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PROGRAM BOOK

16 - 21 JUNE 2024

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WASHINGTON DC 2024

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MICROWAVE WEEK

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Follow us on Twitter: http://twitter.com/MTT_IMS

Follow us on Instagram: http://instagram.com/mtt_ims

Like us on Facebook: http://www.facebook.com/IEEE.MTTS.IMS

Engage with fellow attendees on LinkedIn: https://www.linkedin.com/groups/2375668/ (Group Name: IEEE MTT-S International Microwave Symposium (IMS))

Follow us on YouTube: http://www.youtube.com/user/mttims

Don't forget to use the official IMS hashtag: **#IMS2024**

IMS MICROWAVE WEEK:

There's an app for that! Download papers in real time!

The IMS Microwave Week app is now available in the Apple App Store and Google Play store. Install the app on your Android or iOS device to view the full schedule of Workshops; Technical Lectures; IMS, RFIC, and ARFTG Technical Sessions; Panel Sessions; Social Events; and Exhibition Information. You will be able to download the technical content that you registered for, e.g., IMS and/or RFIC papers/presentations, workshop presentations; as well as locate exhibitors and explore everything that IMS has to offer! The app now includes an opt-in Social Networking Feature that lets you search for fellow attendees who opted-in to be contacted for networking. Download the app today!

To download the app, search for 'IMS Microwave Week' on the app store for your device or scan a QR code below.

Download on the App Store

ANDROID APP ON Google play

For assistance, please email: support@mtt.org

Wifi is available throughout the Convention Center!
SSID: IMS2024
Password: Washington

IMS2024 Table of Contents

WELCOME TO IMS2024 IN WASHINGTON, DC

SCOTT BARKER, SANJAY RAMAN, IMS2024 GENERAL CHAIRS

It is our great honor to welcome you to Washington, DC. The last time the IEEE MTT-S International Microwave Symposium was held in the U.S. capital was 1980! Much has changed since then for both the IMS and DC while some of the best parts of both are alive and well. In 1980 there were ~1,500 attendees, 160 papers, and 123 exhibitors; today the IMS has grown to ~10,000 attendees, ~350 papers, and ~550 exhibitors. Both the Automatic Radio Frequency Techniques Group (ARFTG - first co-located with IMS in 1979) and the Radio Frequency Integrated Circuits Symposium (RFIC - initially launched as the IEEE Microwave and Millimeter-Wave Monolithic Circuit Symposium in 1982) are still vibrant components of Microwave Week. The Washington DC region is home to many high technology companies, major aerospace and defense firms, government science & technology agencies, and national laboratories, including the U.S. Army and Navy Research Labs, and the National Institutes of Standards and Technology.

The area around the Walter E. Washington Convention Center, including Penn Quarter, Chinatown, and the Shaw district, is one of the most dynamic parts of the city with a phenomenal restaurant and bar scene, and within 10 blocks of the White House and the National Mall. And Washington, DC boasts the greatest number of completely free museums — there are over 40 museums and attractions in Washington, DC that can be visited without charge, including the 17 museums and galleries that together comprise the Smithsonian Institution. It is quite convenient to get around the city and the region using DC's extensive Metro system, which also connects directly to Reagan National Airport (DCA) and Dulles International Airport (IAD).

IMS2024 thematic areas that highlight the symposium's focus on "Capitalizing Across the Spectrum." In addition to showcasing a broad spectrum of engaging technical topics, IMS2024 will celebrate the diversity of contributions, talents, and accomplishments across our community's "human spectrum" throughout the week. Moreover, the major technical themes of the conference will emphasize the role our host city of Washington, DC has played in supporting the use and management of the RF-to-THz spectrum, including: **Systems and Applications, Aerospace and Security, Spectrum Coexistence and Sustainability**, each as thematic days, and Emerging Technologies and Directions. The Future Directions theme for this year's IMS is **Wireless Power Transfer**, with a boot camp, workshops, and collection of special, focus and panel sessions on this emerging topic area. On Wednesday, we will also be co-locating with the industry-focused FutureG Summit, which we are jointly sponsoring with the IEEE Microwave Theory and Technology, Antennas & Propagation, Communications, and Photonics Societies. We are also continuing forward several industry engagement efforts introduced in recent years, including the industry showcase session immediately before the Monday plenary session, best industry paper awards, and session keynotes. In addition, we are emphasizing Diversity, Equity, Inclusion and Belonging, cutting across all aspects of the symposium. This effort starts with the creation of a new Executive Committee level position - the Outreach and Inclusion Chair. We have also started collecting additional optional demographic information from our attendees so that we are able to understand and appreciate the great diversity that already exists within our community as well as identify those areas where we need to be more inclusive. In addition, we have updated our selection processes to ensure that our conference events are representative of the diversity of our community. We hope this effort will continue into the future so that the IMS will continue to lead the way as the premier international microwave conference!

We are thrilled to welcome you to IMS2024 in Washington, DC for Microwave Week, 16-21 June 2024. And you will have another opportunity to experience IMS in the capital of the U.S. as IMS will return to Washington, DC in 2029!

GET TO KNOW **WASHINGTON, DC**

Did you know that Washington, DC is not part of any state? It is actually a 68 square-mile US territory. In 1789 the US Constitution required the creation of federal district that is exclusively controlled by the US Congress.

DC was designed by Pierre Charles L'Enfant in 1791 for then president, George Washington. L'Enfant was a French engineer who served in the Continental Army during the American Revolutionary War. His grand plan centered on a 2-mile stretch from the US Capital to the Potomac River, to be used as a grand public walk. This area was named the National Mall. It is surrounded by museums, memorials and monuments.

The avenues of DC were designed to support transportation and ease of movement. It's a very walkable city. However metro is also a great way to get around quickly. When riding the Metro, you should always walk on the left and stand on the right side of any escalator. Never stand on the left side of a Metro escalator.

DC is a waterfront city. There are two main harbors, the National Harbor and the Washington Harbor, along the Potomac River. You can take riverboat cruises and Duck-boat tours. Just be sure to book ahead.

Most of the museums are free! However, be sure to make reservations ahead of time. In an effort to provide a great experience, museums limit the number of admissions per hour or half hour. If you wait until the day before, to reserve a ticket, the museum might not have any availability.

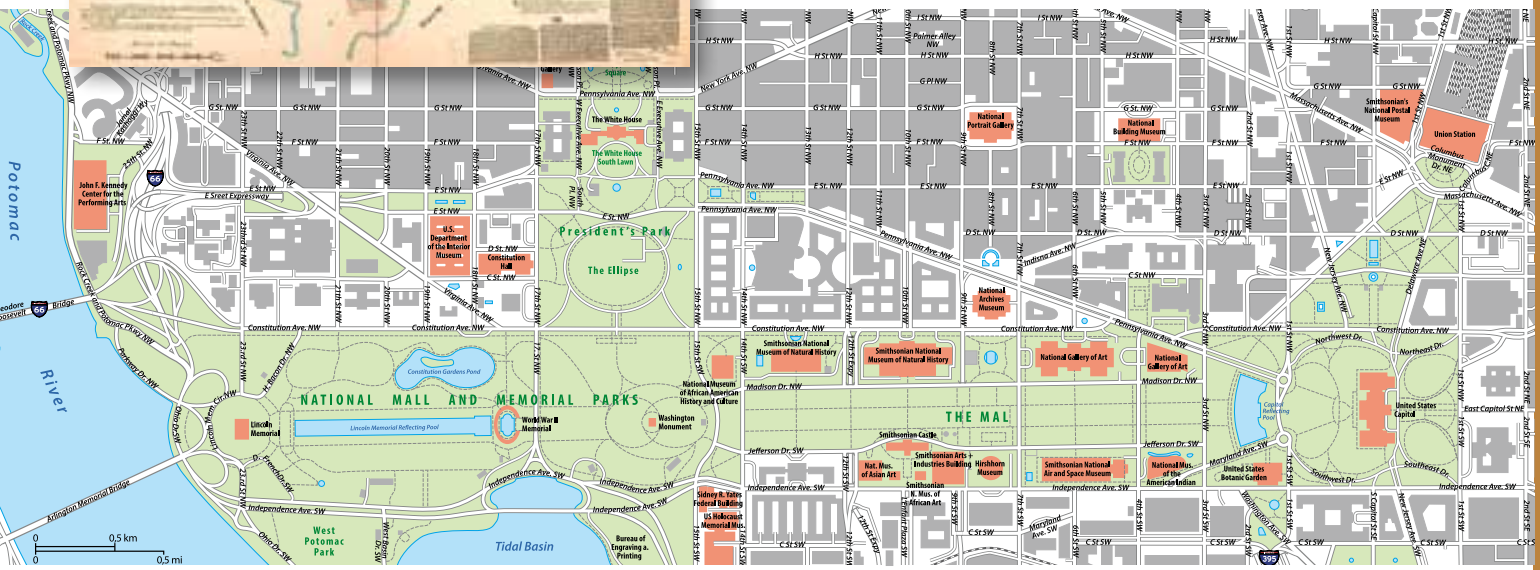
SHORT LIST OF MUSEUMS

Air and Space Museum
American History Museum
American Indian Museum
African American History and Culture Museum (The IMS Welcome Reception will be held here)
African Art Museum
Asian Art Museum
American Art Museum
International Spy Museum (The WIM, YP, HAM and MTT-S Journals Receptions will be held here)
Museum of Natural History
National Gallery of Art
National Archives Museum (home of the Declaration of Independence, Bill of Rights and the US Constitution)
Smithsonian Museums (17 museums and galleries)
United States Holocaust Memorial Museum

SHORT LIST OF MONUMENTS

Washington Monument
Lincoln Memorial
Jefferson Memorial
World War II Memorial
Korean War Veterans Memorial
Vietnam Veterans Memorial
Martin Luther King Jr Memorial
Franklin Delano Roosevelt Memorial
US Government Offices
Library of Congress
Supreme Court
United States Treasury
The White House
US Capitol

Of course, there are great places to eat as well! You can head to U Street and have a meal at the well known Ben's Chili Bowl. https://washington.org/find-dc-listings/bens-chili-bowl. There are tons of options in the city's Penn Quarter and Chinatown districts. https://washington.org/places-to-eat/penn-quarter-chinatown-washington-dc. MasterChef's Gordon Ramsay has planted roots in DC with the iconic Hell's Kitchen, new to The Wharf. For seafood, try the Old Ebbitt Grill, opened in 1856. The restaurant is home to a famed raw bar happy hour and is known for events like its annual Oyster Riot.



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WASHINGTON, DC

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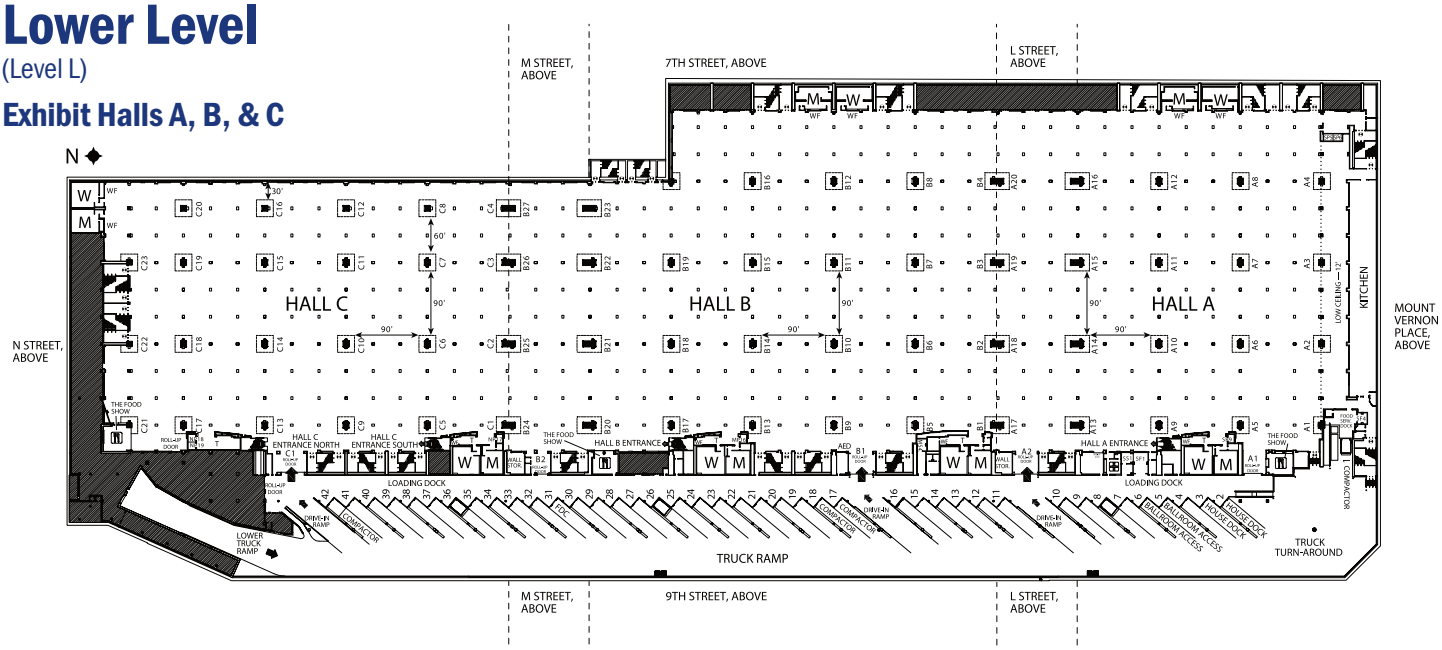
GETTING AROUND AT IMS2024

WALTER E. WASHINGTON CONVENTION CENTER

Lower Level

(Level L)

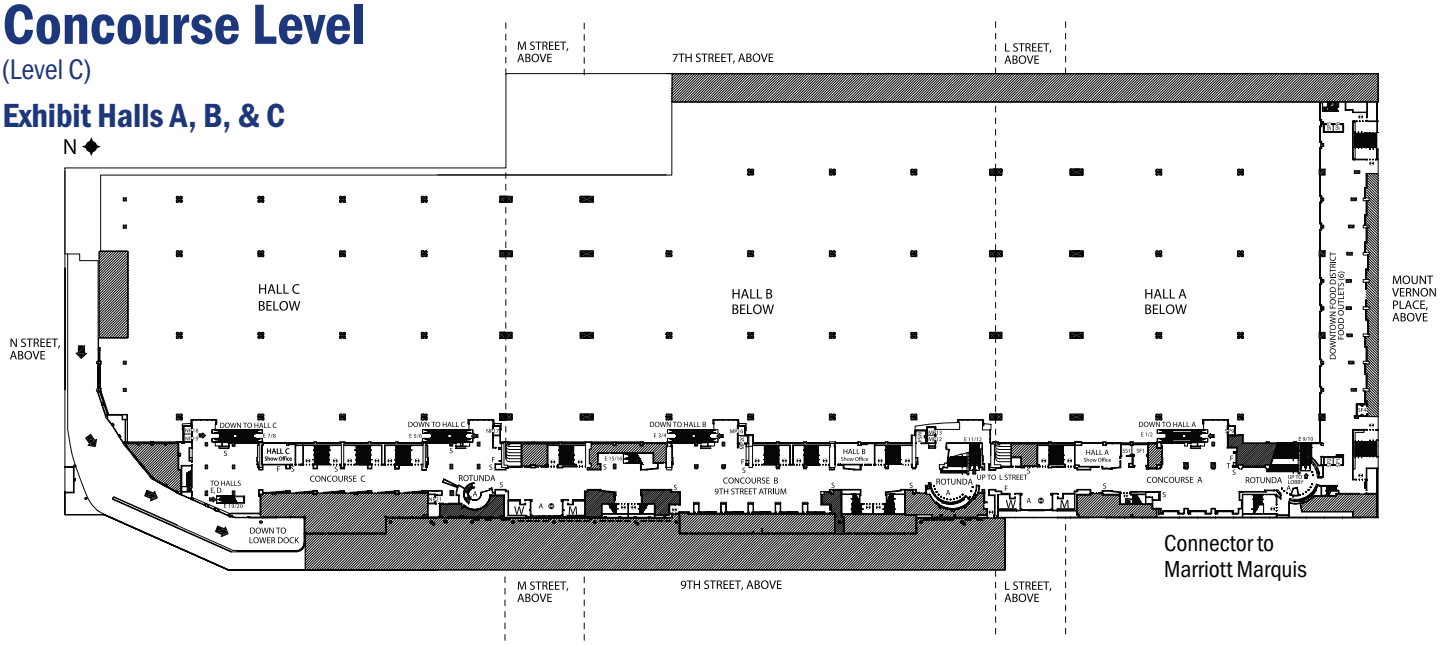
Exhibit Halls A, B, & C



Concourse Level

(Level C)

Exhibit Halls A, B, & C

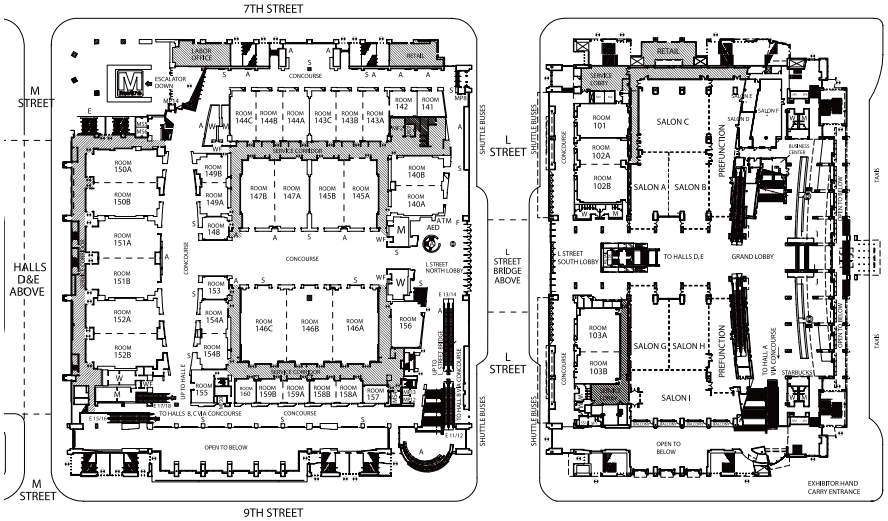


Connector to Marriott Marquis

Street Level

(Level 1)

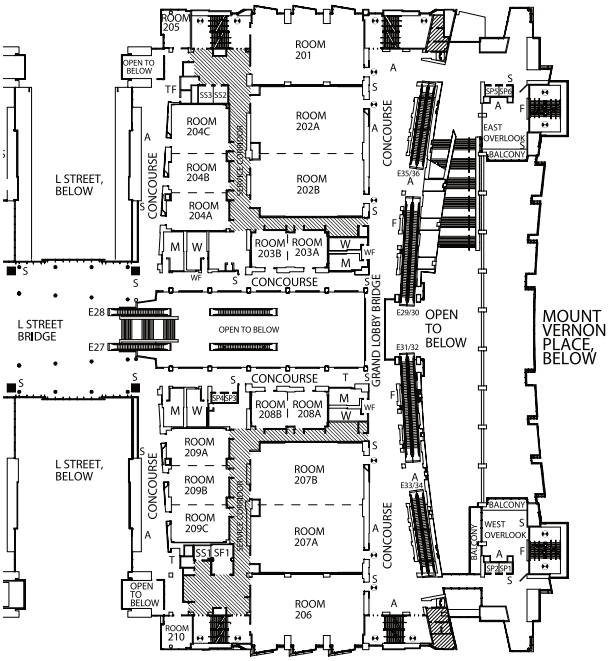
Grand Lobby/Registration/Salons A–I
Meeting Rooms 101–103 & 140–160



Level Two

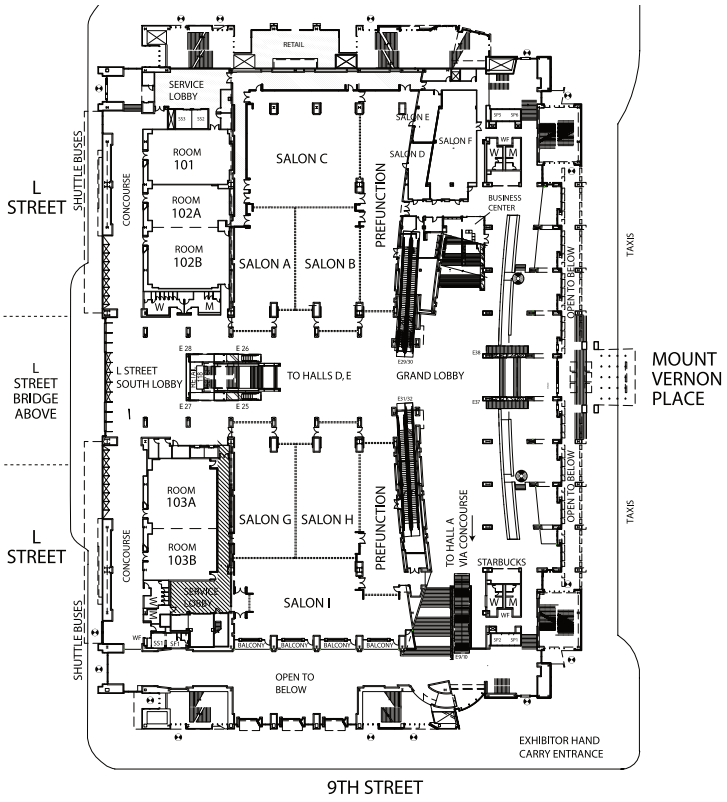
(Level 2)

Exhibit Halls D & E / Meeting Rooms 201–210/ East and West Overlook



Salons

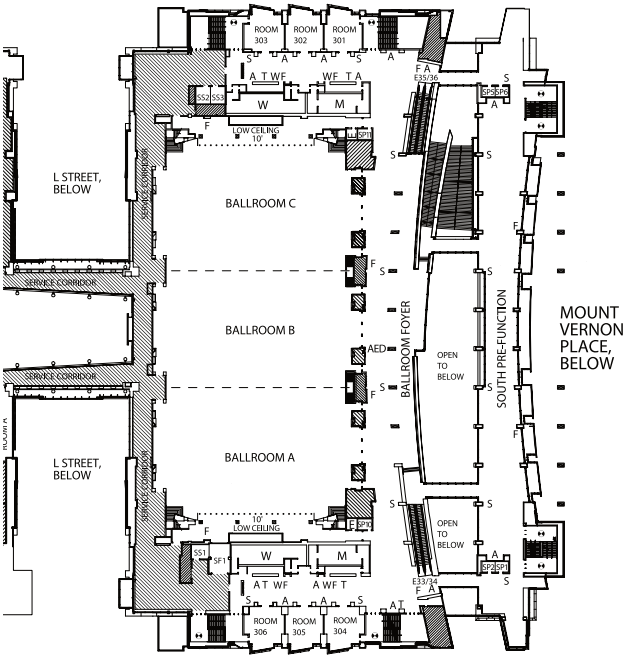
(Level 1)



Level Three

(Level 3)

Ballroom, Meeting Room 301–306, Kitchen



Coffee Breaks

Sunday	AM–09:40-10:10	Level 1 Meeting Room Foyer
	PM–15:10-15:40	Level 1 Meeting Room Foyer
Monday	AM–09:40-10:10	Level 1 Meeting Room Foyer
	PM–15:10-15:40	Level 1 Meeting Room Foyer
Tuesday	AM–09:40-10:10	IMS Exhibit Floor
	PM–15:10-15:40	IMS Exhibit Floor
Wednesday	AM–09:40-10:10	IMS Exhibit Floor
	PM–15:10-15:40	IMS Exhibit Floor
Thursday	AM–09:40-10:10	IMS Exhibit Floor
	PM–15:10-15:40	Level 1 Meeting Room Foyer

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WEEK **AT-A-GLANCE**

Workshops Technical Lectures RFIC Bootcamp Three Minute Thesis IMS
Panel Sessions Future G Summit Exhibit Hall Activities Focus Groups ARFTG

On-site registration for all events will be available at East Registration in the Grand Lobby of the Walter E. Washington Convention Center.

ON-SITE REGISTRATION HOURS

Saturday, 15 June	08:00 - 17:00
Sunday, 16 June	07:00 - 18:00
Monday, 17 June	07:00 - 18:00
Tuesday, 18 June	07:00 - 18:00
Wednesday, 19 June	07:00 - 18:00
Thursday, 20 June	07:00 - 16:00
Friday, 21 June	07:00 - 10:00

BOXED LUNCH DISTRIBUTION:

Boxed Lunch Distribution will take place Sunday–Friday in the Level 1 Meeting Room Foyer of the Walter E. Washington Convention Center.

Note: Boxed Lunches are included with Workshops and Boot Camps. They are also available for pre-purchase in the registration system. through 14 June 2024 (the advance registration deadline).

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SUNDAY WORKSHOPS

08:00 – 17:20 | Sunday, 16 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WSA	**Addressing Microwave Measurement and Engineering Challenges in Realising Practical Quantum Computers** **Sponsor/s:** IMS; ARFTG **Organizers:** Manoj Stanley, *NPL*; Masahiro Horibe, *AIST*; Nick Ridler, *NPL* **ROOM: 149AB** **08:00 – 17:20**	The growing field of quantum computing relies on a broad range of microwave technologies and has spurred development of microwave devices and methods in new operating regimes. But despite the significant progress made in the last decade in the science, engineering and characterization of quantum computation systems, several challenges remain to be overcome before quantum computation can become practically usable. One of the most promising quantum computing technologies is the superconducting quantum computing platform, which relies on microwave waveforms and devices to control and readout quantum bits, typically at cryogenic temperatures of tens of milli-kelvin. The advancement of quantum computing implies an increase in number of qubits within or across quantum processors leading to a significant increase in microwave cabling and components operating at such cryogenic temperatures to operate the quantum processors. This puts stringent requirements on heat-load, space, and signal integrity under these extreme temperatures. The challenges of realizing such practical large-scale quantum computing systems present microwave engineers and metrologists with opportunities in cryogenic microwave modeling, design, measurement, and characterization of cryogenic semiconductor and superconductor components, circuits, systems, and networks. This workshop reviews the existing microwave measurement and engineering challenges in realizing a practical quantum computer and addresses some of these challenges. The workshop includes talks from end-users, instrument and equipment manufacturers, academia, and national measurement labs from around the world.
WSB	**Highly Reconfigurable Mixed-Signal RF Front-End Approaches for 5G and Beyond** **Sponsor/s:** RFIC; IMS **Organizers:** Anis Ben Arfi, *Analog Devices*; Hao Wang, *MediaTek* **ROOM: 144AB** **08:00 – 11:50**	The pursuit of ubiquitous connectivity and the rapid evolution of wireless communication technologies such as 5G and mm-wave have spurred a growing demand for RF front-end design that can operate across a wide frequency spectrum for various communication standards. However, achieving highly reconfigurable transceivers for multiple communication standards and frequencies presents a series of challenges. Accommodating various frequency bands necessitates multiple bulky filters in both transmitter and receiver, leading to increased form factor, cost, and insertion loss. High-speed communications typically with high peak-to-average power ratios (PAPR) require more power backoff in power amplifier (PA) for good linearity while compromising transmitter efficiency. Moreover, ultra-high-speed communications such as 5G mm-wave call for ultra-low-jitter local oscillator (LO) and clock generation with fine frequency resolutions. This workshop focuses on addressing these challenges through the approaches of RF/analog/digital hybrid design techniques. Critical circuit topologies including RF digital-to-analog converter (RFDAC), digital power amplifier (DPA), N-path filter/mixer, magnet-free circulator, and fractional-N sub-sampling all-digital phase-locked loop (ADPLL) are presented. The audiences are invited to explore the integration of these techniques to achieve unified transceiver architectures with exceptional reconfigurability. Five prominent speakers from leading institutes and companies will present their latest works and share insights on the development of advanced RF front-end design. Two speakers will delve into the design of RFDACs and DPAs in high-efficiency transmitters. Afterwards, another two speakers will discuss N-path filters and mixers, as well as magnet-free circulators, for high-selectivity receivers and full-duplex transceivers. Finally, the fifth speaker will guide our attentions to the LO and clock generation, by presenting the design of ultra-low-jitter fractional-N all-digital sampling phase-locked loops. The workshop serves as a collaborative platform, bringing together experts from academia and industry to discuss and envision the future of highly reconfigurable transceiver IC design. Through the presentations and the panel discussion session, attendees will gain valuable insights into the cutting-edge techniques driving the development of RFIC design.
WSC	**Latest Developments in RF/MW Devices, Circuits and System Technology for High-Power Applications in ISM and Aerospace & Defense** **Sponsor/s:** IMS **Organizers:** David Brown, *BAE Systems*; Gabriele Formicone, *Integra Technologies* **ROOM: 209ABC** **08:00 – 17:20**	This workshop gathers together world experts, research and industry leaders to report and discuss the latest RF/MW technology developments that continue to drive innovation in high-power applications in Aerospace & Defense, as well as in ISM. Specific areas of interest discussed in this workshop span from vacuum tubes (VEDs) to solid-state transistors for active devices, to circuit design and techniques, as well as specific applications that leverage the benefits of the evolving technology. This full-day workshop is geared towards practitioners in the high-power RF/MW aerospace, defense, industry, scientific and medical areas who want to gain a broader perspective on the latest technology developments as well as nuances specific to each different application. Novices and newcomers to the A&D and ISM industry will also gain a comprehensive exposure and understanding of the RF/MW landscape that drives innovation in this specific arena.
WSD	**New Trends of R&D of Space Based Solar Power and Beam Wireless Power Technology** **Sponsor/s:** IMS **Organizers:** Christopher T. Rodenbeck, *U.S. Naval Research Laboratory*; Naoki Shinohara, *Kyoto University* **ROOM: 144C** **08:00 – 17:20**	Recently, new research projects toward Space Based Solar Power (SBSP) and related beam Wireless Power Technology (WPT) are born simultaneously in the world. The SBSP was originally called a Solar Power Satellite (SPS) and it was proposed in 1968. The SBSP is a future power station in geostationary satellite orbit and the electricity generated in space is transmitted wirelessly via microwave beam to the ground. In the past 50 years, research and development projects toward the SBSP were carried out several times in US, in Japan, and in Europe. In each R&D project, new SBSPs were designed with the latest technology at the time. What is different now is that the industrial revolution is happening in parallel. For example the commercial WPT (both coupled WPT and far-field WPT) market has started in the past 10 years. Revolutionary start-up companies for space applications are developing. Based on changes in the business market, new R&D projects toward the SBSP have now started in US, in Japan, in Europe, in China, and in other countries. In this workshop, we focus on the new technologies and new R&D projects of the SBSP and related beam WPT R&Ds. The requirements of the beam WPT for the SBSP are accurate beam forming with a huge phased array, high-efficiency microwave transmitter/generators, novel high-efficiency devices, high-efficiency rectifiers with diodes, harmonization between the WPT beam and conventional wireless systems, and suppression of interference between the WPT beam and space plasma/atmosphere, etc. ITU-R (International Telecommunication Union Radiocommunication Sector) recommends frequencies suitable for commercial WPT, especially weak-powered wide-beam WPT in 2022. The Japanese government established new radio regulation of the weak-powered wide-beam WPT in 2022. Radio regulations are under discussion for beam WPT suitable not only for the SBSP but also for WPT aided drone, etc, which is the expected 2nd step of commercial WPT in the world. The WPT technologies introduced in this session are widely applicable both to the SBSP and to 2nd step commercial WPT.

SUNDAY WORKSHOPS

08:00 – 17:20 | Sunday, 16 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WSE	**Multi-Functional RF Integrated Passive Components for 6G, Radar Systems, and Beyond** **Sponsor/s:** IMS **Organizers:** Guoan Wang, *University of South Carolina*; Qingfeng Zhang, *SUSTech*; Sukomal Dey, *IIT Palakkad*; Xun Luo, *UESTC* **ROOM: 201** **08:00 – 17:20**	With ever-increasing advances in the fields of the modern wireless technologies (eg 6G and radar systems), the design of compact and multi-functional transceivers to meet the stringent requirements demanded by such systems remains a great challenge. In this context, multi-functional RF integrated passive components (IPCs) are considered key building circuits for their development. These components are based on novel miniaturized structures and specific technologies that can be utilized for the implementation of RF, microwave, mm-wave, and THz wireless systems. This unique workshop focuses, for the first time, on the area of IPCs and their applications in the context of 6G wireless and radar scenarios by reporting recent research findings in this exciting field. This includes current progress in miniaturized RF passive components enabling multi-functional and adaptive radios from the aspects of thin-films integration (eg ferroelectric and ferromagnetic thin films), on-chip tuning techniques (eg diodes and transistors) and novel THz (eg f-band, D-band, etc) passive components with application in active circuits will be presented. Furthermore, state-of-the-art transmission line synthesis and development will be presented. In particular, the technique of mode diversity and mode composition will be explained and discussed with a number of examples, including an emerging concept of mode selectivity. Theoretical and experimental results will be presented in an effort to explore structural integration, physical agility, multifunctional operation, and performance enhancement of integrated transmission lines. In addition, multi-functional on-chip reflectionless components (eg CMOS and SiGe passives) and integrated antenna sub-system, along with hybrid acoustic-wave lumped-element microwave resonator technologies for the realization of advanced compact microwave filtering devices are described. Finally, the latest advances in the area of RF to THz passive micro-systems for multi-functional applications in 6G, radar system, and beyond, will also be presented.
WSF	**3D Heterogeneous Integration and 3D-Packaging Targeting 5G-6G mm-Wave and Sub-THz Communication and Sensing** **Sponsor/s:** IMS; RFIC **Organizers:** Didier Belot, *STMicroelectronics*; Pierre Busson, *STMicroelectronics* **ROOM: 143ABC** **08:00 – 11:50**	The 6G Telecom generation forecasts mm-wave and sub-THz applications as Fronthaul and Backhaul mm-wave and sub-THz wireless links; Reflective Intelligent Surface between mini-cell station and devices mainly in mm-wave frequency range; Short distance ultra-high data-rate mm-wave and sub-THz wireless data storage transfer; Automotive Joint communication and Sensing Radars; Health and Industrial mm-wave and sub-THz Radars and imagers; and other applications which are not yet defined. A Key challenge facing us is how to manage multi-processes dies with antennas integrated in the same object, reducing losses, and then increasing power efficiency and, at the same time targeting the cost efficiency. The workshop will discuss the trade-off Power Efficiency/Cost Efficiency of different 3D assembly strategies and will try to have a picture of the most promising research in the domain, through topics which will address as III-V GaN/Si and InP/Si, with SiGe and or CMOS Heterogeneous Integration; Wafer to Wafer; Die to Wafer, Backend of line co-integration; mm-wave sub-THz packaging, including Antenna integration, Si-Interposers, organic interposers, and other packaging 3D approach. The power efficiency can be defined as the max data rate ability, with the max distance covered by the transceiver over its power consumption, the cost efficiency is max data rate ability, with the max distance covered by the transceiver over its cost. This simple relation does not take into account the cooling equipment, if necessary, the reliability, and finally the environmental impact of the different strategies. These last points are difficult to quantify at the research level.
WSG	**Digital Intensive Transmitters From RF to mm-Wave: Empowering Intelligent and High Data-Rate Wireless Communication** **Sponsor/s:** IMS; RFIC **Organizers:** Austin Chen, *Peraso, Inc.*; Huizhen Jenny Qian, *Xidian University*; Jeffrey Walling, *Virginia Tech* **ROOM: 143ABC** **13:30 – 17:20**	Advanced CMOS technologies enable direct bits-to-RF conversion, which provides higher energy-efficiency and more compact die area, especially for sub-7GHz. Meanwhile, such digital intensive transmitters, with highly reconfigurable nature are well adapted for multifunction and intelligent communication systems. When the operation bands extend to mm-wave to meet the increasing data streaming requirements of modern communication systems (eg 5G, 6G, etc), digital intensive transmitters also exhibit potential advantages compared to traditional Cartesian transmitters. This workshop discusses techniques of digital intensive transmitters operating from sub-7GHz to mm-wave with continuous evolution of higher output power, efficiency, data-rate, and multi-functions such as distortion self-calibration, multi-band, multi-mode, etc.
WSH	**Operating at the Extreme: RFIC Design Techniques for Operation Beyond the PDK Limits** **Sponsor/s:** RFIC **Organizers:** Amrita Masurkar, *BAE Systems*; Travis Forbes, *Sandia National Laboratories* **ROOM: 147AB** **08:00 – 11:50**	Emerging applications such as satellite-based internet, quantum computing, high-temperature sensors and communications systems, and massive Internet-of-Things (IoT) wireless networks are enabling disruptive advances in computational ability, global internet coverage, device-to-device communications, and industrial and military sensing abilities. However, all of these extreme environments require integrated circuits to operate well beyond environmental ranges and operating voltages provided by the standard Process Development Kits (PDK) and require a combination of design skills traditionally held in non-overlapping design communities. This workshop will bring together these design communities through experts from academia and industry to provide attendees with a holistic view on overcoming these challenges. Starting near zero Kelvin, the first talk will give an overview of circuit design at cryogenic temperatures including effects on devices, matching, and how to overcome these effects. Taking it hotter, the next talk will cover device effects operating well above 150C and ongoing research to enable high yield systems at these temperatures. Making the workshop RAD, the third talk will give an overview of radiation effects on CMOS circuits and ways to design RF and analog circuits to overcome these effects. Taking it out of this world, the fourth talk will cover challenges of both radiation and temperature effects found in space-based applications and design techniques to overcome these challenges. The final talk will cover dense wireless environments with high-power RF blockers pushing the limits of the supported process supply voltage and RFIC design techniques to filter and operate through this interference. To end the workshop, we will bring the experts together for cross-pollination of ideas through a panel interaction with attendees. Can this panel create a space radiation hardened, any temperature-stable, high-power handling device? ... Come and find out!
WSI	**From Prototype to Product: Overcoming Productization Challenges** **Sponsor/s:** RFIC **Organizers:** Bichoy Bahr, *Texas Instruments*; Joseph Cali, *Raytheon*; Oren Eliezer, *Samsung* **ROOM: 147AB** **13:30 – 17:20**	Are you a student or a professional researcher seeking insights into the process of productizing ideas? Perhaps you are an experienced designer keen on understanding how fellow professionals have surmounted challenges during product development. If so, this workshop is tailored for you! Industry experts representing high-volume commercial integrated circuit (IC) companies, IP developers, aerospace, and defense sectors will share their experiences of navigating the journey from conceptualization to fielded product. Engaging discussions will encompass a diverse array of topics, spanning high-speed analog to digital converters, digital to analog converters, mm-wave packaging, multi-antenna beam steering calibration, RF front-ends and the benefits of RF/packaging co-simulation. During the developmental phase of prototypes, constraints related to budgets and schedules often hinder thorough validation, verification, and testing procedures. Consequently, this limitation can lead to the emergence of latent defects that remain undetected until later stages of productization. In these scenarios, research teams and start-ups may be primarily focused on core innovations and transformative concepts, only to encounter obstacles when the company aims to expedite the implementation of these ideas. For instance, in startup environments lacking dedicated facilities for environmental testing, issues like low-temperature oscillations (which are unobservable during simulations) may go unnoticed until far too late. The instances discussed within this workshop serve as valuable examples that can form the basis of a comprehensive checklist, enabling a smoother transition from the prototype phase to the final product. We hope this workshop could potentially prevent the need for extensive reiterations, saving both time and resources for you and your colleagues.

SUNDAY WORKSHOPS

08:00 – 17:20 | Sunday, 16 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WSJ	**Ultra-Wideband Efficient PAs and Broadband Matching Design Techniques** **Sponsor/s:** IMS; RFIC **Organizers:** Salvatore Finocchiaro, *Qorvo*; Teerachot Siriburanon, *University College Dublin* **ROOM: 145AB** **08:00 – 11:50**	The evolution of 5G and the need for increased capacity drive new transmitter requirements. Broadband and multiband operation requires the Power Amplifiers (PAs) to support a wider operating frequency range and high data rate require large instantaneous bandwidths, further extended by carrier aggregation, while delivering high power and maintaining high efficiency. Additionally, modern systems require complex modulation schemes exhibiting high Peak-to-Average-Power Ratio (PAPR) of more than 10dB. When operating at high Output-BackOff (OBO), Drain and Power Added Efficiency (DE and PAE) of traditional PA is typically low, with the majority of power dissipated in heat! New efficiency enhancement architectures and design techniques, from Waveform Engineering, to Load Modulation (Doherty, Outphasing and LMBA) and Supply Modulation (Envelope Tracking), have been explored in recent years. The desire for the widest possible operational bandwidth (operating frequency range) to reduce system complexity and cost is driving new broadband design techniques exploring broadband combining and broadband matching. This workshop will introduce recent trends in PA architectures, PA design and broadband matching techniques addressing the three major challenges listed above, ie wide operating bandwidth, wide instantaneous bandwidth, and large PAPR. We will look at design trade-offs to improve and maintain efficiency while satisfying system requirements which include ACLR, EVM, and other metrics for 5G New Radio (5GNR) waveforms. The concept of linearization and Digital Predistortion (DPD) will be introduced in the context of evaluating the PA performance with respect to system requirements. Experts from industry and academia that are at the frontline of these developments are invited to address these issues and inform the audience about the latest advances in this field.
WSK	**Flexible Arrays as the Next Frontier in Wireless Communications** **Sponsor/s:** IMS; RFIC **Organizers:** Antoine Frappé, *IEMN (UMR 8520)*; Najme Ebrahimi, *University of Florida*; Subhanshu Gupta, *Washington State University* **ROOM: 145AB** **13:30 – 17:20**	With global networking data traffic predicted to reach petabytes in the next few years, mm-wave wireless communications enabled by silicon-based phased arrays is poised as a game-changer for new infrastructure applications. Emergence of untethered space constellations such as low-earth orbit (LEO) satellite communications approximately lying between 500km to 800km altitude such as Amazon Kuiper (590–630km), SpaceX Starlink (550–750km), OneWeb (1200km), and Telesat Lightspeed (1015–1325km) will further benefit global connectivity. By utilizing the fallow spectrum at mm-wave, it is expected to provide gigabits-per-second data rates to multiple users including under-served and remote areas. While planar mm-Wave phased arrays have cemented their position in communication systems, the future of satellite constellation hosting thousands of antenna elements is dependent on the choice of frequency, application, field-of-view, and form factor. Conformal phased arrays, which encompass mechanically flexible, foldable, or stretchable arrays, are one of the promising new frontiers of array development. Conformal antennas provides multiple degrees of freedom to the scan angle that is typically limited by antenna aperture. Recent works have demonstrated new viable research directions at the antenna-RF interface with the adaptive control that will be presented in this workshop.
WSL	**From Waves to Insights: AI/ML Techniques for Wireless Communications and Radar** **Sponsor/s:** RFIC **Organizers:** Alberto Valdes-Garcia, *IBM T.J. Watson Research Center*; Arun Paidimarri, *IBM T.J. Watson Research Center*; Young-Kai Chen, *Coherent* **ROOM: 150AB** **08:00 – 17:20**	Algorithms and processing pipelines based on Artificial-Intelligence (AI) and Machine-Learning (ML) techniques are on a solid trajectory to become an integral part of the next generation of wireless systems. While the exploration of AI/ML to RF applications started decades ago, their development has accelerated recently with the increasing availability of advanced AI knowledge, high-capacity compute infrastructure, and wireless testbeds for generation and training data sets. Nevertheless, the development of AI-enhanced wireless systems remains a challenging multi-disciplinary task, where EM, RF, IC design, signal processing, and ML expertise are all equally important. Emerging 6G wireless communications systems and mm-wave radar applications call for accelerated developments in this area. In particular, power consumption and latency requirements may require the implementation of optimized feature extraction methods in mixed-signal ICs closer to the antennas. The goal of this workshop is to bring together a set of active researchers to share their vision and expertise on these topics in order to bring a cross-disciplinary awareness and understanding among RFIC, AI, and systems communities. The speakers span academic and industrial research institutions from across the globe and the presentations will cover both wireless communications and radar.
WSM	**Future of Chiplet Technology and 3D Heterogeneous Integration** **Sponsor/s:** IMS; RFIC **Organizers:** Bahar Jalali Farahani, *Cisco*; Ko-Tao Lee, *Qorvo*; Mahdi Parvizi, *Cisco*; Salvatore Finocchiaro, *Qorvo* **ROOM: 151AB** **08:00 – 17:20**	As the Moore's law is coming to an end, separating large systems into smaller chips based on their functionality is not only a cost-benefit solution but it allows the complex system to expand beyond theoretical size limits. Although chiplet technology has been around for many years, it has not been till the rise of the AI supercomputers and the accompanied unprecedented computational demand that put the spotlight on SiPs (System in Package). There are different aspects to the design of chiplets including the packaging, the high-speed chip-to-chip interconnect and the interoperability and standardization which allow the SiP built by the combination of chips from different vendors. There are multiple benefits to the chiplet-based architectures. Breaking down the large complex systems into smaller chips based on their functionality means better yields and lower cost due to the lower probability of manufacturing defects. Cost reduction can also come with customizing the process technology for each chiplet (eg using advanced nodes for GPUs and CPUs and less expensive technologies for memories and analog interfaces). Design upgrades can also be done on certain functional blocks without the need for redesigning the whole system. To take full advantage of chiplet-based architectures, the D2D (die-to-die) interface needs to be standardized. The interoperability allows the developer to use multiple vendors. In terms of the packaging, development of 3DHI (3D Heterogeneous Integration) that enables stacking up separately manufactured components, is the perfect technology choice for chiplet-based architectures. Additionally, the ever-increasing demand for high-throughput communication links and high-resolution radar sensors is driving the development of future wireless systems at higher operating frequencies. In order to support multiple functionality, the flexibility requested to those systems, is driving the adoption of large phased array antennas. Heterogeneous technologies and vertical 3D integration will play a vital role in enhancing the performance and functional density, along with reducing the size and costs, of such RF systems. In addition to the already mentioned standardization, both on the digital and RF side, 3DHI will pose a new set of technology (processes and substrates), design (MMICs, RFIC, analog, power management, passives), packaging and thermal challenges. This workshop will address some of the challenges mentioned above both from the digital and RF point of view, combining commercial and defense perspectives with state-of-the-art research in the field. Experts from industry and academia that are at the frontline of these developments are invited to address these issues and inform the audience about the latest advances in this field.

