



AUTOMATIC RF TECHNIQUES GROUP

CONFERENCE NEWSLETTER

FALL 2000

NUMBER 24

The 56th Conference ***Metrology and Test for RF Telecommunications***

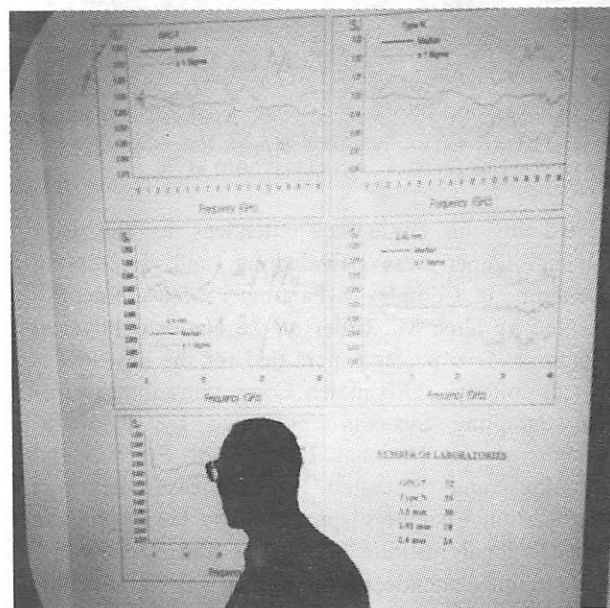
OVERVIEW

Boulder, Colorado provided a very enjoyable setting for the 56th ARFTG conference which was held on November 30th and December 1st. This conference offered a two-day technical program and a tour of facilities associated with the National Institute of Standards and Technology (NIST). A complete listing of the papers presented is given on Pages 5 and 6 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 Dylan Williams put forth considerable effort to ensure an outstanding conference. He was ably assisted by the Technical Program Chairs Kate Remly and Michael Steer.

SHORT COURSE

The 7th annual NIST/ARFTG Microwave Measurements Short Course was given on November 30th and December 1st, 2000 at the Omni Interlocken Hotel in Broomfield, Colorado. 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



Short Course presentation.

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 or by contacting the

ARFTG Short Course Direction, David Walker, at dwalker@boulder.nist.gov.

TECHNICAL SESSIONS

The technical sessions were held November 30th and December 1st at the Omni Interlocken Hotel in downtown Broomfield. These sessions discussed the conference theme as well as a number of other diverse subjects of common interest. Technical Program Chairs Kate Remley and Michael Steer and Conference Chair Dylan Williams assembled an interesting program consisting of 22 presented papers and 9 poster papers. Topics included: Temporal Measurements, Accuracy, OSLT Calibration, Metrology, and Test.



Conference was classroom style

Selected by the conference attendees as the Best Technical Paper was "Evaluating and Expressing Uncertainty in Complex S-Parameter Measurements", presented by Nick M. Ridler of the National Physical Laboratory. Two poster papers tied for the best Poster Paper as follows: "Mismatch Corrections for Electro-Optic Sampling Systems" presented by Dylan F. Williams of the National Institute of Science and Technology and "Radiated Power Measurements in Reverberation Chambers" presented by Galen Koepke of the National Institute of Science and Technology. The conference attendees also selected Tektronix for the Best Exhibitor.

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



Exhibit room at the 56th 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 or by contact Jim Taylor, the ARFTG Executive Secretary, at 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 Robert Judish announced the awards for the 55th conference. The award for the Best Technical Paper titled "Why are Non-linear Microwave Systems Measurements so Involved?" was presented by Yves Rolain. The award for the Best Poster Paper titled "Analysis of Interconnection Networks and Mismatch in Nose-to-Nose Calibration" was by D. C. DeGroot et al. The award for the Best Exhibitor was Cascade Microtech.

President Robert Judish also awarded certificates of appreciation to those who organized the 56th conference: Conference Chair Dylan Williams, Technical Program Chairs Kate Remley and Michael Steer, and the Local Host Mike Harris. The NIST/ARFTG short course was coordinated by David Walker.

President Robert Judish presented the ARFTG Technology Award to Vahe Adamain in recognition of his development of solid-state tuner technology. President Robert Judish also presented the ARFTG Career Award to William E. Pastori in recognition of his outstanding contributions to Microwave Noise Measurements.

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 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 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.

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
7-16	Greg Burns, Northrop Grumman

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.

ANNUAL BUSINESS MEETING

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

The membership voted to incorporate ARFTG. The meeting was closed as the final ARFTG meeting. The President Judish then called the first meeting of ARFTG Inc.



President Judish introduces Arf, our mascot

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 Nominations Chair Jim Taylor was recognized to conduct the election for the four open executive committee seats, each for a term of three years. Biographies detailing each candidate's qualifications were handed out, followed by a vote of the membership. Three current members of the executive committee, Robert Judish (President), Charles Wilker (Vice President and Secretary) and John Cable were reelected. One new member was also elected David Walker of NIST.

