

2008 ANTENNA SYSTEMS CONFERENCE

SEPTEMBER 25-26
HYATT REGENCY AUSTIN
AUSTIN, TEXAS

WWW.ANTENNASONLINE.COM

BRINGING YOU THE LATEST ADVANCEMENTS IN ANTENNA SYSTEMS & TECHNOLOGY

WHY YOU SHOULD ATTEND

- Gain Key Insights from More than 35 Technical Sessions
- Hands-on Access to New Products & Technology Featured in the Exhibit Hall
- A Must Attend Pre-Conference Workshop - *Details on page 12*
- Discover How Recent Technology Developments will Impact Your Product Performance
- Unmatched Networking Opportunities with Peers, Technical Experts And Potential Business Partners in a Relaxed Environment
- Stay Ahead of the Competition by Discovering What's Coming Next

2008 KEYNOTE SPEAKERS



Increased Performance with Antenna Enhancements in 3G And Next-Gen Technology

*Dr. Rao Yallapragada
Senior Director,
Qualcomm Mobile Broadband*



Standards Will Fuel the Spread Of Wireless Network Technologies

*Barry Blount
Director of Business Development,
GreenPeak Technologies*

SPECIAL BONUS

Attendees who sign up for a full conference pass or single-day pass will also have free access to the co-located **2008 Thermal Management & Technology Symposium**.

Details on page 2

THERMAL MANAGEMENT & TECHNOLOGY SYMPOSIUM 2008
SEPT. 25-26 • AUSTIN, TX

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Overview

The 2008 Antenna Systems Conference is a two-day technical symposium dedicated to bringing you the latest advancements in antenna systems & technology and short-range wireless standards, applications & technology for a variety of industries and applications.

Who Should Attend

- OEM Design Engineers & Development Managers
- System Design Engineers & Managers
- System Integrators / Value Added Resellers
- Component Manufacturers & Providers
- Antenna Manufacturers
- Product Managers Seeking New Applications, Technology & Partnering Opportunities
- Wireless Professionals Intent on Staying Up-to-Date with the Latest Cutting-Edge Technology

Why Should You Attend

- More than 35 focused technical sessions
- Discover how recent technical advancements will impact your product performance
- The chance to network with top design engineers, technical experts, leading wireless service providers and potential business partners
- Hands-on access to new products & technology being featured in the interactive exhibit hall
- Informative pre-conference workshop opportunity

Contacts

- For **program information** contact Jeremy Martin at 800-803-9488 or jeremym@infowebcom.com
- For **exhibit/sponsor** information contact Karen Poulson at 800-803-9488 or karen@infowebcom.com
- For **registration** information contact Marsha Grillo at 800-803-9488 or marshag@infowebcom.com

Special Bonus



SPECIAL BONUS - Attendees who sign up for a full conference pass or single-day pass will also have free access to the co-located **2008 Thermal Management & Technology Symposium**. Visit www.thermalnews.com for program information.

Thermal Management and Technology Symposium 2008 is a conference highlighting the latest advancements in thermal technology for product design, system development and process management.

* Note - A \$150 fee is required for those interested in obtaining the Thermal Conference CD ROM.

Schedule: At-A-Glance - Day 1

7:00 am	Registration & Continental Breakfast		
8:05 am	Opening Address		
8:10 am	Morning Keynote		
9:15 am	Track 1	Track 2	Track 3
10:00 am	Networking Break in Exhibit Hall		
10:45 am	Track 1	Track 2	Track 3
11:30 am	Track 1	Track 2	Track 3
12:15 pm	Luncheon in the Dining Hall		
1:15 pm	Track 1	Track 2	Track 3
2:00 pm	Track 1	Track 2	Track 3
2:45 pm	Networking Break in Exhibit Hall		
3:30 pm	Track 1	Track 2	Track 3
4:15 pm	Track 1	Track 2	Track 3
5:00 pm	Cocktail Reception		

Schedule: At-A-Glance - Day 2

7:30 am	Registration & Continental Breakfast		
8:10 am	Morning Keynote		
9:15 am	Track 1	Track 2	Track 3
10:00 am	Networking Break in Exhibit Hall		
10:45 am	Track 1	Track 2	Track 3
11:30 am	Track 1	Track 2	Track 3
12:15 pm	Luncheon in the Dining Hall		
1:15 pm	Track 1	Track 2	
2:00 pm	Track 1	Track 2	
2:45 pm	Conference Conclusion		

Visit www.AntennasOnline.com
for more information



Registration Information

REGISTER EARLY (SAVE \$300)

2008 Antenna Systems Conference

Register 1 person	\$1,295
Register 2 people	\$695 per person
Register 3 or more people	\$595 per person

Huge Team Discounts

If two people from your company will be attending the conference, **\$600** will be deducted from each attendee's registration fee. If three or more people from your company will be attending the conference, **\$700** will be deducted from each attendee's registration fee.

Government/Military & Utility Pass:	\$695
Single Day Conference Pass:	\$695
Expo Only Pass	\$50

Pre-Conference Workshop Pricing

* *Advances in Antenna and Wireless Test and Measurement*

Register after **August 1, 2008** \$400

* A \$150 discount will be applied to your workshop fee if you also register for a full conference pass to the 2008 Antenna Systems Conference by Sept. 5th

4 Ways to Register

By Phone: 800-803-9488
 By Fax: 720-528-3771
 Web: www.AntennasOnline.com
 By Mail: Webcom Communications, Corp.
 7355 East Orchard Road, Suite 100
 Greenwood Village, CO 80111

Cancellation policy

To receive consideration, all cancellations must be received in writing. Upon receipt, a refund or credit will be issued towards a future event produced by Webcom Communications, less a 25% administrative fee. (Cancellations which do not indicate preference will be issued credit.) No refunds will be issued within two (2) weeks of the event. Webcom Communications, Corp. will not be held responsible for cancellations or delays in programming due to acts of God, war, government disorder, curtailment of transportation facilities, or other emergency making it inadvisable, illegal or impossible to hold the meeting.

Hotel Information

Stay where the conference is

The 2008 Antenna Systems Conference will take place at the Hyatt Regency Austin in Austin, TX.

Hyatt Regency Austin
 208 Barton Springs,
 Austin, TX, USA 78704
 Tel: 512 477 1234
 Fax: 512 480 2069
www.hyatt.com



A Special room rate of \$189/night is available for conference attendees. Be sure to reserve your room by **September 3, 2008**, to receive this special rate. Also be sure to mention **Webcom Communications** when registering.

