Nonlinear Model**

Kiyoshi Kuchitsu*, Ruping Dong*, Sangwook Lee*, Shuhai Amakawa*, Takeshi Yoshida*, Minoru Fujishima*  
1 Hiroshima University

**EuMIC07-6**

**An Ultra-Broadband Frequency Multiplier MMICs for Communication and Radar Applications**

Christopher Godfrey*  
1 University of Stuttgart

---

**EuMIC08-1**

**Industrial Keynote: Innovation Driven by MMIC Technology in the Field of Broadcast Systems**

Ana Pelaez Perez*, bookmark.perez@televes.com  
1 Televes S.A., 2 University of Granada

**EuMIC08-2**

**X-band GaAs Phase Driver MMIC Optimized for GaN-Based Phased Array Radar Transmit Chain**

Marc van Heijningen*, Jaap Essing*, Frank van Vliet*  
1 TNO, 2 IEMN, 3 IRCICA

**EuMIC08-3**

**Broadband and Highly Accurate X-Band Vector-Sum Phase Shifter Using LC-Type Power Splitter**

Takatomo Fujimura*, Mitshio Shimozawa*  
1 Mitsubishi Electric Corporation

**EuMIC08-4**

**A New Compact Model for Accurate Simulation of RF Noise in Sub-40nm Multi-finger nMOSFETs**

Jyh-Chyurn Guo*, Kuo-Liang Yeh*  
1 University of Calgary

**EuMIC08-5**

**Ultra-Compact Low-Loss Integrated Transformer-Based Ku-Band Quadrature Hybrid Coupler**

Manuel Potereau*, Nathalie Deltimple*, Anthony Ghigo*  
1 Arelis, 2 CNRS 5218, IMS Laboratory
EuMC01
Power Amplifier Architectures for High Efficiency and Linearity
Chair: Georg Fascher¹
Co-Chair: Paolo Caltolantoni²
¹FAU Erlangen-Nuremberg, ²University of Roma for Vergata

EuMC01-1
A High-Efficiency GaN Transistor Module With Thick-Film BST-Based Tunable Matching Network
Sebastian Preis², Alex Wiers⁵, Enrico Li¹, Wolfgang Heinrich¹, Rolf Jakoby¹, Holger Maune⁹, Olaf Bengtsson¹
¹Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, ²Technische Universität Darmstadt, ³European Space Agency

EuMC01-2
Dynamic Load Modulated Low-Voltage GaN PA Using Novel Low-Loss GaN Varactors
Rud Amberpou², Sebastian Krause¹, Rüdiger Quay¹
¹Fraunhofer Institute for Applied Solid State Physics IAF

EuMC01-3
Band-limited Digital Predistortion with Band-switching Feedback Architecture for 5G mmWave Power Amplifiers
Souvik Das¹, Tao Yang¹, Kento Saito¹
¹Nec Corporation

EuMC01-4
Novel DC-Biasing Circuits with Arbitrary Harmonic-Control Capability for Compact High-Efficiency Power Amplifiers
Shinichiro Tanaka¹, Tomoya Oda¹, Kento Saito¹
¹Shibaura Institute of Technology

EuMC01-5
Practical Load Compensation Networks in Chireix Outphasing Amplifiers Using Offset Transmission Lines
Aleksandar Bogdanov¹, Jonathan Lee¹, Roberto Quaglia¹, Gavin Watkins¹, Steve Cripps¹
¹Cardiff University, ²University of Roma for Vergata

EuMC02
Application Systems
Chair: Ilios Rolle²
Co-Chair: Blanca Villa³
³University of Bordeaux, BH Sudwestfalen

EuMC02-1
Impact of On-Silicon De-Embedding Test Structures and RF Probes Design in the Sub-Thz Range
Chandram Yadav¹, Marina Deng¹, Sebastian Fregoni², Magalé De Matos¹, Bernard Plano¹, Thomas Zimmer¹
¹University of Bordeaux, IMS laboratory

EuMC02-2
On-Wafer Broadband Microwave Measurement Devices - CPW Test Structures with Integrated Metallic Nano-Resonances
Kotham Galle¹, Faisal Mubarak¹, Vincenzo Massaroc¹, H. Vlot¹, Nick Ridler¹, Rabea Alkhow¹, Giles Dambri¹, Kenel Maddal²
¹Univ. Lille - IEMN, ²YSL, ³Advanced Technology Institute, University of Surrey, ⁴NPL

EuMC02-3
A Unified, Wave-Based Calibration Framework for Vector Network Analyzers
Yves Rollin¹, Indy Magnan², Gast Vandersteen²
¹YUB

EuMC02-4
Nonlinear Three-Port Characterization of a Class-G Supply Modulated RF Power Amplifier using a Nonlinear Vector Network Analyzer
Felipe Francesc Tafuru¹, Troels Studsgaard Nielsen¹, Nicola Wulff¹, Ole Kiel Jensen¹, Jan Hugdahl Mikkelsen¹, Old Bengtsson¹, Aalborg University, ²Kwight Technologies, ³Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik

EuMC02-5
On Wafer Millimetre Wave Power Detection Using a PN Junction Diode in BiCMOS 55 nm for In-Situ Large Signal Characterization
João Carlos Azevedo Gonçalves¹, Issa Alaji², Daniel Gloria¹, Vincent Gualde², Federic Garres², Sylvie Legrelle¹, Guillaume Xavier Cussac¹, François Darneuwel¹, Christophe Gauquier²
¹STMicroelectronics, ²IEMN

EuMC03
Couplers and Dividers
Chair: Anthony Ghiotto¹
Co-Chair: Roberto Sorrentino²
¹University of Bordeaux, INSU, ²University of Pavia

EuMC03-1
Compact Tunable Wilkinson Power Divider With Simple Structure
Khadi Wang¹, Zhewang Ma¹, Masataka Ohira¹, Masahisa Chibai¹, Chuan-Ping Chen¹, Tetens Adara¹
¹Taiyama University, ²University of Karagawa, ³University of Bordeaux, IMS laboratory

EuMC03-2
Liquid Crystal Based Tunable Reflection-Type Power Divider
Soubhik Deb¹, Tanio Masaaki¹, Shinichi Hori¹, Noriaki Bengtson¹
¹NEC Corporation

EuMC03-3
High Performance 3dB Coupler (Hybrid) with Broadband Flat Amplitude Characteristics
David López Navarro¹, Ángela Coves Soler¹, Enrique Daniel Gloria¹, David López Navarro¹
¹Universidad Miguel Hernández de Elche (UMH), ²University of Roma for Vergata

EuMC03-4
Design of a SIW Based Hybrid Ring Coupler with Arbitrary Power Splitting Ratio Using Gaussian Process Regression
Xiaolong Wang¹, Zhewang Ma¹, Masataka Ohira¹, Masahisa Chibai¹, Aliaksei S. Alipone¹, Muhammad Fawzi Kater¹
¹Nanyang Technological University

EuMC03-5
Arbitrary Terminated Coupler With Tunable Group Delay Responses
Gimseh Chaudhary¹, Pranam Paul¹, Phirun Kim¹, Yongchae Jeong¹
¹Chonbuk National University

EuMC04
Metamaterials and Periodic Structures
Chair: Ferran Martín¹
Co-Chair: Dmitry Kholodnyak²
¹University of Bordeaux, ²University of Roma for Vergata

EuMC04-1
Three-Dimensional Frequency Selective Surface With Multiple Transmission Zeros for Wide Stopband
Jianping Zhu¹, Zhengyong Yu¹, Wanchun Tang¹
¹Nanjing University of Science and Technology, ²Nanjing Normal University

EuMC04-2
Theoretical Minimum of Phase Shift Error of Switchable-channel Phase Shifters on Left-handed and Right-handed Transmission Lines
Gyorgy Kollonya¹
¹St. Petersburg Electrotechnical University 'LETI'

EuMC04-3
Slow-Wave Artificial Transmission Lines Based on Stepped Impedance Shunt Stub (SISS) Loading: Analysis and Stopband Bandwidth Enhancement
Jan Corominas¹, Jordi Solé¹, París Vázquez¹, Jordi Bonache¹, Ferran Martín¹
¹Universitat Autònoma de Barcelona

EuMC04-4
A Microfluidic-based Reflective-type 1-bit Terahertz Digital Metamaterial
Fangning Hu¹, Peiyong Song¹, Huaifeng Lu¹, Liangcheng Tu¹
¹Huazhong University of Science and Technology
### EuMC05
Special Technology in Asia Pacific
Chair: Maurizio Bozzi¹
Co-Chair: Kamran Ghorbani²
¹University of Pavia, ²Royal Melbourne Institute of Technology

### EuMC06
Non-Planar 3D Waveguide Filters
Chair: Marco Guiglielmi¹
Co-Chair: Jerzy Michalski²
¹Technical University of Valencia, ²SpaceForest

### EuMC/EuMIC01
III-V Low Noise Amplifiers
Chair: Luisa de la Fuente¹
Co-Chair: Julien Lintognat²
¹Universidad de Cantabria, ²XLIM UMR 7252, University of Limoges/CNRS

### EuMC06-1
Spurious Free Non Uniform Width Dielectric Loaded Filters
Sharjeel Afridi¹, Ian Hunter², Muhammad Yameen Sandhu¹
¹Sukkur IBA University, ²University of Leeds, Leeds, United Kingdom

### EuMC/EuMIC01-1
An X-Band Robust GaN Low-Noise Amplifier MMIC with Sub 2 db Noise Figure
Oguz Kazan¹, Fatih Koçer², Ozlem Aydin Civi¹
¹Middle East Technical University, ²Analog Devices, Inc.

### EuMC05-1
Filtering Antennas in China
Quan Xue¹
¹South China University of Technology

### EuMC06-2
Novel Solution for the Coaxial Excitation of Inductive Rectangular Waveguide Filters
Angel-Antonio San-Blas¹, J. C. Melgarejo², Vicente E. Borí³, Marco Guiglielmi²
¹Miguel Hernandez University of Elche, ²Technical University of Valencia

### EuMC/EuMIC01-2
Robust X-band GaN LNA with Integrated Active Limiter
Çağdaş Yağbasan¹, Ahmet Aktuğ¹
¹Aselsan Inc.

### EuMC05-2
Synthesized Transmission Lines - Past, Present, and Future
Tzyh-Ghuang Ma¹
¹National Taiwan University of Science and Technology

### EuMC06-3
Very-Compact Waveguide Bandpass Filter Based on Dual-Mode TM Cavities for Satellite Applications in Ku-band
Luca Pelosi¹, Cristian Tommasoni¹, Fabrizio Cacciamani¹, Paolo Vallettoni¹, Roberto Sorrentino¹, Jaione Galieano¹, Christoph Ernst¹
¹RF Microtech Srl, ²University of Perugia, ³ESA ESTEC

### EuMC/EuMIC01-3
An Ultra-Broadband Low-Noise Distributed Amplifier in InP DHBT Technology
Md Tanjil Shivan¹, Maruf Hossain¹, Dimitri Stoppel¹, Nils Weinmann¹, Stefan Schulz¹, Ralf Doerner¹, Viktor Kraszewski¹, Wolfgang Heinrich¹
¹Ferdinand-Braun-Institut (FBH) Leibniz-Institut für Höchstfrequenztechnik, ²Universität Duisburg-Essen, Duisburg, Germany

### EuMC06-4
Failure Analysis of Microwave Air Breakdown for the Cavity Filter with Remainder
Zhaorong Li¹
¹Institute of Electronic Engineering, China Academy of Engineer Physics

### EuMC/EuMIC01-4
Compensation of Performance Degradation Due to Thermal Effects in GaN LNA Using Dynamic Bias
Johan Steen¹, Lowia Hanning¹, Niklas Rosman¹, Mattias Thores⁵
¹Microwave Electronics Laboratory, Chalmers University of Technology

### EuMC06-5
High Quality TE011 Mode Cavity Filter for Input Multiplexer Applications
Fei Li¹
¹China Academy of Space Technology (Wuhan)

### EuMC/EuMIC01-5
X-band Low Noise Figure T/R Switch- Module using a Superconducting T/R Switch
Hiroaki Ikeuchi¹, Tamio Kawaguchi¹, Noritsugu Shiokawa¹, Yuichi Sawahara¹, Hiroyuki Kayano¹
¹Toshiba Corporation
10:50 - 12:30

**Welcome Address**

*Opening of the European Microwave Week 2018*
Magdalena Salazar Palma, EuMW 2018 General Chair
José Ignacio Alonso Montes, EuMW 2018 General Co-Chair
Almudena Suárez Rodríguez, EuMW 2018 General TPC Chair
Juan-Mari Collantes, EuMW 2018 General TPC Co-Chair

**EuMA Welcome Address**
Wolfgang Heinrich, EuMA President

**Greetings from IEEE MTT-S**
Dominique Schreurs, IEEE MTT-S President

Opening of the European Microwave Conference 2018
Vicente Borja, EuMC 2018 Chair
Miguel Ángel Gómez Laso, EuMC 2018 Co-Chair
Ferran Martín, EuMC 2018 TPC Chair
Francisco Mesa, EuMC 2018 TPC Co-Chair

11:20 - 12:00

**Evolving to 5G**
Enrique Blanco, Telefónica Global CTO

In Telefónica we look at 5G not only as an evolution of radio, but as an opportunity to apply new concepts that can transform our network to make it much more flexible and agile. Concepts like virtualisation, enabled with network function virtualisation (NFV), software defined networking (SDN) and the cloud, can be applied to the architecture – the 5G core and the radio access network (RAN) progressing towards a fully converged fixed and mobile network (FMC). We are talking about an evolutionary transformation of the network that may bring some of the expected 5G capabilities earlier as an evolution of the current LTE networks. On the other hand, a good part of the next investment in 4G in terms of fibre, antennas, base band units, the virtualisation environment and others may be re-used, and sets up the basis, for the future 5G rollout. We understand that 5G is a long journey, and we are working on several areas to get a future-proof network in the meantime.

12:00 - 12:10

Greetings from EuMW 2018 Platinum Sponsor
Bernd Neel, Vice President and General Manager for Keysight EMEA

12:10 - 12:30

**Awards Ceremony**
Alex Yarovoy, Past Chair EuMA Awards Committee

**EuMA Pioneer Award**
**EuMA Distinguished Service Award**
**Certificate of Recognition for EuMW 2017 General Chair**

**International Journal for Microwave and Wireless Technologies Best Paper Prize**
### TUESDAY

#### EuMC/EuMIC04

**Interactive Session**
Chair: Jose A. Garcia⁰  
Co-Chair: Luisa de la Fuente²

1. **Exhibition Hall**

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<td>Characterization of Bond Wire Interconnects in QFN Packages</td>
<td>Qin Xiao⁰, Daniel Kramer⁰</td>
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<td>Rapid Design of Compact Impedance Matching Transformers for Energy Harvesting Applications by Means of Inverse and Forward Surrogates</td>
<td>Slawomir Koziej, Adrian Bekasiewicz</td>
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<td>EuMC/EuMIC04-4</td>
<td>Optimization of PCB Transitions for Vertical Solderless Coaxial Connectors Up to 67 GHz</td>
<td>Paul Stärke⁰, David Frölich⁰, Comado Cano⁰, Frank Ellinger⁰</td>
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<td>EuMC/EuMIC04-5</td>
<td>A Three-layer Resist Process for T- and I-gates in High Electron Mobility Transistor Fabrication</td>
<td>Sandra Redmüller, J.-C. Jacquet², S. Piotrowicz², Sylvain Callet³, Sandra Riedmüller⁰, J.-C. Jacquet², M. Madel³</td>
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<td>EuMC/EuMIC04-6</td>
<td>GaAs Balanced Amplifier for Ka-Band Space Communications System</td>
<td>Leonardo Pantoli¹, Alessandro Baronis², Giorgio Leuzzi³, Francesco Vitulli³, Andrea Suriani²</td>
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<td>Ka-Band P-I-N Diode Based Digital Phase Shifter</td>
<td>Daniel Kramer⁰, Qun Xiao⁰</td>
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<td>An E-band Variable-Gain Amplifier Using a Programmable Attenuator</td>
<td>Kima Arvai¹, Tyler Roos², Morris Hafey³</td>
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<td>EuMC/EuMIC04-9</td>
<td>4 - 18 GHz AlGaAsGanBased Distributed Power Amplifier MMIC</td>
<td>Birgit Hardt-Staudt⁰, Patrick Schuh⁰, Martin Oppermann⁰, Hensoldt Sensors GmbH</td>
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<td>EuMC/EuMIC04-10</td>
<td>On Stability Analysis and Loop Oscillation of Multi-Finger GaN FET Cells for High Power Amplifiers</td>
<td>Ammar Issaoun¹, Petra Hemmes¹, Martin Fagerlind¹, Francis Chai, Thomas Roedle¹</td>
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<td>EuMC/EuMIC04-11</td>
<td>Characterization and Electrical Modeling including Trapping Effects of AlInGaN HEMT 4x50µm on silicon substrate</td>
<td>Mohamed Bouslama¹, Ahmad Alhajjar¹, Jean-Honore Koffi¹, Peter Auer¹, University of Surrey, Keysight Technologies</td>
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<td>EuMC/EuMIC04-12</td>
<td>A 28-GHz CMOS 2x4 Phased Array Chip with High Precision Phase Adjusting Function between Subarrays for Beam Multiplexing</td>
<td>Toshikazu Shimura¹, Takeshi Chihara¹, Shohei Nishikawa¹, Shunsuke Fuji¹, Kazuyuki Otsuka¹, Masahiko Shimizu¹, Yo Oshio¹, Fujitsu Laboratories Ltd.</td>
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<td>A Class E Digital Transmitter for APSK</td>
<td>Gavin Winkler⁰, Toshiba Research Europe Limited</td>
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<td>EuMC/EuMIC04-14</td>
<td>X band GaN Based MMIC Power Amplifier With 36.5dBm P1-dB for Space Applications</td>
<td>Armanan Guérard⁰, Buak Apluq Yilmaz⁰, Ömer Cengiz⁰, Cezim Ser⁰, Ekrem Ozbay⁰, Nanotechnology Research Center (NANOTAG), Bilkent University</td>
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<td>EuMC/EuMIC04-15</td>
<td>A W-Band Frequency Tripler With Integrated Waveguide Filter Matching</td>
<td>Cheng Guo¹, Jeff Powell¹, Xiaobang Shang¹, Mike Lancier¹, Jun Xu¹, The University of Birmingham, National physical laboratory, University of Electronic Science and Technology of China</td>
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<td>Electrothermal X-Parameters for Dynamic Modeling of RF and Microwave Power Transistors</td>
<td>Sean Gillespie¹, David Ross¹, Mihai Marcu¹, Peter Auer¹, University of Surrey, Keysight Technologies</td>
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<td>A Ku-Band Injection-Locked Push-Push Oscillator with Two-WaveLength Ring Resonator</td>
<td>Elton Lima¹, Takeshi Tanaka¹, Ichihiko Toyoda¹, Saga University</td>
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<td>Millimeter-Wave Detection on Basis of Photo-thermoelectric Effect</td>
<td>Yukang Feng¹, Matthew Delahant², Robert Weike², D. Kurt Gazibler³, N. Scott Barber³, University of Virginia, “S. Naval Research Laboratory</td>
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<td>New Compact Antenna Diversity with a Fully Integrated Microwave Circuit for Automotive Satellite Radio Reception</td>
<td>Simon Serege¹, Jürgen Röberlingen, Bird Nanat, Robert Weiger², Christian Heuer², Stefan Lindermeier¹, Universität der Bundeswehr München, Friedrich-Alexander-Universität Erlangen-Nürnberg, “FUBA Automotive Electronics</td>
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<td>EuMC/EuMIC04-21</td>
<td>A Hybrid Bipolar Wideband VCO with Linearized Tuning Behaviour for a New Generation TTC Transponder</td>
<td>Jaime Castrillon Pérez⁰, Amparo Herrera⁰, Javier Cabo Freixeda², Juan Carlos Perez-Ambrojo⁺, University of Cantabria, “Thales Aerial Space Spain</td>
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<td>EuMC/EuMIC04-22</td>
<td>Characterization of Flex to Printed Circuit Board Interconnections using Insertion Connectors</td>
<td>Christian Pedersen¹, Hong Duc Nguyen¹, Jean Philippe Coopman², Philippe Mirabò⁰, Dominique thibault⁰, Pascal Borel², Damien Igard³, MTT Antalique, “Technicor Connector Home, “Centre technique du papier</td>
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**Session Timings**

<table>
<thead>
<tr>
<th>Time</th>
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<tr>
<td>13:30-15:30</td>
<td>EuMC/EuMIC04-16, EuMC/EuMIC04-20, EuMC/EuMIC04-21, EuMC/EuMIC04-22</td>
</tr>
</tbody>
</table>
The last dozen years has seen transistor Maximum Frequency of Oscillation ($f_{MAX}$) push well over 1 THz for transistors in the Indium Phosphide (InP) material system. Integrated circuits have kept pace, and InP HEMT packaged amplifiers have been demonstrated to 1 THz. While InP integrated circuits have seen the largest increase when measured in raw Gigahertz, Si and SiGe integrated circuits have also seen significant advances in operating frequencies.

This talk will describe the current status of transistor based electronics operating above 100 GHz and describe recent progress in communications and sensors at these frequencies. Topics include an overview of device technologies and integrated circuit technology. Traditional applications in this frequency range including atmospheric science and radio-astronomy will be briefly described along with emerging applications in imaging and communications. Benchmarks will be provided in terms of noise figures and output power at frequencies above 100 GHz.

16:55 - 17:20
EuMIC Awards Ceremony
Teresa M. Martín-Guerrero, EuMIC 2018 Chair
Lluis Pradell, EuMW 2018 Awards Chair

EuMIC Prize
EuMIC Young Engineer Prize

TUESDAY

16:10 - 16:55
Terahertz Transistors and their Application
William R. Deal, Northrop Grumman Corporation

The last dozen years has seen transistor Maximum Frequency of Oscillation ($f_{MAX}$) push well over 1 THz for transistors in the Indium Phosphide (InP) material system. Integrated circuits have kept pace, and InP HEMT packaged amplifiers have been demonstrated to 1 THz. While InP integrated circuits have seen the largest increase when measured in raw Gigahertz, Si and SiGe integrated circuits have also seen significant advances in operating frequencies.

