

Workshops and Short Courses

Workshops and Short Courses are offered on Sunday, Monday, and Friday and are distinguished by the following features:

- Advanced-level Workshops (designated as WSA, WSB, etc.) present the state of the art to specialists who are already experienced in the topic area.
- Tutorial-level Workshops (TSA, TSB, etc.) are targeted toward educating attendees in new areas of microwave technology, reviewing material that is primarily a revision of previously published information

- Short Courses (CSA, CSB, etc.) are offered by a well-coordinated team of two experts following a detailed course outline, providing a coherent tutorial presentation of a single topic to non-specialists. Each participant earns IEEE continuing education units.

All Workshops and Short Courses will be held at the Hawaii Convention Center. Specific room assignments will be announced at check-in.

Sunday Workshops and Short Courses

08:00–17:00

WSA

Architectural Design and System Verification for Wireless SoC — Nice to Have or a Real Necessity?

Topics and Speakers:

- Best Practices for Adopting Model-Based Design into Wireless SoC Development Flow, C. Warwick, The Mathworks
- Analog-on-Top Verification of AMS-RF Applications, J. Hartung, Cadence
- Automated Design Validation Flow for Mixed-Signal SoCs, T. Tarim and O. Eliezer, Texas Instruments
- Study of Existing Methods for Wireless System Design and Propose a New Method for Top-down and Bottom-up Design in RF, Y. Miyahara, Panasonic R&D Company of America
- System-Level Verification from RF-Level Design, S. Wedge, Synopsys
- Architectural Design and System Verification for Wireless SoC, a Must for Multimode Cellular Transceivers, D. Schwarz, Freescale Semiconductor
- Architectural Design and System Verification for Wireless SoC - Nice to Have or a Real Necessity? M. Barnasconi, NXP Semiconductors
- A Top Down Design Methodology for Mixed-Signal Integrated Circuits using C++ Behavioral Modeling, M. Perrott, MIT-EECS

Organizers: J. Niehof, NXP Semiconductors; M. Barnasconi, NXP Semiconductors

Sponsor: RFIC

As more and more digital signal processing is included in the RF pipe, not only for modulation and demodulation purposes, but also to facilitate digital calibration, testing and configuration, an overall system-level design approach at architecture level is essential. Furthermore, verification of the complete embedded system solution, including RF and mixed-signal circuitry, is becoming recognized as an essential step in the design release process before committing to tape-out.

72

08:00–17:00

WSB

Wireless Reconfigurable Terminals: Adaptive Analog Circuits or Digital RF Processing?

Topics and Speakers:

- Reconfigurable Si RF Receiver Front-Ends for Multistandard Radios, M. Brandolini, Broadcom Corporation
- Reconfigurable Analog Baseband Circuit Design, O. K. Shanaa, Maxim Integrated Products
- Digital RF Processing for Wireless Receivers, K. Muhammad, Texas Instruments
- Digital RF Processing for Wireless Transmitters, O. Eliezer, Texas Instruments
- Reconfigurable Transmitters and Power Amplifiers, L. Larson, UC San Diego
- Polar Transmitters for Reconfigurable Radios, E. McCune, Panasonic Emerging Advanced RF Laboratory
- Reconfigurable ADCs / DACs for Multimode Terminals, K. Gulati, BitWave Semiconductor Inc
- Reconfigurable VCOs and Synthesizers, A. Gnudi, University of Bologna

Organizers: W. Y. Ali-Ahmad, American University of Beirut; O. K. Shanaa, Maxim Integrated Products

Sponsor: RFIC

“Life goes wireless!” This motto for the 21st century is pushing the evolution of new wireless devices, which confirm to multi-wireless standards and operate over multifrequency bands. This workshop will review current adaptivity design concepts for reconfigurable RF and analog base band integrated front-ends. In addition, it will present new Digital RF Processing (DRP) techniques for wireless transceivers, which move the radio reconfigurability concept to the digital domain.

