THE INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, INC.

NORTH JERSEY SECTION

MTT-Society & AP-Society Joint Chapter

PRESENTS

22nd ANNUAL SYMPOSIUM AND MINI – SHOW

THURSDAY OCTOBER 4, 2007

PLACE: Hanover Manor, 16 Eagle Rock Ave., E. Hanover, NJ 07936. Ph#973-992-7425

The conference presents a series of 8 lectures describing the state of the art in Microwave, RF, Optical and Wireless, technologies by leaders in their respective fields.

MINI SHOW FEATURING LATEST PRODUCTS - (10:00 AM TO 4:30 PM)

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TECHNICAL SESSIONS (8:50AM to 4:30PM)

Time	Topic	Speakers	Title	Affiliation
8:50	Opening Remarks	George Kannell	Tech. Chair IEEE MTT/AP Chapter	LGS Innovations
9:00-9:30	Design of an X-band Amplifier with High Yield	Dr. Murthy Upmaka	Senior Applications Engineer	Agilent Technologies
9:30-10:00	Dynamic Noise-Feedback and Mode-Coupling Silences Oscillator Phase Noise	Dr. Ajay K. Poddar	Chief Scientist	Synergy Microwave Corporation
10:00	LUNCH - MINI SHOW EXHIBITION			
10:30-11:30	Design of RF-CMOS Integrated Circuits for Wireless Communications (sponsored w/ EDS/CAS Chapter)	Prof. Dr.-Ing. Georg Boeck	Professor	Berlin University of Technology
11:30-12:00	RF Technology Trends for Ubiquitous Wireless	Dr. Alex Pidwerbetsky	Consulting Member of Tech Staff	LGS Innovations
12:00	LUNCH - MINI SHOW EXHIBITION			
1:00-1:30	Beamforming Networks For Telecommunications And Defense	Dr. John Howard	President	Electromagnetic Technologies Inc.
1:30-2:00	GaN-on-Silicon RF Power Devices – Current State & Future Directions	Kevin J. Linthicum, Ph.D	Founder and Chief Technology Officer	Nitronex
2:00-2:30	Hybrid Optoelectronic Integration at 100 Gb/s – Design Challenges and Circuit Demonstration	Dr. Jeffrey Sinsky	Member of Technical Staff	Alcatel Lucent
2:30	LUNCH - MINI SHOW EXHIBITION			
2:50-3:50	Who Was James Clerk Maxwell and What Is/Was His Electromagnetic Theory	Dr. Tapan K. Sarkar	Professor	Syracuse University
3:50	Closing remarks	Kirit Dixit	Chair IEEE North Jersey Section	Microcom Sales
4:00-4:30	**MINISHOW EXHIBITORS**			

Registration is on-site. Details are in the October issue of the NORTH JERSEY IEEE NEWSLETTER and at http://www-ec.njit.edu/~ieeenj/NEWSLETTER.html#_IEEE_North_Jersey_5

ALL ARE WELCOME (IEEE Membership not required). REGISTRATION IS ON_SITE
THERE IS NO CHARGE TO ATTEND THE SYMPOSIUM OR SHOW.
FREE BREAKFAST / LUNCH INCLUDED FOR ALL.

FOR FURTHER INFORMATION

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Event / Location Coordinator:	Ken Oexle	(973) 386-1156	
Event Coordinator:	Russell Pepe		
Event Coordinator:	Peter Donegan		
Event Coordinator:	Willie Schmidt		

TOPICS & SPEAKERS

8:50-9:00 Opening Remarks
George Kannell Technical Program Chair LGS Innovations /Bell Labs

George Kannell is a Distinguished Member of Technical Staff in the Government Communication Laboratory at LGS Innovations (successor to the Lucent and Alcatel Government Solutions business units). At Bell Laboratories, he is responsible for System Architecture and leads the design and realization of next generation Wireless and Optical defense systems. He also teaches courses in Digital Communications as an Adjunct Professor at the New Jersey Institute of Technology. Prior to Bell Laboratories, he worked as a Senior Engineer at Ansoft Corporation in Simulation of Communications Systems, Microwave Circuits, RFIC circuits, Bipolar and FET device characterization and software development. Before this, at KDI/Triangle Electronics, he managed an engineering team in the design of Active and Passive Microwave Components and Subsystems. He's published various technical articles, worked on several patents and presented at technical conferences. He received his MSEE degree from NJIT in 1988 and his BSEE in 1984. He is a member of Eta Kappa Nu and a Senior Member of the IEEE.
gkk@lgsinnovations.com gkk@ieee.org

