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10 - 15 JANUARY 2021



**EUROPEAN  
MICROWAVE WEEK**  
JAARBEURS UTRECHT  
THE NETHERLANDS  
10-15 JANUARY 2021  
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EUROPEAN MICROWAVE WEEK 2020

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The European Microwave Week 2020 organisers would like to thank the following companies for their help and valued support throughout this year's event.

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## Welcome to the 23<sup>rd</sup> European Microwave Week

*The Corona virus has swept across the globe. We have managed to move the European Microwave Week from September 2020 to January 2021, because we so much value that real-life, person-to-person interaction. Register and visit!*

***"Be part of the European Microwave Week, that will be remembered as the first big Microwave Conference after Corona."***

Welcome! We are excited to host the European Microwave Week in The Netherlands, the country where it all started in 1998, when three conferences merged into the 'Microwave Week'. This turned out to be a strategic and very successful move: 22 years later this week has grown into the biggest event of its kind in Europe. To me, the week can be summarised in four words: Learn, meet, enjoy and explore!

Learn. This week represents the state-of-the-art in RF, microwaves and radar. Academia and industry present well over 400 scientific talks. Although this is more than any individual can absorb, it guarantees that - if you work in this field - you can pack your week with relevant insights and new developments. Short courses will get you up to speed for new topics, workshops will bring you all the new developments for those already working in the field. Exchange ideas with colleagues from academia and industry. Stay skilled in a world that is changing at an unprecedented rate.

***"If you work in this field - you can pack your week with relevant insights and new developments."***

Meet. This week is where the entire community meets. Meet, to interface with all the relevant industries at the largest microwave and radar tradeshow - this tradeshow alone is more than worth a visit! Stop by the EuMA booth and become a member. That is the first step to get involved in volunteering: Do so for a few years and suddenly realise that you actually know all the famous names in microwaves and radar. Meet, to learn before things even get published. Meet old friends to catch up, meet to make new friends that last a lifetime.

Enjoy. This week's venue maximally facilitates learning and meeting. Utrecht is a historic place that welcomes visitors warmly. Enjoy its canals, churches, modern and ancient art, and over 3000 years of history. Enjoy its famous music scene, century-old restaurants, bars and nightlife. Enjoy the Railway museum where we will host a splendid dinner amidst historic trains. Enjoy the pub crawl and dancing festivities organised by us for you in the heart of the city. Both the conference venue and city centre are within five minutes walking from the railway station, so be prepared to combine work and fun!

***"With over 400 scientific papers, around 30 workshops and short courses this will more than satisfy your scientific thirst."***

EuMIC, EuMC, EuRAD. The European Microwave Integrated Circuits Conference, the European Microwave Conference and the European Radar Conference together form the scientific heart of the Microwave Week. Keynote speakers from around the globe to inspire our audience, semiconductors that literally work up to a THz, dedicated sessions on Teaching Microwave Engineering, a Focus Day on (Active) Array Antennas, there is just too much to name it all here. Female talent can meet their peers and get together during the Women-in-Microwaves event. EuMC, the oldest of the conferences involved, will be celebrating its 50<sup>th</sup> anniversary, which is the reason for the golden crown over this year's logo.

***"We invite you to immerse yourself in the culture, art and history of Utrecht."***

Explore! Browse through this programme to learn about the student activities (including a drone-detecting challenge: build a team, receive hardware and demonstrate your performance on-site), the different fora (the Defence, Security and Space Forum on Space Situational Awareness, the Automotive Forum, this year particularly on waveforms and AI in automotive radar, and the new 5G Forum that bridges the gap between business and technology), a workshop on Quantum Computing for Electronic Engineers, and there is something on 5G at virtually every time-slot. This week is so packed with science and fun, that you'll regret going home when the week is over!



FRANK VAN VLIET

General Chair  
TNO, The Netherlands &  
University of Twente, The Netherlands



BART NAUWELAERS

General Co-Chair  
KU Leuven, Belgium

## Welcome from the President of the European Microwave Association

On behalf of the European Microwave Association (EuMA), I warmly welcome you to the 23<sup>rd</sup> edition of the European Microwave Week in Utrecht! EuMA stands up for our microwave and RF community. We promote our microwave discipline wherever we can. We foster networking between scientists, engineers, decision makers and end-users. We pursue this in various ways. The European Microwave Week (EuMW) is our main asset and key event to do so.

EuMA is continuously improving itself to support our microwave community as good as possible. We recently released a 22 pages White Paper "For a Strong & Competitive European Wireless Technologies Ecosystem". This paper substantiates the strategic importance of wireless technologies for the 4<sup>th</sup> European Industrial Revolution and the digital European society. A free download is available at our website: [www.eumwa.org](http://www.eumwa.org).

EuMA actively supports education and offers to young researchers each year a number of scholarships at selected European industries and research institutes. The deadline of the next call is 28 November 2020. If you want to be a host for the 2021 edition please contact the EuMA Innovation Team at [innovationteam@eumwa.org](mailto:innovationteam@eumwa.org).

Most of you are familiar with EuMA,

but for those who aren't yet: We offer a membership to all working in the field of microwaves. If you are not a EuMA member yet, I encourage you to join. As member, you will enjoy reduced fees for attending the Week and other EuMA-sponsored conferences and workshops as well as the IEEE IMS and the APMC. You'll also have access to an archive of publications and the online version of the International Journal on Microwave and Wireless Technologies.

The European Microwave Week (EuMW) is the premier microwave conference and exhibition event in Europe. The success of the EuMW is also a result of the collaboration with the IEEE MTT Society (technical co-sponsor of the Week) and the GAAS Association (co-sponsor of EuMIC). But the Week is not only conferences, the Exhibition organised by our long-standing partner Horizon House / Microwave Journal forms an integral part of it.

As everybody knows, preparing and hosting the EuMW is a major effort, from paper submission and review to on-site organisation at the venue, and this is accomplished by a team of volunteers year by year. Therefore, my special and sincere thanks go to Frank VAN VLIET and Bart NAUWELAERS, 2020 General Chair and Vice-chair; to Alex YAROVVOY, General TPC Chair; to Marcel VAN DER GRAAF,

Operational Officer; to Laura ANITORI Workshops and Short Courses Chair; to Ioan LAGER, Treasurer; as well as to Wim VAN CAPPELLEN and Dominique SCHREURS, EuMC Chair and TPC Chair; to François DEBORGIES and Domine LEENAERTS, EuMIC Chair and TPC Chair; and to Mayazurra RUGGIANO and Jacco DE WIT, 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 The Netherlands after the successful events in 1998, 2004, 2008 and in 2012. All members of the team have been working hard to set up an outstanding technical and scientific programme for you and I am sure they will make your stay in Utrecht exciting, enjoyable, and a rewarding experience of Dutch hospitality. I congratulate the team with a lot of very nice innovations like the Chinese Call for Papers.

I would like to cordially invite you to the EuMW 2020. Come to the wonderful city of Utrecht. Join us at EuMW 2020 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 Utrecht! And most of all: Get involved in our community!



FRANK  
VAN DEN BOGAART  
President  
European Microwave Association

**EuMA is now also very active on various social media. Follow us @eumassociation on Facebook, LinkedIn, Twitter and Instagram.**

## Welcome to the 15<sup>th</sup> European Microwave Integrated Circuits Conference

It is with immense pride that we would like to welcome you all to Utrecht, The Netherlands, for the 15<sup>th</sup> European Microwave Integrated Circuits (EuMIC 2020) Conference. For once, the Conference will not happen in autumn but will be held on Monday the 11<sup>th</sup> and Tuesday the 12<sup>th</sup> of January 2021. Since we do not change a winning team, the EuMIC conference has been jointly organised by the GAAS<sup>®</sup> Association and EuMA, as ever since 2006. The city of Utrecht is very pleased to host the gathering of microwave experts and IC designers from all over the world.

This conference would not be without the efforts of the numerous authors trying to disseminate their work, and the dedication of the panel of reviewers and TPC members to spend their free time making the best selection in order to provide the most attractive programme. No one would imagine a major Conference without Workshops and Short Courses for which the organisers strive to gather key experts to cover the latest developments. We also have to acknowledge the previous EuMIC teams who did not spare their time to provide precious support. Finally, we would also like to thank all the people who never come under the spotlight though helping tremendously to make this Conference possible.



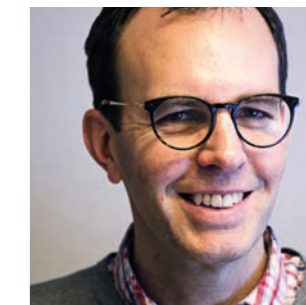
FRANÇOIS DEBORGIES  
EuMIC Chair  
ESA, The Netherlands



STEFAN HEINEN  
EuMIC Co-Chair  
RWTH Aachen University, Germany



DOMINE LEENAERTS  
EuMIC TPC Chair  
NXP, The Netherlands



CHRISTIAN FAGER  
EuMIC TPC Co-Chair  
Chalmers University of Technology, Sweden

The EuMIC "raison d'être" is to provide a unique forum where both seasoned experts and new comers can exchange, learn, disseminate on any topic which relates to high frequency integrated circuits. Indeed, there is no proper design of an MMIC or RFIC without state of the art models, no good device without clever semiconductor engineering, no way to meet stringent requirements without bright and fresh ideas and no chance to convince a customer without sound measurements!

If you intend to be there already on Sunday and can refrain from enjoying Utrecht during the day, do register for one or more of the very good Workshops and Short Course. Monday is a busy day with a large offering: beyond the Opening Session, there will be nine regular sessions and the traditional EuMIC Get-together to conclude the day. On Tuesday, which hosts the Opening of the EuMW 2020, EuMIC offers two regular sessions, one joint session with EuMC, the Foundry Panel Session, the interactive Poster Session that will be preceded by a one-minute pitch for all presenters, and the Closing Session.

The EuMIC Opening Session will feature two distinguished invited speakers. Prof. John D. Cressler of Georgia Tech will break the mold by looking at SiGe Technology in Ways That Were Never Envisioned, while Prof. Alwyn

Seeds of University College London will present the recent developments in Photonic Integrated Circuits for Microwave Applications.

This year, the EuMIC Closing Session will start with the celebration of our best contributors. Indeed the EuMIC Prize for the best-contributed paper and the EuMIC Young Engineer Prize will be awarded by the EuMIC Prize Committee. Three GAAS<sup>®</sup> Association PhD student fellowships will also be awarded. This session will be concluded by two application-oriented presentations. Igor Tasevski, Vice President & Head of Product Development Unit Radio at Ericsson will explore Radio ICs for future wireless networks while Ville Kangas, Arctic Weather Satellite Project Manager at the European Space Agency will look at MetOp Second Generation mm-Wave Instruments and Technologies.

We have done all we could do to make this Conference a reality but only you, the attendees, can turn EuMIC 2020 into a success. The EuMIC team is looking forward to meet you: Hartelijk Welkom in Utrecht!

## Welcome to the 50<sup>th</sup> European Microwave Conference

With great pleasure and honour, the EuMC 2020 team warmly welcomes you to the 50<sup>th</sup> Microwave Conference, celebrating its golden edition! The history of the EuMC dates back to 1969, when the conference first took place in London. Since then, the conference has evolved into 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/millimeterwave circuits and antenna (arrays), up to system level, with innovative solutions for e.g., biomedical, mobile, and IoT applications.

We have done our very best to offer you an attractive conference where you can present your research and meet colleagues, learn about the latest trends and broaden your horizons, be inspired by world-leading keynote speakers from academia and industry, be exposed to the latest products in the exhibition, and make new friends. Our efforts have led to a rich program throughout the entire week. On Sunday and Monday there are 12 EuMC workshops and short courses on hot-topics, such as RF Technologies for 5G, and Advanced Measurement Techniques for Next Generation Communication Systems. Tuesday morning features the EuMW/EuMC Plenary Opening Session where Lars Reger, Executive Vice President & CTO at NXP Semiconductors, will present

the keynote speech "How Connectivity Technologies are Changing Vehicles". Tuesday afternoon, we will host again the Women in Microwaves (WiM) event. This year's WiM event comprises presentations and a panel discussion of leading female scientists from academia and industry. The conference sessions on Tuesday have tracks on power amplifiers, (integrated) antennas, packaging, THz electronics and photonics, and EM field theory and numerical techniques. On Wednesday, the program continues with more sessions on power amplifiers, passive components and filters, metamaterials, IoT, and Energy Harvesting Technologies. In addition, there is the highly recommended short course "Quantum Computing for Electrical Engineers" with 7 talks from experts in the field, organized in three main themes: quantum-computing fundamentals, physical platforms for quantum processors, and electronic interfaces for quantum computers. Plus a focused session on Innovative Antennas for Cubesats and Small-Space platforms. On Thursday, there are sessions on front ends, planar filters, biomedical applications, and characterisation techniques. The Netherlands is hosting an enormous amount of phased array research and development at universities, research institutes, and industry. Thursday is therefore designated as our special day on array technologies. An overview on the latest phased array

developments in Radio Astronomy, Space, and Defence are presented in three special sessions. 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 Hughes Boulnois (Airbus DS) "The Future of High-Throughput Satellites is Laser SatCom" and a keynote on New Frontiers for Wave Engineering Using Metamaterials by Andrea Alù, Founding Director and Einstein Professor at the Photonics Initiative, CUNY Advanced Science Research Center, USA. Last but not least, there are four more short courses and workshops on Friday.

A new element of the 2020 conference are 1-minute poster pitches: In the slot before the morning coffee, the poster presenters of the poster sessions will be pitching their work in the Media Arena for exactly one minute. Action and fun are guaranteed with big traffic lights for the timing, a timer counting down and a big red emergency button.

We hope that you will have a great time at the EuMC. Enjoy the conference!



**WIM VAN CAPPELLEN**  
EuMC Chair  
ASTRON, The Netherlands



**DOMINIQUE SCHREURS**  
EuMC TPC Chair  
KU Leuven, Belgium

## Welcome to the 17<sup>th</sup> European Radar Conference

It is with great pleasure that the EuRAD 2020 team welcomes you to the 17<sup>th</sup> European Radar Conference, the key European event for the present status and future trends in the field of radar research, technology, system design, and applications. It covers a wide variety of topics, ranging from radar components and systems, radar propagation and target modelling, advanced signal processing techniques, up to the most innovative radar architectures and concepts and the latest applications.

We are proud to host EuRAD 2020 from 13<sup>th</sup> to 15<sup>th</sup> January 2021 in Utrecht at the Jaarbeurs, providing an ideal setting from plenary sessions to regular sessions, and individual discussions to workshops. Joining this conference is the ideal opportunity to keep up-to-date with the latest achievements in radar and to interact with international experts from industry and academia. The conference brings together radar experts, researchers, designers, and developers from all over the world to continuously stimulate innovation and benefit from cross-fertilization between applications. This year, the conference embraces the theme of "Awareness through Radar", this thread links the plenary talks with the entire conference program, including the Space Situational Awareness Forum and the Automotive Forum.

In the opening session on Wednesday, two excellent keynote speakers will address important aspects of radar for space observations and naval ballistic missile defense. Goutam Chattopadhyay, senior research scientist at NASA Jet Propulsion Laboratory, will present 'Millimeter-Wave and Terahertz Radar Instruments for Planetary, Cometary, Earth Observations, and Security Applications'. The second invited speaker is Captain Jorn Bleijs, Director of Weapon and Sensor Technology for The Netherlands Defence Material Organisation in the Maritime Systems Department, who will give a talk entitled 'One step ahead of the enemy: innovative radar solutions are decisive for military use'. The EuRAD Opening is held in conjunction with the Defence, Security and Space Forum (DSS), which focuses further on Space Situational Awareness. For the closing session on Friday, an excellent speech will address the evolution of radar suites in the context of the Dutch frigate replacement program. The invited speaker is Winston van Oosterhout, Technical Director at Thales Nederland B.V., who will give a talk on "Multi-Band functionally integrated Multi-Function Radar sensor suites". The opening and closing sessions thus complement each other providing contributions from research institution, government, and industry.

This year 175 papers were submitted to the conference and, after a rigorous selection process, 105 papers have been accepted and were organised into 20 oral sessions, one of them shared with EuMC, and one interactive poster session. Nine industrial keynotes are distributed over the oral sessions addressing recent innovation highlights. Additionally a focus session will address radar interference cancellation and waveform agility. Furthermore a number of special sessions will detail specific topics of interest, including one on Electronic Surveillance and Defence. Five attractive workshops and three short courses will complete and enhance the EuRAD programme, some of them shared with EuMC, on key topics like automotive in-cabin radar and networks with sensor fusion, micro-Doppler radar, multi-beam antennas and beamforming networks, radar system solutions for industrial and consumer sensing, MIMO radar, and cognitive radar signal processing.

We would like to express our deep gratitude to all the reviewers and the TPC members for undertaking their task in a professional and timely manner, and finally to all EuRAD conference delegates for your invaluable contribution to the success of EuRAD 2020. We look forward to meeting you at the EuRAD 2020 conference, and wish you an excellent stay in Utrecht!



**MAYAZZURRA RUGGIANO**  
EuRAD Chair  
Thales Nederland B.V.,  
The Netherlands



**JACCO DE WIT**  
EuRAD TPC Chair  
TNO, The Netherlands

## Welcome from the General TPC Chair

It is my sincere pleasure to welcome the European Microwave Week in the Netherlands in historical and at the same time very young city of Utrecht. For almost two years the Technical Program Committee worked hard to make this Dutch-Belgium Edition of the Week a great success.

A good program starts from good papers. Responding to our call for papers the authors from 61 country throughout the globe submitted 838 papers, with the majority of papers outside of the European Union. The first three largest national paper contributors to the week are Germany, China and the Netherlands. As General Technical Programme Committee Chair, I am very grateful to all reviewers and TPC members who are volunteering in the challenging time of corona crisis to make great technical program for EUMW 2020. More than 500 reviewers have laid down a solid basis for the paper selection by providing from 5 to 7 professional reviews per each submitted paper. For the first time in the history of the European Microwave Week all submitted papers were checked for (self) plagiarism using the standard IEEE tool. The Technical Program Committee with 104 members in virtual TPC meeting on March 28 have decided on paper selection having an acceptance rate of around 62 % (including focused sessions). These contributed papers have been complimented with

carefully selected industrial keynote presentations and special sessions resulting in total 91 oral sessions and 4 poster sessions. The sessions are placed in the conference matrix as much as possible along topical lines. From submitted papers we could clearly see the major trends in development in a broad field of microwaves: from circuitry to systems. To emphasize these trends, we enriched the program with three dedicated forums: DSS Forum on Space Situational Awareness, Automotive Forum and 5G Forum. The program is completed with carefully tuned workshops and special courses on topics of high interest to the microwave community.

The technical program has been managed through a new version of software system and I would like to thank Marc van Heijningen, Cristina Andrej and the staff from CONVERIA, who have efficiently contributed to the final programme preparation via setting up and managing the CONVERIA system. Special thanks to Marcel van der Graaf for his excellent support of TPC work at all stages. I also would like to express my gratitude to the TPC chairs of the individual conferences Dominique Schreurs, Domine Leenaerts and Jacco de Wit, general TPC co-chair Ronny Harmonnijn, WS coordinator Laura Anitori and Focussed/Special Session coordinator Stefania Monni for very efficient team work.

I wish you to enjoy the conference program, meet microwave community at the conference and at the exhibition, visit beautiful down town of Utrecht, recharge your batteries and be inspired by new ideas. Looking forward to meeting you in January in Utrecht.



**ALEXANDER YAROVY**  
General TPC Chair  
Delft University of Technology  
The Netherlands

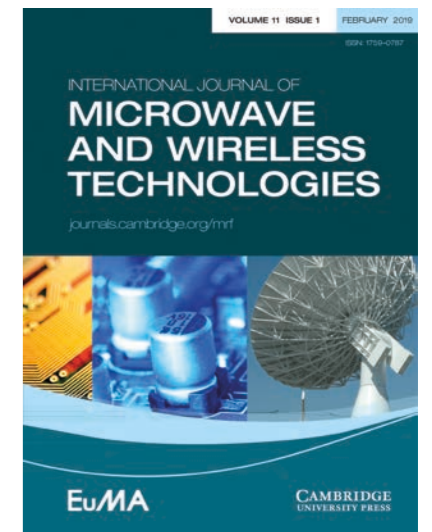
## International Journal of Microwave and Wireless Technologies: EuMW 2020 Special Issue

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

The journal is published ten times a year. It allows academic and industrial researchers to promote their work and stay connected with the most recent developments in microwave and RF technology. The journal is referenced in databases such as Scopus and Google Scholar and is indexed in the Thomson Reuters Web of Science. Following the success of previous microwave weeks, the journal will again publish a special issue dedicated to European Microwave Week 2020.

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 Dominique Schreurs, TPC chair of EuMC 2020, Domine Leenaerts, TPC chair of EuMIC 2020, and Jacco de Wit, TPC chair of EuRAD 2020.

Accepted papers will be published online at <http://journals.cambridge.org/MRF> and can be referenced using their DOI (Digital Object Identifier). Once all submissions are received, the articles will be collated into the Special Issue and published in print, which is expected to appear in June 2021.

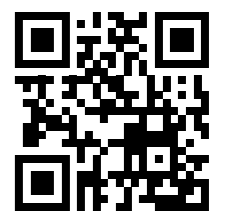


**DOMINIQUE SCHREURS**  
EuMC 2020 TPC Chair

**DOMINE LEENAERTS**  
EuMIC 2020 TPC Chair

**JACCO DE WIT**  
EuRAD 2020 TPC Chair

## Follow us on Social Media



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EuMA Social Media Officer

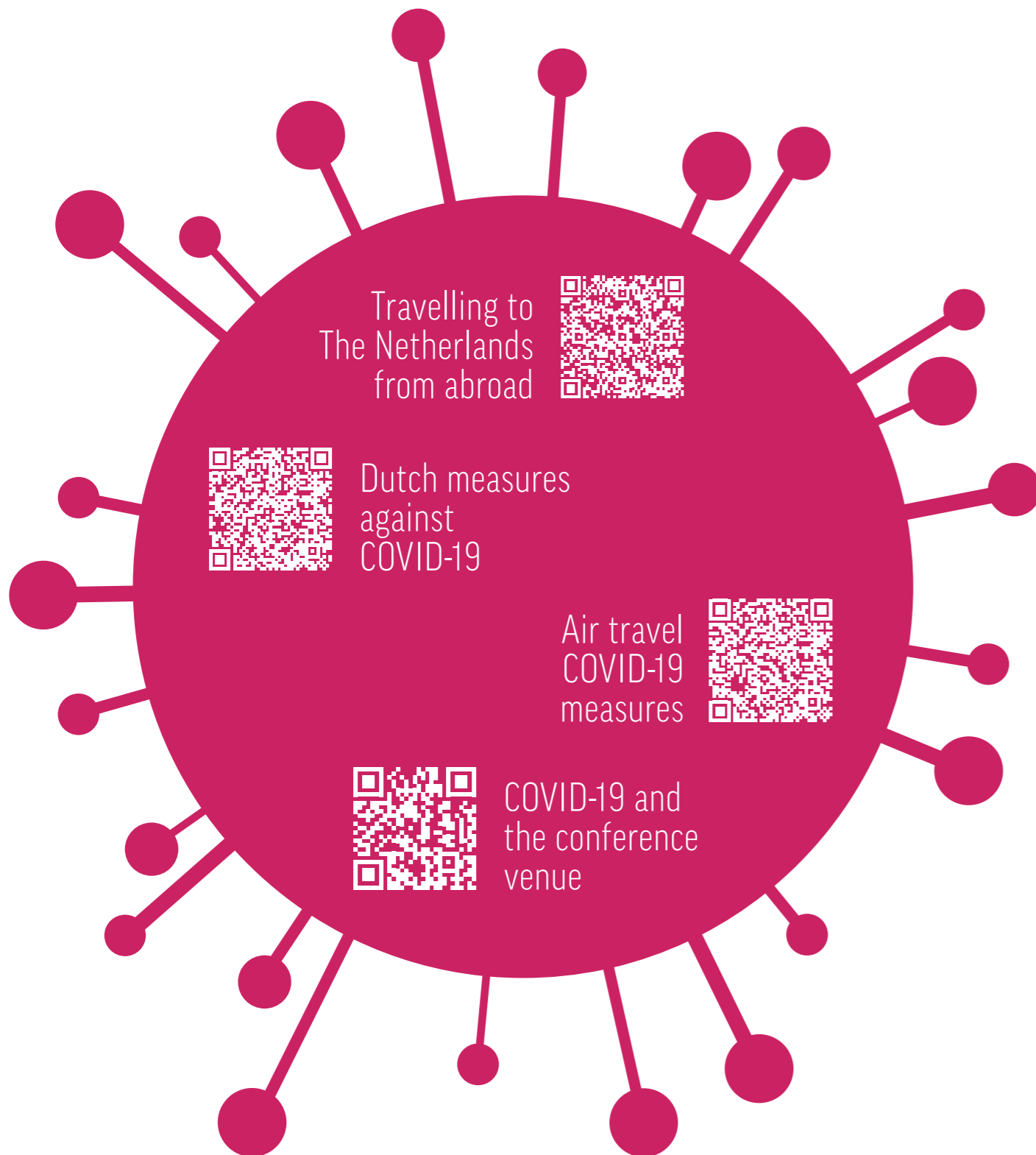
**SOFIA KOTTI**  
EuMW 2020 Social Media Officer

# COVID-19

8 May 2020



Government of the Netherlands



## Hygiene rules for everyone

We can only take the next step forward if everyone follows these rules.



**Wash your hands frequently.**

- Wash your hands before going out, when you return home, after blowing your nose, before eating and after going to the toilet.
- Wash your hands for 20 seconds with soap and water. Dry them thoroughly.



**Cough and sneeze into your elbow.**



**Use paper tissues to blow your nose.**

- Discard tissues immediately after use.
- Always wash your hands after blowing your nose.



**Don't shake hands.**



**Keep a distance of 1.5 metres from others.**

- This does not apply to people living in one household.
- Keeping two arms lengths away reduces the risk of people spreading the infection.

### COVID-19 EXTENDED REFUND POLICY

We understand that uncertainty about the development of the COVID-19 virus is a big concern to many of us. In addition to the regular refund policy, we have therefore implemented an EuMW 2020 extended

refund policy where you can cancel your participation in the EuMW 2020 conferences due to COVID-19 related circumstances (including company travelling policies) up to 31 December 2020, and get a full refund of

your conference registration fees. No questions asked, no further conditions. It's just another measure that we take to make your life as safe as possible, taking care of at least one uncertainty for you

**alleen samen krijgen we corona onder controle**

More information:  
[rijksoverheid.nl/coronavirus](https://rijksoverheid.nl/coronavirus)  
0800 1351

# The EuMW 2020 Organising Committee



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University of Twente - The Netherlands



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**Marc van Heijningen**

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The Netherlands



**Marco Martorella**

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**Patrice Gamand**

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**Patrick Hindle**

DSS Forum, Microwave Journal  
United Kingdom



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Hotels and Partner Programme  
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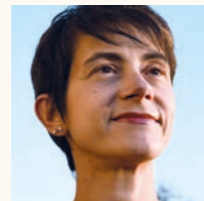
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Publication Chair  
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**Ulf Johannsen**

Student Activities Chair &  
Career Platform Chair  
Eindhoven University of Technology  
The Netherlands



**Stefania Monni**

Focused and Special Sessions Chair  
TNO - The Netherlands



**Laura Anitori**

Workshop and Short Courses Chair &  
Attendee Survey Officer  
TNO - The Netherlands



**Marion Matters-Kammerer**

Awards and Prizes Chair & WiM Chair  
Eindhoven University of Technology  
The Netherlands



**Annemie van Nieuwerburgh**

EuMA Headquarters Assistant  
Belgium



**Thomas Zwick**

Automotive Forum Chair  
Karlsruhe Institute of Technology  
Germany



**Frank Gruson**

Automotive Forum Co-Chair  
Continental AG - Germany



**Martin Kunert**

Automotive Forum Co-Chair  
Robert Bosch GmbH - Germany



**Cicero Vaucher**

Automotive Forum Local Arrangements  
Chair  
NXP - The Netherlands



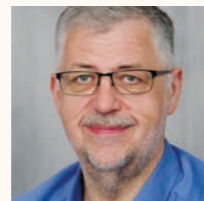
**François Deborgies**

EuMIC Chair  
ESA - The Netherlands



**Domine Leenaerts**

EuMIC TPC Chair  
NXP - The Netherlands



**Stefan Heinen**

EuMIC Co-Chair  
RWTH Aachen University - Germany



**Christian Fager**

EuMIC TPC Co-Chair  
Chalmers University of Technology  
Sweden



**Wim van Cappellen**

EuMIC Chair  
ASTRON - The Netherlands



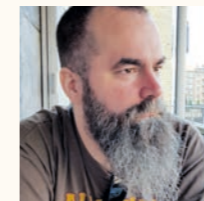
**Dominique Schreurs**

EuMIC TPC Chair  
KU Leuven - Belgium



**Bart Smolders**

5G Forum Chair  
Eindhoven University of Technology  
The Netherlands



**Ulf Gustavsson**

5G Forum Co-Chair  
Ericsson - Sweden



**Toon Norp**

5G Forum Co-Chair  
TNO - The Netherlands



**Henri Werij**

Sponsoring Advisor  
Delft University of Technology - The  
Netherlands



**Mayazzurra Ruggiano**

EuRAD Chair  
Thales Nederland B.V.  
The Netherlands



**Jacco de Wit**

EuRAD TPC Chair  
TNO - The Netherlands



**Cristina Andrei**

EuMA Conference Software Officer  
Brandenburg University of Technology  
Germany



**Matthias Rudolph**

Electronic Submission Advisor  
Brandenburg University of Technology  
Germany



**Daryna Pesina**

EuMA Social Media Officer  
O. Ya. Usikov Institute for Radiophys-  
ics and Electronics NAS - Ukraine



**Sofia Kotti**

Workshop and Short Courses Co-Chair  
& Social Media Officer  
TNO - The Netherlands



**Mark Oude Alink**

Interactive Sessions Chair  
University of Twente - The Netherlands



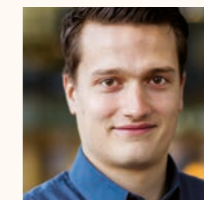
**Hao Gao**

VISA Chair  
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**Harijot Bindra**

VISA Co-Chair  
University of Twente - The Netherlands



**Niels Vertegaal**

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The Netherlands



**Willem Hol**

EuMA Liason  
EuMA - The Netherlands



**Michel Zoghob**

Event Director  
Horizon House - United Kingdom



**Julie Mills**

Event Manager  
Horizon House - United Kingdom



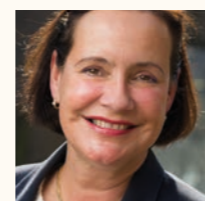
**Tamara Boogaard**

Key Account Manager Jaarbeurs  
Jaarbeurs - The Netherlands



**Corry Neggers**

Conferences Manager Jaarbeurs  
Jaarbeurs - The Netherlands



**Monique André de la Porte**

Utrecht Convention Bureau  
The Netherlands



**Sander Bronckers**

Student Helpers Coordinator  
Eindhoven University of Technology  
The Netherlands



**Jaap Essing**

Tom Brazil Doctoral School of  
Microwaves Chair  
TNO - The Netherlands



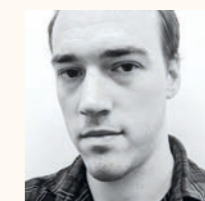
**Jean-Luc Polleux**

Career Platform Advisor  
Université Paris Est, ESYCOM, CNRS,  
ESIEE Paris - France



**Thierry Parra**

Attendee Survey Officer  
University of Toulouse, CNRS,  
LAAS - France



**Daniel Stokes**

Attendee Survey Officer  
National Physical Laboratory  
United Kingdom



## In Memoriam: Roberto Sorrentino

Professor Roberto Sorrentino died on Tuesday, 3 March 2020. Roberto Sorrentino was an electronics engineer who had a distinguished career in the field on microwave and millimetre-wave circuits and antennas. He received in recent years the IEEE Microwave Career Award, the EuMA Distinguished Service Award and the Order of Merit of the Italian Republic. He received his doctoral degree in electronic engineering from the University of Rome "La Sapienza", Rome, Italy, in 1971 and he began his career as an Assistant Professor at "La Sapienza" University in 1974. From 1986 to 1990 he was a Professor at the University of Rome "Tor Vergata" and in November 1990 he became a Professor at the University of Perugia. Between 1983 and 1986 he was a Research Fellow at the University of Texas at Austin, where he worked with Professor Tatsuo Itoh. In 2007 he founded RF Microtech s.r.l., a successful spin-off company from the University of Perugia specialising in microwave and radio-frequency technologies. This Umbrian company became a leader in the field of antenna design and satellite communication systems, employing 25 staff. He was the author of more than 150 technical papers in international journals and 200 refereed conference papers and he wrote and edited several books for John Wiley and McGraw-Hill.



Roberto Sorrentino was one of the six Founder Members of the European Microwave Association, which was created in 1998 to manage the annual European Microwave Conference and to create the European Microwave Week. He attended EuMC annually from 1973 and was deeply involved in the Technical Programme Committee and Management Committee. He served as the first President of the Association from 1998 to 2009. In 2010 the EuMA presented him its Distinguished Service Award. In 2014 he was the General Chair of the 17<sup>th</sup> European Microwave Week, held in Rome.

An active member of the IEEE and the Microwave Theory and Techniques Society (MTT-S) throughout his career, he was elected an IEEE Fellow for his contribution to the modelling of planar and quasi-planar microwave and millimetre-wave circuits. In 1993 he received the IEEE MTT-S Meritorious Service Award, in 2000 the IEEE Third Millennium Medal, in 2004 the IEEE MTT-S Distinguished Educator Award, and in 2015 the IEEE Microwave Career Award. In 2012, with S Bastioli and C Tomassoni, he received the MTT-S Microwave Prize for the paper "A New Class of Waveguide Dual-Mode Filters Using TM and Nonresonating Modes", published in the MTT Transactions.

Roberto Sorrentino was the Chair of the IEEE Section of Central and South Italy, founded and chaired a local MTT/AP Chapter, was the Editor-in-Chief of IEEE Microwave and Guided Wave Letters, served on the MTT AdCom, sat on Technical Committees MTT-15 on Field Theory and MTT-1 on Computer-Aided Design, the Editorial Board of the Proceedings of the IEEE and the IEEE Electromagnetics Award Committee.

He was Vice Chair and then Chair of the International Union of Radio Science (URSI) Commission D (Electronics and Photonics) and from 2007 he was the President of the Italian Commission of URSI. He was one of the founders and from 2002-08 the first

President of the Italian Electromagnetic Society (SIEm).

In January 2020 Roberto Sorrentino was awarded the prestigious honour of the Grand Officer of the Order of Merit of the Italian Republic for his commitment in the field of research. The award was conferred by the Head of State, Sergio Mattarella, on the proposal of the Prime Minister Giuseppe Conte.

Roberto Sorrentino was an outstanding member of our technical community because his achievements combined excellence in different fields. He enjoyed a high reputation as a scientist due to his many significant technical contributions throughout his career. He was a gifted educator and many of his former PhD students are now well-respected members of the microwave community, in Italy and internationally. And, at the same time, he was active as a technical manager, founding a successful spin-off company and running it until after his retirement. Altogether, this is a truly impressive record only very few in our community can demonstrate.

Beyond this, Roberto Sorrentino was always a communicative person, with an open and friendly attitude, building bridges and bringing people together and initiating collaboration between groups in different countries all over the world. The international microwave community is indebted to him for his dedication and his many contributions.

As the European Microwave Association, we have lost a founder, our first President and one of our most active members. More than this, he was a friend to many of us. Our sympathy and our thoughts are with his wife Linda and his family.

## 2019 European Microwave Week in Paris Best Paper Prizes: EuMIC

**EuMIC Prize**  
Sponsored by EPIGAN



EPIGAN representative - Co-Author Arij Battikh - EuMIC Chair



Co-Author Arij Battikh - GAAS<sup>®</sup> Association Representative - EuMIC Chair

Paper Title

Non-linear Modeling and Harmonic Balance Simulations of Track and Hold Amplifier

Authors

Dr. Abhijeet Dasgupta<sup>1, 2</sup>; Arij Battikh<sup>1, 2</sup>; Prof. Guillaume Neveux<sup>1</sup>; Prof. Denis Barataud<sup>1</sup>; Dr. Cédric Chambon<sup>2</sup>

<sup>1</sup> XLIM Research Institute - UMR CNRS 7252; <sup>2</sup> Callisto Space

**EuMIC Young Engineer Prize**  
Sponsored by ENKRIS



Lucas Nyssens - EuMIC Chair - ENKRIS representative



Lucas Nyssens - GAAS<sup>®</sup> Association Representative - EuMIC Chair

Paper Title

Effective Resistivity Extraction of Low-Loss Silicon Substrate at Millimeter-Wave Frequencies

Authors

Lucas Nyssens; Martin Rack; Prof. Jean-Pierre Raskin  
Université catholique de Louvain

## 2019 European Microwave Week in Paris Best Paper Prizes: EuMC

### EuMC Microwave Prize

Sponsored by Thales Alenia Space, Toulouse, France



Thales Alenia Space representative - Akanksha Bhutani - EuMC Chair

#### Paper Title

122 GHz FMCW Radar System-in-Package in LTCC Technology

#### Authors

Akanksha Bhutani<sup>1</sup>; Dr. Benjamin Goettel<sup>2</sup>; Dr. Mario Pauli<sup>1</sup>; Prof. Thomas Zwick<sup>1</sup>

<sup>1</sup> Karlsruhe Institute of Technology; <sup>2</sup> Wellenzahl GmbH & Co. KG

### EuMC Young Engineer Prize

Sponsored by Thales DMS



Award Chair - Thales DMS representative - Maxwell Duffy - TPC General Chair

#### Paper Title

Discrete Supply Modulation of a Three-Stage K-Band PA

#### Authors

Maxwell Duffy; Dr. Gregor Lasser; Prof. Zoya Popovic; CU Boulder

### EuMC Young Engineer Prize

Sponsored by FormFactor



FormFactor representative - Audrey Cayron - Award Chair

#### Paper Title

Wideband and Compact 3-D Quadrature Coupler for 5G Applications

#### Authors

Audrey Cayron<sup>1,2</sup>; Dr. Christophe Viallon<sup>3,1</sup>; Dr. Ayad Ghannam<sup>4</sup>; Dr. Alessandro Magnani<sup>4</sup>; Prof. Thierry Parra<sup>3,1</sup>

<sup>1</sup> LAAS-CNRS; <sup>2</sup> INSA Toulouse; <sup>3</sup> Université de Toulouse; Paul Sabatier; <sup>4</sup> 3DiS Technologies

## 2019 European Microwave Week in Paris Best Paper Prizes: EuRAD

### EuRAD Prize

Sponsored by Thales Nederland B.V.



EuRAD Co-chair and Chair - Ingrid Ullmann - Thales Nederland B.V. representative - EuRAD TPC Co-Chair and Chair

#### Paper Title

SAR Based Non-Destructive Evaluation of Irregularly Shaped Objects with Simultaneous Estimation of Geometry and Permittivity

#### Authors

Ingrid Ullmann, Julian Adametz, Martin Vossiek, Institute of Microwaves and Photonics, Friedrich-Alexander University, Erlangen, Germany

### EuRAD Young Engineer Prize

Sponsored by HENSOLDT



HENSOLDT representative - Daniel Tajik - EuRAD Chair and Co-Chair - EuRAD TPC Chair and Co-Chair

#### Paper Title

Improving Quantitative Microwave Holography Through Simultaneous Use of the Born and Rytov Approximations

#### Authors

Daniel Tajik, Natalia K. Nikolova, Michael D. Noseworthy, McMaster University, Hamilton, Ontario, Canada

### GAAS<sup>®</sup> Ph.D. Student Fellowship



The GAAS<sup>®</sup> Association sponsors three student fellowships of €2,000 each, to be given to young full-time Ph.D. students each having an accepted paper at EuMIC 2020. The purpose is to recognise and provide financial assistance to international Ph.D. students who show promise and interest in pursuing a graduate degree in microwave electronics. In 2019, the three fellowship recipients were: Alberto Maria Angelotti, Abdul Ali and Babak Jamali (absent on the day of award).

#### 1<sup>st</sup> Fellowship Recipient: Alberto Maria Angelotti



Alberto Maria Angelotti - GAAS<sup>®</sup> Association Representative - EuMIC Chair

#### 2<sup>nd</sup> Fellowship Recipient: Abdul Ali



Abdul Ali - GAAS<sup>®</sup> Association Representative - EuMIC Chair

## EuMA Pioneer Award



KOJI MIZUNO

Koji Mizuno, received the B.Eng., M.Eng., and D.Eng. degrees in electronic engineering from Tohoku University, Sendai, Japan, in 1963, 1965, and 1968, respectively. In 1968, he joined the Department of Electronic Engineering, Tohoku University as a Research Associate. He was appointed Professor of Electron Devices at the Research Institute of Electrical Communication (RIEC), Tohoku University in 1984. In March 2004 he retired from his appointment to become an Emeritus Professor.

He spent a sabbatical at Queen Mary College, University of London under the sponsorship of the SRC (Science Research Council, United Kingdom) in 1972–1973, and in 1990 he spent a six-month sabbatical at the California Institute of Technology, Pasadena and Queen Mary and Westfield College, London under the sponsorship of Monbusho (Ministry of Education, Science and Culture, Japan). From 1990 to 1998 he was a team leader of the Photodynamics Research Center, the Institute of Physical and Chemical Research (RIKEN), Sendai, where he ran a laboratory for THz research at the same time as he ran the laboratory at Tohoku University. He has been interested in the millimeter and THz region of the electromagnetic wave spectrum, and particularly in developing technologies of detection, generation and applications in this frequency regime.

He was awarded the IEEE Fellow grade in 1993, the Kenneth J. Button Medal in 1998, the Minister Award of MEXT (Ministry of Education, Culture, Sports, Science and Technology, Japan) in 2003, the Distinguished Educator Award of the IEEE MTT (Microwave Theory and Techniques) Society in 2005, and the Exceptional Service Award of the International Society of Infrared, Millimeter, and Terahertz Waves (IRMMW-THz) in 2015.

## EuMA Distinguished Service Award



RAYMOND QUERE

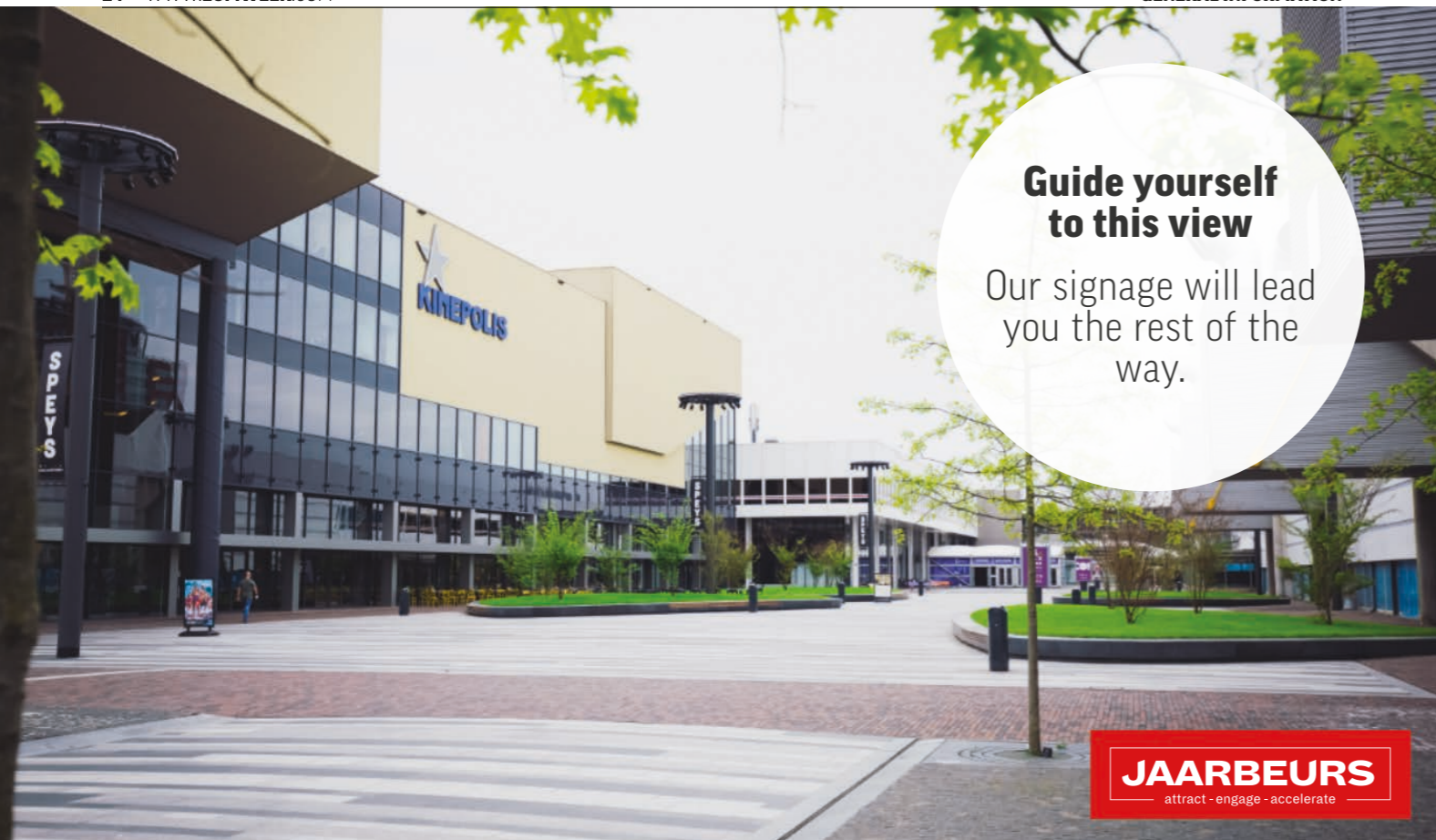
Raymond Quéré, received the engineering degree from ENSEEIHT- Toulouse (France) in 1976, the French "agrégation" in applied sciences in 1978 and a PhD in electronic engineering from the University of Limoges in 1989. He was appointed professor at the University of Limoges in 1992 where he led researches on nonlinear behavior of microwave devices and circuits with a special emphasis on the nonlinear stability analysis and the characterization, modeling and simulation of nonlinear devices. He notably contributed to the characterization and modeling of thermal and trapping effects in Gallium Nitride devices. He authored or co-authored more than 200 papers and conference communications as well as the book "Stability of nonlinear microwave circuits". He served in various technical committees as the Technical Program Committee of the EuMW for years as well as a reviewer for a number of journals and conferences. In 2009 he has been elevated to the grade of Fellow of the IEEE.

From 1998 to 2013 he led the department "Devices, Circuits, Signals and Systems" in XLIM – a joint laboratory of the French CNRS and the University of Limoges. From 2013 to 2017 he was the deputy director of the XLIM labs. During the same period he has been the holder of the chair "DEFIS-RF" funded by the French National Research Agency (ANR), Thales Alenia Space and Thales Corp. This chair aimed at the design of future RF terminals.

He has been serving the European Microwave community through various functions such as General Chairman of EuMW in 2005, member of EuMA BoD from 2012 to 2017 and the first Editor in Chief of the "International Journal of Microwave and Wireless Technologies" from 2009 to 2013.

Finally he has been the scientific advisor and/or funding member of the two spin-offs AMCAD Engineering and VTD. In January 2020 he co-founded NAIoBEE, a start-up specialized in wireless sensor networks for the Building Energy Efficiency.





**Guide yourself  
to this view**

Our signage will lead  
you the rest of the  
way.

**JAARBEURS**  
attract - engage - accelerate

## Travel Information

### GETTING TO UTRECHT JAARBEURS

The city of Utrecht is well connected to the European motorway, rail and flight networks. The Jaarbeurs Convention Centre can be accessed through a variety of transportation means.

#### ADDRESS

Jaarbeurs, Jaarbeursplein, 3521 AL, Utrecht, The Netherlands.

#### BY AIR

From Schiphol Amsterdam Airport:  
Take a direct (Intercity) train from Schiphol Airport to Utrecht Centraal Station (4 × per hour).

