

# **2019 IEEE Radio Frequency Integrated Circuits Symposium (RFIC 2019)**

**Boston, Massachusetts, USA  
2 – 4 June 2019**



**IEEE Catalog Number: CFP19MMW-POD  
ISBN: 978-1-7281-1702-7**

**Copyright © 2019 by the Institute of Electrical and Electronics 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 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:	CFP19MMW-POD
ISBN (Print-On-Demand):	978-1-7281-1702-7
ISBN (Online):	978-1-7281-1701-0
ISSN:	1529-2517

**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

<b>THE DIGITAL FUTURE OF RFICS</b> .....	1
<i>Greg Henderson</i>	
<b>DO THE NETWORKS OF THE FUTURE CARE ABOUT THE MATERIALS OF THE PAST?</b> .....	2
<i>Michael Peeters</i>	
<b>A 1.2-2.8 GHZ TUNABLE LOW-NOISE AMPLIFIER WITH 0.8-1.6 DB NOISE FIGURE</b> .....	3
<i>Hao Gao ; Zhe Song ; Zhe Chen ; Domine M. W. Leenaerts ; Peter G. M. Baltus</i>	
<b>A 28-GHZ CMOS LNA WITH STABILITY-ENHANCED <math>G_m</math>-BOOSTING TECHNIQUE USING TRANSFORMERS</b> .....	7
<i>Sunwoo Kong ; Hui-Dong Lee ; Seunghyun Jang ; Jeehoon Park ; Kwang-Seon Kim ; Kwang-Chun Lee</i>	
<b>KA-BAND CMOS ABSORPTIVE SP4T SWITCH WITH ONE-THIRD MINIATURIZATION</b> .....	11
<i>Bosung Suh ; Byung-Wook Min</i>	
<b>A COMPACT, HIGH-POWER, 60 GHZ SPDT SWITCH USING SHUNT-SERIES SIGE PIN DIODES</b> .....	15
<i>Yunyi Gong ; Jeffrey W. Teng ; John D. Cressler</i>	
<b>LOW-COST, HIGH-GAIN ANTENNA MODULE INTEGRATING A CMOS FREQUENCY MULTIPLIER DRIVER FOR COMMUNICATIONS AT D-BAND</b> .....	19
<i>Francesco Foglia Manzillo ; Jose Luis Gonzalez-Jimenez ; Antonio Clemente ; Alexandre Siligaris ; Benjamin Blanpey ; Cedric Dehos</i>	
<b>SCALABLE ANALYTICAL MODEL OF 1.7 THZ CUT-OFF FREQUENCY SCHOTTKY DIODES INTEGRATED IN 55NM BICMOS TECHNOLOGY</b> .....	23
<i>Vincent Gidel ; Frédéric Giancesello ; Pascal Chevalier ; Grégory Avenier ; Nicolas Guitard ; Victor Milon ; Michel Buczko ; Charles-Alex Legrand ; Cyril Luxey ; Guillaume Ducournau</i>	
<b>EXCELLENT 22FDX HOT-CARRIER RELIABILITY FOR PA APPLICATIONS</b> .....	27
<i>T. Chen ; C. Zhang ; W. Arfaoui ; A. Bellaouar ; S. Embabi ; G. Bossu ; M. Siddabathula ; K. W. J. Chew ; S. N. Ong ; M. Mantravadi ; K. Barnett ; J. Bordelon ; R. Taylor ; S. Janardhanan</i>	
<b>22NM FULLY-DEPLETED SOI HIGH FREQUENCY NOISE MODELING UP TO 90GHZ ENABLING ULTRA LOW NOISE MILLIMETRE-WAVE LNA DESIGN</b> .....	31
<i>L. H. K. Chan ; S. N. Ong ; W. L. Oo ; K. W. J. Chew ; C. Zhang ; A. Bellaouar ; W. H. Chow ; T. Chen ; R. Rassel ; J. S. Wong ; C. K. Lim ; C. W. F. Wan ; J. Kim ; W. H. Seet ; D. Harame</i>	
