

# **2016 International Workshop on Antenna Technology (iWAT 2016)**

**Cocoa Beach, Florida, USA  
29 February – 2 March 2016**



**IEEE Catalog Number: CFP16ATS-POD  
ISBN: 978-1-5090-0268-9**

**Copyright © 2016 by the Institute of Electrical and Electronic Engineers, Inc  
All Rights Reserved**

*Copyright and Reprint Permissions:* Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

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

IEEE Catalog Number:	CFP16ATS-POD
ISBN (Print-On-Demand):	978-1-5090-0268-9
ISBN (Online):	978-1-5090-0267-2

**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

# Technical Papers

---

## M2: Technical Interactive Session

<b>A Compact Pattern Reconfigurable Antenna Utilizing Multiple Monopoles</b> .....	1
<i>Jerzy Kowalewski (Karlsruhe Institute of Technology)</i> <i>Jonathan Mayer (Karlsruhe Institute of Technology)</i> <i>Tobias Mahler (Karlsruhe Institute of Technology)</i> <i>Thomas Zwick (Karlsruhe Institute of Technology)</i>	
<b>A Microfluidically Switched Feed Network for Beam-Scanning Focal Plane Arrays</b> .....	5
<i>Enrique González (University of South Florida)</i> <i>Gokhan Mumcu (University of South Florida)</i>	
<b>A Multi-Material 3D Printing Approach for Conformal Microwave Antennas</b> .....	7
<i>D. Hawatmeh (University of South Florida)</i> <i>E. Rojas-Nastrucci (University of South Florida)</i> <i>T. Weller (University of South Florida)</i>	
<b>Studies on a Fabric Feed Line Sewn to a Flexible Slot Antenna</b> .....	11
<i>Kazuhiro Fujiwara (Kyoto Institute of Technology)</i> <i>Hitoshi Shimasaki (Kyoto Institute of Technology)</i> <i>Kazunari Morimoto (Kyoto Institute of Technology)</i>	
<b>Reconfigurable Double Slot-Ring Antenna for Bandwidth Enhancement</b> .....	15
<i>Mahmoud Shirazi (University of Central Florida)</i> <i>Tianjiao Li (University of Central Florida)</i> <i>Xun Gong (University of Central Florida)</i>	
<b>S-Band Continuously-Tunable Slot-Ring Antennas for Reconfigurable Antenna Array Applications</b> .....	18
<i>Tianjiao Li (University of Central Florida)</i> <i>Mahmoud Shirazi (University of Central Florida)</i> <i>Xun Gong (University of Central Florida)</i>	
<b>Tunable Band Rejection in a Tightly-Coupled Array using Varactor Diodes</b> .....	20
<i>Dimitris K. Papantonis (The Ohio State University)</i> <i>Ersin Yetisir (The Ohio State University)</i> <i>Nima Ghalichechian (The Ohio State University)</i> <i>John L. Volakis (The Ohio State University)</i>	
<b>A Compact LTE Antenna Design for Mobile Device with Full Metal Housing</b> .....	23
<i>Peng Chen (Shanghai University)</i> <i>Ping Wang (Shanghai University)</i> <i>Yumei Yu (Shanghai University)</i> <i>Guangli Yang (Shanghai University)</i>	