From Rotterdam-The Hague Airport:

Take the local RET bus 33 to Rotterdam Centraal station (6 × per hour) and then a direct (Intercity) train from Rotterdam Centraal station to Utrecht Centraal station (4 × per hour).

#### BY TRAIN

The Jaarbeurs Convention Centre is located within 500 m from Utrecht Centraal train station.

#### BY CAR

Please refer to the map on the inner back cover of this booklet for parking lot locations near the Jaarbeurs Convention Centre.

#### HOTEL RESERVATION

Horizon House has teamed up with Connex Hotels and Events, our official hotel booking supplier, to offer you the ability to book your accommodation for EuMW at the most competitive rates available. It is very easy to make an immediate hotel booking. Simply visit their booking page <http://www.connexhotelsandevents.com/eumw-2020-utrecht.html> and make your booking, or email [sally@connexhotelsandevents.com](mailto:sally@connexhotelsandevents.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 Netherlands. Since EuMW events are held in the European Union, no visa is usually required for travellers with passports from a number of countries, like for instance: European Union, Australia, Brazil, Canada, Japan, Singapore, South Korea or the United States. If you are registering as speaker, delegate or exhibitor and you need a visa, we recommend that you speak with the Dutch Consulate, in your own country. You should organise this at least 3 to 4 months prior to the EuMW. The organisers will be pleased to send a letter of invitation to any exhibitor, conference delegate or speaker requesting it. For assistance in obtaining a visa letter, please contact [visa@eumw2020.org](mailto:visa@eumw2020.org).

## 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 230V, 50 Hz. Type F sockets are used in The Netherlands.

#### 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

The city of Utrecht, located in the centre of The Netherlands, features a rich past and a dynamic present. This 2000 year old city features a wide range of interesting museums and cultural events. Its rich history began about twenty centuries ago. In 47 A.D. the Romans built a fortress as part of reinforcements along the Rhine where the Cathedral square (Domplein) is situated today. It is here

where the Union of Utrecht was signed in 1579, which is seen as the beginning of the Dutch Republic. Nowadays, Utrecht is a lively city with a pleasant and intimate atmosphere. The medieval city centre with its canals, wharfs, quaint streets and museum quarter is small enough to explore on foot. Featuring a large student population and many cafés and restaurants it is the ideal place to relax and make new friends. Through its central location, Utrecht serves as the perfect base from which to explore additional must-see Dutch attractions. More information can be found at <https://www.visit-utrecht.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 2020.

## Conference Information

#### BADGES AND REGISTRATION

The registration area will be located near the entrance to Exhibition Hall 1 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 15<sup>th</sup> January 2021. 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](mailto:eumwreg@aventri.com).

#### CONFERENCE ROOMS

Conference rooms are located in the Supernova, Media Plaza, and Juliana area 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.

#### SPEAKER PREPARATION SPACE

A speaker preparation area is located in Break Out 4.

#### 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 Hall 1 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 12<sup>th</sup> January 2021 9.30 - 18.00
- Wednesday 13<sup>th</sup> January 2021 9.30 - 17.30
- Thursday 14<sup>th</sup> January 2021 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

For information on these tours, please contact Sally Garland on [sally@connexhotelsand-events.com](mailto:sally@connexhotelsand-events.com)

## TOURS

### GUIDED WALKING TOUR

A city walk that takes in Utrecht's must-see sights. The Utrecht Hotspots tour is the ideal city walk for first-time visitors to Utrecht. Led by an experienced



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guide, who takes the group along the hotspots of Utrecht, the places that should not be missed during a visit to the city. The tour includes the Dom Tower, the Oudegracht canal and its quays, churches with a story to tell and quaint lanes that are less well-known. During the tour, the guide will give information about all the historical details, highlighting the rich history of the city of Utrecht

### CLIMB THE DOM TOWER

For more than six centuries, the city and its surroundings have been dominated by the magnificent Dom Tower, the highest medieval building in the Netherlands. You will definitely remember this 112-meter-high symbol of Utrecht. Climb its 465 steps and you will be rewarded with a breath-taking view of the city and the rural beauty beyond it.

### DOMUNDER

Grab a smart torch and go on an underground discovery full of exciting stories and archaeological treasures. A visit is an archaeo-

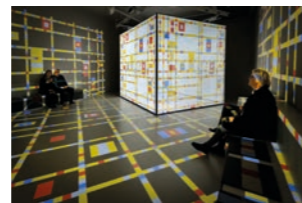


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logical discovery tour. The discovery tours have fixed starting times and first visit the medieval cellars of Domplein 4, where you will also find remains of the Roman fortress 'Trajectum'.

### DISCOVER THE CITY OF AMERSFOORT (INCLUDING A VISIT TO THE MONDRIAAN HOUSE)

During this guided tour you walk around the beautiful medieval city of Amersfoort and experience its rich history. You will go through



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the unique land-and-water gate Koppelpoort and see the special Muurhuizen (wall houses). Your guide will bring you to the house where Piet Mondriaan, the famous artist was born. Here you can see a permanent exhibition about Mondriaan's life as an artist and his work. The museum also contains a full-scale replica of his famous Paris studio. Afterwards you can easily explore the shops and restaurants on your own and take the train back to Utrecht (15 minutes travel time, leaves 4 times per hour).

### DISCOVER THE NEW DUTCH WATER LINE

45 forts, 6 branches and 2 castles. Once intended to defend the Netherlands against the enemy from the east, the 85-kilometer-long



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New Dutch Water Line now offers everything to enjoy for days. In the area that runs from Muiden to the Biesbosch, history, nature and delicious food and drinks go hand in hand. A good starting point to explore the New Dutch Water Line is the Water Line Museum at the 'Fort bij Vechten', near the city of Utrecht. Discover and experience how the Netherlands have been using water to keep the enemy out for years. And find out how it would look when the New Dutch Water Line would be flooded? Put on the VR glasses and make a parachute jump so that you can view it yourself.

## EXPLORE ON YOUR OWN

### MAG MAGAZINE

Your guide to the city's hotspots and cultural events! You can obtain your copy at the tourist information office and the information stand in the conference registration area.

### UTRECHT REGION PASS

The Utrecht Region Pass is a 'pay-as-you-go' public transport card with nation-wide coverage linked to your credit card. It provides easy and carefree access to the entire public transport system in the Netherlands, as well as allowing you to rent a bicycle. Additionally, you can use the Utrecht Region Pass to visit some of the most appreciated destinations and places of interest in the province. More information on the Utrecht Region Pass can be obtained at the tourist information office.

# Technology in Context: A Series of Philosophical Lectures.

A meaningful use of technology is a driving factor behind progress in society. Health care has dramatically improved through the use of technology. Communication between people has dramatically improved, or at least changed through cellphones and social media. As a rapidly evolving and high-tech area, microwaves have changed society and will continue to do so.

This edition of the European Microwave Week introduces a series of Philosophical lectures addressing the context of technological progress in the wider sense. There will be four lectures around lunchtime on Monday, Tuesday, Thursday and Friday, located in the Auditorium. Three of these lectures we can announce already now:

## MONDAY

**Bert Hubert,** geeky entrepreneur, addressing the international and geopolitical effects of networking technology in his talk: **"Network Threats"**

## THURSDAY

**Frans von der Dunk,** Professor and owner of Black Holes, addressing the laws ruling space in a talk entitled: **"The Law of Space"**

## FRIDAY

**Jacob Groote,** KPN Executive VP for 5G, addressing the societal impact and necessity of 5G with a talk entitled: **"5G, But Why?"**

We could not have arranged this set of lectures without the support of the "Cor Wit Fonds", aimed to contribute at the intersection between telecommunication research and

societal relevance to the quality of society. This support is kindly acknowledged.



## Welcome Reception

Take the "Microwave Train" and join us for Tuesday's conference dinner in between historic Dutch trains

# Workshops and Short Courses

Despite the organiser's best efforts to ensure the availability of all listed workshops and short courses, the list below may be subject to change.

Also workshop numbering is subject to change. Please refer to [www.eumweek.com](http://www.eumweek.com) at the time of registration for final workshop availability and numbering.

SUNDAY 10 <sup>th</sup> January 2021			
W-02	EuMIC/EuMC	Half Day PM	Advanced Measurement Techniques for Next Generation Communication Systems
W-03	EuMIC	Full Day	High Performance GaN MMICs
W-06	EuMIC	Full Day	Sub-mmWave On-Wafer Measurements
W-11	EuMIC	Full Day	Integrated Doherty PAs for Cellular and mmWave Applications
W-17	EuMIC/EuMC	Full Day	Advanced RF Technologies for 5G
W-27	EuMC	Half Day AM	Wireless Power Transmission Recent Research Advances
W-29	EuMC	Full Day	Recent Advances in Additive Manufacturing of Microwave Components
S-03	EuMIC	Full Day	Fundamentals of Microwave PA Design
MONDAY 11 <sup>th</sup> January 2021			
W-07	EuMC	Full Day	High-Power Microwave Industrial Applications
W-08	EuMC	Half Day AM	Antenna/Modules in Package for mmWave for 5G
W-10	EuMIC/EuMC	Half Day PM	From Enabling GaN Technology to High-Performing Space-Borne SSPAs at mmWave
W-13	EuMC/EuRAD	Half Day AM	Advanced Applications of In-Band Full-Duplex Technology
W-18	EuMC	Full Day	Measurements at mmWave and Terahertz Frequencies of Three Measurement Quantities: S-Parameters, Power, and Complex Permittivity of Dielectric Materials
W-28	EuMC	Full Day	Microwave Wearable Circuits and Systems for Biomedical Applications
S-05	EuMC/EuRAD	Half Day PM	Multibeam Antennas and Beamforming Networks
S-07	EuMIC/EuMC	Half Day AM	From Device Characterisation to Amplifier Design: Advanced Large Signal Measuring, Fast and Accurate Modelling, and Reliable Designing
S-10	EuMC	Half Day PM	Intuitive Microwave Filter Design with EM Simulation
TUESDAY 12 <sup>th</sup> January 2021			
W-05	EuMC	Full Day	Digital Predistortion for 5G MIMO Wireless Transmitters
W-25	EuMC/EuRAD	Half Day PM	Advanced mmWave Radar System Solutions for Industrial and Consumer Sensing Applications
WEDNESDAY 13 <sup>th</sup> January 2021			
W-12	EuMIC/EuMC	Full Day	High-Efficiency Linear Power Amplifiers for High Bandwidth, High PAR Signals
W-14	EuRAD	Half Day PM	Automotive Radar Networks and Sensor Fusion
S-04	EuMIC/EuMC	Full Day	Quantum Computing for Electrical Engineers
S-08	EuMIC/EuMC	Half Day AM	High Power Amplification for Space Applications
THURSDAY 14 <sup>th</sup> January 2021			
W-15	EuRAD	Half Day PM	Recent Advances in Micro-Doppler Radar and its Applications
W-23	EuRAD	Half Day AM	High Resolution Radar for Automotive
W-31	EuMC	Full Day	5G and Beyond: Enabling RF Architectures and Technologies for Emerging Wireless Systems
FRIDAY 15 <sup>th</sup> January 2021			
W-21	EuMC	Half Day AM	Recent Advances in Topologies, Technologies and Practical Realizations of Microwave Sensors
W-30	EuMC	Half Day AM	Recent Advances on Microwave Filters
W-32	EuMIC/EuMC	Full Day	Practical Aspects of Running a Microwave Laboratory and How to Make Good Measurements Every Time
S-01	EuRAD	Half Day PM	Introduction to MIMO Radar
S-02	EuRAD	Half Day AM	Cognitive Radar Signal Processing

# Registration Information

## CONFERENCE REGISTRATION DETAILS

See pricing table on the following page.

### ONLINE REGISTRATION

- All online registrations should be made at [www.eumweek.com](http://www.eumweek.com).
- Registrations completed up to and including 6<sup>th</sup> December 2020 will be charged at the 'Advance Discounted Rate' and those from 7<sup>th</sup> December 2020 will be charged at the 'Standard Rate'.
- Online registration is open from 13<sup>th</sup> September 2020 up to and during the event until 15<sup>th</sup> January 2021.

### ONSITE REGISTRATION

Onsite registration is available:

- Saturday, 9<sup>th</sup> January 2021 16:00 - 19:00
- Sunday, 10<sup>th</sup> January 2021 08:00 - 17:00
- Monday, 11<sup>th</sup> January 2021 08:00 - 17:00
- Tuesday, 12<sup>th</sup> January 2021 08:00 - 17:00
- Wednesday, 13<sup>th</sup> January 2021 08:00 - 17:00
- Thursday, 14<sup>th</sup> January 2021 08:00 - 17:00
- Friday, 15<sup>th</sup> January 2021 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](mailto: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.

### ONSITE

- The registration area will be located through the 'Oost Entree' and to the right, towards Exhibition Hall 1.
- 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.

## NL MoD Reduced Rate

For the EuMW 2020 only, personnel of the NL MoD can register at a reduced rate. This very attractive rate includes access to EuRAD, the DSS Forum and the exhibition, lunch boxes on Wednesday and Thursday and the seated EuRAD lunch. The Advance Discounted rate for this is € 100,- (up to and including 6<sup>th</sup> December 2020), and € 140,- from 7<sup>th</sup> December 2020 onwards.

No further options or combined discounts will be available.

## BADGE AND DELEGATE BAG COLLECTION

Online registrants: bring a photo ID and a copy of your registration email badge barcode to the Fast Track check-in desks at the registration area.

Onsite registrants: register using our Self Service terminals and receive your printed badge upon payment.

Scan your badge at the specified delegate bag area to collect your delegate bag.

Registration and badge collection 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.

# Registration Fees

**Full Week ticket:** Get the most out of this year's Microwave Week with a Full Week ticket. Combine all three conferences with access to the Defence, Security and Space and the 5G forum (the automotive forum is not included), and top your week off with Workshops or Short Courses of your choosing. To keep you fueled, lunch is included everyday, as are of course the social events: the EuMIC Get-Together, the Welcome reception and the EuRAD seated lunch.

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

**Reduced rates are offered if you have society membership to any of the following: EuMA<sup>®</sup>, 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 18<sup>th</sup> September 2020). The fees shown below are invoiced in the name and on behalf of the European Microwave Association. Fees invoiced by EuMA with respect to the European Microwave Week 2020 are exempt from Dutch VAT. All payments must be in € (Euros) - cards will be debited in € (Euros).

CONFERENCES REGISTRATION	ADVANCE DISCOUNTED RATE (FROM 13 <sup>th</sup> SEPTEMBER UP TO & INCLUDING 6 <sup>th</sup> DECEMBER 2020)				STANDARD RATE (FROM 7 <sup>th</sup> DECEMBER 2020 & ONSITE)			
	Society Member <sup>⊕</sup>		Non-Member		Society Member <sup>⊕</sup>		Non-Member	
1 Conference	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.
EuMC	€ 480,-	€ 130,-	€ 680,-	€ 190,-	€ 680,-	€ 190,-	€ 950,-	€ 260,-
EuMIC	€ 370,-	€ 120,-	€ 520,-	€ 170,-	€ 520,-	€ 170,-	€ 730,-	€ 240,-
EuRAD	€ 330,-	€ 110,-	€ 460,-	€ 160,-	€ 460,-	€ 160,-	€ 650,-	€ 220,-
2 Conferences	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.
EuMC + EuMIC	€ 680,-	€ 260,-	€ 960,-	€ 360,-	€ 960,-	€ 360,-	€ 1.340,-	€ 500,-
EuMC + EuRAD	€ 650,-	€ 250,-	€ 910,-	€ 350,-	€ 910,-	€ 350,-	€ 1.280,-	€ 480,-
EuMIC + EuRAD	€ 560,-	€ 240,-	€ 780,-	€ 330,-	€ 780,-	€ 330,-	€ 1.100,-	€ 460,-
3 Conferences	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.
EuMC + EuMIC + EuRAD	€ 830,-	€ 370,-	€ 1.160,-	€ 520,-	€ 1.160,-	€ 520,-	€ 1.630,-	€ 730,-
Full Week Ticket	€ 1.280,-	€ 750,-	€ 1.690,-	€ 970,-	€ 1.630,-	€ 920,-	€ 2.180,-	€ 1.200,-

## BECOME A MEMBER – NOW! EuMA membership fees: Professional € 25,-/year, Student € 15,-/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.

SPECIAL FORUMS AND SESSIONS REGISTRATION	Date	ADVANCED DISCOUNTED RATE (UP TO & INCLUDING 6 <sup>th</sup> DECEMBER 2020)		STANDARD RATE (FROM 7 <sup>th</sup> DECEMBER 2020 & ONSITE)	
		Delegates*	All Others**	Delegates*	All Others**
Automotive Forum	12 <sup>th</sup> January 2021	€ 260,-	€ 360,-	€ 320,-	€ 420,-
5G Forum	15 <sup>th</sup> January 2021	€ 60,-	€ 90,-	€ 80,-	€ 100,-
Defence, Security & Space Forum	13 <sup>th</sup> January 2021	€ 20,-	€ 60,-	€ 20,-	€ 60,-
European Microwave Student School	12 <sup>th</sup> January 2021	€ 40,-	€ 40,-	€ 40,-	€ 40,-
Tom Brazil Doctoral School of Microwaves	14 <sup>th</sup> January 2021	€ 40,-	€ 40,-	€ 40,-	€ 40,-

\* those registered for EuMC, EuMIC or EuRAD \*\* those not registered for a conference

WORKSHOPS AND SHORT COURSES	IN COMBINATION WITH CONFERENCE REGISTRATION				WITHOUT CONFERENCE REGISTRATION			
	Society Member <sup>⊕</sup>		Non-Member		Society Member <sup>⊕</sup>		Non-Member	
	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.	Standard	Student/Sr.
Half Day	€ 100,-	€ 70,-	€ 130,-	€ 100,-	€ 130,-	€ 100,-	€ 170,-	€ 130,-
Full Day	€ 140,-	€ 100,-	€ 190,-	€ 140,-	€ 190,-	€ 140,-	€ 250,-	€ 190,-

### CONFERENCE TECHNICAL CO-SPONSORS



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# Defence, Security and Space Forum

## Space Situational Awareness

Wednesday 13<sup>th</sup> January 2021

08:30 to 17:50, Auditorium

+ cocktail reception

Chair: Marco Martorella, University of Pisa, Italy

Co-Chair: Mark Bentum, Eindhoven University of Technology & ASTRON, The Netherlands

Space has become a new battleground where both economic and military interests clash. Space Situational Awareness (SSA) refers to keeping track of objects in orbit and predicting where they will be at any given time, in other words: determine a persistent and continuously updated picture of the situation in space. According to NATO's definition, SSA is the knowledge and the understanding of military and non-military events, activities, circumstances

and conditions within and associated with the space environment or space-related systems.

To accomplish this, a complex infrastructure must be in place that includes sensors, communications systems, physical phenomena knowledge, technical and management skills that allow for all the necessary systems to operate and interact effectively.

The Defence, Security and Space Forum will address the topic of Space Situational

Awareness. When thinking of Space and SSA, we tend to ask ourselves many questions that are related to our ability to understand and handle Space, for instance: What have we learnt in the past years of SSA activities? How is the "New Space Era" affecting Space and its safety? Are our SSA systems keeping up the pace of the new developments in Space? Are we prepared to face what the future may hold?

World-wide renowned experts will present and discuss various SSA-related topics, ranging from space surveillance, challenges and threats in Space to Space Weather, providing some answers to the above questions and with the aim of triggering valuable discussions where SSA will be the primary focus. Technological aspects will be considered that are impacting both military and civilian scenarios. Well-known and new threats will also be discussed in order to understand the risks that space induces.



### Registration and Programme Updates

Registration fee is €20 for those who registered for a conference and €60 for those not registered for a conference. Cocktail reception as well as a lunch snack and beverages are included in the fee. The Conference Special Events section of the EuMW website will give further details and updates.

## Programme

**08:30** EuRAD opening  
**10:10**

**10:10** Coffee Break  
**10:50**

**10:50** Space Situational Awareness  
**12:30**  
Moderator: Mark Bentum  
Three renowned experts will present and discuss various SSA-related topics. Peter Knott, Director of Fraunhofer-FHR, will address the radar sensors for SSA. Mohamed Abouzahra and Gregg Hogan, Haystack-MIT-Lincoln Laboratory, will present an emergency-response system supported by NATO and David Otten, Dutch Airforce, will talk about Space In the Dutch MoD, the current focus and activities of the Defense Space Security Center.

**12:40** Strategy Analytics Lunch & Learn Session  
**13:40**  
Eric Higham, Strategy Analytics; "Space Situational Awareness in the New Space Era"  
This session will explore some trends, forecasts and drivers that are influencing the congestion in space. The presentation will address evolving space capabilities in the commercial and defence segments of the space industry, along with the benefits these capabilities will enable.

**13:50** Microwave Journal Industry Panel Session  
**15:30**  
The Microwave Journal Industry Session will be made up of several company presentations that illustrate the technological innovation that industry is developing for Space Situational Awareness related topics.

**15:30** Coffee Break  
**16:10**

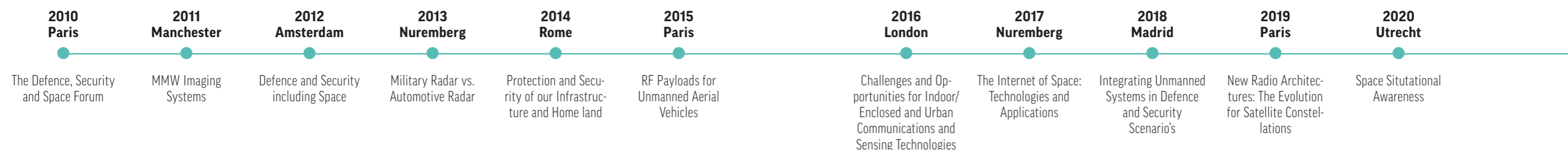
**16:10** Executive Round Table Forum: Space Situational Awareness  
**17:50**  
Which technologies need to be implemented to face future challenges? What are the technological gaps that need to be filled? How important is to collaborate to improve SSA? What are the current and future threats that we should consider and try to mitigate or eliminate? How can research help towards improving SSA?

World-wide experts from academia, industry and military areas are invited to this Table for an open discussion about SSA and its crucial role to safeguard Space and guarantee that current and future services, upon which we rely, are preserved

Moderator: Marco Martorella  

- René de Jongh, Strategy Director, Thales Netherlands
- David Otten, Dutch Airforce
- Peter Knott, Director of Fraunhofer-FHR
- Mohamed Abouzahra/Gregg Hogan, Haystack-MIT-Lincoln Laboratory
- Rene Thaens, NATO

**17:50** Cocktail Reception  
**18:30**



# The Automotive Forum

## Automotive Radar

Tuesday 12<sup>th</sup> January 2021

08:30 to 17:50, Auditorium

+ dinner on Monday evening, 11<sup>th</sup> January 2021

Chair: Thomas Zwick, Karlsruhe Institute of Technology, Germany

Co-Chairs: Martin Kunert, Robert Bosch GmbH & Frank Gruson, Continental AG, Germany

Local Arrangements Chair: Cicero Vaucher, NXP, The Netherlands

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. Modulation & operation principles
2. Radar architectures
3. Artificial intelligence in automotive radar
4. Automotive radar interference

The forum is mainly devoted to technical experts from automotive industry throughout the whole supply chain.

Keynote speakers will present their views on special technical solutions as well as regulatory or strategic issues. The evening before the event, we will get together in a networking dinner. Early registration is recommended.



### Registration and Programme Updates

Advanced Registration fee (up to & incl. 6<sup>th</sup> December 2020) is €260 for those who registered for a conference and €360 for those not registered for a conference. Standard Registration fee (from 7<sup>th</sup> December 2020 & onsite) is €320 for those who registered for a conference and €420 for those not registered for a conference.

The networking dinner as well as a lunch snack and beverages are included in the fee. The Conference Special Events section of the EuMW website will give further details and updates. Due to limited room size early registration is recommended.

## Programme

### SESSION 1: MODULATION AND OPERATION PRINCIPLES

(Chair: Cicero Vaucher, NXP, The Netherlands)

**08:30** **Automated Driving: Market Perspective for Radar**  
Cédric Malaquin, Yole, France

**08:50** **Radar Technology for Assisted and Automated Driving**  
Frank Gruson, Continental AG, Germany

**09:10** **Hybrid Analog Phased Array and Advanced Algorithms Radar for Long-Range High-Resolution Detection and AI**  
Maha Achour, Metawave Corporation, USA

**09:30** **MIMO Radar Waveforms for Automotive**  
Feike Janson, NXP Semiconductors, The Netherlands

**09:50** **Open Discussion on all Presentations of the Session**  
**10:10**

**10:10** **Coffee**  
**10:50**

### SESSION 2: RADAR ARCHITECTURES

(Chair: Frank Gruson, Continental, Germany)

**10:50** **Achieving True Safety on the Road with an Automotive-Dedicated Imaging Radar Chipset**  
Noam Arkind, Arbe Robotics, Israel

**11:10** **Asymptotic Electromagnetic Fields Computation as an Optimal Method for Radar-in-Vehicle Performance Prediction**  
Alexander Ioffe, Aptiv, Germany

**11:30** **Scope, Challenges and Opportunities for 140 GHz Automotive Radar**  
Simon Tejero Alfageme, Huawei Technologies Duesseldorf GmbH, Germany

**11:50** **Radar Digitalization**  
André Roger, Infineon Technologies, Germany

**12:10** **Open Discussion on all Presentations of the Session**  
**12:30**

**12:30** **Lunch**  
**13:50**

### SESSION 3: ARTIFICIAL INTELLIGENCE IN AUTOMOTIVE RADAR

(Chair: Martin Kunert, Robert Bosch GmbH, Germany)

**13:50** **Development of Deep Learning Approaches for Radar-Based Autonomous Driving**  
Georg Kusch, Astyx GmbH, Germany

**14:10** **CNN-Based Signal Processing for Automotive Sensors**  
Tim Berthold, Dream Chip Technologies GmbH, Germany  
**14:30** Nicolai Behmann, IMS Hannover, Germany

**14:30** **Reflex-Level Object Type Classification for Automotive Radar**  
**14:50** Michael Ulrich, Robert Bosch GmbH, Germany

**14:50** **Machine Learning and Radar Techniques for Enhanced Vehicle Perception**  
**15:10** Sonia Ghelani, Texas Instruments, USA

**15:10** **Open Discussion on all Presentations of the Session**  
**15:30**

**15:30** **Coffee**  
**16:10**

### SESSION 4: AUTOMOTIVE RADAR INTERFERENCE

(Chair: Thomas Zwick, Karlsruhe Institute of Technology, Germany)

**16:10** **Automotive Radar Mutual Interference - Snapshots of Today's Situation**  
**16:30** Alicja Ossowska, Valeo Schalter und Sensoren GmbH, Germany & Richard Körber, Astyx GmbH, Germany

**16:30** **Radar to Radar Interference: Real Threat and Opportunities**  
**16:50** Francesco Laghezza, NXP Semiconductors, The Netherlands

**16:50** **Methods to Avoid Radar Interference - An Overview of the Swedish Radcom Project**  
**17:10** Karl Vanas, Volvo Car Corporation, Sweden

**17:10** **IMI-KO-Radar: Methods for Cooperative Interference Mitigation**  
**17:30** Werner Sörgel, Tim Poguntke and Thomas Binzer, Robert Bosch GmbH, Germany

**17:30** **Open Discussion on all Presentations of the Session**  
**17:50**

# The 5G Forum From Technology to Business

Friday, 15<sup>th</sup> January 2021,  
08:45 to 15:45, Auditorium

Chair: Bart Smolders, Eindhoven University of Technology, The Netherlands

Co-Chairs: Toon Norp, TNO, The Netherlands & Ulf Gustavsson, Ericsson, Sweden



## Registration and Programme Updates

Please refer to the special forums and session fees table for registration fees. Lunch and beverages are included in the fee. The Conference Special Events section of the EuMW website will give further details and updates

The introduction of 5G is a major trend in cellular telecommunications; in various countries 5G frequency licenses are being awarded and 5G networks are rolled out. 5G promises to support a range of new applications - automotive, public safety, media, health, satellite communication, and factory automation to name a few - are supported using the same NR radio interface technology. The concept of 5G network slicing enables a single 5G network infrastructure to

provide multiple virtual networks, each optimised for a particular application, service or industrial customer. In Europe, there are three pioneer frequency bands earmarked for 5G. Two of these - the 700 MHz band and the 3.5 GHz band - are in the same sub 6 GHz range of spectrum where most current cellular technologies can be found. The third pioneer band is the 26 GHz band; a new frequency band which will introduce microwave technology in cellular networks.

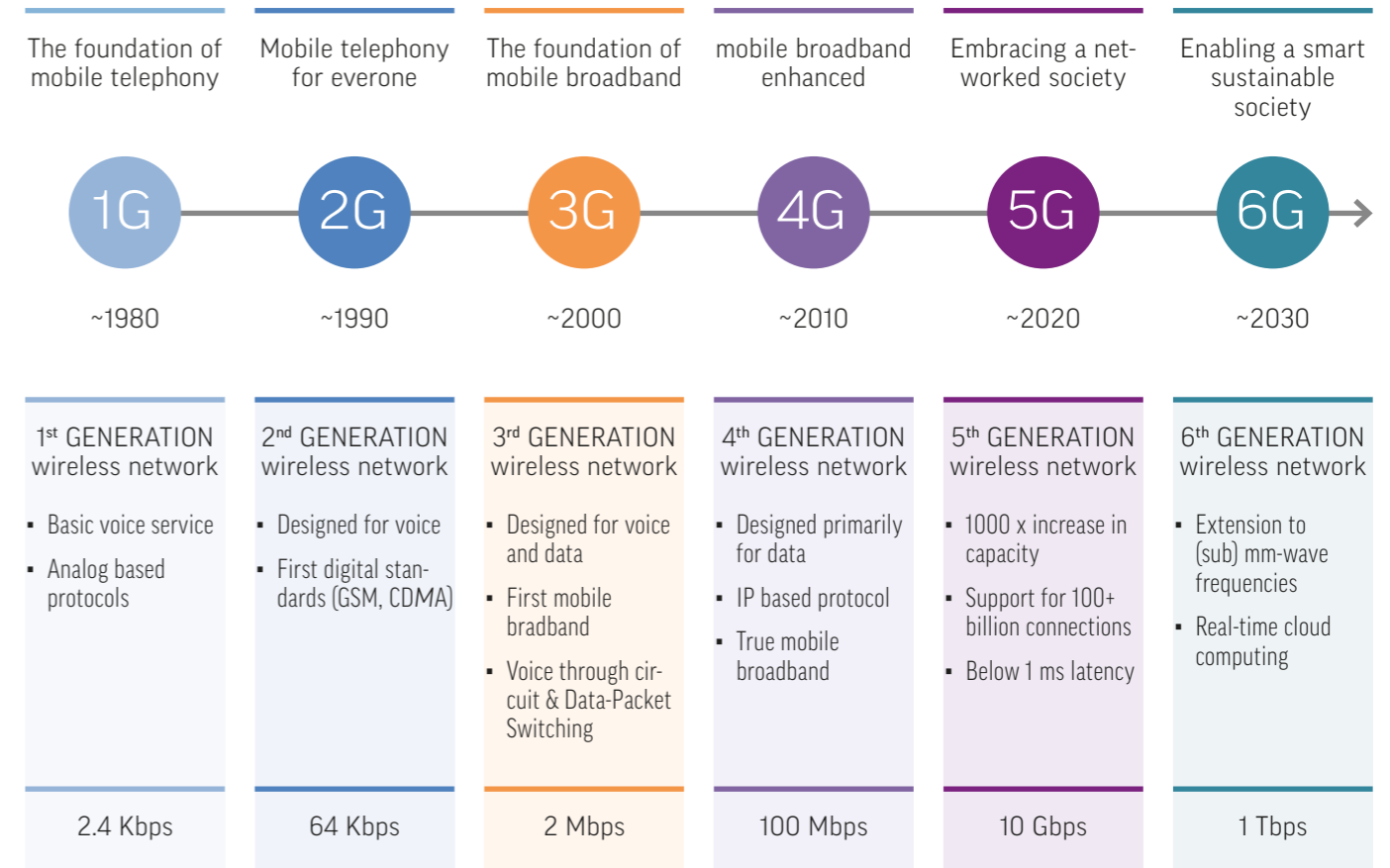
For the microwave industry, 5G will be a major new market opportunity. The market of billions of mobile phones is interesting, and on top of that, the application of microwave frequencies in 5G will imply the deployment of huge numbers of small basestations with electronic beam-steering capabilities. It is therefore of interest for the microwave community to get a system- and technology-level overview of what 5G will bring and how microwave technology can play a role in 5G

The 2020 5G Forum hosts a mix of technical presentations, posters, demo sessions and a panel discussion. Technical presentations from industrial experts will address 5G strategic and market needs and discuss how these can be met with technology solutions. Poster and demo sessions during lunch allow research projects to show their advances with new 5G technology and provides an excellent networking opportunity.

## Programme

<b>08:45</b> <b>09:00</b>	<b>Chairman Welcome Speech</b>
<b>09:00</b> <b>09:30</b>	<b>What can you do with 5G?</b> Anders Furuskär, Ericsson, Sweden
<b>09:30</b> <b>10:00</b>	<b>5G Frequency Licensing and Regulations in Europe</b> Peter Disseldorp, Radiocommunications Agency Netherlands
<b>10:00</b> <b>10:30</b>	<b>5G OTA Testing</b> Pertti Kangas, Keysight Technologies
<b>10:30</b> <b>10:45</b>	<b>Coffee</b>
<b>10:45</b> <b>11:15</b>	<b>Beamforming Concepts in 5G</b> David Astely, Ericsson, Sweden
<b>11:15</b> <b>11:45</b>	<b>Semiconductor Technology for 5G Handsets and Base Stations</b> Domine Leenaerts, NXP Semiconductors, The Netherlands

<b>11:45</b> <b>12:15</b>	<b>Pitches of Posters and Demo Sessions that will be Given During Lunch</b>
<b>12:15</b> <b>13:45</b>	<b>Lunch Combined with Posters and Demo Session</b>
<b>13:45</b> <b>14:15</b>	<b>5G, but why? Business First, Technology Second</b> Jacob Groote, 5G EVP, KPN, The Netherlands
<b>14:15</b> <b>14:45</b>	<b>Opportunities for 5G Features in Autonomous Driving</b> Andreas Kwoczek, Volkswagen, Germany
<b>14:45</b> <b>15:15</b>	<b>The Role of 5G in Factory Automation</b>
<b>15:15</b> <b>15:45</b>	<b>Panel Discussion with the Speakers of the Day</b> Moderator: Toon Norp, TNO, Netherlands
<b>15:45</b> <b>16:00</b>	<b>Chairman Closing Remarks</b>



## Welcome from the Student Activities Chair

The European Microwave Week programme offers valuable events for engineers at every stage of their microwave career. Special emphasis is placed on supporting students and young professionals in our field by a number of dedicated and Corona-proof student activities. For Bachelor and Master students, the Student School, organised by Prof. David Ricketts, is devoted to teaching everything the beginning engineer needs to know about the basics of modern radars with the focus on building their very own radar transceiver in the hands-on part of the course. To keep everybody motivated, the best transceiver design is awarded with a cash prize, kindly sponsored by Thales Nederland B.V. The Student School is also open for interested PhD students who wish to build up knowledge in this area.

PhD students may also participate in the Tom Brazil Doctoral School of Microwaves. This event, founded in 2011, was in former years simply known as the Doctoral School of Microwaves. It has been renamed in honour of Tom Brazil, who passed away in 2018, for his outstanding contribution to Microwaves in general and Microwave education in particular. Tom Brazil was one of the two founding fathers of the Doctoral School. The School is this year organized as a one-day event with lectures on the design of integrated active array systems for 5G millimetre-wave, covering

everything from microwave IC design to signal processing. The in-depth technical programme is complemented with a lecture on concurrent engineering for complex systems, which presents a methodology for working in multi-disciplinary teams, and a lecture on boosting productivity and creativity for a successful completion of a PhD project.

Creativity is also the essential ingredient for the Student Design Competitions. Student teams, which may consist of Bachelor, Master and/or PhD students, take part in one of the two competitions organized by Ampleon and ASTRON. While Ampleon's competition is "biased" on a challenging amplifier topic, ASTRON wants to know how to accurately locate drones using the radio frequency interference emissions of the their electric motors. The best teams will be awarded with cash prizes, so you can expect to see high quality student designs to be presented on the exhibition floor.

For those who want to take their acquired skills to industry, there is the Career Platform. This three-day event aims to bring the jobs and career opportunities to students and young professionals, all in a single place and time. This unique place provides multiple activities like career workshops, a recruitment space, a start-up panel, and special sessions to boost the careers of the next generation of microwave engineers. All

these activities are centred around the Career Lounge, a cosy area with comfortable seats and refreshments, where contacts to companies can be made in an informal fashion.

For the first time in the history of the European Microwave Week, this year's edition features a social event for all young and young-at-heart microwave enthusiasts: Microwave Nightfever! Organised by the Student Activities committee, IEEE Young Professionals and IEEE MTT-S Young Professionals. Everyone is welcome and there will be some complimentary drinks and snacks on a first come first serve basis. It's especially during these informal events that long-lasting relations are made and networks grow!

In this spirit and on behalf of the entire Student Activities committee, I would like to express a warm welcome to all students and young professionals that take part in this special edition of the European Microwave Week! Thank you for staying connected to our community and for choosing this event as your must-visit conference despite the restrictions caused by the Covid-19 pandemic. Special thanks also to the entire Student Activities team, the vast majority of them PhD students themselves. Your dedication and hard work in the recent period have ensured that we can offer a high-quality programme to our colleagues. The future is looking bright!



ULF JOHANNSEN

Student Activities Chair

Eindhoven University of Technology,  
The Netherlands

## Student Design Competitions

Tuesday, 12<sup>th</sup> January and Wednesday, 13<sup>th</sup> January 2021  
Exhibition Hall

The Student Design Competitions involve master and doctoral students designing and measuring a microwave device developed prior to the conference. This competition is open to all students. Measurements will be open to attend for all EuMW participants. A representative of the design team must be present at the conference. This year, two competitions will be offered:

### Competitions

#### Thrust 1: Drone Localisation System

Design a drone localisation system operating from 0.5 GHz to 1.5 GHz. The system should be able to determine the position of drones by detecting the radio frequency interference transmitted by the drones.

This thrust is organised and sponsored by ASTRON. Prizes are co-sponsored by Thales Nederland B.V. and the IEEE Benelux AP/MTT joint chapter. For questions please contact David Prinsloo (prinsloo@astron.nl). For more information and additional competition details visit [www.bit.ly/eumw2020sdc](http://www.bit.ly/eumw2020sdc).

#### Thrust 2: Wideband Amplifier Biasing Network

Design and realise a biasing network for RF high power amplifiers, considering low insertion loss at the operation bandwidth and low input impedance at the low frequency region. This thrust is organised and sponsored by Ampleon Netherlands BV.

For questions please contact Adam Cooman (adam.cooman@ampleon.com) or visit [www.ampleon.com/news/events/student-design-competition-at-eumw-2020.html](http://www.ampleon.com/news/events/student-design-competition-at-eumw-2020.html).

Outsmart  
your fellow students  
on a level Microwave  
playing field.

## Women in Microwaves Stronger Together

Tuesday, 12<sup>th</sup> January 2021  
Media Arena

WiM Chair: Marion Matters-Kammerer, Eindhoven University of Technology, The Netherlands

WiM Co-Chair: Dominique Schreurs, KU Leuven, Belgium

The Women in Microwaves event will be in the theme of "Stronger Together". The past months have shown to us the importance of bringing people together, be it in-person or online. Cooperating in research, industry and education, networking on national and international level and interacting with your colleagues are key aspects in our work and career. In this context we will organize a symposium with several international female speakers showing to us their

career paths. We will engage in joint discussions and actively extend our networks. Don't miss this dedicated and unique event and meet with colleagues from around the world. Join as in the Media Arena at:

12:30 to 13:50 - Lunch Lecture  
16:10 to 17:50 - Panel Discussion and Drinks

More details on the final program will be published via the conference website.

Register (free of charge) for  
this unique networking event  
via: [women.microwaves@eumw2020.org](mailto:women.microwaves@eumw2020.org)

# Career Platform

Tuesday, 12<sup>th</sup> January to Thursday, 14<sup>th</sup> January 2021

Various locations, refer to programme

Organisers: Thomas Bressner & Rabia Syeda, Eindhoven University of Technology, The Netherlands

The Career Platform is a three-day event that is conducted with the support of EuMW, EuMA and the IEEE MTT-S / Region 8 Young Professionals. The Career Platform is dedicated to students, graduates, and young professionals where they can get in touch with companies to increase their network and inform themselves about current job offers. This unique place provides multiple activities like career workshops, recruitment space, a start-up panel, and special

sessions to boost the career of the next generation of microwave/millimetre-wave, radar, wireless, and integrated circuits engineers. All these activities are centred around the Career Lounge, a cosy area with comfortable seats and refreshments, where contacts to companies can be made in an informal fashion. During the conference, all this will be supported by social media (Facebook, LinkedIn, Xing, etc.) as well as the European RF and Microwave job portal

[www.rf-and-microwavejobs-in-europe.eu](http://www.rf-and-microwavejobs-in-europe.eu), which is the virtual marketplace for students and companies to meet at and in-between European Microwave Weeks.

## WHAT IS IN IT FOR YOU?

Get ready to start your own company.  
Meet your future employer.  
Boost your CV.  
Expand your network.

## Events

**08:30 - 17:50** **Career Lounge**  
Tuesday, 12<sup>th</sup> January to Thursday, 14<sup>th</sup> January 2021  
Where: Round Control  
No registration and free access (including visitors)  
A space dedicated to informal chats with the Career Platform's partner-companies.

**10:50 - 17:50** **Job Dating**  
Thursday, 14<sup>th</sup> January 2021  
Where: BOR6  
Companies can invite candidates and book time slots during the Career Platform. Companies that are participating in the Career Platform might invite candidates to 1-on-1 interviews in a quiet environment. The companies can book time slots and hand out invitations to their candidates during the first two days of the Career Platform (12<sup>th</sup> and 13<sup>th</sup> January 2021). The Job Dating will take place on the third day of the Career Platform (14<sup>th</sup> January 2021).

**13:50 - 15:30** **Career Workshops**  
Tuesday, 12<sup>th</sup> January 2021  
Where: Media Arena  
No registration - Restricted to M.Sc. and Ph.D. students

**Workshop 1: "Transferable Skills and Networking" (45min)**  
Presenter: Arjen van Vliet, University of Utrecht  
Do you realise what skills you've acquired at university? People tend not to think much about these things. Transferable skills are useful in all kinds of professional contexts, and you carry them with you from one job to the next. If you want to convince an employer that you're

the right person for a job or an internship, you need the ability to present your skills with clarity and conviction. This workshop will make you aware of the transferable skills you've developed during your studies, at your (temporary) jobs, and during your extracurricular activities and help you to present them while networking.

### 10 minutes break

### Workshop 2: "Improve your Curriculum Vitae (CV) for a Great First Impression" (45min)

Presenter: Arjen van Vliet, University of Utrecht  
You will learn what is standard practice for writing an effective CV. Using instruction videos and detailed explanations of do's and don'ts, we will show you the different components that make up CVs. We'll also discuss how employers select from all the CVs and letters they receive, and how you can use this knowledge to your advantage. During the workshop, you will start working on your CV and give each other feedback. There will be plenty of time for you to ask any questions you may have.

**13:50 - 15:30** **Start-Up Panel**  
Wednesday, 13<sup>th</sup> January 2021  
Where: Media Arena  
No registration - free access (including exhibition visitors)  
Do you have an idea for a start-up? You need some help to make it grow? Then the Start-Up Panel at the EuMW 2020 can help you. Multiple incubators and start-up programs from the EU will present what they are doing and how they can help you. The short presentations of each entity are followed by an open discussion.

**10:50 - 12:30** **Special Session**  
Wednesday, 13<sup>th</sup> January 2021  
Where: Media Arena  
No registration - free access (including exhibition visitors)

### The European Microwave Industry Market and Professional Opportunities

Top industry-leading speakers will give their vision and insights. The session will describe the main market of the European Microwave Industry with a focus on Professional Opportunities.

**08:30 - 17:30** **Company Wall and Job Wall**  
12<sup>th</sup> January to Thursday, 14<sup>th</sup> January 2021  
Where: Loopbrug  
No registration - free access (including exhibition visitors)

The company wall is an additional space where companies can present themselves and their work on a poster (A0 or A1). Furthermore, at the same location is a job wall where companies can announce vacancies (A4).

Connect with us on social media for more



For details on the program and speakers, visit [www.eumweek.com/docs/Career\\_platform.html](http://www.eumweek.com/docs/Career_platform.html)



## 5<sup>th</sup> European Microwave Student School “Practical Workshop: Build a Frequency-Modulated Continuous Wave Radar in 1-day”

Tuesday, 12<sup>th</sup> January 2021

Beam (Introduction) + Transitzone C (Hands-on)

Organiser: David Ricketts, North Carolina State University, US

Co-organisers: Tom van Nunen & Teun van den Biggelaar, Eindhoven University of Technology, The Netherlands

During the EuMW 2020 we will celebrate the fifth edition of the European Microwave Student School. In this workshop you will learn the theory and design of FMCW radar. With this theoretical foundation, you will design, simulate and fabricate by hand, each component of your radar. You will then work in a team to assemble a complete radar and test it before the end of the class. The only background you need is basic microwave engineering knowledge and a desire to learn and build with your hands!

This workshop is sponsored by Thales Nederland B.V.

The registration fee for this event is €40. For further information please visit <https://www.eumweek.com/students/studentschool.html>.

## Tom Brazil Doctoral School of Microwaves “The Route to 5G: Design of mmWave Active Array Systems, from RFIC to Signal Processing”

Thursday, 14<sup>th</sup> January 2021

Spark

Organiser: Jaap Essing, TNO, The Netherlands

Co-organiser: Robbert Schulpen, Eindhoven University of Technology, The Netherlands

Every year, the European Microwave Week features the Doctoral School of Microwaves, which is a one-day workshop. In memory of Tom Brazil, who was one of the founders of this event, it has now been renamed “Tom Brazil Doctoral School of Microwaves”. Its objective is to cover the needs of a Ph.D. student that go beyond the standard conference programme. This year’s Doctoral School will have lectures on technical topics, as well as on boosting your soft skills, by experts from both academia and industry. The overall theme of the technical topics is 5G mmWave with a focus on the

design of integrated active array systems, covering the fields all the way from RFIC to signal processing. The Doctoral School will start with a lecture on the applications and requirements for 5G mmWave communication. From there, the lectures will go bottom-up from the system’s subcomponents, having lectures on IC and antenna design for 5G mmWave, towards the design of a full active array system for mmWave applications. These lectures will emphasize multi-physics and co-design related aspects. Next to these hardware-oriented lectures, the signal processing side of 5G mmWave

M.Sc. and Ph.D. students can register via the delegate registration of the EuMW by selecting the Doctoral School. The registration fee for this event is €40. The possible number of participants is limited, so secure your ticket well in advance.

systems will also be covered. In one of the lectures, the stochastic modelling of radio hardware imperfections to bridge the gap between circuit design and communication engineering is discussed, whereas in another lecture the focus will be on beamforming and massive MIMO for 5G mmWave from a signal processing perspective. The technical programme is complemented with a lecture on concurrent engineering for complex systems, which presents a methodology for working in multi-disciplinary projects, and a lecture on high-performance leadership.

