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# Table of Contents

## Welcome Messages
- Welcome to the 24th European Microwave Week ........................................... 5
- Welcome from the President of the European Microwave Association ........... 6
- Welcome to the 16th European Microwave Integrated Circuits Conference .......... 7
- Welcome to the 51st European Microwave Conference .................................. 8
- Welcome to the 18th European Radar Conference ....................................... 9
- Welcome from the General TPC Chairs ...................................................... 10
- Special Issue and Social Media ................................................................. 11

## General Information
- The EuMW 2021 Organising Committee .................................................. 12
- EuMW 2020 Prizes ....................................................................................... 14
- EuMA Awards ............................................................................................. 17
- EuMA and EuMW Committees ................................................................. 20
- EuMW 2021 Reviewers ............................................................................. 21
- Travel Information ....................................................................................... 22
- Hotel Booking Form ................................................................................... 23
- Local Information and Insurance ............................................................... 25
- Conference Information ........................................................................... 25
- Partner Programme ..................................................................................... 26
- Social Events ............................................................................................. 29

## Registration
- Workshops and Short Courses List ............................................................ 30
- Registration Information .......................................................................... 31
- Registration Fees .................................................................................... 32

## Student Activities and WiM
- EuMW 2021 Student School ....................................................................... 34
- 11th Tom Brazil Doctoral School of Microwaves ....................................... 35
- Tom Brazil Fellowship Award (by the GAAS* Association) Student Essay Competition .......................................................... 36
- IEEE Young Professionals Activities ......................................................... 37
- Women in Microwave Engineering ............................................................. 38
- Career Platform ......................................................................................... 39

## Forums
- The Automotive Forum ............................................................................. 40
- Defence, Security and Space Forum ......................................................... 42
- 5G and Beyond Forum ............................................................................. 44

## Conference Programme
- Sunday 13th February 2022 ...................................................................... 46
- Monday 14th February 2022 ...................................................................... 47
- Tuesday 15th February 2022 ..................................................................... 53
- Wednesday 16th February 2022 ................................................................. 64
- Thursday 17th February 2022 .................................................................. 73
- Friday 18th February 2022 ....................................................................... 86

## Workshops and Short Courses
- Welcome from the Workshop and Short Courses Chairs ......................... 90
- Sunday 13th February 2022 ...................................................................... 91
- Monday 14th February 2022 ..................................................................... 103
- Wednesday 16th February 2022 ................................................................. 114
- Thursday 17th February 2022 .................................................................. 118
- Friday 18th February 2022 ...................................................................... 119

## Exhibitor Workshops
- Rohde & Schwarz Workshop ...................................................................... 124

## Conference Matrix and Venue
- Conference Sessions Matrix ..................................................................... 126
- Venue Overview ....................................................................................... 132
- Exhibitor List ............................................................................................ 134
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Welcome to the 24th European Microwave Week

It is with great pleasure that we welcome you to the 24th European Microwave Week (EuMW), which is taking place at ExCeL in London, UK. At the time of writing this message, the world is still in the grip of the coronavirus pandemic. The pandemic has greatly affected the way we live our lives for almost two years now. Many people around the world have lost their lives and many have had their lives changed permanently by the pandemic. One impact has been how we, the human race, interact with each other. The human instinct is usually to come together to help deal with problems, to form strategies and build partnerships, and, to celebrate successes.

EuMW is one such event that is motivated by these instincts. It is for this reason the organising team for this year’s event has worked long and hard to ensure we have an event where we can come together and meet, face to face, as a community to continue to develop and celebrate our area of science, engineering and technology. We feel that it is vital to achieve this goal. This is the reason why EuMW 2021 is taking place during February 2022 - we have delayed hosting the event so that it is more feasible to hold a successful in-person event whilst still respecting any national and international restrictions on social interactions and travel.

This is the third time that EuMW has been hosted in London, following on from previous highly successful events in 2001 and 2016. London is a natural venue for prestigious scientific events, being the home of such long-standing scientific institutions as the Royal Society (founded in 1660), the University of London (founded in 1836) and the Institution of Electrical Engineers (founded in 1871), as well as the home to many famous scientists, including James Clerk Maxwell, Lord Rayleigh, Charles Wheatstone, Alan Turing, etc. Our motto for this year’s EuMW is ‘United in Microwaves’. This reflects the traditional feeling of unity in our community, and, demonstrates how we can use this conference to re-establish and further develop this feeling of unity within our community of colleagues and fellow professionals, despite the recent problems caused by the pandemic.

EuMW 2021 continues the annual series of highly successful microwave events that started back in 1998. EuMW 2021 comprises three co-located conferences: European Microwave Conference (EuMC); European Microwave Integrated Circuits Conference (EuMIC); European Radar Conference (EuRAD). There are also many workshops and short courses associated with each of these conferences, along with several Special and Focused Sessions. Two particular highlights are Special Sessions on the life and works of two prominent members for our community who sadly passed during 2020; Professor Peter Claricoats and Professor Roberto Sorrentino. Peter Claricoats was Chair of the first European Microwave Conference (EuMC), held in London in 1969, and Chair of the 9th EuMC in the UK in 1979; he received a EuMA Distinguished Service award in 2005. Roberto Sorrentino was a founder member of the European Microwave Association and President of EuMA from 1998 to 2009. They will both be sadly missed.

In addition, there are three Forums, covering: Defence, Security and Space; Automotive; and, Beyond 5G technologies. There is also a very large trade show - the largest RF and microwave trade show in Europe - where the leading companies from our industry exhibit their very latest technological developments. EuMW 2021 also has several activities aimed specifically at students. These include: the Tom Brazil Doctoral School of Microwaves; the European Microwave Training School; the Career Platform; and, IEEE Young Professionals. There is also the Women in Microwave event, in which both women, and men, are encouraged to participate.

We sincerely hope that you will enjoy a memorable experience in London at EuMW 2021.
Welcome from the President of the European Microwave Association

On behalf of the European Microwave Association (EuMA), I warmly welcome you to the 24th edition of the European Microwave Week in London! EuMA stands up for our microwave and RF community. We foster networking between scientists, engineers, decision makers and end-users. The European Microwave Week (EuMW) is our main asset and a real networking event. It’s the place to get information you can’t get anywhere else and to meet colleagues you don’t see every day.

EuMA is continuously improving itself to support our microwave community. We recently released a 22-page White Paper "For a Strong & Competitive European Wireless Technologies Ecosystem". A free download is available at our website www.eumwa.org. Soon EuMA will announce a new series of webinars with interesting and qualified speakers.

EuMA actively supports young researchers. Thereto our Innovation Team is launching the fourth edition of the EuMA Internship Award. Each year, up to seven prizes of 4,500 € each are awarded to selected master and PhD students to spend a period of at least 3 months abroad in one of the leading European microwave industries or institutes. Details are at our website. EuMA continues to provide grants and reduced registration fees to students and delegates from NIS countries to attend the EuMW.

EuMA offers a membership to all working in the field of microwaves. Members enjoy reduced fees for attending EuMW and EuMA-sponsored events as well as the IEEE IMS and the APMC. EuMA members have free access to our archive of publications and the on-line version of the International Journal on Microwave and Wireless Technologies.

EuMW is the premier microwave conference and exhibition event in Europe. We value the cooperation with IEEE Societies MTT, AP and ED and the GAAS* Association and our long-standing partner Horizon House / Microwave Journal as event organiser.

Preparing and hosting the EuMW is a major effort, from paper submission and review to on-site organisation. This is accomplished by a team of volunteers year by year. My special and sincere thanks go to Nick RIDLER and John CUNNINGHAM the 2021 General Chair and Co-chair; to Peter GARDNER, General TPC Chair; to Adrian CROSS, Treasurer; to Emma MCPHERSON and Yi WANG, EuMC Chair and TPC Chair; to Chris CLIFTON and Edward WASIGE, EuMIC Chair and TPC Chair; and to James WATTS and Matt RITCHIE, EuRAD Chair and TPC Chair – just to name a few on behalf of the entire team. Thank you!

The European Microwave Week is back again in UK after the successful events in 2001, 2006, 2011 and in 2016. All members of the team have been working hard to set up an outstanding technical and scientific programme and I am sure they will make your stay in London exciting, enjoyable, and a rewarding experience of Britain’s hospitality. I would like to cordially invite you to EuMW 2021. Come to the wonderful city of London. Join us at EuMW2021 and discover information you won’t get anywhere else. Take the opportunity to meet and talk to colleagues and friends from all over the world you don’t see every day. I hope to see you in London! And most of all: Get involved in our community!

FRANK VAN DEN BOGAART
President
European Microwave Association

EuMA is very active on social media. Follow us @eumassociation on Facebook, LinkedIn, Twitter and Instagram.
Welcome to the 16th European Microwave Integrated Circuits Conference

It is a great pleasure for us to welcome you to London for the 16th European Microwave Integrated Circuits (EuMIC) Conference which has been jointly organised by the GAAS® Association and EuMA since 2006. For the second year, the conference will not happen in Autumn but will be held in the Spring of 2022, on Monday the 14th and Tuesday 15th February 2022. EuMIC is the premier European technical conference for RF & microwave microelectronics as part of the European Microwave Week (EuMW).

The aim of the conference is to promote the discussion of recent developments and trends and to encourage the exchange of scientific and technical information covering a broad range of microwave, mm-wave, terahertz and related topics, from materials and technologies to integrated circuits and applications that will be addressed in all of their aspects: theory, simulation, design and measurement.

Monday is a busy day with a large offering: beyond the Opening Session, there will be twelve regular sessions, two joint sessions with EuMC, two poster sessions, one jointly with EuMC, and the Closing Session. A number of the regular sessions will feature keynote industry talks on topical themes.

The EuMIC Opening Session will feature two keynote addresses by eminent speakers. Sir Christopher Snowden, Fellow of the Royal Society and Chair of the ERA Foundation, will speak on "III-V Nitride Semiconductors for Microwave Applications", while Zoya Popovic, Distinguished Professor, Department of Electrical, Computer and Energy Engineering at the University of Colorado, Boulder, USA, will speak on "High-Efficiency PAs for Broadband High-PAR Signals".

This year, the EuMIC Closing Session will start with the celebration of our best contributors. The EuMIC Prize for the best paper and the EuMIC Young Engineer Prize will be awarded by the EuMIC Prize Committee. For the next three years, the traditional GAAS® Association Fellowship Award will be replaced with the Tom Brazil Fellowship Award (by the GAAS® Association) in dedication to a friend and colleague who made such significant contributions to our microwave community. This award will focus on promoting and encouraging the achievements of research students and further announcements on the details will be made prior to the conference. This session will be concluded by two keynote presentations, one by Dr. Ebrahim Bushehri, CEO and Founder of Lime Microsystems (UK) on "Flexible and Open Source: The brave new world of Software Defined Radio and Open RAN", followed by Dr. Nadine Collaert, Program Director at imec on "6G – Known Technologies with a Twist or Maybe Not?"

We take this opportunity to show our appreciation to our authors for their technical contributions and for choosing to disseminate their work at EuMW and the dedication of the reviewers and TPC members who have spent their free time making the selections in order to provide the best possible programme. Workshops and Short Courses are a major offering of the EuMW and so we would also like to thank the organisers for gathering key experts to cover the latest developments. We also wish to acknowledge the support of the previous EuMIC teams, in particular Utrecht, who were always ready to advise. Finally, we would like to thank the 2021 EuMC and EuRAD teams for sharing experiences as well as to all our colleagues working in the background supporting EuMW as a whole.

We look forward to welcoming you personally in London for an exciting EuMIC!

CHRIS CLIFTON
EuMIC Chair
Sony Europe B.V.

SHOKROLLAH KARIMIAN
EuMIC Co-Chair
University of Oxford, UK

EDWARD WASIGE
EuMIC TPC Chair
University of Glasgow, UK
Welcome to the 51st European Microwave Conference

Welcome to EuMC 2021! Never before has communications technology been so important for the world to retain functionality – last year we had the first virtual conference of this series and while the organisation meetings have largely been done remotely for this event, we are delighted to be able to hold this conference in-person, and, be “United in Microwaves”.

This year is the 51st edition of the conference, returning to London, the city where EuMC was first hosted back in 1969. EuMC is the largest event in Europe dedicated to a broad range of high frequency topics ranging from novel semiconductor and packaging technologies, photonics, passive and active microwave/mmWave circuits and antennas (arrays), up to system level, with innovative solutions for many applications including for example, biomedical, mobile and IoT.

We have received over 440 submissions across 46 countries for EuMC 2021. Our conference programme provides you the perfect platform for you to meet colleagues and learn about the latest advances in your own and related research areas. We have an exciting line up of world leading speakers from academia and industry and there are opportunities for you to learn about new areas through our workshops.

In particular, on Sunday and Monday there are 23 EuMC workshops and short courses on hot topics including new developments in filters and amplifiers, materials, packaging and measurement technology for 5G/6G, terahertz devices and technologies, and many more. Tuesday morning features the EuMW/EuMC plenary Opening Session where Mike Geen, chief scientist at Filtronic will give the opening speech on “What’s next for mmWave?”

Another exciting aspect of this event is the European Microwave Exhibition which has been the largest traditional microwave and RF tradeshow in Europe for many years. This year we expect it to be the biggest such tradeshow post pandemic and hope it assists and inspires many fruitful technology developments and collaborations.

The Women in Microwaves event is sponsored by IEEE MTT-S and will take place on Tuesday afternoon and involve a trip to the Cutty Sark (Greenwich) as well as a Panel Session “Inspiring Women in Engineering”.

The conference sessions on Tuesday have tracks on power amplifiers, passive circuits and filters, integrated antennas, packaging, terahertz and metamaterials. Wednesday has a packed EuMC programme covering all areas including two poster sessions. Thursday features tracks on filters, antennas, characterisation techniques and applications. There is also the Asia-Pacific focused session when we will hear from several expert speakers.

In the EuMC Closing Session, also on Thursday, the EuMC microwave prize and two young engineer prizes will be awarded. The Closing Session features a keynote by Tadao Nagatsuma, Osaka University, entitled “Challenges and opportunities for terahertz communications – towards 6G and beyond”, and a keynote on the "(R)Evolution of wireless communications" by Eric Hawthorn from Radio Design. Finally, on Friday there are four more short courses and workshops on advanced manufacturing/packaging, microwave superconductivity, terahertz and AI.

Enjoy London! Explore some of the many sights in this buzzing city. Perhaps visit the nearby Royal Observatory and stand on the historic prime meridian of the world at the home of Greenwich Mean Time (GMT), or switch to the arts and visit the gallery of your choice be it traditional or modern. Most of all, we hope that you will enjoy EuMC 2021 and we look forward to being “Re-united in Microwaves”!

EMMA MACPHERSON
EuMC Chair
University of Warwick, UK

DOMINIQUE SCHREURS
EuMC Co-chair
University of Leuven, Belgium

YI WANG
EuMC TPC Chair
University of Birmingham, UK
Welcome to the 18th European Radar Conference

It is our pleasure to welcome you to the 18th European Radar Conference (EuRAD 2021) which will be held from the 16th to 18th February 2022 in London, UK, as part of European Microwave Week 2021. This radar conference is the major European event for the present status and the future trends in the field of radar research, technology, system design and applications. The EuRAD conference will bring together a global network of researchers, practitioners and institutes working on topics related to the following four areas of focus: 1) Radar Sub-systems and Phenomenology, 2) Radar Signal and Data Processing, 3) Radar Architecture and Systems and finally 4) Radar Applications.

For many delegates this will be the first face-to-face large-scale event they attend in a long time, and we hope to put on an excellent conference by bringing world class radar researchers together. The ability to interact in person at conference is a brilliant opportunity that is difficult to replicate and as the first physical EuRAD conference for two years we hope attendees can enjoy this experience and get the most out of it. We are proud to put on the EuRAD 2021 conference at the London ExCeL centre. While at the conference our attendees can enjoy the sights and sounds of London.

In the Wednesday Opening Session, we will host an excellent speaker on the cutting-edge perspective of radar & EW research. Barry Trimmer will be speaking on Trends in Defence Electronics – Technological Convergence in Radar & EW. He is presently VP (technical) for Intelligence, Surveillance and Reconnaissance (ISR) within Thales UK, with particular responsibilities for Electronic Warfare, Radar, Airborne Mission Systems and Unmanned Air Systems. This will be followed by a talk by Eva Rajo Iglesias, Professor at the Department of Signal Theory and Communications, University Carlos III de Madrid. Eva will describe the state of the art in antenna technologies for millimetre and sub-millimetre wave radar.

The Closing Session plenary talk will be provided by Nigel Clarke. Nigel led on All-terrain and Autonomy Sensing Research at Jaguar Land Rover Research, and he will show the role that microwave radar must play in making a Level 5 fully autonomous car and how the use of higher frequency radar might make full autonomy more realisable.

The EuRAD conference stands out as the leading European event that puts on show the latest cutting-edge research, development, and new innovations from the field of radar. Strongly attended by academics, industry experts and government representatives we hope to inspire new and experienced radar researchers with our diverse programme. This year we had 179 submitted papers which went through a rigorous review process by our expert review panel. The end result is 129 papers being presented over 2 poster and 21 oral sessions at the conference. Leading industrial keynotes will be provided at a number of our focus oral sessions by leading experts within their fields. This year, the conference provides an array of expertly lead workshops in key focus areas of interest including strong links with both the Defence, Security & Space (DSS) and the Automotive Forums. These events have grown significantly since their inception and provide really important engagement of their respective interlinked communities. The DSS event will be held on Wednesday from 11:20 until the end of the day.

The EuRAD 2021 organisers would like to specially thank all the excellent reviewers and expert TPC members for their support. Despite the need for a fast turn around and high-quality reviews during the peak holiday period we still achieved a rigorous level of peer review. Without our volunteer reviewers it would not be possible to put on this event, many thanks. All that is left is to thank the EuRAD conference delegates for your attendance and contributions to EuRAD 2021.

JAMES WATTS
EuRAD Chair
Theta Technologies Ltd. UK

STEPHEN HARMAN
EuRAD Co-chair
Aveillant Ltd, UK

MATTHEW RITCHIE
EuRAD TPC Chair
University College London, UK
Welcome from the General TPC Chairs

I am delighted that we have been able to host the European Microwave Week in London again. Although much has changed since EuMW 2016, when we were last here, the UK capital city continues to be one of the great global centres for culture, the arts, sport, entertainment, shopping and tourism. I look forward to seeing you during EuMW 2021 as you enjoy our excellent conference programmes, and I hope you will be able to experience some of the other opportunities that this city offers while you are here.

As General Technical Programme Committee Chair, I would like to thank the many people who have worked through very difficult, challenging and frequently changing circumstances to generate what I am sure you agree is an excellent set of conference programmes.

First of all, of course, the paper authors and presenters. Excellent research and development work has continued in our widespread scientific and technical community despite the difficulties and complications caused by the pandemic lockdowns and other restrictions, and this has been reflected in a very high quality set of submitted papers. I must also thank the authors for their patience as circumstances forced us to change submission deadlines several times and postpone the conference.

We now share a distinction with the 2020 Olympics and the European Soccer championships, in holding our event during the year after that which appears in the name!

I also owe huge thanks to the excellent group of over 500 expert reviewers who scrutinised and provided constructive critiques on over 700 submitted papers to enable the Technical Programme Committee to select the best of them for our conferences. The delayed timing of the review period made this task more challenging this year, and I am extremely grateful to all those who fitted in their review tasks during or around their well-earned vacation periods.

For the second time, the Technical Programme Committee meeting has been conducted as a distributed virtual event, because of pandemic related travel constraints. I owe huge gratitude to the EuMW 2020 team for establishing the processes that made it possible to do this efficiently and effectively, and to the EuMW 2021 Operations Team and the EuMA Software Officers who made it work so well again this time. Of course, I would also like to acknowledge the excellent work done by the TPC chairs of the three individual conferences and our Technical Programme Committee, over 100 highly experienced experts in their fields. In their 26 sub-committees, they considered all of the reviewed papers and selected the best, with an overall acceptance rate of approximately 65%, and they formed them into the coherent and attractive set of 84 sessions on key topics in our discipline that make up our three conferences. Several of the sessions also feature invited talks from industry experts, to highlight the industrial context of those key topics. The programmes for the week as usual feature a set of specialist workshop and short courses.

Ours is a dynamic and constantly evolving discipline. As always, the EuMW programmes cover the important and fast developing themes, including: new applications and new passive and active technologies for the high mm-wave and low THz bands; advanced manufacturing processes creating new possibilities in component design and system integration; artificial intelligence (AI), both as a tool in design and fabrication and as a new paradigm in signal processing; new applications for radar in many different aspects of our lives; and the many technologies and applications associated with communications systems, including 5G and beyond.

It has been a pleasure and a privilege to serve as General TPC Chair for EuMW 2021. I look forward to seeing you in London in February 2022.

PETER GARDNER
EuMW General TPC Chair
University of Birmingham, UK

DJURADJ BUDIMIR
EuMW General TPC Co-chair
University of Westminster, UK
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 2021.

The authors of several 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 Yi Wang, TPC chair of EuMC 2021, Edward Wasige, TPC chair of EuMIC 2021, and Matthew Ritchie, TPC chair of EuRAD 2021.

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, which is expected to appear in June 2022.

YI WANG
EuMC 2021 TPC Chair

EDWARD WASIGE
EuMIC 2021 TPC Chair

MATTHEW RITCHIE
EuRAD 2021 TPC Chair

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General Chair  
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John Cunningham  
General Co-chair & Sponsors Chair  
University of Leeds, UK

Peter Gardner  
General TPC Chair  
University of Birmingham, UK

Adrian Cross  
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University of Strathclyde, UK

Djuradj Budimir  
General TPC, Co-Chair & Local Arrangements  
University of Westminster, UK

Xiaobang Shang  
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Emma MacPherson  
EuMaC Chair  
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Martin Salter  
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Lai Bun Lok  
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Claudio Paoloni  
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Mike Antoniou  
DSS Forum Co-Chair  
University of Birmingham, UK

Kamal Samanta  
Awards Chair  
AMWTL Ltd / Sony Europe B.V.
2020 European Microwave Week in Utrecht
Best Paper Prizes: EuMC

EuMC Prize
Sponsored by Eindhoven University of Technology

Authors
Mikko Hietanen¹, Jere Rusanen¹, Janne P. Aikio¹, Nuutti Tervo¹, Timo Rahkonen¹, Aarno Pärssinen¹
¹University of Oulu

Paper Title
Ka-Band TDD Front-End with Gate Shunt Switched Cascode LNA and Three-Stack PA on 22 nm FDSOI CMOS Technology

EuMC Young Engineer Prize
Sponsored by Eindhoven University of Technology

Authors
Anton Sieganschin¹, Thomas Jaschke¹, Arne F. Jacob¹
¹Hamburg University of Technology

Paper Title
A Compact Low-Noise Frontend for Rx/Tx-Integrated SatCom Arrays

EuMC Young Engineer Prize
Sponsored by Antenna Company

Authors
J. Gabriel Buckmaster¹, Thomas H. Lee¹
¹Stanford University

Paper Title
An Electronically Steerable Millimeter-Wave Reflectarray for Wireless Power Delivery
2020 European Microwave Week in Utrecht
Best Paper Prizes: EuRAD

EuRAD Prize
Sponsored by THALES

Authors
Hasan Iqbal¹, Andreas Löffler¹, Mohamed Nour Mejdoub¹, Frank Gruson¹
¹Continental AG

Paper Title
Realistic SAR Implementation for Automotive Applications

EuRAD Young Engineer Prize
Sponsored by HENSOLDT

Authors
Julius Tilly¹, Fabio Weishaupt¹, Ole Schumann¹, Jürgen Dickmann¹, Gerd Wanielik²
¹Mercedes-Benz AG, ²TU Chemnitz

Paper Title
Road User Classification with Polarimetric Radars
2020 European Microwave Week in Utrecht
Best Paper Prizes: EuMIC

EuMIC Prize
Sponsored by Delft University of Technology

Authors
Eswara Rao Bammidi¹, Ingmar Kallfass¹
¹Institute of Robust Power Semiconductor Systems (ILH) - University of Stuttgart

Paper Title
An Analog Costas Loop MMIC in 130 nm SiGe BiCMOS Technology for Receiver Synchronization of QPSK and BPSK Modulated Signals

EuMIC Young Engineer Prize
Sponsored by GAAS® Association

Authors
Tejinder Singh¹, Raafat R. Manso¹
¹University of Waterloo

Paper Title
Reconfigurable PCM GeTe-Based Latching 6-bit Digital Switched Capacitor Bank
This is a new prize, named in remembrance of Roberto Sorrentino. The prize has been initiated by Linda Di Carlo Sorrentino in cooperation with RF Microtech, the Italian EM Society (SIEm) and EuMA. Awarded every year for at least ten years, it will recognize an outstanding young professional who has distinguished technical achievements (not on a single paper) within the microwave field. The technical achievements may include technical papers in journals and/or conferences/symposia sponsored or technically sponsored by EuMA. The technical achievements may also include services as a committee member for these Journals and/or conferences/symposia. This prize focuses on the individual rather than the achievements and would preferably be in yearly alternation between university and industry.

A nominee must be a member of the EuMA and no more than 38 years of age at the time of nomination deadline (i.e. not having reached their 39th birthday). To help bridge the gender gap in the microwave community however, this deadline is postponed by one year per child for women that have had children. A nomination must be made by a EuMA member (not a student member) who has known the nominee for more than 2 years. Self-nomination is not allowed. Two references in addition to the nominator are required. A selection panel, chaired by a member of the EuMA Board of Directors, selects every year a suitable number of panel members (from 5 to 7), whose names are not public. The Chair does not vote. Because of the large financial coverage, the Jury has one member designated by RF Microtech and one by SIEm, respectively.

The annual prize comprises a certificate, a medal and a financial award of 4,000 €, contributed by Mrs Linda Di Carlo Sorrentino, RF Microtech, SIEm, and EuMA. Collectively this might sustain the prize for a longer period as it is intended to keep the amount of the prize at 4,000 € therefore increasing the number of years of availability of the prize beyond 10 years. The prize will be presented at the Opening Session of the European Microwave Week. The first prize will be presented during EuMW 2021.
Richard V. Snyder is the President of RS Microwave (Butler, NJ, USA, founded 1981). He is the author of 145 papers, three book chapters and holds 27 patents. Interests: E-M simulation, network synthesis, dielectric and suspended resonators, high power notch and bandpass filters and active filters. BS, MS and PhD degrees from Loyola-Marymount, USC and Polytechnic Institute of New York University. Served the IEEE North Jersey Section as Chairman, 14 year Chair of the MTT-AP chapter. Chaired the IEEE North Jersey EDS and CAS chapters for 10 years.

He twice received the Region 1 award. January 1997: named a Fellow of the IEEE and is now a Life Fellow. January 2000: received the IEEE Millennium Medal. General Chairman for IMS2003, in Philadelphia, and was Emeritus Chair for IMS2018 also in Philadelphia. He was elected to the MTT-S ADCOM in 2004. Within the ADCOM, he served as Chair of the TCC and Liaison to the EuMA. He served as an MTT-S Distinguished Lecturer: from 2007 – 2010, continuing as a member of the Speakers Bureau.

He served three years as Associate Editor for the IEEE Transactions on Microwave Theory and Techniques, responsible for most of the filter papers submitted. Member of the American Physical Society, the AAAS and the New York Academy of Science. MTT-S President for 2011. IMSEC Chair 2016 – 2019, N&A Chair at present. Reviewer for IEEE-MTT and EMC publications. Reviewer for the EuMA International Journal of Microwave and Wireless.

Teaches and advises at the New Jersey Institute of Technology. Visiting Professor at the University of Leeds, in the U.K. Serves on TPC committees, as reviewer and/or Chair, for IMS, EUMW and other global conferences. He served 7 years as Chair of MTT-8 (now MTT-5 on Filters) and continues in MTT-5/TPC work. He is the organizer of the annual IWS conference in China. He currently serves the EuMA General Assembly as the North American (Region 15) delegate.
Stephen [Steve] Nightingale received his Electrical Engineering degree from the CEI in 1974 and a PhD in Electronics from Kent University in 1980. He worked for Philips Research Laboratories, UK, designing microwave circuits and systems until 1982. He then joined General Electric, Syracuse, USA, as the EHF Technology Manager supervising and designing Gallium Arsenide MMICs up to 94 GHz with specific responsibility for the US Milstar and DSCS programmes. From 1986 to 1996, he worked for THORN EMI Electronics/Racal/Thales as a MMIC Technology Consultant, Department Manager and Technology Manager responsible for technology acquisitions for Radar and EW systems. This included technology acquisitions for the 4-nation military phased-array radar programme, COBRA.

In 1996, he joined ERA Technology/Cobham, UK, designing and manufacturing Mach-Zehnder optical modulator drivers operating at 2.5 and 10Gb/s. Production reached over 12,000 per annum and the developed designs became industry standards. From 2001, he became Chief Consultant for Electronic Design developing interference mitigation systems for civil and military platforms using direct RF cancellation and TDM. Notable deliveries were for the US Rescue 21 programme, various Australian Army equipment upgrade programmes and a number of UK MoD requirements.

Steve was appointed a Visiting Professor at Surrey University in 2002 sponsored by the Royal Academy of Engineering.

He was a Founder Member and Past Director of the EuMA. He has served the EuMA and the EuMC in various capacities for more than 30 years and was Chair of the EuMW and EuMC in 2001. Steve has also served on various boards in UK universities and industries, including Imperial College, London, and ECIT, Belfast.

Steve has published and lectured widely in the UK and abroad, has contributed to 4 books and been awarded 8 patents in the microwave field. He became a Fellow of the IEEE in 2002 with the citation ‘For Contributions to Planar Microwave and Millimeterwave Circuits’. He has also received several Sir Alan Cobham Awards for technical innovation, team leadership and sustainability.
EuMA and EuMW Committees

EuMA General Assembly

Board of Directors: Frank van den Bogaart · Gilles Dambrine · Patrice Gamard · Andrew Gibson · Willem Hol · Renato Lombardi · Luca Perregreni · Herbert Zirath · Danielle Vanhoenacker-Janvier · Thomas Zwick
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Ordinary Members: Serge Verdeyme, Group 1 · Ingnmar Kalfass, Group 2 · Alessandra Costanzo, Group 3 · Chung Li, Group 4 · Dominique Schreurs, Group 5 · Christian Fager, Group 6 · Vitali Zhubenkenko, Group 7 · Jan Vrba, Group 8 · Bartlomiej Salski, Group 9 · Kateryna Archykova, Group 10 · vacancy, Group 11 · Oleg V. Stukach, Group 12 · Jasmin Grosinger, Group 13 · Nuno Borges Carvalho, Group 14 · Dick Snyder, Group 15 · Hiroshi Okazaki, Group 16 · Amir Safwat, Group 17
Founder Members: Leo Lichtart · Asher Madjar · Holger Meinelt · Steve Nightingale · Roberto Sorrentino † · André Vander Vorst
IJMW Editor-in-Chief: Francesca Medina-Mena
EuMA Honorary Secretary: Andrew F Wilson
By invitation: Wolfgang Heinrich, Past President · Jozef Modelski, MTT-S Observer · Almudena Suarez Rodriguez, Publication Officer · Lorenz-Peter Schmidt, EuMW Officer · Annemie Van Nieuwkerug, HQ Assistant
Countries Represented: Group 1 · France · Monaco · Group 2 · Germany · Group 3 · Italy, San Marino, Vatican City · Group 4 · United Kingdom, Ireland, Gibraltar, Malta · Group 5 · Belgium, The Netherlands, Luxembourg · Group 6 · Iceland, Norway, Sweden · Group 7 · Denmark, Faro Islands, Finland, Greenland · Group 8 · Bulgaria, Czech Republic, Hungary, Romania, Slovakia · 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 · Group 13 · Austria, Liechtenstein, Switzerland · Group 14 · Andorra, Portugal, Spain · Group 15 · North America · Group 16 · Asia-Pacific Group 17 · Africa and Middle East countries

EuMA Steering Committee

EuMA Board of Directors
EuMW Officer: Lorence-Peter Schmidt
GAAS Representative: Paolo Colantonio
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By Invitation: Wolfgang Heinrich, Past President · André Vander Vorst, Secretary Emeritus/DPO · Andrew F. Wilson, Hon. Secretary · Annemie Van Nieuwkerug, HQ Assistant

EuMW Technical Programme Committee

EuMC: Joachim Oberhammer · Catherine Algani · Shmuel Auster · Denis Baratoud · John Batchelor · Pierre Blandy · Nuno Borges Carvalho · Maurizio Bozzi · Alessandra Costanzo · Francesco Fornetti · Vincent Fusco · Alessandro Galli · Matthias Geen · Friedel Gerfers · Franco Giannini · Marina Gashinova · Frank Gruson · Stephen Harman · Ingmar Kallfass · Teresa Martin-Guerrero · Angel Mediavilla · Farid Medjdoub · Matthew O’keefe · Ekmel Özbay · Ulrich Pleiffe · Rüdiger Quay · Michael Schlechtweg · Raphael Sommet · Joe Staudinger · Saufumi Suzuki · Frank van Vliet · Lars-Erik Wernersson · Herbert Zirath
EuRAD: Jabra Akhtar · Andre Bourdoux · Alex Charlish · Jacco de Wit · Reinhard Feger · Laurent Ferro-Famil · Marina Gashinova · Frank Gruson · Stephen Harman · Willem Hol · Maria Pilar · Jarabo Amores · Pierfrancesco Lombardo · Claire Migliaccio · Roland Oechslin · Debra Pastina · Niels Pohl · Matthew Ritchie · Mayazza Ruggiano · Andy Stove · Martin Vossiek · Alex Yarovoy
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To our reviewers: Thank you for your great work!
Travel Information

GETTING TO EXCEL LONDON

With two on-site Docklands Light Railway Stations (DLR), parking for 3,070 cars and London City Airport just under 10 minutes away, getting to ExCeL London couldn’t be easier.

VENUE ADDRESS
Royal Victoria Dock, 1 Western Gateway, Royal Docks, London E16 1XL, UK.

The entrance for European Microwave Week is the East Entrance. By DLR alight at the Prince Regent station for the event.

LONDON UNDERGROUND & DLR
The Jubilee Line and the DLR are the quickest routes to ExCeL London. Alight at Canning Town on the Jubilee Line and change onto a Beckton-bound DLR train for the quick two-stop journey to ExCeL: Prince Regent for ExCeL (for the east entrance). DLR services: All trains towards Beckton/Gallions Reach will stop at Prince Regent.

BY RAIL
Your point of departure will determine the best service to take and at what station your train will arrive into London. London’s main rail stations are:
- Charing Cross (27 mins from ExCeL)
- Euston (32 mins)
- Kings Cross/St Pancras International (32 mins)
- Liverpool Street (26 mins)
- London Bridge (16 mins)
- Marylebone (31 mins)
- Moorgate (26 mins)
- Paddington (32 mins)
- Victoria and Waterloo (38 mins)

BY AIR
London has 6 international airports. We recommend flying into London City Airport as it is only about a mile away from the venue and takes about 15 mins to get to the venue using the DLR.

BY CAR
You can download our parking map which shows you the location of the car parks on campus. If you’re arriving via the M11, the North Circular (A406) or the A13, as you get closer to ExCeL you’ll pick up signs for Royal Docks, City Airport and ExCeL London. If you’re using satellite navigation, please enter the postcodes below.

E16 1XL – If you are travelling from the west to ExCeL from Blackwall Tunnel, Limehouse Link, A12 or central London.
E16 1FR – If you are travelling from the east to ExCeL from the M11, A13 or into London from the east.
E16 1AL – If you are using the Royal Victoria Car Park (MSCP). Approximately a 5 minute walk from the venue.

If you have any questions or require more information please email ParkingOnline@excel.london.

For full details on how to reach ExCeL London by underground & DLR, rail, air and driving please visit: https://www.excel.london/visitor/getting-here

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.connexhotelsandeevents.com/eumw-london.html and make your booking.

or email: sally@connexhotelsandeevents.com.

You will find a wide range of accommodation to suit every budget. Alternatively, see the hotel booking pages within this programme.

PERSONAL INVITATION (VISA)
A valid passport will be required for entry into the organising country, in this case the UK. A UK visa may also be required for the purpose of attending EuMW. You can check whether you will need a visa by visiting the following website: https://www.gov.uk/apply-to-come-to-the-uk. If you are registering as a speaker, a delegate or an exhibitor and you need a visa, we recommend that you contact the UK Consulate, in your own country at least 3 to 4 months prior to EuMW.

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

In order to request a letter of invitation, please download and complete the request form https://www.eumw2021.com/docs/EUMW2021_VisaForm.zip and send it to the visa operational officer: visas@eumw2021.org.
Hotel Booking Form
February 2022

Rooms are held on a guaranteed basis. For this reason, you are asked to supply a credit card number and full company details. If your travel plans change and you wish to cancel your accommodation, please contact Sally Garland on +44 (0)7775 744193 or email sally@connexhotelsandevents.com to avoid any non-arrival or cancellation charges, as each hotel has a different cancellation policy, full cancellation details will be clearly marked on every booking confirmation. Prepay rates are non-refundable and non-cancelable.

FOR MORE HOTEL OPTIONS AND TO RESERVE YOUR ROOM ONLINE VISIT
http://www.connexhotelsandevents.com/eumw-london.html
Or complete the booking form below and email to Sally@connexhotelsandevents.com

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Number of rooms required

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Guest Names

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<th>In order to guarantee the accommodation, please provide us with your credit card details:</th>
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<td>Credit Card Number</td>
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I authorise that any no show or late cancellation charges, as stipulated in the Hotelzon / Connex booking confirmation will be charged to this credit card

Signed ____________________________ Date ____________________________

Tel: +44 (0)7775 744193
Email: sally@connexhotelsandevents.com
<table>
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<tr>
<th>HOTEL</th>
<th>TO EXCEL</th>
<th>ROOMS FROM*</th>
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<td>7 minute walk to Excel East Prepay</td>
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<td>HAMPTON BY HILTON LONDON DOCKLANDS – ★★★</td>
<td>7 minute walk to Excel East Prepay</td>
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<td>4 minute walk to Excel West Entrance Prepay</td>
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<td>IBIS BUDGET LONDON CITY AIRPORT – ★</td>
<td>16 minute walk to Excel East Prepay</td>
<td>£37.00 Flexible</td>
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*The above rates are based on single occupancy, during the main days of the event and the standard room type of the hotel. Other room types or pre and post event nights may have different prices. All rates quoted include VAT at the current rate.

**Special Event Rates are only bookable via this form or direct with Sally@connexhotelsandevevents.com
Local Information and Insurance

**WI-FI**
Wi-Fi is available in the exhibition hall and conference area. Login details can be found within your delegate bag.

**ELECTRICITY**
Electricity is supplied at 240V, 50 Hz. UK 3-pin plug.

**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.

**HISTORY & SIGHTSEEING**
London is the cultural, political and economic heart of the United Kingdom. It is the capital city of England and the United Kingdom – a 21st century city with history dating back to Roman times. At its centre stand the imposing Houses of Parliament, the iconic ’Big Ben’ clock tower and Westminster Abbey, site of British monarch coronations. Across the River Thames, the London Eye observation wheel provides panoramic views of the South Bank cultural complex, and the entire city. London is famous for world-class museums, galleries, royal palaces, shopping destinations, West End theatre shows and award-winning restaurants. For more information, visit [https://www.visitlondon.com/](https://www.visitlondon.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 accident, illness, 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 2021.

Conference Information

**BADGES AND REGISTRATION**
The registration area will be located near the entrance to the Exhibition Hall as signposted. 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. 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. Those who have not pre-registered can do so on site until 18th February 2022. There will be on-site 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@aventri.com.

**CONFERENCE ROOMS**
Conference rooms are located in ICC Capital Suite – Level 3 as signposted. 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.

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

**EXHIBITION HOURS**
The exhibition area will be located in Exhibition Halls N20–N23 as shown on the Floor Plan in this booklet. As a registered delegate you will have full access to the exhibition area.

The exhibition opening hours are:
- Tuesday 15th February 2022, 9.30 – 18.00
- Wednesday 16th February 2022, 9.30 – 17.30
- Thursday 17th February 2022, 9.30 – 16.30

See the back cover for a full listing of the exhibitors (correct at the time of going to press).

**CONFERENCE PROCEEDINGS**
All papers published for presentation at your chosen conference will be available to download from an online repository. Four weeks prior to the event, downloading instructions will be communicated to conference registrants.
Partner Programme
Things to see and do in London!

London is the cultural, political, and economic heart of Britain, famous for world-class museums, galleries, royal palaces, shopping destinations, West End theatre shows and award-winning restaurants. With so much to do, it’s hard to narrow down the long list of reasons to visit, but below you’ll find our favourites.

**HOP ON HOP OFF BUS TOUR**

Explore London at your own pace with the Golden Tours hop-on hop-off Bus Tour. Choose between four routes and hop off at more than 60 stops, including Shakespeare’s Globe and Westminster Abbey. As well as having your transport covered, you can enjoy added extras including free walking tours and a 24-hour Thames River pass.

**THE TOTAL LONDON EXPERIENCE – FULL DAY TOUR**

Hop aboard a private, air-conditioned coach for a whistle-stop tour of central London.
First, explore one of the city’s most magnificent buildings: St Paul’s Cathedral. Step inside Sir Christopher Wren’s architectural masterpiece and discover its striking interior, before climbing up to the Golden Gallery for sweeping views of the capital.
Then, head to Buckingham Palace for a quintessential display of British pomp and pageantry, as you watch the famous Changing the Guard ceremony. See the Queen’s New Guard exchange duty with the Old Guard – all active British Army soldiers clad in traditional red tunics and bearskin hats. When the ceremony isn’t available, the tour visits Horse Guards Parade instead.
Afterwards, make your way to the Tower of London, a royal fortress famous for being the prison (and execution place) of choice of one of Britain’s most notorious monarchs: Henry VIII. There, you’ll get the chance to go on a one-of-a-kind tour of the palace with a Yeoman Warder, or “Beefeater”. Learn about the Tower’s fascinating history, stand where famous heads have rolled, get to grips with swords and armour, and take a closer look at the priceless Crown Jewels.
Next, it’s time to jump aboard a riverboat for a relaxing ride along the Thames to one of London’s most charming and underrated neighbourhoods: Greenwich – The home of time, Greenwich is where eastern and western hemispheres meet. Discover its historic attractions, impressive buildings, and panoramic views on a guided walking tour. You’ll take in iconic sights including the world’s last surviving tea clipper, Cutty Sark, and another one of Sir Christopher Wren’s architectural gems, the Old Royal Naval College.
As you head back into central London by boat, sit back and enjoy the city’s skyline, before seeing it from above with a thrilling ride on the London Eye. At 135 metres, this feat of design and engineering is the world’s tallest cantilevered observation wheel. The 360-degree views are incredible and the perfect way to round up the afternoon.

**Prices**

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**Tickets**

- 1 Day Bus Tour £28.00 £14.00
- 24 Hour Bus Ticket £31.45 £14.45
- 24 Hour Ticket + St Paul’s Cathedral £41.00 £19.00
- 48 Hour Ticket £35.00 £17.00
TOP ATTRACTIONS

LONDON EYE

At 135 metres, the London Eye is the world’s tallest cantilevered observation wheel; a feat of design and engineering, it has become the modern symbol representing the capital and a global icon. The experience showcases breath-taking 360-degree views of the capital and its famous landmarks and has been the number one visitor experience in the city for the past decade.