13:00–17:00

WSC

Optimum CMOS Integrated LNA Design Techniques for Handsets

Topics and Speakers:

- Design of CMOS Receiver LNAs, J. Long, Delft University of Technology
- State of the Art Techniques for High Linearity Integrated CMOS Low Noise Amplifiers, V. Aparin, Qualcomm
- Modulated-Signal Distortion Measurements to Support Nonlinear Circuit Simulation, K. Remley, NIST
- Device Modeling and Technology Parameters Affecting LNA Performance, J. Pekarik, IBM
- Interface, Co-Integration and Stability Aspects of Modern CMOS LNA Designs, T. McKay, RFMD
- Case Studies of Three Cellular LNA Designs in 90 nm CMOS, D. Griffith and S. Pennisi, Texas Instruments

Organizers: T. McKay, RFMD; J. Pekarik, IBM; L. Reynolds, RFMD

Sponsor: RFIC

This workshop will cover new techniques specific to CMOS LNA design for handsets in existing and emerging standards bands in the 800 MHz to 6 GHz frequency range. Focus on exploiting CMOS technology, with learning from 0.25 μm through 90 nm, emphasizing 90 nm and below where design iteration is prohibitive and excellence is demanded. By expounding on issues such as source mismatch, stability, nonlinear simulation accuracy, manufacturability, increased confidence in new techniques is developed.

08:00–17:00

WSD

Nanoscale RFIC Design Challenges and Foundry Solutions

Topics and Speakers:

- Advanced Nanoscale RFCMOS Foundry Technology Challenges and Solutions, J. Chern, S. Liu, TSMC
- Nanoscale RFCMOS Foundry Technologies and Design Support, A. Yen, UMC
- Design Challenge of ESD Protection, RF I/O, and Low Voltage Consideration in Mixed Process Note Deep Submicron and Nanometer CMOS Technologies, P. Ouyang, T. Yu, F. Lo, I.C. Chen and L.W. Yang, SMIC, R. Huang, H. Liao, PKU, Beijing, Y. Cheng, SHRIME, Peking U., A. Wang, Illinois Institute of Technology
- Foundry Solutions for Next-Generation RFIC Design, M. Racanelli, Jazz Semiconductor
- Topics in Wireless RFIC Design Methodology Going to Submicron Semiconductor Processes, R. A. Mullen, Cadence Design System
- RF SiP Solution and Challenges, C.T. Chiu, ASE Corp.
- Enhancing Overall Nanoscale RF CMOS System Performance with the Right Packaging Solution, N. Karim, Amkor Technology
- CMOS Scaling Impacts to RF/Mixed-Signal Circuit Design, M.C. Frank Chang, UCLA
- CMOS RF Transceivers for 5-GHz Broadband Wireless Access, S. S. Lu, H. C. Chen, National Taiwan U.

Sunday Workshops and Short Courses

- Mixed-Signal Design Techniques for Deep-Submicron CMOS Single-Chip Receiver SOCs, A. Maxim and R. Poorford, Silicon Laboratories
- Device Variability of Nanoscale RF CMOS Circuits and its System Mitigation, B. Staszewski and O. Eliezer, Texas Instruments Inc.

Organizers: L. W. Yang, SMIC; K. C. Wang, UMC; J. Lin, University of Florida

Sponsors: RFIC, MTT-9

Semiconductor foundries have been playing an increasingly important role in IC industry. RFCMOS technologies are mostly based on the processes for digital applications. The traditional RF design techniques are limited by transistor leakage current, device mismatches, passive components, ESD protection, noise and substrate modeling. This workshop addresses these limitations and solutions.

08:00–17:00

WSE

System-in-Package Technologies for Cost, Size, and Performance

Topics and Speakers:

- RF SiP Technology and Capability Overview, M. P. Gaynor, Antenova
- Laminate SiP Modules, M. Mangrum, Freescale
- RF SiP Modeling and Design, F. Lin, A*STAR IME
- Design and Implementation of Chip Scale Modules for Wireless Applications, K. Sun, Murata
- LTCC-Based SiPs and FEMs for Ultrasmall Size WLAN/WiMAX/BT Connectivity Solutions, P. Heide, EPCOS AG
- Global Universal Radio Units (GURU) Realized Using Multilayer Organics (MLO), G. White JMD
- Silicon Integrated Passive Devices for RF SiP, R. Frey, Independent Consultant
- RF Module Packages, E. Gongora, STATS Chippac
- System on Chip (SoC) as an Alternative to SiP, D. Nobbie, Peregrine

Organizers: M. P. Gaynor, Antenova; P. Heide, EPCOS AG; F. Lin, A*STAR IME

Sponsors: MTT-20, MTT-16

This workshop covers in detail all common current options for System in Package RF modules including laminates, LTCC, LCP, and silicon or GaAs IPDs. These options are constantly balanced by module designers to achieve the lowest cost and size with required RF performance. The trend towards full radio modules from the current PA modules and Front End Modules is demanding ever-higher levels of integration with the passive

73

Sunday Workshops and Short Courses

circuitry lagging the active MMIC.