<b>Dual-Band Leaky-Wave Antenna based on a Dual-Layer Frequency Selective Surface for Bi-Directional Satcom-on-the-Move in Ka-Band</b> .....	25
<i>Alexander Krauss (Technische Universität Ilmenau)</i>	
<i>Hendrik Bayer (Technische Universität Ilmenau)</i>	
<i>Ralf Stephan (Technische Universität Ilmenau)</i>	
<i>Matthias A. Hein (Ilmenau University of Technology)</i>	
<b>Radiation Efficiency Optimization of Electrically Small Antennas: Application to 3D Folded Dipole</b> .....	29
<i>F. Sarrazin (CEA-Léti)</i>	
<i>S. Pflaum (CEA-Léti)</i>	
<i>C. Delaveaud (CEA-Léti)</i>	
<b>Microwave Doppler Tomography of High Impedance Ground Planes for Aerospace Applications</b> .....	33
<i>Kelvin J. Nicholson (Defence Science and Technology Group)</i>	
<i>Thomas Baum (RMIT University)</i>	
<i>Kamran Ghorbani (RMIT University)</i>	
<i>Richard W. Ziolkowski (University of Arizona)</i>	
<b>Suspended 60 GHz Phased Array Antenna with High Efficiency</b> .....	37
<i>Kaveh Keshtkaran (The Ohio State University)</i>	
<i>Nima Ghalichechian (The Ohio State University)</i>	
<b>Highly Integrated VO<sub>2</sub>-Based Antenna for Frequency Tunability at Millimeter-Wave Frequencies</b> .....	40
<i>L. Huitema (University of Limoges)</i>	
<i>A. Crunteanu (University of Limoges)</i>	
<i>H. Wong (City University of Hong Kong)</i>	
<b>BST Thin Film Capacitors Integrated within a Frequency Tunable Antenna</b> .....	44
<i>M. Rammal (University of Limoges)</i>	
<i>L. Huitema (University of Limoges)</i>	
<i>A. Crunteanu (University of Limoges)</i>	
<i>D. Passerieux (University of Limoges)</i>	
<i>D. Cros (University of Limoges)</i>	
<i>T. Monediere (University of Limoges)</i>	
<i>V. Madrangeas (University of Limoges)</i>	
<i>P. Dutheil (University of Limoges)</i>	
<i>C. Champeaux (University of Limoges)</i>	
<i>F. Dumas-Bouchiat (University of Limoges)</i>	
<i>P. Marchet (University of Limoges)</i>	
<i>L. Nedelcu (National Institute for Material Physics)</i>	
<i>L. Trupina (National Institute for Material Physics)</i>	
<i>G. Banciu (National Institute of Materials Physics)</i>	
<i>M. Cernea (National Institute for Material Physics)</i>	
<b>Permittivity and Dielectric Loss Measurement of Paraffin Films for mmW and THz Applications</b> .....	48
<i>Behnam Ghassemiparvin (The Ohio State University)</i>	
<i>Nima Ghalichechian (The Ohio State University)</i>	
<b>M3: Small Antennas for Portable Devices</b>	
<b>Multiband Film Antenna Comprising Offset Fed Dipole Elements using Inkjet Printer for M2M Applications</b> .....	51
<i>Makoto Sumi (NTT DOCOMO, Inc.)</i>	
<i>Yasunori Suzuki (NTT DOCOMO, Inc.)</i>	

## M4: Antennas for 5G and mmW

<b>3D Printing Technology: Enabling Innovative and Cost Effective Industrial Antenna Solution</b> .....	55
<i>Frédéric Giancesello (STMicroelectronics)</i>	
<i>Aimeric Bisognin (STMicroelectronics &amp; University Nice Sophia-Antipolis)</i>	
<i>Diane Titz (University Nice Sophia-Antipolis)</i>	
<i>Cyril Luxey (University Nice Sophia-Antipolis)</i>	
<i>Carlos A. Fernandes (Instituto de Telecomunicacoes)</i>	
<i>Jorge R. Costa (Instituto Universitário de Lisboa)</i>	
<i>Daniel Gloria (STMicroelectronics)</i>	

<b>A Cavity-Backed Angled-Dipole Antenna Array for Low Millimeter-Wave Bands</b> .....	57
<i>Son Xuat Ta (Ajou University)</i>	
<i>Ikmo Park (Ajou University)</i>	

## T2: Technical Interactive Session

<b>New Advances in Gain Measurements in Non-Anechoic Sites: Application to Narrow Band Monopoles</b> .....	60
<i>Razvan D. Tamas (Constanta Maritime University)</i>	

<b>Radiation Efficiency Measurement of a Balanced Miniature IFA-Inspired Circular Antenna using a Differential Wheeler Cap Setup</b> .....	64
<i>F. Sarrazin (CEA-Léti)</i>	
<i>S. Pflaum (CEA-Léti)</i>	
<i>C. Delaveaud (CEA-Léti)</i>	

<b>Effect of Human Body Shadowing on UWB Radio Channel</b> .....	68
<i>Eriko Sasaki (University of Kitakyusyu)</i>	
<i>Hidenobu Hanaki (TOKAI RIKA Co., Ltd.)</i>	
<i>Hiroaki Iwashita (TOKAI RIKA Co., Ltd.)</i>	
<i>Kazuki Naiki (TOKAI RIKA Co., Ltd.)</i>	
<i>Akihiro Kajiwara (University of Kitakyushu)</i>	

<b>Characteristics of Electric Antennas Aboard Scientific Spacecraft</b> .....	71
<i>Tomohiko Imachi (Kanazawa University)</i>	
<i>Koudai Kita (Kanazawa University)</i>	
<i>Mistunori Ozaki (Kanazawa University)</i>	
<i>Ryoichi Higashi (Ishikawa National Institute of Technology)</i>	
<i>Satoshi Yagitani (Kanazawa University)</i>	

