

# Dual-band Impedance Matching Network with Transmission Zeros Using Resonators

Phirun Kim<sup>1</sup>, Girdhari Chaudhary<sup>1</sup>, Yongchae Jeong<sup>1</sup>, and Jongsik Lim<sup>2</sup>

<sup>1</sup>Chonbuk National University, Republic of Korea

<sup>2</sup>Soonchunhyang University, Republic of Korea

**Abstract**— Various wireless communication standards such as wireless local area networks (WLAN), wideband code division multiple access (WCDMA), Long term evolution (LTE) etc. have been developed throughout the world and apparently more standards are to emerge in the near future. The integration of separate standards into one unit increases the size, cost and complexity of systems. For this purpose, the design of matching networks for the multi-band components such as power amplifiers is essential. The multi-band impedance matching networks are the basic design issues in the multi-band RF circuits and systems. The conventional dual-band matching network mainly pays attention to match between two consecutive circuits at just two operating frequencies and rarely consider the out-of-band suppression characteristics. In this paper, the dual-band impedance matching network with the out-of-band suppression with transmission zeros is proposed (Figs. 1 and 2). The proposed network can match two frequencies simultaneously and suppress the out-of-band unwanted signals which can also ease the filtering burden of the RF front-end. Two steps are required to realize the proposed dual-band matching network. First, two T-type single band matching networks are designed at each operating frequency. Secondly, two single band matching networks are converted into the dual-band matching network by the compliance of reactance and susceptance at the single band matching network (Fig. 1). For experimental validation of proposed structure, the dual-band matching network for extracted the source and load impedances (Table 1) of the power amplifier operating at two center frequencies of 881 MHz and 2.14 GHz is designed and measured. From experiment, it found that, the measured results have good agreement with the extracted impedance matching points (Figs. 3 and 4).

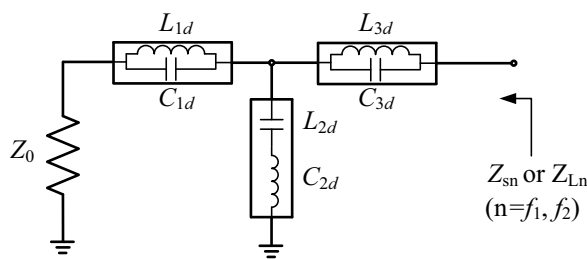


Figure 1.

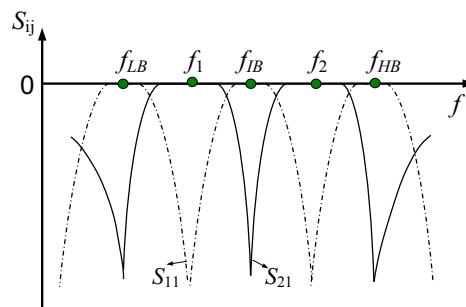


Figure 2.

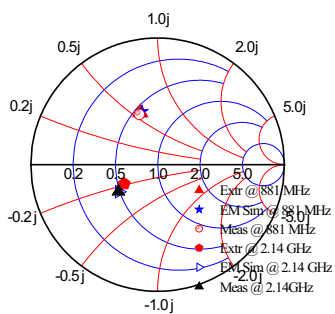


Figure 3.

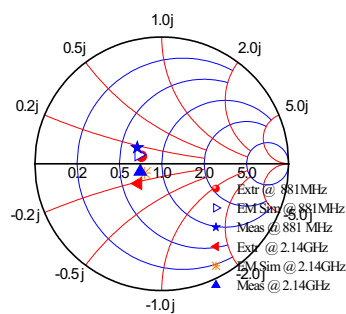


Figure 4.

|                  | Items                       | $f_1 = 881 \text{ MHz}$ | $f_2 = 2.14 \text{ GHz}$ |
|------------------|-----------------------------|-------------------------|--------------------------|
| Source impedance | Extracted impedance         | 27.829+j28.168          | 23.391-j9.4287           |
|                  | Dual-Band M/N EM simulation | 28.2+j29.125            | 24.69-j12.305            |
|                  | Measurement                 | 28.052+j27.081          | 24.515-j12.174           |
| Load impedance   | Extracted impedance         | 36.08+j4.41             | 39.859-j6.783            |
|                  | Dual-Band M/N EM simulation | 34.13+j5.12             | 37.88-j5.62              |
|                  | Measurement                 | 32.9+j8.88              | 35.344-j4.61             |

Table 1.

