44th Annual Meeting and Symposium of the Antenna Measurement Techniques Association

AMTA 2022
DENVER, COLORADO

October 9 - 14, 2022

Denver, Colorado

PRELIMINARY PROGRAM

Hosted by

NIST

AMTA — Antenna Measurement Techniques Association — www.amta.org

Co-Hosted by

NVLAP®

COLORADO SCHOOL OF MINES
EARTH • ENERGY • ENVIRONMENT

Welcome

It is my pleasure to welcome you to Westminster, Colorado for the 44th Annual Symposium of the Antenna Measurement Techniques Association (AMTA). The venue for this year's event is the Westin Westminster Hotel. With the iconic Flatirons serving as its backdrop, The Westin is ideally positioned 15 minutes from both Denver and Boulder, providing convenient access to downtown attractions, as well as abundant outdoor recreation afforded by the Rocky Mountains. Located adjacent to the Westminster City Park and Promenade, there are also many attractions within just walking distance.

This year's technical program kicks-off on Sunday October 9th with a one-day short course on "The Use of Robotics for Antenna Measurements," presented by the pioneers in developing robotic-based antenna measurement systems. On Monday morning the technical session will be launched this year's keynote speaker Dr. Marla Dowell, the Director of the Communications Technology Laboratory at National Institute of Standards and Technology (NIST). Tuesday's IEEE invited speaker will be Erik Lier of Lockheed Martin, followed by our EurAPP invited speaker, Francesco D'Agostino from the University of Salerno, Italy on Wednesday. Dr. Chris Halloway of NIST will be presenting at Thursday's Lunch and Learn. On Friday we will close out the week with a technical tour of NIST's Boulder campus. The tour will include the new robotic based antenna measurement systems that have been recently listed as an NMI on-axis gain calibration service with BIPM.

The week's social program begins with the Sunday evening Welcome Reception, sponsored by NSI-MI Technologies. This event will be hosted in the Westin Lake House, offering a scenic sunset view over the Rocky Mountains. The Monday Night Outing, sponsored by MVG and NPM, will take us to the Wynkoop Brewing Company, Colorado's original craft brewpub located in downtown Denver. Companion tours will offer the opportunity to visit the Denver Botanical Gardens, Estes Park and the historic Stanley Hotel, made famous by Stephen King's "The Shining", and Denver's Meow Wolf Exhibition. And what would be a trip to Colorado without an opportunity to enjoy our scenic outdoors? Those arriving early are welcome to join my lovely wife for a leisurely hike Sunday morning on the nearby Flatirons, weather permitting.

On behalf of the AMTA 2022 Host Committee, the National Voluntary Laboratory Accreditation Program (NVLAP), NIST and the Colorado School of Mines, we invite you to AMTA 2022 and look forward to seeing you in Colorado!

Jeff R. Guerrieri
National Voluntary Laboratory Accreditation Program (NVLAP)

Who is Exhibiting?

The following companies will be exhibiting this year:

7G aa
Advanced Test Equipment Corp.
Altair
AP Americas Inc.
APS FireCo
Chamber Services Inc.
Delta Sigma Company
Diamond Microwave Chambers Ltd.
Dutch Microwave Absorber Solutions BU
ETS-Lindgren
InCompliance Magazine
MVG
Next Phase Measurements
NIST
NSI-MI
NVLAP
OPHIR RF Inc.
QuadSAT
Quantic PMI
Raymond EMC
Resonant Sciences
Rohde & Schwarz USA, Inc.
STAR Dynamics
TDK RF Solutions Inc.

Future Symposia

2023 October 8 - 13, Seattle, WA
Hosted by The Boeing Company

2024 October 27 - November 1, Cincinnati, OH
Hosted by Resonant Sciences

2025 Tucson, AZ
Hosted by Raytheon Missiles & Defense

2026 Austin, TX
Hosted by ETS-Lindgren

Symposium Benefits

- High-quality technical papers presented on a continuous basis over four days
- A practical, full day short course on the application of robotics for antenna measurements.
- Exhibits showcasing antenna and measurement related products and services
- Known leading companies related to antenna measurements products and services will be presenting and exhibiting
- Networking opportunities with industry experts
- A technical tour highlighting techniques related to the industry
- Unique social events in and around the Denver area
- Daytime companion tours to area highlights

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AMTA 2022 Host: Jeff Guerrieri

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Amedeo Capozzoli, University of Naples Federico II

Zhong Chen, ETS-Lindgren

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Marion, Baggett, NSI-MI Technologies

Randy Jost, Ball Aerospace

Kubilay Sertel, The Ohio State University

Joshua Gordon, National Institute of Standards and Technology

Jonathan Frasch, Resonant Sciences

Nathaniel Roman, The Boeing Company

Domenic Belgiovane, Raytheon Technologies

Claudio Curcio, University of Naples Federico II

Satoru Kurokawa, National Institute of Advanced Industrial Science and Technology (AIST)

Adam Mehrabani, NSI-MI Technologies

Stuart Gregson, Next Phase Measurements (NPM)

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Teh-Hong Lee, The Ohio State University

Massimiliano Simeoni, European Space Agency

Edward Urbanik, Applied Research Associates

Alex Yuffa, National Institute of Standards and Technology

About the Hotel

The Westin Westminster

10600 Westminster Blvd., Westminster, CO 80020
Phone: +1-303-410-5000
marriott.com/hotels/travel/denww-the-westin-westminster

Rooms are available at the AMTA group rate of $199 USD plus tax for single or double occupancy, available on a first come, first serve basis for reservations made by **September 23, 2022.** The AMTA group rate includes complimentary high-speed internet access in the guest room.

Click **here** to book at the AMTA 2022 group rate.

NOTE: A limited number of rooms are available at the government per diem rate. Early reservations are recommended.

Welcome to Denver, where 300 days of sunshine, a thriving cultural scene, diverse neighborhoods, and natural beauty combine for the world's most spectacular playground. A young, active city at the base of the Colorado Rocky Mountains, Denver's stunning architecture, award-winning dining and unparalleled views are all here, year-round.

The Four-Diamond Westin Westminster, with Colorado's breathtaking Rocky Mountains as a backdrop, is ideally situated between Boulder and Denver, providing convenient access to downtown area attractions as well as abundant outdoor recreation activities. With 257 guestrooms and more than 76,000 square-feet of meeting space including six distinct outdoor event areas, the Westin Westminster offers the largest meeting space between Denver and Boulder. Located in the Westminster Promenade, the hotel is within walking distance to a variety of shops and restaurants, and adjacent to the 205-acre regional Westminster City Park. Set time aside to discover the many wonderful local dining options, fabulous shopping, take in a round of golf at one of the many nearby courses, or explore the area's more than 50 miles of scenic walking and cycling trails.

Social Calendar

Sunday, October 9

Welcome Reception
6 - 7:30 p.m.

Sponsored by AMETEK NSI-MI Technologies
Cost: Complimentary with Registration

Enjoy drinks and appetizers with friends and colleagues in the

Westin Lake House, while enjoying a scenic sunset view of the Rocky Mountains. This event is complimentary to all registered symposium participants and their guests.

