

---

**ELECTROMAGNETIC WAVES**  
**PIERC 118**

---

Progress

In

Electromagnetics

Research C

© 2022 EMW Publishing. All rights reserved.

No part of this publication may be reproduced. Request for permission should be addressed to the Publisher.

All inquiries regarding copyrighted material from this publication, manuscript submission instructions, and subscription orders and price information should be directed to: EMW Publishing, P. O. Box 425517, Kendall Square, Cambridge, Massachusetts 02142, USA.

---

**ELECTROMAGNETIC WAVES**  
**PIERC 118**

---

**Progress**  
**In**  
**Electromagnetics**  
**Research C**

Chief Editors: Weng Cho Chew and Sailing He

EMW Publishing  
Cambridge, Massachusetts, USA



## CONTENTS

<b>A Novel Surface Wave Diplexer Based on Tensor Impedance Surfaces</b> Mojtaba Mighani .....	1
<b>Defected Star-Shaped Microstrip Patch Antenna for Broadband Applications</b> Mahesh S. Pandey and Virendra S. Chaudhary .....	11
<b>Wide-Band Frequency Tunable Antenna for 4G, 5G/Sub 6 GHz Portable Devices and MIMO Applications</b> Shivleela Mudda, Gayathri KM, and Mudda Mallikarjun .....	25
<b>Ultra-Wideband Reflectarray Antenna Using Two Layers Square-Loop Frequency Selective Surfaces</b> Ali Mohammad and Ali Hassan .....	43
<b>Analysis of UUV Whip Antenna Radiated Power and Optimal Working Frequency in Seawater Environment</b> Menglei Xiu, Lihua Li, Shimin Feng, Wenda Hou, and Longfei Wang .....	61
<b>Compact Ultrawideband Monopole Antenna with Continuously Tunable Notch Band Characteristics</b> Nooshin Moradi, Farid Nazari, Hadi Aliakbarian, and Farhad Azadi Namin .....	71
<b>High Gain Array Antenna Using Electromagnetic Band Gap Structures for 5G Applications</b> Sanae Dellaoui, Abdelmoumen Kaabal, Mustapha El Halaoui, Adel Asselman, Saida Ahyoud, and Loubna Rmili .....	83
<b>Dual Band Compact Square Microstrip Antenna for GSM and GPS Applications</b> Aarti G. Ambekar and Amit A. Deshmukh .....	99
<b>A New Tunable Dual-Mode Dual-Band Square Cavity SIW Bandpass Filter</b> Mohammed F. Abbas and Ali J. Salim .....	113
<b>Design and Fabrication of COVID-19 Microstrip Patch Antenna for Wireless Applications</b> Jihan S. Abdaljabar, Mervat Madi, Asaad Alhindawi, and Karim Kabalan .....	125
<b>Strategies for Selecting Common Elements Excitations to Configure Multiple Array Patterns</b> Duaa Alys Karim and Jafar Ramadhan Mohammed .....	135
<b>Vernier Effect Based Temperature Sensor Revealed Ultra-Sensitivity with High-Detection Resolution</b> Lashari G. Abbas, Farhan Mumtaz, Yutang Dai, Rashda Parveen, and Muhammad A. Ashraf ..	147

<b>Design and Analysis of a Versatile Undesired Radiation Suppression Scheme in the Domain of Collaborative Beamforming</b>	
Robert Macharia, Kibet Langat, and Peter Kihato .....	159
<b>A Circular Sector with an Inverted L Shaped Monopole Antenna for Tri-Band Applications</b>	
Alka Khade, Mahadu Trimukhe, Shishir Jagtap, and Rajiv K. Gupta .....	177
<b>Design of Hemispherical Patch Antenna with Conformally Spaced Log-Periodic Elements for Multi-Directional and Multi-Band Operation</b>	
Venkatesh Nuthan Prasad, Eshwar Dhanush Gowda, Krishnappa Indira, Ananya Kodukula, and Diksha Arora .....	187
<b>A New Broadband Antenna of High Gain: The Double-Cornu Spiral Antenna</b>	
Paul Tcheg, Matthias Möck, and David Pouhè .....	199
<b>Frequency Tunable Filtenna Using Defected Ground Structure Filter in the Sub-6 GHz for Cognitive Radio Applications</b>	
Aicha Bembarka, Larbi Setti, Abdelwahed Tribak, Hamza Nachouane, and Hafid Tizyi .....	213
<b>Wide-Band Directional Cavity Antenna with Low Scanning Loss for WLAN</b>	
Somanatha Pai Swapna, Gulur Sadananda Karthikeya, Shiban Kishen Koul, and Ananjan Basu .	231
<b>Compact MIMO Antenna Designs Based on Hybrid Fractal Geometry for 5G Smartphone Applications</b>	
Muhammad Y. Muhsin, Ali J. Salim, and Jawad K. Ali .....	247
<b>Miniaturized Quad-Port UWB-MIMO Antenna with Band-Notched Characteristics at 5 GHz</b>	
Qasim H. Kareem and Malik J. Farhan .....	263