Issue No. 231

Fall 2011

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EMC

IEEE EMC Society Newsletter

Special Issue:
The 2011 IEEE International Symposium on EMC

IEEE

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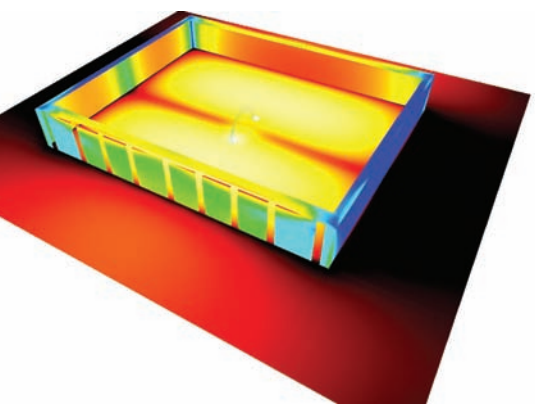

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CHANGING THE STANDARDS

Letter from the Editor

Newsletter Editor Janet O'Neil is shown with ANSI C63® colleagues Bob DeLisi of UL, Zhong Chen of ETS-Lindgren and Don Heirman of Don HEIRMAN Consultants (from left) in Long Beach at EMC 2011.

Longing for Long Beach!

This year's Symposium in Long Beach, California was surely one of the best in recent memory. Now that the weather is getting colder, I long for the sunny climate of southern California.

I trust the uniqueness of the Long Beach Symposium comes through in this issue. It is full of articles on Symposium activity related to the technical program, standards, awards, professional development (iNARTE), education, and exhibitors. We also have our regular articles included for you to enjoy.

It was a pleasure working with the EMC 2011 Symposium Chair Ray Adams of Boeing and his dedicated committee on the 2011 IEEE International Symposium on EMC in Long Beach. Ray and his team are to be commended for an excellent and memorable Symposium.

I've included some photos in my letter showing EMC engineers who traveled great distances to attend the Symposium, celebrating Todd Hubing's birthday aboard the Queen Mary during the Symposium Gala event, and, last but not least, acknowledging the photographers who contributed the many wonderful photos included in this issue. It was nice to turn the camera on them for a change!

Please enjoy the issue and keep in touch. I appreciate your emails and phone calls!

Acknowledgement

The EMC Newsletter wishes to acknowledge the source of the cover art used for the Summer 2011, Issue 230 of the EMC Newsletter. Prof. Dr.-Ing. Thomas Weiland of the Technische Universitaet Darmstadt (thomas.weiland@temf.tu-darmstadt.de) created this computer simulation of a Hertzian dipole field many years ago with the Maxwell-Solver package MAFIA. The original animation is available on his website at temf.de/research/fieldanimations. We thank Dr. Weiland for bringing this to our attention and apologize for the inadvertent omission of his name in the Summer 2011 issue.

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FIELD OF INTEREST

The Field of Interest of the Electromagnetic Compatibility (EMC) Society involves engineering related to the electromagnetic environmental effects of systems to be compatible with itself and their intended operating environment. This includes: standards, measurement techniques and test procedures, instrumentation, equipment and systems characteristics, interference control techniques and components, education, computational analysis, and spectrum management, along with scientific, technical, industrial, professional or other activities that contribute to this field.

Newsletter Staff

IEEE EMC Society Newsletter Publication Schedule

Publication Dates	*Editorial Deadlines*	*Advertising Deadlines*
Summer	July 1	July 12
Fall	October 1	October 11
Winter	January 1	January 14
Spring	April 1	April 11

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President's Message

Francesca Maradei, President, IEEE EMC Society

This is the final President's Message I will be writing as my two-year term is imminent. Serving as President of the IEEE EMC Society (EMC-S) for the calendar years 2010 and 2011 has been a great honor and a very exciting and challenging experience. I have appreciated the many opportunities that have come my way and it has been great to meet so many of our members all over the world at conferences and other social and technical occasions.

