

The 2002 IEEE Radio Frequency Integrated Circuits (RFIC) Symposium will be held in Seattle, WA on June 2-4, 2002 in conjunction with the IEEE MTT-S International Microwave Symposium. It opens Microwave Week 2002, the largest world-wide RF/Microwave meeting of the year.

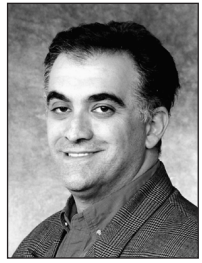
The RFIC Symposium brings focus to the technical accomplishments in RF systems, circuit, device and packaging technologies for mobile phones, wireless communication systems, broadband access modems, radar systems and intelligent transport systems.

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# Message from the RFIC General Chairman

## Radio Frequency Integrated Circuits Symposium 2002 (RFIC 2002)



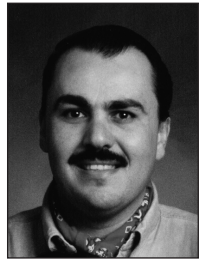
Sayfe Kiaei

The RFIC symposium is a leading international conference dedicated to the advancement of Integrated Radio Frequency Circuits and Subsystems for RF and communication applications. The RFIC symposium program will start with tutorials and workshops held on Sunday. The Technical program will take place on Monday and Tuesday and will include technical papers, a panel session, and a number of invited and special sessions related to the latest advancements in RFIC development. The Technical Program will start off on Monday morning with keynote plenary session. The first keynote talk is "*The Worldwide Wireless Web*" presented by Behrooz Abdi of Motorola Inc. Mr. Abdi is the vice president and general manager of the Radio Products division within the Semiconductor Products Sector. The second keynote talk will be "*From 'Cellphone' to 'Remote Control on Life': How Wireless Communications Will Change the Way we Live Over the Next 20 Years*" by Dr. William Webb. Dr. Webb is with PA Consultants and this paper is based on his book titled, "The Future of Wireless Communications". The third keynote talk will be "*Requirements for High Performance RF/UHF ICs and Possible Solutions*" by Dr. Ulrich Rohde. Dr. Rohde is President of Communications Consulting Corporation and Executive Vice President of Ansoft Corporation. The RFIC social reception will be held on Sunday evening and the Microwave Journal/ MTT-S Reception on Monday evening.

Sayfe Kiaei  
General Chairman  
2002 IEEE RFIC Symposium

# Message from the RFIC Technical Chairman

On behalf of the Technical Program Committee, welcome to the 2002 IEEE Radio Frequency Integrated Circuits (RFIC) Symposium. The RFIC Symposium is one of the foremost IEEE technical conferences dedicated to the latest innovations in RFIC development for wireless and wire-line communication systems. The RFIC Symposium will begin on Sunday with workshops that address various topics on RF technology, design, and system issues. On Sunday there will also be several Tutorial sessions that are intended to be in the form of an educational forum. The Plenary Session will start off the conference on Monday with a focus on wireless systems, the future of cellular communications, and RFIC design. Following the Plenary Session, the regular technical program will start with four parallel sessions. A Panel Session during lunch will allow interactive discussions on the merits of using RF-CMOS in Cell-Phones. The Panelists, representing various industries and academia will address their views on the future of high performance RF-CMOS for mobile handsets. The RFIC symposium will conclude on Tuesday with several Joint sessions with IMS, which also includes an interactive forum. The goal of the technical committee has been to enhance the quality of the technical program. During Monday and Tuesday the RFIC Symposium will have 18 sessions, together with 16 invited papers.



**Natalino Camilleri**

I would like take the opportunity to thank the authors and the technical program committee members for an exciting program. On behalf of the Steering Committee, we are look forward to seeing you in Seattle.

Natalino Camilleri  
RFIC Technical Program Committee Chairman  
2002 IEEE RFIC Symposium

## **RFIC Steering Committee**

Sayfe Kiaei, *General Chair*, Arizona State University  
Natalino Camilleri, *TPC Chair*, RF & Wireless Design Services  
Kirk Ashby, *Finance*, Microtune  
Luciano Boglione, *Publicity*, Agilent Technologies  
Stephen Lloyd, *Transactions*, Conexant Systems, Inc.  
Eric Maass, *Special Sessions*, Motorola, Inc.  
Tina Quach, *Secretary*, Motorola, Inc.  
Joe Staudinger, *Digest*, Motorola, Inc.  
Takao Inoue, *Web Master*

## **RFIC Advisory Board**

Fazal Ali, Nokia Mobile Phones  
Eliot Cohen, Palisades Institute for Research Services  
Reynold Kagiwada, TRW  
Christian Kermarrec, Analog Devices  
Mahesh Kumar, Lockheed Martin  
Louis Liu, TRW  
Dave Lovelace, Gain Technologies  
Vijay Nair, Motorola, Inc.

## **RFIC Technical Program Committee**

Luciano Boglione, Agilent Technologies  
Kirk Ashby, Microtune  
Natalino Camilleri, RF & Wireless Design Services, Inc.  
Glen Chang, Silicon Wave  
Thomas Cho, Wireless Interface Technologies  
Yahn Deval, Laboratoire IXL  
Sherif Embabi, TI  
Fazal Ali, Nokia Mobile Phones  
Aditya Gupta, ANADIGICS Inc.  
Stefan Heinen, Infineon Technologies  
Albert Jerng, DSP Group  
Reynold Kagawida, TRW Inc.  
Andrew Karanicolas, Maxim  
Sayfe Kiaei, Arizona State University  
Kevin Kobayashi, Stanford Microdevices  
Mahesh Kumar, Lockheed Martin Government Electronics  
Bill Kuhn, Kansas State University  
Jenshan Lin, Agere  
Louis Liu, TRW  
Stephen Lloyd, Conexant Systems Inc.  
David Lovelace, Gain Technology  
Joyti Mondal, Motorola Inc.  
Patrick Murphy, University College  
Vijay Nair, Motorola, Inc.  
David Ngo, RFMD  
Dan Nobbe, Peregrine Semiconductor  
Jeffrey Ou, Intel  
Allen Podell, Besser Assos.  
Tina Quach, Motorola, Inc.  
Eli Reese, Triquint  
Joe Staudinger, Motorola, Inc.  
Noriharu Suematsu, Mitsubishi Electric Corp.  
Bruce Thompson, Motorola, Inc.  
Alan Westwick, Silicon Laboratories  
Bernard Xavier, National

## RFIC Schedule

The 2002 RFIC Symposium will be held at the Washington State Convention and Trade Center (WSCTC). The headquarters Hotel is the Sheraton. The RFIC Reception will be held on Sunday June 2, 2002 at the Sheraton. Most IMS Social functions will also be held at the Sheraton. The RFIC Symposium is held in conjunction with the International Microwave Symposium (IMS). Sessions open to attendees of both symposiums include workshops on Sunday, six Joint Sessions on Tuesday and the Interactive Forum Session on Tuesday.

### Saturday June 1, 2002

2:00pm – 6:00pm Registration – WSCTC

### Sunday June 2, 2002

7:00am – 5:00pm Registration – WSCTC

8:00am – 5:00pm Workshops – WSA – WSI, WSCTC

8:00am – 5:00pm Tutorials – TSA-TSC, WSCTC

7:00pm – 9:00pm RFIC Reception, Sheraton Hotel

### Monday June 3, 2002

7:00am – 5:00pm Registration – WSCTC

7:00am – 8:00am Speaker's Breakfast –  
WSCTC – Room TBD

7:00am – 5:00pm Speaker's Preparation –  
WSCTC – Room TBD

8:00am – 5:10pm RFIC Technical Sessions

8:00am – 9:40am MO1A: RFIC Plenary Session,  
WSCTC – Room 6A

10:10am – 11:50am MO2A: Cellular Transceivers,  
WSCTC – Room 6B

10:10am – 11:50am MO2B: Efficiency Enhancement Techniques  
for Handset Applications,  
WSTC – Room 6A

10:10am – 11:50am MO2C: Integrated VCO,  
WSCTC – Room 602-604

10:10am – 11:50am MO2D: Optical System ICs,  
WSCTC – Room 606-607

12:00pm – 1:15pm Panel Session: RF-CMOS in Cell Phones,  
Fact or Fiction - Room 6E

1:20pm – 3:00pm MO3A: Wireless Data System ICs,  
WSCTC – Room 6B

1:20pm – 3:00pm MO3B: LNAs, Mixers, and Switches,  
WSCTC – Room 6A

1:20pm – 3:00pm MO3C: High Frequency  
Receiver and Converter Technology,  
WSCTC – Room 602-604

1:20pm – 3:00pm MO3D: PLL and Frequency Synthesizer,  
WSCTC – Room 606-607

3:30pm – 5:10pm MO4A: 3G Cellular Systems & Chip Sets,  
WSCTC – Room 6B

3:30pm – 5:10pm MO4B: Low Noise Amplifiers,  
WSCTC – Room 6A

## **RFIC Schedule** (continued)

### **Monday June 3, 2002** (continued)

3:30pm – 5:10pm MO4C: Very High Speed Si and SiGe Divider ICs, WSCTC-Room 602-604

3:30pm – 5:10pm MO4D: Power Amplifiers for Handset Applications, WSCTC – Room 606-607

### **Tuesday June 4, 2002**

7:00am – 5:00pm Registration – WSCTC

7:00am – 8:00am Speaker's Breakfast – WSCTC Room TBD

7:00am – 5:00pm Speaker's Preparation – WSCTC Room TBD

8:00am – 5:10pm RFIC Technical Sessions

10:10am – 11:50am TU2A: (Joint IMS-RFIC) Radio Frequency Integrated Circuits for 3G, WSCTC – Room 608-609

10:10am – 11:50am TU2B: (Joint IMS-RFIC) MMIC Technology, WSCTC – Room 606-607

1:20pm – 3:00pm TU3A: (Joint IMS-RFIC) Silicon Substrate and Inductor Modeling, WSCTC – Room 608-609

1:20pm – 3:00pm TU3B: (Joint IMS-RFIC) SiGe RFIC Process Technologies, WSCTC – Room 606-607

3:30pm – 5:10pm TU4A: (Joint IMS-RFIC) Active Device Modeling and Characterization, WSCTC – Room 608-609

3:30pm – 5:10pm TU4B: (Joint IMS-RFIC) RFIC Power Amplifier Technology, WSCTC – Room 606-607

1:30pm – 4:30pm IF-TU: (Joint IMS-RFIC) Tuesday Interactive Forum, WSCTC – Room 6E

**MONDAY, JUNE 3, 2002**

**8:00 AM - 9:40 AM**

**WSCTC — Room 6A**

**Session M01A: RFIC Plenary:**

***Session Chair: S. Kiaei, Arizona State University***

***Session Co-Chair: N. Camilleri***

***RF & Wireless Design Services***

**M01A-1  
8:10 AM**

**Keynote Paper:**

**The Worldwide Wireless Web**

Behrooz Abdi\*, \*Motorola, Inc.