08:00–17:00

WSF

Advances in WiMAX RF Technology

Topics and Speakers:

- Mobile WiMAX: Do We Really Need Another Air-Interface, M. Cooper, ArrayComm Inc.
- Samsung's WiMAX Deployment and Perspectives, K. Lee, Samsung Telecommunications America
- RF Issues Associated with WiMAX in the WCS Band, T. Sutton, NextWave Broadband Inc.
- Compatibility Analysis of Multiple Radios in Mobile/Portable Stations, Q. Gu, Marvell Semiconductor Inc.
- RFIC Architectures and Tradeoffs for WiMAX, R. Eline, Intel Corporation
- Chip-Level RF Technology Aspects for WiMAX, M. Livingston and T. Dillahunty, Atmel Corporation
- Channel Estimation for MIMO Systems for WiFi Applications, N. E. Buris, Motorola Inc.
- Efficient Enhancement Techniques for WiMAX Power Amplifiers, L. E. Larson, UCSD Center for Wireless Communications, University of California, San Diego
- High Efficiency Power Amplifier Developments Using GaN Technology for Both Fixed and Mobile WiMAX Systems, R. Pengelly, CREE
- Circuit Architectures and Designs for WiMAX and Multi-mode RF Receivers, N. K. Yanduru, Texas Instruments Inc

Organizers: E. Niehenke, Niehenke Consulting; U. Dhaliwal, Future Wireless Technologies; B. Spielman, Washington University at St Louis

Sponsors: MTT-20, MTT-6

This workshop will present RF system requirements and market requirements needs for successful WiMAX systems (802.16). The latest transmitter and receiver architectures and tradeoffs will be presented including efficiency transmitter enhancement techniques. Co-existence with other wireless systems such as Bluetooth, WLAN, and emerging UWB devices will be presented. The latest WiMAX architecture and chip sets designs from the leading manufactures will be shown.

08:00–17:00

WSG

Solid-State Power Invades the Tube Realm

Topics and Speakers:

- High-Power Microwave and Millimeter-wave Vacuum Electronics for Military Applications, B. Levush, Naval Research Laboratory
- Today's Vacuum Electronics Industry: Powering Tomorrow's Frontiers, C. Armstrong, L-3 Communications
- Device Technology for High-Power Applications, C. Weitzel, Freescale

- Device Technology for Millimeter-wave Applications, A. Oki, Northrop Grumman
- Characterization and Modeling of GaAs, GaN, SiC and LDMOS RF Power Transistors, W. Curtice, W.R. Curtice Consulting
- A New Perspective on PA Efficiency Enhancement Techniques, S. Cripps, Hywave Associates
- High-Power Power Combining Techniques, R. York, University of California at Santa Barbara
- 500 W L-band / 800 W S-Band GaN HEMTs for High Power Pulsed Applications, E. Mitani, Eudyna Devices
- kW-Class Solid-State PAs for L/S-Band Radar, D. Dawson, Northrop Grumman

Organizers: J. Schellenberg, Trex Hawaii; D. Dawson, Northrop Grumman

Sponsor: MTT-5

Solid-state power amplifiers continue to invade the performance realm of the vacuum tube. At L and S-band frequencies, solid-state power amplifiers are pushing into the kilowatt region and at X-band into the hecto-watt realm. Even at mm-wave frequencies, we are seeing solid-state PAs with power levels of 10 watts or more. Clearly, the future of the tube is limited, or is it? This workshop brings together leading experts from both industries to discuss this issue and present the latest data.