# PIERS 2013 Stockholm

---

Progress In Electromagnetics Research Symposium

---

## Program

---

August 12 - 15, 2013  
Stockholm, SWEDEN

---

[www.emacademy.org](http://www.emacademy.org)  
[www.piers.org](http://www.piers.org)

- 08:40 Implementation of Substrate Integrated Waveguide (SIW) by Inkjet-printing on Paper Substrate  
*Riccardo Moro (University of Pavia, Italy); Sangkil Kim (Georgia Institute of Technology, USA); Maurizio Bozzi (University of Pavia, Italy); Manos M. Tentzeris (Georgia Institute of Technology, USA);*
- 09:00 On the Influence of Edge Roughness in High-speed RFID Antenna Manufacturing Processes  
*Jinlan Gao (Mid-Sweden University, Sweden); Johan Siden (Mid-Sweden University, Sweden); Hans-Erik Nilsson (Mid-Sweden University, Sweden);*
- 09:20 Design of Sierpinski Grid Patch Antenna for Multi-band Application  
*Rajeev Kumar Kanth (University of Turku, Finland); Pasi Liljeberg (University of Turku, Finland); Hannu Tenhunen (Royal Institute of Technology (KTH), Sweden); Yasar Amin (Royal Institute of Technology (KTH), Sweden); Qiang Chen (Royal Institute of Technology (KTH), Sweden); Axel Janstch (Royal Institute of Technology (KTH), Sweden); Li-Rong Zheng (Royal Institute of Technology (KTH), Sweden); Harish Kumar (SLIET, India);*
- 09:40 A Battery Free RFID Sensor for Quality Detection of Food Products  
*Dat-Son Nguyen (Vietnam National University, Vietnam); Gia-Tam Phan (Vietnam National University, Vietnam); Tien-Thong Pham (Vietnam National University, Vietnam); Nguyen-Ngan Le (Vietnam National University, Vietnam); Mau-Chien Dang (Vietnam National University, Vietnam); Smail Tedjni (Grenoble Institute of Technology (Grenoble-INP), France);*
- 10:00 **Coffee Break**
- 10:40 Symmetrical T-stubs Coupled Miniature Square Open-loop Dual-band Bandpass Filter for C- and X-band Applications  
*Ram Krishna Maharjan (Kwangwoon University, South Korea); Nam-Young Kim (Kwangwoon University, Republic of Korea);*
- 11:00 2.4-GHz CMOS Direct Conversion Receiver Using Standard-cell Deep N-well BJT  
*Wei-Ling Chang (National Chiao Tung University, Taiwan); Chinchun Meng (National Chiao Tung University, Taiwan, R.O.C.); Jin-Siang Syu (National Chiao Tung University, Taiwan, R.O.C.); Chia-Ling Wang (National Chiao Tung University, Taiwan); Guo-Wei Huang (National Nano Device Laboratories, Taiwan);*
- 11:20 Theoretical Study of the Coupling Factor of Open-ended Coupled Transmission Lines at First Resonant Frequencies under Quasi-TEM Propagation  
*Enrique Bronchalo (Universidad Miguel Hernández de Elche, Spain); Miguel Ángel Sanchez-Soriano (Universite Bretagne Occidentale, France); German Torregrosa-Penalva (Universidad Miguel Hernández de Elche, Spain); Angela Coves Soler (Universidad Miguel Hernandez, Spain);*
- 11:40 A V-band Low Noise Amplifier with 18.1 dB Gain and 6.3 dB NF in 90-nm CMOS Process Technology  
*Chiu-Hsiang Hsu (National Chung Hsing University, Taiwan); Yen-Chung Chiang (National Chung-Hsing University, Taiwan);*
- 12:00 The Band-pass SIW-filter Based on L-ridged Rectangular Waveguide  
*Viacheslav V. Zemlyakov (Southern Federal University, Russia);*

---

**Session 2A\_11b**

**SC4: Circuit Modelling in Microwave Devices**

---

**Tuesday AM, August 13, 2013**

**Room K**

Organized by Reuven Shavit

Chaired by Enrique Bronchalo

---

- 10:20 A Microstrip-fed Printed Slot Antenna for 3G/Bluetooth/WiMAX and UWB Applications with 3.6 GHz Band Rejection  
*Mohamed Mamdouh Mahmoud Ali (Assiut University, Egypt); Ayman Ayd Ramadan Saad (South Valley University, Egypt); Elsayed Esam M. Khaled (Assiut University, Egypt);*