Pre-Conference Workshop:

Held in Conjunction with the **2008 Antenna Systems Conference**.

Title: Advances in Antenna and Wireless Test and Measurement

Date: Wednesday, September 24, 2008

Location: ETS-Lindgren, Cedar Park, Texas

Presenters:

- Dr. Warren Stutzman, Professor, Virginia Tech
- Mr. Jari Vikstedt, Principal RF Engineer, ETS-Lindgren
- Dr. Vince Rodriguez, Senior Principal Antenna Design Engineer, ETS-Lindgren

Schedule:

- 12:00 pm:** Pick up at Hyatt Regency Hotel
- 12:30-2:00 pm:** Tutorial #1 with Dr. Stutzman
- 2:00-3:15 pm:** Tutorial #2 with Mr. Jari Vikstedt
- 3:15-3:45 pm:** Snacks/Beverages
- 3:45-5:00 pm:** Tutorial #3 with Dr. Vince Rodriguez
- 5:00-6:30 pm:** Facility Tour / Demonstrations / Texas Style BBQ Buffet Dinner
- 7:00 pm:** Drop off at Hyatt Regency Hotel

SEE THE DETAILS ON PAGE 12

**Final Program - Day 1 / September 25**

Blue Sessions - Texas Ballroom
Green Sessions - Hill Country D
Red Sessions - Hill Country C

7:00 A.M. - Registration / Breakfast

8:05 A.M. - Opening Address

KEYNOTE PRESENTATION**8:10 A.M. Increased Performance with Antenna Enhancements in 3G & Next-Generation Technology**

The adoption of higher order multiple receive diversity in wireless deployments has not been all that encouraging, both at the base stations and the handsets.

However, the performance enhancements aimed for the existing and next generation of wireless technologies will surely depend on how best we maximize the reception of the signal in all various possible scenarios. The application of a selective combination of multiple receive diversity, MIMO, beamforming and SDMA techniques will be central to the performance of next generation wireless technologies. This talk will focus on the usage of MIMO, Beamforming and SDMA techniques in HSPA, DO and LTE technologies.

*Dr. Rao Yallapragada, Senior Director,
Qualcomm Mobile Broadband*

9:15 A.M. Radio and Antenna - Is There Such a Thing as a Perfect Match?

Current design philosophy for wireless products involves designing the power amplifier (PA) and low noise amplifier (LNA) to a 50 ohm matching impedance separately from the antenna that is also designed as best as possible over the required frequency bands to match to 50 ohm. However, the emergence of multi-band/multi-mode wireless devices has greatly impacted the antenna's performance. In addition, the antenna's impedance is dependent upon the proximity to the operator's hand, head and other conductors and dielectrics. This presentation will discuss the antenna environmental factors and the common methods to circumvent the reflection effects, such as the use of a load insensitive PA or a continuously tunable antenna, and present a compromised solution - a cellular radio-antenna module - that incorporates the PA and front-end module RF electronics with the antenna, which offers optimized performance and simple, low-cost ways of adapting the matching circuit to different load conditions.

*Mike Gaynor, RF Technical Director,
Antenova Ltd.*

9:15 A.M. Specifying Anechoic or Reverberant Test Chambers for Wireless Device Performance Measurement

For wireless devices to be successful, they must provide the user with an acceptable and reliable level of performance. The RF physical layer performance of a wireless device is a critical link in overall device or network performance. Two industry standard metrics define the limits of an RF link budget: Total Radiated Power (TRP) is the talk metric. Total Isotropic Sensitivity (TIS) is the listen metric. Active antenna pattern measurement techniques are used to determine the transmit or receive radiation pattern of the wireless device under test in order to determine these quantities. Critical to the determination of these transmit and receive characteristics are controlled conditions under which the measurements are made. This talk will describe how to specify the design characteristics of anechoic chambers and control systems for these measurements. Additional considerations will be presented for the use of reverberant chamber designs in wireless test and measurement.

*Garth D'Abreu, Technical Manager,
ETS-Lindgren*

9:15 A.M. Is 2008 the Year of ZigBee?

ZigBee has achieved the critical mass of technical capability, market acceptance, and application developer support required to begin strong accelerated market adoption. As a result, activity in the home control segment and the energy management segment is experiencing very strong growth, and these two segments represent a significant market opportunity for ZigBee-based applications. This session will explore the factors contributing to the current market growth of ZigBee and identify the components required for continued market expansion. Component, software, and module industry participants will be profiled and unique characteristics identified.

*Dr. Kirsten West, Principal Analyst,
West Technology Research*

10:00 A.M. - Networking Break**10:30 A.M. - Rogers Corp. Demonstration****10:45 A.M. Is 2 dB Worth \$2?**

When device manufacturers and engineers are cooking up new designs, exploring all the options for internal components can be a bit costly. But, what is more beneficial for device OEMs? Is it better to spend more money upfront during the initial research phase, which would be substantially more -albeit a one-time cost? Or does it make more sense time wise and financially



Day 1 / September 25 - Final Program

to invest additional costs throughout the devices' life time? Is 2 dB worth \$2?

Attendees will learn the pros and cons of each choice, spending the money upfront during the initial engineering and manufacturing to create a better handset or constructing more base stations nationwide to compensate for the lack of a quality, high-performance antenna. The presentation will cover:

- How much performance that extra 2 dB can offer
- Pros and cons of each tactic
- Which types of mobile devices need the extra 2 dB and why
- The economic trade-off between spending money upfront for 2 dB or waiting until later to get that 2 dB through network enhancements

**Jeff Shamblin, VP of Advanced Technology,
Ethertronics**

10:45 A.M. Analysis of an Anechoic Chamber Designed for Small Wireless Device Measurements

Anechoic chambers are required for the evaluation of wireless and mobile devices. These chambers are designed to minimize errors in the device measurements over the frequency range of interest. The size of the chamber is driven to some extent by the device size, but more importantly it is driven by the lowest frequency of operation. Performance limitations in these chambers are often most prevalent at the lowest frequencies. In order to better evaluate the performance of wireless chambers at these frequencies, ORBIT/FR has developed and thoroughly implemented a detailed analytical procedure for anechoic chambers combining the application of standard commercial software tools and ORBIT/FR in-house analysis capabilities. This procedure not only models the anechoic chamber for a defined absorber layout, but also models the effects of antenna supports, positioners and other items in these chambers. Field levels throughout the chamber may be calculated for various illuminating antennas, and the data is reduced to summarize chamber reflectivity and test zone illumination statistics. This session will summarize the available capability and show results for chambers capable of measuring wireless devices in accordance with standard specifications.