**M01A-2  
8:40 AM**

**Keynote Paper:**

**From 'Telephone' to 'Remote Control on Life':  
How Wireless Communications Will Change  
the Way we Live Over the Next 20 Years**

William Webb\*, \*PA Consultants

**M01A-3  
9:10 AM**

**Keynote Paper:**

**Requirements for High Performance RF/UHF  
ICs and Possible Solutions**

Dr. Ulrich Rohde\*, \*Communications

Consulting Corporation and Ansoft Corporation

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 6B**

**Session MO2A: Cellular Transceivers**

*Session Chair: S. Lloyd, Conexant Systems, Inc.*

*Session Co-Chair: J. P. Mondal, Motorola, Inc.*

- MO2A-1**      **“Invited” - Direct Conversion Transceiver Design for Mobile Phone Systems - Issues, Status and Trends**  
10:10 AM      F. Ali, Nokia, Mobile Phones
- MO2A-2**      **Rf Local Oscillator Path for GSM Direct Conversion Transceiver with True 50% Duty Cycle Divide by Three and Active Third Harmonic Cancellation.**  
10:30 AM      Rahul Magoon\*, Alyosha Molnar\*, \*Conexant Systems, Inc.
- MO2A-3**      **W-Cdma Sige TX-IC with High Dynamic Range and High Power Control Accuracy**  
10:50 AM      Hiroyuki Joba\*, Yoshinori Takahashi\*, Yoshinori Matsunami\*, Kenji Itoh\*, Shintaro Shinjo\*\*, Noriharu Suematsu\*\*, Duljit S. Malhi\*\*\*, Dawn Wang\*\*\*, Kurt Schelkle\*\*\*, Peter Bacon\*\*\*, \*Mobile Communication Business Division, Mitsubishi Electric Corporation
- MO2A-4**      **A Direct-Conversion W-CDMA Front-End SiGe Receiver Chip**  
11:10 AM      D.Y.C. Lie, J. Kennedy, D. Livezey, B. Yang, T. Robinson, N. Sornin\*, T. Beukema, L.E. Larson#, A. Senior, C. Saint, J. Blonski, N. Swanberg, P. Pawlowski, D. Gonya, X. Yuan, and H. Zamat\*, N. Sornin\* is with the IBM LaGaude design center, LaGaude, France
- MO2A-5**      **“Invited” - Highly Integrated, Dual Band/ Tri-Mode SiGe Bi-CMOS Transmitter IC for CDMA Mobile Phone Applications**  
11:30 AM      M. Reddy, D. Yates, P. Mudge, C.H. Lee, and G. Taska, Conexant Systems, Inc.

**MONDAY, JUNE 3, 2002**  
**WSCTC — Room 6A**  
**Session M02B: Efficiency Enhancement**  
**Techniques for Handset Applications**  
*Session Chair: T. Quach, Motorola, Inc.*  
*Session Co-Chair: D. Ngo, RFMD*

- M02B-1**  
**10:10 AM**      **"Invited" - Efficiency Improvement Techniques for Linear CDMA and WCDMA Power Amplifiers**  
T. Fowler, K. Burger, N.S. Cheng, A. Samelis, E. Endobakhave, and S. Rohlfing, Conexant Systems, Inc.
- M02B-2**  
**10:30 AM**      **"Invited" - An Overview of Efficiency Enhancements with Applications to Linear Handset Power Amplifiers**  
J. Staudinger, Motorola, Inc.
- M02B-3**  
**10:50 AM**      **"Invited" - Switched-Mode Tuned High-Efficiency Power Amplifiers: Historical Aspect and Future Prospect**  
A. Grebennikov, M-A-COM, Eurotec
- M02B-4**  
**11:10 AM**      **A Broadband Monolithic S-Band Class-E Power Amplifier**  
R. Tayrani\*, \*Raytheon Electronic Systems
- M02B-5**  
**11:30 AM**      **Variable Output Silicon-Germanium Power Amplifier with Enhanced Low Power Efficiency Method**  
D. R. Helms \*, J. R. Griffiths\*, E. A. Harman\*, C. Bedard\*, \*IBM Microelectronics, Lowell, MA

**MONDAY, JUNE 3, 2002**  
**WSCTC — Room 602-3-4**

**Session MO2C: Integrated VCO**

***Session Chair: Jenshan Lin, Agere Systems***  
***Session Co-Chair: Natalino Camilleri,***  
***RF & Wireless Design Services, Inc.***

- MO2C-1**      **"Invited" - 1/F Noise of NMOS and PMOS**  
**10:10 AM**      **Transistors and their Implications to Design**  
                    **of Voltage Controlled Oscillators**  
                    K.O. Kenneth, N.K. Park, and D.J. Yang,  
                    University of Florida
- MO2C-2**      **A 900 Mhz Low Phase Noise CMOS**  
**10:30 AM**      **Quadrature Oscillator**  
                    José Cabanillas \*, Laurent Dussopt\*\*,  
                    José M. López-Villegas\*, Gabriel M.  
                    Rebeiz\*\*, \*Departament d'Electrónica (SIC),  
                    University of Barcelona, Barcelona, 08028,  
                    Spain., \*\*EECS Department, The University of  
                    Michigan, Ann Arbor, MI 48109-2122, USA.
- MO2C-3**      **A 0.18Um CMOS 2.45 GHz Low-Power**  
**10:50 AM**      **Quadrature VCO with 15% Tuning Range**  
                    D.M.W. Leenaerts\*, C. Dijkmans\*, M.  
                    Thompson\*\*, \*Philips Research Laboratories,  
                    \*\*S3, Dublin
- MO2C-4**      **A 1.8-V 6/9-GHz Switchable Dual-Band**  
**11:10 AM**      **Quadrature LC VCO In SiGe BiCMOS**  
                    **Technology**  
                    H.Shin\*, Z.Xu\*, M. F. Chang\*, \*University of  
                    California, Los Angeles, CA
- MO2C-5**      **A 1V 3.8-5.7Ghz Differentially-Tuned VCO In**  
**11:30 AM**      **SOI CMOS**  
                    N. Fong\*, J-O. Plouchart\*\*, N. Zamdmer\*\*\*,  
                    D. Liu\*\*, L. Wagner\*\*\*, C. Plett\*, G. Tarr\*,  
                    \*Department of Electronics, Carleton  
                    University, \*\*IBM T.J. Watson Research  
                    Center, \*\*\*IBM Microelectronics  
                    Semiconductor Research and Development  
                    Center

**MONDAY, JUNE 3, 2002**  
**WSCT C — Room 606-607**  
**Session MO2D: Optical System ICs**  
***Session Chair: K. Kobayashi,***  
***Sirenza Microdevices***  
***Session Co-Chair: J. Ou, Intel***

- MO2D-1**      **"Invited" - Design of High-Speed**  
**10:10 AM**      **Fiber-Optic Datalinks**  
T. Mader, Intel, Inc.
- MO2D-2**      **A 37~ 50 GHz InP HBT VCO IC for**  
**10:40 AM**      **OC-768 Fiber Optic Communication**  
**Applications**  
Liyang Zhang, Rajasekhar Pullela,  
Christopher Winczewski, Jimmy Chow, \*,  
Gtran Inc., Newbury Park, CA 91320, USA\*\*,  
\*Dino Mensa, Shrinivasan Jaganathan, and  
Ruai Yu, \*\*
- MO2D-3**      **Amplifier Array for 12 Parallel 10 Gb/S**  
**10:50 AM**      **Optical-Fiber Links Fabricated in a SiGe**  
**Production Technology**  
A. Schild\*, H.-M. Rein\*, J. Müllrich\*, L.  
Altenhain\*, J. Blank\*\*, K. Schrödinger\*\*,  
\*Ruhr-University Bochum, D-44780 Bochum,  
Germany, \*\*Infineon Technologies AG, Fiber  
Optics, D-13629 Berlin, Germany
- MO2D-4**      **Front-End CMOS Chipset for 10 Gb/S**  
**11:10 AM**      **Communication**  
Anders K. Petersen, K,rsad Kiziloglu, Ty Yoon,  
Freddie Williams, Jr., Martin R. Sandor\*, \*All  
with Intel Corporation
- MO2D-5**      **Application of Quasi-Static Method of**  
**11:30 AM**      **Moments for the Design of OC-192**  
**And OC-768 Fiber Optic Integrated Circuits**  
Chun-Wen Paul Huang \*, Jian-Wen Bao\*,  
Nat Dwarakanath\*, Shihab Al-Kuran\*,  
\*ANADIGICS, Inc., 35 Technology Drive,  
Warren, NJ