## Programme

**08:30** Introduction and Theory of FMCW Radars and System Simulation of a 2.4 GHz Radar  
**10:10** David Ricketts, Professor (North Carolina State University, US)

**10:10** Coffee break  
**10:50**

**10:50** Hands-on Session 1: Radar Component Design and Simulation.  
**12:30** David Ricketts, Professor (North Carolina State University, US)

**12:30** Lunch  
**13:50**

**13:50** Hands-on Session 2: Radar Component Fabrication  
**15:30** David Ricketts, Professor (North Carolina State University, US)

**15:30** Coffee break  
**16:10**

**16:10** Hands-on Session 3: Radar Component Testing and System Assembly  
**17:00** David Ricketts, Professor (North Carolina State University, US)

**17:00** Testing of Radars with Teams  
**17:50**

## Programme

**08:30** mmWave Applications for 5G Mobile Communication Systems  
**09:20** Wolfgang Templ (Nokia Bell Labs, Germany)

**09:20** Integrated Circuits for 5G Wireless Communication  
**10:10** Giovanni Mangraviti (IMEC, Belgium)

**10:10** Coffee break  
**10:50**

**10:50** Antenna Design for 5G mmWave Communication  
**11:40** Daniele Cavallo (Delft University of Technology, The Netherlands)

**11:40** Leaving the Field Behind - How the best get better  
**12:30** Paul Rulkens (Agrippa Consulting, The Netherlands)

**12:30** Lunch  
**13:50**

**13:50** Modern AESA Panel Array for mmWave Applications  
**14:40** Patrick Schuh (Hensoldt, Germany)

**14:40** Stochastic Modelling of Radio Hardware Imperfections - Bridging the gap between circuit design and communication engineering  
**15:30** Ulf Gustavsson (Ericsson, Sweden)

**15:30** Coffee break  
**16:10**

**16:10** 5G mmWave Massive MIMO - System Architectures, Beamforming and Signal Processing  
**17:00** Thomas Eriksson (Chalmers University of Technology, Sweden)

**17:00** Concurrent Engineering for Large Multi-disciplinary Projects  
**17:50** Michel van Pelt (ESA, The Netherlands)

# SUNDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1	<b>W-03</b> High Performance GaN MMICs				
Mission 2	<b>W-17</b> Advanced RF Technologies for 5G				
Quest	<b>W-29</b> Recent Advances in Additive Manufacturing of Microwave Components				
Auditorium	<b>S-03</b> Fundamentals of Microwave PA Design				
Expedition	<b>W-11</b> Integrated Doherty PAs for Cellular and mmWave Applications				
Flash	<b>W-27</b> Wireless Power Transmission Recent Research Advances		<b>W-02</b> Advanced Measurement Techniques for Next Generation Communication Systems		
Spark	<b>W-06</b> Sub-mmWave On-Wafer Measurements				

# MONDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1	<b>EuMIC02</b> D-Band to H-Band Amplifiers		<b>EuMIC05</b> ICs for mmWave Beamforming Systems	<b>EuMIC08</b> ICs for Communication and Sensing	
Mission 2	<b>EuMIC03</b> GaN MMIC Power Amplifiers		<b>EuMIC06</b> Advances in mmWave and High Power Technologies	<b>EuMIC09</b> Advanced Solutions for Integrated Power Amplifiers	
Quest	<b>EuMIC04</b> Receivers and LNAs		<b>EuMIC07</b> Oscillators and Switches	<b>EuMIC10</b> Nonlinear Modelling	
Expedition	<b>W-28</b> Microwave Wearable Circuits and Systems for Biomedical Applications				
Polar		<b>EuMIC01</b> EuMIC Opening			
Auditorium	<b>W-13</b> Advanced Applications of In-Band Full-Duplex Technology		<b>Technology in                      Context</b> Network Threats	<b>S-05</b> Multibeam Antennas and Beamforming Networks	
Spark	<b>W-08</b> Antenna/Modules in Package for mmWave for 5G			<b>W-10</b> From Enabling GaN Technology to High-Performing Space-Borne SSPAs at mmWave	
Flash	<b>S-07</b> From Device Characterisation to Amplifier Design: Advanced Large Signal Measuring, Fast and Accurate Modelling, and Reliable Designing			<b>S-10</b> Intuitive Microwave Filter Design with EM Simulation	
Glow	<b>W-18</b> Measurements at mmWave and Terahertz Frequencies of Three Measurement Quantities: S-Parameters, Power, and Complex Permittivity of Dielectric Materials				
Beam	<b>W-07</b> High-Power Microwave Industrial Applications				
Off-site					<b>Automotive                      Forum                      Networking                      Dinner</b> 18:30 - 22:00
Off-site					<b>EuMIC                      Get-Together</b> 18:30 - 21:00

# MONDAY 08:30 – 10:10

## Mission 1

### EuMIC02

#### D-Band to H-Band Amplifiers

Chair: Michael Schlechtweg<sup>1</sup>

Co-Chair: Herbert Zirath<sup>2</sup>

<sup>1</sup>Fraunhofer Institute for Solid State Physics IAF, <sup>2</sup>Chalmers University of Technology

## Mission 2

### EuMIC03

#### GaN MMIC Power Amplifiers

Chair: Franco Giannini<sup>1</sup>

Co-Chair: Patrick Schuh<sup>2</sup>

<sup>1</sup>University of Rome Tor Vergata, <sup>2</sup>Hensoldt

## Quest

### EuMIC04

#### Receivers and LNAs

Chair: Julien Lintignat<sup>1</sup>

Co-Chair: Ana Peláez<sup>2</sup>

<sup>1</sup>XLIM UMR 7252, University of Limoges/CNRS, <sup>2</sup>Televés S.A.

08:30  
-  
08:50

### EuMIC02-1

#### A 200 mW D-Band Power Amplifier with 17.8% PAE in 250-nm InP HBT Technology

Ahmed Ahmed<sup>1</sup>, Munkyo Seo<sup>2</sup>, Ali Farid<sup>1</sup>, Miguel Urteaga<sup>3</sup>, James Buckwalter<sup>1</sup>, Mark Rodwell<sup>1</sup>

<sup>1</sup>University of California, Santa Barbara, <sup>2</sup>Department of Electrical and Computer Engineering, Sungkyunkwan University, South Korea, <sup>3</sup>Teledyne Scientific and Imaging

### EuMIC03-1

#### Single-Chip 100-Watt S-Band Power Amplifier in 0.25 μm GaN HEMT MMIC Technology

Gijs van der Bent<sup>1</sup>, Peter de Hek<sup>1</sup>, Frank E. van Vliet<sup>1</sup>, Zineb Ouarch Provost<sup>2</sup>

<sup>1</sup>TNO, <sup>2</sup>UMS

### EuMIC04-1

#### A CMOS Wide-Band Low Noise Mixer for LTE Application

Olim Hidayov<sup>1</sup>

<sup>1</sup>Analog Devices GmbH

08:50  
-  
09:10

### EuMIC02-2

#### G-Band Power Amplifiers in 130 nm InP Technology

Minguan Bao<sup>1</sup>, Vessen Vassilev<sup>1</sup>, David Gustafsson<sup>1</sup>, Herbert Zirath<sup>2</sup>

<sup>1</sup>Ericsson AB, <sup>2</sup>Chalmers University of Technology

### EuMIC03-2

#### 34 dBm GaN Doherty Power Amplifier for Ka-band satellite downlink

Anna Piacibello<sup>1</sup>, Rocco Giofrè<sup>2</sup>, Roberto Quaglia<sup>3</sup>, Vittorio Camarchia<sup>4</sup>

<sup>1</sup>Politecnico di Torino, <sup>2</sup>Università di Roma "Tor Vergata", <sup>3</sup>Cardiff University

### EuMIC04-2

#### 20-Gb/s 60-GHz OOK Receiver for High-Data-Rate Short-Range Wireless Communications

Ali Ferschischi<sup>1</sup>, Sami Ur Rehman<sup>1</sup>, Vincent RieB<sup>1</sup>, Corrado Carta<sup>1</sup>, Frank Ellinger<sup>2</sup>

<sup>1</sup>Technische Universität Dresden, Germany

09:10  
-  
09:30

### EuMIC02-3

#### Full H-Band LNA in 35 nm mHEMT Technology with Constant Current Bias Control

Rainer Weber<sup>1</sup>, Arnulf Leuther<sup>1</sup>, Roger Lozar<sup>1</sup>, Hermann Massler<sup>2</sup>

<sup>1</sup>Fraunhofer IAF

### EuMIC03-3

#### A GaN-on-Si MMIC Power Amplifier with 10 W Output Power and 35% Efficiency for Ka-Band Satellite Downlink

Paolo Colantonio<sup>1</sup>, Rocco Giofrè<sup>2</sup>

<sup>1</sup>University of Rome Tor Vergata, <sup>2</sup>University of Roma Tor Vergata

### EuMIC04-3

#### An 8 Gbps Adaptive Receiver for RF over FSO in 28 nm CMOS

Fatemeh Aghlmand<sup>1</sup>, Saransh Sharma<sup>1</sup>, Azita Emami<sup>1</sup>

<sup>1</sup>California Institute of Technology

09:30  
-  
09:50

### EuMIC02-4

#### A Full D-Band Low Noise Amplifier in 130 nm SiGe BiCMOS using Zero-Ohm Transmission Lines

Tim Maiwald<sup>1</sup>, Julian Potschka<sup>1</sup>, Katharina Kolb<sup>1</sup>, Marco Dietz<sup>1</sup>, Klaus Aufinger<sup>1</sup>, Akshay Visweswaran<sup>1</sup>, Robert Weigel<sup>1</sup>

<sup>1</sup>FAU Erlangen-Nürnberg, <sup>2</sup>Infineon Technologies AG, <sup>3</sup>imec, Leuven

### EuMIC03-4

#### Ka-Band 4 W GaN/Si MMIC Power Amplifier for CW Radar Applications

Chiara Ramella<sup>1</sup>, Corrado Florian<sup>1</sup>, Elisa Cipriani<sup>2</sup>, Marco Pirola<sup>1</sup>, Franco Giannini<sup>1</sup>, Paolo Colantonio<sup>3</sup>

<sup>1</sup>Politecnico di Torino - DET, <sup>2</sup>University of Bologna, <sup>3</sup>ESA / ESTEC, <sup>4</sup>University of Rome Tor Vergata

### EuMIC04-4

#### A High-Gain SiGe BiCMOS LNA for 5G In-Band Full-Duplex Applications

Tahsin Alper Ozkan<sup>1</sup>, Abdurrahman Burak<sup>1</sup>, Ilker Kalyoncu<sup>1</sup>, Mehmet Kaynak<sup>2</sup>, Yasar Gurbuz<sup>3</sup>

<sup>1</sup>Sabancı University, <sup>2</sup>IHP Microelectronics GmbH

09:50  
-  
10:10

### EuMIC02-5

#### Design of a 240-GHz LNA in 0.13 μm SiGe BiCMOS Technology

Mid Najmussadat<sup>1</sup>, Raju Ahamed<sup>1</sup>, Mikko Varonen<sup>2</sup>, Dristy Parveg<sup>3</sup>, Yehia Tawfik<sup>3</sup>, Kari Halonen<sup>1</sup>

<sup>1</sup>School of Electrical Engineering, Aalto University, <sup>2</sup>VTT Technical Research Centre of Finland

### EuMIC03-5

#### Real-Time, In-Circuit Temperature Sensing of an X-Band GaN Power Amplifier

Simon Mahon<sup>1</sup>, Olivia Eli<sup>1</sup>, Leigh Milner<sup>2</sup>, Evgeny Kuxa<sup>2</sup>, Anthony Parker<sup>1</sup>, Melissa Gorman<sup>1</sup>, Michael Heimlich<sup>1</sup>

<sup>1</sup>Macquarie University, <sup>2</sup>Defence Science and Technology Group

### EuMIC04-5

#### A Ku Band MMIC Single Chip Frequency Converter for Telecom Satellite Applications

Davide Resca<sup>1</sup>, Francesco Scappaviva<sup>1</sup>, Andrea Biondi<sup>1</sup>, Luca Cariani<sup>1</sup>, Francesco Vitulli<sup>2</sup>

<sup>1</sup>MEC s.r.l., <sup>2</sup>Thales Alenia Space Italia

# MONDAY 10:50 – 12:30

## ROOM Polar

### EuMIC01

#### EuMIC Opening Session

Chairs: François Deborgies<sup>1</sup>, EuMIC Chair and Domine Leenaerts<sup>2</sup>, EuMIC TPC Chair

Co-chairs: Stefan Heinen<sup>3</sup>, EuMIC Co-Chair and Christian Fager<sup>4</sup>, EuMIC TPC Co-Chair

<sup>1</sup>ESA-ESTEC, <sup>2</sup>NXP, <sup>3</sup>RWTH Aachen University, <sup>4</sup>Chalmers University of Technology

12:30 - 13:50  
Technology in Context  
Bert Hubert  
"Network Threats"  
Room: Auditorium  
Refer to p.27 for more information.

10:50  
-  
11:00

### Welcome Address

#### Opening of the European Microwave Integrated Circuits Conference 2020

François Deborgies

EuMIC Chair

11:45  
-  
12:30

### Photonic Integrated Circuits for Microwave Applications

Prof. Alwyn Seeds

University College London, UK

11:00  
-  
11:45

### Breaking the Mold: Using SiGe Technology in Ways That Were Never Envisioned

Prof. John D. Cressler

Gorgia Institute of Technology, US

The silicon-germanium heterojunction bipolar transistor (SiGe HBT) is the first practical bandgap-engineered device to be successfully implemented in silicon. SiGe HBTs combine transistor-level RF performance approaching that of III-V technologies, with integration levels, reliability, yield, and hence cost commonly associated with conventional Si CMOS fabrication. All at very conservative lithographic feature sizes. While SiGe HBTs possess modest breakdown voltages compared to their III-V counterparts, their performance has reached truly impressive levels, including: multi-hundred GHz frequency response bandwidth, low noise (broadband + 1/f), high output resistance, good RF linearity, and robust power handling capability. As such, SiGe technology, now spanning multiple technology generations in mass production, has made successful in-roads in a diverse set of performance-constrained applications, ranging from precision analog, to PAs for 4G/5G, to μ-wave and mm-wave transceivers for communications, sensing, and radar, to near-THz imaging systems, to integrated photonics.

This remarkable utilization diversity continues to expand in interesting ways, often along avenues that were never envisioned at the technology's inception. Examples include: 1) operation within radiation-intense environments such as space, 2) operation at incredibly low temperatures (to mK temperatures, to support the emerging needs of the quantum realm), 3) operation to very high temperatures (250°C, for power electronics), and 4) deployment as photosensitive elements for integrated photonic systems. This presentation will review the state-of-the-art in SiGe technology, show some impressive illustrations of its more conventional uses, and then will present examples of these surprising, newly-emerging trends, offered here as food-for-thought for the EuMIC community.

Photonics has found application in microwave systems for low loss transmission and distribution of wideband signals, for signal processing and for signal generation, particularly at THz frequencies. Photonic systems require sub-micron alignment of components due to the short wavelength of the optical sources- commonly in the range 0.8 microns to 1.6 microns. This leads to high assembly costs and significant operating environment challenges. The integration of the components required for a microwave photonic system offers the prospect of reduced assembly costs and the ability to deploy systems in challenging environments. This presentation will describe hybrid and monolithic approaches to integration using Indium Phosphide (InP) technology, including the development of advanced devices such as Uni-Travelling Carrier (UTC) THz photodiodes and advanced tuneable semiconductor lasers. It will also introduce system techniques such as comb generation and optical phase-locking for THz frequency synthesis. The presentation will also introduce advanced technologies for the monolithic integration of semiconductor lasers on Silicon (Si) substrates, which could offer major cost reductions and integration scale increases for future systems. The presentation will conclude with a summary of future opportunities and challenges for integrated microwave photonics.





# TUESDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1	<b>EuMIC11</b> Transceiver and Transmitter ICs		<b>EuMIC13</b> Foundry Panel	<b>EuMC07</b> Wireless Communication Systems	<b>EuMC14</b> Microwave and mmWave Systems
Mission 2	<b>EuMC01</b> Power Amplifiers for Sub 6 GHz Application		<b>EuMC08</b> Power Amplifiers Based on III-V & CMOS Technologies for 5G	<b>EuMC15</b> Doherty and Load Modulated Power Amplifier Structures	
Quest	<b>EuMIC/EuMC01</b> Silicon Integrated Sub-mmWave Circuits		<b>EuMC09</b> Terahertz Electronic Devices	<b>EuMC16</b> Terahertz Photonic Devices and System	
Expedition	<b>EuMIC12</b> Design and Characterisation Techniques		<b>EuMC10</b> MIMO and 5G Antennas	<b>EuMC17</b> Phased and Transmit Arrays	
Polar			<b>EuMIC14</b> 1-Minute Poster Pitch (13:50 - 14:10)	<b>EuMIC16</b> EuMIC Closing Session	
Auditorium	<b>Automotive Forum</b> Automotive Radar: Waveforms, Architectures, AI and Interference		<b>Technology in Context</b> Philosophical Lecture	<b>Automotive Forum</b> Automotive Radar: Waveforms, Architectures, AI and Interference	
Spark	<b>EuMC02</b> Array Antennas		<b>EuMC11</b> Waveguide and Horn Antennas	<b>EuMC18</b> 5G Antenna Systems	
Flash	<b>EuMC03</b> Advanced Packaging Components and Techniques		<b>EuMC12</b> Advanced Packaging Solutions for mmWave Applications	<b>EuMC19</b> 3D-Printing Technologies	
Glow	<b>EuMC04</b> Theoretical and Computational Electromagnetics		<b>EuMC13</b> Numerical Methods in Microwave Technology	<b>EuMC20</b> Modelling of Field Radiation and Scattering	
Beam	<b>Student School</b> Build Your Own Radar: Instruction		<b>W-25</b> Advanced mmWave Radar System Solutions for Industrial and Consumer Sensing Applications		
Media arena	<b>EuMC05</b> 1-Minute Poster Pitch (09:40 - 10:10)	<b>Women in Microwaves</b> Lunch Lecture	<b>Career Platform</b> How to Stand Out in a Job Application	<b>Women in Microwaves</b> Panel Discussion	
Fluor				<b>Teaching Microwaves</b> Increase Your Microwave Lecturing Skills	
Round control		<b>Career Platform</b> Career Lounge: Meet Jobs, Build Careers			
Transitzone B		<b>Automotive Forum</b> Lunch			
Transitzone C		<b>Student School</b> Build Your Own Radar: Hands-On Experience			
loopbrug		<b>Career Platform</b> Company Wall and Job Wall			
Beatrix		<b>Opening of the European Microwave Week</b> EuMC/EuMW Opening			
Juliana 2	<b>W-05</b> Digital Predisortion for 5G MIMO Wireless Transmitters				
Hall 1		<b>EuMC06</b> Interactive Poster Session	<b>EuMIC15</b> Interactive Poster Session		
Hall 1	<b>Student Design Competition</b> Detect a Drone / Build (a part of) an Amplifier				
Off-site					<b>EuMW Welcome Reception</b> 18.30 - 22.00

■ EuMW ■ EuMC ■ EuRAD ■ EuMIC ■ Student Activity ■ EuMIC/EuMC ■ EuMC/EuRAD

# TUESDAY 08:30 - 10:10

## Mission 2

**EuMC01**  
Power Amplifiers for Sub 6 GHz Application

Chair: Olof Bengtsson<sup>1</sup>  
Co-Chair: Mark van der Heijden<sup>2</sup>  
<sup>1</sup>Ferdinand-Braun-Institut (FBH), <sup>2</sup>NXP Semiconductors

**08:30 - 08:50**  
**EuMC01-1**  
Efficiency and Linearity of Digital "Class-C Like" Transmitters

Dieuwert Mul<sup>1</sup>, Robert Bootsman<sup>1</sup>, Quinten Bruinsma<sup>1</sup>, Yiyu Shen<sup>1</sup>, Sebastian Krause<sup>2</sup>, Rüdiger Quay<sup>3</sup>, Marco Peik<sup>4</sup>, Fred van Rijs<sup>5</sup>, Rob Heeres<sup>6</sup>, Sergio Pires<sup>7</sup>, Morteza S. Alavi<sup>8</sup>, Leo C.N. de Vreede<sup>9</sup>  
<sup>1</sup>Delft University of Technology, <sup>2</sup>Fraunhofer IAF, <sup>3</sup>Ampleon Netherlands B.V.

**08:50 - 09:10**  
**EuMC01-2**  
A 2.4/3.5 GHz Dual-Band Power Amplifier with Filter-Based Bias Network and SRFT Matching

Saraunsh Bayaskar<sup>1</sup>, Paolo Enrico de Falco<sup>2</sup>, Taylor Barton<sup>3</sup>  
<sup>1</sup>Qorvo, <sup>2</sup>University of Colorado, Boulder, <sup>3</sup>University of Colorado Boulder

**09:10 - 09:30**  
**EuMC01-3**  
A Miniaturized 160 W Power Amplifier with 40% Efficiency at 9 dB Power Back-Off over 2.3-4.7 GHz

Mustazar Iqbal<sup>1</sup>, Rui Hou<sup>1</sup>, Gunnar Johansson<sup>2</sup>, Richard Hellberg<sup>3</sup>, Bo Berglund<sup>4</sup>  
<sup>1</sup>Ericsson AB

**09:30 - 09:50**  
**EuMC01-4**  
2-GHz Class-E Power Amplifier Using a Compact Redundancy-Free Harmonic Tuning Circuit

Shinichi Tanaka<sup>1</sup>, Hirotaka Asami<sup>2</sup>  
<sup>1</sup>Shibaura Institute of Technology

**09:50 - 10:10**  
**EuMC01-5**  
A 90W 1-3 GHz Power Amplifier Module

Mohammad Ghazizadeh<sup>1</sup>, Sayyed-Hossein Javid-Hosseini<sup>1</sup>, Vahid Nayyeri<sup>1</sup>  
<sup>1</sup>Iran University of Science & Technology

## Spark

**EuMC02**  
Array Antennas

Chair: Ilona Rolfes<sup>1</sup>  
Co-Chair: Antti Räisänen<sup>2</sup>  
<sup>1</sup>Ruhr-University Bochum, <sup>2</sup>Aalto University

**EuMC02-1**  
Endfire Coupled-Mode Patch Antenna Array with Balanced Feeding

Haozhan Tian<sup>1</sup>, Tatsuo Itoh<sup>2</sup>  
<sup>1</sup>University of California Los Angeles (UCLA), <sup>2</sup>University of California, Los Angeles

**EuMC02-2**  
Gap-Waveguide Cavity Slot Array Based on Two Metal Layers at 120 GHz

Teng Li<sup>1</sup>, Florian Boes<sup>2</sup>, Karina Schneider<sup>3</sup>, Thomas Zwick<sup>4</sup>  
<sup>1</sup>Karlsruhe Institute of Technology

**EuMC02-3**  
A Wideband Slot Array Antenna with Coscant Squared Pattern

Qiang Wang<sup>1</sup>, Fengyun Cui<sup>1</sup>, Lin Pan<sup>2</sup>, Panpan Chen<sup>1</sup>, Lincui Li<sup>1</sup>  
<sup>1</sup>Institute of Engineering Electronics, China Academy of Engineering physics, <sup>2</sup>China Academy of Engineering physics

**EuMC02-4**  
A C-band Transmitarray for Spatial Multiplexing and Diversity Applications

Pavel Turalchuk<sup>1</sup>, Irina Munina<sup>2</sup>, Vitaliy Kirillov<sup>2</sup>, Alexander Verevkin<sup>3</sup>, Dmitry Zelenchuk<sup>4</sup>  
<sup>1</sup>St. Petersburg Electrotechnical University "LETI", <sup>2</sup>St. Petersburg Electrotechnical University "LETI", <sup>3</sup>Queen's University Belfast

**EuMC02-5**  
A Low-Profile Shared-Aperture Dual-Band Broadband Antenna Array for SAR Applications

Tao Dong<sup>1</sup>, Ke Li<sup>1</sup>, Zhenghuan Xia<sup>2</sup>, Xinhua Li<sup>3</sup>  
<sup>1</sup>Beijing Institute of Satellite Information Engineering

## Flash

**EuMC03**  
Advanced Packaging Components and Techniques

Chair: Kamal K Samanta<sup>1</sup>  
Co-Chair: Miguel Sanchez-Soriano<sup>2</sup>  
<sup>1</sup>Sony Europe B.V., <sup>2</sup>University of Alicante

**EuMC03-1**  
BenzoCycloButene-Based In-Package Substrate Integrated Waveguides for Sub-THz Applications

Giuseppe Aciri<sup>1</sup>, Emmanuel Pistono<sup>2</sup>, Florence Povedin<sup>3</sup>, Philippe Ferrari<sup>4</sup>, Luigi Boccia<sup>5</sup>, Anne-Sophie Grimault<sup>6</sup>, Nicolas Zerouanian<sup>7</sup>, Frédéric Aniel<sup>8</sup>, Loïc Vincent<sup>9</sup>  
<sup>1</sup>INPG, RFIC-Lab, <sup>2</sup>UGA, RFIC-Lab, <sup>3</sup>University of Calabria, <sup>4</sup>Centre de Nanosciences et Nanotechnologies, <sup>5</sup>INPG, CIME

**EuMC03-2**  
Large Scale Array Antenna Packaging for 5G mmWave Base Station

Dohyuk Ha<sup>1</sup>, Kwanghyun Baek<sup>1</sup>, Juneseok Lee<sup>1</sup>, Sanghoon Park<sup>1</sup>, Jung-Ho Park<sup>1</sup>, Jinsu Heo<sup>1</sup>, Youngju Lee<sup>1</sup>  
<sup>1</sup>Samsung Electronics

**EuMC03-3**  
Integrated Microfluidic Cooling for S-Band 10-Watt CW Power Amplifiers on Hybrid PCBs

Huaiqiang Yu<sup>1</sup>  
<sup>1</sup>Sichuan Institute of Piezoelectric and Acousto-optic Technology (SIPAT)

**EuMC03-4**  
A U-Band Rectangular Waveguide-to-Coplanar Waveguide Transition Using Metal Ridge

Yunfeng Dong<sup>1</sup>, Vitaliy Zhurbenko<sup>1</sup>, Tom Keinicke Johansen<sup>2</sup>  
<sup>1</sup>Technical University of Denmark

**EuMC03-5**  
Via-Less Waveguide-to-Stripline Transition Using 2D Electromagnetic Bandgap Structure

Zhi Li<sup>1</sup>, Kevin Xu<sup>1</sup>, Nathan Chordas-Ewell<sup>1</sup>, Dongyin Ren<sup>1</sup>, Jun H. Choi<sup>1</sup>, Ryan Wu<sup>2</sup>  
<sup>1</sup>The State University of New York at Buffalo, <sup>2</sup>NXP Semiconductors

## Glow

**EuMC04**  
Theoretical and Computational Electromagnetics

Chair: Francisco Mesa<sup>1</sup>  
Co-Chair: Alessandro Galli<sup>2</sup>  
<sup>1</sup>Universidad de Sevilla, <sup>2</sup>Sapienza University of Rome

**EuMC04-1**  
Designing Microwave Circuits Using Genetic Algorithms Accelerated by Convolutional Neural Networks

Takuma Akada<sup>1</sup>, Kazuhiro Fujimori<sup>1</sup>  
<sup>1</sup>Graduate School of Natural Science and Technology, Okayama University

**EuMC04-2**  
A DE/WD/VM Hybrid Algorithm for Multiple-Constraint Synthesis of Concentric Ring Arrays

Shaoyi Xie<sup>1</sup>, Jiawei Li<sup>1</sup>, Hao Shao<sup>1</sup>, Letian Guo<sup>1</sup>, Guangjian Deng<sup>1</sup>  
<sup>1</sup>Northwest Institute of Nuclear Technology

**EuMC04-3**  
An Efficient Butterfly Factorization-Based Method for Electromagnetic Near-Field Calculations

XiaoWei Huang<sup>1</sup>, XinQing Sheng<sup>1</sup>  
<sup>1</sup>Beijing Institute of Technology

**EuMC04-4**  
A Randomized Low-Rank Decomposition Based Method for Solving Volume-Surface Integral Equation

Yan-Nan Liu<sup>1</sup>  
<sup>1</sup>CAEP Software Center for High Performance Numerical Simulation

**EuMC04-5**  
Microwave Generation of Bessel-Gauss Beams: A Fully Vectorial Electromagnetic Approach

Walter Fuscaldo<sup>1</sup>, Alessio Benedetti<sup>1</sup>, Davide Comite<sup>1</sup>, Paolo Burghignoli<sup>1</sup>, Paolo Baccarelli<sup>1</sup>, Alessandro Galli<sup>1</sup>  
<sup>1</sup>Sapienza University of Rome, <sup>2</sup>Roma Tre University

## TUESDAY 08:30 – 10:10

### Quest

#### EuMIC/EuMC01

Silicon Integrated Sub-mmWave Circuits

Chair: Christophe Gaquiere<sup>1</sup>

Co-Chair: François Deborgies<sup>2</sup>

<sup>1</sup>University of Lille, <sup>2</sup>ESA-ESTEC

08:30  
-  
08:50

#### EuMIC/EuMC01-1

A 240-GHz FMCW Radar Transceiver with 10 dBm Output Power using Quadrature Combining

Faisal Ahmed<sup>1</sup>, Muhammad Furqan<sup>1</sup>, Klaus Aufinger<sup>1</sup>, Andreas Stelzer<sup>1</sup>

<sup>1</sup>Infinion Technologies AG, <sup>2</sup>Johannes Kepler Universität

08:50  
-  
09:10

#### EuMIC/EuMC01-2

A 160 GHz High Output Power and High DC-to-RF Efficiency Fundamental Oscillator in a 130-nm SiGe BiCMOS Process

Xingcun Li<sup>1</sup>, Wenhua Chen<sup>1</sup>, Yunfan Wang<sup>1</sup>, Zhenghe Feng<sup>1</sup>

<sup>1</sup>Tsinghua University

09:10  
-  
09:30

#### EuMIC/EuMC01-3

250 GHz SiGe SPDT Resonator Switch

Yehia Tawfik<sup>1</sup>, Ahamed Raju<sup>1</sup>, Mikko Varonen<sup>1</sup>, Md Najmussadat<sup>1</sup>, Kari Halonen<sup>1</sup>

<sup>1</sup>Aalto University, <sup>2</sup>VTT Technical Research Centre of Finland

09:30  
-  
09:50

#### EuMIC/EuMC01-4

Compact and Transfer Printable 64 Gb/s Differential Transimpedance Amplifier in 130-nm SiGe BiCMOS

Mesut Inac<sup>1</sup>, Adel Fatemi<sup>1</sup>, Friedel Gerfers<sup>1</sup>, Andrea Malagnaggi<sup>1</sup>

<sup>1</sup>IHP - Leibniz Institut für innovative Mikroelektronik, <sup>2</sup>Technische Universität Berlin

09:50  
-  
10:10

#### EuMIC/EuMC01-5

A 122-242 GHz Dynamic Frequency Divider in an Advanced BiCMOS Technology

Badou Sene<sup>1</sup>, Herbert Knapp<sup>1</sup>, Daniel Reiter<sup>1</sup>, Nils Pohl<sup>1</sup>

<sup>1</sup>Infinion Technologies AG, <sup>2</sup>Ruhr University Bochum

### Mission 1

#### EuMIC11

Transceiver and Transmitter ICs

Chair: Sébastien Chartier<sup>1</sup>

Co-Chair: Ingmar Kalfass<sup>2</sup>

<sup>1</sup>Fraunhofer Institute for Applied Solid State Physics (IAF), <sup>2</sup>Institute of Robust Power Semiconductor Systems (ILH) - University of Stuttgart

#### EuMIC11-1

Single Chip Transmitter with Integrated Up-Converter and PLL for Ku-Band M2M Applications

Maurice van Wanum<sup>1</sup>, Enrico Lia<sup>1</sup>, Lex de Boer<sup>1</sup>, Lennaert Bronts<sup>1</sup>, Marien Rodenburg<sup>1</sup>, Sebastiaan Jacobs<sup>1</sup>, Inês Inácio<sup>1</sup>, Marc van Heijningen<sup>1</sup>, Frank E. van Vliet<sup>1</sup>

<sup>1</sup>TNO, <sup>2</sup>ESA-ESTEC

#### EuMIC11-2

A Full E-Band Single-Channel SiGe Transceiver MMIC for Monostatic FMCW Radar Systems

Christian Bredendiek<sup>1</sup>, Steffen Hansen<sup>1</sup>, Gunnar Briese<sup>1</sup>, Nils Pohl<sup>1</sup>

<sup>1</sup>Fraunhofer FHR, <sup>2</sup>Ruhr-Universität Bochum

#### EuMIC11-3

A 76 GHz CMOS Low-PDC Transmitter with 15 dBm PSAT at 150°C for Automotive Radar

Nobumasa Hasegawa<sup>1</sup>, Shuya Kishimoto<sup>1</sup>, Shinji Yamaura<sup>1</sup>

<sup>1</sup>DENSO CORPORATION

#### EuMIC11-4

A W-Band Transceiver Chip for Future 5G Communications in InP-DHBT Technology

Maruf Hossain<sup>1</sup>, Tanjil Shivan<sup>1</sup>, Michael Hrobak<sup>1</sup>, Thuailfiqar Al-Sawal<sup>1</sup>, Dimitri Stoppel<sup>1</sup>, Hady Yacoub<sup>1</sup>, Nils Weimann<sup>1</sup>, Wolfgang Heinrich<sup>1</sup>, Viktor Krozer<sup>1</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH) Leibniz-Institut für Höchstfrequenztechnik

#### EuMIC11-5

A Low Power Consumption 65-nm CMOS True Time Delay N-path Circuit Achieving 2 ps Delay Resolution

Erez Zolkov<sup>1</sup>, Roy Weiss<sup>1</sup>, Asher Madjar<sup>1</sup>, Emanuel Cohen<sup>1</sup>

<sup>1</sup>Technion - Israel Institute of Technology

### Expedition

#### EuMIC12

Design and Characterisation Techniques

Chair: Ernesto Limiti<sup>1</sup>

Co-Chair: Simona Donati Guerrieri<sup>2</sup>

<sup>1</sup>S EE Dept, University of Rome "Tor Vergata", Rome, Italy, <sup>2</sup>Politecnico di Torino

#### EuMIC12-1

Effects of Load Impedances at Third Order Intermodulation Tones

Eigo Kuwata<sup>1</sup>, Yashar Alimohammadi<sup>1</sup>, Xuan Liu<sup>1</sup>, James Bell<sup>1</sup>, Paul Tasker<sup>1</sup>, Shintaro Shinjo<sup>1</sup>, Johannes Benedikt<sup>1</sup>

<sup>1</sup>Cardiff University, <sup>2</sup>Mitsubishi Electric Corporation

#### EuMIC12-2

Intermodulation Distortion Analysis of Microwave Tunable Filters Using Barium Strontium Titanate Capacitor and Varactor Diode

Patricia Bouça<sup>1</sup>, Ricardo Figueiredo<sup>1</sup>, João Matos<sup>1</sup>, Paula Vilarinho<sup>1</sup>, Nuno Borges Carvalho<sup>1</sup>

<sup>1</sup>University of Aveiro / Instituto de Telecomunicações, <sup>2</sup>University of Aveiro

#### EuMIC12-3

Non-Linear Analysis of a Broad-band Power Amplifier at 300 GHz

haitham ghanem<sup>1</sup>, Benjamin Schoch<sup>1</sup>, Ingmar Kalfass<sup>2</sup>, Pascal Szriftgiser<sup>1</sup>, Malek Zegaoui<sup>1</sup>, Mohammed Zakroune<sup>1</sup>, François Danneville<sup>1</sup>, Guillaume Ducournau<sup>1</sup>

<sup>1</sup>IEMN, Univ. Lille, UMR 8520 CNRS, Avenue Poincaré, F-59652 Villeneuve d'Ascq, <sup>2</sup>Institute of Robust Power Semiconductor Systems, University of Stuttgart, <sup>3</sup>Laboratoire de Physique des Lasers Atomes et Molécules (PhLAM)

#### EuMIC12-4

Global Assessment of PA Variability through Concurrent Physics-Based X-Parameter and Electro-Magnetic Simulations

Simona Donati Guerrieri<sup>1</sup>, Chiara Ramella<sup>1</sup>, Fabrizio Bonani<sup>1</sup>, Giovanni Ghione<sup>1</sup>

<sup>1</sup>Politecnico di Torino

#### EuMIC12-5

Spatial Power Combining and Impedance Matching Silicon-IC-to-Waveguide Contactless Transition Resolution

Piyush Kaul<sup>1</sup>, Alhassan Aljaroshia<sup>2</sup>, Bart Smolders<sup>1</sup>, Marion K. Matters-Kammerer<sup>1</sup>, Rob Maaskant<sup>1</sup>

<sup>1</sup>Eindhoven University of Technology, <sup>2</sup>Eindhoven University of Technology

## TUESDAY 10:50 – 12:30

### Beatrix

#### EuMW01

EuMW/EuMC Opening Session

Chair: Frank E. van Vliet<sup>1</sup>, General Chair

Co-Chair: Wim van Cappellen<sup>2</sup>, EuMC Chair

<sup>1</sup>TNO, <sup>2</sup>ASTRON

10:50  
-  
10:55

Welcome Address: Opening of the European Microwave Week 2020

Frank E. van Vliet

General Chair

10:55  
-  
11:05

EuMA Welcome Address

Frank van den Bogaart

EuMA President

11:05  
-  
11:10

Greetings from the EuMW 2020 Platinum Sponsor

11:10  
-  
11:15

Greetings from the IEEE MTT-S

Alaa Abunjaileh

IEEE MTT-S President

11:15  
-  
11:35

Awards Ceremony

Prof. Andy Gibson

Manchester Metropolitan University, UK

11:35  
-  
12:10

How Connectivity Technologies are Changing Vehicles

Lars Reger<sup>1</sup>

<sup>1</sup>Executive Vice President & CTO, NXP Semiconductors, The Netherlands

Advances in connectivity technologies are opening up new ways for cars to interact with their passengers, objects in their surroundings and other cars. Ultra-Wideband (UWB) technology is growing in importance because of its ability to provide precise, secure and real-time localization capabilities. Designed to give spatial awareness to cars, mobiles, and other smart devices, UWB is ensuring higher levels of security against car theft from relay station attacks in first series cars that are on the road today. But it can do much more. NXP, as well as Volkswagen and Continental, have demonstrated a variety of exciting new use cases for UWB in automotive applications. Automotive radar technology is also evolving to include connectivity-light functionality. How will RFIC, microwave technology and connectivity transform the driving experience of tomorrow?

12:10  
-  
12:30

Interactive EuMW Quiz

Wim van Cappellen

EuMC Chair

This session is dedicated to the following awards and prizes:

- EuMA – Pioneer Award
- EuMA – Distinguished Service Award
- Certificate of Recognition for EuMW 2019 General Chair
- International Journal of Microwave and Wireless Technologies Best Paper Prize

Congratulations to all award and prize recipients!







# TUESDAY 16:10 – 17:50

<b>ROOM</b>	<b>Polar</b>
	<b>EuMIC16</b> EuMIC Closing Session
	Chairs: François Deborgies <sup>1</sup> , EuMIC Chair and Domine Leenaerts <sup>2</sup> , EuMIC TPC Chair Co-chairs: Stefan Heinen <sup>3</sup> , EuMIC Co-Chair and Christian Fager <sup>4</sup> , EuMIC TPC Co-Chair <sup>1</sup> ESA-ESTEC, <sup>2</sup> NXP, <sup>3</sup> RWTH Aachen University, <sup>4</sup> Chalmers University of Technology

<b>16:10</b>	Awards Ceremony
<b>16:20</b>	Marion Matters-Kammerer Awards and Prizes Chair

EuMIC Prize  
EuMIC Young Engineer Prize  
GAAS<sup>®</sup> Association Student Fellowships

<b>16:20</b>	Radio ICs for Future Wireless Networks
<b>17:00</b>	Igor Tasevski, Vice President & Head of Product Development Unit Radio, Ericsson, Sweden

Stretching beyond traditional mobile access, wireless networks is on a quest to transform connectivity, as we know it today. With the ambition to provide data sharing anywhere at any time, for anyone and anything, the implementation challenges are demanding. Emerging RF technologies for 5G, such as MIMO and scaled phased arrays have reached a significant level of maturity, enabling product deployments and standards completion. First generations of millimeter-wave Radio IC are already deployed in products but improvements regarding power consumption, size and functionality are in need to facilitate even more cost effective deployments. Applications and use cases vary between geographies, however the trend is clear - phased arrays, massive MIMO, and millimeter-wave have significantly changed the way we build wireless networks for the future. The presentation will provide an overview of challenges and technology choices in the areas of advanced Radio IC development and antenna integration for 3GPP radio access applications. It will also reflect on various market dynamics and industry trends. Technology considerations for Radio HW research and emerging 6G application trials will be discussed. The emphasis is on projects where new RF capabilities are key differentiators.

<b>17:00</b>	MetOp-SG mm-Wave Instruments and Technologies
<b>17:40</b>	Ville Kangas Arctic Weather Satellite Project Manager, European Space Agency, The Netherlands

The payload complement of MetOp Second Generation (MetOp-SG) includes three passive radiometers, the Microwave Sounder (MWS) on Satellite A, the Microwave Imager (MWI) and Ice Cloud Imager (ICI) on Satellite B. In total MWS, MWI and ICI provide 63 channels ranging from 18.7 GHz up to 664 GHz. During MetOp-SG Phase 0 (2007 – 2008), several challenges in the end-user requirements were identified, requiring technology developments. Channels up to 664 GHz were under consideration for ICI-Europe did not have Schottky technology available up to 664 GHz, even though developments themselves had started already long time ago (already early 90's for planar schottky). Noise performance requirements necessitated use of very low noise amplifiers (LNA) at frequencies up to 230 GHz – Europe did not have such technology available up to 230 GHz, although small gate length III-V HEMT process was available. Although technologies themselves were not available, end-user requirements and needs were very clear. Therefore Requirement specifications could be clearly established and Specific MetOp-SG developments could be then implemented. The speech will explain the technology development logic and history and explains how this development was done tightly together with the instrument design. The results achieved during the technology developments will be described, including qualification test results. Last an overview of the current status of the instruments and technology will be given and also an outlook on how the developments done will be used in future satellite missions.

<b>17:40</b>	Closing Remarks and Invitation to EuMIC 2021 in London
<b>17:50</b>	François Deborgies, Chris Clifton <sup>1</sup> <sup>1</sup> EuMIC 2021 Chair

# WEDNESDAY

Room	08:30 – 10:10	10:50 – 12:30	13:50 – 15:30	16:10 – 17:50	EVENING PROGRAMME
Progress			W-14 Automotive Radar Networks and Sensor Fusion		
Mission 1		EuRAD02 Dual Use & Waveform Design	EuRAD04 Doppler Processing Techniques for Low Reflectivity Targets	EuRAD06 Emerging & Industrial Applications	
Mission 2	EuMC21 Special Antenna Systems	EuMC27 [Focussed Session] Emerging Microwave Technology: Asia-Pacific	EuMC33 Advances on RF Power Amplifier Behavioural Modelling	EuMC39 Solid State High Power Amplifiers for Satellite and Radar Applications	
Quest		EuRAD03 Design and Calibration Concepts for Advanced Radar Systems	EuRAD05 Radar Circuits and Systems	EuRAD07 Radar Scenario Simulations	
Expedition	EuMC22 Novel Circuits Solutions for Energy Transfer in the Near-Field and Far-Field	EuMC28 Novel Wireless Power Transfer and Energy Harvesting Systems	EuMC34 Recent Advances in RFID and IoT Sensors	EuMC40 [Focussed Session] Emerging Antenna Technologies for RFID	
Polar	EuRAD01 EuRAD Opening Session				
Auditorium	EuMC23 [Focussed Session] Innovative Antennas for Cubesat Platforms	DSS Forum Space Situational Awareness	DSS Forum Strategy Analytics Lunch	DSS Forum Space Situational Awareness	DSS Forum Cocktail Reception
Spark	S-08 High Power Amplification for Space Applications		EuMC35 Integrated Antennas	EuMC41 SATCOM and mmWave Antennas	
Flash	EuMC24 Additive Manufacturing and Emerging Materials for mmWave Applications	EuMC29 Reconfigurable Planar Passive Components	EuMC36 Transmission Lines and Passive Components	EuMC42 Planar Power Dividers/ Combiners	
Glow		EuMC30 Non-Planar Filters	EuMC37 Non-Planar Filters and Devices	EuMC43 Non-Planar Devices and Systems	
Beam	EuMC25 Metamaterials for Circuits and Sensors	EuMC31 Frequency Selective Surfaces, Reflectors and Metamaterial Antennas	EuMC38 Metasurfaces and FSSs Applications	EuMC44 [Special Session] Silicon-Based Ka-Band Massive MIMO Systems	
Media arena	EuMC26 1-Minute Poster Pitch (09:40 - 10:10)	Career Platform [Special Session] Industry Market and Professional Opportunities	IEEE Young Professionals	Career Platform Startup Panel	
Fluor	S-04 Quantum Computing for Electrical Engineers				
Shuttle		IEEE Young Professionals			
Round control		Career Platform Career Lounge: Meet Jobs, Build Careers			
loopbrug		Career Platform Company Wall and Job Wall			
Juliana 2	W-12 High-Efficiency Linear Power Amplifiers for High Bandwidth, High PAR Signals				
Hall 1	Student Design Competition Detect a Drone / Build (a part of) an Amplifier		EuMC32 Interactive Poster Session	Student Design Competition Detect a Drone / Build (a part of) an Amplifier	
Off-site					Microwave Nightfever 20.00 - 24.00

## WEDNESDAY 08:30 – 10:10

## Mission 2

## EuMC21

Special Antenna Systems

Chair: Alexandros Feresidis<sup>1</sup>Co-Chair: Lorenz-Peter Schmidt<sup>2</sup><sup>1</sup>University of Birmingham, <sup>2</sup>Uni Erlangen08:30  
–  
08:50

## EuMC21-1

Low-Loss Electro-Mechanical Beam Steering of High Gain THz Antenna

Muhammad Rabbani<sup>1</sup>, James Churm<sup>1</sup>, Alexandros Feresidis<sup>1</sup><sup>1</sup>University of Birmingham08:50  
–  
09:10

## EuMC21-2

A Tactical Broadband High Power Fork-Shaped Monopole Antenna

Ahmad Emadeddin<sup>1</sup>, Abbas Akbarzadeh-Jahromi<sup>2</sup>, B. L. G. Jonsson<sup>1</sup><sup>1</sup>KTH - Royal Institute of Technology, <sup>2</sup>University of Tehran09:10  
–  
09:30

## EuMC21-3

Passive Antenna Systems Embedded into a Load Bearing Wall for Improved Radio Transparency

Lauri Vähä-Savo<sup>1</sup>, Alejandra Garrido Atienza<sup>1</sup>, Christian Cziezowski<sup>1</sup>, Mikko Heino<sup>1</sup>, Katsuyuki Haneda<sup>1</sup>, Clemens Icheln<sup>1</sup>, Xiaoshu Lü<sup>1</sup>, Klaus Viljanen<sup>1</sup><sup>1</sup>School of Electrical Engineering, Aalto University, <sup>2</sup>University of Vaasa, <sup>3</sup>School of Engineering, Aalto University.09:30  
–  
09:50

## EuMC21-4

Compact Dual and Wide Band Monopole-Like Antenna Based on SRR for WLAN Applications

Nilton Santos-Valdivia<sup>1</sup>, Patricia Castillo-Aranibar<sup>1</sup>, Alejandro Garcia-Lamperez<sup>2</sup>, Daniel Segovia-Vargas<sup>3</sup><sup>1</sup>Universidad Católica San Pablo, <sup>2</sup>Universidad Carlos III de Madrid09:50  
–  
10:10

## EuMC21-5

Compact Pattern-Switching Patch Antenna

Abdullah Haskou<sup>1</sup>, Anthony Pesin<sup>1</sup>, Ali Louzir<sup>1</sup><sup>1</sup>InterDigital, Inc.