**John Aubin, CTO & VP of Business Development,
ORBIT/FR**

10:45 A.M. Antenna Systems for RFID: An Applications Perspective

Blue Vector has been an implementor for RFID solutions for a number of different type of applications. From small deployments to very large footprint deployments, these applications have highlighted a number of practical implications for antenna usage for RFID. This talk will detail a number of different instances

where antenna design impacts the system and the success of an implementation. The goal of the talk is to inform antenna designers about application constraints in the deployment of RFID and their direct implications for antenna design, and suggested design directions that will help the evolving RFID industry.

**Dr. Anurag Mendhekar, Founder,
Blue Vector**

11:30 A.M. Base Station Antennas: A Look At the Past, Present & Future

With the advent of the cellular era, the base station antenna has become ubiquitous, visible anywhere on the globe where human population exists. Over the years there has been a constant tradeoff between performance and appearance. Operators and communities have grudgingly accepted certain minimum antenna shapes and sizes. Most advancements in base station antenna technology have involved integrating more and more function into the same volume.

Antennas continue to look the same but what goes on inside has improved dramatically.

This presentation will describe the advancements made over the last 20 years, from single port vertically polarized antennas to two port dual polarized antennas to variable beam tilt antennas to dual and triple band antennas. Recent advancements integrating diplexers, remote electrical tilt, smart bias T and low noise amplifiers (LNAs) will be described. Finally, future advancements now in research will be described including transceivers and baseband processing at each element, with only power and a bit stream connected to the antenna.

Topics include the challenges of evolving from a purely passive device to a device with electromechanical and electronic function, compromises in RF performance and other considerations when planning and deploying sites.

**Stacey Noland, Director,
Antenna Product Line Management,
Powerwave Technologies, Inc.**

11:30 A.M. New Polyolefin Based Laminates For MW Panel Antenna Applications

This presentation will describe the competitive properties of a newly-developed "low-cost" polyolefin based copper-clad laminate for use as a base material for MW printed circuit boards. Polypropylene copolymer performs dielectrically similarly to PTFE, the acknowledged leader in MW substrates. A new generation of polyolefin laminates has a dielectric constant in the range of 2.3 to 3.1 and loss tangent of 0.0010 to 0.0037. By compounding the Polypropylene copolymer with additives and fillers and casting a sheet, then extrusion laminating it to copper foil in a continuous



Final Program - Day 1 / September 25

process - a new low loss laminate is now available as a low cost alternative to PTFE laminate. Antenna boards made from these laminates have moderate peel strength, stand manual soldering and have a coefficient of thermal expansion adjusted to application of panel antennas in segments of base stations and customer premises equipment (CPE). Practical design and implementation actions for fighting the drawbacks will be addressed as well.

Valery Ostrovsky,
Development Leader for MW Laminates,
CLP Industries Ltd.

11:30 A.M. The Power of Cooperative Wireless Communications

This talk will give a comprehensive overview of cooperative communications (CC), a new technique in which physically separated single-antenna radios coordinate with each other to form a "virtual antenna array" to achieve spatial diversity in multi-path fading channels. The diversity can provide gain to save energy or overcome network partitions, or provide spatial multiplexing, to increase throughput. CC can benefit any wireless application where there are multiple users within communication range of each other, such that at least one of the users needs to communicate to a more distant point. Applications include wireless cellular, satellite, mesh, ad hoc and sensor networks.

Dr. Mary Ann Ingram, Professor,
Georgia Institute of Technology

12:15 P.M. - Lunch

1:15 P.M. Emerging Wireless "Unified Field Theory"

This presentation will discuss the new interoperable environment for 4G to offer real time multimedia, downloaded with the highest Quality of Service (QoS). It will also detail the interoperable/integration of all elements of the wireless network, infrastructure and mobile devices. This is a unified system from NOC, Network Switches, BTS, Tower /Top, to the 4G wireless phone and devices.

Burt Calloway, VP of Air Interface Solutions,
KMW Communications

1:15 P.M. Antenna Radomes: Design, Performance & Other Characteristics

This session will discuss design, performance and other characteristics of radomes (dielectric covers) placed over antennas in order to protect them from the environment. Consider that 100 percent of all aircraft antennas and

more than 75 percent of all terrestrial, vehicular and marine antennas are covered with radomes. A poorly designed or specified radome will deteriorate the electrical performance of even the best performing antenna. The effects encompass, but are not limited to, transmission loss resulting in decreased antenna gain, increased antenna noise temperature, increased antenna side lobe levels, a bore sight error (pointing error) as the signal passes through the dome, and depolarization (folding of the energy from one polarization sense into the orthogonal polarization sense).

Attendees will learn how to specify radomes and receive information regarding basic radome materials, wall constructions (thin wall, multiple half wave walls, and higher order sandwich walls) and the typical electrical performance of various radome types. Specifically, the attendee will learn how the radome impacts the performance of various antenna types. We will also look at embedded and encapsulated antennas which can be considered a type of radome construction.

Dr. Dennis Kozakoff, President & CTO,
USDigiComm Corp.

1:15 P.M. Behind the Scenes of AntennaWeb.org

This session will describe www.AntennaWeb.org, as well as detail the design of the computer program used to predict TV reception on this website as well as the CEA standards that define receiver antenna performance characteristics used by AntennaWeb.org to predict TV reception. It will also cover CEA's efforts to define a smart antenna that will steer itself automatically to optimize reception.

Dave Wilson, Sr. Director of Technology & Standards,
Consumer Electronics Association

2:00 P.M. Exploiting the Advantages of Differential Feeds for Compact Antennas

This presentation will use the compact quadrifilar antenna to illustrate the many advantages of a differential feed network. The advantages include:

- Good isolation from the ground plane in a handset
- Better radiation pattern properties due to enhanced symmetry
- Robust immunity to hand and body effects
- A novel tuning method that allows simultaneous alignment of center frequency and impedance match (which are not easy to accomplish). This technique can be applied for tuning active antennas where standard measurement techniques cannot be used to "see" the match. Measured performance results will be presented and explained.

Dr. Stani Licul, President, Maxtena, Inc.