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 6B**

**Session M03A: Wireless Data System ICs**

**Session Chair: W. B. Kuhn, Kansas State University**

**Session Co-Chair: A. Jerng, DSP Group**

- M03A-1**      **"Invited" - CMOS Components for 802.11b**  
**1:20 PM**      **Wireless LAN Applications**  
K.O. Kenneth\*, X. Li\*\*, F.J. Huang\*\*\*,  
B. Foley\*\*\*\*, \*Univ. of Florida, \*\*Intersil,  
\*\*\*Maxim, \*\*\*\*CDG, Inc.
- M03A-2**      **A 3V, 0.35Um CMOS Bluetooth Receiver IC**  
**1:40 PM**      W. Sheng\*, B. Xia\*, A. Emira\*, C. Xin\*, A. Y.  
Valero-Lopez\*, S. T. Moon\*, E. Sanchez-  
Sinencio\*, \*Analog & Mixed Signal Center,  
Department of Electrical Engineering, Texas  
A&M University
- M03A-3**      **Integrated CMOS Transceivers Using Single-**  
**2:00 PM**      **Conversion Standard IF or Low IF RX for**  
**Digital Narrowband Cordless Systems**  
A. Jerng\*, A. Truong\*, D. Wolday\*, E. Unruh\*,  
E. Landi\*, L. Wong\*, R. Fried\*, S. Gibbons\*,  
\*DSP Group
- M03A-4**      **A Highly Integrated, Versatile GPS Receiver**  
**2:20 PM**      **for E911 Applications**  
L. J. Wilz\*, T. J. Shie\*, J. P. Young\*, T.  
Hancock\*\*, \*Conexant Systems, Inc.,  
\*\*University of Michigan Electronics  
Engineering Department
- M03A-5**      **A SiGe Transceiver Chipset for**  
**2:40 PM**      **100Mbps/1Gbps Digital Communication**  
**Over Cable System**  
A. Alexanian\*, M. Wu\*, A. Burgess\*, W. Ye\*,  
X. Zhang\*, \*Narad Networks Inc.

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 6A**

**Session M03B: LNAs, Mixers and Switches**

***Session Chair: Y. Deval, IXL***

***Session Co-Chair: D. Nobbe, Peregrine Semiconductor***

- M03B-1**      **Automatic Synthesis of a 2.1GHz SiGe Low Noise Amplifier**  
1:20 PM      G. Zhang\*, A. Dengi\*\*, L. R. Carley\*,  
\*Carnegie Mellon University Electrical & Computer Engineering Department,  
\*\*Neolinear Inc.
- M03B-2**      **Highly Linear SiGe BiCMOS LNA and Mixer for Cellular CDMA/Amps Applications**  
1:40 PM      Vladimir Aparin, Eric Zeisel, and Pete Gazzo\*, \*QUALCOMM Inc.
- M03B-3**      **An Even Harmonic Type Direct Conversion SiGe-MMIC Receiver for W-CDMA Mobile Terminal**  
2:00 PM      E. Taniguchi\*, M. Shimosawa\*, T. Ikushima\*\*, K. Sadahiro\*\*, T. Katsura\*\*, K. Maeda\*\*, K. Itoh\*\*, N. Suematsu\*, T. Takagi\*, O. Ishida\*,  
\*Information Technology R&D Center, Mitsubishi Electric Corporation, \*\*Mobile Communication Business Division, Mitsubishi
- M03B-4**      **A 2.6 V GSM/PCN Dual Band Variable Gain Low Noise RF Down Conversion Mixer**  
2:20 PM      Bonkee Kim, \*, Kyung-Suc Nah, \*, Tae-Won Ahn, \*, Han-Il Lee, \*, Je-Kwang Cho,\*, Byeong-Ha Park.\*, \*RF products team, Samsung Electronics Co., Ltd.
- M03B-5**      **A +2.4/0 V Controlled High Power GaAs SPDT Antenna Switch IC For GSM Application**  
2:40 PM      Keiichi Numata\*, Yuji Takahashi\*, Tadashi Maeda\*, Hikaru Hida\*, \*Photonic and Wireless Device Research Laboratories, NEC Corporation

**MONDAY, JUNE 3, 2002  
WSCTC — Room 602-3-4**

**Session M03C: High Frequency Receiver  
and Converter Technology**

*Session Chair: M. Kumar, Lockheed Martin*

*Session Co-Chair: E. Reese, TriQuint Semiconductor*

- M03C-1**      **A 2-18 GHz Wideband High Dynamic  
1:20 PM**      **Range Receiver MMIC**  
D.C.Bannister\*, C.A.Zelley\*, A.R.Barnes\*,  
\*QinetiQ Ltd, UK
- M03C-2**      **A 3-33 GHz PHEMT MMIC Distributed  
1:40 PM**      **Drain Mixer**  
Kuo-Liang Deng \*, Huei Wang\*, \*Graduate  
Institute of Communication Engineering,  
National Taiwan University
- M03C-3**      **Ka-Band Direct Digital Receiver Using  
2:00 PM**      **0.25Um GaAs PHEMTs**  
Serioja O. Tatu\*, Emilia Moldovan\*, Gailon  
Brehm\*\*, Ke Wu\*\*\*, Renato G. Bosisio\*\*\*,  
\*Centre de Recherches Avancees en Micro-  
ondes et en Electronique Spatiale(Poly-  
Grames)Departament de genie Electrique,  
Ecole Polytechnique de Montreal, Canada,  
\*\*TriQuint
- M03C-4**      **A Single-Chip 24 GHz Receiver Front-End  
2:20 PM**      **Using a Commercially Available SiGe HBT  
Foundry Process**  
E. Soenmez\*, A. Trasser\*, K.-B. Schad\*,  
P.Abele\*, H. Schumacher\*, \*University of  
Ulm, Dept. of Electron Devices and Circuits

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 606-607**

**Session M03D: PLL and Frequency Synthesizer**

***Session Chair: Jenshan Lin, Agere Systems***

***Session Co-Chair: Natalino Camilleri,  
RF & Wireless Design Services, Inc.***

**M03D-1**      **Low Power, High Speed PII Fabricated in**  
**1:20 PM**      **UTSI Process**  
G. C. Wu\*, D. Kelly\*, \*Peregrine  
Semiconductor Corporation, San Diego, CA  
92121, U. S. A.

**M03D-2**      **A 2V, 2.3/4.6 GHz Dual-Band CMOS**  
**1:40 PM**      **Frequency Synthesizer**  
Wei-Zen Chen, Jia-Xian Chang, Ying-Jen  
Hong, Meng-Tzer Wong, and Chien-Liang  
Kuo \*, \*Department of Electrical Engineering,  
National Central University

**M03D-3**      **A Low Jitter 5.3-GHz 0.18-Um Cmos**  
**2:00 PM**      **PII Based Frequency Synthesizer**  
S. A. Ali \*, Department of Electrical and  
Computer Engineering, \*\*, F. Jain\*\*\*,  
Department of Electrical and Computer  
Engineering\*\*\*\*, Storrs, CT, 06269-  
2157,USA\*\*\*\*\*, \*PhD Student,, \*\*University  
of Connecticut, Storrs, CT, 06269-2157,USA,  
\*\*\*Professor, \*\*

**M03D-4**      **Design Considerations in a**  
**2:20 PM**      **BiCMOS Dual-Modulus Prescaler**  
F. Dulger\*, E. Sanchez-Sinencio\*, Abdellatif  
Bellaouar\*\*, \*Texas A&M University  
Department of Electrical Engineering,  
\*\*Texas Instruments Incorporated

**M03D-5**      **Time Delay Considerations in**  
**2:40 PM**      **High-Frequency Phase-Locked Loops**  
R. A. York\*, \*University of California, Santa  
Barbara ECE Department

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 6B**

**Session MO4A: 3G Cellular Systems & Chip Sets**

*Session Chair: F. Ali, Nokia Mobile Phones*

*Session Co-Chair: J. Mondal, Motorola, Inc.*

- MO4A-1**      **"Invited" - The MSM5100 CDMA2000 +**  
**3:30 PM**      **Amps + Gpsone + Bluetooth Multimode Asci**  
                 **For 3G Handsets**  
                 Brian Butler, K.C. Lai, K. Santis, and B.  
                 Meagher, Qualcomm, Inc.
- MO4A-2**      **A Re-Configurable Receiver Architecture for**  
**3:50 PM**      **3G Mobiles**  
                 B. J. Minnis\*, P. A. Moore\*, \*Philips Research  
                 Laboratories
- MO4A-3**      **A Highly Integrated 0.25Um BiCMOS Chipset**  
**4:10 PM**      **For 3G UMTS/WCDMA Handset RF Sub-System**  
                 Dominique Brunel\*, Claude Caron\*,  
                 Christophe Cordier\*, Emmanuel SoudÈe\*,  
                 \*Philips Semiconductors
- MO4A-4**      **A CMOS Transmit/Receive IF Chip-Set for**  
**4:30 PM**      **WCDMA Mobiles**  
                 U. Dasgupta\*, W. G. Yeoh\*, C. G. Tan\*, S. J.  
                 Wong\*, H. Mori\*\*, R. Singh\*, M. Itoh\*\*\*,  
                 \*Institute of Microelectronics, Singapore,  
                 \*\*Oki Electric Industry, Japan, \*\*\*Oki Techno  
                 Centre, Singapore
- MO4A-5**      **"Invited" - 4G RF Systems on Chip or on**  
**4:50 PM**      **Module?**  
                 D. Belot, ST Microelectronics