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EuMIC Young Engineer Prize

TUESDAY
EuMC12-1 Determining Carbon Fiber Loading with Flip-Chip Measurements
Nina Popovic¹,², Jasper Driks¹, Aaron Hageman³, Joshua Orlitch³, Jennifer Sierens³, Daniel Knox³, Edward Garbocz², Christian Long², Nathan Orlitch³
¹University of Colorado Boulder, National Institute of Standards and Technology, 'Army Research Laboratory, Aberdeen Proving Ground

EuMC12-2 Impact of Substrate Modes on mTRL-Calibrated CPW Measurements in G Band
Gia Ngoc Phung¹, Franz Josef Schmückle², Ralf Doemer¹, Wolfgang Heinloth¹, Thorsten Prodol¹, Uwe Att¹
Ferdinand-Braun-Institut, Leibniz-Institut für Höchstfrequenztechnik, Physikalisch-Technische Bundesanstalt

EuMC12-3 Wideband Complex Material Testing for 5G Materials
Kauko Heinikoski¹, Timo Tarvainen¹, Lauri Hynynen¹
Bundesanstalt für Hochfrequenztechnik, Physikalisch-Technische Bundesanstalt

EuMC12-4 An Accurate Free Space Method for Material Characterization in W-Band Using Material Samples with Two to 130 mm Thicknesses
Isabella Larus³, Martin Frank¹, Kih Shin², Fabian Lust¹, Armin Taial¹, Robert Weger¹, Alexander Koepl²
¹Friedrich-Alexander-University Erlangen-Nuremberg, ²Friedrich-Alexander-University Erlangen-Nuremberg, ³Brandenburg University of Technology

EuMC12-5 Liquids Microwave Characterization Technique Based on Quartz WGM Resonator with Micromachined Liquid Chip
Aleksey Gubin¹, Irina Protavenko², Alexander Barannik¹, Hanna Hlukhova¹, Nickolay Cherpak², Svetlana Vitusevich²
¹Odessa Institute for Radiophysics and Electronics NAS of Ukraine, ²ON Semiconductor

EuMC13-1 Industrial Keynote: Complex Border Tracking Algorithm for Determination of Zeros and Poles of Complex Function and its Application in Microwave Analysis
Jens Michalak³
³SpaceForest

EuMC13-2 Frequency Selective Ferrite Circulators with Quasi-Elliptic Transmission Response
Andrea Ashley¹, Laka Marzali¹, Zoya Popovic¹, Dimitra Psychogiou¹
¹University of Colorado at Boulder

EuMC13-3 Design-Oriented Modelling of Microstrip Ferrite Circulators
Mauricio Pinto¹, Laka Marzali¹, Andrea Ashley¹, Dimitra Psychogiou¹, Zoya Popovic¹
¹University of Colorado at Boulder

EuMC13-4 Two-way Waveguide Power Divider Using 3D Printing and Electroless Plating
Yeonju Lee¹, Sung-min Sint¹, Hye-Lim Kang¹, Ignacio Llamas Garrido¹, Y Wang¹, Yuan-Ji Kang¹, Jung-Mu Kim¹
¹Chonbuk National University, Republic of Korea, ²Centre Tecnològic de Telecomunicacions de Catalunya (CTTC/ERCRA), ³The University of Birmingham, ⁴Microfluidics for all, Inc

EuMC13-5 A Novel 180° Coupler Based on Double-sided Substrate Integrated Suspended Line Technology with Patterned Substrate
Yuan Mai¹, Kaike Ma¹, Yongjiang Wang¹
¹University of Electronic Science and Technology of China

EuMC14-1 Impedance Sensor for Fluid Permittivity Measurements Up to 20 GHz with Single-Liquid Calibration
Alessandar Savic¹, Alexandre Steppull¹, Arre F. Jacob¹
¹Hamburg University of Technology

EuMC14-2 Solute Concentration Measurements in Diluted Solutions by Means of Split Ring Resonators
Pierre Vélez¹, Javier Mata-Contreras¹, David Dubuc², Katja Gremier¹, Ferran Martín¹
¹Universitat Autonoma de Barcelona, ²IAAS-CNRS

EuMC14-3 Near-Field Soil Moisture Sensor with Energy Harvesting Capability
Darpa Polke¹, Christian Schul¹, Motzi Oebesleig¹, Alexandra Sew¹, Peter Unh¹, Peter Awakowicz², Ilona Rolfes¹
¹Ruhr-University Bochum, ²IMST GmbH

EuMC14-4 Progression of the Multipole Resonance Probe: Advanced Plasma Sensors Based on LTCC Technology
Darya Fokina¹, Christian Schul¹, Motzi Oebesleig¹, Alexandra Sew¹, Peter Unh¹, Peter Awakowicz², Ilona Rolfes¹
¹Ruhr-University Bochum, ²MST GmbH

EuMC14-5 Compact Substrate Integrated Wireless Cure Monitoring Sensor for Epoxy Resin
Janina Groh¹, William Barrett Lee¹, Jan Schir¹, Felix Didier¹, Martin Vostrik¹
¹Friedrich-Alexander-University Erlangen

EuMC15-1 An 80-Gbaud Transmitter using Bandwidth Interleaving with Sideband Cancelling Method
Tenu Joa¹, Hiroshi Yamaoza³, Munehiko Nagasaka¹, Hiroshi Hamada¹, Hisayuki Fukujama¹, Hideokuki Nosakura¹
¹NTT Device Technology Lab

EuMC15-2 Linear Front-End Module for 4G/5G LTE Advanced Applications
Florinel Balteanu¹
¹Skyworks Solutions

EuMC15-3 High Dynamic Range Low Power Drive Quadrature Millimeter-Wave Demodulator
Boualem Zouggour¹, Djijali Hammou², Senjia Ovidiu Ta³
¹NRS university, ²Universidad del Rosario, ³Griffith University

EuMC15-4 A Ka-band High Linearity Up-Conversion Mixer with LO Boosting Linearization Technique
Yu-Guang Lin¹, Wen-Je Liu², Jeng-Han Tsai¹, Abdulrah Alshehri³, Mazen Alnami⁴, Abdullrahman Sayek⁴, Tian-Wei Huang⁵
¹National Taiwan University, ²National Taiwan Normal University, ³King Abdullah City for Science and Technology (KACST)

EuMC15-5 MSBT transponder: Flexible Multi-Mode In-Orbit Reconfigurable Transponder
Javier Cabo Freixedas¹
¹Saga University
EuMC16 | N116
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**EuMC16**

Antennas Based on Artificial Structures

Chair: Mohsen Sazegar¹
Co-Chair: Ferran Paredes²

¹Kymeta Corporation, ²Universitat Autonoma de Barcelona

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EuMC17 | N117
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**EuMC17**

Manufacturing Techniques of Non-Planar Filters

Chair: Jorge A. Ruiz-Cruz²
Co-Chair: Petronilo Martin-Iglesias²

²Universidad Autonoma de Madrid, ³ESA/ESTEC

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EuMC18 | N118
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**EuMC18**

Vehicular Connectivity

Chair: Jiri Poutka³
Co-Chair: Jan Barowski²

²Nokia Bell Labs, ³Ruhr-University Bochum

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**EuMC16-1**


Mohsen Sazegar¹

¹Kymeta Corporation

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**EuMC17-1**

Design of a Compact 3D Printed Coaxial Filter

Giuseppe Venanzoni¹, Marco Donge³, Cristiano Tommaso, Roberto Setton Marco Donge³

¹University of Perugia, ²RF Microtech Srl

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**EuMC18-1**

Evaluation of Vehicular 4G/5G-MIMO Antennas via Data-Rate Measurement in an Emulated Urban Test Drive

Mahmud Almarashli¹, Stefan Lindenmeier¹

¹Universität der Bundeswehr München

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**EuMC16-2**

Dichroic Sub-Reflector for Wide Band Techniques for Single Offset Antenna

Yu-Ling Lee¹, Chung-Chin Jian¹, Yu-Lun Su¹, Chung-Hsiu Li¹, Thomas Lohey²

¹Atom Element Matter B.V., ²National Central University, ³Eureka

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**EuMC17-2**

Impact of Fabrication Process Tolerances on Characteristics of Sub-THz Silicon Micromachined Filters

Antti Lamminen¹, Jaakko Saarilahti¹, Pekka Pursula¹, Mikko Kontinen¹, Vladimir Ermolov¹

¹VTT Technical Research Centre of Finland

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**EuMC18-2**

Engineering the Environment to Enhance Millimetre-Wave Communications for Connected Vehicles

Shailesh Raut¹, Aldo Petosa¹

¹Communications Research Centre Canada

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**EuMC16-3**

Assessment of the Dielectric Losses of Artificial Magnetic Conductors for Antenna-on-Chip Applications

Teun van den Biggelaar¹, Ulf Johanssen¹, Bart Smolders¹

¹Eindhoven University of Technology

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**EuMC17-3**

Frequency Correction Design Technique for Additive Manufactured Cavity Filters

Alejandro Pons Abenza¹

¹Technical University of Cartagena

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**EuMC18-3**

Diversity Performance of Benchmark Scenarios for Hidden Vehicle-to-X Antennas Underneath the Roof

Miguel Bueno Diez¹, Stefan Lindenmeier¹

¹Universität der Bundeswehr München

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**EuMC16-4**

Graphene-based Fabry-Perot Cavity Leaky-Wave Antennas: Towards an Experimental Validation

Walter Fuscaldo¹, Shiva Tafmin, Paolo Burghignoli, Paola Bazzarelli, Andrea Notargiacomo, Sara Cibell®, Maria Paola Pratesi, Pasquale Cirecco, Neesel Marnin, Camilla Cirecco, Alessandro Gali²

¹Sapienza University of Rome, ²ROMA TRE University, “Istituto di Fotonica e Nanotecnologie” CNR, “Center for Nanotechnology Innovation” IIT

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**EuMC17-4**

3D Printed Low-Pass Filter with Conical Inductors for RF Broadband Applications

Josef Mário Lopez-Vega³, Amna Salah³, Neus Vidal Martínez³, Javier Sáez³

³University of Barcelona

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**EuMC18-4**

A Multi-Channel Algorithm for Antenna Diversity of SiriusXM High Band Satellite Reception in Vehicles

Nishit Pahuja¹, Simon Senega¹, Stefan Lindenmeier¹

¹Universität der Bundeswehr München

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**EuMC16-5**

Bandpass Filter Based on Skeleton-like Monobloc Dielectric Pucks Made by Additive Manufacturing

Aurélien Périgaud¹, Aurélien Périgaud¹

¹ALM Research Institute, University of Limoges, Limoges, France

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**EuMC17-5**

High-Throughput Satellite Connectivity for the Constant Contact Vehicle

Ryan Stevenson⁴, David Fotheringham⁴, Tom Freeman⁴, Cameron Neill⁴, Tim Mason⁴, Shahnaz Shafi⁴

⁴Kymeta Corporation

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Ryan Stevenson⁴, David Fotheringham⁴, Tom Freeman⁴, Cameron Neill⁴, Tim Mason⁴, Shahnaz Shafi⁴

⁴Kymeta Corporation
WEDNESDAY

EuRAD01
EuRAD Opening Session
Chair: Mateo Burgos, EuRAD 2018 Chair
Co-Chair: Manuel Rosa Zurera, EuRAD 2018 TPC Chair

08:30 - 08:40
Welcome Address
Opening of the European Radar Conference 2018
Mateo Burgos, EuRAD 2018 Chair

08:40 - 09:10
A New Radar Generation for F-110 Frigate Integrated Mast
María Carmen Barbero Arrabe, Naval Programmes Director at Indra S.A.
Spain is tackling the design of an Integrated Mast within the development efforts of the new F-110 frigate. Sensor development has had a special emphasis resulting in the activation of a set of Technological Programs in which criteria of risk reduction and industrial development prevail. In this paper Indra will describe the works that are currently undergoing under the technological programs for F-110 with a special focus on the advances in Radar development on the primary S and X band Radar, secondary radar as well as other sensors. These designs respond to the new challenges that the operational scenarios demand while having in mind the Integrated Mast concept that is the key in the abovementioned frigate. The main operational requirements that have driven the definition of these new systems will be reviewed. In addition, the paper will present the main concepts that have been considered: use of AESA architectures, integration of the most advanced techniques in digitalization and amplification of power, intensive use of the concept of multifunctionality as driver in the optimization of time and resources, data exploitation and integration in 4.0 new concepts.

09:10 - 09:40
Quantum Radar: From Quantum Illumination to a Working Prototype
Stefano Pirandola, Full professor at Computer Science Department, University of York, UK
In this talk, the basic ingredients and the main ideas behind quantum radar will be reviewed. It will start by describing techniques of quantum sensing and metrology, before giving details of the protocol of quantum illumination. This protocol is first presented in the optical setting (quantum lidar) and then extended to the microwave frequencies (quantum radar). In the microwave domain, possible radar designs based on current or next-available quantum technology, for instance, considering the use of electro-opto-mechanical converters or superconducting devices. In particular, the minimum quantum requirements that transmitter and receiver need to have in order to outperform a classical radar-system will be addressed. The quantum advantage specifically occurs in the regime of few photons per pulse, meaning that quantum radar may achieve the same detection performance of highly energetic classical radars while employing extremely faint quantum signals. This low-energy feature is desirable not only for achieving stealthy target detection but also for other potential tasks, including the development of a non-invasive form of microwave rotational spectroscopy. Finally, the current experimental challenges and open problems associated with a full technological deployment of the quantum device will be analyzed. These include extensions beyond yes/no detection to include measurements of range and speed, besides its use in realistic working conditions where clutter and jamming may be present.

09:40 - 10:00
EuRAD 2018 Forecast
Manuel Rosa, EuRAD 2018 TPC Chair

EuMC19
Hyperthermia and Other Biomedical Applications
Chair: Bart Nauwelaers¹
Co-Chair: Luciano Tarricone²
¹KU Leuven, ²University of Salento

EuMC19-1
On the Conservation of Materials for Breast Phantoms in the Frequency Range 0.5–50 GHz
Simona Di Mei¹, Lorenzo Pasotti¹, Marco Pavan¹, Giulia Maltoni²
¹University of Pavia

EuMC19-2
Methods of Coupling 400kHz and 5.8GHz Energy into a Hollow Non-50 Ohm Co-axial Transmission Line Structure
Shaun C. Preston¹, Malcolm White², Christopher Hancock¹
¹Bangor University, ²Crec Medical Ltd

EuMC19-3
Technical and Clinical Evaluation of the ALBA-4D 70MHz Loco-Regional Hyperthermia System
Remko Zweije¹, Petra Kok¹, Akke Bakker¹, Arjan Bel¹, Hans Crezee¹
¹Academic Medical Center

EuMC19-4
RF Heating of Pancreatic Tumours Guided by Hyperthermia Treatment Planning and Limited Thermometry
Petra Kok¹, Rianne De Kooij², Linda Koudsuze³, van Stralen⁴, Tinelle De Jong⁴, Akke Bakker¹, Remko Zweije¹, Jan Sijbrands⁵, Geert van Tienhoven⁶, Johannes Crezee¹
¹Academic Medical Center

EuMC19-5
Flexible Microwave Ablation Device with Integrated RF Cut Modality
Patrick Burn¹, Pallav Shah², Christopher Hancock¹
¹Bangor University, ²Imperial College London
### EuMC20
**Solid State High Power Amplifiers**
Chair: Sergio Pires¹
Co-Chair: Philippe Eudeline²
Ampleon, Thales Air Systems SAS

### EuMC21
**Filter Synthesis Techniques**
Chair: Richard Snyder¹
Co-Chair: Giuseppe Maciarella²
RS Microwave, Politecnico di Milano

### EuMC22
**Non-Conventional Designs in Antenna Technology**
Chair: David Escal-Socanegra³
Co-Chair: Carlos Montesano³
Airbus DS Space, *NTA*

### EuMC23
**THz Components**
Chair: Antti Raisanen³
Co-Chair: Luis Enrique Garcia-Muñoz³
Aalto University, Universidad Carlos III de Madrid

### EuMC20-1
**Quasi-MMIC High Power Amplifier with Silicon IPD Matching Network**
Jinhua Yang⁴, Jian Zou⁴, Planav Perch⁵, Jongik Im⁶, Yongnho Jeong⁶
Chonbuk National University, *Soonchunhyang University*

### EuMC20-2
**New Class-F High Efficiency Multi-Bias Optimised GaN HPA for C-Band Applications**
Wilfried Demestre⁵, Lucas Mandica⁵, Nicolas Berto⁵, Frederic Ploneis⁵, Audrey Thorinius⁵
*Thales Communications & Security, Thales DMS*

### EuMC20-3
**Wideband High Efficiency 50 W GaN-HEMT Balanced Power Amplifier**
Quang Huy Le¹, Gernot Zimmer¹,²
Thales Communications & Security, *Thales DMS*

### EuMC20-4
**50% High Efficiency X-Band GaN MMIC Amplifier for Space Applications**
An-Mari Couturier⁵, Nicolas Potrenaud⁵, Vincentic Serru⁵, Jean-Jacques Fontecave⁶, Nicolas Poitrenaud⁵
*Ampleon, Thales Air Systems SAS*

### EuMC21-1
**Lossy Dual-Mode Bandpass Filter With Non-Uniform Q Method**
Hongming Gu¹, Jiasheng Hong¹, Petronilo Martin Gómez²
*Heriot-Watt University, European Space Agency, ESA/ESTEC*

### EuMC21-2
**Linear Time-Invariant Behavioral Digital Models of Frequency-Peiodic RF/Microwave Filters**
Jose Maria Munoz Ferreras³, Dimitra Psychogiou⁴, Roberto Gomez-Garcia⁴
*University of Alcala, University of Colorado at Boulder*

### EuMC21-3
**A Theoretical Synthesis of Coupling Matrix by Eigen Mode Expansion Method and Householder Transform**
Singkei Tekadi⁵, Tetsuo Anada⁵, Chun-Ping Chen⁵
Antenna Giken Co., Ltd, *Kanagawa University*

### EuMC21-4
**Application of a Series Open Circuit Stub Transform to Bandpass Filter Design.**
Johannes Mahrer²
*University of Pretoria*

### EuMC21-5
**Synthesis of Wideband Filters Using Single-Short-Circuited-Stub-Loaded Parallel-Coupled-Lines**
Chun-Ping Chen¹, Daikukai Takeda¹, Jeun Zhang¹, Tetsuo Anada¹, Shigeki Takeda², Chun-Ping Chen²
Antenna Giken Co., Ltd, *Kanagawa University*

### EuMC22-1
**Miniaturization Design of Millimeter Wave Conformal Array Antenna**
Jingning University of Science and Technology

### EuMC22-2
**Novel Single/Double Beam Scanning Provided by an Array Composed of Two CRLH SIW LWAs**
Rihem Noumi¹, Jan Machacek², Al Gharsallah¹
*Faculty of Sciences of Tunisia, Czech Technical University in Prague*

### EuMC22-3
**Perforated Rectangular Dielectric Resonator Antenna for Wideband, Dual band and Single band application**
Pragya Patel¹, Eeeshan Verma⁵, Malikjun Emani⁵
*NIT Goa*

### EuMC22-4
**An Electrical-Contactless Substrate-Over-Waveguide Planar Array Slot Antenna**
Alfonso Tomas Munoz-Barrado⁵, Manuel Sierra-Perez⁴, José Manuel Fernandez-Gonzalez⁵
*Technical University of Madrid*

### EuMC22-5
**Compact Cavity-Backed Spiral Antennas with Enhanced Axial Ratio and Gain at Low Frequencies**
Andrea Garcia-Estévez⁴, Juan José Sánchez-Martínez⁴, Ana Cristina Gago-Lancho¹, Francisco Vázquez-Vázquez⁴
*Indra Sistemas S.A.*

### EuMC23-1
**300-GHz CMOS Receiver Module with WR-3.4 Waveguide Interface**
Shinsuke Han¹, Kenya Takei¹, Koichi Takahashi², Naoki Watanabe¹, Norihiko Saki¹, Alumini Kasamatsu³, Takeshi Yoneda², Shuhei Amakawa³, Minou Fujihara³
*National Institute of Information and Communications Technology, Hiroshima University, Panasonic Corporation*

### EuMC23-2
**Monopulse RLSA Antenna with Gap-Waveguide Feeding Network for Space Debris Radar at 94 GHz**
Adrian Tamez Dominguez¹, José Manuel Fernandez-Gonzalez⁴, Manuel Sierra Castilla⁴
*Universidad Politécnica de Madrid*

### EuMC23-3
**E-band Radio Fiber as Low-Cost mm-Wave Waveguide Junction**
Stefano Moccalato¹, Mathi Olden², Giuseppe Parisi³
*SAE Microlenticonics, *SM-Optica*

### EuMC23-4
**300-GHz CMOS Receiver Module with WR-3.4 Waveguide Interface**
Shinsuke Han¹, Kenya Takei¹, Koichi Takahashi², Naoki Watanabe¹, Norihiko Saki¹, Alumini Kasamatsu³, Takeshi Yoneda², Shuhei Amakawa³, Minou Fujihara³
*National Institute of Information and Communications Technology, Hiroshima University, Panasonic Corporation*

### EuMC23-5
**Thz and Microwave Dual-Band Ultrafast Photoconductive Antenna**
Eckel Brown¹, Andrea Mingardi¹, Frederico Zunz¹, Enrique Garcia¹, Guillermo Carpenizo³, Daniel Segovia-Vargas³
*Wright State University, *University Carlos III of Madrid
<table>
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<th>Event</th>
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<tr>
<td>EuMC24</td>
<td>Application of Metasurfaces</td>
<td>Chair: Israeli Arad*&lt;br&gt;Co-Chair: Alessandro Gai*&lt;br&gt;*Public University of Navarra, *Sapienza University of Rome</td>
</tr>
<tr>
<td>EuMC25</td>
<td>Numerical Modeling of Microwave Components</td>
<td>Chair: Francesco Mezio*&lt;br&gt;Co-Chair: Jan Vrba*&lt;br&gt;University of Navarra, *Czech Technical University in Prague</td>
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**EuMC24-1 Ultra-Thin Metasurface for Subterahertz Band: Theoretical Aspects and Detector Applications**

Sergey Kuznetsov

*Rohan Institute of Semiconductor Physics SB RAS*

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**EuMC24-2 Towards a Scalable HP Adaptive Finite Element Code Based on a Non-Conformal Domain Decomposition Method**

Adrian Amor-Martín, Luis Emilio García-Castillo, Daniel García-Donoro

*University Carlos III Madrid, Kaidan University*

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**EuMC24-3 A Compact Lenslet as an Alternative to Corrugated Horns for Astronomy Applications**

Lucía Polo-López, Giampaolo Pisan, Jorge A. Ruiz-Cruz, Juan Córdoba

*Universidad Autónoma de Madrid, Cardiff University*

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Mohammad Moen Moesil, Homayoon Oroji, Amrallah Amr

*Tehran University of Science and Technology*

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**EuMC24-5 Fishnet Metamaterial Gradient-Index Lens for Phase Correction of a Horn-Antenna at 60 GHz**

Mario Maret, Valentin Meier, Matthias Maas, Christian Danner

*Technische Universität Darmstadt, Universität Ulm*

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**EuMC25-1 Analysis of Elliptical Structures with Constant Axial Ratio by 2.5D Finite Element Method and Transformation Optics**

Gian Guido Gentili, Stefano Selleri, Giuseppe Pileri, Renzo Nasti, Mikaigh Vicharczuk

*Politecnico di Milano, University of Firenze, YAMF*

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**EuMC25-2 Eight Channel Digital Beamforming Radar Courses and Research**

Lorenzo Dikemeyer, Andreas Dewald, Simon Müller

*Hochschule Trier*

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**EuMC25-3 Amplitude-Monopulse Radar Lab using WiFi cards**

Miguel Piovato Gárraga, Marisa Pinto-Silva, Antonio Gómez-Atzin, Luis Miguel Martínez-Tamarugo, Ángel Martínez-Sabán, David Carletero-Rebapac, José Luis Gómez-Tomero

*Technical University of Cartagena*

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**EuMC25-4 Implementation of Remote and Self-Guided Practical Exercises of Electromagnetic Simulation**

Pierre Blondy, Ahmad Hariri, Ameen Courteau, Cyril Guines, Christophe Hallet, Damien Pascale, Pierre Biondi

*XLIM Research Institute - UMR CNRS 7252 Université de Limoges*

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**EuMC25-5 Ku Band High-Q Switchable Cavity Filter Using Vanadium Dioxide (VO2) Microwave Disk-Shaped Switch**

Maxime Agat, Ameen Courteau, Claire Dalma, Pierre Biondi

*XLIM Research Institute - UMR CNRS 7252 Université de Limoges*

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**EuMC26-1 A Fully Printed Switch Based on VO2 Ink for Reconfigurable RF Components**

Mohammad Vaseem, Su Zhen, Shuai Yang, Atif Sharim

*King Abdullah University of Science and Technology*

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**EuMC26-2 High Performance and Low Energy Consumption in Phase Change Material RF Switches**

Alexander Leshin, Bruno Reig, Vincent Puyal, Etienne Perrot, Philippe Ferrrit, Florence Podlevit

**Univ. Grenoble Alpes, CEA, LETI, Univ. Grenoble Alpes, Grenoble INP, LCS, Institut Universitaire de France, Univ. Grenoble Alpes, Grenoble INP, CNRS, IMEP LaSalle**

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*XLIM Research Institute - UMR CNRS 7252 Université de Limoges*

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**EuMC26-6 Implementation of Remote and Self-Guided Practical Exercises of Electromagnetic Simulation**

Mohammad Vaseem, Su Zhen, Shuai Yang, Atif Sharim

*King Abdullah University of Science and Technology*

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**EuMC26-7 High Performance and Low Energy Consumption in Phase Change Material RF Switches**

Alexander Leshin, Bruno Reig, Vincent Puyal, Etienne Perrot, Philippe Ferrrit, Florence Podlevit

**Univ. Grenoble Alpes, CEA, LETI, Univ. Grenoble Alpes, Grenoble INP, LCS, Institut Universitaire de France, Univ. Grenoble Alpes, Grenoble INP, CNRS, IMEP LaSalle**
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Co-Chair: Michał Mrozowski²
¹KU Leuven, ²Gdansk University of Technology

EuMC28-1 Metal-Polymer Hybrid Embroidered Microwave Multiresonator for High-Frequency Sensing: Modelling, Simulation, and Experimental Analysis
Manuel Schimmack¹, Wolfgang Taute¹, Michael Höft¹
¹Kiel University

EuMC28-2 Radar Imaging Using Bilateral Symmetry of Breast Tissue
Yoshihiko Kuwahara¹, Tomoya Osaki¹
¹Shizuoka University