On January 1, 2012 Ghery Pettit will take over the duties of President. Many of you may know Ghery for his dedication and long experienced service to the EMC Society as Vice President for Conferences (2009–2010) and Vice President for Communication Services (2005–2008). I ask each of you to give him your full support and encouragement just as you have done so for me. I certainly will be there to help and support him as Immediate Past President. That will be my commitment for the next two years. As Past President, one of my duties will be to encourage many of you to run for the EMC Society Board of Directors (BoD). If you have ever thought you might be interested in running for the BoD please, do not hesitate to contact me. I am looking forward assisting those interested in being nominated to run for the Board of Directors as a Director-at-Large.

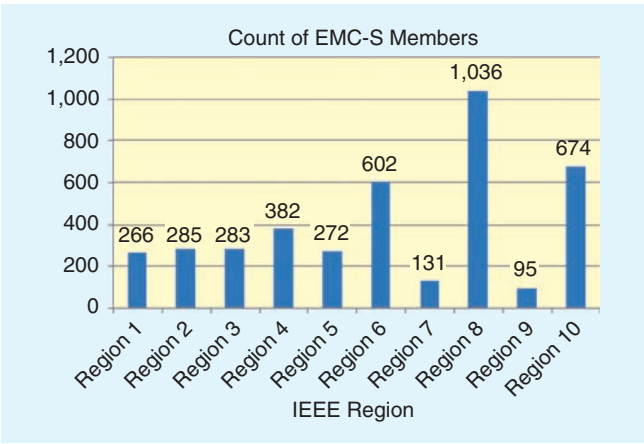
Accomplishments and New Directions

As my term as President is winding down, I would like to take this opportunity to summarize some of the important accomplishments of our Society over the past two years, as well as new initiatives.

Despite the economic slump and the global recession, our Society has managed to remain strong and focused on our primary objectives. The membership has remained stable (slightly above 4,000) and about a half of our members reside outside the U.S.

Important Accomplishments Include:

- **Development and Approval of the Five-Year EMC-S Strategic Plan** – After a three year effort, the EMC-S completed and approved the Strategic Plan (SP). The SP was developed in line with the principles of the IEEE Technical Activities (TA) Strategic Plan. It outlines the EMC-S mission, vision and strategic goals for the coming 5 years.



The **mission** of the EMC-S was defined as follows:

"To foster the development and facilitate the exchange of scientific and technological knowledge in the discipline of electromagnetic environmental effects and electromagnetic compatibility, as detailed in the EMCS's field of interest (FOI), and promote literary, educational and professional aspects thereof, that benefit members, the profession and humanity."

The **vision** of the EMC-S was stated as follows:

"… to be the recognized and respected global organization and leading provider of scientific and engineering information and services in the field of electromagnetic environmental effects and electromagnetic compatibility engineering, technology, and innovation for the betterment of society and the preferred professional development source for our members."

Subsequently, the **five strategic goals** of the EMC-S are:

1) Provide Products of Value to EMC Researchers and Practitioners

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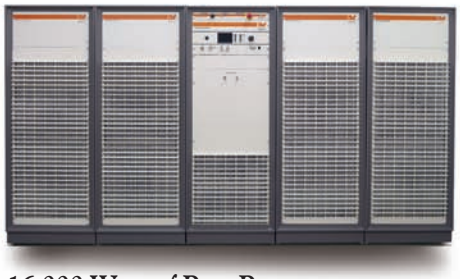
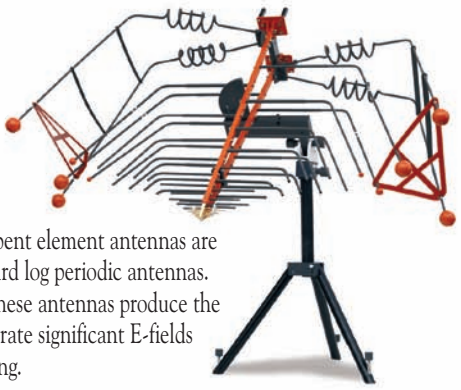
What Have You Done For Me Lately? Plenty!



16,000 Watts of Pure Power

Stand back! We've exceeded our old limits with the new 16000A225 amp. It covers 10 kHz to 225 MHz and delivers 16,000 watts of power.



We've Bent The Rules

Our family of Radiant Arrow bent element antennas are up to 75% smaller than standard log periodic antennas. Covering 26 MHz to 6 GHz, these antennas produce the necessary power levels to generate significant E-fields for radiated susceptibility testing.