**MONDAY, JUNE 3, 2002**

**WSCTC — Room 6A**

**Session M04B: Low Noise Amplifiers**

**Session Chair: D. Nobbe, Peregrine Semiconductor**

**Session Co-Chair: Y. Deval, IXL**

- M04B-1**      **Gain Controllable Very Low Voltage (<1V) 8-9Ghz Integrated CMOS Lna's**  
**3:30 PM**      T. K. K. Tsang\*, M. N. El-Gamal\*,  
\*Microelectronics and Computer Systems  
Laboratory, McGill University.
- M04B-2**      **Step Gain Amplifier with Impedance**  
**3:50 PM**      **Unchanged in Gain Control**  
M. Tanabe\*, T. Fukuda\*, Katsunori Nishii\*,  
\*Semiconductor Devices Research Center,  
Corporate Manufacturing & Development  
Division, Semiconductor Company,  
Matsushita Electric Industrial, Co. Ltd.
- M04B-3**      **Enhancement Mode Phemt Low Noise**  
**4:10 PM**      **Amplifier with LNA Linearity Control (IP3)**  
**And Mitigated Bypass Switch**  
Sushil Kumar, Michael Vice, Henrik Morkner,  
Lam Wayne\*, \*Agilent Technologies, WSD R&D
- M04B-4**      **Low Noise, High Linearity, Wide Bandwidth**  
**4:30 PM**      **Amplifier Using a 0.35  $\mu$ m SiGe BiCMOS For**  
**WLAN Applications.**  
J.Sadowy\*, V.Le-Goascoz\*\*, I.Telliez\*\*,  
J.Graffeuil\*\*\*, E.Tournier\*\*\*, L. Escotte \*\*\*,  
R. Plana\*\*\*, \*LAAS CNRS 7, Av du Colonel  
Roche 31077 Toulouse FRANCE and  
STMicroelectronics 850, rue Jean Monnet  
38926 Crolles Cedex FRANCE,  
\*\*STMicroelectronics 850,
- M04B-5**      **A 5.8-Ghz Two-Stage High-Linearity**  
**4:50 PM**      **Low-Voltage Low Noise Amplifier in**  
**A 0.35-Um CMOS Technology**  
Ren-Chieh Liu\*, Chung-Rung Lee\*, Huei  
Wang\*, Chorng-Kuang Wang\*, \*Dept. of  
Electrical Engineering, National Taiwan  
University

**MONDAY, JUNE 3, 2002**  
**WSCTC — Room 602-3-4**

**Session M04C: Very High Speed Si and SiGe Dividers ICs**

**Session Chair: E. Reese, TriQuint Semiconductor**

**Session Co-Chair: M. Kumar, Lockheed Martin**

- MO4C-1**      **A 14,5 Ghz - 0,35 Mm Frequency Divider for Dual-Modulus Prescaler**  
**3:30 PM**  
Éric Tournier\*, Mathilde Sié\*\*, Jacques Graffeuil\*, \*LAAS/CNRS and University P.Sabatier, 31077 Toulouse cedex 4 - France, \*\*LAAS/CNRS and ST Microelectronics, 38926 Crolles cedex - France
- MO4C-2**      **A 19GHz High Sensitivity Static 2:1 Frequency Divider in 120Nm CMOS**  
**3:50 PM**  
H.-D. Wohlmuth\*, D. Kehrer\*, W. Simbuerger\*, \*INFINEON Technologies AG, CPR HF
- MO4C-3**      **A Low-Power 20 GHz Static Frequency Divider with Programmable Input Sensitivity**  
**4:10 PM**  
M. Apostolidou\*, \*Philips Research Laboratories
- MO4C-4**      **36 GHz Dual-Modulus Prescaler In SiGe Bipolar Technology**  
**4:30 PM**  
H. Knapp\*, M. Wurzer\*, J. Boeck\*\*, Th. F. Meister\*\*, G. Ritzberger\*, K. Aufinger\*\*, \*Infineon Technologies, Corporate Research, \*\*Infineon Technologies, Wireless Products

**MONDAY, JUNE 3, 2002**  
**WSCTC — Room 606-607**  
**Session MO4D: Power Amplifiers**  
**for Handset Applications**

**Session Chair: T. Quach, Motorola, Inc.**

**Session Co-Chair:**

**N. Suematsu, Mitsubishi Electronic Corp.**

- MO4D-1**  
**3:30 PM**      **A GSM/Edge Dual-Mode, 900/1800/1900-MHz Triple-Band HBT MMIC Power Amplifier Module**  
Kazuya Yamamoto\*, Tomoyuki Asada\*\*, Satoshi Suzuki\*\*, Takeshi Miura\*\*, Akira Inoue\*\*, Shinichi Miyakuni\*\*, Jun Otsuji\*\*, Ryo Hattori\*\*, Yukio Miyazaki\*\*, Teruyuki Shimura\*\*, \*RFIP group, System LSI Dev. Ctr., Mitsubishi Electric Corp., \*\*High Frequency
- MO4D-2**  
**3:50 PM**      **A 20Ma Quiescent Current CV/CC Parallel Operation HBT Power Amplifier for W-CDMA Terminals**  
S.Shinjo\*, K.Mori\*, H.Ueda\*, A.Ohta\*\*, H.Seki\*\*, N.Suematsu\*, T.Takagi\*, \*Mitsubishi Electric Corp. Information Technology R&D Center, \*\*Mitsubishi Electric Corp. High Freq. & Opt.Semiconductor Business Division
- MO4D-3**  
**4:10 PM**      **"Invited" - High-Efficiency HBT Power Amplifiers for W-CDMA Handsets**  
H. Shimawaki, T.B. Nishimura, NEC Compound Semiconductors, Ltd.
- MO4D-4**  
**4:30 PM**      **A New Active" Predistorter with High Gain Using Cascode-FET Structures"**  
M. S. Jeon\*, J. Kim\*, H. Kang\*\*, S. Jung\*\*, J. Lee\*\*, Y. Kwon\*, \*School of Electrical Engineering, Seoul National University, Seoul, Korea, \*\*WAVICS Co., Ltd., Telson Venture B/D, 949-3, Dogok-dong, Seoul, 135-270, Korea
- MO4D-5**  
**4:50 PM**      **Integrated Distributed Amplifier with Passive-Free Input Driver**  
Bob Stengel\*, Bruce Thompson\*\*, \*Motorola Inc., Motorola Labs, \*\*Motorola Inc., Wireless Integration Technology Center

**TUESDAY, JUNE 4, 2002**

**WSCTC — Room 608-609**

**Session TU2A: (Joint RFIC/IMS2002 Special Session)  
Radio Frequency**

**Session Chair: R. Weigel, University of Linz, Austria**

**Session Co-Chair: C. C. W. Ruppel, EPCOS AG**

- TU2A-1**            **"Invited" - Integrated Even Harmonic**  
**10:10 AM**        **Type Direct Conversion Receiver for**  
                      **W-CDMA Mobile Terminals**  
Kenji Itoh, Tatsuya Yamaguchi, Takatoshi  
Katsura, Keiichi Sadahiro, Takayuki Ikushima,  
Ryoji Hayashi?, Fumio Ishizu?\*, Mobile  
Communication Business Division, Mitsubishi  
Electric Corporation\*\*, \*Eiji Taniguchi?,  
Tamotsu Nishino?, Mitsuhiro Shimozawa?,
- TU2A-2**            **"Invited" - An Analog Baseband Chain for a**  
**10:40 AM**        **UMTs Zero-IF Receiver in A 75 GHz SiGe**  
                      **BiCMOs Technology**  
Harald Pretl \*, Linus Maurer \*\*, Bernd Adler  
\*\*\*, Robert Weigel \*\*\*\*, Richard Hagelauer  
\*\*\*\*\*, Josef Fenk \*\*\*, \*DICE Linz, \*\*INIT Linz,  
\*\*\*Infineon Munich, \*\*\*\*INIT Linz, DICE Linz,  
\*\*\*\*\*RIIC Linz, DICE Linz
- TU2A-3**            **A 2-GHz RF Front-End Transceiver Chipset in**  
**11:10 AM**        **CMOS Technology For PCS and IMT-2000**  
                      **Applications**  
Yong-Sik Youn\*, Nam-Soo Kim\*, Jae-Hong  
Chang\*, Hyun-Kyu Yu\*, Jong-Kee Kwon\*,  
Kyoung-Soo Kim\*, \*Electronics and  
Telecommunications Research Institute  
(ETRI)
- TU2A-4**            **System Analysis of a W-CDMA Base-Station**  
**11:30 AM**        **PA Employing Adaptive Digital Predistortion**  
Chris Potter\*, \*Wireless & Multimedia Design  
Group, Tality UK Ltd

**TUESDAY, JUNE 4, 2002**

**WSCTC — Room 606-607**

**Session TU2B: (Joint IMS-RFIC Special Session)**

**MMIC Technology**

***Session Chair: Ashar Madjar, Rafael***

***Session Co-Chair: Timothy Lee, Boeing Satellite Systems***

- TU2B-1**      **A Gaas Based E/D-PHEMT Process for Highly Linear Multi-Function Microwave Integrated Circuits**  
**10:10 AM**  
Wayne Struble\*, David Danzilio\*, Costas Varmazis\*, Thomas Lepkowski\*, Anthony Kaleta\*, Andrew Forbes\*, Neil Craig\*, George Samiotes\*, \*M/A-COM Integrated Semiconductor Business Unit
- TU2B-2**      **Ku-Band Mmic's in Low-Cost, SMT Compatible Packages**  
**10:30 AM**  
Ho C. Huang, Amin Ezzeddine, Ali Darwish, Becker Hsu\*, \*AMCOM Communication, Inc.
- TU2B-3**      **ESD Protection of RF Circuits in Standard CMOS Process**  
**10:50 AM**  
K. Higashi\*, A. O. Adan\*, M. Fukumi\*, N. Tanba\*\*, T. Yoshimasu\*\*, M. Hayashi\*, \*Design Technology Development Center, IC Development Group, SHARP Corp., \*\*Analog IC Division, IC Group, SHARP Corp.
- TU2B-4**      **Novel Bicmos Compatible, Short Channel Ldmos Technology for Medium Voltage RF & Power Applications**  
**11:10 AM**  
A. Litwin\*, O. Bengtsson \*\*, J. Olsson \*\*\*, \*Ericsson Microelectronic, \*\*Swedish Linear Microwave, \*\*\*Uppsala University
- TU2B-5**      **Electromagnetic Coupling Effects in RF-CMOS Circuits**  
**11:20 AM**  
A. O. Adan\*, M. Fukumi\*, K. Higashi\*, T. Suyama\*\*, M. Miyamoto\*\*, M. Hayashi\*, \*IC Development Group, SHARP Corp. , \*\*Advanced Research Labs., SHARP Corp.
- TU2B-6**      **Ultra Low-Power VCO Based on InP-HEMT and Heterojunction Interband Tunnel Diode for Wireless Application**  
**11:30 AM**  
A. Cidronali\*, G. Collodi\*, M. Camprini\*, V. Nair\*\*, G. Manes\*, J. Lewis\*\*, H. Goronkin\*\*, \*Dept. Electronics and Telecommunications - University of Florence, \*\*PSRL, Motorola Labs.