EuMC28-3 Investigation of a Time Domain Microwave System for Medical Applications
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*Chalmers University of Technology

EuMC28-4 Microwave Blood Sensing for Monitoring Efficiency of Treatment for Chronic Neurological Disorders
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EuMC28-5 Non-Invasive Detection and Monitoring of Sustained Glycemic Fluctuations Using mm-Wave Spectroscopy
Alina Morais Queiroz¹, Pedro Martin-Mateos², M. Carmen Aguilera-Morillo¹, Giacomo Ulian¹, Ferando Lacar³, Viktor Kozlos³, Pablo Acedo¹
¹University Carlos III Madrid, ²Instituto de Investigaciones sanitarías de la Fundación Jiménez Díaz, ³Centre of Investigation Biomedica en Red de Enfermedades Raras

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Co-Chair: Jose Carlos Pedro¹
¹Politecnico di Torino, ‘Universidade de Aveiro

EuMC29-1 Analysis of Dissipated Power in Envelope Amplifier Output Filters
Sophie Paul¹, Nikola Huft¹, Christophe Delayenauf¹, Valéry Valenta¹, Wolfgang Heinrich¹, Old Bengtsson¹
¹Ferdinand-Braun-Institut, Leibniz-Institut fuer Hochfrequenztechnik, ESA/ESTEC

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Dan Fisher¹, Tommaso Cappello¹, William Hallberg², Taylor Barton¹, Zoya Popovic¹
¹University of Colorado Boulder, ²Chalmers University of Technology

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Florian Höhn¹, Andreas Wenzel¹, Wolfgang Heinrich¹
¹Ferdinand-Braun-Institut (FBH)

EuMC29-4 Dynamic Over-Voltage Operation of a Discrete-Level Supply-Modulated GaN-Based RF PA
Nikolas Woff¹, Wolfgang Heinrich¹, Old Bengtsson¹, Ferdinand-Braun-Institut für Höchfrequenztechnik, ESA/ESTEC

EuMC30 Tunable Planar Filters
Chair: Cedric Quendo¹
Co-Chair: Simone Bastoi²
¹Université de Brest, ²RS Microwave

EuMC30-1 Planar RF Duplexer with Multiple Levels of Transfer-Function Reconfigurability
Dakota Simpson¹, Roberto Gomez-Garcia¹, Dimitra Psychogios¹
¹University of Colorado at Boulder, ‘University of Alcala

EuMC30-2 A New Adaptive Reconfigurable Bandpass Filter With Flexible Resonance Control
Runzi Zhang¹, Ching-Huan Shao², Dimitris Penev³
¹Purdue University

EuMC30-3 Electronically-Controllable Bandpass Planar Filter with Ultra-Large Bandwidth-Tuning Ratio and Enhanced In-Band Amplitude Flatness
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¹University of Alcala, ²Thales Alenia Space Spain, ³European Space Agency, ESA/ESTEC

EuMC30-4 A Bandwidth-Tunable Active Bandstop Filter Having Variable Loss Compensation Circuits
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¹Shonan Institute of Technology

EuMC30-5 Mixed-Technology Quasi-Reflectionless Planar Bandpass Filters
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¹University of Colorado at Boulder, ‘University of Alcala

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<td>A Novel Finite-Difference Solution of the Time-Domain Wave Equation with a Stability Criterion Relaxed from Mesh Sizes in Two Directions Mohammad Monard¹, Vahid Nayyeri¹, Seyed-Mojtaba Sadrpoor¹, Mohammad Soleimani¹, Omar Ramahi² ²University of Science &amp; Technology, ³University of Waterloo</td>
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**Co-Chair:** William Dej

**Chair:** Chalmers University of Technology, **Co-Chair:** Northrop Grumman

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**Co-Chair:** Jose Loo-Yau

**Chair:** Apolinar Reynoso, **Co-Chair:** Jose Loo-Yau | CICESE, **Co-Chair:** Cinvestav-GDL

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Moamer Hasanovic², Nina Slanmik², Conrad Jordan²
¹Smiths Interconnect Inc, °University of Sarajevo

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Petros Bantias¹, Marc Le Roy¹, André Perrenec¹, Raafat Lababidi², Denis Le Jeune¹
¹Lab-STICC UBO, MOM group, ²Lab-STICC ENSTA-Bretagne, MCM group, °ENSTA-Bretagne

EuMC35-3 Miniaturized Humidity Sensor Based on a Partially Air-Filled Slow-Wave SIW Resonator
HO Anh Tu¹
¹IMEP-LAHC Grenoble

EuMC35-4 A Mechanically Tunable Artificial Magnetic Conductor using 3-D Printing Technology
Fengshou Wang¹, Tughrul Arslan¹
¹University of Edinburgh

EuMC35-5 Dispersive Delay Structures Using Cascaded Coupled CRLH-CRLH C-Sections
Hossein Nazemi-Rafii¹, Masoud Movahedi¹
¹Yazd University

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¹Kyungpook National University, °E1GNeT Co. Ltd.

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Shua Yang, Zhen Su¹, Ali Shami²
¹King Abdullah University of Science and Technology

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¹University of Cantabria, °Thales Alenia Space Spain

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Efrain Mateos Duanes³, George Goussev²
¹Nokia Corp, °Herold Watt University

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Sergey Chulk¹, Andrey Mochanovsky¹, Alexander Myakov¹, Alexey Artemenko¹, Roman Matusevich¹
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¹Michigan State University, °Georgia Institute of Technology

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¹Michigan State University

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¹Tohoku University

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¹Lab-STICC Université de Bretagne Occidentale, °Eiffel, °GTID Bret

EuMC35-17 180-Degree Branch Line Coupler Composed of Two Types of Iris-Loaded Waveguides
Hidenori Yukawa¹, Yu Ushijima¹, Takeshi Yusa², Naofumi Yoneda¹, Masayuki Miyazaki¹
¹Nokia Corp, °Hokkaido University

EuMC35-18 Masthead Combiner Employing Asynchronously Coupled Resonant Junctions
Eugene Ogbov², Wu Yuan², Peter Callaghan¹, Yi Wang¹
¹University of Greenwich, °Institute of Physics, Chinese Academy of Sciences (IOP, CAS), °University of Birmingham

EuMC35-19 Fast Method to Optimize RF Bumper Transparency for Wide-Band Automotive Radar
Mohier Chater¹, Eddy Johann¹, Abdedhak Beni²
¹SEGULA Technologies, °Alcatel

EuMC35-20 Temperature Dependence of Bandpass Filters Built of Silica-Based Post-Wall Waveguide for Millimeter-Wave Applications
Yasuke Uemichi¹, Shuhei Kobayashi¹, Shuhei Arakawa¹, Naing Guan¹
¹Fukaura Ltd., °Hiroshima University

EuMC35-21 Balanced Diplexer Design Using Multi-Layered Substrate Integrated Waveguide Cavities
Jen-Chih Li¹, Muhammad Misrata², Cheng-You Hsu¹, Chung-Hao¹, Min-Hsiu Hsi¹
¹Wilton Network Corp., °National Yuan University of Science and Technology, °National Chung Hua University of Education
WEDNESDAY

EuMC36
Wireless Transceivers and Mobile Systems
Chair: Justin King¹
Co-Chair: Guan Lei²
¹University College Dublin, ²Nokia Bell Labs

EuMC37
Special Session: High Frequency Flexible Bendable Electronics for Wireless Communication Systems
Chair: Frank Elsinger³
Co-Chair: Tien Meister³
¹Technical University Dresden, ²Technische Universität Dresden

EuMC38
SIW and Planar Filter Technologies
Chair: Miguel Angel Gomez Lazo⁴
Co-Chair: Felipe Lora⁵
¹Public University of Navarre, ²Thales Alenia Space Spain

EuMC36-1
Industrial Keynote: from Component to System Level, Modeling Needs Bringing New Measurement Challenges
Zacharia Ouardiri¹
¹AMCAD Engineering

EuMC36-2
IEEE802.11ad Packet Transmission Based SSB Optical Modulation on Radio-Over-Fiber in 90 GHz Band
Kohei Fujiwara¹, Koichi Tokita¹, Atsushi Kanno²
¹Tokyo Metropolitan Industrial Technology Research Institute, ²National Institute of Information and Communications Technology

EuMC36-3
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Jose Antonio Martin-Garcia¹, Alberto Sara-Gomara¹, Jose Ignacio Alonso²
¹Universidad Politécnica de Madrid, ²TechOnRails

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Meih Siah¹, Muhammad-Reza Rezadahm²
¹Sinclair Technologies, ²MIMsense Technologies

EuMC36-5
High Accuracy Frequency Detection Method Using 1 to m-th Harmonics
Jun Shimokawatoko¹, Hiroyuki Mizutani¹, Kenichi Tajima¹
¹Mitsubishi Electric Corporation

EuMC37-1
Fundamental Science in RF-Engineering and Funding Opportunities in Germany -the Role of the German Research Foundation in “High Frequency Flexible Bendable Electronics for Wireless Communication Systems” FFlexCom
Göran Dulek¹, Frank Elsinger³
¹DFG, German Research Foundation, ³TU Dresden

EuMC37-2
A Flexible Approach Towards Silicon-Graphene Heterojunction Transistors
C. Alvarado¹, C. Strobel², J. Kitzmann³, M. Lukosius³, M. Albert¹, J.W. Barth¹, B. Leszczynski⁴, S. Leszczynski⁴, Ch. Wenger³
¹IHP, ²TU Dresden

EuMC37-3
Study of Graphene Flexible Electronics for Microwave Application
Chun-Yu Fan¹, M. Seide¹, A. Hamed¹, Z. Wang¹
¹University of Perugia, ²University of Pavia, ³Politecnico di Milano

EuMC37-4
Circuits with Scaled Metal Oxide Technology for Future TOLAE RF Systems
Martin Elsinger¹, D. Schröfer¹, Arne Hagemüller¹, M. Jan¹, Robert Weigel¹, L. Frey¹
¹Friedrich-Alexander University Erlangen-Nürnberg, ²Friedrich-Alexander University Erlangen-Nürnberg, ³University of Erlangen-Nuremberg, ⁴Friedrich-Alexander University Erlangen-Nuremberg

EuMC37-5
RF Characterization and De-Embedding of Parasitic Device Interconnects in a Metal-Oxide TFT Technology
Utpal Katia¹, C. Tissot², Ph. Hilger¹, T. Schulz¹, T. Red¹, Ulrich R. Pfeiffer³
¹Bergische Universität Wuppertal, ²University of Erlangen-Nuremberg

EuMC38-1
Development of a Narrowband 30-GHz Band Bandpass Filter with Coaxial Interface Using Coplanar Type H-slot Resonators
Takashi Shimizu¹, Kousuke Goto¹, Yoshihiro Kogami²
¹University of Tokyo, ²Tokyo Institute of Technology

EuMC38-2
Fabrication-Tolerant AFCSIW Filters Based on Quadruplet Through-Hole Mounted Inductive Posts
Tiffen Martin¹, Anthony Ghidotti¹, Tan-Phu Vuong¹, Friedel Luft²
¹University of Bordeaux, IMS laboratory, ²Cobham Microwave, ³Cobham Microwave

EuMC38-3
A Technique for Spurious Suppression in Substrate Integrated Waveguide Filters
Cristiano Tomassoni¹, Nicolò Delmonte², Giuseppe Macchiarini¹, Maurizio Buzzi², Luca Pergoletti²
¹University of Pavia, ²University of Pavia

EuMC38-4
SIW Cavity Filters with Embedded Planar Resonators in LTCC Package for 5G Applications
Janwil Shook¹, Hanka Latin², Kouda Kar³, Elyd Arab³, Peika Rantasalmi⁴, Jarmo Huhtinen⁴, Tiakio Vähiä-Heikälä⁵, Ali Shamir⁶
¹King Abdullah University of Science and Technology (KAUST), ²Friedrich-Alexander University Erlangen-Nürnberg, ³University of Espoo, ⁴University of Espoo, ⁵Friedrich-Alexander University Erlangen-Nürnberg, ⁶University of Espoo

EuMC38-5
Planar Resonator Embedded Substrate Integrated Waveguide (SIW) Cavity Filter
Khi Shew³, Richard Hadi¹, Tao Yang⁴, Joshua Kovitz⁵, Li Jun Jiang⁴, Tatsuo Itoh¹
¹University of California, Los Angeles, ²UESTC, ³Georgia Tech Research Institute, ⁴University of Hong Kong, ⁵University of Tokyo

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<td>Foundry-Fabricated Heterodyne DFB Laser Microchip for 600 MHz - 23 GHz RF Generation</td>
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<td>Vladimir A. Cherepenin, Sergei M. Kontorov, Victor V. Kuklin, Denis A. Piroshkov, Alexey N. Shulunov, Victor V. Vakanov</td>
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Andrei Lavrinenko¹, Rasmus Jacobsen¹, Samel Arslanagic¹
¹Technical University of Denmark

EuMC42-2
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Plamen Dankov¹,²
¹Sofia University "St. Kliment Ohridski", ²Sofia University "St. Kliment Ohridski"

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Sergius Sminov¹, Ilya Kozhukhar², Dmitri Lioubtchenko¹
¹KTH Royal Institute of Technology

EuMC42-4
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Sizhe An¹, Azat Meredov¹, Atif Shamim¹
¹King Abdullah University of Science and Technology (KAUST)

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César Barquero¹, Juan Gomez¹, Angel Medrano², Belén Salchão¹, José Luis Besada Sanmartín¹
¹INDRA Sistemas, ²University of Cantabria, *Universidad Politécnica de Madrid

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Ya Fe Wu¹, Yu Jia Cheng¹
¹University of Electronic Science and Technology of China

EuMC42-3
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Patrick Grüner¹, Son Nguyen¹, Tobias Chaloun¹, Christian Wachtel¹
¹Ulm University

EuMC42-4
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Guillermo Posada Quijano¹, José Ignacio Gómez Mateo¹, Carlos Zarzuelo Torres¹
¹INDRA Sistemas

EuMC42-5
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Wael A. Ahmad¹, Dietmar Kissinger¹, Herman Ng¹
¹IHP
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<td>Florian Dietrich¹, Renato Negra¹.¹ *RWTH Aachen University</td>
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<td>EuMC43-8</td>
<td>An Enhanced Parameter Extraction of the WPT System Model Valid for Wide Operating Range</td>
<td>Dae Ki Park¹, Kyung Heon Koo¹.¹ *Yonsei University, *Incheon National University</td>
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<td>EuMC43-9</td>
<td>Push-Pull Configuration of High Power MOSFETs for Generation of Nanosecond Pulses for Electroporation of Isolated Cancer Stem Cells.</td>
<td>Ilan Davies¹.¹ *Bangor University</td>
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<td>Analog Signal Processing: A Time-Domain Demonstration of Microwave Differentiation</td>
<td>Jon Nielø Persaud¹, Magdalena Chudzik¹, Ibai Galier¹, Fernando Tabetaro¹, Iahel Armugá¹, Íñigo Llopis§¹.¹ *University of Navarra</td>
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<td>EuMC43-11</td>
<td>Liquid Conductivity Detection by Passive Secure UHF RFID Tag</td>
<td>Chenni Wang¹, Yonghui Tao¹, Hu Man¹.¹ *The 38th Research Institute of China Electronics Technology Group Corporation, *Uppsala University</td>
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<td>EuMC43-12</td>
<td>Numerical Estimation on Human Body Blockage Characteristics of 26GHz Band Indoor Propagation Using FDTD Analysis</td>
<td>Masakazu Tamao¹, Takahiko Higaki¹, Michiharu Sawaki¹, Mitsuki Nakamura¹, Yutaka Takahashi¹.¹ *Hokkaido University, *NTT Corporation</td>
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<td>EuMC43-13</td>
<td>Small Footprint Evaluation of Metal Coatings for Additive Manufacturing</td>
<td>Patrick Kriukov¹, Jürgen O’Callaghan¹.¹ *Universidad Politécnica de Catalunya (UPC), *AILBA-CELLS</td>
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<td>EuMC43-14</td>
<td>A Flexible Measurement System for Dielectric Waveguide Characterization at mmW Frequencies</td>
<td>Febe Dieter¹, Jan Schol¹, Martin Vossiek¹.¹ *University of Duisburg-Essen, *Fraunhofer Institute for High Frequency Physics and Radar Technique (FHR)</td>
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<td>EuMC43-15</td>
<td>Efficient Excitation of a Toroidal Dipole Mode in All-Dielectric Quadrupole Clusters</td>
<td>Vladimir Tuš¹.¹ *Universität Kassel</td>
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<td>EuMC43-16</td>
<td>Noise Figure Verification and Optimization of an Undersampled Software Defined Radio Based Radar Receiver for a Phased Array Radar System</td>
<td>Björn Staufenbiel¹, Olaf Lambert¹, Michael Krist¹.¹ *Fraunhofer Institute for High Frequency Physics and Radar Technique (FHR)</td>
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<td>EuMC43-17</td>
<td>Diffraction by a Right-Angled Wedge Coated by DPS / DNG Metamaterial Layers: the Case of Plane Waves at Normal Incidence</td>
<td>Giovanni Ricci², Gianluca Gennarelli².¹ *University of Salerno, *I.R.E.A. – C.N.R., Naples, Italy</td>
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WEDNESDAY

EuMC44
Microwaves for 5G and Space
Chair: Cesar Barquinero¹
Co-Chair: Christoph Baer²
¹INDRA Sistemas, ²Ruhr-Universität Bochum

EuMC44-1
Industrial Keynote:
Anticipate the 5G and New Space Measurement Challenges
Jean-Pierre Teyssier¹
¹Keysight Technologies

EuMC44-2
Highly Compact GaN-based All-Digital Transmitter Chain Including SPDT Switch for Massive MIMO
Florian Hölln, Andreas Wenzel, Wolfgang Heinrich
²Ferdinand-Braun-Institut (FBH)

EuMC44-3
An FPGA-Based Measurement Generator for Cyclically Shifted Binary Signals
Gordon Notzon¹, Robert Storch¹, Thomas Mucho³, Michael Vogt¹
¹Ruhr-University Bochum

EuMC44-4
A High-Performance Ka-band Cryo-Cooled Receiver for Deep Space Applications
Arne Medinacia, Juan Luis Cano, David Varelaa, Eduardo Arioa, Antonio Tazoca, Luis de la Fuertea, Cédric Chambona, Benoît Faunora, Remi Rayela
²University of Cantabria, ³University of Perugia

EuMC44-5
Low-Voltage Phase Shifters Based on HfzZr1-xO2 Ferroelectrics Integrated with Phased Antenna Arrays
Mircea Dragmanil, Marilena Aldogni, Sergiu Iordanescul, Iulian Moisea, Ion Poveyla, Dan Viakila, Adrian Dinescu, Cosmin Romanila
³National Institute for Research and Development in Microtechnologies (MT), ⁴Tyndall National Institute

EuMC45
Phased-Arrays and MIMO Systems
Chair: Wim van Cappellen¹
Co-Chair: Daniel Segovia-Vargas²
¹ASTRON, ²Carlos III University of Madrid

EuMC45-1
28 GHz Downlink Multi-User MIMO Experimental Verification using 360 Element Digital AAS for 5G Massive MIMO
Noriaki Tawa¹, Toshihide Kanaba², Tsuyoshi Kanari³, Samet Zha¹, Gabriel Rebe³
¹NEC Corporation

EuMC45-2 A Scalable Dual-Polarized 256-Element Ku-Band SATCOM Phased-Array Transmitter with 36.5 dBW EIRP Per Polarization
Abdurrahman H. Aljuhania,², Tumay Kanar¹,³, Samet Zha¹, Gabriel Rebe³
¹University of California, San Diego, ²King Abdulaziz City for Science and Technology, ³Integrated Device Technology

EuMC45-3
W-Band High-Efficiency Wideband Planar Array Antenna Based on MEMS Micromachining Technology
Shi Sen Yao¹, Yu Jian Cheng¹
¹University of Electronic Science and Technology of China

EuMC46
Planar Filter Technology
Chair: Roberto Gomez-Garcia¹
Co-Chair: Anthony Ghiotto²
¹University of Alcala, ²University of Bordeaux, Bordeaux INP, UMR CNRS 5218, IMS Laboratory

EuMC46-1
A Novel S-Band Bandpass Filter (BPF) With Extremely Broad Stopband
Polia Njohns, Salomon Kanai, Abdul Quddious¹, Marco A. Antoniades³, Symeon Nicolaou³
¹Frederick University, Cyprus, ²University of Cyprus

EuMC46-2
A Novel Half-Wavelength Coupled-Resonator Filter with Multiple Attenuation Poles
Toohki Izzah¹, Ayaka Shimizu¹
¹Tokyo University

EuMC46-3
Small Size Dual-band Bandpass Filters with Multiconductor Transmission Lines and Shunt Open Stubs
Mário Ferreiro Eschban³, Juan José Sánchez-Martinez³, Enrique Márquez Segura³
³University of Málaga, ³Edra

EuMC46-4
Design of Compact Quad-band Bandpass Filter Using Stepped Impedance Resonators
Yu-Chen Li¹, Yung-Chih Chen¹, Yu-Chen Jang¹, Hsin-Kuo Wu¹, Yan-Kuei Su¹
¹Yun Shan University, ²National Cheng Kung University

EuMC46-5
Design of a Novel Compact Microstrip Diplexer Using Dual-Mode Square Loop Resonators Having Narrow Sits Loaded Open-Circuited Stubs
Ceyhun Karpuz³, Ali Kursad Gorur³, Adnan Gorur³
³Pamukkale University, ³Nevsehir Haci Bektas Veli University, ³Nigde Omer Halisdemir University