---

**Session 2A\_K**

**Poster Session 3**

---

**Tuesday AM, August 13, 2013**

**9:00 AM - 12:00 AM**

**Room P**

---

- 1 Benefits of Using Wireless Sensor Networks to Predict Plagues in Vineyards  
*Inigo Cuinas (University of Vigo, Spain); Sergio Cervera (University of Vigo, Spain); Jose Antonio Gay-Fernandez (University of Vigo, Spain);*
- 2 Electro-responsive and Dielectric Characteristics of Graphene Oxide Based Composites  
*Wen Ling Zhang (Inha University, Korea); Hyoung Jin Choi (Inha University, Korea);*

- 3 Heterogeneous Oscillator Model of Cardiac Conduction System  
*Elena Ryzhii (University of Aizu, Japan); Maxim Ryzhii (The University of Aizu, Japan);*
- 4 GP GPU Acceleration of a PO Based RF Simulation Software Dedicated to Radar Simulation in Large Scale and Complex Environments  
*A. Boudet (OKTAL Synthetic Environment, France); Nicolas Douchin (OKTAL Synthetic Environment, France); P. Pitot (OKTAL Synthetic Environment, France);*
- 5 Phase Delay of Alternating Multi-layers of Metamaterials and Dielectrics  
*Jonghun Lee (Daegu Gyeonbuk Institute of Science & Technology, Korea); Cheryl-Hee Lee (Daegu Gyeonbuk Institute of Science & Technology, Korea);*
- 6 Hybrid Metal-dielectric Ring Resonators for Optical Magnetism and Magnetic Metamaterials Down to Ultraviolet Wavelengths  
*Jianwei Tang (Zhejiang University, China); Sailing He (KTH-Royal Institute of Technology, Sweden);*
- 7 Atomistic Approach for the Field Enhancement in Quantum Plasmonic Nanostructures  
*Tuomas Rossi (Aalto University, Finland); Arto Sakko (Aalto University, Finland); R. M. Nieminen (Aalto University, Finland);*
- 8 Graphene Waveguides of Ultra-small Mode Areas and Ultra-large Effective Refractive Indices  
*Sailing He (Zhejiang University, China); Xizhou Zhang (Zhejiang University, China); Yingran He (Zhejiang University, China);*
- 9 Fe:BN Nanoceramic — Negative Refraction Material in the Wide Frequency Range  
*Karen Oganisian (Institute of Low Temperature and Structure Research, PAS, Poland); A. Vogt (Wroclaw University, Poland); P. Gluchowski (Institute of Low Temperature and Structure Research, PAS, Poland); K. Orzechowski (Wroclaw University, Poland); W. Strek (Institute of Low Temperature and Structure Research, PAS, Poland);*
- 10 Fano Resonance in Simple and Single Plasmonic Particle  
*Yuan Zhang (South China Normal University, China); Sailing He (Royal Institute of Technology, KTH-ZJU Joint Research Center of Photonics, Sweden);*
- 11 Design and Application of Multi-slots AMC Structure Having Metamaterial Characteristic for 2.45 GHz Band  
*Seung Woo Lee (Chungbuk National University, South Korea); Nam Kim (Chungbuk National University, South Korea); Seung-Yeup Rhee (Chonnam National University, South Korea);*
- 12 Bundle Block Adjustment with Optical and SAR Images  
*Shuai Xing (Zhengzhou Institute of Surveying and Mapping, China); Qing Xu (Zhengzhou Institute of Surveying and Mapping, China); Weisheng Li (Zhengzhou Institute of Surveying and Mapping, China); Yu He (Zhengzhou Institute of Surveying and Mapping, China);*
- 13 Airborne Interferometric SAR Experiment with Multi-carrier Frequencies Using both Chirp and Noise Signals  
*Yunhua Zhang (Center for Space Science and Applied Research, CAS, China); Wenshuai Zhai (Graduate University of the Chinese Academy of Sciences, China); Xueyan Kang (Center for Space Science and Applied Research, CAS, China); Xiaojin Shi (Center for Space Science and Applied Research, CAS, China); Xiang Gu (Center for Space Science and Applied Research, CAS, China); Yueying Tang (Center for Space Science and Applied Research, CAS, China);*
- 14 Micro-doppler Analysis of Rotating Targets in Dual-channel Bistatic SAR  
*Meng Lv (Zhejiang University, China);*
- 15 Snow Wetness Estimation from Polarimetric SAR Image  
*Manickam Surendar (Indian Institute of Technology, India); G. Singh (Niigata University, Japan); Avik Bhattacharya (Indian Institute of Technology, India); G. Venkataraman (Indian Institute of Technology, India); P. A. Bharathi (Indian Institute of Technology, India);*
- 16 Optical Data Storage Using Diffractive Optical Elements  
*Shuhei Yoshida (Tokyo University of Science, Japan); Kai Yamada (Tokyo University of Science, Japan); Noriyuki Unno (Tokyo University of Science, Japan); Jun Taniguchi (Tokyo University of Science, Japan); Manabu Yamamoto (Tokyo University of Science, Japan);*