<b>22NM ULTRA-THIN BODY AND BURIED OXIDE FDSOI RF NOISE PERFORMANCE</b> .....	35
<i>Ousmane M. Kane ; Luca Lucci ; Pascal Scheiblin ; Sylvie Lepilliet ; François Danneville</i>	
<b>A 76-81GHZ FMCW TRANSCEIVER WITH 3-TRANSMIT, 4-RECEIVE PATHS AND 15DBM OUTPUT POWER FOR AUTOMOTIVE RADARS</b> .....	39
<i>Zongming Duan ; Dongfang Pan ; Bowen Wu ; Yan Wang ; Bingbing Liao ; Dong Huang ; Yanhui Wu ; Daiguo Xu ; Hua Xu ; Wei Lv ; Yuefei Dai ; Pei Li ; Yan Wang ; Fujiang Lin</i>	
<b>RECONFIGURABLE 60-GHZ RADAR TRANSMITTER SOC WITH BROADBAND FREQUENCY TRIPLER IN 45NM SOI CMOS</b> .....	43
<i>Wooram Lee ; Tolga Dinc ; Alberto Valdes-Garcia</i>	
<b>A 94GHZ 2x2 PHASED-ARRAY FMCW IMAGING RADAR TRANSCEIVER WITH 11DBM OUTPUT POWER AND 10.5DB NF IN 65NM CMOS</b> .....	47
<i>Dong Huang ; Li Zhang ; Huabing Zhu ; Boshen Chen ; Yang Tang ; Yan Wang</i>	
<b>X/KU-BAND FOUR-CHANNEL TRANSMIT/RECEIVE SIGE PHASED-ARRAY IC</b> .....	51
<i>Prabir Saha ; Sriram Muralidharan ; Jinzhou Cao ; Ozan Gurbuz ; Christopher Hay</i>	
<b>ULTRA-WIDEBAND 8-45 GHZ TRANSMITTER FRONT-END FOR A RECONFIGURABLE FMCW MIMO RADAR</b> .....	55
<i>Mantas Sakalas ; Songhui Li ; Niko Joram ; Paulius Sakalas ; Frank Ellinger</i>	
<b>A 51.5 - 64.5 GHZ ACTIVE PHASE SHIFTER USING LINEAR PHASE CONTROL TECHNIQUE WITH 1.4 PHASE RESOLUTION IN 65-NM CMOS</b> .....	59
<i>Tianjun Wu ; Chenxi Zhao ; Huihua Liu ; Yunqiu Wu ; Yiming Yu ; Kai Kang</i>	
<b>DIGITALLY-ASSISTED 27-33 GHZ REFLECTION-TYPE PHASE SHIFTER WITH ENHANCED ACCURACY AND LOW IL-VARIATION</b> .....	63
<i>Jingjing Xia ; Mahitab Farouk ; Slim Boumaiza</i>	
<b>A 21 TO 30-GHZ MERGED DIGITAL-CONTROLLED HIGH RESOLUTION PHASE SHIFTER-PROGRAMMABLE GAIN AMPLIFIER WITH ORTHOGONAL PHASE AND GAIN CONTROL FOR 5-G PHASE ARRAY APPLICATION</b> .....	67
<i>Wei Zhu ; Wei Lv ; Bingbing Liao ; Yanping Zhu ; Yuefei Dai ; Pei Li ; Lei Zhang ; Yan Wang</i>	

<b>A 20 ~ 43 GHZ VGA WITH 21.5 DB GAIN TUNING RANGE AND LOW PHASE VARIATION FOR 5G COMMUNICATIONS IN 65-NM CMOS</b> .....	71
<i>Tianjun Wu ; Chenxi Zhao ; Huihua Liu ; Yunqiu Wu ; Yiming Yu ; Kai Kang</i>	
<b>A 26-GHZ VECTOR MODULATOR IN 130-NM SIGE BICMOS ACHIEVING MONOTONIC 10-B PHASE RESOLUTION WITHOUT CALIBRATION</b> .....	75
<i>Ilker Kalyoncu ; Abdurrahman Burak ; Mehmet Kaynak ; Yasar Gurbuz</i>	
<b>A 20-32GHZ DIGITAL QUADRATURE TRANSMITTER WITH NOTCHED-MATCHING AND MODE-SWITCH TOPOLOGY FOR 5G WIRELESS AND BACKHAUL</b> .....	79
<i>Huizhen Jenny Qian ; Yiyang Shu ; Jie Zhou ; Xun Luo</i>	
<b>A WIDEBAND DIGITAL POLAR TRANSMITTER WITH INTEGRATED CAPACITOR-DAC-BASED CONSTANT-ENVELOPE DIGITAL-TO-PHASE CONVERTER</b> .....	83