Adult ticket from £24.50
Child ticket from £22.00

WARNER BROS. STUDIO

Duration: Approx. 7 hours (with transportation)
Step on to authentic sets, discover the magic behind spellbinding special effects and explore the behind-the-scenes secrets of the Harry Potter film series.
Discover the iconic Hogwarts Great Hall and explore the Forbidden Forest, all before boarding the original Hogwarts Express at Platform 9¾ and wandering down Diagon Alley. Located at the Studios where all eight films were produced, the Studio Tour showcases the British talent, imagination and artistry that went into making the impossible a reality on screen. Visitors will relive the magic through the eyes of the filmmakers who brought the Harry Potter film series to life.

Adult ticket from £89.00
Child ticket from £84.00

HM TOWER OF LONDON

Despite the Tower of London’s grim reputation as a place of torture and death, within these walls you will also discover the history of a royal palace, an armory and a powerful fortress. Don’t miss Royal Beasts and learn about the wild and wondrous animals that have inhabited the Tower, making it the first London Zoo.
Discover the priceless Crown Jewels, join an iconic Beefeater on a tour and hear their bloody tales, stand where famous heads have rolled, learn the legend of the Tower’s ravens, storm the battlements, get to grips with swords and armour, and much more!

Adult ticket from £28.90
Child ticket from £14.40

THE SHARD

The View from The Shard allows you to go inside The Shard building and look out over London from the viewing platforms on levels 68 and 69. You can also head up to the Skydeck on level 72 - an open-air platform offering spectacular views over London.

While you’re enjoying the views, grab a drink or snack served by one of the bars. You can also book an all-inclusive experience in advance, which includes a glass of champagne and souvenir photos of your visit.

Adult ticket from £45.00
Children under 4 – Free

If you would like to buy tickets for any of the attractions or tours, please contact Sally Garland on sally@connexhotelsandevents.com
FREE LONDON ATTRACTIONS

From London’s exquisite parks to world-class museums, historic houses and stunning art galleries, there are some amazing free experiences to be had in London. You may need to book tickets in advance, even if entrance is free.

There are many more places to visit in London. For more ideas go to: www.visitlondon.com.

TATE MODERN

NATIONAL GALLERY

KENSINGTON GARDEN

NATURAL HISTORY MUSEUM

VICTORIA AND ALBERT MUSEUM

SKY GARDEN BRASSERY

BRITISH MUSEUM

SOMERSET HOUSE

SHOREDITCH
Social Events

EuMIC Cocktail Reception
Monday 14th February 2022
18:00 – 20:00
Cost: Free to all EuMIC delegates
(Sponsor: GAAS® Association)
(please bring your badge to gain admission)
Location: Onsite in the Exhibition Hall N19 – N23

This event will start at 18:00 to permit attendees to also join the Foundry Session which begins at 18:30. However, there will be plenty of food and drinks for attendees who will join the event after the final EuMIC papers finish at 18:20 - so please join us when you are free!

Automotive Forum Networking Dinner
Monday 14th February 2022
19:00 – 22:00
Cost: Free to registered Automotive delegates
(please bring your badge to gain admission)
Location: Off-site: The Fox Excel
Locate just outside the West Entrance of Excel.

Join us for drinks and a 3 course dinner to give you the chance to network and discuss the issues raised throughout the Conference in an informal setting.

EuMW Welcome Reception
Tuesday 15th February 2022
18:30 – 21:30
Cost: Free to conference delegates & invited exhibitors
Location: The Platinum Suite (level 1)

All registered conference delegates, as well as invited representatives from companies participating in the exhibition are invited to the EuMW 2021 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 2021, London to EuMW 2022, Milan as well as an address from the Platinum Sponsor, Keysight Technologies. The open-buffet dinner will be served from 19:00.

EuRAD Lunch
Friday 18th February 2022
13:00 – 14:00
Cost: Free to registered EuRAD delegates
(please bring your badge to gain admission)
Location: ICC Capital Suites 14 – 16

A seated hot plated lunch for EuRAD delegates to catch up and round off a busy week.

The EuMW Cruise on the River Thames
Wednesday 16th February 2022
19:00 – 22:00
Cost: £39.00 for all guests
Location: North Greenwich Pier (by the 02)

Join us aboard City Alpha and City Gamma boats for a traditional three hour Thames sightseeing cruise leaving at 19:00. The cruise will take you along the Thames into Central London before turning and heading back down river to Greenwich. This unique sightseeing experience will be complemented with drinks and canapes. Tickets are limited, so register today!
Workshops and Short Courses List

Despite the organisers’ best efforts to ensure the availability of all listed workshops and short courses, the list below and the numbering are subject to change. Please refer to www.eumw2021.com before registration for final availability and numbering.

Sunday 13th February 2022

<table>
<thead>
<tr>
<th>WS01</th>
<th>EuMC</th>
<th>Full Day</th>
<th>Advances of wireless sensing in harsh and severe environments</th>
</tr>
</thead>
<tbody>
<tr>
<td>WS02</td>
<td>EuMC/EuMIC</td>
<td>Full Day</td>
<td>Terahertz device, circuit and system fundamentals and applications</td>
</tr>
<tr>
<td>WS03</td>
<td>EuMC</td>
<td>Full Day</td>
<td>mmWave Plastic Waveguide High Data Rate Communication</td>
</tr>
<tr>
<td>WS04</td>
<td>EuMC</td>
<td>Full Day</td>
<td>New trends in microwave and mmWave filters</td>
</tr>
<tr>
<td>WS05</td>
<td>EuMC</td>
<td>Full Day</td>
<td>On-chip and scalable RF packaging solutions with integrated antennas for 5G mmWave and 6G applications</td>
</tr>
<tr>
<td>WS06</td>
<td>EuMC/EuMIC</td>
<td>Full Day</td>
<td>Progress and status of Gallium Nitride monolithically microwave integrated circuits</td>
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<tr>
<td>WS07</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>RF reliability status and challenges for 5G mmWave and 6G applications</td>
</tr>
<tr>
<td>WS08</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Technology for RF 5G and satcom: from material to packaged demonstrators</td>
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<td>WS09</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Research in power and S-parameters measurements at mmWave and terahertz frequencies</td>
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<tr>
<td>SS01</td>
<td>EuMC</td>
<td>Half Day PM</td>
<td>Advanced non-linear characterization and design of highly efficient power amplifiers using load pull data for sub 6GHz and mmWave applications</td>
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<tr>
<td>SS02</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Fundamentals of microwave PA Design</td>
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<tr>
<td>SS03</td>
<td>EuMC</td>
<td>Half Day PM</td>
<td>6G mmWave OTA measurements - best practices for fast and reliable results (CANCELLED)</td>
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<tr>
<td>SS04</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>Terahertz technology, instrumentation and applications</td>
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Monday 14th February 2022

<table>
<thead>
<tr>
<th>WM01</th>
<th>EuMC</th>
<th>Half Day PM</th>
<th>Optimizing modulation quality measurements on wide bandwidth signals - from conformance through R&amp;D</th>
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<tr>
<td>WM02</td>
<td>EuMC/EuMIC</td>
<td>Full Day</td>
<td>Advances in circuits and systems for mmWave radar and communication in silicon technologies</td>
</tr>
<tr>
<td>WM03</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Sensing, imaging and biological tissues characterization using microwaves and mmWaves</td>
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<tr>
<td>WM04</td>
<td>EuMC</td>
<td>Full Day</td>
<td>RF on-wafer calibration and measurement eco-system workshop</td>
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<tr>
<td>WM05</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Novel technologies for emerging on-board microwave equipment based on surface mounted electromechanical relays</td>
</tr>
<tr>
<td>WM06</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Recent developments in wireless power transfer and energy harvesting</td>
</tr>
<tr>
<td>WM07</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>Beyond 5G: mmWave and terahertz techniques of 6G research</td>
</tr>
<tr>
<td>SM01</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>R&amp;D trends and challenges in RFPAs for medium/high-volume products</td>
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<tr>
<td>SM02</td>
<td>EuMC</td>
<td>Half Day PM</td>
<td>Intuitive microwave filter design with EM simulation</td>
</tr>
<tr>
<td>SM03</td>
<td>EuMC</td>
<td>Half Day PM</td>
<td>Phase-noise in next-generation aerospace/defense and commercial wireless communications</td>
</tr>
<tr>
<td>SM04</td>
<td>EuMC</td>
<td>Half Day PM</td>
<td>Solid-state microwaves applications in industrial, scientific and medical fields</td>
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</table>

Wednesday 16th February 2022

<table>
<thead>
<tr>
<th>WW01</th>
<th>EuMC/EuMIC</th>
<th>Full Day</th>
<th>Technologies for 6G FEMs</th>
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</thead>
<tbody>
<tr>
<td>WW02</td>
<td>EuRAD</td>
<td>Full Day</td>
<td>Virtual validation of automotive sensors</td>
</tr>
<tr>
<td>SW01</td>
<td>EuRAD</td>
<td>Half Day AM</td>
<td>Joint range-angle superresolution MIMO radar</td>
</tr>
<tr>
<td>SW02</td>
<td>EuRAD</td>
<td>Half Day PM</td>
<td>Radar design from the ground up</td>
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</table>

Thursday 17th February 2022

| WTh01 | EuRAD/EuMC | Half Day AM | Advances in drone antenna measurement techniques for Satcom and RADAR applications |

Friday 18th February 2022

<table>
<thead>
<tr>
<th>WF01</th>
<th>EuMC</th>
<th>Half Day AM</th>
<th>Advanced manufacturing and packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>WF02</td>
<td>EuRAD</td>
<td>Half Day PM</td>
<td>Paradigm change in automotive mm-Wave radar applications - from technology push to demand pull</td>
</tr>
<tr>
<td>WF03</td>
<td>EuMC</td>
<td>Full Day</td>
<td>Innovative THz technologies for imaging, radar and communication</td>
</tr>
<tr>
<td>WF04</td>
<td>EuRAD</td>
<td>Full Day</td>
<td>Advanced processing and deep learning approaches for indoor sensing using short-range radars</td>
</tr>
<tr>
<td>SF01</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>AI techniques for microwave antenna and filter design: from theory to practice (CANCELLED)</td>
</tr>
<tr>
<td>SF02</td>
<td>EuMC</td>
<td>Half Day AM</td>
<td>Microwave superconductivity: applications of SQUID and Josephson junctions in microwave circuits (CANCELLED)</td>
</tr>
</tbody>
</table>
Registration Information

CONFERENCE REGISTRATION DETAILS

See pricing table on the following page.

ONLINE REGISTRATION
- All online registrations should be made at www.eumw2021.com.
- Registrations completed up to and including 31st December 2021 will be charged at the 'Advance Discounted Rate' and those from 1st January 2022 will be charged at the 'Standard Rate'.
- Online registration is open from mid October 2021 up to and during the event until 18th February 2022.

ONSITE REGISTRATION
- Onsite registration is available:
  - Saturday, 12th February 2022, 16:00 – 19:00
  - Sunday, 13th February 2022, 08:00 – 17:00
  - Monday, 14th February 2022, 08:00 – 17:00
  - Tuesday, 15th February 2022, 08:00 – 17:00
  - Wednesday, 16th February 2022, 08:00 – 17:00
  - Thursday, 17th February 2022, 08:00 – 17:00
  - Friday, 18th February 2022, 08:00 – 10:00

Onsite registration will be charged at the Standard Rates.

HOW TO REGISTER

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

ONLINE
- Delegates can register for one, two or all three of the conferences.
- Discounts will be given to those registering for two or more conferences.
- In addition to the conferences, delegates can register for forums, short courses or workshops.
- Discount is given when combining a forum, short course or workshop registration with a conference registration.
- 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.
- Please note that fees are not subject to VAT.

ONSITE
- The registration area will be outside the Exhibition Halls 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.
Registration Fees

Get the most out of this year’s Microwave Week with a Full Week ticket. Combine all three conferences with access to all forums (the Defence, Security and Space forum and the 5G and Beyond forum) except the Automotive forum, as well as all Workshops and Short Courses.

Registration at one conference does not allow access to the sessions of the other conferences.

Subsidised lunchboxes are £7 each (one per day). They are available to all who attend EuMW, and should be ordered at the time of registration, either online or on-site.

Reduced rates are offered if you have society membership to any of the following: EuMA®, GAAS®, IET or IEEE. 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 13th February 2022). The fees shown below are invoiced in the name and on behalf of the European Microwave Association. All payments must be in £ (pound sterling) - cards will be debited in £ (pound sterling).

<table>
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<tr>
<th>CONFERENCES</th>
<th>ADVANCE DISCOUNTED RATE (FROM 11th OCTOBER UP TO &amp; INCLUDING 31ST DECEMBER 2021)</th>
<th>STANDARD RATE (FROM 1ST JANUARY 2022)</th>
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<td>Society Member ©</td>
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<td>1 Conference</td>
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<tr>
<td>EuMC</td>
<td>£430,-</td>
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<td>EuMIC</td>
<td>£330,-</td>
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<td>EuMC + EuMIC</td>
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<td>EuRAD + EuRAD</td>
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<td>3 Conferences</td>
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<td>EuMC + EuMIC + EuRAD</td>
<td>£730,-</td>
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<td>Full Week Ticket</td>
<td>£1,140,-</td>
<td>£680,-</td>
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CONFERENCE TECHNICAL CO-SPONSORS

- EuMIC 2021
- EuRAD 2021
- GAAS
- AS
- EurAAP
**BECOME A MEMBER – NOW!**

EuMA membership fees: Professional £22,-/year, Student £13,-/year.

One can apply for EuMA membership by ticking the appropriate box during registration for EuMW. Membership is valid for one year, starting when the subscription is completed. The discount for the EuMW fees applies immediately.

Members have full e-access to the International Journal of Microwave and Wireless Technologies. The printed version of the journal is no longer available.

EUMA 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.

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**SPECIAL FORUMS AND SESSIONS**

**ADVANCED DISCOUNTED RATE** (UP TO & INCLUDING 31ST DECEMBER 2021)

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<tr>
<th>Date</th>
<th>Delegates*</th>
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<tr>
<td>European Microwave Student School</td>
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<tr>
<td>Tom Brazil Doctoral School of Microwaves</td>
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<td>Automotive Forum</td>
<td>£240,-</td>
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<tr>
<td>Defence, Security and Space Forum</td>
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<td>5G and Beyond Forum</td>
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**STANDARD RATE** (FROM 1ST JANUARY 2022 & ONSITE)

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<tr>
<td>5G and Beyond Forum</td>
<td>£80,-</td>
<td>£90,-</td>
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* Those registered for EuMC, EuMIC or EuRAD ** Those not registered for a conference

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**WORKSHOPS AND SHORT COURSES**

**IN COMBINATION WITH CONFERENCE REGISTRATION**

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<tr>
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<th>Society Member</th>
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**WITHOUT CONFERENCE REGISTRATION**

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<td>£150,-</td>
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**EUROPEAN MICROWAVE WEEK SPONSORS**

Official Publication: [Microwave Journal]

Supported by: [IET, Institution of Engineering and Technology]

Co-Sponsored by: [MT-S, IEEE]
EuMW 2021 Student School

Monday 14th February 2022
9:00 – 17:20, ROOM 3

Organiser: John Crute, The Technology Academy, UK
Co-organiser: Markus Funk and Jamie Lunn, Rohde & Schwarz

The aim of the EuMW 2021 Student School is to enable Undergraduate and Masters Degree Students to become familiar with a range of RF and microwave measurements using modern test and measurement (T&M) equipment. A series of technical presentations will introduce students to key RF and microwave measurements and best practice operation of T&M equipment.

Working in small teams, students will then use various T&M instruments, including vector network analysers, spectrum analysers and power meters, to perform a range of RF and microwave measurements. Students will also learn how to correctly care for and clean connectors and cables to improve measurement quality and reduce the risk of expensive damage to laboratory test equipment.

Leading test equipment manufacturer Rohde & Schwarz will provide a range of modern test equipment for the workshops, which will be supported by expert staff. Attendees will each receive a student pack containing various useful items. Teams will be assessed throughout the workshops and prizes will be awarded for the best overall team and runners-up.

Programme

SESSION 1: TECHNICAL PRESENTATIONS

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Introduction to the Student School</td>
<td>John Crute, The Technology Academy</td>
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<tr>
<td>09:05</td>
<td></td>
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<tr>
<td>09:05</td>
<td>Vector Network Analyzer (VNA) Measure</td>
<td>Jamie Lunn, Rohde &amp; Schwarz</td>
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<tr>
<td>09:50</td>
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<tr>
<td>09:50</td>
<td>Spectrum Analyzer Measurements</td>
<td>Markus Funk, Rohde &amp; Schwarz</td>
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<td>10:35</td>
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<td>11:00</td>
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<td>11:00</td>
<td>Power Measurements</td>
<td>Markus Funk, Rohde &amp; Schwarz</td>
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<tr>
<td>11:45</td>
<td>Connector and Cable Care</td>
<td>Jamie Lunn, Rohde &amp; Schwarz</td>
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<td>12:30</td>
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<tr>
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SESSION 2: HANDS-ON MEASUREMENTS WORKSHOPS

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<td>Closing Session and Awards</td>
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</tr>
</tbody>
</table>
The 2021 European Microwave Week features the 11th Tom Brazil Doctoral School of Microwaves, sponsored by the GAAS® Association. It offers postgraduate students and postdoctoral researchers a focused interactive hands-on workshop and technical lecture series in microwaves that go beyond the standard conference programme.

In the hands-on workshop, attendees will learn the system design of modern digital radios. After interactive demonstrations using a commercial software defined radio, the instructor will lead groups to design one key building block of the modern digital radio. You will learn to simulate and lay out a selected radio component, fabricate it on-site and measure its performance with a USB vector network analyzer (NanoVNA), which you keep after the workshop. A technical lecture series devoted to emerging microwave topics is provided by four invited speakers in the afternoon. The Doctoral School concludes with an announcement of the Tom Brazil Fellowship Award (by the GAAS® Association) shortlist by representatives of the GAAS® Association.

Programme

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Hands-on workshop: Digital Radio Systems &amp; interactive demonstrations</td>
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<tr>
<td>09:30</td>
<td>David Ricketts, North Carolina State University, USA</td>
</tr>
<tr>
<td>10:40</td>
<td>Break</td>
</tr>
<tr>
<td>11:20</td>
<td>Hands-on Workshop: design, build &amp; measurement of radio components</td>
</tr>
<tr>
<td>13:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>14:20</td>
<td>Microwave Near-Field Imaging of Human Tissue</td>
</tr>
<tr>
<td>14:30</td>
<td>Natalia Nikolova, McMaster University, Canada</td>
</tr>
<tr>
<td>15:10</td>
<td>New Frontiers in Terahertz Technology</td>
</tr>
<tr>
<td>15:20</td>
<td>Mona Jarrahi, University of California Los Angeles, USA</td>
</tr>
<tr>
<td>16:00</td>
<td>Break</td>
</tr>
<tr>
<td>16:40</td>
<td>Superconducting microwave circuits for quantum computing</td>
</tr>
<tr>
<td>17:00</td>
<td>Peter Leek, University of Oxford, UK</td>
</tr>
<tr>
<td>17:30</td>
<td>THz applications for artworks and cultural heritage</td>
</tr>
<tr>
<td>18:00</td>
<td>Emilio Giovenale, ENEA, Italy</td>
</tr>
<tr>
<td>18:20</td>
<td>Tom Brazil Fellowship Award (by the GAAS® Association) student essay competition shortlist announcement</td>
</tr>
</tbody>
</table>
Tom Brazil Fellowship Award (by the GAAS® Association) Student Essay Competition

The Role of Microwaves in Contributing to the Realisation of a more Sustainable World

Monday 14th and Tuesday 15th February 2022
Exhibition Hall (MicroApps) + Other Locations

Programme

As part of the Tom Brazil Fellowship Award (by the GAAS® Association), we would like to announce the following essay competition which will be open to students pursuing a research degree in RF/Microwave/mmWave electronics. The first prize will be 1500 € with a runner-up prize of 750 €. You must register for one of the conferences to enter the essay competition.

The student should write a maximum of 4000 word essay or max of 12 pages including diagrams and tables, on the role of microwaves so far in reducing the carbon footprint and what kind of future activities will be important and why. In particular, what aspects of their own research work would be applicable.

Guidance: What we’re looking for is a summary of the role so far of RF/Microwave/mmWave in telecommunications and other fields which have contributed to remote working (especially during the COVID pandemic) and reducing travel(commuting). Also for enabling developing countries to build sustainable agricultural and other industries that require good communications infrastructure. The use of THz for forecasting of catastrophic weather events has also been an important and ongoing development. Microwave activity can help in reducing carbon footprint: for example high efficiency power amplifiers and other components for base station applications, high efficiency antenna beam steering architectures, use of THz for weather forecasting and warning of catastrophic weather/natural events.

We are looking for creative and original ideas and suggestions on how future microwave related research work can be best directed in fulfilling our contribution in reducing climate change and mitigating the effects that we already have to manage.

The shortlist of 4 selected essays will be announced at the end of the Tom Brazil Doctoral school on 14th February and these finalists will be asked to do a final pitch at 8:30am – 9:30am on Tuesday 15th February in the MicroApps area of the Exhibition Hall. The winner and runner-up will be announced during the awards session at the EuMIC closing event on 15th February afternoon.

Submissions: Please submit your essay by the deadline of 18th January 2022 (before midnight UK time) to grants@eumw2021.org.
IEEE Young Professionals Activities

Expanding Your Global Network

Wednesday 16th February 2022
13:00 – 16:00 (Lunch from 13:00), ROOM 15

Organiser: Ana Inês Inácio, IEEE MTT-S Young Professionals and IEEE R8 YP member
Co-organiser: Noel Gomes, IEEE UK and Ireland Young Professionals Chair

Programme

IEEE Young Professionals is the group of IEEE members and volunteers who have graduated from their first professional degree within the past 15 years. It is an international community, whose members are interested in elevating their professional image, expanding their global network, connecting with peers locally and giving back to their community. Since it encompasses all members from recent university graduates to experienced professionals and entrepreneurs, the group is highly diverse in what it has to offer. To join the IEEE Young Professionals community, you need to be an IEEE member.

Following last years’ initiative, EuMW 2021 will have a Young Professionals track devoted to students, young researchers and young industry professionals. The track comprises of a couple of technical and self-development sessions. The sessions are organised and co-sponsored by IEEE MTT-Society Young Professionals, IEEE Young Professionals and IEEE UK and Ireland Young Professionals, and in collaboration with IEEE Region 8 Young Professionals. It is not necessary to be an IEEE member or a Young Professional to attend this event. Everyone is very welcome!

Guest speakers to be announced soon. Keep a close eye on the conference website (www.eumw2021.com) and on our social media platforms to stay up to date.

For additional questions, please contact mtt-yp@ieee.org.
Women in Microwave Engineering
Stronger Together

Tuesday 15th February 2022
13:00 – 18:00, ROOM 15

Chair: Dr. Noushin Karimian, Manchester Metropolitan University, UK
Co-Chair: Dominique Scheurs, KU Leuven, Belgium

We continue the tradition of holding the Women in Microwave Engineering event, sponsored by IEEE MTT-S during the European Microwave Week. Both women and men are welcome.

This year’s event will take place in London, a leading global city and a world cultural capital. The event will focus on inspiring women in engineering and will end with a guided tour of the Cutty Sark.

Two invited speakers will give presentations on their current research and success as a woman in Engineering. At the end of the panel session a guided tour to the Cutty Sark will take place.

Programme

SPECIAL PANEL SESSION ON “INSPIRING WOMEN IN ENGINEERING” – A WOMEN IN MICROWAVE ENGINEERING EVENT
Registration: Free

13:00 – 14:30
Panel Session “Inspiring Women in Engineering”

14:30 – 18:00
Visit to Cutty Sark
A luxury Coach will take you to Greenwich to board the Cutty Sark, the celebrated historic sailing ship and fastest of its time, for a self-guided tour with interactive audio guide.

The Cutty Sark is a tea clipper, a ship built for extreme speed and streamlined ocean wayfaring in order to transport tea across the seas. While it was depended on to bring tea from the East to drinkers in the West, the Cutty Sark actually served multiple purposes during its working. During its lifetime, the Cutty Sark was responsible for bearing and transporting more than 10 million pounds of brew.

18:00
Return to ExCeL
Career Platform

Tuesday 15th and Wednesday 16th of February 2022
Various locations, refer to programme

Organiser: Dr. Noushin Karimian, Manchester Metropolitan University, UK
Co-organiser: Helen Duncan, MWE Media Ltd., UK

The Career Platform has been an integral part of EuMW since 2013. The aim is to foster the dynamic between young researchers, engineers and the job market in the RF and microwave field. It includes a dedicated meeting area for these young people to speak with human resources and recruitment specialists from the companies and organisations that sponsor the platform.

A special conference session will be held to explain more about the industrial market, and to share ideas on career development, which interested young people are invited to attend free of charge.

EuMW 2021 will also continue its e-Platform initiative, which provides a free-to-use job portal for the European RF and Microwave community at http://rf-and-microwave-jobs-in-europe.eu. For further information, contact the Career Platform Chairs:

Dr. Noushin Karimian
Manchester Metropolitan University
career.platform@eumw2021.org

Helen Duncan
MWE Media Ltd.
helen.duncan@mwemedia.com

Events

09:00 – 12:00
Special Session: The European Microwave Industry Market
Date: Tuesday 15th
Venue: Room 15
Registration fee: Free

09:00 – 17:00
Career Platform Lounge
Date: Tuesday 15th and Wednesday 16th
Venue: ICC Capital Suite located on Level 2
Registration fee: Free

This space will encourage networking between job seekers and recruiters. The platform lounge includes recruitment booths from sponsoring European companies and academic institutions.
Young people are invited to bring and share their CVs.

For sponsorship information, please contact the Career Platform Chairs (see above).

ONLINE
E-Career Platform
Venue: Online
Registration fee: Free

The EuMW e-career platform aims to support and promote the RF and Microwave community by providing a job portal on a Europe-wide scale: http://rf-and-microwave-jobs-in-europe.eu

Also please connect with us via our LinkedIn group, RF and Microwave Jobs in Europe
Following applications like keyless entry and tire pressure monitoring systems, mobile communications and recently automotive radar made microwave technologies a strong pillar inside the automotive world. The first 77 GHz automotive radar sensors entered the European market in 1999. In 2019, the European Microwave Association (EuMA) for the first time organized the Automotive Forum to provide an open platform for industrial experts to discuss technical aspects, concepts and radar architectures as well as market issues in the area of microwaves in the automotive industry.

The forum consists of a good mix of technical presentations, plenary and panel discussions as well as networking time. This year’s event will focus on the following topics:

1. Radar testing technologies
2. Virtual radar testing
3. Imaging radar for autonomous driving
4. Radar market, technology and game changers

The forum is mainly devoted to technical experts from automotive industry throughout

### Programme

#### SESSION 1: RADAR TESTING TECHNOLOGIES
(Chair: Thomas Zwick, Karlsruhe Institute of Technology, Germany)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Practical Advice and Considerations for Radar Testing by Vitali Anselm, National Instruments, Germany</td>
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<tr>
<td>09:20</td>
<td>Coffee</td>
</tr>
<tr>
<td>09:20</td>
<td>Road to Lab: Validation of ADAS/AD functions relying on sensor fusion by Henrik Liebau, Seung Chul Shin, Keysight Technologies, Germany/USA</td>
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<tr>
<td>09:40</td>
<td>Radar Target Simulation – Precise and Versatile Testing of Automotive Radars by Andreas Himmler, dSpace, Germany</td>
</tr>
<tr>
<td>10:00</td>
<td>Validation of Radar-Based ADAS and AD Functions on Vehicle-in-the-Loop Test Beds by Holger Gryska, Rohde &amp; Schwarz, Germany</td>
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<tr>
<td>10:20</td>
<td>Open Discussions all Presentations of the Session</td>
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<tr>
<td>10:40</td>
<td>Coffee</td>
</tr>
<tr>
<td>11:20</td>
<td>Practical Advice and Considerations for Radar Testing by Vitali Anselm, National Instruments, Germany</td>
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#### SESSION 2: VIRTUAL RADAR TESTING
(Chair: Xiaobang Shang, National Physical Laboratory, UK)

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<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>11:40</td>
<td>Multiple-Ray-Tracing (MRT) Tool with SystemVue by Riccardo Giacometti, Christopher Groetsch and Mart van-Gijsel, Keysight Technologies, Italy</td>
</tr>
<tr>
<td>12:00</td>
<td>Automated Driving and the Need for Virtual Validation – the VIVID Project by Frank Gruson, Hasan Iqbal and Sandro Reith, Continental, Germany</td>
</tr>
<tr>
<td>12:20</td>
<td>Over-the-Air Radar Target Simulator – Technology, Challenges and Outlook by Prasanna Kannan, IPG Automotive GmbH, Germany</td>
</tr>
<tr>
<td>12:40</td>
<td>Open Discussions all Presentations of the Session</td>
</tr>
<tr>
<td>13:00</td>
<td>Lunch</td>
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</tbody>
</table>
the whole supply chain. Keynote speakers will present their views on special technical solutions as well as regulatory or strategic issues. Early registration is recommended.

SESSION 3: IMAGING RADAR FOR AUTONOMOUS DRIVING
(Chair: Frank Gruson, Continental AG, Germany)

14:20 - 14:40: Regulatory Requirements of Automotive Imaging Radars for Advanced Driver Assistance Systems (ADAS)
Oliver Kneip, KL-Certification GmbH, Germany | Daniel Lenhardt, IB-Lenhardt AG, Germany | Karsten Geraldy, Piotr Sardyko, IBL-Lab GmbH, Germany | Alois Ascher, Rohde & Schwarz GmbH, Germany

14:40 - 15:00: Compact Imaging Radar
Simón Tejero Alfageme, Huawei, Germany/China

15:00 - 15:20: On a vision through Imaging radar
Ankit Sharma & Apu Sivadas, Steradian Semiconductor Pvt Ltd, India

15:20 - 15:40: Challenges in the Design of Radar Transceivers for ADAS/AD
Marta Martinez Vazquez, Renesas Electronics Europe GmbH, Germany/Japan

15:40 - 16:00: Open Discussions all Presentations of the Session

SESESSION 4: RADAR MARKET, TECHNOLOGY AND GAME CHANGERS
(Chair: Martin Kunert, Robert Bosch GmbH, Germany)

16:40 - 17:00: Paradigm change in automotive mm-wave radar applications - from technology push to demand pull
Holger H. Meinel, Germany

17:00 - 17:20: Radar Market Overview and Technology Trends
Cédric Malaquin, Yole Développement, France

17:20 - 17:40: 22FDX technology node @ GlobalFoundries - Solutions for mmWave Radar Applications & 5/6G Communication
Manfred Horstmann, Global Foundries, Germany

17:40 - 18:00: Can sub-THz radar be a game changer?
Marina Gashinova, University of Birmingham, United Kingdom

18:00 - 18:20: Open Discussions all Presentations of the Session

Registration and Programme Updates
Advanced Registration fee (up to & incl. 31st December 2021) is £240 for those who registered for a conference and £290 for those not registered for a conference. Standard Registration fee (from 1st January 2022 & onsite) is £330 for those who registered for a conference and £390 for those not registered for a conference. The Conference Special Events section of the EuMW website will give further details and updates.
Defence, Security and Space Forum
RF Sensing from Space: Modern Trends and Challenges

Wednesday 16th February 2022
11:20 – 18:20, ROOM 8 – 11

Chair: Prof. Chris Baker, University of Birmingham, UK
Co-chair: Dr. Michail Antoniou, University of Birmingham, UK

RF sensing from spaceborne systems is undergoing a revolution. Leveraging the vast legacy of orbital RF sensors, and powered by the latest advances in RF and satellite technologies, next-generation missions, from radar satellites to spaceborne radiometers, are rapidly emerging.

Around the world, there are innovative and new systems in operation, development or concept design stages, some of which involve large-scale radar satellite constellations for the first time ever. Driven by current and future user demands in remote sensing, security and defence, they are pushing the limits of the possible in terms of the fidelity of their sensing outputs, the rate with which these outputs are provided, and their RF sensing instrumentation that enables it, all while the size of spaceborne platforms themselves is reducing.

The purpose of this year’s Defence, Security and Space Forum is to encapsulate the current state of the art in spaceborne RF sensing, and to discuss its key technical enablers as well as the challenges it faces moving forward. World-renowned experts from aerospace primes, SMEs, space agencies and government across Europe will present their work on this exciting topic, from new concepts and RF technologies to established systems currently in operation, with

Programme

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>09:00</td>
<td>EuRAD Opening</td>
</tr>
<tr>
<td>10:40</td>
<td>Free Lunch Boxes Provided on-site by Microwave Journal</td>
</tr>
<tr>
<td>10:40</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:20</td>
<td>RF Sensing from Space: Modern Trends and Challenges</td>
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<td></td>
<td>Moderators: Chris Baker and Michail Antoniou</td>
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<tr>
<td>13:00</td>
<td>Microwave Journal Industry Panel Session</td>
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<tr>
<td>14:20</td>
<td>Free Lunch Boxes Provided on-site by Microwave Journal</td>
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<tr>
<td>14:20</td>
<td>“How Airbus tackles the new spaceborne RF sensing challenges”, Sam Doody, HO Microwave Instruments, Airbus Defence and Space UK</td>
</tr>
<tr>
<td>14:20</td>
<td>“Processing and exploitation challenges for future UK defence and security space-based radar missions”, Prof. David Blacknell, Technical Fellow, Defence Science and Technology Laboratory (DSTL)</td>
</tr>
<tr>
<td>14:20</td>
<td>“The ICEYE orbital SAR constellation”, Dr. Darren Muff, Senior SAR Product Engineer, ICEYE</td>
</tr>
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</table>

Four renowned experts will discuss various topics on RF sensing from space.

- “The Future of Spaceborne SAR systems: NewSpace or Full-Fledged Systems?”, Prof. Alberto Moreira, Director of the Microwaves and Radar Institute, German Aerospace Centre (DLR)
**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.

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- "Towards a Quantum Advantage in Radar," Fabian Kronowetter, Junior Development Engineer technology, Rohde & Schwarz
- "Technology Advancements Enable Next-Generation SATCOM and Space-Based RADAR," Mike Jones, System Platform Manager and Brad Hall, System Applications Manager, Aerospace and Defense, Analog Devices
- "How GaN Technology is Transforming SATCOM RF Architectures," Speaker-TBD, Qorvo

**16:00 – 16:40 Coffee Break**

**16:40 – 18:20 Round table discussion**

Moderators: Chris Baker and Michail Antoniou
Panelists: David Blacknell (DSTL), Sam Doody (Airbus Defence and Space UK), Alberto Moreira (DLR), Darren Muff (ICEYE)

World-wide experts are invited to this Table to discuss the trends, potential, and challenges for new spaceborne RF sensing concepts. Key discussion points include, but are not limited to:

- What are the end user needs (civilian and military) driving innovation in spaceborne RF sensing?
- What are the key technologies that enable it and what new capabilities do they introduce?
- What are the barriers in the adoption and integration of these technologies?
- How can these barriers be overcome?
- What is the role of research in helping to overcome them?
5G and Beyond Forum
Trailblazing the Future

Thursday 17th February 2022
9:00 – 17:15, ROOM 14

Chair: Dr Lutfi Albasha, American University of Sharjah, UAE
Co-Chair: Dr Chris Clifton, Sony Europe B.V.

The forum focus is on technologies beyond 5G. State of the art developments in the fields of wireless technologies for 5G and beyond will be discussed. The forum is for one-day with invited speakers from academia and industry. The topics of the forum cover a wide range of subjects that pertain to next generation communications. This includes 6G standardization, environment aware networks, advanced sensing and low power radars. The forum will include a panel session, coffee breaks and packed lunch.

Programme

08:00 - 09:00
Registration and Morning Coffee

09:00 - 09:15
Welcoming Notes
Chair

09:15 - 10:00
RoF Technology for Beyond 5G Radio’s Design
Fadhel M. Ghannouchi, IEEE Fellow
iRadio Lab, Department of Electrical and Computer Engineering, University of Calgary, Canada

10:00 - 10:45
On the Verge of 6G?
Andreas Roessler
Technology Manager Rohde&Schwarz USA, Inc.

10:45 - 11:30
Towards Environment-Aware Wireless Networks
Mohamed-Slim Alouini, Fellow IEEE
King Abdullah University of Science and Technology [KAUST], Saudi Arabia

11:30 - 12:15
Integrating Communications, Sensing and Intelligence for 6G and Beyond
Christos Masouros
Department of Electronic and Electrical Engineering University College London [UCL]

12:15 - 13:00
On the Application and Performance of Intelligent Reflective Surfaces in 6G
Emad Alsusa
Department of Electrical and Electronic Engineering, University of Manchester

13:00 - 14:00
Lunch

14:00 - 15:00
Panel Session
All speakers Moderator: Co-Chair

15:00 - 15:45
What is the Role of Intelligent Reflecting Surfaces in 6G?
Emil Björnson
KTH Royal Institute of Technology, Stockholm, Sweden

15:45 - 16:30
High Frequency MMICs and Characterization Considerations
Lyndon Pattison, IconicRF, Belfast, Ireland

16:30 - 17:15
Low Power Stretched-Processed Miniaturized Receiver Radar Sensors
Lutfi Albasha, American University of Sharjah, UAE

17:15 - Forum Closing Remark
Registration and Programme Updates

Advanced Registration fee (up to & incl. 31st December 2021) is £60 for those who registered for a conference and £70 for those not registered for a conference. Standard Registration fee (from 1st January 2022 & onsite) is £80 for those who registered for a conference and £90 for those not registered for a conference. The Conference Special Events section of the EuMW website will give further details and updates.

SPECIAL CONFERENCE EVENTS

5G and Beyond Forum
Trailblazing the Future
Thursday 17th February 2022
9:00 – 17:15, ROOM 14
Chair: Dr Lutfi Albasha, American University of Sharjah, UAE
Co-Chair: Dr Chris Clifton, Sony Europe B.V.

The foundation of mobile telephony
Mobile telephony for everyone
The foundation of mobile broadband
Mobile broadband enhanced
Embracing a networked society
Enabling a smart sustainable society

1G ~1980
2G ~1990
3G ~2000
4G ~2010
5G ~2020
6G ~2030

1st GENERATION wireless network
- Basic voice service
- Analog based protocols
- 2.4 Kbps

2nd GENERATION wireless network
- Designed for voice
- First digital standards (GSM, CDMA)
- 64 Kbps

3rd GENERATION wireless network
- Designed for voice and data
- First mobile broadband
- Voice through circuit & Data-Packet Switching
- 2 Mbps

4th GENERATION wireless network
- Designed primarily for data
- IP based protocol
- True mobile broadband
- 100 Mbps

5th GENERATION wireless network
- 1000 x increase in capacity
- Support for 100+ billion connections
- Below 1 ms latency
- 10 Gbps

6th GENERATION wireless network
- Extension to (sub) mmWave frequencies
- Real-time cloud computing
- 1 Tbps
# SUNDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 13:00</th>
<th>14:20 – 18:20</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>WS01</strong></td>
<td></td>
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<tr>
<td></td>
<td>Advances of Wireless Sensing in Harsh and Severe Environments</td>
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<td>4</td>
<td><strong>WS02</strong></td>
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<tr>
<td></td>
<td>Terahertz Device, Circuit and System Fundamentals and Applications</td>
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<td><strong>SS01</strong></td>
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<td>Advanced Non-linear Characterization and Design of Highly Efficient Power Amplifiers Using Load-Pull Data for sub-6GHz and mmWave Applications</td>
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<td>7</td>
<td><strong>WS04</strong></td>
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<td>New Trends in Microwave and mmWave Filters</td>
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<td>8</td>
<td><strong>SS02</strong></td>
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<td>Fundamentals of Microwave PA Design</td>
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<td>9</td>
<td><strong>WS05</strong></td>
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<td>New On-Chip and Scalable RF Packaging Solutions with Integrated Antennas for 5G mmWave and 6G Applications</td>
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<td><strong>WS06</strong></td>
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<td>Progress and Status of Gallium Nitride Monolithic Microwave Integrated Circuits</td>
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<td>11</td>
<td><strong>WS07</strong></td>
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<td>RF Reliability Status and Challenges for 5G mmWave and 6G Applications</td>
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<td>12</td>
<td><strong>WS08</strong></td>
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<td></td>
<td>Technology for RF 5G and Satcom: From Material to Packaged Demonstrators</td>
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<tr>
<td>13</td>
<td><strong>SS04</strong></td>
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<td></td>
<td>Terahertz Technology, Instrumentation and Applications</td>
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<tr>
<td>14</td>
<td><strong>WS09</strong></td>
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<tr>
<td></td>
<td>Research in Power and S-parameters Measurements at mmWave and Terahertz Frequencies</td>
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<td>17</td>
<td><strong>WS03</strong></td>
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<tr>
<td></td>
<td>mmWave Plastic Waveguide High Data Rate Communications</td>
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## MONDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
<th>EVENING PROGRAMME</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>SM01</td>
<td>WM01</td>
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<td>R&amp;D Trends &amp; Challenges in RF PAs for Medium/High-Volume Products</td>
<td>Optimizing Modulation Quality Measurements on Wide Bandwidth Signals - from Conformance Through R&amp;D</td>
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<td>Advances in Circuits and Systems for mmWave Radar and Communication in Silicon Technologies</td>
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<td>Microwave and mmWave Techniques for Sensing, Imaging and Characterisation of Biological Tissues</td>
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<td>Load-pull measurement of SiGe:C HBT in BiCMOS 55 nm featuring 11 dBm of output power at 185 GHz</td>
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<td>Caroline Maye¹</td>
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<td>Sarnath Chaudhury¹, Nuno Borges Carvalho², Marina Jordan³, Marc Vanden Bosch⁴, Adam Couman⁵, Sergio Perez⁶</td>
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<td>Intermodulation Products of a CMOS SP6T Antenna Switch: Results Comparison Between an Experimental Test-Bench and a Corresponding Simulated Virtual Test-Bench</td>
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<td>Manwun Ben Sara¹, Hassan Sabri¹, Davoruncic Sol¹, Imene Latibb³, Gregory D U'Ren¹, L. Hildegen¹, et al.</td>
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<td>A computationally-efficient self-consistent large signal model for GaN HEMTs based on ASM-HEMT</td>
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<td>Sourabh Khadse¹, Ken Knecht¹, Hrishik Vamanisetty¹</td>
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<td>Large-Signal Modeling for Nonlinear Analysis of Experimental Devices in 22nm FDSOI Technology</td>
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<td>Quang Huy Le¹, Dang Khoa Huynh¹, Anurag Nayak¹, Steffen Lehmann², Zhixing Zhao², Thomas Kämpfe², Matthias Rudolph³</td>
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<td>Chair: Peter Magnée¹</td>
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<td>SiGe BICMOS as enabling technology for next generation RF &amp; THz Systems</td>
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<td>Gerhard Krahmer¹</td>
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<td>Analysis of the Relaxed Contacted-Poly-Pitch Effect on the RF Performance of Strained-SiGe Channel p-FETs in 22nm FDSOI Technology</td>
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<td>Guang Huy Le¹, Dang Khoa Huynh¹, Steffen Lehmann², Zhixing Zhao², Thomas Kämpfe², Matthias Rudolph³</td>
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<td>Design Methodology of Wide Tuning Range DGS-based VCO for K-band Applications in 0.18-µm CMOS Technology</td>
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<td>Bacharius Chen¹, Samanveda Kumar Thoppa¹, Abin Babakul¹, Ramesh Kumar Pisharoti¹</td>
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<td>Linearity Assessment of GaN HEMTs on Si using Nonlinear Characterisation</td>
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<td>Rana Ekhachian¹, Mamadou Khalifa¹, Raul Rodriguez¹, Vamsi Pachta¹, Utpakacharana Prchalara², Alifco Alfan¹, Nadine Collaert¹, Piet Wambacq¹, Bertrand Pons¹</td>
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<td>Reconfigurable and Scalable Monolithic Band Reject Circuit Utilizing Phase-Change Switch Matrices</td>
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<td>Srijan Khandelwal¹, Randeep Singh¹, Kishor R. Murmann¹</td>
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<td>mmWave GaN/Si MMICs: The 3rd generation of III/V processes to complement Si RFIC solutions</td>
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<td>Piero Poggi¹</td>
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<td>A Bidirectional 28 GHz RF Transceiver Front-End with Test and Calibration Interface for 5G Phased Arrays</td>
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<td>Katharina Roß¹, Julian Potschka¹, Tim Maros¹, Klaus Auflinger¹, Arend Nachtman², Marco Dett³, Robert Weng⁴</td>
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<td>A 2-channel TX and 4-channel RX in SiGe BICMOS for X-band MIMO Radar Applications</td>
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<td>Matteo Kushatski¹</td>
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<td>Two-Element 81-86 GHz SiGe Transmitter Beamformer for Backhaul Applications</td>
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<td>Reme Ben-Hirika¹, David Kand¹, Guanyu Li¹</td>
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<td>EuMIC03-5</td>
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<td>A W-Band Single-Chip Receiver in a 60 nm GaN-on-Silicon Foundry Process</td>
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<td>Robert Haltgren¹, Ralf Jensch¹, Mingquan Bao², Rémi Leblanc³, Christian Fager⁴, Koen Buisman⁴, Christian Fager⁴, Martin Andersson⁴, Kristoffer Andersson⁴, ²Ericsson Research, ³OMMIC S.A.S, ⁴Chalmers University of Technology</td>
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**MONDAY 11:20 – 13:00**

**Room 7 – 9**

**EuMIC04**
EuMIC Opening Session

Chair: Chris Clifton¹, EuMIC Chair
Co-chair: Shokrollah Karimian², EuMIC Co-chair; Edward Wasige³, EuMIC TPC Chair
¹Sony Europe B.V., ²University of Oxford, UK, ³University of Glasgow, UK

11:20 – 11:30
**Welcome Address: Opening of the European Microwave Integrated Circuits Conference 2021**

Chris Clifton¹
EuMIC Chair

11:30 – 12:15
**III-V Nitride Semiconductors for Microwave Applications**

Christopher Snowden¹
Fellow of the Royal Society, Chair of the EERA Foundation

The demand for high performance semiconductor devices for microwave applications to meet the exacting power, frequency, bandwidth and linearity requirements of 5G, radar and remote sensing has driven the development of wide-band gap semiconductors capable of delivering high powers, with high efficiencies at frequencies up to 100 GHz. This presentation will review the state-of-the-art, highlighting the development and introduction of GaN-based FETs for use in discrete and integrated circuits. A comparison with Si, SiGe and GaAs-based technologies will be made, discussing the relative merits and RF performance. Examples, of applications, and details of the technology for GaN-based devices will be given for operation in the frequency range 2 to 96 GHz. Particular emphasis will be placed on the use of GaN on Si substrate HEMTs in power amplifiers in both MIC and MMIC forms. The modelling and design of devices and circuits will be covered together with some insight into fabrication and production. Finally, future prospects for III-V nitride devices will be presented.

