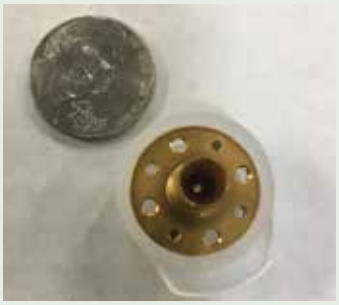
Chapter Chatter

Dennis Lewis, Associate Editor

There are changes afoot in the nosebleed sections of the RF spectrum. As frequencies extend to into the hundreds of GHz, innovative companies are making devices that sense, communicate and extend our understanding of quasi-optics. In that way, we talk wavelength, not frequencies.

Terahertz technologies are now within the grasp of technology companies and the applications include multi-gigahertz bandwidths for very high data rate transfer. Recently, we doodled around with a device that uses the mmWave spectrum to image through paper and plastic packaging to determine if mail and other packaging hold dangerous objects, powders, liquids and explosives. Think X-rays without the "X".

Various companies are currently implementing solutions using the multi-hundreds of gigs. Here in the Old Dominion, Virginia Diodes (http://vadiodes.com/en/) has developed devices that can extend the frequency range of spectrum and network analyzers to 1000+ GHz. The neat thing about these gadgets is that the conversion losses are tens of dBs lower than the harmonic mixers that have kicked around the market for a few years. Even my old beater spec ans have a new lease on life.



A 220-330 GHz horn antenna!

Just don't misplace your teeny-tiny antennas, like this little beauty, cut for 220-330 GHz. *By Mike Violette*

Central New England

The Central New England EMC Chapter organized a hands-on seminar on EMC chamber design for its November 16 meeting held at NTS in Boxborough, Massachusetts. Chapter co-chairs Mike Royer and Boris Shusterman welcomed speaker Zubiao Xiong with ETS-Lindgren who presented "Insights into EMC Chamber Design: How to Achieve an Optimized Chamber for Accurate EMC Measurements." The presentation was followed by a live demonstration of the time domain measurement technique per ANSI C63.25 for test site validation and diagnostics in the 3-meter chamber at NTS.

Ben Lambert and Ken MacGrath (both with Core Compliance Testing Services), Steven Phillips with Amazon Robotics and Keith Henderson with Intertek (from left) attended the Central New England EMC Chapter meeting on November 16 at NTS in Boxborough, Massachusetts.

Zubiao Xiong of ETS-Lindgren was the speaker at the Central New England meeting. He presented "Insights into EMC Chamber Design: How to Achieve an Optimized Chamber for Accurate EMC Measurements."

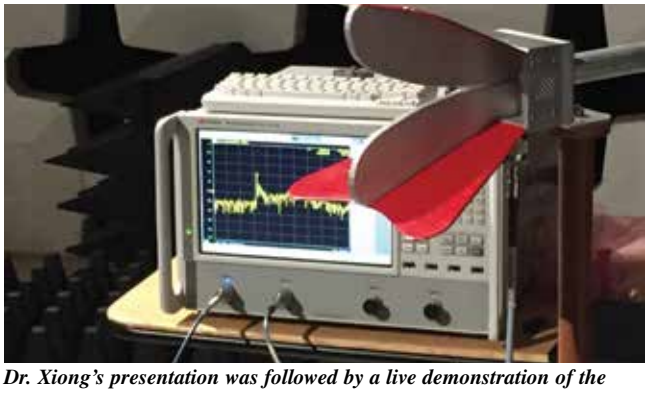


PHOTO BY MARTIN ROWE

Dr. Xiong's presentation was followed by a live demonstration of the time domain measurement technique in the NTS 3-meter chamber. Keysight Technologies generously provided an E5080A ENA for the demo.

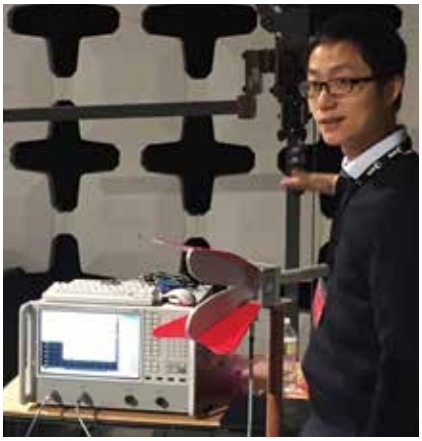


PHOTO BY MARTIN ROWE

The time domain techniques requires two antennas and an ENA as shown. The technique is included in the draft standard ANSI C63.25 for test site validation and diagnostics.

The live demonstration showed the effectiveness of the measurement process. Dr. Xiong pointed out how performance issues can quickly be identified using the time domain measurement technique.

Sven Battermann explains aspects of emission and immunity at the Germany EMC Chapter two-day EMC Boot Camp on October 25-26, 2017.

Dr. Xiong's presentation provided background information to consider when determining the optimal chamber design for varied applications. Since chambers involve a considerable investment, taking the time up front to weigh options for the best design is very cost-effective in the end. Topics presented included a review of EMC standards since the first task is generally to identify which standards the chamber will be used for testing. General design guidelines, performance simulation ability and accuracy, and optimizing a design for a limited space were reviewed. Finally, with existing chambers, guidelines were provided for those considering retrofitting a chamber with new absorber. Troubleshooting tips were provided should an existing chamber fail to meet performance expectations.