## Expedition

## EuMC22

Novel Circuits Solutions for Energy Transfer in the Near-Field and Far-Field

Chair: Yi Wang<sup>1</sup>Co-Chair: Giuseppina Monti<sup>2</sup><sup>1</sup>University of Birmingham, <sup>2</sup>University of Salento

## EuMC22-1

Input-Power-Synchronous Adaptively Biased Wide-Dynamic-Range High-Efficiency Rectifier with Zero-Threshold GaAs HEMTs

Jun Yamazaki<sup>1</sup>, Ryo Ishikawa<sup>1</sup>, Kazuhiko Honjo<sup>1</sup><sup>1</sup>The University of Electro-Communications

## EuMC22-2

Automatically switchable two-way rectifier

Massimo Del Prete<sup>1</sup>, Diego Masotti<sup>2</sup>, Alessandra Costanzo<sup>2</sup><sup>1</sup>Datalogic S.p.a., <sup>2</sup>University of Bologna

## EuMC22-3

A High Sensitivity RF Energy Harvester for Diverse Environments

IBRAHIM KAGAN AKSOYAK<sup>1</sup>, ADAMANTIA CHLET-SOUL<sup>2</sup>, John Papapolymerou<sup>2</sup>, Ahmet Ulusoy<sup>1</sup><sup>1</sup>Karlsruhe Institute of Technology, <sup>2</sup>Michigan State University

## EuMC22-4

Proposal and Demonstration of Power Conversion-Chip/Amplifier Integrated Antenna

Shinji Hara<sup>1</sup>, Asako Suzuki<sup>1</sup>, Hiroshi Hirayama<sup>2</sup><sup>1</sup>Nagoya University, <sup>2</sup>Nagoya Institute of Technology

## Auditorium

## EuMC23

[Focussed Session] Innovative Antennas for Cubesats and Small-Space Platforms

Chair: Nelson Fonseca<sup>1</sup>Co-Chair: Mauro Ettorre<sup>2</sup><sup>1</sup>European Space Agency, ESA/ESTEC, <sup>2</sup>University of Rennes 1

## EuMC23-1

Design of a Dual Circularly Polarized Elliptical Feed Horn for CubeSat Reflectarray Applications

Mustafa Murat Bilgic<sup>1</sup>, Min Zhou<sup>1</sup>, Peter Meincke<sup>1</sup>, Andreas Ericsson<sup>1</sup>, Erik Jørgensen<sup>1</sup>, Michael Lumpholt<sup>1</sup><sup>1</sup>TICRA

## EuMC23-2

Compact Reconfigurable Antenna for Nanostallites

Simone Genovesi<sup>1</sup>, Francesco Alessio Dicandia<sup>2</sup><sup>1</sup>University of Pisa, <sup>2</sup>Greenwaves

## EuMC23-3

3D Printed Ceramic Low-Profile GNSS Antenna for SmallSats

Maxime Romier<sup>1</sup><sup>1</sup>ANYWAVES

## EuMC23-4

Compact End-Fire Antenna Designs for PicoSat Integration and Other Small Satellite Missions

Victoria Gomez-Guillamon Buendia<sup>1</sup>, Symon K. Podilchak<sup>1</sup>, Salvatore Liberto<sup>1</sup>, Dimitris E. Anagnostou<sup>1</sup>, George Goussetis<sup>1</sup>, Constantin Constantinides<sup>1</sup>, Tom Walkinshaw<sup>1</sup>, Maarten van der Vorst<sup>1</sup><sup>1</sup>Heriot-Watt University, <sup>2</sup>The University of Edinburgh, <sup>3</sup>Alba Orbital, <sup>4</sup>ESA-ESTEC

## Flash

## EuMC24

Additive Manufacturing and Emerging Materials for mmWave Applications

Chair: Andrei Muller<sup>1</sup>Co-Chair: Chris Clifton<sup>2</sup><sup>1</sup>École polytechnique fédérale de Lausanne (EPFL), Nanolab, <sup>2</sup>Sony Europe B V

## EuMC24-1

High Performance Cooling Solution for Highly Integrated RF-PCBs

Jens Leiss<sup>1</sup><sup>1</sup>IMST GmbH

## EuMC24-2

Monolithic SLA-Based Capacitively-Loaded High-Q Coaxial Resonators and Bandpass Filters

Kunchen Zhao<sup>1</sup>, Dimitra Psychogiou<sup>1</sup><sup>1</sup>University of Colorado at Boulder

## EuMC24-3

3D Printed Double Ridged Waveguide Rotman Lens System

Karina Hoel<sup>1</sup>, Nathan Jastram<sup>2</sup>, Stein Kristoffersen<sup>1</sup>, Dejan Filipovic<sup>2</sup><sup>1</sup>Norwegian Defence Research Establishment (FFI), <sup>2</sup>University of Colorado at Boulder

## EuMC24-4

Investigation of a Composite Embedded RF Passive Devices

Grzegorz Beziuk<sup>1</sup>, Kamran Ghorbani<sup>1</sup>, Thomas Baum<sup>2</sup>, Kelvin Nicholson<sup>2</sup><sup>1</sup>RMIT University, <sup>2</sup>DST Group, Port Melbourne

## EuMC24-5

A Minimally Invasive Monitoring Concept for Plasma-Assisted Surface Treatments in PET Bottles

Dennis Pohle<sup>1</sup>, Felix Mitschker<sup>1</sup>, Jonathan Jenderny<sup>1</sup>, Marcel Rudolph<sup>1</sup>, Christian Schulz<sup>1</sup>, Peter Awakowicz<sup>1</sup>, Ilona Rolfes<sup>1</sup><sup>1</sup>Ruhr University Bochum

## WEDNESDAY 08:30 – 10:10

## Beam

## EuMC25

Metamaterials for Circuits and Sensors

Chair: Ferran Martín<sup>1</sup>Co-Chair: Francisco Medina<sup>2</sup><sup>1</sup>Universitat Autònoma de Barcelona,<sup>2</sup>Universidad de Sevilla08:30  
–  
08:50

## EuMC25-1

Glide Symmetry to Improve the Bandgap Operation of Periodic Microstrip Defected Ground Structures

Boules A. Mouris<sup>1</sup>, Armando Fernández-Prieto<sup>2</sup>, Ragnar Thobaben<sup>1</sup>, Jesús Martel<sup>2</sup>, Francisco Mesa<sup>2</sup>, Oscar Quevedo-Teruel<sup>1</sup><sup>1</sup>KTH Royal Institute of Technology, <sup>2</sup>Universidad de Sevilla08:50  
–  
09:10

## EuMC25-2

Differential CRLH Coupled-Line Unit Cell with High Common Mode Rejection Ratio

Mariam Ateyya<sup>1</sup>, Amr Safwat<sup>1</sup><sup>1</sup>Faculty of Engineering, Ain Shams University09:10  
–  
09:30

## EuMC25-3

Capacitively-Loaded Slow-Wave Transmission Lines for Sensitivity Improvement in Phase-Variation Permittivity Sensors

Jan Coromina<sup>1</sup>, Jonathan Muñoz-Enano<sup>1</sup>, Paris Véléz<sup>1</sup>, Amir Ebrahimi<sup>1</sup>, James Scott<sup>1</sup>, Kamran Ghorbani<sup>1</sup>, Ferran Martín<sup>1</sup><sup>1</sup>Universitat Autònoma de Barcelona, <sup>2</sup>RMIT University09:30  
–  
09:50

## EuMC25-4

Implementation of K-Band Mushroom Metamaterial Filter for Satellite Applications

Arash Arsanjani<sup>1</sup>, Luke Robins<sup>1</sup>, Reinhard Teschl<sup>1</sup>, Wolfgang Bosch<sup>1</sup><sup>1</sup>Graz University of Technology09:50  
–  
10:10

## EuMC25-5

Compact Size Wideband 0-dB Microstrip Forward Coupler

Mohamed Elsheikh<sup>1</sup>, Amr Safwat<sup>1</sup><sup>1</sup>Ain Shams University, <sup>2</sup>Faculty of Engineering, Ain Shams University



# WEDNESDAY 08:30 - 10:10

## ROOM Polar

### EuRAD01

#### EuRAD Opening Session

Chair: Mayazurra Ruggiano<sup>1</sup>, EuRAD Chair

Co-Chair: Jacco de Wit<sup>2</sup>, EuRAD TPC Chair

<sup>1</sup>Thales Nederland B.V., <sup>2</sup>TNO

**08:30 - 08:40** Welcome Address: Opening of the European Radar Conference 2020

Mayazurra Ruggiano  
EuRAD Chair

as good as few-ppm level accuracy. This instrument allows us, for the first time, range-resolved absolute humidity estimates on Martian surface. Apart from science instrument radars, we also developed a 670 GHz FMCW radar for imaging at stand-off distances for security applications.

**08:40 - 09:20** Millimeter-Wave and Terahertz Radar Instruments for Planetary, Cometary, Earth Observations, and Security Applications

Goutam Chattopadhyay<sup>1</sup>

<sup>1</sup>NASA-Jet Propulsion Laboratory, California Institute of Technology, US

Radar instruments play a critical role in NASA's planetary, cometary, and Earth observing missions. Sometimes they guide space crafts to the surface of another planet (such as Mars) or a comet and some other times they are used for answering fundamental scientific questions by exploring cometary and planetary bodies, including our own Earth. Until recently, the majority of NASA's radar instruments were below 100 GHz. However, in recent years, there has been a lot of interest in using millimeter-wave and terahertz radars to answer critical scientific questions. One such instrument developed by us is a 183 GHz (G-Band) differential absorption radar providing a new measurement capability of simultaneously measuring water vapor and ice content in clouds in Earth's atmosphere with high precision and spatial resolution. Profiling of water vapor within clouds is a critical requirement to address the key unsolved science questions regarding the processes regulating cloud lifecycle and the transport of water vapor by convection. Another instrument we developed is a 90 GHz (W-Band) frequency modulated continuous wave (FMCW) radar for understanding the origin, dynamics, and evolution of jets from a comet. When deployed, this will provide clues to the formation of comets and therefore the early stages of the Solar System. The same W-band radar is also being planned for investigating plumes on icy moons, such as Europa and Enceladus, which will shed light on subsurface processes and structure on these potentially life-harboring bodies. We are also building a revolutionary in situ radar instrument for short-range mapping of near-surface atmospheric water vapor on Mars. This highly compact and low-power differential absorption radar operates near the 557 GHz water absorption line to measure absolute humidity along its beam path with

**09:20 - 10:00** One Step Ahead of the Enemy: Innovative Radar Solutions are Decisive for Military Use

Jorn Bleijs<sup>1</sup>

<sup>1</sup>Netherlands Defence Materiel Organisation, The Netherlands

High-quality kill chains are a requirement for the military to timely detect and recognize potential threats and be able to neutralize them before they can successfully complete their mission. Radar technology and effective sensor-weapon integration are essential in this respect. Efforts in these areas resulted in a Dutch configuration to support anti-air warfare operations during the last four decades. This Dutch configuration always has been at the forefront of innovations.

Threats are evolving. Think of ballistic missiles and supersonic missiles. Continuous development is necessary to keep ahead of the threat and implement new functionality/capability. For this continuous development, we defined a roadmap for radar and integrated sensor suites for the Dutch armed forces. Various studies are being performed together with TNO and Thales Netherlands collaborating in the Dutch Radar Centre of Expertise (D-RACE), and also with international partners like the US Navy, in order to obtain a future-proof Integrated Air and Missile Defence capability. Multi-band sensor integration will provide the Royal Netherlands Navy with the operational flexibility required to effectively counter future threats.

This keynote will elaborate on the importance of radar and integrated sensor suites for future naval operations and the solutions that the Royal Netherlands Navy is aiming for.

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<b>BASTION HOTEL – ★★★</b> Mauritiuslaan 1, 3526 LD Utrecht	11 minute by transport	Flexible € 102,- RO
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**B&B:** Room rate includes breakfast.

# WEDNESDAY 10:50 – 12:30

	Mission 2	Expedition	Flash	Glow
	<b>EuMC27</b> [Focussed Session] Emerging Microwave Technologies in Asia-Pacific Region Chair: Kamran Ghorbani <sup>1</sup> Co-Chair: Luca Perregrini <sup>2</sup> <sup>1</sup> RMIT University, <sup>2</sup> University of Pavia	<b>EuMC28</b> Novel Wireless Power Transfer and Energy Harvesting Systems Chair: Naoki Shinohara <sup>1</sup> Co-Chair: Jiafeng Zhou <sup>2</sup> <sup>1</sup> Kyoto University, <sup>2</sup> University of Liverpool	<b>EuMC29</b> Reconfigurable Planar Passive Components Chair: Petronilo Martin-Iglesias <sup>1</sup> Co-Chair: Anthony Ghiotto <sup>2</sup> <sup>1</sup> ESA ESTEC, <sup>2</sup> University of Bordeaux INP	<b>EuMC30</b> Non-Planar Filters Chair: Richard Snyder <sup>1</sup> Co-Chair: Cristiano Tomassoni <sup>2</sup> <sup>1</sup> RS Microwave, <sup>2</sup> University of Perugia
<b>10:50 – 11:10</b>	<b>EuMC27-1</b> A Polarization-Insensitive Frequency Selective Surface Based Rasorber with Narrow-Band Absorption Between Two Transmission Bands Mehran Manzoor Zargar <sup>1</sup> , Archana Rajput <sup>1</sup> , Kushman-da Saurav <sup>1</sup> , Shiban Kishen Koul <sup>1</sup> <sup>1</sup> INDIAN INSTITUTE OF TECHNOLOGY JAMMU, <sup>2</sup> INDIAN INSTITUTE OF TECHNOLOGY DELHI	<b>EuMC28-1</b> An Electronically Steerable Millimeter-Wave Reflectarray for Wireless Power Delivery J. Gabriel Buckmaster <sup>1</sup> , Thomas H. Lee <sup>2</sup> <sup>1</sup> Stanford University	<b>EuMC29-1</b> VO2-Based Transmit/Receive Switch Junwen Jiang <sup>1</sup> , Raafat R. Mansour <sup>2</sup> <sup>1</sup> University of Waterloo	<b>EuMC30-1</b> Compact On-Board Dielectric Filters and Diplexers for High-Power Satellite Applications Luca Pelliccia <sup>1</sup> , Fabrizio Cacciamani <sup>1</sup> , Paolo Vallerotonda <sup>1</sup> , Alessandro Cazzorla <sup>1</sup> , Francesco Aquino <sup>1</sup> , Roberto Sorrentino <sup>1</sup> , Walter Steffè <sup>2</sup> , Cristiano Tomassoni <sup>2</sup> , Jaione Galdeano <sup>1</sup> , Petronilo Martin-Iglesias <sup>1</sup> <b>INDUSTRIAL KEYNOTE</b> <sup>1</sup> RF Microtech Srl, <sup>2</sup> Thales Alenia Space Italia, <sup>3</sup> University of Perugia, <sup>4</sup> ESA ESTEC
<b>11:10 – 11:30</b>	<b>EuMC27-2</b> Efficient Design and Experimental Verification of High-Q MPhC BPF for mmWave Applications Erika Katsuno <sup>1</sup> , Chun-Ping Chen <sup>1</sup> , Tetsuo Anada <sup>1</sup> , Shigeki Takeda <sup>2</sup> , Zhwang Ma <sup>2</sup> <sup>1</sup> Kanagawa University, <sup>2</sup> Antenna Giken Co., Ltd., <sup>3</sup> Saitama University	<b>EuMC28-2</b> Evaluation of Simultaneous Wireless Information and Power Transfer with Distributed Antennas Ibrahim Can Sezgin <sup>1</sup> , Jose-Ramon Perez-Cisneros <sup>1</sup> , Christian Fager <sup>2</sup> <sup>1</sup> Chalmers University of Technology	<b>EuMC29-2</b> Low-Loss K-Band Photoconductive Switches in SIW Technology Elena Shepeleva <sup>1</sup> , Mikhail Makurin <sup>1</sup> , Artem Vilenskiy <sup>2</sup> <sup>1</sup> Samsung R&D Institute Russia, <sup>2</sup> Chalmers University of Technology	<b>EuMC30-2</b> Hybrid Inline TE/TM Mode Dielectric Resonator Filters with Wide Spurious Free Range and Controllable Transmission Zeros Patrick Boe <sup>1</sup> , Daniel Miek <sup>1</sup> , Fynn Kamrath <sup>1</sup> , Michael Höft <sup>2</sup> <sup>1</sup> Christian-Albrechts-Universität zu Kiel
<b>11:30 – 11:50</b>	<b>EuMC27-3</b> Compact SIW Based Wideband Phase Shifter Loaded with Square Complementary Omega (SCO) Array Karthik Thoathirri Chandrasekaran <sup>1</sup> , Arokiaswami Alphones <sup>1</sup> , Karim Muhammad Faeyz <sup>2</sup> , Nasimuddin Nasimuddin <sup>2</sup> <sup>1</sup> Nanyang Technological University, <sup>2</sup> Agency for Science and Technology (A*STAR)	<b>EuMC28-3</b> An Ambient-Insensitive Battery-Less Wireless Node for Simultaneous Powering and Communication Giacomo Paolini <sup>1</sup> , Diego Masotti <sup>1</sup> , Marco Guermanti <sup>1</sup> , Mazen Shanawani <sup>1</sup> , Luca Benini <sup>1</sup> , Alessandra Costanzo <sup>2</sup> <sup>1</sup> University of Bologna	<b>EuMC29-3</b> Reconfigurable Substrate Integrated Waveguide Circuits Using Dielectric Fluids Matthew Brown <sup>1</sup> , Carlos Saavedra <sup>2</sup> <sup>1</sup> Queen's University	<b>EuMC30-3</b> Narrow-Band and Low-loss Bandpass Filter for 5G Built of Silica-Based Post-Wall Waveguide Yusuke Uemichi <sup>1</sup> , Shinnosuke Tsuchiya <sup>1</sup> , Toru Yamaguchi <sup>1</sup> , Xu Han <sup>1</sup> , Osamu Nukaga <sup>1</sup> , Shuhei Amakawa <sup>1</sup> , Ning Guan <sup>2</sup> <sup>1</sup> Fujikura Ltd., <sup>2</sup> Hiroshima University
	<b>EuMC28-4</b> A 24 GHz Unit Rectenna for Millimeter-Wave Power Transmission Application Hye-Won Jo <sup>1</sup> , Sol Kim <sup>1</sup> , ByungKwon Ahn <sup>1</sup> , Hyunyoung Cho <sup>1</sup> , Jong-Won Yu <sup>1</sup> <sup>1</sup> Korea Advanced Institute of Science and Technology	<b>EuMC29-4</b> Wideband PCB-to-Connectors Impedance Adapters for Liquid Crystal-Based Low-Loss Phase Shifters Jinfeng Li <sup>1</sup> <sup>1</sup> Imperial College London	<b>EuMC30-4</b> A New Directional Filter Design Huairan Yi <sup>1</sup> , Zhengxiang Ma <sup>1</sup> <sup>1</sup> Futurwei Technologies	
	<b>EuMC28-5</b> Loop Antenna Array System with Simultaneous Operation of OAM Multiplex Communication and Wireless Power Transfer Wataru Wada <sup>1</sup> , Ryo Ishikawa <sup>1</sup> , Akira Saitou <sup>1</sup> , Hisanosuke Miyake <sup>1</sup> , Haruki Kikuchi <sup>1</sup> , Hiroshi Suzuki <sup>1</sup> , Kazuhiko Honjo <sup>1</sup> <sup>1</sup> The University of Electro-Communications	<b>EuMC29-5</b> High-Performance Compact Reflection Type Phase Shifter Operating at 2 GHz Using a Transdirectional Coupler Olivier Ocello <sup>1</sup> , Lionel Tiague <sup>1</sup> , Marc Margalef-Rovira <sup>1</sup> , Loïc Vincent <sup>1</sup> , Fabien Ndagijimana <sup>1</sup> , Philippe Ferrari <sup>1</sup> <sup>1</sup> Univ. Grenoble Alpes, RFIC-Lab, <sup>2</sup> Univ. Grenoble Alpes, CIME, <sup>3</sup> Univ. Grenoble Alpes, G2ELab	<b>EuMC30-5</b> Design of an X/Ku Band Coaxial Overmoded Waveguide Diplexer for High Power Microwaves Jiawei Li <sup>1</sup> , Guangjian Deng <sup>1</sup> , Letian Guo <sup>1</sup> <sup>1</sup> Northwest Institute of Nuclear Technology	

## WEDNESDAY 10:50 – 12:30

	<b>Beam</b>	<b>Mission 1</b>	<b>Quest</b>
	<b>EuMC31</b> Frequency Selective Surfaces, Reflectors and Metamaterial Antennas Chair: Christian Person <sup>1</sup> Co-Chair: Thomas Dallmann <sup>2</sup> <sup>1</sup> Telecom Bretagne, <sup>2</sup> Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR	<b>EuRAD02</b> Dual Use & Waveform Design Chair: Stephen Harman <sup>1</sup> Co-Chair: R. Firat Tigrek <sup>2</sup> <sup>1</sup> Aveillant Limited, <sup>2</sup> Eindhoven University of Technology (TU/e)	<b>EuRAD03</b> Design and Calibration Concepts for Advanced Radar Systems and Subsystems Chair: Peter Gardner <sup>1</sup> Co-Chair: Claire Migliaccio <sup>2</sup> <sup>1</sup> The University of Birmingham, <sup>2</sup> Université Côte d'Azur
<b>10:50 – 11:10</b>	<b>EuMC31-1</b> Design of a Polarization Rotating FSS for Polarimetric Automotive Radar Measurements Arvid Sims <sup>1</sup> , Tim Freialdenhoven <sup>2</sup> , Thomas Dallmann <sup>2</sup> <sup>1</sup> Keysight Technologies, <sup>2</sup> Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR	<b>EuRAD02-1</b> Peak Sidelobe Level Based Waveform Optimization for OFDM Joint Radar-Communications Musa Furkan Keskin <sup>1</sup> , R. Firat Tigrek <sup>2</sup> , Canan Aydogdu <sup>1</sup> , Franz Lampe <sup>1</sup> , Henk Wymeersch <sup>1</sup> , Alex Alvarado <sup>2</sup> , Frans M.J. Willems <sup>2</sup> <sup>1</sup> Chalmers University, <sup>2</sup> Eindhoven University of Technology (TU/e)	<b>EuRAD03-1</b> An overarching strategy for radar antenna design, optimization, and system integration Giorgia Zucchi <sup>1</sup> , Rick Gentile <sup>1</sup> <b>INDUSTRIAL KEYNOTE</b> <sup>1</sup> The Mathworks
<b>11:10 – 11:30</b>	<b>EuMC31-2</b> A Ka-Band Polarization Rotating Multilayer Reflector for Polarimetric Radars Tim Freialdenhoven <sup>1</sup> , Thomas Dallmann <sup>2</sup> <sup>1</sup> Fraunhofer FHR	<b>EuRAD02-2</b> Adaptive Filter Design for Simultaneous In-Band Full-Duplex Communication and Radar Seyed Ali Hassani <sup>1</sup> , Barend van Liempd <sup>2</sup> , André Bourdoux <sup>2</sup> , François Horlin <sup>1</sup> , Sofie Pollin <sup>2</sup> <sup>1</sup> KU Leuven, <sup>2</sup> imec, Leuven, <sup>3</sup> ULB, <sup>4</sup> KULeuven	<b>EuRAD03-2</b> Angle-Dependent Mutual Coupling in Antenna Arrays by Electromagnetic Modelling of Sub-Volumes Ricard Grove <sup>1</sup> , Poul Leth-Espensen <sup>1</sup> , Jørgen Dall <sup>1</sup> <sup>1</sup> DTU Space, <sup>2</sup> Terma A/S
<b>11:30 – 11:50</b>	<b>EuMC31-3</b> Gradient Optimization on Third Order Bandpasses for a 24 GHz Metasurface Lens Christoph Kohlberger <sup>1</sup> , Gernot Hueber <sup>1</sup> , Christoph Wagner <sup>1</sup> , Andreas Stelzer <sup>2</sup> <sup>1</sup> Silicon Austria Labs, <sup>2</sup> DICE Danube Integrated Circuit Engineering GmbH & Co. KG, <sup>3</sup> JKU Linz	<b>EuRAD02-3</b> Design and Measurements of MSK-LFM RadCom System Husileng Bao <sup>1</sup> , Ziemann Arvid <sup>1</sup> , Zhongxia Simon He <sup>2</sup> <sup>1</sup> Chalmers University of Technology, <sup>2</sup> SenWellen (Shenzhen) Communications Technologies Ltd. Co.	<b>EuRAD03-3</b> Phase Noise Investigation for a Radar System with Optical Clock Distribution Stephan Kruse <sup>1</sup> , Meysam Bahmanian <sup>1</sup> , Pascal Kneuper <sup>1</sup> , Christian Kress <sup>1</sup> , Heiko Gustav Kurz <sup>2</sup> , Thomas Schneider <sup>1</sup> , J. Christoph Scheytt <sup>3</sup> <sup>1</sup> Heinz Nixdorf Institute, University of Paderborn, <sup>2</sup> Volkswagen Aktiengesellschaft, <sup>3</sup> Technische Universität Braunschweig
<b>11:50 – 12:10</b>	<b>EuMC31-4</b> FR-4 PCB Process-based mmWave Phased Array Antenna Using Planar High-Impedance Surfaces Jae-Young Lee <sup>1</sup> , Jaehyun Choi <sup>1</sup> , Dongkwan Choi <sup>1</sup> , Youngno Youn <sup>1</sup> , Junho Park <sup>1</sup> , Wonbin Hong <sup>1</sup> <sup>1</sup> Pohang University of Science and Technology (POSTECH)	<b>EuRAD02-4</b> An Ultrahigh-Resolution Continuous Wave Synthetic Aperture Radar with Photonic-Assisted Signal Generation and Dechirp Processing Ruoming Li <sup>1</sup> , Wangzhe Li <sup>1</sup> , Bingnan Wang <sup>1</sup> , Zhilei Wen <sup>1</sup> , Yuchen Luan <sup>1</sup> , Zhenli Yang <sup>1</sup> , Yang Xing <sup>1</sup> , Jiyao Yang <sup>1</sup> , Zhenwei Mo <sup>1</sup> <sup>1</sup> Institute of Electronics of the Chinese Academy of Sciences	<b>EuRAD03-4</b> Increasing the Efficiency and Robustness of Angular Radar Calibration by Exploiting Phase Symmetry André Dürr <sup>1</sup> , Matthias Linder <sup>1</sup> , Christian Waldschmidt <sup>1</sup> <sup>1</sup> Ulm University
<b>12:10 – 12:30</b>	<b>EuMC31-5</b> An Equivalent Circuit Diagram for a Hexagonal Ring Frequency Selective Surface Andreas Röhrner <sup>1</sup> , Georg Strauss <sup>1</sup> , Thomas F. Eibert <sup>2</sup> <sup>1</sup> Munich University of Applied Sciences, <sup>2</sup> Technical University of Munich	<b>EuRAD02-5</b> Discrete-Phase Sequence Design with Stopband and PSL Constraints for Cognitive Radar Mohammad Alae-Kerahroodi <sup>1</sup> , Sumit Kumar <sup>2</sup> , Bhavani Shankar Mysore Rama Rao <sup>1</sup> , Kumar Vijay Mishra <sup>1</sup> <sup>1</sup> Interdisciplinary Centre for Security, Reliability and Trust, <sup>2</sup> University of Luxembourg	<b>EuRAD03-5</b> Phase Control Method for Sub-sampling PLL by Varying Phase and Frequency of Clock Signal of S/H Circuit Osamu Wada <sup>1</sup> , Hiroyuki Mizutani <sup>1</sup> , Hideyuki Nakamizo <sup>1</sup> <sup>1</sup> Mitsubishi Electric Corporation

## WEDNESDAY 12:30 – 14:20

<b>Hall 1</b>			
<b>EuMC32</b> EuMC Interactive Poster Session 2 Chair: Jan Geralt bij de Vaate <sup>1</sup> Co-Chair: Mark Oude Alink <sup>2</sup> <sup>1</sup> ASTRON, <sup>2</sup> University of Twente	<b>EuMC32-11</b> Precision Phase Shift Measurement System in the Frequency Range of 1-18 GHz Anton Widarta <sup>1</sup> <sup>1</sup> National Metrology Institute of Japan NMJJ/AIST	<b>EuMC32-17</b> Gain Enhancement Technique for On-Chip Monopole Antenna Carmine Mustacchio <sup>1</sup> , Luigi Boccia <sup>1</sup> , Emilio Armiè <sup>1</sup> , Giandomenico Amendola <sup>1</sup> <sup>1</sup> Università della Calabria	
<b>EuMC32-1</b> Photonic Microwave Oscillator based on an Ultra-stable-laser and an Optical Frequency Comb Michele Giunta <sup>1</sup> , Maurice Lessing <sup>1</sup> , Jialiang Yu <sup>1</sup> , Marc Fischer <sup>1</sup> , Matthias Lezius <sup>1</sup> , Xiaopeng Xie <sup>1</sup> , Giorgio Santarelli <sup>1</sup> , Yann Le Coq <sup>1</sup> , Ronald Holzwarth <sup>1</sup> <sup>1</sup> Menlo Systems GmbH, <sup>2</sup> Physikalisch-Technische Bundesanstalt (PTB), <sup>3</sup> State Key Laboratory of Advanced Optical Communication Systems and Networks, <sup>4</sup> LPZ, <sup>5</sup> IGOS-CNRS-Universités de Bordeaux, <sup>6</sup> LNE-SYRTE, Observatoire de Paris	<b>EuMC32-6</b> THz Wave Scattering by Double-Layer Infinite Graphene Strip Grating Without One Strip in Every Layer Mstyslav Kaliberda <sup>1</sup> , Leonid Lytvynenko <sup>2</sup> , Sergey Pogarsky <sup>3</sup> <sup>1</sup> V.N.Karazin Kharkiv National University, <sup>2</sup> Institute of Radio Astronomy of the National Academy of Sciences of Ukraine	<b>EuMC32-12</b> Aperture Synthesis Method to Investigate on the Reflection Properties of Typical Road Surfaces Jochen Jebramcik <sup>1</sup> , Ilona Rolfes <sup>1</sup> , Jan Barowski <sup>1</sup> <sup>1</sup> Ruhr-University Bochum	<b>EuMC32-18</b> A Single Smart Cut POI Substrate Design for UHF, L and S Band Filters Eric Butaud <sup>1</sup> , Thierry Laroche <sup>1</sup> , Vincent Barec <sup>1</sup> , Alexandre Clairet <sup>1</sup> , Marie Bousquet <sup>1</sup> , Florent Bernard <sup>1</sup> , Raphaël Caumilone <sup>1</sup> , Eric Michoulier <sup>1</sup> , Emilie Courjon <sup>1</sup> , Isabelle Huyet <sup>1</sup> , Brice Tavel <sup>1</sup> , Gabrielle Aspar <sup>1</sup> , Yann Lamy <sup>1</sup> , Ajit Defrasne <sup>1</sup> , Alexandre Ravesk <sup>1</sup> , Sylvain Ballandras <sup>1</sup> , Christophe Didier <sup>1</sup> <sup>1</sup> SOITEC Grenoble, <sup>2</sup> fr[nc]s[us] SASU, <sup>3</sup> CEA LETI
<b>EuMC32-2</b> Design and Development of 3.5 THz Schottky-Based Fundamental Mixer Divya Jayasankar <sup>1</sup> , Vladimir Drakinskiy <sup>1</sup> , Mats Myreback <sup>1</sup> , Peter Sobis <sup>1</sup> , Jan Stake <sup>1</sup> <sup>1</sup> Research Institutes of Sweden, <sup>2</sup> Chalmers University of Technology, <sup>3</sup> Omnisys Instruments	<b>EuMC32-7</b> Evaluation of Twin Silver Nanotubes as a Possible Sensor of the Charged Particle Beam Position Daria Herasymova <sup>1</sup> <sup>1</sup> Institute of Radio-Physics and Electronics NASU	<b>EuMC32-13</b> Hybrid Beamforming Analysis Based on MIMO Channel Measurements at 28 GHz Joerg Eisenbeis <sup>1</sup> , Magnus Tingulstad <sup>1</sup> , Nicolai Kern <sup>1</sup> , Zsolt Kollár <sup>1</sup> , Jerzy Kowalewski <sup>1</sup> , Pablo Ramos López <sup>1</sup> , Thomas Zwick <sup>1</sup> <sup>1</sup> Karlsruhe Institute of Technology (KIT)	<b>EuMC32-19</b> A Dynamic CAD Model for Phase Change Material (PCM) Switches Ines Bettoumi <sup>1</sup> , Cyril Guines <sup>1</sup> , Pierre Blondy <sup>1</sup> <sup>1</sup> XLIM - CNRS - Université de Limoges
<b>EuMC32-3</b> A 122 GHz On-Chip 3-Element Patch Antenna Array with 10 GHz Bandwidth Vincent Lammert <sup>1</sup> , Mohamed Hamouda <sup>1</sup> , Robert Weigel <sup>1</sup> , Vadim Issakov <sup>2</sup> <sup>1</sup> FAU Erlangen-Nuremberg / Infineon Munich, <sup>2</sup> Infineon Technologies AG, <sup>3</sup> FAU Erlangen-Nuremberg, <sup>4</sup> Infineon Technologies AG / OVGU Magdeburg	<b>EuMC32-8</b> Scattering of Natural Waves of Planar Dielectric Waveguide with PEC Wall by Graphene Strip Grating in THz Range Mstyslav Kaliberda <sup>1</sup> , Leonid Lytvynenko <sup>2</sup> , Sergey Pogarsky <sup>3</sup> <sup>1</sup> V.N. Karazin Kharkiv National University, <sup>2</sup> Institute of Radio Astronomy of the National Academy of Sciences of Ukraine	<b>EuMC32-14</b> Angle-Shifted Conformal Array with Multibeam Folded Ground Structures for Wide Coverage Young-Jun Kim <sup>1</sup> , Gun-Hark Noh <sup>1</sup> , Han Lim Lee <sup>1</sup> <sup>1</sup> Chung-Ang University	<b>EuMC32-20</b> A Machine Learning-Based Microwave Device Model for Fully Printed V02 RF Switches Shuai Yang <sup>1</sup> , Ahmad Khuroo <sup>2</sup> , Weiwei Li <sup>1</sup> , Mohammad Vaseem <sup>1</sup> , Mohammad Hashmi <sup>1</sup> , Atif Shamim <sup>1</sup> <sup>1</sup> King Abdullah University of Science and Technology (KAUST), <sup>2</sup> Jamia Millia Islamia (A Central University), <sup>3</sup> Nazarbayev University
<b>EuMC32-4</b> Development of Second-Harmonic Terahertz Gyrotrons with Highly Selective Cavities Ilya Bandurkin <sup>1</sup> , Alexey Fedotov <sup>1</sup> , Andrey Fokin <sup>1</sup> , Mikhail Glyavin <sup>1</sup> , Alexey Luchinin <sup>1</sup> , Ivan Osharin <sup>1</sup> , Dmitriy Radishev <sup>1</sup> , Andrey Savilov <sup>1</sup> , Andrei Starodubov <sup>1</sup> , Yoshinori Tatematsu <sup>1</sup> <sup>1</sup> Federal research center Institute of Applied Physics of the Russian Academy of Sciences (IAP RAS), <sup>2</sup> Saratov State University, <sup>3</sup> FIR Center, University of Fukui	<b>EuMC32-9</b> Optimization Algorithms for Accurate FMCW Millimeter-Wave and Terahertz Thickness Measurements Nina Susan Schreiner <sup>1</sup> , Michael Bortz <sup>2</sup> , Wolfgang Sauer-Greff <sup>1</sup> , Ralph Urbansky <sup>2</sup> , Fabian Friederich <sup>1</sup> <sup>1</sup> Fraunhofer Institute for Industrial Mathematics ITWM, <sup>2</sup> Technische Universität Kaiserslautern	<b>EuMC32-15</b> Angle Estimation of Coherent Targets via Toeplitz Induced Compressed Matrix Method for the Bistatic MIMO Radar evans Baidoo <sup>1</sup> , Jurong Hu <sup>1</sup> , Bilguun Batbaatar <sup>1</sup> , Benjiman Kwakye <sup>1</sup> <sup>1</sup> Hohai University	<b>EuMC32-21</b> Additive Manufacturing of Coplanar Transmission Lines on Alumina Substrate up to 24 GHz using Laser Assisted Selective Metallization Konstantin Lomakin <sup>1</sup> , Li Wang <sup>2</sup> , Alexander Job <sup>2</sup> , Robert Süß-Wolf <sup>1</sup> , Jörg Franke <sup>2</sup> , Gerald Gold <sup>1</sup> <sup>1</sup> Friedrich-Alexander University Erlangen-Nürnberg (FAU), <sup>2</sup> Friedrich-Alexander Universität Erlangen-Nürnberg
<b>EuMC32-5</b> High Power High Efficiency 475-520 GHz Source Based on Discrete Schottky Diodes Diego Moro-Melgar <sup>1</sup> , Oleg Cojocari <sup>1</sup> , Ion Oprea <sup>1</sup> <sup>1</sup> ACST GmbH	<b>EuMC32-10</b> Complex Conductivity Extraction in Monolayer Graphene at Microwave Frequency by Free Space Technique Housssemeldine Kraoui <sup>1</sup> <sup>1</sup> ESPCI	<b>EuMC32-16</b> A Logarithmic Frequency-Diverse Array System for Precise Wire-less Power Transfer Enrico Fazzini <sup>1</sup> , Mazen Shanawani <sup>1</sup> , Alessandra Costanzo <sup>1</sup> , Diego Masotti <sup>1</sup> <sup>1</sup> University of Bologna	



## WEDNESDAY 16:10 - 17:50

	<b>Mission 2</b>	<b>Expedition</b>	<b>Spark</b>	<b>Flash</b>
	<b>EuMC39</b> Solid State High Power Amplifiers for Satellite and Radar Applications Chair: Markus Mayer <sup>1</sup> Co-Chair: Bertrand Gerfault <sup>2</sup> <sup>1</sup> Arelis, <sup>2</sup> Thales Electron Devices	<b>EuMC40</b> [Focussed Session] Emerging Antenna Technologies for RFID Applications Chair: Giovanni Andrea Casula <sup>1</sup> Co-Chair: Riccardo Colella <sup>2</sup> <sup>1</sup> Università degli Studi di Cagliari, <sup>2</sup> Institute of Clinical Physiology - National Research Council Italy	<b>EuMC41</b> SATCOM and mmWave Antennas Chair: Peter De Maagt <sup>1</sup> Co-Chair: Matthias Geissler <sup>2</sup> <sup>1</sup> ESA-ESTEC, <sup>2</sup> IMST GmbH	<b>EuMC42</b> Planar Power Dividers/Combiners Chair: Bart Nauwelaers <sup>1</sup> Co-Chair: Petronilo Martin-Iglesias <sup>2</sup> <sup>1</sup> KU Leuven, <sup>2</sup> ESA ESTEC
<b>16:10 - 16:30</b>	<b>EuMC39-1</b> 20 W Linearized Q-band Solid State Power Amplifier for Satellite Communication Application Francesco Vitulli <sup>1</sup> , Andrea Suriani <sup>1</sup> , Ernesto Limiti <sup>2</sup> , Antonino Massari <sup>1</sup> , Rocco Giofrè <sup>3</sup> <sup>1</sup> Thales Alenia Space Italia, <sup>2</sup> University of Rome Tor Vergata (Italy), <sup>3</sup> Università di Roma Tor Vergata	<b>EuMC40-1</b> Miniaturized Grid Array Antenna for Body-Centric RFID Communications in 5G S-Band Jack Hughes <sup>1</sup> , Cecilia Occhiuzzi <sup>2</sup> , John Batchelor <sup>3</sup> , Gaetano Marrocco <sup>4</sup> <sup>1</sup> University of Kent, <sup>2</sup> University of Roma Tor Vergata	<b>EuMC41-1</b> Flight Model 7-Panel Slot-Array Deployable Antenna Measurement Results of MicroX-SAR 100 Kg Class Demonstration Satellite Budhaditya Pyne <sup>1</sup> , Hirobumi Saito <sup>2</sup> , Prilando Riziki Akbar <sup>3</sup> , Koji Tanaka <sup>4</sup> , Jiro Hirokawa <sup>5</sup> , Takashi Tomura <sup>6</sup> <sup>1</sup> Synspective Inc., <sup>2</sup> Japan Aerospace Exploration Agency, <sup>3</sup> Tokyo Institute of Technology	<b>EuMC42-1</b> Generalized Gysel Power Divider with Arbitrary Power Ratio and Real Termination Impedances Chao Gai <sup>1</sup> , Yulong Zhao <sup>1</sup> , Mohamed Helou <sup>2</sup> , Fadhel M. Ghannouchi <sup>3</sup> <sup>1</sup> University of Calgary
<b>16:30 - 16:50</b>	<b>EuMC39-2</b> Design and Characterization of a Ka-Band 40 W RF Chain Based on GH15-10 GaN Technology for Space Solid State Power Amplifier Applications Amel MAATI <sup>1</sup> <sup>1</sup> THALES AVS / MIS	<b>EuMC40-2</b> Millimeter-Wave Chipless RFID Tag for Authentication Applications Raymundo De Amorim Junior <sup>1</sup> , Etienne Perret <sup>2</sup> , Romain Siragusa <sup>3</sup> , Nicolas Barbot <sup>4</sup> <sup>1</sup> Grenoble-inp/LCIS University Grenoble Alpes Valence, France	<b>EuMC41-2</b> Low-Cost Millimeter-Wave Patch Antenna Array in Package for 5G Communication Applications Xiao-Lan Tang <sup>1</sup> , Zhang Ju Hou <sup>2</sup> <sup>1</sup> Shenzhen Sunway Communication Co. Ltd.	<b>EuMC42-2</b> Miniaturized Couplers with Combined Microstrip and Slotline Ports Mohamed Elswaf <sup>1</sup> , Amr Safwat <sup>2</sup> <sup>1</sup> Ain Shams University, <sup>2</sup> Faculty of Engineering, Ain Shams University
<b>16:50 - 17:10</b>	<b>EuMC39-3</b> L-Band Digital Doherty SSPA Design for Compact SATCOM Terminal Applications Tomáš Götthans <sup>1</sup> , Roman Maršálek <sup>2</sup> , Tomáš Urbanec <sup>3</sup> , Martin Šlanina <sup>4</sup> , Ondřej Kucera <sup>5</sup> , Kamil Pesek <sup>6</sup> , Suat Ayöz <sup>7</sup> , Amitabh Chowdhary <sup>8</sup> <sup>1</sup> Brno University of Technology, <sup>2</sup> Honeywell Aerospace, <sup>3</sup> European Space Agency, <sup>4</sup> ESA/ESTEC	<b>EuMC40-3</b> On Increasing of Read Range of Miniaturized UHF tags Imbotatiana Rakotomalala <sup>1</sup> , Smail Tedjini <sup>2</sup> , Riccardo Colella <sup>3</sup> , Francesco P. Chietera <sup>4</sup> , Pierre Lemaitre-Auger <sup>5</sup> , Luca Catarinucci <sup>6</sup> <sup>1</sup> Grenoble-inp/LCIS University Grenoble Alpes Valence, France, <sup>2</sup> Institute of Clinical Physiology - National Research Council Italy, <sup>3</sup> Department of Innovation Engineering, University of Salento	<b>EuMC41-3</b> A Compact Low-Noise Frontend for Rx/Tx-Integrated SatCom Arrays Anton Sieganschin <sup>1</sup> , Thomas Jaschke <sup>2</sup> , Arne F. Jacob <sup>3</sup> <sup>1</sup> Hamburg University of Technology	<b>EuMC42-3</b> Broadband Equal-Split Planar 4-Way Power Divider-Combiner Suitable for High Power Applications Jeremy Furgal <sup>1</sup> , Kevin Xu <sup>2</sup> , Jun H. Choi <sup>3</sup> , Jay Lee <sup>4</sup> <sup>1</sup> Syracuse University, <sup>2</sup> State University of New York at Buffalo
<b>17:10 - 17:30</b>	<b>EuMC39-4</b> A High Efficiency MMIC X-Band GaN Power Amplifier Mohammed Ayad <sup>1</sup> , Nicolas Poirtenaud <sup>2</sup> , Véronique Serru <sup>3</sup> , Marc Camiade <sup>4</sup> , Jan Grünepütt <sup>5</sup> , Klaus Riepe <sup>6</sup> <sup>1</sup> United Monolithic Semiconductors SAS, <sup>2</sup> United Monolithic Semiconductors GmbH	<b>EuMC40-4</b> A Smart Parking Sensor with Multi-Purpose Antenna for Car Detection and Sensor Charging Moritz Fischer <sup>1</sup> , Marian Guggenberger <sup>2</sup> , Thomas Ullmüller <sup>3</sup> <sup>1</sup> University of Innsbruck	<b>EuMC41-4</b> Design of 94-GHz Wideband Waveguide-Fed Patch Antenna and Array in eWLB Package Chuanming Zhu <sup>1</sup> , Zongming Duan <sup>2</sup> <sup>1</sup> The 38th Research Institute of China Electronic Technology Group Corporation	<b>EuMC42-4</b> Dual-Band Semi-Lumped-Element Power Dividers at UHF/SHF Bands Tadashi Kawai <sup>1</sup> , Kensuke Nagano <sup>2</sup> , Akira Enokihara <sup>3</sup> <sup>1</sup> University of Hyogo
<b>17:30 - 17:50</b>	<b>EuMC39-5</b> A 10 W, 35 % Power Added Efficiency 6 to 18 GHz GaN Power Amplifier ahmed gasmi <sup>1</sup> , Rémy Leblanc <sup>2</sup> , Bertrand Wroblewski <sup>3</sup> , François Lecourt <sup>4</sup> , Julien Poulain <sup>5</sup> , Adrien Cutivet <sup>6</sup> , Ahmad Alhajjar <sup>7</sup> <sup>1</sup> OMMIC SAS	<b>EuMC40-5</b> Laser-Fabricated Antennas for RFID Applications Almudena Rivadeneyra <sup>1</sup> , José F. Salmeron <sup>2</sup> , Noel Rodríguez <sup>3</sup> , Diego P. Morales <sup>4</sup> , Riccardo Colella <sup>5</sup> , Francesco P. Chietera <sup>6</sup> , Luca Catarinucci <sup>7</sup> <sup>1</sup> University of Granada, <sup>2</sup> National Research Council (CNR), <sup>3</sup> Department of Innovation Engineering, University of Salento, <sup>4</sup> University of Salento	<b>EuMC41-5</b> 5G Wideband Dual-Polarized mm-Wave Antennas and 60-GHz Motion-Recognition mm-Wave Antennas in a Non-mm-Wave Antenna Integrating Packages in a Full-Screen Metal-Framed Phone Huan-Chu Huang <sup>1</sup> , Ruipeng Li <sup>2</sup> <sup>1</sup> Etheta Communication Technology Co., Ltd., <sup>2</sup> Pousen System Technology Co., Ltd.	<b>EuMC42-5</b> A Dual-Band Balun Architecture With Unequal Port-Terminations Rahul Gupta <sup>1</sup> , Sabina Kairatova <sup>2</sup> , Mohammad Hashmi <sup>3</sup> , Galymzhan Naurzybayev <sup>4</sup> <sup>1</sup> IIT-Delhi, <sup>2</sup> Nazarbayev University, Nur-Sultan, Kazakhstan