9:00-9:30 Design of an X-band Amplifier with High Yield
Dr. Murthy Upmaka Senior Applications Engineer Agilent Technologies
This presentation will demonstrate how we can improve the yield of an X-band amplifier by identifying areas, properly selecting the parts and finally recalculating the yield. It goes through some of the techniques that are not very commonly used by the designers in most cases due less emphasis on publicizing these...

Murthy Upmaka has been with Agilent technologies for the past 10 years in various positions in R&D, sales and marketing. He is currently a Senior Application Specialist for EDA products.
Prior to joining Agilent Technologies, Murthy has a decade of experience in designing various MW components and systems for Defense applications. He has a PhD in Physics and published over 20 papers in international journals. He is Senior Member of IEEE for the past 12 years.
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9:30-10:00 Dynamic Noise-Feedback and Mode-Coupling Silences Oscillator Phase Noise
Dr. Ajay K. Poddar Chief Scientist Synergy Microwave Corp
Voltage-controlled oscillators (VCOs) are the tunable signal sources in a wide range of synthesizers, communications networks, test equipment, and other systems. Ideally, they provide wide tuning ranges with excellent phase-noise characteristics. The resonators in these sources can be formed in a variety of ways, including the use of crystal, ceramic, dielectric, SAW, and YIG materials. But such three-dimensional (3D) resonators are not conducive to integrated-circuit (IC) realizations and tend to be sensitive to vibration, microphonics, and phase hits. To overcome the limitations of VCOs based on such 3D resonators, the designers at Synergy Microwave Corp. (www.synergymwave.com) found a way to shrink planar resonators while also applying dynamic noise feedback and mode-coupling mechanism to improve the phase noise performances. The result is a line of patent-pending compact coupled planar resonator VCOs that fit in different packages measuring 0.3 x 0.3 inches, 0.5 x 0.5 inches, and 0.75 x 0.75 inches and can be cost-effective and power-efficient alternatives for high Q expensive resonators (CRO, SAW, YIG, and Dielectric resonators) based oscillators. VCOs based on patented technology have been fabricated with the coupled planar resonator approach at fundamental operating frequencies through 10 GHz so far.

Dr. Ajay K. Poddar graduated from IIT Delhi, and did Ph.D. from TU-Berlin (Technical University Berlin) Germany in 2005. Dr. Poddar is a Chief Scientist at Synergy Microwave Research, responsible for design and development of new state-of-the-art technology (oscillator, mixer, amplifier, filters, and MEMS based RF

components) at Synergy Microwave Corporation NJ, USA. Previously, he worked as a Senior Scientist in DRDO (Defense Research and Development Organization) (1991-2001), India. Dr. Poddar holds several patents and has published more than 70 scientific papers in international conferences and professional journals, contributed as a coauthor of book "The Design of Modern Microwave Oscillators For wireless Applications: Theory and Optimization, John Wiley & Sons, Inc. 2005". Dr. Poddar is a senior member of professional societies IEEE (USA), AMIE (India), and IE (India).
akpoddar@synergymwave.com

10:30-11:30 **Design of RF-CMOS Integrated Circuits for Wireless Communications (Sponsored jointly by MTT/AP and CAS/EDS Chapters)**
Dr. Georg Boeck Prof. Dr.-Ing. Berlin University of Technology

The continuous progress of silicon technology has enabled the emergence of digital mobile broadband communication systems for voice, data, multimedia and position with good quality of service. Data-rate and mobility trade-offs, different standards like 2G, 3G, Bluetooth, WLAN, GPS and digital multimedia broadcasting are leading to multimode requirements. Issues concerning coexistence and inter-working of these different technologies have to be solved. Single chip integration with digital part, high integration density and excellent RF-performance, low power consumption and low cost under mass production aspects are further requirements. First system-on-chip (SoC) demonstrations show that today CMOS technologies seem to be able to fulfill all these requirements.