- 17 Multi-dimensional Shift Multiplexing for Holographic Data Storages  
*Shuhei Yoshida (Tokyo University of Science, Japan); Keiko Yamamoto (Tokyo University of Science, Japan); Hiroyuki Kurata (Tokyo University of Science, Japan); Manabu Yamamoto (Tokyo University of Science, Japan);*
- 18 Characterization of Zinc-tin-oxide Films Deposited by Radio Frequency Magnetron Sputtering at Various Substrate Temperatures  
*Ik-Jae Lee (Pohang Accelerator Laboratory (PAL), South Korea); Nark-Eon Sung (Pohang Accelerator Laboratory (PAL), South Korea); Keun Hwa Chae (Korea Institute of Science and Technology (KIST), South Korea); Ray Conley (Brookhaven National Laboratory (BNL), USA);*
- 19 Design of New ITO Electrodes for High Sensitive Capacitive Touch Panel  
*Huai-Yi Chen (Huafan University, Taiwan, R.O.C); Hsi-Ting Huang (Huafan University, Taiwan R.O.C);*
- 20 On the Modeling of an External Cavity Tunable Laser ECTL Source with Finite Mirror Dimensions  
*Ahmed Mohamed Fawzy (Helwan University, Egypt); Salwa El-Sabban (Helwan University, Egypt); Ibrahim I. Ibrahim (Helwan University, Egypt); Diaa Khalil (Ain-Shams University, Egypt);*
- 21 Polarization-insensitive and Broadband Plasmonic Silicon Schottky Diode for Detection of Sub-bandgap Photons  
*Liu Yang (Zhejiang University, China); Pengfei Kou (Zhejiang University, China); El Hang Lee (Zhejiang University, China); Sailing He (Zhejiang University, China);*
- 22 The Fabrication of AlGaN Ultraviolet-B Metal-semiconductor-metal Photodetectors with a MgZnO Thin Film Filter  
*Ming-Jer Jeng (Chang Gung University, Taiwan, R.O.C.); Jun-Yan Chang (Chung-Cheng Institute of Technology, Taiwan); Liann-Be Chang (Chang Gung University, Taiwan, R.O.C.); Ray-Ming Lin (Chang Gung University, Taiwan, R.O.C.); Li-Zen Hsieh (Hwa Hsia Institute of Technology, Taiwan);*
- 23 Omnidirectional Absorber Based on Collision Plasma Heterostructures  
*Xiang-Kun Kong (Nanjing University of Aeronautics and Astronautics, China); Shaobin Liu (Nanjing University of Aeronautics and Astronautics, China); Hai Feng Zhang (Nanjing University of Aeronautics and Astronautics, China); Bo-Rui Bian (Nanjing University of Aeronautics and Astronautics, China); Hui-Chao Zhao (Nanjing University of Aeronautics and Astronautics, China); Huan Yang (Nanjing University of Aeronautics and Astronautics, China);*
- 24 Size Reduction of Narrowband Hairpin Bandpass Filter Using Fractal Koch Geometry  
*Achmad Munir (Institut Teknologi Bandung, Indonesia); Teguh Praludi (Indonesian Institute of Sciences, Indonesia); Mohammad Ridwan Effendi (Institut Teknologi Bandung, Indonesia);*
- 25 Design of a Compact Dual-mode Dual-band Microstrip Bandpass Filter Based on Semi-fractal CSRR  
*Mushtaq A. Alqaisy (Universiti Tenaga Nasional, Malaysia); Jawad K. Ali (University of Technology, Iraq); Chandan Kumar Chakrabarty (Universiti Tenaga Nasional, Malaysia); Goh Chin Hock (Universiti Tenaga Nasional, Malaysia);*
- 26 Odd-order Bandstop Filter (BSF) Topology with Inter-resonator Coupling Structures  
*Tae-Hak Lee (Korea University, South Korea); Kangho Lee (Korea University, Korea); Chang-Soo Ahn (Agency for Defense Development, Korea); Young Sik Kim (Korea University, Korea); Juseop Lee (Korea University, Korea);*
- 27 Dual-band Impedance Matching Network with Transmission Zeros Using Resonators  
*Phirun Kim (Chonbuk National University, Republic of Korea); Girdhari Chaudhary (Chonbuk National University, Republic of Korea); Yongchae Jeong (Chonbuk National University, South Korea); Jongsik Lim (Soonchunhyang University, Republic of Korea);*
- 28 Highly Miniaturized Forced-mode Ring Resonator  
*Jose Roberto Reyes Ayona (Instituto Nacional de Astrofisica Optica y Electronica, Mexico);*
- 29 A Novel Approach to Increase the Multipactor Level in Microwave Transformer  
*Tiancun Hu (Xi'an Institute of Space Radio Technology, China); Wanzhao Cui (Xi'an Institute of Space Radio Technology, China);*
- 30 Design and Realization of a C-band Impedance Transformer  
*Tiancun Hu (Xi'an Institute of Space Radio Technology, China); Wanzhao Cui (National Xi'an Institute of Space Radio Technology, China);*