Following the presentation, the meeting attendees witnessed a live demonstration of the time domain measurement technique per the draft ANSI Standard C63.25 in a 3-meter semi-anechoic EMC chamber. The live demonstration showed the effectiveness of the measurement process, the data post-processing, and analysis of the results. Dr. Xiong showed how the time domain site VSWR is post-processed through statistical techniques, and how the data correlates to the CISPR method. Attendees learned how time domain measurements provide an efficient and cost effective way to validate chamber performance as well as indicate precisely where a chamber may have problems meeting performance expectations. The demonstration was a highlight of the evening!

Dr. Zubiao Xiong is an RF engineer with ETS-Lindgren, located in Cedar Park, Texas. He obtained his B.Eng. and Ph.D. (both degrees in Electronic Information Engineering) from the Huazhong University of Science and Technology, China in 2003 and 2009, respectively. After that, he joined the University of Houston as a research fellow, focusing on the research of computational electromagnetics and its applications in biomedical engineering and electromagnetic compatibility. He developed the simulation software for predicting and analyzing the performance of anechoic chambers, and then joined ETS-Lindgren in September 2016. Dr. Zubiao Xiong is an active member of the working group addressing IEEE-STD-1128 on RF Absorber Evaluation. His current research interests include EMC and microwave chamber design, novel RF absorber material development, and time domain measurements for site validation and antenna calibration. He may be reached at zubiao.xiong@ets-lindgren.com.

Over 30 Chapter members and guests attended the meeting, including Martin Rowe, Senior Technical Editor, Test & Measurement, with EDN who was inspired by the meeting to write an article about the presentation and demonstration for EDN. Many thanks to the meeting sponsors NTS and ETS-Lindgren for providing the excellent meeting space and wonderful dinner. Special thanks to NTS lab manager Clayton Forbes for expertly taking care of the onsite logistics!

Germany

The Germany Chapter of the IEEE EMC Society hosted a two-day EMC Boot Camp on October 25-26, 2017 in the premises of Airbus Defense and Space GmbH in Ottobrunn. This free event with lectures and workshops took place for the first time in

Christian Schuster introduces the fundamentals of signal integrity and power integrity at the EMC Boot Camp held on the premises of Airbus Defense and Space GmbH in Ottobrunn.

Eugen Balzer (center) with Prof. Schuster (left) and Prof. Eibert received the Best-Ph.D.-Thesis-of-the-Year Award his thesis "Interaction between Low-voltage Grid and Pulsed Mains Current Converters."

Ömer Faruk Yildiz (center) received the Best-Master-Thesis-of-the-Year Award for his work entitled: "Analysis of Electromagnetic Interference Variability on RF Integrated Circuits." He also received a book prize!

S. Kaupmann (center) received the Best-Bachelor-Thesis-of-the-Year Award for his work on "Impact of a VOR Antenna Radiation Pattern on the Desired Target Figure" from Prof. Schuster (left) and Prof. Eibert.

On December 6-7, 2017, the Germany EMC Chapter participated in EMWT 2017 - "Electromagnetic Waves and Wind Turbines" - at the Physikalisch-Technische Bundesanstalt (PTB). Dr. Thorsten Schrader of PTB welcomes the workshop participants and introduces the WERAN project.

2016 in Hamburg at the Helmut Schmidt University of the German armed forces. The positive response motivated the German EMC Chapter to organize the reprise in the southern part of Germany.

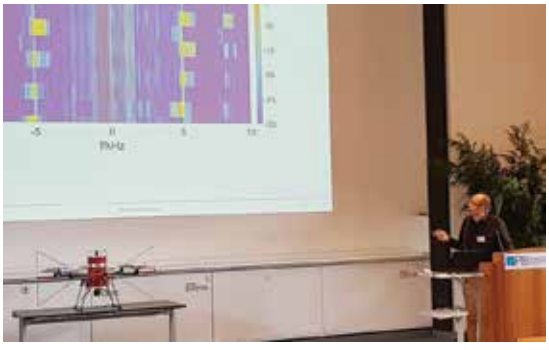
The subtitle "The Most Important Things to Know on Electromagnetic Compatibility in Two Days" summed up the aim of the event: To provide engineers with a compact introduction to this topic. Over 90 participants from all parts of Germany demonstrated the importance of the EMC subject as a cross-sectional discipline of electrical engineering and information technology. Speakers from industry, research and academia presented during the two-day seminar, which featured not only introductory basics, but also interesting applications of EMC.

The speakers included Stefan Dickmann (EMC basics and coupling mechanisms); Sven Battermann (EMC measurements); Thomas Eibert (antennas, near field/far field transformation); Christian Schuster (signal and power integrity); Markus Clemens (EM simulation tools and algorithms); Andreas Barchanski (applications of EM simulation); Robert Kebel (EM simulation of lightning); David Hamann (frequency domain measurements); Alexander Küllmer (time domain measurements), and Stephan Frei (EMC of automotive networks).

The workshop was completed with visits to the labs of German armed forces University Munich (EMC and high voltage labs) as well as to the EMC test facilities of IABG, Ottobrunn.

During their 24th annual meeting on November 29, the IEEE Germany Section EMC Society Chapter granted awards for the best thesis related to EMC subjects. A jury with members from industry and academic institutes selected the best thesis in the categories Bachelor, Master and Ph.D. thesis for the period of October 2016 to September 2017.