Day 1 / September 25 - Final Program

2:00 P.M. Cost Optimized RF Materials for Base Station Antenna Power Handling and Efficiency

Arlon has been developing both PTFE/ceramic (CLTE-AT, AD260A, AD300A, TC300) and advanced low-loss composite laminates (GenClad) that are cost optimized for the price sensitive and loss sensitive applications. These applications include: Base Station Antennas, telemetry, satellite radio and automotive radar antenna markets. This talk will review these advancements and bring light to the value they bring to new applications. These advanced materials also have high thermal conductivity and a very low thermal coefficient of dielectric constant that maintains tight impedance and phase over temperature. The materials incorporate low profile copper that is well suited for aggressive PIM requirements, but still withstand the higher temperatures required in advanced applications.

Jack Frankosky, OEM Bus. Dvlpmt., Arlon-MED

2:00 P.M. Rapid Fire Testing of RFID Antennas & Signaling Schemes

The burgeoning field of RFID tags and sensors requires the ability to test new antenna designs, modulation schemes, and higher carrier frequencies. This talk will present an overview of the Georgia Tech rapid-fire RFID testbed, which is capable of measuring hundreds of RF tags simultaneously. This testbed generates and measures RF tag signals by emulating the presence of an RF integrated circuit on arbitrary tag antennas. By circumventing custom, iterative RF integrated circuit development, an engineer can now conceive, implement, and test new RFID antennas and protocols with orders-of-magnitude savings in cost and time.

Dr. Greg Durgin, Professor, Georgia Tech

2:45 P.M. - Networking Break

3:15 P.M. - ETS-Lindgren Demonstration

3:30 P.M. An Evaluation Edge-Loaded Flexible Patch Antennas and High Impedance Surface Antennas

This session investigates a specific application for which the vast majority of applicable antennas tend to be wire elements, normally configured as dipoles. These antennas couple into the human body, which acts as an absorber and dramatically reduces the overall efficiency of the antenna system. This talk considers two new antenna technologies, and assesses their suitability as alternative solutions for this application.

A number of proto-type antenna systems, for both HiZ surfaces and edge loaded flexible patches, have been procured. These antennas cover a number of frequencies in the range 1 – 3GHz. This talk will discuss the results of a series of initial measurements carried out by Selex

Communications, to assess the performance of these proto-type antennas, when compared to a reference antenna.

David Atkins, Engineering Manager, Selex Comm.

Dr. Ed Totten, R&D Team Leader, Selex Comm.

3:30 P.M. Design and Test of Vertical Antennas for A Wireless Network

This talk discusses the design of a wide bandwidth vertical antenna for a Satellite Wireless System. A conventional quarter-wave long whip has a frequency bandwidth of 5 percent to 10 percent. However, the specified antenna requires a bandwidth of 26 percent or about 3 times the conventional bandwidth. To achieve the wide bandwidth, the following were done:

- 1) Trade-off whip additions - top-hat, loading coils, series/parallel RLC circuits, ferrite toroids
- 2) Increase bandwidth via optimization 4NEC2 software
- 3) Measure gain of two parallel antennas on aluminum screen ground plane
- 4) Compute gain, pattern, VSWR of optimum antenna

Dr. Jerry Glaser, Consultant, Glaser Associates

3:30 P.M. Printed Silver Antennas - Alternative to Conventional Antennas

Steve Dominak, Electrical Engineer, MACTac

4:15 P.M. A Low-Cost Internal Antenna For Mobile TV, GSM, CDMA and WiMax

A novel low-cost internal antenna has been developed for mobile TVs operating at 470-702 MHz. The return loss is lower than -5 dB with more than 70 percent efficiency and 0.5 dBi maximum gain all over the band. The overall size of the new antenna is much smaller than other commercially available antennas. It is an unbalanced resonant antenna that does not need baluns, matching circuits or additional ground planes. This new antenna technology can also be used in GSM, CDMA and WiMax. The new GSM / CDMA antenna simultaneously covers the bands 825-960 MHz and 1710-1990 MHz with -10 dB return loss, 2 dBi maximum gain and 85 percent efficiency.

Dr. Mohamed Sanad, Founder/CTO, AMANT Antennas

4:15 P.M. Multiband Miniaturization Antenna Technology in Wireless

This session will detail a folded package antenna for use in applications such as cellular, PDA, Smartphone, MID and notebook.

Dr. Alan Tang, CTO, Auden Corporation

4:15 P.M. Session To Be Announced

5:00 P.M. - Cocktail Reception

**Final Program - Day 2 / September 26**

Blue Sessions - Texas Ballroom
Green Sessions - Hill Country D
Red Sessions - Hill Country C

KEYNOTE PRESENTATION**8:10 A.M. Standards Will Fuel the Spread of Wireless Network Technologies**

Wireless products & technology for sensing & control applications have become a reality. Analysts, technology providers and product integrators agree that widespread adoption of wireless technology is only a matter of time. When will this happen? ... is the question everybody is asking. Timing of technology adoption is influenced by many factors. Amongst many influencing factors, the ongoing development and acceptance of technology standards is probably the most important. Product integrators require technology standards because it provides product interoperability, a large body of knowledge and development sources, second sourcing flexibility, etc. This session will describe the different standards, investigate the use cases behind them and will describe their strengths and limitations. It will also cover the scope and intended use of the leading standards in this space- ZigBee, ISA-100 and Wireless HART

This talk will provide the high-level overview that technology integrators are looking for to start their search for the technology that best meets their needs.

Barry Blount, Director of Business Development, GreenPeak Technologies

9:15 A.M. Base Station Antennas for Next Generation Cellular Systems

Just as wireless technologies continue to evolve, so too, must base station antenna (BSA) systems in order to meet new requirements. Kevin Linehan, chief technology officer, Base Station Antenna Systems, Andrew Wireless Solutions, will summarize the current state of BSA technology and discuss what to expect from the next generation of BSAs, such as the following:

- Multiple Input Multiple Output (MIMO) systems, which use several antennas at each end of the radio link. MIMO is now a part of all next generation cellular radio standards such as IEEE 802.16e (WiMAX), long term evolution (LTE), and ultra-mobile broadband (UMB). These systems offer distinct performance advantages over existing single antenna systems, especially in terms of potential system capacity.
- Adaptive Array (AA) technology, which provides dynamic beam steering, offers distinct performance advantages over existing single-column, linear array BSAs, such as a dramatic increase in signal to noise ratio.

Kevin Linehan, Chief Technology Officer, Base Station Antennas, Andrew Wireless Solutions

9:15 A.M. Performance Analysis of Automotive Antenna Systems: Numerical Simulation and Model Validation

This talk will investigate the analysis of conformal antennas with profiles that do not affect the esthetic structural design of the vehicle as well as non-conformal antennas, both of which have multiple purposes including; radio communication (AM-FM), GPS communication, remote vehicle control, vehicle location and more.