We've Pushed The Technology Envelope

We ripped that envelope wide open with our small, lightweight Solid State Hybrid Power Modules. They deliver high output power (up to 5 watts) across an ultra-wide instantaneous bandwidth (4 to 18 GHz).

Our New Dual Band Amplifiers Break Down Old Barriers

With two amplifiers in a single package, you can finally go all the way from 0.8 to 18 GHz with the reliability of solid state.

Our New EMI Receiver: Amazing Speed, Incredible Accuracy

The CISPR-compliant DER2018 covers 20 Hz to 18 GHz and beyond. It combines sensitivity, dynamic range and speed with a more intuitive interface.

Accuracy, Linearity & Bandwidth. Need We Say More?

Our two newest laser-powered E-Field probes, FL7040 – 2 MHz to 40 GHz and FL7060 – 2 MHz to 60 GHz; each do the work of multiple probes, with outstanding accuracy and linearity.

More Power To You

They're smaller and lighter. Yet our new "S" Series amps are available from 0.8 to 4.2 GHz, 20 to 1200 watts and everything in between.

All-In-One Fully Integrated Test Systems

Get more done in less time with everything right at your fingertips. Since it's all provided by AR, you obtain the best accuracy, lowest risk and greatest support in a fully tested system prior to shipping.

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2) Enhance Global Technology Presence, Visibility and Excellence
3) Engage Young Professionals in the EMC Society
4) Improve EMC Society Membership Development and Retention
5) Enhance Community Collaboration

- **Technical co-sponsorship** – Recognizing the importance of collaboration with other IEEE and non-IEEE entities in symposia activities, a new process has been approved for providing EMC-S technical co-sponsorship to symposia (http://ewh.ieee.org/soc/emcs/technicalsponsorship.html). This process provides balance between the desire to collaborate with other symposia and conferences (primarily, enhanced visibility and presence globally) and the need to ensure the quality of those events with which the EMC-S is engaged. This process involves an evaluation by the Technical Advisory Committee (TAC) providing the technical point of view, and the entire BoD who approves (or disapproves) the request, while considering additional aspects as well.
- **Institution of an EMC Standards Travel Grant** – The EMC-S Board of Directors has unanimously approved the implementation of a special grant that was received from a donor. The purpose of the grant is to partially offset travel costs for those EMC-S members who actively participate in EMC-S standards development and attend regular meetings of the EMC-S Standards Development Committee (SDCom), the Standards Advisory and Coordination Committee (SACCom) and the Standards Education and Training Committee (SETCom). The EMC-S appreciates the opportunity to assist those members advancing the standards activity of the Society via the implementation of the travel grant. The EMC-S will administer the grant by providing proper oversight of delegated duties to a Standards Travel Grant Committee.
- **Five-Year Society Review** – The EMC Society successfully completed the periodic five-year Society review administered by the TAB Society Review Committee (SRC). This review focuses on the extent to which the Society is maintaining its vitality and technical leadership in its field of interest and the ways in which it is cooperating with other entities.
- **Review of the EMC Transactions** – Our flagship periodical has successfully passed the traditional five-year review by the IEEE. The review process went well and the overall feedback received from the Periodicals Review and Advisory Committee (PRAC) was positive.
- **EMC Magazine** – The IEEE has approved the transition of our newsletter to a magazine that will be launched in the first quarter of 2012.

In my first President's Message that appeared in the Winter 2010 issue, I mentioned **new technologies** and **globalization** as the two keywords associated with my term's challenges. Well, over the last two years we have made significant progress in each of these fields as well.

The Society's Technical Involvement in New Technologies has been Significant as Demonstrated by:

- The upcoming Special Issue of the IEEE Transactions on EMC that addresses *"Applications of Nanotechnology in Electromagnetic Compatibility (nano-EMC)",* which is the result of the activity of the recently established technical committee TC-11 on Nanotechnology;
- The intense and successful activity of the special committees *SC1 – Smart Grid* and *SC2 – Low Frequency EMC* whose sponsored workshops at the Long Beach EMC Symposium were filled to capacity;
- The establishment of the new technical committee TC-7 – Low Frequency EMC, based on the successful and consolidated activity of special committee SC2.

