

PROCEEDINGS OF SPIE

Passive and Active Millimeter-Wave Imaging XV

**David A. Wikner
Arttu R. Luukanen**
Editors

**26 April 2012
Baltimore, Maryland, United States**

Sponsored and Published by
SPIE

Volume 8362

Proceedings of SPIE, 0277-786X, v. 8362

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Passive and Active Millimeter-Wave Imaging XV, edited by David A. Wikner, Arttu R. Luukanen,
Proc. of SPIE Vol. 8362, 836201 · © 2012 SPIE · CCC code: 0277-786X/12/\$18 · doi: 10.1117/12.979018

Proc. of SPIE Vol. 8362 836201-1

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Passive and Active Millimeter-Wave Imaging XV*, edited by David A. Wikner, Arttu R. Luukanen, Proceedings of SPIE Vol. 8362 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 0277-786X
ISBN 9780819490407

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2012, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/12/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

The logo for SPIE Digital Library features the word "SPIE" in a bold, sans-serif font above the words "Digital Library" in a smaller, sans-serif font. To the right of the text is a stylized graphic consisting of three vertical bars of increasing height from left to right, with a curved line above them.

SPIDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

vii *Conference Committee*

SESSION 1 DEVICE TECHNOLOGY

- 8362 02 **Array technology for terahertz imaging** [8362-01]
T. Reck, J. Siles, C. Jung, J. Gill, C. Lee, G. Chattopadhyay, I. Mehdi, K. Cooper, Jet Propulsion Lab. (United States)
- 8362 03 **Millimeter-wave electronically scanned reflectarray optimization and analysis** [8362-02]
A. S. Hedden, C. R. Dietlein, D. A. Wikner, U.S. Army Research Lab. (United States)
- 8362 04 **Millimeter-wave beam forming and dynamic steering using an optically controlled photo-injected Fresnel zone plate antenna at 94 GHz** [8362-03]
T. F. Gallacher, D. A. Robertson, G. M. Smith, Univ. of St. Andrews (United Kingdom)
- 8362 05 **Reflectarray for 120-GHz beam steering application: design, simulations, and measurements** [8362-04]
A. Tamminen, J. Ala-Laurinaho, Aalto Univ. (Finland); D. Gomes-Martins, J. Häkli, P. Koivisto, VTT Technical Research Ctr. of Finland (Finland); M. Kärkkäinen, S. Mäkelä, Aalto Univ. (Finland); P. Pursula, P. Rantakari, M. Sipilä, J. Säily, R. Tuovinen, VTT Technical Research Ctr. of Finland (Finland); M. Varonen, K. A. I. Halonen, Aalto Univ. (Finland); A. Luukanen, VTT Technical Research Ctr. of Finland (Finland); A. V. Räisänen, Aalto Univ. (Finland)

SESSION 2 SYSTEMS I

- 8362 06 **340-GHz 3D radar imaging test bed with 10-Hz frame rate** [8362-05]
D. A. Robertson, P. N. Marsh, D. R. Bolton, R. J. C. Middleton, R. I. Hunter, P. J. Speirs, D. G. Macfarlane, S. L. Cassidy, G. M. Smith, Univ. of St. Andrews (United Kingdom)
- 8362 07 **Wide-field-of-view millimeter-wave telescope design with ultra-low cross-polarization** [8362-06]
B. E. Bernacki, J. F. Kelly, D. Sheen, B. Hatchell, P. Valdez, J. Tedeschi, T. Hall, D. McMakin, Pacific Northwest National Lab. (United States)
- 8362 08 **Stand-off real-time synthetic imaging at mm-wave frequencies** [8362-07]
M. Kahl, Univ. Siegen (Germany); A. Keil, J. Peuser, T. Loeffler, SynView GmbH (Germany); M. Paetzold, A. Kolb, Univ. Siegen (Germany); T. Sprenger, Huebner GmbH (Germany); B. Hils, Goethe Univ. (Germany); P. Haring Bolívar, Univ. Siegen (Germany)
- 8362 09 **Measured performance of a high-resolution passive video-rate submillimeter-wave imaging system demonstrator for stand-off imaging** [8362-08]
A. Luukanen, M. Grönholm, M. M. Leivo, H. Toivanen, A. Rautiainen, J. Varis, VTT Technical Research Ctr. of Finland (Finland)

SESSION 3 SYSTEMS II

8362 0A **Polarimetric passive millimeter-wave imagery from a sensor based on an optical up-conversion architecture** [8362-09]
J. P. Wilson, Univ. of Delaware (United States); C. A. Schuetz, T. E. Dillon, R. D. Martin, Phase Sensitive Innovations, Inc. (United States); D. W. Prather, Univ. of Delaware (United States)