SUNDAY WORKSHOPS

08:00 – 17:20 | Sunday, 16 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WSN	**Integrated Circuits for Control and Characterization of Quantum Processors** **Sponsor/s:** RFIC **Organizers:** Joseph C. Bardin, *Google Quantum AI and UMass Amherst*; Vadim Issakov, *Technische Universität Braunschweig* **ROOM: 152AB** **08:00 – 17:20**	Large-scale quantum computers promise to enable the solution to certain classes of problems for which no other efficient approaches are currently available. The realization of such a computer is hence a major open challenge that is being aggressively researched by academic and industrial teams across the globe. There are several types of competing qubit realizations, each offering different advantages. Yet, all of these realizations require some form of cryogenic cooling and most require RF electronics for control and potentially for readout (in several realizations the readout is optical). Moreover, integrating the control and/or readout electronics at an intermediate temperature stage within the cryostat is an attractive option. However, the circuits still need to fulfill stringent requirements on power consumption, spectral purity, noise budget etc, making their optimization challenging. As such, there is a growing opportunity for the RFIC community to influence this emerging field. In this full-day workshop the state-of-the-art in cryogenic RF circuits for various types of qubit realizations is reviewed. System considerations for various qubit modalities will be discussed, leading to the circuit-level specifications that drive the architectural considerations associated with control ICs targeting different qubit types. The talks will present different RF circuit design solutions for various types of qubits including silicon spin qubits, superconducting qubits, and trapped-ion qubits. The workshop features distinguished speakers from leading companies and academia, who will present their latest advances on cryogenic circuits for quantum computer applications. A brief concluding discussion will round-off the workshop to summarize the key learnings on the wide range of aspects presented during the day.
WSO	**Linearity and Efficiency Challenges in Wide Modulation Bandwidth Power Amplifier Design** **Sponsor/s:** RFIC **Organizers:** Debopriyo Chowdhury, *Broadcom*; Hyun-Chul Park, *Samsung* **ROOM: 146A** **08:00 – 17:20**	The rapid increase in data throughput in recent 5G (FR1 and FR2), Wi-Fi (6E and 7), and 6G (FR3 in the near future) requires high-efficiency, linear and wideband RF power amplifiers. However, it is extremely challenging to simultaneously enhance the linearity and efficiency of the power amplifier, especially for spectrally-efficient and wide modulation bandwidths (eg 320MHz for Wi-Fi 7, 100MHz for 5G FR1, and >400MHz for FR2). Higher order constellations like 4k-QAM for Wi-Fi 7, 256-QAM for FR2 make PA design a challenging task. This workshop will cover the "practical" and "most promising" linearity and efficiency improvement techniques for RF power amplifiers and transmitters. Several techniques like wideband envelope tracking, Doherty power amplifiers, digital transmitters, mm-wave power amplifiers etc, will be covered in a tutorial type fashion, with emphasis on practical aspects of the design.
WSP	**mm-Wave and Sub-THz Broadband Phased Array FE for Communication and Sensing** **Sponsor/s:** RFIC **Organizers:** Didier Belot, *STMicroelectronics*; Hao Gao, *Technische Universiteit Eindhoven*; Wanghua Wu, *Samsung* **ROOM: 146B** **08:00 – 17:20**	With technological advancement, the spectrum of possibilities within the realms of communication and sensing is expanding astonishingly. One of the most exciting frontiers in this domain is the utilization of mm-wave and sub-THz frequencies, offering a gateway to revolutionary advances in wireless communication and sensing. The workshop collects the transformative capabilities of mm-Wave and Sub-THz technologies, which collectively span the frequency range from 30GHz to 300GHz. This previously underutilized spectrum is now at the forefront of technological breakthroughs. At the heart of this paradigm shift lies the broadband front-end, a critical component that enables the seamless harnessing of mm-Wave and Sub-THz frequencies for applications that were once considered futuristic. One of the central themes of the workshop is the advancement of high-frequency communication technologies. Explore the latest developments in ultra-fast data transfer, low-latency networks, and the mm-wave and Sub-THz spectrum integration in wireless systems. Witness how these innovations reshape the connectivity landscape, enabling applications like 6G, autonomous vehicles, smart cities, etc. The workshop takes participants on a journey through the diverse applications of mm-wave and Sub-THz sensing, from radar systems that can revolutionize wireless communication to high-resolution imaging techniques that can potentially transform human life.
WSQ	**Phased Arrays and MIMO for mm-Wave 6G/WiFi and Sensing Systems** **Sponsor/s:** IMS; RFIC **Organizers:** Jin Zhou, *MediaTek*; Kostas Doris, *NXP Semiconductors*; Oren Eliezer, *Samsung*; Rocco Tam, *NXP Semiconductors* **ROOM: 146C** **08:00 – 17:20**	The reliance on digital beamforming and large arrays in mm-wave is increasing as communication and sensing systems migrate to higher frequency bands and occupy wider bandwidths. In this workshop experts in communications, automotive radar/sensing, antennas and silicon and packaging technologies will share their related experience and vision and discuss various challenges and solutions at the system, circuit, and technology levels.
WSR	**Sensing Modalities for the Road to Autonomy and Beyond** **Sponsor/s:** IMS; RFIC **Organizers:** Matt Markel, *Spartan Radar*; Zeshan Ahmad, *Cambridge Terahertz* **ROOM: 204ABC** **08:00 – 17:20**	Sensing modalities are enabling technologies for the ongoing revolution in autonomy. This is evident from the global sensor market that was valued at B in 2019 and is projected to reach over B by 2028. Camera, LiDAR, and RADAR dominate the autonomy field, and IR/thermal is now emerging as an important modality in that space. However, today none of the sensing modalities alone can solve the abundant challenges needed for robust, reliable, and trust-worthy autonomy in difficult environments. To that end, this workshop brings together a unique mix of top industry, academic, and regulatory body speakers to discuss these challenges, the current solutions, and what we can expect today's research to bring for tomorrow. The speakers bring a breadth of expertise and experiences ranging from electronics to photonics, integrated systems to sensor fusion, and OEMs to regulators; this insight comes together in a workshop-concluding panel discussion that dives deep into key forces pushing us towards — and holding us back from — autonomy.

WALTER E. WASHINGTON CONVENTION CENTER

QUANTUM BOOT CAMP

08:00 – 11:50 | Sunday, 16 June 2024 | Room: 206

The quantum computing industry relies heavily on microwave technologies, yet the connection between MTT-S and the quantum efforts is still nascent. For the quantum computing industry to succeed, it is essential to train multidisciplinary engineers who understand both quantum physics and microwave engineering. Quantum engineering is a fast-growing interdisciplinary field of research in which microwave and RF engineers can play an important role, especially in the areas of Quantum Sensing, Quantum Communications, and in the Microwave Control of Quantum Computing platforms.

The Quantum Boot Camp will introduce the basics of quantum engineering, targeting microwave engineers who want to understand how they can make an impact in this emerging field. It features speakers covering quantum engineering basics with a focus on the design, fabrication, control, and measurement of quantum system, with a focus on superconducting qubits. The course will conclude with an industry perspective from one of the leading commercial providers of quantum computing.

The intended audience includes new engineers, engineers who may be changing their career path, marketing and sales professionals seeking a better understanding of quantum technology, as well as current college students looking to learn more about the practical aspects of Quantum technology.

Organizers: **Joseph Bardin,** *Google;* **Nizar Messaoudi,** *Keysight Technologies*

Speakers:			
	Introduction to Quantum Computing William Oliver, *MIT*	**Microwave Engineering of Quantum Computers** Kevin O'Brien, *MIT*	**Industry Perspective: Quantum Computing at Google** Ofer Naaman, *Google Quantum AI*

WALTER E. WASHINGTON CONVENTION CENTER

RFIC TECHNICAL LECTURE

12:00 – 13:30 | Sunday, 16 June 2024 | Room: 207AB

LECTURE TITLE		ABSTRACT
TL1	 **Noise in Oscillators: From Understanding to Design** **Speaker:** Professor Ali Hajimiri, *California Institute of Technology*	In this technical lecture, we will discuss the fundamentals of noise processes within an oscillator and the associated design insights. We will start with understanding evolution of noise from device and external noise sources to phase noise. We will develop the time-varying phase noise model, discuss some of the nuances involved in it, and how a deeper understanding of that process can help us identify additional intuition in design of voltage controlled oscillators (VCO). We will investigate specific applications of this model to various kinds of oscillators, such as LC ad ring VCOs and how it fits with the general picture of frequency generation.

WALTER E. WASHINGTON CONVENTION CENTER

AI/ML BOOT CAMP

13:00 – 17:20 | Sunday, 16 June 2024 | Room: 206

The AI/ML Boot Camp will present the basics of Artificial Intelligence (AI)/machine learning (ML) for microwaves. The course is targeted to general audiences in the microwave community who are not necessarily experts in AI/ML. To start with, the course addresses basic questions such as: what is AI/ML. Why are AI/ML tools relevant for microwave community. How can AI/ML be used in microwave design, and how can it be adopted in microwave circuits and systems. We also address what the benefits and limitations of using AI/ML in microwave technologies are.

The bootcamp will introduce basic types of machine learning methods such as multilayer perceptrons, radial basis function networks, convolutional neural networks, time-delay neural networks, recurrent neural networks, long-short term memory networks, generative adversarial networks, and reinforcement learning. Examples of applications of AI/ML to microwaves will be presented.

This bootcamp is intended for engineers who want to learn the basics of AI/ML or are interested in using AI/ML for microwave applications, marketing and sales professionals who are interested in understanding the basics and relevance of AI/ML for microwaves, and university students who like to acquire the basic knowledge of AI/ML. We will also provide ample opportunities for audience interaction and Q&A.

Organizers: **Qi-Jun Zhang,** *Carleton University;* **Costas Sarris,** *University of Toronto;* **Ulf Gustavsson,** *Ericsson*

Speakers:				
	AI and Machine Learning for Microwave Design – An Introduction Qi-Jun Zhang, *Carleton University*	**AI for 3D Radar – Approaches and Opportunities** Asaf Tzadok, *IBM T.J. Watson Research Center*	**Scientific Machine Learning: Principles, Methods and Applications** Costas Sarris, *University of Toronto*	**Augmented Intelligence for End-to-End Design** Xia (Ivy) Zhu, *Intel Corporation*

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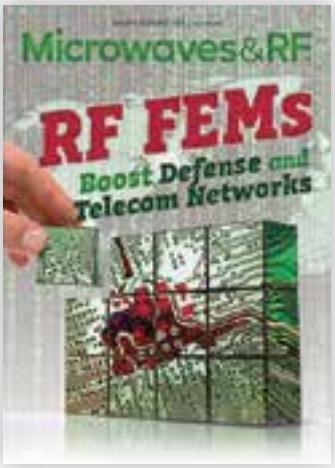

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WALTER E. WASHINGTON CONVENTION CENTER

RFIC PLENARY SESSION | 17:30 – 19:00 | Sunday, 16 June 2024 | Ballroom

The 6G Network at the Center

KEYNOTE SPEAKER: Peter Vetter, *President of Bell Labs Core Research, Nokia*

ABSTRACT: 6G is no longer a mere long-term aspiration. It is a framework of technologies that will become reality by the end of the decade. We are transitioning from the idea-generation phase to systematization and proof-of-concept realization. In this talk, we give our vision of the 6G network at the center that is an essential pilar equal to artificial intelligence (AI) and cloud to shape the future of human augmentation. We will summarize the main technology areas for 6G and provide some research highlights. These include new spectrum technologies in the upper midband 7-15 GHz, which the industry identified as a priority for 6G, sub-THz bands, which is essential for future backhaul and has potential for joint high-capacity communication and sensing, AI, which may cause a paradigm shift for air interface design, and energy efficient radio access, which is seen as one of the key requirements for 6G.

SPEAKER BIO: Peter Vetter is President of Bell Labs Core Research and Bell Labs Fellow. He leads an eminent global research organization with the mission to create game changing innovations that define the future of networks and insure portfolio leadership for Nokia's core business. During an international career of thirty years in research leadership mostly in fixed and mobile networks, he and his teams have realized several world-first system demonstrations and successfully transferred industry leading concepts to the business groups. He received a PhD at Ghent University (Belgium) in 1991 and was a post-doctoral fellow at Tohoku University (Japan) until 1993. He then joined the research center of Alcatel (now Nokia) in Antwerp and has worked at Bell Labs in Murray Hill, New Jersey since 2009. He is IEEE Fellow and Honorary Professor of KU Leuven.

CMOS Technology Evolution for Revolutionary Impact

KEYNOTE SPEAKER: Prof. Tsu-Jae King Liu, *Dean of the College of Engineering, UC Berkeley*

ABSTRACT: Steady advancement in complementary metal-oxide semiconductor (CMOS) integrated circuit (IC) technology has enabled the capability and affordability of computing and communication devices to improve exponentially over time, giving rise to cloud computing and the Internet of Things, which together with advances in machine learning have ushered in the era of Artificial Intelligence. To date, CMOS technology advancement has been driven primarily by market demand for faster and more energy-efficient digital computing; as such, transistor scaling to sub-10 nm technology nodes has presented challenges for analog/RF IC design. In this keynote presentation I will discuss evolutionary advancements in CMOS technology that can address these challenges, focusing on relevant figures of merit, for revolutionary impact.

SPEAKER BIO: Tsu-Jae King Liu received the B.S., M.S. and Ph.D. degrees in Electrical Engineering from Stanford University. She joined the Xerox Palo Alto Research Center as a Member of Research Staff in 1992, to research and develop high-performance thin-film transistor technologies for flat-panel display applications. In 1996 she joined the faculty of the University of California, at Berkeley, where she now holds the Roy W. Carlson Distinguished Professorship in Engineering. From 2000 to 2004 and from 2006 to 2008, she served as the Faculty Director of the UC Berkeley Microfabrication Laboratory. From July 2004 through June 2006 she was Senior Director of Engineering in the Advanced Technology Group of Synopsys, Inc. (Mountain View, CA). From 2008 through 2012, Professor Liu was the Associate Dean for Research in the College of Engineering at UC Berkeley. She also served as Faculty Director of the UC Berkeley Marvell Nanofabrication Laboratory in 2012. From 2012 to 2016 she served as Chair of the Electrical Engineering Division, and from 2014 to 2016 she served as Chair of the EECS Department.

Professor Liu's awards include the Ross M. Tucker AIME Electronics Materials Award (1992) for seminal work in polycrystalline silicon-germanium thin films; an NSF CAREER Award (1998) for research in thin-film transistor technology; the DARPA Significant Technical Achievement Award (2000) for development of the FinFET; the Electrical Engineering Award for Outstanding Teaching at UC Berkeley (2003); the IEEE Kiyo Tomiyasu Award (2010) for contributions to nanoscale MOS transistors, memory devices, and MEMS devices; the UC Berkeley Faculty Mentor Award (2010); the Electrochemical Society Dielectric Science and Technology Division Thomas D. Callinan Award (2011) for excellence in dielectrics and insulation investigations; the Intel Outstanding Researcher in Nanotechnology Award (2012); the Semiconductor Industry Association (SIA) University Researcher Award (2014); and the Semiconductor Research Corporation (SRC) Aristotle Award (2016). Her research activities are presently in advanced materials, fabrication processes and devices for energy-efficient electronics. She has authored or co-authored over 500 publications and holds over 90 patents.

Professor Liu is a Fellow of the IEEE and a member of the U.S. National Academy of Engineering, and serves on the Board of Directors for Intel Corporation.

RFIC RECEPTION AND SYMPOSIUM SHOWCASE

Featuring Systems & Applications Forum and Best Student/Industry Paper Showcase

19:00–21:00 Sunday, 16 June 2024

Ballroom Foyer, Walter E. Washington Convention Center

The RFIC Interactive Reception starts immediately after the Plenary Session and will highlight the Student Paper Awards finalists, the Industry Paper Awards finalists, and the Systems and Applications Forum in an engaging social and technical evening event with food and drinks. Authors of these showcases will present their innovative work, summarized in poster format. Some showcase papers will also offer live demonstrations or be presented via a monitor.

Student Best Paper Finalists' Showcase/Demonstrations:

=Showcase (D)=Demonstration

RMo2C-3 **A 2.8-4.3 GHz Simultaneous Dual-Carrier Transformer-Coupled Passive Mixer-First Receiver Supporting Blocker Suppression**
Jamie Ye, *Cornell University*

RMo1A-4 **A Blocker-Tolerant mm-Wave MIMO Receiver with Spatial Notch Filtering Using Non-Reciprocal Phase-Shifters for 5G Applications**
Shahab Mohin, *Massachusetts Institute of Technology*

RMo1C-1 **A 2.4 GHz, -19dBm Sensitivity RF Energy Harvesting CMOS Chip with 51% Peak Efficiency and 24 dB Power Dynamic Range**
Jing-Ren Yan, *National Yang Ming Chiao Tung University*

RTu2C-1 **An Efficient, High Power Q-Band SiGe HBT Power Amplifier With a Compact Four-Way Wilkinson Power Combiner Balun for Emerging Very Low-Earth-Orbit SATCOM**
H. Lee, *Ajou University*

RMo2A-2 **A Reconfigurable Ultra Compact Bi-directional Amplifier with a Build-in-Self Notch Filter for K-Ka-band Satellite Communication**
Jian Zhang, *Tsinghua University*

RTu1B-3 **A Switchless Dual-core Triple-Mode VCO Achieving 7.1-to-15.7 GHz Frequency Tuning Range and a 202.1 dBc-Hz Peak FoM at 3.7**
Kelvin Yue Wu, *University of Macau*

RMo2B-3 **A 52.3-to-67.3GHz 35.8-kHz-Resolution Triple-Push DCO Exploiting Source-Combining Technique for Third-Harmonic Enhancement Achieving 196.4dBc-Hz Peak FoMT at 10MHz Offset**
Qiyao Jiang, *University of Macau*

RMo1B-3 **A G-Band Glass Interposer Technology for the Integration of an Amplified Noise Source based on SiGe BiCMOS Technology**
Maya Alawar, *University of Lille*

RTu3C-1 **A 360 GHz Single-element Multi-mode Orbital Angular Momentum Cavity Antenna-based Transmitter in 90nm SiGe BiCMOS**
Wei Sun, *University of California, Los Angeles*

RTu1B-1 **Broadband Noise Characterization of SiGe HBTs Down to 4K**
Jad Benserhir, *École Polytechniquecole Polytechnique Fédérale de Lausanne*

RMo3C-2 **A K-Band 4-Element 8-Beam Phased-Array Receiver with Hybrid Vector Interpolation and Impedance-Adapted Multibeam Combining Techniques for Satellite Communications**
Hang Lu, *Zhejiang University*

Industrial Paper Showcase/Demonstrations:

=Showcase (D)=Demonstration

RMo1B-2 **Heterogeneously-Integrated Gallium Nitride and Indium Phosphide Devices for Ka-band Amplifiers**
Justin Kim, *Pseudolitic*

(D) RMo1C-4 **A 21-27-GHz Frequency Quadrupler in 0.13um SiGe BiCMOS with 0-dBm Pout and 40-dBc HRR for Wideband 5G Applications**
Caglar Ozdag, *IBM Research*

(D) RTu1C-4 **A 5G FR2 n260/n259 Phased-Array Transmitter Front-End IC in 28-nm CMOS FD-SOI with 3-Stack Power Amplifier Employing OPA-Based Bias Scheme and Cross-Tied Inductor Topol**
Jongwon Yun, *Samsung*

RMo1B-4 **A 22FDX® Wi-Fi PA demonstrating a new LDMOS Device with 10V Breakdown achieving Output Power of 29.5dBm at 40% PAE**
Arul Balasubramaniyan, *GLOBALFOUNDRIES*

RMo1C-2 **A 45 nm RFSOI CMOS-based 24.25-29.5 GHz 2×16-Channel Phased-Array Transceiver IC for 5G NR Applications**
Jooseok Lee, *Samsung*

Systems and Applications Forum Showcase/Demonstrations:

=Showcase (D)=Demonstration

RMo1B-5 **A Reconfigurable Compact Multiband RF Bi-directional Coupler for sub-6 GHz RF Front-Ends in RF SOI CMOS Switch Technology**
Ting-Li Hsu, *Technical University of Munich*

RMo2A-5 **A ΣΔ-Modulated Linear-in-dB Attenuator for On-Chip Power Detection with 0.12 dB Resolution in RF SOI CMOS Switch Technology**
Ting-Li Hsu, *Technical University of Munich*

RTu2C-3 **An Efficient Ku-Band Two-Way Vertical-like Power-Combining Power Amplifier using Merged Inter-stage Transformers Achieving 23-23.4 dBm Psat and 45.2-46.6% Peak PAE in 65nm CMOS**
Joon-Hyung Kim, *Chungnam National Univeristy*

RTu1B-2 **A Fully Integrated Three-Channel Cryogenic Microwave SoC for Qubit State Control in 9Be+ Trapped-Ion Quantum Computer operating at 4 K**
Peter Toth, *Technische Universität Braunschweig*

RTu4C-3 **A 200 GHz Wideband and Compact Differential LNA Leveraging an Active Balun Input Stage in 16nm FinFET Technology**
Ethan Chou, *University of California, Berkeley*

RMo4A-1 **A D-Band Complex Neutralization Cascode Power Amplifier with A Source-Gate Driven Cascode for Enhanced Bandwidth and Efficiency**
Mohamed Eleraky, *Swiss Federal Institute of Technology*

RMo1A-3 **A 32-Element 25.8-to-30.8 GHz Phased-Array CMOS Transmitter with Programable Piecewise Linear Temperature-Compensation Technique Achieving ±0.002 dB-°C Gain Variation across –60-to-85 °C**
Dongze Li, *Tsinghua University*

RMo3A-4 **A 25-31GHz Compact True Power Detector with >33dB Dynamic Range in 40nm Bulk CMOS**
Haoqi Qin, *Fudan University, Shanghai, China*

RMo4C-3 **A 10ns Delay Range 1.5GHz BW True-Time-Delay Array-based Passive-Active Signal Combiner with Negative-Cap Stabilized RAMP for Fast Precise Localization**
Qiuyan Xu, *Washington State University*

RMo1C-5 **Design of a Dual-Mode Coil-Reuse Data Acquisition System for Miniaturized Wirelessly Powered Biopotential Sensing Nodes**
Hamid Jafari Sharemi, *University of California, Los Angeles*

RMo1C-3 **A Fully Integrated Microplastic Detection SoC with 0.1–3GHz Bandwidth and 35dB Dynamic Range for Narrow-Band Notch RF MEMS Sensor System**
S -B Ku, *Korea University*

WALTER E. WASHINGTON CONVENTION CENTER

2024 WPT BOOT CAMP

08:00 – 11:50 | Monday, 17 June 2024 | Room: 206

As our society and economy continue to digitize rapidly, the number of wireless nodes in every square kilometer has become staggering. Experts predict that there could be as many as 10^7 devices in a single square kilometer, which poses a significant environmental and economic challenge to sustainability. However, there is hope in the form of wireless power technologies (WPT). These technologies offer a promising way to deliver power wirelessly to the nodes, eliminating the need for batteries. This not only reduces the ecological impact of batteries and the use of raw materials but also results in more cost-effective solutions since battery replacements are no longer necessary. By harnessing the power of WPT, we can work towards a more sustainable and efficient future.

The upcoming WPT boot camp will focus on introducing wireless power transfer for wireless devices, which will aid in further advancing the digitalization of society and the economy. The boot camp will cover two different WPT technologies: one that operates in the near-field, already in use for wireless charging with its latest addition, near-field communication (NFC) charging, and the other technology is far-field wireless power transfer, which is gradually entering the market. Both technologies rely on different means of power transfer. The boot camp will provide details on both technologies, with experts from academia teaching the basics and principle design methodologies, while industry experts will offer insight into the different business cases and standards.

The WPT boot camp is designed for engineers who want to learn the fundamentals of WPT or are interested in using it for their applications, marketing and sales professionals who want to understand the basics of WPT technologies, and university students who wish to acquire basic knowledge of WPT. The course offers plenty of chances for audience participation and interaction.

Organizers: Jasmin Grosinger, *Graz University of Technology;* **Nuno Carvalho,** *University of Aveiro*

Speakers:

Near-field Wireless Power Technologies: Basics and Design Principles
Jasmin Grosinger, *Graz University of Technology*

Near-field Wireless Power Technologies: Industry Perspective
Jernej Izak, *Renesas Electronics Corp.*

Far-field Wireless Power Technologies: Basics and Design Principles
Nuno Carvalho, *University of Aveiro*

Far-field Wireless Power Technologies: Industry Perspective
Jennifer Grenz, *Ossia Inc.*

WALTER E. WASHINGTON CONVENTION CENTER

2024 RF BOOT CAMP

08:00 – 17:20 | Monday, 17 June 2024 | Room: 207AB

RF Boot Camp is designed to grow RFMW skills in an educational forum that is focused on the fundamentals of Microwave Theory and Techniques. We focus on teaching the fundamentals, terminology, and applications of RF and microwave design, simulation, and measurement – for those new to RFMW, those wishing to stay current with new technologies and applications or even for booth staff members who would like to understand a little more about microwave technology and terminology.

This course will provide an introduction to RF basics, targeting newcomers to the microwave industry. The intended audience includes technicians, new engineers, engineers who may be changing their career path, marketing and sales professionals seeking a better understanding of microwave technology, as well as current college students looking to learn more about the practical aspects of RF and Microwave technology. The format of the RF Boot Camp is similar to that of a workshop or short course, with multiple presenters from industry and academia presenting on a variety of topics including: RF/Microwave systems basics, network and spectrum analysis, simulation and matching network design modulation and signal analysis, antennas and radar basics.

Organizers: Joanne Mistler, *Keysight Technologies;* **Larry Dunleavy,** *Modelithics and USF*

Speakers:

The RF/Microwave Signal Chain, Network Characteristics, Analysis and Measurement
Joanne Mistler, *Keysight Technologies*

Fundamentals of RF Simulation
Murthy Upmaka, *Keysight Technologies*

Impedance Matching Basics
Larry Dunleavy, *Modelithics and USF*

Spectral Analysis and Receiver Technology
Joanne Mistler, *Keysight Technologies; Larry Dunleavy, Modelithics and USF*

Signal Generation, Modulation and Vector Signal Analysis
Joanne Mistler, *Keysight Technologies*

Sub-THz/THz Link Design
Josep Jornet, *Northeastern University*

THz Communications: from Vision to Reality
Ngwe Thawdar, *Air Force Research Laboratory Information Directorate*

150AB

RMo1A: mm-Wave Transmitters and Receivers

Chair: Giuseppe Gramegna, *IMEC*
Co-Chair: Magnus Wiklund, *BeammWave*

08:00

RMo1A-1: A 60-GHz Positive-Feedback-Based Transmitter Front-End with 22.8% PAEmax in 28-nm Bulk CMOS for Inter-Satellite Communications

K. Ding, D. Milosevic, V. Vidojkovic, *Technische Universiteit Eindhoven*; K. Khalaf, *Pharrowtech*; M. Bentum, P. Baltus, *Technische Universiteit Eindhoven*

08:20

RMo1A-2: A Ka-Band 8-Element 4-Beam Transmitter Front End With Hybrid VGA and Symmetrical Transformer-Based Doherty PA

H. Gao, H. Lu, S. Wang, N. Li, G. Chen, C. Song, *Zhejiang Univ.*; Y.-C. Kuan, *NYCU*; Q.J. Gu, *Univ. of California, Davis*; Z. Xu, *Zhejiang Univ.*

08:40

RMo1A-3: A 32-Element 25.8-to-30.8GHz Phased-Array CMOS Transmitter with Programable Piecewise Linear Temperature-Compensation Technique Achieving ±0.002dB/°C Gain Variation Across -60-to-85°C

D. Li, W. Deng, Z. Guo, H. Jia, X. Li, X. Nie, R. Qiu, B. Chi, *Tsinghua Univ.*

09:00

RMo1A-4: A Blocker-Tolerant mm-Wave MIMO Receiver with Spatial Notch Filtering Using Non-Reciprocal Phase-Shifters for 5G Applications

S. Mohin, *MIT*; S. Araei, *MIT*; M. Barzgari, *MIT*; N. Reiskarimian, *MIT*

09:20

RMo1A-5: A 56–65GHz Highly-Integrated FMCW Radar Transceiver with 7.8dB NF and 8GHz Chirp-Bandwidth in 65-nm CMOS

J. Chen, *Zhejiang Univ.*; S. Wang, *Zhejiang Univ.*; J. Liu, *Zhejiang Univ.*; Q. Yang, *Zhejiang Univ.*; Q. Li, *Zhejiang Univ.*; H. Nie, *Zhejiang Univ.*; Q.J. Gu, *Univ. of California, Davis*; C. Song, *Zhejiang Univ.*; N. Yan, *Fudan Univ.*; Z. Xu, *Zhejiang Univ.*

09:40

151AB

RMo1B: Advanced Packaging Enabling Heterogeneous Integration of SiGe HBT & III-V mmW ICs

Chair: Frédéric Gianesello, *STMicroelectronics*
Co-Chair: Harshpreet Bakshi, *Texas Instruments*

RMo1B-1: A 24-30 GHz GaN Front-End MMIC with Coupled-Resonator based Transmit/Receive Switch for 5G Millimeter-Wave Applications

D. Zeng, *SCUT*; H. Zhu, *SCUT*; Q. Cai, *NJUPT*; G. Shen, *NJUPT*; O. Gao, *SCUT*; W. Che, *SCUT*; Q. Xue, *SCUT*

RMo1B-2: Heterogeneously-Integrated Gallium Nitride and Indium Phosphide Devices for Ka-Band Amplifiers

J.J. Kim, *PseudolithIC*; M.D. Hodge, *PseudolithIC*; M.R. Soler, *PseudolithIC*; F. Herrault, *PseudolithIC*; D.S. Green, *PseudolithIC*; J.F. Buckwalter, *PseudolithIC*

RMo1B-3: A G-Band Glass Interposer Technology for the Integration of an Amplified Noise Source Based on SiGe BiCMOS 55-nm Technology

M. Alawar, *IEMN (UMR 8520)*; V. Fiorese, *STMicroelectronics*; S. Lépilliet, *IEMN (UMR 8520)*; D. Gloria, *STMicroelectronics*; G. Ducournau, E. Dubois, *IEMN (UMR 8520)*

RMo1B-4: A 22FDX Wi-Fi PA Demonstrating a New LDMOS Device with 10V Breakdown Achieving Output Power of 29.5dBm at 40% PAE

A. Balasubramaniyan, X. Hui, A. Bellaouar, M. Meza Campos, A. Bharadwaj, E. Veeramani, S. Syed, *GLOBALFOUNDRIES*

RMo1B-5: A Reconfigurable Compact Multiband RF Bi-Directional Coupler for Sub-6GHz RF Front-Ends in RF SOI CMOS Switch Technology

T.-L. Hsu, *Technische Univ. München*; A. Hagelauer, *Technische Univ. München*; V. Solomko, *Infineon Technologies*

152AB

RMo1C: Unleashing RF Systems: From 5G to Low-Power Sensing

Chair: Pierluigi Nuzzo, *University of Southern California*
Co-Chair: Yao-Hong Liu, *IMEC*

RMo1C-1: A 2.4GHz, -19 dBm Sensitivity RF Energy Harvesting CMOS Chip with 51% Peak Efficiency and 24dB Power Dynamic Range

J.-R. Yan, *NYCU*; Y.-W. Huang, *NYCU*; W.-J. Lai, *Novatek Microelectronics*; J.-H. Liao, *Novatek Microelectronics*; C.-C. Lin, *Novatek Microelectronics*; Y.-T. Liao, *NYCU*

RMo1C-2: A 45nm RFSOI CMOS-Based 24.25–29.5GHz 2×16-Channel Phased-Array Transceiver IC for 5G NR Applications

J. Lee, S. Baek, K. Kim, S. Park, H. Oh, T. Kim, J. Jung, J. Kim, S. Jeon, J.H. Park, W. Lee, J. Park, D.-H. Lee, S. Lee, J.H. Lee, J.H. Kim, Y. Kim, S. Park, B. Suh, S. Oh, D. Lee, J. Son, S.-G. Yang, *Samsung*

RMo1C-3: A Fully Integrated Microplastic Detection SoC with 0.1–3GHz Bandwidth and 35dB Dynamic Range for Narrow-Band Notch RF MEMS Sensor System

S.-B. Ku, *Korea Univ.*; J. Kim, *KETI*; K.-H. Lee, H.-S. Lee, K. Eom, J. Kang, H. Jung, *Korea Univ.*; C. Cha, *KETI*; H.-M. Lee, *Korea Univ.*

RMo1C-4: A 21–27-GHz Frequency Quadrupler in 0.13µm SiGe BiCMOS with 0-dBm POUT and 40-dBc HRR for Wideband 5G Applications

C. Ozdag, *IBM T.J. Watson Research Center*; A. Paidimarri, M. Yoshiyama, Y. Yamaguchi, Y. Tojo, *Fujikura*; B. Sadhu, *IBM T.J. Watson Research Center*

RMo1C-5: Design of a Dual-Mode Coil-Reuse Data Acquisition System for Miniaturized Wirelessly Powered Biopotential Sensing Nodes

H. Jafari Sharemi, *Univ. of California, Los Angeles*; A. Babakhani, *Univ. of California, Los Angeles*

150AB

RMo2A: mm-Wave Transceivers and RF Techniques

Chair: Abhishek Agrawal, *Intel*
Co-Chair: Andrea Bevilacqua, *Università di Padova*

RMo2A-1: A Compact Ka-Band Bi-Directional PA-LNA with 17.4-dBm Psat Using Three-Stack Power Amplifier in 28-nm CMOS

J. Hwang, *Yonsei Univ.*; B.-W. Min, *Yonsei Univ.*

RMo2A-2: A Reconfigurable Ultra Compact Bi-Directional Amplifier with a Build-in-Self Notch Filter for K/Ka-Band Satellite Communication

J. Zhang, *Tsinghua Univ.*; M. Zhai, *Tsinghua Univ.*; D. Wang, *Tsinghua Univ.*; X. Yi, *Tsinghua Univ.*; W. Zhu, *BIT*; Y. Wang, *Tsinghua Univ.*

RMo2A-3: Fully Integrated SiGe HBT BiCMOS Transmit-Receive Front-End IC for 5G mmW Radio with a Reconfigurable Built-In Diode RF Switch

I. Han, *Ajou Univ.*; H. Lee, *Ajou Univ.*; I. Ju, *Ajou Univ.*

RMo2A-4: Non-Coherent TX-RX Chipsets for J-Band Communication in 16-nm FinFET CMOS

B. Gungor, *KU Leuven*; P. Reynaert, *KU Leuven*

RMo2A-5: A ΣΔ-Modulated Linear-in-dB Attenuator for On-Chip Power Detection with 0.12dB Resolution in RF SOI CMOS Switch Technology

T.-L. Hsu, *Technische Univ. München*; V. Solomko, *Infineon Technologies*; A. Hagelauer, *Technische Univ. München*

151AB

RMo2B: High-Performance Multi-Mode, Multi-Core Oscillators

Chair: Andrea Mazzanti, *Università di Pavia*
Co-Chair: Bichoy Bahr, *Texas Instruments*

RMo2B-1: An Octave Tuning Range Quad-Core VCO Using a Compact Quad-Mode Transformer-Based Inductor

H. Kim, *Korea Univ.*; S. Kim, *Korea Univ.*; S. Jeon, *Korea Univ.*

RMo2B-2: An 18.5-to-36.5GHz 206.8dBc/Hz FoMT Quad-Core Triple-Mode VCO with Automatic-Mode-Tracking Output Buffers

Z. Lin, *Tsinghua Univ.*; H. Jia, *Tsinghua Univ.*; W. Deng, *Tsinghua Univ.*; B. Chi, *Tsinghua Univ.*

RMo2B-3: A 52.3-to-67.3GHz 35.8-kHz-Resolution Triple-Push DCO Exploiting Source-Combining Technique for Third-Harmonic Enhancement Achieving 196.4dBc/Hz Peak FoMT at 10MHz Offset

Q. Jiang, *University of Macau*; J. Yin, *University of Macau*; Q. Pan, *SUSTech*; R.P. Martins, *University of Macau*; P.-I. Mak, *University of Macau*

RMo2B-4: An 11GHz 8-Core Series Resonance CMOS VCO with Scalable Ring-Coupling Scheme Achieving Phase Noise of -136.8dBc/Hz at 1MHz Offset

S. Zhang, *Tsinghua Univ.*; W. Deng, *Tsinghua Univ.*; H. Jia, *Tsinghua Univ.*; B. Chi, *Tsinghua Univ.*

RMo2B-5: A K-Band Voltage-Controlled Oscillator with Gate-Drain Phase Shift Achieving 110kHz 1/f³ Corner

Z. Jia, *Fudan Univ.*; D. Ye, *HUST*

152AB

RMo2C: Interference Resilient and Energy Efficient Transmitters and Receivers

Chair: Chun-Huat Heng, *National University of Singapore*
Co-Chair: Justin Wu, *AmLogic*

RMo2C-1: A Sub-6GHz Wideband Transmitter with LO Harmonic Rejection RF Front-Ends Using Frequency-Adaptive Calibration

H. Bai, *Peking Univ.*; D. Wang, *Peking Univ.*; K. Gao, *Peking Univ.*; J. He, *Peking Univ.*; J. Zhou, *Peking Univ.*; J. Liu, *Peking Univ.*; H. Liao, *Peking Univ.*

RMo2C-2: An 11.8mW 0.4-to-2.6GHz Blocker-Tolerant Receiver with LO Duty-Cycle Compensation and High-Q Selectivity Achieving +15.4/19.2dBm OB-IIP3 at 10/80MHz Offset

R. Wu, *Tianjin Univ.*; Y. Wang, *Tianjin Univ.*; R. Hong, *Tianjin Univ.*; K. Xie, *Tianjin Univ.*; K. Wang, *Tianjin Univ.*

RMo2C-3: A 2.8–4.3GHz Simultaneous Dual-Carrier Transformer-Coupled Passive Mixer-First Receiver Front-End Supporting Blocker Suppression

J.C. Ye, *Cornell Univ.*; A. Antón, *Cornell Univ.*; R.H. Huang, *Cornell Univ.*; S. Sadeghi, *Cornell Univ.*; A.C. Molnar, *Cornell Univ.*

RMo2C-4: A 2.3nJ/b 32-APSK Polar Phase-Tracking Receiver with Two-Point Injection Technique

X. Ji, *Tsinghua Univ.*; J. Zhao, *Tsinghua Univ.*; W. Rhee, *Tsinghua Univ.*; Z. Wang, *Tsinghua Univ.*

RMo2C-5: A 0.77mW 1.84nJ/Bit Phase Noise Canceling Receiver for QAM and OFDM and Cellular IoT

T.J. Odelberg, *Univ. of Michigan*; D.D. Wentzloff, *Univ. of Michigan*

10:10
10:30
10:50
11:10
11:30
11:50

150AB

RMo3A: mm-Wave Power Amplifiers

Chair: Jane Gu, *University of California, Davis*
Co-Chair: Gernot Hueber, *United Micro Technology*

13:30

RMo3A-1: A Class-J/F 60GHz Power Amplifier with 42.3% Power Added Efficiency in FDSOI CMOS

M. Cui, *Technische Universität Dresden*; J. Wagner, *Technische Universität Dresden*; F. Ellinger, *Technische Universität Dresden*

13:50

RMo3A-2: A 25–40GHz Three-Way Power Amplifier with No Load Modulation Achieving Broadband Deep Power Back-Off Efficiency Enhancement

E. Liu, *ETH Zürich*; H. Zhou, *Chalmers Univ. of Technology*; C. Fager, *Chalmers Univ. of Technology*; H. Wang, *ETH Zürich*

14:10

RMo3A-3: A 22–44GHz 28nm FD-SOI CMOS 5G Doherty Power Amplifier with Wideband PAE6dBPBO Enhancement and 3:1 VSWR Resiliency

G. Diverrez, *IMS (UMR 5218)*; E. Kerherve, *IMS (UMR 5218)*; M. De Matos, *IMS (UMR 5218)*; A. Cathelin, *STMicroelectronics*

14:30

RMo3A-4: A 25–31GHz Compact True Power Detector with >33dB Dynamic Range in 40nm Bulk CMOS

H. Qin, *Fudan Univ.*; J. Gu, *Fudan Univ.*; H. Xu, *Fudan Univ.*; Z. Xu, *Zhejiang Univ.*; P. Jia, *Starway Communication*; N. Yan, *Fudan Univ.*

14:50

RMo3A-5: A Compact Dual-Mode CMOS Power Amplifier Covering both Sub-6GHz and mm-Wave Bands for 5G NR

J. Zhang, *SCUT*; J. Chen, *Univ. College Dublin*; T. Xu, *SCUT*; P. Qin, *SCUT*; X. Yi, *SCUT*; L. Wu, *CUHK-Shenzhen*; H. Zhu, *SCUT*; W. Che, *SCUT*; Q. Xue, *SCUT*

15:10

151AB

RMo3B: RF and mm-Wave Frequency Multipliers

Chair: Fa Foster Dai, *Auburn University*
Co-Chair: Salvatore Finocchiaro, *Qorvo*

RMo3B-1: A 0.2–25GHz Inductorless Complementary Pseudo-Push-Push Frequency Doubler

C. Song, *CUHK-Shenzhen*; C. Yu, *CUHK-Shenzhen*; L. Wu, *CUHK-Shenzhen*

RMo3B-2: A Compact D-Band Multiply-by-9 Frequency Multiplier with Inductor-Less Active Balun in 16nm p-FinFET Technology

R. Chen, *Univ. of California, Los Angeles*; H.-Y. Chien, *Univ. of California, Los Angeles*; M.-C.F. Chang, *Univ. of California, Los Angeles*

RMo3B-3: A 17.4–26.4-GHz Dual-Injection Injection-Locked Frequency Tripler Featuring Low Power Consumption and High Harmonic Rejection

Q. Zeng, *UESTC*; J. Zhang, *UESTC*; Y. Yu, *UESTC*; H. Liu, *UESTC*; Y. Wu, *UESTC*; C. Zhao, *UESTC*; K. Kang, *UESTC*

RMo3B-4: A 278–348GHz 6th Harmonic Injection Locking Frequency Multiplier Based on 3rd Harmonic Injection Locking Oscillator in 130nm SiGe Process

Z. Yan, *Southeast Univ.*; J. Chen, *Southeast Univ.*; Z. Chen, *Southeast Univ.*; Z. Li, *Southeast Univ.*; R. Zhang, *Southeast Univ.*; R. Zhou, *Southeast Univ.*; P. Zhou, *Southeast Univ.*; W. Hong, *Southeast Univ.*

RMo3B-5: A 192–229GHz Frequency Tripler with 4.4dBm Output Power Using Slotline-Based Drain Harmonic Shaping Technique in 40nm CMOS

Y. Ding, *Southeast Univ.*; Y. Shen, *Southeast Univ.*; Z. Lin, *Southeast Univ.*; Z. Wei, *Southeast Univ.*; Y. Qian, *Southeast Univ.*; S. Hu, *Southeast Univ.*

152AB

RMo3C: Wideband Reconfigurable Beamforming Arrays

Chair: Emanuel Cohen, *Technion*
Co-Chair: Hao Gao, *Technische Universiteit Eindhoven*

RMo3C-1: A 16-Channel W-Band Phased-Array Receiver with a 8-Bit Octant Selector and Reflection-Type Phase Shifter of 0.23°/0.21-dB RMS Phase and Gain Error for ±30° Scanning Angle

X. Luo, *CAEP*; Y. Rao, *CAEP*; X. Cheng, *CAEP*; B. Cheng, *CAEP*; H. Yang, *CAEP*; R. Chen, *CAEP*; Y. Yu, *CAEP*; J. Han, *CAEP*; C. Han, *UESTC*; L. Zhang, *CAEP*; Y. Tang, *CAEP*; X. Deng, *CAEP*; H. Gao, *Technische Universiteit Eindhoven*

RMo3C-2: A K-Band 4-Element 8-Beam Phased-Array Receiver with Hybrid Vector Interpolation and Impedance-Adapted Multibeam Combining Techniques for Satellite Communications

H. Lu, N. Li, H. Gao, B. Yang, X. He, S. Wang, Y. Liu, G. Chen, *Zhejiang Univ.*; Y.-C. Kuan, *NYCU*; X. Qi, *Zhejiang Univ.*; C. Song, *Zhejiang Univ.*; Q.J. Gu, *Univ. of California, Davis*; Z. Xu, *Zhejiang Univ.*

RMo3C-3: A Frequency Reconfigurable Phased-Array Front-End with Enhanced Image-Rejection and High-Resolution LO Phase Shifter for 5G FR2 n258/n260/n261 Bands

