

# **2022 IEEE USNC-URSI Radio Science Meeting (Joint with AP-S Symposium)**

**Denver, Colorado, USA  
10-15 July 2022**



**IEEE Catalog Number: CFP2201W-POD  
ISBN: 978-1-6654-3151-4**

**Copyright © 2022, U.S. National Committee for the International Union of Radio Science (USNC-URSI)  
All Rights Reserved**

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP2201W-POD
ISBN (Print-On-Demand):	978-1-6654-3151-4
ISBN (Online):	978-1-946815-16-3

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# TABLE OF CONTENTS

## MO-A4.1A: RCS AND WIRELESS SENSING

<b>MO-A4.1A.3: A MEDIUM FREQUENCY RF SENSOR FOR DETECTION OF MAGNETIZED QUARK NUGGETS</b> .....	1
<i>Marquan Chaney, John Borchardt, Sandia National Labs, United States</i>	

## MO-UB.3A: MATERIAL EFFECTS AND UNIQUE ANTENNAS

<b>MO-UB.3A.5: ALL-METAL ANTENNAS FOR APPLICATIONS IN EXTREME SPACE ENVIRONMENTS</b> .....	3
<i>Rainee Simons, Felix Miranda, NASA Glenn Research Center, United States</i>	
<b>MO-UB.3A.9: DESIGN OF DUAL-POLARIZED VIVALDI ANTENNA</b> .....	5
<i>Mustafa Ayebe, Ahmed H. Akgiray, Ozyegin University, Turkey</i>	

## MO-UF.1A: PROPAGATION AND REMOTE SENSING IN COMPLEX AND RANDOM MEDIA I

<b>MO-UF.1A.9: COMPLEX PERMITTIVITY MEASUREMENT OF BIOLOGICAL TISSUES USING THE RATIONAL FUNCTION MODEL</b> .....	7
<i>Ismail Dilman, Cemanur Aydinalp, Sulayman Joof, Mehmet Nuri Akinci, Tuba Yilmaz, Istanbul Technical University, Turkey</i>	
<b>MO-SP.1A.8: OBSERVATIONS ON THE ANGULAR STATISTICS OF THE INDOOR SUB-THZ RADIO CHANNEL AT 158 GHZ</b> .....	9
<i>Alper Schultze, Michael Peter, Fraunhofer HHI, Germany; Wilhelm Keusgen, Technische Universität Berlin, Germany; Taro Eichler, Rohde &amp; Schwarz, Germany</i>	

## MO-UA.2P: ANTENNAS AND PROPAGATION

<b>MO-UA.2P.1: INVESTIGATION OF RADIO FREQUENCY PENETRATION THROUGH COLLISIONAL PLASMA USING A REVERBERATION CHAMBER</b> .....	11
<i>Sri Tarun Reddy Chilukury, Joshua T Wewerka, Egduard Jauregui, Aakash Sahai, Vijay Harid, Mark Golkowski, University of Colorado Denver, United States; Daniel Main, Tech-X Corporation, United States</i>	

## MO-UF.1P: MICROWAVE REMOTE SENSING OF THE EARTH

<b>MO-UF.1P.2: NEW ATMOSPHERIC REMOTE SENSING CAPABILITIES DEMONSTRATED BY THE NASA TROPICS MISSION</b> .....	15
<i>William Blackwell, Andrew Cunningham, Michael Diliberto, Shawn Donnelly, James Eshbaugh, Vince Leslie, Nicholas Zorn, MIT Lincoln Laboratory, United States</i>	
<b>MO-UF.1P.5: DESIGN AND IMPLEMENTATION OF A SOFTWARE DEFINED RADIO-BASED RADIOMETER OPERATING FROM A SMALL UNMANNED AIRCRAFT SYSTEMS</b> .....	17
<i>Md Mehedi Farhad, Sabyasachi Biswas, Mohammad Abdus Shahid Rafi, Mehmet Kurum, Ali C Gurbuz, Mississippi State University, United States</i>	

## **MO-UA.1P: ELECTROMAGNETIC MEASUREMENT TECHNIQUES AND MATERIALS CHARACTERIZATION**

### **MO-UA.1P.1: DIELECTRIC PROPERTY RETRIEVAL WITH OPEN-ENDED .....13 COAXIAL PROBE FOR SOLID MATERIALS**

*Cemanur Aydınalp, Kilis 7 Aralık University, Turkey; Sulayman Joof, Mehmet Nuri Akinci, Ibrahim Akduman, Tuba Yilmaz, Istanbul Technical University, Turkey*