12:15 – 13:00
**High-Efficiency PAs for Broadband High-PAR Signals**

Zoya Popovic¹
University of Colorado, USA

Achieving power amplifiers (PAs) with high efficiency and good linearity is challenging if the amplified signals have wide instantaneous bandwidths (> 100 MHz) and high peak-to-average power ratios (PAPR > 10 dB). Examples of such signals include multi-carrier concurrent signals, both closely and widely spaced, and band-limited noise-like signals, typical of 5G and other multi-carrier aggregated signal applications. This talk will overview techniques for supply modulation of broadband signals amplified by different GaN PAs, including a 2 – 4GHz single ended hybrid PA, an X-band MMIC PA, and a K-band MMIC PA. The signals that are considered include band-limited noise with bandwidths from 10 to 250 MHz, and widely spaced multi-carrier with up to 800 MHz spacing. Both continuous and discrete supply modulation of multiple amplifier stages is demonstrated, and linearization methods discussed.
MONDAY 14:20 – 16:00

**Room 5**

**EuMIC05**
Integrated Circuit Modelling and Design Methodology

Chair: Vadim Issakov
Co-Chair: Matthew O’Reele
Technische Universität Braunschweig, INEX Microtechnoogy Ltd

**EuMIC06**
Integrated PAs for 5G, SAT-COM and Vehicular Applications

Chair: Joseph Staudinger
Co-Chair: Alessandro Cidronali
NXP Semiconductor Inc, University of Florence

**Room 10**

**EuMIC07**
Frequency-Converting Circuits

Chair: Ingmar Kallfass
Co-Chair: Lars-Erik Wernersson
University of Stuttgart, Lund University

**Room 17**

**EuMIC08**
A W-Band Up-Conversion Mixer with Integrated LO Frequency Doubler in 60 nm GaN Technology

Mingquan Bao, Robert Malmqvist, Rolf Jonsson, Jonas Hansryd, Kristoffer Andersson
Ericsson AB, Swedish Defence Research Agency (FOI)

**EuMIC09**
A 14.6 GHz - 19.2 GHz Digitally Controlled Injection Locked Frequency Doubler in 45 nm SOI CMOS

Olli Kursu, Timo Rahkonen, Aarno Pärssinen
University of Oulu

**EuMIC10**
A Ka-Band MMIC Single-Chip Frequency Converter for Telecom Satellite Applications

Batuhan Sütbaş, Herman J. Ng, Jan Wessel, Alexander Koelpin, Gerhard Kahmen
IHP - Leibniz-Institut für innovative Mikroelektronik, Karlsruhe University of Applied Sciences, Hamburg University of Technology

**MONDAY 14:20 – 16:00**

**Room 5**

**EuMIC05-1**
A 30-38 GHz Active and Passive Combined Down-conversion Variable Gain Mixer with Low OP1dB Variation in 65-nm CMOS

Mi-Hung Chiu, Chien-Wei Chen, Yu-Han Wang, Hsin-Wang
National Taiwan University

**EuMIC06-1**
Buffer-free GaN-on-SiC HEMT heterostructures for Sub-6GHz and mmWave RF devices

**Room 10**

**EuMIC07-1**
A Ka-Band MMIC Single-Chip Frequency Converter for Telecom Satellite Applications

Francisco Scappaviva, Davide Rosso, Andrea Bonsi, Luca Casari, Francesco Viola, Francois Delcroix
MIS – Microwave Electronics for Communications, Thales Alenia Space Italia, ESA / ESTEC

**Room 17**

**EuMIC08-1**
125W Solid State Power Amplifier for 17.3-20.2GHz SatCOM Applications

Rocco Giofrè, Paolo Colantonio, Lorena Cabria, Mariano Lopez
University of Roma Tor Vergata, University of Roma "Sapienza"

**EuMIC09-1**
44 dBm Output Power and High Gain K-band GaN Power Amplifier for Satellite Communication

Takuma Torii, Yoshifumi Kawamura, Eigo Kuwata, Masaomi Tsuru
Mitsubishi Electric Corporation

**MONDAY 14:20 – 16:00**

**Room 5**

**EuMIC05-2**
Analog Linearization of a 10-W GaN Power Amplifier by Baseband Feedback

**Room 10**

**EuMIC07-2**
A High GBW High Power Wideband Power Amplifier for Automotive Radar Application

Kambo Haddour, Dominik Arndt, Christian Kraadter, Stefano Di Martino
Tessan Technologies Lizis GmbH & Co KG, Technion Technologies Austria

**Room 17**

**EuMIC08-2**
A 15.9 GHz 19.3 dBm Power Amplifier in 45nm SOI Technology

Alice Bossuet, Baudouin Martineau, Cedric Dehos, Benjamin Blampey, Alexis Divay
CEA - LETI, STMicroelectronics, Grenoble

**EuMIC09-2**
A 60 GHz Frequency Doubler with 3.4-dBm Output Power and 4.4% DC-to-RF-Efficiency in 130-nm SiGe BiCMOS Technology

Rui Zhu, Vincent Redi, Haiyan Guo, Niko Jerzem, Frank Elbing
TU Dresden

**MONDAY 14:20 – 16:00**

**Room 5**

**EuMIC05-3**
Statistical Modeling of GaN HEMTs by Direct Transfer of Variances to Model Parameters

Petros Brintzolis, Serguei Chernyshenko, Matthias Rudolph
Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Ferdinand-Braun Institute, Leibniz-Institut für Hochfrequenztechnik

**Room 10**

**EuMIC07-3**
A 6.0 GHz Frequency Doubler with 3.4-dBm Output Power and 4.4% DC-to-RF-Efficiency in 130-nm SiGe BiCMOS Technology

**Room 17**

**EuMIC08-3**
An Analog Linearization of a 10-W GaN Power Amplifier by Baseband Feedback

**EuMIC09-3**
A 15.9 GHz 19.3 dBm Power Amplifier in 45nm SOI Technology

**MONDAY 14:20 – 16:00**

**Room 5**

**EuMIC05-4**
Design of Terahertz InP pHEMT Using Machine Learning Assisted Global Optimization Techniques

Jing Wang, Li-Xuan Xue, Zhu Li, Cheng Li
University of Glasgow

**Room 10**

**EuMIC07-4**
A 14.6 GHz - 19.2 GHz Digitally Controlled Injection Locked Frequency Doubler in 45 nm SOI CMOS

Ontti Karasu, Timo Rahkonen, Aarno Pärssinen
University of Oulu

**Room 17**

**EuMIC08-4**
44 dBm Output Power and High Gain K-band GaN Power Amplifier for Satellite Communication

Taku Murai, Yoshifumi Kawamura, Eigo Kuwata, Masaomi Tsuru
Mitsubishi Electric Corporation

**EuMIC09-4**
A W-Band Up-Conversion Mixer with Integrated LO Frequency Doubler in a 60 nm GaN Technology

Raffaele Barca, Robert Magyari, Rolf Jonsson, Jonas Hänninen, Kristoffer Andersson
Ericsson AB, Swedish Defence Research Agency (FOI)
EuMIC08: Components and Systems for 100 GHz and Above
- Chair: Ulrich Pfeiffer
- Co-Chair: Herbert Zirath
- University of Wuppertal, Chair: University of Technology

EuMIC09: High Performance LNAs
- Chair: Lars Erik Wernerson
- Co-Chair: Ingmar Kaltmann
- Lund University, Chair: University of Stuttgart

EuMIC09-1: 200 GHz Low Noise Amplifiers in 250nm InP HBT Technology
- Ulku Soysal, Ahmed Sarrar Hamet Saifeddin Ahmed, Monika Szel, Alex Find, Marc Buchheit, University of California, Santa Barbara, "Sungkyunkwan University

EuMIC09-2: Output Power Limited Rugged GaN LNA MMIC
- Eyleyn Kassol, Cristina Andree, Mathias Rudolph
- Brandenburg University of Technology Cottbus-Senftenberg

EuMIC09-3: A Highly Linear 79 GHz Low-Noise Amplifier for Civil-Automotive Radars in 22 nm FDSOI CMOS with -6 dBm iP1dB and 5 dB NF
- Stefan De, David Freccero, Lambros Ziagos, Xin Xu, Quang Ngay Le, Detta Wang, Thomas Kamps, Corrado Carta, Frank Ellinger
- 10 Broads, Fraunhofer Institute for Photonic Microsystems (IPM)

EuMIC09-4: 400-Watt S-band Power Amplifier MMIC
- Peter de Hel, Guy van der Bent, Frank C. van Vliet, TNO

EuMIC09-5: C-Band Low Noise Amplifier MMIC with an Average Noise Temperature of 44.5 K and 24.8 mW Power Consumption
- Fabrizio Fazio, Filippo Tassani, Arnaud Lecluffs, Olivier Ambarchi
- Fraunhofer IAF, Chair: University of Applied Solid State Physics

EuMIC09-6: A 41.5 dBm Broadband AlGaN/GaN HEMT Balanced Power Amplifier at K-Band
- Stefan Dams, Christian Frensch, Thomas Mars, Ralf Dams, Arno F. Jacob
- Hamburg University of Technology, Fraunhofer IAF, Chair: University of Applied Solid State Physics, Chair: University of Applied Solid State Physics

EuMIC11: Broadband Integrated Circuits
- Chair: Friedel Gerfers
- Co-Chair: Mehmet Karaslan

EuMIC11-1: Is SiGe BiCMOS an essential technology for 6G?
- Pascal Chavelier

EuMIC11-2: 120 GHz SiGe-Based 2.1 Analog Multiplexer Module for Ultra-Broadband Transmission Systems
- Christian Schmidt, Tobias Taneert, Jang Han Dha, Christof Lups, Bettie Pich, Sebastian Wünsch, Greta Ropers, Jonathan Schmidt, Wilke Jerneck, Ronald Fronek, Markus Grözing, Marius Berntz
- Fraunhofer Heinrich Hertz Institute, University of Stuttgart

EuMIC11-3: A 7-30 GHz, 80-dB9 Noise-Optimized, Bandpass-Like TIA in 130 nm SiGe BiCMOS Technology for Quasi-Coherent Optical Receivers
- Tim Meier-Koch, Johannes, Guillaume Silvia Kaabetsche, Monika Kupol, Jean Alibert, Umar Gallard, Michele Squarcia, Jasper Beerens Jensen
- Technical University of Denmark, Bofm Comunications Aps

EuMIC11-4: Multi-Phase Clock Path Circuit up to 57 GHz Including 5 bit Programmable Phase Interpolators for Time-Interleaved Broadband Data Converters in 28 nm FDSOI CMOS Technology
- Daniel Widmann, Tobias Taneert, Xuan-Quang Du, Markus Grözing, Marius Berntz
- University of Stuttgart

EuMIC11-5: A DC to 20 GHz Variable Gain Amplifier with Tunable Input Matching in 22 nm FDSOI Technology
- Seyedehkhatere Seyyedehkhatere, Mona Wossmann, Thayyil, Corrado Carta, Frank Ellinger
- Technische Universität Dresden, Germany
**MONDAY 18:30 – 20:00**

<table>
<thead>
<tr>
<th>ROOM</th>
<th>Room 17</th>
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<tbody>
<tr>
<td><strong>EuMIC Foundry Session</strong></td>
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<td>Chair: Marc Rocchi, Omnic</td>
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<td>Co-Chair: Sunday Expo, Manchester Metropolitan University</td>
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**18:30 – 20:00**

Panel Session.

Panel comprising leading III-V and Silicon foundries with a lively discussion on the merits of each cutting edge technology for the next generation of communication devices.
## Tuesday Overview

<table>
<thead>
<tr>
<th>Room</th>
<th>08:30</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
<th>Evening Programme</th>
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<tbody>
<tr>
<td>1</td>
<td>EuMIC/EuMC01: Novel Filtering Devices in Integrated Technologies</td>
<td>EuMC02: Innovative Microwave Circulators and Phase Shifters</td>
<td>EuMC05: Novel Structures for Power Combiners and Couplers</td>
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<td>4</td>
<td>EuMIC/EuMC02: THz Components</td>
<td>EuMC16: Phased Array Components from S-band up to 300 GHz</td>
<td>EuMC06: 3D to 2D Transitions and New Materials for mmWave System Integration</td>
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<td>6</td>
<td>EuMW01: Teaching Methods for Microwave Engineering</td>
<td>EuMC03: Non-planar Filters I</td>
<td>EuMC07: Non-planar Filters II</td>
<td>EuMC08: Digital Predistortion, PA Optimisation and MIMO Architectures</td>
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<td>7</td>
<td>EuMW02: Opening Session</td>
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<td>EuMIC09: Metasurfaces and Frequency Selective Surfaces</td>
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<td>12</td>
<td>EuMC12: Device Modelling and Simulation of Parasitic Phenomena</td>
<td>EuMC04: Active Antennas and Architectures</td>
<td>EuMC10: Innovative Antenna Methodology and Design</td>
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<td>13</td>
<td>EuMIC13: Receiver Components</td>
<td>EuMC11: MMIC Power Amplifiers and Supply Modulation</td>
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<td>15</td>
<td>Career Platform</td>
<td>Women in Microwaves (Panel to 3pm, Visit to 6:30pm)</td>
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<td>EuMC01: Advanced Packaging and Interconnect Technologies for Emerging Applications</td>
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<td>17</td>
<td>EuMC14: Advances in mmWave and High Power Integrated PA Technologies</td>
<td>EuMW03: Special Session in Memoriam of Prof. Roberto Sorrentino</td>
<td>EuMC12: THz Systems and Applications</td>
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<td>Exhibition Hall</td>
<td>Tom Brazil Fellowship Award (by the GAAS® Association) Finalists Pitching The Role of Microwaves in Contributing to a Sustainable World (Venue: MicroApps)</td>
<td>EuMIC15: Posters</td>
<td>EuMIC/EuMC04: Posters</td>
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<td>Conference Center: Platinum Suite</td>
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<td>EuMW Welcome Reception 18:30 – 22:00</td>
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TUESDAY 09:00 – 10:40

**Room 16**

**EuMC01**
Advanced Packaging and Interconnect Technologies for Emerging Applications
Chair: Mehmet Kaynak
Co-Chair: Joachim Dührhammer
1HP Microelectronics GmbH, YTH

**EuMC01-1**
Advanced Integration and Packaging of High-Power Components and Amplifiers for 5G/Beyond Industrial Applications
Kamal K. Samanta

**EuMC01-2**
Design and Measurement of Interconnects in Fan-Out Wafer-Level Packaging (FOWLP) for mm-Wave Applications up to 100 GHz
Shinji Enda, Ivan Nippi, Marco Reitz
Fraunhofer Institute for Integrated and Mikronintegration - IZM, Fraunhofer IZM, Berlin

**EuMC01-3**
Demonstration of Millimeter-wave SMT Chip Scale Packaging using Hot-via MMICs and plastic BGA Encapsulation
Alexandre Bessemond
United Monolithic Semiconductors

**EuMC01-4**
Modeling and Measurement of Double Stacked Microvias in Antenna-in-Package Module for 5G mmWave Applications
Kamal K. Samanta, Anvar Hazrati, Oliver Schwantes, Uwe Maass, Ivan Nippi, Andreas Emann, Klaus-Dieter Lang
1HP Microelectronics GmbH, YTH

**EuMC01-5**
Optimised Hot-Via Transition with 20 dB Return Loss for MMIC Packaging from DC to 110 GHz
Leigh Miller, Shymon Merhi, Leonard Hall, Simon J. Mahon, Sudipta Chakraborty, Michael Horlbeck
DST Group, Finite Space Solutions, Macquarie University

**Room 1**

**EuMC/EuMC01**
Novel Filtering Devices in Integrated Technologies
Chair: Roberto Gomez-Garcia
Co-Chair: Michael Hof
University of Alcalá, Christian-Albrechts-Universität zu Kiel

**EuMC/EuMC01-1**
A Millimeter-Wave Substrate Integrated Waveguide Filter in Si-BCB Technology
Jordan Lino, Carapelle Dori, Masoud Moubarek, Nicolaus Zernacki, Anselm Garno, Ivanza Sanchez, Luis Vincente, Gualtiero D’Accorso, Frédéric Ansel, Florence Podzorski, Philipp Ferrand, Emmanuel Piotrowski
Université Grenoble Alpes, Université Paris-Saclay, CNRS, Centre de Nanosciences et de Nanotechnologies, Grenoble INP - RENIM UMR 7520

**EuMC/EuMC01-2**
A 100GHz Bandpass Filter Employing Shielded Folded Ridged Quarter-Mode SIW Resonator in CMOS Technology
Bachchan Chauk, Sunny Kumar, Amin, Baraka, Nareesh Kumar, Pushbala
Kashyap University

**EuMC/EuMC01-3**
SAW Resonator Band-Pass Filter on GaN/Si operating at 8 GHz
Alvaro Cristina Brusca, Claudio Masetti, Adriano Universa
National Institute for Research and Development in Microtechnologies - IMT Bucharest

**EuMC/EuMC01-4**
Engineered High Resistivity Silicon Substrates in IPD Technology Used for Miniaturized sub-6 GHz Filters
Aitor Happarrena, Mikihiro Itoh, Amaury Husser, Kalya Pickyverd, Pekka Ramakrishnan, Tunsu Vahia, Heskia
National ICT, VTT Technical Research Centre of Finland, Aalto University

**EuMC/EuMC01-5**
Class-Integrated Single- and Dual-Band Bandpass Filters
Andrew Ashley, Dimitra Psaltis
University of Colorado Boulder

**Room 4**

**EuMC/EuMC02**
THz components
Chair: Marijan K. Matters-Kammerer
Co-Chair: Öleksiy Sydoruk
Eindhoven University of Technology, Imperial College London

**EuMC/EuMC02-1**
A SiGe Based 0.48 THz Signal Source with 45 GHz Tuning Range
Jonathan Wittenber, Florian Veitkamp, David Heidrich, Holger Buckel, Nik Pohl
RutgersUniversity, New York

**EuMC/EuMC02-2**
The Effect of Surface Passivation for Sub-THz Silicon Gradient Reflective Inductor Technology
Andi Lammere, Alexei Tsvetk, Jakub Sunk, Vladimir Emant, Pekka Pusul, Anu Väystainen
VTT Technical Research Centre of Finland, Aalto University

**EuMC/EuMC02-3**
Optoelectronic Millimeter-Wave Integrated Circuits Fabricated in Pure Silicon-Based Technologies
Urschil Schuster, Wolfgang Weikle
Silicon Radar GmbH

**EuMC/EuMC02-4**
140 GHz Differential Antennas in Embedded Wafer Level Ball Grid Array Technology
Alaknath Bharti, Elizabeth Bieler, Teng C., Lucas Garde de Oliveira, Thomas Ojcius
Karlsruhe Institute of Technology (KIT)

**EuMC/EuMC02-5**
Enhancing Microwave Chip Antennas Using in-Package Electromagnetic Bandgap Structures
Dmitri Kruglov, Elena Tropina, Marianna Ivashina, Rob Macauley
Chalmers University of Technology

**Room 13**

**EuMIC12**
Device Modelling and Simulation of Parasitic Phenomena
Chair: Raphael Sommer
Co-Chair: Valeria Brunel
University of Limoges ULM, United Monolithic Semiconductors

**EuMIC12-1**
Noise Modeling of GaN/AIn HEMT
Canal Kapar, Frank Schmidt, Oliver HIP, Ralf Roemer, Frank Brunner, Matthias Ruchkh
Brandenburg University of Technology, Technische Braunschweig-Institut für Mikrotechnik

**EuMIC12-2**
Efficient TCAD temperature-dependent Large-Signal simulation of a FinFET power amplifier
Eva Langguth, Simona Dorni-Guerrier, Fabrizio Bosisio, Leonardo Albina
Politecnico di Torino

**EuMIC12-3**
A TCAD simulation study on gated-anode diodes for microwave applications
Anji Bec, Deibonk Broua, Daog M, Yacine Touichou, Abdoulaye Tchahutah, Y C Andy, Akos Wilm fek
Ragusa Institute of Technology, Ragusa University

**EuMIC12-4**
Trap Characterization in InAIn/GaN and AInGaN based HEMTs with Fe- and C-doped Buffers
Emmanuel Grpov, Vessileska Kopu-Pramanick, Florent Guillot, Raphael Sommer, Jean Christophe Naklatz
IMT UMR 7232, University of Limoges/CNRS

**EuMIC12-5**
Mechanisms of Buffer and Surface Traps in GaN HEMTs for Low Frequency Y21 and Y22 parameters
Tetsunari Osado
Mitsubishi Electric Corporation
TUESDAY 09:00 – 10:40

Room 14

EuMIC13
Receiver Components
Chair: Frieder Gerfers
Co-Chair: Lars-Erik Wernersson¹
¹TU Berlin, ¹ Lund University

EuMIC13-1
A Low Phase Noise Phase-Locked Loop With Short Settling Times for Automotive Radar
Idobas I. Braun, Marcel van Deelen, Christian Broderschulte, Jan Schepplitz, Nils Pohl
NITRI University Bibe, Vraunshofe FRT

EuMIC13-2
A Passively-Coupled 39.5GHz Colpitts Quadrature VCO in SiGe HBT Technology
Jani Wörmann
Institute of Robust Power Semiconductor Systems (ILH) - University of Stuttgart

EuMIC13-3
30-46 GHz 1.5dB IL Negative Gate Control SPDT with 25.4dBm IP1 in 130nm CMOS Technologies
Sasmita Gondie, Neamat Bar-Helman, Samuel Jammesen, Erin Socher
Tel Aviv University, Rafael Advanced Technologies

EuMIC13-4
A Highly Linear SiGe BICMOS Gilbert-Cell based Downconversion Mixer for 5G Applications
Mir Hassan Mirmahmoud, Abdurrahman Burnal, Can Cakirkan, Sinan Alper Goksan, Ali Bahadir Goksin, Melis Yazi, Yosuf Gurbuz
Sabanci University

EuMIC13-5
37.2- to 42.0 GHz VCO with -93.4 dBc/Hz Phase Noise for FMCO Radar in 22 nm FBDD
Larschen Schögel, Songhan Li, Xia Xi, Paul Vlaminck Testa, Andreas Sendl, Carmane Carta, Frank Ellinger
Technische Universität Dresden

Room 17

EuMIC14
Advances in mmWave and High Power Integrated PA Technologies
Chair: Franco Giannini¹
Co-Chair: Simon J. Mahon²
¹University of Rome Tor Vergata, ²Macquarie University

EuMIC14-1
A 100 GHz Class-F-Like InP-DHBT PA with 25.4% PAE
Amit Shrestha, Ralf Doerner, Hady Yacoub, Tom Keinicke Johansen, Wolfgang Heinrich, Viktor Krozer, Matthias Radolph, Andreas Wendt
Ferdinand-Braun-Institut, Berlin, Germany, Technical University of Denmark (DTU), Kgs. Lyngby, Denmark, ¹Rohde Chair of RF and Microwave Technologies, Brandenburg University of Technology (BTU), Cottbus, Germany

EuMIC14-2
A 117.5-130 GHz 22.1 dBm 11.5% PAE DAT Based Power Amplifier in InP 130 nm HBT Technology
Eunhoang Zhang, Kun Yang, Jay Sheehy, Link Xie, Robert M. Wells, Steven Boevers
University of Virginia

EuMIC14-3
A 47-50GHz 3W MMIC Power Amplifier Using 100nm GaN Technology
Seidatollah Fakhfakh, Guillaume Callet, Estelle Byk, Louis Faivre, Atef andra Mabruke, Sandra Redmoul, Pieter Deconinck, Hervé Blanck
United Monolithic Semiconductors SAS, United Monolithic Semiconductors GmbH

EuMIC14-4
A D-Band Power Amplifier with 12 dBm OP1dB, 10% Power Added Efficiency in InP-DHBT Technology
Marie Hossain, Tarig Shoukair, Karl-Dieter Schaefer, Vincent Senneset, Franklin Alencar, Tomas Koenicke-Johanssen, Wolfgang Heinrich, Viktor Krozer
Ferdinand-Braun-Institut (Fh), Lediuz Institut for Hochfrequenztechnik, Ferdinand-Braun-Institut (Fh), Technical University of Denmark (DTU)

EuMIC14-5
A 28-GHz-Band GaN HEMT MMIC Doherty Power Amplifier Designed by Load Resistance Division Adjustment
Ryo Ishikawa, Takuya Seshimo, Yoichiro Takayama, Kazuhiko Honjo
The University of Electro-Communications, Chofu, Tokyo, Japan

Room 6

EuMW01
Teaching Methods for Microwave Engineering
Chair: David S Ricketts¹
Co-Chair: Ulf Johannsen²
¹North Carolina State University, ²Eindhoven University of Technology

EuMW01-1
Teaching 100 remote students hands-on microwave design: Building a 16 QAM radio at home by hand
David Ricketts, Jordan Besnoff
North Carolina State University

EuMW01-2
Launching the First Massive Open Online Course (MOOC) on Microwave Engineering and Antennas
A. Bart Smolders, Domine Leenaerts, Kevin Hunteberg, Ellen den Boer, Ulf Johannsen
Eindhoven University of Technology, NXP Semiconductors

EuMW01-3
RF Circuits Laboratory for Remote Learning and Massive Open Online Courses
Carlos Mendes da Costa, Jaelino van Mulken, Tushar Tandon
Brandenburgische Technische Universität Cottbus-Senftenberg, Julius-Maximilians-Universität Würzburg

EuMW01-4
A Radar Kit for Hands-On Distance-Learning
Markus Gembölli, Timur Tander
Brandenburgische Technische Universität Cottbus - Senftenberg, Julius-Maximilians-Universität Würzburg

EuMW01-5
Microwave Engineering education during COVID-19 pandemic: challenges and solutions implemented in practical work
André Fontana, Olivier Tantot, Nicolas Delhote, Serge Verdymien, Denis Barataud, Cyril Descazeau, Guillaume Neveux, Thomas Freiber, Guillaume Andrieu
XLIM - Université de Limoges
<table>
<thead>
<tr>
<th>EuMIC15-1</th>
<th>Field-Plate Mixer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon J. Mahon¹, Michael Heinrich¹</td>
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<td>Macquarie University</td>
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</tr>
</tbody>
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<table>
<thead>
<tr>
<th>EuMIC15-2</th>
<th>17.6 dB Variable-Gain and Variable-Bandwidth Upconverter in 65 nm CMOS for 60 GHz Bands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oner Hanay¹, David Berthouze¹, Renato Negra¹</td>
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<tr>
<td>Chair of High Frequency Electronics, RWTH Aachen University</td>
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</tbody>
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<thead>
<tr>
<th>EuMIC15-3</th>
<th>A derating-rules compliant Ka-Band GaN-on-Si power amplifier designed for highly reliable satellite applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferdinando Costanzo¹, Lorenzo Pace¹, Patrick Etters Longhi¹, Walter Cessognini¹, Sergei Solangi¹, Rémy Leblanc², Ernesto Limiti¹</td>
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<tr>
<td>University of Rome “Tor Vergata”, ²OMMIC</td>
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</tr>
</tbody>
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<thead>
<tr>
<th>EuMIC15-4</th>
<th>A 3.3 to 11.3 GHz Differential LNA with Slight Imbalance Active Balun in 0.15-μm GaAs pHEMT Process for Radio Astronomical Receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ting Hsuan Fan¹, Chia Ching Chuang¹, Hans Wang²</td>
<td></td>
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<tr>
<td>National Taiwan University, ²Academia Sinica</td>
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</tr>
</tbody>
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<thead>
<tr>
<th>EuMIC15-5</th>
<th>Benefits of AlGaN/GaN thermal RDM coupling with industrial non-linear transistor model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christophe Chang¹, Laurent Brand¹</td>
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<td>United Monolithic Semiconductors SAS</td>
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</tbody>
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<thead>
<tr>
<th>EuMIC15-6</th>
<th>1-6 GHz 35W Balanced GaN-HEMT Power Amplifier with Innovative Quadrature Couplers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alexey Kochenkov¹, Sergey Garnush¹, Andrei Kuchnirsky¹</td>
<td></td>
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<td>Microwave Systems JSC</td>
<td></td>
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</tbody>
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<tr>
<th>EuMIC15-7</th>
<th>A 300 GHz Frequency Doubler in Transferred Substrate InP DHBT Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arne Tuthonen¹, Marat Hossain¹, Mohamed Brahimi¹, Tor-Kenride Johansen¹</td>
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<td>Technical University of Denmark, Ferdinand Braun Institute (FBI)</td>
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</tbody>
</table>

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<tr>
<th>EuMIC15-8</th>
<th>55% Fractional-Bandwidth Doherty Power Amplifier in 130-nm SiGe for 5G mm-Wave Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amedeo Franzoni¹, Nabil Mustafa¹, Mohamed H. Eisa¹, Muh-Dey Wei², Renato Negra¹, Andrea Malignaggi¹</td>
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<td>²HFE RWTH-Aachen</td>
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<tr>
<th>EuMIC15-9</th>
<th>Full Octave Continuously Tunable SiGe Bipolar LC-VCO in Ku-Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christian Breidenbeit¹, Klaus Aufenger¹, Nils Pol¹</td>
<td></td>
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<tr>
<td>FhG-IPHT, Fraunhofer Technologien AG, ¹Ruhr Universitat Bochum</td>
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<thead>
<tr>
<th>EuMIC15-10</th>
<th>An E-band Bidirectional PALNA in 0.13 μm SiGe BiCMOS Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raju Ahamed¹, Mikko Varonen², Dirty Parvi², Mld Namoussadi¹, Mikko Kanta³r¹, Veli Tunak², Ken A. K. Halonen¹</td>
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<td>Aalto University, ²VTT Technical Research Centre of Finland</td>
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</tbody>
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<thead>
<tr>
<th>EuMIC15-11</th>
<th>A Ka-Band 40 W Output Power and 30 % PAE GaN MMIC Power Amplifier for Satellite Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kengo Nakatani¹</td>
<td></td>
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<tr>
<td>Mitsubishi Electric Corporation</td>
<td></td>
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</tbody>
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<thead>
<tr>
<th>EuMIC15-12</th>
<th>Probabilistic Poly Harmonic Distortion Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anna Manjaly¹, Justin King¹</td>
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<tr>
<td>Trinity College Dublin</td>
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</tbody>
</table>
Welcome Address: Opening of the European Microwave Week
Nick Ridler¹
11:20 – 11:25

Greetings from the IEEE MTT-S
Gregory Lyons¹
11:30 – 11:35

Greetings from the EuMW 2021 Platinum Sponsor
Keysight Technologies
11:40 – 11:45

What’s Next for mmWave?
Mike Geen¹
Filtronic
11:45 – 12:00

Awards Ceremony
Nick Ridler¹
12:00 – 12:05

EuMA Outstanding Career Award
EuMA Distinguished Service Award
Roberto Sorrentino Prize
12:05 – 12:10

Room 7 – 12
EuMW02
EuMW/EuMC Opening Session
Chair: Nick Ridler¹, General Chair
Co-Chair: Emma MacPherson², EuMC Chair
¹National Physical Laboratory, UK, ²University of Warwick, UK

11:20 – 13:00

Announcements and Notifications
Emma MacPherson¹
12:50 – 13:00

Telence: 01142 728080
WWW.EUMW2021.COM – 57
### TUESDAY 13:50 – 16:40

**Exhibition Hall**

**EuMIC/EuMC04**

EuMIC/EuMC Posters

Chair: Mustafa Bakr¹

¹University of Oxford

<table>
<thead>
<tr>
<th>EuMIC/EuMC04-1</th>
<th>EuMIC/EuMC04-5</th>
<th>EuMIC/EuMC04-9</th>
<th>EuMIC/EuMC04-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microwave sensing using metal-insulator-metal diodes based on 4-nm-thick hafnium oxide</td>
<td>Towards an Excitable Microwave Spike Generator for Future Neuromorphic Computing</td>
<td>Doherty Load Modulation Based on Non-Reciprocity</td>
<td>Effect of Switch Figure of Merit on Frequency-Reconfigurable Power Amplifier Performance</td>
</tr>
<tr>
<td>Martino Aldrigo¹, Mircea Dragoman¹, Sergio Iordanescu², Mazen Al Shanawani², George Deligeorgis³</td>
<td>Quux Raghib¹ Al Ahza¹, Razvan Moraru¹, Joe Wang¹, Abdulkarim Al Khudh¹, Ali Al-Mouthe¹, Bruno Romero¹, José Figueiredo³, Edward Mauje²</td>
<td>Paul Saaf¹, Xia Zhou², Jose-Ramon Perez Cozeres¹, Rui He¹, Christian Fager¹, Bo Bergland¹</td>
<td>Adam Don¹, William Sears¹, Taylor Barton¹</td>
</tr>
<tr>
<td>National Institute for Research and Development in Microtechnologies (IMT), University of Bologna, TÜBİTAK</td>
<td>University of Glasgow, International Iberian Nanotechnology Laboratory, Universidade de Lisboa, Campus Grande</td>
<td>Ericsson AB, ”Chairman’s University of Technology”</td>
<td>University of Colorado, Boulder</td>
</tr>
</tbody>
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<thead>
<tr>
<th>EuMIC/EuMC04-2</th>
<th>EuMIC/EuMC04-6</th>
<th>EuMIC/EuMC04-10</th>
<th>EuMIC/EuMC04-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic Nonlinear Nonquasi-Static Diode Model Extraction from Large-Signal Measurements</td>
<td>Numerical and Experimental Investigations of Selfmixing Effect of a Planar Gunn Diode Oscillator</td>
<td>Adopting Supercapacitors in a Single-Stage Marx-Type Multi-level Supply Modulator</td>
<td>Practical Work for Master2 Students: MMIC Distributed Amplifier Design for High Data Rate Receiver on GaAs-UMS Technology</td>
</tr>
<tr>
<td>Alvaro Garcia-Luque¹, Teresa M. Martin-Guerrero¹, Alberto Santarelli¹, Lorenzo Corinaldesi¹</td>
<td>Mingyan Zhang¹</td>
<td>Lukas Heinzer¹, Renato Negra¹</td>
<td>Catherine Alipas¹, Eric Lochtke¹</td>
</tr>
<tr>
<td>Universidade de Lisboa, Ambitika Tech, Universitäten de Bologna</td>
<td>University of Glasgow</td>
<td>IMT-RWTH Aachen</td>
<td>Le Cham, UMS</td>
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<tr>
<th>EuMIC/EuMC04-3</th>
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<th>EuMIC/EuMC04-11</th>
<th>EuMIC/EuMC04-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact GaN RF-Switches for Power Applications</td>
<td>An Ultra-Wideband Microstrip-to-WR15 Waveguide Transition for MMIC Applications</td>
<td>A 30-W GaN Quasi-MMIC Doherty Power Amplifier Based on All-Distributed Inductors Load Network</td>
<td>A Digital Power Amplifier for 32-QAM</td>
</tr>
<tr>
<td>Søren Drath¹, Charles Tryzynski¹, Laurent Callé¹, Christopher Chung¹, Laurent Brunel¹, Hermann Singelsson¹, Volker Braun¹</td>
<td>Ben Walker¹, Marcel van Dellen¹, Thomas Much¹</td>
<td>Rui-Jia Liu¹, Xiao-Wei Zhu¹, Jing Xu², Peng Chen¹, Chun Yu¹, Li Zhang², Zhi-Ping Chen¹</td>
<td>Gavin Watkins¹</td>
</tr>
<tr>
<td>United Monolithic Semiconductors SAG, United Monolithic Semiconductors GmbH</td>
<td>Morepen University Bochum</td>
<td>Southeast University, Jiangsu University, Tsinghua Electronics Corporation</td>
<td>Toshiba Europe Limited</td>
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<th>EuMIC/EuMC04-8</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Analysis of RF Stress Influence on Large-Signal Performance of 22nm FDSOI CMOS Transistors utilizing Waveform Measurement</td>
<td>An Integrated Multiplicity Model for Phase-Change Material Switches</td>
<td>Posters will be ready by 13:40. Presenters will be around their stands at 13:50 – 14:20 and 16:00 – 16:30.</td>
</tr>
<tr>
<td>Daan Khosa Hayaki¹, Quang Huy Le¹, Stephen Lehmann¹, Zheng Zhao¹, Semiramis Broch¹, Wola Arnao¹, Gery Wang¹, Thomas Kampf¹, Matthias Rudolph¹</td>
<td>Pierre Blundy¹, Ines Bettourni¹, Karelyna Knyazevich¹, Olaf Pouf</td>
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</tr>
<tr>
<td>Fraunhofer Institute for Photonics, Microsystems (IPMS), Globalfoundries, Germany, Brandenburg University of Technology (BTU)</td>
<td>Shanghai Jiao Tong University, University of Mexican, University of Michigan, CNR-ICMATE, University of Limoges, Centre National of Studies Spatiales</td>
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</tbody>
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TUESDAY 14:20 – 16:00

**Room 1**

**EuMC02**
Innovative Microwave Circulators and Phase Shifters

Chair: Bart Nauwelaers¹
Co-Chair: Marco Pasian²
¹KU Leuven, ²University of Pavia

**EuMC03-1**
The Extracted Zero Technique

Simone Bastioli¹
¹Beihang University (BUAA)

**EuMC03**
Non-planar Filters I

Chair: Giuseppe Macchiarella¹
Co-Chair: Vicente E. Bora¹
¹Politecnico di Milano, ²Universitat Politècnica de València

**EuMC04-3**
Wideband Ku-Band Filter for High-power Space Applications based on Barrel-shaped cavities

Paolo Valmori, Francesca Caracciolo, Luca Pelliccia, Francesco Aquino, Cristiano Tomassoni, Pietro di Martino, Giorgio Cattaneo
¹Microtech s.r.l, ²University of Perugia, ³IAE, ⁴ESA/ESTRACK

**EuMC04-1**
7.5 GHz-Band Digital Beamforming Using 1-bit Direct Digital RF Transmitter with 10GbE Optical Module

Ryo Saitou, Masahiro Motonoshi, Sagaru Kameda, Noriharu Suematsu
¹Research Institute of Electrical Communication, Tohoku University

**EuMC04-2**
Quadrapole-fed Aperture-coupled Microstrip Patch Antenna for On-antenna Power Combining

Timothée Le Gall, Anthony Ghetti, Stefan Kurzait, Gennadi Morozov, Bruno Lous, Grégoire Pillet
¹THALES DMS, ²Tampere University

**EuMC04-5**
Compact Design of a L-Band 40W Power Amplifier for Small Cells

Peter E. E. Germain, Hiroshi Yoshida, Oliver Nonet, Wilfried Demenitroux, Frederic Crestvolant
¹University of Colorado, Boulder, ²Nihonkai Grumman Corporation

**EuMC04-4**
A 40 MHz Envelope Tracking GaN Power Amplifier for Supply Modulated PAs

Bjorninen³, Brendan O'Flynn¹
¹Tyndall National Institute, ²Macquarie University, ³Tampere University

**EuMC03**
Active Antennas and Architectures

Chair: Nils Pohl¹
Co-Chair: Mark Beach¹
¹Ruhr University Bochum, ²University of Bristol

**EuMC04-4**
Microwave Antenna for On-antenna Power Combining

Connor Nogales¹, Zoya Popovic¹, Gregor Lasser¹
¹University of Colorado, Boulder, ²Northrop Grumman Systems (TDMS)

**Room 6**

**EuMC02-3**
Quasi-Reflectionless Differential Phase Shifter with Arbitrary Prescribed Delay and Flat Phase Difference

Ghifran Chaudhry, Quan Tran, Muhammad A. Odaikari, Yongzhe Jiang
¹Jeonbuk National University, ²Aptum University

**EuMC02**
Broadband Ku- and Ka-Band Circulators in LTCC Using Sintered Bulk Ferrites

Cathien West, Tim Haack, Johannes Schüer, Jens Miller
¹AFT microwave GmbH, ²TU Ilmenau

**EuMC03-5**
Design of a Multi-mode Transmission System Based on Vortex Electromagnetic Wave

John Zhang¹
¹Chongqing University (BUAA)

**EuMC03**
Dielectric-loaded Ku-Band Filter for High-power Space Applications

Paolo Valmori, Francesca Caracciolo, Luca Pelliccia, Francesco Aquino, Cristiano Tomassoni, Pietro di Martino, Giorgio Cattaneo
¹Microtech s.r.l, ²University of Perugia, ³IAE, ⁴ESA/ESTRACK

**EuMC04-3**
Antenna Mutual-Coupling Mitigation With Analogue Compensation Network

Roger Green, Tommaso Lappilli, Geoffrey Hilton, Mark Beach
¹University of Bristol

**Room 13**

**EuMC04-2**
40 MHz Envelope Tracking GaN Power Amplifier

Connor Nogales¹, Zoya Popovic¹, Gregor Lasser¹
¹University of Colorado, Boulder, ²Nihonkai Grumman Corporation