Q. Chen, J. Lu, X. Jiang, X. Yang, Y. Liang, Y. Hu, Y. Wang, J. Liu, L. Lu, *Southeast Univ.*; D. Cheng, *Purple Mountain Laboratories*; J. Feng, *Southeast Univ.*; L. Luo, L. He, *Purple Mountain Laboratories*; X. Wu, *Southeast Univ.*; L. Li, *Southeast Univ.*

RMo3C-4: A 10:1 Bandwidth 2.5–25GHz Multi-Standard High-Linearity 6-Bit Phased-Array Receiver Front-End with Quad-Pole I/Q Network and 2.7° RMS Phase Error

T. Liang, *Univ. of California, San Diego*; Z. Hu, *Univ. of California, San Diego*; O. Hassan, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

RMo3C-5: A 26.5–35GHz High Linearity VGA with an RMS Phase Error of 0.9°–2.8° Utilizing a Novel Hybrid Coupling Technique in 45RFSOI

A. Afifi, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

150AB

RMo4A: Silicon-Based Power Amplifiers for D-Band and Above

Chair: Alexandre Giry, *CEA-LETI*
Co-Chair: Hyun-Chul Park, *Samsung*

RMo4A-1: A D-Band Complex Neutralization Cascode Power Amplifier with A Source-Gate Driven Cascode for Enhanced Bandwidth and Efficiency

M. Eleraky, *ETH Zürich*; H. Wang, *ETH Zürich*

RMo4A-2: A D-Band Power Amplifier with Optimized Common-Mode Behaviour Achieving 32Gb/s in 22-nm FD-SOI

G. Venturini, *KU Leuven*; P. Reynaert, *KU Leuven*

RMo4A-3: Phased-Array-Compatible Area-Efficient D-Band Power Amplifiers in 45 RF SOI Based on Cascade Stacking

A. Davidson, *Columbia Univ.*; H. Krishnaswamy, *Columbia Univ.*

RMo4A-4: A 15.7-dBm 164–270GHz Power Amplifier with Asymmetric Slotline-Based Series-Parallel Combiner in 130-nm SiGe BiCMOS Technology

G. Park, *Korea Univ.*; H. Kim, *Korea Univ.*; S. Jeon, *Korea Univ.*

151AB

RMo4B: High Performance RF and mm-Wave CMOS Frequency Synthesis

Chair: Andreia Cathelin, *STMicroelectronics*
Co-Chair: Xiang Gao, *Zhejiang University*

RMo4B-1: A 45-fsrms-Jitter, 144-to-162-GHz D-Band Frequency Synthesizer Using a Subsampling PLL and a Harmonic-Boosting Frequency Multiplier

S. Jung, *KAIST*; J. Kim, *KAIST*; J. Bang, *KAIST*; J. Choi, *Seoul National Univ.*

RMo4B-2: A 37.2-fs, -254.6-dB FoM, 47.9-to-56.4GHz PLL Using Tightly Coupled Dual-Core VCO with Implicit 4th Harmonic Extraction Technique

Q. Wu, *Tsinghua Univ.*; W. Deng, *Tsinghua Univ.*; M. Xiong, *Tsinghua Univ.*; H. Jia, *Tsinghua Univ.*; R. Wan, *Tsinghua Univ.*; H. Liu, *Tsinghua Univ.*; B. Chi, *Tsinghua Univ.*

RMo4B-3: A 74GHz–80GHz 1.2GHz/µs-Slope 20.9mW FMCW Synthesizer with TDC-Gain-Independent Loop-Bandwidth Employing a TDC-Offset-Free Type-II Digital PLL and a Linearized Hybrid-Tuning DCO

Y. Liu, *HKUST*; Z. Jing, *HKUST*; Z. Liu, *HKUST*; C.C. Yip, *HKUST*; Z. Zong, *HKUST(GZ)*; H.C. Luong, *HKUST*

RMo4B-4: A 4.25GHz–8.45GHz 67%-Chirp-Fractional-Bandwidth -121.5dBc/Hz-PN@1MHz 88fs-Jitter FMCW Synthesizer with Bandwidth-Boosting and Phase-Noise-Cancellation Techniques

Y. Liu, *HKUST*; Z. Jing, *HKUST*; Z. Liu, *HKUST*; W. Yang, *HKUST*; C.C. Yip, *HKUST*; L. Wu, *CUHK-Shenzhen*; H.C. Luong, *HKUST*

RMo4B-5: A 0.2-to-39.2GHz 66.2-fs Jitter and -71.3dBc Spur Sub-Sampling PLL Using DAC-Based Constant Control Voltage Compensator and Quad-Mode 2nd Harmonic Filtering Oscillator

W. Chen, *UESTC*; Y. Shu, *UESTC*; X. Luo, *UESTC*

152AB

RMo4C: Wireline and Localization Systems

Chair: Ahmed Elkholy, *Broadcom*
Co-Chair: Sajjad Moazeni, *University of Washington*

RMo4C-1: Transimpedance Amplifiers with 95GHz Transimpedance Bandwidth and 1.5% THD for 800G Coherent Optical Communications

M.H. Mahmud, *Univ. of California, San Diego*; H. Al-Rubaye, *Broadcom*; G.M. Rebeiz, *Univ. of California, San Diego*

RMo4C-2: A 4–26Gbaud Configurable Multi-Mode Non-Uniform EOM with Improved Twin PI for High-Speed Wireline Communication Achieving 3-µs EW/EH Evaluation and 0.99-R² Accuracy

S. Liu, *Xidian Univ.*; Z. Dong, *Xidian Univ.*; M. Wang, *Xidian Univ.*; X. Zhao, *Xidian Univ.*; C. Han, *Xidian Univ.*; X. Su, *Xidian Univ.*; Z. Zhu, *Xidian Univ.*

RMo4C-3: A 10ns Delay Range 1.5GHz BW True-Time-Delay Array-Based Passive-Active Signal Combiner with Negative-Cap Stabilized RAMP for Fast Precise Localization

Q. Xu, *Washington State Univ.*; C.-C. Lin, *Washington State Univ.*; A. Wadaskar, *Univ. of California, Los Angeles*; H. Hu, *Washington State Univ.*; D. Cabric, *Univ. of California, Los Angeles*; S. Gupta, *Washington State Univ.*

RMo4C-4: An Electro-Optical Synthesizer to Generate Random Chirp Rates for Secure FMCW LiDAR Applications

M. Rezaei, *Univ. of Washington*; L. Hussein, *Univ. of Washington*; A. Dee, *Univ. of Washington*; S. Moazeni, *Univ. of Washington*

15:40
16:00
16:20
16:40
17:00

MONDAY WORKSHOPS

08:00 – 17:20 | Monday, 17 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WMA	**Acoustic Wave Resonators and Filters Based on Advanced Functional Materials** **Sponsor/s:** IMS **Organizers:** Christopher Nordquist, *Sandia National Laboratories*; Jordi Verdú, *Universitat Autònoma de Barcelona* **ROOM: 144AB** **08:00 – 17:20**	The complexity of the requirements in advanced 5G and forthcoming scenarios has a direct impact on the design of acoustic wave filters. Latest developments have pushed acoustic technology to an unprecedented situation mostly due to the developments in advanced functional materials; however, this entails at the same time, new challenges in relation to design and synthesis methodologies, electrical characterization and non-linear behavior and modeling. New scenarios open at the same time an opportunity window where new applications can be faced using acoustic wave technologies due to the outstanding performance and reduced size compared with conventional electromagnetic solutions. The workshop is divided in three differentiated blocks. The first block is focused on design and synthesis methodologies. The objective is to show how the amazing properties of new functional materials may help to overcome existing limitations, mainly related to the achievable bandwidth of the filter. In the second block, the focus is put on modeling and linear/non-linear characterization. New functional materials may require new modes of operation of AW resonators, and higher power handling, which may contribute to a higher non-linear behavior. All this phenomenological behavior can be used for the development of more precise linear and non-linear models. The third block is focused on new modes of operation and AW resonator configurations taking advantage of new material properties such as heterostructures, new doped materials, or other configurations as the periodically polarized piezoelectric P3F. The final block is focused on transversal markets to explore new opportunities where acoustic wave technologies may have a key role in future scenarios (UWB, Sensors, and/or other applications). With the objective of giving the widest view on the topic, half of the presentations are given by international recognized research groups in academia, while the other half are given by the major global industrial players.
WMB	**Recent Advances in High-Voltage RF Switches** **Sponsor/s:** IMS **Organizers:** Amelie Hagelauer, *Technische Universität München*; Valentyn Solomko, *Infineon Technologies*; Xu Zhu, *Menlo Microsystems* **ROOM: 143ABC** **08:00 – 11:50**	High-voltage, linear RF switches are extensively demanded in a wide variety of applications, ranging from high-volume, cost-efficient cellular handsets to performance-centric and high-reliability automated test and measurements, RF infrastructure, military, and medical systems. Antenna tuning techniques utilized in modern cellular mobile devices have been the main driver for rapid improvement of commercial solid-state CMOS-based high-voltage switches. A need for more radical RF performance improvement in other demanding applications calls for innovative solutions based on RF-MEMS and disruptive PCM switch technologies. In this workshop experts from industry and academia will report on recent advances in MOSFET-based, RF-MEMS and PCM-switches for RF communication and test platforms. A panel session will conclude the event, where the speakers will debate on the insights and outlooks for the trending technology candidates for switchable RF devices in cellular RF front-ends, automated test and measurement systems, industrial/military radios and others.
WMC	**Radio Spectrum for Microwave Practitioners** **Sponsor/s:** IMS **Organizers:** Andrew Clegg, *Google*; Charles Baylis, *Baylor University* **ROOM: 144C** **08:00 – 17:20**	This workshop will discuss radio spectrum usage from the view of a microwave practitioner. The basics of wireless spectrum allocation and regulation will be discussed. Presentations will describe the spectrum needs and challenges for defense and the commercial wireless industry, as well as how the test and measurement industry will be challenged. Core microwave technology innovations enabling future innovative spectrum usage will be discussed, including mm-wave devices and reconfigurable circuitry. Finally, a discussion of workforce development for spectrum science and engineering will conclude the presentations. The workshop will include an opening discussion and audience poll for topics of interest, as well as a closing panel session with the speakers for additional participant interaction.
WMD	**Recent Advances in Wideband and Efficient Doherty PAs for 5G and 6G Wireless Communications** **Sponsor/s:** IMS **Organizers:** Bumman Kim, *POSTECH*; Kamal K. Samanta, *AMWT* **ROOM: 145AB** **13:30 – 17:20**	The rising demand for high data traffic, speed, and resolution requires new-generation (5G and B5G) power amplifiers (PAs) to operate at higher frequency bands, and deliver high linear power with wide bandwidth and high efficiency at high PAPR, and these PAs are among the most critical components for the next-generation mobile and backhaul systems. Load-modulated Doherty power amplifiers (DPAs) are highly regarded as suitable candidates, providing high efficiency and supporting higher-order modulation. However, conventional DPA suffers from restricted bandwidth, maintaining efficiency with BW, and increased sensitivity to load mismatch. This timely workshop will feature a wide range of presentations highlighting the recent advances and state-of-the-art developments in Doherty-based PA circuit design theory, methodology, and practical circuit and system implementation techniques for overcoming the above constraints. This will cover analog and hybrid beamforming and massive MIMO applications for sub-6GHz 5G to mm-wave and 6G applications, including those for handsets and infrastructures. This workshop will showcase advanced topologies, including a novel active load-modulated PA architecture called the circulator load-modulated amplifier; advanced sequential version and the voltage-combining approach; and novel analog/digital co-design, reducing undesirable memory effects and extending bandwidths with high efficiency. Further, the latest load-insensitive load-modulation PAs including quasi-balanced Doherty PA and load-modulated balanced and double balanced amplifiers, which provide inherent isolation from the antenna, will be presented. Finally, the workshop will conclude with the latest important trends, possible future directions, and experimental results based on monolithic and hybrid implementation and will compare the performance of novel DPAs with circuit/device technologies in terms of BW, ACLR/linearity, and efficiency at different backoffs (6 to 12dB) for fulfilling the challenging high-performance and low-cost requirements of next-generation wireless communications.
WME	**Latest Trends in Cost-Effective IC Integration, IPDs and Interposer Technologies for Sub-6GHz to Sub-THz Wireless Applications** **Sponsor/s:** IMS **Organizers:** Huei Wang, *National Taiwan University*; Kamal K. Samanta, *AMWT* **ROOM: 145AB** **08:00 – 11:50**	The realization of advanced front-end modules (FEM) for mobile applications, whether below 6GHz and definitely at mm-wave, and their packaging, pose daunting design challenges to fit significant electrical functionality within a relatively small space while meeting or exceeding electrical, mechanical, thermal, and reliability requirements for both the UE and BS use-cases at a low cost. As a result, it will be more important to solve signal integrity, reduce insertion losses imposed by various interconnects and packaging techniques at the chip, module, and board levels with co-engineering across disciplines, and realize an integrated module cost-effectively. This workshop is organized to address current and future design and manufacturing techniques by bringing together subject-matter experts from the IEEE Electronic Packaging Society (EPS) and the MTT-S communities. Presentations will cover the state-of-the-art in advanced, cost-effective multichip module integration, integrated passive devices (IPD) and interposer technologies for circuit and system design for signal diversity, and beam-forming approaches that would leverage emerging next-generation wireless communications, including handset modules, economically. In particular, the workshop will highlight the latest advances and state-of-the-art developments in interposer technologies, including high-resistive Si, glass, and organic substrates for 2.5D/3D IC integration through vias (TSV/TGV), high-Q IPDs, antennas in packages (AiP), and wafer-scale packaging, covering sub-6GHz 5G to 300GHz 6G applications. The workshop will discuss the relative merits and de-merits of existing approaches in terms of losses, Q, isolation, non-linearity, and, most importantly, cost, and it will provide possible solutions with future directions. This will present advanced HR Si (with buffer, passivation, and isolation layers) and glass-based high-Q IPDs integrating filters, matching networks, and integration of antennas optimizing radiation pattern and system performance; RF-optimized silicon interposer developed with TSV and IPDs for above 100GHz applications with particular focus on antenna, CMOS, III-V integration, and thermal management of highly scaled solutions. Further, it will present recent progress in using glass as a material for MMIC packages in the D-band, using the organic chip carrier glass IPD process to design antennas-in-package, and including the design of transmission lines, flip-chip transitions, and antenna arrays for realizing cost-effective integrated modules in the 150GHz and 300GHz bands. The speakers are the experts and are the leading contributors in both the industrial and academic sectors.

MONDAY WORKSHOPS

08:00 – 17:20 | Monday, 17 June 2024

	WORKSHOP TITLE	WORKSHOP ABSTRACT
WMF	**On-Wafer mm-Wave Load-Pull for Beyond-5G Microelectronics Characterization** **Sponsor/s:** IMS; ARFTG **Organizers:** Jerome Cheron, *NIST*; Nicholas Miller, *Michigan State University* **ROOM: 146A** **08:00 – 17:20**	Microelectronics operating in the mm-wave frequency regime have gained considerable attention for numerous applications including beyond-5G communications, satellite communications, and G-band radar for humidity and cloud remote sensing. A central component in the mm-wave integrated circuit development is precise on-wafer characterization of the next-generation transistors for device characterization and model extraction/validation. On-wafer measurements at mm-wave frequencies pose considerable challenges, and these difficulties are compounded when large-signal measurements are required for device optimization and modeling. This workshop incorporates a diverse set of speakers from around the world who are international experts in the field of on-wafer mm-wave calibration and small- and large-signal measurements. The morning session of this workshop will provide a deep background on the need for, challenges of, and calibration requirements for on-wafer mm-wave large-signal measurements. Our afternoon session will present world-class research from both academia and industry on on-wafer load-pull measurements at mm-wave frequencies. This proposed workshop will enable an inclusive, international audience and will welcome open discussions on the technical aspects of the presentations.
WMG	**New Design and Testing Approaches for Optimizing Efficiency and Thermal Performance in Phased Arrays and mm-Wave Front-Ends** **Sponsor/s:** IMS; ARFTG **Organizers:** Mo Shakouri, *Microsanj*; Oren Eliezer, *Samsung*; Sidina Wane, *eV-Technologies* **ROOM: 146B** **13:30 – 17:20**	This interactive half-day workshop of 4 tutorials includes 5 speakers from both industry and academia, who have been involved in the development of new approaches for the design and testing of power amplifiers, phased arrays and antenna-in-package modules. The tutorials present techniques for evaluating and optimizing efficiency and heat dissipation in RF devices and front-ends, and are a combination of recent research, as well as field-proven methods that are already available in the industry products, such as thermoreflectance solutions and over-the-air (OTA) thermal imaging for 5G phased array front-ends incorporating ICs and antenna-in-package modules. In addition to the conventional Q&A time made available to attendees during and after each tutorial, attendees will be encouraged at the beginning of the workshop to present challenges that they are interested in addressing, so as to allow the tutorial speakers to consider these in their tutorials.
WMH	**Efficient and Linear Power Amplifier Design for Wideband Signals: Still an Art?** **Sponsor/s:** IMS; ARFTG **Organizers:** Marc Vanden Bossche, *National Instruments*; Zoya Popović, *University of Colorado Boulder* **ROOM: 146B** **08:00 – 11:50**	The system performance of wireless transmitters depends heavily on the behavior of RF power amplifiers (PA). To satisfy the increasing demand for higher data rates, modern communications standards adopt ever higher modulation orders at increasing modulation bandwidths. Additionally, radar systems are facing increasingly more complex signals while dual functionality remains a desired goal for future systems. As a result, PA designers are faced with the intractable goal of providing PAs with simultaneously high linearity and power at higher carrier frequencies with wide instantaneous bandwidths in a world where power conservation is often a primary objective. Traditional PA design starts typically from (pulsed) continuous waveform (CW) measurements combined with load-pull. Design techniques, like the Cripps method, come to the rescue of the designer to reduce the amount of characterization. Usually, the PA is characterized under the desired modulation conditions only after the design and fabrication, often with degraded performance from the predictions. This requires then one or more expensive redesigns. With the increased demand for active phased arrays, this problem is only magnified as amplifiers interact with each other through the antenna coupling, which affects both efficiency and linearity. This workshop showcases the state-of-the-art of practical design methodologies that anticipate the use of the amplifiers under realistic wideband modulation conditions. The goal of these methodologies is to reduce the number of fabrication iterations by characterizing the transistor and designing the PA in a realistic operating environment at an early stage of the design process.
WMI	**Low Noise Techniques** **Sponsor/s:** IMS **Organizers:** Mehmet Ogut, *JPL*; Shirin Montazeri, *Google* **ROOM: 146C** **13:30 – 17:20**	Understanding instrument noise and building stable, ultra-low-noise receivers have critical importance achieving high-quality accurate RF receivers that are used in a very broad field including 5G systems to weather/meteorological radars/sounders to communication systems. This workshop will fill an important gap by discussing noise parameter measurement techniques at room temperature and cryogenic environments, ultra-low-noise technologies and amplifiers in InGaAs mHEMTs and GaN HEMTs, low noise amplifiers and receivers for radiometric measurements and recent advanced state-of-the-art low-noise technology and their applications.
WMJ	**Chipletization, Heterogeneous Integration, and Advanced Packaging Solutions for mm-Wave and Sub-THz Applications** **Sponsor/s:** IMS **Organizers:** Atom Watanabe, *IBM T.J. Watson Research Center*; Mehmet Kaynak, *Texas Instruments* **ROOM: 146C** **08:00 – 11:50**	In this workshop, we will deeply explore high-frequency technologies, emphasizing the synergy between chipletization, heterogeneous integration, and advanced interconnect solutions for mm-wave and sub-THz applications. We will explore the need for innovative approaches to heterogeneous integration (HI), which involves integrating multiple dies and chiplets (eg CMOS, InP, and SiGe BiCMOS chips) on advanced packaging, to push the boundaries of high-frequency systems into new territories. The workshop will include insightful presentations from both academia and industry, highlighting the latest trends and future technologies in chipletization, HI, and advanced packaging. These talks will merge theoretical research with practical applications, offering a comprehensive view of the field's progression. Additionally, we will discuss the necessity for cutting-edge interconnects and transitions, essential for ultra-broadband, low-loss signal transmission in the high-frequency domains. Through discussions and case studies, we will show how these technologies are crucial for the practical realization of chiplet and HI-based mm-wave and THz systems.
WMK	**Enabling Long Life of Zero-Power IoT Devices Through Wireless Power Transmission** **Sponsor/s:** IMS **Organizers:** Diego Masotti, *Università di Bologna*; Simon Hemour, *IMS (UMR 5218)* **ROOM: 204ABC** **08:00 – 17:20**	Ultra-low-power devices which are pervasive in the IoT world depend on energy autonomy to perform seamlessly their sensing and communication tasks. The wireless provision of power is an appropriate solution for IoT sensors, as demonstrated by the talks of this workshop, given by experts from both academia and industry from all continents. The workshop focuses on different areas, such as the miniaturization of the IoT node, the exploitation of additive manufacturing for eco-friendly solutions, the need for circuital/electromagnetic strategies for accurate low-power transceiver design, system-on-chip solutions with machine-learning assisted sensing capabilities. Moreover, both near- and far-field applications (up to mm-Wave) are considered with special emphasis on complex electromagnetic environments, from the viewpoint of the receiver (rectenna) and the transmitter (energy source), with recent solutions of both single or multiple rectenna combinations and advanced transmitting stations. This workshop is part of the initiative "Future Directions Days on WPT" sponsored by the MTT-S Technical Committee-25 (Wireless Power Transfer and Energy Conversion Committee).

MONDAY WORKSHOPS

08:00 – 17:20 | Monday, 17 June 2024

WORKSHOP TITLE	WORKSHOP ABSTRACT
WML **Quantum Circuits, Methods, and Algorithms in Microwave Engineering** **Sponsor/s:** IMS **Organizers:** Michael Haider, *Technische Universität München*; Thomas E. Roth, *Purdue University*; Vladimir Okhmatovski, *University of Manitoba*; Zhen Peng, *University of Illinois at Urbana-Champaign* **ROOM: 147AB** **08:00 – 17:20**	The recent demonstration of quantum supremacy with superconducting quantum computers has triggered researchers all over the world to work towards improved superconducting microwave devices, as well as novel quantum methods and algorithms. For low temperatures and weak microwave signals, as is the case in the readout of superconducting qubits, the quantum nature of the electromagnetic field becomes apparent. Hence, the design, optimization, and scaling of superconducting microwave components need to be performed on a completely new theoretical basis, given by the framework of circuit quantum electrodynamics. For microwave engineers, this signifies a transfer of knowledge from classical electromagnetics to the quantum realm. More or less common microwave components such as mixers, isolators, parametric amplifiers, and circulators are key for the realization of superconducting quantum computers. They can be modeled using quantum theory or hybrid semi-classical quantum approaches, which is particularly important if quantum effects are fundamental to the device's operation. To exploit the full potential of general-purpose quantum computers based on superconducting qubits, which will enable breakthrough applications in the mid and long-term. Further technological advances in quantum error correction and qubit readout are necessary. Fueled by the remarkable progress in quantum hardware, which has defined a new noisy intermediate-scale quantum computing era, innovative quantum-based algorithms have been proposed. Particularly in electromagnetics, specialized quantum algorithms have the potential of significant speedups against classical computing strategies, especially when it comes to NP-hard optimization problems. Quantum algorithms also show great potential for the solution of integral equations, inverse scattering problems, and the prediction of radiation patterns. However, at the current stage, inevitable noise and limited qubit coherence times are prohibitive for most methods to show a real quantum advantage yet. Current topics in the modeling of RF microwave quantum devices based on circuit quantum electrodynamics will be addressed, which will be connected to the design and implementation of advanced quantum algorithms for general-purpose quantum computers and quantum annealers. One goal of this workshop is to bring together specialists in the modeling, design, and experimental realization of quantum hardware and experts in quantum algorithms with a focus on computational electromagnetics to discuss their individual ideas and perspectives on quantum computing. Another important aspect of this workshop is to introduce microwave engineers step-by-step to the strange new world of quantum theory by means of a comprehensive tutorial in the beginning, bridging the language barrier between quantum physics and RF microwave engineering.
WMM **Space-Borne Microwave and THz Instruments for Earth/Planetary Science Applications** **Sponsor/s:** IMS **Organizers:** Kavita Goverdhanam, *U.S. Army CCDC C5ISR Center*; Rainee N. Simons, *NASA Glenn* **ROOM: 149AB** **13:30 – 17:20**	Over six decades of exploration of our solar system by robotic spacecraft has not only been one of the greatest adventures in history but has also transformed our understanding of the universe. Every mission has enabled stunning scientific discoveries that altered our knowledge of the universe. The breadth and depth of the discoveries from these robotic missions would not have been possible without the parallel development of broad range of science instruments that operate over wide range of wavelengths across the electromagnetic spectrum. These instruments provided the data to address key science questions and test scientific hypotheses. The focus of this workshop is the development of space-borne microwave and THz instruments for exploring our Earth and the numerous objects orbiting the Sun in our solar system such as the planets and moons. At present there are significant technological needs for improving existing instruments and adapting completely new concepts. Practically all instruments can benefit from technology developments that can reduce their mass and power consumption and improve data communications capability. Additionally, increased sensitivity and measurement accuracy are desired attributes along with survivability under extreme temperature/pressure in the ionizing radiation environment of space. Furthermore, autonomy is important given the enormous planetary distances that are involved. Accordingly, the workshop includes presentations from space agencies and organizations across the globe highlighting their instrument development successes and the missions that were enabled. The workshop commences with an overview talk that presents the state of THz instrumentation development, design, and implementation challenges. The second presentation will review the current and upcoming synthetic aperture radar (SAR) missions and their advanced exploitations to deliver actionable information for society in the context of climate change and green transition. In the third presentation, exemplary space-borne instruments such as a limb sounder operating in the microwave and THz spectral range for measuring the atmospheric composition will be discussed. The fourth presentation will highlight two recent projects that utilize Artificial-Intelligence (AI) and Machine-Learning (ML) and discuss successes and challenges experienced during development and provide additional insights into future pathways for AI and ML in spaceborne microwave instruments. The fifth presentation will describe a unique high ground-resolution SAR system on a novel quasi-two-dimensional satellite dubbed as the DiskSat for very low Earth orbit missions. Lastly, a THz heterodyne spectrometer with high sensitivity and resolution and with 2U form factor as a payload on a CubeSat for detecting the presence of hydroxyl and heavy water simultaneously in the Moon's polar and equatorial regions will be presented.
WMN **Massively Distributed MIMO as the New Paradigm in 6G – Implementation Challenges and Opportunities** **Sponsor/s:** IMS **Organizers:** Christian Fager, *Chalmers University of Technology*; Ulf Gustavsson, *Ericsson* **ROOM: 149AB** **08:00 – 11:50**	Large-scale distributed or cell-free MIMO is the next step of the wireless evolution beyond 5G and massive MIMO. The main idea is to utilize a very large number of distributed, low-cost and low-power access points to form a network where the service is user-centric rather than divided into cells as done in conventional wireless networks. With the access points and antenna elements spread out spatially, the network can provide a more ubiquitous service in terms of coverage and throughput, but several challenges come along compared to conventional co-located MIMO. As coherent operation is needed to manage interference, aspects such as front/back-haul and RF synchronization requires novel schemes that scales well with distributed antenna systems. Keeping the access points simple and cost effective also implies challenges on RF front-end design and signal processing algorithms commonly used in co-located antenna arrays. In this workshop, we present some of the recent advances in research on RF and microwave technology aimed to address the challenges of a truly distributed and cell-free network.

INTERSOCIETY PANEL SESSION

12:00 – 13:30 | Monday, 17 June 2024 | Room: 201

PL1: Meeting IEEE Division IV Society Presidents

ORGANIZERS: Alistari Duffy, *Division IV;* **Ke Wu,** *Polytechnique Montréal*

PANELISTS:

Branislav Notaros, *IEEE Antennas and Propagation Society*
Wen-Chung Kao, *IEEE Consumer Technology Society*
Gregory Durgin, *IEEE Council on RFID*
John La Salle, *IEEE Electromagnetic Compatibility Society*
Maurizi Bozzi, *IEEE Microwave Theory and Techniques Society*
Vesna Sossi, *IEEE Nuclear and Plasma Sciences Society*

ABSTRACT: This panel session offers a chance to engage in dialogue with the Presidents of IEEE Societies within IEEE Division IV "Electromagnetics and Radiation." Given their shared research domains, this session presents a valuable opportunity to exchange perspectives on forthcoming technological challenges and foster avenues for future inter-society collaboration.

RFIC PANEL SESSION | 12:00 – 13:30 | Monday, 17 June 2024 | Room: 202AB

PL2: RF and Microwave League of Champions

ORGANIZERS: James Buckwalter, *Univ. of California, Santa Barbara;* **Shahriar Shahramian,** *Nokia-Bell Labs*

PANELISTS:

Ramesh Harjani, *Univ. of Minnesota*
Payam Heydari, *Univ. of California, Irvine*
Donald Lie, *Texas Tech Univ.*
Debabani Choudhury, *Intel Corp.*
Osamu Kusano, *Keysight Technologies*
Bodhisatwa Sadhu, *IBM Corp.*

ABSTRACT: Rather than a traditional panel, the RF and Microwave League of Champions will be a quiz show pitting a team of academics against a team of industry veterans to answer technical riddles sourced from RF and microwave history. Each team will comprise 3 members who will answer as a team on questions about RF/microwave theory, circuits, and systems. This event will be an entertaining diversion from the typical technical panel and hopefully a great deal of fun for participants.

2024 IEEE FELLOWS

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RECOGNIZING THE ACHIEVEMENTS OF ITS MEMBERS IS AN IMPORTANT PART OF THE MISSION OF IEEE. Each year, following a rigorous evaluation procedure, the IEEE Board of Directors confers a selected group of members for elevation to IEEE Fellow. The IEEE Fellow is the highest grade of membership in the IEEE. Less than 0.1% of voting members are selected annually for this member grade elevation. It is recognized by the technical community as a prestigious honour and an important career achievement. The following MTT-S members have been elevated to IEEE Fellow, effective 1 January 2024.

ACTIVE MTT-S MEMBERS, EVALUATED BY MTT-S	
Joseph Bardin	*for contributions to cryogenic microwave circuits*
Alexander Chenakin	*for contributions to microwave frequency synthesizer technologies*
Paolo Colantonio	*for contributions to microwave power amplifiers*
Frank Ellinger	*for contributions to radio frequency integrated phase shifters and amplifiers*
Deukhyoun Heo	*for contributions to CMOS power amplifiers in multi-layer packages and reconfigurable reactive components*
Telesphor Kamgaing	*for contributions to microwave and millimeter-wave packaging and system integration technologies*
Dietmar Kissinger	*for contributions to millimeter-wave integrated circuits*
Miguel Laso	*for contributions to high-power and smooth-profiled filters*
Changzhi Li	*for contributions to portable microwave radar sensor technologies*
Kaixue Ma	*for contributions to low-loss substrate integrated suspended line technology and reconfigurable millimeter-wave front-end integrated circuits*
Ho-Jin Song	*for contributions to wireless terahertz technology*
Alberto Valdes-Garcia	*for contributions to millimeter-wave circuits and systems for communications*
ACTIVE MTT-S MEMBERS, EVALUATED BY OTHER IEEE SOCIETIES/COUNCILS	
Premjeet Chahal	*for contributions to additive manufacturing and materials characterization*
Ji Chen	*for contributions to implantable medical device safety in MRI*
Yu Jian Cheng	*for contributions to substrate integrated millimeter-wave array antenna technology*
Gregory Durgin	*for contributions to the theory of fading in multi-antenna RFID systems*
Josep Miquel Jornet	*for contributions in terahertz communication and nano networking*
Atif Shamim	*for contributions in the field of antenna-on-chip and antenna-in-package*
Osama Shana'a	*for leadership in developing low-cost high-performance RF transceivers*
Mohammad Sharawi	*for contributions to multiband, reconfigurable, and integrated active multiple-input and multiple-output antenna systems*
Kim Fung Tsang	*for contributions to systems safety engineering*

THREE MINUTE THESIS 14:00 – 16:00 Monday, 17 June 2024 Room: 209ABC

In its eighth year, the IMS2024 3MT competition is designed to stimulate interest in the wide range of applications of microwave technology. Contestants will make a presentation of three minutes or less, supported only by one static slide, in a language appropriate to a non-specialist audience. The winners of the 3MT competition will receive their prizes at the Student Awards Luncheon on Thursday, 20 June 2024.

THIS YEAR'S FINALISTS ARE:

We2E-1 Bending The Rules: The Art and Science of Crafting Origami Antennas
Hani Al Jamal, *Georgia Institute of Technology*

Tu1C-4 Adaptive Microwave Filtering in Mobile Devices for Interference Mitigation
Xingyu Du, *University of Pennsylvania*

We1E-4 Towards Multifunctional Structures: Printed Wireless Electronics
Miren Hayet-Otero, *UPV/EHU, Tecnalia*

Tu3E-3 Unleashing the Power of Photonics for Generating Flexible and Clean Microwave Signals for future Communications
Amany Kassem, *University College London*

IF1-2 Shining Light into Microwave
Pedram Shirmohammadi, *University of Virginia*

Th1C-1 A Barrier Free Internet to Everyone Through Space
Bharath Cimbili, *University Freiburg*

Th1H-2 Smart Mirrors: Enabling the Invisible Pathways of Future Wireless Communications
Aditya Singh Shekhawat, *Arizona State University*

Tu1A-4 Wireless Power Meets Neurostimulation: Electromagnetic Solutions for Brain Implants
Mohammad Abdolrazzaghi, *University of Toronto*

Tu3E-2 Contactless Muscle Movement Detection
Marius Schmidt, *Friedrich-Alexander-Universität Erlangen-Nürnberg*

IF1-18 Suppression of Interference in Communication in a Fairly Simple Way
Kevin Martin, *University College Cork*

We3G-3 Dual-Channel Half-Mode Substrate-Integrated Waveguide Link Utilizing Mode Division Multiplexing
Mohamed Elsawaf, *University of Southern California*

Tu2A-3 Wireless Charging in 6G
Xinyu Kong, *IHE(KIT)*

Th1I-4 GaN-on-Si for Next-Gen Wireless Communication
Rana ElKashlan, *imec*

IF1-35 Body-centric Communication to support High Data Rate applications for augmented living
Samyadip Sarkar, *Purdue University*

Tu3F-2 Augmented Reality Enhanced Microwave Sensors for Structural Health Monitoring
Vishal Balasubramanian, *University of British Columbia*

Tu4F-4 Exploring into Greater Depth the Different Interrogation Methods that Exploit the Non-linearity of the Harmonic Transponder
Elsie Eyram Anthonio, *University of Vermont*

RMo2C-3 Redefining Radios: From Antenna Overload to Wireless Wonderland
Jamie C. Ye, *Cornell University*

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Booth 1605

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IMS INDUSTRY SHOWCASE | 15:10–17:00 | Monday, 17 June 2024 | Ballroom Foyer

Join us before the IMS Plenary Session for the Industry Showcase where selected IMS paper authors will present their work.

PAPER TITLE	SPEAKER
Th2G- 3: Enhanced Accuracy in On-Wafer Noise Figure Measurements at Sub-Terahertz Frequencies	**Nizar Messaoudi**, *Keysight Technologies*
Tu4C-3: Advancements in 300mm GaN-on-Si Technology with Industry's First Circuit Demonstration of Monolithically Integrated GaN and Si Transistors	**Qiang Yu**, *Intel Corporation*
Tu4E-5: A 6.8 - 9.4 GHz LNA Achieving 36.5 dB Peak Gain, Consuming 4.28 mW with an Adjustable Threshold Limiter for IR-UWB Applications	**Stefan Lepkowski**, *Sandia National Laboratories*
Th1E-2: A Novel Q-Choked Resonator for Microwave Material Measurements Alleviating Sample Thickness Limitations of Existing Techniques	**Malgorzata Celuch**, *QWED Sp. z o.o.*
Tu4A-5: Incorporating Resistive Foil RF Attenuators and Equalizers on and within PCBs from DC to 60 GHz: Design, Analysis, and Experimental Validation	**Maurio Grando**, *Invictus Animus Research and Design*
IF1-15: Machine-Learning Assisted Digital Predistortion Using Feedback via Dual-Polarized Antenna Arrays	**Yuuichi Aoki**, *Samsung Electronics Co., Ltd.*
IF1-30: Improve RF Dual Probe Calibration Accuracy with Peer-Terminated Standards Hung	**Che Fu**, *MPI Corporation*
IF1-33: Additively Manufactured High-Power Light Weight Millimetre-Wave Band Pass Filter Optimized with AI Tuning Algorithm for 5G Space Applications	**Laila Salman**, *ANSYS, Inc.*
IF1-10: A 0.9 to 4.0 GHz High Efficiency Reactively-Matched GaN Power Amplifier MMIC	**Jun Kamioka**, *Mitsubishi Electric Corporation*
Th2C-1: 220-GHz High-Efficiency Power Amplifiers in 250-nm and 130-nm InP HBT Technologies having 14.4-25.0% PAE and 40-60 mW Pout	**Zach Griffith**, *Teledyne Scientific*
Tu1F-2: An All-Digital Synthesizer Enabled by a Convolutional Neural Network	**Chris Thomas**, *Boeing*
Th2G-4: Measurement of Residual Phase Noise of Amplifiers at 80 GHz Using Interferometric Measurement Technique	**Wolfgang Wendler**, *Rohde & Schwarz GmbH & Co KG*

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WALTER E. WASHINGTON CONVENTION CENTER

IMS PLENARY SESSION | 17:30 – 19:00 | Monday, 17 June 2024 | Ballroom

Redundancy from the Sea Floor to Space: Building Reliable Capabilities for the Joint Force

IMS KEYNOTE SPEAKER:

Ms. Heidi Shyu, *Under Secretary of Defense for Research and Engineering (USD R&E)*

ABSTRACT: Microelectronics form the backbone of modern electronic systems, essential for both military and commercial applications. However, challenges such as diminishing domestic manufacturing and supply chain vulnerabilities have underscored national security risks. In response, the Department of Defense (DoD) is collaborating with industry and academia to ensure secure and robust sources of microelectronics. Leveraging cutting-edge commercial developments, the DoD aims to bolster defense microelectronic solutions. Furthermore, the DoD is spearheading FutureG, a suite of advanced wireless network technologies, in partnership with commercial entities. This initiative not only supports military operations but also contributes to maintaining a free and open internet. As Fifth Generation (5G) technology evolves, FutureG will provide innovative solutions, guiding future standards and cementing U.S. leadership in information technology.

In an address delivered by The Honorable Heidi Shyu, Under Secretary of Defense for Research and Engineering, the importance of wideband sensors in highly contested environments will be discussed as will how the DoD is prioritizing the development of multifunctional sensors capable of addressing cyber, electronic warfare, radar, and communication threats. Shyu will argue this integrated approach, from the ocean floor to space, will ensure reliability, adaptability, and superiority for the joint force in confronting advanced adversaries.

SPEAKER BIO: Ms. Heidi Shyu is the Under Secretary of Defense for Research and Engineering (OUSD(R&E)). In this role, she serves as the Chief Technology Officer for the Department of Defense (DoD), mandated with ensuring the technological superiority of the U.S. military, and is responsible for the research, development, and prototyping activities across the DoD enterprise. She also oversees the activities of the Defense Advanced Research Projects Agency (DARPA), the Missile Defense Agency (MDA), the DoD Laboratory and Engineering Center enterprise, and the Under Secretariat staff focused on developing advanced technology and capability for the U.S. military.

Full speaker bio at http://ims-ieee.org/imsplenarysession

THE NATIONAL MUSEUM OF AFRICAN AMERICAN HISTORY AND CULTURE

IMS WELCOME RECEPTION | 19:30 – 21:30 | Monday, 17 June 2024

IMS2024 starts with a welcome event on Monday for all attendees, which will be hosted at The National Museum of African American History and Culture following the IMS2024 Plenary Session.

About the Museum: The National Museum of African American History and Culture is the only national museum devoted exclusively to the documentation of African American life, history, and culture. It was established by an Act of Congress in 2003, following decades of efforts to promote and highlight the contributions of African Americans. To date, the Museum has collected more than 40,000 artifacts and nearly 100,000 individuals have become members. The Museum opened to the public on 24 September 2016, as the 19th museum of the Smithsonian Institution.

There are four pillars upon which the NMAAHC stands:

1. It provides an opportunity for those who are interested in African American culture to explore and revel in this history through interactive exhibitions
2. It helps all Americans see how their stories, their histories, and their cultures are shaped and informed by global influences
3. It explores what it means to be an American and share how American values like resiliency, optimism, and spirituality are reflected in African American history and culture
4. It serves as a place of collaboration that reaches beyond Washington, DC to engage new audiences and to work with the myriad of museums and educational institutions that have explored and preserved this important history well before this museum was created.