08:00–12:00

WSH

UWB Radio: From Building Block to SoC

Topics and Speakers:

- Use of Cognitive Radio Techniques for OFDM Ultra-Wideband Coexistence with WiMAX, J. Lansford, Alereon, Inc.
- RF/Mixed-Signal IC Design for UWB OFDM Systems, S. Raman, Virginia Polytechnic Institute and State University.
- Design Strategies for CMOS UWB Radios, A. H-C. Kang, Realtek
- ESD Protection for Wideband RF CMOS Circuits — Challenges, Options and Trade-offs, N. Iyer, Silterra Malaysia Sdn Bhd
- Front-end Amplifier Design for Ultra-Wideband Systems, R. Gharpurey, University of Texas at Austin
- C-Wave UWB Chipsets, R. Sengottalyan, Pulse-Link

Organizers: A. Wang, Illinois Institute of Technology; L. Yang, SMIC; Y. Zhou, The Chinese Academy of Sciences

Sponsor: RFIC

This workshop focuses on advances in developing Si-based ultra-wideband (UWB) radio integrated circuit systems. Topics covers from front-end blocks to UWB SoCs, including, low noise amplifiers, pulse generators, mixers, multipliers, ADC, transmitters,

receivers, timing, digital baseband, MAC, etc. Attendees will be exposed to critical design issues and tricks related to UWB SoC designs.

13:00–17:00

WSI

Advances in Mixer Design for UWB Transceivers

Topics and Speakers:

- Mixers in UWB Systems — an Overview, Modeling and System Aspects, R. Follmann, IMST
- Ultra-wideband Linear Mixers for High Datarate Communication and Remote Sensing Systems Based on mHEMT, pHEMT, and CMOS MMIC Technologies, H. Zirath, Chalmers University
- A Mixer Based Method of Generating Pulses for Indoor UWB Systems, A. Beyer, Duisburg-Essen University
- CMOS Transmitter Design for Low Power Low Data-Rate UWB Communication, J. Ryckaert, IMEC
- Use of Six-Port Technology in UWB Transceiver Design, K. Wu, Poly-Grames

Organizers: A. Beyer, Duisburg-Essen University; D. Schreurs, K.U.Leuven; S. Maas, AWR

Sponsors: MTT-1, MTT-22, MTT-20

During the last decade rapidly increased developments in wireless telecommunication applications can be observed. The most challenging in terms of (sub-) system design is the emerging UWB technology. In this workshop, we focus on recent advances in UWB transceiver design and the mixer building block in particular. The talks will treat topics like architectures, analysis methods, circuit design techniques, and performance.

08:00–12:00

WSJ

RFID

Topics and Speakers:

- Introduction to RFID and Passive Tag ICs, N. Camilleri, Alien Technology
- Passive UHF RFID CMOS Tag IC Using Ferroelectric RAM Technology, S. Masui and T. Ninomiya, Fujitsu
- Challenges and Design of UHF RFID Reader Integrated Transceivers, I. Kipnis, Intel Corporation
- Trends for Mobile RFID Reader SoCs, Developed by Korean ASIC Companies, J.S. Park, Kookmin University
- Fully Integrated UHF RFID Systems for Near-field and Far-field Applications, R. Rofougaran and M. Rofougaran, Broadcom
- Reader Chipset for UHF RFID, M. O'Neal, WJ Communications

Organizer: N. Camilleri, Alien Technology

Sponsor: RFIC

Sunday Workshops and Short Courses

RFID technology has come a long way in the last decade. RFIC implementations have enabled very small RFID tag chips that work at 13, 900, and 2400 MHz. Reader technology has also come a long way and is currently morphing from several discrete implementations to custom integrated solutions. The workshop will provide an introduction to RFID and then will dive into the tradeoffs and techniques that one has to do to implement small tag ICs and high performance reader chip sets.

13:00–17:00

WSK

Emerging RFID and Wireless Sensors: Technologies and Applications

Topics and Speakers:

- Paper-based RFID and Wireless Sensors: Is it the Ultimate Low-Cost Solution?, M. Tentzeris, Georgia Tech
- Cognitive Radio and Analog Sensing for Wireless Sensors, J. Laskar, Georgia Tech
- Printed Batteries and Miniaturized Energy Scavenging for RFID and Wireless Sensors, L. Johnson, Excellatron
- RF Performance of Conductive Inks for RFID and Sensors' Printed Circuits, M. Oljaca, Cabot
- Integration and Matching of Low-Power RFID IC in Conformal Sensor Modules, M. Penry, NSC
- Miniaturized Antennas for Enhanced-Range RFID, R. Banerjee, 3M

Organizers: M. Tentzeris, Georgia Tech; J. Laskar, Georgia Tech

Sponsors: MTT-16, MTT-12

This workshop will review and explore challenges in RFID and wireless sensors for both traditional and emerging applications. It will also cover ultralow-cost paper-based electronics, energy scavenging approaches, RFID IC approaches and matching, as well as RF performance under various challenging sensor topologies.