**TUESDAY, JUNE 4, 2002**  
**WSCTC — Room 608-609**  
**Session TU3A: (Joint IMS-RFIC Session)**  
**Silicon Substrate and Inductor**

**Session Chair: A. Gupta, Anadigics**  
**Session Co-Chair: A. Westwick, Silicon Laboratories**

- TU3A-1**            **"Invited" - Modeling of Passive Elements with Asitic**  
**1:20 PM**  
Kenneth, K.O.\* , X. Li\*\*, F.J. Huang\*\*\*, and B. Foley\*\*\*\*, Univ. of Florida, \*\*Intersil, \*\*\*Maxim, CGD, Inc.
- TU3A-2**            **Modeling of Frequency Dependent Losses in Two-Port and Three-Port Inductors on Silicon**  
**1:40 PM**  
T. Kamgaing\*, T. Myers\*, Mel Miller\*, \*Motorola Inc., Semiconductor Product Sector, Tempe, Arizona
- TU3A-3**            **Characterization and Modeling of On-Chip Inductor Substrate Coupling Effect**  
**2:00 PM**  
Chuan-Jane Chao\*, Shyh-Chyi Wong\*\*, Chia-Jen Hsu\*\*\*, Ming-Jer Chen\*, Len-Yi Leu\*\*\*, \*Institute of Electronics Engineering, National Chiao-Tung University, Hsinchu 300, Taiwan, R.O.C., \*\*Acer Laboratories Inc., Taipei 114, Taiwan, R.O.C., \*\*\*Winbond Electric
- TU3A-4**            **Characterization and Modeling of Small-Signal Substrate Resistance Effect In RF CMOS**  
**2:20 PM**  
Yo-Sheng Lin\*, Shey-Shi Lu\*\*, Tai-Hsing Lee\*, Hsiao-Bin Liang\*, \*National Chi-Nan University Electrical Engineering Department, \*\*National Taiwan University Electrical Engineering Department
- TU3A-5**            **A New Method for the Computation of the Substrate Parasitics of Octagonal Inductors**  
**2:40 PM**  
W. Tatinian\*, P. Pannier \*\*, R. Gillon\*\*\*, \*Modelling Ingeneer Alcatel Microelectronics, Ph-D student L2MP, \*\*Maitre de conferences, Ecole Polytechnique Universitaire de Marseille, \*\*\*Competence Leader Modelling and Characterisation Alcatel Microelectroni

**TUESDAY, JUNE 4, 2002**

**WSCTC — Room 606-607**

**Session TU3B: (Joint IMS-RFIC Session)**

**SiGe RFIC Process Technologies**

**Session Chair: K. Ashby, Microtune Inc.**

**Session Co-Chair: B. Xavier, National Semiconductor**

- TU3B-1**            **"Invited" - Review of SiGe BiCMOS Process Technology and its Impact on RFIC Design**  
**1:20 PM**            A. Das, J. Mondal, D. Kaszman, C. Shurboff, and M. Huang, Motorola, Inc.
- TU3B-2**            **"Invited" - High Performance Circuits in 0.18um SiGe BiCMOS Process for Wireless Applications**  
**1:40 PM**            P. Ye, B. Agarwal, L.Li, J. Cheng, and M. Ready, Conexant, Inc.
- TU3B-3**            **Low-Frequency Noise Figures-of-Merit In RF SiGe HBT Technology**  
**2:00 PM**            J. Tang\*, G. F. Niu\*, Z. Jin\*, J. D. Cressler\*, S. Zhang\*, A. J. Joseph\*\*, D. L. Hareme\*\*, \*Auburn University Electrical and Computer Engineering Department, \*\*IBM Microelectronics
- TU3B-4**            **Com2 Enhanced Graded Base SiGe Technology For High Speed Applications**  
**2:20 PM**            T. Ivanov, M. Carroll, S. Moinian\*, M. Mastrapasqua\*, M. Frei\*, A. Chen, C. King\*, A. Hamad, E. Martin, S. Shive, T. Esry, C. Lee, R. Johnson\*, T. Sorsch\*, M. S. Carroll\*, K. Banoo\*, P. Smith\*, L. Bizzarro\* and W. Cochran\*, \* Agere Systems, Murray Hill, NJ
- TU3B-5**            **Advanced Passive Devices for Enhanced Integrated RF Circuit Performance**  
**2:40 PM**            D. Coolbaugh\*, E. Eshun\*, R. Groves\*\*, D. Hareme\*, J. Johnson\*, M. Hammad\*, Z. He\*, V. Ramachandran\*, K. Stein\*\*, S. St Onge\*, S. Subbanna\*\*, D. Wang\*\*\*, R. Volant\*\*, X. Wang\*\*\*, K. Watson\*, \*IBM Corp, Essex Junction, VT 05452 , \*\*IBM Corp

**TUESDAY, JUNE 4, 2002**

**WSCTC — Room 606-607**

**Session TU4A: (Joint IMS-RFIC Session)**

**Active Device Modeling and Characterization**

**Session Chair: J. Staudinger, Motorola**

**Session Co-Chair: P. Murphy, University College Cork**

- TU4A-1**            **"Invited" - Robust High Voltage Si Ldmos**  
**3:30 PM**            **Model Extraction Process To Achieve First**  
                         **Pass Linear Rfic Amplifier Designs**  
                         J.A. Pla, D. Bridges, Motorola, Inc.
- TU4A-2**            **Large-Signal Modeling of GaN FET and**  
**3:50 PM**            **Nonlinearity Analysis Using Volterra Series**  
                         Syed S. Islam \*, University of Connecticut\*\*,  
                         Department of Electrical and Computer  
                         Engineering\*\*\*, \*Department of Electrical  
                         and Computer Engineering, \*\*A. F. M. Anwar,  
                         \*\*\*University of Connecticut
- TU4A-3**            **Direct Parameter Extraction on RF-CMOS**  
**4:10 PM**            F. X. Pengg\*, \*CSEM Swiss Center for  
                         Electronics and Microtechnology, Inc.
- TU4A-4**            **Low Frequency Noise Characterization and**  
**4:30 PM**            **Modeling of Microwave Bipolar Devices :**  
                         **Application to the Design of Low Phase**  
                         **Noise Oscillator**  
                         L. Bary\*, M. Regis\*\*, G. Cibiel\*, J. Rayssac\*,  
                         A. Rennane\*, O. Llopis\*, M. Borgarino\*\*\*, R.  
                         Plana\*, J. Graffeuil\*, \*Laboratory For  
                         Analysis And Architecture Of Systems,  
                         Toulouse, France, \*\*Sige Semiconductor,  
                         Ottawa Ontario, Canada, \*\*\*University Of  
                         Moden
- TU4A-5**            **Lineartiy Analysis of CMOS for**  
**4:50 PM**            **RF Application**  
                         Sanghoon Kang\*, Byounggi Choi\*, Bumman  
                         Kim\*, \*Pohang University of Science and  
                         Technology Electronic and Electrical  
                         Engineering Department

**TUESDAY, JUNE 4, 2002**

**WSCTC — Room 606-607**

**Session TU4B: (Joint IMS-RFIC Session)**

**RFIC Power Amplifier Technology**

**Session Chair: B. Xavier, National Semiconductor**

**Session Co-Chair: K. Ashby, Microtune, Inc.**

- TU4B-1**            **"Invited" - RF Power Semiconductor**  
**3:30 PM**            **Devices for Portable Communications**  
J.A. Pla, D. Bridges, Motorola, Inc.
- TU4B-2**            **SiGe/Si Power HBTS for X- to**  
**3:50 PM**            **K-Band Applications**  
Saeed Mohammadi\*, Zhengqiang Ma\*,  
Jaehoon Park\*, Pallab Bhattacharya\*, Linda,  
P.B. Katehi\*, George E. Ponchak\*\*, Samuel A.  
Alterovitz\*\*, Karl M. Strohm\*\*\*, Johann-  
Friedrich Luy\*\*\*, \*University of Michigan,  
EECS Department, \*\*NASA Glen Research  
Center
- TU4B-3**            **RF Power Characteristics of SiGe**  
**4:10 PM**            **Heterojunction Bipolar Transistor with High**  
**Breakdown Voltage Structures**  
Toshinobu Matsuno\*, Katsunori Nishii\*\*,  
Shinichi Sonetaka\*\*\*, Yasuyuki Toyoda\*\*\*,  
Nobuyuki Iwamoto\*\*\*, \*Semiconductor  
Device Research Center, Semiconductor  
Company, Matsushita Electric Industrial Co.,  
Ltd, \*\*Semiconductor Device Research  
Center, Semiconductor
- TU4B-4**            **Design Techniques for Improved**  
**4:30 PM**            **Performance of Small Outline Packages**  
L.E. Larson\*, D. Jessie \*\*, \*University of  
California - San Diego, \*\*University of  
California - San Diego and Qualcomm
- TU4B-5**            **Spiral Inductor Performance in**  
**4:50 PM**            **Deep-Submicron, Bulk CMOS,**  
**with Copper Interconnects**  
W. B. Kuhn\*, A. W. Orsborn\*, M. C.  
Peterson\*, S. R. Kythakyapuzha\*, A. I.  
Hussein\*, J. Zhang\*, J. Li\*, E. A. Shumaker\*,  
N. C. Nair\*, \*Kansas State University,  
Manhattan, KS 66506, USA"

**TUESDAY, JUNE 4, 2002**  
**WSCTC — Room 6E**  
**Session IF-TU: (Joint IMS-RFIC Session)**  
**Tuesday Interactive Forum**

***Session Chair: R. Lutz, Maximum Integrated Products***

**IF-TU-33**

**A 6.5 Mw Receiver Front-End for Bluetooth in 0.18-Um CMOS**

F. Beffa\*, R. Vogt\*, W. Baechtold\*, E. Zellweger\*\*, U. Lott\*\*\*, \*Swiss Federal Institute of Technology (ETH), \*\*Asulab S.A., Marin, Switzerland, \*\*\*Acter A.G., Zurich, Switzerland