Eugen Balzer received the Best-Ph.D.-Thesis-of-the-Year Award from Prof. Eibert and Prof. Schuster for his thesis "Interaction between Low-voltage Grid and Pulsed Mains Current Converters" (original title in German "Interaktion von Niederspannungsnetzen mit daran betriebenen Netzpulsstromrichtern"). Ömer Faruk Yildiz received the Best-Master-Thesis-of-the-Year Award for his work entitled: "Analysis of Electromagnetic Interference Variability on RF Integrated Circuits." Steffen Kaupmann received the Best-Bachelor-Thesis-of-the-Year Award for his work on "Impact of a VOR Antenna Radiation Pattern on the Desired Target Figure" (original title in German "Einfluss der Strahlungscharakteristik einer VOR-Empfangsantenne auf die Auswertung der Zielgröße").



Karsten Schubert presents data from FMCW radar spectra showing the Doppler effects by wind turbines as part of the EMWT 2017 technical program at PTB in Braunschweig, Germany.

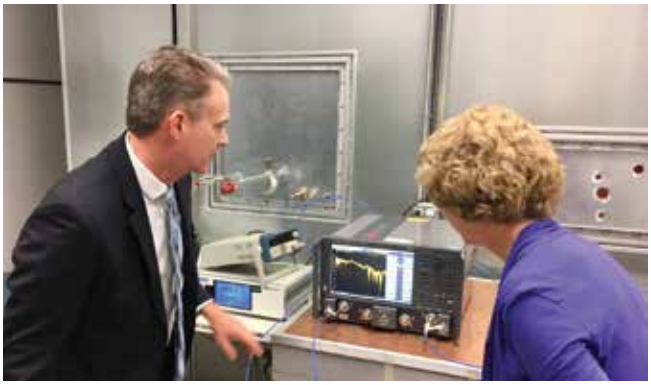
On December 6-7, 2017, the symposium EMWT 2017, "Electromagnetic Waves and Wind Turbines" took place at the Physikalisch-Technische Bundesanstalt in Braunschweig (German national metrological institute). This technical workshop was organized by the PTB Department "High Frequency and Electromagnetic Fields" under the auspices of the Germany Chapter of the IEEE EMC Society as well as the VDE (ITG) and the URSI Commissions A "Electromagnetic Metrology" and F "Wave Propagation". Among the approximately 80 participants were scientists, representatives of authorities and trade associations as well as engineers and other experts in the areas of wind turbine production and planning of wind energy farms.

On the first day, the speakers presented results of the German research project "WERAN" in which investigations on the interaction of wind turbines with terrestrial navigation systems such as VHF radio beacons and radar systems were investigated. The various aspects of the interaction between electromagnetic waves and wind turbines were further discussed on the second day, by presenting simulation results and measurement data.

Los Angeles

The Los Angeles EMC Chapter held a half-day afternoon Reverberation Chamber

Dennis Lewis of Boeing in Seattle, Washington presented at the Reverberation Chamber Workshop organized by the Los Angeles EMC Chapter.



Speakers Dennis Lewis and Kate Remley set up the equipment for one of the demonstrations showing the differences between mechanical and frequency stirring in a reverberation chamber.

Workshop on Wednesday, January 17 at NTS in Fullerton, California. The hands-on course addressed fundamental to advanced reverberation chamber test topics – complemented by live demonstrations in the reverberation chamber at NTS. Speakers included past IEEE EMC Society Distinguished Lecturers, Dennis Lewis of Boeing and Kate Remley of the National Institute for Science and Technology (NIST). Following a complimentary buffet lunch, Chapter Chair Ray Adams of Boeing El Segundo welcomed everyone to the meeting. He reminded those present about the 2018 IEEE Symposium on EMC+SIPI that will take place on July 30-August 3 at the Long Beach Convention Center.

Ray then introduced the first speaker, Dennis Lewis, who is a Technical Fellow with Boeing in Seattle, Washington. Dennis presented "Utilizing Reverberation Chambers as a Versatile Test Environment for Assessing the Performance of Components and Systems." Dennis explained that electromagnetic reverberation chambers have been used for many years by the Electromagnetic Compatibility (EMC) community to measure the susceptibility and emissions for various electronic components and systems. He described how statistical processes were used to reduce the uncertainty of these chambers to a level necessary for precision metrology applications. These processes were applied to the calibration of electromagnetic field probes and the assessment of antenna efficiencies. A brief comparison of traditional calibration methods employing transverse electromagnetic (TEM) cells and anechoic chambers to the new statistical reverberant environment was provided. Dennis explained how these techniques were later applied to a wide variety of aircraft measurements. A technique, which utilizes two side-by-side reverberation chambers sharing a common wall with an arbitrary shaped aperture, useful for the assessment of component shielding, was discussed. Utilizing this same approach, it is possible to assess the shielding of large structures such as commercial aircraft. These aircraft shielding measurements are necessary for High Intensity Radiated Field Susceptibility (HIRF) certifications. Dennis noted that with the proliferation of wireless devices, it is important to understand how they behave in complex electromagnetic environments and how they interact with other devices and systems in which they are collocated. Aircraft environments have been shown to behave similarly to reverberation chambers and therefore these techniques can be employed to study propagation environments and system interactions. This presentation concluded with examples of how these techniques were employed to measure bulk absorption used to simulate passenger loading of aircraft, field mapping which is useful for the evaluation of signal coverage and channel interference as well as signal propagation characteristics.

After a dessert break with yummy cookies, Ray Adams introduced our second speaker, Kate Remley, Leader of the Metrology for Wireless Systems Group, National Institute for Science and Technology (NIST), in Boulder, Colorado. Kate presented "An Introduction to Free-Field Measurements of Wireless Devices in Reverberation Chambers." Kate showed that when an antenna is integrated into the body of a wireless device, as it is for

Kate Remley of NIST in Boulder, Colorado also presented at the Reverberation Chamber Workshop held on January 17 at NTS in Fullerton, California.