Monday, October 10

Wynkoop Brewing Company
6:30 - 9:30 p.m.
Sponsored by Microwave Vison Group (MVG) and Next Phase Measurements (NPM)

Cost: $65
Housed in what was the J.S. Brown Mercantile Building, built in 1899 to support the city's mining and railroad expansion, the Wynkoop Brewing Company is Denver's first brewpub. Enjoy handcrafted beer and great food while sharing a game of pool with friends. Buses will depart the hotel at 6 p.m.

Tuesday, October 11

Student Day
11 a.m. - 7 p.m.

Dinner Sponsored by STAR Dynamics
Cost: Complimentary to all student attendees

Student Day will provide an opportunity for local university students to get a taste of antenna engineering and related disciplines by interacting with practicing engineers in a variety of venues. As in previous years, students will be able to tour vendor exhibits, sit in on papers, and enjoy a complimentary meal while listening to a presentation targeting issues relevant to those soon entering the engineering profession. In addition, AMTA will host a hands-on Student Day Design Contest. This will give students an opportunity to show off their engineering skills to recruiters (students should bring their resumes!) and have fun at the same time.

Details are forthcoming, so keep checking the AMTA 2022 website for the latest updates.

Wednesday, October 12

Banquet Reception
6:30 - 7:30 p.m.

Banquet Dinner & Awards
7:30 - 9:30 p.m.

Banquet wine Sponsored by the Microwave Vison Group (MVG).

Cost: Included In full registration; $90 per additional ticket.
We will start the Awards Banquet with a reception in the Westminster Foyer at 6:30, then at 7:30 move into the Legacy Ballroom for dinner and awards ceremony. The banquet is included with full registration; additional tickets can be purchased for $90 each.

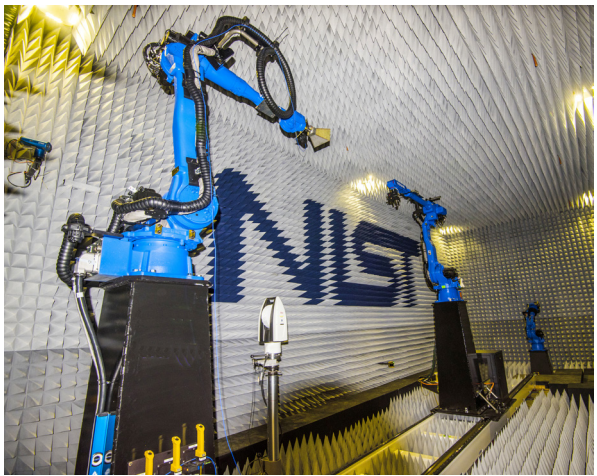
Friday, October 14

Technical Tour – NIST
8 a.m. - Noon.

The tour will include the new robotic based antenna measurement systems that have been recently listed as an NMI on-axis gain calibration service with BIPM.

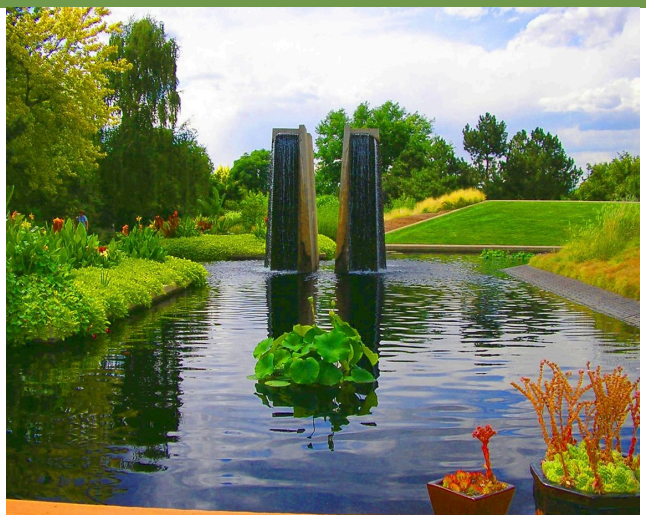
Other stops on the tour will include the National Broadband Interoperability Test Bed, and the Public Safety Communications Research and National Advanced Spectrum and Communications Test Network programs.

- Meet in the hotel lobby at 8 a m. Buses will depart at 8:15 a.m.
- All attendees will be required to provide an approved form of identification on-site in order to enter facility.
- Foreign nationals will need to submit additional information several weeks in advance. Further details to follow.
- Limited to 45 attendees



Companion Tours

Denver Botanic Gardens at York Street plus the Pearl Street Mall



Monday, October 10

9 a.m. - 4 p.m.

Join this docent-led tour and encounter a wide range of distinctive gardens on 24-acres that celebrate a Western identity and the unique high-altitude climate and geography. Other gardens include a Japanese Garden, Scripture Garden, and Sensory Garden. The tour is approximately 60 minutes. Next we'll travel to Boulder's Pearl Street Mall. Grab lunch at one of the famed local eateries with some time for shopping or visit the Boulder Museum of Modern Art.

Stanley Hotel and Downtown Estes Park

Tuesday, October 11

8:30 a.m. - 4:30 p.m.

Immerse yourself in the rich story of the history of The Stanley Hotel! This 1 hour tour will introduce you to Mr. F.O. Stanley, his wife Flora, Stephen King, and other noteworthy visitors since 1909. The Stanley Hotel Historic Day Tour is a unique way to experience the hotel's history, architecture, folklore, and pop culture with a knowledgeable storyteller. Then visit Downtown Estes Park to have lunch and explore the village. Peaks rise all around, from 8,500 feet to more than 14,000 feet, for gorgeous views in every direction. Galleries and shops present a variety of practical to whimsical. Wildlife is still so plentiful that elk wandering downtown seem like the official welcoming committee.

Meow Wolf

Wednesday, October 12

9 a.m. - 3 p.m.

"Come as you are. Leave transformed." Convergence Station is Meow Wolf's third permanent exhibition. Discover immersive, mind-bending art and an underground rich narrative as you journey through 4 floors of 70+ installations, rooms, and portals. Together they tell an unforgettable, cathartic tale of converged worlds. Have lunch at the Meow Wolf café before our return to the Westin.

Please meet in the Westin lobby at 8:45 a.m.
Comfortable walking shoes recommended.
Lunch is on your own. Please bring money for lunch and gratuities.

Short Course

Application of Robotics for Antenna Measurements

Robotic arms, often referred to as an industrial robot, are designed to emulate a human arm using multiple joints that either move along an axis or can rotate in certain directions. They can be programmed to perform a specific task quickly, efficiently, and extremely accurately. For these reasons, they are commonly used for manufacturing, fabrication, and industrial applications. However, their motion flexibility makes them highly reconfigurable and adaptable to numerous applications. In recent years, there has been much developmental work applying this technology for antenna measurements as robotic arms provide antenna positioning that would be constrained by conventional measurement systems. This year's short course provides an introduction into this exciting new area in antenna measurement technology.

Joshua Gordon of the National Institute of Standards and Technology (NIST) in Boulder, Colorado along with Benjamin Moser and Andrew Petruska from the Colorado School of Mines in Golden, Colorado will present a brief history of antenna metrology and discuss the reasons for using robotics in antenna measurements. Basic robotics concepts will be presented including: the math and language of robots, calibrating robot position and orientation, programing, and planning and controlling robots. Finally, the speakers will look at items to consider when using robots in antenna ranges.