<i>Tong Li ; Liang Xiong ; Yun Yin ; Yangzi Liu ; Hao Min ; Na Yan ; Hongtao Xu</i>	
<b>A 5GHZ TO 6GHZ CMOS TRANSMITTER FOR FULL-DUPLEX WIRELESS WITH WIDEBAND DIGITAL CANCELLATION</b> .....	87
<i>Nimrod Ginzberg ; Dror Regev ; Genadiy Tsodik ; Shimi Shilo ; Doron Ezri ; Emanuel Cohen</i>	
<b>A SUB-MW ALL-PASSIVE RF FRONT END WITH IMPLICIT CAPACITIVE STACKING ACHIEVING 13 DB GAIN, 5 DB NF AND +25 DBM OOB-IIP3</b> .....	91
<i>Vijaya Kumar Purushothaman ; Eric Klumperink ; Berta Trullas Clavera ; Bram Nauta</i>	
<b>A 0.3-TO-1.3GHZ MULTI-BRANCH RECEIVER WITH MODULATED MIXER CLOCKS FOR CONCURRENT DUAL-CARRIER RECEPTION AND RAPID COMPRESSIVE-SAMPLING SPECTRUM SCANNING</b> .....	95
<i>Guoxiang Han ; Tanbir Haque ; Matthew Bajor ; John Wright ; Peter R. Kinget</i>	
<b>A 0.5-20 GHZ RF SILICON PHOTONIC RECEIVER WITH 120 DB•HZ<sup>2/3</sup> SFDR USING BROADBAND DISTRIBUTED IM3 INJECTION LINEARIZATION</b> .....	99
<i>Navid Hosseinzadeh ; Aditya Jain ; Kang Ning ; Roger Helkey ; James F. Buckwalter</i>	
<b>A 65NM CMOS CONTINUOUS-TIME ELECTRO-OPTIC PLL (CT-EOPLL) WITH IMAGE AND HARMONIC SPUR SUPPRESSION FOR LIDAR</b> .....	103
<i>Ali Binaie ; Sohail Ahasan ; Harish Krishnaswamy</i>	
<b>A 6.5-GHZ CRYOGENIC ALL-PASS FILTER CIRCULATOR IN 40-NM CMOS FOR QUANTUM COMPUTING APPLICATIONS</b> .....	107
<i>Andrea Ruffino ; Yatao Peng ; Fabio Sebastiano ; Masoud Babaie ; Edoardo Charbon</i>	
<b>DESIGN CONSIDERATIONS FOR SPIN READOUT AMPLIFIERS IN MONOLITHICALLY INTEGRATED SEMICONDUCTOR QUANTUM PROCESSORS</b> .....	111
<i>M. J. Gong ; U. Alakusu ; S. Bonen ; M. S. Dadash ; L. Lucci ; H. Jia ; L. E. Gutierrez ; W. T. Chen ; D. R. Daughton ; G. C. Adam ; S. Iordanescu ; M. Pateanu ; N. Messaoudi ; D. Hame ; A. Müller ; R. R. Mansour ; S. P. Voinescu</i>	
<b>DIRECT DIGITAL SYNTHESIZER WITH 14 GS/S SAMPLING RATE HETEROGENEOUSLY INTEGRATED IN INP HBT AND GAN HEMT ON CMOS</b> .....	115
<i>Steven Eugene Turner ; Mark E. Stuenkel ; Gary M. Madison ; Justin A. Cartwright ; Richard L. Harwood ; Joseph D. Cali ; Steve A. Chadwick ; Michael Oh ; John T. Matta ; James M. Meredith ; Justin M. Byrd ; Lawrence J. Kushner</i>	
<b>A 1 V 54-64 GHZ 4-CHANNEL PHASED-ARRAY RECEIVER IN 45 NM RFSOI WITH 3.6/5.1 DB NF AND -23 DBM IP1DB AT 28/37 MW PER-CHANNEL</b> .....	119
<i>Hyunchul Chung ; Qian Ma ; Gabriel M. Rebeiz</i>	
<b>A FULLY INTEGRATED 60 GHZ 10 GB/S QPSK TRANSCEIVER WITH DIGITAL TRANSMITTER AND T/R SWITCH IN 65NM CMOS</b> .....	123
<i>Zheng Song ; Jianfu Lin ; Yutian Li ; Jialiang Ye ; Ruichang Ma ; Baoyong Chi</i>	