Following the presentations at the Reverberation Chamber Workshop, the speakers provided live demonstrations utilizing the reverberation chamber at NTS.

Attendees at the Los Angeles EMC Chapter's Reverberation Chamber Workshop saw examples in real time of the material presented by the speakers.

cell phones and many other portable devices, performance testing is typically done under free-field conditions. In this overview presentation, she shared information on free-field characterization of some key wireless-device parameters by use of reverberation chambers. Recent research and some of the issues related to the use of these chambers for testing devices that transmit modulated signals was shared with the attendees.

Dennis Lewis provided the final presentation of the Reverberation Chamber Workshop, titled "Introduction to Reverberation Chamber Concepts and its Application for Probe Calibration and Antenna Efficiency Measurements." This presentation provided a brief introduction of current methods used to calibrate electric field probes as defined by IEEE Standard 1309 as well as reviewed some inherent problems with the current test methods. The use of a reverberation chamber to calibrate electric field probes was described as an alternative method along with some of the tradeoffs between methods. The use of modal, spatial, and frequency averaging to improve field uniformity levels to that required for accurate antenna efficiency characterizations was outlined.

Following the three excellent presentations, the speakers provided a live demonstration of reverberation chamber test methodologies. Advanced Test Equipment Corporation (ATEC) generously loaned an antenna for the demonstration. In addition, Keysight Technologies generously loaned a PNA network analyzer with time domain software. Dennis Lewis jokingly asked if it was a speaker gift! It was indeed impressive to see how quickly the measurements were made with this instrumentation. Dennis and Kate showed the difference between mechanical and frequency stirring as well as the difference in random and systematic coupling inside the chamber. Based on the many questions following the demonstration, attendees were very interested!

About our incredible speakers, Dennis Lewis received his BS EE degree with honors from Henry Cogswell College and his MS degree in Physics from the University of Washington. He has worked at Boeing for 29 years and is recognized as a Technical Fellow. He currently has leadership and technical responsibility for the primary RF, Microwave and Antenna Metrology labs. Dennis holds eight patents and is the recipient of the 2013 and 2015 Boeing Special Invention Award. He serves as a Board Member and is a past Distinguished Lecturer for the EMC Society. Dennis is a part time faculty member teaching a course on Measurement Science at North Seattle College and is chair of the Technical Advisory Committee. His current technical interests include aerospace applications of reverberation chamber test techniques as well as microwave measurement systems and uncertainties.

Kate A. Remley received the Ph.D. degree in Electrical and Computer Engineering from Oregon State University, Corvallis, in

Dennis Lewis answered questions posed by the attendees during the demonstration portion of the Reverberation Chamber Workshop.

The Los Angeles EMC Chapter's Reverberation Chamber Workshop was a big success thanks to those shown in this photo, including (from left) Ray Adams of Boeing, Kate Remley of NIST, Dennis Lewis of Boeing, Nicole Harris of ATEC, Matthew Carter of Keysight Technologies and Mike Shook of NTS.

Nicolis Freeman of NTS (second from right) supported the Reverberation Chamber Workshop. He thanked Ray Adams, Dennis Lewis, Kate Remley, Nicole Harris, Matthew Carter and Mike Shook (from left) for the educational event. Nice antenna Nicole!

The Joint Nanjing Chapter technically cosponsored the 2017 International Symposium on InfoComm & Media Technology in Bio-Medical & Healthcare Application (2017 IS-3T-in-3A).

1999. From 1983 to 1992, she was a Broadcast Engineer in Eugene, OR, serving as Chief Engineer of an AM/FM broadcast station from 1989-1991. In 1999, she joined the RF Technology Division of the National Institute of Standards and Technology (NIST), Boulder, CO, as an Electronics Engineer. She is currently the leader of the Metrology for Wireless Systems Group at NIST, where her research activities include development of calibrated measurements for microwave and millimeter-wave wireless systems, characterizing the link between nonlinear circuits and system performance, and developing standardized test methods for RF equipment used by the public-safety community. Dr. Remley was the recipient of the Department of Commerce Bronze and Silver Medals, an ARFTG Best Paper Award, and is a member of the Oregon State University Academy of Distinguished Engineers. She was recognized as an IEEE Fellow in 2013.

The workshop concluded at 5:00 pm. Ray Adams thanked the great speakers for sharing their time and talents with the Los Angeles EMC Chapter. Nicole Harris of ATEC and Matthew Carter of Keysight Technologies were thanked for their help with the demonstration. Finally, yet importantly, Ray also thanked Mike Shook and Nicolis Freeman of NTS for the generous use of their meeting room and reverberation chamber for the Reverberation Chamber Workshop. All agreed it was a very educational afternoon!

Nanjing

The Joint Nanjing Chapter technically cosponsored the 2017 International Symposium on InfoComm & Media Technology in Bio-Medical & Healthcare Application (2017 IS-3T-in-3A). The symposium was held on December 16-19, 2017, in Nanjing, China. The symposium featured eight keynote talks and 24 invited talks. In addition, 24 poster papers were presented. There were seven papers awarded as "Best Student Paper" by the awards committee.

Philadelphia

The IEEE Philadelphia EMC Society Chapter met on Thursday, October 26, 2017 at AR RF/Microwave Instrumentation's facility in Souderton, Pennsylvania. Guest speakers included Don Heirman, President of Don HEIRMAN Consultants, and Sangam Baligar, an engineer at AR RF/Microwave Instrumentation. Mr. Heirman condensed his typical 2-day EMC class into a brief 45-minute discussion on the FCC, CISPR, IEC, and other industry standards organizations with highlights of the newest standards and changes happening within the industry.