Jeffrey Jargon was recognized to announce the award of the 2nd 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 Ken Wong reported that the financial report of the organization is excellent and a balance sheet is available upon request. President Judish adjourned the meeting.



NIST celebrates their first centennial

EXECUTIVE COMMITTEE

The executive committee elected officers as stipulated in the organization's bylaws for the calendar year 2001: President Robert Judish, Vice President Charles Wilker, Secretary Charles Wilker and Ed Godshalk, and Treasurer Ken Wong. For a complete list of the

ARFTG Executive Committee members and assignments, please visit our website: 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

57th ARFTG Conference

The 57th ARFTG Conference will be held on 25 May, 2001, at the Convention Center, in Phoenix, Arizona. The main conference theme is "Best Practice and Strategies for RF Test". Please contact either the conference chair Charles Wilker of Dupont Superconductivity (charles.wilker@usa.dupont.com or (302)-999-3075) or the technical program chair John Barr of Agilent (john_barr@agilent.com). This conference is held in conjunction with the 2001 IEEE MTT-S International Microwave Symposium.

8th NIST/ARFTG Short Course

ARFTG in cooperation with NIST will offer its seventh annual Microwave Measurements Short Course in conjunction with the Fall 2001 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, or contact the short course director, Dave Walker of NIST, (dwalker@boulder.nist.gov) or (303)-497-5490.

58th ARFTG Conference

The 58th ARFTG Conference will be held on 29 and 30 November, 2001 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 or (303)-497-3138).

ARFTG CONFERENCE AT Omni Interlocken Hotel Hotel in Broomfield, Colorado

Presented Papers

Opening Remarks

General Chair Comments: Dylan Williams
 Technical Program Chair Comments: Michael Steer
NIST: 100 Years of Metrology
 Dennis Friday, RF Technology Division Chief,
 NIST, Boulder, CO
 Bob Kamper (retired)

Metrology and Test for RF Telecommunications

**Carrier-to-Interference Ratio Estimation of
 Arbitrary Signals Distorted by Nonlinear Devices**
 Hyunchul Ku, Wangmyong Woo, J. Stevenson Kenney,
 (Georgia Institute of Technology)

Behavioral Models of Microwave Circuits with Fading Memory

Nicholas B. Tufillaro (Agilent), David M. Walker
 (Univ. of Western Australia)

Network Analysis Beyond S-parameters: Characterizing and Modeling Component Behaviour under Modulated Large-Signal Operating Conditions

Jan Verspecht, Frans Verbeyst, Marc Vanden Bossche
 (NMDG, Agilent)

Temporal Measurements for Microwave Systems

**A New Technique for Low-Jitter Measurements in
 Equivalent-Time Sampling Oscilloscopes**
 Michael Nelson (Tektronix)

Improving the Uncertainty Analysis of NIST's Pulse Parameter Measurement Service

Nick G. Paulter and Donald R. Larson (NIST)

A Quasi-Coherent Sampling Method for Wideband Data Acquisition

Kensuke Kobayashi, Masaru Kimura, Haruo Kobayashi
 (Teratec/Gunma Univ.)

General ARFTG Session

High-Frequency Behavior of Coupled CMOS Interconnects Built in Different Metallization Layers

Uwe Arz, Dylan F. Williams, David K. Walker,
 Hartmut Grabinski (NIST/Univ. of Hannover)
 (Mr. Arz is an ARFTG graduate student award
 recipient)

Experimental Results for Parasitic Coupling and Attenuation of Coplanar Waveguides on High Resistivity Silicon

Balaji Lakshminarayanan and Tom Weller (University
 of South Florida)

Accurate Probing of RF Amplifiers Using Vertical Interconnect Boards

Krishna Naishadham (Philips)

Accuracy in Microwave RF Measurement

Millimeter Wave Vector Analysis Calibration and Measurement Problems Caused by Common Waveguide Irregularities

Charles Oleson, Anthony Denning (Oleson Microwave
 Labs)

Evaluating and Expressing Uncertainty in Complex S-Parameter Measurements

Nick M. Ridler and Martin J. Salter (NPL)

Special Mini-Session on OSLT Calibration

Modeling Load Variations with Artificial Neural Networks to Improve On-Wafer OSLT Calibrations

Jeff Jargon, Pete Kirby, K.C. Gupta, Lawrence
 Dunleavy, Tom Weller (NIST/Univ. of Colorado/Univ.
 of S. Florida)

Lumped-Element Models for On-Wafer Calibration

David K. Walker, Raian F. Kaiser, Dylan F.
 Williams, and Kevin J. Coakley (NIST)

Load Models for CPW and Microstrip SOLT Standards on GaAs

Pete Kirby, Lawrence Dunleavy, Thomas Weller (Univ.
 of S. Florida)