<b>A 60 GHZ POLARIZATION-DUPLEX TX/RX FRONT-END WITH DUAL-POL ANTENNA-IC CO-INTEGRATION IN SIGE BICMOS</b> .....	127
<i>Yao Liu ; Arun Natarajan</i>	
<b>A 180-GHZ SUPER-REGENERATIVE OSCILLATOR WITH UP TO 58 DB GAIN FOR EFFICIENT PHASE RECOVERY</b> .....	131
<i>Hatem Ghaleb ; Christian Carlowitz ; David Fritsche ; Corrado Carta ; Frank Ellinger</i>	
<b>A BROADBAND DIRECT CONVERSION TRANSMITTER/RECEIVER AT D-BAND USING CMOS 22NM FDSOI</b> .....	135
<i>Ali A. Farid ; Arda Simsek ; Ahmed S. H. Ahmed ; Mark J. W. Rodwell</i>	
<b>ENHANCED PASSIVE MIXER-FIRST RECEIVER DRIVING AN IMPEDANCE WITH 40DB/DECADE ROLL-OFF, ACHIEVING +12DBM BLOCKER-P1DB, +33DBM IIP3 AND SUB-2DB NF DEGRADATION FOR A 0DBM BLOCKER</b> .....	139
<i>Sashank Krishnamurthy ; Ali M. Niknejad</i>	

<b>A CODE-DOMAIN RF SIGNAL PROCESSING FRONT-END FOR SIMULTANEOUS TRANSMIT AND RECEIVE WITH 49.5 DB SELF-INTERFERENCE REJECTION, 12.1 DBM RECEIVE COMPRESSION, AND 34.3 DBM TRANSMIT COMPRESSION .....</b>	<b>143</b>
<i>Hussam Alshammmary ; Cameron W. Hill ; Ahmed Hamza ; James F. Buckwalter</i>	
<b>A CMOS 0.5-2.5GHZ FULL-DUPLEX MIMO RECEIVER WITH SELF-ADAPTIVE AND POWER-SCALABLE RF/ANALOG WIDEBAND INTERFERENCE CANCELLATION.....</b>	<b>147</b>
<i>Yuhe Cao ; Jin Zhou</i>	
<b>A 0.5-TO-3.5 GHZ SELF-INTERFERENCE-CANCELING RECEIVER FOR IN-BAND FULL-DUPLEX WIRELESS .....</b>	<b>151</b>
<i>Ali Ershadi ; Kamran Entesari</i>	
<b>A BASEBAND-MATCHING-RESISTOR NOISE-CANCELING RECEIVER ARCHITECTURE TO INCREASE IN-BAND LINEARITY ACHIEVING 175MHZ TIA BANDWIDTH WITH A 3-STAGE INVERTER-ONLY OPAMP.....</b>	<b>155</b>
<i>Anoop Narayan Bhat ; Ronan Van Der Zee ; Salvatore Finocchiaro ; Francesco Dantoni ; Bram Nauta</i>	
<b>A 350MV COMPLEMENTARY 4-5 GHZ VCO BASED ON A 4-PORT TRANSFORMER RESONATOR WITH 195.8DBC/HZ PEAK FOM IN 22NM FDSOI.....</b>	<b>159</b>
<i>Omar El-Aassar ; Gabriel M. Rebeiz</i>	
<b>X-BAND NMOS AND CMOS CROSS-COUPLED DCO'S WITH A "FOLDED" COMMON-MODE RESONATOR EXHIBITING 188.5 DBC/HZ FOM WITH 29.5% TUNING RANGE IN 16-NM CMOS FINFET.....</b>	<b>163</b>
<i>R. Levinger ; D. Ben-Haim ; I. Gertman ; S. Bershansky ; R. Levi ; J. Kadry ; G. Horovitz</i>	
<b>A 18.2-29.3 GHZ COLPITTS VCOS BANK WITH -119.5 DBC/HZ PHASE NOISE AT 1 MHZ OFFSET FOR 5G COMMUNICATIONS.....</b>	<b>167</b>
<i>F. Quadrelli ; F. Panazzolo ; M. Tiebout ; F. Padovan ; M. Bassi ; A. Bevilacqua</i>	
<b>A 9.6 MW LOW-NOISE MILLIMETER-WAVE SUB-SAMPLING PLL WITH A DIVIDER-LESS SUB-SAMPLING LOCK DETECTOR IN 65 NM CMOS.....</b>	<b>171</b>
<i>Hao Wang ; Omeed Momeni</i>	
<b>A -40-DBC INTEGRATED-PHASE-NOISE 45-GHZ SUB-SAMPLING PLL WITH 3.9-DBM OUTPUT AND 2.1% DC-TO-RF EFFICIENCY .....</b>	<b>175</b>