Mr. Baligar introduced AR RF/Microwave Instrumentation's multi-tone radiated immunity system, with an emphasis on the future of radiated immunity, how to speed up test time, and the effects of multi-tone test approaches on EUTs. Over 30 people attended the meeting.

Seven papers were recognized as "Best Student Paper" by the awards committee. The students are shown with their awards in during the symposium on December 16-19, 2017, in Nanjing, China.

The IEEE Philadelphia EMC Society Chapter meeting on Thursday, October 26, was held at AR RF/Microwave Instrumentation's facility in Souderton, Pennsylvania. Don Heirman, President of Don HEIRMAN Consultants, was the featured speaker.

Mr. Heirman condensed his typical 2-day EMC class into a brief 45-minute discussion on the FCC, CISPR, IEC, and other industry standards organizations for the Philadelphia EMC Chapter.

Speaker Kris Hatashita presented information on the Canadian Army EMC Doctrine during his November presentation to the Phoenix EMC Chapter.

The end of the year is near, and the Philadelphia EMC Chapter continues to plan meetings for the future, with a meeting tentatively planned for late January.

Phoenix

Chapter Chair Glen Gassaway of Southwest EMI Consulting reported the final meeting in 2017 of the Phoenix EMC Chapter was held at Compliance Testing Labs in Mesa, Arizona on Wednesday, November 15 in conjunction with the IEEE EMC Society Board of Directors meeting in downtown Phoenix that previous weekend. The evening began at 5:30 pm with the customary social hour and excellent Mexican food catered by the Chapter.

The meeting itself began a little before 7:00 pm, with Glen discussing Chapter business. Glen talked about the upcoming 2018 IEEE EMC Symposium in Long Beach, our Chapter's corporate sponsorship program and new developments on our Chapter website. He then introduced Vignesh Rajamani who is both a member of the Phoenix Chapter as well as the Vice President of Member Services with the EMC Society Board of Directors. Vignesh communicated the benefits of IEEE EMC Society membership, including the vast technical resources and the obvious networking and career benefits. Vignesh then introduced Frank Sabath, President of the EMC Society.

Frank gave our Chapter a brief run-down on Society activities, including plans for a new journal of EMC best practices, which will become available next year. Be on the lookout for a call for papers for the new journal. There are also plans to start a "Technician's Corner" in the EMC Magazine to provide more 'hands on' information to our members.

Frank then returned the floor to Glen, who began the usual around-the-room introductions, including announcements about the companies that are hiring and individuals looking for work. There are several companies looking for experienced EMI personnel in the Phoenix area! Glen then introduced our featured speaker, Kris Hatashita, who is a consultant to the Canadian Department of National Defense.

Kris had the 'opportunity' to do EMC work in Afghanistan in 2007 in a real war-zone environment. He mentioned that the Canadian army doctrine is similar to the US army – all equipment has to be effective, self-compatible, compatible to the EM environment, safe to operators and must not emit compromising emissions. In a military environment, EMC is always serious and mission critical. Frequency coordination must be done considering local communications, coalition level communications, intentional jamming, and with regard to hostile intentions to bring down communications systems.

Kris cited a prime EMC example involving a ground vehicle that was being deployed in Kandahar whose communications range was only about 10 miles! He took the vehicle to a remote location in Canada with an approximately 90 km long straight flat road. The vehicle got to a 55 km range before

Kris Hatashita gave a fascinating presentation during the Phoenix EMC Chapter meeting. Kris chaired the successful 2016 IEEE International Symposium on EMC+SIPI in his home town of Ottawa, Canada.

Nuclear EMP, HERO, RADHAZ, and TEMPEST were a few of the topics Kris Hatashita covered during his presentation in Phoenix.

Southeastern Michigan EMC Chapter Chair Scott Lytle (left) is shown with speaker Jerry Begel. Jerry presented "A Brief History of Military Communications" at the Chapter's November 2017 meeting.

Michael Kirkhart (right) presented "Hacking a $10 ISM Band Radio into a Viable Satellite Transceiver: $50SAT and the RFM22B" at the Southeastern Michigan EMC Chapter meeting on January 18.

communication was lost. Then, the vehicle operator was instructed to turn on subsystems. When the IR target acquisition was turned on, it completely buried the communications. It turned out that the coax cable leading to the communications system was routed through two pins through a MIL-circular connector, completely violating its shielding integrity!

A further cause of concern for communications on the vehicle was the microphone/headset. It turned out that soldiers had modified the headset by wiring-in an audio jack for their iPhone, also violating shielding!

Kris mentioned that weapons systems are getting more complex and integrated. Consider the example of the Integrated Soldier System, where IR sensors, short/long range communications, UAV controls, and sensors are all collocated on a single soldier. The remedy to these complex EMC problems is to use MIL-STD-461! Kris showed a standard MIL-STD-461 RS03 setup, which tests Army ground equipment to 50 V/m. A significant field strength indeed.

Nuclear Electromagnetic pulse or NEMP exhibits extremely fast transients with very high levels of magnetic and electric fields. Typical field levels can be 50 kV/m, 100 A/m2 and 6.6 Mw/sq2. While low altitude nuclear events emit a sizeable EMP out to about 50 km, high altitude events can emit sizeable levels on a continental scale – at almost 2000 km distance. In this region, a high percentage of equipment will cease to function. The power grid will be overridden – possibly irreparably. Some 8-10 nuclear weapons could foreseeably take out electronics globally. In the military world, every device is designed to withstand a certain level of EMP.