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Microwave Journal

151AB

RTu1B: RF and Mixed-Signal Circuits for Cryogenic and High-Radiation Environments

Chair: Alexandre Siligaris, *CEA-LETI*
Co-Chair: Travis Forbes, *Sandia National Laboratories*

08:00

RTu1B-1: Broadband Noise Characterization of SiGe HBTs Down to 4K

J. Benserhir, *EPFL*; Y. Zou, *EPFL*; Y. Peng, *EPFL*; H.C. Han, *EPFL*; E. Charbon, *EPFL*

08:20

RTu1B-2: A Fully Integrated Three-Channel Cryogenic Microwave SoC for Qubit State Control in $^{9}Be^{+}$ Trapped-Ion Quantum Computer Operating at 4K

P. Toth, P.S. Eugine, A. Meyer, *Technische Univ. Braunschweig*; K. Yamashita, *Keio Univ.*; S. Halama, *Leibniz Univ. Hannover*; M. Duwe, *Leibniz Univ. Hannover*; H. Ishikuro, *Keio Univ.*; C. Ospelkaus, *Leibniz Univ. Hannover*; V. Issakov, *Technische Univ. Braunschweig*

08:40

RTu1B-3: A Switchless Dual-Core Triple-Mode VCO Achieving 7.1-to-15.7GHz Frequency Tuning Range and 202.1dBc/Hz Peak FoM at 3.7 Kelvin

Y. Wu, *University of Macau*; Y. Peng, *University of Macau*; B. Huo, *University of Macau*; J. Yin, *University of Macau*; R.P. Martins, *University of Macau*; P.-I. Mak, *University of Macau*

09:00

RTu1B-4: A 46.7-dB Gain 9.3-K Noise Temperature 5.8-mW Two-Fold Current Reuse Dual Noise-Canceling LNA in 28-nm CMOS for Qubit Readout

M.K. Chaubey, *National Tsing Hua Univ.*; Y.-C. Chang, *NARLabs-TSRI*; P.-C. Wu, *NARLabs-TSRI*; H.-H. Tsai, *NARLabs-TSRI*; S.S.H. Hsu, *National Tsing Hua Univ.*

09:20

RTu1B-5: A Study of Total Dose Radiation Effects in Ka-Band Fractional-N PLLs in 45nm SiGe BiCMOS

D. Dolt, *Texas A&M Univ.*; L. Pelan, *AFRL*; S. Mcdonnell, *AFRL*; S. Smith, *Ohio State Univ.*; T. Dean, *AFRL*; D. Reents, *Texas A&M Univ.*; W. Gouty, *AFRL*; T. Quach, *AFRL*; W. Khalil, *Ohio State Univ.*; S. Palermo, *Texas A&M Univ.*

09:40

152AB

RTu1C: Digital Power Amplifier and Transmitter Systems

Chair: Xun Luo, *UESTC*
Co-Chair: Zhiming Deng, *MediaTek*

RTu1C-1: A Watt Level, 5–7GHz All Digital Polar TX Based on 3.3V Switched Capacitor Digital PA in 16nm Fin-FET for Wi-Fi7 Applications

N.R. Shay, *Tel Aviv University*; E. Solomon, *Intel*; L. Zohar, *Intel*; A. Ben-Bassat, *Intel*; E. Socher, *Tel Aviv University*; O. Degani, *Tel Aviv University*

RTu1C-2: A SAW-Less 3FLO-Suppression RF Transmitter with a Transformer-Based N-Path Switched-Capacitor Modulator Achieving -157.6dBc/Hz Output Noise and -61dBc CIM_3

G. Qi, *Sun Yat-sen Univ.*; H. Guo, *Sun Yat-sen Univ.*; P.-I. Mak, *University of Macau*; Y. Li, *Sun Yat-sen Univ.*

RTu1C-3: A 32.3dBm Quadrature Complex Domain Doherty Power Amplifier Based on Switched Constant-Current and Symmetrical Transformer Achieving 21.6% Average Power-Added Efficiency

T. Wang, *Fudan Univ.*; L. Shi, *Fudan Univ.*; D. Hua, *Fudan Univ.*; P. Cao, *Fudan Univ.*; J. Xu, *Fudan Univ.*; Z. Hong, *Fudan Univ.*

RTu1C-4: A 5G FR2 n260/n259 Phased-Array Transmitter Front-End IC in 28-nm CMOS FD-SOI with 3-Stack Power Amplifier Employing OPA-Based Bias Scheme and Cross-Tied Inductor Topology

J. Yun, H. Lim, J. Jeong, I. Lee, D. Kim, K. Kim, H.-W. Choi, G. Park, G. Baek, E.-T. Sung, A. Jain, F.A. Malekzadeh, V. Bhagavatula, I.S.C. Lu, S. Son, H.-C. Park, J. Hur, S. Yoo, *Samsung*

RTu1C-5: A 0.48mm² Sub-2.4GHz Transceiver with Reused Matching Network and Duty-Cycle Controlled Class-E PA for Medical Band

H. Huang, *NUDT*; X. Liu, *Beijing Ningju Technology*; Z. Tang, *Tsinghua Univ.*; W. Song, *Tsinghua Univ.*; Y. Ma, *Tsinghua Univ.*; Y. Zhang, *Beijing Ningju Technology*; X. Ma, *Beijing Ningju Technology*; M. Zhang, *Tsinghua Univ.*; J. Wang, *Tsinghua Univ.*; K. Lu, *NUDT*; Z. Wang, *Tsinghua Univ.*; G. Li, *Tsinghua Univ.*

151AB

RTu2B: Silicon Wireless Systems in the D-Band and Beyond

Chair: Minoru Fujishima, *Hiroshima University*
Co-Chair: Shahriar Shahramian, *Nokia Bell Labs*

RTu2B-1: A 210-to-250GHz Sliding-IF Frequency-Interleaved Transceiver with On-Chip Bow-Tie Antenna and 4th-Order FIR-Embedded Digital Modulator — 10:10

L. Gu, *Tsinghua Univ.*; W. Deng, *Tsinghua Univ.*; J. Gong, *Tsinghua Univ.*; T. Ma, *Tsinghua Univ.*; H. Jia, *Tsinghua Univ.*; Q. Wu, *Tsinghua Univ.*; J. Xue, *Tsinghua Univ.*; D. Li, *Tsinghua Univ.*; H. Liu, *Tsinghua Univ.*; Y. Sun, *Tsinghua Univ.*; B. Chi, *Tsinghua Univ.*

RTu2B-2: A 2×40Gb/s Ultra-Wideband 131–173GHz Dual Receiver for Point-to-Point Communication Systems with NF of 5.7dB in RFSOI — 10:30

A. Afifi, *Univ. of California, San Diego*; A. Ahmed, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

RTu2B-3: A 112.64-Gb/s CMOS D-Band Channel-Aggregation RX System-in-Package — 10:50

A. Hamani, *CEA-LETI*; J.L. Gonzalez-Jimenez, *CEA-LETI*; A. Siligaris, *CEA-LETI*; F. Foglia-Manzillo, *CEA-LETI*; C. Dehos, *CEA-LETI*; J.-B. David, *CEA-LETI*; N. Cassiau, *CEA-LETI*; A. Clemente, *CEA-LETI*

RTu2B-4: A D-Band Scalable 128-Channel Dual-Polarized Receive Phased-Array with On-Chip Down Converters for 2×2 MIMO Achieving 2×42Gbps — 11:10

M. Jung, *Univ. of California, San Diego*; L. Li, *Univ. of California, San Diego*; A. Ahmed, *Univ. of California, San Diego*; O. Hassan, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

152AB

RTu2C: Power Amplifiers for Satellite Applications

Chair: Tolga Dinc, *Texas Instruments*
Co-Chair: Aritra Banerjee, *University of Illinois at Chicago*

RTu2C-1: An Efficient, High Power Q-Band SiGe HBT Power Amplifier with a Compact Four-Way Wilkinson Power Combiner Balun for Emerging Very Low-Earth-Orbit SATCOM — 10:10

H. Lee, *Ajou Univ.*; I. Han, *Ajou Univ.*; J. Hwang, *Ajou Univ.*; I. Ju, *Ajou Univ.*

RTu2C-2: A Compact, Highly Linear Ku-Band SiGe HBT Power Amplifier Using Shared Single Center-Tap Four-Way Output Transformer Balun for Emerging Low Earth Orbit SATCOM Phased-Array Transmitter — 10:30

B. Yoon, *Hanyang Univ.*; I. Han, *Ajou Univ.*; J. Kim, *Hanyang Univ.*; I. Ju, *Ajou Univ.*

RTu2C-3: An Efficient Ku-Band Two-Way Vertical-Like Power-Combining Power Amplifier Using Merged Inter-Stage Transformers Achieving 23–23.4dBm Psat and 45.2–46.6% Peak PAE in 65nm CMOS — 10:50

J.-H. Kim, J.-T. Lim, J.-E. Lee, J.-H. Song, J.-T. Son, M.-S. Baek, E.-G. Lee, S. Choi, *Chungnam National University*; H.-W. Choi, *Samsung*; S.-M. Moon, *ETRI*; D. Chang, *ETRI*; C.-Y. Kim, *Chungnam National University*

RTu2C-4: A K-Band CMOS Power Amplifier Using an Analog Predistortion Linearizer with 22.1dBm Psat and 0.9° AM-PM Distortion — 11:10

J. Lim, *ETRI*; W. Lee, *Chonnam National Univ.* ; S.-M. Moon, *ETRI*; E. Oh, *Chonnam National Univ.* ; S. Wang, *ETRI*; D. Chang, *ETRI*; J. Park, *Chonnam National Univ.*

RTu2C-5: A 2–18GHz Frequency Reconfigurable Nonuniform Distributed Power Amplifier with 13.3W Average Power and 39% Average Efficiency — 11:30

S. Ma, *UESTC*; X. Li, *UESTC*; Z. Yu, *UESTC*; D. Shi, *UESTC*; X. Tang, *UESTC*; Y. Wang, *UESTC*

11:50

143ABC

Tu1A: Advanced Systems for Wireless Power Beaming

Chair: Naoki Hasegawa, *Softbank*
Co-Chair: Marco Dionigi, *Università di Perugia*

08:00 – 08:10
Tu1A-1: POWER: Persistent Optical Wireless Energy Relay, and DARPA's Pathway to Energy Web Dominance (Keynote)
P. Jaffe, *DARPA*

08:20 – 08:40
Tu1A-2: A 256-Elements Phased-Array Relay Transceiver for 5G Network Using 24GHz Wireless Power Transfer with Discrete ICs
M. Ide, *Tokyo Tech*; K. Yuasa, *Tokyo Tech*; S. Kato, *Tokyo Tech*; T. Tomura, *Tokyo Tech*; K. Okada, *Tokyo Tech*; A. Shirane, *Tokyo Tech*

08:40 – 08:50
Tu1A-3: A 24-GHz 4-Element Multi-Beam Wireless Energy Harvesting Array with Class-F Rectifiers Achieving 51.5% PCE
M. Ghorbanpoor, *ETH Zürich*; E. Le Roux, *CSEM*; A.M.A. Najafabadi, *CSEM*; O. Vorobyov, *CSEM*; P. Nussbaum, *CSEM*; H. Wang, *ETH Zürich*

09:00 – 09:10
Tu1A-4: Subwavelength-Scale 2D Superoscillatory Beam Scanning in Huygens' Box for Wireless Power Delivery
M. Abdolrazzaghi, *Univ. of Toronto*; R. Genov, *Univ. of Toronto*; G.V. Eleftheriades, *Univ. of Toronto*

09:20 – 09:30
Tu1A-5: Improvement of Data Rate of SWIPT System in Phantom by Integrated Metamaterial-Inspired Absorber for Biomedical Applications
X. Jiang, *Kyushu Univ.*; R.K. Pokharel, *Kyushu Univ.*; A. Barakat, *Kyushu Univ.*

145AB

Tu1B: Advanced Non-Planar Passive Components

Chair: Tarek Djerafi, *INRS*
Co-Chair: Mohamed M. Fahmi, *DRDC*

08:00 – 08:10
Tu1B-1: Exploiting the Coupling Variation of 3D-Printed Cavity Filters for Complex Dielectric Permittivity Sensing
B. Allain, *Télécom Saint-Étienne*; N. Delmonte, *Università di Pavia*; L. Silvestri, *Università di Pavia*; S. Marconi, *Università di Pavia*; G. Alaimo, *Università di Pavia*; F. Auricchio, *Università di Pavia*; M. Bozzi, *Università di Pavia*

08:20 – 08:40
Tu1B-2: A Ka-Band RWG Gysel Power Divider and Combiner Based-on Fixed Characteristic Impedance and Resistor-Less Loaded Ports
A. Moulay, *INRS*; A. Zerfaine, *INRS*; T. Djerafi, *INRS*

08:40 – 08:50
Tu1B-3: 3-D Centrally-Loaded FSS Leveraging Conductive and Dielectric Multimaterial Additive Manufacturing for Broadband Performance
X. Lv, *UTS*; Z. Luo, *UTS*; Y. Yang, *UTS*

09:00 – 09:10
Tu1B-4: 10-Gbit/s Close Proximity Communication in 120GHz Band Sheet LAN Using Dielectric Sheet as Transmission Medium
A. Hirata, *Chiba Institute of Technology*; Y. Komori, *Chiba Institute of Technology*; T. Nishihara, *Chiba Institute of Technology*; Y. Kawamoto, *Osaka Univ.*; T. Nagatsuma, *Osaka Univ.*

09:20 – 09:30
Tu1B-5: Research and Development of WRD600: Innovations in High-Power Double-Ridge Waveguide Combiners for Ultra-Wideband Applications
M.M.M. Ali, *Scientific Microwave*; M.O. Shady, *Scientific Microwave*; M. Elsaadany, *ÉTS*; S.I. Shams, *Concordia Univ.*; G. Gagnon, *ÉTS*; K. Wu, *Polytechnique Montréal*

146A

Tu1C: Magnetostatic, Ferroelectric, and Phase Change Material Based Microwave Devices

Chair: Ruochen Lu, *University of Texas at Austin*
Co-Chair: Tejinder Singh, *Dell Technologies*

08:00 – 08:10
Tu1C-1: Temperature Compensated Magnetostatic Wave Resonator Microsystem
R. Wang, *BAE Systems*; C. Devitt, *Purdue Univ.*; E. Langlois, *BAE Systems*; S. Tiwari, *Purdue Univ.*; A. Ashok, *Purdue Univ.*; S. Bhave, *Purdue Univ.*

08:20 – 08:40
Tu1C-2: A Novel Wideband RF Turbo Switch Using Phase-Change-Material in a SiGe BiCMOS Process
F. Amin, *Northrop Grumman*; T. Beglin, *Northrop Grumman*; N. Edwards, *Northrop Grumman*; N. El-Hinnawy, *Tower Semiconductor*; G. Slovin, *Tower Semiconductor*; D. Howard, *Tower Semiconductor*; D. Nichols, *Northrop Grumman*; R.M. Young, *Northrop Grumman*

08:40 – 08:50
Tu1C-3: SPST Acoustic Switch Based on Poled Ferroelectrics
H. Desai, *Univ. of Michigan*; M.Z. Koohi, *Univ. of Michigan*; A. Mortazawi, *Univ. of Michigan*

09:00 – 09:10
Tu1C-4: Meander Line Transducer Empowered Low-Loss Tunable Magnetostatic Wave Filters with Zero Static Power Consumption
X. Du, *Univ. of Pennsylvania*; S. Yao, *Univ. of Pennsylvania*; Y. Ding, *Univ. of Pennsylvania*; Z. Yu, *Univ. of Pennsylvania*; A.J. Geers, *Univ. of Pennsylvania*; F. Aflatouni, *Univ. of Pennsylvania*; M. Allen, *Univ. of Pennsylvania*; R.H. Olsson III, *Univ. of Pennsylvania*

09:20 – 09:30
Tu1C-5: High-Linearity Bandstop Filter with Frequency and Bandwidth Tunability Utilizing Phase-Change Material Switches
M.D. Hickle, *BAE Systems*; C. Huang, *BAE Systems*

146B

Tu1D: Advanced Low-Phase-Noise Signal Generation Techniques

Chair: José Luis Gonzalez-Jimenez, *CEA-LETI*
Co-Chair: Hong-Yeh Chang, *National Central University*

08:00 – 08:10
Tu1D-1: A Ka-Band 256-QAM Ninefold Sub-Harmonically Injection-Locked CMOS I/Q Modulator Using Pulsed Oscillator
L.-Y. Chen, *National Central Univ.*; P.-Y. Chen, *National Central Univ.*; H.-Y. Chang, *National Central Univ.*

08:20 – 08:40
Tu1D-2: A Ka-Band High Power and Low Phase Noise GaN MMIC Oscillator with a Compact Open-Loop Folded Resonator Filter
Y.-C. Chang, *National Tsing Hua Univ.*; J. Wang, *National Tsing Hua Univ.*; Y.-C. Chang, *NARLabs-TSRI*; C.-C. Chen, *National Tsing Hua Univ.*; D.-C. Chang, *NARLabs-TSRI*; Y. Huang, *University of Liverpool*; S.S.H. Hsu, *National Tsing Hua Univ.*

08:40 – 08:50
Tu1D-3: An Ultra-Low Phase Noise Substrate-Integrated-Waveguide Oscillator
M. Sun, *SUSTech*; D. Lu, *SUSTech*; J. Cai, *SUSTech*; M. Yu, *SUSTech*

09:00 – 09:10
Tu1D-4: 19-GHz VCO with Phase Noise of -117dBc/Hz at 1-MHz Offset Using an Array of Near Minimum Size Transistors and Intelligent Post Fabrication Selection
F. Jalalibidgoli, *Univ. of Texas at Dallas*; Y. Makris, *Univ. of Texas at Dallas*; K.K. O, *Univ. of Texas at Dallas*

09:20 – 09:30
Tu1D-5: A 2.9-to-7.2GHz Dual-Core Quad-Mode VCO Achieving 206.5dBc/Hz FoMT in 55nm CMOS
Y. Zhao, *XJTU*; C. Liang, *XJTU*; C. Fan, *XJTU*; Z. Xue, *XJTU*; X. Dong, *XJTU*; Z. Gao, *XJTU*; Y. Xin, *XJTU*; B. Tang, *XJTU*; L. Geng, *XJTU*

09:40

Denotes Keynote Presentation

146C

Tu1E: Photonic-Enabled Systems and Solutions

Chair: Jonathan Comeau, *BAE Systems*
Co-Chair: Steven M. Bowers, *University of Virginia*

Tu1E-1: Silicon Photonic Integrated Circuit Beamformer for RF Photonic Applications

T. Creazzo, C. Stine, C. Creavin, C. Harrity, K. Shreve, F. Wang, P. Yao, J. Murakowski, *Phase Sensitive Innovations*; G. Schneider, S. Shi, *Univ. of Delaware*; C. Schuetz, *Phase Sensitive Innovations*; D.W. Prather, *Univ. of Delaware*

Tu1E-2: Photonic-Enabled Terahertz Phase Arrays Using Dielectric Rod Waveguides for 6G Wireless Communications

G. Carpintero, D. Headland, *UC3M*; G. Schwanke, M. Deumer, S. Nellen, S. Lauck, L. Liebermeister, *Fraunhofer HHI*; K. Spanidou, *UC3M*; M. Ali, A. Rivera, *Leapwave Technologies*; R. Kohlhaas, *Fraunhofer HHI*

Tu1E-3: 1-Bit Digital Radio-over-Fiber System with Hybrid Architecture for 40-GHz Band

Y. Kase, *NEC*; J. Park, *NEC*; S. Hori, *NEC*

Tu1E-4: Ultrawideband Modular RF Frontend Development for Photonically-enabled Imaging Receiver

S. Shi, *Univ. of Delaware*; F. Wang, J. Abney, Z. Aranda, *Phase Sensitive Innovations*; G. Schneider, *Univ. of Delaware*; C. Schuetz, C. Harrity, K. Shreve, M. Zablocki, S. Dontamsetti, R. Lawrence, *Phase Sensitive Innovations*; D. Prather, *Univ. of Delaware*

Tu1E-5: Experimental Demonstration of a Wideband Frequency Hopping Radio Link

S.R. O'Connor, A. Voshell, D. Moody, N. Tomasello, E. Konitzer, W. Norman, T.R. Clark, *Johns Hopkins APL*

Tu1E-6: Tunable Optically Fed Radiofrequency Source for Distributing Coherent High-Fidelity Signals

C. Harrity, A.A. Mahmud, *Phase Sensitive Innovations*; G. Schneider, *Univ. of Delaware*; T. Creazzo, J. Murakowski, D. Chester, K. Clyne, T. Mascitelli, C. Schuetz, *Phase Sensitive Innovations*; D.W. Prather, *Univ. of Delaware*

147AB

Tu1F: AI/ML for Wireless Systems

Chair: Adrian Tang, *Jet Propulsion Laboratory*
Co-Chair: Qi-jun Zhang, *Carleton University*

Tu1F-1: A Modular, Distributed and Scalable DOA Estimator for MIMO Systems

A.S. Assoa, *Georgia Tech*; A. Bhat, *Georgia Tech*; S. Ryu, *Georgia Tech*; A. Raychowdhury, *Georgia Tech*

Tu1F-2: An All-Digital Synthesizer Enabled by a Convolutional Neural Network

C.M. Thomas, *Boeing*; M. Abderezai, *HRL Laboratories*; L. Dong, *Baylor Univ.*; V. Leung, *Baylor Univ.*

Tu1F-3: A Novel CNN-based Architecture for Over-the-Air 5G OFDM Channel Estimation

Fábio Coutinho, *Instituto De Telecomunicacoes*; Hugerles Silva, *Instituto De Telecomunicacoes*; Petia Georgieva, *IEETA*; Arnaldo Oliveira, *Instituto De Telecomunicacoes*

Tu1F-4: ChirpNet: Noise-Resilient Sequential Chirp Based Radar Processing for Object Detection

S. Sharma, *Georgia Tech*; H. Kumawat, *Georgia Tech*; S. Mukhopadhyay, *Georgia Tech*

08:00
08:10
08:20
08:30
08:40
08:50
09:00
09:10
09:20
09:30
09:40

INDUSTRY WORKSHOPS

08:00 – 17:20 | Tuesday, 18 June 2024

SESSION CODE	TIME & LOCATION	TITLE AND ABSTRACT	SPEAKER/S, AFFILIATION
IWTU1	08:00 – 09:40 Room: 144C	**Technologies and Circuits for 5G/5G+ RF Front End Modules—**The research area of improving the performance, cost and size of 5G RF solutions and evolution to 6G is very active with many developments and it is one of the driving factors for semiconductor industry. Mobile cellular subscribers reached more than 6 billion in 2022 and 5G LTE brings high data capacity and low latency using sub-6GHz and mm-Wave spectrum. Mm-Wave up to 300GHz will play a major role in future 6G networks. The proliferation of worldwide smartphones has been in part possible due to increased computational power of CMOS technology in lower feature nodes as 3nm/7nm. This has made also possible to essentially enhance RF CMOS through digital signal processing (DSP) and digital calibration. The industrial workshop will cover 5G semiconductor technologies and architectures currently used in RF Front End Modules for cellular applications, the challenges for the 5G deployment as well as the evolution to 6G.	Venkata Vanukuru, *GlobalFoundries*, Anurajan Hosagavi Puttaraju, Florinel Balteanu, *Skyworks Solutions*
IWTU2	10:10 – 11:50 Room: 144C	**Linearization of RF Power Amplifiers for Wideband Applications—**Communications standards such as 5G, WLAN, and SatCom as well as radar systems share the common trend towards higher frequencies and larger signal bandwidths. These trends impose tight requirements on transmitter linearity and power amplifiers efficiency. This workshop introduces a workflow to combine state-of-the-art PA measurements with behavioral models and prototypes for accelerating the design, optimization, and testing of linearization techniques. We will introduce recent trends in PA architectures and identify linearization techniques such as DPD, also taking into account load-pull effects. We will use hardware characterization and behavioral models to tradeoff design parameters and improve ACLR, EVM, and other metrics for 5GNR waveforms.	Salvatore Finocchiaro, Jeff Gengler, *Qorvo Inc.*, Markus Lörner, Florian Ramian, *Rohde & Schwarz GmbH,* Wissam Saabe, *AMCAD Engineering;* Giorgia Zucchelli, *MathWorks B.V.*
IWTU3	13:30 – 15:10 Room: 144C	**Model-Based Design of Stable High Efficiency GaN Power Amplifiers—** This workshop will focus on successful model based GaN power amplifier design. Advanced simulation approaches for achieving stable high efficiency amplifiers will be outlined. This will include demonstration examples using Keysight Technologies' Pathwave Advanced Design System software, along with accurate non-linear models for Qorvo GaN HEMT devices developed by Modelithics. Tools and techniques to tackle design challenges, such as load-modulated design will be exemplified, as well as advanced stability analyses enabled by the new WS-probe, now available in ADS and embedded intrinsically in Modelithics Qorvo GaN models.	Fouad Boueri, *Qorvo USA;* Dr. Larry Dunleavy, *Modelithics, Inc.;* Matt Ozalas, *Keysight Technologies;* Dr. Taylor Barton *Univ. of Colorado*
IWTU4	15:40 – 17:20 Room: 144C	**Optimization of RF Power Amplifiers in the sub-THz Range—**This workshop offers a deep dive, how precise load pull measurements support the optimization of RF power amplifiers in the D-band, a frequency range gaining momentum with its growing range of applications. Our session will center around a latest multi-stage power amplifier design operating in D-band. We will explore the distinctions and applications of passive versus hybrid load pull techniques, highlighting their roles in advanced measurement scenarios.	Markus Lörner, *Rohde & Schwarz;* Vince Mallette, *MPI Corp.;* Bryan Hosein, Sajjad Ahmed, *Focus Microwaves;* Andre Engelmann, *Friedrich-Alexander-Univ. Erlangen-Nürnberg;* Marco Dietz, *Fraunhofer Research Institution for Microsystems and Solid State Technologies EMFT*

STUDENT DESIGN COMPETITIONS

09:30 – 17:00 | Tuesday, 18 June 2024 | BOOTH 2439, IMS EXHIBIT FLOOR

All attendees are invited to the annual IMS Student Design Competitions on Tuesday, 18 June 2024. Students have been busy over the past several months designing and building solutions to the challenging engineering problems presented in the nine student design competitions listed below. Judges will measure the students' designs at this event to determine the winners of the various competitions. Come to this event to cheer on the students, celebrate their hard work, and learn about their innovative designs!

SESSION CODE	TOPIC
SDC1	Electromagnetic Tumor Detection
SDC2	1 – 8 GHz Component Less Bias Tee
SDC3	Tunable Impedance Matching Network
SDC4	High Efficiency Power Amplifier
SDC5	mmWave Dual Band 3D Printed Antenna
SDC6	High Efficiency Power Amplifier for 50 MHz Using GaN FET
SDC7	Radar for Noncontact Vital Sign Sensing
SDC8	Switched Acoustic Filter Module
SDC9	Reflectionless High-pass Filter Design for Load-Pull Measurement Setups

IMS2024 **Young Professionals Program**

Tuesday, 18 June 2024

YP Mentorship Luncheon | 12:00-13:30 | Room: 144AB | Walter E. Washington Convention Center

Understand the benefits of mentorship. Discover mentorship opportunities. Establish networks with potential colleagues and mentors.

Joint WIM/YP Panel Session: Developing Your Personal Brand | 15:45-16:30 | Room: 144AB | Walter E. Washington Convention Center

Whether you recognize it or not, you have a personal brand. If you are wondering: How did that happen? Or, how can I influence how my brand is perceived in the industry? Then, this panel is for you!

WIM, YP Receptions and Scavenger Hunt | 17:30-21:30 | The Spy Museum

After the panel, help continue the conversation and laughs at the annual WIM and YP receptions! Network over cocktails and snacks and be sure to participate in the scavenger hunt!

Wednesday, 19 June 2024

An Exploration on Leadership with DARPA's Dr. Whitney Mason, *Office Director, Microsystems Technology Office (MTO), Defense Advanced Research Projects Agency (DARPA)* | 09:50-10:50 | Room: 144AB | Walter E. Washington Convention Center

Abstract: Join DARPA's Dr. Whitney Mason for a fireside on key leadership traits, enabling the development of future workforces, and empowering the next generation of STEM leaders.

Dr. Whitney Mason is the director of the Microsystems Technology Office (MTO). Previously, she held the deputy director role in the agency's Strategic Technology Office (STO) from June 2022 to October 2023. Prior to joining STO, Dr. Mason served as a program manager in MTO from November 2017 to May 2022. Her research interests include imaging sensors that provide multifunction capability. In particular, she is interested in novel device structures, optics, and electronics that enable new capabilities compared to current state-of-the-art imaging systems.

Dr. Mason joined DARPA from the Army C5ISR Center, formerly the Army Communications-Electronics Research, Development and Engineering Center, where she was the director of the Science and Technology Division within the Night Vision and Electronic Sensors Directorate at Fort Belvoir, Virginia. In that role, she led a team of scientists and engineers in the pursuit of new and improved focal plane array materials and devices; advanced read-out circuits; and enhanced optical materials and designs, lasers, and image processing. Dr. Mason holds a Doctor of Philosophy degree in physics from the University of Oklahoma and a Bachelor of Science degree in physics from Georgetown University.

Entrepreneurship 101 Panel Session: Collaboration with Young Professionals (YP) and Women in Microwaves (WIM) | 11:00-12:00 | Room: 144AB, Walter E. Washington Convention Center

YP Panel Session: Grow Your Career! | 15:10-16:10 | Room: 144AB, Walter E. Washington Convention Center

Get your first position! Earn promotions in your current position! Expand your knowledge base and network!

Panelists:

Angela Wallace, *Booz Allen Hamilton*

Dimitra Psychogiou, *Professor University College Cork (UCC)* and *Tyndall National Institut*

Dr. Adilson S. Cardoso, *Raytheon*

Thursday, 20 June 2024

Publish with Microwaves101 | 11:00-12:00

Brenda Huettner is an independent technical communication consultant who has worked for the past 40 years as a writer, editor, trainer, and manager, for both software and hardware companies. She's a principal of Microwaves101.com, an online encyclopedia of microwave engineering knowledge. Brenda is a Fellow of the Society for Technical Communication, and a Senior Member of IEEE, active in the Professional Communication Society, the Engineering Management council, and the Tucson section. She's also a member of the Usability Professionals Association. Brenda has published several books and articles, and presented half-day, full-day, and multi-day courses on writing, project management, usability, and career management. She has also been a member of NASA's Solar System Ambassador education and public outreach program for the past ten years.

IEEE youngprofessionals

Sponsored By: Microwaves&RF

150AB

Tu2A: Devices and Components for Effective Wireless Power Transfer

Chair: Jasmin Grosinger, *Technische Universität Graz*

Co-Chair: Dieff Vital, *University of Illinois at Chicago*

10:10 – 10:20

Tu2A-1: A Novel e-Textile Body-Worn Antenna Array for Wireless Power Transfer and Energy Harvesting

Y. Jiang, *Univ. of Manchester*; Z. Zhang, *Univ. of Manchester*; X. Liao, *Univ. of Manchester*; Z. Hu, *Univ. of Manchester*

10:30 – 10:40

Tu2A-2: A New Security and Identification Concept for SWIPT Systems in IoT Applications

T.E. Djidjekh, *LAAS-CNRS*; L. Sanogo, *LAAS-CNRS*; G. Loubet, *LAAS-CNRS*; A. Sidibé, *LAAS-CNRS*; D. Dragomirescu, *LAAS-CNRS*; A. Takacs, *LAAS-CNRS*

10:50 – 11:00

Tu2A-3: A 124–144GHz Rectifier Achieving 22% RF-to-DC Conversion Efficiency in 22nm FD-SOI CMOS Technology

X. Kong, *KIT*; A.Ç. Ulusoy, *KIT*

11:10 – 11:20

Tu2A-4: Broadband High-Efficiency Microwave Rectifier with Nonuniform Transmission-Line Input Matching for Harmonic Backscattering Applications

L. Hüssen, *RWTH Aachen Univ.*; M.-D. Wei, *RWTH Aachen Univ.*; R. Negra, *RWTH Aachen Univ.*

11:30 – 11:40

Tu2A-5: A 28GHz Band Highly Efficient GaAs Rectenna MMIC with EM Coupling Structure for an External Highly Efficient Wire Antenna

N. Sakai, *Kanazawa Institute of Technology*; Y. Tondokoro, *Kanazawa Institute of Technology*; A. Kobayashi, *Kanazawa Institute of Technology*; K. Noguchi, *Kanazawa Institute of Technology*; M. Tsuru, *Kanazawa Institute of Technology*; K. Itoh, *Kanazawa Institute of Technology*

145AB

Tu2B: Advanced Non-Planar Filter Design

Chair: Cristiano Tomassoni, *Università di Perugia*

Co-Chair: Vicente E. Boria, *Universitat Politècnica de València*

10:10 – 10:20

Tu2B-1: Direct-Coupled TE–TM Dual-Mode Waveguide Cavities

C. Tomassoni, *Università di Perugia*; S. Bastioli, *RS Microwave*; R. Snyder, *RS Microwave*; V. de la Rubia, *Universidad Politécnica de Madrid*

10:30 – 10:40

Tu2B-2: Practical Design of Waveguide Filters with Quarter-Wavelength Resonators Implementing Transmission Zeros Using Frequency-Variant Couplings

D. Rubio, *UPV*; S. Cogollos, *UPV*; V.E. Boria, *UPV*; M. Guglielmi, *UPV*

10:50 – 11:00

Tu2B-3: A Novel Six-Port Three-Way Filtering Splitter-Combiner Network Using a Lattice of Coupled Resonators Realized in Ridge Waveguides

M.M. Fahmi, *DRDC*; J.A. Ruiz-Cruz, *UPM*; R.R. Mansour, *Univ. of Waterloo*

11:10 – 11:20

Tu2B-4: A Novel Trisection for Implementing Below-Passband Transmission Zeros in Evanescent-Mode Waveguide Filters

M. Martinez-Mendoza, *UPV*; D. Smacchia, *Val Space Consortium*; J.V. Morro, *UPV*; P. Soto, *UPV*; J. Vague, *UPV*; M. Guglielmi, *UPV*; V.E. Boria, *UPV*

11:30 – 11:40

Tu2B-5: Design of Multifunctional Filtering Power Divider in Coaxial Technology for Power Combining Applications

M. Kumar, G. Basavarajappa, K. Rawat, *IIT Roorkee*

11:40 – 11:50

Tu2B-6: Short-End Half-Wavelength Four-Sections Coaxial Stepped Impedance Resonators for Tx Space Bandpass Filter

K. Kouny, J. Benedicto, J.-F. Favennec, A.B. Bernal, *Lab-STICC (UMR 6285)*; M. Belhaj, *ONERA*; N. Fil, *CNES*; D. Payan, *CNES*; E. Rius, *Lab-STICC (UMR 6285)*

146A

Tu2C: Recent Advances on Microwave Acoustics

Chair: Holger Maune, *OvG Universität Magdeburg*

Co-Chair: Amelie Hagelauer, *Technische Universität München*

10:10 – 10:20

Tu2C-1: Synthesis and Design of a Highly Selective Band-5 SAW Filter Using Cascaded DMS with Non-Uniform Polarities

H. Tian, *UESTC*; Y. Dong, *UESTC*

10:30 – 10:40

Tu2C-2: 23.8 GHz Acoustic Filter in Periodically Poled Piezoelectric Film Lithium Niobate with 1.52 dB IL and 19.4% FBW

S. Cho, *Univ. of Texas at Austin*; O. Barrera, *Univ. of Texas at Austin*; J. Kramer, *Univ. of Texas at Austin*; V. Chulukhadze, *Univ. of Texas at Austin*; T.-H. Hsu, *Univ. of Texas at Austin*; J. Campbell, *Univ. of Texas at Austin*; I. Anderson, *Univ. of Texas at Austin*; R. Lu, *Univ. of Texas at Austin*

10:50 – 11:00

Tu2C-3: A Fin-Mounted A5-Mode Lithium Niobate Resonator at 27.58GHz with k^2 of 4.4%, Qp of 448, and FoM of 19.7

J. Fang, *USTC*; K. Yang, *USTC*; F. Lin, *USTC*; H. Tao, *USTC*; J. Chen, *USTC*; C. Zuo, *USTC*

11:10 – 11:20

Tu2C-4: A 56GHz Trilayer AlN/ScAlN/AlN Periodically Poled FBAR

W. Peng, *Univ. of Michigan*; S. Nam, *Univ. of Michigan*; D. Wang, *Univ. of Michigan*; Z. Mi, *Univ. of Michigan*; A. Mortazawi, *Univ. of Michigan*

11:30 – 11:40

Tu2C-5: Experimental Study of Periodically Poled Piezoelectric Film Lithium Niobate Resonator at Cryogenic Temperatures

J. Kramer, *Univ. of Texas at Austin*; O. Barrera, *Univ. of Texas at Austin*; S. Cho, *Univ. of Texas at Austin*; V. Chulukhadze, *Univ. of Texas at Austin*; T.-H. Hsu, *Univ. of Texas at Austin*; R. Lu, *Univ. of Texas at Austin*

146B

Tu2D: Advanced mm-Wave Frequency Conversion Techniques

Chair: Stephen Maas, *Nonlinear Technologies*

Co-Chair: Chinchun Meng, *NYCU*

10:10 – 10:20

Tu2D-1: A W-Band Stacked Frequency Quadrupler With A Dual Driven Core Achieving 10.3% Drain Efficiency

Y. Mensah, *Georgia Tech*; S. Rao, *Georgia Tech*; J. Teng, *Georgia Tech*; J. Cressler, *Georgia Tech*

10:30 – 10:40

Tu2D-2: A F-Band ×4 Frequency Multiplier Chip with High Spectral Purity Using Vertically Stacked Marchand Baluns and TF-MSL

R. Weber, *Fraunhofer IAF*; S. Wagner, *Fraunhofer IAF*; A. Leuther, *Fraunhofer IAF*; A. Tessmann, *Fraunhofer IAF*

10:50 – 11:00

Tu2D-3: A 43–84GHz, Wideband Frequency Doubler With a Symmetric, AC-Terminated Transformer Balun

W. Lim, A. Moradinia, S. Lee, J.W. Teng, C.T. Coen, N.E. Lourenco, J.D. Cressler, *Georgia Tech*

11:00 – 11:10

Tu2D-4: Strong Fundamental Rejection in Frequency Doublers at 220–260GHz Using a 250-nm InP HBT Process

J.S.-C. Chien, E. Lam, J. Tao, J.F. Buckwalter, *Univ. of California, Santa Barbara*

11:10 – 11:20

Tu2D-5: A Wideband Bi-directional Active Mixer for 5G Millimeter-Wave Applications

Pei-Wen Wu, *National Taiwan Univ.*; Jia-Wei Ye, *National Taiwan Univ.*; Zi-Hao Fu, *National Taiwan Univ.*; Yu-Teng Chang, *Yuan Ze Univ.*; Kun-You Lin, *National Taiwan Univ.*

11:30 – 11:50

Tu2D-6: A Low Power 185 GHz Static CML Frequency Divider in SiGe HBTs Using Band-switching Technique in 45nm PDSOI BiCMOS

H.-Y. Chien, *Univ. of California, Los Angeles*; C. Chen, *Univ. of California, Los Angeles*; R. Chen, *Univ. of California, Los Angeles*; J. Woo, *Univ. of California, Los Angeles*; S. Pamarti, *Univ. of California, Los Angeles*; M.-C.F. Chang, *Univ. of California, Los Angeles*; C.-K.K. Yang, *Univ. of California, Los Angeles*

Denotes Keynote Presentation

146C

Tu2E: Does Analog Photonics have a Role in 6G Systems and Beyond?

Chair: Siva Yegnanarayanan, *MIT Lincoln Laboratory*

Tu2E-1: Generation and Transport of mmWaves for the Next Generation Communication Applications

S. S.J., *IIT Madras*; B. Gopalan, *IIT Madras*; D. Venkitesh, *IIT Madras*

Tu2E-2: TERA6G: Reconfigurable Transceivers Reaching into the Millimeter-Wave Range

G. Carpintero, *UC3M*; H. Avramopoulos, *NTUA*; D. de Felipe, *Fraunhofer HHI*; S. Nellen, *Fraunhofer HHI*; C. Roeloffzen, *LioniX International*; Z. Tegegne, *PHIX*; A. Alexiou, *Univ. of Piraeus*; J. Kokkoniemi, *Univ. of Oulu*; J. Costa-Requena, *Cumucore*; D. Kritharidis, *Intracom Telecom*; E. Yusta, *Telefónica I+D*

Tu2E-3: Ultrabroadband Indoor Optical Wireless Networks

A. Nirmalathas, *Univ. of Melbourne*; T. Song, *Univ. of Melbourne*; S. Edirisinghe, *Jayawardenapura University*; J. Li, *Shandong Normal University*; C. Ranaweera, *Deakin University*; K. Wang, *Shandong Normal University*; C. Lim, *Univ. of Melbourne*

Tu2E-4: Optical Fronthauling and mm-Wave/Sub-THz Signal Generation Techniques for the 6G and Beyond 6G Wireless Systems

A. Delmade, *Dublin City University*; L. Barry, *Dublin City University*

147AB

Tu2F: AI / ML For Transmitter Systems

Chair: Sudipto Chakraborty, *IBM*

Co-Chair: Adrian Tang, *Jet Propulsion Laboratory*

Tu2F-1: MP-DPD: Low-Complexity Mixed-Precision Neural Networks for Energy-Efficient Digital Pre-distortion of Wideband Power Amplifiers

Y. Wu, A. Li, M. Beikmirza, G. Singh, *Technische Universiteit Delft*; Q. Chen, *Universiteit Leiden*; L. de Vreede, M. Alavi, C. Gao, *Technische Universiteit Delft*

Tu2F-2: IMS Deep Learning Enabled Generalized Synthesis of Multi-Port Electromagnetic Structures and Circuits for mmWave Power Amplifiers

E.A. Karahan, *Princeton Univ.*; Z. Liu, *Texas Instruments*; K. Sengupta, *Princeton Univ.*

Tu2F-3: Transfer Learning Assisted Fast Design Migration Over Technology Nodes: A Study on Transformer Matching Network

Chenhao Chu, *ETH Zurich*; Yuhao Mao, *ETH Zurich*; Hua Wang, *ETH Zurich*

Tu2F-4: Optimizing Direct Learning Neural Network Digital Predistortion Through the Lottery Ticket Hypothesis Agent

E. Loebl, *Technion*; N. Ginzberg, *Tel-Aviv Univ.*; E. Cohen, *Technion*

143ABC

Tu2G: Microwave-Based Space Based Solar Power

SPECIAL SESSION

Tu2G-1: (Space-based solar) Wireless Power Transfer: The Airbus vision

V. Ziegler, *Airbus*

Tu2G-2: Toward an Ecosystem of Wireless Energy from Earth to Space and Back

A. Hajimiri, *CalTech*

Tu2G-3: Space Based Solar Power in Japan

N. Shinohara, *Kyoto Univ.*

Tu2G-4: ESA's Solaris Initiative and results from recent Concept studies on Space-based Solar Power Systems

S. Vijendran, *ESA*

Tu2G-5: POWER: Persistent Optical Wireless Energy Relay, and DARPA's pathway to Energy Web Dominance

P. Jaffe, *DARPA*

10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50

STARTUP PANEL SESSION

11:00 – 12:00 | Tuesday, 18 June 2024 | MicroApps Theater, Booth 2159

Voice of the Founder Industry Panel Session

Past and present founders share insights, investor due diligence is unraveled, and the art of pitching and storytelling is explored. Hear directly from StartUp Founders at various stages of their journey; from early stage through generating revenue, to successfully exiting and launching new startups.

MODERATORS:

Chris Marki, *CEO and Chief Technologist, Marki Microwave*

James Buckwalter, *Co-Founder, Chief Design Officer PseudolithIC, Inc.*

PANELISTS:

Harish Krishnaswamy, *Founder of MixComm (acquired by Sivers)*

Paul Blount, *Founder of Custom MMIC (acquired by Qorvo)*

Gabriel Rebeiz, *Founder of Spectrabeam (acquired by Renasas) and ExtremeWaves*

John Richardson, *Founder of XMicrowave (acquired by Quantic Electronics)*

Reception to follow in the StartUp Networking Lounge

RFIC PANEL SESSION

12:00 – 13:30 | Tuesday, 18 June 2024 | Room: 207AB

PL3: AI in RFIC Design: Opportunities, Threats, and Limitations

PANEL ORGANIZERS:
Kaushik Sengupta, *Princeton Univ.*
Oren Eliezer, *Samsung Semiconductor, Inc.*

PANELISTS:
Daivd Pan, *Univ. of Texas at Austin*
Jian Yang, *Synopsys, Inc.*
Michael Thompson, *Cadence Design Systems, Inc.*
Silvia Zhang, *Northeastern University*
Tom Kazior, *Defense Advanced Research Projects Agency*

ABSTRACT: The growth in generative AI has, naturally, raised the question of its impact on RFIC design. The latter has been traditionally regarded as somewhat of a black art, requiring the 'magic' of human intuition and creativity. But is RFIC design really so, or will AI be able to automate large portions of the design process in the future? Are the days of hand-crafted RFIC design limited? Will AI replace design engineers or only augment their capabilities, to some extent? This lunch time panel, with both industry and academic experts, will attempt to unentangle the impact of AI in RFIC design.

IMS PANEL SESSION

12:00 – 13:30 | Tuesday, 18 June 2024 | Room: 206

PL5: Will Long Range WPT Become a Reality?

PANEL ORGANIZERS AND MODERATORS:
Nuno Carvalho, *Instituto De Telecomunicacoes*
Jasmin Grosinger, *University of Graz*

PANELISTS:
Greg Kushnir, *EMROD*
Dinesh Kithany, *WAWT*
Chris Davlantes, *REACHPOWER*
Jennifer Grenz, *Ossia Inc.*
Volker Ziegler, *Airbus*
Jason Gill, *Powercast Co*

ABSTRACT: This panel will bring together industry, government laboratories, and academia to discuss long-range WPT links. The koto will be: Will Long Range WPT become a reality? What are the bottle-necks and limitations, and what has been done already? Which energy efficiencies are foreseen? It is expected to have a diverse group of researchers in different areas talking about these topics and to create enough discussion in the room to allow microwave enthusiasts and practitioners to foresee where to focus their interests and research strategies to work towards a future of WPT.