**EuMC03-4**
On-chip Power Combining with 3 Stage/75-110 GHz GaN MMIC Power Amplifiers

Shane Vergnolle, Timothy Gemmell, Mauricio Pinto, Alain Barbeau, Zoya Popovic
¹University of Colorado at Boulder, ²Raytheon Company

**EuMC03**
MMIC Power Amplifiers and Supply Modulation

Chair: Jeff Powell⁷
Co-Chair: Markus Mayer⁷
¹Teratech Components, ²Arelis

**EuMC03-5**
Design of a Multi-mode Transmission System Based on Vortex Electromagnetic Wave

John Zhang¹
¹Chongqing University (BUAA)

**Room 14**

**EuMC03-1**
The Extracted Zero Technique

Simone Bastioli¹
¹Beihang University (BUAA)

**EuMC03-2**
Dielectric-loaded Ku-Band Filter for High-power Space Applications based on Barrel-shaped cavities

Paolo Valmori, Francesca Caracciolo, Luca Pelliccia, Francesco Aquino, Cristiano Tomassoni, Pietro di Martino, Giorgio Cattaneo
¹Microtech s.r.l, ²University of Perugia, ³IAE, ⁴ESA/ESTRACK

**EuMC03-4**
A 6-16 GHz 13 W and 22% PAE GaN Power Chipset

Mendes (DNAnt), ²Brest MALT/GRC, ³Yom Marouss
⁷Teratech Components, ²Arelis

**EuMC03-3**
LTC-based Ka-Band Diplexer for Miniaturized Ground-Segment User Terminals

Davide Tarabusi, Paolo Valmori, Luca Pelliccia, Stefano Moscato, Antonio Tresvento, Gianantonio Cannata, Peter Jankovic, Fabrizio De Paolis
¹Microtech s.r.l, ²University of Perugia, ³IAE, ⁴ESA/ESTRACK

**EuMC03-2**
Dielectric-loaded Ku-Band Filter for High-power Space Applications based on Barrel-shaped cavities

Paolo Valmori, Francesca Caracciolo, Luca Pelliccia, Francesco Aquino, Cristiano Tomassoni, Pietro di Martino, Giorgio Cattaneo
¹Microtech s.r.l, ²University of Perugia, ³IAE, ⁴ESA/ESTRACK

**EuMC03-1**
The Extracted Zero Technique

Simone Bastioli¹
¹Beihang University (BUAA)

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On-chip Power Combining with 3 Stage/75-110 GHz GaN MMIC Power Amplifiers

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¹University of Colorado at Boulder, ²Raytheon Company

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Design of a Multi-mode Transmission System Based on Vortex Electromagnetic Wave

John Zhang¹
¹Chongqing University (BUAA)

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Compact Design of a L-Band 40W Power Amplifier for Supply Modulated PAs

Oliver Nonet, Adrian Deschamps, Frederic Picon, Denis Baudat, Michel Campeau, ³Tales Group, ²Thales Group, ³Thales Group, ⁴Thales Group, ⁵Thales Group, ⁶Thales Group, ⁷Thales Group, ⁸Thales Group, ⁹Thales Group, ¹⁰Thales Group
¹Teratech Components, ²Arelis

**EuMC03-1**
The Extracted Zero Technique

Simone Bastioli¹
¹Beihang University (BUAA)
**Room 4**

**EuMIC16-5**
A 270 – 330 GHz Vector Modulator Phase Shifter in 130nm SiGe BiCMOS

Mohammed Hanum Mestain, Sunil Pratap Singh, Markku Jokinen, Timo Rahkonen, Marko E. Leinonen, Aarno Pärssinen

University of Oulu

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**Room 17**

**EuMW03-5**
When academic excellence gets inspired by new challenges: the growth of RF Microtech

Elsa Fratticcioli

---

**Room 4**

**EuMIC16-4**
A 25-50 GHz Digitally Controlled Phase-Shift Filter for 5G Wireless Systems

Stéphane Verset, Vincent Krigui, Eric Verheve

STMicroelectronics, University of Bordeaux, Bordeaux INP, UMR CNRS 5218, IMS Laboratory

---

**Room 17**

**EuMW03-4**
Roberto Sorrentino as EuMA President

Wolfgang Heinrich

Ferdinand-Braun-Institut gGmbH, Leibniz-Institut für Höchstfrequenztechnik

---

**Room 4**

**EuMIC16-3**
A 26 GHz to 34 GHz Active Phase Shifter with Tunable Polyphase Filter for 5G Wireless Systems

Alok Sethi, Rehman Akbar, Mikko Jokinen, Timo Rahkonen, Aarno Pärssinen

Center for Wireless Communication, University of Oulu; Circuits and systems Group, University of Oulu

---

**Room 17**

**EuMW03-3**
How did EuMA start?

Alf Van der Vorst

European Microwave Association

---

**Room 4**

**EuMIC16-2**
A Phase Coherent DC-25 GHz 6-bit SiGe BiCMOS Step Attenuator with IP1dB >20 dBm

Rama Kando, Adilur Rahman-ural, Gonghuan Kao, Melik Nutzi, Vasil Gerzha

Sabanci University

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**Room 17**

**EuMW03-2**
Remembering Roberto Sorrentino - A man inspired by knowledge and culture

Wolfgang Hoefer

University of Victoria

---

**Room 4**

**EuMIC16-1**
An S-band 34dBm Stacked-HBT Phase Driver in 0.25µm BICMOS Technology for GaN-Based Phased-Array Radar Transmit Chain

Jaap Essing, Alke Bossuet, Rob Knippen, Peter de Hink, Frank E. van Vliet

TNO

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**Room 17**

**EuMW03-1**
How did EuMA start?

André Vander Vorst

European Microwave Association

---

**Room 4**

**EuMIC16**
Phased Array Components from S-band up to 300 GHz

Chair: Frank E. van Vliet
Co-Chair: Michael Schlechtweg
TNO, Fraunhofer Institute for Solid State Physics IAF

---

**Room 17**

**EuMW03**
Special Session in Memoriam of Prof. Roberto Sorrentino

Chair: Cristiane Tomassoni
Co-Chair: Maurizio Bozzi
University of Perugia, University of Pavia

---

**Room 4**

**EuMIC16**
Phased Array Components from S-band up to 300 GHz

Chair: Cristiano Tomassoni
Co-Chair: Maurizio Bozzi
University of Perugia, University of Pavia

---

**Room 17**

**EuMW03**
Phased Array Components from S-band up to 300 GHz

Chair: Frank E. van Vliet
Co-Chair: Michael Schlechtweg
TNO, Fraunhofer Institute for Solid State Physics IAF

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**Room 4**

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Phased Array Components from S-band up to 300 GHz

Chair: Frank E. van Vliet
Co-Chair: Michael Schlechtweg
TNO, Fraunhofer Institute for Solid State Physics IAF

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**Room 17**

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Phased Array Components from S-band up to 300 GHz

Chair: Frank E. van Vliet
Co-Chair: Michael Schlechtweg
TNO, Fraunhofer Institute for Solid State Physics IAF

---

**Room 4**

**EuMIC16**
Phased Array Components from S-band up to 300 GHz

Chair: Cristiano Tomassoni
Co-Chair: Maurizio Bozzi
University of Perugia, University of Pavia
<table>
<thead>
<tr>
<th>Room</th>
<th>Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room 1</td>
<td>EuMC05: Novel Structures for Power Combiners and Couplers&lt;br&gt;Chair: Maurizio Boszo&lt;br&gt;Co-Chair: Marco Pasian&lt;br&gt;University of Pavia</td>
</tr>
<tr>
<td>Room 4</td>
<td>EuMC06: 3D to 2D Transitions and New Materials for mmWave System Integration&lt;br&gt;Chair: Joachim Oberhammer&lt;br&gt;Co-Chair: Ivan Nedić&lt;br&gt;KTH, &quot;Fraunhofer IZM&quot;</td>
</tr>
<tr>
<td>Room 6</td>
<td>EuMC07: Non-planar Filters II&lt;br&gt;Chair: Richard Snyder&lt;br&gt;Co-Chair: Simone Bartoli&lt;br&gt;RS Microwave</td>
</tr>
<tr>
<td>Room 7</td>
<td>EuMC08: Digital Predistortion, PA Optimisation and MIMO Architectures&lt;br&gt;Chair: José Carlos Pedro&lt;br&gt;Co-Chair: Gavriel Waksman&lt;br&gt;Universidade de Aveiro - IT, &quot;Toshiba Europe Limited&quot;</td>
</tr>
</tbody>
</table>

**Room 1**

**16:40 - 17:00**

**EuMC05-1**

Electrical Balance Duplexer as In-Band Full-Duplex Antenna Interface with Fast Orthogonal Searching Methodology<br>Ting Li Wang, Multifunc. W. Wan, Hesam Negrou<br>Chair of High Frequency Electronics, RWTH Aachen University

**Room 4**

**16:40 - 17:40**

**EuMC06-1**

Low 140-175 GHz MMC to Waveguide Transitions and MMC to MMC Interconnections<br>Kai Deng, Xiaoting Shang, Chris Back, Mike Green, Nick Rider<br>Hitronics, National Physical Laboratory (NPL)

**Room 6**

**16:40 - 17:40**

**EuMC07-1**

Miniaturized All-Reconfigurable Dual-Mode Diode Filter Using Piezomotors for Future Satellite Communications<br>Abdulrahman Widaa, Yuan Bao, Michael Hirt<br>Kiel University, Ruhr University

**Room 7**

**16:40 - 17:40**

**EuMC08-1**

A Hybrid Heuristic Search Control Assisted Optimization of Dual-Input Doherty Power Amplifier<br>Chirudh Thakur, Rui Ma, Michalczuk Ben-Amos, Yu Kanatsukai, Koichi Iwasaki<br>Mitsubishi Electric Research Laboratories, Mitsubishi Electric Corporation

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**Room 2**

**17:00 - 17:20**

**EuMC05-2**

A Miniaturized and Hybrid SIW Resonator Solution for Filtering Power Divider and Antenna Array<br>Hossein Sadrzadeh Darafsh, Behroze Rezaee, W. T. A. Al-Dhalami<br>Graz University of Technology (GFT) - TU Graz

**Room 4**

**17:00 - 17:40**

**EuMC06-2**

A Compact K- / Ka-Band Waveguide Transition with Integrated Diplexer and Power Divider<br>Kevin Sikharu, Luca Meyer, Noah Selisk, Bjorn Brutschmann, Arne P. Jacob<br>Hamburg University of Technology

**Room 6**

**17:00 - 17:40**

**EuMC07-2**

3D Metal Printed High-Q Inline Filter With Helical Antenna Using Strong Mixed Coupling Resonator<br>Jiao Rui, Kenneth Niu, Pavlos Vatavukas, Zhijie Hong<br>Yerase-Watt University, treasons PLC

**Room 7**

**17:00 - 17:40**

**EuMC08-2**

Offline Method to Determine Optimal Complexity in Predistortion of RF Power Amplifiers<br>Marc Vigneron, Adam Cornale, Andre Prata, Christopher Dinnendal<br>Ampereon

---

**Room 3**

**17:20 - 17:40**

**EuMC05-3**

A Novel Compact Four-Way Power Combiner with an Embedded Microstrip-to-Waveguide Transition for Ka-band Power Amplifiers<br>AliReza Haghshenas, jedem Bouschitz, Richard Bozuyuk, Audrey Martin, Pierre Blondy<br>Université de Littoral (DST) - TH Lille

**Room 4**

**17:20 - 17:40**

**EuMC06-3**

220 GHz E-Plane Transition from Waveguide to Suspended Striplines Integrated on Industrial Organic Laminate Substrate Technology<br>Victor Holm, Faramarz Larijani, Jean-Christophe Gollot, Didier Magain, Guillaume Labeau, Frederic Gaspard, C. Gaspard, B. Tristram, M. Gregorius, B. Gress<br>MICM, University of Lille, ME2 Technologies

**Room 6**

**17:20 - 17:40**

**EuMC07-3**

Dielectric TM Mode Extracted Pole Filters with Large Spurious Free Range<br>Renard Brunsch, Daniel Mier, Patrick Bove, Fynn Karrath, Michael Hirt<br>Christian-Albrechts-Universität zu Kiel

**Room 7**

**17:20 - 17:40**

**EuMC08-3**

Simultaneous Measurement of Multiple Power Amplifiers for Phased Array Digital Predistortion Using a Shared Dual-Output Feedback<br>Balí Kuri, Noosli Teren, Rehema Alzah, Mario E. Lepom, Sili Sim, Aaron Pierson, Mathieu Jetté<br>University of Oulu

---

**Room 4**

**17:40 - 18:00**

**EuMC05-4**

Planar N-Way Power Combiner with High Isolation Between Input Ports<br>Chauvrow Kooperman, Seyed-Hossein Zada, Hossein, Valid Nayeri<br>Iran University of Science and Technology

**Room 4**

**17:40 - 18:00**

**EuMC06-4**

Special glass for packaging of high frequency electronics<br>Martin Lutz, Harry Engstrom, Gerhard Ladstein, Christian Schulz, Mikhail B. Zaitsev, Burkhard Stopf, Tamaz Karpits<br>SCHOTT AG, Warsaw University of Technology

**Room 6**

**17:40 - 18:00**

**EuMC07-4**

Compact Monolithic SLM 3D-Printed Filters using Pole-Generating Resonant Iris<br>Liu Qian, Xiyan Miao, Milan Saka, Muazzar Ali Shah, Li Wang, Michael J. Lucey<br>University of Birmingham, UK

**Room 7**

**17:40 - 18:00**

**EuMC08-4**

Direct Input to Output Neural Network for Efficient Digital Predistortion of MIMO Transmitters<br>Andres Vacare, Ang Ho, Jim Deign<br>Mayerhov University

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**Room 5**

**18:00 - 18:20**

**EuMC05-5**

Wideband Compact Size 3-dB Backward Directional Coupler Using Slotted Microstrip Based Unit Cells<br>Mohamed Elsish, Amy Salih<br>Faculty of Engineering, Ain Shams University, Faculty of Engineering, Ain Shams University

**Room 6**

**18:00 - 18:20**

**EuMC07-5**

Analysis and Design of Re-Configurable Combine Filters Using Dielectric Tuners<br>Abdelkrim Shams, Santiago Cuadros Borrás, Vicente Enrique Banz, Marco Galgani<br>ITEAM, Universitat Politècnica de València, Spain

**Room 7**

**18:00 - 18:20**

**EuMC08-5**

Averaged and Cluster DPDs for Beamforming Applications<br>Abdulrahman Widaa, M. Reza Khamis, M. Asad, Abbas Askari, Mariam Al-Dhalami, Behroze Rezaee<br>University of Calgary, Huawei, Tufts University
TUESDAY 16:40 – 18:20

**Room** Room 12
**Programme** EuMC09
**Metasurfaces and Frequency Selective Surfaces**
- Chair: Francisco Medina¹
- Co-Chair: Alexandros Feresidis²
  ¹Universidad de Sevilla, ²University of Glasgow

16:40 – 17:00
**EuMC09-1**
**Transparent Metal Mesh Metasurfaces**
- Theme: Keynote
  - Co-Chair: Andreas Röhrner¹
  ¹Munich University of Applied Sciences
  
17:00 – 17:20
**EuMC09-2**
**Multimode scattering matrix optimisation for the mitigation of harmonics in anomalous reflection metasurfaces**
- Kareem Guettou¹, Gulnur waż ¹Nazarbayev University, Nur-Sultan, Kazakhstan, Nazarbaye
  ¹Nazarbayev University, Nur-Sultan, Kazakhstan, Nazarbayev University, Nur-Sultan, Kazakhstan

17:20 – 17:40
**EuMC09-3**
**Assessment of Compact Digital Metasurface with Beam Control for WBAN Applications**
- Kamal Ghiottone, Gyunhoon Na, Mohammadmukhammad
  ¹Hamburg University of Technology, ²Technische Universität Hamburg

17:40 – 18:00
**EuMC09-4**
**Design process of novel electromechanically tunable reflectarray antennas**
- Efthimios Vassilias, James Charn, Alexandros Feresidis¹
  ¹University of Birmingham

18:00 – 18:20
**EuMC09-5**
**A broadband polarization-independent frequency selective surface with an inhomogeneous design**
- Andreas Kohlmeier¹
  ¹Munich University of Applied Sciences

**Room** Room 13
**Programme** EuMC10
**Innovative Antenna Methodology and Design**
- Chair: Stefan Lindenmeier¹
- Co-Chair: Hubert Vissers²
  ¹University of the Bundeswehr, ²Imec

16:40 – 17:00
**EuMC10-1**
**RF and Antenna Design Methodology for Reliable Air-to-Ground Mobile Communications**
- Adrian Payner, Mark Yetman, Marco Degiorgi, Javier Vazquez¹
  ¹University of Birmingham

17:00 – 17:20
**EuMC10-2**
**A Squint Compensated Fully Differential Patch Antenna for Automotive MIMO Applications**
- Jan Schepker, Stefan Greuter, Jonas Wagner²
  ²Nob-Pol²

17:20 – 17:40
**EuMC10-3**
**A Circular Polarized Set of Ground Terminal Radiators Capable of Beamforming for the Reception of BGAN Services**
- Zahir Toprak¹, Stefan Lindenmeier¹
  ¹Bundeswehr University Munich

17:40 – 18:00
**EuMC10-4**
**Frequency-Scanning Multi-Yagi-Uda Array Antenna**
- Raphaël Gillard¹, Geneviève Mazé-Merceur², Pascal Pagani²
  ²CEA, ³DGA (Direction Générale de l’Armement)

18:00 – 18:20
**EuMC10-5**
**Wideband Dual-Polarized Antennas for Sub-6 GHz Applications**
- Nikita Buldygin¹, Greg Szedmak¹, Sergey Guchen¹
  ¹Institute of Robust Power Semiconductor Systems (IRPSS), ²Fraunhofer Institute for Applied Solid State Physics (IFW), ³Hamburg University of Technology

**Room** Room 14
**Programme** EuMC11
**Front-End and Transceiver Modules**
- Chair: Lorenz-Peter Schmidt¹
- Co-Chair: Ernesto Limiti²
  ¹Uni Erlangen, ²University of Rome

16:40 – 17:00
**EuMC11-1**
**How to package mmWave MMICs: Understanding the issues, avoiding the problems and optimising performance**
- Um Desai¹
  ¹IMEC

17:00 – 17:20
**EuMC11-2**
**A 56.32 Gb/s 16-QAM link over dielectric fiber using a D-band channel bonding transceiver**
- José-Luis Gonzalez Jimmen, Bazdesign Marie, Alexander Stigen, Francesco Fuglia Marsili³, Frederic Nameau², Cedric DeShez⁴
  ³University Grenoble-Alpes/CLEAN, ⁴University Grenoble-Alpes/CLEAN

17:20 – 17:40
**EuMC11-3**
**Wideband High-Gain Transmitter Antenna for Point-to-Point Communications at 300 GHz**
- Orestis Koutsos¹, Francesco Fuglia Marsili³, Antonio Clemente³, Rarun Sarkar²
  ²CEA – LETI, ³University of Rennes 1

17:40 – 18:00
**EuMC11-4**
**A Heterodyne Transceiver With Integrated Calibrator for K/Ka-Band Phased Arrays**
- Anton Szegeschan³, Miroslav Vázquez³, Robert Weigt³, Fabian Lude³
  ³University of the Bundeswehr, ²University of Rome

18:00 – 18:20
**EuMC11-5**
**A K/Ka-Band Frontend for Dual-Beam, Dual-Polarized Tx/Rx Phased Arrays**
- Anton Szegeschan³, Thomas Jauch³, Jan Woldebrun²
  ²Nob-Pol², ³University of the Bundeswehr

**Room** Room 15
**Programme** EuMC12
**THz Systems and Applications**
- Chair: Oleksiy Sydoruk¹
- Co-Chair: Catherine Allan²
  ¹Imperial College London, ²Le Cnam

16:40 – 17:00
**EuMC12-1**
**Uses of terahertz pulse techniques in industry**
- Priti Talukdar¹
  ¹IETR, INSA Rennes

17:00 – 17:20
**EuMC12-2**
**A 5.62 Gb/s 16-QAM link over dielectric fiber using a D-band channel bonding transceiver**
- José-Luis Gonzalez, Bazdesign Marie, Alexandre Stigen, Francesco Fuglia Marsili³, Frederic Nameau², Cedric DeShez⁴
  ³University Grenoble-Alpes/CLEAN, ⁴University Grenoble-Alpes/CLEAN

17:20 – 17:40
**EuMC12-3**
**Wideband High-Gain Transmitter Antenna for Point-to-Point Communications at 300 GHz**
- Orestis Koutsos¹, Francesco Fuglia Marsili³, Antonio Clemente³, Rarun Sarkar²
  ²CEA – LETI, ³University of Rennes 1

17:40 – 18:00
**EuMC12-4**
**Short Range Wireless Transmission Using a 295-315 GHz Superheterodyne Link Targeting IEEE802.15.3d Applications**
- Borek Wiercza, Łukasz Górecki, Benjamin Schacht, Sandrine Wagner², Ingmar Kallfass³
  ³Institute of Hybrid Power Semiconductor Systems (ILH), University of Stuttgart, Fraunhofer IPE, Fraunhofer Institute for Applied Solid State Physics

18:00 – 18:20
**EuMC12-5**
**22Gbps/80cm Low-Cost THz Wireless System**
- Jee Young, Abdulrah Al-Khalidi¹, Abdullah Al-Khalidi¹, Sean Ahearne²
  ¹University of Glasgow, ²DELL EMC Technologies
**Programme**

**TUESDAY 16:40 – 18:20**

**Room 8 – 11**

**EuMIC17**

**EuMIC Closing Session**

Chair: Chris Clifton, EuMIC Chair  
Co-chair: Shokrollah Karimian, EuMIC Co-chair; Edward Wasige, EuMIC TPC Chair

¹Sony Europe B.V., ²University of Oxford, UK, ³University of Glasgow, UK

16:40 – 16:50

**Awards Ceremony**  
Kamal K Samanta, EuMW 2021 Awards Chair

EuMIC Prize  
EuMIC Young Engineer Prize  
Tom Brazil Fellowship Award (by the GAAS® Association)

16:50 – 17:30

**FLEXIBLE AND OPEN SOURCE: The brave new world of Software Defined Radio and Open RAN**  
Ebrahim Bushehri, CEO and Founder, Lime Microsystems

The fifth generation mobile networks radically changes the way components in the Radio Access Networks (RAN) are designed and implemented. This trend is likely to continue into the 6G era where software defined radios covering up to THz frequency bands could bring about some exciting and demanding opportunities for future front-end IC and module technologies. In parallel, there is a major effort in Telecommunications industry to virtualize the RAN, accelerated by the initiatives such as the O-RAN alliance. The overall objective is to allow for the adoption of web scale technologies and software into 5G and future 6G networks. Web scale technologies rely primarily on open source software and general availability of programmable hardware solutions for which adoption in RAN poses a number of challenges.

17:30 – 18:10

**6G – Known Technologies with a Twist or Maybe Not?**  
Nadine Collaert, Imec, Leuven

With 5G in full deployment, industry has kickstarted the research for the next generation of wireless communication 6G. While the vision for 6G still needs to take shape, and with CMOS scaling under pressure, more than ever System-Technology Co-optimization (STCO) will be needed to define the best blend of technologies to get benefits at the system level. In this talk, we will discuss how compound semiconductor devices and advanced packaging could play a key role in enabling ultra-fast, reliable and power-efficient connectivity.
### WEDNESDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
<th>EVENING PROGRAMME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EuMC17 New Design Concepts for Microwave Filters in Planar and Hybrid Technologies</td>
<td>EuMC22 Advanced Implementations for Substrate-Integrated and Quasi-Planar Filters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exhibitor Workshops</td>
<td>Exhibitor Workshops</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Exhibitor Workshops</td>
<td>Exhibitor Workshops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>EuMC13 Non-planar Passive Components</td>
<td>EuMC18 Frequency Generation, Conversion and Nonlinear Modelling</td>
<td>EuMW04 Memorial Session for Professor Tatsuo Itoh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Exhibitor Workshops</td>
<td>Exhibitor Workshops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SW01 Joint Range-angle Super Resolution MIMO Radar</td>
<td>SW02 Radar Design from the Ground Up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>WW01 Technologies for 6G Front End Modules</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>EuRAD01 Opening Session</td>
<td></td>
<td>Defence, Security and Space (DSS) Forum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
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<tr>
<td>12</td>
<td></td>
<td></td>
<td>WW02 Virtual Validation of Automotive Sensors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>EuMC14 Electromagnetic Scattering and Diffraction Effects</td>
<td>EuMC19 3D Printing: Processes and Reliability</td>
<td>EuMC23 5G Communication and Beyond</td>
<td>EuMC26 Novel 3D Printing Approaches for mmWave Applications</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>IEEE Young Professionals Lunch</td>
<td>IEEE Young Professionals Session</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>EuMC16 Integrated Components for Transceivers</td>
<td>EuRAD02 Radar Applications</td>
<td>EuRAD03 Emerging Radar Applications</td>
<td>EuMC28 5G and mmWave Arrays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exhibition Hall</td>
<td>EuMC21 Posters</td>
<td>EuMC25 Posters</td>
<td></td>
<td>The EuMW Cruise on the River Thames 19:00 – 22:00</td>
</tr>
<tr>
<td></td>
<td>North Greenwich Pier (by the O2)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

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* EuMC: Conference Sessions
* EuMIC: Students and Exhibitors
* EuRAD: Young Professionals Sessions
* EuMW: Exhibitor Workshops
* Exhibitors: Exhibition Hall

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**WEDNESDAY 09:00 - 10:40**

**Room 4**

**EuMC13**

**Non-planar Passive Components**

- Chair: Cristiano Tomassoni¹
- Co-Chair: Eric Rius¹

1. University of Perugia, ²University of Brest

**09:00 - 09:20**

**EuMC13-1**

Hybrid Orthomode Transducer for E-band Point-to-Point Communication Systems

- Andrei Mudranovsky¹, Alexey Klimov¹, Alexey Artemenko¹, Sergey Charlot¹, Ilya Synyts¹, Roman Magenenko¹
- Radio Gigabit LLC

**09:20 - 09:40**

**EuMC13-2**

Methods for Attenuating and Terminating Waves in Ridge Gap Waveguide at W-Band: Carbon-Loaded Foam, Carboloy Iron Paint, and Nickel Plating

- Artem Blinovsky¹, Yingli Zhang¹, Manasa Ikhvadna¹
- Chalmers University of Technology

**09:40 - 10:00**

**EuMC13-3**

Design of Compact and High Q-factor W-Band Cavity in 0.18μm CMOS Technology

- Tamotsu Fukuda¹, Ramesh Kumar Peshkari¹, Bachshu Che¹, Sumendra Kumar Thapa¹, Addi Barakat¹
- Kyushu University

**10:00 - 10:20**

**EuMC13-4**

Compact C-band Wilkinson Power Divider in Empty Substrate Integrated Coaxial Line

- Joaquín Mérine⁴, Vicente Novo¹, Carmen Bachiller Martin¹, Víctor E. Borz¹
- Universitat Politècnica de València

**10:20 - 10:40**

**EuMC13-5**

Full-Band Millimeter Wave Waveguide Magic Tees and Power Dividers for Manufacturing Ability

- Yongti Ren¹, Kamesh Malakal¹, Jihana Jafavi¹, Fang Liu¹, Yonghui Shu¹
- ERAWAVE inc.

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**Room 13**

**EuMC14**

**Electromagnetic Scattering and Diffraction Effects**

- Chair: Ke Wu¹
- Co-Chair: Jian-Phu Xiong¹

¹IMEP-LAHC Grenoble

**09:00 - 09:20**

**EuMC14-1**

Angle-Dependent Reflectivity of Microwave Absorbers at Oblique Wave Incidence

- Will Helmans¹, Andreas Schwend¹, Christian Berkmann¹, Matthias A. Herr¹
- Technische Universität Ilmenau

**09:20 - 09:40**

**EuMC14-2**

Time and Frequency Analysis of Rough Surface Scattering in the THz Spectrum

- Toby Attwood¹, Emily Adams¹, Suzanna Freer¹, Alexander J. Vernor¹, Stephen M. Ruhani¹, Caterina Constantine¹, Leon Agapie¹, Miguel Navarro-Cuña¹
- University of Birmingham, King’s College London, Politécnica de Madrid

**09:40 - 10:00**

**EuMC14-3**

Uncertainty Quantification for the RCS of a Coated Target using an IBC-based Metamodell

- Pascal Fagant¹, Pierre Mouvelle¹, Muriel Sesques¹
- CEA

**10:00 - 10:20**

**EuMC14-4**

Scattering characterization of a blended wing body using numerical simulations

- Rakhel Soedjito¹
- DSTO

**10:20 - 10:40**

**EuMC14-5**

Sensing the Charged-Particle Beam Position Using the Terahertz Range Diffraction Radiation from Two Dielectric Rods Covered with Graphene

- Daria Khramtsova¹
- Institute of Radio Physics and Electronics NASU

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**Room 14**

**EuMC15**

**Metamaterial Based Devices and Applications**

- Chair: Ferran Martín¹
- Co-Chair: Pierre Blondy¹

¹Universitat Autònoma de Barcelona, ²Xlim - UMR 7252 - CNRS - Limoges University

**09:00 - 09:20**

**EuMC15-1**

Metamaterial Lens for Monopulse Beamforming with a 77-GHz Long-Range Radar

- Christoph Kohlberger¹, Richard Hutten¹, Andreas Sotiri¹
- Technische Universität Ilmenau

**09:20 - 09:40**

**EuMC15-2**

Stacked Metasurfaces for Misalignment Improvement of WPT System Using Spiral Resonators

- Yutaro Iwata¹, Fuchin Sekami¹
- Kyushu University

**09:40 - 10:00**

**EuMC15-3**

Beam-Scanning Leaky-Wave Antenna Based on Dielectric Image-Line for Millimetre-Wave Applications

- Alejandro Juarez Chávez¹, Christian Schurig¹, Albert Fierro¹, Solmam Hameed¹
- University of Birmingham, UK

**10:00 - 10:20**

**EuMC15-4**

On the Capacitance of Slotted Metamaterial Resonators for Frequency-Variation Permittivity Sensing

- Jonathan Martin Ensinat¹, Pascal Vise¹, Ljupco Lo¹, Marta Gil¹, Paul Casasubirats¹, Ferran Martín¹
- Universitat Autònoma de Barcelona, Universitat Politècnica de Madrid

**10:20 - 10:40**

**EuMC15-5**

Ultra-Compact Ka-band Metamaterial Waveguide Filters, Fabricated by Lost-Wax Casting

- Aiman Khateeb¹, Mohammadreza Khooroe¹, RezaAbbasi¹, Arne F. Jacob¹
- Radio Gigabit LLC

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**Room 17**

**EuMC16**

**Integrated Components for Transceivers**

- Chair: Almudena Suarez Rodriguez¹
- Co-Chair: Arne F. Jacob¹

¹University of Cantabria, ²Hamburg University of Technology

**09:00 - 09:20**

**EuMC16-1**

Receive and Transmit Beamforming SiGe BiCMOS ICs for Scalable E-Band Phased Arrays

- Mikko Kannonen¹, Antti Lammenen¹, Mikko Kautanen¹, Jan Parkkonen¹, Antti Ruusula¹, Jussi Säily¹, Gority Parvat¹, Miklos Kauszlau¹, Jukka Auttamaa¹
- VTT Technical Research Centre of Finland

**09:20 - 09:40**

**EuMC16-2**

A Q-Band Capable Sampler for Direct Microwave Sampling in Software Defined Radio Context

- Roman Pištelj¹, Matthieu Martín¹, François Benoît¹, Oliver Legrand¹, Itziar Pelayo¹, Šahin Rošev¹
- Telebit.eu

**09:40 - 10:00**

**EuMC16-3**

Amplifier Bias for Minimum Noise Figure in Thermally Constrained Systems

- Anton Seeger¹, Nick E. Albrecht¹, Thomas Jacob¹, Arne F. Jacob¹
- Hamburg University of Technology

**10:00 - 10:20**

**EuMC16-4**

A Novel GaN/SiC MMIC Gain Switch Using a Resonant Bidirectional FET Amplifier

- Remye Muskarr¹, Ryo Enoki¹, Kazuhiko Heng¹
- Nippon Polytechnic, ²Kyoto University, ³Johannes Kepler University

**10:20 - 10:40**

**EuMC16-5**

Gain and Phase Control of a Single-Stage MMIC Low-Noise Amplifier with High-Linearity Using a Variable Tapered Delay Line

- Shuichi Ryo¹, Hiroki Fujita¹, Shinsuke Masuda¹, Ryota Ohtomi¹
- The University of Electro-Communications, Chofu, Tokyo, Japan
The presentation does not attempt to define a single route forward for sensing RF systems, but rather presents the challenges and opportunities presented by technological, industrial and human / AI trends.

The evolution of radar systems to the high band of the spectrum implies new challenges in all aspects including the design of the antenna systems.

An overview of the emerging antenna technologies with application in these frequency bands will be presented in this talk, with special emphasis on the use of gap waveguide technology and its application to radar systems.
WEDNESDAY 10:40 – 13:30

**Exhibition Hall**

**EuMC21 EuMC Posters 1**

**Chair:** Mustafa Bakr¹  
¹University of Oxford

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**EuMC21-1**  
**Compact Wideband Circularly Polarized Quarter-Mode Substrate Integrated Waveguide Antenna for Low-cost 2.4 GHz RFID Reader**

Yanping Pan¹, Yuanfeng Deng¹  
¹University of Electronic Science & Technology of China, University of Oxford

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**EuMC21-5**  
**Investigate LTCC technology for compact SIW resonators and filters with strong coupling for 5G applications**

Ekin Yilmaz¹, Brian Langdon¹, C. A. Täubig¹, J. Wu¹, Hyun-Jae Shin²  
¹University of Oxford, ²Shanghai Jiao Tong University

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**EuMC21-9**  
**Design of 130-290 GHz Rectangular CDC Fibers for High-speed Data Links**

Neman Sidikagic¹, Yingyang Lu¹, Huajun Li², Qingqian Wang¹, Muhammad Tafal Ali Khan¹, Jonas Honney¹, Shaghil Aksanazemi³  
¹Loughborough University, ²King’s College London, ³University of Oxford

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**EuMC21-13**  
**Microstrip Coupled-Line Directional Coupler for High Sensitivity Dielectric Constant Measurement**

Zhao Ruhang Gao¹, Wael Nayer², Omar M. Ramahi³  
¹University of Toronto, ²University of Waterloo, ³University of Oxford

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**EuMC21-2**  
**Miniaturized and Process-Tolerant Ku-Band Power Dividers Using GaN on SiC**

Vulan Erturk¹, Parvez Uttam², Ekmel Özbay¹, Ali Atalar²  
¹Bilkent University, ²Abington Electronics

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**EuMC21-6**  
**A Novel Concept in Design of Microwave Planar Dual Band Filter having the Controllable Closed/Isolated Bands by Using the Simple Vias and the Slow Wave Effect for 5G/IoT Applications**

Daryoush Gardouzi¹, Marina Deng¹, Chihandak Mulderene², Christopher Caillaud², Patrick Mounaix², Magali de Matos², Cristell Maneux²  
¹University of Bordeaux, ²III-V Lab, Nokia Bell Labs, ³University of Tours

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**EuMC21-10**  
**Access Modelling-based De-embedding Method for High-frequency Characterization of Uni-traveling carrier Photodiodes**

György Guenzdorz¹, Marina Deng¹, Chihandak Mulderene², Christopher Caillaud², Patrick Mounaix², Magali de Matos², Cristell Maneux²  
¹University of Bordeaux, ²III-V Lab, Nokia Bell Labs, ³University of Tours

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**EuMC21-14**  
**Measurement Uncertainties for Mixed-Mode S-Parameters**

Kosten Kul hugmann¹, Frauke Gellersen¹, Rainer Pflüger¹  
¹Physikalisch-Technische Bundesanstalt (PTB), ²LED On Kabel GmbH, ³University of Luxembourg

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**EuMC21-3**  
**Micromachined W-band Eight-way Power Divider Based on Micro-coaxial Lines**

Ruihua Liang¹, Guanghua Shi¹, Minjie Shu¹, Zixian Wu¹, Cheng Guo¹, Anxue Zhang¹  
¹Xi’an Jiaotong University

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**EuMC21-7**  
**A Novel Chip to PCB-Half-Embedded Waveguide Transition**

Thomas Langerfinger¹, Reinhard Feger¹, Markus Josef Lang¹, Jürgen Münchhofer¹, Sebastian Wolfgang Pistor², Andreas Schröder²  
¹TU Graz, ²Institute of Communication Technology

---

**EuMC21-11**  
**Physical coupling background of in-line-connectors at system and vehicle level**

Emanuel Panholzer¹, Stefan Lindermeyer¹  
¹University of Applied Sciences Hamburg

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**EuMC21-15**  
**Characterization of Microwave Substrates for High Accuracy and Long-Term Stability Using Full-Wave Microstrip Ring Resonator Method**

Yuanyuan Su¹, Jinya Shi², Matthew Pferdes¹, Christian Hafenzleben¹, Christian Mehl¹, M. Weck³  
¹North University of Technology, ²University of Manchester, ³University of Ulm

---

**EuMC21-4**  
**Bandpass Filter at 5 GHz with Reconfigurable Bandwidth Using Integrated ScDDAs**

Roxane Allias¹, Denis Le Berre¹, Yves Guerin², Cedric Quenot³, Didier Chastel³, Yohann Grimal³, Damien Valente³, Jean-Luc Bilbao³  
¹University of Brest, ²University of Paris Sud, ³Université de Tours

---

**EuMC21-8**  
**Design and Test of Wearable Textile-based Transmission Lines**

Rahil Jami¹, Aykut K. Palaçok¹, Constantin Constantinedes², Bob Low³  
¹The University of Edinburgh, ²University of St Andrews, ³Jagdschwil Ltd

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**EuMC21-12**  
**Simulation of granular media by numerical characterization in the microwave range in coaxial line and in free space**

Céline Pigot¹, Patrick Lacoste², Geneviève Massoun², Nicolas Malecot³  
¹University of Rennes 1, ²IRIT, ³University of Rennes 1

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**EuMC21-16**  
**Inter-Laboratory Comparison of On-Wafer Broadband 70kHz - 220 GHz Single-Sweep Measurements**

Andreas Rammert¹, Ralf Doerner², Jon Martens³, Steve Reyes³  
¹MPI Corporation, ²Ferdinand-Braun-Institut (FBH), ³University of Konstanz

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Posters will be ready by 10:40. Presenters will be around their stands at 10:50 – 11:20 and 13:00 – 13:30.
<table>
<thead>
<tr>
<th>TIME</th>
<th>ROOM</th>
<th>EU MC17</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:20</td>
<td>Room 1</td>
<td>New Design Concepts for Microwave Filters in Planar and Hybrid Technologies</td>
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<td>11:40</td>
<td>Room 1</td>
<td>Spatiotemporal Modulated Three-Pole Non-Reciprocal Quasi-Elliptic Bandpass Filter</td>
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<td>Room 1</td>
<td>Transversal-Coupled-Line Dual-Band Bandpass Planar Filters With Quasi-Elliptic-Type Response</td>
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<td>12:20</td>
<td>Room 1</td>
<td>ANN Model Development for Tunable Bandpass Filter</td>
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<td>12:40</td>
<td>Room 1</td>
<td>Reconfigurable Transfer Function BST Acoustic Wave Lumped Element Resonator Filters</td>
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<td>13:00</td>
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<td>Quad-Band Bandpass Filter Using Modified Asymmetric Stepped Impedance Resonators</td>
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<td>11:20</td>
<td>Room 4</td>
<td>Frequency Generation, Conversion and Nonlinear Modelling</td>
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<td>11:40</td>
<td>Room 4</td>
<td>A Static Frequency Divider in GaN HEMT Technology</td>
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<td>12:00</td>
<td>Room 4</td>
<td>Blind Receiver Distortion Compensation</td>
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<td>Room 4</td>
<td>Analysis of Inductively injection locked oscillators at an integer frequency ratio</td>
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<td>12:40</td>
<td>Room 4</td>
<td>Analysis of Clock Signals Imperfections and Their Impact on an N-path Frequency Down-converter</td>
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<td>13:00</td>
<td>Room 4</td>
<td>A Real-Valued 4D Memory Polynomial Algorithm for Mixer Modeling</td>
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<td>11:20</td>
<td>Room 13</td>
<td>3D Printing: Processes and Reliability</td>
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<td>11:40</td>
<td>Room 13</td>
<td>Space Qualified Additive Manufacturing for RF Components</td>
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<td>12:00</td>
<td>Room 13</td>
<td>Reliability Investigations of Additive Manufactured RF-Structures on Low-Cost PCB Materials Based on Inkjet Technology</td>
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<td>12:40</td>
<td>Room 13</td>
<td>Performance of SLA and DMLS 3D printed Ka-Band Resonators with Integrated Coaxial Launchers</td>
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<td>13:00</td>
<td>Room 13</td>
<td>Different Metallization Techniques Using Novel Inkjet Technology</td>
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<td>11:20</td>
<td>Room 14</td>
<td>Advanced High Efficiency Power Amplifier Techniques</td>
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<td>11:40</td>
<td>Room 14</td>
<td>Phase Compensated Sequential Load Modulated Balanced Amplifier Using Harmonically Tuned Control Amplifier</td>
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<td>12:00</td>
<td>Room 14</td>
<td>A Wideband Highly- Efficient Linearizable 700W Doherty Power Amplifier</td>
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<td>Room 14</td>
<td>An Enhanced Active Load-Pull Algorithm for Faster Convergence</td>
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<td>A 2 GHz 75%-PAE Power Amplifier with a Novel Harmonic Tuning Circuit Using Only CRLH TLs</td>
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<td>13:00</td>
<td>Room 14</td>
<td>Bandwidth and Power Back-Off Performances of a Class-EM/F3 Power Amplifier</td>
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WEDNESDAY 11:20 – 13:00

**Room 17**

**EuRAD02**
Radar Applications
Chair: Mayazzurra Ruggiano¹
Co-Chair: Willem A. Hol
¹Thales Nederland B.V.

11:20 – 11:40

**EuRAD02-1**
A Human-Machine Distance Control System Using Incoherent Cooperative FMCW Radar Sensors
Stefan Ederstorfer, Dominik Mueller¹
Štemmer Mobility GmbH

11:40 – 12:00

**EuRAD02-2**
Polarimetric UAV-deployed FMCW Radar for Buried People Detection in Rescue Scenarios
Carlos Sempere Chaves¹, Riana Helena Geschke¹, Maksim Shargorodskyy¹, Ralf Brauns¹, Reinhold Herschel¹, Christian Krebs¹
¹Fraunhofer FHR

12:00 – 12:20

**EuRAD02-3**
Ground penetrating capabilities of Airborne SAR System SETHI
Remi Baque¹, SEBASTIEN ANGELLIAUME¹, PASCALE Dubois-Fernandez¹, Olivier Ruault du Plessis¹
¹ONERA

12:20 – 12:40

**EuRAD02-4**
Improved RBFNN Based Rainfall Estimation: Initial Result
Jie Fan¹, Ru Bi¹, Shaoqi Wei¹, Yanfei Hu¹, Xingmei Li¹, Shuang Ji¹
¹Nanjing University of Aeronautics & Astronautics

12:40 – 13:00

**EuRAD02-5**
An Approach for Sleep Apnea Detection based on Radar Spectrogram Envelopes
Yichuang Han¹, Alexander Forsey¹, Francesco Fioraroli¹
¹Til Delft
EuMC25-1
A Linear-to-Circular Polarization Converter with Wide Angular Stability and High Ellipticity for Ka-Band Applications
Muhammad Ayyub Soh, Kushmanda Saaur, Shiban Rishen Neal
Indian Institute of Technology Jammu, Indian Institute of Technology Delhi

EuMC25-2
Integrated Antenna Module for 5G Applications
Zamuram Ahmed, Hans Peter Wolfsheu, Heinrich Hess, Khai Ruan Chung
Infineon Technologies AG, Infineon

EuMC25-3
A Wideband Circularly Polarized Horn Antenna using Transmission Type Linear to Circular Polarization converter for Ka-band Applications
Javid Ahmad Ganie, Kushmanda Saaur
Indian Institute of Technology Jammu

EuMC25-4
Evaluations of the Vector Electric Field under a Wideband Transmitting Conical Antenna
Davide Guglielmi, Alain Delhez, Jean-Christophe Delo, Bernard Crabos, Jean-Luc Lavergne
CEA Grenoble - CEA DAM

EuMC25-5
Rational Fitting with Weighted Iteration (RFWI) with Application to Chassis Antenna
Yuming Bai, Peter Gardner
University of Birmingham

EuMC25-6
Reverberation-Chamber Performance of the Oscillating-Wall Stirrer for Estimating Antenna Efficiency
Anaïs Hubrecht, Ad Ronier, A. Burt Snekkers, Sander Brodersen
Eindhoven University of Technology (TU/e)

EuMC25-7
A Local Hot-Cold Antenna Measurement System
Sean Mannal, Emily Meyer, Jack Gilman
Stellenbosch University, Eindhoven University of Technology

EuMC25-8
Wideband, Dual Circularly Polarized Slot Antenna for 5G- and Beyond-Applications
Abdul Halim, Ali LUSA, Anthony Petri
InterDigital, Inc.