<i>Sangyeop Lee ; Kyoya Takano ; Shinsuke Hara ; Ruibing Dong ; Shuhei Amakawa ; Takeshi Yoshida ; Minoru Fujishima</i>	
<b>A HIGH EFFICIENCY 39GHZ CMOS CASCODE POWER AMPLIFIER FOR 5G APPLICATIONS .....</b>	<b>179</b>
<i>Hyun-Chul Park ; Byungjoon Park ; Yunsung Cho ; Jaehong Park ; Jihoon Kim ; Jeong Ho Lee ; Juho Son ; Kyu Hwan An ; Sung-Gi Yang</i>	
<b>A COMPACT E-BAND PA WITH 22.37% PAE 14.29 DBM OUTPUT POWER AND 26 DB POWER GAIN WITH EFFICIENCY ENHANCEMENT AT POWER BACK-OFF .....</b>	<b>183</b>
<i>Liang Chen ; Lei Zhang ; Li Zhang ; Yan Wang</i>	
<b>AN E-BAND COMPACT POWER AMPLIFIER FOR FUTURE ARRAY-BASED BACKHAUL NETWORKS IN 22NM FD-SOI .....</b>	<b>187</b>
<i>Umut Çelik ; Patrick Reynaert</i>	
<b>AN E-BAND FULLY-INTEGRATED TRUE POWER DETECTOR IN 28NM CMOS.....</b>	<b>191</b>
<i>Valdrin Qunaj ; Patrick Reynaert</i>	
<b>A COUPLER-BASED DIFFERENTIAL DOHERTY POWER AMPLIFIER WITH BUILT-IN BALUNS FOR HIGH MM-WAVE LINEAR-YET-EFFICIENT GBIT/S AMPLIFICATIONS.....</b>	<b>195</b>
<i>Huy Thong Nguyen ; Hua Wang</i>	
<b>VSWR ROBUST LINEARIZER TO IMPROVE SWITCH IMD BY &gt;20DB.....</b>	<b>199</b>
<i>Thomas Meier ; Atif Mehmood ; Jonas Kaps</i>	
<b>A BLOCKER-TOLERANT TWO-STAGE HARMONIC-REJECTION RF FRONT-END.....</b>	<b>203</b>
<i>Faizan Ul Haq ; Mikko Englund ; Yury Antonov ; Kari Stadius ; Marko Kosunen ; Kim B. Östman ; Kimmo Koli ; Jussi Ryyänen</i>	
<b>A LOW NOISE FIGURE 28GHZ LNA IN 22NM FDSOI TECHNOLOGY .....</b>	<b>207</b>
<i>Chi Zhang ; Frank Zhang ; Shafiullah Syed ; Michael Otto ; Abdellatif Bellaouar</i>	
<b>A 1.7-DB MINIMUM NF, 22-32 GHZ LOW-NOISE FEEDBACK AMPLIFIER WITH MULTISTAGE NOISE MATCHING IN 22-NM SOI-CMOS .....</b>	<b>211</b>
<i>Bolun Cui ; John R. Long ; David L. Harame</i>	
<b>A 112-GS/S 1-TO-4 ADC FRONT-END WITH MORE THAN 35-DBC SFDR AND 28-DB SNDR UP TO 43-GHZ IN 130-NM SIGE BICMOS.....</b>	<b>215</b>
<i>X.-Q. Du ; M. Grözing ; A. Uhl ; S. Park ; F. Buchali ; K. Schuh ; S. T. Le ; M. Berroth</i>	
<b>A DUAL-28GB/S DIGITAL-ASSISTED DISTRIBUTED DRIVER WITH CDR FOR OPTICAL-DAC PAM4 MODULATION IN 40NM CMOS.....</b>	<b>219</b>
<i>Qiwen Liao ; Shang Hu ; Jian He ; Bozhi Yin ; Patrick Yin Chiang ; Jian Liu ; Nan Qi ; Nanjian Wu</i>	

<b>A 77DB-SFDR MULTI-PHASE-SAMPLING 16-ELEMENT DIGITAL BEAMFORMER WITH 64 4GS/S 100MHZ-BW CONTINUOUS-TIME BAND-PASS <math>\Delta\Sigma</math> ADCS</b> .....	223
<i>Rundao Lu ; Sunmin Jang ; Yun Hao ; Michael P. Flynn</i>	
<b>A WIDEBAND DIGITALLY CONTROLLABLE RFIC WITH GAIN AND WAVELENGTH TUNABILITY AND BUILT-IN SELF TEST FUNCTIONALITIES FOR OPTICAL TRANSCEIVER MODULES IN FTTX APPLICATIONS</b> .....	227