Dennis Lewis of Boeing in Seattle, Washington, Greg Masters of Next Phase Measurements in Garden Grove, California and Roland Moch of RWTH Aachen University, in Aachen, Germany will discuss some of the practical aspects of integrating robotics into antenna measurement systems/facilities. The speakers will discuss such topics as multiple coordinate systems, rotation matrices and sampling strategies. Special emphasis will be placed on personnel and equipment safety. Several robotic antenna ranges will be showcased during the class.

Breakfast, lunch and coffee breaks are provided for all Short Course attendees.

Keynote Speaker

Marla Dowell

NIST Communications Technology Laboratory (CTL) and NIST Boulder Laborator

Monday, October 10, 8:15 - 8:55 a.m.

Marla Dowell is Director of the NIST Communications Technology Laboratory (CTL) and NIST Boulder Laboratory. NIST has a long role in advanced wireless communications going back over 100 years, to the development of the first radios running on AC electricity and radio triangulation techniques used during World War I. Today, NIST CTL serves as the leader for advanced communications standards and measurements, enabling dramatic changes in how consumers, manufacturers, governments, and others provide and consume information, transact business, provide and use essential services, among many other tasks. NIST CTL works closely with its partners in industry, academia, and across the federal government to address the insatiable societal demand for connectivity, one that requires significant advancements in communication technologies.

Dr. Dowell has served the broader NIST community as a member of the NIST Assessment Review Board, NIST Safety Council, and the NIST People Council. For over 15 years, she has served as a mentor in NIST leadership programs and has learned a great deal from mentees on the changing workforce needs. In addition, she has represented NIST on national and international standards committees for optics and photonics as well as external advisory committees on research innovation, photonics, and communications.

Dr. Dowell's breadth of technical expertise and superior people management skills have been recognized by several prestigious awards: Department of Commerce Silver Medal, NIST Equal Employment Opportunity/Diversity Award, Judson C. French Award, Allen V. Astin Award, and the Arthur S. Flemming Award from George Washington University.

Dr. Dowell is a senior member of IEEE, as well as a member of AAAS, AAUW, APS, and SPIE.

IEEE AP-S Invited Speaker

Erik Lier

Lockheed Martin

Tuesday, October 11, 8 - 8:30 a.m.

Erik Lier received his M.Sc. and Ph.D. from the Norwegian University of Science and Technology, Trondheim, Norway. He started working as a research scientist at the university and later Electronics Laboratory (ELAB/SINTEF), carrying out national and international research on microwave antennas. He co-invented the concept of “Soft and Hard electromagnetic surfaces” which is related to the field of electromagnetic bandgap (EBG) structures and complex surfaces. He spent a year at UCLA as a visiting scholar. Since 1990 he has been with Lockheed Martin Space, where he has been involved in developing new spacecraft antennas and payload technologies. He has been instrumental in building up internal technology on shaped reflector and active phased array design and calibration. He has been involved in the development and modernization of the GPS satellite payload for 25 years. He was the phased array architect for two antenna payloads launched into space. He headed up the internal metamaterials research collaboration effort, including university collaboration, which has led to several groundbreaking and practical metamaterial-enhanced antennas for space and ground applications.

He is granted 37 US patents, has authored and co-authored over 140 journal and conference papers, including two papers in the journal Nature, co-authored one book and authored a book chapter. He received the 2014 IEEE AP-S Harold A. Wheeler Applications Prize Paper Award. He is an IEEE AP-S Distinguished Lecturer, a Lockheed Martin Senior Technical Fellow, a Life Fellow of IEEE and a Fellow of IET.

EurAAP Invited Speaker

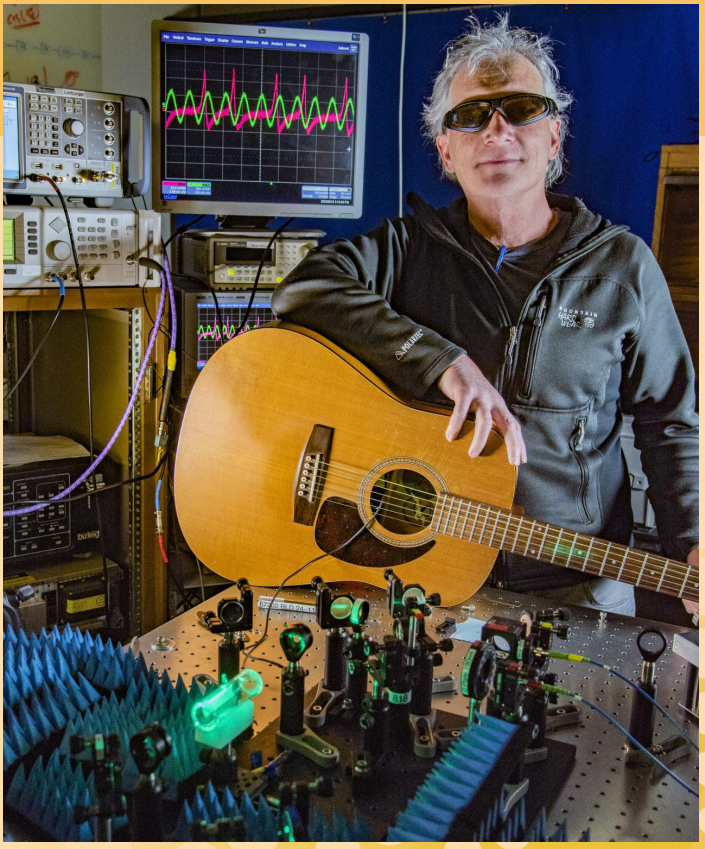
Francesco D’Agostino

University of Solerno

Wednesday, October 12, 1:30 - 2 p.m.

Francesco D’Agostino (Senior Member, IEEE) was born in Salerno, Italy, in 1965. He received a bachelor’s degree in electronic engineering and Ph.D. degree in information engineering from the University of Salerno in 1994 and 2001, respectively. From 2002 to 2005, he was an Assistant Professor with the Faculty of Engineering, University of Salerno. In October 2005, he was appointed as an Associate Professor of Electromagnetics and joined the Department of Industrial Engineering, University of Salerno, where he is currently working. His research activity includes application of sampling techniques to electromagnetics and to innovative NF-FF transformations, diffraction problems, radar cross section evaluations, electromagnetic compatibility. In this area, he has coauthored four books and over 260 scientific papers, published in peer-reviewed international journals and conference proceedings. He is a regular reviewer for several journals and conferences. He has chaired some international events and conferences. He is a member of AMTA and EurAAP.