151AB

RTu3B: Silicon-Based Low-Noise Amplifiers and Mixers

Chair: Tong Zhang, *Google*
Co-Chair: Hsieh-Hung Hsieh, *TSMC*

13:30

RTu3B-1: A 4.4-mW 19–46-GHz Low-Noise Amplifier with Pole-Converging Gain Flattening and Triple-Resonance Input Matching

J. Fu, *CUHK-Shenzhen*; C. Song, *CUHK-Shenzhen*; Y. Wang, *CUHK-Shenzhen*; L. Wu, *CUHK-Shenzhen*

13:50

RTu3B-2: A Compact 28/39GHz Dual-Band Concurrent/Band-Switching LNA for 5G Multi-Band Multi-Stream Applications

D. Cheng, *Purple Mountain Laboratories*; Q. Chen, *Purple Mountain Laboratories*; J. Feng, *Purple Mountain Laboratories*; X. Chen, *Purple Mountain Laboratories*; X. Ma, *IP Paris*; L. Li, *Purple Mountain Laboratories*

14:10

RTu3B-3: A High-Gain D-Band LNA with Compact Gm-Boosting Core Based on Slow-Wave Feedback Achieving 6.1dB NF in 40nm CMOS

Y. Qian, *Southeast Univ.*; X. Huang, *Southeast Univ.*; Y. Shen, *Southeast Univ.*; Y. Ding, *Southeast Univ.*; Z. Wei, *Southeast Univ.*; Q. Han, *Southeast Univ.*; S. Hu, *Southeast Univ.*

14:30

RTu3B-4: A Multi-Band and High-IRR Down-Conversion Mixer for 5G NR FR2 Using Compact Transformer-Based Mutual-Image-Rejection Filter

H. Duan, *Southeast Univ.*; Q. Chen, *Southeast Univ.*; X. Wu, *Southeast Univ.*; D. Wang, *Southeast Univ.*; L. Li, *Southeast Univ.*; X. You, *Southeast Univ.*

14:50

RTu3B-5: A Compact Ultra-High-Linearity 7-to-20GHz Passive Mixer Achieving up to 37dBm IIP3 and 25.1dBm IP1dB in 45nm CMOS SOI

O. Hassan, *Univ. of California, San Diego*; A. Ahmed, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

15:10

152AB

RTu3C: D-Band and THz Transmitters

Chair: Vadim Issakov, *Technische Universität Braunschweig*
Co-Chair: Mona M. Hella, *Rensselaer Polytechnic Institute*

13:30

RTu3C-1: A 360GHz Single-Element Multi-Mode Orbital Angular Momentum Cavity Antenna-Based Transmitter in 90nm SiGe BiCMOS

W. Sun, *Univ. of California, Los Angeles*; S. Thomas, *Univ. of California, Los Angeles*; A. Babakhani, *Univ. of California, Los Angeles*

13:50

RTu3C-2: A 300-GHz-Band 40-Gb/s 2D Phased-Array CMOS Transmitter with Near-Half-Wave Antenna Pitch

K. Takano, S. Beppu, H. Yagi, *Tokyo University of Science*; Y. Sugimoto, K. Sakakibara, *Nagoya Institute of Technology*; S. Hara, M.H. Mubarak, A. Kasamatsu, *NICT*; S. Kubo, *THine Electronics*; K. Katayama, *Tokuyama KOSEN*; S. Tanaka, T. Yoshida, S. Amakawa, M. Fujishima, *Hiroshima Univ.*

14:10

RTu3C-3: A 110-to-170-GHz OOK Transmitter with 40-Gb/s Data Rate and 40-dB On-Off Ratio in 28-nm CMOS

C. Yang, *Southeast Univ.*; D. Tang, *Southeast Univ.*; P. Zhou, *Southeast Univ.*; Z. Chen, *Southeast Univ.*; J. Chen, *Southeast Univ.*; W. Hong, *Southeast Univ.*

14:30

RTu3C-4: A CMOS Fully Integrated 120-Gbps RF-64QAM F-Band Transmitter with an On-Chip Antenna for 6G Wireless Communication

Z. Wang, *Univ. of California, Irvine*; H. Wang, *Qualcomm*; Y.O. Hassan, *Univ. of California, Irvine*; P. Heydari, *Univ. of California, Irvine*

14:50

RTu3C-5: A 56Gb/s Zero-IF D-Band Transmitter for a Beamformer in 22nm FD-SOI

Y. Zhang, *IMEC*; K. Vaesen, *IMEC*; G. Mangraviti, *IMEC*; S. Park, *IMEC*; Z. Zong, *IMEC*; P. Wambacq, *IMEC*; G. Gramegna, *IMEC*

15:10

150AB

Tu3A: In Memoriam: Special Session Honoring Reynold Shigeru Kagiwada

13:30 – 15:10

Talk 1

E. Niehenke, *Niehenke Consulting*

Talk 2

A. Oki, *Northrop Grumman Corp.*

Talk 3

T. Lee, *Boeing, Past President*

Talk 4

P. Stacker, *Dura Sales of Southern California*

Talk 5

JK McKinney, *Dura Sales of Southern California*

145AB

Tu3B: Advanced Filter Synthesis Techniques

Chair: Ming Yu, *SUSTech*
Co-Chair: Simone Bastioli, *RS Microwave*

Tu3B-1: Synthesis of Underdetermined Filter Topologies with Nonresonating Nodes within a Limited Range

Y. Zeng, *SUSTech*; M. Yu, *SUSTech*

Tu3B-2: Circuit Model Extraction of Coupled-Resonator Diplexers with Common Resonator from Two-Port S-Parameters

Y. Chen, *CUHK*; H. Meng, *CUHK*; W.H. Hung, *CUHK*; J. Liu, *CUHK*; K.-L. Wu, *CUHK*

Tu3B-3: Synthesis Design of Wideband 3-D Polarization-Rotating Spatial Filter

T. Wei, *NJUPT*; W. Zhang, *NJUPT*; H. Li, *NJUPT*; B. Li, *NJUPT*; L. Zhu, *University of Macau*

Tu3B-4: Analytical Synthesize and Dimensioning of FDC Waveguide Filters

Y. Yang, *Xidian Univ.*; Q. Wu, *Xidian Univ.*; B. Liu, *Xidian Univ.*; M. Yu, *SUSTech*

Tu3B-5: Design of Monoblock Antenna-Loaded Bandpass Filters with General Synthesis Theory of Complex-Loaded Filters

X. Tan, *CUHK*; Y. Chen, *CUHK*; K.-L. Wu, *CUHK*

146A

Tu3C: Sub-THz and THz Circuits and Systems

Chair: Hamed Rahmani, *New York University*
Co-Chair: Chun-Hsing Li, *National Taiwan University*

Tu3C-1: An Energy Efficient 56-Gb/s D-band Point-to-point Link based on CMOS TX and RX Modules and Transmitarray Beamformers

J.L. Gonzalez-Jimenez, *CEA-LETI*; A. Siligaris, *CEA-LETI*; A. Hamani, *Univ. Grenoble Alpes*; F. Foglia Manzillo, *CEA-LETI*; P. Courouve, *CEA-LETI*; N. Cassiau, *CEA-LETI*; C. Dehos, *CEA-LETI*; A. Clemente, *CEA-LETI*

Tu3C-2: An FMCW-Modulated-Oscillator-Based Wide-Band Terahertz Detector in 16nm FinFET

J. Zhou, *Univ. of California, Los Angeles*; C. Chen, *Univ. of California, Los Angeles*; M.-C.F. Chang, *Univ. of California, Los Angeles*

Tu3C-3: 235-GHz Amplifier-Frequency-Multiplier Chain with Optimal Harmonic Impedance Matching Network in 40-nm CMOS

C.-H. Lin, C.-S. Lin, C.-H. Li, *National Taiwan Univ.*

Tu3C-4: A 240-GHz Wideband LNA with Dual-Peak-Gmax Cores and Customized High-Speed Transistors in 40-nm CMOS

Y.-K. Chen, W.-Z. Su, Y.-F. Tseng, C.-H. Li, *National Taiwan Univ.*

Tu3C-5: Micromachined Waveguide-Integrated Sub-THz Crossover Switch

A. Karimi, *KTH*; U. Shah, *KTH*; J. Oberhammer, *KTH*

Tu3C-6: Sub-THz Photoconductive Evanescent-Mode Waveguide SPST Switch

T. Jones, *Purdue Univ.*; D. Peroulis, *Purdue Univ.*

146B

Tu3D: Building Blocks for Advanced mm-Wave Systems

Chair: Kenneth Mays, *Boeing*
Co-Chair: Wooram Lee, *Pennsylvania State University*

Tu3D-1: Design of a W-Band Transformer-Based Switchless Bidirectional PALNA in 65-nm CMOS Process

C.-C. Chien, *National Taiwan Univ.*; Y. Wang, *National Taiwan Univ.*; Y.-S. Ng, *National Taiwan Univ.*; C.-C. Chiong, *Academia Sinica*; H. Wang, *National Taiwan Univ.*

Tu3D-2: 39 GHz Transmit/Receive Front-End-Module With Back-Off Efficiency Enhancement for 5G Communication

H. Yu, *Univ. of Waterloo*; M. Hazer Sahlabadi, *Univ. of Waterloo*; S. Boumaiza, *Univ. of Waterloo*

Tu3D-3: A Compact 28-GHz Transmitter Front-End with Co-Optimized Wideband Chip-Antenna Interface Achieving 18.5-dBm P1dB and 1.0-W/mm² Power Density for Phased Array Systems

Z. Liu, *HKUST*; L. Wang, *HKUST*; H. Fallah, *HKUST*; Z. Chen, *SCUT*; C.P. Yue, *HKUST*

Tu3D-4: Broadband Low-Noise Ka-Band Front-End MMIC in a 0.15-µm GaN-on-SiC HEMT Technology

F. Thome, *Fraunhofer IAF*; P. Neininger, *Fraunhofer IAF*; S. Krause, *Fraunhofer IAF*; P. Brückner, *Fraunhofer IAF*; R. Quay, *Fraunhofer IAF*

Tu3D-5: A Ka-Band Low-Power Ultra-Compact Reconfigurable Amplifier with Reverse Bypass Mode for Multi-Element Phased Array Transceivers

Y. Lee, H. Lim, D. Chun, B.-W. Min, *Yonsei Univ.*

Tu3D-6: A 90–100GHz Vector Modulator 7-Bit Phase Shifter with Voltage Summation Topology

T. Elazar, *Tel-Aviv Univ.*; E. Socher, *Tel-Aviv Univ.*

Denotes Keynote Presentation

146C

Tu3E: Generation, Amplification, and Radiation of mm-Wave and sub-THz Signals Using Microwave Photonic and Electronic Techniques

Chair: Kamran Entesari, *Texas A&M University*

Co-Chair: Siva Yegnanarayanan, *MIT Lincoln Laboratory*

Tu3E-1: Photonic Generation of Tunable Sub-THz Signals Using Two Semiconductor Lasers with Highly Asymmetric Mutual Coupling — 13:30

C.-H. Tseng, *National Cheng Kung Univ.*; B.-K. Liao, *National Cheng Kung Univ.*; S.-K. Hwang, *National Cheng Kung Univ.*

Tu3E-2: Efficient Synthesis of Broadband Linear Frequency-Modulated Quadrature Signals for Coherent Electro-Optical Sensor Systems — 13:50

M. Schmidt, *FAU Erlangen-Nürnberg*; C. Carlowitz, *FAU Erlangen-Nürnberg*

Tu3E-3: Photonic Synthesis of Continuously Tunable (5–170GHz) Microwave Signals with Frequency Independent Phase Noise — 14:10

A. Kassem, *Univ. College London*; Z. Zhou, *Univ. College London*; I. Darwazeh, *Univ. College London*; Z. Liu, *Univ. College London*

Tu3E-4: Photonic Microwave Amplification Using Optically Injected Semiconductor Lasers at Stable Locking Dynamics — 14:30

G.-T. Lu, *National Cheng Kung Univ.*; C.-H. Tseng, *National Cheng Kung Univ.*; S.-K. Hwang, *National Cheng Kung Univ.*

Tu3E-5: On-Chip Terahertz Topological Filter Antenna for 6G — 14:50

S. Kumar, *NTU*; N. Navaratna, *NTU*; A. Alphones, *NTU*; R. Singh, *NTU*

147AB

Tu3F: Wireless Solutions for Autonomous Sensors

Chair: Mohammad H. Zarifi, *University of British Columbia*

Co-Chair: Jasmin Grosinger, *Technische Universität Graz*

Tu3F-1: Integrated Dual-Mode Energy Harvesting for Self-Sustaining Sensor Nodes: Synergy of Solar and RF Energies — 13:30

Y. Qaragoez, *KU Leuven*; S. Pollin, *KU Leuven*; D. Schreurs, *KU Leuven*

Tu3F-2: Augmented Reality-Assisted Battery-Less Microwave-Based Sensors for Smart Health Monitoring of Coatings — 13:50

V. Balasubramanian, *Univ. of British Columbia*; M.H. Zarifi, *Univ. of British Columbia*

Tu3F-3: Spatial Multiplexing Technique for MIMO Backscatter Communication — 14:10

H. Jeong, *Pusan National Univ.*; H. Kim, *Pusan National Univ.*; N. Ha, *Pusan National Univ.*; S. Kim, *Pusan National Univ.*

Tu3F-4: A Stand-Alone Moisture Content Sensor Based on a Loaded Self-Oscillating Antenna — 14:30

A. Di Florio Di Renzo, *Univ. of Bologna*; S. Trovarello, *Univ. of Bologna*; O. Afif, *Univ. of Bologna*; L. Franceschelli, *Univ. of Bologna*; M. Tartagni, *Univ. of Bologna*; D. Masotti, *Univ. of Bologna*; A. Costanzo, *Univ. of Bologna* — 14:50

15:10

The IEEE MOVE truck is deployed to respond to hardest hit disaster areas that frequently have no power or communications. MOVE can quickly set up temporary operations and provide the power and communications required to initiate services to the people affected by the disaster. These temporary emergency relief provisions help people stay connected and make sure they can access the help they need. Services include cell phone charging, wi-fi access, and lighting to disaster victims. Come see the application of RF expertise!

Location: IMS Exhibit Floor, at the Societies Pavilion, (Booth 1605)

Hours:		
	Tuesday, 18 June 2024	09:30-17:00
	Wednesday, 19 June 2024	09:30-18:00
	Thursday, 20 June 2024	09:30-15:00

STUDENTS | INDUSTRY | ACADEMIA **RFIC**hat

17:00 – 18:30 | Tuesday, 18 June 2024 | 207AB

Burning Career Questions? Come Chat with the Pros!

Join us for an engaging discussion (and food!) at the RFIChat event. Students and experts from academia, industry, and research will converge for an open discussion on RFIC careers and future trends. Bring your questions and come learn how to kickstart, advance, and optimize your career path for variables such as innovation, work-life balance, positive impact, financial stability and more. Our panelists promise to offer invaluable insights (secrets!?) into the unique landscapes of academia and industry, so come meet them and have a chat!

Organizers: Spyridon Baltsavias, *Apple*, **Travis Forbes**, *Sandia National Laboratories*, **Amin Arbabian**, *Stanford University*

Panelists: Ali Hajimiri, *Caltech*, **Jennifer Kitchen**, *Arizona State University*, **Kostas Doris**, *NXP Semiconductors*, **Shahriar Shahramian**, *Nokia Bell Labs*, **Margaret Szymanowski**, *Crane A&E*

MICROAPPS

09:30 – 17:00 | Tuesday, 18 June 2024 | MicroApps Theater, Booth 2159

SESSION CODE	TIME	TITLE	SPEAKER/S, AFFILIATION
TUMA1	09:30 – 9:45	**Overview of High Dk Circuit Materials and Their Use with Different Circuit Structures**	John Coonrod, *Rogers Corporation*
TUMA2	09:45 – 10:00	**2d Scanner for Surface-Wise Measurements of Complex Permittivity Of Emerging LTCC and ULTCC Materials**	Marzena Olszewska-Placha, *QWED Sp. z o.o*
TUMA3	10:00 – 10:15	**Application of Microwave Imaging Techniques for the Characterization of Ion-Implanted Battery Materials**	Malgorzata Celuch, *QWED Sp. z o.o.*
TUMA4	10:15 – 10:30	**Converting dBFS and dBm for Accurate Signal Measurements**	Robin Getz, *MathWorks*
TUMA5	10:30 – 10:45	**Frequency Finesse: The Art of Synchronized RF Spectrum Analysis**	Alejandro Buritica, *Tektronix*
TUMA6	10:45 – 11:00	**Full XYZ Compensated Motion for Optimal on Wafer Pad Placement Accuracy**	Gavin Fisher, *FormFactor Inc.*
TUMA7	11:00 – 12:00	**StartUp Program: Voice of the Founder Industry Panel Session** **Moderators:** James Buckwalter, *Co-Founder and Chief Design Officer, PsuedolithIC, Inc.;* Chris Marki, *CEO and Chief Technologist, Marki Microwave* **Panelists:** Paul Blount, *Founder of Custom MMIC (acquired by Qorvo);* Harish Krishnaswamy, *Founder of MixComm (acquired by Sivers);* Gabriel Rebeiz, *Founder of Spectrabeam (acquired by Renasas) and ExtremeWaves;* John Richardson, *Founder of XMicrowave (acquired by Quantic Electronics)*	
TUMA8	12:00 – 12:15	**Measurement of Residual Phase Noise of Amplifiers at 80 GHz Using Interferometric Measurement Technique**	Wolfgang Wendler, *Rohde & Schwarz*
TUMA9	12:15 – 12:30	**Noise Figure Measurement in the 90 GHz Range Using a Noise Source and Harmonic Mixers in Combination with a Spectrum Analyzer**	Kay-Uwe Sander, Wolfgang Wendler, *Rohde & Schwarz*
TUMA10	12:30 – 12:45	**RF & Microwave Test of Printed-Circuit Board Assemblies Using Spring-Contacts and Probes**	Matthias Zapatka, *Ingun USA, Inc.*
TUMA11	12:45 – 13:00	**Screening of the Mmwave Signal Loss Properties of Copper Foils without the Need for Test Circuit Manufacturing**	Malgorzata Celuch, *QWED Sp. z o.o.*
TUMA12	13:00 – 13:15	**The Wideband Vector Channel Analyzer — New Features And Applications**	Tom Costello, *Astronics Test Systems*
TUMA13	13:15 – 13:30	**Trigger Tactics: Revolutionizing Real-Time Spectrum Analysis**	Alejandro Buritica, *Tektronix, Inc.*
TUMA14	13:30 – 13:45	**A New Approach to Load Pull Measurements**	Markus Lörner, *Rohde & Schwarz*
TUMA15	13:45 – 14:00	**How to Perform 800MHz (8ccx100mhz) 256QAM Phased Array Direct DPD Measurements and What Does It Mean for Your Linearization Efforts?**	Fabricio Dourado, *Rohde & Schwarz, GmbH & Co KG*
TUMA16	14:00 – 14:15	**Pulser Plus: A Complete Solution for Sequencing and Biasing GaN Radar Power Amplifiers**	Eamon Nash, *Analog Devices*
TUMA17	14:15 – 14:30	**Flexible and Powerful Environment For Modeling Complex Microwave Systems Composed Of Multiple Elements In WIPL-D Suits**	Branislav Ninkovic, *WIPL-D d.o.o.*
TUMA18	14:30 – 14:45	**Enablement of Foundry-Approved PDKs for Microwave Design Platform Expands Functionality to Silicon MMIC Designers**	Paul Sibrell, Dustin Hoekstra, *Tektronix*
TUMA19	14:45 – 15:00	**Frontiers of Flexibility: Pioneering Radar with Custom Waveform Generation**	Alejandro Buritica, *Tektronix, Inc.*
TUMA20	15:00 – 15:15	**Radar Cross Section Analysis for Target System-Level Simulation**	Vishwanath Iyer, *MathWorks, Inc.*
TUMA21	15:15 – 15:30	**Tackling The FR3 Implementation Challenges: Study of Radio Architectures and Enabling Technologies**	Rui Ma, Peter Bacon, *pSemi*
TUMA22	15:30 – 15:45	**Dynamic, Multi-Asset Scenario Analysis In Matlab**	Mike McLernon, *MathWorks*
TUMA23	15:45 – 16:00	**Matlab and the Phaser Development Kit**	Robin Getz, *MathWorks;* Sam Ringwood, *Analog Devices*
TUMA24	16:00 – 17:00	**IMS Executive Forum: A&D Semiconductor to Systems Trends** **Moderator:** Sanjay Raman, *Dean of Engineering, University of Massachusetts Amherst* **Panelists:** Nick Kolias, *Principal Engineering Fellow, Raytheon*; Tim Lee, *Technical Fellow, Boeing;* Bryan Goldstein, *President, Analog Devices Federal, Vice President, Aerospace and Defense Group, Analog Devices;* Tom Kole, *Vice President of Sales and Marketing, Integra Technologies;* Dean White, *Director, Defense and Aerospace Market Strategy, Qorvo*	

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IMS EXECUTIVE FORUM

16:00 – 17:00 | Tuesday, 18 June 2024 | MicroApps Theater, Booth 2159

A&D Semiconductor to Systems Trends

This panel of RF/microwave device and system company executives will discuss current trends in semiconductor technology and how they affect system design and performance. New types of compound semiconductor technology, AI integration, heterogeneous integration, chiplets, 3D packaging, new thermal materials and other related topics will be discussed including how these advancements affect system architecture and improve SWaP-C.

MODERATOR:

Sanjay Raman, *Dean of Engineering, University of Massachusetts Amherst*

PANELISTS:

Nick Kolias, *Principal Engineering Fellow, Raytheon*

Tim Lee, *Technical Fellow, Boeing*

Bryan Goldstein, *President, Analog Devices Federal, Vice President, Aerospace and Defense Group, Analog Devices*

Tom Kole, *Vice President of Sales and Marketing, Integra Technologies*

Dean White, *Director-Defense and Aerospace Market Strategy, Qorvo*

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IMS STUDENT PAPER COMPETITION

THIS YEAR'S IMS STUDENT PAPER COMPETITION FINALISTS:

Tu2C-2 23.8 GHz Acoustic Filter in Periodically Poled Piezoelectric Film Lithium Niobate with 1.52 dB IL and 19.4% FBW
Student Finalist: Sinwoo Cho, *University of Texas at Austin*
Advisor: Ruochen Lu, *University of Texas at Austin*

Tu1A-3 A 24-GHz 4-Element Multi-Beam Wireless Energy Harvesting Array with Class-F Rectifiers Achieving 51.5% PCE
Student Finalist: Mohsen Ghorbanpoor, *Eidgenössische Technische Hochschule Zürich*
Advisor: Hua Wang, *ETH Zurich*

Tu3C-5 Micromachined Waveguide-Integrated Sub-THz Crossover Switch
Student Finalist: Armin Karimi, *KTH Royal Institute of Technology*
Advisor: Joachim Oberhammer, *KTH Royal Institute of Technology*

Tu4D-2 A 37-43.5-GHz Fully-Integrated 16-element Phased-Array Transceiver with 64-QAM 7.2-Gb/s Data Rates Supporting Dual-Polarized MIMO
Student Finalist: Xin Chen, *Southeast University*
Advisor: Lianming Li, *Southeast University*

Tu4D-3 A 60-GHz Highly-Reused Joint Radar-Communication Transceiver with Reconfigurable Dual-Mode Gilbert Cells in 65-nm CMOS
Student Finalist: Lin Lu, *Southeast University*
Advisor: Lianming Li, *Southeast University*

We3E-1 Beyond Planar: An Additively Manufactured, Origami-Inspired Shape-Changing, and RFIC-Based Phased Array for Near-Limitless Radiation Pattern Reconfigurability in 5G/mmWave Applications
Student Finalist: Hani Al Jamal, *Georgia Institute of Technology*
Advisor: Manos M. Tentzeris, *Georgia Institute of Technology*

We3C-3 Decade-Bandwidth RF-Input Pseudo-Doherty Load Modulated Balanced Amplifier Using Signal-Flow-Based Phase Alignment Design
Student Finalist: Pingzhu Gong, *University of Central Florida*
Advisor: Kenle Chen, *University of Central Florida*

We2D-3 Fully Wireless Coherent Distributed Phased Array System for Networked Radar Applications
Student Finalist: Jason Merlo, *Michigan State University*
Advisor: Jeffrey Nanzer, *Michigan State University*

Th1D-3 A 1.6 mW Cryogenic SiGe LNA IC For Quantum Readout Applications Achieving 2.6 K Average Noise Temperature from 3–6 GHz
Student Finalist: Zhenjie Zou, *University of Massachusetts, Amherst*
Advisor: Joseph Bardin, *University of Massachusetts Amherst*

Th1D-4 A 6mW Cryogenic SiGe Receiver IC For High-Fidelity Qubit Readout
Student Finalist: Randy Kwende, *University of Massachusetts, Amherst*
Advisor: Joseph Bardin, *University of Massachusetts, Amherst*

TUESDAY

150AB

Tu4A: Emerging Passive Multiport Components

Chair: Bayaner Arigong, *FAMU-FSU*
Co-Chair: Hualiang Zhang, *UMass Lowell*

15:40 – 15:50
Tu4A-1: Advancing Performance in 3DHI
D. Palmer, *DARPA*

16:00 – 16:10
Tu4A-2: Image Dielectric Guides based Crossover for Millimeter-Wave Applications
F. Faisal, *INRS*; M. Chaker, *INRS*; T. Djerafi, *INRS*

16:20 – 16:30
Tu4A-3: A Novel Compact Uniplanar Isolation Circuit for Three-Port Baluns
X. Que, *SCUT*; L. Jiang, *SCUT*; Y. Wang, *SCUT*

16:40 – 16:50
Tu4A-4: A Compact 1.08–5.94GHz Balun With 1°/0.07dB Phase-/Amplitude-Imbalances Using Reverse Series Paths
C. Wang, *UESTC*; X. Luo, *UESTC*

17:00
Tu4A-5: Incorporating Resistive Foil RF Attenuators and Equalizers on and within PCBs from DC to 60GHz: Design, Analysis, and Experimental Validation
M. Grando, *Invictus Animus Research and Design*; R. Direen, *Invictus Animus Research and Design*; J. Richardson, *Quantic X-Microwave*; S. Martinez, *Quantic X-Microwave*; J. Andresakis, *Quantic Ohmega Ticer*; L. Wilhelm, *Quantic Ohmega Ticer*

145AB

Tu4B: Reconfigurable Filters and Passive Devices

Chair: Julien Lintignat, *XLIM (UMR 7252)*
Co-Chair: Charles F. Campbell, *Qorvo*

15:40 – 15:50
Tu4B-1: Multi-functional Bandpass Filter with Co-designed Tunable Attenuator and Reflectionless Phase Shifter Functionalities
Z. Zhang, *Univ. College Cork*; D. Psychogiou, *Univ. College Cork*

16:00 – 16:10
Tu4B-2: Liquid Metal-Enabled Multi-Functional Passive Device
Y.-W. Wu, *Univ. of Birmingham*; L. Qian, *Univ. of Birmingham*; Y. Wang, *Univ. of Birmingham*

16:20 – 16:30
Tu4B-4: Monolithically Integrated Liquid Crystal Tunable Reflective Load for Millimeter-Wave Phase Shifter Applications
H. Kianmehr, *Univ. of Waterloo*; R.R. Mansour, *Univ. of Waterloo*

16:40 – 16:50
Tu4B-5: Reconfigurable Quadrature Couplers
C.F. Campbell, *Qorvo*

146A

Tu4C: mm-Wave Technology Opportunities and Challenges for 5G/6G Applications

Chair: Jeong-sun Moon, *HRL Laboratories*

15:40 – 15:50
Tu4C-1: 3D Heterogeneous Integration (3DHI): Revolutionizing RF Systems
T. Kazior, *DARPA*

16:00 – 16:10
Tu4C-2: A <5dB NF, >17dBm OP1dB F-Band GaN-on-SiC HEMT LNA with a Monolithic Substrate-Integrated Waveguide Filter
F. Thome, *Fraunhofer IAF*; D. Schwantuschke, *Fraunhofer IAF*; P. Brückner, *Fraunhofer IAF*; X. Wang, *Cornell Univ.*; J.C.M. Hwang, *Cornell Univ.*; R. Quay, *Fraunhofer IAF*

16:20 – 16:30
Tu4C-3: Advancements in 300mm GaN-on-Si Technology with Industry's First Circuit Demonstration of Monolithically Integrated GaN and Si Transistors
Q. Yu, *Intel*; A. Farid, *Intel*; I. Momson, *Intel*; J. Garrett, *Intel*; H. Vora, *Intel*; S. Bader, *Intel*; A. Zubair, *Intel*; P. Koirala, *Intel*; M. Beumer, *Intel*; A. Vyatskikh, *Intel*; P. Nordeen, *Intel*; T. Hoff, *Intel*; M. Radosavljevic, *Intel*; S. Rami, *Intel*; F. O'Mahony, *Intel*; H.W. Then, *Intel*

16:40 – 16:50
Tu4C-4: Enabling Monolithic Integration of an Advanced 7-Layer Silicon Back-End-Of-Line (BEOL) on 40nm GaN for Next Generation MMICs
Jonathan Roderick, *HRL Laboratories, LLC*; Georges Siddiqi, *HRL LLC*; Dan Denninghoff, *HRL LLC*; Daniel Berkoh, *HRL LLC*; Joe Tai, *HRL LLC*; Sunil Rao, *HRL LLC*; Jonathan Lynch, *HRL LLC*; Clayton Tu, *HRL LLC*; Hasan Sharifi, *HRL Laboratories, LLC*; Daniel Kuzmenko, *HRL LLC*; Jana Georgieva, *HRL LLC*; Warren McArthur, *TowerSemi*; Seyed Mirshafieyan, *TowerSemi*; David Howard, *TowerSemi*

146B

Tu4D: Advanced mm-Wave Transceiver Subsystems

Chair: Mahdi Javid, *Qorvo*
Co-Chair: Payam Heydari, *University of California, Irvine*

15:40 – 15:50
Tu4D-1: From Waves to Insights: AI-Enhanced mmWave Systems
A. Valdes-Garcia, *IBM*

16:00 – 16:10
Tu4D-2: A 37-43.5-GHz Fully-Integrated 16-Element Phased-Array Transceiver with 64-QAM 7.2-Gb/s Data Rates Supporting Dual-Polarized MIMO
X. Chen, *Southeast Univ.*; X. Niu, *Purple Mountain Laboratories*; X. Wang, H. Duan, J. Feng, L. Lu, *Southeast Univ.*; L. He, *Purple Mountain Laboratories*; Q. Chen, *Southeast Univ.*; D. Cheng, L. Luo, *Purple Mountain Laboratories*; X. Wu, J. Si, *Southeast Univ.*; X. Ma, *Télécom SudParis*; X. Fan, L. Li, *Southeast Univ.*

16:20 – 16:30
Tu4D-3: A 60-GHz Highly-Reused Joint Radar-Communication Transceiver with Reconfigurable Dual-Mode Gilbert Cells in 65-nm CMOS
L. Lu, *Southeast Univ.*; X. Ma, *Télécom SudParis*; J. Feng, *Southeast Univ.*; L. He, *Purple Mountain Laboratories*; X. Fan, *Southeast Univ.*; Q. Chen, *Southeast Univ.*; X. Chen, *Southeast Univ.*; Z. Liu, *Purple Mountain Laboratories*; J. Si, *Southeast Univ.*; X. Fan, *Southeast Univ.*; L. Li, *Southeast Univ.*

16:40 – 16:50
Tu4D-4: Fine Pitch D-Band Transmit Modules with Flip-Chip Aperture Coupled Antennas
A. Ayling, *Caltech*; A. Hajimiri, *Caltech*

17:00
Tu4D-5: A K/Ka-Band Satellite Terminal Beamforming Front-End-Module Utilizing Dual-Band Self-Diplexing Antennas
J. Mayeda, *Tokyo Tech*; D. You, *Tokyo Tech*; X. Fu, *Tokyo Tech*; X. Wang, *Tokyo Tech*; H. Heridian, *Tokyo Tech*; M. Ide, *Tokyo Tech*; T. Tomura, *Tokyo Tech*; H. Sakai, *Tokyo Tech*; K. Kunihiro, *Tokyo Tech*; K. Okada, *Tokyo Tech*; A. Shirane, *Tokyo Tech*

Denotes Keynote Presentation

RFIC TECHNICAL SESSIONS

15:40 – 17:00

WALTER E. WASHINGTON CONVENTION CENTER

146C

Tu4E: Advances in Low Noise Amplifiers

Chair: Jesse Moody, *Sandia National Laboratories*

Co-Chair: Luciano Boglione, *U.S. Naval Research Laboratory*

Tu4E-1: Radiometry and the Ever Shrinking Spectra and Ever Expanding Needs

S. Misra, *Jet Propulsion Lab*

Tu4E-2: A Power-Efficient, F-Band, 6.5-dB NF, Staggered-Tuned, Inverter-Based CMOS LNA for 6G Receivers

Y.O. Hassan, *Univ. of California, Irvine*; M. Oveisi, *Univ. of California, Irvine*; H. Wang, *Univ. of California, Irvine*; P. Heydari, *Univ. of California, Irvine*

Tu4E-3: W-Band Low-Noise-Amplifier MMICs in InGaAs HEMT Technologies on Gallium-Arsenide and Silicon Substrates

F. Heinz, *Fraunhofer IAF*; A. Leuther, *Fraunhofer IAF*; F. Thome, *Fraunhofer IAF*

Tu4E-4: A Ku-Band +2 dBm IIP3 Transformer-Based LNA with Loop-Gain-Enhanced Capacitive Negative Feedback

T.-S. Yang, *National Taiwan Univ.*; P.-Y. Hsu, *National Taiwan Univ.*; L.-H. Lu, *National Taiwan Univ.*

Tu4E-5: A 6.8–9.4GHz LNA Achieving 36.5dB Peak Gain, Consuming 4.28mW with an Adjustable Threshold Limiter for IR-UWB Applications

S. Lepkowski, *Sandia National Labs*; T. Forbes, *Sandia National Labs*; J. Moody, *Sandia National Labs*

147AB

Tu4F: RFID-Based Technologies for Advanced Sensing Applications

Chair: Paolo Mezzanotte, *Università di Perugia*

Co-Chair: Smail Tedjini, *Université Grenoble Alpes*

Tu4F-1: Hand Motion-modulated Chipless RFID for Gesture Recognition

Ashkan Azarfar, *Univ of Grenoble-Alpes France*; Nicolas Barbot, *Univ of Grenoble-Alpes France*; Etienne Perret, *Univ of Grenoble-Alpes France*

Tu4F-2: Passive Coupled Microwave Resonators for VOC Monitoring Using Flexible PDMS Beam

H. Mirzaei, *Univ. of British Columbia*; M. Arjmand, *Univ. of British Columbia*; M.H. Zarifi, *Univ. of British Columbia*

Tu4F-3: Enhancing Battery-Free Sensor Nodes: Integrating Passive Beamforming with Frequency Division Duplexing

Y. Qaragoez, *KU Leuven*; S. Pollin, *KU Leuven*; D. Schreurs, *KU Leuven*

Tu4F-4: Determining Media Absorption Loss using Embedded Harmonic Transponders

Rye Fought, *University of Vermont*; Elsie Anthonio, *University of Vermont*; Tara Harte, *University of Vermont*; Pawan Bastola, *University of Vermont*; Ruth Petzoldt, *University of Vermont*; Harrison Jaffe, *University of Vermont*; Mandar Dewoolkar, *University of Vermont*; Jeff Frolik, *University of Vermont*

Tu4F-5: Comparative Study: Evaluating Chipless RFID Tag Authenticity with a Portable MIMO Reader-Based Approach

S. Khan, *Monash Univ.*; L. Lasantha, *Monash Univ.*; N. Karmakar, *Monash Univ.*

151AB

RTu4B: mm-Wave and Beyond Radars and Imagers

Chair: Raja Pullela, *MaxLinear*

Co-Chair: Vito Giannini, *UHNDER*

RTu4B-1: A 90–98-GHz FMCW Radar Transceiver Supporting Broadband Modulation in 65nm CMOS

S. Wang, *Zhejiang Univ.*; J. Chen, *Zhejiang Univ.*; J. Liu, *Zhejiang Univ.*; Q. Li, *Zhejiang Univ.*; Q. Yang, *Zhejiang Univ.*; X. Yu, *Zhejiang Univ.*; C. Song, *Zhejiang Univ.*; Q.J. Gu, *Univ. of California, Davis*; Z. Xu, *Zhejiang Univ.*

RTu4B-2: A 200-GHz Modulable Transceiver With 35-dB TX ON/OFF Isolation and 16Gb/s Code Rate for MIMO Radar in 130nm SiGe Process

R. Zhou, *Southeast Univ.*; J. Chen, *Southeast Univ.*; S. Tang, *Southeast Univ.*; Z. Li, *Southeast Univ.*; D. Tang, *Southeast Univ.*; P. Zhou, *Southeast Univ.*; F. Xie, *Southeast Univ.*; Z. Chen, *Southeast Univ.*; W. Hong, *Southeast Univ.*

RTu4B-3: An On-Chip Antenna-Coupled Preamplified D-Band to J-Band Total Power Radiometer Chip in 130 nm SiGe BiCMOS Technology

J. Grzyb, *Bergische Universität Wuppertal*; M. Andree, *Bergische Universität Wuppertal*; H. Rücker, *IHP*; U. Pfeiffer, *Bergische Universität Wuppertal*

RTu4B-4: An E-Band FMCW Radar Receiver Achieving 38dB Cancellation for Arbitrary-Path Spillover Up to -10dBm and 5.7dB NF in 65nm CMOS

B. Chen, *HKUST(GZ)*; Z. Zong, *HKUST(GZ)*

152AB

RTu4C: Circuit Building Blocks in the 100–200GHz Frequency Range

Chair: Teerachot Siriburanon, *University College Dublin*

Co-Chair: Rocco Tam, *NXP Semiconductors*

RTu4C-1: 110–170GHz 25% Duty-Cycle Gilbert-Cell Frequency Doubler with 6.5dBm Peak Output Power in BiCMOS 55nm Technology

L. Piotto, *Università di Pavia*; G. De Filippi, *Università di Pavia*; A. Mazzanti, *Università di Pavia*

RTu4C-2: A Low Conversion Loss 120GHz Passive IQ Down-Conversion Subharmonic Mixer with Multiphase LO Distribution in 28nm CMOS

S. Koop-Brinkmann, V. Lasserre, *Technische Univ. Braunschweig*; M. Caruso, D. Dal Maistro, G. Volpato, *Infineon Technologies*; C. Ziegler, F. Stapelfeldt, V. Issakov, *Technische Univ. Braunschweig*

RTu4C-3: A 200GHz Wideband and Compact Differential LNA Leveraging an Active Balun Input Stage in 16nm FinFET Technology

E. Chou, *Univ. of California, Berkeley*; N. Baniasadi, *Univ. of California, Berkeley*; A. Niknejad, *Univ. of California, Berkeley*

RTu4C-4: A D-Band Bi-Directional Current-Reuse Common-Gate Amplifier in 45nm RFSOI

S.M.A. Uddin, *Pennsylvania State Univ.*; L. Zhong, *Pennsylvania State Univ.*; W. Lee, *Pennsylvania State Univ.*

15:40 15:50 16:00 16:10 16:20 16:30 16:40 16:50 17:00

TUESDAY

WALTER E. WASHINGTON CONVENTION CENTER

WIM/YP JOINT PANEL SESSION | 15:45 – 16:30 | Tuesday, 18 June 2024 | Room 144AB

Developing Your Personal Brand

Whether you recognize it or not, you have a personal brand. If you are wondering: How did that happen? Or, how can I influence how my brand is perceived in the industry? Then, this panel is for you!

PANELISTS:

Moderator: Judy Warner, *The EEcosystem Podcast*

Deborah Cooper, *DC Associates, LLC*

Aline Eid, *University of Michigan*

Laura Martin, *Isola Group*

THE SPY MUSEUM

WIM RECEPTION | 19:30 – 21:30 | Tuesday, 18 June 2024

After the panel, help continue the conversation and laughs at the annual WIM reception, which will be held at the International Spy Museum in Washington, DC on Tuesday evening. Be sure to stop by the WIM area to participate in a Women in Espionage scavenger hunt, meet our sponsors Microwaves & RF and Samtec, as well as network over cocktails and snacks.

Sponsored By: samtec Microwaves&RF

THE SPY MUSEUM

HAM RADIO SOCIAL 2024 | 19:30 – 21:30 | Tuesday, 18 June 2024

All radio amateurs and other interested IMS participants are cordially invited to the event.

THE SPY MUSEUM

YP RECEPTION | 19:30 – 21:30 | Tuesday, 18 June 2024

The reception is a place to celebrate the young professionals, the future of the microwave community, network and interact with like-minded people.

Sponsored By: Microwaves&RF

THE SPY MUSEUM

MTT-S JOURNALS RECEPTION | 19:30 – 21:30 | Tuesday, 18 June 2024

The MTTS Publications committee has put together a unique and informative, Reviewers' Recruiting Reception, Publications Question and Answer Panel, and MTT Journals' Poster Session for you to attend! Come and meet our Editors-in-Chief while you sample a tasty and thirst quenching variety of hors d'oeuvres and libations.

WALTER E. WASHINGTON CONVENTION CENTER

INDUSTRY WORKSHOPS

08:00 – 15:10 | Wednesday, 19 June 2024

SESSION CODE	TIME & LOCATION	TITLE AND ABSTRACT	SPEAKER/S, AFFILIATION
IWWE1	08:00 – 09:40 Room: 144C	**Unlocking the Spectrum: Advancements in X-Band Radar, Electronic Defense, and Instrumentation with Analog Devices' 20GSPS Apollo MxFE—**Join us in this workshop as we delve deep into the unique capabilities of the 20GSPS Apollo MxFE designed to enable high performance applications in X-Band Radar, Electronic Defense, and Instrumentation. Learn how to leverage the on-chip hardened DSP feature set to add significant performance and lower power. We will move beyond theory and share real world performance data, link to specific applications, and demonstrate the tangible impact on your next generation design.	Robert Dandaraw, Judy Chui, Kate Berry, *Analog Devices Inc.*
IWWE2	10:10 – 11:50 Room: 144C	**How to Carry Out the Full Spectrum of on Wafer Tests—**This talk will provide practical guidance on how to best carry out full over temperature testing over multiple bands from 10 MHz all the way up to 1.1 THz using Wincal 5.0 software. We discuss benefits of a range of calibration techniques to optimise for test time and accuracy out and approaches to fully automate the data acquisition process. Recent techniques will be shown including Load pull to 170 GHz / 220 GHz and modulated testing with the Vector Component Analyser also to 170 GHz. Workshop examples using Python / Wincal 5.0 will be provided along with supporting videos.	Gavin Fisher, *FormFactor, Inc.*
IWWE3	13:30 – 15:10 Room: 144C	**Over-the-air mmWave Phased Array Distortion Analysis and Linearization Testing—** Phased array antenna modules (PAAM) need to operate at highest efficiency and still meet emissions and EVM requirements. A very high number of tests in power, frequency, waveform type, and modes are required. We will explain EVM impairments, techniques to diagnose root causes, and how to minimize the influence of test equipment. Then, review fundamentals of linearization, how to estimate if DPD is recommended, and present linearization results with gap analysis. The device under test will be a PAAM with at least 64 elements. Metrics include ACLR, EVM with and without demodulation, AMAM, AMPM, frequency response, and group delay.	Fabricio Dourado, *Rohde & Schwarz GmbH & Co KG;* Lei Xu, *Fujikura Ltd.*

BOOTH 2431, IMS EXHIBIT FLOOR

Build Your Own "Foxhole" Radio Receiver

09:30 – 17:00 | Wednesday, 19 June 2024

AND 09:30 – 15:00 | Thursday, 20 June 2024

PRESENTED BY: PROFESSOR DAVID S. RICKETTS, *NORTH CAROLINA STATE UNIVERSITY*

Ever wanted to build one of the early radios by hand?

Did you know you can do it without special parts, just a coil of wire, a pencil, a piece of metal and a paper towel tube? Join this hands-on experience where you will learn to build the ingenious radio receiver built by Lieutenant M. L. Rupert in the 1940s. The radio doesn't use a local oscillator so as to avoid being detected and was popular in areas (foxholes) where you didn't want to be detected. You will be able to build your own radio on site and take home or simply come by to learn how it operates and take a turn at tuning a radio with a pencil point – the parts are simple, but perhaps not the tuning! This hands-on experience is created by Prof. David S. Ricketts and is part of his work on disseminating wireless education in a more exciting way. See www.interactrf.org for educational materials on wireless systems and circuits.

David S. Ricketts received the PhD in Electrical Engineering from Harvard University. He is currently a Full Professor of Electrical and Computer Engineering at North Carolina State University.

His scientific research focuses on emerging microwave and analog circuits and systems from 1 MHz to 300 GHz. His work has appeared in *Nature* and in numerous IEEE conferences and journals. He is the author of the two books on jitter in high-speed electronics and electrical solutions. He is the recipient of the NSF CAREER Award, the DARPA Young Faculty Award and the George Tallman Ladd research award and is a Harvard Innovation Fellow. In addition as a teacher he is the recipient of the 2009 Wimmer Faculty Teaching Fellow at Carnegie Mellon University, 2013 Harvard University Bok Center Teaching Award and the 2021 William F. Lane Outstanding Teaching award at NCSU. Since 2015, Prof. Ricketts has taught experiential hand-on workshops on building a QAM Radio and a FMCW RADAR across the globe at all of the major microwave conferences.

WALTER E. WASHINGTON CONVENTION CENTER

ENTREPRENEURSHIP 101 PANEL SESSION:

11:00 – 12:00 | Wednesday, 19 June 2024 | Room: 144AB

A Collaboration between Young Professionals (YP), Women in Microwaves (WIM) and the StartUp Program

PANELISTS:

Tristan El Bouyadi, *Thintronics*	**Isar Mostafanezhad**, *Nalu Scientific*	**Ken Vanhille**, *Sandia National Laboratories (formerly with Nuvotronics)*

WALTER E. WASHINGTON CONVENTION CENTER | ROOM 207AB

FUTURE G SUMMIT

08:00 – 17:00 | Wednesday, 19 June 2024

Overview: The day-long Future G Summit will feature four sessions throughout the day, each focusing on a different theme: Spectrum Co-Existence and Sustainability, Non-Terrestrial Networks (NTNs), Metaverse Technologies, and 6G Technologies. Each of the themed sessions will feature speakers from industry describing some of the interdisciplinary concepts enabling these Future G systems. At the conclusion of each session, there will be an interactive panel comprising technical experts who will field questions from the audience and discuss some of the challenges for the realization of Future G networks. The Summit will conclude with inviting all of its attendees down to the IMS Exhibit Floor to take part in the Industry Hosted Reception.

SPEAKERS AND AGENDA:

SESSION 1: SPECTRUM CO-EXISTENCE AND SUSTAINABILITY		
08:00 – 09:45	**Spectrum Coexistence Activities for ITU's WRC Agenda for Future G**	**Veena Rawat**, *Senior Spectrum Advisor, GSMA*
	Overcoming the 6G Spectrum Challenge	**Edward Tiedemann**, *Qualcomm Fellow and SVP of Engineering, Qualcomm Technologies, Inc.*
	Unlocking 6G Through Innovations in Spectrum Sharing Technologies	**Michael Miller**, *Director of Engineering, Virginia Tech-Applied Research Corporation/NextG Alliance*
SESSION 2: NON-TERRESTRIAL NETWORKS		
10:15 – 12:00	**Ushering In the Next Era of Satcoms: Ubiquitous Connectivity with Metasurface Antenna Technology**	**Ryan Stevenson**, *Senior Vice President and Chief Scientist, Kymeta Corporation*
	Introduction of NTT's Research and Development of Elemental Technologies for Non-Terrestrial Networks	**Munehiro Matsui**, *Senior Research Engineer, NTT Access Network Service Systems Laboratories, NTT Corporation*
	Recent Advances in Standards Based Direct to Device Satellite Communications	**Kamran Etemad**, *Senior Technology Advisor, Federal Communications Commission (FCC)*
SESSION 3: METAVERSE TECHNOLOGIES		
13:00 – 14:45	**Spectrum Considerations for AR/VR**	**Alan Norman**, *Public Policy Director, Meta Platforms*
	Advances in Wi-Fi Technology and Spectrum Regulation Powering the Metaverse	**Carlos Cordeiro**, *Intel Fellow & Wireless CTO, Client Computing Group, Intel Corporation*
	Networks for Metaverse	**Tiberiu Grigoriu,** *Senior Director, Network Infrastructure Strategy and CTO, Nokia*
SESSION 4: 6G TECHNOLOGIES		
15:15 – 17:00	**6G Vision, Key Enablers and Timeline**	**Gary Xu**, *VP, Research, Samsung Research America*
	Wireless Digital Twin – A New System Design Paradigm via 3D Electro-Magnetic Field Neural Reconstruction	**Qi Qu**, *System Architect/Director, Research Meta Reality Lab Research*
	Goals and Technologies for 6G	**Martin Weiss**, *Director of FutureG Applied Research, Office of the Under Secretary of Defense for Research and Engineering*

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WALTER E. WASHINGTON CONVENTION CENTER

INTERSOCIETY PANEL SESSION

12:00 – 13:30 | Wednesday, 19 June 2024 | Room: 206

PL4: Climate Change – A Global Grand Challenge

ORGANIZERS:

Ke Wu, *Polytechnique Montréal;* **Steven Reising,** *Colorado State University;* **J.-C. Chiao,** *Southern Methodist University*

PANELISTS:

Jean-Pierre Raskin, *Université catholique de Louvain, Belgium;* **Nils Weimann**, *University of Duisburg-Essen*; **Rabia Munsaf Khan**, *State University of New York*; **Suleka Chattopadhyay**, *IEEE Women in Engineering, Climate Change Committee;* **Peter Siegel**, *California Institute of Technology;* **David Kunkee**, *Aerospace Corporation;* **Al Gasiewski,** *University of Colorado*

ABSTRACT: This panel session offers a chance to engage conversation and exchange ideas about the significance and challenges in monitoring climate change and the potentials of utilizing microwave technologies for remote sensing in various applications.