<i>Sreekesh Lakshminarayanan ; Harman Malhotra ; David Navara ; Norbert Reiss ; Klaus Hofmann</i>	
<b>A COMPACT SINGLE-ENDED DUAL-BAND RECEIVER WITH CROSSTALK AND ISI REDUCTIONS FOR HIGH-DENSITY I/O INTERFACES</b> .....	231
<i>Jieqiong Du ; Jia Zhou ; X. Shawn Wang ; Chien-Heng Wong ; Huan-Neng Chen ; Chewn-Pu Jou ; Mau-Chung Frank Chang</i>	
<b>A 26 DBM 39 GHZ POWER AMPLIFIER WITH 26.6% PAE FOR 5G APPLICATIONS IN 28NM BULK CMOS</b> .....	235
<i>Kaushik Dasgupta ; Saeid Daneshgar ; Chintan Thakkar ; James Jaussi ; Bryan Casper</i>	
<b>A 24-43 GHZ LNA WITH 3.1-3.7 DB NOISE FIGURE AND EMBEDDED 3-POLE ELLIPTIC HIGH-PASS RESPONSE FOR 5G APPLICATIONS IN 22 NM FDSOI</b> .....	239
<i>Li Gao ; Gabriel M. Rebeiz</i>	
<b>A 4-ELEMENT 28 GHZ MILLIMETER-WAVE MIMO ARRAY WITH SINGLE-WIRE INTERFACE USING CODE-DOMAIN MULTIPLEXING IN 65 NM CMOS</b> .....	243
<i>Manoj Johnson ; Armagan Dascurcu ; Kai Zhan ; Arman Galioglu ; Naresh Adepu ; Sanket Jain ; Harish Krishnaswamy ; Arun Natarajan</i>	
<b>A 16-ELEMENT PHASED-ARRAY CMOS TRANSMITTER WITH VARIABLE GAIN CONTROLLED LINEAR POWER AMPLIFIER FOR 5G NEW RADIO</b> .....	247
<i>Yunsung Cho ; Woojae Lee ; Hyun-Chul Park ; Byungjoon Park ; Jeong Ho Lee ; Jihoon Kim ; Jooseok Lee ; Seokhyeon Kim ; Jaehong Park ; Sangyong Park ; Kyu Hwan An ; Juho Son ; Sung-Gi Yang</i>	
<b>A 37-40 GHZ PHASED ARRAY FRONT-END WITH DUAL POLARIZATION FOR 5G MIMO BEAMFORMING APPLICATIONS</b> .....	251
<i>Ankur Guha Roy ; Ozgur Inac ; Amitoj Singh ; Tsvika Mukatel ; Ohad Brandelstein ; Thomas W. Brown ; Salah Abughazaleh ; Joseph S. Hayden ; Byungcho Park ; Greg Bachmanek ; Te-Yu Jason Kao ; Josef Hagn ; Sidharth Dalmia ; Doron Shoham ; Brandon Davis ; Iris Fisher ; Raanan Sover ; Amit Freiman ; Bin Xiao ; Baljit Singh ; Jonathan Jensen</i>	
<b>AN 802.11BA 495<math>\mu</math>W -92.6DBM-SENSITIVITY BLOCKER-TOLERANT WAKE-UP RADIO RECEIVER FULLY INTEGRATED WITH WI-FI TRANSCEIVER</b> .....	255
<i>Renzhi Liu ; Asma Beevi K. T. ; Richard Dorrance ; Deepak Dasalukunte ; Mario A. Santana Lopez ; Vinod Kristem ; Shahrnaz Azizi ; Minyoung Park ; Brent R. Carlton</i>	
<b>A -80.9DBM 450MHZ WAKE-UP RECEIVER WITH CODE-DOMAIN MATCHED FILTERING USING A CONTINUOUS-TIME ANALOG CORRELATOR</b> .....	259
<i>Vivek Mangal ; Peter R. Kinget</i>	
<b>A 4 <math>\times</math> 4 <math>\times</math> 4-MM<sup>3</sup> FULLY INTEGRATED SENSOR-TO-SENSOR RADIO USING CARRIER FREQUENCY INTERLOCKING IF RECEIVER WITH -94 DBM SENSITIVITY</b> .....	263