This lecture will review RF-CMOS technologies, RF-architectures and re-configurability principles as well as circuit and system design aspects for mobile multi-mode communication applications. It will consider special requirements on wafer processes like leakage and analogue and RF capabilities and will look to the world of system-level design. In this context, power-levels, form factors and cost are key requirements for system-in-package and system-on-chip solutions. Of course, new challenges for the future will be considered and explored, too.

Prof. Boeck received the doctoral degree from Berlin University of Technology, Berlin, Germany, in 1984. In the same year he joined Siemens Research Labs in Munich, Germany, where his research areas were on fiber optics and GaAs electronics. From 1988 to 1991, he was a Full Professor for electronic devices and circuits at the University of Applied Sciences Regensburg, Regensburg, Germany. Since 1991, he has been the head of the Microwave Engineering Lab at Berlin University of Technology. His main areas of research are characterization, modeling and design of microwave semiconductor devices, MICs, and MMICs up to the 100 GHz regime.

Prof. Boeck has authored or co-authored more than 160 technical papers and one book and holds several patents. He serves at several Technical Program Committees and is a member of the editorial board of the Journal of RF-Engineering and Telecommunications. He is a Guest Professor of the Southeast University Nanjing, Nanjing, China and an international IEEE Distinguished Microwave Lecturer for the years 2006-2008 in the field of "Design of RF CMOS Integrated Circuits".
boeck@tu-berlin.de

11:30-12:00 **RF Technology Trends for Ubiquitous Wireless**
Dr. Alex Pidwerbetsky Consulting Member of Tech Staff LGS Innovations

.Mankind has had a long standing dream of ubiquitous communications, of being able to reach out and touch someone or get information anywhere at any time. Remarkably, there are a number of wireless technologies that are undergoing rapid development right now that are making this dream a reality. They include small, low-cost, low-power radios on a chip, small, lightweight, high-efficiency antennas, ad-hoc networking, cognitive radios and MIMO (Multiple Input Multiple Output) communications. These technologies are making wireless

communications smaller, lower cost, faster, able to support more traffic, easier to imbed and much more flexible and adaptive. This talk will provide a quick survey of these technological developments. Each of these technologies represents an impressive set of breakthroughs and capabilities in their own right. Even more remarkable is that their emergence is collectively enabling the realization of the vision of ubiquitous wireless communications.

Dr. Pidwerbetsky received a B.S. in Physics from Rensselaer Polytechnic Institute and a M.S. and Ph.D. in Applied Physics from Cornell University. He has served as the Chief Technical Officer for Government Research and Security Solutions, Bell Laboratories, Lucent Technologies. He was the Principal Investigator for DARPA's Mobile Network MIMO Program. Previously, he was the Principal Investigator for a number of DARPA efforts exploring, developing and applying MIMO communications and innovative radio technologies. Additionally, he was the Principal Investigator for an ARPA effort integrating the low-cost wireless infrastructure enabled by the RF tag technology with sensors on a chip, creating a new generation of wireless distributed sensor networks. Dr. Pidwerbetsky has extensive experience in modeling, data analysis, system analysis, simulation, and concept development. While at Cornell University, he was with the Center for Radiophysics and Space Research working on simulation and analysis of wave propagation through random media. He has 5 patents awarded and 6 patent applications in the area of wireless communications.
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1:00-1:30 Beamforming Networks For Telecommunications And Defense

Dr. John Howard President Electromagnetic Technologies Industries

Beamforming networks are used in both transmission and reception of electromagnetic energy, by creating multiple beams in phased array antennas either simultaneously or sequentially. They can be passive structures utilizing 90 or 180 degree hybrids along with phase shifting circuits or they can be active structures using in addition to the above, switching and digital networks. In certain cases microwave lenses may be used, whereas in others, beamforming can be achieved by employing specific algorithms in specialized software. The beams are isolated and may be of different frequency and carry different data. Thus, a number of distinct sectors can be created from a single antenna array. This effect of spatial diversity can increase the bandwidth several times. In this paper several examples of beamforming network and antenna combinations are presented.