Numerous results [6] (validated by means of comparison among multiple solvers as well as measurement results) will be presented and an effort will be made to provide a certain level of confidence in numerical simulations to enable their full integration in the design workflow.

Enow Tanjong, Application Engineer, CST of America

9:15 A.M. 10 Years Strong: Open Up to Billions of Possibilities with Bluetooth Wireless Technology

This presentation will discuss the newest version of the Bluetooth specification, Bluetooth v. 2.1 + EDR, which supports Near Field Communication (NFC) for a "touch to connect" pairing process. NFC is just one example of how the Bluetooth SIG has turned Bluetooth technology from a 'good neighbor' wireless connection to an umbrella technology, partnering with 802.11, UWB, Wibree and NFC. Additionally, Bluetooth technology has an unprecedented install base and significant consumer awareness, and with the latest version of the technology which includes NFC, Bluetooth technology presents a solution for a secure link to allow for mobile transactions and secure mobile payments. Among other enhanced features, Bluetooth technology v.2.1+EDR offers secure, simple pairing and improved battery life. Also discussed during the presentation will be Bluetooth low energy wireless technology and the SIG's merge with Nokia's Wibree forum to create an ultra low power Bluetooth technology, enabling Bluetooth technology to provide wireless connectivity for smaller devices such as watches, sensors and medical devices such as heart rate monitors as well as Bluetooth high speed wireless technology - meeting the high speed demands of synchronizing and transferring large amounts of data as well as enabling high quality video and audio applications for portable devices, multi-media projectors and television sets.

Kevin Keating, Senior US Marketing Manager, Bluetooth SIG

10:00 A.M. - Networking Break



10:45 A.M. Single Structure Antenna Solutions for WWAN and Diversity Applications

Achieving acceptable antenna performance in small devices continues to be a challenge for the designer, with complications introduced by MIMO or Diversity protocols that require co-existence of multiple antennas. To the standard metrics of antenna efficiency, gain and bandwidth are added requirements for low in-band coupling, high out of band isolation, and low correlation coefficient. This session will feature example performance characteristics of single structure antennas having multiple feedpoints for a variety of platforms and air interfaces.

Dr. Frank Caimi, Chief Technical Officer, SkyCross, Inc.

10:45 A.M. The AN/TRC-170 Needs a New Antenna: A Call for Ideas / Designs

The US Military family of Tropospheric Scatter Radio Sets AN/TRC-170(V) needs new antennas. These antennas are currently of the reflector type, using vertical and horizontal polarization to support duplex communications. The antennas are subject to repeated moving and setup, location anywhere on earth, transportation by land/sea/air. Antenna and materials technology improvements over the past few years may provide new levels of performance, mobility, durability and reparability over the current models. This presentation will be a call for ideas from companies interested in supplying new antennas for this radio set.

*Dr. Doug Moody, ARINC
Randy Spensley, Lead Engineer, ARINC*

10:45 A.M. Replacing Infrared Technology in Consumer Electronics

Today's Infrared (IR) remote controls are no longer able to keep up with the demands of today's sophisticated consumer electronics market. A confusing landscape of emerging and projected RF technologies are vying to become the "new" IR replacement. Most are plagued by problems of cost and complexity, and have proven unreliable or even useless in typical residential environments, due to unavoidable interference from common household electronics. This presentation will discuss why replacement technology for IR, more than 500 million remote controls each year, will undoubtedly be based on wireless radio frequencies (RF).

Bernd Grohmann, Sr. Director of Product Management, Zensys

11:30 A.M. A Cognitive Antenna for Cellular and Sensor Network Applications

Self-Structuring Antenna (SSA) is a cognitive antenna, which dynamically alters its aperture to maximize Signal-to-Noise-Ratio (SNR) in varying RF environments. SSA is a patented technology and is the product of a decade of collaborative R&D effort between Delphi Corporation and Michigan State University. Aperture is made up of sub-resonant antenna elements connected via RF relays, which are turned on or off to form and maintain the optimum aperture for the perceived RF environment. A feedback from the device provides a measure of signal quality for the optimizing algorithm, which in turn decides on the switch states.

Genetic Algorithm (GA) has been adopted for its effectiveness in binary optimization problems. The talk will highlight recent activities in terms of prototypes developed for cellular and ZigBee applications. The talk will also outline how this technology could provide relief in meeting high data rate and MIMO requirements in today's handset designs.

At the conference, the theory and operational principles of the SSA along with the prototypes will be presented. The presentation will also lay out in a systematic fashion the competitive differentiators of the SSA technology, the market (civilian and military) and the business case.

Dr. Tayfun Ozdemir, Chief Technical Officer, Monarch Antenna, Inc.

11:30 A.M. A Tunable WiMAX Antenna Chip

There is no uniform global licensed spectrum for WiMax, although the WiMax Forum has published three licensed spectrum profiles: 2.3 GHz, 2.5 GHz and 3.5 GHz. It is very difficult to design a broadband low-profile antenna in order to cover two or more bandwidths used by WiMax. In this presentation, a tunable WiMax chip antenna was design to cover the 2.5 - 3.5 frequency range. The size of the antenna is 9 by 2.5 by 1 mm. It is mounted on a ground plane with the size 40 by 20 mm. By using a BST varactor, a matching network could tune the bandwidth from (2.4, 3.3) to (3.0, 3.6) with the Return Loss lower than -10 dB. Radiation pattern was also measured to show the gain variation when the BST capacitance was changed.

Dr. Nan Ni, RF Engineer, AgileRF

**Register Today At
www.AntennasOnline.com**



Final Program - Day 2 / September 26

11:30 A.M. Advanced Computational Tools For Antenna Design and Placement

Recent advances in computational electromagnetic tools made antenna design possible along with integration of antennas on various ground, sea and air platforms. This talk will cover various computational techniques that can be used for antenna designs, and also in-situ analysis of antennas installed on platforms. Full wave techniques such as Method of Moments (MoM), Multilevel Fast Multipole Method (MLFMM) along with asymptotic techniques such as Physical Optics (PO) and Uniform Theory of Diffraction (UTD) will be reviewed. Following applications using the above techniques will be discussed.

- Antenna design - Antenna-platform interaction studies
- EMI/EMC - Bio-electromagnetics - RFID system design etc. A benchmark study of computational resources required by available computational tools for electrically large platforms will be presented.