13:00–17:00

WSL

Software Defined Radio to Cognitive Radio

Topics and Speakers:

- Software Defined Radio Transceiver SOC approach, A. Abidi, UCLA
- Software Defined Radio Transceiver SIP approach, L. Larson, UCSD
- Industrial Software Defined Radio Transceiver example, R. B. Staszewski, Texas Instruments
- Towards Cognitive Radio, T. Martin, Science & Technology Associates

Organizers: D. Belot, STMicroelectronics; J. B. Begueret, IXL Lab

Sponsor: RFIC

This workshop will focus on new design of radio architectures

Sunday Workshops and Short Courses

(circuits and systems) dedicated to Software Defined Radio (SDR) and Cognitive Radio (CR), which is the main challenge for the next generation of RF transceivers. In order to frame the workshop we have extracted two definitions of what are SDR and CR.

SDR is a radio that includes a transmitter in which the operating parameters of frequency range, modulation type or maximum radiated power (either radiated or conducted), or the circumstances under which the transmitter operates can be altered by making a change in software without making any changes to hardware components that affect the RF emission.

Extracted from U.S. FCC Cognitive Radio Report and Order, CR is a radio or system that senses and is aware of its operational environment and can be trained to dynamically and autonomously adjust its radio operating parameters accordingly.

08:00–12:00 WSM

24 GHz ISM-Band Communications

Topics and Speakers:

- SiGe for mmWave Applications: Capabilities and Limitations, B. Goucher, IBM
- 65 nm CMOS for 24 GHz: Potential and Pitfalls, J. Rizk, Intel
- Standards and System Level Issues in 24 GHz ISM Communications: Smart Antennas and Phased Arrays for Reliable Link Design, W. Ali-Ahmad, MAXIM
- Silicon Phased Arrays: Comparison between RF, LO and IF Phase-Shifting Architectures and latest results from UCSD/Intel, G. Rebeiz, UCSD
- 24 GHz CMOS Phased Arrays: Latest Developments at USC, H. Hashemi, USC
- 24 GHz Low Cost Plastic Packaging and High-Volume IC Testing, A. Street, MACOM

Organizers: I. Gresham, Tyco Electronics Wireless Systems; G. Rebeiz, UCSD

Sponsor(s): MTT-16

CMOS has now reached the level of maturity that low-cost transceivers with sophisticated performance can be envisaged. This workshop will review the status of the technologies, standards, and applications, and postulate what the next steps may be before commercial products become widely available.

13:00–17:00 WSN

Millimeter-Wave/Quasi-Millimeter-Wave Highly Integrated Circuits

Topics and Speakers:

- Silicon Technology, Circuits, Packages, and Systems for 60–100GHz Communications and Radar Systems, B. Floyd, IBM
- Highly Integrated GaAs MMICs using Three-dimensional MMIC Technology, Y. Yamaguchi, NTT Corporation
- SoP Integration of 60GHz Radio, C.S. Park, Information and Communications University
- CMOS Millimeter-wave Frequency Sources, C. Cao and K. K. Oh, University of Florida

Organizers: T. Nakagawa, NTT Corporation; N. Suematsu, Mitsubishi Electric Corp.

Sponsor: RFIC

There are many RF system-on-chip devices in which the operating frequencies are below 6 GHz. Because millimeter-wave and quasi-millimeter-wave integrated circuits are traditionally implemented using compound semiconductors such as GaAs or InP, the integration scale is limited. However, recent progress in device technology can overcome the problem. This workshop will focus on highly integrated circuits whose operating frequency is over 20 GHz.

08:00–12:00 WSO

Silicon BiCMOS and CMOS PA from RF to mmWave

Topics and Speakers:

- CMOS Devices for Power Amplifiers, J. D. Alamo, MIT
- CMOS Power Amplifiers for mmWave Applications, A. Niknejad, University of Berkeley
- RF CMOS PA for Cellular and WLAN Applications, D. Masliah, Acco Company
- CMOS Transmitter Combining Amplitude Modulator and Power Amplifier, J. Loraine, RadioSis, Limited

Organizers: D. Belot, STMicroelectronics; E. Kerherv, IXL Lab; Y. Deval, IXL Lab

Sponsor: RFIC

This workshop will deal with the most recent developments of CMOS or BiCMOS power amplifiers for cellular, LAN, PAN, satellite and radar applications. The frequency range covered is from 1 GHz up to 100 GHz. The presenters will compare new BiCMOS or CMOS circuits and/or devices with existing ones in technologies brought into play presently (i.e., InP, GaAs). The presenters will be balanced with academic and industrial affiliations.

