



# ***AUTOMATIC RF TECHNIQUES GROUP***

## **CONFERENCE NEWSLETTER**

**FALL 1999**

**NUMBER 22**

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### **The 54<sup>th</sup> Conference Characterization of Broadband Access Technologies**

#### **OVERVIEW**

Atlanta Georgia provided a very enjoyable setting for the 54<sup>th</sup> ARFTG conference which was held on December 2<sup>nd</sup> and 3<sup>rd</sup>. This conference offered a two-day technical program and a tour of facilities associated with the Georgia Institute of Technology. A complete listing of the papers presented is given on Pages 3 and 4 with complete copies of each presentation available in the conference digest. Additional conference information is available on our website at [www.arftg.org](http://www.arftg.org). Conference Chair Larry Dunleavy put forth considerable effort to ensure an outstanding conference. He was ably assisted by the Local Arrangements Chair Mike Harris and Technical Program Chair Joy Laskar.

#### **SHORT COURSE**

The 6<sup>th</sup> annual NIST/ARFTG Microwave Measurements Short Course was given on November 30<sup>th</sup> and December 1<sup>st</sup>, 1999 at the Westin Peachtree in downtown Atlanta. This two-day course offers an excellent introduction for those new to the field or review for those who wish to expand their knowledge on a wide variety of topics germane to high frequency measurements. The course material included: microwave measurements overview; circuit theory; vector network analyzer, interconnects, IC test fixtures, probing, and RF connectors, on-wafer measurements, power, noise temperature, phase noise, load pull, digital modulation, time domain,

wideband radio link modeling, simulation, and measurement. The course organizers and instructors put forth considerable effort in keeping the presentations up to date. The goal of the 2-day course is to keep the first day focused on RF and Microwave measurement basics, while tailoring the second day to be in-line with the conference theme. The author benefited greatly when he took the course several years ago. Additional short course information is available on our website at [www.arftg.org](http://www.arftg.org) or by contacting the ARFTG Short Course Direction, David Walker, at [dwalker@boulder.nist.gov](mailto:dwalker@boulder.nist.gov).

#### **TECHNICAL SESSIONS**

The technical sessions were held on December 2<sup>nd</sup> and 3<sup>rd</sup> at the Westin Peachtree in downtown Atlanta. These sessions discussed the conference theme as well as a number of other diverse subjects of common interest. Technical Program Chair Joy Laskar was assisted by



Co-Chairs Manos Tentzeris and Ramana Murty and the ARFTG Technical Committee Chair Dylan Williams. Together they assembled an interesting program consisting of 24 presented papers. Topics included: Broadband System Measurements, Broadband Measurements for Digital Interconnects, VNA Measurement Accuracy, and RF Passives and Board Characterization.

Selected by the conference attendees as the Best Technical Paper was "Equivalent Circuit Models for Coaxial OSLT Standards", presented by Donald DeGroot, Kristopher Reed and Jeffery Jargon of the National Institute of Standards and Technology.



Don DeGroot being congratulated by Ken Wong

## EXHIBITS

The exhibits area at ARFTG Conferences provides attendees with the opportunity to view some newly developed products and to have in depth discussions with the suppliers about their test and measurement problems and needs. For additional information please contact Exhibits Chair Leonard Hayden at [leonard@cmicro.com](mailto:leonard@cmicro.com)



Leonard Hayden introducing the Exhibitors at the 53<sup>rd</sup> ARFTG Conference

## DIGESTS AND COURSE NOTES

Digests and course notes from this and previous conferences are available for purchase. For additional information, visit our website at [www.arftg.org](http://www.arftg.org) or by contact Jim Taylor, the ARFTG Executive Secretary, at [jtaylor@blitz-it.net](mailto:jtaylor@blitz-it.net).