## **TU-UB.2A: ANTENNA THEORY, DESIGN AND MEASUREMENTS**

### **TU-UB.2A.2: 3D-PRINTED CIRCULAR POLARIZED CYLINDRICAL DRA USING .....19 PARASITIC DIELECTRIC HELIX**

*Sebastian Diaz, Francisco Pizarro, Pontificia Universidad Catolica de Valparaiso, Chile; Marcos Diaz, University of Chile, Chile; Eva Rajo-Iglesias, University Carlos III of Madrid, Spain*

### **TU-UB.2A.10: A NOVEL EXPONENTIALLY INCREASED IRREGULAR MINKOWSKI .....21 FRACTAL ANTENNA**

*Chenyi Wang, Xin Cao, Qiangming Cai, Yuyu Zhu, Southwest University of Science and Technology, China; Weiping Li, East China Jiaotong University, China*

## **TU-UK.1A: HUMAN-BODY INTERACTIONS WITH ANTENNAS AND OTHER ELECTROMAGNETIC DEVICES**

### **TU-UK.1A.4: LOW-COST SYSTEM FOR ELECTROMAGNETIC SAR EVALUATION .....23 IN A HUMAN PHANTOM**

*Andrés Gallego, Edwin Pineda, Francisco José Román Campos, Javier Leonardo Araque Quijano, Universidad Nacional de Colombia, Colombia; Manuel Ricardo Pérez Cerquera, Pontificia Universidad Javeriana, Colombia*

### **TU-UK.1A.6: FIVE-PORT RECEIVER FOR VITAL SIGNS DETECTION .....25**

*Chang Huan, Panagiota Kontou, Souheil Ben-Smida, Dimitris Anagnostou, Heriot-Watt University, United Kingdom; Symeon Nikolaou, Frederick University, Cyprus*

### **TU-UK.1A.8: MULTI-PHYSICS ANALYSIS OF HUMAN EXPOSITION TO .....27 ELECTROMAGNETIC FIELDS BY 5G SYSTEMS**

*José Luis Duque Muñoz, Javier Enrique Arévalo Peña, Marlon Patiño Bernal, Francisco José Román Campos, Javier Leonardo Araque Quijano, Universidad Nacional de Colombia, Colombia; Juan Camilo Vargas González, Hospital Universitario Nacional de Colombia, Colombia; Manuel Ricardo Pérez Cerquera, Pontificia Universidad Javeriana, Colombia*

## **TU-SP.2P: IN REMEMBRANCE OF ALLEN TAFLOVE: FDTD PIONEER AND EDUCATOR**

### **TU-SP.2P.8: THE STRANGE RESEARCH PLACES FDTD TOOK ME TO .....29**

*Michal Okoniewski, University of Calgary, Canada*

## **TU-A1.3P: QUANTUM TECHNOLOGY RELATED TO ELECTROMAGNETICS II**

### **TU-A1.3P.5: COMPARISON OF HALL MOBILITY AND CARRIER DENSITY OF .....31 THIN BLACK PHOSPHORUS EXFOLIATED FROM BULK CRYSTALS PROVIDED BY VARIOUS VENDORS**

*Katie Welch, Mahmudul Doha, Zachary Uttley, Arash Fereidouni, Abayomi Omolewu, Jose Santos, Magda El-Shenawee, Hugh Churchill, University of Arkansas, United States*

## **TU-UB.1P: NUMERICAL METHODS III**

### **TU-UB.1P.6: ANALYSIS OF CALIBRATION PROCEDURE FOR OPEN-ENDED COAXIAL PROBE .....34**

*Sulayman Joof, Cemanur Aydinalp, Ismail Dilman, Mehmet Nuri Akinci, Tuba Tuba Yilmaz, Istanbul Technical University, Turkey*

## **TU-UK.1P: MEDICAL IMAGING AND ELECTROMAGNETICS**

### **TU-UK.1P.3: PORTABLE MICROWAVE HEAD IMAGING DEVICE USING LOW-COST VNA .....38**

*Muhammad Hashir, Muhammad Qasim Mahmood, Kashif Riaz, Muhammad Zubair, Information Technology University, Pakistan*

## **TU-UA.1P: ELECTROMAGNETIC COMPATIBILITY AND METROLOGY**

### **TU-UA.1P.5: NEW COUPLING ANALYSIS OF TRANSMISSION LINES BY PORT SOLVER METHOD .....36**

*Mohammad G. H. Alijani, Ferdowsi University Mashhad, Iran; Shahin Sheikh, Ahmed Kishk, Concordia University, Canada*

