



AUTOMATIC RF TECHNIQUES GROUP

CONFERENCE NEWSLETTER

SPRING 2000

NUMBER 23

The 55th Conference Going Beyond S-Parameters

OVERVIEW

Boston Massachusetts provided a very enjoyable setting for the 55th ARFTG conference which met on June 15th and 16th. The conference was held in conjunction with IMS 2000 and offered an extensive technical program, a vendor exhibits area and perhaps most importantly, time to interact with other microwave and RF professionals about measurement needs, problems and solutions. A complete listing of the papers presented is given on Pages 4 and 5 with complete copies of each presentation available in the conference digest. Additional conference information is available on our website at www.arftg.org. Conference Chair Mike Fennelly and Technical Program Chair Marc Vanden Bossche put forth considerable effort to ensure an outstanding conference.

TECHNICAL SESSIONS

The technical sessions were held on June 15th and 16th at the Hynes Convention Center in downtown Boston. The program included a joint IMS-ARFTG technical session, four ARFTG technical sessions and an ARFTG interactive forum. Technical Program Chair Marc Vanden Bossche and ARFTG Technical Committee Chair Dylan Williams assembled an interesting and topical technical program. The joint IMS-ARFTG session, "Linear and Nonlinear Network Measurements", consisted of 7 papers. The four ARFTG sessions: "From Large-Signal Measurements to Models"; "From Calibration to Model Verification"; "Closing the Design Loop by Measuring, Modeling and Simulating"; and "About Loadpull, Tuners and a Noisy

Final Touch", consisted of a total of 18 papers. The four ARFTG interactive forum topics: "Calibration Technology for Large-Signal Characterization"; "Measurement Technology"; "Modeling"; and "Simulation", consisted of a total of 11 papers.

Selected by the conference attendees as the Best Technical Paper was "Why are Non-Linear Microwave Systems Measurements so Involved?", presented by Yves Rolain and co-authored by Wendy Van Moer, Gerd Vandersteen and Johan Schoukens of Vrije Universiteit Brussels. Also selected as the Best Interactive Forum Paper was "Analysis of Interconnection Networks and Mismatch in the Nose-to-Nose Calibration" presented by Don DeGroot and co-authored by P.D. Hale, M. Vanden Bossche, F. Verbeyst and J. Verspecht of National Institute of Standards and Technology and Agilent Technologies.



Informal discussions amongst the conference attendees about measurement needs, problems and solutions is an important part of every ARFTG meeting

EXHIBITS

The exhibit's area at ARFTG Conferences provides attendees with the opportunity to view latest products and to have in depth discussions with their suppliers about their test and measurement needs, problems and possible solutions. To exhibit at an ARFTG conference or for additional information please contact Exhibits Chair Leonard Hayden at leonard@cmicro.com

AWARDS

President Bob Judish presided over the awards luncheon held at the Hynes Convention Center on Friday, June 16th. The award for the Best Technical Paper from the 54th conference, held in Atlanta, Georgia, titled "Equivalent Circuit Models for Coaxial OSLT Standards", was presented to Donald DeGroot, Kristopher Reed and Jeffery Jargon of the National Institute of Standards and Technology. The award for the Best Exhibitor from the 54th conference was presented to Cascade Microtech. Certificates of appreciation were also presented to those who organized the 55th conference: Conference Chair Mike Fennelly and Technical Program Chair Marc Vanden Bossche.

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. Once each year a \$7500 award may be granted to a deserving candidate.

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.

The recipient of this year's \$7500 student fellowship award is Alberto Rodriguez of the University of South Florida. His work will involve 100 GHz on-wafer noise measurements.

For more information visit our website at www.arftg.org or contact Jeff Jargon at jargon@boulder.nist.gov.

MEASUREMENT COMPARISON PROGRAM

The ARFTG Measurement Comparison Program allows participating laboratories to compare their measurements on an ARFTG standards kit 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 has been added to the program.