13:00–17:00 WSP

Integrated Broadband Tuners for Satellite and Terrestrial Applications

Sunday Workshops and Short Courses

Topics and Speakers:

- Silicon RFICs for Direct Broadcast Satellite Communications, W. Gao, Conexant Systems
- Multiband Multimode Mobile TV Tuner in CMOS, B. Kim, Integrant Technologies Inc.
- Frequency Synthesizer Architectures for Broadband Tuners: Ring Oscillator versus LC Oscillator and Low-IF versus Zero-IF Receivers, A. Maxim, Silicon Laboratories
- SiGe IC Design for Satellite Microwave Front-Ends, C. Vaucher, NXP Semiconductors

Organizers: B. Bakkaloglu, Arizona State University; S. Kiaei, Arizona State University; Y. Deval, University of Bordeaux

Sponsor: RFIC

Integrated broadband tuners have several design challenges due to wide tuning range, linearity under several blocker channels, dynamic range and harmonic mixing of blocker channels. This workshop will focus on architectures and circuits for addressing several design challenges associated with integrated broadband tuners for terrestrial, cable and satellite applications.

08:00–17:00 TSA

RFIC Circuit and System Design Tutorial

Topics and Speakers:

- On-chip Inductor and Transformer Modeling, D. K. Shaeffer, Beceem Communications
- RF CMOS IC Simulation Improvements and New Industry Standard MOSFET and CMOS Varactor Models, J. Victory, Jazz Semiconductor
- Transmitter Architectures and Circuits, J. C. Rudell, Intel Corporation
- Receivers: Architectures and Circuit Design, D. Ozis, Telegent Systems
- A/D Converters for Wireless Communication in Nanometer CMOS, Y. Chiu, University of Illinois
- Piezoelectric Contour-Mode Vibrating RF MEMS, G. Piazza, University of Pennsylvania
- Frequency Synthesis for Wireless Systems, W. Khalil, Intel Corporation
- All-Digital TX and Discrete-Time RX, R. Staszewski, Texas Instruments

Organizer: J. C. Rudell, Intel Corporation; D. K. Shaeffer, Aspendos Communications

Sponsor: RFIC

This workshop will begin by covering the basics of transceiver design. Topics will range from CMOS device and passive component modeling to wireless building block design to the realization of full transceiver systems on a chip. High integration transmitters, receivers, and synthesizers as well as newer digital

transceivers systems will be discussed. In general, this tutorial heavily emphasizes CMOS circuit design and high integration radios for common commercial standards including cellular and Wireless LAN.

08:00–17:00 TSB

Analog and High-Speed Circuit Design Solutions for Nano RF CMOS

Topics and Speakers:

- RFIC Case Study, D. Schmidt, Intel Corporation
- Challenges for Nanoscale Transceivers Embedded in Highly Complex SoC's, A. Hanke, Infineon Technologies
- Digital RF Processor (DRP™) Wireless SoC in Nano RF CMOS, S. Pennisi, Texas Instruments
- Silicon – Package Co-Design, N. Karim, Amkor
- Overview of 90 nm Challenges, A. Yen, UMC Corporation
- On-chip Transformer Cascode Circuit Design Techniques, D. Huang, UCLA
- EDA Design Solutions for Nano CMOS, D. Wu, Ansoft Corporation
- Nano-scale CMOS Computer Hands-on Session, Ansoft Corporation

Organizer: L. I. Williams, Ansoft Corporation; Y. Cheng, Siconlinx Inc.

Sponsor: RFIC

Better performance and integration motivates RF designers to implement circuits at the 90-nm node and below. This scaling enables greater performance but introduces significant risks for designing and fabricating RF, analog, and high-speed circuits. This workshop provides practical design solutions to challenges of nano-scale CMOS by leading experts in IC design, packaging, foundry, and EDA. Issues such as low-threshold voltage, noise, high leakage, high variability, and DFM will be explored. A unique computer hands-on session allows attendees to simulate many of the concepts covered.