*Dr. CJ Reddy, President & CTO,
AppliedEM, Inc.*

12:15 P.M. - Lunch

1:15 P.M. Feature Selected Validation and Verification of Computational Electromagnetic Code Predictions Using Infrared Thermal Images of EM Fields

Infrared (IR) thermal measurement technique is presented to independently validate and verify (V&V) numerical codes used for computational electromagnetic (CEM) field predictions using Feature Selected Validation & Verification (FSVV) routines. The thermal technique is applied in this session to validate and verify new aircraft scattering codes. IR thermal images (temperature distributions) of the electromagnetic (EM) field scattered from a simple, canonical aircraft are measured for selected microwave frequencies, angles-of-incidence, and polarizations. Using a color-temperature table calibrated at NIST/Boulder, the temperature distributions are converted into equivalent field-intensity distributions of the scattered EM field being measured. These IR thermal images (thermograms) are compared to the predicted images (contour plots or relief maps) of the scattered fields calculated with a selected CEM simulation code over the same measurement plane to validate and verify that the field patterns and the intensity levels are correct. In addition, the measured field can be visualized with the IR thermogram images. A "picture-to-picture" correlation code is used to compare the predicted and measured results and to assess and score their similarities. This is the first step in a progressive approach using a suite of CEM codes to compare predicted results of more sophisticated aircraft geometries with the measured results from the IR thermograms to develop confidence in the complementary measurement and simulation methods.

Dr. John Norgard, University of Colorado

1:15 P.M. Advances in Antenna Design For Circuit Designers

Designers today need an EDA toolset that helps them cope with the challenges of high frequency, highly integrated and highly outsourced design work.

High frequency and small scale integration are causing signal integrity problems. This implies the need to simulate the Electromagnetic effects of 3D elements such as bondwires and dielectric bricks together with the circuit. Increased outsourcing, as we see in the wireless appliance industry, has seriously increased quality risks. This presentation will show how those can be reduced if the various components such as the antenna, the circuit and the human manipulation are simulated in the same environment.

*Dr. Erwin De Baetselier, Program Manager,
AMDS Product, Agilent EEs of EDA*

2:00 P.M. Low Profile Internal PDA 6 Band Antenna

The attendee will be presented with an internal antenna for PDAs covering 6 bands: GPS plus 5 band GSM/GPRS/UMTS (850MHz, 900MHz, 1800MHz, 1900MHz and 2100MHz). This low profile antenna, less than 1mm thick, is making it possible for a PDA to be fully functional everywhere around the world on any network / operator. The PDA using this antenna supports the latest standards for high speed internet download over the Wide Area Networks plus WIFI and Bluetooth, so this new design has been successful in dealing with the coexistence problems between all of these communication standards.

*Laurian Petru Chirila, Sr. RF Specialist,
Psion Teklogix, Inc.*

2:00 P.M. Ku Band Beam Steering Phase Array Antenna

In this presentation, a Ku band phase array antenna is realized by integrating patch antennas, analog phase shifters and the control circuits through a multiple layered board. The voltage control analog phase shifters are designed using 4-stage all pass filters based on tunable capacitors which offer phase shift and insertion loss smaller than 8 dB. Tunable capacitors are built by the thin film ferroelectric materials BST (Ba_xSr_{1-x}Ti₃) which has very high dielectric constant and can make the capacitor size pretty small. The antenna is designed on a thicker (1.58 mm) and low dielectric (2.2) material to maximize the bandwidth which is from 11.9 GHz to 14.1GHz. On the other hand, since the RF components are crowded in the feeding network, the network is built on a thin (0.508 mm) and higher dielectric (10.2) constant board to reduce the size. The beam steering function will also be detailed in this presentation when every single element is biased by different dc voltages.

Tim Chen, RF Design Engineer, Agile RF

2:45 P.M. - Conference Conclusion



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Advances in Antenna and Wireless Test and Measurement

PRE-CONFERENCE WORKSHOP

Date: Wednesday, September 24, 2008

Location: ETS-Lindgren, Cedar Park, Texas

Presenters:

- Dr. Warren Stutzman, Virginia Tech
- Mr. Jari Vikstedt, Principal RF Engineer, ETS-Lindgren
- Dr. Vince Rodriguez, Senior Principal Antenna Design Engineer, ETS-Lindgren

Overview: This workshop, organized by ETS-Lindgren, will cover current and future trends related to antenna and wireless test and measurement. The technical material will be of a practical nature and application oriented with supporting theory provided. Presented by leaders in the industry, the workshop will address antenna design and usage, wireless testing methods available and rationale as well as future trends for antenna and wireless technologies.



Special guest speaker, **Dr. Warren Stutzman**, will begin the program by addressing the basic principles of antennas as applied to wireless communication systems. The fundamental types of antennas (electrically small, resonant, broadband and aperture) will be discussed, including examples of popular antennas for base stations and for satellite, vehicular and handheld terminals. Array antenna basics will be introduced. Special considerations for popular systems such as cellular radio and ultra-wideband radio will be presented. The presentation will conclude with a photo presentation of antennas in practice.



ETS-Lindgren speakers will address test and measurement methodology for wireless devices drawing on their experience as key contributors to the organizations

that are driving the technology for wireless testing, such as the Wi-Fi Alliance, CTIA 802.11 WPP and the WiMAX Forum, as well as the American National Standards Institute (ANSI) C63 (Electromagnetic Compatibility) and IEC/CISPR A related to antenna calibration, RF shielded enclosures and RF absorber. Time will be allocated following each presentation for open discussion. Hands-on demonstrations will supplement the material presented utilizing the expansive ISO 17205 certified open area test site, A2LA-accredited lab and wireless test chambers on site at ETS-Lindgren.

Schedule:

- 12:00 pm:** Pick up at Hyatt Regency Hotel
- 12:30 - 2:00** Tutorial #1 with Dr. Stutzman
- 2:00 - 3:15** Tutorial #2 with Mr. Jari Vikstedt
- 3:15 - 3:45** Snacks/Beverages
- 3:45 - 5:00** Tutorial #3 with Dr. Vince Rodriguez
- 5:00 - 6:30** Facility Tour / Demonstrations / Texas Style BBQ Buffet Dinner
- 7:00 pm** Drop off at Hyatt Regency Hotel

Special Bonus:



Schedule permitting, **Dr. John Norgard** of the University of Colorado - Colorado Springs, IEEE Fellow and Vice-President for Technical Services of the IEEE EMC Society, will address a unique method using antennas for selected validation and verification (FSVV) of computational electromagnetic (CEM) code predictions using IR thermal images of EM fields. Dr. Norgard will also share his latest research on 3D microwave tomography as related to waveform diversity and distributed sensors for detecting and imaging buried objects with suppressed electromagnetic interference (EMI).