## WEDNESDAY 16:10 - 17:50

	<b>Glow</b>	<b>Beam</b>	<b>Mission 1</b>	<b>Quest</b>
	<b>EuMC43</b> Non-Planar Devices and Systems Chair: Vicente Enrique Boria Esbert <sup>1</sup> Co-Chair: Richard Snyder <sup>2</sup> <sup>1</sup> Technical university of Valencia, <sup>2</sup> RS Microwave	<b>EuMC44</b> [Special Session] Silicon-Based Ka-Band Massive MIMO Antenna Systems for New Telecommunication Services Chair: Ulf Johannsen <sup>1</sup> Co-Chair: Bart Smolders <sup>2</sup> <sup>1</sup> Eindhoven University of Technology,	<b>EuRAD06</b> Emerging & Industrial Applications Chair: Naruto Yonemoto <sup>1</sup> Co-Chair: André Bourdoux <sup>2</sup> <sup>1</sup> ENRI/MPAT, <sup>2</sup> imec, Leuven	<b>EuRAD07</b> Radar Scenario Simulations Chair: Stéphane Kemkemian <sup>1</sup> Co-Chair: Mohammed Jahangir <sup>2</sup> <sup>1</sup> Thales Defence Mission Systems (TDMs), <sup>2</sup> University of Birmingham
<b>16:10 - 16:30</b>	<b>EuMC43-1</b> Ridge-Gap Waveguide Enabled Wireless Power Transfer for Electrical Vehicle Application Walid Dyab <sup>1</sup> , Mourad Ibrahim <sup>2</sup> , Ahmed Sakr <sup>3</sup> , Ke Wu <sup>4</sup> <sup>1</sup> Prince Sultan University, <sup>2</sup> Faculty of Engineering, Cairo University, <sup>3</sup> Polytechnique Montreal	<b>EuMC44-1</b> SILIKA: Silicon-Based Ka-Band Massive-MIMO Antenna Systems for New Telecommunication Services Bart Smolders <sup>1</sup> <sup>1</sup> Eindhoven University of Technology - TU/e	<b>EuRAD06-1</b> Millimetre-Wave Radar for Touchless Interaction: Soli in the Pixel 4 Jian Wang <sup>1</sup> , Jaime Lien <sup>2</sup> <b>INDUSTRIAL KEYNOTE</b> <sup>1</sup> Google LLC	<b>EuRAD07-1</b> Radar Signature Prediction with Shooting-and-Bouncing Rays and Hybrid Method David Prestaux <sup>1</sup> <b>INDUSTRIAL KEYNOTE</b> <sup>1</sup> ANSYS
<b>16:30 - 16:50</b>	<b>EuMC43-2</b> A Compact Ridge Waveguide Four-Port Junction Circulator Guangjian Deng <sup>1</sup> , Letian Guo <sup>2</sup> , Jiawei Li <sup>3</sup> , Wenhua Huang <sup>4</sup> , Hao Shao <sup>5</sup> , Shaoyi Xie <sup>6</sup> <sup>1</sup> Northwest Institute of Nuclear Technology	<b>EuMC44-2</b> Antenna Systems for 5G mmWave Radio Access Guy Vandenbosch <sup>1</sup> <sup>1</sup> KU Leuven	<b>EuRAD06-2</b> Background and Clutter Removal Techniques for Ultra Short Range Radar Matthias G. Ehrnsperger <sup>1</sup> , Maximilian Noll <sup>2</sup> , Uwe Siart <sup>3</sup> , Thomas F. Eibert <sup>4</sup> <sup>1</sup> Technische Universität München	<b>EuRAD07-2</b> Radar Target Simulator and Antenna Positioner for Real-Time Over-the-Air Stimulation of Automotive Radar Systems Muhammad Ehtisham Asghar <sup>1</sup> , Sreehari Buddappagari Jayapal Gowdu <sup>2</sup> , Florian Baumgärtner <sup>3</sup> , Sebastian Graf <sup>4</sup> , Felix Kreutz <sup>5</sup> , Andreas Löffler <sup>6</sup> , Johannes Nagel <sup>7</sup> , Thomas Reichmann <sup>8</sup> , Ralf Stephan <sup>9</sup> , Matthias A. Hein <sup>10</sup> <sup>1</sup> Technische Universität Ilmenau, <sup>2</sup> Mercedes-Benz AG, <sup>3</sup> dSPACE GmbH, <sup>4</sup> Continental AG
<b>16:50 - 17:10</b>	<b>EuMC43-3</b> A Turnstile OMT Covering a Full Octave using Ridge Waveguide (25-50 GHz) Doug Henke <sup>1</sup> , Ivan Wevers <sup>2</sup> , Lewis B. G. Knee <sup>3</sup> <sup>1</sup> NRC Herzberg Astronomy and Astrophysics	<b>EuMC44-3</b> IC Design Aspects for 5G mmWave Systems Christian Fager <sup>1</sup> , Eduardo Anjos <sup>2</sup> , Artem Roev <sup>3</sup> , Paras-too Taghikhani <sup>4</sup> , Marianna Ivashina <sup>5</sup> , Rob Maaskant <sup>6</sup> , Koen Buisman <sup>7</sup> , Anders Höök <sup>8</sup> , Dominique Schreurs <sup>9</sup> , Guy Vandenbosch <sup>10</sup> , Marcel Geurts <sup>11</sup> <sup>1</sup> Chalmers University of Technology, <sup>2</sup> KU Leuven, <sup>3</sup> Saab AB, <sup>4</sup> KULeuven, <sup>5</sup> NXP Semiconductors	<b>EuRAD06-3</b> Standoff Non-Line-of-Sight Vibration Sensing Using Millimeter-Wave Radar Samuel Wagner <sup>1</sup> , Anh-Vu Pham <sup>2</sup> <sup>1</sup> University of California, Davis	<b>EuRAD07-3</b> Back Scattering of Traffic Participants Based on an Automotive Radar Measurement Sevdia Abadpour <sup>1</sup> , Axel Diewald <sup>2</sup> , Thomas Zwick <sup>3</sup> , Mario Pauli <sup>4</sup> , Sören Marahrens <sup>5</sup> <sup>1</sup> Karlsruhe Institute of Technology (KIT)
<b>17:10 - 17:30</b>	<b>EuMC43-4</b> Stripline Dual-Band Ferrite Circulators Operating on Weak Field Conditions Vincent Olivier <sup>1</sup> , Laure Huitema <sup>2</sup> , Bertrand Lenoir <sup>3</sup> , Hamza Turki <sup>4</sup> , Christophe Breuil <sup>5</sup> , Philippe Poulliguen <sup>6</sup> , Thierry Monédière <sup>7</sup> <sup>1</sup> Xlim - UMR 7252 - CNRS - Université De Limoges, <sup>2</sup> INOVEDS SAS, <sup>3</sup> DGA (Direction Générale de l'Armement)	<b>EuMC44-4</b> Signal Processing for mmWave Antenna Systems Ulf Gustavsson <sup>1</sup> <sup>1</sup> Ericsson Research	<b>EuRAD06-4</b> Multi-Phase CW Doppler Radar for Measuring Small Periodic Displacement Jae-Hyun Park <sup>1</sup> , Jae-Young Sim <sup>2</sup> , Jong-Ryul Yang <sup>3</sup> <sup>1</sup> Yeungnam University	<b>EuRAD07-4</b> SimROS : A Simulator for the Design of HF Surface Wave Radar. Application to Maritime Target Detection Alain Reineix <sup>1</sup> , Christophe Guiffaut <sup>2</sup> , Nicolas Bouray <sup>3</sup> , Muriel Darces <sup>4</sup> , Marc Hélier <sup>5</sup> , Sébastien Reynaud <sup>6</sup> , et al. <sup>1</sup> XLIM - CNRS - Université de Limoges, <sup>2</sup> Sorbonne Université, <sup>3</sup> CISTEME, <sup>4</sup> ONERA, <sup>5</sup> IEEA
<b>17:30 - 17:50</b>	<b>EuMC43-5</b> Broadband 32-Way E-Band Inline Power Combiner for High-Power MMIC Amplifiers Anil Kumar Pandey <sup>1</sup> <sup>1</sup> Keysight Technologies	<b>EuMC44-5</b> The SILIKA Demonstrator Marcel Geurts <sup>1</sup> , Eduardo Anjos <sup>2</sup> , Marzieh SalarRahimi <sup>3</sup> <sup>1</sup> NXP Semiconductors, <sup>2</sup> KU Leuven	<b>EuRAD06-5</b> Sensory Substitution Device for the Visually Impaired Using 122 GHz Radar and Tactile Feedback Pascal Kneuper <sup>1</sup> , Stephan Kruse <sup>2</sup> , Björn Luchterhandt <sup>3</sup> , Jan Tünnermann <sup>4</sup> , Ingrid Scharlau <sup>5</sup> , J. Christoph Scheytt <sup>6</sup> <sup>1</sup> Heinz Nixdorf Institute, University of Paderborn, <sup>2</sup> University of Paderborn, <sup>3</sup> University of Marburg	<b>EuRAD07-5</b> Synthetic Sea-Clutter for Long Integration Processing Sabrina Machhour <sup>1</sup> , Stéphane Kemkemian <sup>2</sup> , Pierre-Albert Breton <sup>3</sup> , Vincent Corretja <sup>4</sup> <sup>1</sup> Thales Defence Mission Systems (TDMs)

## THURSDAY



Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Progress	W-23 High Resolution Radar for Automotive				
Mission 1	EuRAD08 Object Classification in Automotive Radars	EuRAD12 [Focussed Session] Radar Interference Cancellation	EuRAD16 Automotive		
Mission 2	EuRAD09 Defence Applications	EuRAD13 [Special Session] Radar and Electronic Warfare	EuRAD17 Advanced Techniques and Innovative Array Configurations for DoA		
Quest	EuRAD10 SAR Processing	EuRAD14 Surveillance and SAR	EuRAD18 SAR Applications		
Expedition	EuMC/EuRAD01 Radar Receivers and Front-Ends	EuMC49 Front-End and Active Module	EuMC54 Low Noise Amplifier and Phased Array Module		
Polar				Closing of the European Microwave Week EuMC/EuMW Closing and Awards Ceremony	
Auditorium	EuMC45 [Special Session] Focus Day: Array Antennas for Radio Astronomy	EuMC/EuRAD02 [Special Session] Focus Day: Active Array Antennas for Space	Technology in Context The Law of Space	EuMC/EuRAD03 [Special Session] Focus Day: Active Array Antennas for Defence	HAM Radio Social 18.00 - 21.00
Spark	EuMC46 Advanced Planar Filter Principles and Technologies	EuMC50 Compact Planar Filtering Devices		W-15 Recent Advances in Micro-Doppler Radar and its Applications	
Flash	EuMC47 Dielectric Measurements	EuMC51 Calibration and Characterisation Techniques		EuMC55 Antenna Characterisation Techniques	
Glow	EuMC48 Microwave Monitoring and Sensing of Biomedical Parameters	EuMC52 Biological Microwave Effects and Imaging Techniques		EuMC56 [Focussed Session] Electromagnetics in Biomedical Applications	
Beam	Tom Brazil Doctoral School of Microwaves The Route to 5G: Design of mmWave Active Array Systems, from RFIC to Signal Processing				
Media arena	EuRAD11 1-Minute Poster Pitch (09:40 - 10:10)	EuMC53 1-Minute Poster Pitch (12:00 - 12:30)	EuMC57 In Recognition: Prof. Dr. A.T. de Hoop		
Round control	Career Platform Career Lounge: Meet Jobs, Build Careers				
BOR 6	Career Platform Job Dating				
loopbrug	Career Platform Company Wall and Job Wall				
Juliana Congress Room 1	W-31 5G and Beyond: Enabling RF Architectures and Technologies for Emerging Wireless Systems				
Hall 1		EuRAD15 Interactive Poster session	EuMC58 Interactive Poster Session		

■ EuMW ■ EuMC ■ EuRAD ■ EuMIC ■ Student Activity ■ EuMIC/EuMC ■ EuMC/EuRAD

## THURSDAY 08:30 - 10:10

## Expedition

## EuMC/EuRAD01

Radar Receivers and Front-Ends

Chair: Massimo C Comparini<sup>1</sup>

Co-Chair: Jens Engelmann<sup>2</sup>

<sup>1</sup>Telespazio, Italy & France, <sup>2</sup>Thales DIS AIS Deutschland GmbH

08:30 - 08:50

EuMC/EuRAD01-1  
A 1.5-40 GHz FMCW Radar Receiver Front-End

Mantas Sakalas<sup>1</sup>, Niko Joram<sup>2</sup>, Frank Ellinger<sup>2</sup>

<sup>1</sup>Baltic Institute of Advanced Technology, <sup>2</sup>Technical University Dresden

08:50 - 09:10

EuMC/EuRAD01-2  
Analysis of Time-Interleaved ADC Offset and Gain Mismatch Errors in PMCW Radar

Daan Rosenmuller<sup>1</sup>, Kostas Doris<sup>2</sup>, Georgi Radulov<sup>1</sup>, Marion K. Matters-Kammerer<sup>1</sup>

<sup>1</sup>Eindhoven University of Technology, <sup>2</sup>NXP Semiconductors

09:10 - 09:30

EuMC/EuRAD01-3  
Analogue Baseband Processing for Single Chip Radar Proximity Sensor

Maurice van Wanum<sup>1</sup>, Michael Polushkin<sup>1</sup>, Raymond van Dijk<sup>1</sup>

<sup>1</sup>TNO

09:30 - 09:50

EuMC/EuRAD01-4  
Active MMIC Circulator Performance in a Phased-Array-Like Environment

Laila Marzall<sup>1</sup>, Shane Verploegh<sup>1</sup>, Tommaso Cappello<sup>1</sup>, Zoya Popovic<sup>1</sup>, Michael Roberg<sup>2</sup>

<sup>1</sup>University of Colorado at Boulder, <sup>2</sup>Qorvo

09:50 - 10:10

EuMC/EuRAD01-5  
A 9 to 12.1 GHz Sub-Sampling AD-PLL Based on a Stochastic Flash TDC and a DCO with a "Folded" Common-Mode Resonator Exhibiting less than 90 fs Jitter\*

Run Levinger<sup>1</sup>, Evgeny Shumaker<sup>1</sup>, Aryeh Farber<sup>1</sup>

<sup>1</sup>Intel Corporation

\*Paper title has been shortened. Please refer to the conference proceedings for the complete title.

## Auditorium

## EuMC45

[Special Session] Focus Day: Array Antennas for Radio Astronomy

Chair: Mark Bentum<sup>1</sup>

<sup>1</sup>Eindhoven University of Technology

## EuMC45-1

Aperture Arrays in Radio Astronomy - Overview of Past, Present and Future Radio Telescopes

Mark Bentum<sup>1</sup>

<sup>1</sup>Eindhoven University of Technology (TU/e)

## EuMC45-2

First In-Flight Results of the NCLE Instrument - A Low Frequency Radio Receiver Exploring the Dark Ages in Lunar Orbit

Eric Bertels<sup>1</sup>

<sup>1</sup>ISIS - Innovative Solutions in Space B.V.

## EuMC45-3

The Mid-Frequency Aperture Array

Kristian Zarb Adami<sup>1</sup>

<sup>1</sup>University of Oxford

## EuMC45-4

DISTURB: A 30 MHz to 3 GHz Solar Monitoring Phased Array System

David Prinsloo<sup>1</sup>, Pieter Benthem<sup>1</sup>, Michiel A. Brentjens<sup>1</sup>, Paulus P. Krüger<sup>1</sup>, Dick Boersma<sup>1</sup>, Lars Venema<sup>1</sup>, Ronald de Wild<sup>1</sup>, Richard A. Fallows<sup>1</sup>, Edo Loenen<sup>1</sup>, Erwin Platen<sup>1</sup>, Paul Stewart<sup>1</sup>, Ludo Visser<sup>1</sup>, André Bos<sup>1</sup>, Bert Van den Oord<sup>1</sup>, Wietse Bouwmeester<sup>1</sup>

<sup>1</sup>Netherlands Institute for Radio Astronomy - ASTRON, <sup>2</sup>Netherlands Institute for Space Research (SRON), <sup>3</sup>Science [8] Technology Corporation, <sup>4</sup>Royal Netherlands Meteorological Institute - KNMI, <sup>5</sup>Delft University of Technology

## EuMC45-5

Coherent Receiver Arrays for Radio Astronomy in the Tera Hertz Regime

Jan Geralt Bij de Vaate<sup>1</sup>

<sup>1</sup>Netherlands Institute for Space Research (SRON)

## Spark

## EuMC46

Advanced Planar Filter Principles and Technologies

Chair: Roberto Gomez-Garcia<sup>1</sup>

Co-Chair: Miguel Sanchez-Soriano<sup>2</sup>

<sup>1</sup>University of Alcala, <sup>2</sup>University of Alicante

## EuMC46-1

Cover-Ended Resonators to Increase Corona Discharge Thresholds in Microstrip Bandpass Filters

Aitor Morales-Hernández<sup>1</sup>, Miguel Sanchez-Soriano<sup>1</sup>, Stephan Marini<sup>1</sup>, Vicente Enrique Boria Esbert<sup>1</sup>, Marco Guglielmi<sup>2</sup>

<sup>1</sup>University of Alicante, <sup>2</sup>Team - Universitat Politècnica de València

## EuMC46-2

Comparative Analysis of Out-of-Band Power Handling Capacities for Lossy Filters

Liang-Feng Qiu<sup>1</sup>, Lin-Sheng Wu<sup>1</sup>, Bin Xia<sup>1</sup>, Junfa Mao<sup>1</sup>

<sup>1</sup>Shanghai Jiao Tong University

## EuMC46-3

Co-Designed Quasi-Circulator and Bandpass Filter

Andrea Ashley<sup>1</sup>, Dimitra Psychogiou<sup>1</sup>

<sup>1</sup>University of Colorado Boulder

## EuMC46-4

3-D Metal Printed Inline Quasi-Elliptic Bandpass Filter

Jiayu Rao<sup>1</sup>, Kenneth Nai<sup>1</sup>, Jiasheng Hong<sup>1</sup>

<sup>1</sup>Heriot-Watt University, <sup>2</sup>Renishaw PLC

## EuMC46-5

High-Order Fully-Reconfigurable Balanced Bandpass Filters Using Mixed Technology Resonators

Dakotah Simpson<sup>1</sup>, Dimitra Psychogiou<sup>1</sup>

<sup>1</sup>University of Colorado Boulder

## Flash

## EuMC47

Dielectric Measurements

Chair: Andrej Rumiantsev<sup>1</sup>

Co-Chair: Xiaobang Shang<sup>2</sup>

<sup>1</sup>MPI Corporation, <sup>2</sup>National Physical Laboratory (NPL)

## EuMC47-1

Characterization of Permittivity of Liquids-in-Flow with Spherical Dielectric Resonators

Georg Sterzl<sup>1</sup>, Jan Hesselbarth<sup>1</sup>

<sup>1</sup>University of Stuttgart

## EuMC47-2

Microwave Characterisation of the Coefficient of Thermal Expansion and the Thermal Evolution of Electric Conductivity for Metal-lised Substrate

Thibault Charlet<sup>1</sup>, Olivier Tantot<sup>1</sup>, Nicolas Delhote<sup>1</sup>, Clément Hallepée<sup>1</sup>, Serge Verdeyme<sup>1</sup>, David Nevo<sup>1</sup>

<sup>1</sup>Xlim - UMR 7252 - CNRS- Limoges University, <sup>2</sup>Thales Alenia Space France

## EuMC47-3

Solid and Non-Solid Dielectric Material Characterization for Millimeter and Sub-Millimeter Wave Applications

Alain Peden<sup>1</sup>, Daniel BOURREAU<sup>1</sup>

<sup>1</sup>IMT Atlantique

## EuMC47-4

Novel Method for Measuring Complex Permittivity of Thin Films at Millimeter Frequencies

Yuto Kato<sup>1</sup>, Masahiro Horibe<sup>1</sup>

<sup>1</sup>National Institute of Advanced Industrial Science and Technology

## EuMC47-5

New Methods for Improved Accuracy of Broad Band Free Space Dielectric Measurements

John Schultz<sup>1</sup>, Ren Geryak<sup>1</sup>, James Maloney<sup>2</sup>

<sup>1</sup>Compass Technology Group, <sup>2</sup>Maloney Solutions



# THURSDAY 10:50 - 12:30

## Glow

**EuMC52**  
Biological Microwave Effects and Imaging Techniques  
Chair: Katia Grenier<sup>1</sup>  
Co-Chair: Juan-Mari Collantes<sup>2</sup>  
<sup>1</sup>LAAS-CNRS, <sup>2</sup>UPV/EHU

## Mission 1

**EuRAD12**  
[Focussed Session] Radar Interference Cancellation and Waveform Agility  
Chair: Stefan Brüggerwirth<sup>1</sup>  
Co-Chair: Christoph Fischer<sup>2</sup>  
<sup>1</sup>Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR), <sup>2</sup>Hensoldt Sensors GmbH

## Mission 2

**EuRAD13**  
[Special Session] Radar and Electronic Warfare  
Chair: Sue Robertson<sup>1</sup>  
Co-Chair: Mayazzurra Ruggiano<sup>2</sup>  
<sup>1</sup>EW Defence Ltd, <sup>2</sup>Thales Nederland B.V.

## Quest

**EuRAD14**  
Surveillance and SAR  
Chair: Volker Ziegler<sup>1</sup>  
Co-Chair: Willem A. Hol<sup>1</sup>  
<sup>1</sup>Airbus Defence and Space GmbH

10:50 - 11:10

**EuMC52-1**  
Novel challenges and available solutions for in situ real time SAR (Specific Absorption Rate) assessment in any environment and up to millimeter waves  
Gwenaél Gaborit<sup>1</sup>, Lionel DUVILLARET<sup>1</sup>  
**INDUSTRIAL KEYNOTE**  
<sup>1</sup>Kapteos S.A.S.

**EuRAD12-1**  
FMCW-Interference of Frequency Agile OFDM Radars  
Christina Knill<sup>1</sup>, Benedikt Schweizer<sup>2</sup>, Simon Stepany<sup>2</sup>, David Werbanat<sup>1</sup>, Christian Waldschmidt<sup>1</sup>  
<sup>1</sup>Ulm University

**EuRAD13-1**  
Cognitive Electronic Warfare (EW) as a Training Aid  
Warren du Plessis<sup>1</sup>, Nicholas Osner<sup>1</sup>  
<sup>1</sup>University of Pretoria

**EuRAD14-1**  
Next Generation AESA Radar Architectures  
Chris Mountford<sup>1</sup>  
**INDUSTRIAL KEYNOTE**  
<sup>1</sup>Leonardo UK

11:10 - 11:30

**EuMC52-2**  
A Coplanar Waveguide System for Drug Delivery Mediated by Nanoelectroporation: an Experimental and Numerical Study  
Laura Caramazza<sup>1</sup>, Alessandra Paffi<sup>1</sup>, Micaela Liberti<sup>1</sup>, Francesca Apollonio<sup>1</sup>  
<sup>1</sup>Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome

**EuRAD12-2**  
PMCW Waveform Cross-correlation Characterization and Interference Mitigation  
André Bourdoux<sup>1</sup>, Marc Bauduin<sup>1</sup>  
<sup>1</sup>IMEC

**EuRAD13-2**  
A brief introduction to Electronic Warfare and the AOC  
Sue Robertson<sup>1</sup>  
<sup>1</sup>EW Defence Ltd

**EuRAD14-2**  
Small UAV-Based High Resolution SAR using Low-Cost Radar, GNSS/RTK and IMU Sensors  
Jan Svedin<sup>1</sup>, Anders Bernland<sup>1</sup>, Andreas Gustafsson<sup>1</sup>  
<sup>1</sup>Swedish Defence Research Agency (FOI)

11:30 - 11:50

**EuMC52-3**  
Generating Bipolar Nanosecond Pulsed Electric Field using Open Circuit Transmission Line Technique and Avalanche Transistors  
Ilan Wyn Davies<sup>1</sup>, Christopher P. Hancock<sup>1</sup>  
<sup>1</sup>Bangor University

**EuRAD12-3**  
Radar Waveform Coexistence: Interference Comparison on Multiple-Frame Basis  
Jeroen Overvest<sup>1</sup>, Francesco Laghezza<sup>1</sup>, Feike Jansen<sup>1</sup>, Alessio Filippi<sup>1</sup>  
<sup>1</sup>NXP Semiconductors

**EuRAD13-3**  
Collecting Intelligence from Modern Radar Systems  
David Stupples<sup>1</sup>  
<sup>1</sup>London City University

**EuRAD14-3**  
Recent L-C- and X-Band MetaSensing Airborne SAR Campaigns for Emerging Applications  
Karlus Macedo<sup>1</sup>, Gerard Masalias<sup>1</sup>, Alex Coccia<sup>1</sup>, Adriano Meta<sup>1</sup>  
<sup>1</sup>MetaSensing

11:50 - 12:10

**EuMC52-4**  
7T MRI Loop Antenna for Carotid Imaging  
Lars Hinge<sup>1</sup>, Nicolai Mortensen<sup>1</sup>, Vitaliy Zhurbenko<sup>2</sup>, Vincent Öltman Boer<sup>2</sup>, Wenjun Wang<sup>3</sup>  
<sup>1</sup>Technical University of Denmark, <sup>2</sup>Copenhagen University Hospital Hvidovre

**EuRAD12-4**  
Interference Avoidance and Mitigation in Automotive Radar  
Mouhammad Alhumaidi<sup>1</sup>, Markus Wintermantel<sup>1</sup>  
<sup>1</sup>Continental AG

**EuRAD13-4**  
MicroESM: broadening the application of passive radar detection  
John Roe<sup>1</sup>  
<sup>1</sup>Esroe Ltd

**EuRAD14-4**  
The SWALIS Project: First Results for Airborne Radar Measurements in Ka-Band  
Jean-Claude Kokou KOUMI<sup>1</sup>, Stéphane Méric<sup>1</sup>, Eric Pottier<sup>1</sup>, Guy GRUNFELDER<sup>1</sup>  
<sup>1</sup>Institut d'Electronique et de Télécommunications de Rennes, Insa Rennes, <sup>2</sup>Institut d'électronique et de télécommunications de Rennes, IETR, <sup>3</sup>CNRS, Institut d'Electronique et de Télécommunications de Rennes, UMR-6164

12:10 - 12:30

**EuMC52-5**  
Intracellular Delivery of Graphene Oxide Quantum Dots for Bio-Imaging and Ferric Ion Sensing Based on Bulk Acoustic Wave Resonator  
Miaosen Zhang<sup>1</sup>, Shan He<sup>1</sup>, Xuexin Duan<sup>1</sup>, Wei Pang<sup>1</sup>, Yanyan Wang<sup>1</sup>  
<sup>1</sup>Tianjin University

**EuRAD12-5**  
Analysis of Automotive Radar Interference Mitigation for Real-World Environments  
Mate Toth<sup>1</sup>, Johanna Rock<sup>2</sup>, Paul Meissner<sup>3</sup>, Alexander Melzer<sup>4</sup>, Klaus Witrisal<sup>5</sup>  
<sup>1</sup>Infinion Technologies AG, Graz University of Technology, <sup>2</sup>Graz University of Technology, <sup>3</sup>Infinion Technologies Austria AG

**EuRAD13-5**  
Microwave Photonics as an Emerging Technology to enhance EW receivers  
David Lázaro Loscos<sup>1</sup>  
<sup>1</sup>Indra

**EuRAD14-5**  
Direct Ocean Surface Velocity Measurement for Chinese Gaofen-3 SAR Satellite  
Lei Liu<sup>1</sup>, Mihai Detcu<sup>2</sup>, Qingjun Zhang<sup>3</sup>, Gottfried Schwarz<sup>4</sup>, Yadong Liu<sup>1</sup>, Jie Liu<sup>1</sup>  
<sup>1</sup>Beijing Institute of Spacecraft System Engineering, China Academy of Space Technology, <sup>2</sup>Remote Sensing Technology Institute, German Aerospace Center (DLR)

# THURSDAY 12:30 - 14:10

## Hall 1

**EuRAD15**  
EuRAD Interactive Poster Session  
Chair: Jacco de Wit<sup>1</sup>  
Co-Chair: Mark Oude Alink<sup>2</sup>  
<sup>1</sup>TNO, <sup>2</sup>University of Twente



**EuRAD15-1**  
On the Needlessness of Signal Bandwidth for Precise Holographic Wireless Localization  
Melanie Lipka<sup>1</sup>, Stefan Brückner<sup>1</sup>, Erik Sippel<sup>1</sup>, Martin Vossiek<sup>1</sup>  
<sup>1</sup>FAU Erlangen-Nuremberg

**EuRAD15-5**  
A Radar Target Simulator for Generating Synthesised and Measured Micro-Doppler-Signatures of Vulnerable Road Users  
Johannes Iberle<sup>1</sup>, Patrick Rippel<sup>1</sup>, Thomas Walter<sup>1</sup>  
<sup>1</sup>University of Applied Sciences Ulm

**EuRAD15-9**  
Scalable 2x2 MIMO Radar with BPSK Data Communication at 79 GHz  
Wael A. Ahmad<sup>1</sup>, Arzu Ergintav<sup>1</sup>, Maciej Kucharski<sup>2</sup>, Dietmar Kissinger<sup>2</sup>, Herman Jalli Ng<sup>2</sup>  
<sup>1</sup>IHP - Leibniz-Institut für innovative Mikroelektronik, <sup>2</sup>Ulm University

**EuRAD15-13**  
Series-Fed Single-Layer Ring Resonator Antenna Array with Wide Fan-Beam and High Gain  
Hyunyoung Cho, Hye-Won Jo<sup>1</sup>, Byungkuon Ahn<sup>1</sup>, Ju-ik Oh<sup>1</sup>, Jong-Won Yu<sup>1</sup>  
<sup>1</sup>Korea Advanced Institute of Science and Technology

**EuRAD15-2**  
Dynamic Estimation of Vital Signs with mmWave FMCW Radar  
Guigeng Su<sup>1</sup>, Nikita Petrov<sup>1</sup>, Alexander Yarovoy<sup>1</sup>  
<sup>1</sup>Delft University of Technology, <sup>2</sup>TU Delft

**EuRAD15-6**  
RCS-Enhancement for Improving the Detectability of Bikes in Road Safety Applications  
Corentin Charlo<sup>1</sup>, Stéphane Méric<sup>1</sup>, Raphaël Gillard<sup>1</sup>  
<sup>1</sup>Institut d'Electronique et de Télécommunications de Rennes, Insa Rennes, <sup>2</sup>IETR, INSA

**EuRAD15-10**  
Deep Neural Network Detection for Pulsed Radar-Embedded M-PSK Communications  
Christopher Liu<sup>1</sup>, Ric Romero<sup>1</sup>  
<sup>1</sup>USN, <sup>2</sup>Naval Postgraduate School

**EuRAD15-14**  
High Permittivity CPW-SIW Power Divider for Antenna Feed Networks in Airborne Phased Arrays Applications  
Diego Lorente Catalan<sup>1</sup>, Alicja Schreiber<sup>2</sup>, Markus Limbach<sup>3</sup>, Hector Esteban Gonzalez<sup>2</sup>, Vicente Enrique Boria Esbert<sup>2</sup>  
<sup>1</sup>German Aerospace Center (DLR), <sup>2</sup>Universidad Politécnica de Valencia

**EuRAD15-3**  
Further Investigation of Two-Way Classification for Activities of Daily Living  
Ronny G. Guendel<sup>1</sup>  
<sup>1</sup>Delft University of Technology

**EuRAD15-7**  
A Cognitive FMCW Radar to Minimize a Sequence of Range-Doppler Measurements  
Marco Altmann<sup>1</sup>, Peter Ott<sup>1</sup>, Nicolaj C. Stache<sup>1</sup>, Dmitrii Kozlov<sup>2</sup>, Christian Waldschmidt<sup>2</sup>  
<sup>1</sup>Hochschule Heilbronn, <sup>2</sup>Ulm University

**EuRAD15-11**  
Vibrating Antenna Doppler Radar  
Nathan Chordas-Ewell<sup>1</sup>, Kevin Xu<sup>2</sup>, Ravi Kadlimatti<sup>1</sup>, Adly T. Fam<sup>1</sup>, Jun H. Choi<sup>1</sup>  
<sup>1</sup>The State University of New York at Buffalo

**EuRAD15-15**  
Novel Noise-Tolerant Method for Extracting Target Resonances Using Pulse Radar  
Mihail Georgiev<sup>1</sup>, Paul Rice<sup>2</sup>, Jian-Kang Zhang<sup>1</sup>  
<sup>1</sup>McMaster University, <sup>2</sup>Patriot One Technologies

**EuRAD15-4**  
Human Walking Detection by Cascaded Deep Neural Networks Classifying Micro-Doppler Signals  
Jihoon Kwon<sup>1</sup>, Nojun Kwak<sup>2</sup>, Junho So<sup>2</sup>  
<sup>1</sup>Hanwha Systems, <sup>2</sup>Seoul National University, <sup>3</sup>Agency for Defense Development

**EuRAD15-8**  
A Novel Velocity Estimation Algorithm for TDM-MIMO Based Automotive Radar  
Ben Wang<sup>1</sup>, Dejian Li<sup>1</sup>, Dapeng Lao<sup>1</sup>, Jiamin Chen<sup>1</sup>  
<sup>1</sup>Hisilicon Technologies Co., Ltd.

**EuRAD15-12**  
A New Radar Based On Panel Active Array  
Jia Fang<sup>1</sup>  
<sup>1</sup>cet38

**EuRAD15-16**  
Avoiding Interference in Multi-Emitter Environments: A Reinforcement Learning Approach  
Serkan Ak<sup>1</sup>, Stefan Brüggerwirth<sup>1</sup>  
<sup>1</sup>Fraunhofer Institute for High Frequency Physics and Radar Techniques (FHR)



## THURSDAY 13:50 – 15:30

	<b>Auditorium</b>	<b>Expedition</b>	<b>Flash</b>	<b>Glow</b>
	<b>EuMC/EuRAD03</b> [Special Session] Focus Day: Active Array Antennas for Defence Chair: Peter Knott <sup>1</sup> Co-Chair: Patrick Langlois <sup>2</sup> <sup>1</sup> Fraunhofer FHR, <sup>2</sup> EDA	<b>EuMC54</b> Low Noise Amplifier and Phased Array Module Chair: Almudena Suarez Rodriguez <sup>1</sup> Co-Chair: Jean-François Villemazet <sup>2</sup> <sup>1</sup> University of Cantabria, <sup>2</sup> Thales Alenia Space France	<b>EuMC55</b> Antenna Characterisation Techniques Chair: Nuno Borges Carvalho <sup>1</sup> Co-Chair: Olof Bengtsson <sup>2</sup> <sup>1</sup> Instituto de Telecomunicações, Universidade de Aveiro, <sup>2</sup> Ferdinand-Braun-Institut (FBH)	<b>EuMC56</b> [Focussed Session] Electromagnetics in Biomedical Applications Chair: Maarten Paulides <sup>1</sup> Co-Chair: Desmond T.B. Yeo <sup>2</sup> <sup>1</sup> Eindhoven University of Technology (TU/e), <sup>2</sup> GE Global Research
<b>13:50 – 14:10</b>	<b>EuMC/EuRAD03-1</b> Research progress of intelligent active phased array radar Jun Sun <sup>1</sup> <sup>1</sup> Nanjing Research Institute of Electronics Technology	<b>EuMC54-1</b> A Full Ka-Band GaN-on-Si Low-Noise Amplifier Dristy Parveg <sup>1</sup> , Mikko Varonen <sup>1</sup> , Mikko Kantanen <sup>1</sup> <sup>1</sup> VTT Technical Research Centre of Finland	<b>EuMC55-1</b> Preliminary Characterization of the Digitally Formed Beams of PHAROS2 Phased Array Feed Giuseppe Pupillo <sup>1</sup> , Alessandro Navarrini <sup>1</sup> , Andrea Melis <sup>1</sup> , Raimondo Concu <sup>1</sup> , Pierluigi Ortu <sup>1</sup> , Pasquale Marongiu <sup>1</sup> , Giovanni Naldi <sup>1</sup> , Simone Rusticelli <sup>1</sup> , Andrea Saba <sup>1</sup> , Alessandro Scalambra <sup>1</sup> , Luca Schirru <sup>1</sup> , Adelaide Ladu <sup>1</sup> , Tonino Pisanu <sup>1</sup> , Enrico Urru <sup>1</sup> <sup>1</sup> INAF - IRA, <sup>2</sup> INAF - OAC, <sup>3</sup> ASI	<b>EuMC56-1</b> Ultra-High Field MRI RF Transmit Coil Arrays Carel van Leeuwen <sup>1</sup> , Bart Steensma <sup>1</sup> , Alexander Raaijmakers <sup>1</sup> <sup>1</sup> University Medical Center Utrecht
<b>14:10 – 14:30</b>	<b>EuMC/EuRAD03-2</b> Digital Frontends for Multi-Functional RF Systems Michael Brandfass <sup>1</sup> <sup>1</sup> Hensoldt Sensors GmbH	<b>EuMC54-2</b> A High Linearity W-Band LNA With 21-dB Gain and 5.5-dB NF in 0.13 μm SiGe BiCMOS Huanbo Li <sup>1</sup> , Jixin Chen <sup>1</sup> , Debin Hou <sup>1</sup> , Wei Hong <sup>1</sup> , Pingpin Yan <sup>1</sup> <sup>1</sup> Southeast University	<b>EuMC55-2</b> Characterization and Calibration Challenges of a K-Band Large Scale Active Phased-Array Antenna with a Modular Architecture Naimeh Ghafarian <sup>1</sup> , Wael Abdel-Wahab <sup>1</sup> , Amir Raeesi <sup>1</sup> , Ehsan Haj Mirza Alian Aminabad <sup>1</sup> , Ardeshir Palizban <sup>1</sup> , Ahmad Ehsandar <sup>1</sup> , Milad Khaki <sup>1</sup> , Mohammad-Reza Nezhad-Ahmadi <sup>1</sup> , Safieddin Safavi-Naeini <sup>1</sup> <sup>1</sup> University of Waterloo	<b>EuMC56-2</b> Non-Invasive Brain Stimulation: From Field Modeling to Neuronal Activation Rob Mestrom <sup>1</sup> , Debby Klooster <sup>1</sup> , Elles Raaijmakers <sup>1</sup> , Maarten van Rossum <sup>1</sup> , Martijn van Beurden <sup>1</sup> , Paul Boon <sup>1</sup> <sup>1</sup> Eindhoven University of Technology, <sup>2</sup> Ghent University
<b>14:30 – 14:50</b>	<b>EuMC/EuRAD03-3</b> Naval and ground-based multi-mission AESA radars Simon van den Berg <sup>1</sup> <sup>1</sup> Thales Nederland B.V.	<b>EuMC54-3</b> A MMIC Low-Noise Amplifier Realized with Two Different Gate Length GaN-on-Si Technologies Lorenzo Pace <sup>1</sup> , Patrick Ettore Longhi <sup>1</sup> , Walter Ciccognani <sup>1</sup> , Sergio Colangeli <sup>1</sup> , Rémy Leblanc <sup>1</sup> , Ernesto Limiti <sup>1</sup> <sup>1</sup> University of Rome "Tor Vergata", <sup>2</sup> MMIC SAS	<b>EuMC55-3</b> A Low Complexity Approach for Calibration and Characterization of a Millimeter-Wave Phased-Array Transceiver-Antenna Module Mehdi Salehi <sup>1</sup> , Safieddin Safavi-Naeini <sup>1</sup> , Mohammad-Reza Nezhad-Ahmadi <sup>1</sup> <sup>1</sup> Sinclair Technologies, <sup>2</sup> University of Waterloo	<b>EuMC56-3</b> 7T MRI Fractionated Dipole Antenna for CarotidImaging Nicolai Mortensen <sup>1</sup> , Lars Hinge <sup>1</sup> , Vitaliy Zhurbenko <sup>1</sup> , Vincent Oltman Boer <sup>1</sup> <sup>1</sup> Technical University of Denmark, <sup>2</sup> DTU, <sup>3</sup> DRMCR
<b>14:50 – 15:10</b>	<b>EuMC/EuRAD03-4</b> AESA Radar for Space Situational Awareness – about the status of GESTRA Helmut Wilden <sup>1</sup> , C. Kirchner <sup>1</sup> , Andreas R. Brenner, Thomas Eversberg <sup>1</sup> <sup>1</sup> Fraunhofer FHR, <sup>2</sup> German Aerospace Center (DLR)	<b>EuMC54-4</b> G-Band Frequency Converters in 130 nm InP DHB Technology Ahmed Hassona <sup>1</sup> , Vessen Vassilev <sup>1</sup> , Herbert Zirath <sup>1</sup> <sup>1</sup> Chalmers University of Technology	<b>EuMC55-4</b> A Reproducible Semi-Virtual Test-Drive for Analysis of Car-to-Car/Car-to-X Diversity Performance at 5.9 GHz in Noisy Fading Conditions Anton Dabler <sup>1</sup> , Olha Voitsun <sup>1</sup> , Stefan Lindenmeier <sup>1</sup> <sup>1</sup> University of the Bundeswehr Munich	<b>EuMC56-4</b> Simulation Comparison of Bird-cage Coil and Metamaterial Liner for MRI at 3T and 4.7T Adam Maunders <sup>1</sup> , Nicola De Zanche <sup>1</sup> , Ashwin Iyer <sup>1</sup> <sup>1</sup> University of Alberta
<b>15:10 – 15:30</b>	<b>EuMC/EuRAD03-5</b> AESA Radar Development at Lincoln Lab David Conway <sup>1</sup> <sup>1</sup> MIT Lincoln Laboratory	<b>EuMC54-5</b> Millimetre-Wave Active Phased Array SIP Module for UE Devices in 5G Communications Wenyao Zhai <sup>1</sup> , Hari Krishna Pothula <sup>1</sup> , Morris Repeta <sup>1</sup> , David Wessel <sup>1</sup> , Wen Tong <sup>1</sup> <sup>1</sup> Huawei Technologies, <sup>2</sup> Huawei Technologies CO., LTD	<b>EuMC55-5</b> A Preliminary Study on Uncertainty of NB-IoT Measurements in Reverberation Chambers Anouk Hubrechsen <sup>1</sup> , Vincent Neylon <sup>1</sup> , Kate Remley <sup>1</sup> , Robert Jones <sup>1</sup> , Robert Horansky <sup>1</sup> , Sander Bronckers <sup>1</sup> <sup>1</sup> Eindhoven University of Technology (TU/e), <sup>2</sup> National Institute of Standards and Technology	<b>EuMC56-5</b> PNS Estimation of a High Performance Head Gradient Coil by a Coupled Electromagnetic Neurodynamic Simulation Method Yihe Hua <sup>1</sup> , Desmond T.B. Yeo <sup>1</sup> , Thomas KF Foo <sup>1</sup> <sup>1</sup> GE Global Research

## THURSDAY 13:50 – 15:30

	<b>Media Arena</b>	<b>Mission 1</b>	<b>Mission 2</b>	<b>Quest</b>
	<b>EuMC57</b> [Special Session] In Recognition: Prof.Dr. A.T. de Hoop Chair: Peter Zwamborn <sup>1</sup> Co-Chair: Arnold van Ardenne <sup>2</sup> <sup>1</sup> TNO Defense, Safety and Security, <sup>2</sup> ASTRON (retired)	<b>EuRAD16</b> Automotive Chair: André Bourdoux <sup>1</sup> Co-Chair: Noam Arkind <sup>2</sup> <sup>1</sup> imec, Leuven, <sup>2</sup> Arbe Robotics	<b>EuRAD17</b> Advanced Techniques and Innovative Array Configurations for Direction of Arrival Estimation Chair: Laurent Ferro-Famil <sup>1</sup> Co-Chair: Francois Le Chevalier <sup>2</sup> <sup>1</sup> University of Rennes 1, <sup>2</sup> TU Delft	<b>EuRAD18</b> SAR Applications Chair: Debora Pastina <sup>1</sup> Co-Chair: Mikhail Cherniakov <sup>2</sup> <sup>1</sup> University of Rome La Sapienza, <sup>2</sup> University of Birmingham
<b>13:50 – 14:10</b>	<b>EuMC57-1</b> A few Introductory remarks Arnold van Ardenne <sup>1</sup> <sup>1</sup> ASTRON (retired)	<b>EuRAD16-1</b> Channel Influence for the Analysis of Interferences Between Automotive Radars Lizette Lorraine Tovar Torres <sup>1</sup> , Maximilian Steiner <sup>1</sup> , Christian Waldschmidt <sup>1</sup> <sup>1</sup> Universität Ulm	<b>EuRAD17-1</b> An IEEE 802.15.4 Wireless Half-Cubic Node Based on a Switched-Beam Antenna for Indoor Direction of Arrival Estimation Alessandro Cidronali <sup>1</sup> , Giovanni Collodi <sup>1</sup> , Matteo Lucarelli <sup>1</sup> , Stefano Maddio <sup>1</sup> , Marco Passafiume <sup>1</sup> , Giuseppe Pelosi <sup>1</sup> <sup>1</sup> University of Florence	<b>EuRAD18-1</b> Realistic SAR Implementation for Automotive Applications Hasan Iqbal <sup>1</sup> , Andreas Löffler <sup>1</sup> , Mohamed Nour Mejdoub <sup>1</sup> , Frank Gruson <sup>1</sup> <sup>1</sup> Continental AG
<b>14:10 – 14:30</b>	<b>EuMC57-2</b> To have "(De) Hoop" in Difficult Times Guy Vandenbosch <sup>1</sup> <sup>1</sup> KU Leuven	<b>EuRAD16-2</b> Automotive Radar Interference Mitigation via Multi-Hop Cooperative Radar Communications Canan Aydogdu <sup>1</sup> , Musa Furkan Keskin <sup>1</sup> , Henk Wymeersch <sup>1</sup> <sup>1</sup> Chalmers University of Technology	<b>EuRAD17-2</b> Improving an IEEE 802.15.4 Based Direction of Arrival Estimation System Reliability in a Real Case Scenario Exploiting a Smart Multichannel Approach Alessandro Cidronali <sup>1</sup> , Giovanni Collodi <sup>1</sup> , Matteo Lucarelli <sup>1</sup> , Stefano Maddio <sup>1</sup> , Marco Passafiume <sup>1</sup> , Giuseppe Pelosi <sup>1</sup> <sup>1</sup> University of Florence	<b>EuRAD18-2</b> Space-Variant Phase Error Estimation and Correction for Automotive SAR Masoud Farhadi <sup>1</sup> , Reinhard Feger <sup>1</sup> , Johannes Fink <sup>1</sup> , Thomas Wagner <sup>1</sup> , Markus Gosner <sup>1</sup> , Jürgen Hasch <sup>1</sup> , Andreas Stelzer <sup>1</sup> <sup>1</sup> Johannes Kepler University Linz, <sup>2</sup> Robert Bosch GmbH
<b>14:30 – 14:50</b>	<b>EuMC57-3</b> Time-domain Antenna Engineering – A Story About Scientific Affinity Ioan Lager <sup>1</sup> <sup>1</sup> Delft University of Technology	<b>EuRAD16-3</b> An Efficient Sparse Sensing Based Interference Mitigation Approach For Automotive Radar Tai Fei <sup>1</sup> , Honghao Guang <sup>1</sup> , Yuliang Sun <sup>1</sup> , Christopher Grimm <sup>1</sup> , Ernst Wartsitz <sup>1</sup> <sup>1</sup> HELLA GmbH & Co. KGaA,	<b>EuRAD17-3</b> Selecting the best DOA estimates among estimates obtained using Toeplitz matrix approximation and general covariance matrix Volodymyr Vasylyshyn <sup>1</sup> <sup>1</sup> Kharkiv national Air force university	<b>EuRAD18-3</b> Ego-Motion Estimation for a Sensor Platform by Fusion of Radar and IMU Data Patrick Wallrath <sup>1</sup> , Reinhold Herschel <sup>1</sup> <sup>1</sup> Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR, <sup>2</sup> Fraunhofer FHR
<b>14:50 – 15:10</b>	<b>EuMC57-4</b> The Cagniard-deHoop Method of Moments (CdH-MoM) – A New Time-Domain Integral-Equation Technique Based on EM Reciprocity and the Cagniard-deHoop Method Martin Stumpf	<b>EuRAD16-4</b> Over-the-Air Vehicle-in-the-Loop Test System for Installed-Performance Evaluation of Automotive Radar Systems in a Virtual Environment Sreehari Buddappagari Jayapal Gowdu <sup>1</sup> , Ehtisham Asghar Muhammad <sup>1</sup> , Johannes Nagel <sup>1</sup> , Ralf Stephan <sup>1</sup> , Matthias A. Hein <sup>1</sup> <sup>1</sup> TU Ilmenau, <sup>2</sup> Mercedes-Benz AG	<b>EuRAD17-4</b> A Discriminant-Based RMSE Improvement Technique for Classical Prony Method in Small Array Radars Atsushi Yoshizawa <sup>1</sup> , Shigenori Uchida <sup>1</sup> <sup>1</sup> Sony Corp.	<b>EuRAD18-4</b> Azimuth Ambiguity Discrimination Using Doppler Spectrum of the Compressive Sensing-Based SAR Image with Downsampled PRF Ryogo Horiuchi <sup>1</sup> , Takehiro Hoshino <sup>1</sup> , Noboru Oishi <sup>1</sup> , Kei Suwa <sup>1</sup> <sup>1</sup> Mitsubishi Electric Corporation
<b>15:10 – 15:30</b>	<b>EuMC57-5</b> A Roadside Camera-Radar Sensing Fusion System for Intelligent Transportation Lefei Wang <sup>1</sup> , Zhaoyu Zhang <sup>1</sup> , Xin Di <sup>1</sup> , Jun Tian <sup>1</sup> <sup>1</sup> Fujitsu Research and Development Center Co., Ltd, China	<b>EuRAD16-5</b> A Roadside Camera-Radar Sensing Fusion System for Intelligent Transportation Lefei Wang <sup>1</sup> , Zhaoyu Zhang <sup>1</sup> , Xin Di <sup>1</sup> , Jun Tian <sup>1</sup> <sup>1</sup> Fujitsu Research and Development Center Co., Ltd, China	<b>EuRAD17-5</b> Direction of Arrival Estimation using the Generalized SPICE Criterion Adham Sakhnini <sup>1</sup> <sup>1</sup> Centre for Mathematical Sciences, Lund University	<b>EuRAD18-5</b> Spatial Mapping of Material Properties utilizing FMCW Near Field Radar Scans Sebastian Pawliczek <sup>1</sup> , Reinhold Herschel <sup>1</sup> , Nils Pohl <sup>1</sup> <sup>1</sup> Ruhr University Bochum, <sup>2</sup> Fraunhofer FHR