Lunch & Learn

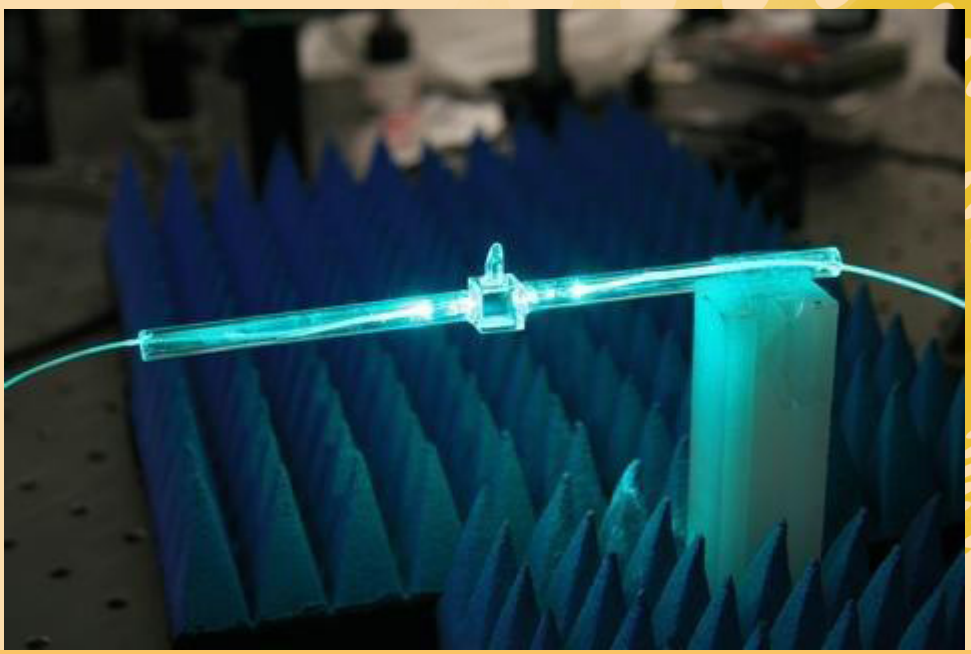


Dr. Christopher Holloway

NIST

Thursday, October 13, Noon - 1:30 p.m.

Dr. Christopher Holloway is a Fellow of the IEEE and has been at NIST for over 25 years. He is also on the Graduate Faculty at the University of Colorado at Boulder. He received his B.S.E degree from the University of Tennessee, and his master and PhD degrees from the University of Colorado at Boulder. He is an expert in electromagnetic theory and metrology, quantum-optics, Rydberg-atom systems, and atom-based sensors. He has a publication h-index of 55 with over 300 technical publications (including 143 refereed journal papers and 130 conference papers) and has over 12,000 citations of his papers. He also has 10 patents in various fields in engineering and physics. He is the project leader for the Rydberg-Atom-Sensor Project and is the group leader for the Electromagnetic Fields Group.



Rydberg Probe
© NIST

Preliminary Technical Program

This program is preliminary and is subject to change. Updated listings can be found at **2022.amta.org**.

Monday, October 10

8 - 9:06 a.m. Meeting Opening/Keynote Address

8 - 8:10 a.m. Welcome and Introduction of Keynote Speaker: CJ Reddy (AMTA President)

8:15 - 8:55 a.m. Keynote Speaker: Marla Dowell, NIST

8:55 - 9:06 a.m. Opening Remarks and Technical Session Overview: Cosme Culotta-López (Technical Coordinator)

Session 1

9:06 - 10 a.m. 5G and Wireless Design and Applications

9:06 - 9:24 a.m. 0664_0931_000014 Optimization of In-Vehicle Connectivity through Simulation-Augmented Antenna Measurements, Benoit Derat[1], Mert Celik[1], Winfried Simon[2], David Schaefer[2], Adrian Fleidl[3], Konstantin Schorp[3], [1]Rohde & Schwarz GmbH & Co. KG, [2]IMST GmbH, [3]BMW Group

9:24 - 9:42 a.m. 0664_0931_000097 5G Base-station Network Optimization in Urban Wireless Scenario using Machine Learning, JAEHOON KIM, Altair Engineering Inc.

9:42 - 10 a.m. 0664_0931_000011 Tunable Cellular Desensitization using SD Card Data Transfer, Michael Foegelle, ETS-Lindgren, Inc.

10 - 10:30 a.m. **MORNING BREAK**

Session 2

10:30 - 11:42 a.m. Standards and Characterization

10:30 - 10:48 a.m. 0664_0931_000066 Antenna Gain Calibration with Improved Accuracy Modeling of Pyramidal Standard Gain Horns, Andrea Giacomini[1], Domenic Belgiovane[2], Justin Dobbins[2], Francesco Saccardi[1], Lars Foged[1], Raffaele Scuderi[3], [1]Microwave Vision Italy, [2]Raytheon Technologies, [3]Dassault Systèmes

10:48 - 11:06 a.m. 0664_0931_000033 A Benchmark Biconical Antenna for Standardized Antenna Measurement and Simulation: Contribution to IEEE P2816 Satyajit Chakrabarti[1], Vikass Monebhurrun[2], Ashim Chakraborty[1], [1]Society for Applied Microwave Electronics Engineering and Research, Kolkata Centre, [2]Paris UMR CNRS – Centrale Supélec – Université Paris-Saclay

11:06 - 11:24 a.m. 0664_0931_000088 Calibration and Cross-Polarization Measurement Standard Requirements for Focus Beam Material Characterization Systems, Jeffrey Massman[1], Michael Havrilla[2], [1]Sensors Directorate Air Force Research Laboratory, [2]Air Force Institute of Technology

11:24 - 11:42 a.m. 0664_0931_000044 Revision of IEEE Std. 1720-2012: Recommended Practice for Near-Field Antenna Measurements, Lars Foged[1], Justin Dobbins[2], Vince Rodriguez[3], Jeff Fordham[3], Vikass Monebhurrun[4], [1]MVG, Microwave Vision Italy, [2]Raytheon Technologies, [3]AMETEK / NSI-MI Technologies, [4]CentraleSupélec

11:42a.m. - Noon 0664_0931_000023 Compact Range Measurements of Digital Arrays Leading to Outdoor RADAR Experiments, Thomas Pemberton, Thomas Kendo, George Kakas, Andrew Braun, Air Force Research Laboratory, Sensors Directorate

Noon - 1:30 p.m. **LUNCH**

Session 3

1:30 - 3 p.m. UAV and Robotic Antenna Measurements

1:30 - 1:48 p.m. 0664_0931_000001 Use of UASs for Outdoor Diagnostics of Large Antennas, Cosme Culotta-López, Snorre Skeidsvoll, Andrian Buchi, Joakim Espeland, QuadSAT

1:48 - 2:06 p.m. 0664_0931_000108 Comparison of Extrapolated Gain Measurement Techniques Using a Dual Robotic Antenna Measurement System, Dennis Lewis[1], Zhong Chen[2], Stuart Gregson[4], [1]The Boeing Company, [2]ETS-Lindgren, [3]Next Phase Measurements, [4]Queen Mary University of London

2:06 - 2:24 p.m. 0664_0931_000087 Path Optimization in Robotic Antenna Test Ranges through Spline-Based Measurement Sequences and Pointwise Probe Correction, Roland Moch[1], Dirk Heberling[12], [1]Institute of High Frequency Technology, RWTH Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

2:24 - 2:42 p.m. 0664_0931_000089 Satellite Communication Handover Test Planning with Multi-Agent System of UAVs Hyo-Sang Shin[1], Antonios Tsourdos[1], Joakim Espeland[2], Andrian Buchi[2], Saki Omi[1], [1]Cranfield University, [2]QuadSAT

2:42 - 3 p.m. 0664_0931_000107 Drone based RF measurements as a viable Broadcast Antenna Pattern Verification Tool, Jason Schreiber, SixArms

3 - 3:30 p.m. **AFTERNOON BREAK**

Preliminary Technical Program

Session 4

3:30 - 5:30 p.m. Chamber Design, Measurement, and Instrumentation

3:30 - 3:48p.m. 0664_0931_000079 Using a Higher-Order Basis Function based Method of Moments Analysis for Designing Compact Antenna Test Ranges, Vince Rodriguez[1], Anil Tellakula[1], Branko Mrdakovic[2], Daniel Janse van Rensburg[1], [1]NSI-MI, [2]WiPI-D d.o.o.