## **WE-UB.2A: ANTENNA ARRAYS AND SYSTEMS**

### **WE-UB.2A.2: DUAL KU-BAND DIELECTRIC RESONATOR ANTENNA SUB-ARRAY FED BY A SUBSTRATE INTEGRATED COAXIAL LINE .....48**

*Benoit Brizard, Jean-Jacques Laurin, Polytechnique Montréal, Canada; Santiago Sierra-Garcia, MDA Corporation, Canada*

### **WE-UB.2A.9: ARRAY ARRANGEMENT DESIGN OF MULTISTATIC SPARSE LINEAR ARRAY SAR FOR 3-D IMAGING .....50**

*Zhichao Sun, Hang Ren, Jianyu Yang, Junjie Wu, University of Electronic Science and Technology of China, China*

## **WE-UE.1A: SIMULATION IN ELECTROMAGNETIC NOISE AND INTERFERENCE CONTROL**

### **WE-UE.1A.2: ON THE USE OF A MICROSTRIP MEANDER LINE TO REDUCE MUTUAL COUPLING BETWEEN A PATCH ANTENNA AND A TRANSMISSION LINE ON PRINTED CIRCUIT BOARDS .....52**

*Tania Islam, Tasin Nusrat, Sayan Roy, South Dakota Mines, United States*

### **WE-UE.1A.3: RAPID PRE-CHARACTERIZATION OF FINE-GRAINED EM SIDE-CHANNEL (IN)VULNERABILITY OF AES MODULES .....54**

*Vishnuvardhan Iyer, Ali Yilmaz, The University of Texas at Austin, United States*

### **WE-UE.1A.4: ON EIGENVALUE DISTRIBUTION OF IMPERFECT CSI IN MMWAVE COMMUNICATIONS .....56**

*Ahmad Ghasemi, Seyed (Reza) Zekavat, Worcester Polytechnic Institute (WPI), United States*

### **WE-UE.1A.5: A 2X-THRU STANDARD DE-EMBEDDING METHOD OF SURFACE COMPONENTS IN HIGH-SPEED PCBs .....58**

*Jian-Yao Ye, Jun Fan, Xin Cao, Qiang-Ming Cai, Yuyu Zhu, Yuying Zhu, Southwest University of Science and Technology, China*

## **WE-UB.1A: PROPAGATION, SCATTERING AND SENSING I**

### **WE-UB.1A.3: ANALYSIS OF CHIRAL ORDERING OF A FOUR-TIER WIRELESS NEAR-FIELD WIRELESS POWER TRANSFER (WPT) SYSTEM .....40**

*Saeed Khan, Kansas State University, United States; Chad Bailey, Kansas State University Salina, United States*

### **WE-UB.1A.5: CHARACTERIZATION AND REDUCTION OF BISTATIC RADAR CROSS SECTION OF HOLLOW CYLINDRICAL CAVITY .....42**

*Sudeb Bhattacharya, Kumar Vaibhav Srivastava, Indian Institute of Technology, Kanpur, India*

### **WE-UB.1A.9: EM SIMULATION OF SEA SURFACE POINT-TO-POINT COMMUNICATION SYSTEM .....44**

*Jiangnan Xing, Tao Jiang, Harbin Engineering University, China; Linshu Gong, Shanghai Electro-Mechanical Engineering Institute, China; Bin Cao, Marine Design Research Institute of China, China*

### **WE-UB.1A.10: THE CHARACTERISTICS ANALYSIS OF IONOSPHERIC CLUTTER IN MULTIPLE DIMENSIONS FOR HFSWR .....46**

*Xiaowei Ji, Qiang Yang, Xin Zhang, Harbin Institute of Technology, China; Yong Yang, Hainan Tropical Ocean University, China*

## **WE-SP.2P: ENDURING IMPACT AND LEGACY OF PROF. TAPAN K. SARKAR II**

### **WE-SP.2P.6: TUNING AN ELECTRICALLY SHORT ANTENNA FOR FIELD OPERATION .....60**

*James Breakall, Penn State University, United States; Ulrich L. Rohde, Federal University of the Armed Forces of Germany, Munich, Germany; Ajay K. Poddar, Synergy Microwave Corp, United States*