# THURSDAY 14:30 – 16:20

## Hall 1

### EuMC58

EuMC Interactive Poster Session 3

Chair: Sander Bronckers<sup>1</sup>

Co-Chair: Mark Oude Alink<sup>2</sup>

<sup>1</sup>Eindhoven University of Technology, <sup>2</sup>University of Twente

#### EuMC58-1

##### Design of Wideband Frequency Selective Absorber Based on Multilayer Structures

YE Han<sup>1</sup>, Longjie Xu<sup>1</sup>, Hanjing Xu<sup>1</sup>, Siyu Xie<sup>1</sup>

<sup>1</sup>Nanjing University of posts and telecommunication

#### EuMC58-6

##### GaN-FET Class-E Amplifier for 60-MHz Radar

Frederick Raab<sup>1</sup>

<sup>1</sup>Green Mountain Radio Research

#### EuMC58-11

##### Cross-Polarization Chipless Tag for Orientation Sensing

Nicolas Barbot<sup>1</sup>, Olivier Rance<sup>1</sup>, Etienne Perret<sup>1</sup>

<sup>1</sup>Grenoble Alpes University

#### EuMC58-16

##### A 79-GHz Automotive Wide-Beam Patch Antenna With I-Shaped Parasitic Elements

Guan-Ren Su<sup>1</sup>, Eric S. Li<sup>1</sup>, Jia-Chang Chen<sup>1</sup>, Ting-Wei Kuo<sup>1</sup>, Yu-You Lin<sup>1</sup>, Kuo-Sheng Chin<sup>2</sup>

<sup>1</sup>National Taipei University of Technology, <sup>2</sup>Chang Gung University

#### EuMC58-2

##### A 2.5 GHz Tunable Negative Varactor of Inductance Using Reconfigurable Non-Foster Circuit

Ngoc Duc Au<sup>1</sup>

<sup>1</sup>Soongsil University

#### EuMC58-7

##### A High Efficiency Compact Class F GaN MMIC Power Amplifier for 5G Applications

Rachit Joshi<sup>1</sup>, Min-Hsin Liu<sup>1</sup>, Shawn S. H. Hsu<sup>1</sup>

<sup>1</sup>National Tsing Hua University

#### EuMC58-12

##### Anti-Aliasing Digital Predistortion for Nonuniform-Sampling-Rate Concurrent Dual-Band Transmitters

Long Chen<sup>1</sup>, Wenhua Chen<sup>1</sup>, Youjiang Liu<sup>2</sup>, Zhenghe Feng<sup>1</sup>

<sup>1</sup>Tsinghua University, <sup>2</sup>China Academy of Engineering Physics

#### EuMC58-17

##### Hemishperical Coverage Antenna using Pattern Reconfiguration of Electronically Steerable Parasitic Array Radiator and Microstrip Patch

ByungKwon Ahn<sup>1</sup>, Hyunyoung Cho<sup>1</sup>, Hye-Won Jo<sup>1</sup>, Ju-Ik Oh<sup>1</sup>, Jong-Won Yu<sup>1</sup>

<sup>1</sup>Korea Advanced Institute of Science and Technology

#### EuMC58-3

##### Design of a Cloak with Diagonally Slotted Square Patch for TE and TM Scattering Reduction

Archana Rajput<sup>1</sup>, Meheran Manzoor Zargar<sup>1</sup>, Kushmanda Saurav<sup>1</sup>, Shiban Kishen Koul<sup>2</sup>

<sup>1</sup>INDIAN INSTITUTE OF TECHNOLOGY JAMMU, <sup>2</sup>Indian Institute of Technology Delhi

#### EuMC58-8

##### Reliable Structural Failure Detection in Eye Bolts using Reflectometry Signals

H. V. H. Silva Filho<sup>1</sup>, D. C. P. Barbosa<sup>1</sup>, M. S. Coutinho<sup>1</sup>, M. T. de Melo<sup>1</sup>, R. G. M. dos Santos<sup>1</sup>, Ignacio Llamas Garro<sup>2</sup>

<sup>1</sup>Universidade Federal de Pernambuco, <sup>2</sup>Centre Tecnològic de Telecomunicacions de Catalunya

#### EuMC58-13

##### A Complementary Series-Parallel Resonant Circuit Pair and Its Application in Linearization of Power Amplifiers

Zeji Gu<sup>1</sup>

<sup>1</sup>Ampleon USA

#### EuMC58-18

##### Antenna Library for IoT Devices with Antenna Boosters

Jaume Anguera<sup>1</sup>

<sup>1</sup>Fractus Antennas and Universitat Ramon Llull

#### EuMC58-4

##### A Compact Load-Modulation Amplifier for Improved Efficiency Next Generation Mobile

Ahmed Abdulkhaleq<sup>1</sup>, Maan Yahya<sup>2</sup>, Yasir Al-Yasir<sup>3</sup>, Naser Ojaroudi Parchin<sup>1</sup>, Maryam Sajedin<sup>1</sup>, Syed Muhammad Syed Aneer<sup>1</sup>, Ashwain Rayit<sup>1</sup>, Issa Elfergani<sup>1</sup>, Raed A. Abd-Alhameed<sup>1</sup>, Jonathan Rodriguez<sup>2</sup>

<sup>1</sup>Saras Technology, <sup>2</sup>Northern Technical University, <sup>3</sup>University of Bradford, <sup>4</sup>Instituto de Telecomunicações

#### EuMC58-9

##### Integrated System with Enhanced Performances to Recover Energy from Microstrip Circuits

Miguel Sanchez-Soriano<sup>1</sup>, Yves Quéré<sup>2</sup>, Cédric Quendo<sup>1</sup>

<sup>1</sup>University of Alicante, <sup>2</sup>University of Brest

#### EuMC58-14

##### Technique for Load-Independent Millimeter-Wave Output Power Monitoring for Mass-Volume Testing

Matthias Saurer<sup>1</sup>, Vadim Issakov<sup>1</sup>, Oliver Frank<sup>1</sup>

<sup>1</sup>Infineon Technologies

#### EuMC58-19

##### Analysis and Optimization of Packaged Floating-Ground RF Power GaN-HEMTs

Sophie Paul<sup>1</sup>, Wolfgang Heinrich<sup>1</sup>, Olof Bengtsson<sup>1</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH)

#### EuMC58-5

##### A 65 W Power Amplifier without Load Modulation to Achieve 50% Efficiency at 8 dB Power Back-Off over 1.8-2.5 GHz

Paul Saad<sup>1</sup>, Rui Hou<sup>1</sup>, Richard Hellberg<sup>1</sup>, Bo Berglund<sup>1</sup>

<sup>1</sup>Ericsson AB

#### EuMC58-10

##### An Efficient Wireless Power Transfer for Retinal Prosthesis using Artificial Intelligent Algorithm

Nam Ha-Van<sup>1</sup>, Lam Vu Tung<sup>1</sup>

<sup>1</sup>Soongsil University

#### EuMC58-15

##### A Microstrip Filtering Patch Antenna with Asymmetric Gain Response

Yun Wu<sup>1</sup>, Jinhao Dai<sup>1</sup>, Liang Sun<sup>1</sup>, Yi Wang<sup>1</sup>, Yunlong Lu<sup>1</sup>, Jifu Huang<sup>2</sup>

<sup>1</sup>Institute of Physics, Chinese Academy of Sciences (IOP, CAS), <sup>2</sup>University of Birmingham, <sup>3</sup>Ningbo University

## Enjoy:

Don't miss the Week's last opportunity to enjoy an insightful walk between the posters of Thursday's session.

# THURSDAY 16:10 – 17:50

## ROOM

### Polar

#### EuMW03

EuMW/EuMC Closing Session

Chair: Frank E. van Vliet<sup>1</sup>, General Chair

Co-Chair: Wim van Cappellen<sup>2</sup>, EuMC Chair

<sup>1</sup>TNO, <sup>2</sup>ASTRON

**16:10** Session Welcome

Frank E. van Vliet

**16:20**

General Chair

**17:40** Closing Remarks and Invitation to EuMW 2021 in London

Frank E. van Vliet, Nick Ridler<sup>1</sup>

**17:50**

<sup>1</sup>EuMW 2021 General Chair

**16:20** Laser Communications: A Game Changer

Laurent Grouès<sup>1</sup>

<sup>1</sup>Deputy HD EDRS - SpaceDataHighway, Airbus Defence & Space, Germany

**16:50**

Laser communications are changing the way we think about connectivity. A quick dive into the end to end systems architectures of the future. The exciting new applications and markets which the new technology will unlocked. This keynote will address Laser Communications emerging technology, the challenges and opportunities ahead. Laser Communications are disrupting the connectivity solutions landscape and will bring a considerable differentiator to the early adopters.

**16:50** Awards Ceremony

Marion K. Matters-Kammerer

**17:10**

Awards and Prizes Chair

**17:10** New Frontiers for Wave Engineering Using Metamaterials

Andrea Ali<sup>1</sup>

<sup>1</sup>CUNY Advanced Science Research Center, Photonics Initiative, US

**17:40**

Metamaterials are engineered materials with properties that go well beyond what offered by nature, providing unprecedented opportunities to tailor and enhance the control of waves. In this talk, I discuss our recent activity at microwaves and THz frequencies, showing how suitably tailored meta-atoms and their arrangements open exciting avenues for wave manipulation, including metasurfaces with enhanced wavefront manipulation, and magnet-free nonreciprocity and topological phenomena. Insights into the underlying physics and new devices based on these concepts will be presented.

# FRIDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Progress			EuRAD25 Closing Session		
Mission 1	EuRAD19 MIMO Radar	EuRAD22 Automotive Radar MIMO Processing			
Mission 2	EuRAD20 Passive Radars	EuRAD23 Target Characterisation with Radar			
Quest	EuRAD21 New Radar Concepts	EuRAD24 [Special Session] Civilian Radar Research and Development in China			
Expedition	S-02 Cognitive Radar Signal Processing		S-01 Introduction to MIMO Radar		
Auditorium	5G Forum 5G: From Technology to Business		Technology in Context 5G, But Why?	5G Forum 5G: From Technology to Business	
Flash	W-21 Recent Advances in Topologies, Technologies and Practical Realizations of Microwave Sensors				
Glow	W-30 Recent Advances on Microwave Filters				
BOR 2	W-32 Practical Aspects of Running a Microwave Laboratory and How to Make Good Measurements Every Time				
Transitzone A		EuRAD Seated Lunch			
Transitzone B		5G Forum and WS/SC Seated Lunch			

# FRIDAY 08:30 - 10:10

	Mission 1	Mission 2	Quest
	<b>EuRAD19</b> MIMO Radar Chair: Andreas Stelzer <sup>1</sup> Co-Chair: Matthew Ritchie <sup>2</sup> <sup>1</sup> Johannes Kepler University Linz, <sup>2</sup> UCL	<b>EuRAD20</b> Passive Radars Chair: María-Pilar Jarabo-Amores <sup>1</sup> Co-Chair: Nathan Goodman <sup>2</sup> <sup>1</sup> University of Alcalá, <sup>2</sup> University of Oklahoma	<b>EuRAD21</b> New Radar Concepts Chair: Daniel O'Hagan <sup>1</sup> Co-Chair: Pierfrancesco Lombardo <sup>2</sup> <sup>1</sup> Fraunhofer FHR, <sup>2</sup> Sapienza University of Rome
<b>08:30 - 08:50</b>	<b>EuRAD19-1</b> Radar Imaging Using Electrically Large Arrays With High Range Resolution at 160 GHz André Dürr <sup>1</sup> , Benedikt Schneele <sup>1</sup> , Dominik Schwarz <sup>2</sup> , Christian Waldschmidt <sup>1</sup> <sup>1</sup> Ulm University	<b>EuRAD20-1</b> Airborne Targets Detection by UAV-Embedded Passive Radar Benjamin GABARD <sup>1</sup> , Valentine WASIK <sup>1</sup> , Olivier RABASTE <sup>1</sup> , Thierry DELOUES <sup>1</sup> , Dominique POULLIN <sup>1</sup> , Hervé JEULAND <sup>1</sup> <sup>1</sup> ONERA	<b>EuRAD21-1</b> Cognitive approaches to detection of small targets Ellis Humphreys <sup>1</sup> , Michael Antoniou <sup>1</sup> , Christopher Baker <sup>1</sup> , William Stafford <sup>2</sup> <sup>1</sup> University of Birmingham, <sup>2</sup> BAE Systems
<b>08:50 - 09:10</b>	<b>EuRAD19-2</b> On the Impact of Channel Imbalance on MIMO Radar Performance Ricard Grove <sup>1</sup> , Jørgen Dall <sup>1</sup> <sup>1</sup> DTU Space	<b>EuRAD20-2</b> Comparing Phase-Locked and Non-Phase-Locked Architectures for Dual-Channel DVB-S Passive Radar Octavio Cabrera <sup>1</sup> , Pierfrancesco Lombardo <sup>1</sup> , Fabiola Colone <sup>1</sup> , Carlo Bongioanni <sup>1</sup> <sup>1</sup> Sapienza University	<b>EuRAD21-2</b> Co-Engineering of a Radar System with Mixed Grey Wolf Optimizer: Application to Concealed Object Classification Julien Marot <sup>1</sup> , Claire Migliaccio <sup>2</sup> , Jérôme Lanteri <sup>2</sup> , Paul Lauga <sup>1</sup> , Salah Bourennane <sup>1</sup> <sup>1</sup> Institut Fresnel, Aix Marseille Université, <sup>2</sup> Université Côte d'Azur, <sup>3</sup> Université Cote d'Azur - CNRS, <sup>4</sup> Inst. Fresnel, Aix Marseille Université
<b>09:10 - 09:30</b>	<b>EuRAD19-3</b> MIMO ISAR Based UWB Imaging System for Non-Destructive Testing Harun Cetinkaya <sup>1</sup> , Sandra Nowok <sup>1</sup> , Reinhold Herschel <sup>1</sup> <sup>1</sup> Fraunhofer FHR	<b>EuRAD20-3</b> Characterization of Single Frequency Networks for Passive Radar Applications Volker Winkler <sup>1</sup> , Steffen Lutz <sup>1</sup> , Michael Brandfass <sup>1</sup> <sup>1</sup> Hensoldt Sensors GmbH	<b>EuRAD21-3</b> Millimeter- and Submillimeter-Wave Differential Absorption Radar Ken Cooper <sup>1</sup> , Richard Roy <sup>1</sup> , Jose V. Siles <sup>1</sup> , Matthew Lebsack <sup>1</sup> , Luis Millan <sup>1</sup> , Raquel Rodriguez-Monje <sup>1</sup> , Robert Dengler <sup>1</sup> , Omkar Pradhan <sup>1</sup> , Leslie Tamparari <sup>1</sup> , Brian Drouin <sup>1</sup> <sup>1</sup> Jet Propulsion Laboratory, California Institute of Technology
<b>09:30 - 09:50</b>	<b>EuRAD19-4</b> Coherent MIMO Radar Systems in Three-Dimensional Surveillance Scenarios David R. Sanchez-Jacome <sup>1</sup> , Salvatore Maresca <sup>2</sup> , Carsten Rockstuhl <sup>1</sup> , Paolo Ghelfi <sup>1</sup> , Antonella Bogoni <sup>1</sup> <sup>1</sup> Karlsruhe School of Optics and Photonics, Karlsruhe Institute of Technology, Karlsruhe, Germany, <sup>2</sup> Scuola Superiore Sant'Anna - TECIP, <sup>3</sup> PNTLab, Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNT), Pisa, <sup>4</sup> TECIP Institute, Scuola Superiore Sant'Anna, Pisa	<b>EuRAD20-4</b> Passive DVB-T SAR Phenomenology: First Results from a Bistatic Campaign George Atkinson <sup>1</sup> , Michael Antoniou <sup>1</sup> , Mikhail Cherniakov <sup>1</sup> <sup>1</sup> University of Birmingham	<b>EuRAD21-4</b> Passive Radio Imaging of Hybrid Radar System for Security Inspections Naruto Yonemoto <sup>1</sup> <sup>1</sup> ENRJ/MPAT
<b>09:50 - 10:10</b>	<b>EuRAD19-5</b> Sparse MIMO Array for Improved 3D mmWave Imaging Radar Rabia Zainab Syeda <sup>1</sup> , Timofey Savelyev <sup>2</sup> , Martijn van Beurden <sup>1</sup> , Bart Smolders <sup>1</sup> <sup>1</sup> Eindhoven University of Technology, <sup>2</sup> Radarxense BV	<b>EuRAD20-5</b> A DVB-T Passive Radar 3D-Detection Approach Based on Non-Coherent Spatial Integration Nerea del Rey-Maestre <sup>1</sup> , María-Pilar Jarabo-Amores <sup>1</sup> , David Mata-Moya <sup>1</sup> , Anabel Almodóvar-Hernández <sup>1</sup> , Pedro José Gómez-del-Hoyo <sup>1</sup> <sup>1</sup> University of Alcalá	<b>EuRAD21-5</b> The Application of Performance Metrics to Staring Radar for Drone Surveillance Mohammed Jahangir <sup>1</sup> , Bashar Ahmad <sup>2</sup> , Christopher Baker <sup>1</sup> <sup>1</sup> University of Birmingham, <sup>2</sup> Aveillant Limited, <sup>3</sup> The University of Birmingham

## FRIDAY 10:50 – 12:30

## Mission 1

## EuRAD22

Automotive Radar MIMO Processing

Chair: Reinhard Feger<sup>1</sup>Co-Chair: Kevin Cinglant<sup>2</sup><sup>1</sup>Johannes Kepler University Linz, <sup>2</sup>ZF

## Mission 2

## EuRAD23

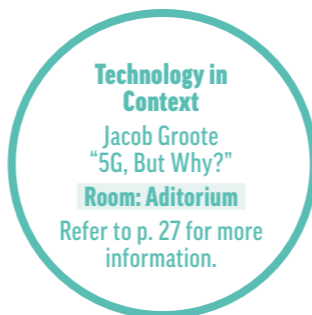
Target Characterisation with Radar

Chair: Christopher Baker<sup>1</sup>Co-Chair: Jacco de Wit<sup>2</sup><sup>1</sup>University of Birmingham, <sup>2</sup>TNO

## Quest

## EuRAD24

[Special Session] Civilian Radar Research and Development in China

Chair: Cheng Hu<sup>1</sup>Co-Chair: Alexander Yarovoy<sup>2</sup><sup>1</sup>Beijing Institute of Technology, <sup>2</sup>TU Delft10:50  
-  
11:10

## EuRAD22-1

High Angle Resolution Automotive Radar Based on Simultaneous 12 Tx Doppler-Multiplex MIMO

Nadjah Touati<sup>1</sup>, Christian Sturm<sup>1</sup><sup>1</sup>Valeo Schalter und Sensoren GmbH

## EuRAD23-1

Physics Based Radar Simulation

Thijs van Putten<sup>1</sup>, Rogier van Aken<sup>1</sup>, Michael Phillips<sup>2</sup>**INDUSTRIAL KEYNOTE**<sup>1</sup>Siemens Digital Industries Software

## EuRAD24-1

Probabilistic Deep Models for Radar Target Recognition

Bo Chen<sup>1</sup><sup>1</sup>Xidian University11:10  
-  
11:30

## EuRAD22-2

Fast Chirp MIMO Radar System using Doppler Offset Orthogonal Codes

Takaaki Kishigami<sup>1</sup>, Kenta Iwasa<sup>1</sup>, Tomohiro Yui<sup>1</sup>, Hidekuni Yomo<sup>1</sup>, Akihiko Matsuoka<sup>1</sup>, Junji Satou<sup>1</sup><sup>1</sup>Panasonic Corporation

## EuRAD23-2

Towards Safe Autonomous Driving: Challenges of Pedestrian Detection in Rain with Automotive Radar

Dagmar Steinhäuser<sup>1</sup>, Thomas Brandmeier<sup>1</sup>, Patrick Held<sup>1</sup>, Bernhard Thöresz<sup>2</sup><sup>1</sup>Technische Hochschule Ingolstadt

## EuRAD24-2

Entomological Radar Signal Processing and Experimental Validation

Cheng Hu<sup>1</sup>, Weidong Li<sup>1</sup>, Rui Wang<sup>1</sup><sup>1</sup>Beijing Institute of Technology11:30  
-  
11:50

## EuRAD22-3

Millimeter-Wave Automotive Radar using Extrapolation for Improved Angular Resolution

Cristian-Alexandru Alistarh<sup>1</sup>, Laura Anitori<sup>2</sup>, Symon K. Podilchak<sup>3</sup>, John Thompson<sup>4</sup>, Pascual David Hilario Re<sup>5</sup>, Mathini Sellathurai<sup>6</sup>, George Goussestis<sup>7</sup>, Jaesup Lee<sup>8</sup><sup>1</sup>Heriot-Watt University, <sup>2</sup>TNO, <sup>3</sup>The University of Edinburgh, <sup>4</sup>Heriot Watt University, <sup>5</sup>Samsung Advanced Institute of Technology

## EuRAD23-3

High Resolution 802.11Ax-Based Passive Radar for Human Movement Monitoring

Hasan Can Yildirim<sup>1</sup>, Laurent Storrer<sup>1</sup>, François Rottenberg<sup>2</sup>, Jérôme Louveaux<sup>2</sup>, Philippe De Doncker<sup>3</sup>, François Horlin<sup>4</sup><sup>1</sup>Université Libre de Bruxelles, <sup>2</sup>Université catholique de Louvain

## EuRAD24-3

Coherent Multidimensional Agility Radar Signal Processing

Wen-Qin Wang Wang<sup>1</sup><sup>1</sup>University of Electronic Science & Technology of China11:50  
-  
12:10

## EuRAD22-4

Kalman Tracking in Driver Assistance Systems - Collision Warning for Vulnerable Road Users

Simon Hüsges<sup>1</sup>, Christoph Degen<sup>1</sup><sup>1</sup>Hochschule Niederrhein University of Applied Sciences

## EuRAD23-4

Refraction Compensation for Non-Destructive Testing of Fibre-Composite Materials

André Froehly<sup>1</sup>, Reinhold Herschel<sup>1</sup><sup>1</sup>Fraunhofer FHR

## EuRAD24-4

The State-of-the-Art of Terahertz Technologies and Applications

Weidong Hu<sup>1</sup><sup>1</sup>Beijing Institute of Technology12:10  
-  
12:30

## EuRAD22-5

Automatic Delay and Phase Mismatch Calibration in FMCW MIMO Radar

Adrian Figueroa<sup>1</sup>, Niko Joram<sup>1</sup>, Frank Ellinger<sup>1</sup><sup>1</sup>TU Dresden

## EuRAD23-5

Size estimation of space debris models from their RCS measured in anechoic chamber

Selenia Ghio<sup>1</sup>, Marco Martorella<sup>2</sup><sup>1</sup>Consorzio Nazionale Interuniversitario Telecomunicazioni (CNIT), <sup>2</sup>CNIT - University of Pisa

## EuRAD24-5

Microwave photonics Radar Technology

Wangzhe Li<sup>1</sup><sup>1</sup>Institute of Electronics of the Chinese Academy of Sciences

## FRIDAY 13:50 – 15:10

## ROOM

## Progress

## EuRAD25

EuRAD Closing Session

Chair: Mayazurra Ruggiano<sup>1</sup>, EuRAD ChairCo-Chair: Jacco de Wit<sup>2</sup>, EuRAD TPC Chair<sup>1</sup>Thales Nederland B.V., <sup>2</sup>TNO13:50  
-  
14:30

Multi-Band Functionally Integrated Multi-Function Radar Sensor Suites

Winston van Oosterhout<sup>1</sup><sup>1</sup>Thales Nederland B.V., The Netherlands

Current and future naval missions are evolving. The operational scene that we know today is likely to change at an increasing pace: technological developments occur not only in defense mission systems, but also in threats that rely on the very same developments. This means that future missions have a high level of uncertainty, increasing the naval challenges that we know today.

Naval combat systems call for developments that are designed around the expectation for the unexpected. One of the answers to overcome such uncertainty, is the extension of today's multi-function radar systems to multi-band, functionally integrated sensor suites. With scalability in the genes, reconfigurability is the extension to deploy the benefits that multi-band radar sensor suites have to offer. This is further augmented by the incremental capability upgrades that have emerged with radar systems which have a large dependency on software defined functionalities. This talk shows developments that Thales has undertaken in the Dutch radar ecosystem to provide an answer in the radar and adjacent domains to overcome the challenges that are foreseen in the naval domain. A sneak preview is given of the suite architectural setup, main subsystems and underlying technologies to highlight the benefits of multi-band functionally integrated multi-function radar sensor suites.

14:30  
-  
14:50

Awards Ceremony

Marion K. Matters-Kammerer

Awards and Prizes Chair

14:50  
-  
15:10

Closing Remarks and Invitation to EuRAD 2021 in London

Mayazurra Ruggiano, James Watts<sup>1</sup><sup>1</sup>EuRAD 2021 Chair

# Welcome from the Workshop and Short Courses Chair

The Workshops and Short Courses program is one of the major scientific components of the European Microwave Week. In this year edition, despite the difficulties due to the Corona virus pandemic and the necessity to re-organize the conference, we are pleased and proud to be able to offer a wide range of workshops and short courses, covering all most relevant topics in the microwave field, ranging from classical to upcoming technology areas. A total of 32 workshops and short courses will be presented throughout the entire week, and will cover topics of interest to both experts as well as junior scientists entering the amazing microwave world.

Short courses offer the possibility to get acquainted with a new topic while workshops will get you up to speed on a specific subject through a hand-picked set of lectures given by the best scientists and “microwave practitioners” in the field. Upcoming technologies and applications like 5G and full-duplex communications, quantum computing, as well as automotive radar and micro-Doppler target classification, will be presented by world recognized experts in the field. A large number of workshops will also address technological topics like GaN, CMOS, SiGe as well as THz-technologies. Fundamental knowledge is provided in short courses on circuit design and high power amplifiers, MIMO and cognitive radar

fundamentals. Workshops and short courses on practical measurements methodologies and filter design will also be presented. Each workshop and short course is individually endorsed by one or two of the conferences within the 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.

The workshop and short courses program is distributed throughout the entire week. Workshops that focus on topics relevant to EuMIC mainly take place from Sunday to Tuesday. On Thursday and Friday we present most of the workshops endorsed by EuRAD. Throughout the whole week EuMC workshops take place.

Slides for the workshops and short courses will be provided electronically. Please note that upon registration to one WS/SC, you will receive not only the proceedings of that workshop, but of all workshops and short courses presented during the entire week. These will be available for download via a weblink provided after registration to one of the WS/SC. The material will be available for download from 2 to 31 January 2021.

We are very grateful to all the organizers, presenters and authors of the

workshop and short course materials for their hard work. It is thanks to their outstanding spirit and dedication to this field and to this conference that the European Microwave Week 2020 has survived the pandemic.

I would like to thank the whole EuMW2020 team and my collaborator Sofia Kotti who supported me in the organization of the workshops and short courses for their hard work and dedication to this conference. Despite all difficulties of this pandemic year, it was a real pleasure and a source of fun to be able to work, organize and re-organize this conference with you all. Thanks for making the microwave field so lively and exciting.

Finally, I would like to encourage everyone working in this field to become part of our community and join us in organizing future European Microwave Conferences. There is so much to learn from this community, even beyond microwaves!



**LAURA ANITORI**

Workshop and Short Courses Chair  
TNO, The Netherlands



**SOFIA KOTTI**

Workshop, Short Courses Co-Chair  
TNO, The Netherlands

## SUNDAY 08:30 – 17:50

### Fundamentals of Microwave PA Design

Chair: Paolo Colantonio<sup>1</sup>

Co-Chair: Franco Giannini<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

**Room: Auditorium**

Semiconductor Power Amplifiers are key components in radio frequency and microwave transmitter systems. They have received a great deal of attention and development effort over the last decades and are still a hot topic in research area. This short course aims to provide a comprehensive overview of all aspects of fundamental semiconductor microwave power amplifier design. It is an introductory course, aimed at graduate engineers who have moved into the field of RF design, as well as to microwave designers who aim to deeply understand the power amplifier 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. Very recent advances in semiconductor amplifiers and their applications will also be covered.

Starting from the fundamental concepts on semiconductor devices, the core of a power amplifier design, the theoretical foundations of a power amplifier design are discussed. It will include fundamental concepts and

state-of-the-art results on actual designs of a range of semiconductor power amplifiers using existing foundries. The load pull technique is also addressed and focused on the designer perspective.

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

The short course will also focus on 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.

**S-03**  
**EuMIC**

#### PROGRAMME

##### Semiconductor Devices for PAs

Ilcho Angelov<sup>1</sup>

<sup>1</sup>Chalmers University of Technology

##### PA Theoretical Foundation

Franco Giannini<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

##### Design and Model Oriented Load Pull Techniques

Marco Pirola<sup>1</sup>

<sup>1</sup>Politecnico di Torino

##### The Doherty Power Amplifier

Paolo Colantonio<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

##### Load Modulated PAs

Steve Cripps<sup>1</sup>

<sup>1</sup>Cardiff University

##### X-Parameters High-Power PAs Modeling for System Level Analysis

Alessandro Cidronali<sup>1</sup>

<sup>1</sup>University of Florence

##### Linear and Nonlinear Stability Analysis of Power Amplifiers

Giorgio Leuzzi<sup>1</sup>

<sup>1</sup>University of L'Aquila

##### Linearization Techniques Overview

Pere L. Gilibert<sup>1</sup>, Gabriel Montoro<sup>1</sup>

<sup>1</sup>Universitat Politècnica de Catalunya

##### Design of a C-band Single-Stage Hybrid 100W GaN PA

Francesco Scappaviva<sup>1</sup>, Davide Resca<sup>1</sup>

<sup>1</sup>MEC srl

## SUNDAY 08:30 – 17:50

### High Performance GaN MMICs

Chair: Rüdiger Quay<sup>1</sup>

Co-Chair: Farid Medjdoub<sup>2</sup>

<sup>1</sup>Fraunhofer IAF, <sup>2</sup>University of Lille

Room: Mission 1

GaN technologies are ongoing drivers for system advancements. The 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. Important industrial major vendors of GaN MMICs do contribute. Eight international speakers will give their view to the evolution of important applications such as sensing, defence, data com, and 5 and 6G with emphasis on IC technology. Their 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 are addressed. The first talk by Qorvo addresses various self-configuring and frequency

reconfigurable GaN design techniques with applications to power amplifiers, switches, limiters and self-interference rejection. The UMS presentation will present the recent development of GaN power technologies addressing X to Q bands. The link with applications like space and 5G applications will be emphasized through different demonstrators, some of them being complete System-In-Package. The paper by Win will provide an overview of WIN Semiconductor's GaN platforms used in wireless Infrastructure and satellite communications. Device-level RF performance data will be presented along with select MMIC results from several customers. The talk by Ommic will review how scaled down GaN /Si fully complements sub 40-nm CMOS to meet the stringent specifications

and cost budget of mmW 5G base stations, handsets and backhaul links. The presentation by Wolfspeed will discuss size, power density, and efficiency the demands, focus on key developments to enable MMICs for backhaul and satcom, and present examples of designs. The talk by Fraunhofer will discuss several design approaches for enhancing the performance of GaN-based amplifier MMICs for applications above 100 GHz. The presentation by Sumitomo introduces real GaN HEMT 5G basestation PAs in terms of performance, reliability, and cost competitiveness. The final speaker will give a talk on the impact of GaN with a European defense perspective.

**W-03**  
EuMIC

#### PROGRAMME

##### Self-Configuring, Adapting and Reconfigurable GaN MMICs

Charles Campbell<sup>1</sup>

<sup>1</sup>Qorvo

##### Recent Development of GaN Power Technology Applied to RF Sensors

Didier Floriot<sup>1</sup>

<sup>1</sup>United Monolithic Semiconductors

##### WIN GaN HEMT Platforms

David Danzilio<sup>1</sup>

<sup>1</sup>Win Semiconductors

##### State-Of-The-Art mmW GaN/Si MMICs

Marc Rocchi<sup>1</sup>

<sup>1</sup>Ommic

##### Design of High Performance Microwave and Millimeter Wave GaN HPAs

Jeremy Fisher<sup>1</sup>

<sup>1</sup>Wolfspeed

##### Design of GaN Power Amplifier MMICs Operating Beyond 100 GHz

Maciej Ćwikliński<sup>1</sup>

<sup>1</sup>Fraunhofer IAF

##### GaN HEMT Power Amplifier Technologies for 5G Basestations

Kazutaka Inoue<sup>1</sup>

<sup>1</sup>Sumitomo

##### Perspectives using GaN Devices in Defense Systems

Jean-Marc Tanguy<sup>1</sup>

<sup>1</sup>French MOD

## SUNDAY 08:30 – 17:50

### Sub-mmWave On-Wafer Measurements

Chair: Viktor Krozer<sup>1</sup>

Co-Chair: Ralf Doerner<sup>1</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH)

Room: Spark

The workshop focuses on on-wafer device characterisation techniques, methodologies, and modelling for device operating well beyond 100 GHz. Many of these aspects have entered into focus due to the increased interest in electronic and photonic devices, circuits, and systems for communications and sensing applications. The presentations will present effects especially important at mm-wave and sub-mm-wave frequencies, potential pitfalls and how to overcome those when performing on-wafer measurements. The workshop will cover electronic and photonic approaches to on-wafer characterisation of active and passive devices, will enlighten broadband measurement capabilities, and will present not only small-signal characterisation, but also large-signal, noise, and power characterisation techniques.

On-wafer antenna measurement systems and photonic approaches to on-wafer optoelectronic device characterisation will be discussed.

**W-06**  
EuMIC

#### PROGRAMME

##### Uncertainties in On-Wafer Measurements at mm- and Sub-mm-Wave Frequencies

Uwe Arz<sup>1</sup>

<sup>1</sup>Physikalisch Technische Bundesanstalt (PTB)

##### A Practical Guide for Verifying On-Wafer Measurement System Integrity at sub-mm-Wave Frequencies

Ralf Doerner<sup>1</sup>, Andrej Rumiantsev<sup>2</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH), <sup>2</sup>MPI Corporation

##### Guidelines for the Design of Calibration Substrates, Including the Suppression of Parasitic Modes, Influence of Microwave Probes and Crosstalk Effects up to W-Band

Gia Ngoc Phung<sup>1</sup>

<sup>1</sup>Physikalisch Technische Bundesanstalt (PTB)

##### Broadband 220 GHz VNA Calibration and Measurement Techniques

Steve Reyes<sup>1</sup>

<sup>1</sup>Anritsu

##### Impact of Calibration Uncertainties on Device Modelling

Tom Keinicke Johansen<sup>1</sup>

<sup>1</sup>Technical University of Denmark

##### On-Wafer Noise Measurements Above 110 GHz

Mikko Kantanen<sup>1</sup>

<sup>1</sup>Millimeter Wave Laboratory of Finland - Millilab

##### Micromachined Wafer Probes with Integrated Detectors for Power Measurements

Robert Weikle, II<sup>1</sup>

<sup>1</sup>University Virginia / Dominion Inc.

##### Sub-THz Load-Pull Techniques

Marco Spirito<sup>1</sup>

<sup>1</sup>Delft University of Technology

##### On-Wafer Antenna and Photomixer Measurements up to 750 GHz

Guillaume Ducourneau<sup>1</sup>

<sup>1</sup>University of Lille

##### Non-Contact Probing for On-Chip Characterization of mm-Wave and THz Devices

Kubilay Sertel<sup>1</sup>

<sup>1</sup>The Ohio State University / TeraProbes

## SUNDAY 08:30 – 17:50

### Integrated Doherty PAs for Cellular and mmWave Applications

Chair: Rocco Giofrè<sup>1</sup>

Co-Chair: Joseph Staudinger<sup>2</sup>

<sup>1</sup>University of Roma Tor Vergata, <sup>2</sup>NXP Semiconductors

**Room: Expedition**

The ability of the Doherty architecture of operating at high efficiency at significant output power back-off has led the RF and microwave community to re-discover its concept and adapt it to the requirements of modern high frequency transmitters both for terrestrial and space applications. In the former case, upcoming 5<sup>th</sup> generation cellular (5G) represents a keen area of interest for both academia and industry. Required power levels are such that both Si- and III-V-based technologies can be viable semiconductor platforms to implement highly performing integrated DPAs. On the other hand, under the pressure of the evolving mobile cellular networks (e.g. 5G), satellite-based communications are asked to significantly improve their performance to remain competitive. Therefore, they are evolving towards high throughput satellites (HTS) adopting spectral efficient digital modulation schemes and multi-beam active antennas. In this context,

the implementation of high efficiency and linearity DPAs in GaN technology has potential significantly change the landscape. This workshop aims to report about recent progress on integrated Doherty PAs for both cellular (sub 6GHz) and mm-wave applications, starting from the assessment of the scenarios, in both ground and space applications, to the system level evaluation, also describing advanced experimental characterization techniques at device/circuit level, and actual MMIC Doherty implementations on state-of-art GaN-based and Si-based semiconductor technologies.

**W-11**  
EuMIC

#### PROGRAMME

##### Challenges and Opportunities of 5G mm-Wave Power Amplifiers from an Industrial Point of View

Maurizio Pagani<sup>1</sup>, Renato Lombardi<sup>1</sup>

<sup>1</sup>Huawei Italy

##### GaN Enabling Technology for mm-Wave Applications

Rémy Leblanc<sup>1</sup>

<sup>1</sup>OMMIC Foundry

##### Advanced GaN Power Amplifier MMICs for Millimeter-Wave Applications

Keigo Nakatani<sup>1</sup>, Shintaro Shinjo<sup>1</sup>

<sup>1</sup>Mitsubishi Electric Corporation

##### Is GaN Doherty PA Ready for Space Applications?

Vittorio Camarchia<sup>1</sup>

<sup>1</sup>Politecnico di Torino

##### Sub 6 GHz Power Amplifiers for 5G – An Ericsson Prospective

Vincenzo Carrubba<sup>1</sup>

<sup>1</sup>Ericsson

##### High Power RF GaN Doherty Design from Technology to Circuit

Cédric Cassan<sup>1</sup>

<sup>1</sup>NXP Semiconductors

##### GaN-on-SiC Integrated Power Amplifiers for 5G Multi-User Massive MIMO Applications

Jangheon Kim<sup>1</sup>, Abdulrhman M.S. Ahmed<sup>2</sup>

<sup>1</sup>WolfSpeed

##### DPA Solutions for Sub 6 GHz 5G mMIMO (With Emphasis on Si Based Solutions)

John Gajadharsing<sup>1</sup>, Jean-Jacques Bouny<sup>1</sup>

<sup>1</sup>Ampleon The Netherlands BV

## SUNDAY 08:30 – 17:50

### Advanced RF Technologies for 5G

Chair: Florinel Balteanu<sup>1</sup>

Co-Chair: Andrei Grebennikov<sup>2</sup>

<sup>1</sup>Skyworks Solutions, <sup>2</sup>Sumitomo Electric Group

**Room: Mission 2**

5G is supposed to transform our world, creating an ecosystem where everyone is connected to everything, all the time. Worldwide adoption of 3G/4G smartphones and the transition to 5G has been the main engine behind semiconductor industry with a very active research area. Mobile cellular subscribers are expected to reach more than 6 billion by 2020 and 5G LTE will bring high data capacity as low latency using sub-6GHz and mm-Wave spectrum. The workshop presents the current status of 5G RF technologies and techniques to deliver an over gigabit-per-second data rate and low latency. The high speed wireless ecosystem which includes 5G LTE and WiFi 6 (802.11ax) will be deployed in the near future and will use two frequency domains: sub 6GHz frequency domain and mm-Wave spectrum. Mm-Wave will be used initially to increase the capacity for backhaul 5G networks and allow low latency. From this prospective and

the concurrently deployment for 5G LTE New Radio (NR) with the actual 4G LTE will increase the complexity for 5G RF Front End Modules (RF FEMs) and will be covered in this workshop.

**W-17**  
EuMIC/  
EuMC

#### PROGRAMME

##### 5G New Radio Design Challenges

Laurent Noel<sup>1</sup>, Dominique Brunel<sup>1</sup>

<sup>1</sup>Skyworks Solutions Inc.

##### Industrial RF SOI and BiCMOS Technologies Targeting 5G Wireless Market

Frederic Giansello<sup>1</sup>

<sup>1</sup>ST Microelectronics

##### Design and Integration of Multiband High Efficiency Linear PA Modules for 5G

Alexandre Giry<sup>1</sup>

<sup>1</sup>LETI

##### 5G Front Module for Mobile Applications

Florinel Balteanu<sup>1</sup>

<sup>1</sup>Skyworks Solutions

##### High Efficiency and Wideband GaN PA Techniques for Sub-6 GHz 5G Base-Station Applications

Shuichi Sakata<sup>1</sup>, Shintaro Shinjo<sup>1</sup>

<sup>1</sup>Mitsubishi Electric Corporation

##### Do SOI Technologies Bring Added Value for New Connectivity Challenges?

Didier Belot<sup>1</sup>

<sup>1</sup>CEA-LETI

##### Advanced Modeling and Characterization Techniques for mm-Wave Antenna Arrays

Koen Buisman<sup>1</sup>, Christian Fager<sup>1</sup>

<sup>1</sup>Chalmers University of Technology

##### The 5G NR Signals Impact on the RFLPA Envelope Impedance and Bias Network Design

Sergio Pires<sup>1</sup>, Jan-Willem van Velzen<sup>1</sup>

<sup>1</sup>Ampleon

##### Fully Tunable mm-Wave Solutions in Advanced BiCMOS Technology

Gaëtan Prigent<sup>1</sup>

<sup>1</sup>University of Toulouse

##### Technical Challenges and Trends for 4G/5G Acoustic Filters

Marie Bousquet<sup>1</sup>

<sup>1</sup>CEA LETI

## SUNDAY 08:30 – 12:30

### Wireless Power Transmission Recent Research Advances

Chair: Nuno Borges Carvalho<sup>1</sup>

Co-Chair: Alessandra Costanzo<sup>2</sup>

<sup>1</sup>Universidade de Aveiro, <sup>2</sup>University of Bologna

**Room: Flash**

This workshop will be devoted to present the recent research advances in the area of Wireless Power Transmission, the work herein presented will be devoted mainly to radiative wireless power transmission and will address the new advancements in the area, spanning from European, Asian and American speakers.

It is expected to address the most recent results in these area and the approaches followed to increase significantly the end to end energy efficiency.

The presentations will address also some of the recent advances when combining wireless power with information, and discuss some of these ideas of Simultaneous Wireless Information and Power Transmission as an enabler of long-range radiative wireless power application.

#### PROGRAMME

##### Towards a Common Metrology Paradigm for Wireless Power

Paul Jaffe<sup>1</sup>

<sup>1</sup>U.S. Naval Research Laboratory

##### Novel Beam Forming Technology for High Efficiency and Safe Wireless Power Transfer

Naoki Shinohara<sup>1</sup>

<sup>1</sup>Kyoto University

##### Emerging Developments on Integrated SWIPT Receivers

Steven Claessens<sup>1</sup>

<sup>1</sup>KU Leuven

##### System and Circuit-Level Design for RF Energy on Demand in Industrial IoT

Alessandra Costanzo<sup>1</sup>

<sup>1</sup>University of Bologna

##### SWIPT – Combining Wireless Power with Backscatter Communications

Nuno Borges Carvalho<sup>1</sup>

<sup>1</sup>Universidade de Aveiro

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EuMC

## SUNDAY 08:30 – 17:50

### Recent Advances in Additive Manufacturing of Microwave Components

Chair: Maurizio Bozzi<sup>1</sup>

Co-Chair: Cristiano Tomassoni<sup>2</sup>

<sup>1</sup>University of Pavia, <sup>2</sup>University of Perugia

**Room: Quest**

Additive Manufacturing (AM) is becoming a very popular technology in several fields. It originated as a solution for fast prototyping of objects mainly used in the mechanical engineering area. In the last years, this technology has found many additional applications, including the manufacturing of microwave/millimetre-wave components.

Several AM technologies are currently available. The material used for the manufacturing can be very different, ranging from plastic to metal and ceramics. Plastic and ceramic objects can be used directly as dielectric material or as a support to be subsequently metallized.

The application of AM to microwave/millimetre-wave components requires special attentions to some particular aspects. As an example, in the manufacturing of microwave filters, small manufacturing tolerances, minimum surface roughness, and low surface resistivity are of key importance.

This workshop offers an overview of the latest developments in the use of AM for the implementation of microwave components. The use of several AM technologies will be shown and compared. Different applications including sensors, filters, high power components, etc. will be considered. Solutions adopted to improve the component performance will be illustrated. Manufactured components and their applications will be presented.

A time slot will be devoted to questions and open discussion, involving all speakers and the attendees.

#### PROGRAMME

##### Additive Manufacturing of New Classes of Filters with Non-Conventional Geometries

Cristiano Tomassoni<sup>1</sup>

<sup>1</sup>University of Perugia

##### Microwave and Millimetre-Wave 3D Printed Waveguide Filters

Yi Wang<sup>1</sup>

<sup>1</sup>University of Birmingham

##### Additive Manufacturing Applied to Reconfigurable Microwave Filters

Nicolas Delhote<sup>1</sup>

<sup>1</sup>University of Limoges

##### Development of All Metal RF Components Via Selective Laser Melting

Oscar Antonio Peverini<sup>1</sup>

<sup>1</sup>CNR-IEIT

##### Inkjet-/3D-/4D-Printed “Sero-Power” Wireless Ultrabroadband Modules for IoT, SmartAg and Smart Cities Applications

Manos M. Tentzeris<sup>1</sup>

<sup>1</sup>Georgia Institute of Technology

##### High Power 3D Printed Parts: From Multipactor to Thermal Aspects

Petronilo Martin-Iglesias<sup>1</sup>

<sup>1</sup>European Space Agency

##### Implementation of Microfluidic Sensors by Additive Manufacturing

Maurizio Bozzi<sup>1</sup>

<sup>1</sup>University of Pavia

##### Polymer-Based 3D Printing for Earth Observation Satellite Payload Front Ends

Stepan Lucyszyn<sup>1</sup>

<sup>1</sup>Imperial College London

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EuMC



## SUNDAY 13:50 – 17:50

### Advanced Measurement Techniques for Next Generation Communication Systems

Chair: Dominique Schreurs<sup>1</sup>

Co-Chair: Antonio Raffo<sup>2</sup>

<sup>1</sup>University of Leuven, <sup>2</sup>University of Ferrara

**Room: Flash**

The workshop focuses on recent advances in large-signal measurement techniques for microwave applications. In particular, starting from the main issues that hinder measurement accuracy under nonlinear high-frequency operation of devices, circuits, and systems, the speakers will present the state-of-the-art performance of ultra wideband instrumentation and will discuss actual measurement scenarios of interest for next generation communication systems.

The challenges related to ultra wideband measurements will be clearly discussed by particularly explaining how measurement techniques that represent an acceptable solution for large-signal characterization under CW excitation lose meaning when actual modulated signals are considered. Moreover, the importance of performing accurate measurements will be highlighted in connection of using large-signal microwave measurements for the extraction of behavioral models. These models, whose uncertainty almost coincides with measurement uncertainty, allow the designer to simplify the design flow and thereby reducing the time and cost related to multiple foundry runs.

This workshop will represent a unique and amazing opportunity for the attendees to discuss their doubts about state-of-the-art measurement and modelling techniques with some of the most important scientists in the field.