Dr. John Howard has been an Associate Professor at Chelsea College, University of London from 1976 to 1978 teaching Electromagnetic Theory. From 1978 to 1979, Dr. Howard was a Principal Member of Staff at the Electronic Counter Measures Division of British Aerospace, Stevenage, England. From 1979 to 1981, Dr. Howard was Section Head of the Microwave Department at the Radar and Missile Systems Division of Marconi Space and Defense Systems, Frimley, England. There, Dr. Howard was involved in a number of Radar and Electronic Counter Measure Systems with a team of 23 Microwave and Electronic Engineers. In 1982, Dr. Howard was invited to join the RCA Astro Space Center in Princeton, New Jersey, USA as Principal Member of Staff. The same year, Dr. Howard received the prestigious award for Authors and Inventors provided every year to the best engineer of RCA Astro Space Center. From 1983 to 1986, Dr. Howard was Principal Member of Staff and a member of the Tiger Research Team at Narda Microwave Corporation, a Loral Subsidiary. There, Dr. Howard developed numerous components and sub-systems for the Defense and Communication Industries. During the same period, Dr. Howard was an Adjunct Professor at the Polytechnic of New York, teaching Advanced Electromagnetic Theory, at BS level. From 1986 to 1989, Dr. Howard was Vice President of Engineering at FEL Corporation in charge of developing a number of new products and responsible for the Financial Management of the Engineering Division. In 1989, Dr. Howard established Microwave Research and Development, MRD, in Newark, New Jersey for the development of advanced RF and Microwave components and subsystems. At the same time, Dr, Howard became an Adjunct Professor at the New Jersey Institute of Technology in Newark, New Jersey teaching Advanced Electromagnetic Theory at the MS level. In 1992, Microwave Research and Development was acquired by Merrimac Industries in West Caldwell, New Jersey where Dr. Howard received the position of Senior Vice President/ Chief Scientist, being third in line in the

corporate structure of the company. In 1994, Dr. Howard proceeded to establish a new company to assist in the development of a number of Military Systems for the US Government. Dr. Howard established ETI, Inc. to service initially the United States Defense requirements and later a number of subsidiaries and affiliate companies for Defense, Commercial Programs and Business Development and Acquisitions. ETI, Inc and its group of companies are presently involved in major US and European Defense Contracts as well as a number of Commercial Programs and Business Transactions.

Dr. Howard, in addition to heading the ETI Group of Companies and being involved in the business aspects of the group, is still providing engineering leadership in a number of Advanced Defense and Communications programs. This is evident form his over 84 publications in various Scientific Journals and Conferences. In addition, Dr. Howard has chaired a number of Scientific Conferences both in the United States and overseas. Dr. Howard is a member of various Engineering Societies. He is a senior member of the IEEE and a Chartered Engineer for the IET.
jh@etiworld.com

1:30-2:00 **GaN-on-Silicon RF Power Devices – Current State & Future Directions**
Kevin Linthicum, PhD Founder and Chief Technology Officer Nitronex

A GaN-on-silicon platform technology has been developed to provide the performance advantages of GaN combined with the manufacturing advantages of silicon. The NRF1 process technology has been formally qualified for 28V operation and released for production. Extensive reliability studies have been performed yielding demonstrated EA=2.0eV predicting an MTTF of 10E7 hours at 200 C junction temperatures. Air cavity and plastic over-mold assembly techniques are used for 7 discrete product offerings available today. The NRF1 process technology is currently undergoing 48V qualification and will support the production release of a family of high power transistors for WiMAX, Cellular and Broadband market applications.

Kevin Linthicum is the founder and Chief Technology Officer of Nitronex Corporation, a NCSU start-up incorporated in 1999. Kevin is responsible for the materials, process and product engineering activities at Nitronex. Prior to forming Nitronex, Kevin completed his Ph.D. in Materials Science & Engineering under the direction of Professor Robert F. Davis focusing on the growth of Gallium Nitride using MBE and MOCVD. Kevin earned his B.S. in Materials Science & Engineering at Virginia Tech in 1993. Prior to pursuing his academic studies, Kevin served in the U.S. Naval Trident Submarine Force from 1980-1988 in nuclear propulsion & engineering.
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2:00-2:30 **Hybrid Optoelectronic Integration at 100 Gb/s – Design Challenges & Circuit Demonstration**
Dr. Jeffrey Sinsky Member of Technical Staff Bell Lab, Alcatel-Lucent