3:48- 4:06 p.m. 0664_0931_000109 Low Frequency Solutions in a Compact Range, Marlow Rumreich, Sean Raffetto, Boeing

4:06 - 4:24 p.m. 0664_0931_000046 Investigation of Inhomogeneity of Material Characteristics on the Hybrid-Absorber Performance, Amin Enayati, E&C Anechoic Chambers

4:24 - 4:42 p.m. 0664_0931_000035 Comparison of Angle-Dependent Scattering of Convoluted and Straight Microwave Absorbers, Willi Hofmann, Andreas Schwind, Christian Bornkessel, Matthias Hein, RF & Microwave Research Group, Thuringian Center of Innovation in Mobility, Technische Universität Ilmenau

4:42 - 5 p.m. 0664_0931_000099 Compact Range Focal Plane Array Antenna Feed, William Carter, Jerry Jost, STAR Dynamics

5 - 5:18 p.m. 0664_0931_000105 Circularly-Polarized Gain Uncertainty Caused By Rotating Linearly-Polarized Feeds in CATRs, Adam Mehrabani, Jeffrey Fordham, Robert Mercer, AMETEK NSI-MI Technologies

Tuesday, October 11

8 - 8:30 a.m. Invited AP-S Speaker: Dr. Erik Lier - Lockheed Martin

8:30 - 8:36 a.m. Daily Annoucements and Technical Session Overview by Technical Coordinator

Session 5

8:36 - 9:30 a.m. RCS Measurements

8:36 - 8:54 a.m. 0664_0931_000039 Analytical and Experimental Studies of Ground Reflections on Bi-static Radar Signal Propagation, Andreas Schwind, Isabella Varga, Willi Hofmann, Matthias Hein, RF & Microwave Research Group, Thuringian Center of Innovation in Mobility, Technische Universität Ilmenau

8:54 - 9:14 a.m. 0664_0931_000106 RCS Calculations and Measurements of a Spherical Drone Based Calibration Device, Spencer Wallentine[1], CJ Reddy[2], Joel Cannon[3], R. Jerry Jost[1], [1]STAR Dynamics Corporation, [2]Altair, [3]National Radar Test Facility (NRTF)

9:14 - 9:32 a.m. 0664_0931_000021 Stepped-Frequency CW RCS measurement in Semi-Anechoic Cha.m.ber, Papa Ousmane Leye, David Martinez, Shaikha Aldhaheri, Chaouki Kasmi, Nicolas Mora, Directed Energy Research Centre, Technology Innovation Institute

9:32 - 10 a.m. **MORNING BREAK**

Session 6

10 a.m. - Noon Antenna Measurements I

10 - 10:18 a.m. 0664_0931_000060 Arbitrary Rigid Translation of the Spherical Vector Wave Functions, Kyriakos Kaslis[1], Samel Arslanagic[1], Olav Breinbjerg[2], [1]Technical University of Denmark, [2]ElMaReCo

10:18 - 10:36 a.m. 0664_0931_000034 Electromagnetic Field Transformations of Near-Field Data Without Global Reference for Magnitude and Phase, Alexander Paulus, Jonas Kornprobst, Thomas Eibert, Technical University of Munich

10:36 - 10:54 a.m. 0664_0931_000071 Genetic Optimization of Edge Treatments of Single Offset Reflector Compact Antenna Test Ranges, Marc Dirix[1], Stuart Gregson[23], [1]Antenna Systems Solutions, [2]Next Phase Measurements, [3]Queen Mary, University of London

10:54 - 11:12 a.m. 0664_0931_000102 Evaluating the RF Performance of a 3D Printed Millimeter-Wave Helical Antenna for Operations in Harsh Conditions, Ljubodrag Boskovic, Mohamed Elmansouri, Dejan Filipovic, University of Colorado Boulder

11:12 - 11:30 a.m. 0664_0931_000022 Antenna Far-Field Characterization From Small Phaseless Dataset, Nicolas Mézières[1], Laurent Le Coq[1], Benjamin Fuchs[2], [1]IETR - UMR CNRS 6164, [2]Federal Office of Communications

11:30 - 11:48 a.m. 0664_0931_000055 Additional Insights into Cha.m.ber Effects in the Gain Extrapolation Data using Empirical Mode Decomposition, Zhong Chen, Yibo Wang, ETS-Lindgren, Inc.

11:48 a.m. - 12:06 p.m. 0664_0931_000069 Spectrum-analyzer-based Radar System Measurements in a Compact Antenna Test Range, Florian Reher[1], Anna Granich[1], Dirk Heberling[12], [1]Institute of High Frequency Technology, RWTH

Preliminary Technical Program

Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

12:06 - 1:30 p.m. **BUSINESS LUNCH**

Session 7

1:30 - 3 p.m. Near-field Measurements I

1:30 - 1:48 p.m. 0664_0931_000041 Cylindrical Near-Field Measurement and Far-Field Characterization of 300-GHz Band Antenna Based on an Electrooptic Measurement Technique, Yusuke Tanaka, Shintaro Hisatake, Gifu University

1:48 - 2:06 p.m. 0664_0931_000084 Phaseless Spherical Near-Field Antenna Measurements Using an Arbitrary Oriented Translation Axis, Adrien Guth[1], Dirk Heberling[12], [1]Institute of High Frequency Technology, RWTH Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

2:06 - 2:24 p.m. 0664_0931_000012 Full-Sphere Characterization of Low-Gain Antennas via Truncated Field Pattern Stitching, Jure Soklic, Holger Arthaber, TU Wien

2:24 - 2:42 p.m. 0664_0931_000019 Single-Cut Phaseless Near-Field Measurements using Specialized Probes, Fernando Rodriguez Varela, Belén Galocha-Iragüen, Manuel Sierra-Castañer, Universidad Politécnica de Madrid

2:42 - 3 p.m. 0664_0931_000008 Highly Efficient Near-Field to Far-Field Transform for Polar Near-Field Scanned Data, Stuart Gregson[1,2], Clive Parini[1], [1]Queen Mary University of London, [2]Next Phase Measurements

3 - 3:18 p.m. 0664_0931_000010 A New Valid Angle Equation for PNF Measurements, Ryan Cutshall, Justin Dobbins, Jacob Freking, Brandon HertnekyRaytheon Technologies

3:18 - 3:36 p.m. 0664_0931_000052 Design and Verification of Innovative Wideband Spherical Near Field Probes with High Modal Purity, Andrea Giacomini[1], Vincenzo Schirosi[1], Francesco Saccardi[1], Lars Foged[1], Anders Jernberg[2], Kazi Alam[2], Joseph Byström, Dan Karlsson[3], [1]Microwave Vision Italy SRL, [2]MVG Germany GmbH, [3]CellMax Technologies AB

3:36 - 4 p.m. **AFTERNOON BREAK**

Session 8

4 - 5:30 p.m. **Poster Session I**

0664_0931_000058 Adaptive Virtual Linearity for non-Linear Array Antenna System in a Millimeter-wave Beamforme, Peter Taiwo[1], David Oyediran[2], [1]Morgan State University, [2]NAVSEA