## **WE-SP.1P: FRONTIER BIOMEDICAL TECHNOLOGIES AND APPLICATIONS**

### **WE-SP.1P.6: COMBINATION OF COMPLEX-VALUED NEURAL NETWORKS WITH SILICON-LOADED PROBES FOR MILLIMETER-WAVE NON-INVASIVE BLOOD GLUCOSE CONCENTRATION ESTIMATION .....62**

*Seko Nagae, Lena Azuma, Ryo Natsuaki, Akira Hirose, The University of Tokyo, Japan*

## **WE-UF.1P: POINT-TO-POINT PROPAGATION EFFECTS**

### **WE-UF.1P.2: COMPUTING VERTICAL REFRACTIVITY PROFILES BY NEURAL NETWORKS. COMPARISON WITH BULK MODEL RESULTS .....68**

*Jacques Claverie, Academie Militaire de St-Cyr Coëtquidan & Institut d'Electronique et du Numérique, France; Jean Motsch, Academie Militaire de St-Cyr Coëtquidan, France*

### **WE-UF.1P.3: PREDICTING AIS RECEPTION USING TROPOSPHERIC PROPAGATION FORECAST AND MACHINE LEARNING .....70**

*Zackary Vanche, ENSG, France; Ambroise Renaud, Aldo Napoli, Mines Paris, France*

### **WE-UF.1P.7: INVESTIGATING A PORTABLE LOW-COST TARGET SIMULATOR FOR DOPPLER RADARS .....72**

*Prateek Nallabolu, Changzhi Li, Texas Tech University, United States*

### **WE-UF.1P.8: ULTRA-WIDEBAND MICROWAVE RADAR FOR MEDICAL IMAGING APPLICATIONS .....74**

*Mathias Kromer, Hima Dominic, Reinhard Echle, Marlene Harter, Offenburg University, Germany*

<b>WE-UF.1P.9: DEEP NEURAL NETWORK FOR LOCALIZATION OF MOBILE USERS USING RAYTRACING</b>	<b>76</b>
<i>Jaspreet Kaur, Olaoluwa R Popoola, Muhammad Ali Imran, Qammer H Abbasi, Hasan T Abbas, University of Glasgow, United Kingdom</i>	
 <b>WE-UB.1P: MICROSTRIP ANTENNAS AND PRINTED DEVICES</b>	
<b>WE-UB.1P.5: DESIGN OF CIRCULARLY POLARISED RING SLOTTED PATCH ANTENNA FOR SUBTHZ APPLICATIONS</b>	<b>64</b>
<i>Ansha K K, Abdulla P, SOE,CUSAT, India; Jasmine P M, Sam Kollannore, MES College Marampally, India</i>	
<b>WE-UB.1P.6: A WIDEBAND CPW-FED MONOPOLE ANTENNA FOR HIGH-TEMPERATURE APPLICATIONS</b>	<b>66</b>
<i>Aleks Mertvyv, Noah Renk, Vincent Bigelow, Bachir Adham Younes, Praveen Sekhar, Tutku Karacolak, Washington State University Vancouver, United States</i>	
 <b>WE-A5.2P: ON-CHIP ANTENNAS &amp; TECHNOLOGIES</b>	
<b>WE-A5.2P.4: A 94% HIGH H_(RF-DC) RECTIFIER DESIGN FOR WIRELESS POWER TRANSFER APPLICATIONS</b>	<b>78</b>
<i>Rafsan Mahin, Adnan Basir Patwary, Ifana Mahbub, University of North Texas, United States</i>	
<b>WE-A5.2P.5: WIDE BANDGAP SEMICONDUCTOR DEVICES AND SYSTEMS FOR COMMUNICATIONS IN EXTREME ENVIRONMENT</b>	<b>80</b>
<i>Rainee Simons, NASA Glenn Research Center, United States</i>	
 <b>TH-A2.1A: METAMATERIALS FOR RCS REDUCTION AND CLOAKING</b>	
<b>TH-A2.1A.8: DUAL BAND HARMONIC SUPPRESSED ANTENNA WITH PERIODIC METASURFACE FOR 5G APPLICATIONS</b>	<b>82</b>
<i>Brinta Chowdhury, Abdullah Eroglu, North Carolina A&amp;T State University, United States</i>	
 <b>TH-UB.2A: PROPAGATION, SCATTERING AND SENSING II</b>	
<b>TH-UB.2A.3: SURFACE WAVE ATTENUATION IN SALISBURY SCREEN IN TM0 MODE</b>	<b>84</b>
<i>Varsha Mishra, Filippo Costa, Danilo Brizi, Agostino Monorchio, University of Pisa, Italy</i>	
<b>TH-UB.2A.8: STOCHASTIC LOSS IN DIELECTRIC SLAB WAVEGUIDES DUE TO EXPONENTIAL AND UNCORRELATED SURFACE ROUGHNESS</b>	<b>86</b>
<i>Brian Guiana, Ata Zadehgo, University of Idaho, United States</i>	
 <b>TH-UK.2A: MEDICAL APPLICATIONS OF ELECTROMAGNETICS</b>	
<b>TH-UK.2A.4: NON- INVASIVE CONTINUOUS BLOOD GLUCOSE MONITORING USING EM WAVES</b>	<b>88</b>
<i>Pratik Sawant, Jayanta Mukherjee, Indian Institute of Technology Bombay, India</i>	