EuMC25-9
Wideband Dual Polarized Shared Aperture Antenna for LTE Applications
Yang Cheng, Yuanqian Deng
University of Electronic Science & Technology of China, University of Electronic Science and Technology of China

EuMC25-10
A Dual-band Flexible Printed Graphene Antenna Array for 2.4 and 5 GHz WLAN IoT Applications
XINING ZHOU, Ying Song, Xiuwei Pan, Zhihao Hu
University of Manchester

EuMC25-11
Miniaturized Supershaped Sinuous Antenna
Gianluca Miozzi, Claudio Maria Lapoghi, Pietro Bai, Antonio Marino, Diego Caratelli, Luciano Mioscia
Politecnico di Milano, IMAtek Srl, Elettronica SpA, "The Antenna Company"

EuMC25-12
High performance C/Ku band dual polarization feed system for large reflector antennas
Oleksandr Sushko, Stepan Piltyay, Serhiy Martysh, Fedor Dobrovikov
Igor Sikorsky Kyiv Polytechnic Institute

EuMC25-13
Air-filled cavity-backed 28 GHz Antenna array implemented by 2.5D PCB process and Network Analysis
Himadri Sahukar, Sebastian Wolfgang Sattler, Holmat Fautsch, Hossein Soroush Farahani, Wolfgang Bloechl, Einrich Schaffner, Bernd Reitmaier
Graz University of Technology, "ABS Austria Technologie & Systemtechnik AG"

EuMC25-14
20 GHz Dual-Polarized Array Antenna With Low Cross-Polarization and High Gain
Qingling Yang, "W Wang", Steven Gao
University of Birmingham, University of Birmingham, University of Kent

EuMC25-15
The GAMMA Project: Development of a Galileo-Based Multi-Frequency Multi-Purpose Antenna
Marno Faliero, Gianluca Fanaron, Gianfrano Pastore, Nicoletta Patierno, Roberto Moricenti, Riccardo Poppi, Giuseppe Menni, Gianluca Pugliese
Amphast SARL, "ANAS Alava Space Italy, SpazioEX, Business Integration Partners, "EUSPA"
### Room 1
**EuMC22**
Advanced Implementations for Substrate-Integrated and Quasi-Planar Filters
- Chair: Michael Hütt³
- Co-Chair: Anthony Ghiozzo⁷
  - Christian-Albrechts-Universität zu Kiel, ³Bordeaux INP, IMS Laboratory
- Room 17

### Room 13
**EuMC23**
5G Communication and Beyond
- Chair: Yinggang Li⁴
- Co-Chair: Holger Maune⁴
  - Ericsson AB, ³Otto von Guericke University Magdeburg

### Room 14
**EuMC24**
Advances in Electromagnetic Modeling and Numerical Techniques
- Chair: Alessandro Galli⁶
- Co-Chair: Walter Fuschak⁷
  - Sapienza University of Rome, ³CNR-IMM, Consiglio Nazionale delle Ricerche, Rome, Italy

### Room 17
**EuRAD03**
Emerging Radar Applications
- Chair: Pierfrancesco Lombardo⁷
- Co-Chair: Willem A. Hol⁶
  - Sapienza University of Rome

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### Wednesday 14:20 – 16:00

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Presenter(s)</th>
<th>Institute(s)</th>
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<tbody>
<tr>
<td>14:20</td>
<td><strong>EuMC22</strong></td>
<td>A Compact Filter With Dual-Mode Folded Circular SIW Cavities</td>
<td>Anton Segarscheit³, Bartosz Tepowicki⁴, Jernej Jakob⁵</td>
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<td>Hamburg University of Technology, Technische Universität Hamburg</td>
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<td>14:40</td>
<td><strong>EuMC23</strong></td>
<td>Millimeter-wave and sub-THz technology and research trends for “beyond 5G” applications - an industry view</td>
<td>Renato Colosimo⁹, \textit{INDUSTRIAL KEYNOTE}</td>
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<tr>
<td>14:40</td>
<td><strong>EuMC22-1</strong></td>
<td>Ultra-broadband SIW Diplexer on Low-cost Laminated Technology for Channel Bonding</td>
<td>Hidenao Hayashi⁸, \textit{INDUSTRIAL KEYNOTE}</td>
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<td>Fugaku Ltd, Toshiba Fugaku Ltd</td>
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<td>15:00</td>
<td><strong>EuMC22-2</strong></td>
<td>28 GHz Over-the-Air Measurement using an OTFS Multi-User Distributed MIMO Transmitters</td>
<td>Norimasa Tono, Toshihide Kusuda, Yasushi Maruta, Toshio Kuroki</td>
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<td>NEC Corporation</td>
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<td>15:00</td>
<td><strong>EuMC22-3</strong></td>
<td>Compact and Low-loss Stripline Bandpass Filter Made of Liquid Crystal Polymer for n275 and n285 Application</td>
<td>Katsu Higuma, \textit{INDUSTRIAL KEYNOTE}</td>
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<td>Tohoku University, University of Tokyo, University of Hiroshima</td>
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<td>15:20</td>
<td><strong>EuMC22-4</strong></td>
<td>First Demonstration of Ultra-Miniaturized, High-Performance Filters on Alumina Ribbon Ceramic Substrates for 5G Applications</td>
<td>Rafael Adar Abed⁹, \textit{INDUSTRIAL KEYNOTE}</td>
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<td>University of Electronic Science and Technology of China</td>
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<tr>
<td>15:40</td>
<td><strong>EuMC22-5</strong></td>
<td>Half-Mode Substrate Integrated Waveguide Filters with Arbitrarily Inserted Transmission Zeros</td>
<td>Ying Li, \textit{INDUSTRIAL KEYNOTE}</td>
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<td>North Carolina State University, Beijing University of Posts and Telecommunications</td>
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<td>16:00</td>
<td><strong>EuMC23</strong></td>
<td>Waveguide Filters with Arbitrarily Half-Mode Substrate Integrated Substrates for 5G Applications</td>
<td>Yilong Zhu³, Yuandan Dong³</td>
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<td>University of Electronic Science and Technology of China</td>
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<td>16:00</td>
<td><strong>EuMC23-1</strong></td>
<td>Segmentation of a Complex Horn Antenna for Efficient Analysis and Optimization</td>
<td>Luca Pietro Leporini, Luca Cordoni, Jorge A. Ruiz-Cruz, José R. Mentana-Garcia, Jesus M. Rebollar³</td>
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<td>NEC Corporation</td>
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<td>16:00</td>
<td><strong>EuMC23-3</strong></td>
<td>Preserving Causality in Time Domain Integral Equation-Based Methods</td>
<td>Emanuele Cardillo³, \textit{INDUSTRIAL KEYNOTE}</td>
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<td>16:00</td>
<td><strong>EuMC23-4</strong></td>
<td>A Finite Element formulation for waveguides with first and second order symmetries</td>
<td>Carles Garcia-Comellas², Gabriel Carcées⁴, Jorge A. Ruiz-Cruz</td>
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<td>16:00</td>
<td><strong>EuMC23-5</strong></td>
<td>Efficient Modeling of Nonlinear Graphene as a Surface Boundary Condition in the Finite-Difference Time-Domain Method</td>
<td>Fatemeh Moharrami³, Vahid Nayyeri², \textit{INDUSTRIAL KEYNOTE}</td>
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<td>16:00</td>
<td><strong>EuMC24</strong></td>
<td>Multi-User Macro Gesture Recognition using mmWave Technology</td>
<td>Alexandros Nanes, \textit{INDUSTRIAL KEYNOTE}</td>
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## WEDNESDAY 16:40 – 18:20

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<tr>
<th>ROOM</th>
<th>Room 13</th>
<th>Room 14</th>
<th>Room 17</th>
<th>Room 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EuMC26</strong></td>
<td>Novel 3D Printing Approaches for mmWave Applications</td>
<td><strong>EuMC27</strong></td>
<td>Measurements for 5G and 6G Systems</td>
<td><strong>EuMW04</strong></td>
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<td><strong>Chair:</strong> Tudor Williams¹</td>
<td><strong>Chair:</strong> Jon Martens¹</td>
<td><strong>Chair:</strong> Steven Gao¹</td>
<td><strong>Chair:</strong> Kamal K. Samanta¹</td>
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<td><strong>Co-Chair:</strong> John Papapolymerou²</td>
<td><strong>Co-Chair:</strong> TBA</td>
<td><strong>Co-Chair:</strong> John Papapolymerou²</td>
<td><strong>Co-Chair:</strong> Bumman Kim²</td>
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<td>'CSA Catapult, 'Michigan State University</td>
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<td>'University of Kent, 'NEC Corporation</td>
<td>'AMWT Ltd. / Sony Europe B.V., 'Pohang University of Science and Technology</td>
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| 16:40 | EuMC26-1 | Additively Manufactured Electronic (AME) Devices for mmWave Applications | Jan Nuthe | **INDUSTRIAL KEYNOTE**  

**NAME:** Jan Nuthe  
**AFFILIATION:** NAME |

| 17:00 | EuMC26-2 | 3D-Printed Dielectro optic Lens for a 140 GHz CMOS Radar Transceiver | Juan Sarmiento | NAME & more |

**NAME:** Juan Sarmiento  
**AFFILIATION:** NAME |

| 17:20 | EuMC26-3 | Aerosol Jet Printed Microstrip Lines on Polyimide for D-Band | Georg Granath, Joachim Heider, Christian Bohr, Ulf Lennartz, Thomas Zwicz | Karlsruhe Institute of Technology (KIT) |

**NAME:** Georg Granath, Joachim Heider, Christian Bohr, Ulf Lennartz, Thomas Zwicz  
**AFFILIATION:** Karlsruhe Institute of Technology (KIT) |

| 17:40 | EuMC26-4 | Three-Dimensional Printing of a Waveguide Termination for Millimeter Wave Applications | Evan Roué, Vincent Laur, Alexis Chevalier, Gérard Tanné, Camille Patri, Olivier Veldner, Rose-Marie Sauvage | NAME & more |

**NAME:** Evan Roué, Vincent Laur, Alexis Chevalier, Gérard Tanné, Camille Patri, Olivier Veldner, Rose-Marie Sauvage  
**AFFILIATION:** NAME & more |

| 18:00 | EuMC26-5 | Comparison of E-band SLM and SLA printed waveguides and automotive radar antennas | Aleksandar Đukanović, Maximilian Eschbaumer | Infineon Technologies AG |

**NAME:** Aleksandar Đukanović, Maximilian Eschbaumer  
**AFFILIATION:** Infineon Technologies AG |

| **EuMC27** | **EuMC28** | **EuMW04** |
| **Chair:** Jon Martens¹ | **Chair:** Steven Gao¹ | **Chair:** Kamal K. Samanta¹ |
| **Co-Chair:** TBA | **Co-Chair:** John Papapolymerou² | **Co-Chair:** Bumman Kim² |
| | | 'AMWT Ltd. / Sony Europe B.V., 'Pohang University of Science and Technology |

| 17:00 | EuMC27-1 | Sub THz Bands for 6G: 10x the bandwidth with 10x the problems? | Michael Davidson | **INDUSTRIAL KEYNOTE**  

**NAME:** Michael Davidson  
**AFFILIATION:** NAME |

| 17:20 | EuMC27-2 | A Novel OTA Near-Field Measurement Approach Suitable for 5G mmWave Validation and Test | Martin Lucia, Dirk Plummer, Thomas Beckert, Vincent Ketzsch, Marc Sander Bosche | Technical University Dresden, National Instruments Corporation, Austin, Texas, U.S. |

**NAME:** Martin Lucia, Dirk Plummer, Thomas Beckert, Vincent Ketzsch, Marc Sander Bosche  
**AFFILIATION:** Technical University Dresden, National Instruments Corporation, Austin, Texas, U.S. |

| 17:40 | EuMC27-3 | Benchmarking of GHz resonator techniques for the characterisation of 5G / mmWave materials | Małgorzata Cieruch, Michael Hill, Tomasz Krapacz, Marzena Jakubowska-Picha, Saj S. Photoshakarzewski, Uwe Rüll, Barbara Stadel | WROE Sp. z o.o., Institute of Radioelectronics and Multimedia Technology, Warsaw University of Technology, Key Sight Technologies, The International Electronics Manufacturing Initiative |

**NAME:** Małgorzata Cieruch, Michael Hill, Tomasz Krapacz, Marzena Jakubowska-Picha, Saj S. Photoshakarzewski, Uwe Rüll, Barbara Stadel  
**AFFILIATION:** WROE Sp. z o.o., Institute of Radioelectronics and Multimedia Technology, Warsaw University of Technology, Key Sight Technologies, The International Electronics Manufacturing Initiative |

| 18:00 | EuMC27-4 | Transient phased array distortion measurements | Jian Marenzi | NAME |

**NAME:** Jian Marenzi  
**AFFILIATION:** NAME |


**NAME:** Priyansha Kaurav, Shiban Kishen Koul, Ananjan Basu  
**AFFILIATION:** Indian Institute of Technology Delhi |

| 17:00 | EuMC27-2 | A Novel OTA Near-Field Measurement Approach Suitable for 5G mmWave Validation and Test | Martin Lucia, Dirk Plummer, Thomas Beckert, Vincent Ketzsch, Marc Sander Bosche | Technical University Dresden, National Instruments Corporation, Austin, Texas, U.S. |

**NAME:** Martin Lucia, Dirk Plummer, Thomas Beckert, Vincent Ketzsch, Marc Sander Bosche  
**AFFILIATION:** Technical University Dresden, National Instruments Corporation, Austin, Texas, U.S. |

| 17:20 | EuMC28-1 | A 39 GHz MU-MIMO using 256 Element Hybrid AAS with Coherent Beam-Forming for 5G and Beyond IAB Applications | Yoshitake Kazuki, Kimitake Taya, Yasushi Morita, Shinsuke Hori, Tomoya Kaneko | NEC Corporation |

**NAME:** Yoshitake Kazuki, Kimitake Taya, Yasushi Morita, Shinsuke Hori, Tomoya Kaneko  
**AFFILIATION:** NEC Corporation |

| 17:40 | EuMC28-2 | An Eight-Port Antenna Array for 5G MIMO Handset | Long Qian, Xiaodong Chen, Wei Hu | Queen Mary University of London, 'Italian University |

**NAME:** Long Qian, Xiaodong Chen, Wei Hu  
**AFFILIATION:** Queen Mary University of London, 'Italian University |

| 18:00 | EuMC28-3 | 26 GHz Band Beam-Steered Antenna for Mm-Wave 5G Systems | Muhammad Rabbani, James Churm, Sohail Payami, Pei Xiao, Rahim Tafazolli, Tian Hong Loh, Alexandros Feresidis | University of Birmingham, University of Surrey, National Physics Laboratory |

**NAME:** Muhammad Rabbani, James Churm, Sohail Payami, Pei Xiao, Rahim Tafazolli, Tian Hong Loh, Alexandros Feresidis  
**AFFILIATION:** University of Birmingham, University of Surrey, National Physics Laboratory |

| 18:20 | EuMC28-4 | Scalable Planar Phased Array Antenna with Dual Polarization and Metasurface Shield at 28 GHz | Mohammad Reza Kavoshi, Junjie Zhou, Sandra Kito, Sergio Fere | Ampleon Netherlands BV |

**NAME:** Mohammad Reza Kavoshi, Junjie Zhou, Sandra Kito, Sergio Fere  
**AFFILIATION:** Ampleon Netherlands BV |

| 18:00 | EuMC28-5 | Low-Coupling and Dual-Polarized Horn-based Antenna Array aimed to Massive MIMO Applications | Tiago Henriques Brandão, Hugo Rodrigues Dias Filipe, Tapani Pihlajaniemi | National Institute of Telecommunications (Inatel) |

**NAME:** Tiago Henriques Brandão, Hugo Rodrigues Dias Filipe, Tapani Pihlajaniemi  
**AFFILIATION:** National Institute of Telecommunications (Inatel) |
# Thursday Overview

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00–10:40</th>
<th>11:20–13:00</th>
<th>14:20–16:00</th>
<th>16:40–18:20</th>
<th>Evening Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EuMC35</td>
<td>EuMC/EuRAD04</td>
<td>EuRAD13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-planar Filters and Passive Components</td>
<td>Radar Architectures and Systems</td>
<td>Radar Imaging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exhibitor Workshops</td>
<td>Exhibitor Workshops</td>
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<tr>
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<td>4</td>
<td>EuRAD04</td>
<td>EuRAD07</td>
<td>EuRAD10</td>
<td>EuRAD14</td>
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<tr>
<td></td>
<td>Distributed and Multistatic Radar</td>
<td>Drone Detection and Recognition</td>
<td>Signal Processing for Automotive Radar</td>
<td>Target and Clutter Classification in Automotive Radar</td>
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<td>5</td>
<td>Exhibitor Workshops</td>
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<td></td>
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<tr>
<td>6</td>
<td>EuMC29</td>
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<tr>
<td></td>
<td>On the Occasion of Nikola Tesla's 165th Anniversary</td>
<td>Special Session: HEPPA - An International Project on Highly Efficient and Flexible Phased Arrays</td>
<td>Advances in Biological and Medical Applications</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>EuRAD05</td>
<td>EuMC/EuRAD01</td>
<td>EuMC41</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AI Methods in Automotive Signal Processing and Information Extraction</td>
<td>High Resolution Methods in Range and Azimuth for Environmental Perception</td>
<td>Material and On-wafer Measurements</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>EuRAD06</td>
<td>EuMW05</td>
<td>EuMC44</td>
<td>EuMC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radar Characteristics Measurement, Modelling and Simulation</td>
<td>Special Session in Memory of Prof. Peter Claricoats</td>
<td>EuMC Closing Session</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>EuMC30</td>
<td>EuRAD08</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Asia Pacific Focused Session</td>
<td>Radar Antennas, Arrays and Calibration</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>EuMC31</td>
<td>EuRAD09</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Electromagnetic Interactions, Environmental and Biological Applications</td>
<td>Positioning and Localization Systems</td>
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<td></td>
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<tr>
<td>11</td>
<td>EuMC32</td>
<td>EuMC/EuRAD02</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Calibration Techniques and Nonlinear Measurements</td>
<td>Channel and Radar Characterization</td>
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<td>EuMC37</td>
<td>EuMC38</td>
<td>EuMC42</td>
<td></td>
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<tr>
<td></td>
<td>Radar and Communication Systems</td>
<td>Advances in mmWave Antennas</td>
<td>Antennas Using Advanced Manufacturing and Novel Substrate Materials</td>
<td></td>
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</tr>
<tr>
<td>13</td>
<td>EuMC33</td>
<td>EuMC39</td>
<td>EuMC43</td>
<td>EuRAD15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sub-10GHz Antennas</td>
<td>Novel IoT Technologies</td>
<td>Sensing and Dynamic Technologies</td>
<td>Human Activity Sensing</td>
<td></td>
</tr>
<tr>
<td>14</td>
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<td></td>
<td></td>
<td></td>
<td>5G and Beyond Forum</td>
</tr>
<tr>
<td>15</td>
<td>WTh01</td>
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<td>Advances in Drone Antenna Measurement Techniques for Satcom and Radar Applications</td>
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<td>EuMC43</td>
<td>EuRAD15</td>
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<tr>
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<td>RFID and WPT Technologies</td>
<td>Novel IoT Technologies</td>
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<td>Human Activity Sensing</td>
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- **EuMC**: Conference Sessions Matrix
- **EuMC/EuRAD**: Joint Conference Sessions Matrix
- **EuRAD**: Radar Sessions Matrix
- **EuMIC**: Microwaves Sessions Matrix
- **Students**: Students Sessions Matrix
- **EuMW**: Microwave-Wireless Sessions Matrix
- **Exhibitors**: Exhibitor Workshops
THURSDAY 09:00 – 10:40

**Room 6**

**EuMC29**

On the Occasion of Nikola Tesla’s 165th Anniversary

Chair: Dušan Bušmíča¹, University of West Bohemia
Co-Chair: Zdeněk Popovic², University of West Bohemia

**Room 9**

**EuMC30**

Asia Pacific Focused Session

Chair: Yi Wang¹
Co-Chair: Kamran Ghorbani², University of Birmingham, RMIT University

**Room 10**

**EuMC31**

Electromagnetic Interactions, Environmental and Biological Applications

Chair: Michael Mozrzed³
Co-Chair: Osuama Shrankova¹, Gdańsk University of Technology, Interdigital, R&D France

**Room 11**

**EuMC32**

Calibration Techniques and Nonlinear Measurements

Chair: Nuno Borges Carvalho²
Co-Chair: Anding Zhu², University of Aveiro / Instituto de Telecomunicações, University College Dublin, Chalmers University of Technology

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**EuMC29-1**

No Bigger than a Pocketwatch: Nikola Tesla’s Early Vision of the Information Age

Bernard Laherre, University of Colorado Boulder

**EuMC30-1**

Millimeter-wave Digital Beam-forming Massive-MIMO and Distributed-MIMO Technologies and Their Verifications toward 5G-Beyond Further Capacity Enhancement

Sophia Kanko, NEC Corporation

**EuMC31-1**

On the Potential for Viruses as Nano Microwave Transmitters

Gabriel García-Muñoz¹, Gabriela Santamaría-Botello², Luis M. Mir³, Francesca Laura Caramazza¹, Annalisa De Angelis², Zain Haider³, Micaela Liberti¹, A4ST's, Sapienza University of Rome, Fondazione Istituto Italiano di Tecnologia, Italy, University of Rennes, Università del Salento, Università di Firenze, University of Naples Federico II, Universidad de Navarra

**EuMC31-2**

Impact of Small-Cell Deployment on Combined Uplink and Downlink RF Exposure Compared to the Status Quo in Mobile Networks

Dima Puspan, Sander de Kersenmaker, Jeroen de Groot, Yves Rolain, Vrije University Brussels

**EuMC31-3**

Microwave-assisted chemical recycling for polymeric waste valorisation

Ignacio Julian¹, ALVARO Toquero-Nava, Alberto Fresno-Podest, Helena Garcia-Polanco², Nelson Garcia-Polanco², University of Cantabria, Madrid, Spain

**EuMC31-4**

A microdosimetric study at the cellular and intracellular level using a 3D realistic cell model

Laura Carpanezo¹, Fabio De Angelis, Zain Haider, Mudassir Zudhiuddin, Francois André, Luis M. Mir, Francesca Laura Caramazza¹, Annalisa De Angelis², Zain Haider³, Micaela Liberti¹, Sapienza University of Rome, Fondazione Istituto Italiano di Tecnologia, Italy, University of Rennes, Universidad de Navarra, Università del Salento, Università di Firenze

**EuMC31-5**

Emulation of Non-Reciprocity applied in Load Modulated Power Amplifier Architectures using Single Amplifier Load-Pull Measurements

Jose-Ramon Perez-Comensal¹, Nan Zhou², Christian Fayre³, Kim Kriemhild³, Chalmers University of Technology, University of Surrey
<table>
<thead>
<tr>
<th>Room</th>
<th>EuMC33</th>
<th>EuMC34</th>
<th>EuMC35</th>
<th>EuMC36</th>
<th>EuMC37</th>
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<th>EuMC39</th>
<th>EuMC40</th>
<th>EuMC41</th>
<th>EuMC42</th>
<th>EuMC43</th>
<th>EuMC44</th>
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</table>
| 09:00 - 09:20 | **EuMC33-1**  
Fifth Generation Sub-6GHz Antennas  
Chair: Wim van Cappelken  
Co-Chair: Hendrik Roiger²  
¹ASTRON, ²Ghent University | **EuMC34-1**  
Comparison and Circular Polarization Interrogation for Robust Chipless RFID Reading  
Oliver Kuncz, Nicolas Barba, Etienne Perret  
¹University Grenoble Alpes | **EuMC35-1**  
Ghost-Target Suppression in Ghost-Target Suppression in Radar Networks to Enable Vectorial Velocity Estimation  
Benedikt Mennecke, David Webburz, Firmen Schneider, Christian Waldschmidt  
Ulm University | **EuMC36-1**  
A Deep Learning Approach for Drivable Free Space Detection on High-Resolution Radar Using Convolutional Neural Networks  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies | **EuMC37-1**  
Error Resistant Baseband Interference Mitigation Using Bi-LSTM for Automotive Radar and Signal Reconstruction Using Weakly Supervised Semantic Segmentation for Range-Doppler Maps  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies | **EuMC38-1**  
Design of a high gain highsteering angle and wide band antenna for S band applications  
Paul Karmann¹, Dominik Schoeder¹, Christian Waldschmidt¹  
¹Technische Hochschule Ingolstadt | **EuMC39-1**  
A Dielectric Waveguide based A Deep Learning Approach for Drivable Free Space Detection on High-Resolution Radar Using Convolutional Neural Networks  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies | **EuMC40-1**  
A Dielectric Waveguide based Signal Distribution Network for Time Multiplexed Fixed Target Radar Measurements  
Konstantinos Fatseas¹, David Webburz, Thomas Musch¹  
¹University of Twente | **EuMC41-1**  
A Deep Learning Approach for Drivable Free Space Detection on High-Resolution Radar Using Convolutional Neural Networks  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies | **EuMC42-1**  
Comparison and Circular Polarization Interrogation for Robust Chipless RFID Reading  
Oliver Kuncz, Nicolas Barba, Etienne Perret  
¹University Grenoble Alpes | **EuMC43-1**  
Ghost-Target Suppression in Ghost-Target Suppression in Radar Networks to Enable Vectorial Velocity Estimation  
Benedikt Mennecke, David Webburz, Firmen Schneider, Christian Waldschmidt  
Ulm University | **EuMC44-1**  
A Deep Learning Approach for Drivable Free Space Detection on High-Resolution Radar Using Convolutional Neural Networks  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies | **EuMC45-1**  
Error Resistant Baseband Interference Mitigation Using Bi-LSTM for Automotive Radar and Signal Reconstruction Using Weakly Supervised Semantic Segmentation for Range-Doppler Maps  
David Forino, Chetan Mara, Juan Pablo Steierl  
¹Automotive Safety Technologies |
<table>
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<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Speakers</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>EuRAD06-1</td>
<td>Signal Reduction Due to Layer of Water at Low-THz Frequency for Automotive Radar Applications</td>
<td>Shahrzad Sabery¹, Fatemeh Norouzian¹, Aleksandr Bystrov¹, Emidio Marchetti¹, Peter Gardner¹, Marina Gashinova¹</td>
<td>Room 8</td>
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<tr>
<td>09:40</td>
<td>EuRAD06-3</td>
<td>Numerical Analysis of Radar-Plasma Signatures of a Sphere in a Mach 10 Hypersonic Wind Tunnel Flow</td>
<td>René Petervari¹</td>
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<tr>
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<td>EuRAD06-4</td>
<td>Scattering Properties of Antennas used for Stimulating Radar Sensors</td>
<td>Michael Ernst Gadringer¹, Michael Vorderderfler¹, Helmut Schreiber¹, Wolfgang Bösch¹</td>
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<tr>
<td>10:20</td>
<td>EuRAD06-5</td>
<td>Quasi-monostatic Radar Cross-Section Measurement in Reverberation Chamber</td>
<td>Corentin Charlo¹, Stéphane Méric²</td>
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EuMC/EuRAD03-1
Design of narrow wall slotted waveguides planar array for 3D S-band radar with very low side lobe level
Quoc Duy Nguyen¹, Hoang Viet Tran¹, Thoi Huu Hung Ng⁸, Dinh Hung Pham¹
¹Viettel High Technology Industries Corporation, Hanoi, Vietnam

EuMC/EuRAD03-2
Transmission Line Based Frequency Modulated Continuous Wave Radar for Monitoring Airbag Deployment Processes
Björn Möhring¹, Uwe Siart¹, Sebastian Schweizer², Thomas F. Eibert¹
¹Technical University of Munich, ²Audi AG

EuMC/EuRAD03-3
Compressed Sensing for MIMO Radar using SIW Antennas for High Resolution Detection
Cristian-Alexandru Alistarh¹, Laura Avraii¹, William van Rossum¹, Simon R. Peddie¹, John Thompson¹, Marlines Selkhalten¹
¹Heriot-Watt University, ²Sapienza University of Rome, ³The University of Edinburgh

EuMC/EuRAD03-4
Spectrum Estimation for Very High Frequency RF Systems
Marina LaMonte⁹, Pietro Mancinì⁹, Pasquale Tommasino⁹, Alessandro Triffletti⁹
⁹Electroechronic, Sapienza University of Rome

EuMC/EuRAD03-5
Enhancing Unambiguous Velocity in Doppler-Division Multiplexing MIMO Radar
Vuolam Sau¹, Marc Bauduin¹, André Bourdoux¹
¹Interuniversity Microelectronics Centre (imec)

EuMC/EuRAD03-6
VBR: A S Band Tile of 16 T-R Modules for Fully Digital AESA Antennas (DAR Technology)
Francesco Macro¹, Marco Di Battista¹, Bruno Buccinas¹
¹Virtualabs

EuMC/EuRAD03-7
Wideband 6-Bit SiGe BiCMOS T/R ModuleCore-Chip for X-Band Phased-Arrays
Can Cakacak¹, Atisurahman Burak¹, Mehdi Yucil², Nihan Oztas³, Yasar Gurbuz¹
¹Sabanci University, ²ASELSAN Inc.

EuMC/EuRAD03-8
Enhanced Self-Interference Cancellation by Means of Adaptively Calibrated Filters
Johannes Steigert¹, Daniel Schwab¹
¹COMMSCOPE

EuMC/EuRAD03-9
Dosimetric Analysis of Plane Wave Propagation in Biological Tissues: Comparison Between Planar Multilayer vs Realistic Anatomical Models
Micol Colella¹, Simona Di Meo¹, Paolo Marcacino¹, Micaela Libert¹, Marco Pozzani¹, Francesca Apollonio¹
¹Sapienza University of Rome, ²University of Pavia, ³Rise Technology S.r.l., Rome

EuMC/EuRAD03-10
Design of a Miniature Smart Pill Antenna
Hubregt Visser¹, Esmee Huismans², Minyoung Song³, Yao-Hong Liu³
¹Imec Netherlands, ²Eindhoven University of Technology, ³Imec

EuMC/EuRAD03-11
Status and Ongoing Development of a kW-level Broadband W-band Gyro-TWA
Liang Zhang¹, Craig Donaldson¹, Colin Whyte¹, Adrian Cross¹
¹University of Strathclyde
<table>
<thead>
<tr>
<th>Time</th>
<th>Room 7</th>
<th>Room 11</th>
<th>Room 1</th>
<th>Room 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:20</td>
<td>EuMC/EuRAD01-1</td>
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<td>Real-time DoA Estimation</td>
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<td>HEFPA – An International</td>
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<td>11:40</td>
<td>Vahid Wolf, Cheng-Yang Li, Thomas Hou, Wenjing Lou</td>
<td>for Infrastructure</td>
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<td>and Flexible Phased Arrays</td>
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<td>Simultaneous Multi-Mode</td>
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<td>Design and Characterization</td>
<td>HEFPA – Highly Efficient</td>
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<td>Automotive Imaging Radar</td>
<td>Quality at the Physical</td>
<td>of a compact 6-18GHz 200W Dual</td>
<td>and Flexible Phased Arrays</td>
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<td>Using Cascaded Transceivers</td>
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<td>Directional Coupler for Power</td>
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<td>Channel Capacity</td>
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<td>James Bevis, Jeremie Gerbaud</td>
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<td>University of Stuttgart,</td>
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<td>in Moving Automotive MIMO</td>
<td>in Compacts on</td>
<td>Radiometer Physics GmbH,</td>
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<td>Radar</td>
<td>Terahertz Scattering</td>
<td>Graz University of Technology,</td>
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<td>12:40</td>
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<td>Laser Systems Research</td>
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<td>EuMC/EuRAD02-4</td>
<td>High Temporal Resolution</td>
<td>THALES-APS/MPD</td>
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<td>Synthetic Aperture Radar</td>
<td>Time-Gating for</td>
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<td>Imaging of Moving Targets</td>
<td>Wideband Radar Cross</td>
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<td>Imaging of Moving Targets</td>
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</table>
THURSDAY 11:20 – 13:00

**Room 12**

**EuMC37**
Radar and Communication Systems
Chair: Nils Pohl¹
Co-Chair: Ilona Rolfes²
¹Ruhr University Bochum, ²Ruhr-University Bochum

11:20 – 11:40

**EuMC37-1**
An automatic driving test for V2X-communication and application on a scan-phase-antenna diversity
Anton Dobler¹, Stefan Lindenmeier¹
University of the Bundeswehr Munich

**EuMC37-2**
Experimental Evaluation of Filtering and Isolation in Highly Integrated mmWave Harmonic Radar
Steffen Hansen¹, Nils Pohl²
¹Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR, ²Ruhr-University Bochum

12:00 – 12:20

**EuMC37-3**
Car-to-car communication based on modulated active backscatter and automotive radar
Antoni Karen Lázaro Guixè¹, Marc Lázaro Herrero¹, Ramon Maria Villaverde Villarino¹, Pedro de Paz²
Reina and Virgili University, Universitat Autonoma de Barcelona

**EuMC37-4**
Real-Time Wideband Spectrum Monitor Using Multiple Sampling Frequency Direct RF Undersampling for Wireless IoT
Sakshi Shukla¹, Sompali Forshani¹, Kiren Alimottu¹, Murali Mutyapu¹, Sagar Kandeta¹, Neeraj Suematsu¹
IIT Bombay

12:20 – 12:40

**EuMC37-5**
Cyclic Wiener Filtering of BPSK Signals for WLAN Adjacent Channel Interference Suppression
Alessandro Demonti¹, Kalyan Kamaraju², Andrea Bic¹, Massimiliano Cencetti³
¹Acustica Gelettanu, ²Murom Aviation Institute (National Research University)

12:40 – 13:00

**EuMC38**
Advances in mmWave Antennas
Chair: Tian Hong Loh¹
Co-Chair: Zhirun Hu²
¹National Physical Laboratory, ²University of Manchester

11:20 – 11:40

**EuMC38-1**
A Self-Diplexing Dual-Polarized K/Ka-Band Patch Antenna
Naoli Such¹, Kevin Ekeren², Arne F. Jacobsen¹
THW Berlin University of Technology

**EuMC38-2**
5G mmWave Dual-Polarized Stacked Patch Antenna
Mizukazu Saitou¹, TO Dresden

11:40 – 12:00

**EuMC38-3**
Side Lobe Lowered Novel Axially Displaced Ellipse Antenna Design for Radio Link System Compliant with ETSI EN 302 217-4-2 Class 3
Remi Aitou Toufou², JAMET-BERARD-TURK³
Nokia Corporation, ³USM

**EuMC38-4**
Novel Bull’s Eye Antenna at Ku Band With Enhanced Gain Bandwidth
Daniel Camps-Christiansen¹, Alejandro Fernandez²
¹University of Birmingham, UK

12:00 – 12:20

**EuMC38-5**
Vertical and Horizontal SIW Horn Antennas at 60 GHz
Tien-Hong Loh¹, Thinh Tran¹, Minh Thuy Le¹, Alejandro Nunez Martinez¹, Emmanuel Demers², Tran Phu Vuong¹
Greenfield Institute University, ²Hanoi University of Science and Technology, ³Schneider Electric

**EuMC38-6**
RF Energy Extraction Using Wave Impedance Matching
Sandyr Chandraakaran¹, Vincent Fucou², Neil Buchan²
¹Queen's University Belfast

12:20 – 12:40

**EuMC38-7**
An Automatic Driving Test for V2X-Communication and Application on a Scan-Phase-Antenna Diversity
Anton Dobler¹, Stefan Lindenmeier¹
University of the Bundeswehr Munich

**EuMC38-8**
Experimental Evaluation of Filtering and Isolation in Highly Integrated mmWave Harmonic Radar
Steffen Hansen¹, Nils Pohl²
¹Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR, ²Ruhr-University Bochum

12:40 – 13:00

**EuMC38-9**
A Self-Diplexing Dual-Polarized K/Ka-Band Patch Antenna
Naoli Such¹, Kevin Ekeren², Arne F. Jacobsen¹
THW Berlin University of Technology

**EuMC38-10**
5G mmWave Dual-Polarized Stacked Patch Antenna
Mizukazu Saitou¹, TO Dresden

**EuMC38-11**
Side Lobe Lowered Novel Axially Displaced Ellipse Antenna Design for Radio Link System Compliant with ETSI EN 302 217-4-2 Class 3
Remi Aitou Toufou², JAMET-BERARD-TURK³
Nokia Corporation, ³USM

**EuMC38-12**
Novel Bull’s Eye Antenna at Ku Band With Enhanced Gain Bandwidth
Daniel Camps-Christiansen¹, Alejandro Fernandez²
¹University of Birmingham, UK

**EuMC38-13**
Vertical and Horizontal SIW Horn Antennas at 60 GHz
Tien-Hong Loh¹, Thinh Tran¹, Minh Thuy Le¹, Alejandro Nunez Martinez¹, Emmanuel Demers², Tran Phu Vuong¹
Greenfield Institute University, ²Hanoi University of Science and Technology, ³Schneider Electric

**EuMC38-14**
RF Energy Extraction Using Wave Impedance Matching
Sandyr Chandraakaran¹, Vincent Fucou², Neil Buchan²
¹Queen's University Belfast

**Room 13**

**EuMC39**
Novel IoT Technologies
Chair: Dominique Schreurs¹
Co-Chair: John Batchelor²
¹KU Leuven, ²University of Kent

**Room 17**

**EuMC39-1**
A Self-Diplexing Dual-Polarized K/Ka-Band Patch Antenna
Naoli Such¹, Kevin Ekeren², Arne F. Jacobsen¹
THW Berlin University of Technology

**EuMC39-2**
5G mmWave Dual-Polarized Stacked Patch Antenna
Mizukazu Saitou¹, TO Dresden

11:20 – 11:40

**EuMC39-3**
Wireless Power Transfer Procedure via Hybrid Frequency Diversity
Enrico Fazzini¹, Alessandra Costanzo², Diego Massari²
¹Alma Mater Studiorum - Universita di Bologna, ²Università di Bologna

11:40 – 12:00

**EuMC39-4**
Meshed Microstrip Printed Antenna for Matching Network-Free RF Energy Harvesting
Hamoud Wagni¹, Alex S. Weldon², Steve Beder³
University of Southampton, ³USM

12:00 – 12:20

**EuMC39-5**
A Temperature-Compensated BLE Beacon and 802.15.4-to-BLE Translator on a Crystal-Free Mote
Titan Yuan¹, Filip Maksimovic¹, Brad Wheeler¹, David C. Burnett¹, Lydia Lee¹, Thomas Watteyne², Kristofer S.J. Pister¹
¹University of California, Berkeley, ²INRIA

**Room 8**

**EuMW05**
Special Session in Memory of Prof. Peter Clarricoats
Chair: Rostyslav Dubrovka¹
Co-Chair: Robert Donnan²
¹Queen Mary University of London

11:20 – 13:00

**EuMW05-1**
Shaped Beam Reflector Antennas
Gerald Cron

11:40 – 12:00

**EuMW05-2**
Modern research and achievements at UCLA inspired by Interaction with Peter
Takuo Kunitsuka

12:00 – 12:20

**EuMW05-3**
Peter Clarricoats - Scholar and Innovator
Claud Silver

12:20 – 12:40

**EuMW05-4**
A tribute to Peter Clarricoats
Graeme James

13:00 – 13:20

**EuMW05-5**
My way: How I become an antenna man due to Professor Peter Clarricoats
Fedir Dubrovka¹
¹Igor Sikorsky Kyiv Polytechnic Institute

13:20 – 13:40

**EuMW05-6**
My Friend and Great Contributor to Science and Academia
Muhammad Sobhy
THURSDAY 11:20 – 13:00

**ROOM**

**Room 4**
**EuRAD07**
Drone Detection and Recognition
Chair: Francesco Fioranelli¹
Co-Chair: Duncan A. Robertson¹
¹TU Delft, ²University of St Andrews

**Room 5**
**EuRAD08**
Radar Antennas, Arrays and Calibration
Chair: Claudio Migliaccio¹
Co-Chair: Thomas Zwick²
¹Università Côte d’Azur, ²Karlsruhe Institute of Technology (KIT)

**Room 6**
**EuRAD09**
Positioning and Localization Systems
Chair: Maria-Pilar Jarabo-Amores¹
Co-Chair: Markus Steck²
¹University of Alcalá, ²Hensoldt Sensors GmbH

**THURSDAY 11:20 – 11:40**

**Room 4**
**EuRAD07-1**
bladeRAD: Development of an Active and Passive, Multistatic Enabled, Radar System
Piers Beasley¹, Matthew Ritchie¹
University College London

**Room 5**
**EuRAD08-1**
Design of Antennas with Capacitively Coupled Patches for Enlarged Bandwidth in the 80 GHz Band
Jonathan Mayer¹, Jerry Kovaleski², Akarshka Bhutan¹, Lucas Girotto de Oliveira¹, Thomas Zwick¹
Karlsruhe Institute of Technology (KIT), ²Haber+Suhner

**Room 6**
**EuRAD09-1**
Near Field DoA estimation utilizing a Large Aperture MIMO Array Radar with 1x Beamforming
Kazunori Imaizumi¹, Hisako Mon²
Nvidia Corporation

**THURSDAY 11:40 – 12:00**

**Room 4**
**EuRAD07-2**
ARESTOR: A Multi-role RF Sensor based on the Xilinx RFSoC
Nial Peters¹, Colin Horne¹, Matthew Ritchie¹
University College London

**Room 5**
**EuRAD08-2**
Phase Distortion Correction of 79 GHz Frequency-Modulated Continuous Wave Radar
Sangdi Cho¹, Seung-tae Kang¹, Hyun-Woong Cho¹, Minsoon Go¹, Jangseok K Im²
Samsung Advanced Institute of Technology

**Room 6**
**EuRAD09-2**
Outlier Rejection Approach for Direction of Arrival Estimation in Low SNR Conditions
Andrea Quirini¹, Francesca Filippini¹, Carlo Bongianni¹, Fabiola Colone¹, Pierfrancesco Lombardo¹
Sapienza University of Rome

**THURSDAY 12:00 – 12:20**

**Room 4**
**EuRAD07-3**
Development of a Passive Dual Channel Receiver at L-Band for the Detection of Drones
Benjamin Cartier¹, Alain Bailleul¹, Chris Baker¹, Mohammed Jahangir¹
Cranfield University, ¹University of Birmingham

**Room 5**
**EuRAD08-3**
Compact, Broadband, and Highly Efficient Leaky-Wave Antenna in Air-Filled Substrate Integrated Waveguide Technology
Kamil Yavuz Kapusuz¹, Andres Vanden Berghe¹, Sam Lemey¹, Hendrik Rogier¹
Ghent University

**Room 6**
**EuRAD09-3**
Concept analysis of a frequency-sweeping delta/sigma beam-switching RADAR using machine learning
Mohammad Assa Seddigh¹, Jamshid Harewood¹, Jochen Ohnhauser¹
ISTE, “School of Electrical and Computer Engineering, College of Engineering, University of Tehran

**THURSDAY 12:20 – 12:40**

**Room 4**
**EuRAD07-4**
Receivers placement for UAV localization in a surveillance area
Piers Beasley¹, Jean-Pierre Audast¹, Antoine Mercier¹, Matthew Russon², Pierre-Yves Janssen¹
¹TBF, ²TBF, INRA-Reims

**Room 5**
**EuRAD08-4**
Active Ka-band Open-Ended Waveguide Antenna with Built-in IC Cooling for use in Large Arrays
Marino de Kie¹, A. Hart Smolders¹, Niels Veress⁰¹, Ulf Johansson¹
Eindhoven University of Technology

**Room 6**
**EuRAD09-4**
Indoor Positioning with a Six-Beam Planar Antenna Suitable for 2.45 GHz Wireless Communications
Alessandro Cipolli¹, Eduardo Cerqueira¹, Giovanni Colos⁰¹, Stefano Maddola¹, Marco Pascualone¹, Giuseppe Perra¹
Universita di Firenze

**THURSDAY 12:40 – 13:00**

**Room 4**
**EuRAD07-5**
Realistic Simulation of Drone Micro-Doppler Signatures
Cameron Emmett¹, Stephen Harman¹, Ivan Polotvenko¹
Axelestard Ltd, ¹Cranfield University

**Room 5**
**EuRAD08-5**
Dual-Polarized Multilayer L-Band Asymmetric Subarray with Truncated Electric Walls Separation for Airborne SAR Applications
Doge Lorenzo Gabano¹, Markus Lemm¹, Bernd Gaboi², Hector Esteban Gonzalez³, Vincenzo Enrico Bertozzi⁴
German Aerospace Center (DLR), ¹University Politecnica de Valencia

**Room 6**
**EuRAD09-5**
Experimental deep learning assisted super-resolution radar imaging
Mohsen Akhavan¹, Mohammad Choochoki¹, Ane Sana², Ahmed Melibya³, Ali Bakur³, Mohamed Bahal², Safiaddine Safi¹
University of Waterloo, ¹University of Calgary
Thursday 13:50 – 16:40

EuRAD Posters

Chair: Mustafa Bakr¹
¹University of Oxford

Exhibition Hall

EuRAD12

EuRAD Posters

EuRAD12-1
Detection of Helicopters on a Single Range-Doppler Map Using LSTM Networks
Deniz Dikrun Emre¹, Fatih Pekicap²
¹Acusan Inc.