# Session 2AK

## Poster Session 3

|  |     |
|--|-----|
| Benefits of Using Wireless Sensor Networks to Predict Plagues in Vineyards   | 600 |
| <i>Inigo Cuinas, Sergio Cervera, Jose Antonio Gay-Fernandez, .....</i>   |     |
| Electro-responsive and Dielectric Characteristics of Graphene Oxide Based Composites   | 601 |
| <i>Wen Ling Zhang, Hyoung Jin Choi, .....</i>  |     |
| Heterogeneous Oscillator Model of Cardiac Conduction System  | 602 |
| <i>Elena Ryzhii, Maxim Ryzhii, .....</i>   |     |
| GP GPU Acceleration of a PO Based RF Simulation Software Dedicated to Radar Simulation in Large Scale and Complex Environments | 603 |
| <i>A. Boudet, Nicolas Douchin, P. Pitot, .....</i>   |     |
| Phase Delay of Alternating Multi-layers of Meta-materials and Dielectrics  | 604 |
| <i>Jonghun Lee, Cheryl-Hee Lee, .....</i>  |     |
| Hybrid Metal-dielectric Ring Resonators for Optical Magnetism and Magnetic Metamaterials Down to Ultraviolet Wavelengths       | 605 |
| <i>Jianwei Tang, Sailing He, .....</i>   |     |
| Atomistic Approach for the Field Enhancement in Quantum Plasmonic Nanostructures   | 606 |
| <i>Tuomas Rossi, Arto Sakko, R. M. Nieminen, .....</i>   |     |
| Graphene Waveguides of Ultra-small Mode Areas and Ultra-large Effective Refractive Indices                                     | 607 |
| <i>Sailing He, Xizhou Zhang, Yingran He, .....</i>   |     |
| Fe:BN Nanoceramic — Negative Refraction Material in the Wide Frequency Range   | 608 |
| <i>Karen Oganisian, A. Vogt, P. Gluchowski, K. Orzechowski, W. Strek, .....</i>  |     |
| Fano Resonance in Simple and Single Plasmonic Particle   | 609 |
| <i>Yuan Zhang, Sailing He, .....</i>   |     |
| Design and Application of Multi-slots AMC Structure Having Metamaterial Characteristic for 2.45 GHz Band                       | 610 |
| <i>Seung Woo Lee, Nam Kim, Seung-Yeup Rhee, .....</i>  |     |
| Bundle Block Adjustment with Optical and SAR Images  | 611 |
| <i>Shuai Xing, Qing Xu, Wei Sun, Jiansheng Li, Yu He, .....</i>  |     |
| Airborne Interferometric SAR Experiment with Multi-carrier Frequencies Using both Chirp and Noise Signals                      | 612 |
| <i>Yunhua Zhang, Wenshuai Zhai, Xueyan Kang, Xiaojin Shi, Xiang Gu, Yueying Tang, .....</i>                                    |     |
| Micro-doppler Analysis of Rotating Targets in Dual-channel Bistatic SAR  | 613 |
| <i>Meng Lv, .....</i>  |     |
| Snow Wetness Estimation from Polarimetric SAR Image  | 614 |
| <i>Manickam Surendar, G. Singh, Avik Bhattacharya, G. Venkataraman, P. A. Bharathi, .....</i>                                  |     |
| Optical Data Storage Using Diffractive Optical Elements  | 615 |
| <i>Shuhei Yoshida, Kai Yamada, Noriyuki Unno, Jun Taniguchi, Manabu Yamamoto, .....</i>  |     |
| Multi-dimensional Shift Multiplexing for Holographic Data Storages   | 616 |
| <i>Shuhei Yoshida, Keiko Yamamoto, Hiroyuki Kurata, Manabu Yamamoto, .....</i>   |     |
| Characterization of Zinc-tin-oxide Films Deposited by Radio Frequency Magnetron Sputtering at Various Substrate Temperatures   | 617 |
| <i>Ik-Jae Lee, Nark-Eon Sung, Keun Hwa Chae, Ray Conley, .....</i>   |     |
| Design of New ITO Electrodes for High Sensitive Capacitive Touch Panel   | 618 |
| <i>Huai-Yi Chen, Hsi-Ting Huang, .....</i>   |     |
| On the Modeling of an External Cavity Tunable Laser ECTL Source with Finite Mirror Dimensions                                  | 620 |
| <i>Ahmed Mohamed Fawzy, Salwa El-Sabban, Ibrahim I. Ibrahim, Dina Khalil, .....</i>  |     |
| Polarization-insensitive and Broadband Plasmonic Silicon Schottky Diode for Detection of Sub-bandgap Photons                   | 621 |
| <i>Liu Yang, Pengfei Kou, El Hang Lee, Sailing He, .....</i>   |     |
| The Fabrication of AlGaN Ultraviolet-B Metal-semiconductor-metal Photodetectors with a MgZnO Thin Film Filter                  | 621 |