**W-02**  
EuMIC/  
EuMC

#### PROGRAMME

##### Traceability for Large-Signal Measurement Applications

Dylan Williams<sup>1</sup>

<sup>1</sup>National Institute of Standards and Technology

##### Characterizing Modulation Distortion of Active Devices in the Frequency Domain

Jan Verspecht<sup>1</sup>

<sup>1</sup>Keysight Technologies

##### Wideband Modulated Load-Pull for Design Validation and Verification

Mauro Marchetti<sup>1</sup>

<sup>1</sup>Anteverta-mw

##### Behavioural Model Generation for Advanced Microwave Transistors

Paul Tasker<sup>1</sup>

<sup>1</sup>Cardiff University

## MONDAY 08:30 – 12:30

### From Device Characterisation to Amplifier Design: Advanced Large Signal Measuring, Fast and Accurate Modelling, and Reliable Designing

Chair: Steve Dudkiewicz<sup>1</sup>

Co-Chair: Osman Ceylan<sup>1</sup>

<sup>1</sup>Maury Microwave

**Room: Flash**

The wireless telecommunications industry has responded to our insatiable demand for high-speed streaming with the development of 4G LTE and 5G communications systems. These systems use complex and high-order modulation schemes with high peak-to-average ratios (PAPR) in order to meet the needed high-speed cellular data rate within a given limited bandwidth. Therefore, highly optimized and engineered RF amplifiers are needed to achieve adequate linearity and high efficiency also at the deep back-off power levels.

Device characterization and modeling is the first and most important step for high-performance power amplifier design. Accurate modeling of a high-power RF solid-state device requires extended large signal analysis in a wide frequency range, including several harmonics and wide operation range, such as Class-C, B, and AB. Today's rapidly changing and competitive wireless telecommunication technology world also needs reduced time from development to market. Therefore, preparing a reliable and verified device model and designing a power amplifier should be done precisely in a short time.

In this short course, fundamentals of high-power RF device characterization techniques, basics of Load-Pull, calibration methods, high-speed nonlinear measurement methods with harmonics, Enhanced Poly Harmonic (EPHD) model extraction from measured data, and high power RF amplifier design with EPHD model will be introduced. High-power transistors for sub-6 GHz applications and mmW devices are considered in the sessions.



**S-07**  
EuMIC/  
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#### PROGRAMME

##### Fundamentals of Large Signal Characterization and High-Power Amplifier Design Considerations

Osman Ceylan<sup>1</sup>

<sup>1</sup>Maury Microwave

##### Wideband Active Load-Pull and Baseband Control

Mauro Marchetti<sup>1</sup>

<sup>1</sup>Anteverta-mw

##### mmW Device Characterization and Modeling

Alireza Shamsafar<sup>1</sup>

<sup>1</sup>Ampleon BV

##### Modeling of High-Power RF Transistors and Applications

Mitra Gilasgar<sup>1</sup>

<sup>1</sup>Ampleon BV

##### Behavioural Models and EPHD Modeling

Wissam Saabe<sup>1</sup>

<sup>1</sup>AMCAD Engineering (France)

## MONDAY 08:30 – 17:50

### High-Power Microwave Industrial Applications

Chair: Zoya Popovic<sup>1</sup>

Co-Chair: Vadim Yakovlev<sup>2</sup>

<sup>1</sup>University of Colorado, <sup>2</sup>Worcester Polytechnic Institute

**Room: Beam**

This workshop addresses the increasing industrial applications of high-power microwaves. In 2009, the IEEE MTT-S IMS Workshop "Recent Advances in Microwave Power Applications and Techniques (RAM-PaNT)" received significant interest among IMS attendees and won the "Best Quality Workshop" Award. The RAMPANt Workshop was designed as an inauguration forum that introduced the MTT community to microwave energy applications in science and industry. For the past 10 years, topics related to this Workshop have gradually increased in scope. This Workshop proposed for the EuMW2020 will review the recent advancements in industrial and scientific applications of high-power microwave technology. The discussions will cover well-established systems and processes as well as new trends and emerging applications: beyond

well-known microwave heating of food products, they include powder metallurgy (include sintering of particulate materials), microwave-assisted chemistry, microwave plasma generation, manufacturing of nanomaterials and composites (including microwave-assisted 3D printing), waste-to-fuel conversion, etc. Topics that support many of the applications, such as advanced multiphysics modeling and accurate characterization of material parameters, will also be discussed. The Workshop includes ongoing developments of solid-state technology and prospects of the use of solid-state generation in high-power applications for more flexibility and control.



#### PROGRAMME

##### High Power Industrial Microwave Applications and Market Trends

Jens Hofmann<sup>1</sup>

<sup>1</sup>MUEGGE GmbH

##### Review of Systems and Processes in Microwave Power Drying Applications

Peter-A. Püschner<sup>1</sup>

<sup>1</sup>Püschner GmbH

##### Microwave-Induced Plasma – From Academia to Industry

Kostyantyn Achkasov<sup>1</sup>

<sup>1</sup>Consultant

##### Field-Assisted Manufacturing of Materials

Bala Vaidhyanathan<sup>1</sup>

<sup>1</sup>Loughborough University

##### Microwave Assisted Metallurgy Using Hybrid Systems

Paolo Veronesi<sup>1</sup>

<sup>1</sup>University of Modena and Reggio Emilia

##### Principles and Practice of High-Power In-Cavity SSPA Combining

Zoya Popovic<sup>1</sup>

<sup>1</sup>University of Colorado

##### The Challenge of Scaling-Up Microwave Assisted Technologies

Marilena Radoiu<sup>1</sup>

<sup>1</sup>Microwave Technologies Consulting

##### Development of Solid-State Technology and Its Impact on Microwave Power Engineering

Klaus Werner<sup>1</sup>

<sup>1</sup>pink RF

##### Advanced Multiphysics Simulation of Microwave Power Processes and Systems

Vadim Yakovlev<sup>1</sup>

<sup>1</sup>Worcester Polytechnic Institute

##### Measurement of Temperature-Dependent Complex Permittivity of Materials

José M. Catalá-Civera<sup>1</sup>

<sup>1</sup>Universidad Politécnica De Valencia

##### In Situ Monitoring of High-Power Microwave Material Processing

Sébastien Vaucher<sup>1</sup>

<sup>1</sup>EMPA - Swiss Federal Laboratories for Material Science and Technology

## MONDAY 08:30 – 12:30

### Antenna/Modules in Package for mmWave for 5G

Chair: Rajesh Mandamparambil<sup>1</sup>

Co-Chair: Rob Maaskant<sup>2</sup>

<sup>1</sup>NXP, <sup>2</sup>Chalmers University of Technology

**Room: Spark**



This combined Workshop/Short Course addresses the key challenges in terms of material, process and testing of IC packages. Advanced packaging level approaches will be discussed, allowing packaging of different semiconductor compounds (Si, GaN), as well as multi-die System-in-Package solutions. A complete chip-package co-design flow will be explored which allows improvement of RF performance and power efficiency. An overview of the latest material developments in the mmw/ RF domain will be presented. Challenges on mmW packaging especially on antennas integration will be discussed. Phased array antenna modules for 5G is an important driver and their pros and cons will be shared.

#### PROGRAMME

##### Analysis of 5G mmW Use Cases and Its Implications on Phased Array Antenna Module Realizations

Thomas Emanuelsson<sup>1</sup>

<sup>1</sup>Gapwaves AB

##### Needs and Challenges in Packaging for mm-Wave Antennas

Stefania Monni<sup>1</sup>

<sup>1</sup>TNO

##### Advanced pPackaging Approaches for 5G and mm-Wave Applications

Tanja Braun<sup>1</sup>

<sup>1</sup>Fraunhofer IZM

##### Innovative Packaging Material Developments for RF Applications

Ruud de Wit<sup>1</sup>

<sup>1</sup>Henkel

##### mmWave Reference Design Flow and Correlation with Measurements

Mart van Gijssel<sup>1</sup>

<sup>1</sup>Keysight Technologies

## MONDAY 08:30 – 12:30

### Advanced Applications of In-Band Full-Duplex Technology

Chair: Kenneth E. Kolodziej<sup>1</sup>

Co-Chair: Taneli Riihonen<sup>2</sup>

<sup>1</sup>MIT Lincoln Laboratory, <sup>2</sup>Tampere University

**Room: Auditorium**

Many wireless systems could benefit from the ability to transmit and receive on the same frequency at the same time, which is known as In-Band Full-Duplex (IBFD) and/or Simultaneous Transmit and Receive (STAR). This technology could lead to enhanced spectral efficiency for future wireless networks, such as fifth-generation New Radio (5G NR) and beyond, and/or could enable capabilities and applications that were previously considered impossible, such as IBFD with phased array systems. In this workshop, experts from academic and federal research institutions will discuss advanced applications of IBFD that move beyond basic communication systems. Presentations will contain details and measured results that encompass military, radar and multiple-input multiple-output (MIMO) applications.

#### PROGRAMME

##### Omni- and Directional Approaches to In-Band Full-Duplex Systems

Kenneth E. Kolodziej<sup>1</sup>  
<sup>1</sup>MIT Lincoln Laboratory

##### Robust Transceiver Design for Full-Duplex Relay-Assisted MIMO Systems

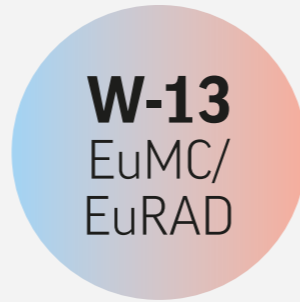
Aydin Sezgin<sup>1</sup>  
<sup>1</sup>Ruhr-University Bochum

##### Joint Radar and Communication Using In-Band Full-Duplex Technology

Sofie Pollin<sup>1</sup>, Seyed Ali Hassani<sup>1</sup>  
<sup>1</sup>KU Leuven

##### Simultaneous Transmit and Receive Radios Beyond Full-Duplex Communications

Taneli Riihonen<sup>1</sup>  
<sup>1</sup>Tampere University



## MONDAY 08:30 – 17:50

### Measurements at mmWave and Terahertz Frequencies of Three Measurement Quantities: S-Parameters, Power, and Complex Permittivity of Dielectric Materials

Chair: Xiaobang Shang<sup>1</sup>

Co-Chair: Nick Ridler<sup>1</sup>

<sup>1</sup>National Physical Laboratory (NPL)

**Room: Glow**

There is a rapid increase in exploitation of the millimetre-wave and submillimetre-wave spectrum, driven by demands from diverse applications including wireless backhaul links for 5G mobile networks, radar sensors for advanced or autonomous vehicles, space deployed radiometers for remote sensing of climate change, security imaging (e.g. terahertz body scanners), and medical diagnosis. Advancement in these applications has led to an increased demand for accurate and traceable electrical measurements for devices and integrated circuits operating at these high frequencies.

This workshop will review the latest developments that are taking place for the three electrical measurement quantities, namely S-parameters, power and complex permittivity of dielectric materials, at millimetre-wave and terahertz frequencies. Most of these activities are undertaken in a recent European Metrology Programme for Innovation and Research (EMPIR) project, 18SIB09 TEMMT, which involves 19 partners globally. The workshop consists of 14 proposed talks and will present the current state of the art of the measurements, specifically,

to 1.5 THz  
 ii Planar S-parameter measurements up to 1.1 THz  
 iii Calibration technique for power measurements at D-band (110-170 GHz)  
 iv Material characterizations at millimetre-wave and terahertz frequencies using free-space method, TDS, open and closed resonators techniques.  
 Calibration and verification techniques of these measurements, together with measurement uncertainties, will also be covered in the workshop.

#### PROGRAMME

##### Considerations for Calibrating and Measuring Using Vector Network Analysers at Millimetre and Submillimetre Wavelengths

Nick Ridler<sup>1</sup>  
<sup>1</sup>National Physical Laboratory (NPL)

##### Vector Network Analysis and Waveguide Interfaces to 1.5 THz

Jeffrey Hesler<sup>1</sup>  
<sup>1</sup>Virginia Diodes Inc.

##### On-Wafer Traceable Mixed-Mode S-parameter Calibration

Djamel Allal<sup>1</sup>  
<sup>1</sup>LNE

##### Nanorobotic On-Wafer Probe Station Under Scanning Electron Microscope

Kamel Haddadi<sup>1</sup>  
<sup>1</sup>University of Lille

##### Numerical Modelling of On-Wafer Scattering Parameter Measurements

Thomas Flisgen<sup>1</sup>  
<sup>1</sup>Ferdinand-Braun-Institut (FBH)

##### Development of Probing-System for Accurate On-Wafer Measurements up to 1.1 THz

Faisal Mubarak<sup>1</sup>  
<sup>1</sup>VSL

##### Enabling Over Temperature S-Parameter Measurement Confidence to THz Frequencies

Anthony Lord<sup>1</sup>, Gavin Fisher<sup>1</sup>  
<sup>1</sup>FormFactor

##### Practical Steps to Improve On-Wafer S-Parameters High Frequency Measurements

Robin Schmidt<sup>1</sup>  
<sup>1</sup>Keysight Technologies

##### Calibration of RF Power at 110-170 GHz

Gia Ngoc Phung<sup>1</sup>  
<sup>1</sup>Physikalisch-Technische Bundesanstalt (PTB)

##### Measurement of Electrical Properties of Materials in the Frequency Range up to 110 GHz

##### with the Help of Fabry-Perot Resonator

Marcin Wojciechowski<sup>1</sup>, Jerzy Krupka<sup>1</sup>  
<sup>1</sup>GUM (Central Office of Measures)

##### Uncertainties and Error Analysis of Material Parameter Extraction Methods

Alireza Kazempour<sup>1</sup>  
<sup>1</sup>METAS

##### Free-Space Broadband Measurements of THz Dielectric Properties and Material Data From the TEMMT Project

Mira Naftaly<sup>1</sup>  
<sup>1</sup>National Physical Laboratory (NPL)

##### Material Characterization by Closed Resonator Method and In-Situ On-Wafer Measurement Method for 6G Application

Masahiro Horibe<sup>1</sup>  
<sup>1</sup>National Metrology Institute of Japan (NMIJ) / National Institute of Advanced Industrial Science and Technology (AIST)

## MONDAY 08:30 – 17:50

### Microwave Wearable Circuits and Systems for Biomedical Applications

Chair: Milica Popović<sup>1</sup>

Co-Chair: Alessandra Costanzo<sup>2</sup>

<sup>1</sup>McGill University Montreal, <sup>2</sup>University of Bologna

**Room: Expedition**

Microwave techniques are being increasingly exploited to realize next generation biomedical sensors able to be less invasive than traditional ones. Furthermore the exploitation of novel materials for their realizations, such as textiles and flexible substrates, enable their use in wearable solutions.

This workshop presents a significant number of research activities in this field from different countries and continents, spanning from materials characterization, by microwave techniques, to circuit-level realization up to the system level implementation, with in depth analysis of the signal processing challenges to enable real-time monitoring of the sensors. Some significant implementations are presented, such as systems for wearable breast cancer diagnosis, temperature measurements and liquids detection.

W-28  
EuMC

#### PROGRAMME

#### Challenges and Complexity of Dielectric Tissue Characterisation

Martin O'Halloran<sup>1</sup>

<sup>1</sup>National University of Ireland

#### Recent Progress in Microwave Breast Tissue Screening with Time-Domain Radar

Milica Popović<sup>1</sup>, Lena Kranold<sup>1</sup>

<sup>1</sup>McGill University Montreal

#### Fast, 2D Microwave Tomographic Breast Imaging Utilizing a Discrete Dipole Approximation-Based Reconstruction Algorithm

Paul Meaney<sup>1</sup>, Samar Hosseinzadegan<sup>2</sup>, Andreas Fhager<sup>2</sup>, Mikael Persson<sup>2</sup>

<sup>1</sup>Thayer School of Engineering at Dartmouth, <sup>2</sup>Chalmers University of Technology

#### Backscattering Communication for Biomedical Sensors Readout

Nuno Borges Carvalho<sup>1</sup>

<sup>1</sup>Universidade de Aveiro

#### Microwave Passive Sensing for Wearable Applications

Alessandra Costanzo<sup>1</sup>, Francesca Benassi<sup>1</sup>, Diego Masotti<sup>1</sup>

<sup>1</sup>University of Bologna

#### Muscle Rupture Detection with Microwave Techniques

Andreas Fhager<sup>1</sup>

<sup>1</sup>Chalmers University of Technology

#### Wearable Wireless Thermometers for Internal Body Temperature Measurements

Zoya Popovic<sup>1</sup>, Robert Streeter<sup>1</sup>

<sup>1</sup>University of Colorado

## MONDAY 13:50 – 17:50

### Multibeam Antennas and Beamforming Networks

Chair: Piero Angeletti<sup>1</sup>

Co-Chair: Giovanni Toso<sup>1</sup>

<sup>1</sup>European Space Agency

**Room: Auditorium**

Multi-Beam Antennas (MBAs) find application in several fields including wireless and satellite communications, RADARs for electronic surveillance and remote sensing, science (e.g. radio telescopes), RF navigation systems, etc.

Beam-Forming Networks (BFNs) play an essential role in any antenna system relaying on a set of radiating elements to generate a beam.

Depending mainly on the antenna mission (i.e. operational frequency, pattern requirements, transmitting and/or receiving functionality, number of beams to be generated, etc.) different MBA architectures may be selected: from antenna systems completely based on independent feeds illuminating a number of reflectors, to hybrid systems based on both arrays and reflectors, from phased arrays to lens antennas.

The trade-off on the antenna solution largely

involves the BFN interconnectivity and flexibility requirements, with a wide range of applicable BFN architectures with different complexity and performance.

The course presents design principles and state-of-the-art in Multi-Beam Antennas (MBAs) and Beam-Forming Networks (BFNs) covering both theoretical and practical aspects. The covered topics include:

#### Overview of Multibeam Antennas and system requirements.

- Satellite Communication Systems;
- Wireless Communications;
- RADARs.

#### Multibeam Array Antennas

- Linear and Planar Direct Radiating Arrays (based on Periodic or Aperiodic lattices)
- Reflector-based architectures (Single-Feed-per-Beam, Multiple-Feed-per-Beam)

- Lens-based architectures (free space and constrained)

#### Analog Beamforming Networks

- Corporate divider/combiners;
- Blass and Nolen matrices;
- Butler matrices.

#### Digital Beamforming Networks

#### Overview of some Operational Multibeam Antennas/BFNs

- MBAs for Spaceborne Narrowband and Broadband Satellite Communication Systems
- MBAs for Wireless Communications

#### On-going European Developments and Current Design and Technological Challenges

## MONDAY 13:50 – 17:50

### Intuitive Microwave Filter Design with EM Simulation

Chair: Daniel Swanson<sup>1</sup>

<sup>1</sup>DGS Associates LLC

**Room: Flash**

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. Luckily, 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. 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.

S-10  
EuMC

## MONDAY 13:50 – 17:50

### From Enabling GaN Technology to High-Performing Space-Borne SSPAs at mmWave

Chair: Rocco Giofrè<sup>1</sup>

Co-Chair: Paolo Colantonio<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

**Room: Spark**

The development for next generation Very High Throughput Satellites (vHTS) systems, will make use of Ka/Q/V gateways, where the forward payload link will operate in K-band. This kind of spacecraft will offer high capacity, large number of users and communication volumes (1 Terabit/s per satellite), with lower cost per GBPS, increasing the flexibility being the the satellite capacity allocated only when-&-where it is needed. Traditionally, demand for high power levels at high frequencies has been satisfied by using TWTAs as amplifying device; this is because SSPA technology was unable to attain similar performance levels. However, technological advancements such as linearization, miniaturisation, and the use of different materials such as GaN, have levelled the playing field open the actual possibility

to replace TWTAs with SSPAs.

This workshop aims to report about recent progress on millimetre wave GaN-based SSPAs for space applications, starting from the assessment of the scenarios, in both ground and space segments, to the actual SSPA design, realization and tests, also describing state-of-art GaN semiconductor technologies.



#### PROGRAMME

##### Space Initiatives at European Level

Fabio Vitobello<sup>1</sup>

<sup>1</sup>REA

##### SSPAs for High-Throughput Satellites: Challenges and Solutions

Václav Valenta<sup>1</sup>

<sup>1</sup>European Space Agency

##### The Space Market Needs in Term of SSPAs and HPAs for 5G Application

François Bouscasse<sup>1</sup>

<sup>1</sup>Airbus Defence

##### MiGaNSOS: Millimetre Wave Gallium Nitride Space Evaluation and Application to Observation Satellites

Ernesto Limiti<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

##### Design of High Efficiency Power Amplifier Based on GaN Technology for Ka-Band

Rocco Giofrè<sup>1</sup>, Paolo Colantonio<sup>1</sup>

<sup>1</sup>University of Roma Tor Vergata

##### Ka-Band HPA MMICs for Cryosat-2 Follow-On Mission (CS2-FO)

Chiara Ramella<sup>1</sup>, Corrado Florian<sup>2</sup>

<sup>1</sup>Politecnico di Turin, <sup>2</sup>University of Bologna

## TUESDAY 08:30 – 17:50

### Digital Predistortion for 5G MIMO Wireless Transmitters

Chair: Anding Zhu<sup>1</sup>

Co-Chair: Pere L. Gilabert<sup>2</sup>

<sup>1</sup>University College Dublin, <sup>2</sup>Universitat Politècnica de Catalunya

**Room: Juliana 2**

In the existing cellular base stations, to guarantee linearity, digital predistortion (DPD) is widely used to compensate for the nonlinear distortion generated by RF power amplifiers (PAs). In 5G, particularly in wide-band millimetre wave transmitters, the conventional DPD is no longer workable. With increasing demands for higher data rates, the signal bandwidth will continue to increase. At millimetre wave bands, the modulation signal bandwidths can reach hundreds of MHz or even multi-GHz and the peak to average power ratio of the signal may well exceed 10 dB. This requires not only very high sampling rates for digital signal processing but also sophisticated DPD models to compensate the nonlinearity, that leads to high power consumption and high cost. In the meantime, to increase power efficiency

and meet demands for high capacity, dense networks of base stations will be deployed and transmitters with multiple antennas (e.g., with massive MIMO architectures) and multiple power amplifiers will be used. In these transmitters, the output power of each PA will be significantly reduced compared to that in the existing high-power base stations, which leaves limited headroom for digital predistortion in terms of power and cost budget. New digital compensation solutions for linear and nonlinear distortion compensation of ultra-wideband or multi-band 5G systems will be required. In addition, due to multiple antennas and PAs are used in MIMO transceivers, characterization and compensation of coupling effects between the antenna array and the PAs must be addressed.

In this workshop, we will discuss the requirement of 5G wireless transmitters and related modelling and system design challenges that we are facing. Particular emphasis will be given to MIMO system architectures, digital compensation model selection, feedback loop data acquisition, model extraction algorithms and various system architecture, and model order reduction techniques. System characterisation, theoretical analysis, experimental test and hardware/software system implementation issues will also be discussed.



#### PROGRAMME

##### DPD Requirement and Development for 5G: Industrial Perspective

John Wood<sup>1</sup>

<sup>1</sup>Wolfspeed

##### Beam-Oriented Digital Predistortion for Massive MIMO Transmitter

Wenhua Chen<sup>1</sup>

<sup>1</sup>Tsinghua University

##### Digital Predistortion for 5G Beam-Forming Architectures

Chao Yu<sup>1</sup>

<sup>1</sup>Southeast University

##### Digital Predistortion for 5G MIMO Transmitters: OTA-Based Data Acquisition

Anding Zhu<sup>1</sup>

<sup>1</sup>University College Dublin

##### Linearizing Strongly Nonlinear Systems: DPD Methods and Application to mmWave Active Arrays

Mikko Valkama<sup>1</sup>

<sup>1</sup>Tampere University

##### A Circuit Model to Behavioural Model Volterra-Based Approach: Parameters Estimation and Linearization Procedures for DPD Design

María J. Madero Ayora<sup>1</sup>, Juan A. Becerra<sup>1</sup>

<sup>1</sup>Universidad de Sevilla

##### Model Order Reduction Techniques for Digital Predistortion Linearization of NR-5G Amplification Architectures

Pere L. Gilabert<sup>1</sup>

<sup>1</sup>Universitat Politècnica de Catalunya

##### Power Consumption Reduction Techniques for Digital Predistortion of Broadband RF Power Amplifiers

Yue Li<sup>1</sup>

<sup>1</sup>University College Dublin

##### Distortion-Aware Precoding for Massive MIMO Downlink

Sina Rezaei Aghdam<sup>1</sup>

<sup>1</sup>Chalmers University of Technology

## TUESDAY 13:50 – 17:50

### Advanced mmWave Radar System Solutions for Industrial and Consumer Sensing Applications

Chair: Vadim Issakov<sup>1</sup>

Co-Chair: Amelie Hagelauer<sup>2</sup>

<sup>1</sup>Otto-von-Guericke University Magdeburg, <sup>2</sup>University Bayreuth

**Room: Beam**

The amount of new applications based on millimeter-wave radar sensors is continuously growing. Driven by the demand for cost reduction, module size reduction, lower power consumption and complexity of usage for the end user, several trends can be observed recently. First, the operating frequencies keep on increasing, enabling integration of antenna arrays in package and on-chip. Secondly, the increasing level of integration enables advanced functionality. Finally, with the emerging applications operated from a battery, ultra-low-power operation is required.

In this workshop, we discuss these recent trends and give examples of radar systems at mm-wave frequencies providing system-level solutions. The first talk presents solution for wearable FMCW sensors at 60GHz with extreme hardness for thru-the-fire scenarios. Next, by means of advanced state machine, an ultra-low-power radar solution at 24GHz is shown for presence detection. Further, cost-reduction and system level optimization techniques towards software-defined radar are presented. Next, highly-integrated 3D sensing solution at 60GHz is discussed for collaborative robotics applications.

Afterwards, challenges and solutions for realization of systems on chip and in package for FMCW radar above 300GHz and substrate antennas are discussed. Finally, we present fully-integrated solutions for consumer and industrial sensing applications at 60GHz with antenna in package and 122GHz with antenna on chip.

In this workshop we have a good mixture of industry (Infineon, Staal Technologies, Inxpect, InnoSent, Uhnder) and academia (FAU Erlangen, TU Hamburg, Uni Magdeburg). As well, we have contributions from three different countries (The Netherlands, Germany and Italy) by industry experts and recognized speakers in the field of radar circuits and systems.



**W-25**  
EuMC/  
EuRAD

#### PROGRAMME

##### Design Considerations on Wearable Through-The-Fire Radar

Natalia Alexandrovna Antonyuk<sup>1</sup>  
<sup>1</sup>Staal Technologies B.V.

##### Ultra-Low Power Radar Based Presence Detection

Fabian Lurz<sup>1</sup>, Alexander Koelpin<sup>2</sup>  
<sup>1</sup>Friedrich Alexander University of Erlangen-Nürnberg, <sup>2</sup>Technical University Hamburg (TUHH)

##### A System Perspective on State-Of-The-Art mm-Wave Radar Sensors

Markus Gardill<sup>1</sup>  
<sup>1</sup>University of Würzburg

##### mm-Wave Radar-Based 3D Sensing for Collaborative Robotics

Aleksey Dyskin<sup>1</sup>  
<sup>1</sup>Inxpect

##### Highly-Integrated Radar Transceiver at 320 GHz for Near-Field Sensing

Marco Dietz<sup>1</sup>, Robert Weigel<sup>1</sup>  
<sup>1</sup>Friedrich Alexander University of Erlangen-Nürnberg

##### Fully-Integrated System-In-Package Solutions for Industrial and Consumer Applications

Vadim Issakov<sup>1</sup>, Mohamed Hamouda<sup>2</sup>, Ismail Nasr<sup>2</sup>  
<sup>1</sup>Otto-von-Guericke University Magdeburg, <sup>2</sup>Infineon Technologies

## WEDNESDAY 08:30 – 17:50

### Quantum Computing for Electrical Engineers

Chair: Fabio Sebastiano<sup>1</sup>

<sup>1</sup>Delft University of Technology/QuTech

**Room: Fluor**



**S-04**  
EuMIC/  
EuMC

Quantum computing promises to solve problems that are intractable even by the most powerful supercomputers. Progress in quantum computing has recently gained great attention from the media, as it is gaining momentum thanks to the involvement of both key industries and an ever-growing academic research community.

This short course aims at providing electrical engineers with the background knowledge to understand what a quantum computer is and how it works. Furthermore, it will show the current and future trends in quantum computing. At the same time, the fundamental role of electrical engineers in building such wonderful machines will be addressed, by stressing the need for electrical and microwave engineering to build a large-scale quantum computer.

The course consists of 7 talks from experts in the field, organized in three main themes: quantum-computing fundamentals, physical platforms for quantum processors, and electronic interfaces for quantum computers. The first two talks will introduce the basic notions of quantum computing and present relevant quantum algorithms. Next, we will dive into the most promising solid-state

physical implementations of quantum processors, i.e. those based on the spin of electrons trapped in quantum dots (third talk) and those based on superconducting circuits (fourth talk). Finally, the requirements and the challenges for the implementation of the electronic interface for quantum processors will be discussed, both in terms of microwave engineering (fifth talk) and in terms of cryogenic integrated-circuit solutions (sixth and seventh talk).

#### PROGRAMME

##### What is Quantum Computing All About?

Carmen G. Almudever<sup>1</sup>  
<sup>1</sup>Delft University of Technology/QuTech

##### Quantum Algorithms

Ronald de Wolf<sup>1</sup>  
<sup>1</sup>QuSoft, CWI

##### Two Decades of Quantum Computation with Quantum Dots

Menno Veldhorst<sup>1</sup>  
<sup>1</sup>QuTech

##### The Superconducting Transmon Qubit as a Nonlinear Microwave Resonator

Daniel Sank<sup>1</sup>  
<sup>1</sup>Google

##### Microwave Engineering for Preparation, Control, and Readout of Quantum Processors

Marc Almendros<sup>1</sup>  
<sup>1</sup>Keysight Technologies

##### Towards Scalable Control of Superconducting Quantum Processors

Joseph Bardin<sup>1</sup>  
<sup>1</sup>University of Massachusetts Amherst/Google

##### A Scalable Integrated Microwave Signal Generator for Qubit Control: From Specifications to Cryo-CMOS Implementation and Qubit Testing

Masoud Babaie<sup>1</sup>  
<sup>1</sup>Delft University of Technology

## WEDNESDAY 08:30 – 12:30

### High Power Amplification for Space Applications

Chair: Iain Davies<sup>1</sup>

Co-Chair: Natanael Ayllon<sup>1</sup>

<sup>1</sup>European Space Agency

**Room: Spark**

A one day short course introducing the important topic of High Power Amplification in space-borne environments. The aim of the workshop is to provide a general overview of solid-state power amplifiers (SSPAs) and travelling wave tube amplifiers (TWTAs), their architecture, component technologies, and use in space applications in the fields of Telecommunications, Navigation and Earth Observation. The course will outline the main drivers in designing SSPAs and TWTAs in terms of performance, and the provisions made to ensure the high level of reliability required in space. The space environment will be discussed, in relation to its influence on electronic components. The need for research and development at both architectural and technological levels will also be discussed, in order to deliver increased efficiency and output power whilst at the same time reducing volume, mass and cost for satellite applications. A view on market perspective and future trends will be given by a notable industry expert.

#### PROGRAMME

##### General Introduction to HPAs for Space Applications

Natanael Ayllon<sup>1</sup>

<sup>1</sup>European Space Agency

##### TWTA Architecture, Building Blocks & Technologies

Roberto Dionisio<sup>1</sup>

<sup>1</sup>European Space Agency

##### SSPA Architecture, Building Blocks & Technologies

Iain Davies<sup>1</sup>

<sup>1</sup>European Space Agency

##### Space Environment and Its Influence in Electronics

Cesar Boatella Polo<sup>1</sup>

<sup>1</sup>European Space Agency

##### Reliability Aspects of Space-Borne Amplifiers

Jouni Lähti<sup>1</sup>

<sup>1</sup>European Space Agency

##### Future Trends and Market Perspective

Jean-François Villemazet<sup>1</sup>

<sup>1</sup>Thales Alenia Space



**S-08**  
EuMIC/  
EuMC

## WEDNESDAY 08:30 – 17:50

### High-Efficiency Linear Power Amplifiers for High Bandwidth, High PAR Signals

Chair: Olof Bengtsson<sup>1</sup>

Co-Chair: Zoya Popovic<sup>2</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH), <sup>2</sup>University of Colorado

**Room: Juliana 2**

Achieving power amplifiers (PAs) with high efficiency and good linearity is challenging if the amplified signals have wide instantaneous bandwidths (>100MHz) and high peak-to-average power ratios (PAPR > 10dB). 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 workshop focuses on current trends in achieving high efficiency when amplifying such signals at microwave and millimeter-wave carrier frequencies. The topics that are covered include PA architectures and design, such as Doherty, balanced and supply-modulated PAs, both analog and digital linearization techniques and how such amplifiers perform and are analyzed in systems such as massive MIMO. The workshop speakers are well established researchers in industry and academia, and come from Sweden, Germany, Spain, Portugal, China and the USA.

#### PROGRAMME

##### A Bandwidth Extension Technique for Power Amplifiers Employing Large PAPR Signals

Paul Saad<sup>1</sup>

<sup>1</sup>Ericsson

##### Doherty PA Solutions for Wideband Signals and Considerations for Improved DPD Linearizability

Joseph Staudinger<sup>1</sup>

<sup>1</sup>NXP Semiconductors

##### Energy-Efficient GaN PA MMIC for Massive MIMO

Wenhua Chen<sup>1</sup>

<sup>1</sup>Tsinghua University

##### Linearization of Wideband Transmitters for Multi-Band igh PAPR Signal Transmission

Siqi Wang<sup>1</sup>, Wenhui Cao<sup>1</sup>

<sup>1</sup>Chalmers University of Technology

##### Simultaneous Linearity and Efficiency Improvements Using Broadband Supply Modulation

Maxwell Duffy<sup>1</sup>, Gregor Lasser<sup>2</sup>

<sup>1</sup>Northrop Grumman, <sup>2</sup>University of Colorado

##### Efficiency Degradation in Concurrent-Band Power Amplifiers

José Carlos Pedro<sup>1</sup>

<sup>1</sup>Universidade de Aveiro

##### Multi-Band Doherty and Broadband Load-Modulated Balanced PAs for 5G

Anding Zhu<sup>1</sup>

<sup>1</sup>University College Dublin

##### Analog Linearization of High-Efficiency PAs for Broadband Signals

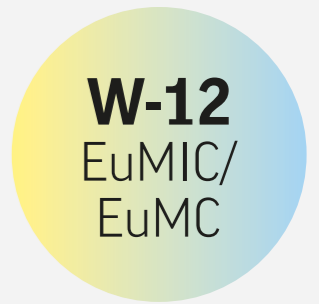
Taylor Barton<sup>1</sup>, Zoya Popovic<sup>1</sup>

<sup>1</sup>University of Colorado

##### Discrete Level Supply Modulation with Large Dynamic Wideband Signals

Olof Bengtsson<sup>1</sup>

<sup>1</sup>Ferdinand-Braun-Institut (FBH)



**W-12**  
EuMIC/  
EuMC

## WEDNESDAY 13:50 – 17:50

### Automotive Radar Networks and Sensor Fusion

Chair: Christian Waldschmidt<sup>1</sup>

Co-Chair: Martin Vossiek<sup>2</sup>

<sup>1</sup>University of Ulm, <sup>2</sup>Friedrich Alexander University of Erlangen-Nürnberg

**Room: Progress**

Today's vehicles are typically equipped with a number of radars sensor and other sensors for driver assistance and more sophisticated functions. These sensors may be used to set up a network of radars in large variety of different approaches. Those sensors can be netted coherently or incoherently and on very different levels of the signal processing chain. All approaches lead to networks with very different properties. On higher signal processing layers, the radar data is fused with other sensors like video or lidar. The workshop will present fundamentals, concepts and practical examples of such networks and functions building on them.

The first two presentations discuss the fundamentals of radar networks at 77 GHz, whereas the later talks focus on applications and functions.



**W-14**  
EuRAD

## THURSDAY 08:30 – 12:30

### High Resolution Radar for Automotive

Chair: Feike Jansen<sup>1</sup>

Co-Chair: Christian Waldschmidt<sup>2</sup>

<sup>1</sup>NXP Semiconductors, <sup>2</sup>University of Ulm

**Room: Progress**

Automotive radars are a popular sensor technology to implement Advanced Driver Assistance Systems (ADAS) such as blind spot detection and automatic emergency braking (AEB) due to their robustness and adverse weather tolerance. At the same time, these radars fall short with respect to cameras and lidars in the field of direction of arrival resolution. Hence, the application of radar for heterogeneous sensor fusion and the application of artificial intelligence as found in highly automated driving applications is challenging.

In this workshop several ways to realize high resolution automotive radars based upon different approaches using either synthetic or real aperture concepts as well as various aspects of these radars regarding weather dependence, radar to radar interference mitigation and artificial intelligence will be presented.



**W-23**  
EuRAD

#### PROGRAMME

##### Concepts for Automotive Radar Networks

Benedikt Meinecke<sup>1</sup>, Christian Waldschmidt<sup>1</sup>

<sup>1</sup>University of Ulm

##### Many Eyes See Better Than Just a Few - Novel Solutions, Challenges and Potential of Automotive Radar Networks

Marcel Hoffmann<sup>1</sup>, Martin Vossiek<sup>2</sup>, Mark Christmann<sup>2</sup>, Peter Gulden<sup>2</sup>

<sup>1</sup>Friedrich Alexander University of Erlangen-Nürnberg, <sup>2</sup>Analog Devices/Syneo GmbH

##### Loosely Coupled Automotive Radar Sensor Network

Tobias Schmid<sup>1</sup>, Felix Müller<sup>1</sup>, Martin Fink<sup>1</sup>, Robert Korn<sup>1</sup>, Jürgen Hasch<sup>1</sup>

<sup>1</sup>Robert Bosch GmbH

##### Vulnerable Road User Detection by Camera-Radar Fusion

Dariu Gavrilă<sup>1</sup>

<sup>1</sup>Delft University of Technology

##### Pre-Processing and Neural Network Co-Design for Automotive Radar Perception

Gennady Benderman<sup>1</sup>

<sup>1</sup>Daimler AG

##### Platooning Application Using Connected Automation and Sensor Fusion

Clara Otero Perez<sup>1</sup>, Gerardo Daalderop<sup>1</sup>

<sup>1</sup>NXP Semiconductors

#### PROGRAMME

##### Realizing High Resolution Radars

Feike Jansen<sup>1</sup>, Francesco Laghezza<sup>1</sup>

<sup>1</sup>NXP Semiconductors

##### Effects and Compensation of Phase Errors in Automotive SAR

Reinhard Feger<sup>1</sup>, Masoud Farhadi<sup>1</sup>

<sup>1</sup>Johannes Kepler University Linz

##### High-Resolution Imaging for Automotive Radars

Jianping Wang<sup>1</sup>

<sup>1</sup>Delft University of Technology

##### Artificial Intelligence in High-Resolution Radars – Challenges and Necessity

Martin Kunert<sup>1</sup>

<sup>1</sup>Robert Bosch GmbH

##### Let's get Real about Imaging Radar

Arunesh Roy<sup>1</sup>

<sup>1</sup>Uhnder

##### Classification of Threats and the Benefits of High Resolution

Noam Arkind<sup>1</sup>

<sup>1</sup>Arbe



## THURSDAY 08:30 – 17:50

### 5G and Beyond: Enabling RF Architectures and Technologies for Emerging Wireless Systems

Chair: Roberto Gómez-García<sup>1</sup>

Co-Chair: Xun Luo<sup>2</sup>, Nuno Borges Carvalho<sup>3</sup>

<sup>1</sup>University of Alcalá, <sup>2</sup>University of Electronic Science and Technology of China, <sup>3</sup>Instituto de Telecomunicações, Universidade de Aveiro

**Room: Juliana Congress Room 1**

Future wireless systems will require a paradigm shift in how their supporting transceiver modules will be configured to provide all the flexible functionalities required by them. Also, it is expected that upcoming 5G wireless networks, known as more than an extension to 4G, can be hybridized with other wireless applications, such as IoT, in co-integrated wireless-communications/sensing platforms. As a result, fully-renewed RF modules enabled by more-advanced RF subsystems and technologies will be required. In this workshop, novel solutions for the key RF constituent blocks of wireless-transceiver architectures in the context of 5G and beyond, complete modules, enabling technologies, and multi-functional platforms hybridizing 5G-communications/IoT-sensing applications are presented. In the first two talks, modern configurations of power amplifiers in the context of 5G and emerging wireless-communications systems will be covered. Research themes in this area include novel digital power amplifiers

for polar and quadrature transmitter modules, advanced linearization techniques, and innovative Doherty IQ power amplifiers and their demonstration in complete phase-array-enabled transmitters with gain compensation in the millimeter-wave range. In the third presentation, main technological challenges involved in the realization of 5G wireless systems at the millimeter-wave range are addressed from a system-level viewpoint. Here, a 28 GHz front-end-module in SOI CMOS is characterized and evaluated for different modulations (e.g., 256 QAM and OFDM), as required by flexible wireless-communications modules. All-digital transceiver architectures based on FPGA implementations and system solutions for all-digital radio-over-fiber testbeds in the context of 5G-and-beyond applications are expounded in the fourth and fifth talks. The topic of 5G-system characterization is further addressed in the sixth talk, where behavioral models of active antenna arrays consisting on active nonlinear elements

in the context of 5G mMIMO systems are proposed, and the associated practical-laboratory tests for multi-sine excitations are conducted. In the last two talks, enabling technologies and novel architectures of 5G/IoT multi-functional platforms are presented. First, inkjet-/3D-printed antennas, interconnects, “smart” encapsulation and packages, RF electronics, microfluidics and sensors fabricated on glass, PET, paper and other flexible substrates are introduced as a system-level solution for advanced millimeter-wave modules for 5G+ communication, energy harvesting and sensing applications. Finally, as a recent research field, the potential of batteryless sensing based on wireless power transfer (WPT) and backscattering by recycling present RF power for 5G/IoT applications is discussed. Experimental proof-of-concept designs featuring advanced performance over the state-of-the-art solutions are shown for demonstration purposes.

**W-31**  
EuMC

#### PROGRAMME

##### Energy-Efficient PAs for 5G and Beyond

Wenhua Chen<sup>1</sup>, Guansheng Lv<sup>1</sup>, Xin Liu<sup>1</sup>, Dehan Wang<sup>1</sup>, Fadhel Ghannouchi<sup>2</sup>  
<sup>1</sup>Tsinghua University, <sup>2</sup>University of Calgary

##### Wideband Microwave/mm-Wave Transmitter for 5G and Beyond

Xun Luo<sup>1</sup>  
<sup>1</sup>University of Electronic Science and Technology of China

##### Design Challenges of mm-Wave Front-Ends for 5G and Beyond

Vadim Issakov<sup>1</sup>  
<sup>1</sup>Otto-von-Guericke University Magdeburg

##### All-Digital Transceivers for 5G and Beyond Communications Systems

Arnaldo Oliveira<sup>1</sup>  
<sup>1</sup>Universidade de Aveiro

##### Investigation of Beyond-5G Wireless Communication Systems Using an All-Digital Radio-Over-Fiber Testbed

Christian Fager<sup>1</sup>  
<sup>1</sup>Chalmers University of Technology

##### Advanced Techniques for 5G System Characterization

Nuno Borges Carvalho<sup>1</sup>  
<sup>1</sup>Universidade de Aveiro

##### Inkjet-/3D-/4D-Printed Wireless Ultra-Broadband Modules for 5G+, IoT, SmartAg and Smart Cities Applications

Manos M. Tentzeris<sup>1</sup>  
<sup>1</sup>Georgia Institute of Technology

##### Batteryless Sensing for 5G/IoT Applications Based on WPT and Backscattering

Ke Wu<sup>1</sup>  
<sup>1</sup>Ecole Polytechnique Montréal

## THURSDAY 13:50 – 17:50

### Recent Advances in Micro-Doppler Radar and its Applications

Chair: Lorenzo Cifola<sup>1</sup>

Co-Chair: Francesco Fioranelli<sup>2</sup>

<sup>1</sup>Thales Nederland B.V., <sup>2</sup>Delft University of Technology

**Room: Spark**

The combination of machine learning techniques and radar-based sensing opens new research opportunities for a vast range of applications in the domain of automatic target recognition. Specifically, the intelligent use of radar micro-Doppler signatures has become an exciting area of research in fields such as automotive, human gestures and activities, unmanned aerial vehicles (drones), amongst others.

Based on the information provided by micro-Doppler signatures, several processing techniques have been developed, either based on available target models or on the definition and extraction of handcrafted features. However, these “model-driven” approaches have been very recently challenged by the explosion of methods based on artificial intelligence and deep learning, often inspired from work by the image and audio processing community.

Interesting research questions arise from the application of “data-driven” approaches to the problems of radar-based target

classification. What is the best domain/format of radar data for classification in a given application? What is the best neural network architecture to work with radar data which are neither images nor speech or audio? How to get enough radar data to train deep neural networks and how to make their decision process fully explainable? And the list of outstanding research questions could continue.

To address some of these questions it is desirable to have an overview of the state of the art of available techniques and related results. This workshop will discuss recent outcomes from the research activities of the speakers in a wide and diverse range of applications, such as analysis and classification of human movements, gait, and activities indoor and outdoor; characterization of the signatures of small drones; exploitation of micro-Doppler information generated by multistatic/distributed radar sensing; generation of reliable synthetic data from a small set of experimental radar data.

**W-15**  
EuRAD

#### PROGRAMME

##### Radar, Micro-Doppler, Models, Data: What is Driving Classification?

Lorenzo Cifola<sup>1</sup>, Francesco Fioranelli<sup>2</sup>  
<sup>1</sup>Thales Nederland B.V., <sup>2</sup>Delft University of Technology

##### Analysis and Classification of Drones Based on Radar Micro-Doppler

Jacco de Wit<sup>1</sup>  
<sup>1</sup>TNO

##### Multistatic C-UAV Micro-Doppler Analysis

Matthew Ritchie<sup>1</sup>  
<sup>1</sup>UCL

##### The Challenge of Training Deep Neural Networks for RF Applications with Low Sample Support

Sevgi Zubeyde Gurbuz<sup>1</sup>  
<sup>1</sup>The University of Alabama

## FRIDAY 08:30 – 12:30

### Cognitive Radar Signal Processing

Chair: Joseph R. Guerci<sup>1</sup>

Co-Chair: Augusto Aubry<sup>2</sup>

<sup>1</sup>Information Systems Laboratories San Diego, <sup>2</sup>University of Naples "Federico II"

**Room: Expedition**

Cognitive radar refers to an emerging signal processing paradigm which is envisioned as the core of the next generation of active surveillance systems. The key idea behind cognition is to take as much as possible inspiration from the human brain, as well as from the behaviour of other echolocating mammals, that continuously learn and react to stimulations from the surrounding environment according to four basic processes: perception-action-cycle, memory, attention, and intelligence. This short course is organized as follows.

In the first part, the cognitive radar architecture is introduced providing basic concepts and definitions as well as explaining the analogies with the biological counterpart. Hence, some notional examples revealing the potentiality of this paradigm to boost conventional radar systems are illustrated. In the second part, advanced radar waveform design algorithms are presented. In particular, the focus will be on: A-techniques capable to mitigate undesired effects

produced by signal-dependent interference in radar system; B-strategies that enable spectral compatibility with surrounding licensed emitters. In both cases, the key performance metric is detection probability and the environment awareness provided by the cognitive architecture plays a pivotal role.

In the third part, results on bio-inspired radar signal processing techniques are illustrated, focusing on advanced joint waveform and guidance control design techniques for target rendezvous.

Finally, recent results delivering space-frequency awareness to the surveillance system (as required by the perception-action-cycle) and based on 2-D spectrum sensing techniques are shown. Practical examples with Software-Defined-Radio (SDR) equipment are illustrated to complement the theoretical aspects of the tutorial.



**S-02**  
EuRAD

## FRIDAY 08:30 – 12:30

### Recent Advances in Topologies, Technologies and Practical Realizations of Microwave Biosensors

Chair: Benjamin Potelon<sup>1</sup>

Co-Chair: Enrique Bronchalo<sup>2</sup>

<sup>1</sup>Université de Bretagne Occidentale, <sup>2</sup>Universidad Miguel Hernández de Elche

**Room: Flash**

The fast-growing emergence of IoT, together with the increased ability for systems to process high volumes of data (AI, Machine Learning, Big data...) has opened the way and enhanced the needs for a new generation of sensors. Indeed, the constant seek for continuous, live data has appealed a new paradigm where coping with a high volume of data is no longer a problem as long as those data are reliable. In this context, microwave sensors can usually exhibit interesting features such as non-invasiveness, continuous measuring, and of course the ability to track structural, chemical, mechanical or physical properties specifically linked to RF waves. This workshop proposes to focus on the recent advances on the design of microwave sensors from the topological, technological and practical realizations aspects, together with the benefits for various applications, including biomedical and industrial fields.