08:00–17:00 TSC

Tutorial Workshop on RF and Microwave Filter Design

Speaker and Organizer: H. Clark Bell, HF Plus

Sponsor: MTT-8

Topics include two-port parameters; lowpass/highpass ladders; Chebyshev filter; immittance inverters and narrowband design; resonator Q, delay and loss, and lossy coupling; TEM bandpass filters and bandstop filters; waveguide bandpass filters; general coupled-resonator prototype; loss approximation, the elliptic function filter; realization polynomials and immittances; band-

Sunday Workshops and Short Courses

pass filters with cross couplings; dual mode filters; environmental effects on filter performance.

08:00–12:00 TSD

SDR and Cognitive Radio — The Need for Reconfigurable RF Front-Ends

Topics and Speakers:

- RF Requirements for Evolution of SDR, C. Bostian, A.B. MacKenzie, and S. Raman, Virginia Tech
- Front End Challenges for Cognitive Radio, J. Mitola, Mitre Corporation
- Front Ends for Commercial Digitally Controlled Radios, B. Krenik, Texas Instruments
- Tunable RF Front-End Technologies, S. Toncich, Qualcomm
- Reconfigurable Front-End Microsystems, J. Papapolymerou, Georgia Tech
- BST Technology for RF Front-Ends, T. Watson, AgileRF

Organizers: A.S. Morris, wiSpry, Inc.; R.F. Drayton, University of Minnesota

Sponsor: MTT-21

This half-day workshop will begin with the system requirements for tunable front-end sub-systems to enable SDR and CR. Details of needed components for these subsystems will be presented and their required performance and features will be elucidated. Candidate technology solutions will follow including details of remaining challenges. Both industrial and academic perspectives will be presented.

08:00–17:00 CSA

Micro Coaxial Lines: Theory, Design, and CEM Lab

Instructors: Dejan S. Filipović, University of Colorado; Chris Nichols, Rohm and Hass

Topics: Miniature Coaxial Lines; Recta-Coax Design; Multiphysics Modeling; Fabrication and Measurements; Resonators; Antennas; Butler Matrix as Integration Example

Sponsor: MTT-1

High level of three-dimensional (3D) integration of various passive components is necessary for achieving compact, low-cost, multifunctional millimeter-wave systems designed to deliver high quality performance. In this course, attendees will be introduced to the theory, modeling, design, fabrication, measurements and application of rectangular coaxial lines (RCLs) and components built using surface micromachining. Focus will be on a recently developed PolyStrata process (by Rohm and Hass). Low loss,

high packaging density, low crosstalk, dispersion-free transmission lines, high Q-factor resonators and filters, multilevel directional couplers, efficient antennas are just a few topics that will be covered. Ka-band phased array with Butler matrix beamforming network will be used to demonstrate the integration capabilities. The laboratory component will include three computational exercises, where attendees will develop conformal mapping and finite element based analytical and numerical models of RCLs.

08:00–12:00 CSB

Galileo — Europe's Share for a Global Navigation Satellite Service

Instructors: Henning Ehm and Robert Weigel, Institute for Electronics Engineering, University Erlangen-Nuremberg, Germany

Topics: Satellite Navigation; Galileo; GPS; Receiver Technology; Modulation

Sponsor: MTT-9

Galileo is Europe's first satellite navigation system, which is at present in the in-orbit validation phase and will be fully available from 2011 on. With Galileo, the first civil and global satellite navigation system will be introduced. With Galileo a completely new set of services and signals will be introduced, with higher accuracy than today's GPS, which will lead to new classes of applications. Furthermore, for the first time availability and integrity data of the satellite navigation signal will directly be available on a global scale, paving the way to security critical applications, e.g., aircraft landing and train- and ship-guiding.

This course gives a broad introduction to the Galileo satellite system. The course will start with a general introduction into satellite navigation. In the second part the Galileo system will be presented in detail, containing services, signals, system architecture, etc. In the third part advanced receiver architectures for combined Galileo/GPS reception will be presented and an outlook to upcoming and future trends in the area of satellite navigation will be given.