Further Growth at an International Level has been Achieved as Evidenced by:

Internationalization of the EMC-S Board of Directors – The "international" representation (i.e., non-US residents) on the BoD has significantly increased over the last couple of years, moving from three international members in 2009 to the current seven international members.

- **Expanding EMC Symposia worldwide** – For the first time in many years, the 2015 IEEE International EMC Symposium will be held outside the United States. The EMC-S Board Directors has approved to hold two EMC Symposia in 2015, one International that will be held in Dresden (Germany), and one in Santa Clara (CA, USA). The last time the EMC-S held a Symposium outside the US was in Istanbul in 2003! The 2015 IEEE International Symposium on EMC in Dresden is expected to be a memorable event as it will be held in conjunction with the EMC EUROPE conference.
- **Increased cooperation with EMC related conferences worldwide** – In the past two years, the EMC Society has approved cooperation with the following international conferences:
  - *2010 Asia Pacific EMC Symposium*, April 12–16 2010, Beijing, China
  - *EMC Europe 2010*, September 13–17, 2010, Wroclaw, Poland
  - *SPI 2011 – 15th IEEE Workshop on Signal Propagation on Interconnects*, May 8–11, 2011, Naples, Italy
  - *2011 Asia Pacific EMC Symposium*, May 16–19 2011, Jeju Island, Korea
  - *EEMC 2011,* September 15–17, 2011, Split-Hvar-Bubrovnik, Croatia
  - *EMC Europe 2011*, September 26–30, 2011, York, UK
  - *APL 2011*, November 1–4, 2011, Chendu, China
  - *EMC COMPO 2011*, November 6–9, 2011, Dubrovnik, Croatia
  - *IEEE COMCAS 2011*, November 7–9, 2011, Tel Aviv, Israel
  - *The 10th EMC Society of Australia Symposium*, Nov. 9–11, 2011, Perth, Australia
  - *SPI 2012 – 16th IEEE Workshop on Signal Propagation on Interconnects*, May 13-14, 2012, Sorrento, Italy
  - *2012 Asia Pacific EMC Symposium*, May 21–24, 2012, Singapore
  - *2012 ESA Workshop on Aerospace*, May 21–23, 2012, Venice, Italy
  - *EUROEM 2012*, July 2–6, 2012, Toulouse, France
  - *EMC Europe 2012,* September 17–21, 2012, Rome, Italy
  - *CEEM 2012*, November 6–9, 2012, Shanghai, China
- **Increased chapter development worldwide** – In the last two years we have welcomed seven new chapters worldwide:

Syracuse, Pikes Peak and South Michigan in IEEE Regions 1–7; Nigeria, Serbia and Montenegro in IEEE Region 8; and Shanghai and Chengdu in IEEE Region 10.

New chapters formed over the last two years (2010 and 2011)

IEEE Region 1–7	Syracuse, Pikes Peak, South Michigan
IEEE Region 8	Nigeria, Serbia and Montenegro
IEEE Region 10	Shanghai, Chengdu

Another Memorable Symposium

I am pleased to report that the Long Beach Symposium was a huge success. As usual, the Annual EMC Symposium was the most productive, exciting, and extremely busy week of the year. The full week Symposium has provided a wide range of activities including workshops, tutorials, technical sessions, meetings, experiments, demonstrations, a technical exhibition, and the Global EMC University Program. I want to take this opportunity to thank Ray Adams, the 2011 EMC Symposium General Chair, and his dedicated symposium committee for their efforts in running such a high-quality and extremely enjoyable event.

One of many interesting creatures at the Aquarium of the Pacific.