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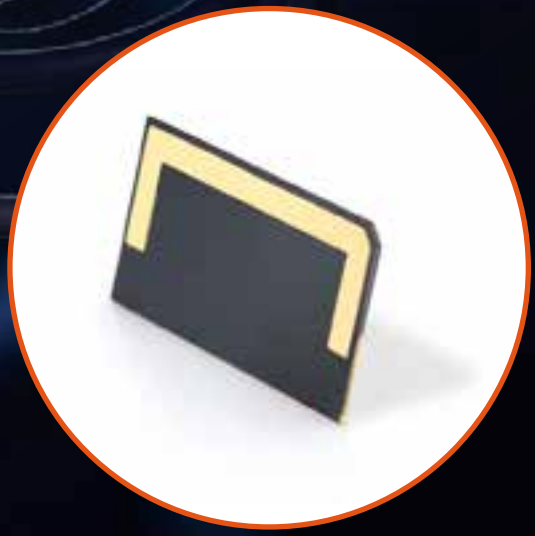

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146A

We1C: High-Efficiency and High-Linearity Power Amplifiers for Communication and Satellite Systems

Chair: Vittorio Camarchia, *Politecnico di Torino*
Co-Chair: Varish Diddi, *Qualcomm*

08:00–08:10
We1C-1: GaAs & GaN MMIC Power Amplifier and Front-End Module Design for K-Ka Band Commercial Communication Systems
M. Roberg, *mmTron*

08:20–08:40
We1C-2: High-gain and High-linearity MMIC GaN Doherty Power Amplifier with 3-GHz Bandwidth for Ka-band Satellite Communications
A. Piacibello, *Politecnico di Torino*; R. Quaglia, *Cardiff University*; R. Giofrè, *Università di Roma "Tor Vergata"*; R. Figueiredo, *Universidade de Aveiro*; P. Colantonio, *Università di Roma "Tor Vergata"*; N. Carvalho, *Universidade de Aveiro*; V. Valenta, *European Space Agency*; V. Camarchia, *Politecnico di Torino*

08:40–08:50
We1C-3: A High Efficiency and High Linearity GaAs HBT Doherty Power Amplifier for 5G NR 3.4V Application
S. He, *OnMicro*; J. Liang, *OnMicro*; L. Xu, *OnMicro*; H. Meng, *OnMicro*; Y. Qian, *OnMicro*

09:00–09:10
We1C-4: A Highly Linear and Efficient Differential Power Amplifier with 35-dBm Saturated Output Power, 65% Peak PAE by Reducing Base Voltage Peaking in InGaP/GaAs HBT Process for Handset Applications
S. Bae, *Hanyang Univ.*; J. Jeon, *Gangneung-Wonju National University*; S. Hwang, *Hanyang Univ.*; B. Yoon, *Hanyang Univ.*; J. Kim, *Hanyang Univ.*

09:20–09:30
We1C-5: Integrated 5-W GaN Doherty Power Amplifier for 5G FR1 Bands with 19dB Gain Over a 41% Bandwidth
G. Bartolotti, *Politecnico di Torino*; A. Piacibello, *Politecnico di Torino*; V. Camarchia, *Politecnico di Torino*

146B

We1D: Advances in High-Precision Radar Sensing

Chair: Suresh Venkatesh, *North Carolina State University*
Co-Chair: Nils Pohl, *Ruhr-Universität Bochum*

08:00–08:10
We1D-1: Considerations on Near-Field Correction: µm Accuracy with mmWave Radar
L. Piotrowsky, *Ruhr-Universität Bochum*; N. Pohl, *Ruhr-Universität Bochum*

08:20–08:40
We1D-2: Micro Vibration Reconstruction Under In-Range Large-Scale Dynamic Clutters Using a Bi-Exponential Radar Signal Model
X. Ma, *SAMOVAR (UMR 5157)*; P. Wang, *SAMOVAR (UMR 5157)*; J. Liu, *Nanjing Forestry University*; D. Zhang, *SAMOVAR (UMR 5157)*

08:40–08:50
We1D-3: Uncorrelated Phase Noise Cancellation in Intermediate Frequency with a Low-IF Dual-PLL Radar System
M. Zhang, *SUSTech*; X. Wu, *SUSTech*; D. Pang, *SUSTech*; L. Qin, *SUSTech*; J. Li, *SUSTech*; Y. Cao, *SUSTech*; X. Jiang, *Qualcomm*; X. Liu, *SUSTech*

09:00–09:10
We1D-4: Improved Performance in PMCW Radar Systems Through Equalization Using Predistortion and Postprocessing
S. Peters, *FAU Erlangen-Nürnberg*; S. Faghih-Naini, *FAU Erlangen-Nürnberg*; R. Weigel, *FAU Erlangen-Nürnberg*; T. Reissland, *FAU Erlangen-Nürnberg*

09:20–09:30
We1D-5: A Fully Integrated Radar-Based True-Speed-Over-Ground Sensor for Highly Dynamic Road Vehicles
N.C. Albrecht, *Technische Universität Hamburg*; D. Langer, *Technische Universität Hamburg*; A. Koelpin, *Technische Universität Hamburg*

146C

We1E: Novel Microwave Packaging Structures and Applications up to Sub-THz Frequencies

Chair: Kamal Samanta, *AMWT*
Co-Chair: Nicholas Kolias, *Raytheon*

08:00–08:10
We1E-1: A Low Loss Die-Embedded Glass Substrate for 140GHz InP Power Amplifier Integration
X. Jia, *Georgia Tech*; X. Li, *Georgia Tech*; J.W. Kim, *Georgia Tech*; K.-S. Moon, *Georgia Tech*; M.J.W. Rodwell, *Univ. of California, Santa Barbara*; M. Swaminathan, *Georgia Tech*

08:20–08:40
We1E-2: Integration Approach for Radar Transceiver MMICs with Integrated Antennas Enabling Adaptability to Customized Passive Frontend Design
D. Langer, *Technische Universität Hamburg*; N.C. Albrecht, *Technische Universität Hamburg*; F. Bartels, *Technische Universität Hamburg*; B. Tegowski, *Technische Universität Hamburg*; A. Koelpin, *Technische Universität Hamburg*

08:40–08:50
We1E-3: Flip Chip-Enhanced QFN Package Millimeter-Wave Slot Bowtie Antenna Performance Using Two Feeding Methodologies
O.F. Medina, *Univ. of Texas at Dallas*; A.N. Jogalekar, *Univ. of Texas at Dallas*; K. Nambiar, *Univ. of Texas at Dallas*; D. Iyer, *Amkor Technologies*; A. Blanchard, *Univ. of Texas at Dallas*; H. Lu, *Univ. of Texas at Dallas*; R. Henderson, *Univ. of Texas at Dallas*

09:00–09:10
We1E-4: Embedded Printed Split Ring Resonators in Polymer Composites for Temperature Sensing
M. Hayet-Otero, *UPV/EHU*; L. Bilbao-Alba, *Tecnalia*; O. Echeverria-Altuna, *Tecnalia*; I. Bustero-Martinez de Zuazo, *Tecnalia*; J.M. Gonzalez, *UPV/EHU*

147AB

We1F: Airborne and Space Systems

Chair: Dennis Lewis, *Boeing*
Co-Chair: Glenn Hopkins, *Georgia Tech*

08:00–08:10
We1F-1: Direct-Detect 250/310 GHz Pseudo-Correlation Radiometer and Double-Sideband 380 GHz Sounder for Ice Cloud Sensing
A.A. Babenko, *Jet Propulsion Lab*; P. Kangaslahti, *Jet Propulsion Lab*; I. Ramos, *Jet Propulsion Lab*; M. Ogut, *Jet Propulsion Lab*; C.M. Cooke, *Northrop Grumman*; W. Deal, *Northrop Grumman*

08:20–08:40
We1F-2: A Hybrid CMOS-InP W-Band Imaging Radiometer with Compact MetaSurface Antenna for UAV-Based Wildfire Imaging
A. Tang, *Jet Propulsion Lab*; N. Chahat, *Jet Propulsion Lab*; G. Gupta, *Jet Propulsion Lab*

08:40–08:50
We1F-3: UAV-Based Relays Using Active Phased Arrays for Non-Line-of-Sight Millimeter-Wave Communications: Real-Time Field Testing
X. Zhang, *Univ. of Waterloo*; N. Esfarayeni, *Univ. of Waterloo*; A. Ben Ayed, *Univ. of Waterloo*; M.A. Chalaki, *Univ. of Waterloo*; P. Namaki, *Univ. of Waterloo*; H. Jin, *Univ. of Waterloo*; S. Boumaiza, *Univ. of Waterloo*

09:00–09:10
We1F-4: Prototype Design of Airborne Antenna System for HAPS Backhaul Networks Using 100GHz Band Frequency
T. Nishibori, *JAXA*; N. Okada, *JAXA*; K. Kimura, *JAXA*; T. Sato, *Waseda Univ.*; K. Tamesue, *Waseda Univ.*; K. Jitsuno, *Waseda Univ.*; T. Sato, *Waseda Univ.*; T. Kawanishi, *Waseda Univ.*

09:40

Denotes Keynote Presentation

150AB

We1G: Advanced Integrated Passive Development with GaN and CMOS Technology

Chair: Ki Shin, *Qorvo*
Co-Chair: Pei-Ling Chi, *NYCU*

We1G-1: Advancements in Integrated Passive Circuits and Filters: A Decade of Technological Evolution

A. Darwish, *U.S. Army Research Laboratory*

We1G-2: Record Fast Recovery Performance from Microwave High-Power Limiters with All-GaN SBD-MMIC Technology: 39ns@100W

R. Zhao, *CAS*; X. Kang, *CAS*; Y. Zheng, *CAS*; H. Wu, *CAS*; Q. Li, *CAS*; Y. Huang, *CAS*; J. Gao, *East China Normal Univ.*; K. Wei, *CAS*; X. Liu, *CAS*

We1G-3: Broadband G-Band GaN Digital Step Attenuators

P. Neininger, *Fraunhofer IAF*; F. Thome, *Fraunhofer IAF*; D. Gebauer, *Fraunhofer IAF*; P. Brückner, *Fraunhofer IAF*; R. Quay, *Fraunhofer IAF*

We1G-4: A 0.013-mm² 40–67-GHz Voltage-Controlled Distributed Attenuator with 1.9-dB Insertion Loss and Sub-6.1° Insertion Phase Imbalance

X. Jiang, *Southeast Univ.*; Q. Chen, *Southeast Univ.*; Y. Liang, *Southeast Univ.*; L. Li, *Southeast Univ.*; X. You, *Southeast Univ.*

We1G-5: An Ultra-Compact Wideband Tunable Autotransformer-Based Electrical-Balanced Duplexer with 46-70GHz 30dB Isolation Bandwidth

Yanir Schwartz, *Technion - Israel Institute of Technology*; Emanuel Cohen, *Technion - Israel Institute of Technology*

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We1H: mm-Wave Variable Gain Amplifiers and Phase Shifters

Chair: Damla Dimlioglu, *Cornell University*
Co-Chair: Mohammad Ghadiri-Sadrabadi, *Kyocera*

We1H-1: A 22-to-37.8 GHz Low-Gain-Phase-Error Variable-Gain Amplifier With Impedance-Compensation Technique in 65-nm CMOS Process

Y. Yu, *UESTC*; M. Geng, *UESTC*; S. Peng, *UESTC*; J. Li, *UESTC*; C. Zhao, *UESTC*; H. Liu, *UESTC*; Y. Wu, *UESTC*; K. Kang, *UESTC*

We1H-2: Design of Ku-Band Bi-Directional Active Phase Shifter Enabling a Low RMS Error Utilizing Switch-Less Staggered Core with the Identical In-Out Matching

U. Park, *Seoul National Univ.*; S. Hwangbo, *Seoul National Univ.*; J. Kim, *Seoul National Univ.*; T. Yoon, *Seoul National Univ.*; J. Oh, *Seoul National Univ.*

We1H-3: A 57–71-GHz Accurate dB-Linear Variable Gain Power Amplifier with Ultralow Gain Error Using Particle Swarm Optimization Algorithm

X. Li, *Southeast Univ.*; D. Cheng, *Purple Mountain Laboratories*; X. Jiang, *Southeast Univ.*; D. Wang, *Southeast Univ.*; L. Li, *Southeast Univ.*

We1H-4: A 29–48GHz Variable Gain Low Noise Amplifier Using Active Load in 90-nm CMOS Process

C.-H. Lai, *National Taiwan Univ.*; Y. Wang, *National Taiwan Univ.*; Y.-S. Ng, *National Taiwan Univ.*; C.-C. Chiong, *Academia Sinica*; H. Wang, *National Taiwan Univ.*

152AB

We1I: Advances in Computational Techniques

Chair: Zhizhang David Chen, *Dalhousie University*
Co-Chair: Vladimir Okhmatovski, *University of Manitoba*

We1I-1: Parallel Fast Direct Error-Controlled Scattering Solutions via an H-Matrix-Accelerated Locally Corrected Nyström Method for the Combined Field Integral Equation

O. Babazadeh, *Univ. of Manitoba*; J. Hu, *Univ. of Southern California*; E. Sever, *Aselsan*; I. Jeffrey, *Univ. of Manitoba*; C. Sideris, *Univ. of Southern California*; V. Okhmatovski, *Univ. of Manitoba*

We1I-2: Coupled Electromagnetic-Thermal Analysis for Temperature-Dependent Materials with Physics-Informed Neural Networks

S. Qi, *Univ. of Toronto*; C.D. Sarris, *Univ. of Toronto*

We1I-3: Numerical Demonstration of THz Traveling Wave Amplifications in 2DElectron Gas (2DEG) under Scattering-Free and Low-Charge Density Regime

S. Bhardwaj, *University of Nebraska-Lincoln*; M.F. Bin Hassan, *University of Nebraska-Lincoln*

We1I-4: A Novel Causal Method to Blend the DC and AC Solution Over the Entire Frequency Band

P. Liu, *Ansys*; W. Thiel, *Ansys*; X. Xu, *Ansys*; K. Zhu, *Ansys*; E. Bracken, *Ansys*

We1I-5: Order Reduction Using Laguerre-FDTD with Embedded Neural Network

Y. Wang, *Georgia Tech*; Y. Guo, *Georgia Tech*; R. Kumar, *Pennsylvania State Univ.*; M. Swaminathan, *Georgia Tech*

08:00
08:10
08:20
03:30
08:40
08:50
09:00
09:10
09:20
09:30
09:40

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We2B: In Celebration: Special Session for Dr. Kawthar A. Zaki and Dr. Ali E. Atia

Chair: Mohamed Fahmi, *Defence Research and Development Canada*
Co-Chair: Aly Fathy, *Univ. of Tennessee*

10:10

We2B-1: Dual Mode Canonical Waveguide Filters, A Look Back

R. Snyder, *RS Microwave*

10:30

We2B-2: Modelling of Dielectric resonators and their Use in Microwave Filters

R. Mansour, *Univ. of Waterloo*

10:50

We2B-3: Pioneering Satellite Technologies and Microwave Filters

A. Zaghloul, *U.S. ARMY Research Office*

11:10

We2B-4: The Filters that Fly

H. Yao, *AST SpaceMobile*

11:30

We2B-5: Mode Matching Technique and its Applications

J. Ruiz-Cruz, *Universidad Politécnica de Madrid*

11:50

We2B-6: Modelling and Design of Ridge Waveguide Components

M. Fahmi, *DRDC*

146A

We2C: Novel Techniques for Power Amplifiers

Chair: Wing Shing Chan, *CityU*
Co-Chair: Anna Piacibello, *Politecnico di Torino*

We2C-1: A GaN-Based MMIC Doherty Power Amplifier With Class F Peaking Branch

F. Manni, *Università di Roma "Tor Vergata"*; R. Giofrè, *Università di Roma "Tor Vergata"*; V. Camarchia, *Politecnico di Torino*; A. Piacibello, *Politecnico di Torino*; F. Giannini, *Università di Roma "Tor Vergata"*; P. Colantonio, *Università di Roma "Tor Vergata"*

We2C-2: Compact Dual-Core Drive Stage using Three-winding Transformer for CMOS Broadband Power Amplifier

J.-H. Kim, *Chungnam National University*; J.-T. Son, *Chungnam National University*; J.-H. Song, *Chungnam National University*; J.-E. Lee, *Chungnam National University*; M.-S. Baek, *Chungnam National University*; J.-T. Lim, *Chungnam National University*; H.-W. Choi, *Samsung*; S.-M. Moon, *ETRI*; D. Chang, *ETRI*; C.-Y. Kim, *Chungnam National University*

We2C-3: A 1.2 to 5.7GHz Multi-Mode Dual-Input Power Amplifier Using a Novel Sigmoid-Function-Based Power Splitter

T. Torii, *Mitsubishi Electric*; A. Yamashita, *Mitsubishi Electric*; Y. Komatsuzaki, *Mitsubishi Electric*; S. Shinjo, *Mitsubishi Electric*

We2C-4: High-Power BAW-Based FDD Front-End using Indirect-Duplexing Load Modulated Balanced Amplifier for Massive MIMO Array

Y. Cao, *Qorvo*; S.P. Gowri, *Univ. of Central Florida*; N.B. Vangipurapu, *Univ. of Central Florida*; K. Chen, *Univ. of Central Florida*

146B

We2D: Advances in Multichannel and Distributed Radar Systems

Chair: Christian Waldschmidt, *Universität Ulm*
Co-Chair: Walter Wall, *HRL Laboratories*

We2D-1: A 140GHz FMCW Ultra Wideband High Dynamic Range RADAR Utilizing 8×8 Phased Arrays

A. Ahmed, *Univ. of California, San Diego*; L. Li, *Univ. of California, San Diego*; M. Jung, *Univ. of California, San Diego*; G.M. Rebeiz, *Univ. of California, San Diego*

We2D-2: All-Digital Carrier Frequency Synchronization for Distributed Radar Sensor Networks

R.H. Kenney, *Univ. of Oklahoma*; J.W. McDaniel, *Univ. of Oklahoma*

We2D-3: Fully Wireless Coherent Distributed Phased Array System for Networked Radar Applications

J. Merlo, *Michigan State Univ.*; S. Wagner, *Lawrence Livermore National Lab*; J. Lancaster, *Lawrence Livermore National Lab*; J. Nanzer, *Michigan State Univ.*

We2D-4: Specularity Resistant Millimeter-Wave Imaging with Distributed Repeater Apertures

T. Nusrat, *Univ. of South Florida*; S. Vakalis, *Univ. of South Florida*

146C

We2E: Additive Manufacturing Technologies and Applications

Chair: Dominique Baillargeat, *Université de Limoges*
Co-Chair: Debabani Choudhury, *Intel*

We2E-1: Beyond Planar: An Additively Manufactured, Origami-Inspired Shape-Changing, and RFIC-Based Phased Array for Near-Limitless Radiation Pattern Reconfigurability in 5G/mmWave Applications

H. Al Jamal, *Georgia Tech*; C. Hu, *Georgia Tech*; N. Wille, *Georgia Tech*; K. Zeng, *George Mason Univ.*; M.M. Tentzeris, *Georgia Tech*

We2E-2: Additively Manufactured Al_2O_3 W-Band RFID Tag Based on a Reflective 1D Photonic Crystal

J. Sánchez-Pastor, *Technische Univ. Darmstadt*; K.-D. Jenkel, *Universität Duisburg-Essen*; M. Späth, *Technische Univ. Darmstadt*; M. Sakaki, *Universität Duisburg-Essen*; R. Jakoby, *Technische Univ. Darmstadt*; N. Benson, *Universität Duisburg-Essen*; A. Jiménez-Sáez, *Technische Univ. Darmstadt*

We2E-3: Electro-Thermal Modeling of AM-SLM Based Cavity Resonators

Q.M. Khan, *Chalmers Univ. of Technology*; D. Kuylenstierna, *Chalmers Univ. of Technology*

We2E-4: 3D Screen Printing: Efficient Additive Manufacturing of Groove Gap Wave Guide Filters in D-band

K. Reuter, *Fraunhofer IFAM*; P. Boe, *CAU*; D. Miek, *CAU*; M. Höft, *CAU*; T. Studnitzky, *Fraunhofer IFAM*; C. Zhong, *Fraunhofer IFAM*; T. Weissgärber, *Fraunhofer IFAM*; I.O. Leon, *European Space Agency*

We2E-5: Additive Manufacturing of a Copper Elliptical Corrugated Horn Antenna in the Sub-Terahertz Regime

K. Braasch, *CAU*; A. Teplyuk, *CAU*; D. Miek, *CAU*; J. Scheibler, *Fraunhofer IFAM*; T. Weißgärber, *Fraunhofer IFAM*; C. Zhong, *Fraunhofer IFAM*; M. Höft, *CAU*

Denotes Keynote Presentation

147AB

We2F: Mixed-Signal Circuits and Systems for Space and Communication Applications

Chair: Hermann Boss, *Rohde & Schwarz*
Co-Chair: Christian Carlowitz, *FAU Erlangen-Nürnberg, Germany*

We2F-1: Recent Advances in Signal Processing Technologies for Wireless and Optical Communications
Y.-K. Chen, *Coherent*

We2F-2: A 10-Bit DAC 3GS/s Interpolating DDFS for Distortion-Limited Long Acquisition Time FMCW Ground Penetrating Radars
A. Bharathan, *Univ. of California, Los Angeles*; A. Tang, *Jet Propulsion Lab*; M.-C.F. Chang, *Univ. of California, Los Angeles*

We2F-3: S-Band Phase-Locked Loop Frequency Synthesizer for Satellite Communication and Space Applications
X. Xia, *SCUT*; Y. Wang, *SCUT*

We2F-4: Microwave Frequency Comb Generator for Radio Astronomy Applications
M. Toennies, *Jet Propulsion Lab*; R. Wang, *Jet Propulsion Lab*; W. Diener, *Jet Propulsion Lab*; A. Matsko, *Jet Propulsion Lab*

We2F-5: Update Time of a Closed-Loop Digital Pre-Distortion on an RF System-on-Chip for Reconfigurable Transmitters
F. Raimondo, *Univ. of Bristol*; J. Ma, *Univ. of Bristol*; M.A. Beach, *Univ. of Bristol*; T. Cappello, *Univ. of Bristol*

150AB

We2G: Emerging Design Methodologies for Next-Generation Low-Loss Couplers Enabling Highly Integrated Chipsets

Chair: Abhishek Sahu, *Qorvo*
Co-Chair: James Hwang, *Cornell University*

We2G-1: The Role of AI in Device Modeling and Characterization
F. Kharabi, *Qorvo*

We2G-2: A Low-Loss Millimeter-wave Fully-Differential Coupler Using Dual Patch on SISL Platform
F. Zhang, *Tianjin Univ.*; Y. Wang, *Tianjin Univ.*; K. Ma, *Tianjin Univ.*

We2G-3: A Low-Loss 3-dB Coupler Using Metal-Integrated Suspended Line
J. Ye, *Tianjin Univ.*; Y. Wang, *Tianjin Univ.*; K. Ma, *Tianjin Univ.*

We2G-4: Transformer-Based Multisection Quadrature Coupler with 1.5 Octave Bandwidth Using GaAs-Based Integrated Passive Device Technology
Z.-T. Zhao, *Taipei Tech*; H.-S. Yang, *Taipei Tech*

We2G-5: On-Chip Hybrid Couplers Enabling Highly Integrated MMIC Components at Millimeter and Submillimeter Wave Frequencies
Caitlyn Cooke, *Northrop Grumman Corp.*; Maxwell Duffy, *Northrop Grumman Corp.*; Mason Fordham, *Northrop Grumman Corp.*; Michael Eller, *Northrop Grumman Corp.*; Alfonso Escorcia, *Northrop Grumman Corp.*; William Deal, *Northrop Grumman Corp.*

151AB

We2H: Power Amplifier Performance Improvement Techniques

Chair: José Carlos Pedro, *Universidade de Aveiro*
Co-Chair: Paul J. Draxler, *MaXentric Technologies*

We2H-1: Unlocking the Next Generation of Cellular Connectivity: Advances in RF PA and Transmitter Architectures
R. Ma, *pSemi*

We2H-2: A Baseband Impedance Cancellation Technique for Wideband Multi-Transistor Amplifiers
I. van den Heuvel, *Cardiff University*; S. Cripps, *Cardiff University*; R. Quaglia, *Cardiff University*; P. Tasker, *Cardiff University*; M. Omisakin-Edwards, *Compound Semiconductor Applications Catapult*; E. Azad, *Compound Semiconductor Applications Catapult*

We2H-3: A Robust Search Algorithm of Optimal Driving Signals for Dual-Input High Power Amplifiers
F.M. Barradas, *Universidade de Aveiro*; L.C. Nunes, *Universidade de Aveiro*; J.C. Pedro, *Universidade de Aveiro*; C. Erdmann, *AMD*

We2H-4: A Tri-Branch Analog Pre-Distortion Linearizer for the Compensation of Gain Inflection in Doherty Power Amplifiers
A. Pitt, *Univ. of Bristol*; M.A. Beach, *Univ. of Bristol*; T. Cappello, *Univ. of Bristol*

We2H-5: A Method for Designing a Linear, Efficient 2-Stage GaN PA for Supply Modulation
M. Olavsbråten, *NTNU*; A.I. Hagen, *NTNU*

152AB

We2I: Design and Characterization of Novel Microwave/mm-Wave Structures

Chair: Costas D. Sarris, *University of Toronto*
Co-Chair: Werner Thiel, *ANSYS*

We2I-1: Electronic Control of Structural Asymmetry for Tunable Nonreciprocal Phase Shift in CRLH Transmission Lines
H. Yasuda, *Kyoto Institute of Technology*; T. Ueda, *Kyoto Institute of Technology*

We2I-2: A 3D-Printed Millimeter-Wave Free-Form Metasurface Based on Automatic Differentiable Inverse Design
Y. Huang, *UMass Lowell*; H. Tang, *UMass Lowell*; H. Zhao, *UMass Lowell*; Y. Dong, *UMass Lowell*; B. Zheng, *UMass Lowell*; H. Zhang, *UMass Lowell*

We2I-3: A Modified Gradient Model to Determine Surface Impedance from Measured Roughness Profiles with Printed Circuit Board Emphasis
F. Sepaintner, *Technische Hochschule Deggendorf*; A. Scharl, *Rohde & Schwarz*; J. Jakob, *Technische Hochschule Deggendorf*; F. Roehrl, *Rohde & Schwarz*; W. Bogner, *Technische Hochschule Deggendorf*; S. Zorn, *Rohde & Schwarz*

We2I-4: Plasma Based Absorptive and Adaptive High-Power Waveguide Protector
K.K. V., *Univ. of Toledo*; Md.T. Ahmed, *Univ. of Toledo*; A. Semnani, *Univ. of Toledo*

We2I-5: Electromagnetic Stability Characterization of Millimeter-Wave Dielectric Fibers at Extremely High-Temperatures: Enabling Harsh Environment Communication and Sensing
A. Sharma, *Stevens Institute of Technology*; Y.R. Kim, *Stevens Institute of Technology*

We2I-6: Twisting Effects on X-Shaped Millimeter-Wave Plastic Waveguides
S. Lagoug, *IMS (UMR 5218)*; A. Ghiotto, *IMS (UMR 5218)*; É. Kerhervé, *IMS (UMR 5218)*

10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50

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We3B: In Memoriam: Special Session Honoring John Bandler

Chair: Jose Ernesto Rayas Sanchez, *ITESO*

13:30 **We3B-1: Remembering John W. Bandler - A Maverick for All Seasons**
W. J.R. Hoefer, *Univ. of Victoria*

13:40 **We3B-2: Working With The Bandler**
J. Rautio, *Sonnet Software*

13:50 **We3B-3: John Bandler's Contributions to Sensitivity Analysis: A Cornerstone of Design and Imaging Methodologies**
N. Nikolova, *McMaster Univ.*

14:00 **We3B-4: Cognition-driven Design for Microwave CAD**
Q. Zhang, *Carleton Univ.*

14:10 **We3B-5: Advanced Design of Microwave Devices for Space Applications - A Tribute to Prof. John Bandler**
M. Yu, *SUSTech*

14:20 **We3B-6: On the Advanced Use of Space Mapping Techniques with Passive Microwave Components for Space Applications (in grateful memory of Prof. Bandler)**
V. Boria-Esbert, *Univ. Politècnica de València (14:20 - 14:30)*

14:30 **We3B-7: Neural Space Mapping as a Pioneering Artificial Intelligence approach to Microwave Modeling and Design**
J. Rayas-Sánchez, *ITESO*

14:40 **We3B-8: Space Mapping - A Gateway to Explainable AI**
Q. Cheng, SUSTech (14:40 - 14:50

14:50 **We2B-5: Mode Matching Technique and its Applications**
J. Ruiz-Cruz, *Universidad Politécnica de Madrid*

15:00 **We2B-6: Modelling and Design of Ridge Waveguide Components**
M. Fahmi, *DRDC*

15:10

146A

We3C: Load Modulated GaN Power Amplifier Design Techniques

Chair: Yulong Zhao, *Skyworks*
Co-Chair: Chenyu Liang, *Qorvo*

We3C-1: Stability Analysis Methods for Microwave Power Amplifiers: A Modern Perspective
T.A. Winslow, *Macom*

We3C-2: Design and Characterization of an MMIC Current Mode Outphasing Power Amplifier
A. Bogusz, *Cardiff University*; W. Li, *UPC*; J. Lees, *Cardiff University*; R. Quaglia, *Cardiff University*; G. Montoro, *UPC*; P.L. Gilabert, *UPC*; S. Cripps, *Cardiff University*

We3C-3: Decade-Bandwidth RF-Input Pseudo-Doherty Load Modulated Balanced Amplifier using Signal-Flow-Based Phase Alignment Design
P. Gong, *Univ. of Central Florida*; J. Guo, *Univ. of Central Florida*; N.B. Vangipurapu, *Univ. of Central Florida*; K. Chen, *Univ. of Central Florida*

We3C-4: Mode Extension of Load-Modulated Balanced Amplifier with Enhanced Efficiency
J. Xie, *CUHK*; K.-K.M. Cheng, *CUHK*; P. Yu, *CUHK*; X. Fang, *SUSTech*

We3C-5: A 3.2–4.2GHz Wideband 47dBm GaN HEMT Sequential-LMBA with Harmonic Tuned Using CRLH Transmission Line Stub
H. Asami, *Sumitomo Electric Industries*; T. Sumiyoshi, *Sumitomo Electric Industries*; H. Yamamoto, *Sumitomo Electric Industries*; T. Maehata, *Sumitomo Electric Industries*

146B

We3D: Radar-Based Structures for Advanced Sensing Applications

Chair: Changzhan Gu, *SJTU*
Co-Chair: Kazuya Yamamoto, *Mitsubishi Electric*

We3D-1: Radar Based Heart Rate Sensing on the Smart Glasses
I.W. Huang, *Facebook*; P. Rajbhandary, *Facebook*; S. Shiu, *Facebook*; J. Ho, *Facebook*; J. Zhu, *Facebook*; B. Wilson, *Facebook*; G. Ye, *Facebook*

We3D-2: A Cost-Effective Single-Channel Displacement Measurement Technique Without Down-Conversion Using Low-IF Doppler Radar
Zhiwei Zhang, *Shanghai Jiao Tong Univ.*; Fei Tong, *Shanghai Jiao Tong Univ.*; Jiayu Zhang, *Shanghai Jiao Tong Univ.*; Changzhan Gu, *Shanghai Jiao Tong Univ.*

We3D-3: Measurement of the Radial and Angular Velocity of Tagged Objects Using Interferometric Harmonic Micro-Doppler Radar
C. Hilton, *Michigan State Univ.*; J.A. Nanzer, *Michigan State Univ.*

We3D-4: Accurate Representation of the Rolling Motion for the Self-Rolled-Up Inductor with Radar Interferometry
Keke Zheng, *Shanghai Jiao Tong Univ.*; Yue Wu, *Fudan Univ.*; Wei Xu, *Shanghai Jiao Tong Univ.*; Changzhan Gu, *Shanghai Jiao Tong Univ.*; Junfa Mao, *Shanghai Jiao Tong Univ.*

We3D-5: Interferometric Approaches for Accurate Location and Displacement Measurement Using Passive Frequency-Doubling Reflectennas
I.H. Uluer, *Oregon State Univ.*; J. Frolik, *University of Vermont*; T.M. Weller, *Oregon State Univ.*

147AB

We3F: Emerging Planar Filter Architectures and Design Methods

Chair: Xun Luo, *UESTC*
Co-Chair: Li Yang, *Universidad de Alcalá*

We3F-1: Balanced Flat-Group-Delay RF Low-Pass Filter with Differential-Mode Input-Quasi-Reflectionless Behavior for Digital-Communication Systems
Z. Luo, *Sun Yat-sen Univ.*; L. Yang, *Universidad de Alcalá*; T. Su, *Sun Yat-sen Univ.*; R. Gómez-García, *Universidad de Alcalá*

We3F-2: RF Balanced-to-Single-Ended Out-of-Phase/3-dB Filtering Power Divider With Differential-Mode Input-Quasi-Reflectionless Behavior
X.-B. Zhao, *Xidian Univ.*; F. Wei, *Xidian Univ.*; L. Yang, *Universidad de Alcalá*; R. Gómez García, *Universidad de Alcalá*

We3F-3: FDTD Modeling of Time-Modulated Resonators-Based Bandpass Filters Using Modified Telegrapher's Equations
A. Kumar, *Tyndall National Institute*; Z. Zhang, *Tyndall National Institute*; D. Sarkar, *Indian Institute of Science*; S. Nikolaou, *Frederick University*; P. Vryonides, *Frederick University*; D. Psychogiou, *Tyndall National Institute*

We3F-4: Compact, Multilayer 5G Filter Based on Extracted-Pole Shielded Lumped Resonators
Y. Zheng, *UESTC*; Y. Dong, *UESTC*

We3F-5: Design of Multifunctional Bandpass Filter With Tunable Attenuation and Reflectionless Behavior
A. Nadeem, *Frederick University*; S. Nikolaou, *Frederick University*; D. Psychogiou, *Tyndall National Institute*; P. Vryonides, *Frederick University*

Denotes Keynote Presentation

150AB

We3G: Integrated Passives for Innovative Front-Ends

Chair: Anthony Ghiotto, *Université de Bordeaux*

Co-Chair: Jason Soric, *Raytheon*

We3G-1: A Novel RF Hilbert Transformer Single Sideband Mixer

H. Yan, *FAMU-FSU*; H. Zhang, *FAMU-FSU*; P. Liu, *FAMU-FSU*; S. Zolfaghary Pour, *FAMU-FSU*; J. Casamayor, *FAMU-FSU*; M. Plaisir, *FAMU-FSU*; B. Arigong, *FAMU-FSU*

We3G-2: A Wideband 4-Port Gyrator-Based Circulator in 0.15µm GaN MMIC

A. Dascurcu, *Columbia Univ.*; N. Jahan, *Columbia Univ.*; H. Krishnaswamy, *Columbia Univ.*

We3G-3: Dual-Channel Half-Mode Substrate-Integrated Waveguide Link Utilizing Mode Division Multiplexing

M. Elsawaf, *Univ. of Southern California*; C. Sideris, *Univ. of Southern California*

We3G-4: A Novel Microwave Modulator Based on Complex Impedance Loads

A. Venere, *CNEA*; R. López La Valle, *UNLP*; M. Hurtado, *UNLP*

We3G-5: A 94-GHz Absorptive SP4T Switch with Pad Parasitic Cancellation

Y.-C. Tseng, *NYCU*; C.-N. Kuo, *NYCU*

151AB

We3H: Digital Linearization Techniques for Wireless Transmitter Applications

Chair: Anding Zhu, *University College Dublin*

Co-Chair: Pere L. Gilabert, *Universitat Politècnica de Catalunya*

We3H-1: Role of AI/ML in PA Linearization for Next G Wireless

K. Chuang, *Analog Devices*

We3H-2: Adaptive Kernel Function Sharing for Digital Predistortion of RF Power Amplifiers With Dynamic Resource Block Allocation

H. Yin, *Univ. College Dublin*; A. Zhu, *Univ. College Dublin*

We3H-3: A Low-Complexity DPD Coefficient Update Method for Varying Transmission Configurations

T. Zhong, *UESTC*; J. Peng, *UESTC*; S. He, *UESTC*; Y. Bian, *UESTC*; X. Wang, *UESTC*; Y. Tang, *UESTC*; B. Pang, *UESTC*

We3H-4: Behavioral Modeling of Millimeter Wave GaN Power Amplifiers for 6G Integrated Sensing and Communications Application

Y. Yu, *Southeast Univ.*; L. Yu, *Southeast Univ.*; P. Chen, *Southeast Univ.*; C. Yu, *Southeast Univ.*

We3H-5: On the Parameter Identification of Cascaded Behavioral Models for Wideband Digital Predistortion Linearization

R. Criado, *UPC*; W. Li, *UPC*; W. Thompson, *Analog Devices*; G. Montoro, *UPC*; K. Chuang, *Analog Devices*; P.L. Gilabert, *UPC*

152AB

We3I: Modeling Techniques for Advanced Applications

Chair: Da Huang, *MathWorks*

Co-Chair: David R. Jackson, *University of Houston*

We3I-1: Spectrum of Insights with Advanced Engineering Simulation

L. Williams, *Ansys*

We3I-2: Analytic Differential Admittance Operator Solution of a Dielectric Sphere Under Radial Dipole Illumination

M. Huynen, *IDLab*; D. De Zutter, *IDLab*; D. Vande Ginste, *IDLab*; V. Okhmatovski, *Univ. of Manitoba*

We3I-3: A Rigorous 3D Near to Far Field Transformation When Only an Electric or Magnetic Field is Available

J.M. Tamayo, *Ansys*; A. Mathis, *Ansys*; W. Thiel, *Ansys*

We3I-4: Integrated Distributed Equivalent Circuit Model of PCIe 5.0 Connector with AIC and Baseboard Loading Resonances for Fast SI Diagnosis

Y. He, *University of Illinois Urbana-Champaign*; K. Song, *University of Illinois Urbana-Champaign*; M. Feng, *University of Illinois Urbana-Champaign*

We3I-5: Optically-Transparent FSS for Outdoor-to-Indoor Transmission Improvement Featuring Electromagnetic-Thermal Co-Analysis

Y. Youn, *POSTECH*; C. Lee, *POSTECH*; D. Kim, *POSTECH*; D. An, *POSTECH*; A.A. Omar, *KFUPM*; W. Hong, *POSTECH*

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15:10

MICROAPPS

09:45 – 18:00 | Wednesday, 19 June 2024 | MicroApps Theater: Booth 2159

SESSION CODE	TIME	TITLE	SPEAKER/S, AFFILIATIONS
WEMA2	09:45 – 10:00	**Enabling Electromagnetic Simulations with Encrypted Components**	Gary Lytle, Cadence
WEMA3	10:00 – 10:15	**Ultra-Fast Electromagnetic Simulation Tool for Coaxial Connectors and Large-Scale Axisymmetric Reflector Antennas**	Marzena Olszewska-Placha, *QWED Sp. z o.o.*
WEMA4	10:15 – 10:30	**Utilizing Real World Signal in Simulation**	Michael Thompson, Tawna Wilsey, *Cadence Design Systems*
WEMA5	10:30 – 10:45	**COTS, Low-Cost Space Qualified Microwave Components**	Joseph Buonaiuto, *Narda Miteq*
WEMA6	10:45 – 11:00	**Active Emissivity Correction In Millimeter-Wave Radiometric Temperature Sensors**	Andrew Laundrie, *Eravant*
WEMA7	11:00 – 11:15	**Understanding the Benefits of Low Dk Thermoset High Frequency Circuit Materials**	John Coonrod, *Rogers Corporation*
WEMA8	11:15 – 11:30	**A 4-Channel Transmit/Receive, 0.1-18GHz 3UVPX Tuner+Digitizer+Processor System on Module**	Mike Jones, *Analog Devices, Inc.*
WEMA9	11:30 – 11:45	**Discrete RF Sampling Transceiver Support Wide Bandwidth for Space and Defense**	Russell Hoppenstein, *Texas Instruments*
WEMA10	11:45 – 12:00	**Expanding Horizons: USRP Radios with MATLAB**	Robin Getz, *MathWorks;* Neel Pandeya, *Ettus Research*
WEMA11	12:00 – 12:15	**War Driving with MATLAB and USRP Radios: Data Capture sync'ed with GPS Location**	Robin Getz, *MathWorks*
WEMA12	12:15 – 12:30	**PAPR as a Fast and Cost-Effective Indicator of EVM Degradation**	Bob Buxton, *Boonton*
WEMA13	12:30 – 12:45	**6G FR3 Signal Chain for Wireless Test Systems**	Mark D'Amato, *Analog Devices*
WEMA14	12:45 – 13:00	**Characterization of Solid and Liquid Materials for 5G/6G Applications in 1-130 GHz Range**	Marzena Olszewska-Placha, *QWED Sp. z o.o.*
WEMA15	13:00 – 13:15	**Noise Cancellation by Vector Averaging of the IQ Data of Repetitive Signals for Analysis of WLAN or 5G Signals**	Florian Ramian, Wolfgang Wendler, *Rohde & Schwarz*
WEMA16	13:15 – 13:30	**Open-Source 5G FR2 Test Network (FR2 OAI)**	Ethan Lin, *TMYTEK*
WEMA17	13:30 – 14:30	**StartUp Program: SBIR/STTR Panel Session** **Moderator:** Quenton Bonds, *NASA* **Panelists:** Ben Schrag, *National Science Foundation*; Dave McCarthy, *Department of Energy*; Mohamed Mounir Abdin, *NASA*	
WEMA18	14:30 – 14:45	**AI Classification of Waveform Types: Differentiating 5G NR and RADAR Signals**	Robin Getz, *MathWorks*
WEMA19	14:45 – 15:00	**AI-Based Digital Predistortion in MATLAB**	Mike McLernon, *MathWorks*
WEMA20	15:00 – 15:15	**External Optimization and AI/ML Training of a 3GHz Filter Using Python in ADS**	Daren McClearnon, Jason Boh, Matt Ozalas, *Keysight Technologies*
WEMA21	15:15 – 15:30	**200W Ka-Band High Power Amplifier Technology Realized by an 8-Way Power Combiner with 30W GaN-Based Chips**	Hiroshi Hosaka, *Nisshinbo Micro Devices Inc.*
WEMA22	15:30 – 15:45	**mmWave CMOS Power Amplifier Design and Simulation with Custom Compiler and PrimeSim**	Jian Yang, *Synopsys*
WEMA23	15:45 – 16:00	**RAPID-VT Vector Signal Transceiver Extension Enabling Easy Characterization of Different Power Amplifier Architectures Under Realistic Conditions**	Sajjad Ahmed, *Focus Microwaves*; Marc Vanden Bossche, *NI*
WEMA24	16:00 – 16:15	**Wideband Modulated PA Validation in the THz Range**	Markus Lörner, *Rohde & Schwarz*
WEMA25	16:15 – 16:30	**Advancements in Linear and Non-Linear Bidirectional Impedance and Stability Analysis**	Bryce Hotalen, *Cadence Design Systems*
WEMA26	16:30 – 16:45	**Advances In Thermal Analysis and Over-The-Air Electromagnetic Analysis of Advanced Microwave Devices and Front-End-Modules**	Dustin Kendig, *Microsanj LLC*; Sidina Wane, *eV Technologies*
WEMA27	16:45 – 17:00	**High-Performance RF AFE with integrated DPD/CFR**	Serkan Tokgoz, Kang Hsia, *Texas Instruments*
WEMA28	17:00 – 18:00	**The Next Top Startup Competition: Paving Paths to Financial Success**	

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WALTER E. WASHINGTON CONVENTION CENTER

STARTUP PANEL SESSION: **SBIR/STTR**

13:30 – 14:30 | Wednesday, 19 June 2024 | MicroApps Theater Booth 2159

Learn about the SBIR/STTR programs from several agencies. During the Q&A session, you will have the opportunity to ask the hard questions.

MODERATOR:

Quenton Bonds, *NASA*

PANELISTS:

Ben Schrag, *National Science Foundation*

Dave MCcarthy, *Department of Energy*

Mohamed Mounir Abdin, *NASA*

Reception to follow in the StartUp Networking Lounge

WALTER E. WASHINGTON CONVENTION CENTER

17:00 – 18:00 | Wednesday, 19 June 2024 | MicroApps Theater, Booth 2159

The Next Top Startup Competition: Paving Paths to Financial Success

A perennial highlight of IMS, the Top Start-Up Competition in 2024 offers an exhilarating opportunity for prominent entrepreneurs to pitch their ventures to seasoned judges and an audience deeply entrenched in the RF/microwave technology ecosystem and new venture creation. Leveraging their wealth of experience, the judges will provide valuable insights, enabling participants to spotlight their products and ideas before the diverse audience at the IMS Exhibit Floor. Here, their pitches undergo rigorous evaluation, and outstanding contributions are duly recognized with well deserved prizes. Winners will be announced at the IMS Closing Session on Thursday, 20 June 2024 at 15:30 in the Ballroom of the Walter E. Washington Convention Center.