**IF-TU-34**

**An Active Sige Sub-Harmonic Direct-Conversion Receiver Front-End for 5-6 Ghz Band Applications**

R. M. Svitek\*, S. Raman\*, D. A. Johnson\*\*, \*Virginia Tech, Bradley Dept. of Electrical and Computer Engineering, \*\*M/A-COM Integrated Semiconductor Business Unit

**IF-TU-35**

**Soft Breakdown and Hot Carrier Reliability for CMOS RF Mixers**

Q. Li\*, J. Zhang\*\*, J. S. Yuan\*, \*Chip Design and Reliability Laboratory, School of Electrical Engineering & Computer Science, University of Central Florida, \*\*VLSI Tech. Laboratory, Agere Systems, Orlando

**IF-TU-36**

**High-Q Copper Inductors on Standard Silicon Substrate with a Low-K BCD Dielectric Layer**

Huo Xiao\*, K. J. Chen\*, P. C-H. Chan\*, \*Hong Kong University of Science and Technology

**IF-TU-37**

**Geometry And Bias Current Optimization for SiGe HBT Cascode Low-Noise Amplifiers**

Q. Liang\*, G. F. Niu\*, J. D. Cressler\*, S. Taylor\*\*, D. L. Hareme\*\*\*, \*Auburn University Electrical and Computer Engineering Department, \*\*Maxim Integrated Products, \*\*\*IBM Microelectronics

**IF-TU-38**

**High Linearity Low-K BCD-Bridged AlGaAs/InGaAs Power HFETs**

Hsien-Chin Chiu, Ming-Jyh Hwu, Shih-Cheng Yang, Yi-Jen Chan\*, Taiwan 32054, R.O.C\*\*, \*Department of Electrical Engineering, National Central University, Chungli,, \*\*Phone: 886-3-4273593 Fax: 886-3-4255830

#### **IF-TU-39**

##### **Performance of a CMOS Bluetooth Transceiver IC with Copper RF Passives**

M.T.Doan\*, Y.Qian\*, E.S.Khoo\*, P.B.Khannur\*, S.C.Rustagi\*, J.Shi\*, P.D.Foo\*, A.B.Ajjikuttira\*, \*Institute of Microelectronics, Singapore

#### **IF-TU-40**

##### **Effects of Dummy Patterns and Substrate on Spiral Inductors for Sub-Micron RFICs**

jae-hong Chang\*, Young-Sik Youn\*\*, Hyun-Kyu Yu\*\*, Choong-Ki Kim\*, \*Department of EECS, Korea Advanced Institute of Science and Technology, \*\*Electronics and Telecommunications Research Institute (ETRI)

#### **IF-TU-41**

##### **Schottky Junction Transistors for Micropower RFICs**

J. Spann, Zhiyuan Wu, P. Jaconelli, Jinman Yang, T J Thornton\*, \*Arizona State University, Department of Electrical Engineering and Center for Solid State Electronics

#### **IF-TU-42**

##### **ESD Protection Design for 900MHz RF Receiver with 8-KV HBM ESD Robustness**

(1) Ming-Dou Ker, Wen-Yu Lo, Chien-Ming Lee\*, Hsinchu, Taiwan.\*\*, Tamarack Microelectronics Inc., Science-Based Industrial Park, \*\*\*, \*Institute of Electronics, National Chiao-Tung University,, \*\* (2) Chia-Pei Chen, and Hong-Sing Kao, \*\*\*Hsinchu, Taiwan.

#### **IF-TU-43**

##### **Improvements to Performance of Spiral Inductors on Insulators**

D.J. Kelly\*, F.A. Wright\*, \*Peregrine Semiconductor

#### **IF-TU-44**

##### **Octave Tunable, Highly Linear, RC-Ring Oscillator with Differential Fine-Coarse Tuning, Quadrature Outputs and Amplitude Control for Fiber Optic Transceivers**

M.A.T. Sanduleanu\*, D. van Goor\*, H. Veenstra\*, \*Philips Research Eindhoven

#### **IF-TU-45**

##### **A 2.45Ghz Fully-Differential Cmos Image-Reject Mixer For Bluetooth Application**

P.B.Khannur\*, S.L.Koh\*\*, \*Institute of Microelectronics, Singapore, \*\*Oki Techno Centre Singapore

**IF-TU-47****High Performance Single Supply Power Amplifiers for GSM and DCS Applications Using True Enhancement Mode FET Technology**

E Glass\*, M Shields\*, A Reyes\*, \*Motorola Semiconductor Product Sector

**IF-TU-48****Integrated 2.4 GHz CMOS Quadrature VCO with Symmetrical Spiral Inductors and Differential Varactors**

Baoyong Chi\*, Bingxue Shi\*, \*Institute of Microelectronics, Tsinghua University, Beijing, China

**IF-TU-49****A Fully Monolithic SiGe Quadrature Voltage Controlled Oscillator Design for GSM/DCS-PCS Applications**

D. Cordeau\*, J. M. Paillot\*\*, H. Cam\*, G. De Astis\*, L. Dascalescu\*\*, \*ACCO, 21 bis rue d'Hennemont, 78100 Saint-Germain-en-Laye, France, \*\*LAI-ESIP, IUT d'Angoulême 4, avenue de Varsovie 16021 Angoulême, France

**IF-TU-50****Hot Carrier And Soft Breakdown Effects on VCO Performance**

E. Xiao\*, J. S. Yuan\*, \*University of Central Florida, School of Electrical and Computer Science

**IF-TU-51****A 1.5-V 4-GHz Dynamic-Loading Regenerative Frequency Doubler in a 0.35- $\mu$ m CMOS Process**

Joseph M.C. Wong\*, Howard C. Luong\*, \*Hong Kong University of Science and Technology Electrical and Electronic Department

**IF-TU-52****Very Low Phase-Noise Fully-Integrated Coupled VCOs**

H. Jacobsson\*, B. Hansson\*, H. Berg\*\*, S. Gevorgian\*\*\*, \*Ericsson Microwave Systems, Microwave and High Speed Electronics Research, \*\*Chalmers University of Technology, Microwave Electronics Laboratory, \*\*\*Ericsson Microwave Systems and Chalmers University

**IF-TU-53****Wide-Tuning-Range Dual-Vcos for Cable Modem Receivers**

Kari Stadius\*, Kari Halonen\*, \*Helsinki University of Technology, Electronic Circuit Design laboratory

**IF-TU-54****A 5.8Ghz Fully Integrated Low Power Low Phase Noise CMOS LC VCO for WLAN Applications**

J. Bhattacharjee\*, D. Mukherjee\*, E. Gebara\*, S. Nuttinck\*, J. Laskar\*, \*School of ECE, Georgia Institute of Technology, Atlanta, GA

**IF-TU-55****A 5Ghz Fast-Switching CMOS Frequency Synthesizer**

X. Yang\*, T. X. Wu\*, J. McMacken\*\*, \*University of Central Florida School of Electrical engineering and computer science, \*\*Agere Systems, Inc.

**IF-TU-56****A Wilkinson Power Divider on a Low Resistivity Si Substrate with a Polyimide Interface Layer for Wireless Circuits**

John Papapolymerou\*, George E. Ponchak\*\*, Emmanouil M. Tentzeris\*\*\*, \*School of ECE -Georgia Tech, \*\*NASA Glenn Research Center, \*\*\*School of ECE - Georgia Tech

**IF-TU-57****Development and Verification of a New Non-Linear Mosfet Model**

H. Romdane\*, E. Bergeault\*, B. Huyart\*, \*ENST-Dep. Comelec-CNRS\_URA 820

**IF-TU-58****Design and Analysis of a Multi-Layer Transformer Balun for Silicon RF Integrated Circuits**

H.Y. David Yang, Lijun Zhang, and Jesse Castaneda\*, \*Broadcom Corporation

**IF-TU-59****Smoothing Gate Capacitance Models for CMOS Radio Frequency and Microwave Integrated Circuits CAD**

J. Dobes\*, \*Czech Technical University, Department of Radioelectronics

**RFIC MONDAY PANEL SESSION**  
**RF-CMOS in Cell Phones: Fact or Fiction**  
**MONDAY, JUNE 3, 2002**  
**12:00-1:15 PM**  
**WSCTC — Room 6E**

**Organizers & Affiliations:**

Natalino Camilleri, RF and Wireless Design Services  
 Fazal Ali, Nokia Mobile Phones

**Panelists & Affiliations:**

Stephen Dow, Motorola  
 Stefan Heinen, Infineon Technologies  
 Christian Kermarrec, ADI  
 Stephen Lloyd, Conexant  
 Ahmadreza Rofougaran, Broadcom  
 Jacques C. Rudell, U.C. Berkeley  
 Darke K. Shaeffer, BigBear Networks  
 Bernard Xavier, National Semiconductor

**Summary:**

RF-CMOS development has come a long way toward being implemented in several systems for multiple applications. One can find RF-CMOS in some Cordless devices, WLAN and Bluetooth products. However, in Cellular Handset systems, RF-CMOS has had a difficult time competing with the SiGe BiCMOS technology in offering the "best in class" RF performance while maintaining the lowest power consumption. The Panelist, representing various industries and academia will address their views on the future of high performance RF-CMOS for mobile handsets.

**OTHER PANEL SESSIONS**

DAY	NUMBER	TIME	DESCRIPTION
Tue	PT	12:00 PM-1:15 PM	Is the Single Chip Radio Dead?
Wed	PW	12:00 PM-1:15 PM	RF MEMS: Revolution of Evolution
Thu	PTH	12:00 PM-1:15 PM	Making Sense or Cents: Which WLAN Technology will Survive?