## AWARDS

The awards banquet was held at the conference hotel and included an evening of entertaining piano music and sparkling conversation. President Ken Wong announced the awards for the 53<sup>rd</sup> conference. The Best Technical Paper was "Measuring the Characteristics of Modulated Non-Linear Devices", presented by Yves Rolain. The Best Interactive Paper was "Automating the Importation of Load Pull Data into a Non-Linear CAD Simulator", presented by David Anderson.



Yves Rolain presenting his paper at the 53<sup>rd</sup> conference

President Ken Wong awarded certificates of appreciation to those who organized the 54<sup>th</sup> conference. The conference chair was Larry Dunleavy, the technical program chair was Joy Laskar, and the local host was Mike Harris. The NIST/ARFTG short course was coordinated by Robert Judish, Larry Dunleavy and David Walker.

An Honorary Membership was presented to Bill Pastori for his outstanding service to ARFTG. Bill has served for many years as a member of the Executive Committee including President. He is also an instructor in the short course imparting his extensive knowledge in noise measurements. Even though Bill has retired and moved to Florida, he and his brightly colored jackets can still be spotted at ARFTG conferences.

### **MICROWAVE MEASUREMENT STUDENT FELLOWSHIP**

ARFTG has announced a new Microwave Measurement Student Fellowship. The purpose of this fellowship is to recognize and provide financial assistance to graduate students who show promise and interest in pursuing research related to improvement of radio frequency and microwave measurement techniques. One or more \$7500 awards may be granted each year, based on available funding and on the number and quality of applications received.

Applicants must have a bachelor's degree in engineering, physics or computer science and be enrolled as a full-time student in a graduate degree program at a suitably qualified institution of higher learning. Applicants must be carrying out research as part of the degree program, rather than just taking course work. The proposed research project must clearly involve RF/microwave measurements and be supervised by a full-time faculty member. The faculty advisor or supervisor must be an ARFTG member, or the proposal must be sponsored by an ARFTG member.

For more information visit our website at [www.arftg.org](http://www.arftg.org) or contact Jeff Jargon at [jargon@boulder.nist.gov](mailto:jargon@boulder.nist.gov).

### **MEASUREMENT COMPARISON PROGRAM**

The ARFTG Measurement Comparison Program allows participating laboratories to compare their measurements on the ARFTG standards kits to those obtained from other laboratories. This allows for the inter-comparison of a large number of vector network analyzers. Given the increasing emphasis on measurement assurance, this program provides a valuable, cost-effective method for validating the participant's measurement capability. This program is not intended to provide an uncertainty analysis but should give the participants more confidence in their measurement capability and assist in identifying measurement deficiencies. Data obtained from the participating labs are sent to NIST where the results are

added to a database and a report is sent to the customer. Maury Microwave Corporation has generously donated a 7/16 connector calibration kit, which will be added to the program.

#### Calibration kits available in the Measurement Comparison Program

For more information or to obtain a signup sheet visit our website at [www.arftg.org](http://www.arftg.org) or contact John Cable at

| Connector       | Contact                   |
|-----------------|---------------------------|
| Type N          | John Cable, Allied Signal |
| 7 mm            | Brian Lee, Agilent        |
| 3.5 mm          | Phil Yates, JPL           |
| Type K, 2.92 mm | Ron Guzman, Anritsu       |
| 2.4 mm          | Ken Wong, Agilent         |

[jcable@kcp.com](mailto:jcable@kcp.com).

### **MEMBERSHIP**

ARFTG dues are \$25.00 US per year. This maintains your name on the mailing list and allows you to use the member discount rate for Conferences and Digests. For your convenience, membership may be renewed by paying the non-member/renewal rate at either the spring or fall conference each year. For additional information, visit our website at [www.arftg.org](http://www.arftg.org) or contact Ray Tucker, the ARFTG Membership Chairman, at 315-330-3884, FAX 315-330-7083 or [tuckerr@rl.af.mil](mailto:tuckerr@rl.af.mil).

### **ANNUAL BUSINESS MEETING**

The annual business meeting, consisting of the membership present, was called to order by President Ken Wong.