As the volume of data transmitted around the planet continues to explode, it is very easy to see why 100G networks will be necessary in the not to distant future. In order to implement such systems, very high speed electronic and electro-optic system components are essential for fiber optic communication links. Unlike narrow band RF and microwave communication links, these systems require broadband performance from DC to the bit rate. Design challenges for 100G serial transmission components will be discussed, and the need for optoelectronic integration will be explained. A 107-Gb/s optoelectronic receiver with an integrated electronic demultiplexer will be presented. This receiver was the first of its type ever built. Using an electrical time division multiplexed (ETDM) transmitter, we achieved the lowest reported required optical signal-to-noise (OSNR) at 107-Gb/s. The feasibility of commercialization of this technology will be discussed

Jeffrey H. Sinsky was born in Baltimore, Maryland in 1963. He received his B. Sc., M.Sc., and Ph.D. degrees in Electrical Engineering from The Johns Hopkins University in 1985, 1992, and 1997 respectively.

From 1985 to 1997, he worked in the field of satellite communications at The Johns Hopkins Applied Physics Lab, where he designed microwave communication systems and antennas for deep space and earth orbiting satellites. Additionally, he did research in electronically tunable microwave circuits and co-discovered a new microwave stability parameter, "μ," commonly referenced in most modern microwave textbooks and commercially available microwave software packages.
In 1997 he joined the Wireless Technology Research Department of Bell Laboratories in Holmdel, NJ, where his research was in the area of phased array antenna calibration algorithms and hardware implementation for fixed wireless access applications. For the last 7 years he has worked in the Optical/Data Networking Research Department under Martin Zirngibl. His current research interests include high-speed data transmission over electrical backplanes, signal integrity for gigahertz-speed data communications and electro-optic integrated circuit design, high-speed electronics for 40 Gb/s optical transmission, microwave signal processing for optical communication systems, 100 Gb/s electro-optic packaging techniques, and microwave photonics.
Dr. Sinsky is a senior member of the IEEE, member of Tau Beta Pi, and a member/past chapter president of Eta Kappa Nu.
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2:50-3:50 **Who Was James Clerk Maxwell and What Is/Was His Electromagnetic Theory**

Dr. Tapan K. Sarkar Professor Syracuse University

The contribution of one of the greatest scientist of the last century – James Clerk Maxwell – will be presented as his name is synonymous with the development of modern physics. He laid the basic foundation for electricity, magnetism, and optics. The theory on electromagnetism is one of the few theories where the equations have not changed since its original conception, whereas their interpretations have gone through revolutionary changes at least twice. He introduced the terms "curl", "convergence" and "gradient". Nowadays, the convergence is replaced by its negative, which is called "divergence", and the other two are still in the standard mathematical literature.

The first revolution was by Hertz and Heaviside and the second by Larmor. Maxwell's work on electromagnetic theory was only a very small part of his research. In his hands electricity first became a mathematically exact science and the same might be said of other larger parts of Physics. In whatever area he worked, he brought new innovation. He published five books and approximately 100 papers. Maxwell can be considered as one of the world's greatest scientists even if he had never worked on electricity and magnetism. His influence is everywhere, which surprisingly is quite unknown to most scientists and engineers!

The talk will describe some of that research including for example, the ophthalmoscope and the Maxwell's yellow spot test for macular degeneration, the three colors used in color television, as inventor of the concept of ensemble averaging and the developer of the concept of entropy which was expounded by Leo Szilard and others as information theory. He took the first color photograph, laid the basic foundation on the choice of three primary colors in characterizing any color, and developed accessories for color blind people, which are still used today. He developed general laws of Optical instruments and even developed a theory on the composition of Saturn's rings.

He created a standard for electrical resistance. He also wrote the first paper on negative feed back which was the cornerstone of Norbert Wiener's work on cybernetics. He also developed the system of dimensional analysis and surprisingly the method of solving the loop currents as the ratio of determinants, to name a few. He developed a coherent set of units of measurement of electricity and magnetism, which became misleadingly known as the Gaussian system.
Even though Maxwell has influenced development in many areas of physical sciences and had started a revolution in the way physicists look at the world, he is not very well known, unfortunately, outside some selected scientific communities. The reasons for that will also be described.