Registration:

Register after **August 1, 2008** \$400

* A \$150 discount will be applied to your workshop fee if you also register for a full conference pass to the 2008 Antenna Systems Conference by Sept. 5th.

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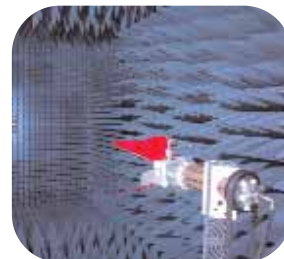
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http://www.antennasonline.com/ast08_reg.php

Contact Jeremy Martin with Questions.

jermeym@infowebcom.com / 720-528-3770 X118



Attendees will have the opportunity to tour ETS-Lindgren's 145,000 sq. ft. facility which includes numerous test chambers, and an open area test site for antenna calibrations. Engineers will appreciate the R&D conducted at the facility as well as the hands on experience of working in ETS-Lindgren's test chambers.

Images courtesy of ETS-Lindgren



Registration Options

HUGE TEAM DISCOUNTS

2008 Antenna Systems Conference

Register after Aug. 1 - full pass \$1,295

Team Discounts

If two people from your company will be attending the conference, \$600 will be deducted from each attendee's registration fee.

If three or more people from your company will be attending the conference, \$700 will be deducted from each attendee's registration fee.

Government/Military & Utility Pass:	\$695
Single Day Conference Pass:	\$695
Expo Only Pass	\$50

***Full Conference Passes** include a copy of the conference CD-ROM, admittance to all conference sessions, the exhibit hall, the cocktail reception and breakfast & lunch on both days, and all networking opportunities

***Single Day Passes** include a copy of the conference CD-ROM, admittance to all conference sessions, the exhibit hall, networking opportunities and food/beverage offerings on either day 1 or day 2 of the event.

***Exhibit Only Passes** provide access to the exhibit hall, but do NOT include a copy of the conference CD-ROM, admittance to conference sessions or food/beverage.

***Govt./Military & Utility Passes** include a copy of the conference CD-ROM, admittance to all conference sessions, the exhibit hall, the cocktail reception, breakfast & lunch on both days, and all networking opportunities for the special price of \$695.

Register online at

www.antennasonline.com/ast08_reg.php



SPECIAL BONUS - Attendees who sign up for a full conference pass or single-day pass will also have free access to the co-located **2008 Thermal Management & Technology Symposium**. Visit www.thermalnews.com for program information.

* Note - A \$150 fee is required for those interested in obtaining the Thermal Conference CD ROM.

Networking Opportunities

Each year, hundreds of today's leading wireless solutions providers and OEMs of products that utilize antennas and related component technologies, converge to discuss the latest advancements in the field. Below is a partial list of companies that will attend this year's conference or have attended past Antenna Systems Conferences.

7 Layers, Inc.	Dexmet Corp.
Accurate Electronics	DRG Technologies, Inc.
Acheson Colloids Co.	Duchossois Technology Partners
Advanced Circuitry Intl	Duel Systems
AEMI	DuPont
AeroSat Corporation	Echelon
Agilent Technologies	EDO Corp.
Airgain	EMSS USA
Air Force	EMS-Wireless
ALPS Electric NA	Ember Corp.
Alvarion Ltd.	Emerson & Cuming
Ansoft Corp.	EPCOS
Applied Geomechanics	Equinox RF Equipment
Amphenol	ETS-Lindgren
Amcom	Fairbanks Scales
AMI Semiconductor	FBI
Anaren Microwave	FIAMM Technologies
Andrew Corp.	Filtronix
Antenna Specialists	Flextronics Semi
Antenova Limited	FPR Enterprises
Arc Wireless	Freescale Semi
Arc Technologies, Inc.	Galtronics USA, Inc.
Arlon Materials	GCI
Army Research Labs	GE Healthcare
ATCi	General Dynamics
Atmel Corporation	Grand-Tek Technology
Aura Communications	Harbour Industries
Badger Meter, Inc.	Hercules Thrustmaster
Ball Aerospace	Hewlett Packard
Beginning Balance	Idaho National Labs
BioPlastics	Isreal MoD
Blue Streak, Inc.	Itronix Corporation
Bluewave Antenna	JEM Engineering
Boeing	Kathrein-Werke KG
Broadcom Corp.	Kaveri Telecoms Limited
California DOT	KDDI Labs
Cambridge Telephone	Kimberly-Clark
Caterpillar, Inc.	KMW USA, Inc.
Chase Systems Inc.	Kyocera Wireless
Chelton, Inc	L-3 Communications
Cisco Systems, Inc.	Motorola Mobile Devices
Circoflex	MTI Wireless Edge Ltd.
CLP	NAS Wireless
CLS America, Inc.	NASA
CMC Electronics	Nellcor, Tyco Healthcare
Codem Systems, Inc.	Nextel Communications
Cognio	Primex Wireless
Comant Industries, Inc.	Qualcomm
CommScope	Radiall/Larsen Antenna
Corad	Raytheon
CSA Wireless	Redline Communications
CST	SamSung
Cuming Microwave	Sandia National Labs
Cushcraft Corp.	Sanyo Technology Center
Conexant	Sensus Metering Systems
Delphi Automotive	Shanghai MEC Inc.
Department of Defense	



Meets Some of the Speakers

Dr. Rao Yallapragada **Senior Director** *Qualcomm Mobile Broadband*

Dr. Rao Yallapragada is the Senior Director of Mobile Broadband Initiatives for Qualcomm. Dr. Yallapragada is a leading expert on OFDMA and CDMA/WCDMA mobile broadband technologies, working with mobile operators, with service providers, regulators and government agencies around the world. He has also been an instrumental part of the IEEE 802.20 working group. Dr. Yallapragada first joined Qualcomm in 1993 to address the development of wireless performance standards. While at Qualcomm, he has worked on many leading projects including the role as lead systems engineer in the design and development of 1xEV-DO Mobile-Station and Cell-Site Modems. Dr. Yallapragada has served as a key member in leading several projects in the design, development and testing of the Globalstar System and designing essential air-interface algorithms in power control, positioning, system search and acquisition. He has contributed to several academic publications and holds patents in system search and acquisition procedures for wireless systems.