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<td>EuMC47</td>
<td>RF and Millimeter-Wave Identification Techniques</td>
<td>Chair: Hervé Aubert¹, Co-Chair: Luciano Tarricone², LAAS-CNRS, University of Salento</td>
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<td>16:30 - 16:50</td>
<td>EuMC48</td>
<td>Integrated Signal Generation</td>
<td>Chair: Patrice Gamand¹, Co-Chair: Ichihiko Toyoda², Consulting², Saga University</td>
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<td>EuMC49</td>
<td>Microwave Passive Components</td>
<td>Chair: Roberto Sorrentino¹, Co-Chair: Benjamin Potelbon², RF Microtech Srl, Université de Brest</td>
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<td>17:10 - 17:30</td>
<td>EuMC48-1</td>
<td>An Enhanced Chipless RFID System in 60 GHz Using Pattern Recognition Techniques</td>
<td>Larry M. Arjomandi¹, Nemai Chandra Kamakar², Monash University</td>
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<td>EuMC49-1</td>
<td>Realization of Fully 3D Printed W-band Bandpass Filters using Aerosol Jet Printing Technology</td>
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<td>17:50 - 18:10</td>
<td>EuMC48-2</td>
<td>60 GHz Tail-Node-Coupled Multi-Core Push-Push VCOs in 22 nm FD SOI CMOS Technology</td>
<td>Johannes Rimmelspacher¹, Robert Weigel¹, Annele Hagelauer¹, Vadim Isaakov², University of Erlangen-Nuremberg, Infineon Technologies AG</td>
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<td>18:10 - 18:30</td>
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<td>Towards Carbon Based Artificial Impedance Surfaces for Conformal Aerospace Applications</td>
<td>Alco Tod², Kamaran Ghorbani¹, Thomas Baurn¹, Kevin Nicholson¹, Rick Zelkowski¹, Royal Melbourne Institute of Technology, DST Group, University of Arizona</td>
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<td>18:30 - 18:50</td>
<td>EuMC48-3</td>
<td>Design of a Low Power 24 GHz LC-VCO in 45 nm RF-SOI CMOS</td>
<td>Naglaa El Agroudy¹, Mohammed El-Shennawy¹, Niko Joran¹, Frank Elinger¹, TU Dresden</td>
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<td>18:50 - 19:10</td>
<td>EuMC49-3</td>
<td>Signal-Interference-Based Structural Group Delay Properties</td>
<td>Miguel Sanchez-Soriano¹, Javier Durà¹, Stefano Sirci², Stephan Marin¹, University of Alicante, Universitat Politècnica de València</td>
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<td>19:10 - 19:30</td>
<td>EuMC48-4</td>
<td>A Novel Design Strategy for Small On-Metal UHF-RFID Tags with Long Read Range based on Complementary Split-Ring Resonator (CSR)</td>
<td>Ferran Paredes¹, Gerard Zamoral¹, Tomáš Nýgraven¹, Ferran Martín¹, Jordi Bonache¹, Universitat Autònoma de Barcelona</td>
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<td>19:30 - 19:50</td>
<td>EuMC49-4</td>
<td>A Continuous 2π Phase Shifter for Ka-Band Applications</td>
<td>Hussam Al-Saedi¹, Suren Gagnon¹, Nael Abdul-Wahab¹, Andrea Pasztern¹, S. Safian-Kooi², University of Waterloo</td>
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<td>19:50 - 20:10</td>
<td>EuMC48-5</td>
<td>Orientation Independent Printable Backscattering Chipless RFID Tags Based on L-Resonator</td>
<td>Vidy Sharma¹, Sambhav Mahato², Mohammad Hashmi², IIT Delhi, Nazarbayev University</td>
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<td>20:10 - 20:30</td>
<td>EuMC49-5</td>
<td>Mitigation of Passive Intermodulation on Planar Microstrip Circuits with Distributed Current-Driven Nonlinearities</td>
<td>Dimitry Kudin¹, Seddi Bulka¹, Ross Lundy¹, Pawel Rulkowski¹, James Walsh¹, Bel Labs, Nokia, Dublin City University</td>
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EuMC/EuRAD04-1
3D Printed Slotted Waveguide Array Antenna for Automotive Radar Applications in W-Band
Konstantin Lomakin¹, Dominik Simon¹, Mark Sippel¹, Gerald Goltz¹, Klaus Helmreich², Ernst Seiler², Jozsef Torg¹, Ralf Reuter¹
¹Friedrich-Alexander University Erlangen-Nürnberg (FAU), ²NXP Semiconductors Germany GmbH
EuMC/EuRAD04-2
A 24-GHz Radar With 3D-Printed and Metallized Lightweight Antennas for UAV Applications
Thomas Lampersberger¹, Reinhard Feger¹, Andreas Hader², Christian Egger¹, Martin Friedl¹, Andreas Steiner¹
¹Johannes Kepler University Linz, ²Inras GmbH
EuMC/EuRAD04-3
Additive Manufactured Antenna in Mixed Material Technology for 24 GHz FMCW Miniaturized Radar
Cristina Yepes¹,², Erio Gandini², Raymond van Dijk³, Fabian Brüning¹, Hessel Maalderink³, Stefania Monni²
¹Delft University of Technology, ²TNO Defense, Safety and Security, ³AMSYSTEMS Center/TNO
EuMC/EuRAD04-4
A New Waveguide Slot Array Antenna with High Isolation and High Antenna Bandwidth operation on Ku- and K- bands for Radar and MIMO Systems
Mohammad Alibakhshikenari¹, Ermenes Luna¹, Bai Singh Virdee², Francisco Falcao¹, Raed Abd-Alhameed⁴, Chan H. See⁵
¹University of Rome “Tor Vergata”, ²London Metropolitan University, ³Universidad Pública de Navarra, ⁴University of Bradford, ⁵University of Bolton
EuMC/EuRAD04-5
Study on Antenna Mutual Coupling Suppression Using Integrated Metasurface Isolator for SAR and MIMO Applications
Shahzad Sabery¹, Mohammad Alibakhshikenari¹, Bai Singh Virdee², Chan H. See⁵, Raed Abd-Alhameed⁴, Francisco Falcao¹, Aurora Ardaçalan¹, Jaume Aragues¹, Ernesto Lloré³, University of Rome “Tor Vergata”, London Metropolitan University, University of Bradford, University of Navarra, Technology Department, Fractus, University of Ramon Llull
EuMC/EuRAD05-1
Long Range-Doppler Demonstration of a 95 GHz FMCW Radar
Raquel Monje¹, Ken Cooper¹, Robert Dengle¹, Corey Cordnare₂, Stephen Dudden³, Adrian Tang³, Mathieu Choukroun⁴
¹Jet Propulsion Laboratory, California Institute of Technology
EuMC/EuRAD05-2
Size determination in Particle Streams Using a Multistatic Dual Frequency Millimeter Wave Radar
Alex Reinhardt¹, Alexander Teplyuk¹, Reinhard Knöchel¹, Michael Hoff¹
¹University of Kiel
EuMC/EuRAD05-3
Differential Absorption Radar at 170 GHz for Atmospheric Boundary Layer Water Vapor Profiling
Richard Roy¹, Ken Cooper¹, Matthew Lebsock¹, Luis Milan², Jose V. Stief³, Raquel Rodríguez Monje¹
¹Jet Propulsion Laboratory, California Institute of Technology
EuMC/EuRAD05-4
CM-CFAR Parameter Learning based Square-Law Detector For Foreign Object Debris Radar
Kudret Açıkgöz¹, Süleyman Baykal¹
¹TÜBİTAK BİLGEM
EuMC/EuRAD05-5
Signal Reduction by Tree Leaves in Low-THz Automotive Radar
Shahzad Sabery¹, Fatemeh Norouzian¹, Marina Gashkina⁴, Mikhail Chernikov⁴, Peter Gardner⁵, Edward Hoare³
¹University of Birmingham
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<td>Measurement Techniques</td>
<td>Tuans Lantern³</td>
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<td>5G Antennas</td>
<td>Al-Louzi⁴, Ioan Leger⁵</td>
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## EuMC50 - 8:30 - 10:10

### EuMC50-1

**Bare chip Connections via Aerosol Jet Technology for Millimeter Wave Applications**

Franz Rohr³, Philipp Senger⁴, Stefan Zorn⁵

DIT Deggendorf Institute of Technology, Friedrich-Alexander University Erlangen-Nurnberg, Rohde & Schwarz GmbH & Co. KG

### EuMC50-2

**Fully Inkjet-Printed Ramp Interconnects for Wireless Ka-Band MMIC Devices and Multi-Chip Module Packaging**

Bijan Tehrani⁴, Christian Michels⁵

Georgia Institute of Technology

### EuMC50-3

**Low-Loss Silicon Micromachined Waveguides Above 100 GHz Utilising Multiple H-Plane Splits**

Bernhard Beuerle¹, Christian Jakobs², Umer Shah³

KTH Royal Institute of Technology

### EuMC50-4

**A Rectangular Waveguide-to-Planar Waveguide Transition at D-band Using Wideband Patch Antenna**

Yunfeng Dong⁶, Tom Karsticke⁷, Vitaly Zhurbenko⁶, Peter Jesper Hanberg⁷

Technical University of Denmark

### EuMC50-5

**Low-cost D-band Waveguide Transition on LCP Substrate**

Ahmed Hassan², Maurizio Panseri-Corteggia⁷, Zongli Zhang⁸, Simon He¹, Herbert Zirath¹

Chalmers University of Technology

## EuMC51 - 10:10 - 11:30

### EuMC51-1

**Resolution Improvement Method for Non-Destructive Imaging with Near-Field Scanning Microwave Microscopy**

Lin Tianjun¹, Lasri Tuami¹, Gu Sijia¹

Université des Sciences et Technologies de Lille 1

### EuMC51-2

**Demonstration of Improvement of Repeatability in Thru-Reflect-Line Calibration Using Precision Probing Technique**

Pyo Sakaizaki¹, Mashhadi Horbaki²

National Institute of Advanced Industrial Science and Technology

### EuMC51-3

**Accurate Millimeter-Wave Carrier Frequency Offset Measurement Using Six-Port Technique**

Seyyid M. Dilek¹, Ralf Henneberger², Ingmar Kallfass¹

Universität Stuttgart, Radiometer Physics

### EuMC51-4

**Six-Port Based Multitone and Low-Power Radar System for Waveguide Measurements in Smart Factories**

Benedikt Scherning⁷, Fabian Lurz⁷, Fabian Möller⁷, Sarah Lenz⁷, Robert Weigel⁷, Alexander Koelpin²

Friedrich-Alexander University of Erlangen-Nürnberg, Brandenburg University of Technology

### EuMC51-5

**Graphene Based Antenna Array for 5G Applications**

Siti Nor Hafizah Sa’don¹, Mohd Haizal Jamaluddin¹, Muhammad Ramlee Kamarudin², Fauzan Ahmad¹

Universiti Teknologi Malaysia, Cranfield University

## EuMC52 - 10:10 - 11:30

### EuMC52-1

**Antenna Module with new Wideband 5G-Antenna Array at 28 GHz in Combination with GNSS- and 4G/WLAN/DSRC in Automotive Environment**

Seman Hostakoglu¹, Stefan Lindenmeier¹

University of the Bundeswehr Munich

### EuMC52-2

**5G Vehicle MIMO Antenna Capacity Based on a Rigorous Electromagnetic Channel Modeling**

Christian Ballesteros¹, Andreas Pfadler¹, Lluis Romeu¹, Lluís Jofre¹

Universitat Politècnica de Catalunya (UPC)

### EuMC52-3

**Graphene Based Antenna Array for 5G Applications**

Siti Nor Hafizah Sa’don¹, Mohd Haizal Jamaluddin¹, Muhammad Ramlee Kamarudin², Fauzan Ahmad¹

Universiti Teknologi Malaysia, Cranfield University

## EuMC52-4

**A Wideband Dielectric Resonator Antenna with Truncated Ground for 5G Applications**

Ahmed Abulaziz¹, Adel AbdElrahman², Ahmad Alam², Mohammed Noorouzifar³

Egypt-Japan University of Science and Technology, Alexandria 21934, Egypt

### EuMC52-5

**A Rectangular Waveguide-to-Planar Waveguide Transition at D-band Using Wideband Patch Antenna**

Yunfeng Dong⁶, Tom Karsticke⁷, Vitaly Zhurbenko⁶, Peter Jesper Hanberg⁷

Technical University of Denmark

### EuMC52-6

**Low-cost D-band Waveguide Transition on LCP Substrate**

Ahmed Hassan⁴, Maurizio Panseri-Corteggia⁷, Zongli Zhang⁸, Simon He¹, Herbert Zirath¹

Chalmers University of Technology

### EuMC52-7

**Performance Analysis of E-band Duplex Transceiver Based on Waveguide Diplexer Filters**

Seysel M. Diehl¹, Ralf Henneberger⁷, Ingrmar Kallfass⁷

Universität Stuttgart, Radiometer Physics

### EuMC52-8

**Graphene Based Antenna Array for 5G Applications**

Siti Nor Hafizah Sa’don¹, Mohd Haizal Jamaluddin¹, Muhammad Ramlee Kamarudin², Fauzan Ahmad¹

Universiti Teknologi Malaysia, Cranfield University
EuMC53
Advanced Technologies for Microwave Passive Components
Chair: Richard Stryker¹
Co-Chair: Ferran Martín²
¹RS Microwave, ²Universitat Autonoma de Barcelona

EuMC54
Antenna Technology
Chair: Nuno Paul¹
Co-Chair: Nutapong Somji²
¹Karlsruhe Institute of Technology (KIT), ²University of Leeds

EuRAD03-1
Automotive Radar 1
Chair: Marwina Gashinova¹
Co-Chair: Carlos Castillo²
¹University of Birmingham, ²India

EuRAD04-1
Managing and Promoting Innovation in Defence: EDAs R&T Activities related to RF Sensor Technologies
Roland Krebs²
European Defense Agency

EuMC53-1
Compact Duplexer Design with High Isolation Based on Low-Temperature Co-Fired Ceramics (LTCC) Process for LTE Band 1
Yang-Chih Huang¹, Po-Yuan Tsai¹, Tsong-Lin Wu¹
¹Graduate Institute of Communication Engineering, National Taiwan University

EuMC53-2
A Novel Type of Broadband Radial Stub
Mioz Cevik¹, Christian Froschke¹, Friedbert van Raay¹, Hermann Massler¹, Rüdiger Quay¹, Oliver Ambacher¹
¹Fraunhofer Institute for Applied Solid State Physics (IAF)

EuMC53-3
Experimental Comparison of Integrated Transformers in a 28 nm Bulk CMOS Technology
Johannes Rimmelspacher¹, Vadim Issakov²
¹University of Erlangen-Nuremberg, ²Infineon Technologies Austria AG

EuMC53-4
A Folded Edge-coupled Transformer Balun in GaAs with Excellent Balance from 9 to 20 GHz
Sudipta Chatterjee¹, Leigh Miller¹, Anthony Parker¹, Michael Headrick¹
¹Macquarie University

EuMC53-5
Large-Scale Fabrication of RF MOPS/ETs on Liquid-Exfoliated MoS₂
Kaanchen Kong¹, Lei Li¹, Amar Madjar¹, James C. M. Ho¹, Zhanpeng Lin¹, Yu Huang¹, Rangfang Duan¹, Alexander Görtz¹, Matthias Wietstruk¹, Meier²
¹Leigh University, ²EUMA Founder Member, ³University of California Los Angeles (UCLA), ⁴HP Microelectronics

EuMC54-1
120-GHz and 240-GHz Broadband Bow-Tie Antennas in eWLB Package for High Resolution Radar Applications
Faisal Ahmed¹, Muhammad Furan¹, Andreas Steiber¹
¹DICE GmbH & Co KG, ²Johannes Kepler University Linz

EuMC54-2
On-Chip Millimeter Wave Surface Wave Launcher for Off-Chip Leaky Wave Antennas
Jochen Schäfer¹, Heiko Gudan¹, Daniel Müller¹, Thomas Zwick¹
¹Karlsruhe Institute of Technology

EuMC54-3
Mutual Coupling Reduction in UWB Modified Maltese Shaped DRA Array for MIMO Applications
Kedar Trivedi¹, Deepak Pujara¹
¹Institute of Technology, Nirma University

EuMC54-4
Noise Measurement of a Small Antenna, Actively Matched with a non-Foster Form
Frederico Mesquita-Vargas¹, Daniel Segovia-Vargas¹
¹National University of Colombia, ²Carlos III university of Madrid

EuMC54-5
A Compact Dual-Band MIMO Antenna with High Isolation for WLAN Applications
Zixin Yang¹, Fang Li¹, Xiaowei Yang¹, Fazong Li¹
¹China Academy of Engineering Physics

EuRAD03-2
Expanding the Unambiguous Velocity Limitation of the Stepped-Carrier OFDM Radar Scheme
Benedikt Schweizer¹, Christian Waldschmidt¹
¹University of Erlangen-Nuremberg, ²Infineon Technologies Austria AG

EuRAD03-3
Self-Adaptive Short-Range Leakage Cancellor for Automotive FMCW Radar Transceivers
Alexander Meißner¹, Oleksiy Onyshchuk², Mario Hämmerl³
¹Infineon Technologies Austria AG, ²DICE Danube Integrated Circuit Engineering GmbH & Co KG, ³DICE GmbH & Co KG

EuRAD03-4
Polarimetric SAR for Automotive Applications
Hasan Iqbal¹, Muhammad Zeeshan Khan¹, Tobias Chalouhi¹, Christian Waldschmidt¹
¹University of Erlangen-Nuremberg

EuRAD03-5
Impact of an Automotive Chirp-Sequence Interferer on a Wideband OFDM Radar
Christian Knill¹, Benedikt Schweizer¹, Philipp Högner¹
¹University of Erlangen-Nuremberg

EuRAD04-2
Deep Learning for Automatic Target Recognition with Radar
Malía Helgadóttir¹, Albert Huzing², Jacob J. M. de Wijs³
¹INO

EuRAD04-3
Multichannel Passive ISAR Imaging for Military Applications (MAPIS)
Fabrizio Berzani¹, Michele Conti¹, Angelo Capria¹, Elisa Gioli¹, Anna Lisa Savoini², Kryzstof Kulpa³, Stefan Brinker³, Iole Pisciottano, Anna Rita Di Laldo³, Lwenta Kovacev³, Rudolf Sefer², Nicola Battista², Maria Pilar Jasso-Amorós³
³CNR, Warsaw University of Technology, ⁴Fraunhofer Institute, ⁵RIT A SzéP, ⁶Budapest University of Technology and Economics, ⁷NEDO Italia, ⁸University of Alcalá

EuRAD04-4
Architectures for Multifunction RF & Optronics Sensors Onboard RPAS Platforms
Adrian Jimenez Gonzalo¹, Miguel Alliegria¹, David I. Llamazares¹
¹Valentine Pista³, Elisabet Puerta³, Santiago Simon³
³evers Aerospacial y Defensa, ⁴DAS Photonics

EuRAD04-5
Signal Processing for Enhanced Radar Imaging
Stefan Brüggenwirth¹, Simon Wagner¹, Tanja Biere¹
¹Fraunhofer FHR, ²MBDA Italia, ³IDS Ingegneria dei Sistemi S.p.A., ⁴University of Pisa

THURSDAY

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**EuMC55**
**Wireless IoT and Localization**
Chair: Mehmet Kanaan1
Co-Chair: Sema Dumanli Oktar2
1TeleEye e2v, 2Bogazici University

**EuMC56**
**Antennas for Space Applications**
Chair: David Escot-Bocanegra1
Co-Chair: Santiago Sobrino Arias2
1INTA, 2Thales Alenia Space

**EuMC57**
**Special Session: Additive Manufacturing**
Chair: Petronilo Martin-Iglesias1
Co-Chair: Paul Booth2
1ESAESTEC, 2Airbus Defence & Space

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**EuMC55-1**
2% EVM 920 MHz 13 dBm Constant Envelope π/2 shift BPSK Modulation Transmitter for IoT
Hosashi Mihayama1, Sachia Iida2, Ken Yamamoto1, Noboru Saito1, Masahisa Tamura1, Norihito Suzuki1, Nao Tashiro1, Katsuyuki Tanaka1, Hiroshi Aki1, Noto Shige1, Seiji Kobayashi1
1Sony Semiconductor Solutions

**EuMC56-1**
Industrial Keynote: On Board Deep Space Steerable Antennas for Extremely Harsh Environments
Vicent Sanchez1, Fernando Martin2, Francisco Jose Caro2
1SENER INGENIERIA Y SISTEMAS

**EuMC57-1**
Additive Micro-Fabricated Waveguide Components
Horia Slav-Mihai1, Nicolae Prusa1, Francois David2, Claire Dalmay3, Pierre Blondy3
1Xlim - UMR 7252 - CNRS-Universite De Limoges

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**EuMC55-2**
Hybrid RSSI-AoA Positioning System with Single Time-Modulated Array Receiver for LoRa IoT
Kyung-Jin Baik1, Sangjoon Lee1, Byung-Jun Jang1
1Kookmin University

**EuMC56-2**
Circularly Polarized Lens Antenna for 100 Gbps Wireless Communications
Maria Artie Campo1,2, Darvin Blanco1, Giorgio Carlozzi1, Olvier Ushchik1, Simon Bruin1, Nuria Lombart Juan1
1IMST GmbH, 2TU Delft

**EuMC57-2**
Integrating Lens Antennas for E-band
Sabin Karki1, Juha Ala-Laurinaho1, Aki Karttunen1, Ville Vilkari1
1Aalto University

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**EuMC55-3**
Enhanced GSM Broadcast Receiver Using the Phase Output of a Sub-GHz Transceiver
Stefan Erhardt1, Bernhard Grabe1, Robert Weigel1, Alexander Koelpin2
1Friedrich-Alexander University of Erlangen-Nurnberg, 2Brandenburg University of Technology

**EuMC56-3**
Integrated Lens Antennas for E-band
Salin Kaukki1, Ulvi Alas-Laurinaho1, Ali Karttunen1, Ville Vilkari1
1Aalto University

**EuMC57-3**
Study of Designing and Manufacturing of a Ku-Band Pyramidal Horn Antenna with Integrated Transition Using 3-D Printing Technology
Julien Hauman1, Dassult D'haude1, Anaelle Martin-Guenno1, Yves Quere1, Cedric Quend1, Rozenn Allard1
1Elytech, 2Lab-STICC UBO

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**EuMC55-4**
Detailed Performance Analysis of an Ultra Wideband Transceiver for Real-Time Localization
Fabian Mitter1, Harun Deniz1, Fabian Luz1, Robert Weigel1, Alexander Koelpin2
1Friedrich-Alexander University of Erlangen-Nuremberg, 2Brandenburg University of Technology

**EuMC56-4**
A Compact Circularly-Polarized Lens-Horn Antenna with Very Low Axial Ratio and SLL
Fernando Rodriguez Varela1, Jose Luis Breda Sarraino1, Belden Guckha-Heig1
1UPM

**EuMC57-4**
Low-Loss Metal Additive Manufactured Passive Waveguide Components
Toni Slav Debourgovic1, Esteban Menargues1, Alexandre Dimitriadis1, Santiago Capotevid1, Mathieu Bilo1, Emma D'Arg1
1SWISSia12

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**EuMC55-5**
Antenna Performance in Satellite Communications Small Ground Stations: New Patterns Representation for a Faster Evaluation
Gianluca Dassano1, Mario Orefice2, Fulvio Fresia3, Fritz Schurig2
1Politecnico di Torino, 2DE-T-LACE, 3CNR-IEIIT, 4F2SatConsulting, 5Eutelsat S.A.