|  |     |
|--|-----|
| <i>Ming-Jer Jeng, Jun-Yan Chang, Liann-Be Chang, Ray-Ming Lin, Li-Zen Hsieh, .....</i>   | 622 |
| <b>Omnidirectional Absorber Based on Collision Plasma Heterostructures</b>   |     |
| <i>Xiang-Kun Kong, Shaobin Liu, Hai Feng Zhang, Bo-Rui Bian, Hui-Chao Zhao, Huan Yang, .....</i>   | 623 |
| <b>Size Reduction of Narrowband Hairpin Bandpass Filter Using Fractal Koch Geometry</b>  |     |
| <i>Achmad Munir, Teguh Praludi, Mohammad Ridwan Effendi, .....</i>   | 624 |
| <b>Design of a Compact Dual-mode Dual-band Microstrip Bandpass Filter Based on Semi-fractal CSRR</b>   |     |
| <i>Mushtaq A. Alqaisy, Jawad K. Ali, Chandan Kumar Chakrabarty, Goh Chin Hock, .....</i>   | 625 |
| <b>Odd-order Bandstop Filter (BSF) Topology with Inter-resonator Coupling Structures</b>   |     |
| <i>Tae-Hak Lee, Kangho Lee, Chang-Soo Ahn, Young Sik Kim, Juseop Lee, .....</i>  | 626 |
| <b>Dual-band Impedance Matching Network with Transmission Zeros Using Resonators</b>   |     |
| <i>Phirun Kim, Girdhari Chaudhary, Yongchae Jeong, Jongsik Lim, .....</i>  | 627 |
| <b>Highly Miniaturized Forced-mode Ring Resonator</b>  |     |
| <i>Jose Roberto Reyes Ayona, .....</i>   | 628 |
| <b>A Novel Approach to Increase the Multipactor Level in Microwave Transformer</b>   |     |
| <i>Tiancun Hu, Wanzhao Cui, .....</i>  | 629 |
| <b>Design and Realization of a C-band Impedance Transformer</b>  |     |
| <i>Tiancun Hu, Wanzhao Cui, .....</i>  | 630 |
| <b>Synthesis of Non-uniform Planar Lines and Coupled Line Filters Using Inverse Scattering Approach</b>  |     |
| <i>Harishankar Prasad, Mohammad Jaleel Akhtar, .....</i>   | 631 |
| <b>Calculating the Scattering from Periodic Conducting Surfaces without Using Evanescent Modes, Part II: Formulation of the Solution</b>             |     |
| <i>Dayalan Prajith Kasilingam, Christopher Goonan, .....</i>   | 632 |
| <b>Changes in the Degree of Polarization of a Stochastic Electromagnetic Plane-wave Pulse Scattered by a Spherical Medium</b>                        |     |
| <i>Liuzhan Pan, Chaoliang Ding, .....</i>  | 633 |
| <b>Some Ideas Yet Unattempted in Georadar Full Waveform Inversion</b>  |     |
| <i>Giovanni Meles, Stewart Greenhalgh, Hansruedi Maurer, Alan Green, .....</i>   | 634 |