IMS EARLY CAREER PAPER COMPETITION

Now in it's second year, this competition is open to authors from industry, government agencies, and post-doctoral candidates, with less than 10 years of professional experience, and who are not full-time students or faculty members.

THIS YEAR'S **IMS EARLY CAREER PAPER COMPETITION** FINALISTS:

IF1-39 A Low-Loss DC-to-300 GHz InP-Si Interconnection Based on Wafer Level Packaging Using Chip-First-Facedown Process
Yusuke Araki, *NTT*

Tu1B-3 3-D Centrally-Loaded FSS Leveraging Conductive and Dielectric Multimaterial Additive Manufacturing for Broadband Performance
Xiaojing Lv, *UTS*

Tu4B-2 Liquid Metal-Enabled Multi-Functional Passive Device
Yi-Wen Wu, *University of Birmingham*

Tu2E-3 Ultrabroadband Indoor Optical Wireless Networks
A. Nirmalathas, *University of Melbourne*

We1F-1 Direct-Detect 250-310 GHz Pseudo-Correlation Radiometer and Double-Sideband 380 GHz Sounder for Ice Cloud Sensing
Akim A. Babenko, *Jet Propulsion Laboratory*

We1G-3 Broadband G-Band GaN Digital Step Attenuators
Philipp Neininger, *Fraunhofer IAF*

We3C-5 A 3.2–4.2GHz Wideband 47dBm GaN HEMT Sequential-LMBA with Harmonic Tuned Using CRLH Transmission Line Stub
Hirotaka Asami, *Sumitomo Electric Industries*

INTERACTIVE FORUM | IF1

15:10 – 17:00 | Wednesday, 19 June 2024 | BOOTH 2505, IMS EXHIBIT FLOOR

Chair: Matthew Morgan, *NRAO*

IF1-1: 57-GHz Low-Power Subharmonic Parametric Downconverter Exploiting Capacitance Nonlinearity in SiGe BiCMOS

P. Palacios, *RWTH Aachen Univ.*; M. Saeed, *InCirT*; R. Negra, *RWTH Aachen Univ.*

IF1-10: A 0.9 to 4.0GHz High Efficiency Reactively-Matched GaN Power Amplifier MMIC

J. Kamioka, *Mitsubishi Electric*; H. Sato, *Mitsubishi Electric*; S. Miwa, *Mitsubishi Electric*; Y. Kamo, *Mitsubishi Electric*; S. Shinjo, *Mitsubishi Electric*

IF1-12: Rigorous Approach to the Coupling Matrix Synthesis Problem Based on Geometric Interpretation

S. Lee, *Korea Univ.*; J. Lee, *Korea Univ.*; J. Lee, *Korea Univ.*

IF1-13: A Novel Wideband Power Amplifier Enhanced Through Controlled Prescribed Transmission Zeros by Coupling Block

S. López de Pablo, *UAB*; J. Verdú, *UAB*; P. de Paco, *UAB*

IF1-14: A Low-Complexity Harmonic Technique for RF Power Amplifiers

Xinyu Wang, *Univ. of Electronic Science and Technology of China*; Jun Peng, *Univ. of Electronic Science and Technology of China*; Songbai He, *Univ. of Electronic Science and Technology of China*; Bo Pang, *Univ. of Electronic Science and Technology of China*; Tianyang Zhong, *Univ. of Electronic Science and Technology of China*; Yijie Tang, *Univ. of Electronic Science and Technology of China*; Haiqian Tang, *Univ. of Electronic Science and Technology of China*

IF1-15: Machine-Learning Assisted Digital Predistortion Using Feedback via Dual-Polarized Antenna Arrays

Yuuichi Aoki, *Samsung Electronics Co., Ltd.*; Yonghoon Kim, *Samsung Electronics, Co., Ltd.*; Heedo Kang, *Samsung Electronics Co., Ltd.*; Wonki Kim, *Samsung Electronics Co., Ltd.*; Kihong Min, *Samsung Electronics Co., Ltd.*; Sung-Gi Yang, *Samsung Electronics Co., Ltd.*

IF1-16: A Fully Additively Manufactured Reconfigurable Millimeter-Wave Bandpass Filter Based on VO_2 Dielectric Layer

H. Tang, *UMass Lowell*; P. Liu, *FAMU-FSU*; S. Li, *Yunnan Precious Metal Laboratory*; B. Zheng, *UMass Lowell*; H. Zhao, *UMass Lowell*; Y. Dong, *UMass Lowell*; Y. Huang, *UMass Lowell*; J. Li, *Argonne National Lab*; B. Arigong, *FAMU-FSU*; H. Zhang, *UMass Lowell*

IF1-17: Measurement of Multiband Complex Permittivity by Perturbation Insertion Method

Q. Shi, *SCUT*; Q.-X. Chu, *SCUT*; F.-C. Chen, *SCUT*

IF1-18: Enhanced In-Band Self-Interference Suppression by Combining Bandpass Filter-Based RF Cancellers and Dual-Polarized Antennas

Kevin Martin, *Univ. College Cork*; Dimitra Psychogiou, *Univ. College Cork*

IF1-19: A Millimeter-Wave "Quasi-Reflectionless" Filter Prototype Implemented with Micromachined Silicon

N.D. Sauber, *Univ. of Virginia*; M.F. Bauwens, *Dominion Microprobes*; M.E. Cyberey, *Univ. of Virginia*; A.W. Lichtenberger, *Univ. of Virginia*; N.S. Barker, *Univ. of Virginia*; R.M. Weikle II, *Univ. of Virginia*

IF1-2: An X-Band Phase Noise Canceling Feedforward Amplifier in InP 250nm HBT Process

P. Shirmohammadi, *Univ. of Virginia*; S. Hanifi, *Univ. of Virginia*; S.M. Bowers, *Univ. of Virginia*

IF1-20: A Quantum Model for a Graphene Josephson Junction Parametric Amplifier for Quantum-Noise-Limited Microwave Amplification

Y. Yuan, *Technische Univ. München*; Ö.E. Asirim, *Technische Univ. München*; M. Haider, *Technische Univ. München*; C. Jirauschek, *Technische Univ. München*

IF1-21: A Millimeter-Wave Low-Loss On-Chip Filter Design Using a Wideband Synthesis Method in 90-nm SiGe BiCMOS Process

X. Huang, *Princeton Univ.*; Z. Liu, *Princeton Univ.*; E.A. Karahan, *Princeton Univ.*; K. Sengupta, *Princeton Univ.*

IF1-22: Design and Analysis of SPDT Switch and Array Antenna for 28GHz 5G New Radio

C.-T. Huang, *National Chi Nan Univ.*; Y.-S. Lin, *National Chi Nan Univ.*; C.-Y. Huang, *National Chi Nan Univ.*; K.-S. Lan, *National Chi Nan Univ.*

IF1-23: Wi-Fi SIMO Radar for Deep Learning-Based Sign Language Recognition

Y.-C. Lai, *National Sun Yat-sen Univ.*; P.-Y. Huang, *National Sun Yat-sen Univ.*; T.-S. Horng, *National Sun Yat-sen Univ.*

IF1-24: Compact, Low Loss 4-Bit Ku-Band Hybrid Passive Phase Shifter Realized in 0.13-µm SiGe HBT BiCMOS for LEO SATCOM

S. Kim, *Hanyang Univ.*; K.W. Choi, *Ajou Univ.*; B. Yoon, *Hanyang Univ.*; J. Kim, *Hanyang Univ.*; I. Ju, *Ajou Univ.*

IF1-25: Topology Optimization of Microwave Filters Based on Direct Computation of Poles and Zeros

M. Oldoni, *Politecnico di Milano*; Y.E. Elhouchy, *Politecnico di Milano*; G. Macchiarella, *Politecnico di Milano*; G.G. Gentili, *Politecnico di Milano*

IF1-26: A Monolithic X-Band 32dBm GaAs HBT Power Amplifier with Efficient Operation Over a Wide Range of Power Supply Voltages

P. Asbeck, *Univ. of California, San Diego*; S. Alluri, *Univ. of California, San Diego*; J.-H. Li, *WIN Semiconductors*; J.-T. Chung, *WIN Semiconductors*

IF1-27: A Ku-Band Internally Matched 50W GaN HEMT Power Amplifier Using Advanced Cu-Mo-Cu Heat Sink

Y. Park, *KETI*; J.Y. Jeong, *RFMTL*; W. Kang, *RFMTL*; M. Park, *KETI*; D. Kim, *KETI*

IF1-28: 938Gb/s, 145-GHz-Bandwidth Wireless Transmission Over the Air Using Combined Electronic and Photonic-Assisted Signal Generation

Z. Zhou, *Univ. College London*; A. Kassem, *Univ. College London*; J. Seddon, *Univ. College London*; E. Sillekens, *Univ. College London*; I. Darwazeh, *Univ. College London*; P. Bayvel, *Univ. College London*; Z. Liu, *Univ. College London*

IF1-29: Recursive Neural Network with Phase-Normalization for Modeling and Linearization of RF Power Amplifiers

A. Fischer-Bühner, *Nokia Bell Labs*; L. Anttila, *Tampere Univ.*; M.D. Gomony, *Nokia Bell Labs*; M. Valkama, *Tampere Univ.*

IF1-3: A D-Band Traveling-Wave Amplifier by Embedding GaN HEMTs as Current Probes in a SiC SIW

L. Li, *Cornell Univ.*; T. Li, *Cornell Univ.*; P. Fay, *Univ. of Notre Dame*; J.C.M. Hwang, *Cornell Univ.*

IF1-30: Improve RF Dual Probe Calibration Accuracy with Peer-Terminated Standards

H.C. Fu, *MPI*; K. Jung, *MPI*

IF1-31: Various RF Substrate Solutions for 22nm FD-SOI Technology Targeting Cryogenic Applications

M. Vanbrabant, *UCLouvain*; M. Rack, *UCLouvain*; D. Lederer, *UCLouvain*; V. Kilchytska, *UCLouvain*; J.-P. Raskin, *UCLouvain*

IF1-32: Innovative Development Approach for a High-Power 8-Way Coaxial Radial Combiner

M.M.M. Ali, *Scientific Microwave*; S.M. Sifat, *Scientific Microwave*; M. Elsaadany, *Concordia Univ.*; S.I. Shams, *Concordia Univ.*; K. Wu, *Polytechnique Montréal*

IF1-33: Additively Manufactured High-Power Light Weight Millimeter-Wave Band Pass Filter Optimized with AI Tuning Algorithm for 5G Space Applications

L. Salman, *Ansys*; D. Liu, *SynMatrix Technologies*; S. Acharya, *Ansys*; L. Vancleef, *3D Systems*; K. Huybrechts, *3D Systems*; G. Saad, *Scientific Microwave*; M.M.M. Ali, *Scientific Microwave*

IF1-34: A ROM-Less DDS with High-Speed Selectors for Reduction in DAC Settling Time Requirements

H. Shibue, *Ritsumeikan Univ.*; H. Nosaka, *Ritsumeikan Univ.*

IF1-35: Wearable Human Body Communication Channel Measurements in the Body Resonance Regime

S. Sarkar, *Purdue Univ.*; Q. Huang, *Purdue Univ.*; M. Nath, *Purdue Univ.*; S. Sen, *Purdue Univ.*

IF1-36: 6.5GHz Longitudinal Leaky SAW Filter Using $LiNbO_3$-on-SiC Structure for Wi-Fi 7

M. Sun, *USTC*; S. Zhang, *CAS*; P. Zheng, *CAS*; X. Fang, *CAS*; X. Ou, *CAS*

IF1-37: System and Characterization Method for Controlled Microwave Heating in Medical Applications

S. Pawar, *Pennsylvania State Univ.*; B. Westhafer, *Pennsylvania State Univ.*; A. Attaluri, *Pennsylvania State Univ.*; M.-R. Tofighi, *Pennsylvania State Univ.*

IF1-38: A 256–287 GHz Full 360° Hybrid-type Phase Shifter with Active SPDT Switches

Eunjung Kim, *Korea Univ.*; Sanggeun Jeon, *Korea Univ.*

IF1-39: A Low-Loss DC-to-300 GHz InP/Si Interconnection Based on Wafer Level Packaging Using Chip-First/Facedown Process

Y. Araki, *NTT*; Y. Shiratori, *NTT*; H. Hamada, *NTT*; M. Muto, *NTT*; I. Abdo, *NTT*; T. Jyo, *NTT*; F. Nakajima, *NTT*

IF1-4: Scalable GaN-Based 64-Element Circularly-Polarized Transceiver with 65-dBm Saturated EIRP for Millimeter-Wave CubeSat Applications

Y.-F. Tsao, *NYCU*; A. Desai, *NYCU*; H.-T. Hsu, *NYCU*

IF1-40: Noise-Adaptive Auto-Encoder for Modulation Recognition of RF Signal

J. Woo, *Georgia Tech*; K. Jung, *Georgia Tech*; S. Mukhopadhyay, *Georgia Tech*

IF1-41: Reconstruction of Arbitrarily Shaped Sources with Electromagnetic Time-Reversal and Kurtosis

J. Li, *Fuzhou Univ.*; Z.D. Chen, *Fuzhou Univ.*; X. Feng, *Dalhousie University*; J. Cai, *Fuzhou Univ.*; Z. Xu, *Fuzhou Univ.*

IF1-42: 28GHz GaAs pHEMT High-Efficiency Power Amplifier Using Multi-Section Transmission-Line Power Combining/Matching Technique

Y.-S. Lai, *National Taiwan Univ.*; Z.-H. Fu, *National Taiwan Univ.*; J.-W. Ye, *National Taiwan Univ.*; C.-S. Wu, *Yuan Ze Univ.*; K.-Y. Lin, *National Taiwan Univ.*

IF1-43: A 5.6dB Noise-Figure X-Band to W-Band CMOS Frequency-Extender Receiver Frontend

T. Elazar, *Tel-Aviv Univ.*; E. Socher, *Tel-Aviv Univ.*

IF1-5: Experimental Study on Transition Loss of On-Chip SIW Interconnects and Transmission Lines Using Two De-Embedding Reference Planes in 200GHz Band Frequency

S.K. Thapa, *Kyushu Univ.*; R.K. Pokharel, *Kyushu Univ.*; A. Barakat, *Kyushu Univ.*; S. Amakawa, *Hiroshima Univ.*; M.H. Mubarak, *NICT*; S. Hara, *NICT*; I. Watanabe, *NICT*; A. Kasamatsu, *NICT*

IF1-6: A 5.2-GHz Area-Efficient RF Front-End with 2.79× PAE Enhancement at 7.7-dB Power Back-Off

T.-S. Yang, *National Taiwan Univ.*; W.-W. Wang, *National Taiwan Univ.*; P.-Y. Hsu, *National Taiwan Univ.*; L.-H. Lu, *National Taiwan Univ.*

IF1-7: Consistent Q(v)-I(v) AlGaN/GaN HEMT Nonlinear Equivalent-Circuit Modeling

J.C. Pedro, *Universidade de Aveiro*; L.C. Nunes, *Universidade de Aveiro*

IF1-8: Practical Considerations for RF Measurements of Cryogenic CMOS Circuits for Quantum Computing

D. Frolov, *IBM*; S. Chakraborty, *IBM*; D. Underwood, *IBM*; J. Glick, *IBM*; J. Timmerwilke, *IBM*; R. Robertazzi, *IBM*; K. Inoue, *IBM*; M. Yeck, *IBM*; P. Rosno, *IBM*; B. Snell, *IBM*; D. Moertl, *IBM*; S. Lekuch, *IBM*; C. DeSantis, *IBM*; K. Tien, *IBM*; J.-O. Plouchart, *IBM*; D. Frank, *IBM*; D. Wisnieff, *IBM*; J. Bulzacchelli, *IBM*; C. Baks, *IBM*; D. Friedman, *IBM*; B. Gaucher, *IBM*

IF1-9: Rapid Calibration of Variable Gain Phase Shifters: A Novel Characterization Approach with Sparse Measurements

Y. Chen, *Univ. of Waterloo*; S. Boumaiza, *Univ. of Waterloo*

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ADVANCED PRACTICE AND INDUSTRY PAPER COMPETITIONS

The Advanced Practice Paper Competition (APPC) recognizes outstanding technical contributions that apply to practical applications. All finalist papers are on advanced practices and describe an innovative RF/microwave design, integration technique, process enhancement, and/or combination thereof that results in significant improvements in performance and/or in time to production for RF/microwave components, subsystems, or systems.

The Industry Paper Competition (IPC) recognizes outstanding technical contributions from industry sources. All finalist papers are from the RF/microwave industry and describe innovation of a product or system application that potentially has the highest impact on an RF/microwave product and/or system which will significantly benefit the microwave community and society at large.

ADVANCED PRACTICE PAPER FINALISTS:

IF1-21 A Millimeter-Wave Low-Loss On-Chip Filter Design Using a Wideband Synthesis Method in 90-nm SiGe BiCMOS Process
X. Huang, Z. Liu, E.A. Karahan, K. Sengupta, *Princeton Univ.*

IF1-5 Experimental Study on Transition Loss of On-Chip SIW Interconnects and Transmission Lines Using Two De-Embedding Reference Planes in 200GHz Band Frequency
S.K. Thapa, R.K. Pokharel, A. Barakat, *Kyushu Univ.*; S. Amakawa, *Hiroshima Univ.*; M.H. Mubarak, S. Hara, I. Watanabe, A. Kasamatsu, *NICT*

IF1-8 Practical Considerations for RF Measurements of Cryogenic CMOS Circuits for Quantum Computing
D. Frolov, S. Chakraborty, D. Underwood, J. Glick, J. Timmerwilke, R. Robertazzi, K. Inoue, M. Yeck, P. Rosno, B. Snell, D. Moertl, S. Lekuch, C. DeSantis, K. Tien, J.-O. Plouchart, D. Frank, D. Wisnieff, J. Bulzacchelli, C. Baks, D. Friedman, B. Gaucher, *IBM*

Th1B-4 Automated mmWave Power Amplifier Design Flow and a 28-GHz Design Example in 45-nm CMOS SOI
Yaolong Hu, Xiaohan Zhang, Qiang Zhou, *Rice Univ.*; Fan Cai, Cindy Cui, *Keysight Technologies*; Taiyun Chi, *Rice Univ.*

Th1B-5 Analysis and Modeling of Super-Regenerative Oscillators with FMCW Signals
S. Sancho, M. Ponton, A. Suarez, *Universidad de Cantabria*

Th2C-2 Low-Noise Power-Amplifier MMICs for the WR4.3 and WR3.4 Bands in a 35-nm Gate-Length InGaAs mHEMT Technology
F. Thome, A. Leuther, *Fraunhofer IAF*

Th2G-5 Millimeter-wave Device Characterization Under Wideband Modulated Signals using Vector Network Analyzer Frequency Extenders
A. Ben Ayed, P. Mitran, S. Boumaiza, *Univ. of Waterloo*

Tu2A-5 A 28GHz Band Highly Efficient GaAs Rectenna MMIC with EM Coupling Structure for an External Highly Efficient Wire Antenna
N. Sakai, Y. Tondokoro, A. Kobayashi, K. Noguchi, M. Tsuru, K. Itoh, *Kanazawa Institute of Technology*

Tu2B-1 Direct-Coupled TE–TM Dual-Mode Waveguide Cavities
C. Tomassoni, *Università di Perugia*; S. Bastioli, R. Snyder, *RS Microwave*; V. de la Rubia, *Universidad Politécnica de Madrid*

Tu2E-3 Ultrabroadband Indoor Optical Wireless Networks
A. Nirmalathas, T. Song, *Univ. of Melbourne*; S. Edirisinghe, *Jayawardenapura University*; J. Li, *Shandong Normal University*; C. Ranaweera, *Deakin University*; K. Wang, *Shandong Normal University*; C. Lim, *Univ. of Melbourne*

Tu3C-1 An Energy Efficient 56-Gb/s D-band Point-to-point Link based on CMOS TX and RX Modules and Transmitarray Beamformers
J.L. Gonzalez-Jimenez, A. Siligaris, *CEA-LETI*; A. Hamani, *Univ. Grenoble Alpes*; F. Foglia Manzillo, P. Courouve, N. Cassiau, C. Dehos, A. Clemente, *CEA-LETI*

Tu3D-4 Broadband Low-Noise Ka-Band Front-End MMIC in a 0.15-µm GaN-on-SiC HEMT Technology
F. Thome, P. Neininger, S. Krause, P. Brückner, R. Quay, *Fraunhofer IAF*

We1D-1 Considerations on Near-Field Correction: µm Accuracy with mmWave Radar
L. Piotrowsky, N. Pohl, *Ruhr-Universität Bochum*

We2C-4 High-Power BAW-Based FDD Front-End using Indirect-Duplexing Load Modulated Balanced Amplifier for Massive MIMO Array
Y. Cao, *Qorvo*; S.P. Gowri, N.B. Vangipurapu, K. Chen, *Univ. of Central Florida*

We2H-5 A Method for Designing a Linear, Efficient 2-Stage GaN PA for Supply Modulation
M. Olavsbråten, A.I. Hagen, *NTNU*

We2I-5 Electromagnetic Stability Characterization of Millimeter-Wave Dielectric Fibers at Extremely High-Temperatures: Enabling Harsh Environment Communication and Sensing
A. Sharma, Y.R. Kim, *Stevens Institute of Technology*

INDUSTRY PAPER FINALISTS:

IF1-10 A 0.9 to 4.0GHz High Efficiency Reactively-Matched GaN Power Amplifier MMIC
J. Kamioka, H. Sato, S. Miwa, Y. Kamo, S. Shinjo, *Mitsubishi Electric*

IF1-15 Machine-Learning Assisted Digital Predistortion Using Feedback via Dual-Polarized Antenna Arrays
Yuuichi Aoki, Yonghoon Kim, Heedo Kang, Wonki Kim, Kihong Min, Sung-Gi Yang, *Samsung Electronics Co., Ltd.*

IF1-32 Innovative Development Approach for a High-Power 8-Way Coaxial Radial Combiner
M.M.M. Ali, S.M. Sifat, *Scientific Microwave*; M. Elsaadany, S.I. Shams, *Concordia Univ.*; K. Wu, *Polytechnique Montréal*

Th1E-2 A Novel Q-Choked Resonator for Microwave Material Measurements Alleviating Sample Thickness Limitations of Existing Techniques
M. Celuch, M. Olszewska-Placha, L. Nowicki, W. Gwarek, *QWED*

Th2C-1 220-GHz High-Efficiency Power Amplifiers in 250-nm and 130-nm InP HBT Technologies Having 14.4–25.0% PAE and 40–60mW Pout
Z. Griffith, M. Urteaga, P. Rowell, *Teledyne Scientific & Imaging*

Th2G-4 Measurement of Residual Phase Noise of Amplifiers at 80GHz Using Interferometric Measurement Technique
W. Wendler, A. Roth, *Rohde & Schwarz*

Tu1E-1 Silicon Photonic Integrated Circuit Beamformer for RF Photonic Applications
T. Creazzo, C. Stine, C. Creavin, C. Harrity, K. Shreve, F. Wang, P. Yao, J. Murakowski, *Phase Sensitive Innovations*; G. Schneider, S. Shi, *Univ. of Delaware*; C. Schuetz, *Phase Sensitive Innovations*; D.W. Prather, *Univ. of Delaware*

Tu1F-2 An All-Digital Synthesizer Enabled by a Convolutional Neural Network
C.M. Thomas, *Boeing*; M. Abderezai, *HRL Laboratories*; L. Dong, V. Leung, *Baylor Univ.*

Tu3C-6 Sub-THz Photoconductive Evanescent-Mode Waveguide SPST Switch
T. Jones, D. Peroulis, *Purdue Univ.*

Tu4B-5 Reconfigurable Quadrature Couplers
C.F. Campbell, *Qorvo*

Tu4C-3 Advancements in 300mm GaN-on-Si Technology with Industry's First Circuit Demonstration of Monolithically Integrated GaN and Si Transistors
Q. Yu, A. Farid, I. Momson, J. Garrett, H. Vora, S. Bader, A. Zubair, P. Koirala, M. Beumer, A. Vyatskikh, P. Nordeen, T. Hoff, M. Radosavljevic, S. Rami, F. O'Mahony, H.W. Then, *Intel*

We1I-4 A Novel Causal Method to Blend the DC and AC Solution Over the Entire Frequency Band
P. Liu, W. Thiel, X. Xu, K. Zhu, E. Bracken, *Ansys*

We2G-5 On-Chip Hybrid Couplers Enabling Highly Integrated MMIC Components at Millimeter and Submillimeter Wave Frequencies
Caitlyn Cooke, Maxwell Duffy, Mason Fordham, Michael Eller, Alfonso Escorcia, William Deal, *Northrop Grumman Corp.*

MTT-S AWARDS BANQUET

18:30 – 22:00 | Wednesday, 19 June 2024 | Marquis Ballroom, Marriott Marquis

We are delighted to introduce the 2024 recipients of MTT-S Society Awards. Congratulations to all the awardees for being recognized for their outstanding contributions to the field of microwave theory and technology, significant achievements in their career, or distinguished services to the society. The MTT-S Awards Banquet program includes dinner, entertainment, and technical and service awards presented by the MTT-S Awards Committee.

MTT-S AWARDS	2024 AWARD RECIPIENTS AND DESCRIPTIONS
Microwave Career Award	**Les Besser**—For a Career of Leadership, Meritorious Achievement, Creativity and Outstanding Contributions in the Field of Microwave Theory and Technology
Microwave Pioneer Award	**Marian Pospieszalski**—For the development of an excellent noise model for the design of low noise FET microwave circuits especially at low temperatures which is successfully in use since more than 30 years.
Microwave Application Award	**Lei Zhu**—For the development of multiple-mode resonators and their application in wide-band filters, matching circuits and antennas.
Distinguished Service Award	**Victor Fouad Hanna**—In Recognition of a Distinguished Record of Service to the MTT Society and the Microwave Profession over a Sustained Period of Time
Distinguished Educator Award	**Jenshan Lin**—For Outstanding Achievements as an Educator, Mentor, and Role Model for Microwave Engineers and Engineering Students
N. Walter Cox Award	**Vijay Nair**—For Exemplary Service to the Society in a Spirit of Selfless Dedication and Cooperation
N. Walter Cox Award	**Ali Darwish**—For Exemplary Service to the Society in a Spirit of Selfless Dedication and Cooperation
IEEE MTT-S Outstanding Young Engineer Award	**Markus Gardill**—For Outstanding Early Career achievements as an ambassador of microwave systems and applications.
IEEE MTT-S Outstanding Young Engineer Award	**Chung-Tse Michael Wu**—For Outstanding Early Career achievements in Microwave Metamaterials-Based Antennas, Circuits, and Radar Sensing Systems.
IEEE MTT-S Outstanding Young Engineer Award	**Steven Callender**—For Outstanding Early Career achievements in mmWave and subTHz SoC development in deeply-scaled CMOS technology.
IEEE MTT-S Outstanding Young Engineer Award	**Kaushik Dasgupta**—For Outstanding Early Career Achievements in Reconfigurable RF and mmWave CMOS ICs and Power Amplifiers.
Microwave Prize	**João L. Gomes, Luís C. Nunes, Filipe M. Barradas, José C. Pedro, Adam Cooman, Aryan E. F. de Jong, Rob M. Heeres,** —"The Impact of Long-Term Memory Effects on the Linearizability of GaN HEMT-Based Power Amplifiers, in IEEE Transactions on Microwave Theory and Techniques," vol. 70, no. 2, pp. 1377-1390, Feb. 2022
IEEE Microwave Magazine Best Paper Award	**Roberto Quaglia, Jingzhou Pang, Steve C. Cripps, Anding Zhu,**—"Load-Modulated Balanced Amplifier: From First Invention to Recent Development," IEEE Microwave Magazine vol. 23, no. 12, pp. 60-70, Dec. 2022
IEEE Microwave and Wireless Components Letters Tatsuo Itoh Prize	**Mohamed Hussein Eissa, Gunter Fischer, Thomas Mausolf, Holger Ruecker, Andrea Malignaggi, Gerhard Kahmen,**—"220-320-GHz J-Band 4-Way Power Amplifier in Advanced 130-nm BiCMOS Technology," IEEE Microwave and Wireless Components Letters, vol. 32, no. 11, Nov. 2022
IEEE Transactions on Terahertz Science & Technology Best paper Award	**Y. Koyama, Y. Kitazawa, K. Yukimasa, T. Uchida, T. Yoshioka, K. Fujimoto, T. Sato, J. Iba, K. Sakurai, T. Ichikawa,**—"A High-Power Terahertz Source Over 10 mW at 0.45 THz Using an Active Antenna Array With Integrated Patch Antennas and Resonant-Tunneling Diodes", IEEE Transactions on Terahertz Science and Technology, vol. 12, no. 5, Sep. 2022
IEEE Journal of Microwaves Best Paper Award	**Tobias Chaloun, Luigi Boccia, Emilio Arnieri, Michael Fischer, Vaclav Valenta, Nelson Fonseca, Chritiastian Waldschmidt**—"Electronically Steerable Antennas for Future Heterogeneous Communication Networks: Review and Perspectives," IEEE Journal of Microwaves, vol. 2, no. 4, pp. 545-581, Oct. 2022

145AB

Th1B: Advances in CAD Techniques for RF and Microwave Circuits and Systems

Chair: José E. Rayas-Sánchez, *ITESO*
Co-Chair: Marco Pirola, *Politecnico di Torino*

08:00

Th1B-1: A Novel Transfer Learning Approach for Efficient RF Device Behavior Model Parameter Extraction

R. Wang, *HangZhou DianZi University*; J. Su, *HangZhou DianZi University*; W. Xie, *HangZhou DianZi University*; M. Xu, *HangZhou DianZi University*; K. Xu, *HangZhou DianZi University*; L. Sun, *HangZhou DianZi University*

08:10

08:20

Th1B-2: Transfer Learning Framework for 3D Electromagnetic Structures

O. Akinwande, *Georgia Tech*; S.L. Ganna, *Pennsylvania State Univ.*; R. Kumar, *Pennsylvania State Univ.*; M. Swaminathan, *Georgia Tech*

03:30

08:40

Th1B-3: Analysis of Two Wirelessly Locked Oscillators Based on Realistic Nonlinear Oscillator Models

C. Moncada Guayazan, *Universidad de Cantabria*; F. Ramirez, *Universidad de Cantabria*; A. Suarez, *Universidad de Cantabria*

08:50

09:00

Th1B-4: Automated mmWave Power Amplifier Design Flow and a 28-GHz Design Example in 45-nm CMOS SOI

Yaolong Hu, *Rice Univ.*; Xiaohan Zhang, *Rice Univ.*; Qiang Zhou, *Rice Univ.*; Fan Cai, *Keysight Technologies*; Cindy Cui, *Keysight Technologies*; Taiyun Chi, *Rice Univ.*

09:10

09:20

Th1B-5: Analysis and Modeling of Super-Regenerative Oscillators with FMCW Signals

S. Sancho, *Universidad de Cantabria*; M. Ponton, *Universidad de Cantabria*; A. Suarez, *Universidad de Cantabria*

09:30

09:40

146A

Th1C: Advanced mm-Wave Power Amplifiers for Ka- to E-Band Applications

Chair: Michael Roberg, *mmTron*
Co-Chair: Munkyo Seo, *Sungkyunkwan University*

Th1C-1: A 52-to-86GHz V-/E-band GaN Distributed combined Power Amplifier with Output Power Beyond 1W and 34GHz Bandwidth

Bharath kumar Cimbili, *Ericsson*; Mingquan Bao, *Ericsson*; Christian Friesicke, *Fraunhofer Institute for Applied Solid State Physics*; Sandrine Wagner, *Fraunhofer Institute for Applied Solid State Physics*; Ruediger Quay, *Fraunhofer Institute for Applied Solid State Physics*

Th1C-2: V-Band GaN Power Amplifier MMICs with High Power-Bandwidth and Low Gain Compression for RF Inter-Satellite Links

C. Friesicke, *Fraunhofer IAF*; F. van Raay, *Fraunhofer IAF*; S. Krause, *Fraunhofer IAF*; B. Cimbili, *Fraunhofer IAF*; P. Brückner, *Fraunhofer IAF*; R. Quay, *Fraunhofer IAF*; A. Colzani, *SIAE MICROELETTRONICA*; A. Traversa, *SIAE MICROELETTRONICA*; A. Fonte, *SIAE MICROELETTRONICA*

Th1C-3: Compact K/Ka-Band Frontend PA and LNA in 16nm FinFET for Next Generation Digitally Intensive Arrays

E. Liu, *ETH Zürich*; B. Lin, *ETH Zürich*; C.-Y. Lu, *TSMC*; H. Wang, *ETH Zürich*

Th1C-4: A 31–41GHz SiGe Power Amplifier with Sandwiched-Coupler-Balun and Folded-T-Line Power Combiner Achieving 23.5-dBm/22.2-dBm Psat/OP1dB and Supporting 64-QAM Modulation

K. Xie, *Tianjin Univ.*; R. Wu, *Tianjin Univ.*; K. Wang, *Tianjin Univ.*

146B

Th1D: Low-Noise Cryogenic Integrated Circuits for Quantum Computing

Chair: Kavita Goverdhanam, *US Army CCD-C5ISR Center*
Co-Chair: Sorin P. Voinigescu, *University of Toronto*

Th1D-1: A Gm-Boosting Inductorless Noise-Canceling Low Noise Amplifier in 40-nm CMOS for Quantum Applications

M.K. Chaubey, *National Tsing Hua Univ.*; Y. Liu, *National Tsing Hua Univ.*; Y.-C. Chang, *NARLabs-TSRI*; P.-C. Wu, *NARLabs-TSRI*; H.-H. Tsai, *NARLabs-TSRI*; S.S.H. Hsu, *National Tsing Hua Univ.*

Th1D-2: Sub-10-GHz Cryo-CMOS LNAs Achieving Up to 0.07-dB Average NF Thanks to Back Biasing for Qubit Readout in 28-nm FD-SOI

V. Puyal, *CEA-LETI*; Q. Berlingard, *CEA-LETI*; J. Lugo-Alvarez, *CEA-LETI*; B. Blampey, *CEA-LETI*; M. Cassé, *CEA-LETI*; D. Belot, *STMicroelectronics*

Th1D-3: A 1.6 mW Cryogenic SiGe LNA IC For Quantum Readout Applications Achieving 2.6 K Average Noise Temperature from 3–6 GHz

Z. Zou, *UMass Amherst*; S. Raman, *UMass Amherst*; J. Bardin, *UMass Amherst*

Th1D-4: A 6mW Cryogenic SiGe Receiver IC For High-Fidelity Qubit Readout

R.C. Kwende, *UMass Amherst*; D. Rosenstock, *UMass Amherst*; C. Wang, *UMass Amherst*; J.C. Bardin, *UMass Amherst*

146C

Th1E: Material Sensing at Microwave and mm-Wave Frequencies

Chair: Zoya Popović, *University of Colorado Boulder*
Co-Chair: Pawel Kopyt, *Warsaw University of Technology*

Th1E-1: Accurate Materials' Testing as an Enabler for Microwave and Millimeter-Wave Industries

M. Celuch, *QWED*

Th1E-2: A Novel Q-Choked Resonator for Microwave Material Measurements Alleviating Sample Thickness Limitations of Existing Techniques

M. Celuch, *QWED*; M. Olszewska-Placha, *QWED*; L. Nowicki, *QWED*; W. Gwarek, *QWED*

Th1E-3: Characterizing the Broadband RF Permittivity of 3D-Integrated Layers in a Glass Wafer Stack from 100MHz to 30GHz

J.T. Pawlik, *NIST*; T. Karpisz, *NIST*; N. Derimow, *NIST*; S.R. Evans, *NIST*; J.C. Booth, *NIST*; N.D. Orloff, *NIST*; C.J. Long, *NIST*; A.C. Stelson, *NIST*

Th1E-4: A Dielectric Permittivity Sensor Based on Inverted Microstrip/3D-Printing Hybrid Technology

S. Rustioni, *Università di Pavia*; L. Silvestri, *Università di Pavia*; S. Marconi, *Università di Pavia*; G. Alaimo, *Università di Pavia*; F. Auricchio, *Università di Pavia*; M. Bozzi, *Università di Pavia*

Th1E-5: Radar-Based Smoke Detection at Millimeter Wave Frequencies: An Experimental Study

F. Schenkel, *Ruhr-Universität Bochum*; T. Schultze, *Universität Duisburg-Essen*; C. Baer, *Ruhr-Universität Bochum*; I. Rolfes, *Ruhr-Universität Bochum*; C. Schulz, *Ruhr-Universität Bochum*

Denotes Keynote Presentation

147AB

Th1F: Insights on Vital-Sign Radars

Chair: Alexander Koelpin, *Technische Universität Hamburg, Germany*

Co-Chair: Davi V.Q. Rodrigues, *University of Texas at El Paso*

Th1F-1: Displacement Monitoring Using a Four-Channel Phase- and Quadrature Self-Injection-Locked (PQSIL) Radar with Channel Compression Demodulation (CCD) for Sensitivity Improvement

J.-X. Zhong, *National Sun Yat-sen Univ.*; J.-Y. Shih, *National Sun Yat-sen Univ.*; F.-K. Wang, *National Sun Yat-sen Univ.*

Th1F-2: Wavelet- and Cosine-Transform-Based Super-Resolution Algorithm (WCT-SRA) for Radar-Based Multi-Person Vital Sign Monitoring

J.-Y. Shih, *National Sun Yat-sen Univ.*; J.-X. Zhong, *National Sun Yat-sen Univ.*; Y.-J. Chu, *National Sun Yat-sen Univ.*; F.-K. Wang, *National Sun Yat-sen Univ.*

Th1F-3: A Low-Power Low-Latency 84.5-GHz GaAs pHEMT Self-Injection-Locked Radar with Integrated Frequency Differentiator for Vital Sign Detection

D. Gao, *Rutgers Univ.*; S. Li, *Rutgers Univ.*; M. Zhu, *Rutgers Univ.*; A.Y.-K. Chen, *CSUN*; C.-T.M. Wu, *Rutgers Univ.*

Th1F-4: Spectrum-Efficient Multi-target Vital Sign Monitoring Using Metamaterial-Integrated Space-Time-Coding Transmitting Array

S. Li, *Rutgers Univ.*; D. Gao, *Rutgers Univ.*; S. Vosoughitabar, *Rutgers Univ.*; C.-T.M. Wu, *Rutgers Univ.*

150AB

Th1G: Who Needs Contact? Developments in OTA Measurements

Chair: Marcus Da Silva, *National Instruments*

Co-Chair: Marco Spirito, *Technische Universiteit Delft*

Th1G-1: Electro-Optic Mapping Techniques for Characterization of Microwave Circuits, Devices and Antenna Systems

K. Sabet, *EMAG Technologies*

Th1G-2: A Near-Field Quasi-Optical Measurement Technique for Probe-Fed High-Gain Backside-Radiating Antennas

N. van Rooijen, *Technische Universiteit Delft*; M. Spirito, *Technische Universiteit Delft*; A. Bechrakis Triantafyllos, *Technische Universiteit Delft*; N. Llombart, *Technische Universiteit Delft*; M. Alonso-delPino, *Technische Universiteit Delft*

Th1G-3: Load-Impedance-Aware EIRP Calibration in FR2 Phased Arrays

Viduneth Ariyarathna, *Samsung Semiconductor, Inc.*; Wan Jong Kim, *Samsung Semiconductor, Inc.*; Pranav Dayal, *Samsung Semiconductor, Inc.*; Venumadhav Bhagavatula, *Samsung Semiconductor, Inc.*; Ivan Lu, *Samsung Semiconductor, Inc.*; Chinh Doan, *Samsung Semiconductor, Inc.*

Th1G-4: Toward Free Space Local Characterization Method in Microwave

M. Granger, *Laboratoire Hubert Curien (UMR 5516)*; A. Ghaddar, *Laboratoire Hubert Curien (UMR 5516)*; B. Bayard, *Laboratoire Hubert Curien (UMR 5516)*; B. Sauviac, *Laboratoire Hubert Curien (UMR 5516)*

Th1G-5: Simplifying Polarization Alignment in Modulated Antenna Measurements

G. Orozco, *National Instruments*; T. Deckert, *National Instruments*; N. Yang, *National Instruments*

Joint Session with ARFTG

151AB

Th1H: Advances in Reconfigurable Intelligent Surfaces, Antennas, and Beamformers

Chair: Nizar Messaoudi, *Keysight Technologies*

Co-Chair: Najme Ebrahimi, *Northeastern University*

Th1H-1: Scalable 32×32 1-Bit Reconfigurable Intelligent Surfaces for Upper-Mid Band 6G Communications

S. Kim, *Yonsei Univ.*; H.-S. Choi, *Yonsei Univ.*; B.-W. Min, *Yonsei Univ.*

Th1H-2: A Scalable, Binary Phase, Millimeter-Wave Reconfigurable Intelligent Surface

A.S. Shekhawat, *Arizona State Univ.*; B.G. Kashyap, *Arizona State Univ.*; R.W. Raldiris Torres, *Arizona State Univ.*; G.C. Trichopoulos, *Arizona State Univ.*

Th1H-3: A Wideband Configurable Multi-Port Wire Antenna

S. Rezaeeahvanouee, *Univ. of Minnesota*; Y. Tousi, *Univ. of Minnesota*

Th1H-4: Spatial-Spectral Mapping Beamspace MIMO Receiver Enabled by a Programmable Space-Time-Modulated Metamaterial Antenna

S. Vosoughitabar, *Rutgers Univ.*; A. Nooraiepour, *Qualcomm*; W. Bajwa, *Rutgers Univ.*; N. Mandayam, *Rutgers Univ.*; C.-T.M. Wu, *Rutgers Univ.*

Th1H-5: A Fully-Passive 4-Channel RF Beamformer with Ultra-Low Insertion Loss at 12GHz X/Ku-Band for Low-Power Applications in 28nm CMOS

M.G. Anderson, *Univ. of California, Berkeley*; S. Krishnamurthy, *Univ. of California, Berkeley*; A. Niknejad, *Univ. of California, Berkeley*; J. Rabaey, *Univ. of California, Berkeley*

152AB

Th1I: Device and Integration Technology for RF through mm-Wave

Chair: Shahed Reza, *Sandia National Laboratories*

Co-Chair: Ko-Tao Lee, *Qorvo*

Th1I-1: Ultra-Wide Bandgap MMW/Sub-MMW Devices

T. Oder, *DEVCOM ARL*

Th1I-2: An Adaptable In(Ga)P/Ga(Sb)As/Ga(In)As HBT Technology on 300mm Si for RF Applications

A. Kumar, *IMEC*; S. Yadav, *IMEC*; A. Vais, *IMEC*; G. Boccardi, *IMEC*; Y. Mols, *IMEC*; R. Alcotte, *IMEC*; B. Parvais, *IMEC*; B. Kunert, *IMEC*; N. Collaert, *IMEC*

Th1I-3: Local Interface RF Passivation Layer Based on Helium Ion-Implantation in High-Resistivity Silicon Substrates

M. Perrosé, *CEA-LETI*; P. Acosta Alba, *CEA-LETI*; S. Reboh, *CEA-LETI*; J. Lugo, *CEA-LETI*; C. Plantier, *CEA-LETI*; P. Cardinael, *UCLouvain*; M. Rack, *UCLouvain*; F. Allibert, *Soitec*; F. Milesi, *CEA-LETI*; X. Garros, *CEA-LETI*; J.-P. Raskin, *UCLouvain*

Th1I-4: Large-Signal Characterisation and Analysis of AlN/GaN MISHEMTs on Si with a PAE > 62% at 28GHz

R. ElKashlan, *IMEC*; S. Yadav, *IMEC*; A. Khaled, *IMEC*; D. Xiao, *IMEC*; B. Kazemi, *IMEC*; H. Yu, *IMEC*; A. Alian, *IMEC*; U. Peralagu, *IMEC*; N. Collaert, *IMEC*; B. Parvais, *IMEC*

08:00
08:10
08:20
03:30
08:40
08:50
09:00
09:10
09:20
09:30
09:40

145AB

Th2B: HF Through UHF Techniques and Applications

Chair: Frederick H. Raab, *Green Mountain Radio Research*
Co-Chair: Marc Franco, *Macom*

10:10 – 10:20

Th2B-1: A Modern HF/VHF/UHF Transceiver for All Applications — What Would it Look Like Today?