**EuMC56-5**
Silver Metallization of 77 GHz 3D Printed Horn Antennas
Samuel Shemaderfer1
1Jet Metal Technologies

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**EuMC57-5**
Silver Metallization of 77 GHz 3D Printed Horn Antennas
Samuel Shenaderfer1
1Jet Metal Technologies
**EuMC/EuRAD07 Interactive Session**

**Chair:** Manuel Sierra-Castaner¹  
**Co-Chair:** Daniel Segovia-Vargas²  
¹Technical University of Madrid, ²Carlos III university of Madrid

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Christian Person¹, Hong Duc Nguyen¹, Jean Philippe Coupez², Philippe Minaire², Dominique Iwave-Tong³, Pascal Barra³  
¹Centre technique du papier, ²Technicolor Connected Home, ³Centre technique du papier
|                | EuMC/EuRAD07-2 Digitally Compensated Millimeter Wave Frequency Doubler Based Outphasing Systems using Multi-tone Based Stimuli  
Arthur Chung¹, Manwen Ben Rejeb¹, Ali Darwiche¹, H. Alfred Hung¹, Slim Boumaza¹  
¹University of Waterloo, ²Army Research Lab
|                | EuMC/EuRAD07-3 A 2D Method for Acquiring the Radiation Pattern of Two-Identical Vivaldi Antennas by Using a Stepped-Frequency Continue Wave (SCCW) Radar and a Rotation Stage  
Valentino Ortega¹, Jorge Luis Solana¹, Ramakrishna Saril¹, Werner Schröder¹, Luther Schussele¹  
¹Offenburg University Of Applied Sciences
|                | EuMC/EuRAD07-4 Dipole Antenna Printed on Paper Substrate for WLAN Applications  
Dominique Iwave-Tong¹, Philippe Minaire¹, Christian Person¹, Jean Philippe Coupez², Damien Barra³  
¹Centre technique du papier, ²Technicolor Connected Home, ³Centre technique du papier
|                | EuMC/EuRAD07-5 EBG Enhanced Broadband Dual Antenna Configuration for Passive Self-Interference Suppression in Full-Duplex Communications  
Pratul Das¹, Darian Minshenk-Syakhla¹, Gan Zheng¹  
¹University of Essex, ²Loughborough University
|                | EuMC/EuRAD07-6 A Real-Time Non-Destructive Water Status Monitoring System at Terahertz Band  
Carlos Guarreta¹, Juan Carlos Ibarra², Diana Matri¹, Carlos Miranda¹, Ramon Gonzalo², L. Gonzalez Santesteban², Rigo Eternaz²  
¹Public University of Navarra, ²Public University of Navarra, ³Instituto Superfibra, 4NULL
|                | EuMC/EuRAD07-7 W-Band Millimeter-Wave On-Chip Log-Periodic Dipole Antenna with Integrated Balun Filter in GIPD Process  
Huay-Ru Chuang¹  
¹National Cheng Kung University
|                | EuMC/EuRAD07-8 Design of a Dual-Band Feed System for SIX-band VLBI Observations  
Mooi-Hee Chung¹  
¹Korea Astronomy and Space Science Institute
|                | EuMC/EuRAD07-9 Low-Loaded Linealized Local Phase Shifter for Radar in X band  
Xiaolong Sun¹, José Manuel Fernandez-Gonzalez¹, Manuel Sierra-Pérez¹, Belén Galocha-Iragüen¹  
¹Universidad Politécnica de Madrid
|                | EuMC/EuRAD07-10 Mode Conversion Processes in Multilayer Spherical Resonators  
Ingo Wolff¹  
¹MST GmbH
|                | EuMC/EuRAD07-11 Double-Tuned Composite Right/Left-Handed Leaky Wave Antenna Based on Liquid Crystal  
Shuang Ma¹, Fan-Yi Meng¹, Fu-Liang Zhang¹, Lei Zhu¹, Qin Wu¹  
¹Harbin Institute of Technology, ²Institute of Electrical Power Company Limited, ³Qiqihar University
|                | EuMC/EuRAD07-12 A Stand Alone Millimetre Wave Imaging Scanner: System Design and Image Analysis Setup  
Andrés Kieler¹, Christopher Schwabig¹, Christian Krebs¹, Ralf Brauns¹, Stefan Kosel¹, Dirk Müller¹  
¹Fraunhofer FHR, ²Ruhr-Universität Bochum
|                | EuMC/EuRAD07-13 Dispersion of THz Modes Localized on Layered Superconductor Controlled by DC Magnetic Field  
Tetiana Kohrmanova¹, Stanislav Apostolov¹, Nika Kvitka¹, Valery Yampol'ski¹  
¹O. Ya. Usikov Institute for Radiophysics and Electronics NAS of Ukraine, ²Technical University of Dnipropetrovs’k, ³Institute of Applied Physics
|                | EuMC/EuRAD07-14 E-band Impulse Radio Transceiver with 2-bit Pulse Position Modulation  
Hrishik Matsumura¹, Kuo Soga¹, Schedi Sibie¹, Kazuaki Onishi¹, Yusaku Nakata¹, Yoichi Kawano¹, Tooshide Suzuki¹  
¹Fujitsu Laboratories Ltd.
|                | EuMC/EuRAD07-15 A DC to 40 GHz, High Linearity Monolithic GaAs Distributed Amplifier with Low DC Power Consumption as a High Bit-Rate Pre-Drive  
Laura Diego¹, Benoît Haentjens¹, Amparo Herreras¹, Raman Gnanasiriam¹  
¹Telecommunication Technology Institute of Spain, ²University of Cantabria
|                | EuMC/EuRAD07-16 Design of Broadband Gap Waveguide Transitions for Millimeter-Wave Antenna Arrays  
Miguel Fernando-Roché¹, Daniel Sánchez-Escudero¹, José Ignacio Herranz-Hernández¹, Alejandro Valeo-Noguerà¹  
¹Universidad Politécnica de Valencia
|                | EuMC/EuRAD07-17 A Circularly Polarized Circular Antenna Array for Satellite TV Reception  
Ahmed Aledrin¹, Yi Huang¹, Manoj Banarî¹, Sunir Joseph¹  
¹University of Liverpool
|                | EuMC/EuRAD07-18 Design and Demonstration of Linearly-Polarized Transmit-Arrays in X-band  
Hanzu Kauan¹, Mohamed Ali Beladi¹  
¹LAPLACE, ²LATS - ENIS
|                | EuMC/EuRAD07-19 Distributed Signal Processing of High-Resolution FMCM MIMO Radar for Automotive Applications  
Farhan Bin Khalid¹, Dan Nugsaha¹, Andre Roger¹, Roman Ignace¹, Markus Bichl¹  
¹Infineon Technologies AG
|                | EuMC/EuRAD07-20 Real-Time Synthetic Aperture Radar for Automotive Embedded Systems  
Farhan Bin Khalid¹, Florian Fernández¹, Gabor Balacs¹, Andre Roger¹, Dan Nugsaha¹  
¹Infineon Technologies AG
|                | EuMC/EuRAD07-21 Dual-Channel Single Sideband Transmitter in 45 nm CMOS SOI for a 70 GHz OFDM Radar  
Daniel Schindler¹, Michael Taw¹, Mohamed Elkholy¹, Yung Yu¹, Benedict Schweizer¹, Jürgen Hasch¹, Christian Waldschmidt¹  
¹Robert Bosch GmbH, ²Ulm University

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In the podium discussion, this idea and circuit systems. The question is whether its infancy and far from an application to available for simple components and also for the opposite direction, i.e., synthesizing then analyze its behavior. First approaches All these techniques, however, are basically analysis methods, i.e., one has to define a microwave component or system and can then analyze its behavior. First approaches for the opposite direction, i.e., synthesizing techniques based on an EM simulation, are available for simple components and also partly installed in the simulation tools. A method called "inverse Local Imaging" which allows to calculate the current sources from a given electromagnetic field is still in its infancy and far from an application to synthesize complex microwave antennas and circuit systems. The question is whether upcoming "artificial intelligence" processes are able to perform this task together with fast analysis tools in the background.

In the podium discussion, this idea and alternative strategies will be presented and discussed, using an antenna or circuit design task as an example.
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<td>Roberto Grimaldi, Paolo Petrini, Andrew F. Peterson</td>
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<td>Mateusz Grotli, Łukasz Kulas, Gdańsk University of Technology</td>
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<td>Leonardo Lambro, Scuola Superiore Sant’Anna</td>
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**16:10 - 17:50**

**Session Remarks**
Magdalena Salazar Palma, EuMW 2018 General Chair
José Ignacio Alonso Montes, EuMW 2018 General Co-Chair

**16:20 - 17:10**

**Galileo: Europe’s Global Satellite Navigation System**
Giuliano Gatti, Galileo Space Segment Manager, European Space Agency

Galileo is Europe’s own global navigation satellite system, providing a highly accurate, guaranteed global positioning and time service under civilian control. The Galileo System began Initial Services on 15 December 2016, and since then performances are excellent and steadily improving, as regularly reported through the Galileo open service quarterly performance reports. A growing number of commercial devices are using the system today. It is actually estimated that over 95% of the satellite navigation chipset supply market supports today Galileo in their new products, including the leading manufacturers of smartphone chipsets. Completion of the nominal constellation is planned to be achieved this year with the launch of 4 new Galileo satellites on July 2018, which will bring the 24-satellite Galileo constellation to the point of completion, plus two orbital spares. In parallel to that, a steady stream of orbital spares, ready to replace satellites reaching the end of their operational lives, is necessary to ensure Galileo continues operating seamlessly. A further 12 satellites were therefore ordered from industry in June 2017. During this presentation the current status of Galileo, its performances and its future modernization plans will be presented, highlighting also the extraordinary contribution of the European microwave and RF community on this program.

**17:10 - 17:30**

**Awards Ceremony**
Lluís Pradell i Cara, EuMW 2018 Awards Committee Chair
Germán Torregrosa Penalva, EuMW 2018 Student Activities Committee Chair

**EuMC Microwave Prize**

**EuMC Young Engineer Prizes**

**Student Challenge Prize**

**Student Design Competition Prize**

**17:30 - 17:40**

**Closing Remarks**
Magdalena Salazar Palma, EuMW 2018 General Chair
Denis Barataud, EuMW 2019 General Chair
FRIDAY

EuRAD12

Radar Micro Doppler Analysis
Chair: Felix Yanovsky
Co-Chair: Jacco J. M. de Wit
*National Aviation University, **TNO

EuRAD13

Remote Sensing
Chair: Mayazzurra Ruggiano
Co-Chair: Stephen Herman
*TNO, **CetinIQ

EuRAD12-1

Target Detection and Classification of Small Drones by Boosting on Radar Micro-Doppler
Svante Björklund
*Swedish Defence Research Agency (FOI)

EuRAD13-1

Industrial Keynote: Multi-Temporal Space-Borne SAR Data Exploitation for Surface Monitoring Applications
Ruben Iglesias, Javier Duro, Johanna Granada, Fernando Vicente, Giuseppe Centola, Emma Garcia, Dan Morelo
*Thales Nederland B.V., **QinetiQ

EuRAD12-2

Radar Classification for Traffic Intersection Surveillance Based on Micro-Doppler Signatures
Alexis González Argüello, Dominic Berges
*Technical University of Munich

EuRAD13-2

Ground Based Synthetic Aperture Radar with 3D Imaging Capability
Massimiliano Pieraccini, Neda Rojhani, Lapo Miccinesi
*University of Florence

EuRAD12-3

Deep Learning-Based Segmentation for the Extraction of Micro-Doppler Signatures
Javier Martinez Garcia, Martin Vossiek
*FAU Erlangen-Nuremberg

EuRAD13-3

Radar Detection Algorithms for Oil Spill Applications
Bilal Hammoud, Ghaleb Faour, Hussam Ayad, Fabien Ndagijimana, Jalal Jomaah
*Lebanese University, **Grenoble Alpes University, ***CNRS-L

EuRAD12-4

Deep Learning for Range-Doppler Map Single Frame Classifications of Cooking Processes
Marco Altmann, Peter Ott, Christian Waldschmidt
*Hochschule Heilbronn, **Universität Ulm

EuRAD13-4

First Results of Passive Radar Imaging and Tracking Using Geostationary Satellites
Holger Nies, Florian Betzner, Simon Reuter, Olmar Loeb
*University of Siegen

EuRAD12-5

Human Detection by Deep Neural Networks Recognizing Micro-Doppler Signals of Radar
Jihoon Kwon, Seungeui Lee, Nojun Kwak
*Seoul National University
EuRAD 14 Interactive Session
Chair: Manuel Rosa-Zurera¹
Co-Chair: María Pilar Jarabo-Amores¹
¹University of Alcalá

10:10 – 12:30

Corridor EuRAD14-1
Kernel Extended Local Tangent Space Alignment for SAR Image Classification
Xuelia Yu¹
¹University of Electronic Science and Technology of China

Corridor EuRAD14-2
Polarimetric Scattering Center Representation for Electric-Large Targets
Xuan Wang¹
¹Leiden University

Corridor EuRAD14-3
Enhanced ISAR for Classification of Multiple Drones in Air by Time-Varying Micro-Doppler Rejection
Wookyoung Lee¹, Kyung Min Song²
¹Korea Aerospace University

Corridor EuRAD14-4
Comparison of DoA Algorithms for MIMO OFDM Radar
Jessica Sanson¹, Atílio Gameiro¹, Daniel Castanheira¹, Paulo Monteiro¹
¹Instituto de Telecomunicacões-Aveiro

Corridor EuRAD14-5
Deep Learning Based Human Activity Classification in Radar Micro-Doppler Image
Yuan He¹
¹Beijing University of Posts and Telecommunications

Corridor EuRAD14-6
Monopole Fed Grounded Dielectric Slab Leaky Wave Bull’s-Eye Antenna
Unai Beaskoetxea¹, Alicia Elena Torres-García¹, Miguel Berujón¹
¹UPNA
FRIDAY

EuRAD15
FMCW and Continuous Wave Radar
Chair: Reinhard Feger¹
Co-Chair: Nils Pohl¹
¹Ruhr-University Bochum, ²Johannes Kepler University Linz

EuRAD16
Drones Detection by Radar
Chair: Pierfrancesco Lombardo¹
¹Sapienza University of Rome, ²National Aviation University

EuRAD15-1
BPSK-based MIMO FMCW Automotive-Radar Concept for 3D Position Measurement
Yoke Lean Goh¹, Gang Li¹, Sarath Manchala¹, Hamid Ahsalabi¹, Christian Sturm¹, Urs Lübbert¹
¹Valeo Schalter und Sensoren GmbH

EuRAD16-1
Numerical and Experimental Evaluation of the Radar Cross Section of a Drone
Bartolo Piai¹, Emanuele Pizzolo¹, Erika Pinte³, Pierfrancesco Lombardo¹, Alessio Genovese¹, Domenico Boldi¹, Daniele Nardi¹, Paolo D’Alessandro², Alessandro Zambotti³
¹Sapienza University of Rome, ²ENEA

EuRAD15-2
Mixed-Signal Transmitter Leakage Cancellation for PMCW MIMO Radar
Marc Bauduin¹, André Bourdoux¹
¹IMEC

EuRAD16-2
Drone Detection Feasibility with Passive Radars
María Pilar Jaramillo-Amores¹, David Mald-Moya¹, Pedro José Gómez-del-Hoyo¹, José Luis Bárcenas-Humanez¹, Javier Roasado Sand¹, Nerea de Rey-Maestre¹, Manuel Rosa-Zurera¹
¹University of Alcala

EuRAD15-3
IQ Imbalance Robust OFDM Radar Waveform
André Bourdoux¹, Marc Bauduin¹, Claude Desset¹
¹IMEC

EuRAD16-3
Remotely Piloted Aircraft Detection with Persistent Radar
Álvaro Duque de Quevedo¹, Fernando Ibáñez Utriz⁴, Javier Gismero Menoyo¹, Alberto Asensio López⁵, Information-Processing and Telecommunications Center. Universidad Politécnica de Madrid

EuRAD15-4
Non-Linear Effect Mitigation for FMCW Radar System
Nizar Bouhel¹, Stéphane Meric¹, Claude Moulec¹, Christian Broesee¹
¹Institut d’électronique et de télécommunications de Rennes, IETR, ²ADVANTEN

EuRAD16-4
Circular Micro-SAR for Mini-UAV
Malcolm Otten¹, Noud Maas¹, Roland Bolt¹, Miguel Caro-Cuencà¹, Henk Medenblik¹
¹TNO Defense, Safety and Security

EuRAD15-5
A Highly Integrated Dual Band FMCW Radar Receiver for Indoor Positioning Applications
Mohamed Djeddir², Belal Al-Qudsi¹, Niko Jorani¹, Frank Ellinger¹
¹TU-Dresden

EuRAD16-5
Comparisons Between Simulated and Measured X-band Signatures of Quad-, Hexa- and Octocopters
Peter Späth¹, Arne Schröder¹, Matthias Renker², Peter Wellig², Axel Mark³
¹Universität Bern, ²armasuisse
13:50 - 14:30

Spanish Advanced Radar for LEO Space Surveillance and Tracking
Domingo Castro Fernández, Defence Systems Director, Indra Sistemas, Rafael Casado Gómez, Primary Radars Director, Indra Sistemas, Jacobo Martínez-Villa Salmerón, Project Leader, Indra Sistemas.

The S3T Surveillance Radar (S3TSR) is a radar system developed by Indra within a project funded by Spanish Administration and technically managed by ESA. It is a ground-based radar, based in a close monostatic configuration, operating at L band and capable of providing positional information of orbital objects. The radar provides automatic surveillance and tracking of space objects in Low Earth Orbit (from 200 km to 2000 Km of orbit height above Earth). This is performed by continuously scanning the instrumented Field of Regard (FoR), generating track reports for all detected objects. Situational awareness of LEO is an activity with increasing strategic value for national sovereignty. Based on this tracks, the SSTOC (Space Surveillance and Tracking Operation Centre) generates a catalogue in which objects are updated every pass. The radar architecture is scalable and the performances of the radar can improve by just adding building blocks (tiles). Both, TX and RX antennas are separated electronically scanning arrays (AESA). The TX antenna has high power amplifier modules based in GaN technology to improve efficiency and reliability. The RX modules use direct RF undersampling technology. RX beamforming architecture is fully digital, each antenna input is digitized to maximize functional flexibility, and entirely over optical fiber making possible the simultaneous formation of multiple RX radiation patterns. The system is designed as very modular to improve availability.

14:30 - 14:50
EuRAD Awards Ceremony
Gonzalo de Miguel, EuRAD 2018 Co-Chair, Lluís Pradell, EuMW 2018 Awards Chair

14:50 - 15:00
Closing of EuRAD 2018
Mateo Burgos, EuRAD 2018 Chair

Invitation to EuRAD 2019
Philippe Eudeline, EuRAD 2019 Chair
Welcome from the Workshop and Short Courses Chair

This year we are pleased to offer the EuMW 2018 delegates a wide range of workshops and short courses that cover the topics of all three conferences throughout the week.

To guarantee this wide coverage of topics, the accepted 33 workshops and eight short courses were selected from a pool of 51 submitted proposals. This selection was the result of a pre-established review process.

Current key applications of microwave technology are addressed ranging from quantum information systems, or biomedical sensors to 5G communications, Internet-of-Things, wireless power transfer, automotive radar or satellite communications. In addition, other workshops cover technological topics such as GaN, CMOS and SiGe as well as THz-technologies. Fundamental knowledge is provided in short courses on active and passive microwave circuit design, radar fundamentals and packaging and interconnect technology. The nowadays hot topics of automotive radar, power amplifiers and THz are covered by another series of workshops and short courses.

We are very grateful to all the organisers, presenters and authors of workshop and short course materials for sharing their knowledge with the EuMW 2018 delegates, and for their hard work and dedication before and during the conference. These events could only happen because of their willingness to serve the microwave community.

Each workshop and short course is individually endorsed by one or two of the conferences that make up EuMW. However, they are available and accessible to any scientist or engineer wishing to gain a broader perspective on microwave and RF systems and devices, or to learn about a new specialism within our broad field.

Due to the wide range of covered topics, the workshops and short courses’ programme fills the entire week. Workshops or short courses that focus on topics relevant for EuMIC mainly take place from Sunday to Tuesday. On Thursday and Friday, we present most of the workshops endorsed by EuRAD. Similarly, EuMC devoted workshops are distributed throughout the whole week.

Slides for the workshops and short courses will be provided electronically at the conference on a separate USB stick. No hard copies of the slides will be provided.

José Carlos Pedro
Workshops and Short Courses Chair

Telmo Cunha
Workshops and Short Courses Co-Chair
Semiconductor Power Amplifiers are key components in radio frequency and microwave transmitter systems. They have received a great deal of attention and development effort over the last decades and are still a hot topic in the research area.

This short course aims to provide a comprehensive overview of all aspects of the fundamental semiconductor microwave power amplifier design. It is an introductory course, aimed at graduate engineers who have moved into the field of RF design, as well as to microwave designers who aim to deeply understand the power amplifier’s basic concepts.

This short course features a range of presentations and provides a comprehensive overview and basic understanding on recent important progress and novel state-of-the-art achievements in semiconductor power amplifiers. Very recent advances in semiconductor amplifiers and their applications will also be covered.

Starting from the fundamental concepts on semiconductor devices, the core of a power amplifier design, the theoretical foundations of a power amplifier design are discussed. It will include fundamental concepts and state-of-the-art results on actual designs of a range of semiconductor power amplifiers using existing foundries. The load pull technique is also addressed and focused on the designer’s perspective.

The presentations will also cover a variety of advanced topics, and will provide the attendees with a clear overview of the main streams of current and important research trends worldwide in this field, as the Doherty architecture and the more recent load modulation power amplifier design concepts.

The short course will also focus on major challenges, such as stability (small and large signal) and how to address these in the amplifier design. Finally, accounting for the linearity issue, a basic overview on linearization techniques and their adoption to properly mitigate the amplifier distortion effects will conclude the short course.
Additive Manufacturing (AM) has the potential to change how future space products are designed, integrated and operated. This technology is considered already as a strategic technology approach for space applications. AM will enable design for performance, mass optimization and easy design changes possible while also massively reducing the design/manufacturing/assembly cycle/costs as well as providing an environmentally friendly alternative to conventional machining. AM is also considered a key enabling technology for the miniaturization of small complex systems.

AM is likely to become a breakthrough technology for the development of RF hardware. The use of this manufacturing process allows RF hardware manufacturers to achieve enhanced performance. RF, thermal and mechanical performance can be improved by using the additional design freedom provided by AM.

The assessment of different AM approaches for RF hardware has already started and will consider the whole process chain, including design, material supply, processing, post processing, qualification and verification, and standardization. This assessment exercise is helping to identify already those AM approaches (materials, designs, processing, etc.) best suited for the manufacturing of RF hardware.

However, the goal of AM is not to replace well-known and consolidated manufacturing approaches such as milling, but to exploit the additional freedom for advanced designs.

This workshop will focus on three main aspects related to the use of AM for the manufacturing of RF hardware.

The first part will introduce the AM process and review its features. The suitability of AM for the space sector will also be addressed. In a second part, the impact of AM on satellite systems will be presented, followed by a third part, where some manufacturing approaches and real examples will be presented by companies and universities.
The telecommunication industry is preparing the fifth generation (5G) of mobile network to connect people and machines on a massive scale with broadband mobile communication with tens of gigabits per second. With the information-communication technology ecosystem estimated to use up to 10% of the world's total energy generation, an important goal of 5G is to save energy while accommodating 10 times more traffic. Given the higher cell density expected, power amplifiers (PAs) exhibiting high average efficiencies are thus needed for 5G microcell and metrocell base-stations to curtail the operating cost. In this workshop, experts from Europe and America will present the recent advances in device modeling tools, which will facilitate the development of such high-performance GaN power amplifiers from microwave to mm-Waves.

The workshop will start with several presentations on the state-of-the-art GaN technologies available from different foundries for wireless, military and space applications at mm-Wave including the 28 and 38 GHz bands of 5G and at higher frequencies (backhaul). The trade-off between power gain, output power and dissipated power will be explored and the measured performances of state-of-the-art power amplifiers at 30, 40 and 50 GHz presented. The GaN FET modelling at the single intrinsic gate finger will be investigated to facilitate the development of device models for more complex layouts and address issues such as internal oscillations. The PA design using a nonlinear embedding device model will also be reviewed to address the unique opportunities it offers for the accelerated design of high-performance PAs at mm-Waves.

The challenges in device modeling and characterization of memory effects, stability and noise in GaN HEMTs at microwave and mm-waves will be the focus of the second half of the workshop. The goal will be to more accurately describe the device behavior for various PA classes of operation, such as envelope tracking, nonlinear dynamic load modulation, and pulse operation. Novel characterization and modeling techniques available to account for the dependence of the device characteristic on trapping and self-heating and to reliably predict the response of GaN HEMTs under modulated and pulsed waveforms will be presented. Further, the linear and noise modeling of GaN/Si HEMTs will be presented, with applications to both single-chip front-ends and mm-wave HPA design.
WS-02 (EuMC/EuMIC)
High Efficiency mm-Wave Power Amplifiers for 5G

Organiser: Anh-Vu Pham¹, Roberto Quaglia², Vittorio Camarchia³
¹University of California, Davis, ²Cardiff University, ³Politecnico di Torino

In this workshop, speakers from leading industries and universities will present state-of-the-art results in advanced power amplifiers for 5G wireless communications. The 5G communication system offers high data rate up to 10 Gbps and potentially deploys beamforming techniques with high device density and dense base-station deployment. These unprecedented demands require new-generation power amplifiers (PAs) operating at millimeter-wave bands and delivering high linear power with wide-bandwidth and high efficiency yet with a highly reduced size and cost. Therefore, broadband linear PAs with high efficiency at high PAPR, supporting higher order modulation, are among the most critical components for 5G. The workshop will include a wide range of presentations highlighting the recent trends and the state-of-the art developments of power amplifiers in different semiconductor technologies from K-band to E-band. In addition, several advanced circuit architectures to achieve high efficiency will be presented, encouraging the audience to ask questions and discuss results.

WS-04 (EuMC)
RF Techniques for Cellular Carrier Aggregation and Beyond

Organiser: Florinel Balteanu¹
¹Skyworks Solutions

The demand for higher data rates in 4G and future 5G determines a great focus on the development of user equipment (UE) radio and RF front-end (RFFE) architectures and implementation. In these days, mobile video traffic accounts for 55% of total data traffic and specifically for smartphones, which accounts for 97% of global handset traffic. In order to address this explosive demand for data rates, a number of enabling features are being standardized and deployed in commercial handset products. One of the features is LTE carrier aggregation (CA) which enhances cellular network performance by enabling operators to combine multiple LTE component carriers (CC) to create wider-bandwidth services. LTE carrier aggregation (4G) used to increase the data rate together with key technologies in millimeter-wave, massive MIMO antenna arrays paved the way for 5G. This workshop will present the RF circuit, technology and system requirements for RF front-end used to implement 4G and future 5G in mobile devices.
Terahertz Technologies from Fundamentals to Implementations: A Device and Application Prospective

Organiser: Dimitris Pavlidis¹, Imran Mehdi², Javier Mateos³
¹Boston University and National Science Foundation, ²Jet Propulsion Laboratory, ³University of Salamanca

THz technology opens up new possibilities for various applications extending among other from sensing and spectroscopy to communications and imaging. While important advances have been made over the last two decades, THz technology can benefit from further developments in the area of devices, circuits and system implementation. This requires understanding of fundamentals, consideration of new device concepts and/or optimization of their characteristics, hybrid or integrated approaches for circuit realization and use of the knowledge obtained from such studies for system development. This workshop will bring together experts from various academic, national labs and commercial enterprises to discuss the most recent advances in their respective fields and to provide insight into what the future might hold for exploration of this frequency range. It will focus on a variety of materials such as traditional III-Vs, III-Nitrides, Silicon, Graphene and Transition metal dichalcogenides (TMDs), as well as various device concepts for efficient THz generation and detection. The operation of the components to be discussed is based on plasmonics, photoconductors, plasma waves, photomixing, Resonant Tunneling, Negative Differential Resistance and CMOS. Devices such as Quantum Cascade Lasers and Self-switching Diodes will also be addressed. Advanced Sensing, Imaging and Communications and terrestrial, space applications will be discussed. The Workshop is intended for young scientists and engineers who are interested in learning about this emerging field, as well as individuals with a more advanced understanding of related concepts. The topics addressed include fundamental and engineering considerations together with the latest results in Terahertz technology.