<i>Li-Xuan Chuo ; Yejoong Kim ; Nikolaos Chiotellis ; Makoto Yasuda ; Satoru Miyoshi ; Masaru Kawaminami ; Anthony Grbic ; David Wentzloff ; Hun-Seok Kim ; David Blaauw</i>	
<b>A 55NM SAW-LESS NB-IOT CMOS TRANSCEIVER IN AN RF-SOC WITH PHASE COHERENT RX AND POLAR MODULATION TX</b> .....	267
<i>Ps. Tseng ; W. Yang ; Mj. Wu ; Lm. Jin ; Dp. Li ; Ec. Low ; Ch. Hsiao ; Ht. Lin ; Kh. Yang ; Sc. Shen ; Cm. Kuo ; Cl. Heng ; Gk. Dehng</i>	
<b>A 1.04 - 4V, DIGITAL-INTENSIVE DUAL-MODE BLE 5.0/IEEE 802.15.4 TRANSCEIVER SOC WITH EXTENDED RANGE IN 28NM CMOS</b> .....	271
<i>Nam-Seog Kim ; Myoung-Gyun Kim ; Ashutosh Verma ; Gyungseon Seol ; Shinwoong Kim ; Seokwon Lee ; Chilun Lo ; Jaeyeol Han ; Ikkyun Jo ; Chulho Kim ; Chih-Wei Yao ; Jongwoo Lee</i>	
<b>A 24.5-43.5GHZ COMPACT RX WITH CALIBRATION-FREE 32-56DB FULL-FREQUENCY INSTANTANEOUSLY WIDEBAND IMAGE REJECTION SUPPORTING MULTI-GB/S 64-QAM/256-QAM FOR MULTI-BAND 5G MASSIVE MIMO</b> .....	275
<i>Min-Yu Huang ; Taiyun Chi ; Fei Wang ; Sensen Li ; Tzu-Yuan Huang ; Hua Wang</i>	
<b>A 39GHZ 64-ELEMENT PHASED-ARRAY CMOS TRANSCEIVER WITH BUILT-IN CALIBRATION FOR LARGE-ARRAY 5G NR</b> .....	279
<i>Yun Wang ; Rui Wu ; Jian Pang ; Dongwon You ; Ashbir Aviat Fadila ; Rattanan Saengchan ; Xi Fu ; Daiki Matsumoto ; Takeshi Nakamura ; Ryo Kubozoe ; Masaru Kawabuchi ; Bangan Liu ; Haosheng Zhang ; Junjun Qiu ; Hanli Liu ; Wei Deng ; Naoki Oshima ; Keiichi Motoi ; Shinichi Hori ; Kazuaki Kunihiro ; Tomoya Kaneko ; Atsushi Shirane ; Kenichi Okada</i>	

<b>A 24.2-30.5GHZ QUAD-CHANNEL RFIC FOR 5G COMMUNICATIONS INCLUDING BUILT-IN TEST EQUIPMENT .....</b>	<b>283</b>
<i>D. Dal Maistro ; C. Rubino ; M. Caruso ; M. Tiebout ; I. Maksymova ; M. Ilic ; P. Thurner ; M. Zaghi ; K. Mertens ; S. Vehovc ; I. Tsvelykh ; E. Schatzmayr ; M. Druml ; R. Druml ; M. Mueller ; M. Anderwald ; J. Wuertele ; U. Rueddenklau</i>	
<b>A HIGHLY LINEAR 28GHZ 16-ELEMENT PHASED-ARRAY RECEIVER WITH WIDE GAIN CONTROL FOR 5G NR APPLICATION .....</b>	<b>287</b>
<i>Youngchang Yoon ; Kyu Hwan An ; Daehyun Kang ; Kihyun Kim ; Sangho Lee ; Jae Sik Jang ; Donggyu Minn ; Bohee Suh ; Jooseok Lee ; Jihoon Kim ; Meeran Kim ; Jeong Ho Lee ; Sung Tae Choi ; Juho Son ; Sung-Gi Yang</i>	
<b>A QUADRATURE CLASS-G COMPLEX-DOMAIN DOHERTY DIGITAL POWER AMPLIFIER.....</b>	<b>291</b>
<i>Shih-Chang Hung ; Si-Wook Yoo ; Sang-Min Yoo</i>	
<b>A FREQUENCY TUNEABLE SWITCHED-CAPACITOR PA IN 65NM CMOS .....</b>	<b>295</b>
<i>Zhidong Bai ; Ali Azam ; Jeffrey S. Walling</i>	
<b>A BROADBAND HIGH-EFFICIENCY SOI-CMOS PA MODULE FOR LTE/LTE-A HANDSET APPLICATIONS .....</b>	<b>299</b>