<b>Parametric Study of the Effect of Annular Slot on the Operating Frequency of Solid Cone Antenna</b> .....	73
<i>O. Agunlejika (Loughborough University)</i>	
<i>J.A. Flint (Loughborough University)</i>	
<i>R.D. Seager (Loughborough University)</i>	

<b>Compact Line Source Generator for Low Profile Continuous Transverse Stub Array Antenna</b> .....	77
<i>Pengfei Zhang (Xidian University)</i>	
<i>Raj Mittra (University of Central Florida)</i>	
<i>Shuxi Gong (Xidian University)</i>	

<b>A Miniturized, Circularly Polarized Log Periodic Dipole Array</b> .....	80
<i>Joshua Haney (Georgia Southern University)</i>	
<i>Sungkyun Lim (Georgia Southern University)</i>	

<b>Broadband Hybrid Water Antenna for ISM-Band Ingestible Capsule Endoscope Systems</b> .....	82
<i>Yunnan Jin (Hanyang University)</i>	
<i>Jinpil Tak (Hanyang University)</i>	
<i>Jaehoon Choi (Hanyang University)</i>	
<b>Multi-Layer Substrate Loaded 10:1 (900MHz-9GHz) Ultrawideband Tightly Coupled Antenna Array</b> .....	N/A
<i>Hao Huang (National University of Defense and Technology)</i>	
<i>Ke Xiao (National University of Defense and Technology)</i>	
<i>Shengshui Wang (National University of Defense and Technology)</i>	
<i>Shunlian Chai (National University of Defense and Technology)</i>	
<b>Misalignment Sensitivity and Human Body Effects on Wearable Conformal SCMR System</b> .....	89
<i>Pablo J. Gonzalez (Florida International University)</i>	
<i>Karina A. Quintana (Florida International University)</i>	
<i>Stavros V. Georgakopoulos (Florida International University)</i>	
<b>On the Bandwidth of Convex Conformal Reflectarray Antennas</b> .....	92
<i>Michele Beccaria (Politecnico di Torino)</i>	
<i>Paola Pirinoli (Politecnico di Torino)</i>	
<i>Mario Orefice (Politecnico di Torino)</i>	
<b>An Electrically Small Loop Antenna with Usefully Isotropic Radiation and Common Mode Feed</b> .....	95
<i>Francis E. Parsche (Harris Corporation)</i>	
<b>Technique for Realizing Specific Radiation Patterns of Antennas Operating in Mobile Phones and Topside Environments</b> .....	99
<i>Chao Li (University of Central Florida)</i>	
<i>Raj Mittra (University of Central Florida)</i>	
<b>UWB Radar for Indoor Detection and Ranging of Moving Objects: An Experimental Study</b> .....	102
<i>Wahab Khawaja (Florida International University)</i>	
<i>Kory Sasaoka (Florida International University)</i>	
<i>Ismail Güvenç (Florida International University)</i>	
<b>A 2.45 GHz Novel Electrically Small Planar Dipole Antenna</b> .....	106
<i>Mina Wahib (Royal Military College of Canada)</i>	
<i>Sebastien Clauzier (Royal Military College of Canada)</i>	
<i>Said Mikki (Royal Military College of Canada)</i>	
<i>Yahia Antar (Royal Military College of Canada)</i>	
<b>An Omni-Directional Electrically Small Helical Antenna with High Radiation Efficiency</b> .....	110
<i>Lidong Huang (University of Electronic Science and Technology of China)</i>	
<i>Jiang Xiong (University of Electronic Science and Technology of China)</i>	
<i>Bing-Zhong Wang (University of Electronic Science and Technology of China)</i>	
<b>Performance Improvement of Stepped Frequency UWB Sensor for Frequency Interference</b> .....	113
<i>Shizuka Kuboyama (University of Kitakyushu)</i>	
<i>Nobuyasu Keya (University of Kitakyushu)</i>	
<i>Akihiro Kajiwara (University of Kitakyushu)</i>	
<b>Deployable Small Satellite Antenna: Quadrifilar Helical Antenna</b> .....	116
<i>Greg O'Neill (Helical Communication Technologies)</i>	

<b>A Combination of Alamouti Code and Beamforming Technologies via Dual-Polarized Antenna Array Systems</b> .....	119
<i>Xin Su (Hohai University)</i>	
<i>Xiaofeng Liu (Hohai University)</i>	
<i>Xiaochun Lu (Hohai University)</i>	
<i>Chengming Luo (Hohai University)</i>	