Kris then described radiation hazards (RADHAZ) examples. One was a personnel radiation hazard, where an ARV vehicle went straight to Afghanistan due to operations requirements without EMC testing beforehand. This vehicle had a high-power counter-IED jamming transmitter. Soldiers complained about blurred vision, ringing in ears and sinus problems. Measurements showed that the soldiers were in a 450 V/m field! This is about 4-6 times the permitted levels. The solution was to reduce the RF power and to reduce soldiers' time allowed in the EM field.

Kris then spoke about high-energy radiation on ordnance or HERO. He showed video of the infamous USS Forrestal incident in 1967. Now ordnance has its own set of high field strength radiated test limits. Finally, Kris talked about EM Security – TEMPEST and showed a very interesting example of coupling between two LCD monitors. Kris closed his presentation by stating that EM spectrum is one of four new battlegrounds introduced in the 20th century: Air, Space, Internet and the EM spectrum. It is interesting to note that the EM spectrum is common to all battlegrounds. After the talk, Glen Gassaway thanked Kris for his fine presentation! The meeting adjourned at 8:30 pm. We are grateful to Compliance Labs in Mesa, Arizona for hosting and providing their facilities for this event.

Southeastern Michigan

In November 2017, the Southeastern Michigan EMC Chapter hosted Jerry Begel who gave the talk, "A Brief History of Military Communications." Encryption methods, including some high tech, EMC type encryption devices were included. Toyo graciously covered the cost of dinner. For those of us who have experienced the miraculous evolution of communications, it was a great presentation and brought back fond memories.

Most engineers dream of hearing from space. For Michael Kirkhart, this dream became a reality in 2013. Michael Kirkhart was part of a team that made a $50SAT or PocketQube. Michael gave the talk, "Hacking a $10 ISM Band Radio into a Viable Satellite Transceiver: $50SAT and the RFM22B" on January 18, 2018 to the Southeastern Michigan EMC Chapter. He explained to his audience that a chance encounter at the 2011 Detroit Maker Faire led him to attend the first annual hackerSPACE workshop in Lexington, Kentucky, where he met Morehead State University Professor Robert Twiggs, one of the creators of the CubeSat. During the workshop, he inquired how folks outside the university community could participate in the design, construction, and operation of a small satellite. In an example of "be careful what you wish for", he found himself working with university students and other outside advisors on the construction of a new class of satellite called a PocketQube. The result of this collaboration were two PocketQubes: the T-LogoQube, built by students at Sonoma State University and Morehead

Professor Andy Marvin met some African Penguins at the Boulders penguin breeding colony in Simon's Town during his visit to the South Africa Section Joint AP/MTT/EMC Chapter in November.

Prof. Renato Procopio (fifth from left) gave a lecture about lightning modeling at the Swiss Federal Institute of Technology (EPFL) in Lausanne, Switzerland. Several Ph.D. students and special distinguished guests attended, including (from left) EPFL Ph.D. students Zhaoyang Wang, Amirhossein Mostajabi, Quanxin Li, and Lixia He, speaker Prof. Renato Procopio (University of Genova), Prof. Farhad Rachidi (EPFL), Prof. Michel Ianoz (EPFL), Prof. Hans-Peter Geromiller (Karlsruhe University of Applied Sciences), Dr. Jun Guo (EPFL), and Dr. Mohammad Azadifar (EPFL).

State University, and the $50SAT, built by Michael and the other advisors. Both were launched on November 21, 2013, and were operational shortly after launch.

Michael started by making a Lego prototype of the satellite to determine where the antenna and solar cells would be placed. A tape measure served as a very accurate, small and retractable dipole antenna. The radio was a $10 ISM Band Radio. He powered the whole satellite using a small lithium ion battery. The device operated for 20 months, an amazing feat considering that the device operated with a +300C to -300C temperature variation as it traversed the skies. We enjoyed listening to Michael Kirkhart, an electronics engineer, hardware hacker, and amateur radio operator (call-sign KD8QBA). He is also a graduate electrical engineering student at the University of Michigan at Dearborn, where he has taken (and survived) Professor Mark Steffka's ECE519 graduate EMC course.

South Africa

The South Africa Section Joint AP/MTT/EMC Chapter was pleased to host Prof Andy Marvin from York University (UK), from 20 to 23 November 2017 as part of the EMC Society Distinguished Lecturer program. He gave presentations on "Shielded Enclosure Metrics" at three different Universities in South Africa, namely Stellenbosch University, University of Cape Town and University of Pretoria. The presentations were fairly well attended (20, 15 and 23 attendees for the respective universities) and well received by the audiences. Luckily, there was also time to show Prof. Marvin around the Cape Town area, with a visit to a penguin-breeding colony at Boulders, Simon's Town, beautiful scenery around Chapman's Peak drive at Hout Bay, and around the Stellenbosch Winelands.

The South African Joint Chapter on AP/MTT/EMC will also be hosting our local biennial conference in Stellenbosch, late in August 2018. This provides an excellent networking opportunity, with invited presentations from some 25 local and three international speakers, and about 140 attendees.

Arrangements are also well on their way for the 4th IEEE Global Electromagnetic Compatibility Conference (GEMCCON) which will be coming to Stellenbosch, South Africa from 7 to 9 November 2018. The normal EMC topics will be covered, but special sessions are planned for time domain measurement techniques, as well as radio frequency interference and EMC in large installations.