Connector	Contact
7/16	Greg Burns, Northrup Grumman
Type N	John Cable, Honeywell
7 mm	Brian Lee, Agilent Technologies
3.5 mm	Phil Yates, JPL
Type K, 2.92 mm	Ron Guzman, Anritsu
2.4 mm	Ken Wong, Agilent Technologies

Calibration kits available in the Measurement Comparison Program

For more information or to obtain a signup sheet visit our website at www.arftg.org or contact John Cable at 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 or contact Ray Tucker, the ARFTG Membership Chairman, at 315-330-3884, FAX 315-330-7083 or tuckerr@rl.af.mil.

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 or contact Jim Taylor, the ARFTG Executive Secretary, at jtaylor@blitz-it.net.

FUTURE CONFERENCES



The Omni Hotel and Resort located just outside Boulder

7th NIST/ARFTG Short Course

ARFTG in cooperation with NIST will offer its 7th annual Microwave Measurements Short Course on November 28th and 29th, 2000 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: a 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, or contact the short course director, Dave Walker of NIST, (dwalker@boulder.nist.gov or (303)-497-5490).

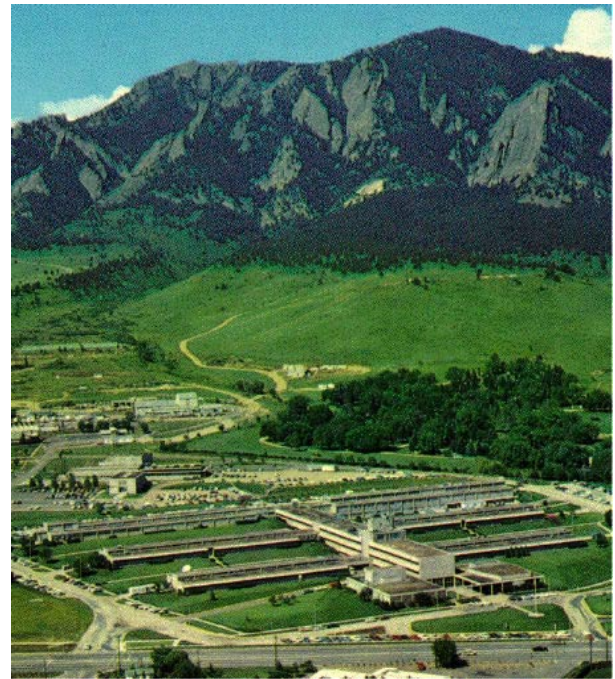
56th ARFTG Conference

The 56th ARFTG Conference will be held on November 30th and December 1st, 2000 in Boulder, CO. The main conference theme is "Characterization of Broadband Access Technologies". For more information, please visit our web site, www.arftg.org and check out the virtual tour or contact the conference chair Dylan Williams of NIST (dylan@boulder.nist.gov or (303)-497-3138).

A number of special events associated with the conference have also been planned. On Wednesday evening, join us and unwind at a reception in the Dushanbe Tea House in Boulder. On Friday evening, do not miss a once-in-a-lifetime opportunity to participate in the celebration of NIST's centennial by visiting the Boulder labs. There will be several special talks on cutting edge technology and a chance to visit your favorite NIST metrologist in their native environment. On Saturday, you can also join us for a run down the mountain in Loveland.

John Martinis	Counting Electronics
Bob Drullinger	Ion Storage
Ron Goldfarb	Magnetic Measurements

NIST talks on cutting edge technology



NIST Laboratories in Boulder

John Juroshek	Verification of ANA Measurements
Fred Walls	Phase Noise Measurements
Paul Hale	Nose-to-Nose Calibrations
Dave Walker	4-port S-Parameter Measurements
Katie MacReynolds	Antenna Gain in the Near Field
Jim Baker-Jarvis	Permittivity and Loss of Dielectrics
Bill Riddle	
Mike Janezic	
Don DeGroot	Non-linear Measurements
Dylan Williams	On-wafer TRL Calibrations
Peter Papazian	Impulse Response and BER
George Free	Impedance Bridge Measurements
Galen Koepke	Emmission Measurements for EMC
Ron Ginley	Power Sensor Calibrations
Jim Randa	Noise Temperature Measurements