### **T3: Materials and 3D Printing for Antennas**

<b>Multi-Material Additive Manufacturing of Antennas</b> .....	123
<i>Mark S. Mirotznik (University of Delaware)</i>	
<i>Zachary Larimore (University of Delaware)</i>	
<i>Peter Pa (University of Delaware)</i>	
<i>Paul Parsons (University of Delaware)</i>	
<i>Matt Mills (University of Delaware)</i>	

### **T4: Wearable and Implanted Antennas**

<b>A Printed UWB Antenna with Full Ground Plane for WBAN Applications</b> .....	127
<i>Roy B.V.B. Simorangkir (Macquarie University)</i>	
<i>Syed Muzahir Abbas (Macquarie University)</i>	
<i>Karu P. Esselle (Macquarie University)</i>	

<b>Electrically-Small Wearable Antennas for Emergency Services Applications</b> .....	131
<i>Mario Orefice (Politecnico di Torino)</i>	
<i>Paola Pirinoli (Politecnico di Torino)</i>	
<i>Gianluca Dassano (Politecnico di Torino)</i>	

<b>Metal-Based Materials for the Development of Implanted Bio-Devices</b> .....	135
<i>Ildiko Peter (Politecnico di Torino)</i>	
<i>Ladislau Matekovits (Politecnico di Torino)</i>	
<i>Karu P. Esselle (Macquarie University)</i>	

### **W1: Metamaterials and Metamaterial-based Antennas**

<b>Metamaterial Magneto Inductive Lens for Magnetic Resonance Imaging</b> .....	138
<i>Siew Bee Yeap (Institute for Infocomm Research)</i>	
<i>Xianming Qing (Institute for Infocomm Research)</i>	
<i>Zhi Ning Chen (Institute for Infocomm Research &amp; National University of Singapore)</i>	

<b>Linearly and Circularly Polarized Radiation from Metaline Antennas</b> .....	142
<i>Hisamatsu Nakano (Hosei University)</i>	
<i>Kazutoshi Sakata (Hosei University)</i>	
<i>Junji Yamauchi (Hosei University)</i>	

<b>Multi-Functional Composite Metamaterial-Inspired EEAD Antenna for Structural Applications</b> .....	144
<i>Thomas C. Baum (RMIT University)</i>	
<i>Kelvin J. Nicholson (Defence Science and Technology Group)</i>	
<i>Amir Galehdar (Defence Science and Technology Group)</i>	
<i>Kamran Ghorbani (RMIT University)</i>	
<i>Richard W. Ziolkowski (University of Arizona)</i>	