U.L. Rohde, *Universität der Bundeswehr München*

10:30 – 10:40

Th2B-2: A 0.1–3.2GHz Reconfigurable LPF With Peaking Reducing and Selectivity Enhancement Using Adaptive Impedance Transformation

X. Cheng, *CAEP*; Y. Rao, *CAEP*; X. Luo, *CAEP*; L. Zhang, *CAEP*; J. Han, *CAEP*; R. Wu, *CAS*; H. Tang, *CAS*; X. Liang, *CAS*; X. Deng, *CAEP*; H. Gao, *Technische Universiteit Eindhoven*

10:50 – 11:00

Th2B-3: High Isolation CMOS TDD RF Front-End Using Sandwich-Type Concentric Vortical Transformer and Leakage Elimination Technique

S.-H. Tsai, *Taipei Tech*; S.-J. Yang, *Taipei Tech*; Z.-T. Zhao, *Taipei Tech*; H.-S. Yang, *Taipei Tech*

11:10 – 11:20

Th2B-4: A Monolithic GaN based Supply Modulator with Dual-Antibootstrap Level Shifter for Envelope Tracking Application

Chenhao Li, *Institute of Microelectronics*; Qingyang Dong, *Institute of Microelectronics*; Xin Jiang, *Institute of Microelectronics*; Xinyu Liu, *Institute of Microelectronics*; Ke Wei, *Institute of Microelectronics*; Weijun Luo, *Institute of Microelectronics*

11:30 – 11:40

Th2B-5: Understanding Linearization and its Recent Developments

A. Katz, *TCNJ*

146A

Th2C: Sub-Thz Power Amplifiers for D-Band and Beyond

Chair: David Brown, *BAE Systems*
Co-Chair: Sensen Li, *University of Texas at Austin*

10:10 – 10:20

Th2C-1: 220-GHz High-Efficiency Power Amplifiers in 250-nm and 130-nm InP HBT Technologies Having 14.4–25.0% PAE and 40–60mW Pout

Z. Griffith, *Teledyne Scientific & Imaging*; M. Urteaga, *Teledyne Scientific & Imaging*; P. Rowell, *Teledyne Scientific & Imaging*

10:30 – 10:40

Th2C-2: Low-Noise Power-Amplifier MMICs for the WR4.3 and WR3.4 Bands in a 35-nm Gate-Length InGaAs mHEMT Technology

F. Thome, *Fraunhofer IAF*; A. Leuther, *Fraunhofer IAF*

10:50 – 11:00

Th2C-3: Highly-Compact 20-mW, 270–320-GHz InGaAs mHEMT Power Amplifier MMIC

L. John, *Fraunhofer IAF*; A. Tessmann, *Fraunhofer IAF*; S. Wagner, *Fraunhofer IAF*; A. Leuther, *Fraunhofer IAF*

11:10 – 11:20

Th2C-4: Analysis and Design of Differential Complex Neutralization Power Amplifiers for Efficient-Yet-Linear High mm-Wave Applications

M. Eleraky, *ETH Zürich*; T.-Y. Huang, *Georgia Tech*; Y. Liu, *ETH Zürich*; H. Wang, *ETH Zürich*

11:30 – 11:40

Th2C-5: A 10-230-GHz InP Distributed Amplifier Using Darlington Quadruple-Stacked HBTs

P. Nguyen, *Univ. of California, Davis*; N. Wagner, *Keysight Technologies*; A. Stameroff, *Keysight Technologies*; A.-V. Pham, *Univ. of California, Davis*

146B

Th2D: Advances in Quantum Technologies

Chair: Yanghyo Rod Kim, *Stevens Institute of Technology*
Co-Chair: Dimitris Pavlidis, *Florida International University*

10:10 – 10:20

Th2D-1: Demonstration of Microwave Harvesting Through Pyroelectricity in Cryogenic Conditions: A Quantum-to-Experimental Approach

M. Aldrigo, M. Dragoman, A. Dinescu, D. Vasilache, S. Iordanescu, L.A. Dinu, *IMT-Bucharest*; D. Dragoman, *University of Bucharest*; E. Laudadio, E. Pavoni, L. Pierantoni, D. Mencarelli, *Università Politecnica delle Marche*

10:30 – 10:40

Th2D-2: A 4 to 10GHz 11-mW Cryogenic Driver Module Design for Quantum Computer Application

C.-H. Li, *ITRI*; C.-N. Kuo, *NYCU*; C.-S. Chen, *ITRI*; C.-D. Chen, *Academia Sinica*; P.-Y. Hsu, *ITRI*; L.-C. Hsiao, *Academia Sinica*; L.-W. Chang, *Academia Sinica*

10:50 – 11:00

Th2D-3: A Sub mW Low Flicker Noise Cryo-CMOS QVCO for Quantum Computing Application

C. Liang, *XJTU*; Y. Zhao, *XJTU*; Z. Guo, *XJTU*; Z. Gao, *XJTU*; B. Tang, *XJTU*; C. Fan, *XJTU*; Y. Xin, *XJTU*; L. Geng, *XJTU*

11:10 – 11:20

Th2D-4: Characterizing a Frequency Converter Based on a Superconducting Coplanar Waveguide

G. Giesbrecht, *NIST*; N.E. Flowers-Jacobs, *NIST*; A. Sirois, *NIST*; M. Castellanos-Beltran, *NIST*; M. Vissers, *NIST*; J. Gao, *NIST*; P. Dresselhaus, *NIST*; T. Barton, *University of Colorado Boulder*

146C

Th2E: Near-Field Wave-Matter Interaction

Chair: Kamel Haddadi, *Université de Lille*
Co-Chair: Malgorzata Celuch, *QWED*

10:10 – 10:20

Th2E-1: Scanning Microwave Microscopy Subsurface Detection of Magneto-Impedance Effect in Thin Film Permalloy

G. Fabi, M. Sparey, M. Leitner, A. Silvestri, I. Alic, V. Ney, A. Ney, *Johannes Kepler Universität Linz*; M. Farina, *Università Politecnica delle Marche*; G. Gramse, *Johannes Kepler Universität Linz*

10:30 – 10:40

Th2E-2: Advanced Microwave Impedance Microscopy for Emerging Materials and Devices

J. Shan, *Univ. of California, Berkeley*; N. Morrison, *Univ. of California, Berkeley*; E.Y. Ma, *Univ. of California, Berkeley*

10:50 – 11:00

Th2E-3: Near-Field Nonlinear Microwave Microscope for Fundamental Superconducting Studies

C.-Y. Wang, *Univ. of Maryland, College Park*; S.M. Anlage, *Univ. of Maryland, College Park*

11:10 – 11:20

Th2E-5: A 3-D Split Ring Resonator for Power-Efficient Microwave Plasma Jets

M. Parsaei, *Univ. of Toledo*; M.R. Akram, *Univ. of Toledo*; A. Semnani, *Univ. of Toledo*

11:30 – 11:40

Th2E-6: A Highly-Efficient 2.45 GHz Plasma Jet Based on A Dielectric Microwave Anapole Structure

M.R. Akram, *Univ. of Toledo*; A. Semnani, *Univ. of Toledo*

10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50

Denotes Keynote Presentation

147AB

Th2F: Advances in Microwave Biomedical Applications

Chair: Christian Damm, *Universität Ulm*
Co-Chair: Chung-Tse Michael Wu, *Rutgers University*

Th2F-1: Towards Ultra-Low RF Power Simultaneous Transmit and Receive(STAR) MRI with a Wearable RF Transceiver Head Coil

Zachary Colwell, *Arizona State Univ.*; Sri Kirthi Kandala, *Arizona State Univ.*; Lance DelaBarre, *Univ. of Minnesota*; Djaudat Idiyatullin, *Univ. of Minnesota*; Gregor Adriany, *Univ. of Minnesota*; Michael Garwood, *Univ. of Minnesota*; John Vaughan, *Columbia Univ.*; Sung-Min Sohn, *Arizona State Univ.*

Th2F-2: Combined Gradient and RF Injection Tests for MR Safety

F. Ebrahimi, *Univ. of Houston*; Q. Wang, *Univ. of Houston*; J. Zheng, *Univ. of Houston*; J. Chen, *Univ. of Houston*

Th2F-3: Extension to In Situ Single Cell Electroporation of a Microwave Biosensor

A. Calvel, *LAAS-CNRS*; O. Peytral-Rieu, *LAAS-CNRS*; M.-P. Rols, *IPBS-CNRS*; D. Dubuc, *LAAS-CNRS*; K. Grenier, *LAAS-CNRS*

Th2F-4: RF Interference Cancellation for Microwave Thermometry

J. Dunbar, *University of Colorado Boulder*; G. Santamaría-Botello, *Colorado School of Mines*; Z. Popovic, *University of Colorado Boulder*

150AB

Th2G: Advancing Characterization at mm-Wave Frequencies

Chair: Shuhei Amakawa, *Hiroshima University*
Co-Chair: Ricardo Figueiredo, *Universidade de Aveiro*

Th2G-1: Current Limitations and Novel Approaches to THz On-Wafer Electronic Characterization

J. Cheron, *NIST*

Th2G-2: On-Wafer Calibration Comparisons of Multiline TRL with Platinum and Gold Conductors

T. Karpisz, *NIST*; J.T. Pawlik, *NIST*; J. Hoffmann, *METAS*; S.R. Evans, *NIST*; C.J. Long, *NIST*; N.D. Orloff, *NIST*; J.C. Booth, *NIST*; A.C. Stelson, *NIST*

Th2G-3: Enhanced Accuracy in On-Wafer Noise Figure Measurements at Sub-Terahertz Frequencies

N. Messaoudi, *Keysight Technologies*; S. Gao, *Focus Microwaves*; M.W. Mansha, *Nokia Bell Labs*; Y. Baeyens, *Nokia Bell Labs*; M. Sayginer, *Nokia Bell Labs*; S. Boumaiza, *Univ. of Waterloo*; B. Hosein, *Focus Microwaves*; S. Shahramian, *Nokia Bell Labs*

Th2G-4: Measurement of Residual Phase Noise of Amplifiers at 80GHz Using Interferometric Measurement Technique

W. Wendler, *Rohde & Schwarz*; A. Roth, *Rohde & Schwarz*

Th2G-5: Millimeter-wave Device Characterization Under Wideband Modulated Signals using Vector Network Analyzer Frequency Extenders

A. Ben Ayed, *Univ. of Waterloo*; P. Mitran, *Univ. of Waterloo*; S. Boumaiza, *Univ. of Waterloo*

Joint Session with ARFTG

151AB

Th2H: Advanced Circuits and Techniques for Next-Generation Wireless Systems

Chair: Kenneth E. Kolodziej, *MIT Lincoln Laboratory*
Co-Chair: Marcus Pan, *Semiconductor Research Corporation*

Th2H-1: Active Calibration Approach Addressing Antenna Mutual Coupling and Power Amplifier Output Mismatch in Fully Digital MIMO Transmitters

H. Barkhordar-pour, *Univ. of Waterloo*; J.G. Lim, *Univ. of Waterloo*; A. Ben Ayed, *Univ. of Waterloo*; P. Mitran, *Univ. of Waterloo*; S. Boumaiza, *Univ. of Waterloo*

Th2H-2: Indirectly-Non-Reciprocal Load Modulated Balanced Amplifier with Equivalent Operation at Antenna Interface

N.B. Vangipurapu, *Univ. of Central Florida*; N.B. Vangipurapu, *Univ. of Central Florida*; P. Gong, *Univ. of Central Florida*; J. Guo, *Univ. of Central Florida*; K. Chen, *Univ. of Central Florida*

Th2H-3: An Efficient Analog Self-Interference Canceller Using a Balanced Topology for Mitigating Inherent Multi-Tap Loss

K.D. Bhakta, *Naval Air Warfare Center Weapons Division*; J.P. Santos, *Naval Air Warfare Center Weapons Division*; M. Panahi, *Univ. of California, Los Angeles*; M. Hedayati, *Univ. of California, Los Angeles*; L.K. Yeung, *Univ. of California, Los Angeles*; Y.E. Wang, *Univ. of California, Los Angeles*

Th2H-4: Integrated 75-100 GHz In-Band Full-Duplex Front End GaN MMIC

S. Johannes, *University of Colorado Boulder*; A. Romano, *University of Colorado Boulder*; Z. Popovic, *University of Colorado Boulder*

Th2H-5: A Compact 130 GHz CMOS OOK-Doubler with Embedded 10 Gb/s Modulator and Integrated Glass Antenna for Scalable Array Systems and Efficient Short-Range Communication

S.Z. Aslam, *Univ. of Florida*; H. Yan, *Univ. of Florida*; M. Asghari, *Univ. of Florida*; N. Ebrahimi, *Northeastern University*

152AB

Th2I: GaN Devices and Technology for Wireless Applications

Chair: Wolfram Stiebler, *Raytheon*
Co-Chair: Peter Magnee, *NXP Semiconductors*

Th2I-1: Overview of RF Power Amplifier Technology for Wireless Infrastructure and Future Trends

F. van Rijs, *Ampleon*

Th2I-2: A Heterogeneously-Integrated Ka-Band, N-Polar Gallium Nitride HEMT Amplifier

J.J. Kim, *PseudolithIC*; M.D. Hodge, *PseudolithIC*; M.R. Soler, *PseudolithIC*; F. Herrault, *PseudolithIC*; D.S. Green, *PseudolithIC*; J.F. Buckwalter, *PseudolithIC*

Th2I-3: Ka Band GaN MIS-HEMT with ALD-SiN Gate Dielectric and Lp-SiN Passivation Layer

K. Wei, *CAS*; Y. Zhang, *CAS*; S. Zhang, *CAS*; X. He, *CAS*; J. Guo, *CAS*; K. Wang, *CAS*; R. Zhang, *CAS*; X. Wang, *CAS*; S. Huang, *CAS*; H. Ying, *CAS*; Y. Li, *CAS*; W. Luo, *CAS*; J. Niu, *CAS*; X. Liu, *CAS*

Th2I-4: Characterization and Modeling of Dynamic Thermal Coupling in GaN MMIC Power Amplifiers

T. Kristensen, *Chalmers Univ. of Technology*; T.M.J. Nilsson, *Saab*; A. Divinyi, *Saab*; J. Bremer, *Chalmers Univ. of Technology*; M. Thorsell, *Chalmers Univ. of Technology*

10:10 10:20 10:30 10:40 10:50 11:00 11:10 11:20 11:30 11:40 11:50

INDUSTRY WORKSHOPS

08:00 – 15:10 | Thursday, 20 June 2024

SESSION CODE	TIME & LOCATION	TITLE AND ABSTRACT	SPEAKER/S, AFFILIATION
IWTH1	08:00 – 09:40 Room: 144C	**Machine Learning (ML) and Analysis Advancements Embedded in a Complete High-Frequency Design Flow—**Simulation, DRC, LVS, ERC, EM, PI, Thermal, Minimal Routing, Performance, Price, and Manufacturability all complicate and restrict design space. Increasing design and system complexity require designers to consider individual designs within the larger system earlier in the design flow to maximize system performance. Cadence's complete design flow with EM and Thermal Analysis is the backbone infrastructure needed for the next generation of designs. In this workshop, we will review the complete flow and introduce the audience to the ML capabilities within the Virtuoso flow to aid designers in satisfying increased requirements and exploring additional solutions.	Michael Thompson, Sanam Vakili, Claudia Roesch, Kerry Judd, Ron Pongratz, *Cadence Design Systems*
IWTH2	10:10 - 11:50 Room: 144C	**Design Flow for the Assembly and Analysis of 3D Heterogenous Integrated Technologies—**What happens to your chip's performance when it is placed in the package? How close is "too close" when placing multiple chips next to each other? Does the loop height of that bondwire impact your RF output? Does the void in board below your chip impact the operating bandwidth? Wouldn't you like to know BEFORE you go to manufacturing? Now you can! Here is a design flow that is built to do 3D Heterogenous Integration and it can be easily integrated with several EDA tools including ADS, Virtuoso, Custom Compiler, and Tanner.	Nathan Altaffer, *Keysight Technologies*
IWTH3	13:30 - 15:10 Room: 144C	**FPGA-Accelerated Deep Learning for 5G FR2 Channel Estimation—**Ever increasing demand for high throughput, low latency, and ultra reliability in wireless transmission requires accurate channel estimation under impairment conditions including Doppler shifts and noise. Traditional techniques for channel estimation in 5G NR involve known pilot sequences inserted into the transmission from which the rest of the channel response can be interpolated across all sub-carriers. This workshop will demonstrate a convolutional neural network (CNN) for channel estimation using OTA measurements through mmWave PAAM and AMD RFSoC-based 5G NR receiver in a CATR chamber. Training is accelerated by combining MATLAB with hardware-based channel impairments including AWGN and variable carrier-frequency offsets.	Luc Langlois, *Avnet*; Fabrício Dourado, *Rohde & Schwarz GmbH & Co KG*; Yoshiharu Fujisaku, *Fujikura Ltd.*; Noam Levine, *The MathWorks*

IMS PANEL SESSION

12:00 – 13:30 | Thursday, 20 June 2024 | Room: 207AB

PL6: Weather vs Wireless: How Do We Balance the Use of Critical Microwave Bands?

ORGANIZERS:
Renee Leduc, *Narayan Strategy*
Paolo de Matthaeis, *NASA Goddard Space Flight Center*
Beau Backus, *Applied Physics Laboratory at Johns Hopkins University*

ABSTRACT: A recent high profile spectrum conflict has been between weather forecasters and the wireless industry on the use of passive microwave spectrum. While both sides are addressing critical economic and societal needs, there are many questions about the possibility for and impacts of coexistence, especially related to 50-58 GHz, which will be considered at the World Radiocommunication Conference-2027. The wireless industry, as it deploys 5G technologies and plans for 6G, has a critical need to expand its access to spectrum to support the deployment of numerous wireless technologies that fuel economies and international competition. But the world is also facing increasing weather and climate related disasters that rely on improvements in environmental prediction to keep people and communities safe. Eighteen disasters in the US in 2022 (the third highest) had damage values above $1 billion (and an overall cost of $177.3 billion with 474 deaths). This panel discussion will feature high level panelists from across the public, private and NGO sectors to discuss the increasing demand for passive microwave spectrum for both wireless tech and meteorology. The discussion will seek to foster more productive science and engineering discussions on these topics and highlight possible solutions for coexistence.

MICROAPPS

09:30 – 15:00 | Thursday, 20 June 2024 | MicroApps Theater: Booth 2159

SESSION CODE	TIME	TITLE	SPEAKER/S, AFFILIATIONS
THMA1	09:30 – 09:45	**Bandwidth Trades in Passive Microwave Components**	Shaun Moore, *Quantic TRM*
THMA2	09:45 – 10:00	**Highly Efficient BOR FEM Simulation of Antennas and Waveguide Structures Having Rotational Symmetries**	Ralf Ihmels, *Mician GmbH*
THMA3	10:00 – 10:15	**Impedance-Tuner Matching in XFdtd**	Justin Newton, *Remcom, Inc.*
THMA4	10:15 – 10:30	**26-30GHz USB-Controlled Scalable Modular TX/RX Beamformer**	Sidina Wane, *eV-Technologies*
THMA5	10:30 – 10:45	**Beam Direction Accuracy and 2D Radiation Antenna Pattern Measurements of 256 Elements Phased Array**	Yujiro Tojo, *Fujikura Ltd.*
THMA6	10:45 – 11:00	**How to Measure Beam Switching Speed, Why is it Important and What is the Necessary Performance?**	Fabricio Dourado, *Rohde & Schwarz;* Yujiro Tojo, *Fujikura Ltd*.
THMA7	11:00 – 11:15	**Automation of 4 Port Multiline TRL Calibration on the Keysight pna Using Wincal 5.0**	James Hibbert, *Formfactor*
THMA8	11:15 – 11:30	**Use an Array When a Standard PCB Connector Won't Do**	Kiana Montes, *Samtec*
THMA9	11:30 – 11:45	**A Compact USB-Controlled 16-32 GHz Dual-Channel Up & Down Converter VNA Extender Module**	Sidina Wane, *eV-Technologies*
THMA10	11:45 – 12:00	**Advantages of Harmonic Downconverters for Tuned Receiver Applications**	Madrone Coopwood, *HYPERLABS*
THMA11	12:00 – 12:15	**Design Technology Co-Optimization (DTCO) for RF Circuit with GaN-based Devices**	Nelson de Almeida Braga, *Synopsys, Inc.*
THMA12	12:15 – 12:30	**Interoperable Design Platforms Support High-frequency Silicon MMIC Design**	Johana Yan, *MaXentric Technologies*; Dustin Hoekstra, *Cadence Design Systems;* Daniel Mejia, *MaXentric Technologies*
THMA14	12:45 – 13:00	**Using Load Pull Simulation and Optimization to Design Doherty Power Amplifiers**	Andy Howard, *Keysight Technologies*
THMA19	13:00 – 14:00	**StartUp Program Panel Session: Voice of the Customer** **Panelists:** Theo Williams, *Third Vector;* Sherman William, *AIN Ventures;* David Beck, *U.S. Space Force;* Ian Adams, *NASA*	
THMA15	14:00 – 14:15	**Digitally Enhanced mmWave Link Via Digital Twin for Scalable 5G Deployment**	Rui Ma, *pSemi;* Giorgia Zucchelli, *The MathWorks B.V.*
THMA16	14:15 – 14:30	**Benefits of Ultra-Low Phase Noise Frequency Synthesis to Space and Terrestrial Applications**	Sarah Schnoll, *Narda-Miteq*
THMA17	14:30 – 14:45	**Improving Synthesizer Performance with Ultra-low Phase Noise Frequency References**	Mike Sawicki, *Quantic Wenzel*
THMA18	14:45 – 15:00	**Achieving Exceptional RF Performance for Low Noise Amplifiers and RF Switches with a Unique GaAs Semiconductor Process**	Joe Simanis, *Nisshinbo Micro Devices Inc.*

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STARTUP PANEL SESSION

13:00 – 14:00 | Thursday, 20 June 2024 | MicroApps Theater, Booth 2159

Voice of the Customer Panel Session

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PANELISTS:

Theo Williams, *Third Vector*

Sherman William, *AIN Ventures*

David Beck, *U.S. Space Force*

Ian Adams, *NASA*

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IMS POSTDEADLINE PAPER SESSION

13:30 – 15:10 | Thursday, 20 June 2024 | Ballroom

The IMS2024 PostDeadline Paper Session will be a major new feature and technical highlight of the conference. A limited number of PostDeadline papers will be selected for presentation, and only those judged to be truly outstanding and compelling in their timeliness will be accepted. Each PostDeadline paper presentation will be 12 minutes in duration with a 3-minute Q&A period.

The accepted papers will be announced at the IMS Plenary Session on Monday, 17 June 2024 and can be viewed on the IMS website: www.ims-ieee.org/postdeadlinepapers.

IMS CLOSING SESSION

15:30 – 17:00 | Thursday, 20 June 2024 | Ballroom

Real-world Performance Measurements of Cellular Networks Using Smartphones

KEYNOTE SPEAKER: Monisha Ghosh, *Professor of Electrical Engineering, University of Notre Dame and Former Chief Technology Officer at the Federal Communications Commission (FCC)*

Monisha Ghosh, IMS Closing Session Keynote Speaker

ABSTRACT: As 5G deployments increase in the newly allocated mid-band and mmWave spectrum, and discussions on 6G begin, it is important to characterize real-world performance of the enhancements made to 5G to determine how best to design the next generation of cellular networks. For example, how well does massive MIMO work in the real-world? How is sharing in CBRS performing? In this talk we will present recent results from detailed measurements of 4G and 5G in the various bands: mmWave (> 24 GHz), mid-band (2.5 - 3.98 GHz) and CBRS (3.55 - 3.7 GHz). Our studies demonstrate that mmWave 5G is severely limited in coverage, especially outdoors-to-indoors, while performance of 5G in mid-band also depends on network densification, contrary to popularly held beliefs. Our studies in CBRS show that secondary co-channel sharing as well as adjacent channel interference from high power deployments pose fundamental challenges for cellular networks in shared spectrum. We conclude with some directions for future network design based on our research that will allow 6G to be "sharing native".

SPEAKER BIO: Monisha Ghosh is a Professor of Electrical Engineering at the University of Notre Dame and a member of the Notre Dame Wireless Institute. She is also the Policy Outreach Director for SpectrumX, the first NSF Center for Spectrum Innovation and the co-chair of the FCC's Technological Advisory Council (TAC) Working Group on Advanced Spectrum Sharing, 2022 - 2023. Her research interests are in the development of next generation wireless systems: cellular, Wi-Fi and IoT, with an emphasis on spectrum sharing and coexistence. Prior to joining the University of Notre Dame in 2022, she was the Chief Technology Officer at the Federal Communications Commission, a Program Director at the National Science Foundation, Research Professor at the University of Chicago and spent 24 years in industry research at Bell Labs, Philips Research and Interdigital working on a wide variety of wireless systems: HDTV, Wi-Fi, TV White Spaces and cellular. She obtained her B.Tech from IIT Kharagpur in 1986 and Ph.D. from USC in 1991. She is a Fellow of the IEEE.

103RD ARFTG MICROWAVE MEASUREMENT CONFERENCE—ADVANCED MEASUREMENT TECHNIQUES FOR NEXT-G COMMUNICATION SYSTEMS

NVNA USERS' FORUM **open to all conference attendees**

Thursday, 20 June 2024 | 15:00 – 16:15 | 143ABC, Walter E. Washington Convention Center

ORGANIZER: Gia Ngoc Phung, *Physikalisch-Technische Bundesanstalt (PTB)*

ON-WAFER USERS' FORUM **open to all conference attendees**

Thursday, 20 June 2024 | 16:15 – 17:30 | 143ABC, Walter E. Washington Convention Center

ORGANIZER: Gia Ngoc Phung, *Physikalisch-Technische Bundesanstalt (PTB)*

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Automatic RF Techniques Group | 08:00 – 17:00 | Friday, 21 June 2024 | Rooms: 145AB, 146ABC, 147AB, Walter E. Washington Convention Center

103RD ARFTG MICROWAVE MEASUREMENT CONFERENCE

Advanced Measurement Techniques for Next-G Communication Systems

07:55-08:00 | Welcome to the 103rd ARFTG Conference – Introduction

07:55-08:00	**Welcome**

08:00-08:40
Keynote: Approaches to Industrialize and Characterize Near-THz Communication Systems

Session A: Measurements for 6G and Future-G systems
Session Chair: Jon Martens

A-1 **08:40-09:00**	**Wideband Vector Signal Generation Using Multiple Narrowband Phase-Coherent Synchronous Signal Channels** Zi Jun Su *(University of Waterloo)**; Ahmed Ben Ayed *(University of Waterloo)*; Slim Boumaiza *(University of Waterloo,Canada)*
A-2 **09:00-09:20**	**Comparison of Signal Generation Techniques for D-Band for Component Testing** Zi Jun Su *(University of Waterloo)*; Nizar Messaoudi *(Keysight Technologies, University of Waterloo)**; Ahmed Ben Ayed *(University of Waterloo)*; Jean-Pierre Teyssier *(Keysight Technologies)*; Slim Boumaiza *(University of Waterloo, Canada)*
A-3 **09:20-09:40**	**Characterization Methods for Millimeter Wave IQ Mixers on the Example of a Planar Star Mixer** Patrick Umbach *(Fraunhofer IAF)**; Fabian Thome *(Fraunhofer IAF)*; Arnulf Leuther *(Fraunhofer IAF)*; Ruediger Quay *(Fraunhofer IAF)*

09:40–10:40 | BREAK – EXHIBITS AND INTERACTIVE FORUM

Session B: Characterization of Material Properties
Session Chair: Rusty Myers

B-1 **10:40-11:00**	**Temperature Humidity Bias Testing of a Wafer Embedded Coplanar Waveguide Line up to 40 GHz** Lewis J Manning *(National Physical Laboratory)**; Ana Robador *(National Physical Laboratory)*; James A Skinner *(National Physical Laboratory)*
B-2 **11:00-11:20**	**Complex Permittivities of Ultra-Low-Loss 4H-SiC from 55 GHz to 330 GHz** Yoshiyuki Yanagimoto *(EM labs, inc.)*
B-3 **11:20-11:40**	**High Frequency Characterization of Ajinomoto Build-Up (ABF) Laminates for Millimeter Wave Applications** Aditya Jogalekar *(Texas Instruments)**; Rajen Murugan *(Texas Instruments)*; Mahadevan Iyer *(Amkor Technologies Inc.)*; Rashaunda Henderson *(The University of Texas at Dallas)*
B-4 **11:40-12:00**	**Characterization of Dielectric Materials at WM-380 Band (500 - 750 GHz) Using Three Broadband Measurement Techniques** Xiaobang Shang *(National Physical Laboratory)**; Minjie Shu *(Xi'an Jiaotong University)*; Mira Naftaly *(National Physical Laboratory)*; Nick Ridler *(National Physical Laboratory)*; Stephen Hanham *(Imperial College London)*

12:00–13:20 | AWARDS LUNCHEON

Session C: mm-Wave and Sub-THz Measurements
Session Chair: Marco Spirito

C-1 **13:20-13:40**	**Construction and Initial Studies on a 0.6 mm Coaxial Calibration Kit to 220 GHz** Jon Martens *(Anritsu)**; Tom Roberts *(Anritsu)*
C-2 **13:40-14:00**	**Modified Semi-Additive Manufacturing of PCBs for Enabling Accurate Device Measurements at Millimeter-Wave and Sub-Terahertz Frequencies** Arash Arsanjani *(Graz University of Technology)**; Ziad Hatab *(Graz University of Technology)*; Ahmad Bader Althoman Alterkawi *(AT&S AG)*; Michael E Gadringer *(Graz University of Technology)*; Wolfgnag Bösch *(Technical University of Graz)*
C-3 **14:00-14:20**	**Repeatability of Programmable Waveguide Attenuators at 110-170 GHz and 220-330 GHz** Piyaphat Phukphan *(University of Oulu)**; Juha-Pekka Mäkelä *(University of Oulu)*; Klaus Nevala *(University of Oulu)*; Aarno Pärssinen *(University of Oulu)*; Marko E. Leinonen *(University of Oulu)*
C-4 **14:20-14:40**	**Experimental Determination of the Internal Aperture Dimensions of Sub-Terahertz Waveguides** James A Skinner *(National Physical Laboratory)** Nick Ridler *(National Physical Laboratory)*

14:40–15:30 | BREAK – EXHIBITS AND INTERACTIVE FORUM

Session D: Advances in Linear and Non-linear Measurements

Session Chair: Patrick Roblin

D-1 15:30-15:50	**Cold-Termination Noise-Parameter Measurements at Cryogenic Temperatures** Marwa Safa *(University of Calgary)**; Ismail Majed *(University of Calgary)*; Leo Belostotski *(Nil)*; Karl Warnick *(Brigham Young University)*; Christopher Groppi *(Arizona State University)*
D-2 15:50-16:10	**Traceable RF Power Metering Procedures With Thermoelectric Sensors** Zenn Roberts *(National Institute for Standards and Technology)**; Aaron Morgan Hagerstrom *(National Institute of Standards and Technology)*; Daniel C Gray *(National Institute of Standards and Technology)*; Christian Long *(NIST)*; Angela Stelson *(NIST)*; Vincent Neylon *(NIST)*
D-3 16:10-16:30	**Comparative Study on De-embedding of Highly Assymetrical Differential Devices using Multimode TRL and Applicability of Mode Separation** Milan Rother *(Technische Universität Braunschweig)**; Martin Maier *(Technische Universität Braunschweig)*; Franz Engelsberger *(Infineon)*; Macej Wojnowski *(Infineon)*; Vadim Issakov *(Technische Univ*
D-4 16:30-16:50	**Linearizability Assessment of a 3.5 GHz 16-Chain Fully Digital MIMO Transmitter Under Wideband Modulated Signals** Hoda Barkhordarpour *(University of Waterloo)**; Jin Gyu Lim *(University of Waterloo)*; Ahmed Ben Ayed *(University of Waterloo)*; Patrick Mitran *(University of Waterloo)*; Slim Boumaiza *(University of Wa*
D-5 16:50-17:10	**RF Power Amplifier Model Extraction for Accurate and Fast Load Pull Simulations with Wideband Signals** Wissam Saabe *(Amcad Engineering)**; Christophe Maziere *(Amcad Engineering)*; Arnaud Delias *(Amcad Engineering)*; Sebastien Mons *(2XLIM, UMR n°7252, University of Limoges)*; Edouard Ngoya *(XLIM, UMR n°7252, University of Limoges)*

Poster Session

Session Chair: Patrick Roblin

Comparison of S-Parameter Measurement Methods for Attenuators
Andreas Schramm *(PTB)**

Smart Signals: Key to Decrease Measurement Time?
Yves Rolain *(VUB)**; Sander De Keersmaeker *(Vrije Universiteit Brussel)*; Dries Peumans *(Vrije Universiteit Brussel)*; Gerd Vandersteen *(VUB)*

Exploring Phase Skew in Load-pull Configurations
Alex K. Chang *(Maury Microwave)*; Rafael Lopez *(Maury Microwave)*; John J. Dominguez *(Maury Microwave)*; Osman Ceylan *(Maury Microwave)**

Uncertainty in Vector Mixer Measurements Using Harmonic Phase Reference Calibration
Joel Dunsmore *(Keysight Technologies)*

Calibration of an Oscilloscope-Based NVNA for Periodic Modulated Signals
Miles Lindquist *(Ohio State University)**; Patrick Roblin *(Ohio State University)*

A Fast High Sensitivity Power Transfer Device Approach for (sub)mm-wave Applications
Marco Spirito *(TU Delft)**; Carmine De Martino *(Vertigo Technologies)*; Juan Bueno Lopez *(TU Delft)*; Ehsan Shokrolahzade *(TU Delft)*; Marco Pelk *(TU Delft)*; Bart Louwes *(THUAS)*

Ultra-Fast Characterization Setup for Empirical Optimization of Dual-Input Power Amplifiers
Shuichi Sakata *(Mitsubishi Electric Corporation)**; Shinro Yatsuda *(Shonan Institute of Technology)*; Ayano Yano *(Shonan Institute of Technology)*; Rikito Matsuo *(Shonan Institute of Technology)*; Yuji Komatsuzaki *(Mitsubishi Electric Corporation)*; Shintaro Shinjo *(Mitsubishi Electric Corporation)*; Takana Kaho *(Shonan Institute of Technology)*; Koji Yamanaka *(Mitsubishi Electric Corporation)*

A 2-Tier TRL Calibration Technique to Assess Flip-Chip Interconnects at D-Band
Nick van Rooijen *(TU Delft)**; Rik Bokhorst *(TU Delft)*; Sander Dorrestein *(CITC, TNO)*; Francesca Chiappini *(CITC, TNO)*; Paolo Sberna *(TU Delft)*; Nuria Llombart *(TU Delft)*; Marco Spirito *(TU Delft)*; Maria Alonso-delPino *(TU Delft)*

On-wafer Characterisation of Noise Parameters of GaN HEMTs at Between 77 K and 400 K
Jing Wang *(University of Glasgow)**; Afesomeh Ofiare *(University of Glasgow)*; Qingxia Li *(University of Glasgow)*; James Kelly *(University of Glasgow)*; Edward Wasige *(University of Glasgow)*; Chong Li *(University of Glasgow)*

Using Commercial Source Measure Units for Traceable RF Power Measurements
Daniel C Gray *(National Institute of Standards and Technology)**; Aaron Morgan Hagerstrom *(National Institute of Standards and Technology)*; Zenn Roberts *(National Institute of Standards and Technology)*; Christian Long *(NIST)*

Inclined vs. Horizontal Waveguide Port Saver Approach in WR3.4 Band for On-Wafer Measurements
Pranav Kumar Shrivastava *(FormFactor GmbH)**; Gavin Fisher *(FormFactor GmbH)*; Giancarlo Chirico *(FormFactor GmbH)*

Efficient Computational Complexity Reduction of Digital Predistortion Using PLS Method for Beamforming Systems
Dusari Nageswara Rao *(IIT Roorkee)**; Meenakshi Rawat *(Indian Institute of Technology, Roorkee)*

Inverted Scanning Microwave Microscopy of GaN/AlN High-Electron Mobility Transistors
Xiaopeng Wang *(Cornell University)**; Kazuki Nomoto *(Cornell University)*; Gianluca Fabi *(Cornell University)*; Richard Al Hadi *(École de technologie supérieure)*; Marco Farina *(Marche Polytechnic University)*; Debdeep Jena *(Cornell University)*; Huili Grace Xing *(Cornell University)*; James C. M. Hwang *(Cornell University)*

Exhibit Hall Hours and Happenings

EXHIBIT HOURS:

Tuesday, 18 June	09:30 – 17:00
Wednesday, 19 June	09:30 – 18:00
Thursday, 20 June	09:30 – 15:00

TUESDAY:

Professional Headshots in the Societies Pavilion (Booth 1605)	09:30 – 17:00
IMS Game Zone (Booth 1366)	09:30 – 17:00
StartUp Pavilion (Booth 2343)	09:30 – 17:00
IMS Student Design Competitions (Booth 2439)	09:30 – 17:00
MicroApps Seminars (Booth 2159)	09:30 – 17:00
Coffee Break	09:40 – 10:10
StartUp Panel Session: Voice of the Founder Industry (Booth 2159)	11:00 – 12:00
Sweet Treat Tuesday	12:30
Coffee Break	15:10 – 15:40
IMS Executive Forum (Booth 2159)	16:00 – 17:00

WEDNESDAY:

Professional Headshots in the Societies Pavilion (Booth 1605)	09:30 – 18:00
IMS Game Zone (Booth 1366)	09:30 – 18:00
StartUp Pavilion (Booth 2343)	09:30 – 17:00
Build a “Foxhole” Radio Receiver (Booth 2431)	09:30 – 17:00
MicroApps Seminars (Booth 2159)	09:30 – 18:00
Coffee Break	09:40 – 10:10
StartUp Panel Session: SBIR/STTR (Booth 2159)	13:30 – 14:30
Coffee Break	15:10 – 15:40
IMS Interactive Forum (Booth 2505)	15:10 – 17:20
The Next Top StartUp Competition: Paving Paths to Financial Success (Booth 2159)	17:00 – 18:00
Industry Hosted Reception	17:00 – 18:00

THURSDAY:

Professional Headshots in the Societies Pavilion (Booth 1605)	09:30 – 15:00
IMS Game Zone (Booth 1366)	09:30 – 15:00
StartUp Pavilion (Booth 2343)	09:30 – 15:00
Build a “Foxhole” Radio Receiver (Booth 2431)	09:30 – 15:00
STEM Robotics Demonstration (Booth 2621)	09:30 – 15:00
MicroApps Seminars (Booth 2159)	09:30 – 15:00
Coffee Break	09:40 – 10:10
StartUp Panel Session: Voice of the Customer (Booth 2159)	14:00 – 15:00

Visit the Societies Pavilion (Booth 1605) to learn more about the IEEE Microwave Theory & Technology Society (MTT-S) as well as other IEEE Societies!

Visit the IEEE MOVE Truck near the Societies Pavilion (Booth 1605) to learn how the truck is deployed to respond to hardest hit disaster areas that frequently have no power or communications. Come see the application of RF expertise!

Stop by the StartUp Pavilion (Booth 2343) to engage with up and coming companies in the RF & Microwave space! Participants include: Aerospace BD AnTrust • BoldRF LLC • Cheshir Industries Inc. COTS RF • Falcomm Inc. • InCirT • K-PA Inc. Lintrinsic Devices • Nullspace, Inc. PseudolithIC Inc. • Thintronics Inc. TransEON Inc.

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IMS2025 (www.ims-ieee.org) is the centerpiece of Microwave Week 2025, which includes the RFIC Symposium (www.rfic-ieee.org) and the ARFTG Microwave Measurement Conference (www.arftg.org).

Microwave Week is the world's largest gathering and industry exhibition for MHz through THz professionals. IMS2025 will feature a far-reaching Technical Program focused on innovative and disruptive technology, applications, and entrepreneurship. Microwave Week provides a wide variety of technical and social activities for attendees and exhibitors. In addition to the diverse choices in technical sessions, attendees can explore interactive forums, plenary and panel sessions, workshops and technical lectures, application seminars, and also participate in paper contests for Students, Industry, and Young Professionals.

Welcome to IMS2025, where research and innovation create new opportunities in iconic San Francisco, California. The symposium will be held in the newly renovated Moscone Convention Center that is nestled in the dynamic South of Market (SoMa)/Yerba Buena district and is surrounded by cultural landmarks such as the San Francisco Museum of Modern Art (SFMOMA) and the picturesque Yerba Buena Gardens. During your stay, explore some of San Francisco's renowned attractions, including the Golden Gate Bridge and Fisherman's Wharf. Other notable tourist spots in San Francisco include Pier 39, Golden Gate Park, the California Academy of Sciences, the de Young Museum, the Asian Arts Museum, and the Exploratorium.

The San Francisco Bay Area is the largest hub for RF/microwave and semiconductor companies, hosting a significant population of high-frequency/high-speed engineers and entrepreneurs. Silicon Valley, a global icon of technology, is nestled within this region and is synonymous with cutting-edge technology and innovation with tech giants like Hewlett-Packard, Intel, Apple, Google, Meta, and Nvidia. The valley's unique ecosystem, fueled by a tradition of entrepreneurship and culture that embraces risk and failure, is a model for innovation hubs worldwide. Silicon Valley continues to attract top talent and venture capital, driving progress through the Wireless Golden Gateway. We look forward to welcoming you to San Francisco for IMS2025!

For more information: ims-ieee.org

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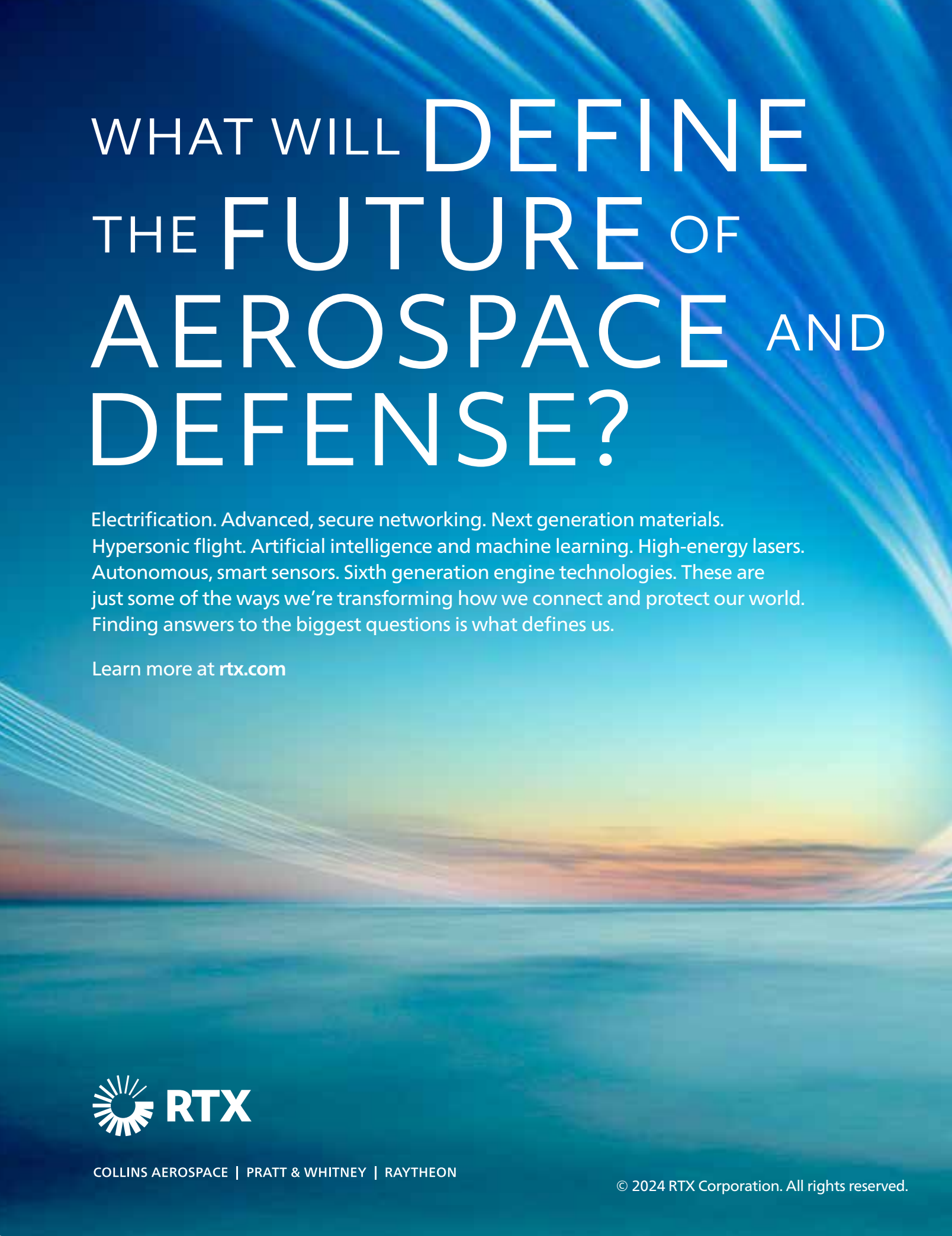
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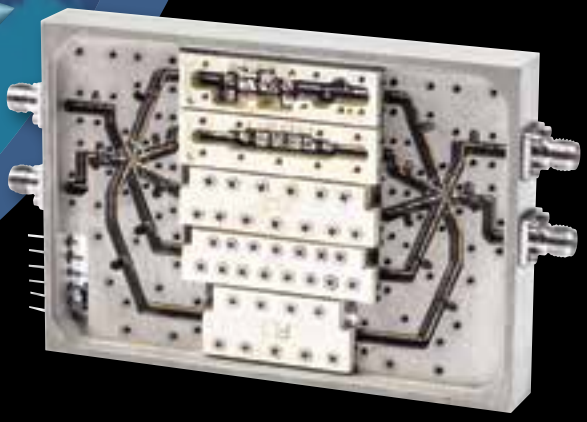

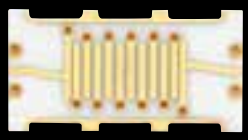

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