## **TH-UK.1A: IMPLANTABLE AND INGESTIBLE DEVICES**

### **TH-UK.1A.2: POWER EFFICIENCY IMPROVEMENT USING METASURFACES IN A HYBRID WIRELESS POWER TRANSFER SYSTEM .....90**

*Sima Noghanian, CommScope Ruckus Wireless, United States; Reem Shadid, Applied Science Private University, Jordan; Sayan Roy, South Dakota Mines, United States; Satish Sharma, San Diego State University, United States*

### **TH-UK.1A.5: A POWER BUDGET ANALYSIS FOR AN IMPLANTABLE UWB TRANSCEIVER FOR BRAIN NEUROMODULATION APPLICATION .....92**

*Sakib Reza, Ifana Mahbub, University of North Texas, United States*

## **TH-UC.1P: EMERGING APPLICATIONS OF MACHINE LEARNING IN SENSING AND COMMUNICATION**

### **TH-UC.1P.1: DETECTING COHERENT SOURCES WITH DEEP LEARNING .....98**

*Jayakrishnan Vijayamohanan, Arjun Gupta, Christos Christodoulou, University of New Mexico, United States; Sotirios Goudos, Aristotle University of Thessaloniki, Greece*

### **TH-UC.1P.2: LOW-DISPERSION METASURFACES FOR WIDEBAND GRADIENT-INDEX (GRIN) MEDIA UP TO KA-BAND ..... 100**

*Jiahao Huang, Caitlin Covestone, Jonathan Chisum, University of Notre Dame, United States*

### **TH-UC.1P.5: ENERGY-SAVING ALGORITHM OF UAVS IN TASK OFFLOADING OF UAV-ASSISTED MOBILE EDGE COMPUTING ..... 102**

*Jingchuan Zhang, Jingpeng Gao, Fang Ye, Yibing Li, Harbin Engineering University, China*

## **TH-UB.1P: PROPAGATION, SCATTERING AND SENSING III**

### **TH-UB.1P.2: RADIO FREQUENCY INTERROGATION OF SENSORS IN METAL PIPES FOR STRUCTURAL HEALTH MONITORING .....94**

*Jagannath Devkota, Richard Pingree, National Energy Technology Laboratory, United States; David W. Greve, Carnegie Mellon University, United States*

### **TH-UB.1P.4: DESIGN OF A NOVEL MICROSTRIP FILTER USING PAIRED FAN-SHAPED CAPACITORS FOR HARMONIC SUPPRESSION .....96**

*Chenyi Wang, Xin Cao, Qiangming Cai, Yuyu Zhu, Southwest University of Science and Technology, China; Weiping Li, East China Jiaotong University, China*

## **FR-UC.1A: SOFTWARE DEFINED AND AGILE RADIO SYSTEMS**

### **FR-UC.1A.1: TELECOMMUNICATION TESTBED REPEATABILITY ASSESSMENT ..... 104**

*Jeanne Quimby, Alec Weiss, Jacob Rezac, Mary Gregg, Michael Frey, Jason Coder, Anna Otterstetter, National Institute of Standards and Technology, United States*

### **FR-UC.1A.4: LINK BUDGET CONSIDERATIONS FOR AUTOMOTIVE 5G LEO SATELLITE-BASED COMMUNICATIONS ..... 106**

*Ashish Kumar, Umair Tayyab, Matthias Hein, Technische Universität Ilmenau, Germany; Hans-Peter Petry, Deutsches Zentrum für Satellitenkommunikation, Germany*

### **FR-UC.1A.5: SPATIAL MULTIPLEXED WIRELESS COMMUNICATION BY E-BAND ROM ANTENNAS AND ROF ..... 108**

*Takashi Tomura, Jiro Hirokawa, Tokyo Institute of Technology, Japan; Muhsin Ali, Guillermo Carpintero, Universidad Carlos III de Madrid, Spain*