NIST Metrology Laboratories



Skining in Loveland

57th ARFTG Conference

The 57th ARFTG Conference will be held on May 24th and 25th, 2001 in Phoenix, Arizona in conjunction with IMS 2001. The main conference theme is "Best Practice and Strategies for RF Test". For more information, please visit our web site, www.arftg.org or contact the conference chair Charles Wilker of DuPont Superconductivity (charles.wilker@usa.dupont.com or (302)-999-3075).

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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ARFTG CONFERENCE AT Hynes Convention Center Boston, Massachusetts

Joint IMS-ARFTG Session

Linear and Nonlinear Network Measurements

High Power Time Domain Measurement System with Active Harmonic Load-Pull for High Efficiency Base Station Amplifier Design

J. Benedikt, R. Gaddi and P.J. Tasker, Cardiff University

An Active Pulsed RF and Pulsed DC Load-Pull System for the Characterization of Power Transistors Used in Coherent Radar and Communication Systems

C. Arnaud, D. Barataud, J.M. Nebus, J.P. Teyssier, J.P. Villotte and D. Floriot, IRCOM and Thomson-CSF

Measurement Based Nonlinear Modeling of Spectral Regrowth

W. VanMoer and Y. Rolain, Vrije Universiteit Brussel

A Low Cost AM/PM Sideband Generator for Low Noise Calibration

D.A. Bittler, F.H. Harris and D.W. Strack, Northrop Grumman

Realistic Sampling Circuit Model for a Nose-to-Nose Simulation

K.A. Remely, D.F. Williams and D.C. DeGroot, NIST

A Comprehensive Milimeter-Wave Calibration Development and Verification Approach

W.M. Okamura, M.M. DuFault and A.K. Sharma, TRW

A New Method for Characteristic Impedance Determination on Lossy Substrates

A. Bracale, D. Pasquet, J.L. Gautier, N. Fel, V. Ferlet and J.L. Pelloie, ENSEA and CEA

ARFTG Presented Papers

Session 1: From Large-Signal Measurements to Models

Why are Non-linear Microwave Systems Measurements so Involved?

Y. Rolain, W. Van Moer, G. Vandersteen and J. Schoukens, Vrije Universiteit Brussel

Extraction of Transistor Large Signal Models from Vector Nonlinear Network Analyzers

M.C. Curras - Francos, P.J. Tasker, M. Fernandez - Barciela, Y. Campos-Roca and E. Sanchez, University de Vigo and Cardiff University

Waveform Measurements - The Load-Pull Aspect

F. Van Raay and G. Kompa, University of Kassel

A Novel Experimental Noise Power Ratio Characterization Method for Multicarrier Microwave Power Amplifiers

T. Reveyrand, D. Barataud, J. Lajoinie, M. Campovecchio, J-M Nebus, E. Ngoya, J. Sombrin, and D. Roques, IRCOM, CNES and Alcatel Space Industries.

Measurement Driven Models of Nonlinear Electronic Components

N. Tuffilaro, D. Usikov and L. Barford, Agilent Technologies

Session 2: From Calibration To Model Verification

Estimating the Magnitude and Phase Response of a 50 GHz Sampling Oscilloscope using the 'Nose-to-Nose' Method

P.D. Hale, T.S. Clement, K.J. Coakley, C.M. Wang, D.C. DeGroot, A.P. Verdoni, National Institute of Standards and Technology

Ka-Band Quasi-Optical Measurements using Focused Gaussian Beams

B. Deckman, J.J. Rosenberg and D. Rutledge, California Institute of Technology and Harvey Mudd College

Broadband Determination of 2-port Transmission of PHEMTs Embedded in Transmission Lines

J.A. Reynoso-Hernandez and C.F. Estrada-Maldonado, Centro de Investigacion Cientifica y de Educacion Superior de Ensenada