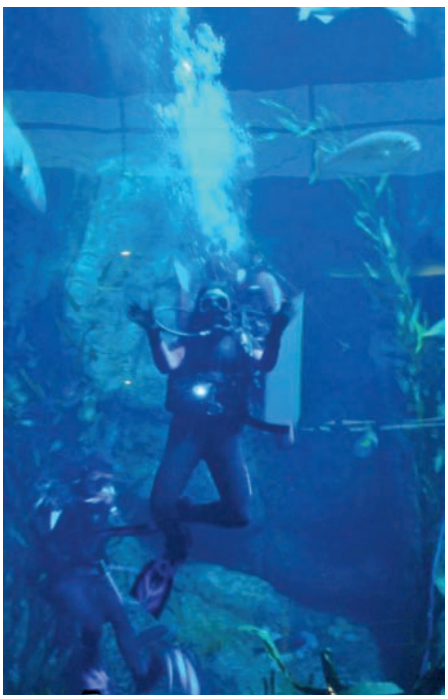
Francesca Maradei of the University of Rome, "La Sapienza" with Board members Janet O'Neil of ETS-Lindgren and Todd Hubing of Clemson University at the 2011 EMC Symposium's Awards Luncheon.

Although several technical and social events deserve to be acknowledged, I wish to point out just a few personally relevant moments as you will find a detailed report and photos of the annual Symposium in the following pages of this Fall 2011 Newsletter.

The Monday workshops on low frequency EMC, power quality, and EMC aspects of smart grid were a true success. I was impressed to see such a huge participation and so much interest in these topics. I wish to acknowledge the outstanding activity of the Special Committees SC1 – Smart Grid and SC2 – Low Frequency EMC.

Regarding the social program, the Welcome Reception held at the Aquarium of the Pacific was for sure the most memorable in the history of the IEEE EMC Symposia. The Symposium Chair Ray Adams and I welcomed the participants to the 2011 EMC Symposium from the Blue Cavern tank of the aquarium with a really unusual dive/speech. I was

Francesca Maradei with Professor Wu Qun of the Harbin Institute of Technology and founder of the Harbin, China joint MTT/AP/EMC Chapter.



Francesca Maradei greets the Welcome Reception attendees from the 350,000 gallon tropical reef habitat at the Aquarium of the Pacific.

delighted to jump into the 350,000 gallon tropical reef habitat with more than 1,000 tropical fish to deliver a welcome message. It was very exciting to surprise the symposium participants, and really fun to see the astonished faces of people looking at the tank and trying to figure out which diver was Ray and which was me!

I look forward to enjoying the 2012 EMC Symposium in Pittsburgh; I know that Mike Oliver and his committee are working hard to make this another successful and memorable event.

Global Outreach

As part of the traditional global outreach focused on strengthening the relationship with EMC communities around the world, I attended the *EMC EUROPE 2011 Symposium*, held at the University of York, United Kingdom, on September 26–30. This high quality Symposium was attended by more than 300 delegates from all over the world. Over 200 contributions were submitted for presentation; of these, 158 papers were accepted for presentation and organized in 35 oral sessions and two poster sessions.

In addition to the high quality technical program, I was pleased to be involved in the nice celebration that Symposium chair Andy Marvin organized for our European colleagues Christos Christopoulos and Vesna Roje to celebrate their forthcoming retirements. I had the pleasure to acknowledge our colleagues' most significant achievements during the Welcome Reception at the National Railway Museum, in York, UK.

I would also like to acknowledge the memorable dinner organized for the EMC EUROPE International Steering Committee at a gorgeous mansion built in an early Georgian style. The Mansion House is the home of the Lord Mayors of York during their term in office and we had the honor of having the presence of the Lord Mayor and Lady Mayoress at the dinner.

The IEEE EMC Society has endorsed the EMC EUROPE conferences for many years, and it has been a great pleasure for me to help in strengthening this cooperation. As already mentioned elsewhere in this message, in 2015 the EMC Society will hold the 2015 IEEE International Symposium on EMC in Dresden in conjunction with EMC EUROPE.

The exhibition center at the University of York.

The EMC EUROPE Welcome Reception was held at the fascinating Railway Museum.

Welcome Newly Elected Board Members!

I would like to congratulate the newly elected members of the Board as they look forward to their three-year terms of serving the Society in their special roles. Congratulations to Amy Pinchuk and Frank Sabath who are both elected to the Board for the first time, and to past Board members Colin Brench, Fred Heather, Mark Montrose and Dave Staggs for joining us on the Board again.

IEEE EMC Society Newsletter Goodbye!