<i>A. Serhan ; D. Parat ; P. Reynier ; R. Berro ; R. Mourot ; C. De Ranter ; P. Indirayanti ; M. Borremans ; E. Mercier ; A. Giry</i>	
<b>A 27 GHZ ADAPTIVE BIAS VARIABLE GAIN POWER AMPLIFIER AND T/R SWITCH IN 22NM FD-SOI CMOS FOR 5G ANTENNA ARRAYS .....</b>	<b>303</b>
<i>Christian Elgaard ; Stefan Andersson ; Peter Caputa ; Eric Westesson ; Henrik Sjöland</i>	
<b>A 9 DB NOISE FIGURE FULLY INTEGRATED 79 GHZ AUTOMOTIVE RADAR RECEIVER IN 40 NM CMOS TECHNOLOGY .....</b>	<b>307</b>
<i>Tomotoshi Murakami ; Nobumasa Hasegawa ; Yoshiyuki Utagawa ; Tomoyuki Arai ; Shinji Yamaura</i>	
<b>A COMPACT 76-81 GHZ 3TX/4RX TRANSCEIVER FOR FMCW RADAR APPLICATIONS IN 65-NM CMOS TECHNOLOGY .....</b>	<b>311</b>
<i>Liang Chen ; Lei Zhang ; Weiping Wu ; Li Zhang ; Yan Wang</i>	
<b>A FULL-BAND MULTI-STANDARD GLOBAL ANALOG &amp; DIGITAL CAR RADIO SOC WITH A SINGLE FIXED-FREQUENCY PLL .....</b>	<b>315</b>
<i>Lucien J. Breems ; Jan Van Sinderen ; Tom Fric ; Hans Stoffels ; Franco Fritschij ; Hans Brekelmans ; Hendrik Van Der Ploeg ; Ulrich Moehlmann ; Robert Rutten ; Muhammed Bolatkale ; Shagun Bajoria ; Jan Niehof ; Bert Oude-Essink ; Gerard Lassche</i>	
<b>LASER SPECTRAL LINEWIDTH REDUCTION USING AN INTEGRATED POUND-DREVER-HALL STABILIZATION SYSTEM IN 180 NM CMOS SOI .....</b>	<b>319</b>
<i>Mohamad Hossein Idjadi ; Firooz Aflatouni</i>	
<b>22NM FD-SOI TECHNOLOGY WITH BACK-BIASING CAPABILITY OFFERS EXCELLENT PERFORMANCE FOR ENABLING EFFICIENT, ULTRA-LOW POWER ANALOG AND RF/MILLIMETER-WAVE DESIGNS .....</b>	<b>323</b>
<i>S. N. Ong ; L. H. K. Chan ; K. W. J. Chew ; C. K. Lim ; W. L. Oo ; A. Bellaouar ; C. Zhang ; W. H. Chow ; T. Chen ; R. Rassel ; J. S. Wong ; C. W. F. Wan ; J. Kim ; W. H. Seet ; D. Harame</i>	
<b>A LOW POWER FULLY-INTEGRATED 76-81 GHZ ADPLL FOR AUTOMOTIVE RADAR APPLICATIONS WITH 150 MHZ/US FMCW CHIRP RATE AND -95DBC/HZ PHASE NOISE AT 1 MHZ OFFSET IN FDSOI.....</b>	<b>327</b>
<i>Ahmed R. Fridi ; Chi Zhang ; Abdellatif Bellaouar ; Man Tran</i>	
<b>AN 82.2-TO-89.3 GHZ CMOS VCO WITH DC-TO-RF EFFICIENCY OF 14.8% .....</b>	<b>331</b>
<i>A. Tarkeshdouz ; M. Haghi Kashani ; E. Hadizadeh Hafshejani ; S. Mirabbasi ; E. Afshari</i>	
<b>A 62 GHZ TX/RX 2X128-ELEMENT DUAL-POLARIZED DUAL-BEAM WAFER-SCALE PHASED-ARRAY TRANSCEIVER WITH MINIMAL RETICLE-TO-RETICLE STITCHING .....</b>	<b>335</b>
<i>Umut Kodak ; Bhaskara Rupakula ; Samet Zehir ; Gabriel M. Rebeiz</i>	
<b>A 1-4 GHZ 4x4 MIMO RECEIVER WITH 4 RECONFIGURABLE ORTHOGONAL BEAMS FOR ANALOG INTERFERENCE REJECTION .....</b>	<b>339</b>
<i>Sajad Golabighezelahmad ; Eric Klumperink ; Bram Nauta</i>	
<b>Author Index</b>	