Programme

THz Applications: From Devices to Space Systems
Imran Mehdi²
²Jet Propulsion Laboratory

Fundamentals and Latest Results on Nitride-based Two- and Three-Terminal Devices for Frequencies Extending to THz
Dimitris Pavlidis¹
¹Boston University and National Science Foundation

Self-switching Nanodiodes for THz Detection
Javier Mateos³
³University of Salamanca

THz Oscillators Using Resonant Tunneling Diodes and their Functions for Various Applications
Masahiro Asada¹, Satumi Suzuki¹
¹Tokyo Institute of Technology

Cutting the Gordian Knot of THz Biospectroscopy: The Critical Effect of Hydration
E. R. Brown¹, W-D. Zhang¹, A. Bykhovski²
¹Wright State University, ²North Carolina State University

Terahertz Electronics using GaN-based Schottky Barrier Diodes and FinFETs and HgCdTe Bulk Films for Emission
Wojciech Knop¹, Grzegorz Cywinski¹, D. B. Bu¹, C. Consejo³, S. S. Krishtopenko⁴, N. Dyakonov⁵, A. M. Kadykov⁵, S. A. Dvoretskii⁵, S. Ruffenacht⁶, S. V. Morozov⁶, F. Teppe⁶
¹University of Montpellier & CNRS / Polish Academy of Sciences, ²Polish Academy of Sciences, ³University of Montpellier & CNRS / Institute of Semiconductor Physics, ⁴University of Montpellier & CNRS, ⁵University of Montpellier & CNRS / Institute for Physics of Microstructures RAS, ⁶Institute of Semiconductor Physics / Novosibirsk State University, ⁷Institute for Physics of Microstructures RAS

Graphene and Dirac Materials Beyond Graphene: Applications in THz Metamaterials and Plasmonics
Berardi Sensale-Rodriguez¹
¹University of Utah

High Performance Terahertz Radiation Sources Based on Plasmonic Photoconductors
Mona Jarrahi¹
¹University of California Los Angeles

Photomixing mW THz Sources
G. Ducournau¹, P. Latzel¹, F. Pavanello¹, E. Peytavit¹, M. Zaknoun¹, J.-F. Lampin¹
¹IEMN

Laser-free THz Pulse Sources and Detectors in Silicon
Aydin Babakhani¹
¹University of California Los Angeles

Chip-Scale Molecular Clock Using THz Rotational Spectroscopy
Ruonan Han¹
¹University of California Los Angeles

Optically-Controlled Tunable/Reconfigurable Terahertz Devices for Advanced Sensing, Imaging and Communications
L. Liu², L-J. Cheng²
²University of Notre Dame, ²Oregon State University

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WS-07 (EuMC)
Broadband Power Amplifiers for Wireless Applications

Organiser: Wenhua Chen¹, Karun Rawat²
¹Tsinghua University, ²IIT

The workshop will focus the design theory of broadband power amplifiers and novel techniques below or around 6 GHz for wireless applications, perhaps including broadband continuous mode PA, broadband load modulated or distributed PA. The PA back-off output power efficiency enhancement techniques will also be covered in this workshop.

WS-08 (EuMC/EuMIC)
Transmitter Modules for Smart Antennas and MIMO Systems

Organiser: Christian Fager¹, Leo de Vreede²
¹Chalmers University of Technology, ²Delft University of Technology

MIMO- and smart antennas are key technologies to improve capacity and energy efficiency in future wireless systems. However, shifting from traditional single-antenna systems to active antenna systems, with up to hundreds of individually controlled low power transmitter modules, is a paradigm shift that raises fundamental and practical challenges that need to be addressed by both industrial and academic researchers with the highest priority. These challenges are exacerbated by the recent trend towards higher frequencies and larger bandwidths for further capacity enhancement.

This workshop will review the most important research directions in the area of transmitter modules for smart antennas and MIMO systems, with a focus on the emerging 5G communication applications. While the stand-alone power amplifier was traditionally considered to be the key building block of any transmitter, this workshop will particularly target more complete transmitter solutions that serve the smart antenna operation. Therefore, highly-integrated TX solutions are within the focus of this workshop. Several talks will illustrate the great integration possibilities offered by modern silicon CMOS and SiGe technologies for realizing high performance digital and analogue functions in the range below 6 GHz, as well as, at mm-wave frequencies.

The workshop is based on a combination of presentations by leading industry, institute, and academic researchers. This will give the audience both perspectives of detailed technical solutions, as well as, an overview of the requirements that drive the industrial system and testbed development activities.
Victor Veselago first predicted the unique, unusual and exotic properties of metamaterials, particularly left-handed media, in 1968. However, David R. Smith and his team conducted the first experimental verification of such properties many years later, in 2000. This singular year is considered by many researchers involved in the topic to represent the onset of the Metamaterials History, initiated by its “big bang” after 32 years of latency. Therefore, 2018 is a key year, coinciding with the 50th anniversary of the seminal paper by Veselago, and with the adult age of Metamaterials. Since 2000, the research activity on the topic of metamaterials and artificial materials, and related topics, including metasurfaces, frequency selective surfaces, electromagnetic bandgaps, etc., has experienced a significant growth, and many applications, in fields as diverse as communications, sensing, or security, among others, have been reported. The aim of this workshop is to provide the attendees an overview of the research activity on the topic of microwave and THz metamaterials, with special emphasis on metasurfaces (a hot topic nowadays), and their applications. To this end, a balanced team of prominent researchers worldwide has been carefully selected. Workshop topics include metasurfaces for blazed gratings and reflectors, metasurfaces for sensing, metasurfaces for anomalous and negative refraction, high-gain antennas based on metasurfaces, metamaterials and metasurfaces based on active ‘negative’ elements, analytical circuit modeling of metasurfaces, wave propagation in time-modulated metamaterials, invisibility cloaks for advanced antennas, novel sensors and chipless-RFID systems based on metamaterials and symmetry, and industrial applications of metamaterials. These topics will be presented in a coherent manner in the workshop, and the different concepts introduced will be illustrated with multiple examples of applications, including applications in industry.

Workshops and Short Courses - Sunday

WS-09 (EuMC/EuMIC)
Metamaterials, Metasurfaces and Applications

Organiser: Ferran Martin¹, Francisco Medina²
¹Universitat Autònoma de Barcelona, ²Universidad de Sevilla

Programme

Metasurface for Blazed Gratings and Reflectors for Microwave through THz Applications
Tatsuo Itoh¹
¹University of California Los Angeles

Metasurfaces for Anomalous and Negative Refraction
Sergei Tretyakov¹
¹Aalto University

Terahertz Metasurfaces for High Sensitivity Thin-film Sensing Devices
Miguel Beruete¹
¹Universidad Pública de Navarra

Low Profile High Gain Antennas Based on Modulated Metasurfaces
Enrica Martini¹
¹University of Pisa

Radiofrequency Metamaterials and Metasurfaces based on Active ‘Negative’ Elements
Silvio Hrabar¹
¹University of Zagreb

Analysis of 2D Periodic Structures from an Equivalent Circuit Standpoint
Francisco Mesa¹
¹Universidad de Sevilla

Wave Propagation in Time-modulated Metamaterials
Andrea Alú¹
¹University of Texas Austin

From Artificial Electromagnetic Materials to Metamaterials: Unprecedented Properties for Conceptually New Microwave Devices
Filiberto Bilotti¹
¹University of Rome TRE

Novel Sensors and Chipless-RFID Systems Based on Metamaterials and Symmetry Properties
Ferran Martin¹, Paris Vélez², Cristian Herrojo³
¹Universitat Autònoma de Barcelona

Commercializing Metamaterial Surface Antenna Technology: A Market-Driven Approach
Ryan Stevenson¹
¹KyMETA

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Radioastronomy Instrumentation

Organiser: Luis García Muñoz¹, José López Fernández²
¹Universidad Carlos III de Madrid, ²National Observatory

Radioastronomy instrumentation is a very exciting area where huge interdisciplinary areas must work together.

This workshop aims to bring together astronomers, physicists, and engineers working on detectors and low-noise instruments for the far-infrared/submm/mm wavelength range. It will cover current and future imaging and spectroscopic arrays, both bolometric and heterodyne, for ground-based and space-borne telescopes, the physics of semiconducting and superconducting detectors and readouts, the optimization of long-wavelength optical systems, new developments in coherent receivers and spectrometers, and the design and optimization of components such as optics, filters, and local oscillators. In addition to these component technologies, the conference will examine instrument architectures as well as recent application examples.

This Radiostronomy instrumentation workshop is designed to explore the current and foreseeable state-of-the-art of space telescope and instrumentation programs, concepts and technologies from the near-ultraviolet and visible wavelengths through the infrared and millimeter regions. NASA’s Hubble Space Telescope (HST), the Spitzer Space Telescope, Kepler/K2, and the airborne SOFIA programs are continuing observations and/or reviewing science proposals for new observation cycles. ESA has launched and is collecting data from the Global Astrometric Interferometer for Astrophysics (GAIA), a mission that will compile an astrometric catalogue of ~1 billion stars with a second data release in April 2018.

For this workshop, status reports on projects of all sizes and the science questions that they address are sought, as well as talks addressing topics that include, but are not limited to, the following issues and opportunities: performance requirements; instrumentation (imaging, polarimetric, and spectroscopic); instrument performance; detectors; receiver technologies; signal read-out; optical design; optical components; other associated technologies; observing techniques; emerging concepts.

Finally, the events and studies that will determine the future of space observatories for the next few decades are occurring right now, and the active participation of students is particularly important for this workshop. Students are encouraged to assist addressing both science requirements and technology enablers, conventional and unconventional. Opportunities to reach out to other disciplines and to the public at large are sought to increase understanding of the value of space observatories and consequently their basis of support. We look forward to a vigorous response to this workshop from across the space telescope community.
With the advent of nano-scale CMOS technology, exciting new developments have recently taken place in the field of RF and mm-wave transmitters, receivers and frequency synthesizers. The low-voltage, fast speed, fine feature-size and low cost of the new technology have forever changed the way we design circuits, architectures and systems. Not only the RF/mm-wave circuits have taken different shapes from what has been taught in textbooks but also their integration with digital processors have enabled new possibilities for digital assistance, offering autonomous built-in self-testing and self-calibration. This workshop gives an overview and samples of such latest developments.

Programme

A CMOS 79GHz PMCW Radar SoC
Mark Ingels¹
¹imec

Pushing the Linearity and RF Selectivity of Mixer-First Receivers and N-path Filters
Eric Klumperink¹
¹University Twente

A Wideband Single-PLL Multi-Channel and Multi-Band Car Radio Receiver with High-Resolution DS ADCs
Lucien Breems²
²NXP Semiconductors

28nm FDSOI Technology for 5G Transceiver Integration
Andreia Cathelin¹
¹ST Microelectronics

Recent Advances in Radio ICs for Wireless Cubic-mm Sensor Nodes
David Wentzloff¹
¹University Michigan

Pursuing Hardware Integration for Commercial mmW Cellular Systems
Fredrik Tillman¹
¹Ericsson Research

New System Concepts Towards 5G RFIC’s
Aarno Pärssinen¹
¹University of Oulu

Capacitor-based TX Architectures: from Low-noise to High Power
Pedro Paro Filho¹
¹University College Dublin
The impact of market trends will be described, driving the need for research and equipment to ensure the high level of reliability needed in space. The course will describe the environment in which the equipment operates and give an overview of the necessary provisions made during the design of this equipment. The course will also delineate the main differences in designing SSPAs for ground and for space applications. The applications and possible suggested architectures for such systems will be presented in this workshop with their respective pros and cons.

A challenge in the design of such systems is the characterization and modelling for digital pre-distortion (DPD), since most systems feature a low-frequency (LF) supply modulator input in addition to the RF input. Multi-port vectorial data for such dual-input, single-output (DISO) system with one LF non-50 Ohm port is required for the dynamic characterization necessary for extracting the appropriate shaping function. Some measurement solutions based on alternative hardware for the vectorial receiver and the LF path will be presented in this workshop, as well as novel DPD models optimized for linearization of DISO systems.

A special challenge in modelling poses discrete level supply modulated systems (class-G) with large discontinuous non-linearities, as well as supply modulated systems with digital supply modulators (class-S) where the dynamic supply signal is coded in a pulse-pattern.

Finally, with the novel communication systems operating at much higher frequencies, the technology is directed to smaller integrated transceiver cells, fabricated in short gate length GaN technology. The supply modulator operates in the baseband and is less affected by the RF operational frequency, but in general, the maximum supply voltage of the RF PA drops for short gate length technology, which lowers the expected performance improvement using supply modulation since the possible voltage swing is reduced. Furthermore, short-channel GaN technology is more immature and shows larger trapping effects. In supply modulated systems, the drain lag can have a severe effect depending on the modulation BW and on the type of supply modulation (discrete or continuous modulation). This is also discussed in the workshop.

Programme

Wideband GaN-based Discrete Level Supply Modulated Power Amplifier Systems
Nikolaus Wolff
*FBH Berlin

Efficient Supply-modulated GaN PAs for Wide RF and Instantaneous Bandwidths
Zoya Popovic
*University of Colorado

Modular RF and Baseband Measurement Architectures Enabling Calibrated Multi-port Supply-modulated PAs
Marc Vanden Broecke
*National Instruments

Digital Class-S Supply Modulators for Envelope Tracking
Andreas Wentzel
*Ferdinand-Braun-Institute (FBH)

Three-Port Characterization of Nonlinear Power Amplifiers using a PNA-X Microwave Network Analyzer
Troels Nielsen
*Keysight Technologies

Long-Term Memory Effects in GaN Devices: From Modeling to Compensation
José Carlos Pedro
*Instituto de Telecomunicaciones, DETI, Universidade de Aveiro

Roadmap to Envelope Tracking in L-Band for Space Applications
Natanael Ayllon
*European Space Agency

Welcome & General Introduction to SSPAs
Natanael Ayllon
*European Space Agency

SSPA Architectures & Building Blocks
Iain Davies
*European Space Agency

Semiconductor Technologies for SSPA
Vaclav Valenta
*European Space Agency

Power Amplifier Design Techniques and Architectures for Higher Efficiency
Vaclav Valenta
*European Space Agency

Space Environment and its Influence on SSPA Design
Natanael Ayllon
*European Space Agency

Design Considerations for Reliable Space-borne SSPA Operation
Iain Davies
*European Space Agency

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Iain Davies
*European Space Agency
The ever-increasing demand for high data-traffic expects significant deployment of 5G cellular systems as of 2020. The 5G communication system demands high data rate, up to 10 Gbps, RF or hybrid beamforming, high-density devices for IOT and very dense base-station deployment. These unprecedented demands require new-generation power amplifiers (PAs) operating at higher frequency bands and delivering high linear power with wide-bandwidth and high efficiency, yet at a highly reduced size and cost. Therefore, broadband linear PAs with high efficiency at high PAPR, supporting higher order modulation, is one of the most critical components for a 5G mobile and backhaul system.

In this very timely workshop, we will highlight the recent important trends and the state-of-the-art developments in GaN- (for higher performance) as well as CMOS- (for lower cost) based PA circuits design and linearization to system implementation (with analog and hybrid beamforming) for 5G applications, including those for Ka-, V- and W-band handsets and infrastructure. GaN being the most suitable candidate for mmW performance, a special emphasis will be given on GaN based PA developments on Si as well as SiC semiconductor and linearization (recent advances in software and hardware implementations), covering PAs for large arrays and hybrid sub-six single element. The workshop will present the latest result and compare performance of novel PAs for various circuit and device technologies, and in terms of BW, ACLR/linearity, efficiency with high PAPR, and cost. Further, it will present PAs with circuit topologies including Doherty, out phasing, stacked and envelope tracking for enhanced performance (especially efficiency and bandwidth) at back-off power, to meet the challenging high performance and low cost requirements for 5G deployment.

The speakers are experts and are the leading contributors in both the industrial and academic sectors.
With the potential to break RSA encryption, the promise of perfectly secure communication, and the possibility to solve certain computational problems exponentially faster than anything even conceivable on a classical computer, Quantum Information Technology (QIT) is one of the most compelling (or sensational, depending on your perspective) areas of science and technology now in the public eye. From the perspective of "Groundbreaking Microwave Applications," this proposed one day Short Course is intended as an Introduction to QIT for microwave engineering students, practitioners, and researchers. It introduces the science and applications of QIT to those with little to no background in quantum mechanics, and highlights the essential role of microwaves and significant opportunities for further microwave engineering contributions to the burgeoning new field of quantum engineering.

The course begins with a high-level overview of QIT including quantum computation, quantum communication, quantum sensing, and quantum cryptography. The basic physical principles of QIT, from qubits (quantum bits) to quantum algorithms, and challenges to realization, are introduced next. The course focuses on several specific technologies of practical importance where microwaves play a critical role. Quantum engineering of superconducting qubits is covered from the perspectives of control, extensibility, measurement, and the quantum states of microwave light. Advanced, scalable, microwave electronics and software tools are presented that can address the significant challenges of classical control of multiple qubits, including preparation, programming, and readout of quantum computers. Silicon-based quantum technologies are presented, where microwaves are used to control the electron spin, THz pulses control orbital angular momentum, and information manipulation and read-out is based on principles similar to microwave-based nuclear magnetic resonance. The role of cryogenic CMOS (Cryo-CMOS) circuits and systems for scalable quantum computing, operating down to 4K, is highlighted and shown to provide integration levels that may be needed to go from today's small number (~10) qubits to thousands of qubits as may be needed for the realization of practical quantum algorithms.

High-speed signaling is the critical enabler of multi-gigabit data transfer rates that are essential for today's communications. The true challenges, however, are the physical limitations of the channel (in board, package, and connector), the transceiver circuits, as well as the voltage and timing noises introduced along the signal paths. Accurate design of high-speed digital systems requires a good understanding of the physical effects and system architecture. Modeling and analysis capabilities, based on a sound microwave background, are needed to analyze and optimize the design of the channel, and of the transmitter and receiver subsystems. This tutorial provides an overview of the basic concepts and of the strategies that can be used to successfully design high-speed systems.

Topics covered in this tutorial include the most important issues of Signal Integrity, like single ended and differential signal propagation from the transmitter to the receiver, including problems such as impedance control, discontinuities, reflections, losses, topology, terminations, ISI, jitter, eye diagrams, crosstalk and ground bounce. The issues associated with supplying low noise DC voltages to the active devices, aka Power integrity, are also addressed, due to their critical influence on the design performance. This includes the interconnects behavior in the power distribution network (PDN), the effects of decoupling capacitances, package lead inductance, multiple plane cavities and parallel resonance structures and interactions in the entire PDN.
Filters and Multiplexers

Classical and Novel Synthesis Methods for Filters and Multiplexers

Organiser: Vicente Boria¹, Giuseppe Macchiarella², Petronilo Martin-Iglesias³
¹Technical University of Valencia, ²Politecnico di Milano, ³ESTEC (European Space Agency)

Over the past decade, there has been a spectacular increase in demand for cellular communication and satellite-based services. This has been the singular reason in pushing the state-of-the-art of wireless systems to achieve even higher communication capacity within the constraints of the available frequency spectrum. Therefore, frequency allocations are regarded as a natural resource. Filters and multiplexing networks play a critical role in maximizing the effective use of the available bandwidth to achieve the highest capacity for a diverse range of traffic scenarios, and are deemed as critical elements of these communication systems.

This short-course is designed to give the attendees a system overview and tradeoffs for microwave filtering requirements in satellite communication systems. This is followed by a critical review of classical and modern synthesis techniques, either using lumped element parameters, circuit models and/or coupled-mode theory, with special emphasis on different filter performances (e.g., single- and multi-band responses), duplexer and multiplexers. The next step in filter design is the realization of the physical dimensions of the filter from the circuit model and the required coupling coefficients. This topic is dealt with: (i) a brief overview of the classical techniques based on circuit models of the physical structures and (ii) an extensive and in depth review of modern techniques based on EM modelling. A number of examples will be shown to illustrate the filter tradeoffs and realization of different filtering and multiplexing networks.

This short course introduces students to the science and art of RF/Microwave filter design. Students taking this course should be familiar with fundamental RF concepts, such as impedance matching, transmission line theory, and scattering parameters. Previous exposure to filter design is helpful but not required. The course starts by introducing students to the importance of RF filters in current high-frequency applications, followed by the fundamentals of filter design. It subsequently introduces students to the coupling-matrix-based design theory, followed by many practical synthesis examples. Without sacrificing mathematical rigor, the course emphasizes the practical step-by-step design process. Relevant MatlabTM scripts will also be provided to students as a guideline so they can perform their own designs. Students will be able to design complex transfer-function filters (e.g., multi-band, filter cascades) that go beyond traditional textbook-style filter examples. In addition, several planar and three dimensional filter developments will be presented as supporting practical examples. The course will also include many advanced practically-important topics including: high-quality resonator technologies, reconfigurable filter architectures and technologies, acoustic-wave-based filter design, and high-power reconfigurable filters. We will conclude by providing examples of the most successful reconfigurable filter architectures that exploit the aforementioned techniques to realize adaptive-transfer-function filters. Students who complete this course will be able to understand basic and advanced filter concepts as well as comprehend the state-of-the-art designs published in recent technical literature.
**Programme**

**On the Calibration of Multi-Antenna Arrays**
Thomas Eriksson¹
¹Chalmers University of Technology

**Prediction and Compensation of PA Linearity and Efficiency in MIMO Scenarios**
Filipe M. Barradas²
²University of Aveiro / Instituto de Telecomunicações

**Low Complexity DPD for 5G Massive MIMO**
Wenhua Chen³
³Tsinghua University

**Linearization Technique in 5G Massive MIMO Array**
Chao Yu¹
¹Southeast University

**Model Order Reduction Techniques for Digital Predistortion**
Pere L. Gilabert¹
¹Universitat Politècnica de Catalunya

**Re-development of DPD for 5G Wireless Transmitters**
Anding Zhu¹
¹University College Dublin

**Stochastic Modeling to Understand Dirty MIMO Transmitters**
Wenhua Chen¹
¹University of Gävle, KTH Royal Institute of Technology

**Introduction to High Power RF Breakdown Effects and PIM**
David Raboso García-Baquero¹
¹European Space Agency

**Secondary Electron Emission Yield in Multipactor Breakdown**
Mohamed Belhaaj¹
¹ONERA

**High Power Breakdown in Dielectrics and Ferrites**
John Pett²
²Honeywell Aerospace

**Additive Manufacturing for High Power Applications**
Petronilo Martín-Iglesias³, Isabel Montero²
²ESTEC (European Space Agency), ³ICMM-CSIC

**Multipactor Simulations with Arbitrary Geometries and Waveforms**
Carlos Vicente³
³Aurora Software and Testing, Dassault Systemes

**Signal Management in High Power Modulated Testing**
Oscar Monerris²
²Val Space Consortium

**Passive Intermodulation Measurement and Extension to Multicarrier Scenarios**
Davide Smacchia³
³Val Space Consortium

**Towards a New Regulatory Consensus (New ECSS Standard on Multipaction)**
Jérôme Puech¹
¹Centre National d’Études Spatiales (CNES)
This workshop aims to present the state-of-the-art for microwave filter design and where is needed. This is forcing the satellite manufacturers to move to flexible architectures (active antennas, beam hopping, digital processors, etc.). This new ecosystem where shorter lead times, lowers cost, additional flexibility, new payload architectures among others, are forcing the filter manufacturers to be highly innovative. Additionally, new market opportunities also comes with new players.

This workshop aims to present the state-of-the-art for microwave filter design and manufacturing, but also aims to create an adequate forum for the discussion regarding the current market situation and perspective.

**Programme**

**Recent Advances in RF/microwave Filters for Space Application**

Organiser: Santiago Sobrino Arias¹, Petronilo Martín-Iglesias²

¹Thales Alenia Space Spain, ²ESTEC (European Space Agency)

Filters and multiplexers are key building blocks in science, navigation, and earth observation and telecommunication applications. However, it is in the telecommunication systems where filter specifications are specially demanding due to accommodation issues, power handling, RF performance and cost among others. In the last years, telecommunication system requirements have evolved very fast due to the increase in traffic demand.