**TUTORIALS**

DAY	NUMBER	TIME	TITLE
Sun	TSA	8:00 AM-5:00 PM	RF Fundamentals
Sun	TSB	8:00 AM-5:00 PM	MEMS Technology for Highly Integrated RF Systems
Sun	TSC	8:00 AM-5:00 PM	EM Simulators – Theory and Practice

**WORKSHOPS**

DAY	NUMBER	TIME	TITLE
Sun	WSA	8:00 AM-5:00 PM	Developments in Integrated Circuits for Communications at 40 Gb/s and Beyond
Sun	WSB	8:00 AM-5:00 PM	Highly Integrated Packaging Techniques for Microwave and mm-wave Packaging for Broadband Applications
Sun	WSC	8:00 AM-5:00 PM	Direct Conversion Transceivers for Cellular and Wireless Applications

## WORKSHOPS (continued)

DAY	NUMBER	TIME	TITLE
Sun	WSD	8:00 AM-5:00 PM	RF and High Speed Flip-chip Technology and Design
Sun	WSE	8:00 AM-5:00 PM	Advances in Bluetooth Technology
Sun	WSF	8:00 AM-12:00 PM	Wireless Systems on a Chip
Sun	WSG	8:00 AM-12:00 PM	GHz and THz Solid State Device Simulation
Sun	WSH	1:00 PM-5:00 PM	RF Solutions for GPS-to-handset Applications
Sun	WSI	1:00 PM-5:00 PM	Intelligent RF Front-ends
Mon	WMA	8:00 AM-5:00 PM	Automotive Radar and Prospective Circuit/Antenna Technologies – From Car Collision Avoidance to Autonomous Driving
Mon	WMB	8:00 AM-5:00 PM	Microwave Component Design Using Space Mapping Methodologies
Mon	WMC	8:00 AM-5:00 PM	Ultrahigh Speed Microwave and Photonic Devices and Systems: How Will They Be Tested?
Mon	WMD	8:00 AM-5:00 PM	Wideband Gap Technologies: Applications, Devices and Circuit Issues
Mon	WME	8:00 AM-5:00 PM	Advances in Ceramic Interconnect Technologies for Wireless, Microwave and Photonic Applications
Mon	WMF	8:00 AM-5:00 PM	Introducing New Concepts in Nonlinear Network Design
Mon	WMG	8:00 AM-5:00 PM	EM-based CAD and Optimization of Waveguide Components, Planar Circuits and Antennas
Mon	WMH	8:00 AM-12:00 PM	Passive Components for RF Applications
Mon	WMI	8:00 AM-12:00 PM	Spectrum Management Issues
Mon	WMJ	8:00 AM-12:00 PM	Advances in RF MEMS Technology
Mon	WMK	8:00 AM-12:00 PM	Microwave Photonics for Medical Imaging
Mon	WML	1:00 PM-5:00 PM	Wireless Microsensors: Technology and Applications
Mon	WMM	1:00 PM-5:00 PM	Microwave and Lightwave System Architecture
Mon	WMN	1:00 PM-5:00 PM	Modeling of RF MEMS Switches
Mon	WMO	1:00 PM-5:00 PM	Differential Device Characterization and Modeling
Fri	WFA	8:00 AM-5:00 PM	Cryogenic and Superconductor Microwave Subsystems
Fri	WFB	8:00 AM-12:00 PM	Evolution of the Photonic Antenna
Fri	WFC	8:00 AM-12:00 PM	Optical Packaging Techniques Combining Optics and Electronics

# μAPS

<b>DAY</b>	<b>TIME</b>
Tue	9:00 AM-5:00 PM
Wed	8:00 AM-5:00 PM
Thu	9:00 AM-3:00 PM

## SOCIAL EVENTS

<b>DAY</b>	<b>TIME</b>	<b>TITLE</b>
Sat	1:00 PM-5:00 PM	Golf Tournament
Sun	7:00 PM-9:00 PM	RFIC Reception
Mon	6:00 PM-8:00 PM	<i>Microwave Journal</i> Reception
Tue	5:00 PM-10:00 PM	Tillicum Village
Wed	6:00 PM-7:30 PM	Industry Reception
Wed	7:30 PM-10:00 PM	Awards Banquet
Wed	12:00 PM-1:30 PM	Student Awards Banquet

## GUEST PROGRAMS

<b>DAY</b>	<b>NUMBER</b>	<b>TIME</b>	<b>TITLE</b>
Sun	GSA	7:30 AM-8:00 PM	Victoria Day Trip (unescorted)
Mon	GMB	8:00 AM-6:00 PM	Mt. Rainier Tour
Mon	GMC	9:00 AM-2:00 PM	Seattle City Highlights with Lunch at the Space Needle
Tue	GTD	12:30 PM-4:30 PM	Northwest Winery and Brewery Tour
Tue	GTE	9:00 AM-3:00 PM	Snoqualmie Falls, Steam Engine Train and Hedges Winery Tour
Wed	GWF	8:30 AM-12:00 PM	Boeing Everett Plant Tour
Wed	GWG	9:00 AM-2:00 PM	Seattle's Museum Tour with Lunch in Pike Place Market
Thu	GTHH	9:30 AM-1:30 PM	Cruise the Locks and Seattle Harbor Tour with Lunch at Harborside Restaurant
Thu	GTHI	12:30 PM-4:00 PM	Boeing Everett Plant Tour
Fri	GFJ	6:30 AM-10:00 PM	Victoria Overnight (escorted) (Friday AM to Saturday PM)
Fri	GFK	7:30 AM-8:00 PM	Victoria Day Trip (unescorted)

## SOCIAL EVENTS: YOU'RE INVITED

**RFIC Symposium Reception** – All RFIC Symposium attendees are invited to attend a reception hosted by the RFIC Steering Committee and several leading RF/Wireless IC vendors on Sunday, June 2 from 7:00 PM to 9:00 PM at the Sheraton Hotel. Admission tickets for attendees and one guest will be included in the registration packets.

**Microwave Journal/MTT-S Reception:** All Microwave Week attendees and exhibitors are invited to attend a reception hosted by *Microwave Journal* and MTT-S on Monday, June 3 from 6:00 PM to 8:00 PM at the Pacific Science Center, 200 Second Avenue North, Seattle. Transportation will leave the Convention Center starting at 5:45 PM.

**Industry Hosted Cocktail Reception:** Symposium exhibitors will host a cocktail reception on Wednesday, June 5 from 6:00 PM to 7:30 PM at the Sheraton Hotel. Complementary beverage tickets will be included in the registration packages.

**IEEE MTT-S Awards Banquet:** The Annual Awards Banquet will be held on Wednesday, June 5 from 7:30 PM to 10:00 PM at the Sheraton Hotel. This evening will consist of an elegant dinner, awards presentation and entertainment featuring the first "MTTV" production.

**Student Awards Banquet:** Student paper awards will be presented at the Student Awards Banquet on Thursday, June 6 at noon. The banquet is free of charge for all Symposium student registrants and advisors.

**Tillicum Village:** A unique Northwest experience is available on Tuesday evening, June 4 from 5:00 PM to 10:00 PM. Leave Seattle on a boat cruise to Blake Island while enjoying the view of islands, mountains and the Seattle skyline. Once there, savor a delicious buffet inside the huge cedar longhouse featuring Northwest Coast Indian-style baked salmon. The evening includes a spectacular dance show by the Tillicum Village Dancers, who bring to life the dances and legends of the Northwest Coast. Tickets are limited; transportation is included. **(\$48)**

**Golf Tournament:** Designed by Englishman William Henry Tucker, Sr. and Frank James in 1930, Jackson Park Golf Course is a traditional 18-hole championship course. Named after Andrew Jackson, the former President of the United States, Jackson Park is located north of downtown in the Olympic Hills section of Seattle. Tee time begins at 1:00 PM on Saturday, June 1. Transportation, greens fees and golf cart are included.

## GUEST PROGRAM

**Sunday, June 2 & Friday, June 7, 2002**

**7:30 AM-8:00 PM**

**(2 hr service to Victoria)**

**Pre and Post Tour Options**

**Independent Victoria Day Trip**

**(unescorted)**

For those wishing to visit the picturesque town of Victoria, British Columbia on their own, a scenic two or three hour cruise aboard the Victoria Clipper catamaran will bring you to this quaint "Old English" town. Reservations aboard the Victoria Clipper can be made for any day of the week. You are responsible for transportation to and from Pier 69, which is a short cab ride from the downtown Seattle hotels. You must check in at the dock 45 minutes prior to departure to collect your boarding passes. **(\$115)**

**Note:** Proof of U.S. citizenship (such as a passport, photo drivers license or certified copy of birth certificate) is required for all U.S. citizens (including minors) entering Canada. Foreign nationals should check possible visa needs for entry into Canada and re-entry into the U.S.

Boat departs Seattle at 8:30 AM and arrives in Victoria at 10:30 AM (Guests MUST check in one hour in advance) • Boat departs Victoria at 6:00 PM and arrives in Seattle at 8:00 PM.

**Includes:** Round trip Victoria Clipper Fare; Seattle VIP Services Victoria Clipper Voucher

**Monday, June 3-Thursday, June 6, 2002**

**6:30 AM-7:15 AM**

**Morning Activities**

**Morning Run Through Downtown Seattle**

You have the opportunity of joining one of our fitness experts on either a run or a slower paced jog through scenic downtown Seattle. Each guide will be sensitive to the group's fitness level and desired intensity. The morning run will provide you an opportunity to see different areas of downtown Seattle. Each morning, our running guide will take you on a different run through the city. **(Free)**

**Morning Walking Tour of Seattle**

Guests who prefer a walk in the mornings will enjoy an invigorating walk through downtown Seattle. Our walking guide will narrate the walk, pointing out interesting sights, architecture and public art highlights. Each morning will offer a different tour of the downtown area. **(Free)**

**Monday-Wednesday: 8:00 AM-5:00 PM**

**Thursday: 8:00 AM-12:00 NOON**

**Hospitality Desk**

Our knowledgeable hosts, hostesses and tour guides delight in our city and enjoy the opportunity to share Seattle with others. They are involved in the community and are well versed in the Pacific Northwest. Many guides have also traveled extensively and are conversant on a broad range of topics. They will provide you with restaurant suggestions, make reservations, give ideas on where to explore and answer any questions.