0664_0931_000101 High Performance 5G Array-driven Transmitarray Antennas for 39 GHz Band, Xiaolong Huang[1], Guanghui Xu[2], [1]Princeton University, [2]Anhui University

0664_0931_000007 Membrane Based Unit Cell Design For Large Rfa For Satellite Communication, Amitkumar Patel[1], Alpesh Vala[1], Keyur Mahant[1], Pratik Mevada[2], Milind Mahajan[2], Jitendra Chaudhari[1], [1]CHARUSAT Space Research and Technology Center, [2]Space Application Center

0664_0931_000062 Numerical modeling of deployable crossed-dipole antennas, Zachary Myrtle, Ashanthi Maxworth, University of Southern Maine

0664_0931_000092 Design, develop.m.ent, and characterization of WR-38 3D metal printed near field probe, Ila Agnihotri, Kymeta Corporation

0664_0931_000076 Antenna Characterization From Spherical Spiral Near-Field Measurements Acquired Over An Infinite Perfectly Conducting Ground Plane, Francesco D'Agostino, Fla.m.inio Ferrara, Claudio Gennarelli, Rocco Guerriero, Massimo Migliozzi, D.I.In. - University of Salerno

0664_0931_000103 Estimating Shale Maturity from Ultra-Fast Microwave Heating, Jose Alvarez, David Jacobi, Poorna Srinivasan, Aramco Americas: Aramco Research Center - Houston

0664_0931_000027 Design and Measurements of a Small End-fed Normal Mode Helical Antenna with Integrated Microstrip Structure, Sri Lekha Srimat Kilambi, Herbert Aumann, Mauricio Pereira da Cunha, University of Maine

0664_0931_000045 A Near to Far-Field Transformation With Planar Wide-Mesh Scan From Near-Field Measurements Affected by 3-D Probe Positioning Errors, Florindo Bevilacqua, Francesco D'Agostino, Flaminio Ferrara, Claudio Gennarelli, Rocco Guerriero, Massimo Migliozzi, D.I.In. - University of Salerno

0664_0931_000070 Evaluation of uncertainty in the extrapolation range method: Site contributions, Doug Kramer[1], Dennis Lewis[2], Yibo Wang[1], [1]ETS-Lindgren Inc., [2]The Boeing Company

0664_0931_000073 Preliminary Demonstration of Field Emulator for Wireless Communication Devices Based on Progra.m.mable Metasurface, Zeqi Shao, Zhiping Li, Beihang University

Wednesday, October 12

8 - 8:30 a.m. "Invited Talk" (EurAAP): Prof. Francesco D'Agostino - Univ. of Salerno

8:30 - 8:36 a.m. Daily Annoucements and Technical Session Overview by Technical Coordinator

Session 9

8:36 - 9:30 a.m. RF Material Design and Characterization

8:36 - 8:54 a.m. 0664_0931_000104 A Loss Tangent Measurement Surface for Free Space Focused Beam Characterization of Low-Loss Dielectrics, Christopher Howard[1], Kenneth Allen[1], Bill Hunt[2], [1]Georgia Tech Research Institute, [2]Georgia Institute of Technology

8:54 - 9:14 a.m. 0664_0931_000040 Metal Mesh Selection Guide for Shielding Effectiveness and Optical Visibility, Nika Amralah, AP A.m.ericas Inc.

9:14 - 9:32 a.m. 0664_0931_000078 A New Handheld Sensor for Measuring Intrinsic Dielectric Properties at 100 to 1000 MHz, John Schultz, Ren Geryak, Compass Technology Group

9:32 - 10 a.m. **MORNING BREAK**

Session 10

10 a.m. - Noon Antenna Measurements II

10 - 10:18 a.m. 0664_0931_000056 Three-Antenna Polarization Measurements Again, Ronald Wittmann[1], Michael Francis[1], David Novotny[2], Allen Newell[3], [1]NIST, Retired, [2]SpaceX, Inc., [3]Newell Near-Field Consultants

10:18 - 10:36 a.m. 0664_0931_000057 Ground Penetrating Radar Antenna Evaluation, Joseph Friedel, David Oyediran, David Rohde, EOD Electronic Protection Systems

10:36 - 10:54 a.m. 0664_0931_000050 Numerical considerations to improve the Reduced-Order Model Approach for Antenna Measurements, Benjamin Fuchs[1], Laurent Le Coq[2], Michael Mattes[3], Nicolas Mézières[2], Samuel Corre[2], [1]Federal Office of Communications, [2]IETR - UMR CNRS 6[1]6[4], [3]DTU

10:54 - 11:12 a.m. 0664_0931_000085 Radiation pattern measurements using an active radar module, Anna Granich[1], Roland Moch[1], Amar Al-Bassam[1], Dirk Heberling[12], [1]Institute of High Frequency Technology, RWTH Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR

11:12 - 1:30 a.m. 0664_0931_000096 Uncertainty analysis of the receiver inaccuracy in near-field antenna measurement system, Rezvan Rafiee Alavi, Sriram Balasubramani, Diamond Microwave Chamber Ltd.

11:30 a.m. - 12:48 p.m. 0664_0931_000018 Huffman Radar Site: Far Field Calibration and Testing Range, Tomas Kendo[1], Ryan Thompson Thompson[1], Thomas Corigliano[1], Chad Shaffer[2], Thomas Steffen[2], [1]Air Force Research Laboratory (AFRL), [2]Defense Engineering Corporation (DEC)

12:48 - 12:06 p.m. 0664_0931_000031 Millimeter-Wave S-Para.m.eter Measurements with a Vector Field Analyzer in Antenna Measurement Systems, Niyati Sanandiya, Bruce Williams, Steve Nichols, NSI-MI Technologies

12:06 - 1:30 p.m. **Exhibitor Sponsored Lunch**

Session 11

1:30 - 3 p.m. Near-Field Measurements II

1:30 - 1:48 p.m. 0664_0931_000052 Design and Verification of Innovative Wideband Spherical Near Field Probes with High Modal Purity, Andrea Giacomini[1], Vincenzo Schirosi[1], Francesco Saccardi[1], Lars Foged[1], Anders Jernberg[2], Kazi Alam[2], Joseph Byström, Dan Karlsson[3], [1]Microwave Vision Italy SRL, [2]MVG Germany GmbH, [3]CellMax Technologies AB

1:48 - 2:06 p.m. 0664_0931_000030 Experimental Validation of Non Invasive SAR Evaluation from Measurements and Numerically Assisted Post Processing, Lucia Scialacqua[1], Shoaib Anwar[2], Francesca Mioc[1], Jerome Luc[2], Aurelien Lelievre[2], Mohamad Mantash[2], Nicolas Gross[2], Lars Foged[1], [1]Microwave Vision Italy, [2]Microwave Vision Group

2:06 - 2:24 p.m. 0664_0931_000047 Numerical and Experimental Validation of Near-Field Power Density Reconstruction from Radiative Field Measurements, Benoit Derat[1], Martin Wittmann[1], Mert Celik[1], Walid El Hajj[2], Davide Colombi[3], [1]Rohde and Schwarz GmbH & Co. KG, [2]Intel Corporation SAS, [3]Ericsson Research

2:24 - 2:42 p.m. 0664_0931_000094 Methodology and Practical Considerations for the Implementation of the Three-Antenna Method in a Spherical Near-Field Range, Bennett Gibson-Dunne[1], Jill Smithson[2], Ken Oueng[2], Greg Brzezina[2],