EuRAD12-2
Efficient Velocity Disambiguation with Hypothetical Ambiguity Assessment
Sungbi Cho¹, Younghee Choi¹, HyeonWoo Cho¹, Minseong Lee¹, Jongseok Kim¹
¹Samsung Advanced Institute of Technology

EuRAD12-3
FPGA Implementation of Multiple Low-Rate Sampling Composite Detector
Canisio Barth¹, Ric Romero¹, Douglas Fouts¹
¹Naval Postgraduate School

EuRAD12-4
Fast 3D-CFAR for Drone Detection with MIMO Radars
Siyang Wang¹, Reinhold Henschel²
¹Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

EuRAD12-5
Least squares calibration of MIMO radars with collocated arrays
Nikita Petrov¹, Alexander Yarmony²
¹Delft University of Technology

EuRAD12-6
Joint Range-Angle Super-resolution Estimation for Frequency Division MIMO Radar
Hu Zhang¹, Sida Song¹, Shu Mei¹, Lei Wan¹
¹Huawei Technologies Co., Ltd., China

EuRAD12-7
Machine Learning using Support Vector Regression in Radar Remote Sensing for Oil-Spill Thickness Estimation
Chuteri Buu Hanh¹, Georges Claus¹, Bassem Hamoud¹, Paul Hamoud¹
¹Tulane University, American University of Beirut (AUB), Beirut, Lebanon

EuRAD12-8
Quantum Enabled Staring Radar with Low Phase Noise
Mohammed Jahanzeb¹, Jonathan Jones¹, Jethin Kunwarthara¹, Chris Baker¹, Kai Bongs¹, Michael Antoniadis¹, Nicolelly Sgroi²
¹University of Birmingham, UK, ²University of Birmingham, UK

EuRAD12-9
Increased traffic safety by means of intelligent detection and localization technologies
Renhard Kwikke¹, Tobias de Ponte Mäki²
¹THOR GmbH, ULR, German Aerospace Center

EuRAD12-10
Cognitive Radar Tracking with Adaptation of Update Interval and Integration Time
Snorre Banklund¹, Thomas Sängen²
¹Swedish Defence Research Agency (FOI)

EuRAD12-11
Clutter characterization for robust detection of slow moving targets in Ka-band Noise Radar Images
Nemanja del Rey-Mastern¹, Sergio Luca¹, Marisa Piara Saro-Ayore¹, Konstantin Laliev¹, David Mata-Mos¹, Pedro José González del Hoyo²
¹University of Alcalá, National Academy of Sciences of Ukraine

EuRAD12-12
Nonlinear Least Squares Estimation for Breathing Monitoring Using FMCW Radars
Gabriel Berti¹, Mohammad Alaei-Keradrood¹, Ugo Schneider¹, Dimitri Tatarinov², Bhawna Sharma²
¹Soft - Interdisciplinary Center for Security, Reliability and Trust, University of Luxembourg, ²TIEE S.A., Luxembourg

EuRAD12-13
An Inexpensive SDR System for Emitter Localization
Sven Hoogers¹, Michael Meuleners¹, Christoph Orgen²
¹Hochschule Niederrhein

EuRAD12-14
2D Matched Filtering with Time-Stretching; Application to Orthogonal Matching Pursuit (OMP)
Renkith Srinivasan¹, Faruk Uysal¹, Wim van Rossum¹
¹TNO

EuRAD12-15
Radar calibration by corner reflectors with mass-production errors
Nikita Petrov¹, Erkut Yigit¹, Oleg Krasnov¹, Alexander Yarmony²
¹Delft University of Technology

EuRAD12-16
Increased traffic safety by means of intelligent detection and localization technologies
Renhard Kwikke¹, Tobias de Ponte Mäki²
¹THOR GmbH, ULR, German Aerospace Center

Posters will be ready by 13:40. Presenters will be around their stands at 13:50 – 14:20 and 16:00 – 16:30.
<table>
<thead>
<tr>
<th>Time</th>
<th>Room 1</th>
<th>Room 6</th>
<th>Room 7</th>
<th>Room 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>14:20</td>
<td>EuMC/EuRAD04-1</td>
<td>EuMC/EuRAD04-2</td>
<td>EuMC40</td>
<td>EuMC42</td>
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<tr>
<td>14:40</td>
<td>Efficient Calibration of Very Large mm-Wave Radars by Virtual Phase Center Analysis</td>
<td>Radar-based Detection of Hidden People at Different Frequency Bands</td>
<td>First-In-Human Clinical Investigation of the Wavelia Microwave Breast Imaging System</td>
<td>Antennas Using Advanced Manufacturing and Novel Substrate Materials</td>
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<tr>
<td>15:00</td>
<td>Impact of channel imbalances on beamforming performance in Automotive MIMO Radar</td>
<td>Radar-based Detection of Hidden People at Different Frequency Bands</td>
<td>In-situ automatic adjustment of probe positions and tilt angles for GSSSG probe</td>
<td>Indoor and Mobile Radars Using Glass Technology</td>
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<tr>
<td>15:20</td>
<td>A Low-Power 24-GHz Radar Transceiver for Automotive Hands-Free Trunk Opener Applications in a 0.13um SiGe BiCMOS Technology</td>
<td>Long-Range LoRaWAN backscatter based sensors for medical and wearable applications</td>
<td>Complex Permittivity of 3D-Printing Filaments in the 20 - 50 GHz Frequency Band</td>
<td>HIS design for an environment-robust UHF/UWB antenna with 3D-printed inclusions</td>
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<tr>
<td>15:40</td>
<td>D-Band FMCW Radar with sub-cm Range Resolution based on a BiCMOS mmWave IC</td>
<td>Optimized Sensor for Broadband Dielectrometry of Biological Liquids of Small Volume</td>
<td>Single and Differential Microstrip Lines Excitation Using a Contactless Dielectric Waveguide Probe for V-Band</td>
<td>Using Gypsum Material as the Substrate for Inside Wall Embedded Wireless IoT Sensors</td>
</tr>
<tr>
<td>16:00</td>
<td>Surface pressure sensing radar using V-band</td>
<td>Controlled Drug Delivery Mediated by CW Electric fields: Experimental Setup and 3D Microdosimetry Modeling</td>
<td>Terahertz Non-destructive Testing of the Mica Insulation of Power Generator Bars in FMCW Measurements with a Dielectric Waveguide Antenna</td>
<td>Holographic Conical Beam Scanning Antenna for mm-Wave Radars Using Glass Technology</td>
</tr>
</tbody>
</table>

**INDUSTRIAL KEYNOTE**

**Programme**

**EuMC/EuRAD04-1**

**Efficient Calibration of Very Large mm-Wave Radars by Virtual Phase Center Analysis**

André Czar, Matthias Lender, Donnack Schwarz, Thomas Frey, Christian Waida Schneider

Sapienza University of Rome, Italy

**EuMC/EuRAD04-2**

**Radar-based Detection of Hidden People at Different Frequency Bands**

Sandra Nowak, Patrick Wullath, Reinhildt Henrichs

Fraunhofer IKTS

**EuMC/EuRAD04-3**

**A Low-Power 24-GHz Radar Transceiver for Automotive Hands-Free Trunk Opener Applications in a 0.13um SiGe BiCMOS Technology**

Mohamad Echaboune, Jürgen Meier, Heiko Mattheis

Infineon Technologies AG

**EuMC/EuRAD04-4**

**D-Band FMCW Radar with sub-cm Range Resolution based on a BiCMOS mmWave IC**

Vlad A. Ahmad, Razzaq Kachour, Herman J. Ng, Dietmar Krosinger

RTI Sensing and Imaging Research Center

Karlsruhe University of Applied Sciences, Ulm University

**EuMC/EuRAD04-5**

**Surface pressure sensing radar using V-band**

Attila Sallai, Jozsef Hadzisaf, Martin Michalka, Mark Tadir, Michael Tsai

NASA Jet Propulsion Laboratory

**EuMC40-1**

**First-In-Human Clinical Investigation of the Wavelia Microwave Breast Imaging System**

Angel Llauradó

**EuMC40-2**

**Radar-based Detection of Hidden People at Different Frequency Bands**

Sandra Nowak, Patrick Wullath, Reinhildt Henrichs

Fraunhofer IKTS

**EuMC40-3**

**Long-Range LoRaWAN backscatter based sensors for medical and wearable applications**

Marc Lavade Martí, Antonio Roman Ramos Guillén, Renato Massa Wilterin Villare

Reina and Virginia University

**EuMC40-4**

**Optimized Sensor for Broadband Dielectrometry of Biological Liquids of Small Volume**

Shahriar Parvaz, Jennifer J. Bader, Sander Schmidt, Martin Schüller, Stephen W. W. O'Connor, Nick Olson, T. Cherbel, Ralf Jakoby, Carolin Hessinger

Technical University of Darmstadt, Germany

**EuMC40-5**

**Controlled Drug Delivery Mediated by CW Electric fields: Experimental Setup and 3D Microdosimetry Modeling**

Cecilia Caramazza, Alessandra Paffi, Michele Liberti, Francesco Appelino

University of Rome, Italy

**EuMC41-1**

**In-situ automatic adjustment of probe positions and tilt angles for GSSSG probe**

Ryo Sakamaki, Masahiro Horibe

National Metrology Institute of Japan (NMIJ) / National Institute of Advanced Industrial Science and Technology (AIST)

**EuMC41-2**

**Dielectric Measurement of Substrate Materials Using 3D Printed Re-Entrant Cavity Resonator**

Ali Mousa Mohammed, Y. Wang, M. Saito

University of Birmingham

**EuMC41-3**

**Complex Permittivity of 3D-Printing Filaments in the 20 - 50 GHz Frequency Band**

Mateusz Kryczyński, Bartholoméi Sándor, Tamas Karpisz

Wroclaw University of Technology

**EuMC41-4**

**Using Gypsum Material as the Substrate for Inside Wall Embedded Wireless IoT Sensors**

Zehra Balamaci, Sreeraj Venkatesh

DWS EMT

**EuMC41-5**

**Terahertz Non-destructive Testing of the Mica Insulation of Power Generator Bars in FMCW Measurements with a Dielectric Waveguide Antenna**

Marc Reuter, Carsten Hanke, Andreas Mutschler, Stefan Leonhardt, Stefano Rotella, Friedrich Poltmann, Fabian Friedl

Fraunhofer IWM, Siemens Energy Global GmbH & Co KG

**EuMC42-1**

**Additive Manufactured Filtering Lens Antennas for Radar Measurements at 240 GHz**

Benjamin Thomas, Alex Chayanovsky, Nils Pohl

Fraunhofer IKTS, Ulm University

**EuMC42-2**

**A Compact 26 GHz Filtering Antenna with Cross Coupling Using LTCC Substrate**

Kaoru Sudo, Ryoko Nakatsu, Yudinori Taguchi, Kichi Takahashi, Natsumi Minamitani, Kenji Shiba, Masashi Arai, Koichi Hara

Murata Manufacturing Co., Ltd., Oita University

**EuMC42-3**

**HIS design for an environment-robust UHF/UWB antenna with 3D-printed inclusions**

Slobodan Tijou, David Chandramohan, Abdul Quddus, Diego Magnani, Svenn-Nikola Tesla, Alejandro Contreras

Alma Mater Studiorum - University of Bologna, RF AND MICROWAVE SOLUTIONS LTD, LYNN, UK, RUS Research and Innovation Center of Excellence, University of Cyprus, Friedrich-Universität, KÖS Nicosia, University of Bologna

**EuMC42-4**

**Using Gypsum Material as the Substrate for Inside Wall Embedded Wireless IoT Sensors**

Zehra Balamaci, Sreeraj Venkatesh

DWS EMT

**EuMC42-5**

**Holographic Conical Beam Scanning Antenna for mm-Wave Radars Using Glass Technology**

Thomas Frey, Andre Czar, Christian Waida Schneider, Mark Tadir, Michael Tsai

Ulm University
THURSDAY 14:20 – 16:00

ROOM 4

EuRAD10
Signal Processing for Automotive Radar
Chair: Mikhail Chernakov
Co-Chair: Marc Bauduin
¹University of Birmingham, ²Interuniversity Microelectronics Centre (imec)

EuRAD10-1
PMCW Radar Robust to Power Amplifier non-Linearity and IQ Imbalance with pi/K-BPSK Modulation
Marc Bauduin, André Boudreau
¹imec

EuRAD10-2
PreCFAR Gridmaps for Automotive Radar
Fabio Weishaupt¹, Nils Appenrodt¹, Julius F. Tilly¹, Jürgen Dickmann¹, Dirk Heberling²
¹Mercedes-Benz AG, ²Institute of High Frequency Technology - RWTH Aachen

EuRAD10-3
A Radar-Oriented Approach to the Normal Distributions Transform
Martijn Heller¹, Nikita Petrov¹, Alexander Yarovoy¹
¹Delft University of Technology

EuRAD10-4
Reduction of Sidelobe Effects in Automotive Polarimetric Radar Measurements
Julius F. Tilly¹, Ole Schumann¹, Fabio Weishaupt¹, Jürgen Dickmann¹, Gerd Wanielik²
¹Mercedes-Benz AG, ²TU Chemnitz

EuRAD10-5
Comparing Non-Adaptive with Adaptive Windowing Using Multi-Dimensional Spatially Variant Apodization for Automotive Radar
Hein Nguyen, Rambert Feger, Jonathan Becker¹, Andreas Steiner¹, Markus Pichter-Schedler¹
¹Advance Kepler University Linz, ²Fraunhofer IAF, ³Linz Center Of Mechatronics Gmbh

ROOM 12

EuRAD11
Radar Processing Techniques for Automotive and Transportation
Chair: Marina Gashinova
Co-Chair: Kevin Cinglant
¹University of Birmingham, ²ZF Autocruise

EuRAD11-1
Extended Object Tracking with IMM Filter for Automotive Pre-Crash Safety Applications
ANUSHKA HANUMEGOWDA¹, Soumya Dewangan¹, Srihari Bhislapal, Franck Gros¹, Eugen Stiefvater¹
¹Continental Automotive Components (India) Pvt. Ltd., ²Continental Automotive GmbH, ³CARISSMA, Technische Hochschule Ingolstadt

EuRAD11-2
A Real-Time, Frame-Level Platform Vibration Compensation Approach for mmWave Radar Systems
Nikhil Poole¹, Soheil Hor¹, Amin Arbabian¹
¹Stanford University

EuRAD11-3
Implementation and Assessment of a Radar Based True-Speed-Over-Ground Estimation Approach Utilizing Complex-Valued Correlation
Bernt Reindl¹, Fabian Matej¹, Robert Weigel¹, Alexander Ropke¹, Fabian Lurz²
¹Friedrich-Alexander University Erlangen-Nuremberg, ²Technical University Hamburg (TUHH)

EuRAD11-4
Localization and Navigation of Service Robots by means of M-sequence UWB Radars
Carsten Schröck, Tim Enich Wegner¹, Bernt Knopp¹, Johannes Trahan¹, Giovanni Del Cujo³
¹Technische Universität Hannover, ²Media Labs GmbH

EuRAD11-5
Comparison of ZF and MF filters through PSLR and ISLR assessment in automotive OFDM radar
Brother BENIREJIANE¹, Jean-Pierre Baubet, Stephane Metz¹, Kevin Cinglant¹
¹ZF Autocruise, ²ETIK, ³INSI Rennes

ROOM 17

EuMC43
Sensing and Dynamic Technologies
Chair: Jasmin Grosinger
Co-Chair: TBA
¹Graz University of Technology

EuMC43-1
Comparison between Hybrid- and TM-polarized Bessel-Beam Launchers for Wireless Power Transfer in the Radiative Nearfield at Millimeter Waves
Francesca Benassi¹, Walter Taccari¹, Eduard Negri¹, Giacomo Paulini¹, Diego Musetti¹, Paolo Burgagni¹, Alessandro Galli¹, Alessandra Costa²
¹University of Bologna, ²Cagliari

EuMC43-2
Optimal Operation of RF Energy Rectifiers by Adaptive Number of Frequency Selection using Multisine Excitation
Lichen Fan¹, Gábor Döhrmann¹, Jie Han²
¹IMEC/ Holst Centre, Eindhoven

EuMC43-3
Smart tire sensor design using numerical simulations
Raffaele Scuderi¹
¹Dassault Systèmes

EuMC43-4
Remote Microwave Sterilization Applicable Coronaviruses Using Van-Atta Retractive Antenna Array with 2-D Tracking Capability
M. Komorowski¹, R. Kucerovsky¹, S. Predzyński¹, O. Czerny¹, P. Milos¹, G. Gontier¹, S. Pawelek¹, S. Griffiths¹, M. Chudzicki¹, C. Gaug¹, N. Brunt¹, E. Duf-Burkland², et al
¹Heriot-Watt University, ²University of Edinburgh, ³Università di Roma “Sapienza”, ⁴University of Strathclyde

EuMC43-5
Differential Analysis in Microwave Dielectric Probing for Transcutaneous Biomedical Sensing
Adrian Llop-Reche¹, Doug Ferguson-Wilson¹, Tor Sverre Landør¹, Kristian G. Kjelgaard¹
¹University of Oslo

EuMC43-6
Comparison between Hybrid- and TM-polarized Bessel-Beam Launchers for Wireless Power Transfer in the Radiative Nearfield at Millimeter Waves
Francesca Benassi¹, Walter Taccari¹, Eduard Negri¹, Giacomo Paulini¹, Diego Musetti¹, Paolo Burgagni¹, Alessandro Galli¹, Alessandra Costa²
¹University of Bologna, ²Cagliari

EuMC43-7
Optimal Operation of RF Energy Rectifiers by Adaptive Number of Frequency Selection using Multisine Excitation
Lichen Fan¹, Gábor Döhrmann¹, Jie Han²
¹IMEC/ Holst Centre, Eindhoven

EuMC43-8
Smart tire sensor design using numerical simulations
Raffaele Scuderi¹
¹Dassault Systèmes

EuMC43-9
Remote Microwave Sterilization Applicable Coronaviruses Using Van-Atta Retractive Antenna Array with 2-D Tracking Capability
M. Komorowski¹, R. Kucerovsky¹, S. Predzyński¹, O. Czerny¹, P. Milos¹, G. Gontier¹, S. Pawelek¹, S. Griffiths¹, M. Chudzicki¹, C. Gaug¹, N. Brunt¹, E. Duf-Burkland², et al
¹Heriot-Watt University, ²University of Edinburgh, ³Università di Roma “Sapienza”, ⁴University of Strathclyde

EuMC43-10
Differential Analysis in Microwave Dielectric Probing for Transcutaneous Biomedical Sensing
Adrian Llop-Reche¹, Doug Ferguson-Wilson¹, Tor Sverre Landør¹, Kristian G. Kjelgaard¹
¹University of Oslo

EuMC43-11
Comparison between Hybrid- and TM-polarized Bessel-Beam Launchers for Wireless Power Transfer in the Radiative Nearfield at Millimeter Waves
Francesca Benassi¹, Walter Taccari¹, Eduard Negri¹, Giacomo Paulini¹, Diego Musetti¹, Paolo Burgagni¹, Alessandro Galli¹, Alessandra Costa²
¹University of Bologna, ²Cagliari

EuMC43-12
Optimal Operation of RF Energy Rectifiers by Adaptive Number of Frequency Selection using Multisine Excitation
Lichen Fan¹, Gábor Döhrmann¹, Jie Han²
¹IMEC/ Holst Centre, Eindhoven

EuMC43-13
Smart tire sensor design using numerical simulations
Raffaele Scuderi¹
¹Dassault Systèmes

EuMC43-14
Remote Microwave Sterilization Applicable Coronaviruses Using Van-Atta Retractive Antenna Array with 2-D Tracking Capability
M. Komorowski¹, R. Kucerovsky¹, S. Predzyński¹, O. Czerny¹, P. Milos¹, G. Gontier¹, S. Pawelek¹, S. Griffiths¹, M. Chudzicki¹, C. Gaug¹, N. Brunt¹, E. Duf-Burkland², et al
¹Heriot-Watt University, ²University of Edinburgh, ³Università di Roma “Sapienza”, ⁴University of Strathclyde

EuMC43-15
Differential Analysis in Microwave Dielectric Probing for Transcutaneous Biomedical Sensing
Adrian Llop-Reche¹, Doug Ferguson-Wilson¹, Tor Sverre Landør¹, Kristian G. Kjelgaard¹
¹University of Oslo
THURSDAY 16:40 – 18:20

Room 8 – 11

EuMC44
EuMC Closing Session

Chair: Nick Ridler¹, General Chair
Co-Chair: Emma MacPherson², EuMC Chair
¹National Physical Laboratory, UK, ²University of Warwick, UK

16:40 – 16:50
Session Welcome
Nick Ridler¹
¹General Chair

16:50 – 17:20
The (R)Evolution of Wireless Communications
Eric Hawthorn¹
¹Radio design

James Clerk Maxwell died before his prediction of the existence of Radio Waves was proved experimentally. Since then, wireless communications have revolutionised the way we communicate and the way we live. Where did it come from, where are we now and where are we going? In this presentation I will briefly outline some of the key historical achievements that have contributed to the evolution of wireless communications, take a look at some of the technology advancements that have contributed to the success of today’s systems and discuss how this revolutionary technology might continue.

17:20 – 17:40
Awards Ceremony
Kamal K Saranta¹
¹EuMW 2021 Awards Chair

EuMC Prize
EuMC Young Engineer Prizes

17:40 – 18:10
Challenges and Opportunities for Terahertz Communications Towards 6G and Beyond
Tadao Nagatsuma¹
¹Osaka University, Japan

Since the first utilization of radio waves for wireless communications by G. Marconi in early 20th century, we have been increasing a carrier frequency of radio waves to ensure a data rate and/or a channel capacity. Currently, the demand for much greater data rate of wireless technologies is growing in accordance with a rapid advancement of mobile networks and rich media contents handled by the networks and computers. For these reasons, researchers have been aggressively seeking a use of terahertz (THz) waves whose frequency is over 100 GHz for ultrahigh-speed wireless links. This talk will overview latest advances in THz communications research and testbeds, and will discuss the future perspective and directions with respect to technological challenges and applications towards 6G and beyond.

18:10 – 18:20
Closing Remarks
Chair: Nick Ridler, General Chair
Co-Chair: Emma MacPherson, EuMC Chair
THURSDAY 16:40 – 18:20

Room 1
**EuRAD13**
Radar Imaging
Chair: Laurent Ferro-Famil¹
Co-Chair: Debora Pastina²
¹University of Rennes 1, ²University of Rome La Sapienza

16:40 – 17:00
**EuRAD13-1**
Pulse-to-Pulse Radar-Aided Positioning using Multibeam Autofocus
Keith T.J., Klein', Faruk Iyidal, Miguel Lazo-Cuenca', Marvin Döllken', Jacek-Dz Witt¹
¹Technical University of Berlin

17:00 – 17:20
**EuRAD13-2**
Detection of Fiber Orientation with SAR Imaging via Amplitude and Phase Filtering
Anne Freyholz¹, Reinhold Herschel¹
¹Fraunhofer FHR, "Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)

17:20 – 17:40
**EuRAD13-3**
The end-to-end segmentation on automotive radar imagery
Yang Xiao¹, Liam Daniel¹, Marina Luchinav⁴
¹University of Birmingham

17:40 – 18:00
**EuRAD13-4**
A Comparison of Tomographic SAR Reconstruction Methods Using Spaceborne Data
Prithvi Laguduvan Thyagarajan¹, Wouter Nies¹, Florian Behner², Simon Reiter², Osama Luft⁴
¹University of Siegen

18:00 – 18:20
**EuRAD13-5**
Refraction Compensation via Ray Tracing Methods for Complex-Shaped Objects
André Froehly¹, Reinhold Herschel¹
¹Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)

Room 4
**EuRAD14**
Target and Clutter Classification in Automotive Radar
Chair: Thomas Zwick¹
¹Karlsruhe Institute of Technology (KIT), ²TU Delft

16:40 – 17:00
**EuRAD14-1**
Radar-Based Classification of Automotive-Related Scenarios using Temporal Info
Karim Ishak¹, Christian Waldschmidt¹, Nils Apennin²
¹Ulm University, ²Daimler AG

17:00 – 17:20
**EuRAD14-2**
Ray-Tracing-Based Micro-Doppler Simulation for 77 GHz Automotive Scenarios
Stefan Wald¹, Thomas Guldbrand¹, Frank Weinmann¹
¹Fraunhofer FHR, "Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)

17:20 – 17:40
**EuRAD14-3**
Dynamic Road Surface Signatures in Automotive Scenarios
Wietse Bouwmeester¹, Francesco Fioranelli¹, Alexander Varonov¹
¹TU Delft

17:40 – 18:00
**EuRAD14-4**
Digital FIR filtering for static clutter suppression in low resolution MIMO radar
Rahul Krishna Arumugam¹, Reinhold Herschel¹, Roseman Mani², Kathrina Burger², Willibald Reitmeier²
¹Fraunhofer FHR, ²Vitesco Technologies

18:00 – 18:20
**EuRAD14-5**
Classification of Vulnerable Road Users Based on Spectrogram Autocorrelation Features
Patrick Rippl¹
¹Hochschule Ulm

Room 17
**EuRAD15**
Human Activity Sensing
Chair: Michael Antoniou¹
Co-Chair: Francesco Fioranelli²
¹University of Birmingham, ²TU Delft

16:40 – 17:00
**EuRAD15-1**
Hand Gesture Recognition Using a Dual Axis Millimeter-Wave Interferometric-Doppler Radar and Convolutional Neural Networks
Eric Altwicker¹, Jeffrey Nanzer¹
¹Michigan State University

17:00 – 17:20
**EuRAD15-2**
Distributed Radar-based Human Activity Recognition using Vision Transformer and CNNs
Kai Zhao¹, Konny U. Landenberg¹, Alexander Varonov¹, Francesco Fioranelli¹
¹TU Delft

17:20 – 17:40
**EuRAD15-3**
A Novel Micro-Doppler Coherence Loss for Deep Learning Radar Applications
Mihaila Christakos¹, Christoph Voigt¹, Carmen Clemente¹, Craig Mott¹, Ivan Andonovic¹, Christos Tachtatzis¹
¹University of Strathclyde

17:40 – 18:00
**EuRAD15-4**
High resolution human clustering based on complex signal correlation coefficients
AliJasmani Hereshinuddin¹, Reinhold Herschel¹
¹Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)

18:00 – 18:20
**EuRAD15-5**
Car Occupancy Detection Using Ultra-Wideband Radar
David莫斯¹
¹Technical University Graz
# FRIDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
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<td>Paradigm Change in Automotive mmWave Radar</td>
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<td>Innovative THz Technologies for Imaging, Radar and Communication</td>
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**Note:**
- EuMC: Euclid Microwave Conference
- EuMIC: Euclid Microwave Industry Conference
- EuRAD: Euclid Radar Conference
- Students: Student Sessions
- EuMW: Euclid Microwave Workshop
- Exhibitors: Exhibitor Sessions
**FRIDAY 09:00 – 10:40**

**Room 4**
- **EuRAD16**
  - Waveforms
  - Chair: Aled Catherall¹
  - Co-Chair: Tobias Chakoun¹
  - ‘Plextek, Ulm University

**Room 10**
- **EuRAD17**
  - Multistatic and Fusion Techniques
  - Chair: Krzysztof Kulpa
  - Co-Chair: Reinhard Feger¹
  - Johannes Kepler University Linz

**Room 11**
- **EuRAD18**
  - Object Classification Techniques
  - Chair: Chris Baker¹
  - Co-Chair: Jacco de Wit²
  - University of Birmingham, "TNO

**Room 09:00 – 10:40**

**09:00 – 09:20**
- **EuRAD16-1**
  - Frequency Comb Generation for High Range Resolution OFDM Radar
  - Alexander Quint¹, Benjamin Nos¹, Axel Dieval¹
  - Thomas Zwick¹
  - Karlsruhe Institute of Technology (KIT)

**09:20 – 09:40**
- **EuRAD16-2**
  - Effects and Countermeasures at High Velocities for the Frequency Comb OFDM Radar Scheme
  - Benjamin Nos¹, Luca Giusto de Oliveira¹, Thomas Zwick¹
  - Karlsruhe Institute of Technology (KIT)

**09:40 – 10:00**
- **EuRAD16-3**
  - IQ-Transmitter Digital Predistortion for an OFDM Radar
  - Roman Michy¹, David Wernbaur¹, Jan-Nico²
  - Christian Multschmidt²
  - Robert Bosch GmbH, Universität Ulm

**10:00 – 10:20**
- **EuRAD16-4**
  - Doppler Effect in a 79-GHz Sequential Sampling Pulse Radar
  - Alexander Lehmerbacher², Andreas Jehn²
  - Telefunken Technologies Linz GmbH & Co KG, Institute for Communications Engineering and RF Systems / Johannes Kepler University Linz

**10:20 – 10:40**
- **EuRAD16-5**
  - Cognitive FMCW-Radar Concept for Ultrafast Spatial Mapping using Frequency Coded Channels
  - Nicholas Karach¹, Christoph Baer¹, Thomas Mouch¹
  - Ruhr-Universität Bochum

**10:40 – 11:00**
- **EuRAD17-1**
  - Multi-Radar Fusion for Failure-tolerant Vulnerable Road Users Classification
  - Mounir Khayrani¹, Elody de Leenheer¹, Habib El-Hajj Alkaf³
  - "Concordia University, "Québec, "Canada
  - "Inmec, "VIB & imec, "VIB

**11:00 – 11:20**
- **EuRAD17-2**
  - On two approaches to radar band fusion
  - Sahitha Gubu¹, Andreas Barthel¹, Joachim Endler¹
  - Fraunhofer FHR

**11:20 – 11:40**
- **EuRAD17-3**
  - Modelling of Extended Targets with Dual-Band MIMO Radar Networks
  - Malik Muhammad Haris Amir¹, Salvatore Maresca¹, Giovanni Seraciti¹, Paolo Gelli², Antonella Biggi¹
  - "Tulip Institute, "Scuola Superiore Sant’Anna, "Pisa

**11:40 – 12:00**
- **EuRAD17-4**
  - Contactless Inspection of Handwritten Documents with Terahertz Imaging
  - Rigtshulsman, Konstantinos Ross¹, Jan Schmidt¹, Lorenz Scholze², Martin Vossok²
  - Friedrich-Alexander-Universität Erlangen-Nürnberg

**12:00 – 13:00**
- **EuRAD17-5**
  - Bistatic GB-SAR with moving transponder
  - Cajo Moscon², Luca Bigazzi¹, Monamikano Pierattini¹, Michal Baran²
  - Florence University

**13:00 – 14:20**
- **EuRAD18-1**
  - Transfer Learning-Based Fully-Polarimetric Radar Image Classification with a Rejection Option
  - Elisa Gaif¹, Selena Uhal¹, Anne Hosen Ouer¹, Marco Martorella²
  - "CNIT ( National Inter-University Consortium for Telecommunications), "CNIT - University of Pisa

**14:20 – 15:40**
- **EuRAD18-2**
  - Convolutional Neural Networks for Drone Model Classification
  - Holly Odl¹, Michael Antonacci¹, Chris Baker¹, Mehran Salarang¹, Aled Catherall¹
  - University of Birmingham, "Plextek

**15:40 – 16:00**
- **EuRAD18-3**
  - Classification of Unmanned Aerial Vehicles (UAVs) Carrying Payloads with Polarimetric Radar
  - Hannen Vovkivitathan Sathivatan¹, Alexander Yemen¹, Francesco Farad¹
  - "TU Delft

**16:00 – 16:20**
- **EuRAD18-4**
  - Objects classification based on UWB scattered field and SEM data using machine learning algorithms
  - Rennes Zaky¹, Nicolas Fonteyn¹, Jean-Christophe Vignaud¹, Bonal Mohamad¹
  - "Université Côte d’Azur, CNRS, LIAAT, France

**16:20 – 16:40**
- **EuRAD18-5**
  - Fruit Sorting with Amplitude-only Measurements
  - Flora ZIDANE¹, Jérôme Lanteri¹, Julien Marn¹, Claire Migliazzi¹
  - "Université Côte d’Azur, "Aix Marseille Université

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¹Ruhr-Universität Bochum
²Université Côte d’Azur, CNRS, LIAAT, France
³Institute for Communications Engineering and RF Systems / Johannes Kepler University Linz
FRIDAY 11:20 – 13:00

Room 4

EuRAD19
Short Range Radar
Chair: Marina Gashinova
Co-Chair: Reinhold Herschel¹
¹University of Birmingham, ²Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

EuRAD19-1
Hand-Guided Mobile Terahertz 3D Imaging Platform with Aspherical Telecentric F-theta Optics
Shiva Mohammadzadeh¹, Andreas Keil¹, Sven Leuchs², Christian Krebs², Dirk Nüssler², Jörg Seewig³, Fabian Friederich¹
¹Fraunhofer ITWM, ²Fraunhofer FHR, ³Institute for Measurement and Sensor Technologies, TU Kaiserslautern

11:40 – 12:00

EuRAD19-2
Real Time Ultra High Resolution Microwave Imaging Curtain
Marwan Cetinkaya¹, Remi Baque², Reinhold Herschel¹, Nils Helbig¹
¹Fraunhofer FHR, ²ONERA, ³Ruhr-University Bochum

12:20

EuRAD19-3
Analysis of a Physically-Embedded Radar Sensor System
Thomas Kuris¹, Evgeni Iskakov¹, Stefan Erhardt¹, Robert Winger¹, Fabian Lurz¹
¹Friedrich-Alexander University Erlangen-Nuremberg, ²Institute of Measurement and Sensor Technologies, TU Kaiserslautern

12:40 – 13:00

EuRAD19-4
Towards a Field-Ready HF-VHF Ground-Based Ice Penetrating Synthetic Aperture Radar: Forward Modelling and Validation for SAR Imaging
Jonathan Howells¹, Li-Bon-Lin², Paul Brennan², Keith Nicholls²
¹University College London, ²British Antarctic Survey

Room 10

EuRAD20
Phased Array and MIMO Systems
Chair: Alexander Charlsh¹
Co-Chair: David Malta-Moya²
¹Fraunhofer Institute for Communication, Information Processing and Ergonomics, ²University of Alcalá

EuRAD20-1
Architecture considerations for AESA antennas providing maritime Air Defence
Martin Wotting³
³EM Systems

EuRAD20-2
Compressive Sensing for Direction of Arrival Estimation Using an Electronically Steered Multiple-Input Multiple-Output Array
Max Schurwanz¹, Jan Mietzner¹, Peter Adam Hoeher²
¹University of Applied Sciences (HAW), ²Christian-Albrechts-University of Kiel

11:20 – 11:40

EuRAD20-3
A Practical Concept for Precise Calibration of MIMO Radar Systems
Johanna Geiss¹, Erik Sippel¹, Martin Vossiek¹
¹Institute of Microwaves and Photonics, University of Erlangen-Nuremberg

EuRAD20-4
Combined ISAR and MIMO processing for near-field 3D radar imaging
Srinivas Jarwal¹, Dahi Heidari², Henki Men¹
¹British Research & Innovation Laboratory, Toshiba Corporation

EuRAD20-5
Automotive Interference Suppression in MIMO and Phased Array Radar
Anam Ahmed Pirkani¹, Fatemeh Norouzian¹, Edward Hoare¹, Mikhail Cherniakov¹, Marina Gashinova¹
¹The University of Birmingham

Room 11

EuRAD21
Radar Signal Processing and Imaging
Chair: Martin Vossiek¹
Co-Chair: Fatemeh Norouzian¹
¹Friedrich-Alexander University Erlangen-Nuremberg, ²University of Birmingham

EuRAD21-1
Doppler Beam Sharpening for Enhanced MIMO Imagery in the Presence of Automotive Interference
Anam Ahmed Pirkani¹, Scott Cassidy¹, Fatemeh Norouzian¹, Marina Gashinova¹, Mikhail Cherniakov¹
¹University of Birmingham

EuRAD21-2
Finding Anomalies in Radar Sea Clutter Using Radon Transforms
Andrew Stone¹, Lai Bun Lok¹, Paul Brennan¹, Keith Nicholls²
¹University College London, ²British Antarctic Survey

EuRAD21-3
Images of satellite elements with a Sub-THz ISAR system
Emilio Martinez¹, Andrew Stone¹, Edward Hoare¹, Mikhail Cherniakov¹, Marina Gashinova¹
¹University of Birmingham

EuRAD21-4
Doppler Centroid Estimation for Ocean Surface Current Retrieval from Sentinel-1 SAR Data
MERSHAD MADAD (UBIC), André Angelé¹, Miha Dubes¹
¹University of Bucharest, ²University POLITEHNICA of Bucharest (UPB) Romania, ³German Aerospace Center (DLR)

EuRAD21-5
Radar Travel Time Tomography for Subsurface Ice Exploration at Saturn’s Moon Enceladus
Christian Huber¹, Andreas Benedikter², Gerhard Krüger¹, Marc Rodriguez-Cassola²
¹Friedrich Alexander University of Erlangen-Nuremberg, ²Microwaves and Radar Institute, German Aerospace Center (DLR)
FRIDAY 14:20 – 15:40

**Room 7 – 9**

**EuRAD22**

**EuRAD Closing Session**

*Chair: James Watts¹, EuRAD Chair*

*Co-Chair: Stephen Harman², EuRAD Co-chair and Matthew Ritchie³, EuRAD TPC Chair*

¹Theta Technologies Ltd., UK, ²Aveillant Ltd, UK, ³University College London, UK

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**14:20 – 15:00**

**The Long and Winding Road that Leads to Autonomy?**

Nigel Clarke¹

¹Consultant

Autonomous vehicles continued to be a significant growth area for radar sensing. The most manufactured radars in the world will be for automotive sensing and hence it represents a key use case of RF sensors but sensing is only part of the full challenge. This talk focuses on the difficulties faced in trying to build a Level 5 fully autonomous car in terms of sensors and scenarios whilst highlighting the role that microwave radar must play in making a robust sensor system for it. Examples highlights will be reviewed of UK research into what higher frequencies than the standard automotive 76 GHz radars can bring to making full autonomy more realisable.

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**15:00 – 15:20**

**Award Ceremony**

Kamal K Samanta¹

¹EuMW 2021 Awards Chair

EuRAD Conference Prize
EuRAD Young Engineer Prize

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**15:20 – 15:40**

**Closing Remarks and Invitation to EuRAD 2022 in Milan**

James Watts, EuRAD 2021 Chair; EuRAD 2022 Chair
Welcome from the Workshop and Short Courses Chairs

As the first physical event in the field of microwave engineering after the outbreak of COVID-19 pandemic, EuMW 2021 committee are uniting students, academics, and industrial experts again in a less formal format at our workshops and short courses sessions. After careful considerations, we are pleased to offer an extensive and diverse programme of workshops and short courses throughout the entire week.

The wide-ranging programme of half-day and full-day workshops and short courses has been chosen to cover a range of important topics of interest to the whole EuMW community. The short courses will cover fundamental knowledge of specific areas or hands-on experience such as power amplifier designs, filter simulation, radar signal processing and AI technology for designing antennas and filters etc.; on the other hand, the workshops attracted world-leading scientists and engineers in the fields showcasing the latest developments of popular subjects such as 6G front-end developments, wireless power transfers, microwave in biomedical engineering, advanced manufacturing, and millimetre-wave and terahertz on-wafer/off-wafer S-parameters, power and load-pull measurements etc. Advances in semiconductor devices circuits based on GaN, SiC, CMOS and SiGe technologies and their applications will also be covered in a series of workshops.

We are very grateful to all the organisers, presenters and authors of workshops and short courses for their hard work and dedication before and during the conference. Each workshop and short course is individually endorsed by one or two of the conferences of 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. Workshop organisers have been asked to provide panel sessions within their events for discussion and interaction, and we hope that you will benefit from participating in the international networking opportunity that this will present.

The workshops and short courses are mainly arranged on Sunday, Monday and Friday with few on Wednesday and Thursday. The EuMC endorsed sessions are distributed over the entire week and the EuRAD endorsed sessions are scheduled on Wednesday onwards, after the end of the main EuMIC conference sessions. We are confident that this structure will enable you to attend multiple workshops or short courses to incorporate into your schedule for the week, to enhance conference experience in London.

Slides for the workshops and short courses will be available to download from the conference’s websites approximately two weeks before the conference. No hard copies of the slides will be provided. Instructions for the download process will be provided to the registered participants near the conference.

Finally, we would like to welcome you all in London in February 2022 and be United in Microwaves!