Monday Workshops and Short Courses

08:00–17:00 WMA

Advances in Active Device Characterization and Modeling for RF and Microwave

Topics and Speakers:

- Nonlinear FET Modeling Fundamentals and Neural Network Applications, D. E. Root, Agilent Technologies
- The Chalmers University FET Model and Applications, I. Angelov, Chalmers University
- Characterization of FET Dynamics and Nonlinearity, A. E. Parker, Macquarie University
- Large-Signal Characterization and Modeling of Transistors, D. Schreurs, Katholieke Universiteit Leuven
- HBT Characterization and Modeling, M. Rudolph, Ferdinand Braun Institute
- High-Power Measurements of RF Transistors, P.J. Tasker, Cardiff University
- Product and Package Modeling for High Power RF Transistors, P. H. Aaen, Freescale Semiconductor
- Global Modeling of Nonlinear Transistors and Devices, M. B. Steer, North Carolina State University
- Neuro-Space-Mapping Techniques for Transistor Modeling, Q.J. Zhang, Carleton University

Organizer: J. Wood, Freescale Semiconductor; D. Schreurs, Katholieke Universiteit Leuven

Sponsors: MTT-1, MTT-11, ARFTG

In recent years, several new microwave device technologies have been developed and are entering the marketplace, including LDMOS, GaN FETs; SiGe and III-V HBTs, and RF CMOS. There have been contemporary developments in nonlinear device characterization methods during this time, such as fast pulse measurement systems at DC and RF, and the large-signal network analyzer, for example. We have also seen a tremendous development in nonlinear device modeling techniques, including optimization for parameter extraction, in multivariate function-fitting for generating the model functions, and advances in integration of several simulation engines, in "Global Modeling" methods. In this workshop, we bring together the leading experts in these fields to present an up-to-date view of a range of nonlinear RF and microwave transistor modeling and characterization methods, reviewing established practices and presenting new techniques.

08:00–17:00 WMB

On-Chip/Off-Chip DC, RF, and Microwave Measurement Modules for RFIC, SoC, and SiP Self Characterization, Self Test, Self Debug, and Diagnosis

Topics and Speakers:

- RF and Microwave Measurement Block Requirements for DFC, DFT and DFDD, J.L. Carbonéro, ST Microelectronics
- RF to DC Correlation Used for Pass/Fail Screening to Reduce Test Cost in Production Environment, M. Slamani, IBM
- Current Sensor Design for ZIGBEE LNA Monitoring, H. Lapuyade, University of Bordeaux
- Low Cost Built-In Test of Wireless DATA Transceivers, A. Chatterjee, Georgia Tech Institute
- Progress in On-Chip S-Parameter Measurement Techniques, W.R. Eisenstadt, University of Florida
- On-Chip Estimation of RF Power Amplifier's Non-Linearity, J.M. da Silva, University of Porto
- Embedded Test Strategies for System in Package and Multi Technology MEMS, A. Richardson, University of Lancaster
- Effect of Advances in RF and Radio Architectures on Test Strategies, S. Abdennadher, Intel

Organizers: J.L. Carbonéro, ST Microelectronics; H. Lapuyade, University of Bordeaux; W.R. Eisenstadt, University of Florida

Sponsors: MTT-11, MTT-23

More and more SoC or SiP products incorporate Analog, Mixed-Signal and RF parts. The Characterization, Test, Diagnostic and Debug of these parts are very challenging and costly, especially when the parts are embedded in a larger digital system. One way to reduce these test costs is to design and develop off-chip measurement modules to be incorporated on the test board itself or to implement DFT inside the chip in order to reduce either the test time or the required test resources. This workshop will present recent results obtained in the RF and microwave frequency range for on-chip and off-chip measurement blocks. DC measurement modules for these circuits will also be presented as an alternate or companion methods to test microwave and RF circuits. A mini-panel will conclude the workshop by a discussion on the advantages and drawback of on-chip solutions compared to off-chip ones.

08:00–17:00 WMC

High-Speed Signal Integrity

Topics and Speakers:

- Building Bridges between Today's Digital and Microwave Technologies, M. Resso, Agilent Technologies
- Measurement-based Modeling for High Speed Semiconductor Test Interface Boards, H. Barnes, Verigy
- Challenges and Solutions for Measuring Multiple Aggressor Differential Crosstalk, B. Schaefer, Agilent Technologies
- Practical Design and Implementation of Stripline TRL Calibration Fixtures for 10 Gigabit Interconnect Analysis, D. Dunham, Molex
- Packaging a Supercomputer in a PCI Express Form Factor, G. Edlund, IBM