Prof. Tapan K. Sarkar received the B.Tech. Degree from the Indian Institute of Technology, Kharagpur, India in 1969, the M.Sc.E. degree from the University of New Brunswick, Fredericton, NB, Canada, in 1971, and the M.S. and Ph.D. degrees from Syracuse University, Syracuse, NY, in 1975.
From 1975 to 1976, he was with the TACO Division of the General Instruments Corporation. He was with the Rochester Institute of Technology, Rochester, NY, from 1976 to 1985 and a Research Fellow at the Gordon McKay Laboratory, Harvard University, Cambridge, MA, from 1977 to 1978. He is now a Professor in the Department of Electrical and Computer Engineering, Syracuse University. His current research interests deal with numerical solutions of operator equations arising in electromagnetism and signal processing with application to system design. He obtained one of the "best solution" awards in May 1977 at the Rome Air Development Center (RADC) Spectral Estimation Workshop.
He has authored or coauthored more than 280 journal articles and numerous conference papers and 32 chapters in books and fifteen books, including his most recent ones, *Iterative and Self Adaptive Finite-Elements in Electromagnetic Modeling* (Boston, MA: Artech House, 1998), *Wavelet Applications in Electromagnetics and Signal Processing* (Boston, MA: Artech House, 2002), *Smart Antennas* (John Wiley & Sons, 2003) and History of Wireless (John Wiley & Sons, 2006)
Dr. Sarkar is a Registered PE in the State of New York. He received the Best Paper Award of the IEEE Transactions on Electromagnetic Compatibility in 1979 and in the 1997 National Radar Conference. He received the College of Engineering Research Award in 1996 and the Chancellor's Citation for Excellence in Research in 1998 at Syracuse University. He was an Associate Editor for feature articles of the IEEE Antennas and Propagation Society Newsletter (1986-1988). He received Docteur Honoris Causa both from Universite Blaise Pascal, Clermont Ferrand, France in 1998 and from Politechnic University of Madrid, Madrid, Spain in 2004. He received the medal of the *friend of the city of Clermont Ferrand*, France, in 2000.

He was the Chairman of the Inter-commission Working Group of International URSI on Time Domain Metrology (1990–1996). He was a distinguished lecturer for the Antennas and Propagation Society from 2000-2003. He is currently a member of the IEEE Electromagnetics Award board and an associate editor for the IEEE Transactions on Antennas and Propagation. He was the vice president of the Applied Computational Electromagnetics Society (ACES) and the technical chair for the combined IEEE 2005 Wireless Conference along with ACES to be held in Hawaii. He is on the editorial board of *Journal of Electromagnetic Waves and Applications* and *Microwave and Optical Technology Letter*s. He is a member of Sigma Xi and International Union of Radio Science Commissions A and B.
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3:50-4:00 **Closing remarks**

Kirit Dixit **Chair, IEEE North Jersey Section** **Microcom Sales LLC**

Kirit Dixit is one of the founders of Microcom Sales LLC since 2004 and works as a manufacturer's representative in Metro NY/NJ Area. He was with RFESCO for the past 15 years prior to forming his company in similar capacity. For the prior eight years, he was the area manager for California Eastern Labs, representing NEC RF and Microwave products. He was responsible for the successful development and growth of eastern Canada and the Metropolitan NY/NJ territories. For the three years prior to CEL, Kirit was a Product Marketing Manager for Microwave Semiconductor Corp., in the Hi-Rel Satcom and Military Markets. Kirit received his BSEE in India, and his MSEE Specializing in Microwave from Stevens Institute of Technology, Hoboken, NJ. Kirit has been active in IEEE activities and was Chair of APS/MTTS for the past 5 years. Presently from 2007 he is the Chair of the North Jersey section and Co-Chair of MTT/AP Chapter.
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MINI-SHOW EXHIBITORS

	MTT/AP Mini-Symposium-Exhibitors	2007	IEEE North Jersey Sesction
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5	Sonnet Software, Inc.	25	Microcom Sales Llc
6	E T Industries Inc.	26	Tekmar Sales Inc.
7	Tektronix	27	Advanced Technical Materials
8	Maury Microwave	28	Nitronex
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10	The Math Works	30	TRU Corporation
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16	Aeroflex Corp.		
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18	AR Worldwide (ATM)		
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