



The IEEE EMC Society - Italy Chapter  
with the IEEE Italy Section, the University of Rome, "La Sapienza" and L'Aquila University



SAPIENZA  
Università di Roma

*Proudly present*  
**Latest Developments in the Use of Reverberation and Anechoic Chambers  
for Wireless Test Applications**

- Date:** Monday, September 24, 2012
- Venue:** Faculty of Engineering of "Sapienza" University of Rome at San Pietro in Vincoli
- Program:** Two internationally known speakers will provide extended presentations and will be available for questions following the seminar.
- Registration:** 9:15 am There is no fee to attend, but you must be pre-registered by September 19 in order to ensure adequate seating and catering. Please see below for registration contact information.
- Time:** 10:00 am Welcome by Italy IEEE EMC Chapter Vice-Chair, Luigi Caputo and La Sapienza, Faculty Dean, Professor Fabrizio Vestroni
- 10:10 am **Overview and Applications of Reverberation Chambers for Wireless Testing**  
By Christopher L. Holloway, Ph.D., Electromagnetics Division, National Institute of Standards and Technology (NIST), U.S. Department of Commerce, Boulder Laboratories, Boulder, Colorado, USA
- 11:30 am Coffee Break / Refreshments
- 11:45 am **The Anechoic Chamber Environment for Over-The-Air Measurement of Wireless Devices**  
By Garth D'Abreu, Director of RF Engineering, Test Solutions Group, ETS-Lindgren, Cedar Park, Texas, USA
- 1:00 pm Lunch

**Abstract:** Anechoic chambers have been used for a number of years for the measurement of antenna performance and more recently for the over-the-air (OTA) performance testing of wireless devices. There have been a number of enhancements in measurement techniques for anechoic chambers. The introduction of MIMO technology has resulted in yet another leap in anechoic chamber design and test advancements.

An alternate test and measurement environment is available with the reverberation chamber. While these chambers were primarily used for military and automotive EMC testing, today they represent one of the new additions to the wireless test arena. Reverberation chambers are increasingly being used for new and diverse applications due to their inherent efficiency, cost effectiveness and unique performance attributes. An overview of anechoic chamber and reverberation chamber test and measurement methodologies will be presented, including a discussion of performance pros and cons. The theory behind the increasing acceptance of and the science behind the reverberation chamber and its use as a suitable wireless measurement tool will be discussed. On a practical side, cost versus benefits of the reverberation chamber method as compared to the accepted anechoic method of performing standard wireless OTA measurements will be reviewed. The applicable current and developing CTIA and other OTA wireless standards, such as 3GPP and ETSI, will also be discussed.

### **Speaker Biographies**



**Christopher L. Holloway** (S'86-M'92-SM'04-F'10) is a Fellow of the IEEE and received the B.S. degree from the University of Tennessee at Chattanooga in 1986, and the M.S. and Ph.D. degrees from the University of Colorado at Boulder in 1988 and 1992, respectively, both in electrical engineering. Since 2000 he has been with the National Institute of Standards and Technology (NIST), Boulder, CO, where he works on electromagnetic theory. His research interests include electromagnetic field theory, wave propagation, guided wave structures, remote sensing, numerical methods, metamaterials, measurement techniques, and EMC/EMI issues. Dr. Holloway is currently serving as chair for US Commission A of the International

Union of Radio Science and is an Associate Editor for the *IEEE Transactions on Electromagnetic Compatibility*. Dr. Holloway has served as an IEEE Distinguished Lecturer for the EMC Society from 2004-2006. He has published over 200 technical articles including: 86 refereed journal articles, 98 conference papers, 73 conference presentation without publications, 2 book chapter, and 31 technical reports. Dr. Holloway has received numerous awards from the US Department of Commerce and the IEEE EMC Society. He also has various best paper awards for both journal and conference publications. He holds U.S. Patents on electromagnetic absorbing materials, radar systems and antennas for atmospheric radars, and on volume measurements devices.



**Garth D'Abreu** is the Director of RF Engineering at ETS-Lindgren based at the corporate office in Cedar Park Texas. He has primary responsibility for the design and development functions within the Systems Engineering group. The Systems group provides technical support for ETS-Lindgren worldwide and is directly responsible for Anechoic and Reverberation chamber, E-Field generator, TEM device and instrumentation system design and development. Mr. D'Abreu is the lead engineer for reverberation chamber design and test and is responsible for the development of GTEM cells, EMP protection applications and wireless device test systems. He also provides technical support to the RF filter department. He holds a BSc degree in Electronics & Communications Engineering, from North London University, UK. He is a member of the IEEE EMC Society and has presented several papers at conferences in the US,

Europe and Asia. He is an active participant in standards development and has over 20 years experience in the RF industry.

***Refreshments and lunch generously sponsored by:***



***Registration: Please contact Luigi Caputo as below no later than Wednesday, 19 September to reserve your seat at this seminar!***

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