CHONG LI
Workshop, Short Courses Chair
University of Glasgow, UK

QAMMER ABBASI
Workshop, Short Courses Co-Chair
University of Glasgow, UK
This short course aims to provide a comprehensive overview of all aspects related to the design of microwave power amplifier design. It is an introductory course, dedicated to 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 basic concepts. This short course features a range of presentations and will provide a comprehensive overview and basic understanding on recent important progress and novel state-of-the-art achievements in semiconductor power amplifiers. Advances in semiconductor amplifiers and their applications will also be covered.

Starting from the fundamental concepts on semiconductor devices and their modelling development, 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 from the designer 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 load modulation power amplifier design concepts.

The short course will also focus on the major challenges, such as stability (small and large signal) and how to address these in 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.

**PROGRAMME**

**Semiconductor devices and modelling for PAs**
Iltcho Angelov¹
¹Chalmers University

**PA basic concepts**
Franco Giannini¹
¹University of Roma Tor Vergata

**Design and model oriented load pull techniques**
Marco Pera³
³Politecnico di Torino

**The Doherty power amplifier**
Paolo Colantonio¹
¹University of Roma Tor Vergata

**Load modulated PAs**
Steve Cripps¹
¹Cardiff University

**X-parameters high-power PAs modeling for system level analysis**
Alessandro Cidronali¹
¹University of Florence

**Linear and nonlinear stability analysis of power amplifiers**
Giorgio Leuzzi¹
¹University of L’Aquila

**Linearization techniques overview**
Pere L. Gilabert¹
¹Universitat Politècnica de Catalunya UPC-Barcelona Tech.

**Design of the power amplifier section of a X-band MMIC single chip front end**
Davide Resca¹, Francesco Scappaviva¹
¹MEC srl
Wireless communications are irremediably moving into millimetre-waves and THz; evidence of this is the IEEE 802.15.3d-2017 standard. THz is also becoming key for security screening, quality control and medical imaging because of its excellent balance between spatial resolution and material penetration. Unquestionably, THz will play a major role in coming years. In this context, engineers need to be well aware of the current technology and the challenges related to THz in order to wangle the next generation of THz components and systems. This Short Course aims to provide an opportunity for attendees to familiarize with THz technology (CW and pulsed). The storyline of the Short Course will build upon the researcher’s research in THz devices and experience with: (CW) the commercial instruments ABmm VNA, Keysight N5247B PNA-X with VDI extenders and TeraSense imaging systems; (pulsed) the commercial instruments TeraView TPS Spectra 3000 and Menlo Systems TERA K15, and with an in-house (University College London) near-field time-domain-microscopy system. The Short Course will include the following sections:

2. Challenges from the material point of view.
4. THz technology: Passive components; sources (thermal, electrical and optical/laser based); detectors (thermal, coherent, others); commercial instruments, including cameras; my own experience: ABmm, TPS Spectra 3000, TERA K15 and non-commercial near-field TDS.
5. TDS in detail: generation & detection.
6. Applications
The research on wireless sensors and IoT devices is proceeding at full speed, and the potential of such technologies as game changers in different application scenarios is rapidly emerging. IoT devices can bring a significant support to industry, providing the correct tools to implement continuous condition monitoring of production processes, inventory, and supply chains (the so-called Industry 4.0 and Industrial IoT). In such a context, one of the main bottlenecks to achieve full deployability of the IoT devices is their reliability. Indeed, production facilities are characterized by harsh and severe environments (such as high temperature, humidity, and electromagnetic interferen-
ces) which can threaten the device integrity and deteriorate the quality of the wireless links. Additionally, due to the considerable extension of industrial buildings and farms, wireless sensor networks must be deployed over large and remote areas, which hinders the possibility to perform maintenance and to guarantee continuous power supply to the single sensor nodes. Similar challenges are faced by IoT devices utilized in different contexts, such as Smart Cities and Structural Health Monitoring, which makes the design of electronics for harsh environments a transversal topic. The present workshop aims at providing an extended overview of the current advances in wireless sensing for harsh and severe environments. The impact of adverse operating conditions on devices and signals will be analyzed, and this study will be used to derive models and design strategies for IoT devices. The most recent outcomes in such context will be described and discussed, and future directions will be outlined.

**PROGRAMME**

Additively manufactured wireless sensors for rugged IoT, structural health monitoring, smart agriculture and smart cities applications

Manos M. Tentzeris¹

Emerging design strategies and technologies for wireless sensing in harsh environments

Valentina Palazzi¹

End-to-end characterization of wireless sensor links for the Industrial IoT (IIOT)

Alessandra Costanzo¹

Accurate wireless sensor connectivity simulations in industrial environments

with severe electromagnetic interference

Martin Vogel¹, C. J. Reddy¹

Reliability enhancements with frequency diverse RFID systems

Thomas Oehmichen¹

Passive HF RFID repeater for communicating with tags in metal housings

Jürgen Geisinger¹

Development and implementation of RFID sensors for the monitoring of cheeseindustry

Smaïl Tedjini¹

Autonomous sensors for environmental monitoring

Nuno Borges Cavaleiro¹

Advancements on packaging additive manufacturing for harsh environment wireless sensors

Eduardo Bajz¹

RFID battery-less sensing in generators and transformers of hydroelectric power plants

Kostas Zarvos¹

Wireless, battery-less and packageless SAW sensors for harsh environments

Omar ELMAZRIA¹
Terahertz Device, Circuit and System Fundamentals and Applications

Chair: Dimitris Pavlidis¹
Co-Chair: Imran Mehdi² and Javier Mateos³
¹Florida International University, ²Jet Propulsion Laboratory, ³University of Salamanca
Room 4

THz technology has reached a certain degree of maturity but there are still important developments necessary for implementing it to systems. At the same time, there are still needs for device and circuit studies in order to improve, frequency, power, sensitivity performance and provide integrated solutions to system requirements. The workshop will provide the opportunity to new generations of scientists and engineers to learn about the unique features of Terahertz technologies, while at the same time addressing the latest achievements in the field. THz applications to be discussed extending among from sensing and spectroscopy to communications and imaging. The 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, phototransistors, plasma waves, photomixing, Resonant Tunneling, Negative Differential Resistance, CMOS and High-Electron Mobility Transistors. Devices such as Quantum Cascade Lasers, Self-switching Diodes and Uni-Traveling-Carrier Photodiodes and nanoscale Vacuum Transistors 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.

**THz applications: from devices to space systems**

Imran Mehdi²
Jet Propulsion Laboratory

**Nitride-based two- and three-terminal devices for THz applications; from diodes to transistors and Nanoscale Vacuum transistors**

Dimitris Pavlidis¹
¹Florida International University

**Terahertz characterization and applications of III-Nitride and complex oxide heterostructures**

Bernard Sensale-Rodriguez*¹
*¹The University of Utah

**Gated planar nanodiodes for THz detection**

Javier Mateos²
²University of Salamanca

**InP HBTs for THz microsystems**

Miguel Urteaga²
²Teledyne Scientific Company

**Low-power consumption THz metasurface quantum-cascade VECSELs.**

Benjamin Williams¹
¹University of California Los Angeles

**THz devices and systems: from technology to applications**

Guillaume Ducournau*, J. F. Lampin¹, E. Peytavit¹ and S. Barbieri¹
*¹CNRS - University of Lille

**Terahertz communications using resonant tunneling diodes**

Masayuki Fujita¹
¹Osaka University

**Resonant-tunneling-diode THz oscillators and applications**

Satomi Suzuki¹ and Masahiro Asada¹
¹Tokyo Institute of Technology

**High-speed terahertz wireless is hot, how about its contrary?**

Ruonan Han¹
¹MIT

**Challenges and advances in terahertz antennas**

Marina Alonso del Pino¹
¹Delft University of Technology

**THz spectroscopy of agricultural samples**

Marin K. Metters-Kummer*¹
*¹Eindhoven University of Technology
Driven by the requirements of emerging applications such as the autonomous driving, the mini-cell base stations, the e-health and the industry 4.0, the enablement of high-speed, low-latency, and low-power communication technologies is a key challenge to unlock the forthcoming sixth generation standard for wireless communications technologies (6G). Leveraging the availability of cost effective high performance silicon technologies, CMOS and BiCMOS sub-THz integrated circuits (IC) have demonstrated impressive performances (both in terms of achievable data rate and low power consumption) leading to innovative product introduction on the market. However, most of those developments have been focusing on wireless link and are consequently limited by the spectrum regulation (in terms of usable bandwidth). This limits the optimization that can be achieved at the system level in order to propose the best trade-off between power consumption and data rate. Europe is leading the thematic, with exploratory labs as KU Leuven, IMS Bordeaux and CEA-LETI Grenoble.

Maximum data-rate transmitted with this technique is 36Gbs over 1m, and maximum distance is 15m with 1.5Gbs transmitted. Three technologies are needed to transmit data:
- The RF-mmWave transceiver IC, generally using OOK, ASK, FSK modulation and targeting few pJ/bit efficiency.
- The Electromagnetic coupling element, generally an antenna structure that must be as efficient as possible to limit the losses.
- The plastic fiber, where material specificities as Epsilon R and Tangent Delta are the main, but not the only one key factors.

Main challenges for this technique are:
- How to address 100Gbs over 1m for Data-center market.
- How to increase data rate at medium-long distance (5m-20m) reducing losses for other connectivity markets (vehicles, mini-cells, home, factories,...)
- How to aim the pJ/bit increasing as far as possible the efficiency to reduce the power consumption, thus the environmental impact.
- Which plastic material to reduce the environmental impact?

This Workshop will propose state of art presentations from research public and private organizations, and will give the opportunity to the audience to deeply discuss the potentiality of this technology. At the end of the Workshop, a Panel discussion will be organized with the speakers and Audience will be able to discuss with them to understand more this approach.
SUNDAY 09:00 – 18:20

New Trends in Microwave and mmWave Filters

Chair: Maurizio Bozzi¹
Co-Chair: Cristiano Tomassoni²
¹University of Pavia, ²University of Perugia
Room 7

The aim of the workshop is to provide the attendees with a comprehensive overview of the most recent advances and the major research trends in area of microwave and millimetre-wave filters. Besides being a key component of any RF system, filters represent a major portion of the research activity on passive components, and attract special interest both in the academia and in the industry. Currently, all main applications (from 5G/6G to space) require filters with superior performance and specific fabrication properties.

The workshop includes 10 presentations (possibly one more will be subsequently added). The topics covered by the presentations will range from innovative design techniques to novel technological and manufacturing processes. The hot topic of tunable filters will be discussed, along with applications to space. World-recognized authorities in the field will illustrate their recent achievements, and ample time will be devoted to the discussion, with the audience with a panel session that will cover approximately 25% of the total allotted time.

PROGRAMME

Wideband filtering circuits under multimode resonance
Yunpeng Lu¹ and Lei Zhu¹
¹Nanjing University of Posts and Telecommunications

Advanced techniques for microwave planar filter realization
Roberto Giner-García¹, Li Yang¹ and José-María Muñoz-Ferreras¹
¹University of Alcalá

Compact and multilayer substrate integrated waveguide (SIW) filters
Cristiano Tomassoni² and Maurizio Bozzi¹
¹University of Pavia, ²University of Perugia

Multilayer and 3D filters
Benjamin Potelon¹
¹Lab-STICC University of Brest

Recent researches and future trends of millimeter-wave on-chip bandpass filters
Wenquan Che¹ and Guangxu Shen²
¹South China University of Technology, ²Nanjing University of Posts and Communications, China

High Q tunable filters using a single tuning element
Raafat R. Mansour¹
¹University of Waterloo

Fully-directional RF co-designed bandpass filtering technologies
Dimitra Psaltis¹
¹University College Cork and Tyndall National Institute

New high manufacturing yield filter design methods and topologies for high-capacity satellites
Fernando Teberio¹
¹Anteral/Public University of Navarre UPNA-MCG

Novel solutions of waveguide filters for microwave space applications
Vicente Enrique Baria-Eustaf²
¹Universitat Politècnica de Valencia

Shape optimization of microwave cavity filters
Stéphane Bla²
¹UM CNRS Limoges
The on-going commercialization of 5G focuses on sub-6 GHz 5G-systems. Although some 5G mmWave devices are already in market, R&D of miniaturized, scalable, cost-effective and energy-efficient 5G mmWave systems which operate in the 24-29 GHz and 37-40 GHz bands is still underway. These systems are expected to enable peak data-rates up to 20 Gbps and latency of about 1ms. Unlike 5G, 6G is envisioned to operate above 100 GHz, e.g., in D-band, and would enable data-rates up to about 1 Tbps as well as latency of approximately 100 μs. Such extremely high data-rates and low latency, combined with novel artificial intelligence techniques, will enable new applications that would transform our lives, economy and society. However, the development of these 5G mmWave and 6G THz-systems is challenging, partly because of very high channel losses, which have severe impact on signal-to-noise ratio and throughput. To overcome these challenges, new mmWave/THz MIMO and beamforming-architectures as well as new on-chip, packaging, integrated-antenna and frontend-module (FEM)-integration solutions are required. In this workshop, experts from industry and academia will present novel system-architectures, on-chip and scalable Antenna-in-Package solutions for 5G mmWave and 6G. Key challenges and various RF system integration approaches (monolithic/heterogeneous-integration...) for the development of 5GmmWave/6G frontend-modules as well as chip-package co-optimization and multi-physics techniques will be presented. Recent results of some national/international 5GmmWave/6G projects such as SERENA (5G-mmWave EU Project), mmWave-IPCEI (Important Project of Common European Interest) and 6GKom (first 6G D-band-module project funded by German Federal Ministry of Education & Research) will also be discussed.

On-Chip and Scalable RF Packaging Solutions with Integrated Antennas for 5G mmWave and 6G Applications

Chair: Marcel Wieland¹
Co-Chair: Ivan Ndip²
¹Globalfoundries, ²Fraunhofer IZM

Room 9

WS05
EuMC

The on-going commercialization of 5G focuses on sub-6 GHz 5G-systems. Although some 5G mmWave devices are already in market, R&D of miniaturized, scalable, cost-effective and energy-efficient 5G mmWave systems which operate in the 24-29 GHz and 37-40 GHz bands is still underway. These systems are expected to enable peak data-rates up to 20 Gbps and latency of about 1ms. Unlike 5G, 6G is envisioned to operate above 100 GHz, e.g., in D-band, and would enable data-rates up to about 1 Tbps as well as latency of approximately 100 μs. Such extremely high data-rates and low latency, combined with novel artificial intelligence techniques, will enable new applications that would transform our lives, economy and society. However, the development of these 5G mmWave and 6G THz-systems is challenging, partly because of very high channel losses, which have severe impact on signal-to-noise ratio and throughput. To overcome these challenges, new mmWave/THz MIMO and beamforming-architectures as well as new on-chip, packaging, integrated-antenna and frontend-module (FEM)-integration solutions are required. In this workshop, experts from industry and academia will present novel system-architectures, on-chip and scalable Antenna-in-Package solutions for 5G mmWave and 6G. Key challenges and various RF system integration approaches (monolithic/heterogeneous-integration...) for the development of 5GmmWave/6G frontend-modules as well as chip-package co-optimization and multi-physics techniques will be presented. Recent results of some national/international 5GmmWave/6G projects such as SERENA (5G-mmWave EU Project), mmWave-IPCEI (Important Project of Common European Interest) and 6GKom (first 6G D-band-module project funded by German Federal Ministry of Education & Research) will also be discussed.
This workshop gives an overview of the progress of important Gallium Nitride MMIC technologies available to the microwave and RF community for frequencies from 400 MHz to 200 GHz. Prominent industrial vendors of GaN MMICs have been invited and have agreed to participate. Several international speakers will give their view to the evolution of important applications such as sensing, data com, with emphasis on mm-wave IC technology. Several roadmaps will be provided to enable the audience to estimate the progress of MMIC on a global scale. Further, the research progress with respect to higher frequency scaling beyond commercial technologies is addressed. The workshop thus will provide an overview on the overall status of MMIC technology, device technology, circuit design, reliability, and integration.

**PROGRAMME**

**Self-configuring, adapting and reconfigurable GaN MMICs**
Charles Campbell¹
¹Qorvo (USA)

**Recent development of GaN power Technology applied to RF sensors**
Didier Floriot¹
¹UMS (France, Germany)

**State of the art mmWave GaN/Si MMICs**
Marc Rocchi¹
¹Ommic (France)

**Design of high performance microwave and millimeter wave GaN HPAs**
Bill Pribble¹
¹Wolfspeed (USA)

**Design of GaN power amplifier MMICs operating beyond 100 GHz**
Maciej Cwiklinski¹
¹Fraunhofer IAF (Germany)/Rohde und Schwarz

**Mm-wave space applications using GaN at ESA**
Piero Angeletti¹
¹European Space Agency/ESA

**Reliability evaluation, failure modes and mechanisms of scaled RF GaN high electron mobility transistors**
Enrico Zanoni¹, Matteo Buñol³, Carlo De Sarro³, Matteo Meneghini¹ and Gaudenzio Meneghesso¹
¹University of Rome Tor Vergata

**mmWave GaN HEMTs and enhanced reliability**
Farid Medjdoub¹, Ernesto Limiti¹
¹U. Lille/IEMN

**Multifunctional front-end integration for radar/earth observation at mmWaves**
Ernesto Limiti¹
¹U. Lille/IEMN
RF Reliability Status and Challenges for 5G mmWave and 6G Applications

In this workshop, the current status of reliability methods as well as the challenges faced for the reliability assessment and qualification for 5G and 6G mmWave applications will be examined. Each of the material systems will be discussed for each of the major technology solutions being offered for 5G-6G; GaN, SiGe and Silicon CMOS RF (including SOI). While some of the underlying degradation mechanisms will be common, each material system will have its own properties, unique failure mode and reliability risks, as well as limitations on operating temperature as they will have different self-heating profiles. A careful review and consideration for the performance/reliability balance will be given for each of the technology solutions (GaN, SiGe, Si CMOS-RF). One of the major goals will be to provide a practical overview of the key reliability mechanisms and methodologies for reliability characterization. We will also discuss the challenges faced by reliability engineers when assessing the reliability of 5G-6G/mmWave/RF applications.

PROGRAMME

System level reliability requirements
Mark Ingels¹
¹Imec

GaN mmWave reliability status and challenges
Jesus del Alamo¹
¹MIT

GaN HEMTs reliability status and challenges for 5G applications
Jose Jimenez¹
¹QORVO

SiGe mmWave reliability status and challenges
John Cressler¹
¹GeorgiaTech

SOI mmWave reliability status and challenges
Purushothaman Srinivasan¹
¹GlobalFoundries
This workshop is dedicated to GaN Front-End and Back-End technologies to fulfil microwave circuits and packaging solutions for 5G telecommunications and Satcom applications. In this workshop, an overview of GaN MMIC advanced epitaxial materials and processes on Si and SiC substrate working from Ka to E band is presented. Advanced materials are keys for achieving electrical performances nd high power at millimetre wave frequencies for 5G and more generally telecom applications. Wide band gap (WBG) semiconductor materials based on GaN are expected to enable superior electrical performances. The partners of the European Project 5G_GaN2 work on epitaxial layer designs on optimized substrate materials. The manufacturing of the epitaxial grown layers is carried out on MOCVD tools that are optimized to deposit this extreme hard to control materials. Low defect density at epitaxial growth and the control of impurities are a great challenge. Front-End and Back-End processes and especially Advanced Packaging were done on these materials to address the different demonstrators. Microwave function designs using advanced GaN technologies are addressed. FEM (Front End Module) at 39GHz, high efficiency and linear HPA, E band HPA, Tx/Rx at 28GHz are the key functions to comply with 5G requirements. The circuit design phase is carried out including the effects of the package selected for the housing. In this scope, the integration of the circuits into low-cost package as SMD plastic or Fan Out Wafer Level Package (FOWL) is presented. Main challenges for packaging are thermal dissipation, heterogeneous integration (Si and GaN), reliability and cost price. All these aspects covering the complete value chain from wafer suppliers, semiconductor fabrication and system integration are reviewed and trade-offs are proposed to fulfil the 5G telecommunication requirements.

**PROGRAMME**

**GaN HEMT devices for V- to E-Band applications**
Nicolas Michel¹
²III-V Lab

**Characterization and simulation of power devices electro-thermal properties**
Jaroslav Kovac¹
¹Slovak University of Technology

**GaN/SiC technology optimisation for 5G applications up to Ka-band**
Jan Grünenpütt¹
¹UMS GmbH

**Scaling of GaN channel thickness in buffer-free GaN-on-SiC HEMT heterostructures for microwave devices**
Jr-tai Chen¹
²SWEGAN

**200mm CMOS compatible GaN/ Si HEMT for Ka Band power amplifiers**
Antoine Chauvel¹
³CEA LETI

**Advanced IAF 100 nm GaN HEMT Technology for 5G E-Band Backhaul Applications**
Dirk Schwanteschke²
³Fraunhofer Institute

**39GHz Front End Module on GaN for 5G applications**
Mohammed Ayad¹
²UMS SAS

**High Efficiency HPA on GaN/SiC technology**
Mingquan Bao¹
Ericsson

**Fan Out Wafer Level Package for 5G telecommunications**
Anssam Garrahi²
³CEA LETI

**SPDT and LNA on SOI for 5G applications**
Vincent Payot¹
³CEA LETI

**30GHz HPA in SMD plastic package for Satcom applications**
Jeremy Aubain¹
²Thales Six

**20GHz 4W PA in SMD plastic package for SatCom applications**
Jens Fresen³
²Thales
Research in Power and S-parameters Measurements at mmWave and Terahertz Frequencies

Chair: François Ziadé¹
Co-Chair: Djamel Allal¹
¹Laboratoire National de Métrologie et d’Essais (LNE) France
Room 14

Power and S-parameters are two key measurement quantities in high frequency metrology. Driven by emerging applications such as 5G communications and terahertz security imaging, there is an increasing demand for establishing traceability in electrical measurements at millimetre-wave and terahertz frequencies. In this workshop, we will present the recent progress in power and S-parameter measurements at these high frequencies.

For power measurement, key players in metrology have been developing new waveguide power standards above 110 GHz, as well as on-chip power standards to establish the link between connectorized primary calibration standards and on-chip measurements. In particular, the recent development of accurate on chip power sensors is expected to improve efficiency of power management for mobile devices. From a primary metrology point of view, new microcalorimeters are developed to achieve the highest uncertainty level in the millimetre frequency range and free-space measurement techniques are explored to extend power measurement traceability to terahertz frequencies. On-wafer S-parameter measurements are of primary importance for industry to characterize integrated circuits. The increase in frequency to the terahertz frequency range requires improving the probe positioning accuracy as well as developing strategy to reduce probing pads effects. Extracting the electrical modelling of passive elements is also needed to support circuit simulations. The validation of these modelling can be obtained from S-parameter measurements. The most accurate calibration technique, such as Multiline TRL, can be used for measurements in industry environment.

WS09
EuMC

SUNDAY 09:00 – 18:20

PROGRAMME

Development of a thin-film bolometric power sensor for D-band
Yi Wang¹
¹University of Birmingham

Design of frequency compensated power detector in the G-band
Issa Alaj¹
¹University of Lille

Primary calibration method for RF power at 110 to 170 GHz
Gia Ngoc Phung¹
²Physikalisch – Technische Bundesanstalt (PTB)
¹University of Lille

WR6 band micro-calorimeter
Murat Cepa¹
³National Physical Laboratory (NPL)
¹Laboratoire National de Métrologie et d’Essais (LNE) France

Comparative measurements with commercial power meter
Przemysław Żagaj¹, Marcin Wojciechowski²
¹Wojskowa Akademia Techniczna im. Jarosława Dąbrowskiego (WAT), Poland, ²Central Office of Measures (GUM)

Calibration of free-space THz detectors based on waveguide power standard
Aleks Kureepov¹
¹Eidgenössisches Institut für Metrologie (METAS)

Free space calibration method for VNA measurement
Kazzen Kuhlmann¹
¹Physikalisch – Technische Bundesanstalt (PTB)

Transferring the accuracy of multiline TRL to industrial on-wafer calibrations
Uwe Are¹
¹Physikalisch – Technische Bundesanstalt (PTB)

Measuring S-Parameters using millimetre-wave power measurements
Kamel Haddadi¹
¹University of Lille

Innovative on-wafer measurement solutions at THz frequency
Masahiro Horibe¹
¹National Institute of Advanced Industrial Science and Technology (AIST)

Modelling the Scattering parameters of passive MMIC elements
Thomas Flingern¹
²BTH Berlin
¹University of Lille

Results and advances in mmWave on-wafer S-parameters measurement accuracy
Robin Schmidt¹
²Roysign Technologies BE

Measurement uncertainties of RF probes in traceable on-wafer measurements
Faisal Mubarak¹
³VSL
SUNDAY 14:20 – 18:20

Advanced Non-linear Characterization and Design of Highly Efficient Power Amplifiers Using Load Pull Data for Sub 6 GHz and mmWave Applications

Chair: Vince Mallette¹
¹Focus Microwaves

This half day workshop will cover a broad range of topics which include 30GHz high efficiency power amplifier design using load pull data, the need and benefit of isolating trapping effect In GaN Charaterization and finally a technical analysis of wide bandwidth load pull systems and how they are helping both designers and test engineers better their designs and test times for modulated applications. As Satellite, 5G networks and mobile devices are being deployed worldwide, the need for efficient sub 6GHz and mmWave power amplifiers is in high demand and will continue to grow.

The competitive market for such amplifiers leaves no room for average designs, and the design team needs to fully grasp all the key elements in characterization and modelling of transistors employed, as well as applying the models to design the amplifier. In this Workshop we will describe some of the key steps in designing a highly efficient 30 GHz GaN SiC HEMT power amplifier as well as lower frequency designs which follow a strict characterization and design process. The steps will include pulsed IV characterisation, pulsed s-parameters, mmWave load pull, behavioural and compact modeling, importing data to design tools and final design within the CAD tools. We will discuss the challenging task of mmWave load pull on high power GaN transistors that require high gamma loads to fully explore the maximum power and efficiency contours and compare the use of active and recent passive and hybrid active load pull techniques to produce the high Gamma loads required.

PROGRAMME

Using measurements to drive successful design – 30 GHz high efficiency PA example
Vince Mallette¹
¹Focus Microwaves

Isolating Trapping Effect In GaN Characterization
Vince Mallette¹
¹Focus Microwaves

“Mind the gap” the value of high bandwidth loadpull systems?
Aamir Sheikh¹
¹Focus Microwaves
New 5G mmWave beamforming devices like Antenna-in-Module (AIM), mmWave-capable user equipment (UE) and customer premise equipment (CPE) designs require accurate Over-the-Air (OTA) validation and test to determine their beamforming performance. This short course introduces several real and practical challenges of mmWave OTA test, and presents considerations, trade-offs, and best practices for optimizing system calibration and measurement performance. This presentation also includes live demonstrations of the discussed OTA measurement techniques on an active antenna system, using mmWave signal generation and analysis within an RF anechoic chamber. Finally, it will introduce methodologies for speeding up the characterization of these new 5G mmWave devices.
With the advent of 5G and the need for ever increasing connectivity, new requirements and restrictions of the associated applications embed the adoption of research by the industry, and hence the translation of innovative ideas into products. One of the key components – if not the most important – for any wireless communications system is the power amplifier (PA). Although PAs have been the focus of research for many decades resulting in a vast number of architectures and implementations, it is still unclear why certain types of PAs have dominated particular applications and what are the key aspects that a new architecture must possess to outplace an established solution. This course will introduce the most prominent techniques for sub-6GHz and mmWave PAs and discuss them in the context of medium/high volume products i.e. for user-equipment, IoT and small-cells. The speakers, coming from both academia and industry, will discuss the theory and variations of the Doherty, Outphasing, Envelope Tracking and Digital Pre-Distortion. They will present implementations and highlight the aspects that have allowed each PA architecture to be widely accepted for a certain application or those that need to be improved to convince the industry. This course aims at helping students and researchers get familiar with PA efficiency/linearity enhancement techniques and inform them on the directions their research should focus in order to maximise their impact.

**PROGRAMME**

**The need for high performance PAs and application requirements**  
Souheil Ben Smida¹ and K. Mimis²  
¹Herriot-Watt University, ²Sony Europe B.V.

**Outphasing transmitters in CMOS technology**  
Renato Negra¹  
¹RWTH Aachen University

**The Doherty PA in mmWave frequencies**  
David Williams¹  
¹Iconic RF Ltd.

**Envelope tracking flavours and implementation considerations**  
Jonathan Lees¹  
¹Cardiff University

**Enabling digital predistortion for today’s power amplifiers**  
Oualid Hammi¹  
¹American University of Sharjah

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**MONDAY 09:00 – 13:00**

**R&D Trends and Challenges in RF PAs for Medium/High-Volume Products**

Chair: Souheil Ben Smida¹  
Co-Chair: Konstantinos Mimis²  
¹Herriot-Watt University, ²Sony Europe B.V.
Recent developments in nano-scale CMOS allow for MOS transistors to achieve $f_T$ and $f_{max}$ in excess of several hundreds of gigahertz. This enables realization of highly integrated radar and communication systems operating at mmWave frequencies. Particularly, the frequency range around 140 GHz is an interesting candidate to become approved for licensed usage worldwide in the near future for radar and for 6G wireless communication applications. In this workshop, we discuss highly-integrated radar and communication systems operating at W-band and D-band realized in advanced nano-scale CMOS and BiCMOS technologies. The workshop offers a balanced distribution between both fields. We cover a wide range of topics starting from the technology choice for mmWave applications, a talk by Globalfoundries. Bosch will provide a vision on a fully integrated automotive radar system-on-chip in 22nm FDSOI technology. The team of Prof. Zwick (IEEE Fellow) presents packaging and antenna solutions for D-band FMCW radar. Next, mixed-signal part and RF part of a digitally modulated PMCW 140 GHz radar transceiver is discussed by TU Dresden and Infineon, respectively. Second half of the workshop focuses of communication transceivers towards 6G. It covers system considerations, mixed-signal part (ADCs and DACs) and novel system architectures. Finally, Prof. Mark Rodwell closes the workshop with a talk on 140 GHz MIMO arrays transceiver in CMOS and InP. In this workshop we have a good mixture of industry (Globalfoundries, Bosch, Infineon) and academia (FAU Erlangen, TU Dresden, TU Berlin, TU Braunschweig, Karlsruhe Institute of Technology). We have presentations from Europe and the USA. We will round up the workshop by a panel discussion in which we will address the challenges and future directions for circuit design for mm-wave frequency in radar and communication transceivers.

**Enabling silicon technologies for mmWave radar trends and requirements**

Farzad Inanlou¹

¹Globalfoundries

**An automotive radar demonstrator with a 22nm CMOS FD-SOI transceiver**

Philipp Ritter¹ and Juergen Hasch¹

¹Robert Bosch GmbH

**Millimeter-wave antenna and packaging solutions for D-band FMCW radar Systems**

Akashel Bushara¹ and Thomas Zwick¹

¹Karlsruhe Institute of Technology

**High-speed ADCs for D-band radar in 22 nm FDSOI CMOS**

Simon Buhr¹ and Frank Ellinger¹

¹Dresden University of Technology (TU Dresden)

**Design of a D-band PMCW radar transceiver in 45 nm RFSOI technology**

Vadim Issakov¹, Vincent Lameire² and Michael Leyster²

¹TU Braunschweig, ²Infineon Technologies, Infineon

**mm-Wave advanced-sampling transceiver enabling 6G data transmission with 100 Gbit/s per mobile User**

Patrick James Artz¹, Julius Edler¹ and Friedel Gerfers¹

¹Technische Universität Berlin

**High-speed DACs in 22 nm FDSOI CMOS for D-band wireless communication towards 6G**

Tobias Schirmer¹ and Frank Ellinger¹

¹Dresden University of Technology (TU Dresden)

**High-speed ADC (>20 GS/s) with high resolution (>10 bit) for Low-IF receiver in 22nm FDSOI**

Julius Edler¹, P. Artz¹, E. Wittenhagen¹, N. Luth² and F. Gerfers¹

¹Technische Universität Berlin

**Highly-integrated mmWave transceivers for communication systems in BiCMOS technologies**

Marco Dietz¹ and Robert Weigel¹

¹Friedrich-Alexander University of Erlangen-Nuremberg

**D-band CMOS+InP and CMOS-only MIMO communication transceivers technologies**

Mark Rodwell¹, Ali Farid¹, Ahmed Ahmed¹, Utku Solyu¹ and Munkyoo Seo¹

¹UC Santa Barbara
Microwave and mmWave Techniques for Sensing, Imaging and Characterisation of Biological Tissues

Chair: Alessandra Costanzo¹
Co-Chair: Marco Pasian²
¹University of Bologna, ²Università degli Studi di Pavia
Room 6

The use of electromagnetic fields for sensing, imaging, and characterization of biological tissues is a field where the research and development aspects represent an hot topic, and are fundamental to move toward real-life applications. Microwave frequencies are suited for several of these applications, and mm-waves are also investigated to provide new and/or alternative solutions. In both cases, the promise is the possibility to provide new diagnostic tools, able to complement the existing ones, maintaining an high safety standard for the patient, due to the use of non-ionizing radiation, as well as easy-to-use operations and reasonable comfort. Maintaining at the same time reasonable costs, to contribute to the new healthcare paradigm, which foresees continuous and personalized medicine as one of the future pillar. This workshop will present the state-of-the-art for some key elements, ranging from innovative applications, including invivo sensing and imaging, key considerations in measuring heterogeneous tissues, and sensing volume and tissue contributions, up to the characterization of tissues from the molecular point of view, fluctuations properties due to overode-hydration and robust procedure to overcome these uncertainties will be discussed.

Two half-hour panel sessions will be organized within the full-day workshop during which speakers and attendees will have the opportunity to be engaged in discussions about potential applications and issues of the techniques presented during the workshop.

PROGRAMME

Energy-autonomous for detection of fluids
Francesca Benassi¹, Alessandra Costanzo²
¹Università degli Studi di Bologna, ²University of Bologna

Perspectives for mm-wave biomedical applications for invivo sensing and imaging
Simona Di Meo¹, Marco Pasian²
¹Università degli Studi di Pavia, ²University of Pavia

Skin phantoms for microwave and millimeter-wave applications: A comparative study
Milica Popovic²
²McGill University

The significance and challenges of heterogeneities in dielectric measurements of Biological Tissues
Emily Porter¹
¹University of Texas at Austin

Characterization of exposure in emerging 5G/6G bands: effect of age and impact of textile
Giulia Sacco¹, Maxim Zhadobov²
¹Univ Rennes, ²University of Rennes 1, CNRS, IETR

Modeling dielectric response of biological structures at microscopic level
Micaela Libero¹ and Francesca Apollone²
¹Università degli Studi di Roma “La Sapienza”

Improving measurement accuracy
Gertjan Maenhout¹ and Dominique Schreurs¹
¹KU Leuven
Up until recently, on-wafer measurements of semiconductor devices, either of narrow band Integrated Circuits or broadband transistors, was typically limited to 67GHz or in some cases 110GHz. However, with the growing demand of consumer devices working in the mm-wave range, including 5G or automotive radar for example, the requirements are growing for more measurements and data not only to 110GHz, but 220GHz and beyond. Even if the operating frequencies of these devices are sub 100GHz, the need to characterize the models of the transistors and other components used in these circuits typically is much higher than the working band they are eventually used in. In addition, it’s helpful to have an understanding of the out of band performance and harmonics of the ICs, meaning it’s becoming more common for engineers to measure all the way to 220GHz and beyond. And already emerging is research into 6G, that could potentially be working in the 200GHz frequency band. To compound this, the variety of applications and real world environments our devices are used in, data needs to be collected over a wide temperature range – putting even more demand on todays testing. As we progress up the frequency spectrum, new developments of RF probes, instrumentation, calibration standards and techniques need to be developed and integrated together to allow easy, accurate, repeatable and trustworthy data. This workshop brings together the on-wafer RF Eco-system providers and users of instrumentation, probes and calibration methods to share experiences and best practices.
Monday 09:00 – 13:00

Novel Technologies for Emerging On-board Microwave Equipment Based on Surface Mounted Electromechanical Relays

Chair: Vicente E. Boria¹
Co-Chair: Jorge D. Martínez²
¹UPV
Room 15

The development of highly miniaturized electromechanical relays is of primary importance for the implementation of reconfigurable microwave space subsystems in line with the evolution toward more digital satellites supporting higher data capacities. The increase on the architecture complexity imposes stronger constraints in terms of cost and mass, with no compromise on reliability. This workshop will present the latest advances on the development of miniature electromechanical relays (MEMRs), which are developed within the framework of SELECTOR H2020 project. Firstly, a broad perspective on how RF PCB technology can be employed for developing future on-board microwave equipment will be given. Then, the implementation of low-loss and broadband interconnections will be presented. Embedded waveguides are essential for taking advantage of the excellent performance of novel surface mounted compatible devices, while enabling full compatibility with standard multi-layer PCB technology with higher density of integration. Then, recent technological innovations on the implementation of MEMR devices at electrical, mechanical and thermal levels will be thoroughly discussed, showing the increased frequency of operation. Lastly, a thorough analysis of the reliability tests required for guaranteeing a spacequalified product will be presented and discussed.

Programme

Perspectives of RF on PCB technology to develop new microwave on-board equipment
Olivier Vendier¹
¹Thales Alenia Space

Embedded waveguides technologies for board-level interconnection of electromechanical relays at microwave and mmWave frequencies
José VM. Sánchez de Baja¹, Jorge D. Martínez²
¹Universitat Politècnica de València, ²UPV

Reliability evaluation of SMT compatible electromechanical relay for compact redundancy ring applications
Ivan Marozau¹
¹CSEM

SMT-compatible electromechanical relay for compact redundancy ring
Olivier Berenfeld¹
¹Radiall
MONDAY 09:00 – 18:20

Recent Developments in Wireless Power Transfer and Energy Harvesting

Chair: Jiafeng Zhou¹
Co-Chair: Naoki Shinohara²
¹University of Liverpool, ²Kyoto University

Room 16

The workshop will include 12 talks in the area of wireless power transfer and energy harvesting. Leading experts with both academia and industry backgrounds will introduce the latest progress in related areas. The speakers are from Japan, Korea, China, Singapore, Europe, UK, USA and Canada. The workshop will focus on low power electronics, including sensors, batteries and power management circuits, for the energy harvesting technology and its applications. It will also introduce the state-of-the-art developments of near-field, mid-field and far-field wireless power transfer techniques in recent years, including the exciting project of wireless charging for space applications. The trendy topic of simultaneous wireless communication and wireless power transfer (SWIPT) will also be presented in this full-day workshop.

**PROGRAMME**

<table>
<thead>
<tr>
<th>Title</th>
<th>Speaker</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Wireless powered IoT sensor technology</td>
<td>Naoki Shinohara¹</td>
<td>Kyoto University</td>
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<tr>
<td>Low power beat sensor</td>
<td>Koichiro Ishibashi³</td>
<td>The University of Electro-Communications</td>
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<tr>
<td>Near-field wireless power transfer</td>
<td>Paul Mitcheson¹</td>
<td>Imperial College London</td>
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<tr>
<td>Simultaneous wireless information and power transfer</td>
<td>Nuno Borges Cardoso²</td>
<td>the University of Aveiro</td>
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<tr>
<td>High performance wireless power transfer under misaligned conditions</td>
<td>Jiafeng Zhou¹</td>
<td>University of Liverpool</td>
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<td>Harmonic based integrated rectifier-transmitter for wireless uplink</td>
<td>Yongxin Gu²</td>
<td>University of Singapore</td>
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<td>Progress in making a magnetically coupled resonant WPT system insensitive to misalignments and distances</td>
<td>Zhisheng David Chen¹</td>
<td>Dalhousie University</td>
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<tr>
<td>Waste to energy: beyond ambient microwave energy recycling</td>
<td>Xiaoqiang Gu¹ and Ke Wu¹</td>
<td>University of Montreal</td>
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<tr>
<td>Wireless charging on the moon</td>
<td>Joshua R. Smith¹</td>
<td>University of Washington</td>
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Beyond 5G: mmWave and Terahertz Techniques of 6G Research

Chair: Kevin Thompson¹
Co-Chair: Allison Douglas¹
¹Keysight Technologies
Room 17

mmWave and sub-terahertz frequencies (100-300 GHz) with extreme modulation bandwidths are part of 6G research. This presents many unknowns given the novelty of these wavelengths for use in communications. One of those unknowns is exploring the level of system performance that is achievable and reasonable given new frequency bands, extreme modulation bandwidths, and new waveforms. This workshop will provide insight into several of these topics by discussing new sub-terahertz system-level design and test challenges presented by 6G. These include RF MIMO channel sounding techniques for these bands, broadband component scattering parameter and noise-figure evaluation using vector network analysis, EVM measurements at 140 GHz with varying waveforms and bandwidths up to an occupied bandwidth of 10 GHz, and time-synchronization in networks involving multiple RF links (access, radio & fiber fronthaul, GPS/PPS, 3GPP air-interface frames).

PROGRAMME

New sub-terahertz R&D testbed for 6G research
Greg Jue¹
¹Keysight Technologies

Channel sounding from mmWave to sub-THz
Wen Zhu¹
¹Keysight Technologies

Broadband VNA component characterization
Suren Singh¹
¹Keysight Technologies

Maintaining and measuring end-to-end timing integrity in networks with multiple RF links
Mike Beyers¹
¹Keysight Technologies
Microwave filters are one of the basic building blocks in RF systems along with amplifiers, mixers and oscillators. At some point, you may be called on to design or specify a filter, even though you are not a filter design expert. Fortunately, there is simple design method for narrow band filters that is easy to learn and quite universal. It can be applied to any lumped element or distributed topology and any manufacturing technology except SAW/BAW. And, the method is valid for bandwidths from a fraction of a percent up to 20 percent or more.

This short course is a "no math" approach to filter design that requires only simple algebra and no knowledge of complex filter synthesis techniques. It is suitable for industry non-experts, technical managers, students and educators. The root of the design flow is based on Dishal’s method, with the addition of EM simulation for accuracy and port tuning for updates to the filter geometry. The basic design method can also be expanded to include cross-coupled filters and multiplexers.

Two design flow examples have been prepared for this short course. The first is a high Q cavity combline bandpass filter and the second is a microstrip combline bandpass filter. The design flow can be realized using software from many different vendors. Example project files will be made available to attendees.

### PROGRAMME

**Intuitive microwave filter design with EM simulation**

Daniel Swanson¹

¹DGS Associates, LLC

**AGENDA**

1. Coupling coefficient concepts
2. Introduction to Dishal’s method
3. Design flow for any narrow band filter
4. Example 1:
   4a. Microstrip combline filter design
   4b. EM simulation techniques for planar filters
   4c. Port tuning for planar filters
5. Example 2:
   5a. Cavity combline filter design
   5b. EM simulation techniques for cavity filters
   5c. Port tuning for cavity filters
6. More advanced commercial design tools
7. Summary
Phase Noise in Next Generation Aerospace, Defense and Commercial Wireless Communications

The ability to manage the effects of noise in components and systems is critical to communications link performance. Noise can be added by power supplies, modulation, thermal and additive characteristics of devices. Phase-Noise, AM-Noise, Baseband Noise and Noise Figure must be fully characterized, as well as their effects on the dynamic range of communications links and on the performance of radar systems.

This course explains phase noise theory and its impact on performance in communication systems. We will describe multiple phase-noise measurement techniques, the role of the phase detector and the use of cross correlation in optimizing sensitivity, and we'll discuss the impact of reference sources, stimulus sources and AM on phase noise measurements.

We describe the origins of noise along with AM, residual and absolute noise and cross-correlation techniques for measurement from DC to mmWave frequencies. We also discuss Phase-Noise measurements across various instruments and the effects of external mixers on mmWave noise measurements.