8362 0C **Real-time video rate imaging with a 1k-pixel THz CMOS focal plane array** [8362-11]
J. Grzyb, Bergische Univ. Wuppertal (Germany); H. Sherry, Bergische Univ. Wuppertal (France), STMicroelectronics (Germany), and Institut d'Electronique, de Microélectronique, et de Nanotechnologie (France); Y. Zhao, R. Al Hadi, Bergische Univ. Wuppertal (Germany); A. Cathelin, STMicroelectronics (France); A. Kaiser, Institut d'Electronique, de Microélectronique, et de Nanotechnologie (France); U. Pfeiffer, Bergische Univ. Wuppertal (Germany)

8362 0D **Flight test of MMW radar for brown-out helicopter landing** [8362-12]
C. A. Martin, V. Kolinko, G. P. Otto, J. A. Lovberg, Trex Enterprises Corp. (United States)

SESSION 4 PHENOMENOLOGY AND IMAGE PROCESSING

8362 0E **Simulation of millimeter-wave body images and its application to biometric recognition** [8362-13]
M. Moreno-Moreno, J. Fierrez, R. Vera-Rodriguez, Univ. Autónoma de Madrid (Spain); J. Parron, Univ. Autónoma de Barcelona (Spain)

8362 0F **Applicability of radio astronomy techniques to the processing and interpretation of aperture synthesis passive millimetre-wave applications** [8362-14]
C. T. Taylor, P. N. Wilkinson, N. A. Salmon, The Univ. of Manchester (United Kingdom); C. D. Cameron, QinetiQ Ltd. (United Kingdom)

8362 0G **Sub-wavelength resolution of MMW imaging systems using extremely inexpensive scanning Glow Discharge Detector (GDD) double row camera** [8362-15]
N. S. Kopeika, Ben-Gurion Univ. of the Negev (Israel); A. Abramovich, Ariel Univ. Ctr. of Samaria (Israel); A. Levanon, A. Akram, D. Rozban, Ben-Gurion Univ. of the Negev (Israel) and Ariel Univ. Ctr. of Samaria (Israel); Y. Yitzhaky, Ben-Gurion Univ. of the Negev (Israel); O. Yadid-Pecht, Ben-Gurion Univ. of the Negev (Israel) and Univ. of Calgary (Canada); A. Belenky, Ben-Gurion Univ. of the Negev (Israel)

8362 0H **Concealed object recognition based on geometric feature descriptors** [8362-16]
S. Yeom, D.-S. Lee, Daegu Univ. (Korea, Republic of); Y. Chang, M.-K. Lee, S.-W. Jung, Samsung Thales Co., Ltd. (Korea, Republic of)

8362 0I **Evaluation of passive millimeter wave system performance in adverse weather conditions** [8362-17]
N. Gopalsami, S. Liao, T. Elmer, E. R. Koehl, A. C. Raptis, Argonne National Lab. (United States)

8362 0J **Real-time computer treatment of THz passive device images with the high image quality** [8362-18]
V. A. Trofimov, V. V. Trofimov, Lomonosov Moscow State Univ. (Russian Federation)

POSTER SESSION

- 8362 0K **Thermal human phantom for testing of millimeter wave cameras** [8362-19]
N. Palka, R. Ryniec, M. Piszczek, M. Szustakowski, M. Zyczkowski, M. Kowalski, Military Univ. of
Technology (Poland)

Author Index

Conference Committee

Symposium Chair

Kevin P. Meiners, Office of the Secretary of Defense (United States)

Symposium Cochair

Kenneth R. Israel, Lockheed Martin Corporation (United States)

Conference Chairs

David A. Wikner, U.S. Army Research Laboratory (United States)

Arttu R. Luukanen, VTT Technical Research Center of Finland (Finland)

Program Committee

Roger Appleby, Consultant (United Kingdom)

Erich N. Grossman, National Institute of Standards and Technology
(United States)

Christopher A. Martin, Trex Enterprises Corporation (United States)

Session Chairs

- 1 Device Technology
Arttu R. Luukanen, VTT Technical Research Center of Finland (Finland)
- 2 Systems I
David A. Wikner, U.S. Army Research Laboratory (United States)
- 3 Systems II
Roger Appleby, Consultant (United Kingdom)
- 4 Phenomenology and Image Processing
Christopher A. Martin, Trex Enterprises Corporation (United States)