**Monday, June 3, 2002**

**Mount Rainier Tour**

For many years Mount Rainier has been the landmark and sacred ground for the Northwest Native American Indians and is now the symbol of natural grandeur for the Northwest. This majestic peak (Elevation: 14,411 feet) was named by Captain Vancouver of the English Navy in 1792 for his friend, Admiral Peter Rainier. You will enjoy a drive through the countryside to Mount Rainier National Park (Elevation: 5,400 feet) with its easy hiking trails that pass

waterfalls, massive glaciers and fields of wildflowers. There is an informative Visitor Center with panoramic views and slide and movie presentations on the park and its history. Snack and gift shops can be found at the Visitor Center and the beautiful Paradise Inn. Sturdy walking shoes are advised. Lunch is on your own. We recommend the lovely restaurant at the Paradise Inn. **(\$87)**

**Includes:** Motorcoach Transportation; Mt. Rainier Nat'l Park Admission; Seattle VIP Services Tour Guide

**Monday, June 3, 2002**  
**9:00 AM-2:00PM**

**Seattle City Highlights**  
**with lunch at the Space Needle**

You will learn why Seattle has been named one of America's most livable cities! Our friendly and informative guides will give historical background on the area, point out interesting landmarks, as well as give insider tips on special shopping and sightseeing areas. Included in the tour is historic Pioneer Square, the location for Seattle's top art galleries; the International District, heart of Seattle's Asian community; and the beautiful Univ. of Washington campus. A stop at the Hiram H. Chittenden Locks will show how the area's fresh and salt waters meet, and you will enjoy the underwater viewing at the adjoining salmon ladders. Last but not least a short stop at Seattle's renowned Pike Place Market, an exciting array of color, aroma and sounds. A highlight of the tour is lunch at the Space Needle. The Seattle Center is the park-like setting created for the 1962 World's Fair, and home to Seattle's most famous landmark, the Space Needle. **(\$68)**

**Includes:** Motorcoach Transportation; Map of Pike Place Market' Lunch at the Space Needle; Private Room with view; Admission to Observation Deck of Space Needle; All Applicable Gratuities; Washington State Sales Tax; Seattle VIP Services Tour Guide

**Tuesday, June 4, 2002**  
**12:30 PM-4:30 PM**

**Northwest Winery and Brewery Tour**

Situated on the same latitude as the French wine country, Washington State has a growing wine industry that is winning prestigious awards throughout the world. You will learn about Northwest wines as you visit a popular local winery. Located on 87 acres of arboretum-like grounds, Chateau Ste. Michelle is Washington's oldest and most famous winery. After a cellar tour and wine tasting, you will enjoy strolling the grounds and visiting the extensive wine and accessory shop. You will also visit Columbia Winery, the pioneer of premium wine production in Washington State, and Red Hook Brewery, one of the finest microbrews that Seattle has to offer! **(\$33)**

**Includes:** Motorcoach Transportation; Columbia and Chateau Ste. Michelle Tour and Tasting; All Applicable Taxes and Gratuities

**Tuesday, June 4, 2002**  
**9:00 AM-3:00 PM**

**Snoqualmie Falls, Steam Engine Train**  
**and Hedges Winery Tour**

Twenty-five miles east of Seattle, you will find one of Washington's most popular scenic attractions, Snoqualmie Falls. The Snoqualmie River cascades 270 feet through a spectacular rock gorge into a 65-foot deep pool. On top of the falls sits one of Seattle's most popular romantic getaways – the Salish Lodge. The exterior of the Salish may look familiar, as it was the lodge used to film the quirky TV hit *Twin Peaks* After enjoying the views from the

falls, guests will enjoy a gourmet boxed lunch before traveling to Snoqualmie's Historic Train Depot. After lunch, guests will experience a scenic train excursion aboard antique railroad coaches through the upper Snoqualmie Valley. This round trip excursion will last an hour. Afterwards, guests will board deluxe motorcoaches and head back toward Seattle with a stop in the town of Issaquah, home to a favorite Washington wine, Hedges Cellars. **(\$63)**

**Includes:** Motorcoach Transportation; Seattle VIP Services Guide; Viewing of Snoqualmie Falls; Steam Engine Train Tour; Hedges Wine Tasting; Washington State Sales Tax

**Wednesday, June 5 & Thursday, June 6, 2002** *Boeing's Everett Plant Tour*  
**Wednesday: 8:30 AM-12:00 PM; Thursday: 12:30-4:00 PM**

A trip to Boeing's Everett facility offers an in-depth view of the construction and assembly of jet aircraft. This is a fascinating tour which gives insight into the many facets of the airplane industry. The 90-minute tour includes a video presentation followed by a visit to the 747 assembly building and a drive to the flight line. There are 21 steep steps, a 1/3 mile walk and an elevator ride to 35 feet above the factory floor. On the way to the plant our informative guide will also give visitors the opportunity to learn about life in the Pacific Northwest and the area's relationship to Boeing, one of its largest employees. **(\$40)**

**Includes:** Motorcoach Transportation; Boeing Plant Tour Admission; Washington State Sales Tax; Seattle VIP Services Tour Guide

**Wednesday, June 5, 2002**  
**9:00 AM-2:00 PM**

**Seattle's Museum Tour with lunch in  
Pike Place Market; Seattle Art Museum**

The pride of the city's art community, the new Seattle Art Museum is itself a work of art, designed by world-renowned architect Robert Venturi. A beautifully displayed Northwest Native American collection includes masks, sculptures, textiles, decorative and household objects. Contemporary Pacific Northwest artists are featured as well as world-renowned artists from America, Europe and Asia.

#### ***Burke Museum***

See displays of Washington's only real dinosaur fossils, our world-renowned Northwest Coast Native art and other fabulous treasures from the Burke collections. The Burke Museum has served the people of Washington State as the premier museum of natural history and culture for more than 100 years.

#### ***Museum of History and Industry***

The Museum of History and Industry, opened on February 15, 1952, has grown to become the largest private heritage organization in the state of Washington, attracting more than 60,000 visitors annually from the Northwest and beyond. The Museum collects, preserves and presents everything from ship's wheels to evening gowns, gramophones to baby carriages, time clocks to crosscut saws, which gives visitors glimpses of life in Puget Sound from the 1780s to the present day.

#### ***Lunch at No Boundaries Café***

No Boundaries is a quaint little European-style café in the heart of Pike Place Market. They serve fresh soups, salads and sandwiches. Each guest will receive a \$10 voucher to use at their

convenience, while strolling through Pike Place Market for an hour and a half. **(\$58)**

**Includes:** Motorcoach Transportation; Museum Tour Package

**Thursday, June 6, 2002**

**9:30 AM-1:30 PM**

**(Lock tour departs at 10:00 AM)**

**Cruise the Locks and Seattle Harbor Tour**

**with Lunch at Harborside Restaurant**

Since 1963, this 2 1/2 hour cruise has been operating on both salt and fresh water via Seattle's famous Hiram Chittenden Locks. The Hiram Chittenden Locks, built early in the century, were as important for Seattle and Puget Sound as the Panama Canal was for the Western Hemisphere. As you pass through the locks, you will learn how they operate. Cruising in Elliott Bay, you will be fascinated by the maritime activity of chugging tugboats, smoothly gliding sailboats, mighty oceangoing tankers and cargo ships while you watch the architecturally exciting Seattle skyline unfold. For spectacular views, look west to the Islands of Puget Sound and the snowcapped Olympic Mountains. The cruise is narrated so you will understand just what you are seeing. **(\$85)**

**Note:** *Sweater, jacket and comfortable walking shoes are recommended.*

**Includes:** Motorcoach Transportation; Harbor/Locks Cruise; Lunch at Harborside Restaurant; Washington State Sales Tax; Seattle VIP Services Tour Guide

**Friday, June 7 – Saturday, June 8, 2002**

**6:30 AM, Friday – 10:00 PM, Saturday**

**Escorted Victoria Trip**

**Pre and Post Overnight Tour Options**

Enjoy a 2 day/1 night outing to nearby Canada by visiting the "Old English" town of Victoria, British Columbia. The morning begins with a scenic cruise aboard the Victoria Clipper. Once in Victoria, you will be whisked away to your hotel to drop off your belongings. Our knowledgeable guide will be on hand throughout the day to help you make the most of your trip, and there will be ample free time to enjoy shopping and sightseeing in Victoria before the return trip to Seattle. **(\$285)**

**Note:** *Proof of U.S. citizenship (such as a passport, photo drivers license or certified copy of birth certificate) is required for all U.S. citizens (including minors) entering Canada. Foreign nationals should check possible visa needs for entry into Canada and re-entry into the U.S.*

Friday, June 7: Boat departs Seattle at 8:00 AM and arrives in Victoria at 11:00 AM (Guests MUST check in one hour in advance)

• Saturday, June 8: Boat departs Victoria at 7:00 PM and arrives in Seattle at 9:45 PM.

**Includes:** Round-trip Motorcoach Transportation to Pier 69; Round trip Victory Clipper fare; Seattle VIP Services Victoria Clipper voucher, Transfer between Hotel and Pier in Victoria; (1) Night Accommodation in Victoria (double occupancy); Luggage handling; Continental Breakfast; Seattle VIP Services Staff.

**Note:** *Guest wishing to have High Tea at the Empress Hotel should be aware that there is a dress code. Shorts, blue jeans, jogging attire and T-shirts are not allowed.*

NOTES:

NOTES:

<b>Map No.</b>	<b>Hotel</b>
1	Sheraton Seattle Hotel
2	Westin Seattle Hotel
3	Elliot Grand Hotel
4	W. Seattle Hotel
5	The Warwick Hotel
6	WestCoast Grand
7	Hilton Seattle Hotel
8	The Paramount Hotel
9	The Claremont Hotel
10	Summerfield Suites
11	Crowne Plaza Seattle
12	Renaissance Madison Hotel
13	Mayflower Park Hotel
14	The Roosevelt Hotel
15	Washington Athletic Club