Congestion in lower (and traditional) frequency bands have forced the operators to move to high frequencies (Ka-, Q-, V) and they are already thinking about higher frequencies such as W-band.

However, the satellite resources (power, space) are limited and a good management of all of them will help the satellite operators to cover the traffic demand when and where is needed. This is forcing the satellite manufacturers to move to flexible architectures (active antennas, beam hopping, digital processors, etc.).

This new ecosystem where shorter lead times, lowers cost, additional flexibility, new payload architectures among others, are forcing the filter manufacturers to be highly innovative. Additionally, new market opportunities also comes with new players.

This workshop aims to present the state-of-the-art for microwave filter design and manufacturing, but also aims to create an adequate forum for the discussion regarding the current market situation and perspective.

**Substrate Integration Technologies and Applications**

Organiser: Maurizio Bozzi¹, Ke Wu²

¹University of Pavia, ²Ecole Polytechnique de Montreal

The evolution of microwave and RF technology towards the needs of the Internet of Things (IoT) and the fifth generation of mobile communication (5G) requires innovative technologies for the development and integration of the wireless systems. Substrate integrated waveguide technology represents a viable solution for the integration of complete systems at microwave and millimeter waves. This workshop will cover a variety of topics related to substrate integration technologies and their current and future applications.

With worldwide known experts in the field, the workshop will provide the attendees with a complete view on the current scenario of the substrate integrated waveguide technology. The speakers have been selected to guarantee a good balance between industrial and academic contributions and a reasonable geographical distribution, with contributions from Europe, America, and Asia. The proposed topics cover in a coherent way both different applications (ranging from radars to radio-astronomy) and innovative technological solutions (from miniaturized filters to air-filled structure).

The full-day workshop comprises nine presentations and a complete session (1 hour and 40 minutes) for the panel discussion, involving the speakers, the organizers, and the attendees.

**Programme**

**The State-of-the-Art of Substrate Integration Technology**

Ke Wu²

¹Ecole Polytechnique de Montreal

**Applications of SIW Technologies to Photonics and Microwaves**

Renato Lombardi¹, Valentina Verri¹, Maurizio Mattivi¹, Alberto Rampulla¹

¹Huawei Italy
Due to rapid advances in radar techniques, high frequency electronics, wireless communication, and integration of microfluidics and microsensors in RF devices, microwave technologies have become readily available for uses in biomedical applications. Utilization of electromagnetic techniques for biological interaction and effects has enabled a dramatic paradigm shift in medicine and science. Particularly, these techniques make it possible for new noninvasive and continuous sensing methods that potentially can create novel clinical tools and understanding of diseases.

This workshop includes state-of-the-art reports on RF, microwave, and millimeter-wave technologies in clinical applications and biology studies by pioneering experts in the fields. These applications include radio frequency sensors for individual cells and physiological monitoring. The research scopes presented are truly multidisciplinary and broad. With the evident increase of research activities and progresses, the workshop aims to provide a platform to present stimulating information and inspire microwave engineers to explore new applications.

Programme

**Ultra-wideband Impedance Spectroscopy of Live Biological Cells**
James C. M. Hwang¹
¹Lehigh University

**Microwave Dielectric Spectroscopy as an Analytic and Label Free Technique for Molecular and Cellular Sensing**
Katia Grenier¹, David Dubuc¹
¹LAAS-CNRS

**In Vitro and in Vivo Applicators for Pico- and Nanopulses Electric Fields Require RF-design Structures: an Overview**
Micaela Liberti¹, Caterina Merla¹, Francesca Apollonio¹
¹University of Rome

**Exploiting Short-range Multi-mode Continuous-wave Radar Architectures in Biomedical Applications**
Roberto Gomez-Garcia¹
¹University of Alcala, Madrid

**Electromagnetic Sensors for the Detection of African Trypanosomiasis using RNA Aptamer Derivatized Surfaces**
Christian Damm¹
¹Ulm University

**Microwave Non-invasive Blood Glucose Monitoring for People with Diabetes: Potential and Challenges**
Heungjae Choi¹
¹Cardiff University
Automotive radar at 77 GHz is in production and on our roads since 1998; only recently the production numbers have exploded. Currently, we have around 120 million radar systems on our streets worldwide. Two of the big 4 – Bosch and Conti – are delivering about 5 million. Radar sets each per year. VALEO presented a 77 GHz radar sensor based on LTCC for mass production at the recent EuMWeek 2017 in Nuremberg.

Up-to-now OEMs just sell their cars – and that’s it.

In the future, we will need maintenance facilities at the dealership of the different OEMs as well as certifications; otherwise, automotive radar cannot be part of a safety system. A 77 GHz sensor already on the road for 100,000 km or being nearly 10 years old must still be able to perform faultlessly! AEB (Automated Emergency Braking) Systems for trucks and sedans have already become an important economic issue – especially under insurance considerations.

Quo Vadis - ADAS and HAD? – Market, measurement and society-wise. These future directions will be reviewed and discussed in this workshop being described here.
Current research on wireless radiofrequency (RF) and Microwave systems often makes unphysical simplifying assumptions and treats the associated signal-processing and electromagnetic (EM) analyses independently, resulting in the improper inclusion of the underlying physics (EM theory) of such systems and consequently leading to inaccurate and erroneous performance predictions of various microwave systems. To achieve accurate modeling and predictions, EM theory and signal processing must be intelligently merged. Examples of such errors commonly appear in both fields: not including the platform on which an antenna is mounted leads to completely erroneous predictions of antenna coverage, a serious issue for designing relevant antennas for RF systems; optimizing transmitted waveforms without including proper differentiability requirements imposed by Maxwellian electromagnetics yields inaccurate and physically unrealizable waveforms. This presentation will also discuss the different concepts of channel capacity and their implications and the antenna and its relationship to the Maximum Power Transfer Theorem. Although the discussion addresses communication systems, much of it is applicable to non-communication systems. A future of improved performance and better spectral harmony requires coding at RF for microwave transmission and receive systems, initially envisioned by Shannon and subsequently investigated by Viterbi, which is similar to the coding in GPS and satellite communication. Such a methodology can also be carried out in radar, where, for example, a radar can transmit coded waveforms, such as a Barker code, to increase detection capabilities. In summary, the objective of this workshop will be to illustrate that certain issues need to be factored into the design of microwave radiofrequency systems (communication, radar, navigation, countermeasures, etc.). For example, the exclusive use of communication principles in the design of the physical layer of such systems may not be sufficient in the proper design of a microwave system. Three specific topics will be treated in detail: the different concepts of channel capacity and their implications; the antenna and its relationship to the Maximum Power Transfer Theorem and the S-parameters used in conventional Microwave system design and, ultra wideband (UWB) wireless transmission of microwave signals without any distortion. Examples will be presented to illustrate these issues.
THz Applications: Present and Future

Organiser: Israel Arnedo¹, Albert Redo-Sanchez²
¹Public University of Navarre, ²das-Nano S.L.

The terahertz frequency range can be defined as the band of the electromagnetic spectrum centered at 1THz. Thus, the rule of factor 10 expands the frequency range from 0.1 THz to 10 THz. The so-called THz range lies in the gap between the microwave and the infrared bands. The combination of the technologies used in these two frequency ranges has been applied during the last decade to develop successful application oriented THz systems.

This workshop covers two fundamental aspects of the THz field. On one hand, the differences between THz generators/receivers consist of radiation sources, detectors, passive/active components, and transmission technologies will characterize their pros and cons. Indeed, the availability of commercial THz generators/receivers (with all the components needed to perform its correct operation) is quite modern. Hence, in the first part of the workshop our top-recognized speakers will present an overview of the commercial THz generators/receivers along with its fundamental physical insight. On the other hand, due to the fact that the THz band is the last region of the electromagnetic spectrum technologically conquered (from RF to optics should be understood) many unsolved industrial problems have tried to be figured out with THz waves. Thus, in the second part of the workshop, a multitude of thriving applications in many fields will be presented: communication, biology, medicine, astrophysics, security, material detection, non-destructive evaluation, etc.

The historical perspective, the current state-of-the-art and the future perspective of both THz generators/receivers and THz applications are covered in this workshop being a great opportunity for beginners in the field but also for experts who want to expand their scope of knowledge in a really broad sense.

Programme

Introduction to THz and their Applications
Israel Arnedo¹
¹Public University of Navarre

Fundamentals of THz Generation
Bjorn Globisch¹
¹Fraunhofer Heinrich Hertz Institute

Fundamentals of THz Generation
Javier Tejada¹
¹Universidad de Barcelona

Available Current Instrumentation for THz
Joachim Jonuscheit¹, Fabian Friederich¹
¹Fraunhofer Institute for Industrial Mathematics ITWM

Future Trends in THz Instrumentation
Ole Peters¹, Milan Öri¹
¹Menlo Systems GmbH

THz Applications in Pharmaceutics and Medicine
Phil Taday¹
¹Teraview

THz Applications in Automotive and Wind-power Industry
Albert Redo-Sanchez¹
¹das-Nano S.L.

THz Rays for the Graphene Industry
Peter Uhd Jepsen¹
¹Technical University of Denmark

THz Rays for Art and Object Conservation
Enrique Castro-Camús¹
¹Centro de Investigaciones en Óptica A.C. Mexico

Future THz Applications
Jan Balzer¹
¹Faculty of Engineering, University Duisburg-Essen

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In recent years, wearable electronics has gained a great research interest, with applications that range from health-care monitoring, to public safety and mobile computing. The design and fabrication of wearable electronics require that the embedding of electronic components inside clothes and/or other wearable accessories must not compromise the appearance and usability of the product. Additionally, it must not be intrusive to the user, who must be able to carry out his daily activities without any movement limitation and/or additional burden.

One of the crucial aspects which complicate the design of a wearable device is the need to use dedicate materials, such as conductive threads or textiles, able to guarantee a seamless integration into wearable accessories.

Another issue is related to the need of operating on or in the proximity of the human body; in fact, for most devices (consider the case of a dipole antenna) the performance is strongly affected by the operation in the proximity of the human tissues that should be taken into account during the design process.

Additionally, when a device is intended for wearable applications, a key role is played by the variability of the operating conditions in terms of parameters such as geometry and surface application materials.

All the above considerations suggest that the best strategy for developing high-added value wearable devices consists in adopting an application-centered design approach, where the materials, the design and the fabrication technique are selected taking into account the constraints of the specific application of interest.

Accordingly, the contributions of this workshop will illustrate different possible approaches for the development of performing and robust wearable devices; the main problems to be solved for developing non-intrusive and comfortable wearable devices and systems will be addressed.
The Doherty Power Amplifier (DPA) was invented in 1936 by W.H. Doherty, a very brilliant engineer working on the development of high efficiency radio transmitters for transoceanic communications, at American Telegraph and Telephone Company Long Lines Department in Boston. The ability of the DPA of operating at high efficiency at significant output power back-off has led the RF and microwave community to re-discover its concept and adapt it to the requirements of modern high frequency transmitters. In particular, the DPA has had a huge success in the mobile base-stations market, where in combination with powerful digital linearizers, has become the de-facto standard HPA configuration. This workshop aims to present and describe all the aspects related with this architecture, starting from the basic idea up to more advanced and state-of-the-art results and guidelines. The DPA historical aspect is also covered describing the time-line of its evolution, highlighting why, more than 80 years after its invention, this architecture is still on the wave to realize very advanced power amplifier stages for modern wireless systems. The limitations of the original DPA architecture are put into evidence and the proposed solutions aiming to improve its performances in terms of efficiency, gain and bandwidth will be presented and commented. To this purpose, the integration of the DPA architecture with high efficiency power amplifier classes, some solutions to improve the output power back-off, and several advantage solutions to improve its frequency response will be described.

Both Silicon and compound based solutions will be presented and both hybrid and monolithic examples will be shown and commented. Finally, the usefulness of the DPA architecture in space application will be addressed by the European Space Agency and a Ka-band Doherty HPA MMIC will be presented as example.

**Programme**

**Doherty Standard Architecture and its Limitations**
Rocco Giofrè¹  
¹University of Roma Tor Vergata

**Optimized Design of Doherty Amplifier with Transistors**
Bumman Kim¹  
¹Pohang University of Science and Technology

**State of the Art and Present Trends of Doherty PAs**
Marco Pirola¹  
¹Politecnico di Torino

**Technologies and Architectures for Space-borne High-efficiency HPAs**
Vaclav Valenta¹  
¹European Space Agency

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**WTh-06 (EuMC)**

**Doherty Legacy: From Invention to Revival**

Organiser: Rocco Giofrè¹, Paolo Colantonio¹  
¹University of Roma Tor Vergata

The Doherty Power Amplifier (DPA) was invented in 1936 by W.H. Doherty, a very brilliant engineer working on the development of high efficiency radio transmitters for transoceanic communications, at American Telegraph and Telephone Company Long Lines Department in Boston. The ability of the DPA of operating at high efficiency at significant output power back-off has led the RF and microwave community to re-discover its concept and adapt it to the requirements of modern high frequency transmitters. In particular, the DPA has had a huge success in the mobile base-stations market, where in combination with powerful digital linearizers, has become the de-facto standard HPA configuration. This workshop aims to present and describe all the aspects related with this architecture, starting from the basic idea up to more advanced and state-of-the-art results and guidelines. The DPA historical aspect is also covered describing the time-line of its evolution, highlighting why, more than 80 years after its invention, this architecture is still on the wave to realize very advanced power amplifier stages for modern wireless systems. The limitations of the original DPA architecture are put into evidence and the proposed solutions aiming to improve its performances in terms of efficiency, gain and bandwidth will be presented and commented. To this purpose, the integration of the DPA architecture with high efficiency power amplifier classes, some solutions to improve the output power back-off, and several advantage solutions to improve its frequency response will be described.

Both Silicon and compound based solutions will be presented and both hybrid and monolithic examples will be shown and commented. Finally, the usefulness of the DPA architecture in space application will be addressed by the European Space Agency and a Ka-band Doherty HPA MMIC will be presented as example.

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**WTh-03 (EuRAD)**

**Millimeter-wave Radar for Industrial and Consumer Applications**

Organiser: Christian Waldschmidt¹, Nils Pohl²  
¹Ulm University, ²Ruhr University Bochum

A decade ago, Millimeter-wave Radar showed potentials in many applications, but during that time, the realization was based on very expensive niche technologies. Due to the improvements if integrated silicon technologies, during the last decade the integration of Radar-on-chip operating at these frequencies became possible and led to compact and cheap radar sensors. Therefore, Millimeter-wave Radar found its way to a mass-market solution in automotive Radar, as well as in various industrial and consumer applications.

This workshop will cover the full scope starting from the used technologies and circuits in SiGe and CMOS, coming to system realization and finally showing the requirements and potentials of diverse applications, like tank level probing radar, industrial production control, Radars for UAVs and security aspects.
In recent years, the number of frequency users has increased continuously and this trend is ongoing for several reasons: With the unbroken demand for more digital bandwidth, the evolution of communication technology towards 5G requires more radio frequency (RF) bandwidth and more frequency users are active in all bands (1-6 GHz and in the future mm-wave). New radars arise from new operational needs (e.g. sense & avoid radars, hostile fire indication, multifunctional systems). In addition, new requirements for radars, such as a better resolution in range, result in higher demand for RF bandwidth. Reliability and immunity to interference becomes more and more important. Especially in the automotive area, where the number of cars equipped with radar sensors is constantly increasing, automated driving requires a new level of reliability.

Coexistence by spectral separation is not realistic anymore in this crowded environment, as frequency spectrum is finite and rare. Caused by the dense packing of frequency channels, interference from adjacent frequencies increases and new technologies for interference mitigation become necessary. The coordination of frequency allocation is getting more and more important between technologies and beyond borders, for communication as well as for radar. Frequency users and interferers today are commonly mobile, so that a spatial separation cannot be ensured.

The aim of this workshop is to present the experiences related to coexistence and interference of different spectrum users from the fields of radar (automotive and surveillance) and communications. Technologies that allow coexistence without interference as well as intelligent frequency sharing concepts are discussed.
The amount of new applications based on millimeter-wave radar sensors is continuously growing. The radar sensors are used extensively almost everywhere to make daily life more comfortable. Particularly driven by the advance of the Internet of Things (IoT), autonomously driving cars and Industry 4.0, the amount of radar sensors and their networks is fast growing, promising radar chipset to reach mass volume market in the near future. Driven by the demand for module size reduction, the operating frequencies of the radar modules keep on increasing, as one can integrate antennas in package and reduce the chip size. However, higher frequencies also pose challenge on circuit level realization, due to limitations of the technology.

Hence, in this half-day workshop we will address several emerging radar applications for consumer, industrial and automotive electronics, operating at higher mm-wave frequencies. Each talk will address the system architecture, the performance requirements translated into specification of circuit blocks and considerations during circuit design. Additionally, each application will be described in detail from the system point of view.

Hence, the main idea of the workshop is to cover the full range of the design considerations for radar applications at mm-wave frequencies starting from the circuit design, to system specification, to system architecture and to the final target application. The applications themselves are novel and emerging radar applications with mass-market potential.

In this workshop, the first talk focusses on circuits and system for novel radar-based 140 GHz sensors for people tracking and vital signs detection. Next, modulated mm-wave MIMO radar at 77GHz is discussed both on system level, as well as on circuit design level, for secure resilient to interferences autonomous driving. Next, 3D high-differentiation mm-Wave Radar Systems for Emerging IoT Applications are discussed. Further, 61 GHz transceivers are presented and discussed for the application of Touch-Free Industrial Vibration Monitoring System. Next, NXP Semiconductor presents their newest development on automotive 77 GHz radar sensor networks and considerations on the suitable semiconductor technology. Finally, Infineon discusses 60 GHz and 120 GHz radar chipsets and systems for gesture sensing and additional consumer and industrial applications.

In this workshop we have a good mixture of industry (Infineon, NXP, Uhnder) and research institutes/academia (imec, IHP, TU Cottbus). As well, the contributions are from three different countries (Belgium, USA and Germany) by highly recognized speakers in the field of radar circuits and systems.
Multi-beam Antennas (MBAs) find application in several fields, including wireless and satellite communications, RADARs for electronic surveillance and remote sensing, science (e.g. radio telescopes), RF navigation systems, etc.

Beam-Forming Networks (BFNs) play an essential role in any antenna system relaying on a set of radiating elements to generate a beam. Depending mainly on the antenna mission (i.e. operational frequency, pattern requirements, transmitting and/or receiving functionality, number of beams to be generated, etc.) different MBA architectures may be selected: from antenna systems completely based on independent feeds illuminating a number of reflectors, to hybrid systems based on both arrays and reflectors, from phased arrays to lens antennas.

The trade-off on the antenna solution largely involves the BFN interconnectivity and flexibility requirements, with a wide range of applicable BFN architectures with different complexity and performance.

The objective of the course is to present design principles and state-of-the-art in MBAs and BFNs.

The course presents design principles and state-of-the-art in MBAs and BFNs covering both theoretical and practical aspects. The covered topics include:

- Overview of Multi-beam Antennas and system requirements.
  - Satellite Communication Systems;
  - Wireless Communications;
  - RADARs.
- Multi-beam Array Antennas
  - Linear and Planar Direct Radiating Arrays (based on Periodic or Aperiodic lattices)
  - Reflector-based architectures (Single-Feed-per-Beam, Multiple-Feed-per-Beam)
  - Lens-based architectures (free space and constrained)
- Analog Beam-forming Networks
  - Corporate divider/combiners;
  - Blass and Nolen matrices;
  - Butler matrices.
- Digital Beam-forming Networks
- Overview of some Operational Multi-beam Antennas/BNFs
  - MBAs for Spaceborne Narrowband and Broadband Satellite Communication Systems
  - MBAs for Wireless Communications
- On-going European Developments and Current Design and Technological Challenges

Part I of the Course
Piero Angeletti¹
¹European Space Agency

Part II of the Course
Giovanni Toso¹
¹European Space Agency
WF-02 (EuMC)
Modern Trends in Terahertz Electronics and Systems

Organiser: Jan Stake¹, Heinz-Wilhelm Hübers²
¹Chalmers University of Technology, ²Deutsches Zentrum für Luft- und Raumfahrt

Submillimeter wave radiation (0.1-1 mm) or radiation in the terahertz frequency range (0.3-10 THz) occurs between the short wavelength of infrared light and the long wavelength limit of radio waves, which represents the area of the electromagnetic spectrum where optical and microwave techniques meet. In this frequency range, electromagnetic waves are difficult to generate ("THz-gap"), explaining why this region has been uncharted for decades. However, the recent development of advance terahertz systems and terahertz sources, mainly driven by space applications, has opened up new possibilities also for high-speed wireless communication and remote sensing for a wide range of applications at terahertz frequencies. With the goal to expand the use of the electromagnetic spectrum and close the terahertz gap, the workshop aims to discuss latest trends in terahertz applications with a focus on recent progress in terahertz electronics. The workshop offers a number of selected talks by renowned international experts, covering topics from basic research on components to new applications and THz-systems.

### Programme

**Integrated THz Electronics in SiGe BiCMOS Technology**
Dietmar Kissinger¹
¹Technical University Berlin / IHP, Frankfurt (Oder)

**THz MMIC for Signal Generation and Reception**
Viktor Krozer¹
¹FBH

**THz Radar**
Tomas Bryllert¹
¹Chalmers University of Technology

**Development of Solid State THz Transceivers for Test and Measurement Applications**
Jeffrey Hesler¹
¹Virginia diodes, Inc.

**An Integrated-Circuit Approach to Terahertz Nearfield Imaging**
Ulrich R. Pfeiffer¹
¹University of Wuppertal, Wuppertal

**THz Detection with Integrated FETs towards a THz Camera**
Hartmut Roskos¹
¹GOETHE, Frankfurt

**THz Sensing using Resonant Tunneling Diode Oscillator**
Safumi Suzuki¹
¹Tokyo Institute of Technology

**THz HEMT MMICs**
William Deal¹
¹Northrop Grumman

**Terahertz Instrumentation based on Heterogeneous Integration and Silicon Micromachining**
Bobby Weikle¹
¹UVa

**THz Integrated Circuits**
Goutam Chattopadhyay¹
¹JPL
WF-03 (EuMC)

Tunable/Reconfigurable Filters and Multiplexers for Multi-Band Applications

Organiser: Roberto Gomez-Garcia¹, Holger Maune²
¹University of Alcala, Madrid, ²Technical University of Darmstadt, Darmstadt

Modern trends for the development of multi-mode/multi-standard wireless communication and remote-sensing systems demand the development of highly adaptable RF electronics for their RF front ends. Reconfigurable filters and multiplexers are among the key devices in this scenario to carry out the dynamic signal-preselection task demanded by these upcoming highly versatile RF systems. However, several challenges need to be overcome before their practical employment in real applications. Among them, enabling very-high levels of transfer-function adaptivity for different technologies (e.g., planar, integrated, and 3-D), the conception of new tuning principles and materials for high-power operation in linearity regimes, the implementation of robust automatic-tuning mechanisms, and even the incorporation of advanced features such as power dependent/activated behavior for dynamic-range preservation and interference protection.

The purpose of this workshop is to present the latest advances in the exciting area of adaptive microwave filtering components for multi-band RF systems from the academia, national laboratories, and industry. Specifically, new reconfigurable filter structures in planar technologies and their system implications are presented. Tunable filtering devices in integrated circuits based of signal-interference and N-path schemes are also described, as well as frequency-selective limiters and power-dependent/activated filters and multiplexers suitable for interference congested EM environments. Advanced tuning materials (e.g., ferrofluidic and liquid-metal) and real-time monitoring and control mechanisms for notch- and bandpass-type filters are also expounded. Furthermore, high-performance reconfigurable 3-D filters and multiplexers in substrate-integrated and classic waveguide/cavity implementations for satellite communications are also covered on this workshop.