## W2: Technical Interactive Session

<b>Small Microfluidically Tunable Top Loaded Monopole</b> .....	148
<i>Abhishek Dey (University of South Florida)</i> <i>Gokhan Mumcu (University of South Florida)</i>	
<b>Design of Polarization Reconfigurable Microstrip Antenna with Frequency Tuning</b> .....	150
<i>A. Bharathi (Osmania University)</i> <i>Lakshminarayana Merugu (Kshatriya College of Engineering)</i> <i>P.V.D. Somasekhar Rao (JNTU Hyderabad)</i>	
<b>Frequency-Reconfigurable Single-Layer Design of Microstrip Patch Electrically-Steerable Parasitic Array Radiator (ESPAR)</b> .....	154
<i>Wei Ouyang (University of Central Florida)</i> <i>Xun Gong (University of Central Florida)</i>	
<b>Radio-Frequency Power Distribution Measurement System using Thin Metamaterial Absorber</b> .....	157
<i>Ryohei Hayashi (Kanazawa University)</i> <i>Ryohei Kanaura (Kanazawa University)</i> <i>Satoshi Yagitani (Kanazawa University)</i> <i>Tomohiko Imachi (Kanazawa University)</i> <i>Mitsunori Ozaki (Kanazawa University)</i> <i>Yoshiyuki Yoshimura (Industrial Research Institute of Ishikawa)</i> <i>Hirokazu Sugiura (Industrial Research Institute of Ishikawa)</i>	
<b>Array Antenna with High Isolation based on EBG Structures for ETC Applications</b> .....	161
<i>Ying Liu (Xidian University)</i> <i>Bo Shen (Xidian University)</i> <i>Yunxue Xv (Xidian University)</i> <i>Ho-Jun Lee (Korea Electronics Technology Institute)</i> <i>Se-Hwan Choi (Korea Electronics Technology Institute)</i>	
<b>Logo Antenna for 5.8 GHz Wireless Communications</b> .....	165
<i>Kasper L�uthje J�rgensen (Technical University of Denmark)</i> <i>Kaj Bjarne Jakobsen (Technical University of Denmark)</i>	
<b>Condition Number Variability of Ultra Wideband MIMO on Body Channels</b> .....	167
<i>Qammer H. Abbasi (Texas A&amp;M University at Qatar)</i> <i>Hassan El Sallabi (Texas A&amp;M University at Qatar)</i> <i>Erchin Serpedin (Texas A&amp;M University)</i> <i>Khalid Qaraqe (Texas A&amp;M University at Qatar)</i> <i>Akram Alomainy (Queen Mary University of London)</i>	
<b>Electromagnetic Fields at the Surface of Human-Body Cylinders</b> .....	170
<i>Nikolaj P.B. Kammersgaard (Technical University of Denmark)</i> <i>S�ren H. Kvist (GN ReSound A/S)</i> <i>Jesper Thaysen (GN ReSound A/S)</i> <i>Kaj B. Jakobsen (Technical University of Denmark)</i>	
<b>A Low Profile Penta-Band Antenna for Portable Devices</b> .....	174
<i>Usama Shameem (University of Bedfordshire)</i> <i>Masood Ur-Rehman (University of Bedfordshire)</i> <i>Qammer Hussain Abbasi (Texas A&amp;M University at Qatar)</i> <i>Khalid Qaraqe (Texas A&amp;M University at Qatar)</i>	
<b>Millimeter-Wave Automotive Radar with PLL-Generated Ramps Modelling by using SystemVue and MATLAB</b> .....	178
<i>Libo Huang (Tongji University)</i> <i>Jie Bai (Tongji University)</i> <i>Huanlei Chen ()</i>	



<b>Multiple-Input Multiple-Output Dynamic Charging using Multiple Parallel Line Feeders</b> .....	182
<i>William-Fabrice Brou (Nara Institute of Science and Technology)</i>	
<i>Duong Quang Thang (Nara Institute of Science and Technology)</i>	
<i>Minoru Okada (Nara Institute of Science and Technology)</i>	

<b>Dielectric-Loaded End-Fire Slot Antenna with Low Back-Lobe Radiation for UHF RFID Applications</b> .....	186
<i>Ramiro A. Ramirez (University of South Florida)</i>	
<i>Thomas M. Weller (University of South Florida)</i>	

<b>Home Security Monitoring based Stepped-FM UWB</b> .....	189
<i>Yuta Jitsui (The University of Kitakyushu)</i>	
<i>Akihiro Kajiwara (The University of Kitakyushu)</i>	

<b>DOA Estimation of Signals with Frequency Characteristics and Different Powers using a Compressed Sensing Technique</b> .....	192
<i>Taiki Endo (Hokkaido University)</i>	
<i>Toshihiko Nishimura (Hokkaido University)</i>	
<i>Yasutaka Ogawa (Hokkaido University)</i>	
<i>Takeo Ohgane (Hokkaido University)</i>	

<b>Concept of Substrate Integrated E-Plane Waveguide and Waveguide Filter</b> .....	196
<i>Danyang Huang (Minnesota State University, Mankato)</i>	
<i>Xuan Hui Wu (Minnesota State University, Mankato)</i>	
<i>Qun Zhang (Minnesota State University, Mankato)</i>	

### **W3: Wireless Power Transmission, Charging, and Harvesting**

<b>Large Area Wireless Power via a Planar Array of Coupled Resonators</b> .....	200
<i>Xingyi Shi (University of Washington)</i>	
<i>Joshua R. Smith (University of Washington)</i>	

### **W4: Beamsteering and Multibeam Antennas/Arrays**

<b>High Data Rate Multi-Path Transmit/Receive System with On-Site Coding</b> .....	204
<i>Elias A. Alwan (The Ohio State University)</i>	
<i>Dimitrios Sifarakas (The Ohio State University)</i>	
<i>John L. Volakis (The Ohio State University)</i>	

<b>Optically Addressed Ultra-Wideband Connected Array Antenna</b> .....	207
<i>Dylan D. Ross (University of Delaware)</i>	
<i>Matthew R. Konkol (University of Delaware)</i>	
<i>Shouyuan Shi (University of Delaware)</i>	
<i>Dennis W. Prather (University of Delaware)</i>	