Adrian Momciu[2], [1]University of Waterloo, [2]Canadian Space Agency at the David Florida Lab

2:42 - 3 p.m. 0664_0931_000110 Reflectivity reconstruction from only a.m.plitude non-redundant near-field data: numerical validation, Florindo Bevilacqua[1], Amedeo Capozzoli[2], Claudio Curcio[2], Francesco D'Agostino[1], Flaminio Ferrara[1], Rocco Guerriero[1], Angelo Liseno[2], Massimo Migliozzi[1], Yiannis Vardaxoglou[3], [1]University of Salerno, [2]University of Naples "Federico II", [3]Loughborough University

3 - 3:18 p.m. 0664_0931_000091 Antenna gain determination by spherical near-field substitution method without full-sphere measurement of reference gain antenna, Sergiy Pivnenko, Antenna Systems Solutions

3:18 - 3:36 p.m. 0664_0931_000043 Testing of a 60 MHz Cubesat in an Electrically Small Environment with the Synthetic Probe Array Technique, Francesco Saccardi[1], Rubén Tena-Sánchez[1], Enrico Tartaglino[1], Andrea Giacomini[1], Lars Foged[1], Paul Moseley[2], Luis Rolo[2], [1]Microwave Vision Italy SRL, [2]European Space Agency, ESTEC

3:36 - 4 p.m. **AFTERNOON BREAK**

Session 12

4 - 5:30 p.m. **Poster Session 2**

0664_0931_000042 Emulation of LTE Link Scenarios Reproducibly Derived from Field-Operational Tests, Philipp Berlt, Berk Altinel, Christian Bornkessel, Matthias Hein, RF & Microwave Research Group, Thuringian Center of Innovation in Mobility, Technische Universität Ilmenau

0664_0931_000086 A Trade Study on Quasi Far Field Accuracies and Measurements, Marion Baggett, NSI-MI Technologies

0664_0931_000013 Novel structure for Broadband Carbon loaded polystyrene absorbers, Marco Anacleto, Amit Baghel, Pedro Pinho, Instituto de Telecomunicações

0664_0931_000017 A Fast Beam Switching Method for Characterizing Active Phased Array Antennas, Cameron Seidl, James Downey, NASA Glenn Research Center

0664_0931_000100 Initial Development of Low-cost Custom Spherical Measurement Range, Songyi Yen, Ljubodrag Boskovic, Dejan Filipovic, University of Colorado Boulder

0664_0931_000067 RCS ISAR Imaging Motion Sidelobe Reduction, Jason Stutz, Austin Penney, Lockheed Martin Aeronautics

0664_0931_000082 Look Through Hygroscopic Indoor Materials at Frequencies from 750 GHz to 1.1 THz, Fawad Sheikh, Aman Batra, Andreas Prokscha, Dien Lessy, Thomas Kaiser, University of Duisburg-Essen

0664_0931_000077 Free-space One-/two-port Calibration Using Planar Offset Short for Material Parameter Measurement, Jin-Seob Kang, Safety Measurement Institute, Korea Research Institute of Standards and Science

0664_0931_000054 Reinstatement of the NIST Field Strength Probe Calibration Service,Matthew Simons, Christopher Parks, Vincent Neylon, Galen Koepke, Christopher Holloway, National Institute of Standards & Technology

0664_0931_000074 Activities within the EurAAP Working Group on Antenna Measurements, Lucia Scialacqua[1], Tian Hong Loh[2], Michael Mattes[3], Javier Fernandez Alvarez[3], Lars Foged[1], Manuel Sierra-Castañer[4], [1]Microwave Vision Italy, [2]National Physical Laboratory, [3]Technical University of Denmark, [4]Technical University of Madrid

0664_0931_000072 Peculiar Multipath Channels from THz Horn Antennas, Fawad Sheikh, Yamen Zantah, Andreas Prokscha, Thomas Kaiser, University of Duisburg-Essen

Thursday, October 13

Session 13

8 - 9:30 a.m. Computational Electromagnetics and Numerical Methods

8 - 8:18 a.m. 0664_0931_000049 Antenna Diagnostics of a Large Deployable Reflector Antenna, Andreas Ericsson[1], Oscar Borries[1], Martin Haulund Gaede[1], Peter Meincke[1], Erik Jørgensen[1], Cecilia Cappellin[1], Erio Gandini[2], [1]TICRA, [2]European Space Agency, ESTEC

8:18 - 8:36 a.m. 0664_0931_000016 A Novel Complex Image Expansion for Horizontally Polarized Sources Above a Lossy Half Space, David Tonn, NUWC Newport

8:36 - 8:54 a.m. 0664_0931_000081 Co-Site Interference Analysis on Aerospace and Naval Platforms using Advanced Simulation Tools, V B Murthy D, CJ Reddy, Altair Engineering Inc

8:54 - 9:12 a.m. 0664_0931_000036 EMF simulation of base station antennas in real sites using Spherical Wave Expansion and diffracted fields, Celia Fontá Romero[1], Alicia Auñón Marugán[1], Fernando Rodríguez Varela[1], Pablo Bielza López-Manterola[1], José Luis Alcolea Coronel[2], José Ignacio Alonso

Montes[1], Manuel Sierra Castañer[1], [1]Universidad Politécnica de Madrid, [2]Vantage Towers

9:12 - 9:30 a.m. 0664_0931_000093 Determination of the Number of Valid Scan Pairs in a Multielement Waveguide Simulator, Collin Wallish, Dejan Filipovic, University of Colorado Boulder

9:30 - 10:00 a.m. **MORNING BREAK**

Session 14

10 a.m. - Noon Antennas and Measurements for 5G and Future Communication Systems

10 - 10:18 a.m. 0664_0931_000025 Acceleration of Over-The-Air Measurements Under Extreme Temperature Conditions Through Optimization of Air Flow and Thermal Efficiency, Benoit Derat, Ralf Meissner, Anes Belkacem, Guenter Pfeifer, Constantin Sinn, Markus Herbrig, Jose Fortes, Rohde & Schwarz GmbH & Co. KG

10:18 - 10:36 a.m. 0664_0931_000048 An Extension of a Single-Cut Near-Field to Far-Field Transformation to a Multi-Cut Fresnel-Field to Far-Field Transformation Depending on the Heights of Antennas, Masanobu Hirose[1], Satoru Kurokawa[2], [1]7G aa Co., Ltd., [2]AIST

1**0:36 - 10:54 a.m.** 0664_0931_000038 Experimental validation of Plane Wave Generator for 5G New Radio FR2 applications, Shoaib Anwar[1], Evgueni Kaverine[1], Fabien Henry[1], Nicolas Gross[1], Francesco Scattone[2], Darko Sekuljica[2], Andrea Giacomini[2], Francesco Saccardi[2], Alessandro Scannavini[2], Per Iversen[1], Lars Foged[2], [1]MVG Industries France, [2]MVG Industries Italy SRL

10:54 - 11:14 a.m. 0664_0931_000075 Design of a Thermal Testbed for Metrology of Active Antennas, Bryan Schoenholz, James Downey, Marie Piasecki, NASA Glenn Research Center

11:14 - 11:32 a.m. 0664_0931_000083 A Novel Reduced-Complexity Low-Profile Beam Steerable Risley Prism Antenna, Junbo Wang, Yahya Rahmat-Samii, University of California, Los Angeles

11:32 a.m. - Noon 0664_0931_000037 Using a VNA Based Spherical Near Field Antenna Measurement System for Active Antenna System Performance Verifications, Chang-Lun Liao[1,2], You-Hua Lin[3], Ike Lin[3], Bo-Cheng You[1], Chang-Fa Yang[1], De-Xian Song[1], Wen-Jiao Liao[1], Yuan-Chang Hou[1], Tswen-Jiann Huang[2], [1]National Taiwan University of Science and Technology, [2]Telecommunication Laboratories Chunghwa Telecom Co., Ltd., [3]WaveFidelity Inc.