An election was held for four members to serve on the Executive Committee. As currently constituted, the Executive Committee is composed of twelve voting members each elected for a three year term. The six candidates were introduced to the membership. Biographies of the candidates were distributed with the conference materials and each member was asked to review them. The ballots were passed out, a vote requested and the ballots were collected. Larry Dunleavy, Ed Godshalk, Ray Tucker and Ken Wong were each elected to terms expiring in 2002.

Jeffrey Jargon was recognized to announce the award of the 2<sup>nd</sup> ARFTG Student Fellowship. \$7500 was awarded to Rebecca Peterson from the University of Minnesota for her proposal titled "High Frequency Characterization

of Advanced Microwave Materials". A special acknowledgement was given to the three proposal evaluators: Leonard Hayden, Joy Laskar and Kevin Kerwin.

John Cable was recognized to report on the ARFTG Measurement Comparison Program. Treasurer Gary Simpson reported that the financial report of the organization is excellent and a balance sheet is available upon request. President Wong adjourned the meeting.



### **EXECUTIVE COMMITTEE**

The executive committee elected officers as stipulated in the organization's bylaws for the calendar year 2000: Robert Judish, President; Ed Godshalk, Vice President; Charles Wilker, Secretary; and Ken Wong, Treasurer. For a complete list of the ARFTG Executive Committee members and assignments, please visit our website: [www.arftg.org](http://www.arftg.org).

The executive committee authorized Ray Tucker to proceed with the incorporation of ARFTG as a not-for-profit organization with tax-exempt status and also to pursue the determination of the organization's tax-exempt status with the Internal Revenue Service.

## **FUTURE CONFERENCES**

### **55<sup>th</sup> ARFTG Conference**

The 55<sup>th</sup> ARFTG Conference will be held on June 15-16, 2000, at the Convention Center, in Boston, Massachusetts. The main conference theme is "Going Beyond S-Parameters". Please contact either the conference chair Mike Fennelly of Roos Instruments ([mfennelly@ieee.org](mailto:mfennelly@ieee.org) or (978)-258-4101) or the technical program chair Markus Vanden Bossche of Aglient ([Marc.Vanden\\_Bossche@belgium.hp.com](mailto:Marc.Vanden_Bossche@belgium.hp.com)). This conference is held in conjunction with the 2000 IEEE MTT-S International Microwave Symposium.

### **7<sup>th</sup> NIST/ARFTG Short Course**

ARFTG in cooperation with NIST will offer its seventh annual Microwave Measurements Short Course in conjunction with the Fall 2000 ARFTG Conference to be held in Boulder, Colorado. This popular two-day course provides both a grounding in the fundamentals as well as the latest in measurement techniques taught by the experts. Basic measurement techniques are covered on Day 1, including: microwave measurement overview, circuit theory, vector network analyzers, test fixtures, on-wafer measurements, power, and noise. Additional in-depth topics are covered on Day 2, including: phase noise, load-pull, digital modulation, and time domain techniques. Several tutorials specifically related to the conference theme are also covered on Day 2. For more information, please visit our web site, [www.arftg.org](http://www.arftg.org), or contact the short course director, Dave Walker of NIST, ([dwalker@boulder.nist.gov](mailto:dwalker@boulder.nist.gov) or (303)-497-5490).

### **56<sup>th</sup> ARFTG Conference**

The 56<sup>th</sup> ARFTG Conference will be held on November 30 and December 1, 2000 in Boulder, CO. The main conference theme is "Characterization of Broadband Access Technologies". Please contact the conference chair Dylan Williams of NIST ([dylan@boulder.nist.gov](mailto:dylan@boulder.nist.gov) or (303)-497-3138).