The relevant dates are the following:

- 11 May 2018 - Full-Paper Submission Deadline
- 11 May 2018 - Proposals due for workshops, tutorials, special sessions and short courses
- 25 June 2018 - Notification of Acceptance
- 3 August 2018 - Early Bird Registrations and Final Paper Submission Deadline

Switzerland

Prof. Renato Procopio gave a lecture about lightning modeling in the auditorium of the Swiss Federal Institute of Technolo-

Professor Marvin enjoyed seeing the beautiful scenery overlooking Hout Bay from the Chapman's Peak Drive viewpoint during his visit to Cape Town.

Prof. Jan Machac visited the Turkey AP/MTT/EMC/ED Chapter and delivered two talks at Bilkent University and Middle East Technical University.

During Saturday sightseeing in Ankara, the capital of Turkey, Prof. Machac (third from left) further discussed the activities of the Chapter with the representatives.

gy (EPFL) located in Lausanne, Switzerland. Several Ph.D. students attended the meeting as well as faculty members. At the end of the talk, many questions and answers were exchanged. The event included the special presence of retiree Prof. Michel Ianoz and Prof. Farhad Rachidi from EPFL.

Turkey

The Turkey AP/MTT/EMC/ED joint Chapter closed the year 2017 with five new seminars and two special talks. Prof. Jan Machac (IEEE-MTT Region 8 coordinator) visited the Chapter and delivered two talks (Substrate Integrated Waveguide – Base for Leaky Wave Antennas) at Bilkent University and Middle East Technical University. During Saturday sightseeing in Ankara, the capital of Turkey, Jan further discussed the activities of the Chapter with the representatives. The other seminars organized during this period included:

17 November 2017
Speaker: Assoc. Prof. Özgür Özdemir, Istanbul Technical University
Topic: "Microwave Imaging in Layered Media"

24 November 2017
Speakers: BarışDinç and Burcu Aybak, TAMSAT
Topic: "Details of a Low Earth Orbiting (LEO) Cubesat's Subsystems"

08 December 2017
Speaker: Assoc. Prof. Mehmet Ünlü, Ankara Yıldırım Beyazıt University
Topic: "Tera-Nano: Novel Terahertz Components Using Nanotechnology"

15 December 2017
Speaker: Prof. Ergin Atalar, Bilkent University
Topic: "Magnetic Resonance Imaging Technologies"

22 December 2017
Speaker: Prof. Gönül Turhan-Sayan, Middle East Technical University
Topic: "Metamaterial Research with Applications in Microwave, Terahertz and Infrared Bands"

Under the leadership of the Chapter chair Dr. Özgür Ergül and steering committee members Hande Ibili, Sadri Güler, and Türker Dolapçı, the Turkey AP/MTT/EMC/ED Chapter has been revitalized having more than 24 distinct activities in 2017 and even more planned for 2018.

On November 17, Assoc. Prof. Özgür Özdemir with Istanbul Technical University presented "Microwave Imaging in Layered Media."

Speakers BarışDinç and Burcu Aybak with TAMSAT presented "Details of a Low Earth Orbiting (LEO) Cubesat's Subsystems" on November 24.

On December 8, Assoc. Prof. Mehmet Ünlü with Ankara Yıldırım Beyazıt University presented "Tera-Nano: Novel Terahertz Components Using Nanotechnology"

Prof. Ergin Atalar with Bilkent University presented "Magnetic Resonance Imaging Technologies" on December 15 at the Turkey AP/MTT/EMC/ED Chapter meeting.

On December 22, Prof. Gönül Turhan-Sayan with the Middle East Technical University presented "Metamaterial Research with Applications in Microwave, Terahertz and Infrared Bands."

Xi'an

The 4th International Conference on Electric Power Equipment-Switching Technology (ICEPE-ST) covering all aspects of the science and technology of electric power equipment was successfully held in Xi'an, China, on October 22-25, 2017. Xi'an Jiaotong University and Pinggao Group Co., Ltd. organized ICEPE-ST. The conference is held by an Asia-based Society and focuses on encouraging innovation in the field of science, technology and application of electric power equipment especially switching technology. For this conference, 222 papers from 12 countries (including China, Japan, Korea, Netherlands, Italy, France, Iran, Switzerland, UK and USA) were accepted and included in the conference proceedings, including 86 oral presentations and 136 poster presentations. Attendance included 248 delegates. Four plenary lectures were presented by internationally renowned professors and experts from China, Japan, South Korea and Europe, respectively. The Wang Jimei Best Paper Award was presented to Bin Xiang from Xi'an Jiaotong University, and the Wang Jimei Best Young Investigator Award was presented to three young investigators from China and Europe.

The International Seminar on Electromagnetic Environment and Electromagnetic Safety 2017 was successfully held by the National Center for International Research on Transient Electromagnetic Environment and Applications, in Xi'an in November 2017. Dozens of teachers, students and scholars at the university attended the seminar including Dr. D. V. Giri and Dr. Armin Kaelin, renowned experts in high-power electromagnetic environment and protection.

Dr. Giri is an IEEE Life Fellow, EMP Fellow and adjunct professor of the University of New Mexico in the USA. He is one of the most influential scientists in the high-power electromagnetics field around the world, having over forty years of research experience in the fields of high altitude electromagnetic pulse, high power microwave, lightning, ultra-wideband, etc. Dr. Armin Kaelin is an EMP Fellow and the founder of EMProtec. He is engaged in the fields of transient electromagnetic environment protection in high altitude electromagnetic pulse, high power microwave and lightning over a long period of time.