Jeff Shamblin **VP of Advanced Technology** *Ethertronics*

Jeff Shamblin is Vice President of Advanced Technology at Ethertronics, and is responsible for overseeing all research and development projects for the corporation. Shamblin brings 29 years of experience in antenna engineering to this position. Before joining Ethertronics, Jeff worked for two RFID start-up companies, SCS Corp. and Claridy Solutions. At Claridy Jeff was manager in charge of antenna development and assisted in all aspects of RFID relating to antenna and scattering issues. Shamblin previously worked as an antenna consultant providing design and analysis services to several wireless start-ups in Southern California. Prior to his work with RFID, Jeff spent more than 20 years in antenna design and development in the aerospace industry at Lockheed and Northrop where he was responsible for several antenna designs on various aircraft and missile programs. Shamblin holds several patents relating to antenna technology.

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Kevin Linehan **Eng. Director / Base Stations Antennas** *Andrew Wireless Corporation*

Kevin Linehan is currently the Engineering Director for base station antenna systems at Andrew Corporation. Prior to assuming a management role, responsibilities have included antenna design engineer positions for base station antennas, terrestrial microwave antennas and earth station antennas. He has a BSEE from the University of Illinois at Champaign-Urbana with post graduate studies at the U of I Electromagnetics Research Lab.

Mike Gaynor **RF Technical Director** *Antenova Ltd.*

As RF Technical Director, Mike is responsible for RF circuit and system architecture design and development of Antenova's RF antenna module product line. Mike joined Antenova as part of Antenova's acquisition of the RF team from Xindium in 2006 and is based in Antenova's Elgin, Ill. design center. Prior to Xindium, Mike held senior RF positions at CEL, Amkor and Motorola. He has 22 years experience in RF/Microwave product development with an emphasis on transmitter linearization. Mike received his MSEE from the Illinois Institute of Technology. He is a member of the IEEE and its Microwave Theory and Techniques Society, Eta Kappa Nu and Tau Beta Pi. He has numerous patents and publications, including a recent book titled *System-in-Package: RF Design and Applications*.

Dr. Mohamed Sanad **Founder & CTO** *Amant Antenna*

Mohamed Sanad received his Ph.D. degree from the Department of Electrical Engineering, University of Manitoba, Canada, in 1986. In 1987, he was appointed as an Assistant Professor at the Faculty of Engineering, Cairo University, Egypt. In 1991, Dr. Sanad moved to the USA where he was the Director of Antenna Engineering for Wireless Access Inc. He was then approached by Nokia Mobile Phones Inc. to be their Director of Antenna Engineering in the USA. He established an antenna laboratory (anechoic chamber) and an antenna research center for Nokia from scratch in San Diego, Calif. and directed Nokia's antenna technical strategic planning. In 1996, Dr. Sanad started his own antenna consulting company in the USA, Amant-Antennas. In 2005, Dr. Sanad re-established AMANT Antennas in Egypt with Egyptian investors. Moreover, he is now a part-time professor at Cairo University. He is currently leading a team of engineers in developing innovative antenna technologies.



Meets Some of the Speakers

Valery Ostrovsky Dvlp. Leader for MW Laminates *CLP Industries, Ltd.*

Valery holds an MSc in mechanical engineering, with accumulated profound knowledge of material science, polymer processing and applications, related tooling and product design and applied physics and chemistry. Valery's experience over the last 15 years includes design and technology development of massive producing panel antenna, polypropylene radome compounding and metal foil lamination and bonding it to metals. He led developments of polyolefin to copper/aluminum laminations in order to bring about an inexpensive low loss material that would serve the needs of the panel antenna industry. Before joining the MW Laminate development program at CLP, Valery was the Chief Technologist of MTI Wireless Edge from Israel.

Dr. Anurag Mendhekar Founder, *Blue Vector*

Anurag started his career at Xerox's prestigious Palo Alto Research center, where he was one of the inventors of Aspect Oriented Programming, a rapidly spreading paradigm of programming that forms the core of Blue Vector Systems' products. Along with several scientific publications to his credit, Anurag has six patents awarded with several more pending. Anurag holds Ph.D. and MS degrees in Computer Science from Indiana University, a M.Sc (Engg) from the Indian Institute of Science and a Bachelor's degree in Computer Engineering from Bombay University.

Burt Calloway Executive Vice President *KMW Communications*

Burton Calloway is currently Executive Vice President and Chief Marketing Officer for KMW Communications. He has been with KMW for five years. Calloway introduced the concept of Programmable Antenna Systems Solutions. He increased significantly KMW's market share, competitive position and financial value. Prior to KMW, Calloway was the Executive Vice President of Antennas America division of ARC Wireless, a NASDAQ OTC Company. At ARC Wireless he established ARC's mobile antenna division and broadband wireless antenna market leader position. Calloway also worked for Ericsson and AT&T in executive sales management and marketing positions. He introduced strategic marketing to Ericsson and AT&T. Calloway is an author and presenter in the telecommunication wireline and wireless industry. He has several awards for his industry contributions.

Dr. Kirsten West Principal Analyst *West Technology Research*

Dr. Kirsten West has 15 years of experience in Business Development, Technical Marketing and Market Research positions working for both established companies and start-up organizations. Her technical experience ranges from research at NASA Ames Research Center to the Laser Laboratory at University of California at Irvine.

Dr. Erwin De Baetselier Program Manager *Agilent EEs of EDA*

Erwin De Baetselier holds a BS degree in Medical Sciences, an engineering degree in Applied Physics and a PhD degree in electronics. He worked as a researcher in the Faculty of Medicine at the VUB (Brussels University) and at the Electronics and Information Systems department of the Ghent University. He joined Hewlett Packard/Agilent EEs of EDA in 1997 as a research engineer in the SI domain. As of 1999 he was the Agilent EEs of EDA technical support manager for Europe. Last year he became program manager for the AMDS product.

Dr. Nan Ni RF Engineer, *Agile RF*

Dr. Ni received his Ph.D degree from the New Jersey Institute of Technology in 2007. He is now a RF engineer at Agile RF, Inc. Areas of current interests include antenna design, phase shifter design, impedance matching and package modeling.

Garth D'Abreu Technical Manager *ETS-Lindgren*

As Technical Manager, Garth has primary responsibility for the design of ETS-Lindgren's range of reverberation chambers and associated products. He is also responsible for the development of the chamber control software and the lead engineer in the reverberation chamber designs and testing. Garth also provides technical support to the Filter division, and has responsibility for the development and support of GTEM Cells, TEM cells and other test cells within the group. The design and development of antennas is one of the responsibilities of the RF group and is supported by a dedicated engineer.



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