**W-21**  
EuMC

#### PROGRAMME

##### Cognitive Radar Architecture

Joseph R. Guerci<sup>1</sup>

<sup>1</sup>Information Systems Laboratories San Diego

##### Advanced Radar Waveform Design Techniques

Augusto Aubry<sup>1</sup>

<sup>1</sup>University of Naples "Federico II"

##### Bio-Inspired Radar Systems

Alessio Balleri<sup>1</sup>

<sup>1</sup>Cranfield University

##### Spectrum Sensing Algorithms

Vincenzo Carotenuto<sup>1</sup>

<sup>1</sup>University of Naples "Federico II"

#### PROGRAMME

##### RF/Microwave Non-Invasive Blood Glucose Sensing: An Overview of the Limitations, Challenges & State-Of-The-Art

Volkan Turgul<sup>1</sup>

<sup>1</sup>University of Westminster

##### Strategies to Enhance the Sensitivity in Planar Microwave Sensors and Application to Biosensing

Ferran Martín<sup>1</sup>, Paris Vélez<sup>2</sup>, Jonathan Muñoz-Enano<sup>1</sup>, Jan Coromina<sup>1</sup>, Marta Gil<sup>1</sup>

<sup>1</sup>Universitat Autònoma de Barcelona, <sup>2</sup>Universidad Politécnica de Madrid

##### MEMS Based Sensors and Devices

Said Al-Sarawi<sup>1</sup>

<sup>1</sup>The University of Adelaide

##### Radio Frequency Sensors & Lab-On-Chip Technologies: New Opportunities for Biomedical Diagnosis

Arnaud Pothier<sup>1</sup>

<sup>1</sup>XLIM – Limoges University

##### Single and Coupled Microwave Resonators as Glucose Concentration Sensors

Carlos Gabriel Juan<sup>1</sup>, Benjamin Potelon<sup>2</sup>, Cédric Quendo<sup>2</sup>, Enrique Bronchalo<sup>1</sup>, José M. Sabater-Navarro<sup>1</sup>

<sup>1</sup>Universidad Miguel Hernández de Elche, <sup>2</sup>Université de Bretagne Occidentale

## FRIDAY 08:30 – 12:30

### Recent Advances on Microwave Filters

Chair: Giuseppe Macchiarella<sup>1</sup>

Co-Chair: Cristiano Tomassoni<sup>2</sup>

<sup>1</sup>Politecnico di Milano, <sup>2</sup>University of Perugia

**Room: Glow**

Over the past decade, there has been a spectacular increase in demand for cellular communication and satellite-based services. This has been the singular reason in pushing the state-of-the-art of wireless systems to achieve even higher communication capacity within the constraints of the available frequency spectrum. Therefore, frequency allocations are regarded as a natural resource. Filters and multiplexing networks play a critical role in maximizing the effective use of the available bandwidth to achieve the highest capacity for a diverse range of traffic scenarios, and are deemed as critical elements of these communication systems. This half-day workshop aims to provide the attendees with an overview of current trends in the development of high performance filters conceived for satellite and wireless (5G) applications.

The speakers will outline the application potentials, the design challenges and the proposed solutions, covering all the steps from the synthesis up to the technological

implementation. This will allow the audience to explore in deep the opportunities offered by the presented solutions.

#### PROGRAMME

##### Advanced Design of Waveguide Filters with Transmission Zeros

Giuseppe Macchiarella<sup>1</sup>

<sup>1</sup>Politecnico di Milano

##### Miniaturization of High-Performance Filters

Cristiano Tomassoni<sup>2</sup>

<sup>2</sup>University of Perugia

##### Novel Topologies of Waveguide Filters for High Power Space Applications

Vicente Boria<sup>1</sup>

<sup>1</sup>Universitat Politècnica de Valencia

##### Modern Tunable Filtering Components with Multi-Functional and Multi-Configurable Capabilities

Roberto Gómez-García<sup>1</sup>, Dimitra Psychogiou<sup>2</sup>

<sup>1</sup>University of Alcalá, <sup>2</sup>University of Colorado



**W-30**  
EuMC

## FRIDAY 08:30 – 15:30

### Practical Aspects of Running a Microwave Laboratory and How to Make Good Measurements Every Time

Chair: Frank E. van Vliet<sup>1</sup>

Co-Chair: Diogo Ribeiro<sup>1</sup>

<sup>1</sup>TNO

**Room: BOR 2**

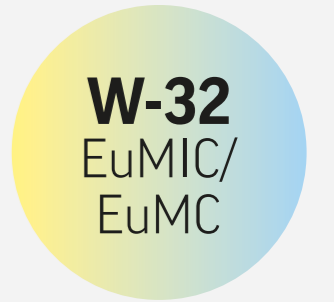
This workshop addresses best practices when running a successful microwave laboratory: from regulatory compliance to the more practical side of performing accurate measurements.

The workshop will cover the accreditation experience from both the perspective of the laboratory manager and the accreditation official. The importance of understanding regulatory procedures and accurate record keeping will be covered as well.

Procedures that ensure that every microwave measurement is accurate are also key to the success of any microwave laboratory and will be an important focus of the workshop. The workshop presenters will outline the practical steps required to perform accurate and repeatable microwave measurements. For example, often the best way of avoiding time-consuming problems in microwave measurement setups is to employ good maintenance and usage practices to extend the life of connectors, cables and other microwave components. Even the simplest

of procedures can eliminate many microwave-measurement pitfalls and help smooth the operation of your microwave laboratory. This workshop will not only be based on the typical set of presentations, it will go beyond the theory, beyond the traditional examples in slides, and provide a practical and interactive component. "Hands-on" demonstrations will be offered to the extent possible.

Finally, the workshop will touch on changes in the analysis of uncertainties that will be required to support the future needs of the microwave industry as it evolves and touch on some new software tools designed to support these changes.



**W-32**  
EuMIC/  
EuMC

#### PROGRAMME

##### Practical Aspects of Running a Microwave Laboratory

Dylan Williams<sup>1</sup>, Bart Schrijver<sup>2</sup>

<sup>1</sup>National Institute of Standards and Technology, <sup>2</sup>Keysight Technologies

##### VNAs, Scattering-Parameters and Calibrations

Jamie Lunn<sup>1</sup>

<sup>1</sup>Rohde & Schwarz

##### Power and Electrical-Phase Calibrations

Bart Schrijver<sup>1</sup>

<sup>1</sup>Keysight Technologies

##### Spectrum Analyzers and VSAs

Jon Martens<sup>1</sup>

<sup>1</sup>Anritsu

##### METAS VNA Tools

Michael Wollensack<sup>1</sup>

<sup>1</sup>Federal Institute of Metrology METAS

##### Microwave Uncertainty Framework

Dylan Williams<sup>1</sup>

<sup>1</sup>National Institute of Standards and Technology

## FRIDAY 13:50 – 17:50

### Introduction to MIMO Radar

Chair: Frank Robey<sup>1</sup>

Co-Chair: Vito Mecca<sup>1</sup>, Daniel Rabideau<sup>1</sup>

<sup>1</sup>MIT Lincoln Laboratory

Room: Expedition

Recent advances in the technologies associated with phased array apertures, digital waveform generators, and signal processing have enabled a broad class of Multiple-Input Multiple-Output (MIMO) radar techniques. In the last decade and a half, the MIMO radar nomenclature has been applied to various signaling and processing techniques that employ multiple, independent radiating transmitter elements that work cooperatively with multiple, independent receiver elements. This tutorial is intended to provide an overview of the principles of MIMO radar with an emphasis on applications and beamforming techniques for phased array radar systems.

First, this tutorial will briefly review the history of developments in the fields of radar, communication and control theory that led to the emergence of the "MIMO radar" taxonomy in the early 2000's. An overview of MIMO radar will be provided covering the broad class of MIMO-enabling waveforms, comparisons with traditional single-input

radar systems, and the various canonical forms of MIMO radar in the published literature. Second, this course will expand upon waveform design approaches for MIMO radars. A coherent MIMO radar signal model will be presented that illustrates the utility of spatio-temporal signal processing for phased array systems – including a posteriori transmit beamforming. Then, performance of MIMO radar systems will be explored in the areas of parameter estimation, track and search rates, and requirements and cost for hardware implementations. Finally, several examples of MIMO radar operation will be presented spanning pulsed-Doppler, airborne GMTI, automotive radar and high frequency over-the-horizon radar applications.

#### PROGRAMME

### Introduction to MIMO Radar

Frank Robey<sup>1</sup>, Vito Mecca<sup>1</sup>, Daniel Rabideau<sup>1</sup>

<sup>1</sup>MIT Lincoln Laboratory

S-01  
EuRAD

## Rohde & Schwarz Tutorial Seminars and Technical Workshops

Date: Tuesday 12<sup>th</sup> to Thursday 14<sup>th</sup> January 2021

Location: Juliana 4

**FREE TO ATTEND**  
Due to the COVID-19 pandemic, this program is only preliminary. Final details are expected to be available from December 2020. For more information, details and registration:  
<http://www.rohde-schwarz.com/eumw>

ROHDE & SCHWARZ

Make ideas real



#### TUTORIAL SEMINARS – RF BASICS IN TEST AND MEASUREMENT

The Rohde & Schwarz seminars covering RF basics in test and measurement will familiarize you with the elementary aspects of signal generators, spectrum analyzers and network analyzers. You will learn how to benefit from the tremendous 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 frequency domains and demonstrates the great benefits for analysis of every mmWave engineer's complex circuitries.

Using vector network analyzers for component testing and applying various calibration techniques allows highly precise characterization of RF and mmWave components, which are necessary for mmWave designs and digital communications systems.

#### TUESDAY, 12<sup>TH</sup> JANUARY 2021

**09:30 – 11:00** Fundamentals of signal generators and oscillators (VCO versus VCO)

**11:15 – 12:45** Fundamentals of spectrum analysis

#### WEDNESDAY, 13<sup>TH</sup> JANUARY 2021

**09:30 – 11:30** Introduction to digital signals and digital modulation

**11:45 – 13:15** Real-time spectrum analysis embedded in advanced spectrum analyzers

#### THURSDAY, 14<sup>TH</sup> JANUARY 2021

**09:30 – 10:30** Fundamentals of vector network analysis

**10:45 – 12:15** Calibration in vector network analysis

#### TECHNICAL WORKSHOPS

##### TUESDAY, 12<sup>TH</sup> JANUARY 2021, 13:30 TO 16:15

##### Modern RF frontend design and testing

Workshop chair: Markus Lörner, Market Segment Manager RF & Microwave Components, Rohde & Schwarz

5G is real. The focus is now on improving the system and enhancing it to mmWave. This drives growing integration in components and the creation of more efficient designs to minimize form factor, improve energy efficiency and ultimately drive overall costs down. Multifunction RF components such as beamformers are used in 5G mmWave as well as in satellite communications and defense applications. The high density of RF frontends for massive MIMO systems calls for unprecedented energy efficiency in order to minimize the physical size while ensuring stable temperature conditions. This 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 world and industry partners will provide solutions that meet demanding requirements.

##### WEDNESDAY, 13<sup>TH</sup> JANUARY, 2021, 13:30 TO 16:15

##### Millimeterwave and THz technology for 5G and beyond

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 utilization of the radio spectrum between 30 GHz and 300 GHz is intended to resolve the spectrum crunch and to enable ultra-broadband mobile communications up to the terabit-class range. Since highly integrated frontends including array antennas will be implemented, advanced over-the-air testing methods with an extreme 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 analyzers. 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 on hardware implementation issues.

# MathWorks Hands-on Workshops

Date: Tuesday 12<sup>th</sup>, to Thursday 14<sup>th</sup> January 2021

Location: Juliana 3



## ACCELERATE THE PACE OF YOUR ENGINEERING AND SCIENCE

Join one or more of the 90-minute MathWorks hands-on workshops on Tuesday, Wednesday, and Thursday (September 15, 16, 17) at the European Microwave Week. Topics include: using MATLAB® for designing and testing 5G and WLAN systems, antenna and antenna array design and optimization for radar applications, modeling RF propagation effects in urban scenarios, using Software Defined Radios (SDR) for rapid prototyping and over-the-air testing, plus

lots more! These workshops do not require familiarity with MATLAB. Bring your own laptop to get a hands-on experience and rapidly get started under the supervision of MathWorks experts. There will be 3 different sessions each day. Please sign up to our workshops here: <https://www.mathworks.com/EUMW-2020-workshops.html> These workshops are free to attend for everyone who has registered for European Microwave Week.

### Highlights

- 5G, LTE, WLAN, and Bluetooth Wireless Standards Made Easy
- AI Driven Antenna Optimization and Platform Integration
- RF Propagation and Ray Tracing in Urban Scenarios
- Modeling Tracking Scenarios and Simulating Radar Detections

### TUESDAY, 12<sup>TH</sup> JANUARY 2021

**10:00 - 11:30** 5G, LTE, WLAN, and Bluetooth Wireless Standards Made Easy

**13:00 - 14:30** Modeling the RF Frontend of a Wireless System

**15:00 - 16:30** Masterclass: Testing Your Software Defined Radio Algorithm on Real Hardware

### WEDNESDAY, 13<sup>TH</sup> JANUARY 2021

**10:00 - 11:30** Antenna and Antenna Array Design and Prototyping Using MATLAB®

**13:00 - 14:30** AI Driven Antenna Optimization and Platform Integration

**15:00 - 16:30** RF Propagation and Ray Tracing

### THURSDAY, 14<sup>TH</sup> JANUARY 2021

**10:00 - 11:30** Introduction to Radar System Simulation

**13:00 - 14:30** Modeling Tracking Scenarios and Simulating Radar Detections

**15:00 - 16:30** Machine Learning & Deep Learning Applied to Radar Target Classification

# Keysight PathWave Workshops

Date: Wednesday, 13<sup>th</sup> January 2021

Location: Juliana 1



## PROGRAMME

**TIME: 10:00 - 12:00**

### Modeling Non-Linear RF Design - Unifying Circuit Design with System Design

The evolving RF system requirements are pushing the use of Spreadsheet custom templates to their limits. At the same time, fragmented design flows for RF system and circuit design restrict the final validation options.

With PathWave Advanced Design System (ADS), you can easily design your circuits; with complex modulation schemes, it becomes even more important to verify your design against System specifications. PathWave System Design (formerly known as SystemVue) is a multi-domain modeling implementation and verification platform for electronic system-level (ESL) design. It allows system architects and algorithm developers to cross traditional baseband and RF boundaries and provides a verification platform for RF circuit designers to innovate the physical layer (PHY) of next generation wireless communications systems and to prevent costly hardware integration delays downstream.

In this workshop you will learn about:

- Extracting behavioral models from your circuit designs in the form of X-parameters and Fast Circuit Envelope (FCE) models and how to simulate them at the system level
- System level verification against golden standards using Virtual Test Benches (VTBs) in ADS
- How to linearize a Power Amplifier designed in ADS using the Digital Pre-Distortion (DPD) design capabilities in PathWave System Design

**TIME: 13:00 - 15:00**

### Integrated Electromagnetic Analysis - Enabling PCB-Chip-Package Co-Design for RF & mm-Wave Applications

The level of integration of RF and mm-wave systems is increasing, which has an impact on the electrical properties and system parameters. Furthermore, RF applications are typically combined with non-RF digital sections such as CPU, DSP, control circuits and power distribution networks. As a result, it is insufficient to model chip, package and PCB separately, as unwanted coupling effect of both RF and high-speed digital signals may not be captured.

During this workshop we will present a complete chip-package co-design flow, which allows improvement of RF performance and power efficiency. By designing concurrently, silicon, package and system can be optimized and validated with fewer iterations before tape-out. This flow has been validated on GlobalFoundries' 22FDX process which targets mm-Wave designs.

ADS enables EM-circuit analysis of any selected portion of the PCB to identify and fix sources of interference before building hardware board turns. We will show an integrated Electromagnetic (EM) solution, RFPro, with automatic net, ground and component extractions from an imported ODB++ layout.

# IHP Workshop: "High Performance SiGe BiCMOS Technology Platform for leading edge RF and Photonic ICs"

Date: Thursday, 14<sup>th</sup> January 2021

Location: Juliana 2

**FREE TO ATTEND**  
For further information  
and to register for this work-  
shop please email:  
Anna Sojka-Piotrowska: [sojka@ihp-microelectronics.com](mailto:sojka@ihp-microelectronics.com)



## FAMILIARISE YOURSELF WITH IHP'S TECHNOLOGIES

The Workshop delivers firsthand information and opportunities about IHP's technologies, services and integrated circuits. IHP's offerings are very suitable for highly demanding applications such as wireless and broadband communication, medical technology, aerospace, mobility, wireless security and industrial automation.

### PROGRAMME

**09:30 - 09:40** Welcome and Introduction - R.F. Scholz

**09:40 - 10:10** MM-Wave Packaging and Heterogeneous Integration - M. Wietstruck  
In this talk, the latest developments for mm-wave packaging and heterogeneous integration at IHP will be presented: BiCMOS embedded Through-Silicon Vias (TSV), wafer-level interconnection technologies and a novel wafer-level packaging technology.

**10:10 - 10:40** Next generation THz SiGe-BiCMOS technology and future perspectives - tbd  
Recently IHP demonstrated first results for a SiGe-BiCMOS technology featuring transit frequencies  $f_T$  and maximum oscillation frequencies  $f_{max}$  both exceeding 0.5 THz. Status and future perspective of these developments will be discussed.

**10:40 - 11:10** Overview on MPW offerings and Process Design Kit features - R.F. Scholz  
IHP offers research partners and customers access to its powerful cutting edge SiGe:C BiCMOS technologies e.g.: Integrated HBTs with cut-off frequencies of up to 500 GHz, Through Silicon Vias, Localized Backside Etching

**11:10 - 11:40** Space evaluation of two BiCMOS technologies SGB25RH and SG13RH - J. Kroel  
SGB25RH is already fully evaluated against ESCC standards and the technology is EPPL listed. The evaluation of SG13RH supported by the ESA component group consists of different activities and this overview gives an overall status of the progress.

**11:40 - 12:10** IP portfolio and customized IP block offerings via IHP Solutions - M. Petri  
Through IHP Solutions, customers have access to the whole range of IHP's IP portfolio e.g.: building blocks, cores, integrated analog devices, complex digital processors, wireless sensor networks, embedded security or application software solutions.

**12:10 - 12:20** Introduction Demonstrators: SRS Radar, UWB Localization, Broadband SDR, 5G - R.F. Scholz

**12:20 - 13:30** Lunch & Demo Session

# EuMW MicroApps 2020

Date: Tuesday 12<sup>th</sup>, to Thursday 14<sup>th</sup> January 2021

Location: MicroApps Theatre, Exhibition Hall

Free Admission  
with Exhibition and Conference  
Badges



## TAKE 20 MINUTES TO LEARN SOMETHING NEW

Welcome to the tenth annual European Microwave Week (EuMW) Microwave Application Seminars (MicroApps), sponsored by Rohde & Schwarz and Horizon House. MicroApps will be held from Tuesday 12<sup>th</sup> - Thursday 14<sup>th</sup> January 2021 in the MicroApps Theatre, which is located within the exhibition floor, making it a convenient stop while attending EuMW.

MicroApps are 20-minute exhibitor technical presentations that provide an opportunity for EuMW attendees to experience state-of-the-art applications, products, design techniques, and processes

of interest to the RF and microwave community.

2020 MicroApps highlights include:

- Keynote talks by known experts in the RF/microwave industry
- Industry workshops
- A variety of practical application topics describing novel products and processes.

Once finalized, a complete agenda will be posted on [www.eumweek.com](http://www.eumweek.com) and published in the official EuMW Show Guide. Additional printed copies will also be available

on site at the EuMW registration desks.

MicroApps admission is free for both exhibition-only and conference badges. Also included is a complimentary web download of the papers presented and bottled water.

We look forward to seeing you at EuMW 2020 in the MicroApps Theatre.

# EXHIBITOR WORKSHOP MATRIX

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
<b>TUESDAY 12<sup>TH</sup> JANUARY 2021</b>					
Juliana 3		10:00 - 16:30 MathWorks			
Juliana 4	09:30 - 12:45 Rohde & Schwarz Tutorial Seminars		13:30 - 16:15 Rohde & Schwarz Workshops		
<b>WEDNESDAY 13<sup>TH</sup> JANUARY 2021</b>					
Juliana 1	10:00 - 12:00 Keysight Technologies Workshops		13:00 - 15:00 Keysight Technologies Workshops		
Juliana 3		10:00 - 16:30 MathWorks			
Juliana 4	09:30 - 13:15 Rohde & Schwarz Tutorial Seminars		13:30 - 16:15 Rohde & Schwarz Workshops		
<b>THURSDAY 14<sup>TH</sup> JANUARY 2021</b>					
Juliana 2		09:30 - 13:30 IHP			
Juliana 3		10:00 - 16:30 MathWorks			
Juliana 4		09:30 - 12:15 Rohde & Schwarz Tutorial Seminars			

# SUNDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1		W-03 High Performance GaN MMICs			
Mission 2		W-17 Advanced RF Technologies for 5G			
Quest		W-29 Recent Advances in Additive Manufacturing of Microwave Components			
Auditorium		S-03 Fundamentals of Microwave PA Design			
Expedition		W-11 Integrated Doherty PAs for Cellular and mmWave Applications			
Flash	W-27 Wireless Power Transmission Recent Research Advances		W-02 Advanced Measurement Techniques for Next Generation Communication Systems		
Spark		W-06 Sub-mmWave On-Wafer Measurements			

# MONDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1	EuMIC02 D-Band to H-Band Amplifiers		EuMIC05 ICs for mmWave Beamforming Systems	EuMIC08 ICs for Communication and Sensing	
Mission 2	EuMIC03 GaN MMIC Power Amplifiers		EuMIC06 Advances in mmWave and High Power Technologies	EuMIC09 Advanced Solutions for Integrated Power Amplifiers	
Quest	EuMIC04 Receivers and LNAs		EuMIC07 Oscillators and Switches	EuMIC10 Nonlinear Modelling	
Expedition	W-28 Microwave Wearable Circuits and Systems for Biomedical Applications				
Polar		EuMIC01 EuMIC Opening			
Auditorium	W-13 Advanced Applications of In-Band Full-Duplex Technology	Technology in Context Network Threats	S-05 Multibeam Antennas and Beamforming Networks		
Spark	W-08 Antenna/Modules in Package for mmWave for 5G		W-10 From Enabling GaN Technology to High-Performing Space-Borne SSPAs at mmWave		
Flash	S-07 From Device Characterisation to Amplifier Design: Advanced Large Signal Measuring, Fast and Accurate Modelling, and Reliable Designing		S-10 Intuitive Microwave Filter Design with EM Simulation		
Glow	W-18 Measurements at mmWave and Terahertz Frequencies of Three Measurement Quantities: S-Parameters, Power, and Complex Permittivity of Dielectric Materials				
Beam	W-07 High-Power Microwave Industrial Applications				
Off-site					Automotive Forum Networking Dinner 18:30 - 22:00
Off-site					EuMIC Get-Together 18:30 - 21:00

# TUESDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Mission 1	<b>EuMIC11</b> Transceiver and Transmitter ICs		<b>EuMIC13</b> Foundry Panel	<b>EuMC07</b> Wireless Communication Systems	<b>EuMC14</b> Microwave and mmWave Systems
Mission 2	<b>EuMC01</b> Power Amplifiers for Sub 6 GHz Application		<b>EuMC08</b> Power Amplifiers Based on III-V & CMOS Technologies for 5G	<b>EuMC15</b> Doherty and Load Modulated Power Amplifier Structures	
Quest	<b>EuMIC/EuMC01</b> Silicon Integrated Sub-mmWave Circuits		<b>EuMC09</b> Terahertz Electronic Devices	<b>EuMC16</b> Terahertz Photonic Devices and System	
Expedition	<b>EuMIC12</b> Design and Characterisation Techniques		<b>EuMC10</b> MIMO and 5G Antennas	<b>EuMC17</b> Phased and Transmit Arrays	
Polar			<b>EuMIC14</b> 1-Minute Poster Pitch (13:50 - 14:10)	<b>EuMIC16</b> EuMIC Closing Session	
Auditorium	<b>Automotive Forum</b> Automotive Radar: Waveforms, Architectures, AI and Interference		<b>Technology in Context</b> Philosophical Lecture	<b>Automotive Forum</b> Automotive Radar: Waveforms, Architectures, AI and Interference	
Spark	<b>EuMC02</b> Array Antennas		<b>EuMC11</b> Waveguide and Horn Antennas	<b>EuMC18</b> 5G Antenna Systems	
Flash	<b>EuMC03</b> Advanced Packaging Components and Techniques		<b>EuMC12</b> Advanced Packaging Solutions for mmWave Applications	<b>EuMC19</b> 3D-Printing Technologies	
Glow	<b>EuMC04</b> Theoretical and Computational Electromagnetics		<b>EuMC13</b> Numerical Methods in Microwave Technology	<b>EuMC20</b> Modelling of Field Radiation and Scattering	
Beam	<b>Student School</b> Build Your Own Radar: Instruction		<b>W-25</b> Advanced mmWave Radar System Solutions for Industrial and Consumer Sensing Applications		
Media arena	<b>EuMC05</b> 1-Minute Poster Pitch (09:40 - 10:10)	<b>Women in Microwaves</b> Lunch Lecture	<b>Career Platform</b> How to Stand Out in a Job Application	<b>Women in Microwaves</b> Panel Discussion	
Fluor				<b>Teaching Microwaves</b> Increase Your Microwave Lecturing Skills	
Round control		<b>Career Platform</b> Career Lounge: Meet Jobs, Build Careers			
Transitzone B		<b>Automotive Forum</b> Lunch			
Transitzone C		<b>Student School</b> Build Your Own Radar: Hands-On Experience			
loopbrug		<b>Career Platform</b> Company Wall and Job Wall			
Beatrix		<b>Opening of the European Microwave Week</b> EuMC/EuMW Opening			
Juliana 2		<b>W-05</b> Digital Predistortion for 5G MIMO Wireless Transmitters			
Hall 1		<b>EuMC06</b> Interactive Poster Session	<b>EuMIC15</b> Interactive Poster Session		
Hall 1		<b>Student Design Competition</b> Detect a Drone / Build (a part of) an Amplifier			
Off-site					<b>EuMW Welcome Reception</b> 18.30 - 22.00

■ EuMW ■ EuMC ■ EuRAD ■ EuMIC ■ Student Activity ■ EuMIC/EuMC ■ EuMC/EuRAD

# WEDNESDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Progress			<b>W-14</b> Automotive Radar Networks and Sensor Fusion		
Mission 1		<b>EuRAD02</b> Dual Use & Waveform Design	<b>EuRAD04</b> Doppler Processing Techniques for Low Reflectivity Targets	<b>EuRAD06</b> Emerging & Industrial Applications	
Mission 2	<b>EuMC21</b> Special Antenna Systems	<b>EuMC27</b> [Focussed Session] Emerging Microwave Technology: Asia-Pacific	<b>EuMC33</b> Advances on RF Power Amplifier Behavioural Modelling	<b>EuMC39</b> Solid State High Power Amplifiers for Satellite and Radar Applications	
Quest		<b>EuRAD03</b> Design and Calibration Concepts for Advanced Radar Systems	<b>EuRAD05</b> Radar Circuits and Systems	<b>EuRAD07</b> Radar Scenario Simulations	
Expedition	<b>EuMC22</b> Novel Circuits Solutions for Energy Transfer in the Near-Field and Far-Field	<b>EuMC28</b> Novel Wireless Power Transfer and Energy Harvesting Systems	<b>EuMC34</b> Recent Advances in RFID and IoT Sensors	<b>EuMC40</b> [Focussed Session] Emerging Antenna Technologies for RFID	
Polar	<b>EuRAD01</b> EuRAD Opening Session				
Auditorium	<b>EuMC23</b> [Focussed Session] Innovative Antennas for Cubesat Platforms	<b>DSS Forum</b> Space Situational Awareness	<b>DSS Forum</b> Strategy Analytics Lunch	<b>DSS Forum</b> Space Situational Awareness	<b>DSS Forum</b> Cocktail Reception
Spark	<b>S-08</b> High Power Amplification for Space Applications		<b>EuMC35</b> Integrated Antennas	<b>EuMC41</b> SATCOM and mmWave Antennas	
Flash	<b>EuMC24</b> Additive Manufacturing and Emerging Materials for mmWave Applications	<b>EuMC29</b> Reconfigurable Planar Passive Components	<b>EuMC36</b> Transmission Lines and Passive Components	<b>EuMC42</b> Planar Power Dividers/Combiners	
Glow		<b>EuMC30</b> Non-Planar Filters	<b>EuMC37</b> Non-Planar Filters and Devices	<b>EuMC43</b> Non-Planar Devices and Systems	
Beam	<b>EuMC25</b> Metamaterials for Circuits and Sensors	<b>EuMC31</b> Frequency Selective Surfaces, Reflectors and Metamaterial Antennas	<b>EuMC38</b> Metasurfaces and FSSs Applications	<b>EuMC44</b> [Special Session] Silicon-Based Ka-Band Massive MIMO Systems	
Media arena	<b>EuMC26</b> 1-Minute Poster Pitch (09:40 - 10:10)	<b>Career Platform</b> [Special Session] Industry Market and Professional Opportunities	<b>IEEE Young Professionals</b>	<b>Career Platform</b> Startup Panel	
Fluor	<b>S-04</b> Quantum Computing for Electrical Engineers				
Shuttle		<b>IEEE Young Professionals</b>			
Round control		<b>Career Platform</b> Career Lounge: Meet Jobs, Build Careers			
loopbrug		<b>Career Platform</b> Company Wall and Job Wall			
Juliana 2		<b>W-12</b> High-Efficiency Linear Power Amplifiers for High Bandwidth, High PAR Signals			
Hall 1	<b>Student Design Competition</b> Detect a Drone / Build (a part of) an Amplifier		<b>EuMC32</b> Interactive Poster Session	<b>Student Design Competition</b> Detect a Drone / Build (a part of) an Amplifier	
Off-site					<b>Microwave Nightfever</b> 20.00 - 24.00

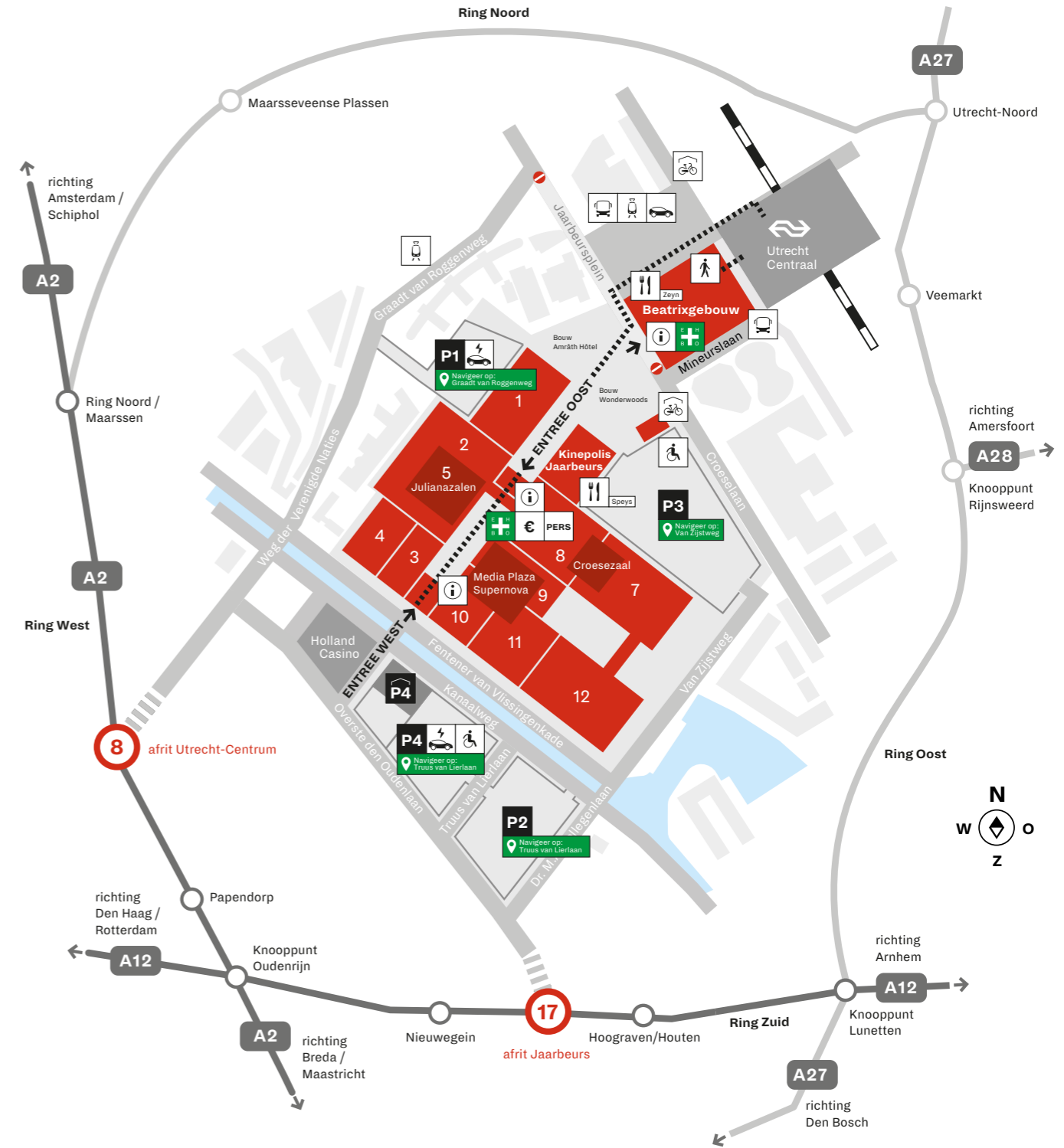
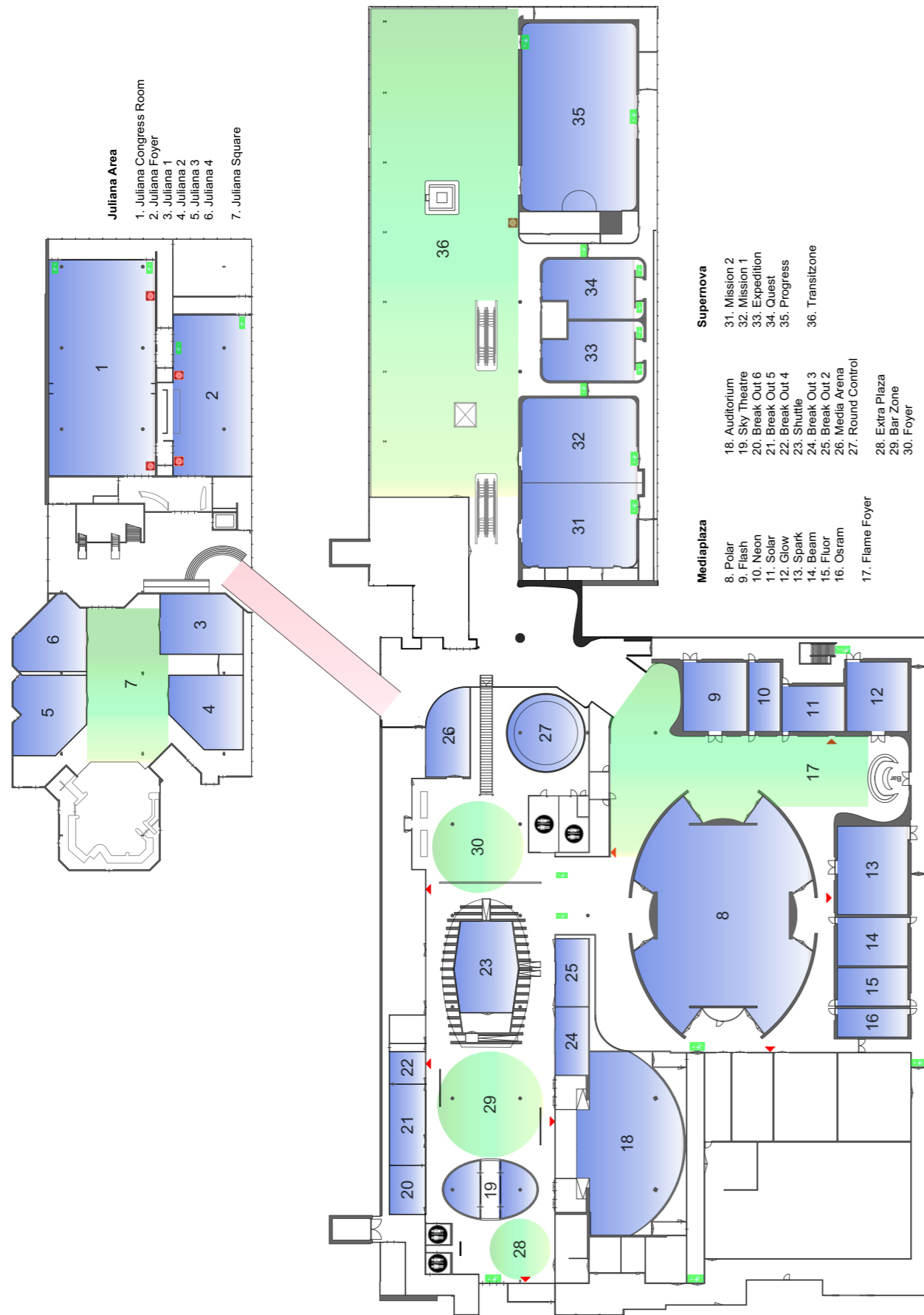


# THURSDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Progress	W-23 High Resolution Radar for Automotive				
Mission 1	EuRAD08 Object Classification in Automotive Radars	EuRAD12 [Focussed Session] Radar Interference Cancellation		EuRAD16 Automotive	
Mission 2	EuRAD09 Defence Applications	EuRAD13 [Special Session] Radar and Electronic Warfare		EuRAD17 Advanced Techniques and Innovative Array Configurations for DoA	
Quest	EuRAD10 SAR Processing	EuRAD14 Surveillance and SAR		EuRAD18 SAR Applications	
Expedition	EuMC/EuRAD01 Radar Receivers and Front-Ends	EuMC49 Front-End and Active Module		EuMC54 Low Noise Amplifier and Phased Array Module	
Polar				Closing of the European Microwave Week EuMC/EuMW Closing and Awards Ceremony	
Auditorium	EuMC45 [Special Session] Focus Day: Array Antennas for Radio Astronomy	EuMC/EuRAD02 [Special Session] Focus Day: Active Array Antennas for Space	Technology in Context The Law of Space	EuMC/EuRAD03 [Special Session] Focus Day: Active Array Antennas for Defence	HAM Radio Social 18.00 - 21.00
Spark	EuMC46 Advanced Planar Filter Principles and Technologies	EuMC50 Compact Planar Filtering Devices		W-15 Recent Advances in Micro-Doppler Radar and its Applications	
Flash	EuMC47 Dielectric Measurements	EuMC51 Calibration and Characterisation Techniques		EuMC55 Antenna Characterisation Techniques	
Glow	EuMC48 Microwave Monitoring and Sensing of Biomedical Parameters	EuMC52 Biological Microwave Effects and Imaging Techniques		EuMC56 [Focussed Session] Electromagnetics in Biomedical Applications	
Beam	Tom Brazil Doctoral School of Microwaves The Route to 5G: Design of mmWave Active Array Systems, from RFIC to Signal Processing				
Media arena	EuRAD11 1-Minute Poster Pitch (09:40 - 10:10)	EuMC53 1-Minute Poster Pitch (12:00 - 12:30)		EuMC57 In Recognition: Prof. Dr. A.T. de Hoop	
Round control	Career Platform Career Lounge: Meet Jobs, Build Careers				
BOR 6	Career Platform Job Dating				
loopbrug	Career Platform Company Wall and Job Wall				
Juliana Congress Room 1	W-31 5G and Beyond: Enabling RF Architectures and Technologies for Emerging Wireless Systems				
Hall 1			EuRAD15 Interactive Poster session	EuMC58 Interactive Poster Session	

# FRIDAY

Room	08:30 - 10:10	10:50 - 12:30	13:50 - 15:30	16:10 - 17:50	EVENING PROGRAMME
Progress			EuRAD25 Closing Session		
Mission 1	EuRAD19 MIMO Radar	EuRAD22 Automotive Radar MIMO Processing			
Mission 2	EuRAD20 Passive Radars	EuRAD23 Target Characterisation with Radar			
Quest	EuRAD21 New Radar Concepts	EuRAD24 [Special Session] Civilian Radar Research and Development in China			
Expedition	S-02 Cognitive Radar Signal Processing			S-01 Introduction to MIMO Radar	
Auditorium	5G Forum 5G: From Technology to Business		Technology in Context 5G, But Why?	5G Forum 5G: From Technology to Business	
Flash	W-21 Recent Advances in Topologies, Technologies and Practical Realizations of Microwave Sensors				
Glow	W-30 Recent Advances on Microwave Filters				
BOR 2	W-32 Practical Aspects of Running a Microwave Laboratory and How to Make Good Measurements Every Time				
Transitzone A			EuRAD Seated Lunch		
Transitzone B			5G Forum and WS/SC Seated Lunch		



## Route to the Jaarbeurs by car or from Utrecht Central station

- |  |              |  |                 |  |  |  |  |  |   |
|--|--------------|--|-----------------|--|--|--|--|--|---|
|  | Taxi         |  | Informatie      |  | Event & Exhibition Centre<br>Hal 1 t/m 4 en 7 t/m 12<br>Speys                        |  | Beatrixgebouw<br>Beatrix Theater<br>Expozaal<br>Jaarbeurs MeetUp<br>Kantoren Jaarbeurs<br>Trade Mart<br>Zeyn       |  | Jaarbeurs<br>Jaarbeursplein   3521 AL Utrecht<br>jaarbeurs.nl |
|  | Bus          |  | Fietsenstalling |  | Eerste verdieping:<br>Croesezaal<br>Julianazalen (Hal 5)<br>Media Plaza<br>Supernova |  | Parkeren en navigeren<br>Bekijk de plattegrond om te beoordelen op welk parkeerterrein je het beste kunt parkeren. |  |   |
|  | Sneltram     |  | Restaurant      |  |  |  |  |  |   |
|  | EHBO         |  |                 |  |  |  |  |  |   |
|  | Geldautomaat |  |                 |  |  |  |  |  |   |
|  | Pers         |  |                 |  |  |  |  |  |   |

# Exhibitor List 2020

**A:** ACST GmbH · AdTech Ceramics · AFT Microwave GmbH · AGC · AGC-NELCO Europe SA · AINFO Inc. · AIRMEMS · Alfred Tronser GmbH · ALPHA-RLH · Altair Engineering GmbH · AMCAD Engineering · American Standard Circuits, Inc. · American Technical Ceramics Corp. (ATC) · Ampleon · Analog Devices GmbH · Anyarc (Kunshan) Technology Co., Ltd · API Tech · AR Europe Ltd · Arralis · Artech House Books · ASB Inc. · ATEM · Atlantic Microwave Ltd · Auriga PIV-Tech · AVX Corp.

**B:** BAE Systems Surface Ships Ltd · Bits&Chips · Bruco IC · BSC Filters Ltd · bsw TestSystems & Consulting BV

**C:** Cadence · China Electronics Technology Instruments Co., Ltd (CETC) · Cicor Group · CISTEME · Cobham Electrical and Electronic Equipment · Coilcraft · COMSOL BV · Copper Mountain Technologies · CPE Italia SpA

**D:** DICONEX · DELTA OHM · Ditom Microwave Inc. · Dow-Key Microwave · dSPACE GmbH · DYCONEX AG

**E:** ECA Group · EDI CON China · Electronic Specifier Ltd · Elektor · Elite RF · ERZIA Technologies S.L. · ETL Systems · European Microwave Week 2021 · Everything RF

**F:** Farran Technology Ltd · Filtronic Broadband Limited · Focus Microwaves Inc. · Focusimple Electronics Co., Ltd · FormFactor Inc. · Fraunhofer FHR · Fraunhofer IAF · Fuzhou Micable Electronic Technology Co., Ltd

**G:** Gapwaves · Greenray Industries

**H:** Hangzhou Freqcontrol Electronic Technology Ltd · hf-Praxis · High Frequency Electronics · Holzworth Instrumentation · Huber + Suhner AG · Hytem

**I:** IHP GmbH · IMST GmbH · iNOVEOS · Institut d'Electronique, de Microelectronique et de Nanotechnologies (IEMN) · Intech Microwaves S.R.L. · Isola GmbH

**J:** JQL Technologies Corporation

**K:** K&L Microwave, Inc · Keysight Technologies · Knowles Precision Devices · KOA Europe GmbH · KOSTECSYS Co., Ltd · Kuhne Electronic GmbH

**L:** LPKF Laser & Electronics AG · Lancaster University Engineering Department

**M:** Mathworks B.V. · Maury Microwave Corp. · Mesuro Limited · METDA Corp · Mician GmbH · Micro Harmonics Corporation · Micro Systems Engineering GmbH · Micro Systems Technologies Management AG (MST) · Microsanj LLC · Microwave Engineering Europe · Microwave Journal · Microwave Products Group · Microwave Systems JSC · Microwaves and RF · Millwave Silicon Solutions Inc. · Millway Microelectronics · MISOTECH · Mitron Inc · Mouser Electronics · MPI Corporation · MRC Gigacomp GmbH & Co. KG · MTR S.R.L. · MUEGGE GmbH · Murata Software Co., Ltd

**N:** NI · NSI-MI Technologies · NXP Semiconductors

**O:** OMMIC

**P:** Pasquali Microwave Systems SRL · Pickering Interfaces Ltd · Pico Technology Ltd · Planar Monolithics Industries Inc · Plexsa Manufacturing · Pole Zero · Prana R&D · Pure Pro Technology Co., Ltd

**Q:** Quartzcom AG

**R:** Remcom Inc. · Research Fab Microelectronics Germany (FMD) · RF MORECOM · RF-Lambda Europe GmbH · Rflight Communication Electronic Co., Ltd · RFMW Europe Ltd · Rogers Corporation · Rohde

& Schwarz GmbH & Co. KG · Rosenberger Hochfrequenztechnik GmbH & Co. KG

**S:** SARAS Technology Ltd · Schmid & Partner Engineering AG · Schott AG · Shenzhen Superlink Technology Co., Ltd · Siglent Technologies Germany GmbH · Signal Integrity Journal · Smiths Interconnect · Hypertac SA · Southwest Microwave · SpaceForest · SPINNER GmbH · STACEM · Stratedge Corporation · Sumitomo Electric Europe Ltd · Sumitomo Electric Industries · Sungsan Electronics & Communications Co., Ltd · Suzhou Astroniks Electronic Technology Co., Ltd

**T:** Tech-X Corporation · Teledyne Technologies · Telemeter Electronic GmbH · TEMSTRON Co., Ltd · TEMWELL Corp · TICRA · Times Microwave Systems · TMD Technologies Ltd · TNO Defence, Safety and Security · Trilight Microwave AB + Microwave Systems · Tronser, Inc. · Tusk IC nv

**U:** UIY Inc. · United Monolithic Semiconductors SAS

**V:** Varioprint AG · Vectawave · Ventec International Group · VIA Electronic GmbH · Virginia Diodes Inc. · Vishay Electronic GmbH · VTT

**W:** W.L. Gore & Associates GmbH · WAVEPIA Co., Ltd · Wavice Inc. · Wevercomm Co., Ltd · WIN Semiconductors Corp · WIPL-D d.o.o. · Withwave Co., Ltd · Wolf-speed, A Cree Company · Wuerth Elektronik eiSos GmbH & Co. KG

**X:** XLIM - UMR CNRS 7252 - Université de Limoges

**Y:** Yole Développement

**Z:** Zhejiang Wazam New Materials Co., Ltd · Zhongshan Fragrant Mountain Microwave Co., Ltd



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