**ARFTG CONFERENCE AT  
Westin Peachtree Hotel in Atlanta, Georgia**

**Presented Papers**

**Broadband System Measurements**

**A Novel Load and Source Tuning System for Balanced and Unbalanced WCDMA Power Amplifiers**

Reza Mahmoudi, M. Spirito, P. Valk and J. Tauritz, Hewlett Packard, Delft University of Technology and Universita di Napoli

**Integral Measurement System Design Using HP's Advanced Design System**

P. Valk and J.L. Tauritz, Delft University of Technology

**Impact of Ingress Noise on the Communication on Hybrid Fiber-Coax (HFC) Networks**

E. Claus, K Haelvoet and L. Martens, University of Gent

**Test Methodologies for Evaluating Digital Signal Performance on Cable and Alternate Media**

Marc Ryba and Joseph Waltrich, General Instrument Corporation

**Georgia Tech Software Radio Laboratory**

Thomas Pratt, Georgia Institute of Technology

**Measurement and Analysis of the Channel Characteristics of an In-building Wireless Network**

Jung-Hyuck Jo and Nikil Jayant, Georgia Institute of Technology

**Analysis and Design of RF Circuits Including Non-linear Elements using the Multiresolution Time Domain Technique (MRTD)**

Manos Tentzeris, Georgia Institute of Technology

**Broadband Measurements for Digital Interconnects**

**Broadband Measurement-Based Modeling of Digital Interconnect**

Luc Martens, University of Gent

**Extraction of S-Parameters from TDR/TDT Measurements using Rational Functions**

Sreemala Pannala and Madhavan Swaminathan, Georgia Institute of Technology and Sun Microsystems

**Characterization of Skin Effect in High-Speed Interconnects and Spiral Inductors**

Fethi Choubani, Jos Schutt-Ainé and Richard Baca, University of Illinois

**Influence of the Substrate Resistivity on the Broadband Propagation Characteristics of Silicon Transmission Lines**

Uwe Arz, Hartmut Grabinski and Dylan Williams, Universität Hannover and National Institute of Standards and Technology

**Nose-to-Nose Response of a 20-GHz Sampling Circuit**

Dylan Williams, Kate Remley and Donald DeGroot, National Institute of Standards and Technology

**Causality and Characteristic Impedance**

Dylan Williams and Bradley Alpert, National Institute of Standards and Technology

**VNA Measurement Accuracy**

**Sources of Error in Coplanar-Waveguide TRL Calibrations**

Raian Kaiser and Dylan Williams, National Institute of Standards and Technology

**The effect of Load Variations on On-Wafer Lumped Element Based Calibrations**

Pete Kirby, Lawrence Dunleavy and Thomas Weller, University of South Florida

**Periodically Estimated Reflection Coefficient Measurement Uncertainties for Vector Network Analyzer**

Leonard Duda, Sandia National Laboratories

**Equivalent Circuit Models for Coaxial OSLT Standards**

Donald DeGroot, Kristopher Reed and Jeffery Jargon, National Institute of Standards and Technology

**Deriving Error Bounds on Measured Noise Factors using Active Device Verification**

Sven Van den Bosch and Luc Martens, University of Gent

**RF Passives and Board Characterization**

**PC Board Characterization using Accurate Hybrid Probing Techniques**

S. Gross, L. Dunleavy, T. Weller, B. Schmitz and T. Winslow, University of South Florida and ITT

**Development of Vertical Interconnects for Mixed Substrate Technology**

A. Pham, A. Sutono, J. Laskar, V. Krishnamurthy, D. Lester, E. Balch and J. Rose, Clemson University, Georgia Institute of Technology and General Electric

**A Novel De-Embedding Technique for Millimeterwave Package Characterization**

Hongwei Liang, Joy Laskar, Mike Hyslop, Ram Panicker, Georgia Institute of Technology and MicroSubstrates Corporation

**Substrate-Dependent Air-Wound Inductor Model in the DC-4 GHz Range**

E. Benabe, H. Gordon and T. Weller, University of South Florida

**Tour of Georgia Institute of Technology**

**Additions/Corrections**

Every effort has been made to publish correct information. Problems should be reported to the undersigned. Corrections will be made in the final copy of the Newsletters found in the Digest.

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