Noon - 1:30 p.m. **LUNCH**
"Lunch & Learn" Speaker: Chris Holloway, NIST

Session 15

1:30 - 3 p.m. Imaging, Algorithms, and Processing Techniques

1:30 - 1:48 p.m. 0664_0931_000068 Investigation of THz SAR Through-Wall Sensing in Indoor Environment, Aman Batra[1], Fawad Sheikh[1], Michael Wiemeler[1], Diana Göhringer[2], Thomas Kaiser[1], [1]Institute of Digital Signal Processing, Universität Duisburg-Essen, [2]Chair of Adaptive Dyna.m.ic Systems, Technische Universität Dresden

1:48 - 2:06 p.m. 0664_0931_000020 ISAR Image Gating Using Backprojection and Smoothed Reweighted L1-optimization, Christer Larsson[12], Andreas Gällström[12], [1]Saab, [2]Lund University

2:06 - 2:24 p.m. 0664_0931_000028 Further Exploration of the Holographic PNF Filter, Scott McBride, NSI-MI Technologies

2:24 - 2:42 p.m. 0664_0931_000090 A Technique of Holographic Projection from Far Field Pattern to an Unconstrained Planar Surface, Yibo Wang, Zhong Chen, Ets-Lindgren

2:42 - 3 p.m. 0664_0931_000059 Diffraction from Rotating Absorber Array and Field probe Using Long Vertical Objects, Pax Wei, The Boeing Company

3 - 3:30 p.m. **AFTERNOON BREAK**

Session 16

3:30 - 5 p.m. Antenna Design and Analysis

3:30 - 3:48 p.m. 0664_0931_000080 Equivalent Multipole Source Models for the TE/TM-R Spherical Wavefunctions, James McLean, TDK Corp.

3:48 - 4:06 p.m. 0664_0931_000029 Compact Ultra-wideband Ground Penetrating Radar Antenna Design, Cole Harlow, Chi-Chih Chen, The Ohio State University Electroscience Laboratory

4:06 - 4:24 p.m. 0664_0931_000063 Crosstalk is Good: Antenna Design to Enable Polarimetric Compressive Sensing, Jeffrey Massman[1], Julie Jackson[2], John Becker[12], [1] Air Force Research Laboratory, [2] Air Force Institute of Technology

Preliminary Technical Program

4:24 - 4:42 p.m. 0664_0931_000098 A 77 GHz Microstrip Comb Line Antenna Array for Automotive RADAR application, Neha Pazare, Vivek Kamble, University of Colorado Boulder

4:42 - 5 p.m. 0664_0931_000061 Ultra-thin EBG backed flexible antenna for 24 GHz ISM band WBAN, Mubasher Ali[1], Irfan Ullah[2], John Batchelor[1], Nathan Gomes[3], [1]University of Kent, [2]University of Southampton, [3]University College London

5 - 5:20 p.m. **Closing Remark**

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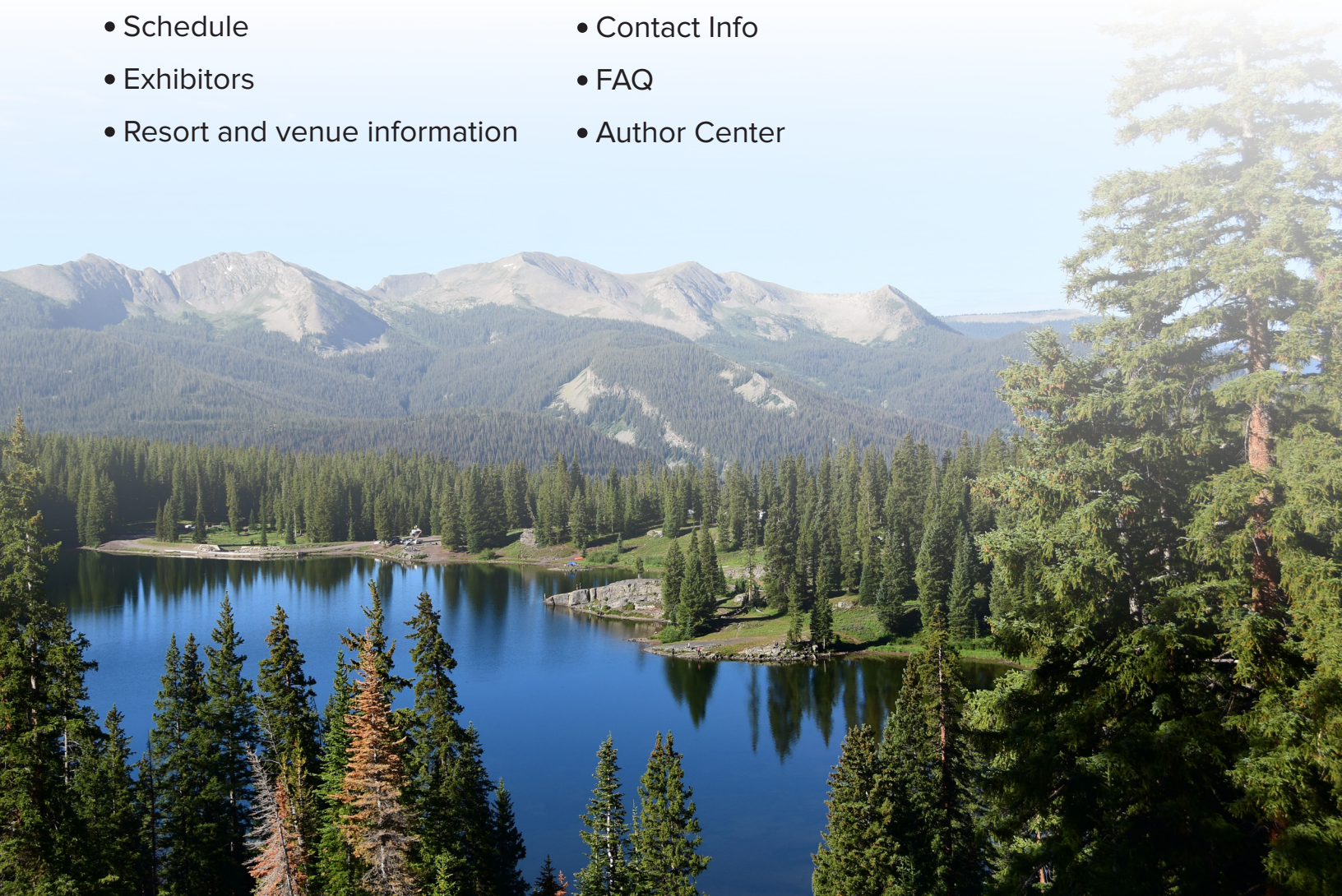

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