This course describes the origins of noise and how the resultant components affect devices and are measured. We will also show how Phase-Noise relates to Noise Figure, view the accuracy and limitations of Noise Figure Y-Factor and Cold Source methods, and describe the differences in characterizing devices, particularly amplifiers, with each Figure of Merit.

**PROGRAMME**

mmWave phase noise impacts in wireless communications

Noise concepts for mmWave communications
Solid-state microwave technology for Industrial, Scientific and Medical (ISM) applications is progressively gaining momentum although legacy magnetron technology still allows lower CAPEX burdens, especially for high-power applications. Apart from the hardware-linked advantages of solid-state technology (compactness, safety, parametric accuracy, life cycle extension, operating ease and flexibility), a huge boost towards extensive acknowledgement by the microwave community certainly comes from in-depth synergy with modern distributed software platforms. The short course will explore technology trends, design clues and business scenarios, especially trying to emphasize the real added value of software engineering to microwave-driven processes, obtainable through careful hardware-software co-design based on solid-state microwave power devices, digital microprocessors and accurate sensor networks. Innovative designs of solid-state microwave systems typically adopt a distributed intelligence approach, where each generator is equipped by real-time computational capability (e.g., linked to accurate control & monitoring of frequency, phase, power, dynamic impedance mismatch conditions, etc.) and a flexible real-time cooperative functionality that enables infinite modular combinations governed by a central – local or remote – brain. The main target of enabling efficient self-regulating workflows is accompanied by equally important achievements of allowing modern big data approach to industrial applications, high testability and manufacturability and perfectly tailored software-assisted maintenance and after-sales assistance. A description of significative achievements will be presented regarding medical hyperthermia, food materials processing, experimental nanomaterials development and other innovative ISM applications.

**PROGRAMME**

- **Solid-state microwave technology in ISM fields**  
  Marco Fiore¹  
  LEANFA Srl

- **Hardware-software synergies in solid-state microwave applications**  
  Marco Fiore¹  
  LEANFA Srl

- **Semiconductor technologies for solid-state microwaves**  
  Nicola Di Modugno¹  
  LEANFA Srl

- **The advantage of solid-state microwave technology in medical applications**  
  Fabio Lobascio¹  
  LEANFA Srl

- **Solid-state microwaves: the best is yet to come**  
  Marco Fiore¹  
  LEANFA Srl
MONDAY 14:20 – 18:20

Optimizing Modulation Quality Measurements on Wide Bandwidth Signals – From Conformance Through R&D

Chair: Kevin Thompson¹
Co-Chair: Allison Douglas¹
¹Keysight Technologies
Room 1

We can’t wait for you to join us in this workshop, confronting real-world wireless engineering challenges with real-world measurements and expert insights.

Keysight inventors and lead experts are eager to meet you in this half-day workshop and share everything you need to know to optimize your modulation quality measurements on wide bandwidth signals, and be successful from conformance through R&D. For chipset and device makers, network equipment manufacturers, and operators, this workshop is a must – we made it for you!

We will begin with a look at industry movements and conformance requirements for today’s and tomorrow’s 5G base stations. Then, we will dive deep into measurement science and tackle EVM measurement optimization, and a new, novel method for digital pre-distortion. Finally, we will share exciting research and advancements in quantifying modulation quality using waveform-based modulation analysis, which does not require demodulation.

PROGRAMME

Evaluating 5G Base Stations for Compliance to the 3GPP Specifications
Randy Becker¹
¹Keysight Technologies

Quantifying modulation quality at the physical layer using equalized channel Capacity
Jan Verspecht¹
¹Keysight Technologies

Optimizing EVM measurements for wide bandwidth signals
Jennifer Stark¹
¹Keysight Technologies

Spectral DPD: A novel method of digital pre-distortion
Sam Kusano¹
¹Keysight Technologies
Resolution is the most critical factor for radar to detect targets and portray the object details. On one hand, range resolution is proportional to signal bandwidth. However, signal bandwidth is limited by both hardware capability and spectrum regulation. On the other hand, angle resolution depends on antenna aperture. High angle resolution implies large antenna aperture, which is subject to installation limitation. Here we propose a novel distributed MIMO radar structure which employs each antenna with different frequency, to achieve both high range resolution and high angle resolution simultaneously. Several small bandwidth signals are processed together to form an equivalent large one, and at the same time, the aperture of the whole system is enlarged. We further analyse the factors influencing the performance, such as, the number of transmit antennas, the frequency offsets between different transmit antennas, and the ratio of the aggregated bandwidth to total spreading bandwidth, etc.

### PROGRAMME

**High range-angle resolution MIMO radar**

Hui Zhang¹

¹Huawei Technologies Co., Ltd

### AGENDA

1. High range-angle resolution MIMO radar
2. Sparse frequency allocation for wide-band aggregation radar
Carrier frequencies > 100GHz are attractive for next generation 6G cellular systems due to the large amount of available spectrum in the D- and G-bands that can be leveraged for high data rate communications. Operation at these high mmWave frequencies comes with many challenges, though, particularly in the demands placed on technology performance, integration and cost for the phased array front end. Losses on and off chip are very high. Transistor performance is significantly worse, with challenges in achieving acceptable gain, Pout, and PAE for the PA, acceptable gain and NF for the LNA and low insertion loss for the switch. Thermal management and antenna/FEM/transceiver integration will be particularly demanding due to the constraints of the lattice spacing at these frequencies. This workshop will delve into the candidate semiconductor and packaging technologies for the 6G beamformer FEM, and will explore the unique strengths and limitations of each for addressing these challenges.

**Programme**

- View and trends in RF design towards 6G
  Aarno Pärssinen¹
  ¹University of Oulu

- SiGe BiCMOS technologies for 6G millimeter-wave
  Pascal Chevalier¹
  ¹STMicroelectronics

- State of the art SOI technology for mmWave FEM applications
  Sameer Jain¹
  ¹GlobalFoundries

- D-band circuits in 16nm FinFET: design and layout considerations
  Patrick Reynaert¹ and Bart Philippe¹
  ¹KU Leuven ESAT-MICAS

- InP and GaN devices for the next generation of wireless communication
  Nadine Collaert¹
  ¹Imec

- Chip package co-optimization: circuit-level optimization with RDL passive components for mm-wave Power Amplifiers in 22nm FDSOI
  Corrado Carta¹
  ¹TU Dresden

- Circuits and technologies for applications above 100 GHz
  Hua Wang¹
  ¹University of California - Santa Barbara
Virtual Validation of Automotive Sensors

Chair: Hasan Iqbal¹
Co-Chair: Sreehari Buddappagari Jayapal Gowdu²
¹Continental, ²TU Ilmenau
Room 12

Automotive environment perception sensors, predominantly radar, lidar, and camera enable driver assistance and highly automated driving functions. The exploding number of safety requirements necessitates reliable and efficient validation and homologation methods for these automotive sensors at highly automated driving at levels L3...L5. One approach is to conduct billions of miles of field-operational road tests in a variety of driving environments and challenging scenarios. However, this option is expensive and risky for both life and property. This method also makes it hard to ensure that every edge scenario is adequately tested. Hence, complementary approaches for testing in virtual environments become increasingly necessary. In the virtual validation methods, researchers are addressing the key question: “How can the safety of automated and connected driving functions be evaluated and assured?” To address this, the industry and academic partners are working on the design and implementation of a virtual validation tool chain, connecting software-based traffic and sensor simulations with propagation modelling and installed performance testing in virtual environment. In this workshop, state-of-the-art contributions on topics that implement virtual validation of automotive sensors will be presented. Among these, scenario-based testing using software-in-the-loop, hardware-in-the-loop and over-the-air vehicle-in-loop methods will be focused primarily on radar. Highly relevant topics of ray-tracing, sensor modelling and installed performance will be addressed along with measurement-based modelling and simulation of radar cross section and signatures of traffic objects.

PROGRAMME

Ray tracing for critical radar scenarios
Hasan Iqbal¹ and Frank Gruson¹
Continental

Installed performance testing of automotive radar in virtual environment
Sreehari Buddappagari Jayapal Gowdu and P. Aust¹
¹TU Ilmenau

Simulation technology development for automated drive safety assurance
Satoshi Taniguchi¹
DVP

Assessing the ADAS RADAR performance in harsh operating condition (e.g. rain) using simulation.
Koen Delanghe¹
Siemens

Sensor modeling and integration with standardized interfaces
Korel Saud²
Apollo

Sensor modelling and virtual validation using raytracing-based sensor simulation software
Christoph Brodehl²
GEPACT

Ray tracing and radar channel simulation
Martin Paul³ and Arak Wilker³
Karlsruhe Institute of Technology

5 years of radar sensor modeling research: Current status and development trends within the PEGASUS-Family projects
Martin Holder¹, Lukas Elster²
¹TU Darmstadt

Enabling analysis of perception phenomena for highly automated driving by using redundant sensor setups in automotive scenarios
Christian Gutenkunst¹, Kai Domhardt²
¹AVL, ²TU Darmstadt

Testing of automotive radars in complex scenarios by measurement and simulation
Andrew Stone³
³University of Birmingham

Virtual testing of automotive lidar
Arsalan Hakeem¹, Benjamin Rosenfeld²
¹Blickfeld & Hochschule Kempten

Increasing Realism in Auto-Radar Drive Scenario Simulation with Multipath, Diffuse Scattering, and Micro-Doppler
Greg Skidmore³
³Remcom Inc.
This short course introduces an overarching strategy for designing radars from the ground up, covering theoretical and practical aspects. We will start with antenna design, optimization, pattern synthesis, and integration with the RF transceiver. We will introduce how to process beam characteristics such as steering angle, beamwidth, null locations, beam tapering, grating lobes, and beam squint. In addition, we will show how to design and analyze PCB-based antennas for integration in an active array including coupling, noise, and non-linear effects.

You will learn how to create end-to-end system-level models of radars and process detections generated from these models or from data collected from radar systems, and how to analyze cognitive radars that operate in crowded RF shared spectrum environments.

Step by step, we will simulate a complete multi-function radar system including scheduling and resource management with the ability to define tasks, jobs, priorities, time allowances, and the capability to efficiently handle large scenes. We will evaluate side-by-side the radar performance on realistic large-scale tracking scenarios, including bayesian state estimation, different multtarget tracking systems architectures, multi-sensor fusion engines, and track analytics. We will describe how to build a virtual platform for system-level development, facilitating debugging eventual problems before costly prototypes are available. Similar to the antenna and RF models, scenario fidelity must scale with the project phase, with increasing levels needed as the project matures.

During this short course will share with the participants different radar models based on MATLAB.

**PROGRAMME**

**Modeling RF transceivers and antenna for radar applications**

Giorgia Zucchelli¹

¹The MathWorks B.V.

**Multisensor tracking radar design and analysis**

Rick Gentile¹

¹The MathWorks Inc.
The aim of the workshop is to present the latest developments in drone-based antenna measurements through several presentations and a real live virtual demonstration where a drone will be engaged in the measurement of a ground VSAT antenna. QuadSAT will present a real demonstration of state-of-the-art drone-based antenna measurements in the context of SATCOM applications.

The global deployment of satellite terminals is well under way, in the context of Earth Observation and Satellite LEO constellations. The increasing demand for satellite-based services like inflight connectivity, maritime broadband services along with growth of telecommunication sector is anticipated to generate demand for new communication satellite launches during the forecast period and an increased demand for in-situ testing. A significant rise in ground satellite antennas and the advent of new multi beam antennas in the satellite and RADAR markets is forcing end users to consider mitigating radio interference.

To find out the latest news in this field, join QuadSAT in our ‘Drone Workshop’ where our CEO, Joakim Espeland, will take you through our journey and demonstrate how this technique can bring the measurement range to the customer by providing a real demonstration of measurements of an offset 1.3m antenna and comparing results with a traditional outdoor far-field system.

**PROGRAMME**

**Drone based antenna measurements in the SATCOM market**

Joakim Espeland¹

¹QuadSAT

**Live Demonstration of Drone Based Antenna Measurement**

Andrian Buchi¹

¹QuadSAT

**A service perspective on drone-based field measurements**

Markus Ridde¹

¹Cetecom GmbH
Microwave antenna/array and filter/multiplexer design is becoming a tedious process. The success of existing design methods highly depends on designers’ experience and has a low success rate when the structure is complex or the specifications are stringent. In recent years, machine learning and evolutionary computation have been introduced into microwave design, which shows promising results. For antennas, state-of-the-art AI-driven design techniques can successfully address several tens of stringent specifications without any initial design, while reducing the optimization time by more than 20 times and obtaining even better design quality compared to standard global optimization methods. For filters, state-of-the-art methods have realized increasing design automation while having a high success rate for complex structures and applied to designers of all levels. However, many microwave and antenna designers are not familiar with AI-driven microwave design techniques or are not aware of how these techniques can be used to enhance their design ability and efficiency. Hence, the overarching goal of this short course is to not only provide a timely overview of how AI techniques can be used for antenna/array and filter design but also present recently developed methods with case studies. To achieve this goal the course is structured in six complementing parts:

1. Concepts and fundamentals of machine learning and evolutionary computation
2. AI-driven antenna/array design methods
3. Challenging antenna cases solved by AI-driven design methods
4. AI-driven filter/multiplexer design with case studies
5. Tutorial on using AI-driven microwave design tools
6. MATLAB Antenna Toolbox: an interactive AI-driven antenna design environment
7. AI techniques in microwave design and communication systems: new applications and challenges

**PROGRAMME**

- Concepts and fundamentals of machine learning and evolutionary computation; AI-driven antenna/array design methods
  - Bo Liu¹
  - University of Glasgow

- Challenging antenna cases solved by AI-driven design methods
  - Akram Alomainy¹
  - Queen Mary University of London

- AI-driven filter/multiplexer design with case studies
  - Yi Wang¹
  - University of Birmingham

- Tutorial on using AI-driven microwave design tools
  - Mobayode O. Akinsolu¹
  - Wrexham Glyndwr University

- MATLAB Antenna Toolbox: an interactive AI-driven antenna design environment
  - Giorgia Zucchelli¹
  - MathWorks

- AI techniques in microwave design and communication systems: new applications and open challenges
  - Muhammad Imran¹
  - University of Glasgow
With the advent of modern and efficient cryogenic techniques and availability of high temperature superconductors (HTS), applications of these materials in microwave circuits and systems are on the rise. Examples are HTS filters and antennas in mobile base stations and satellite systems, Rapid Single Flux Quantum (RSFQ) logic in multi-GHz digital circuits and quantum bits (qubits) based on Josephson junctions (JJ), among others. On the other hand, young microwave engineers and students cannot afford spending their time reading hefty tomes to master the physics of superconductivity and low temperature physics. This pedagogical short course aims at filling this gap.

In the first part of this short course, the microwave properties of bulk and nanoscale superconductors are presented based on macroscopic quantum model. The circuit models of Josephson junction and superconducting quantum interference device (SQUID) are presented and their nonlinear behaviour in microwave frequencies are explained.

In the second part, the applications of JJ and SQUID in microwave circuits and systems are introduced including parametric amplifiers, mixers, and oscillators. Hands-on simulation examples based on Spice® and Simulink® are presented.
Communication systems become even more pervasive in our life. 5G systems will dramatically increase the telecommunication capabilities allowing the implementation of the so called Internet of Things (IoT) where an incredible number of objects will communicate through the internet. Part of the 5G communications will be supported by satellite infrastructures made of very large constellations of low orbit mini/nano satellites. In such a scenario a wide variety of new RF/microwave/millimiter wave components will be required. Indeed, they will be used in a lot of different situations, from sensors to satellites. Aspects like miniaturization, packaging and advanced manufacturing became essentials. In this workshop some compact components (especially filters) will be presented together with the advanced manufacturing technique used for their realization. Presented materials also include space applications. Ample time will be devoted to the discussion with the audience.

**PROGRAMME**

**Additive manufacturing of non-conventional miniaturized filters**
Cristiano Tomassoni¹, Enrique Lopez¹ and Abdul Rehman¹
¹University of Perugia

**Compact Realizations of Advanced Filter Responses in Planar and 3D Waveguide Technologies**
Vicente E. Boria¹, El Mehdi Messaoudi¹, Abhishek Sharma², Jorge D. Martinez³
¹Technical University of Valencia, ²iTeam - Universitat Politècnica de València, ³UPV

**Additive manufacturing approaches for the Implementation of a K-band Mushroom meta-material filter**
Reinhard Teschl¹, Azizul Amanpuri¹, Luke Robins¹
¹Graz University of Technology

**Advanced Bandpass Filter Structures for W-Band Applications**
Michael Höft¹, Chad Bartlett¹ and Daniel Miek¹
¹Kiel University
Innovative THz Technologies for Imaging, Radar and Communication

Chair: Werner Prost¹
Co-Chair: Daniel Erni¹
¹University Duisburg-Essen
Room 12

The European Doctoral Training Network in Terahertz Technologies for Imaging, Radar and Communication Applications (TeraApps) was a multi-site network comprising 10 internationally reputed research teams and 14 associated partners all internationally leading academic groups. The network has finalized a unique research training programme for the cohort of 15 young researchers in the novel and multidisciplinary field of semiconductor terahertz technologies with exceptional prospects for career development and a potential of dramatic impact on the imaging, radar, communications and sensing application areas for our increasingly connected and smart world. Thereby it has strengthened Europe’s human resources and industry competitiveness in the ever-growing field of terahertz electronics and opto-electronics. The mission of this workshop is to bring together this pool of young THz researchers with world-leading experts to present and to discuss their key complementary skills in a multidisciplinary scientific consortium.

The workshop will present the design, fabrication, characterisation and systems utilisation of terahertz sources and detectors mainly based on RTD semiconductor technology but also using emerging novel technologies such as 2D materials.

**PROGRAMME**

**Micro-PL analysis of high current density resonant tunnelling diodes for THz applications**
Michele Cito¹
¹University of Glasgow

**Design of calibration structures for On Wafer S-parameters measurements up to 500GHz**
Robin Schmidt¹, Thomas Nowack²
¹Keysight Technologies Belgium BVBA, ²University of Glasgow

**Coherent receivers based on TB-RTD/On wafer TB-RTD measurements up to 500 GHz**
Simone Costi¹
¹University of Duisburg-Essen

**Antimony and indium arsenide based resonant tunnelling devices for high-Speed and mid-infrared applications**
Yaish D. Rawal¹
¹Julius Maximilians Universität Würzburg

**InGaAs based resonant tunnelling diode photo detector**
Bogomir Novak¹
Julius Maximilians Universität Würzburg

**Models for fully-quantum treatment of scattering in the THz and Optical domains**
Matteo Villani¹
¹Universitat Autònoma de Barcelona

**Accurate quantum transport modeling and epitaxial structure design optimisation of InGaAs/AlAs double-barrier resonant tunneling diodes for high-power terahertz oscillators**
Davide Cento¹
¹University of Glasgow

**Feasibility of Travelling-Wave Microstrip RTD Oscillators**
Julian Johns¹
¹Technische Universität Wien

**Wireless subharmonic injection-locked, resonant tunneling diode array with beam steering capability at 720 GHz.**
Meng Zhang¹
¹University of Duisburg-Essen

**Semiconducting quantum dot single electron transistor as high sensitive cooled photodetector in THz bandwidth**
Mahadi Asgari¹
¹CNR- Nanoscience Institute

**Advanced Terahertz imaging systems based on tailored metasurface optic**
Thomas Nowack¹
¹University of Glasgow

**CNR- Nanoscience Institute**
Mahadi Asgari¹
¹CNR- Nanoscience Institute

**Panel Session**
Robin Schmidt¹
¹Keysight Technologies Belgium BVBA
Advanced Processing and Deep Learning Approaches for Indoor Sensing Using Short Range Radars

Chair: Avik Santra¹
Co-Chair: Robert Weigel²
¹infineon, ²FAU
Room 13

Radars are non-intrusive sensors and finds applications in medical care, surveillance, human-machine interface, industrial water-level monitoring to name a few. Short range radar systems, featuring light weight and low cost, offer perfect solution for indoor human sensing however they need to be offer optimal performance requiring advanced receiver processing techniques. Radar can wirelessly detect and estimate the tiny physiological movements due to heart-beat and respiration activities. Furthermore, the micro-Doppler components from the humans can be sensed and utilized by radar processing to discern meaningful insights related to their activities, gestures or people density. This workshop outlines some of the most important topics related to radar processing for indoor sensing. We present the talk on security and techniques to mitigate malicious attacks on radar sensors for their reliable operation. We present the talk on processing techniques for sequential human activity classification in the context of assisted living and gesture sensing for a practical real-time solution. We present the talk on remote vital sign monitoring for day-to-day remote patient monitoring using radars from the hybrid viewpoint of a practicing cardiologist and an electrical engineering professor. We present the talk on assisted living using radars, the advanced processing techniques including deep learning to address some of open challenges. We further present a talk on indoor people counting using radars addressing challenges of different environments and indoor artifacts. We then present a talk on kinematic and linguistic considerations that one needs for design of reliable deep neural network models for human classification tasks.

Programme

Parametric deep neural networks for learning from raw radar ADC data
Thomas Stadelmayer¹, Anand Dubey²
¹University of Erlangen-Nuremberg, ²FAU Erlangen

Security for modern radar sensors: potential attacks and risk mitigation
Changzhi Li¹
¹Texas Tech University

Kinematic and linguistic considerations in DNN design for radar-based biological signal classification
Singi Zahid Saleha Gaur¹
¹The University of Alabama

Remote vital sign monitoring, and the use of radars towards a viable solution: A hybrid engineering/medical viewpoint.
George Sharkei¹, Jonathan Toma¹
¹University of Waterloo & NLP Life Sciences, ²NLP Life Sciences

Radar sensing in assisted living
Julien Le Kernec¹
¹University of Glasgow

Radar indoor People Counting using Cross-modal Learning
Souvik Huara¹
¹Infineon Technologies

Radar approaches for sequential human activity classification
Francesco Farinelli¹
¹TU Delhi

Waveform design for interference mitigation in indoor radar sensing
Bhuvani Shankar M.R.¹, Mohammad Alameer Karimddi²
¹The University of Luxembourg, ²Interdisciplinary Centre for Security, Reliability and Trust

Simulation of dynamic radar targets in complex indoor propagation Environments
Shibhu Sundar Rani¹
¹IIT Delhi

Deep reinforcement learning applied to short-range radars
Lorenzo Seravala¹, Michael Stephan²
¹Infineon Technologies, ²FAU Erlangen
Not too long ago the use of mm-Wave Radar sensors for automotive applications had a straightforward and well understood way to go into the future. The subsequent development of L4 and L5 sensors were beyond any questioning.

**=> technology push**

Today, these quite ambitious development directions have been re-focused: main interests are L2+ or L2++, i.e. near term results. The needs of the final user, the driver itself - i.e. all of us - have become the most important aim. What really is an easy to use and easy to understand driver assistance system?

**=> demand pull/ customer orientation.**

Car insurance fee reduction based on radar (or Lidar!) for secure AEB (Automotive Emergency Breaking) functions and as a 2nd step AES (Automotive Emergency Steering) are helping the customer to pay for these (not yet cheap) high-tech systems;

**=> changed financial/ industrial circumstances.**

The direct customer orientation: How do these systems help the driver to take driving easier and make it more enjoyable, while letting him know how safe the systems are in use, is in focus today.

What does all of this mean for us - the mm-Wave community?

1) Easy to handle and to understand - as well as to maintain - sensor measurement and test systems, that will make it easy to convince the customer - the driver - that he has an advantageous tool for his own safety.

2) Based on new regulations - the forced employment of mm-Wave Radar sensors for in-cabin monitoring - as a new application area.

The later – in-cabin monitoring - e.g. by radar at 24, 60, 120 and 160 GHz – is becoming mandatory in new to be delivered cars from 2022 on - in Europe and the US, respectively.
Rohde & Schwarz Workshop
Tutorial Seminars and Technical Workshops

Date: Tuesday 15th and Wednesday 16th February 2022
Location: ICC Capital Suite - Level 3 - Room 3

TUTORIAL SEMINARS – RF BASICS IN TEST AND MEASUREMENT

The advances of 5G and mmWave communications – one of its key driving factors – are considerably changing the world of cellular and non-cellular communications. The automotive industry and Industry 4.0 are further technology drivers that have significantly impacted mmWave engineering development and the design of new products. Modern communications technologies, telemetry applications, radar technologies and industrial assembly of mmWave circuits increase the amount of cross-disciplinary collaboration.

Nowadays, mmWave engineers are also being confronted with the challenge of how to master the field of RF signal and digital communications. Therefore, a sound understanding of RF and mmWave testing methods is key for every mmWave engineer, since it helps them implement solutions and designs in RF and mmWave circuits.

The Rohde & Schwarz seminars covering RF basics in test and measurement will familiarise you with the fundamental aspects of signal generators, spectrum analysers and network analysers. You will learn how to benefit from the high flexibility of our T&M equipment when designing RF and mmWave circuits.

The seminar on real-time spectrum analysis will introduce the methods for debugging RF and mmWave circuits in the time and the frequency domain and demonstrate the excellent benefits for analysing complex mmWave circuitries.

Using vector network analysers for component testing and applying various calibration techniques allows highly precise characterisation of RF and mmWave components, which are necessary for mmWave designs and digital communications systems.

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<tr>
<th>TUESDAY, 15TH FEBRUARY, 2022</th>
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<tr>
<td>09:30 Fundamentals of signal generators and oscillators (YIG versus VCO)</td>
<td>09:30 Introduction to digital signals and digital modulation</td>
<td>09:30 Fundamentals of vector network analysis</td>
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<td>11:00</td>
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<td>10:30 Calibration in vector network analysis</td>
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<td>11:15 Fundamentals of spectrum analysis</td>
<td>11:45 Real-time spectrum analysis embedded in advanced spectrum analysers</td>
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TECHNICAL WORKSHOPS

TUESDAY, 15 FEBRUARY, 2022, 13:30 – 16:15
Modern RF frontend design and testing
Workshop chair: Markus Lörner, Market Segment Manager RF and Microwave Components, Rohde & Schwarz

5G is here. The focus is now on improving systems and enhancing them with mmWave. This drives the growing integration of components and creation of more efficient designs to minimise the form factor, improve energy efficiency and thereby drive overall costs down. Multifunction RF components such as beamformers are used in 5G mmWave as well as in satellite communications and defence applications. The high density of RF frontends for massive MIMO systems requires unprecedented energy efficiency to minimise the physical size while ensuring stable temperature conditions. The workshop will provide an overview of the latest technologies and requirements of RF frontends, focusing on the topics of improved efficiency and enhanced integration. Experts from the test and measurement field and industry partners will provide solutions that meet demanding requirements.

WEDNESDAY, 16 FEBRUARY, 2022, 13:30 – 16:15
Millimeterwave and THz technology for beyond 5G
Workshop chair: Dr Taro Eichler, Market Segment Manager Wireless Communications, Rohde & Schwarz

Millimeterwave and THz technology are seen as key components for beyond 5G and 6G systems. The radio spectrum between 30 GHz and 300 GHz is used with the intention of resolving the spectrum crunch and enabling ultrabroadband mobile communications up to the terabit range. The research and development of such systems gives rise to new challenges in the area of frontend, mixed signal and baseband technology and new requirements for the test and measurement industry. Since highly integrated frontends including array antennas will be implemented, advanced over-the-air testing methods with an extremely extended frequency range up to 500 GHz will become mandatory. Furthermore, the use of extremely wideband channels up to several GHz will become a challenge in terms of broadband signal generation and signal analysers. These tasks require an interdisciplinary approach with close collaboration between semiconductor, assembly and signal processing experts. This workshop gives an overview of recent developments in the area of broadband mmWave and THz communications systems with a special focus on radio channel and OTA measurements as well as on hardware implementation issues.

The schedule is subject to change. The latest version can be downloaded at www.rohde-schwarz.com/eumw
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<th>Room</th>
<th>09:00 – 13:00</th>
<th>14:20 – 18:20</th>
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<tr>
<td>1</td>
<td>WS01 Advances of Wireless Sensing</td>
<td>WS02 Terahertz Device, Circuit</td>
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<td>WS02 Terahertz Device, Circuit</td>
<td>SS01 Advanced Non-linear</td>
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<td>Amplifiers Using Load-Pull Data</td>
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<td>WS04 New Trends in Microwave and</td>
<td>WS05 New On-Chip and Scalable RF</td>
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<td>mmWave Filters</td>
<td>Packaging Solutions with</td>
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<td>Integrated Antennas for 5G mmWave</td>
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<td>WS06 Progress and Status of</td>
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<td>SS02 Fundamentals of Microwave</td>
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<td>Challenges for 5G mmWave and 6G</td>
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<td>WS08 Technology for RF 5G and</td>
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<td>Satcom: From Material to Packaged</td>
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<td>Demonstrators</td>
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<td>SS04 Terahertz Technology,</td>
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<td>WS03 mmWave Plastic Waveguide</td>
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<td>High Data Rate Communications</td>
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## Monday Overview

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<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
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<td>SM01</td>
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<td>R&amp;D Trends &amp; Challenges in RFPA for Medium/High-Volume Products</td>
<td>Optimizing Modulation Quality Measurements on Wide Bandwidth Signals - from Conformance Through R&amp;D</td>
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<td>Advances in Circuits and Systems for mmWave Radar and Communication in Silicon Technologies</td>
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<td>Tom Brazil Doctoral School of Microwaves</td>
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<td>EuMIC05</td>
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<td>Integrated Circuit Modelling and Design Methodology</td>
<td>Components and Subsystems for 100 GHz and Above</td>
<td>High Performance LNAs</td>
<td>Advances in Si and GaN Based Integrated PAs</td>
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<td>WM03</td>
<td>EuMIC04</td>
<td>EuMIC06</td>
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<td>Microwave and mmWave Techniques for Sensing, Imaging and Characterisation of Biological Tissues</td>
<td>Opening Session</td>
<td>Integrated PAs for 5G, SATCOM and Vehicular Applications</td>
<td>Frequency-Converting Circuits</td>
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<td>Silicon Based RF Solutions</td>
<td>Transceiver MMICs</td>
<td>Components and Subsystems for 100 GHz and Above</td>
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<td>Large Signal and Non-linear Characterization Techniques</td>
<td>Integrated Circuit Modelling and Design Methodology</td>
<td>Solid State Microwave Applications in Industrial, Scientific and Medical Fields</td>
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<td>RF On-wafer Calibration and Measurement Eco-system Workshop</td>
<td>Microwave Equipment Based on SM EM Relays</td>
<td>Recent Developments in Wireless Power Transfer and Energy Harvesting</td>
<td>Beyond 5G, mmWave and THz Techniques of 6G Research</td>
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**Off-site**

- **18:30 – 20:00**
  - EuMIC Cocktail Reception
  - EuMIC Foundry Session
  - Automotive Forum Networking Dinner
  - EuMIC Foundry Session
  - EuMIC Forum Networking Dinner

- **19:00 – 22:00**
  - EuMIC Forum Networking Dinner

- **18:00 – 20:00**
  - EuMC Cocktails
# TUESDAY OVERVIEW

## Room 08:30

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>EuMIC/EuMC01</strong>&lt;br&gt;Novel Filtering Devices in Integrated Technologies</td>
<td><strong>EuMC02</strong>&lt;br&gt;Innovative Microwave Circulators and Phase Shifters</td>
<td><strong>EuMC05</strong>&lt;br&gt;Novel Structures for Power Combiners and Couplers</td>
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<td>Exhibitor Workshops</td>
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<td>4</td>
<td><strong>EuMIC/EuMC02</strong>&lt;br&gt;THz Components</td>
<td><strong>EuMC16</strong>&lt;br&gt;Phased Array Components from S-band up to 300 GHz</td>
<td><strong>EuMC06</strong>&lt;br&gt;3D to 2D Transitions and New Materials for mmWave System Integration</td>
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<td>Exhibitor Workshops</td>
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<td>6</td>
<td><strong>EuMW01</strong>&lt;br&gt;Teaching Methods for Microwave Engineering</td>
<td><strong>EuMC03</strong>&lt;br&gt;Non-planar Filters I</td>
<td><strong>EuMC07</strong>&lt;br&gt;Non-planar Filters II</td>
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<td><strong>EuMC08</strong>&lt;br&gt;3D and Digital Predistortion, PA Optimization and MIMO Architectures</td>
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<td><strong>EuMC09</strong>&lt;br&gt;Metasurfaces and Frequency Selective Surfaces</td>
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<td><strong>EuMC10</strong>&lt;br&gt;Innovative Antenna Methodology and Design</td>
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<td>13</td>
<td><strong>EuMIC12</strong>&lt;br&gt;Device Modelling and Simulation of Parasitic Phenomena</td>
<td><strong>EuMC04</strong>&lt;br&gt;Active Antennas and Architectures</td>
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<tr>
<td>14</td>
<td><strong>EuMIC13</strong>&lt;br&gt;Receiver Components</td>
<td><strong>EuMC11</strong>&lt;br&gt;MMIC Power Amplifiers and Supply Modulation</td>
<td><strong>EuMC12</strong>&lt;br&gt;Front-End and Transceiver Modules</td>
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<tr>
<td>15</td>
<td>Career Platform</td>
<td>Women in Microwaves (Panel to 3 pm, Visit to 6:30 pm)</td>
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<td>16</td>
<td><strong>EuMC01</strong>&lt;br&gt;Advanced Packaging and Interconnect Technologies for Emerging Applications</td>
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<tr>
<td>17</td>
<td><strong>EuMC14</strong>&lt;br&gt;Advances in mmWave and High Power Integrated PA Technologies</td>
<td><strong>EuMW03</strong>&lt;br&gt;Special Session in Memoriam of Prof. Roberto Sorrentino</td>
<td><strong>EuMC12</strong>&lt;br&gt;THz Systems and Applications</td>
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<tr>
<td>Exhibition Hall</td>
<td><strong>EuMIC15</strong>&lt;br&gt;Posters</td>
<td><strong>EuMIC/EuMC04</strong>&lt;br&gt;Posters</td>
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<tr>
<td>Conference Center: Platinum Suite</td>
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<td><strong>EuMW Welcome Reception</strong>&lt;br&gt;18:30 – 22:00</td>
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## WEDNESDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
<th>EVENING PROGRAMME</th>
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<td>2</td>
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<tr>
<td>4</td>
<td>EuMC13 Non-planar Passive Components</td>
<td>EuMC16 Frequency Generation, Conversion and Nonlinear Modelling</td>
<td>EuMW04 Memorial Session for Professor Tatsuo Itoh</td>
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<td>6</td>
<td>SW01 Joint Range-angle Super Resolution MIMO Radar</td>
<td>SW02 Radar Design from the Ground Up</td>
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<td>WW01 Technologies for 6G Front End Modules</td>
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<td>13</td>
<td>EuMC14 Electromagnetic Scattering and Diffraction Effects</td>
<td>EuMC19 3D Printing: Processes and Reliability</td>
<td>EuMC23 5G Communication and Beyond*</td>
<td>EuMC26 Novel 3D Printing Approaches for mmWave Applications</td>
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<td>17</td>
<td>EuMC16 Integrated Components for Transceivers</td>
<td>EuRAD02 Radar Applications</td>
<td>EuRAD03 Emerging Radar Applications</td>
<td>EuMC28 5G and mmWave Arrays</td>
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<td>Exhibition Hall</td>
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<td>North Greenwich Pier (by the O2)</td>
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**EuMC**  
**EuMIC**  
**EuRAD**  
**Students**  
**EuMW**  
**Exhibitors**
## THURSDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
<th>14:20 – 16:00</th>
<th>16:40 – 18:20</th>
<th>EVENING PROGRAMME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EuMC35 Non-planar Filters and Passive Components</td>
<td>EuMC/EuRAD04 Radar Architectures and Systems</td>
<td>EuRAD13 Radar Imaging</td>
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<td>2</td>
<td>Exhibitor Workshops</td>
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<td>3</td>
<td>EuRAD04 Distributed and Multistatic Radar</td>
<td>EuRAD07 Drone Detection and Recognition</td>
<td>EuRAD10 Signal Processing for Automotive Radar</td>
<td>EuRAD14 Target and Clutter Classification in Automotive Radar</td>
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<td>4</td>
<td>Exhibitor Workshops</td>
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<tr>
<td>5</td>
<td>EuMC29 On the Occasion of Nikola Tesla's 165th Anniversary</td>
<td>EuMC36 Special Session: HEPFA – An International Project on Highly Efficient and Flexible Phased Arrays</td>
<td>EuMC40 Advances in Biological and Medical Applications</td>
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<td>6</td>
<td>EuRAD05 Al Methods in Automotive Signal Processing and Information Extraction</td>
<td>EuMC/EuRAD01 High Resolution Methods in Range and Azimuth for Environmental Perception</td>
<td>EuMC41 Material and On-water Measurements</td>
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<td>EuRAD06 Radar Characteristics Measurement, Modelling and Simulation</td>
<td>EuMW05 Special Session in Memory of Prof. Peter Claricoats</td>
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<td>EuMC44 EuMC Closing Session</td>
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<td>8</td>
<td>EuMC30 Asia Pacific Focused Session</td>
<td>EuRAD08 Radar Antennas, Arrays and Calibration</td>
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<td>9</td>
<td>EuMC31 Electromagnetic Interactions, Environmental and Biological Applications</td>
<td>EuRAD09 Positioning and Localization Systems</td>
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<td>EuMC32 Calibration Techniques and Nonlinear Measurements</td>
<td>EuMC/EuRAD02 Channel and Radar Characterization</td>
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<td>11</td>
<td>EuMC33 Sub-10GHz Antennas</td>
<td>EuMC37 Radar and Communication Systems</td>
<td>EuRAD11 Radar Processing Techniques for Automotive and Transportation</td>
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<td>12</td>
<td>EuMC34 RFID and WPT Technologies</td>
<td>EuMC38 Advances in mmWave Antennas</td>
<td>EuMC42 Antennas Using Advanced Manufacturing and Novel Substrate Materials</td>
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<td>EuMC35 Sub-10GHz Antennas</td>
<td>EuMC/EuRAD03 Posters</td>
<td>EuRAD12 Posters</td>
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<td>14</td>
<td>5G and Beyond Forum</td>
<td>WTh01 Advances in Drone Antenna Measurement Techniques for Satcom and RADAR Applications</td>
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<td>17</td>
<td>EuMC34 RFID and WPT Technologies</td>
<td>EuMC39 Novel IoT Technologies</td>
<td>EuMC43 Sensing and Dynamic Technologies</td>
<td>EuRAD15 Human Activity Sensing</td>
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Exhibition Hall

- EuMC
- EuMIC
- EuRAD
- Students
- EuMW
- Exhibitors
### FRIDAY OVERVIEW

<table>
<thead>
<tr>
<th>Room</th>
<th>09:00 – 10:40</th>
<th>11:20 – 13:00</th>
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<th>16:40 – 18:20</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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<td><strong>WF01</strong> Advanced Manufacturing and Packaging</td>
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<td>EuRAD16 Waveforms, EuRAD19 Short Range Radar</td>
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<td>EuRAD22 Closing Session</td>
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<td>EuRAD17 Multistatic and Fusion Techniques, EuRAD20 Phased Array and MIMO Systems</td>
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<td>EuRAD18 Object Classification Techniques, EuRAD21 Radar Signal Processing and Imaging</td>
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<td>WF02 Paradigm Change in Automotive mmWave Radar</td>
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<td>WF03 Innovative THz Technologies for Imaging, Radar and Communication</td>
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<td>WF04 Advanced Processing and Deep Learning Approaches for Indoor Sensing Using Short-Range Radars</td>
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<td>EuRAD Lunch</td>
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<td>SF01 AI Techniques for Microwave Antenna and Filter Design: from Theory to Practice</td>
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**Notes:**
- **WF** sessions are dedicated to Working Groups.
- **Eu** sessions are dedicated to European Societies.
- **EuMW** sessions are dedicated to European Microwave Societies.
- **Students** sessions are dedicated to Student Societies.
- **Exhibitors** sessions are dedicated to Exhibitors.
Venue Overview

ICC Capital Suite - Level 3
Rooms 1 – 17
Exhibitor Workshops: Rooms 2, 3 & 6
EuMC Plenary: Rooms 7 – 12
Coffee breaks (Sunday, Monday and Friday)

5 13
14 12
15 11
16 10
17 9

Kitchen
Reception Space
Reception Space

Custom House for ExCeL London

West Entrance
Platinum Suite
Welcome Reception (Tuesday)
VENUE OVERVIEW

Prince Regent for ICC London

Exhibition Halls N20 – N23
Entrance N11
Poster Panels (Tuesday – Thursday)
Coffee Breaks (Tuesday – Thursday)
MicroApps

Registration
Exhibition Entrance
Delegate Bags

East Entrance
Exhibitor List

A: AFT Microwave GmbH · ALPHA · RLH · American Standard Circuits, Inc. · Analog Devices GmbH · APC Technology Group plc · API Tech · AR Europe Ltd · Artech House Books
B: BAE Systems · Bits & Chips
C: Castle Microwave Ltd · CEA · Cobham Electrical and Electronic Equipment · Copper Mountain Technologies
D: dSPACE GmbH
E: E&T · Electronic Specifier Ltd · ESTER Technopole · ETL Systems Ltd · EuMA · European Microwave Week 2022 · everythingRF
F: Farran Technology Ltd · Filtronic · Focus Microwaves Group · FormFactor · Fraunhofer FHR · Fraunhofer IAF · Fraunhofer Institute for Applied Solid State Physics IAF · Fraunhofer Institute for High Frequency Physics and Radar Technologies FHR
H: Hermetic Solutions Group · hf-Praxis
I: IEEE Microwave Theory and Techniques Society (MTTS) · IEEE Microwaves Magazine · IEEE MTT-s International Microwave Symposium · IET · IHP GmbH · IMST GmbH · Institut d’Electronique, de Microélectronique et de Nanotechnologies (IEMN) · Intellisnect Europe Ltd · Isola GmbH · Junkosha Inc.
K: Keysight Technologies UK Limited · Knowles Precision Devices · KOSTECSYS Co., Ltd
L: L3Harris · Link Microtek Ltd · LPKF Laser & Electronics AG
M: Maury Microwave · MCS Test Equipment · Melcom Electronics Ltd · Mician GmbH · Microwave Applications Group · Microwave Journal · Microwave Product Digest · Microwave Products Group · Microwave Systems JSC · Microwaves & RF · Milexia · Morion, Inc · MPI Corporation · MTR S.R.L.
N: Narda MITEQ · NSI-MI Technologies
O: OKTAL Synthetic Environment · OMMIC · OPHIR RF Inc · Optiprint AG · Optomec
P: Pendulum Instruments S.P. 200 · Planar Monolithics Industries Inc
R: RF MORECOM COREO Co., Ltd · RF-Lambda USA LLC · RFMW UK Ltd · Rogers BV · Rogers Corporation · Rohde & Schwarz GmbH & Co KG · Rosenberger Hochfrequenztechnik GmbH & Co. KG
S: Samtec Europe Ltd · Sensorview Co., Ltd · Serma Group · SIAE MICROELETTRONICA S.p.A. · Sigilent Technologies Germany GmbH · Signal Integrity Journal · Silicon Radar GmbH · Smiths Interconnect · Smith Industries Industrial Group · Sonnet Software · Sumitomo Electric Europe Ltd · Synopsis Corporation Group · Synopsis Technologies · Syntony
T: Tech Comm · TNO Defence, Safety and Security · Triasys
V: Varioprint AG · Virginia Diodes Inc · Vishay Electronic GmbH · VTT · VTT Technical Research Centre of Finland Ltd
W: WAVEPIA Co., Ltd · Wireless Telecom Group
X: XLIM

Latest Update

The information on this Programme Book is subject to change. Please check the latest news and download the final version of the Programme Book at: https://www.eum2021.com

Attendees should check the latest requirement and updated advice concerning access to ExCeL from this website: https://www.excel.london