Dr. Giri gave a series of reports on the research of radiation and effects on high power ultra-wideband, and discussed biomedical applications with teachers and students from the School of Life Science and Technology. Dr. Kaelin introduced the principle, classification, protection, and conduction test methods of high-power electromagnetic environment threats, including examples of electromagnetic protection. The Head of the Center, Professor Xie Yanzhao, researchers Guo Jie, Zhou Yi, Zhang Yaohui, Dong Ning, and other teachers and students introduced the research progress in ultra-wideband radiation systems, protection device characteristics and pulse current coupling methods.

Dr. Giri also discussed the debugging and measurement of high-power IRA antennas and helical antennas together with some postgraduates in our university. In addition, he participated in the postgraduate course teaching on "high-power electromagnetism" by giving lessons about the switch oscillator, the spiral antenna and so on. During the visit, Dr. Giri discussed with two experts about the coming cooperation in new technologies of blood glucose measurement and high-power radiation antenna and protection.

Prof. Flavio Canavero, Dean of Doctoral School of Polytechnic University of Turin, Italy, visited Xi'an Jiaotong University from December 24-31, 2017. He participated in the symposium on multi-conductor transmission lines and statistical electromagnetism organized by the National Center for International Research on Transient Electromagnetic Environments and Applications. He introduced the achievements and the latest scientific research progress at the Polytechnic University of Turin in Italy, on the interference and protection of electromagnetic compatibility, the theory and modeling computation of transmission lines, statistical electromagnetism, etc., and discussed several academic issues with students, yielding fruitful results.

During the visit, Prof. Flavio Canavero also held friendly talks with Executive Vice Dean Prof. Li Shengtao, Vice Dean Prof. Yang Xu of the School of Electrical Engineering, and Prof. Long Jiangang, Vice Dean of the Graduate School. Finally, consensus was achieved on the cultivation of double-degree doctoral students and scientific research cooperation.

Following is a brief introduction of Prof. Flavio Canavero. He is the current Dean of the Doctoral School of Polytechnic University of Turin and head of the Electromagnetic Compatibility Laboratory. His research interests include signal integrity analysis and EMC, interconnect modeling, black box characterization of digital integrated circuits, electromagnetic interference, and statistical studies related to electromagnetic compatibility. Professor Canavero is an IEEE Fellow, former chief editor of the IEEE Transaction on Electromagnetic Compatibility and chair of Section E of the URSI Committee. In 2007, he co-chaired the first Global EMC University with Prof. Clayton R. Paul. He has received numerous industry and IEEE awards, including the prestigious Richard R. Stoddart Award, the Honored Member Award, and the Honored Member Award from the EMC Association, and has a renowned reputation in the area of electromagnetic compatibility. **EMC**

EMC Young Professionals

Caroline Chan, Associate Editor

Now that 2017 is gone and 2018 is here, we would like to wish you a happy New Year 2018 (how long after the New Year can we still say it? IT DEPENDS on which calendar you are using).

We have seen more Young Professionals (YPs) getting involved at different levels of the EMC Society and in IEEE. Last year in Washington, DC was the first time where YPs were invited to co-chair some technical sessions during the 2017 IEEE International Symposium on EMC+SIPI. We believe that this experience brings confidence and is a first step to seeing the work behind the scenes. If you were not selected as a session co-chair, it was due to not all Technical Committees (TCs) having sessions or that we had more volunteers than positions so do not hesitate to apply again when we call for YP co-chair volunteer positions. Announcements will always be made late in spring/early summer at www.facebook.com/ieeeypemc so "like it" now before you forget.

Be ready to participate in the TCs or Special Committees (SCs) of your choice. Not familiar what TCs/SCs are? Check out: http://www.emcs.org/technical-committees.html. Make sure to select it to the calendar on the online Symposium app.

We are in for a treat this year with the Joint APEMC and IEEE EMC International Symposium in Singapore and the IEEE EMC+SIPI Symposium in Long Beach. YP activities are scheduled and local YPs will be invited to participate at both of these symposiums as follows:

Singapore:

- Luncheon "What Does your Body Language Say about You" on Monday, May 14. Time TBD
- YP Social Street Food and Walk-around Gardens by the Bay on Tuesday, May 15. Time TBD

Long Beach:

- Luncheon "What Does your Body Language Say about You" on Wednesday, Aug 1 at Rock Bottom Restaurant, 12:00-1:30 pm
- YP Social BBQ/Picnic on Monday, July 30 at the Shoreline Aquatic Park, 6:00 - 8:00 pm. We are looking for volunteers to setup at 5:00 pm

YPs activities are open to registered and non-registered attendees of the symposium. Contact caroline.chan.us@ieee.org for more information. You can also download the IEEE app where you can search for future events occurring around you. Note that the database might not be updated, so drop an email to the EMC Chapter Chair.

However, if you are unable to come physically to the Symposium, you can still join your peers "Live" through the Digital Online Symposium. You will also have the chance to play back the tracks you miss.

Check out our new IEEE EMC Society website www.emcs.org. It has a facelift based on your feedback!

Are you interested in volunteering and not sure where to start? We have many volunteer positions from Technical/Non-Technical to Outreach at University and High School programs.

I am also looking to feature individual YPs in the next several issues. Do you have a paper presented at a past EMC symposium that you would like to republish? Are you working on a project that you would like to give a shout? Drop me an email at caroline.chan.us@ieee.org.

See you in Singapore and Long Beach! **EMC**