Accuracy Evaluation of On-wafer Load-Pull Measurements

A. Ferrero and V. Teppati, Politecnico di Torino
Verification of Non-linear MOSFET Models by Intermodulation Measurements under Load Pull Conditions

D. Schreurs, E. Vandamme, S. Vandenberghe, G. Carchon and B. Nauwelaers, K.U. Leuven

Session 3: Closing the Design Loop by Measuring, Modeling, and Simulating

Methodology for Large Signal Behavioral Modeling of Non Linear RF Circuit Easily Affordable for Industrials

F. Graux, F. Dhondt, C. Tolant, P. Eudeline, B. Bonte and Y. Crosnier, Thomson-CSF Airsys, IEMN

Automated Macromodeling of Time-Varying Systems, with RF Applications

J. Roychowdhury, Bell Laboratories.

A Systematic Simulation of Large Signal On-Chip Amplifier Modules Excited by WCDMA Signals

R. Mahmoudi and J.L. Tauritz, Philips and University Twente

Bit-Error-Rate Estimation for OFDM Based Telecommunication Systems Schemes in the Presence of Nonlinear Distortions

G. Vandersteen, Y. Rolain, W. Van Moer, J. Verbeeck and J. Schoukens, Vrije Universiteit Brussel

Session 4: About Loadpull, Tuners, And A Noisy Final Touch

A New Six-Port Based Time Domain Load-Pull Measurement Technique

P. Poire, F.M. Ghannouchi and G. Brassard, Alcatel CIT, Polytechnique Montreal and Canadian Space Agency

Accuracy of Extremely High SWR Prematching Tuners

D. Dubouil and C. Tsironis, Focus Microwave

Nonlinear Noise Measurement on a High Power Amplifier

M.S. Muha, A.A. Moulthrop and C.P. Silva, Aerospace Corporation

Multiport Noise Characterization and Differential Amplifiers

J. Randa, National Institute of Standards and Technology

ARFTG Interactive Forum

Session 1: Calibration Technology For Large-Signal Characterization

Analysis of Interconnection Networks and Mismatch in the Nose-to-Nose Calibration

D.C De Groot, P.D. Hale, M. Vanden Bossche, F. Verbeyst and J. Verspecht, National Institute of Standards and Technology and Agilent Technologies

Progress of Nose-to-Nose Calibration Theory and SPICE Simulation

L. Mao-Liu, L. Wei-Jin, Z. Hua, W. Hai-Ming, Harbin Institute of Technology

Session 2: Measurement Technology

Noise behavior of an Amplifier in Compression

A. Geens and Y. Rolain, Vrije Universiteit Brussel
NFRad - Review of New NIST Noise Measurement System

C.A. Grosvenor, J. Randa and R.L. Billinger, National Institute of Standards and Technology
Parametric study of nonlinear ACPR and Harmonic Load Behavior of PCS Transistors using a Load Pull System

C. Tsironis and D. Dubouil, Focus Microwave
Comparison of Calibrated S-parameters Measured under CW and Pulsed RF Excitation with a Nonlinear Vectorial Network Analyzer

P. Vael and Y. Rolain, Vrije Universiteit Brussel
Novel Concept for a Modular mmwave Probe Tip
M. Wollitzer, B. Rosenberger and W. Strasser, Connexion Rosenberger

Session 3: Modeling

Non-linear Modeling of a Multi-FET Multi-Port IC

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

Efficient Isolation of the Nonlinearity of Reconstruction Problems

T. Meyer and A.S. Omar, University of Magdeburg
Simulation and Experimental Waveform Study on Optimum Harmonic Loading

C.J. Wei, Y.A. Tkachenko, D. Bartle, Alpha Industries

Session 4: Simulation

Comparison of SPICE vs. Harmonic-Balance Simulations

D. Anderson, Maury Microwave Corporation
Adaptive Feedforward Linearization for RF Power Amplifiers

S.P. Stapleton, Simon Fraser University