Programme

Design and Tuning of Reconfigurable Microwave Filters
Christian Schuster¹, Holger Maune¹
¹Technical University of Darmstadt, Darmstadt

Reflectionless and Highly-Reconfigurable Filtering Devices with Static Couplings
Roberto Gomez-Garcia¹, Dimitra Psychogiou²
¹University of Alcala, Madrid, ²University of Colorado, Boulder

Multi-Band and Reconfigurable Filters: From Hybrid Technologies to Silicon Integration
Julien Lintignat¹
¹University of Limoges, Limoges

Frequency-Selective Limiters and Tunable RF-Power-Activated Filters for Interference Protection in Wireless Systems
Eric J. Naglich¹
¹Naval Research Laboratory, DC

Reconfigurable and Switchable Filters using Ferrofluidic and Liquid-Metal Actuation
Hjalti H. Sigmarsson¹
¹University of Oklahoma, OK

Automatically-Tuned Bandpass and Notch-Type Filters
Dimitrios Peroulis¹
¹Purdue University, West Lafayette

Space Qualification on Frequency and Bandwidth Tunable Filters and Multiplexers
Christian Arnold¹
¹Tesat Spacecom, Backnang

Advanced Reconfigurable OMUX/DEMUX Design with Flexible Channel-Bandwidth Reallocations
Petronilo Martin-Iglesias¹, Uwe Rosenberg²
¹ESTEC (European Space Agency), ²Mician Global Engineering GbR, Bremen
WORKSHOPS AND SHORT COURSES - FRIDAY

WF-04 (EuRAD)
Future Automotive Radar towards Autonomous Driving

Organiser: Jürgen Hasch¹, Christian Waldschmidt²
¹Bosch GmbH, Stuttgart, ²Ulm University

Autonomous driving and the electric car are the two hottest topics in the automotive industry today. With announcements of new field tests for electrified and autonomous vehicles nearly every day, these topics are present in the news all over the world. Still, there are significant challenges to the realization of the vision of fully autonomous driving. Especially, the correct and reliable perception of the environment using sensors plays a key role in providing safe and reliable autonomous driving. Radar plays a crucial part here.

The workshop will present the state-of-the-art in automotive radar, providing an overview of state-of-the-art sensors, technological realization, and sensor information processing using advanced signal processing and machine learning techniques. The key issues and challenges still present in today’s radars will be discussed, and an outlook on what future radar sensors will be able to accomplish will be given.

WF-05 (EuMC)
Advances Toward Autonomous RF Filter Design

Organiser: Wesley N. Allen¹, Dimitra Psychogiou²
¹Purdue University, Indiana, ²University of Colorado, Boulder

Historically, the design of RF filters has been viewed as a combination of science, experience, and art. However, over the past decades significant advances in computational capabilities have led to the widespread adoption of computer-aided design tools from the circuit to the 3D multi-physics level that assist and provide new insights to the designer or engineer. In parallel, developments in synthesis procedures, optimization approaches, and machine learning have led to high impact results in areas such as filter coupling matrix synthesis and the application of space mapping and neural networks to the RF filter domain.

While the marriage of these paths has pushed the field closer toward autonomous design, challenges remain in computational efficiency, particularly when dealing with complex systems. In this workshop, area experts from academia and industry will present the most recent advances, remaining challenges, and ultimate limitations in the road toward fully-autonomous RF filter design.

Programme

WF-04 (EuRAD)
Future Automotive Radar towards Autonomous Driving

Organiser: Jürgen Hasch¹, Christian Waldschmidt²
¹Bosch GmbH, Stuttgart, ²Ulm University

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WF-05 (EuMC)
Advances Toward Autonomous RF Filter Design

Organiser: Wesley N. Allen¹, Dimitra Psychogiou²
¹Purdue University, Indiana, ²University of Colorado, Boulder

Historically, the design of RF filters has been viewed as a combination of science, experience, and art. However, over the past decades significant advances in computational capabilities have led to the widespread adoption of computer-aided design tools from the circuit to the 3D multi-physics level that assist and provide new insights to the designer or engineer. In parallel, developments in synthesis procedures, optimization approaches, and machine learning have led to high impact results in areas such as filter coupling matrix synthesis and the application of space mapping and neural networks to the RF filter domain.

While the marriage of these paths has pushed the field closer toward autonomous design, challenges remain in computational efficiency, particularly when dealing with complex systems. In this workshop, area experts from academia and industry will present the most recent advances, remaining challenges, and ultimate limitations in the road toward fully-autonomous RF filter design.

Programme

WF-04 (EuRAD)
Future Automotive Radar towards Autonomous Driving

Organiser: Jürgen Hasch¹, Christian Waldschmidt²
¹Bosch GmbH, Stuttgart, ²Ulm University

Autonomous driving and the electric car are the two hottest topics in the automotive industry today. With announcements of new field tests for electrified and autonomous vehicles nearly every day, these topics are present in the news all over the world. Still, there are significant challenges to the realization of the vision of fully autonomous driving. Especially, the correct and reliable perception of the environment using sensors plays a key role in providing safe and reliable autonomous driving. Radar plays a crucial part here.

The workshop will present the state-of-the-art in automotive radar, providing an overview of state-of-the-art sensors, technological realization, and sensor information processing using advanced signal processing and machine learning techniques. The key issues and challenges still present in today’s radars will be discussed, and an outlook on what future radar sensors will be able to accomplish will be given.

WF-05 (EuMC)
Advances Toward Autonomous RF Filter Design

Organiser: Wesley N. Allen¹, Dimitra Psychogiou²
¹Purdue University, Indiana, ²University of Colorado, Boulder

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WF-06 (EuMC)
Advanced Solutions for Near-field and Far-field Wireless Charging

Organiser: Alessandra Costanzo¹, Diego Masotti¹
¹University of Bologna

Many researchers are currently focusing their activities on the challenging task of wireless recharging the inexpensive and wherever distributed computing devices, representing the so-called “pervasive intelligence”. This full-day workshop is aimed at providing an overview of the most recent promising approaches that enable to reach both the near- and the far-field Wireless Power Transfer performances. Signal, circuit and system design solutions will be considered and their possible integration will be discussed. Engineering requirements and design challenges for making wireless power a reliable solution for pervasive distributed sensors are deeply investigated.

The investigation will be carried out in a twofold manner: (i) from the RF source point of view, by properly synthesizing the transferred signal shape for RF-to-dc efficiency maximization (e.g. multi-sine or delayed-pulsed signals) or by resorting to advanced radiating architectures, such as leaky-wave antennas, and to specific optimization rules in their design; (ii) from the receiving antenna/coil point of view, by considering realistic and unconventional scenarios (e.g. sliding coils).

All the talks will be enriched with the most recent results on the prototyping and experimentation, in the wide range of areas covered by the workshop spanning sensors and devices, RF design for wireless power and wireless communications.

Lecturers presentations will be alternated with periods of open discussions to engage the audience and to discuss next exploitable research areas in this field.

WF-07 (EuMC)
Backscatter Communications the Next Paradigm for IoT Approaches

Organiser: Nuno Borges Carvalho¹, Smail Tedjini²
¹Instituto de Telecomunicações, Universidade de Aveiro, ²Université Grenoble-Alpes

The Internet-of-Things’ (IoT) vision calls for thousands of interconnected devices in wearables, vehicles, buildings, using a multitude of sensors to provide us with useful information. As a result, mechanical and electrical properties become important, such as conformal profile, compact size, flexibility, stretchability, or even biodegradable properties and performance in terms of operating range, low power consumption and energy efficiency. Backscatter communication provides an enabling technology to address the needs of IoT due to the simplicity of the tag circuit and the ability to minimize battery usage or even eliminate them completely by taking advantage of wireless power transmission as well as energy harvesting. This workshop presents the latest advances in backscatter communication technology in an IoT environment.

Programme

Wearable Antennas for Wireless Applications
Smail Tedjini²
²Université Grenoble-Alpes

Higher Order Modulation Backscatter Combined with WPT
Nuno Borges Carvalho¹
¹Instituto de Telecomunicações, Universidade de Aveiro
A sound understanding of RF and mmWave testing methods is a key factor for every mmWave engineer, helping them to successfully implement solutions and designs in mmWave and RF circuits. Moreover, digital communications engineering and mmWave engineering are merging more and more and becoming a cross-discipline. As a result, mmWave engineers are confronted with the challenge of how to master the territory of the former RF and digital communications world.

The Rohde & Schwarz seminars about RF basics in test and measurement will familiarize you with the elementary aspects of signal generators, spectrum analyzers and network analyzers. You will learn to benefit from the great flexibility of our T&M equipment when designing communications and radar systems. New this year is a seminar on realtime spectrum analysis that will introduce you to the methods for debugging RF and mmWave circuits in the time and the frequency domain.

Using vector network analyzers for component testing and evaluation and applying various calibration techniques common in advanced network analysis lets you characterize mmWave and RF components, which are necessary for mmWave designs and digital communications systems, to the highest precision.

**Tuesday 25th September 2018**

*09:30 – 11:00*

**Fundamentals of Signal Generators and Oscillators (YIG vs. VCO)**

*11:15 – 12:45*

**Fundamentals of Spectrum Analysis**

**Wednesday 26th September 2018**

*09:30 – 11:30*

**Introduction to Digital Signals and Digital Modulation**

*11:45 – 13:15*

**Real time Spectrum Analysis Embedded in Advanced Spectrum Analyzers**

**Thursday 27th September 2018**

*09:30 – 10:30*

**Fundamentals of Vector Network Analysis**

*10:45 – 12:15*

**Calibration in Vector Network Analysis**
NI AWR Software Workshops
- Free to attend -
Location: A9.8
Tuesday 25th September 12:00 – 16:00
Filter Design Forum
The first EuMW Filter Design Forum focuses on design and simulation techniques of RF and microwave filters and provides insight into the latest approaches relevant to filter design, as well as modern filter theory. Noted filter specialist Dan Swanson of DSG Associates will open the session with a keynote presentation. The agenda is segmented into sequential sessions to enable attendees to selectively attend any/all presentations of interest.

To view the complete agenda and to register, visit: awrcorp.com/eumw2018

Wednesday 26th September 10:00 – 16:00
RF and Microwave Power Amplifier (PA) Forum
The fifth annual EuMW RF and Microwave PA Forum focuses on device technologies, characterization, modeling, and end-use applications of RF and microwave PAs and provides insight into the latest approaches to device models, parameter extraction measurement techniques, and process technologies, as well as modern PA design flow and theory. Noted PA expert Dr. Steve C. Cripps of Cardiff University will open the session with a keynote presentation. The agenda is segmented into sequential sessions to enable attendees to selectively attend any/all presentations of interest.

To view the complete agenda and to register, visit: awrcorp.com/eumw2018

EuMW MicroApps 2018
Free Admission
with Exhibition and Conference Badges
25th - 27th September
MicroApps Theatre
Welcome to the eighth annual European Microwave Week (EuMW) Microwave Application Seminars (MicroApps), sponsored by National Instruments, Rohde & Schwarz, and Horizon House. MicroApps will be held from Tuesday, September 25th through Thursday, September 27th, 2018 in the MicroApps Theatre, which is located within the exhibition floor, making it a convenient stop while attending EuMW.

MicroApps are 20-minute exhibitor technical presentations that provide an opportunity for EuMW attendees to experience state-of-the-art applications, products, design techniques, and processes of interest to the RF and microwave community.

2018 MicroApps highlights include:
- Keynotes:
  - Dr. Steve Cripps, Cardiff University, UK
  - Dr. David Ricketts, North Carolina State University, USA
- Special Panel Session:
  - Hosted by Pat Hindle, Microwave Journal, USA
- A variety of practical application topics describing novel products and processes.

Once finalized, a complete agenda will be posted on the EuMW MicroApps website at www.eumicroapps.com and published in the official EuMW Show Guide. Additional printed copies will also be available on site at the EuMW registration desks. MicroApps admission is free for both exhibition-only and conference badges. Also included is a complimentary web download of the papers presented and bottled water.

We look forward to seeing you at EuMW 2018 in the MicroApps Theatre!

Antti Lautanen
EuMW 2018 MicroApps Co-Chair
## WORKSHOPS AND SHORT COURSES - SUNDAY

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### WORKSHOPS

- **WS-01**: GaN HEMT Characterization and Modeling for micro- and mm-Wave Power Amplifier Applications
- **WS-02**: High Efficiency mm-wave Power Amplifiers for 5G
- **WS-04**: RF Techniques for Cellular Carrier Aggregation and Beyond
- **WS-06**: Terahertz Technologies from Fundamentals to Implementations: A Device and Application Perspective
- **WS-07**: Broadband Power Amplifiers for Wireless Applications
- **WS-08**: Transmitter Modules for Smart Antennas and MIMO Systems
- **WS-09**: Metamaterials, Metasurfaces and Applications
- **WS-10**: Radioastronomy Instrumentation
- **WS-11**: Highly Integrated RF Transceiver Systems
- **WS-12**: Wideband Supply Modulated RF Power Amplifiers for Energy Efficient Wireless Communication Infrastructure
- **WS-03**: Current Trends in Broadband, Efficient and Linear PAs for 5G Wireless Applications
- **WS-05**: 5G Systems & Millimeterwave Communications in Smart Public Transport
- **SS-01**: Introduction to SSPA Design and Considerations for Spaceborne Applications
- **SS-02**: Fundamentals of Microwave PA Design
- **SS-03**: Additive Manufacturing of Radio-Frequency Components
## Conference Sessions Matrix - Monday

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### EuMIC
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- EuMIC02: Millimeter-Wave Amplifiers and Detectors
- EuMIC03: mm-Wave Systems-on-Chip
- EuMIC04: Large-Signal Modelling
- EuMIC05: EuMIC Opening Session
- EuMIC06: Power Amplifier ICs
- EuMIC07: Millimeter-Wave Signal Generation
- EuMIC08: MMIC Components
- EuMIC09: Small-Signal & Noise Modelling
- EuMIC10: Si-Based High-Frequency and Power Devices and Novel Microwave Technologies
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- EuMIC14: Coupling-Matrix-Based Design of RF/Microwave Filters
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<td>Career Platform (1 of 2)</td>
<td>EuMW WiM</td>
<td>Welcome Reception</td>
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### Conference Sessions Matrix - Wednesday

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<tr>
<th>Room</th>
<th>08:30-10:10</th>
<th>10:50-12:30</th>
<th>13:50-15:30</th>
<th>16:10-17:50</th>
<th>18:30 - 22:00</th>
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<tr>
<td>N101 + N102</td>
<td>EuRAD01</td>
<td>The Defence, Security and Space Forum</td>
<td>EuMC28 Devices and Systems for Biomedical Sensing</td>
<td>EuMC36 Wireless Transceivers and Mobile Systems</td>
<td>The Defence, Security and Space Forum</td>
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<td>EuMC19 Hyperthermia and Other Biomedical Applications</td>
<td>EuMC29 Bias Modulated Power Amplifier</td>
<td>EuMC37 Special Session: High Frequency Flexible Bendable Electronics for Wireless Communication Systems</td>
<td>EuMC45 Phased-Arrays and MIMO Systems</td>
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<td>N106</td>
<td>EuMC20 Solid State High Power Amplifiers</td>
<td>EuMC30 Tunable Planar Filters</td>
<td>EuMC38 SWI and Planar Filter Technologies</td>
<td>EuMC46 Planar Filter Technology</td>
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<td>N108</td>
<td>EuMC22 Non-Conventional Designs in Antenna Technology</td>
<td>EuMC32 Computational Electromagnetics and Material Characterization</td>
<td>EuMC40 Microwave Photonics</td>
<td>EuMC48 Integrated Signal Generation</td>
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<td>N109</td>
<td>EuMW Student/Doctoral School (4 of 4) Hands-on Experience</td>
<td>EuMC/EuRAD02 Radar Applications</td>
<td>EuMC/EuRAD02 Radar Antennas</td>
<td>EuMC/EuRAD04 Emerging Antenna Fabrication Technologies</td>
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<td>EuMC/EuRAD01 Thz Electronics</td>
<td>EuMC/EuRAD03 Thz Communications</td>
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<td>EuMC24 Application of Metasurfaces</td>
<td>EuMC33 Special Session: Microwave Research in Latin America (10:50 - 12:50)</td>
<td>EuMC34 Innovative Materials for Microwave Applications</td>
<td>EuMC42 Microwave Passive Components</td>
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<td>EuMC25 Numerical Modeling of Microwave Components</td>
<td>EuMC35 Interactive Session 1</td>
<td>EuMC36 Interactive Session 2 (15:10-16:30)</td>
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**Career Platform**
- 13:20 - 17:50
- Defence, Security and Space Forum Cocktail Reception

**EuMW Student Challenge**
- Interactive Session 1
- Interactive Session 2
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<th>Room</th>
<th>08:30-10:10</th>
<th>10:50-12:30</th>
<th>Lunch</th>
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<th>Coffee Break</th>
<th>16:10-17:50</th>
<th>18:30-22:00</th>
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<td>EuRAD05 Automotive Radar 2</td>
<td>EuRAD08 Industrial Applications</td>
<td>EuMW02 EuMW/EuMC Closing Session</td>
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<td>EuMC50 Advances in Millimeter-wave Packaging and Additive Manufacturing</td>
<td>EuRAD06 Radar Target Classification and Tracking</td>
<td>EuRAD09 MIMO Radars</td>
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<td>EuMC51 Measurement Techniques</td>
<td>EuMC55 Wireless IoT and Localization</td>
<td>EuRAD10 Synthetic Aperture Radar</td>
<td>EuMW Young Professionals in Microwave Engineering (2 of 2) Microwave Engineering in Humanitarian Projects</td>
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<td>EuMC56 Antennas for Space Applications</td>
<td>EuMC/EuRAD08 Innovative Signal Processing in Array Technology</td>
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<td>WTh-03 Millimeter-wave Radar for Industrial and Consumer Applications</td>
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<td>EuRAD04 Special Session: Radar Projects at the European Defense Agency</td>
<td>EuRAD07 EM Field Scattering and Target RCS</td>
<td>EuRAD11 Multi-Static and Netted Radar</td>
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<td>EuMC54 Antenna Technology</td>
<td>EuMC/EuRAD06 Array Technology and Characterization</td>
<td>EuMC/EuRAD08 EM simulation based modelling of antennas and systems Podium discussion on the occasion of the 80th birthday of Ingo Wolff (12:40-13:40)</td>
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<td>Advances Toward Autonomous RF Filter Design</td>
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<td>Advanced Solutions for Near-Field and Far-Field Wireless Charging</td>
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<td>Backscatter Communications the Next Paradigm for IoT Approaches</td>
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## EXHIBITOR WORKSHOP MATRIX

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<tr>
<td><strong>Tuesday 25th September</strong></td>
<td></td>
<td>12:00 – 16:00</td>
<td>National Instruments Workshops</td>
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<tr>
<td>Meeting Room A10.3</td>
<td>09:30 - 12:45</td>
<td>Rohde &amp; Schwarz Tutorial Seminars</td>
<td>13:30 - 17:30 Rohde &amp; Schwarz Workshops</td>
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<td>Meeting Room A94</td>
<td>09:30 - 17:30</td>
<td>MathWorks Ltd Workshops</td>
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<td><strong>Wednesday 26th September</strong></td>
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<td>10:00 – 16:00</td>
<td>National Instruments Workshops</td>
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<td>12:30 - 16:30 Rohde &amp; Schwarz Workshops</td>
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EuMW 2018 Conference Rooms (North Convention Center, First Floor)

The Career Platform will be located at the West Entrance Hall, First Floor
Please note: EuMW 2018 Conference Rooms and Exhibition Hall are located near the North Entrance
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<tr>
<td>IW Microwave Products Division</td>
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<tr>
<td>Jet Metal Technologies</td>
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<tr>
<td>JPW Industries Inc.</td>
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<tr>
<td>Jiaxing Focussime Electronics Co., Ltd</td>
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<td>Johannon Manufacturing</td>
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<td>JQL Electronic Inc.</td>
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<td>JunkoWalka Inc.</td>
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<td>KKL Microwave</td>
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<td>Keylight Technologies</td>
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<td>Knowles</td>
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<td>Knowles Precision Devices</td>
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<tr>
<td>KOA Europe GmbH</td>
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<tr>
<td>Kuine Electronic GmbH</td>
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<tr>
<td>Kyocera Fineceramics GmbH</td>
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<tr>
<td>L-3 Narda-ATM</td>
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<td>L-3 Narda-MTEQ</td>
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<tr>
<td>LHPF Laser &amp; Electronics AG</td>
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<td>MACOM</td>
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<td>Magic Kald Ltd</td>
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<td>Mathworks</td>
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<td>Maury Microwave Corp.</td>
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</table>
| MCG-UPA/Microwave Components Group-
  Public University of Navarrn       |
| Mega Industries                    |
| Metela Corp.                       |
| Mician GmbH                        |
| Micran Research and Production CJS  |
| Micro Systems Engineering GmbH     |
| Microwave Amplifiers Ltd.          |
| Microwave Applications Group       |
| Microwave Engineering Europe       |
| Microwave Innovation Group (MIG)  |
| Microwave Journal                  |
| Microwave Product Digest           |
| Microwave Products Group           |
| Microwave Systems                  |
| Microwave Systems join-stock Company |
| Microwave & RF                     |
| Mitsubishi Electric Europe BV      |
| Molex Deutschland GmbH             |
| MGSIS                             |
| MPJ Corporation                    |
| MRC Gigagmp GmbH & Co. KG          |
| Nanjing Transcom Information Technology Co., LTD |
| National Instruments               |
| Netela SA                          |
| Noise XT                          |
| Noletec                            |
| NovaCap                            |
| NVP Semiconductors                 |
| OMMIC                             |
| Optenni Ltd.                       |
| Park Electrochemical Corp.         |
| Paragual Microwave Systems Srl     |
| Passive Plus Inc.                  |
| Pickering Interfaces Ltd.          |
| Pico Technology Ltd.               |
| Planar Monolithics Industries, Inc.|
| Planes SE                         |
| Pole/Zero                         |
| Premix Oy                          |
| PRESTO ENGINEERING                |
| Radar Systems Technology Inc.      |
| Radiall                           |
| Remcom Inc.                       |
| Revista Espanola de Electrónica (REDE)  |
| Ritcor Co., Ltd                   |
| RRHF Corp.                        |
| RFMW Europe Ltd.                   |
| Rogers Corp.                      |
| Rohde & Schwarz                   |
| Rosenberger Hochfrequenztechnik GmbH & Co. KG |
| RYMSA RF                          |
| RymSat Satellite Technology        |
| Schmid & Partner Engineering AG    |
| Schott AG                          |
| Sector Microwave Industries        |
| Semaklon España                    |
| Senor Ingeniería y Sistemas Sa     |
| Shanghai Haijinx Information Technology Co., Ltd |
| Shanghai Huaquang Computer Communication Engineering Co. Ltd. |
| Shenzhen Superlink Technology Co., Ltd|
| Shenzhen Yulongtong Electron Co. Ltd|
| Silicon Radar GmbH                 |
| Sivers Lab                         |
| Sonnet Software Inc.               |
| Southwest Microwave Inc.           |
| SpaceForest                        |
| Spartech Microwave Technology      |
| Spectrum Elektrotechnik GmbH      |
| Sphenra                           |
| Spinner GmbH                       |
| STACEM                            |
| Sumitomo Electric Device Innovations |
| Sumitomo Electric Europe Ltd.     |
| Sungain Electronics & Communications Co., Ltd |
| SuperAero Corporation              |
| Syfer                             |
| Synopsis Corporation Group         |
| Tabor Electronics                  |
| Taconic                            |
| Teclia Inc.                       |
| Tecnomec srl                       |
| Tektronix                          |
| Teledyne Coax                      |
| Teledyne Microwave Solutions       |
| Teledyne Relays                    |
| Teledyne Sturm Microwave           |
| Teltecs, S.A                      |
| Temstron Co., Ltd                  |
| Temwell Corp.                      |
| Thales Alelia Space Espana, S.A    |
| The 2019 IEEE MTT-S International Microwave Symposium (IMS) |
| Times Microwave Systems            |
| TKO-Fernt Development and Manufacturing Ltd |
| TMD Technologies                   |
| TNO Defense, Safety and Security  |
| ToerntJazz                         |
| Transcom Inc.                      |
| Tolight Microwave                  |
| Toner Inc.                         |
| Tryo Aerospace & Electronics SL    |
| TUI                                |
| UTD                                |
| Unitd Monolithic Semiconductors SAS|
| Varioprint AG                      |
| Vectrawave                         |
| Vector Telecom                     |
| Vectorwave SA                      |
| VIA electronic GmbH                |
| Virginia Diodes Inc.               |
| Visky Electronic GmbH              |
| VLC Photonics, S.L                |
| Volttronics Corp.                  |
| WavePia Co., Ltd                   |
| Weverscomm                         |
| WiM-Gemiconductors Corp.           |
| WIP - D.T.O.                       |
| Wofspread, A Cree Company          |
| Wurfacher Elektron eSas GmbH & Co. KG |