| <b>Compton Effect in the Medium with Non-unity Refractive Index</b>  |     |
| <i>S. G. Chefanov, A. G. Chefranov, Vinay Venugopal, .....</i>   | 635 |
| <b>An Acoustic Inverse Scattering Problem for Spherical Coating Materials with Radially Inhomogeneous Profile</b>                                    |     |
| <i>Egemen Bilgin, Ali Yapar, .....</i>   | 636 |
| <b>Reflection of TEM Waves from a Finite Gap on the Inner Wall of a Coaxial Waveguide</b>  |     |
| <i>Ozge Yanaz Cinar, Sinan Aksimsek, .....</i>   | 637 |
| <b>Properties of One-way Magneto-optic Nanostructures in THz Range</b>   |     |
| <i>P. Kwiecień, Vladimir Kuzmiak, Ivan Richter, Jiri Ctyroky, .....</i>  | 638 |
| <b>Broadband Characterization Using Stripline Structure</b>  |     |
| <i>Ellen Yoshie Sudo Lutfi, Alberto Jose de Faro Orlando, Antonio Carlos da Cunha Migliano, .....</i>  | 640 |
| <b>Few-quantum-dot Lasing in Photonic Crystal Nanocavities</b>   |     |
| <i>Jin Liu, S. Ates, S. Stobbe, M. Lorke, Peter Lodahl, .....</i>  | 641 |
| <b>Investigations on Two-wavelength Holographic Recording in Thick Phenanthrenequinone-doped Poly(Methyl Methacrylate) Photopolymer</b>              |     |
| <i>June Hua Lin, Shiuan Huei Lin, Ken-Yuh Hsu, .....</i>   | 643 |
| <b>Optical Control of Guided-mode-resonance in the Waveguide Grating Structures with Azo-dye Polymers</b>  |     |
| <i>Jian-Hung Lin, Yu Chung Huang, Jian Hao Huang, Hung-Chih Kan, Chia Chen Hsu, .....</i>  | 644 |
| <b>Design and Simulation of Optimized Ultra-wideband Saddle Antenna</b>  |     |
| <i>Alapati Sudhakar, Devabhaktuni Madhavi, .....</i>   | 645 |
| <b>Printed Yagi-Uda Antenna for WLAN Applications</b>  |     |
| <i>Amira El-Tokhy Ali, Deena A. Salem, .....</i>   | 646 |
| <b>Digital Public Safety Radio Communication</b>   |     |
| <i>Eduil Nascimento Junior, Horacio Tertuliano Filho, Jose-Ricardo Descardecı, C. A. Dartora, Theoma M. Sanchez Otobo, E. Cherubini Rolin, .....</i> | 647 |
| <b>A Compact UWB Antenna with Wide Band-notch at 5 GHz for WLAN Band</b>   |     |
| <i>Qurratulain, Neela Chatteraj, .....</i>   | 648 |
| <b>Effect of Stationary Magnetic Fields on Different Bacterial Strains</b>   |     |
| <i>Pavel Krepelka, Eliska Hutová, Karel Bartušek, .....</i>  | 650 |