Poster Session/Reception

1. **Identification and Measurement of
 Transmitter Nonlinearities**
 Dave Wisell (Ericsson/Univ. of Gävle)
2. **Improved Uncertainty for the Noise Source
 Based on the Adapter Removal Methods**
 Yeou-Song (Brian) Lee, Norm Royce (Golden
 Gate Standards Lab/Agilent)
3. **Finite Aperture Time and Sampling Jitter
 Effects in Wideband Data Acquisition
 Systems**
 Haruo Kobayashi, Kensuke Kobayashi, Yuuich
 Takahashi, Kouhei Enomoto,
 Hideyuki Kogure, Yoshitaka Onaya, Masanao
 Morimura, (Gunma Univ./Teratec)
4. **Aberration Measurement of Fast Pulse
 Generators Using Sampling Oscilloscopes**
 Andrew J.A. Smith, Alan G. Roddie, Peter D.
 Woolliams, Matthew R. Harper (NPL)
5. **Accurate Characterization of Fringing Effects
 at On-Chip Line Steps**
 Thomas-Michael Winkel (IBM), Lohit Sagar
 Dutta, Hartmut Grabinski (Univ. of Hannover)
6. **Radiated Power Measurements in
 Reverberation Chambers**
 Galen Koepke and John Ladbury (NIST)
7. **Mismatch Corrections for Electro-Optic
 Sampling Systems**

Dylan F. Williams, Paul D. Hale, Tracy S. Clement, and Juanita M. Morgan (NIST)

8. **A Method to Evaluate Power Sensor Calibration Systems**

J. Gregory Burns (Burns Engineering)

9. **NIST Centennial Exhibit**

Metrology and Test for RF Telecommunications
Nonlinear Characterization of Multiple Carrier Power Amplifiers

Olav Andersen, David Wisell, Peder Malmlof (Univ. of Gävle/Ericsson)

Microwave Component Analyzer: A Novel Instrument for Measuring Pulsed or CW Signal-to-Noise Ratio

Lowell (Roy) Hoover and Alexander MacMullen (Technology Service Corporation)

A Wideband Method for the Rigorous Low-Impedance Loadpull Measurement of High-Power Transistors Suitable for Large-Signal Model Validation

Peter H. Aaen, Jaime Plá, Daren Bridges, Eric Shumate (Motorola)

Synchronous Sampling and Applications to Analytic Signal Estimation

Steve Pepper (Picosecond Pulse Labs)

Temporal Measurements for Microwave Systems

Microwave Electric-Field Mapping Using Optical-Fiber-Mounted Electro-Optic Probes

Kyoung Yang, John F. Whitaker, Linda P.B. Katehi (Univ. of Michigan)

Picosecond Pulse Propagation Images and Oppositely Polarized Pulse Shapes on CPS Lines Measured by a Scanning Force Optoelectronic Microscope

Yukio Kasahara, Koichiro Takeuchi, Akira Mizuhara, Koji Mizuno (Teratec/RIKEN)

Electro-Optic Sampling of Coplanar to Coaxial Transitions to Enhance the Calibration of Fast Oscilloscopes

Andrew J.A. Smith, Alan G. Roddie, Peter D. Woolliams (NPL)

Overview of Applications of Optical Measurements in Microwave Circuit and Antenna Array Design
Manoja Weiss (Univ. of Colorado), John Whitaker (Univ. of Michigan), Zoya Popovic (Univ. of Colorado)

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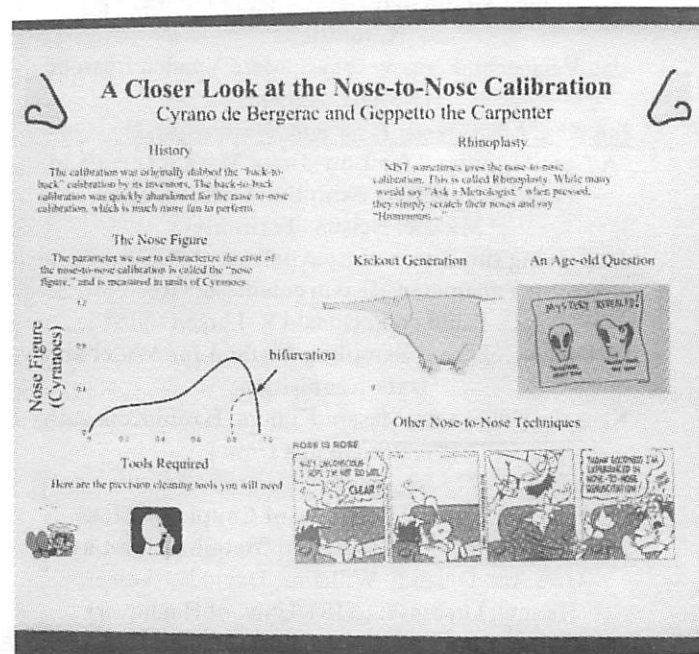
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Tour of NIST/Ask a Metrologist



Poster showing that metrologist can have a sense of humor