<b>FR-UC.1A.6: DISTRIBUTED ARRAYS IN MULTIPATH CHANNELS</b> .....	110
<i>Hassna Ouassal, Jonathan Chisum, University of Notre Dame, United States; Daniel Galanos, Alion Science &amp; Technology, United States; Charles Dietlein, NTIA, United States; William Diehl, U.S. Army DEVCOM Army Research Laboratory, United States</i>	
<b>FR-UC.1A.9: 5G SMALL CELL AND OPEN RAN:DESIGN PARAMETER PERSPECTIVES AND ANALYSIS FOR INDOOR COVERAGE</b> .....	112
<i>Ali Ahmed, Dr. Akram Aburas, Dr. Khalid Al-Mashouq, Eng.Atef A.Aburas, ACES (Advanced communication &amp; Electronics System Co.,LTD), Saudi Arabia</i>	
<b>FR-UC.1A.10: OPTIMAL APERTURE AND PATH DESIGN FOR PASSIVE UAV SAR SYSTEM WITH GEOSYNCHRONOUS ILLUMINATOR</b> .....	114
<i>Zhichao Sun, Hang Ren, Jianyu Yang, Junjie Wu, University of Electronic Science and Technology of China, China</i>	
 <b>FR-A3.2A: TECHNIQUES FOR TRANSIENT SIMULATIONS</b>	
<b>FR-A3.2A.8: DESIGN AND PARTICLE-IN-CELL MODELING OF SOLID-STATE TRAVELLING WAVE AMPLIFIER AT 330 GHZ</b> .....	116
<i>Michail Anastasiadis, John Volakis, Shubhendu Bhardwaj, FIU, United States</i>	
 <b>FR-UC.1P: PARAMETER ESTIMATION AND DETECTION</b>	
<b>FR-UC.1P.1: AN ENHANCED GPR FWI SCHEME WITH LOW-FREQUENCY DATA EXTRAPOLATED BY PROGRESSIVE TRANSFER LEARNING</b> .....	120
<i>Yuchen Jin, Yuan Zi, Xuqing Wu, Jiefu Chen, University of Houston, United States</i>	
<b>FR-UC.1P.3: SLICE-CONNECTION CLUSTERING ALGORITHM FOR TREE ROOTS RECOGNITION IN NOISY 3D GPR DATA</b> .....	122
<i>Wenhao Luo, Yee Hui Lee, Nanyang Technological University, Singapore; Lai Fern Ow, Mohamed Lokman Mohd Yusof, Abdulkadir C. Yucel, National Parks Board, Singapore, Singapore</i>	
<b>FR-UC.1P.5: TWO-DIMENSIONAL DIRECTION OF ARRIVAL ESTIMATION BASED ON NESTED CIRCULAR ARRAY</b> .....	124
<i>Bin Cao, Marine Design Research Institute of China, China; Cong Xiong, Tao Jiang, Harbin Engineering University, China; Linshu Gong, Shanghai Electro-Mechanical Engineering Institute, China</i>	
<b>FR-UC.1P.8: FAST ANGLE OF ARRIVAL ESTIMATION ON ROTATING PLATFORMS THROUGH MACHINE LEARNING</b> .....	126
<i>John Willis, Satheesh Venkatakrishnan, John Volakis, Florida International University, United States</i>	
<b>FR-UC.1P.10: FRAME-BASED REAL-TIME SAR IMAGING WITH SQUINT COMPENSATION</b> .....	128
<i>Md Anowar Hossain, Mobien Shoaib, Muhammad Abdul Hadi, Raza Umar, Khalid Jamil, Salaheldin Salem, Prince Sultan Defense Studies and Research Center, Saudi Arabia; Adriano Meta, MetaSensing BV, Saudi Arabia</i>	
 <b>FR-UB.1P: NUMERICAL ANALYSIS OF DEVICES II</b>	
<b>FR-UB.1P.5: COMPARATIVE ANALYSIS OF LIQUID-CRYSTAL DRIVING BETWEEN THE GROUNDED-COPLANAR WAVEGUIDE AND THE FLOATING-ELECTRODE-FREE COPLANAR WAVEGUIDE IN LIQUID-CRYSTAL PHASE SHIFTERS</b> .....	118
<i>Jun-Seok Ma, Jin-Young Choi, Hyun-Ji Shin, Wook-Sung Kim, POSTECH, Korea (South)</i>	