By coincidence, my final President's message appears in the final issue of this venerable Newsletter. I wish to acknowledge the extensive service to our members that the IEEE EMC Society Newsletter has provided over the years. It has become a respected source of technical information related to EMC with improved quality technical papers and expanded coverage of EMC technical meetings and events. The success and popularity of the EMC Newsletter can be credited to the tireless work, dedication and skillful leadership of Editor-in-Chief Janet O'Neil and her team of Associate Editors.

As already announced, at the beginning of 2012 this Newsletter will be replaced by the IEEE Electromagnetic Compatibility Magazine and will be included in the IEEE Xplore digital library. Therefore, the technical papers appearing in the EMC Magazine will have much wider exposure. I solicit authors to submit the outcomes of their practical research and design tips for publication in the forthcoming EMC Magazine.

Board of Directors Meetings

The next EMC Society Board of Directors (BoD) meeting is scheduled for **March 16–18, in Scottsdale (AZ)**. All meetings

Francesca Maradei (center) with Vesna Roje of the University of Split (Croatia) and Christos Christopoulos of the University of Nottingham (UK) after celebrating their retirement during the EMC EUROPE conference.

The EMC Society delegation attending the EMC EUROPE International Steering Committee dinner with the Lord Major of York (center left) included Perry Wilson, Ghery Pettit, Andy Marvin (who chaired the EMC EUROPE Conference), Francesca Maradei and Vesna Roje (from left).

Francesca Maradei passes the gavel to the upcoming EMC-S President Ghery Pettit of Intel at the November Board meeting.

of the EMC Society BoD are open. Any members who want to attend will be most welcome. The schedule of the BoD meetings is posted on the website at http://www.ewh.ieee.org/soc/emcs/conferences.html.

Stepping Down

In closing, I would like to thank the Executive Committee of the Board of Directors for all their tremendous support over the past two years and for making my job go very smoothly. I would also like to thank the Board members who served with me in 2010 and 2011. I appreciated their time and efforts to continue to make the EMC Society successful. Special thanks to Janet O'Neil for her tremendous support and for her patience in waiting for my President's Message!

My thanks go also to the committee chairs for their initiatives in accomplishing their specific responsibilities; the chapter chairs for maintaining a global Society influence, and last but not the least, the regular members of the Society for their support and dedication. Without the cooperation and hard work of the many members who serve the Society in a volunteer position, the success of the Society wouldn't be possible.

All in all, it has been an enjoyable and productive two years and I believe that the EMC Society will accomplish even greater things in the coming years. As for me, I am looking forward to continuing my commitment and active involvement in the EMC Society. **EMC**

Chapter Chatter

Todd Robinson, Associate Editor

A New York Hour: My Lunch With Vinny. Part 1

By Mike Violette

The magazine industry has hosted many legends of the written word, notably Stephen Crane, Ernest Hemingway and Sir Arthur Conan Doyle. More recently, Stephen King released *The Green Mile* in serial form. This technique provided for a method to break longer novels into short, easier to digest bits and, more pointedly, kept the magazine with returning subscribers, eager to find out the next twist of the plot.

The tradition of serialized stories goes back many years, before widespread use of the printed word, to the 10th Century AD, where the "*Stories of the Arabian Nights*" was assembled in the city of Baghdad. Originally *"One Thousand and One Nights,"* the story was translated into Arabic from the Persian prototype, *Hazār Afsān,* and features the use of the cliffhanger device, which helped a young woman stay alive night after night.

You see, the Persian King, Shahryar, had sentenced the clever Scheherazade to die because of his misogynistic view of the fairer sex. In order to spare her own life, she wove a series of cliffhanger tales together for one thousand and one nights - hence the title - which included the story of Aladdin's Lamp, Sinbad the Sailor and Ali Baba. Now that these classics have morphed into the common experience (as immortalized by Disney Co.) one would say that the serialization strategy was a success. I am not sure what happened at night one-thousand and *two*. Perhaps Shahryar relented and fell in love with the comely Scheherazade. After nearly three years, one would think that he formed some kind of opinion.

Alas, in EMC, once you've wrapped up the test or troubleshooting exercise or the workshop, there is not much in the way of immortalization. No one really remembers that extra 2 dB that took much labor and tears. Sadly, no songs are sung about the tireless efforts of the antenna balun designer. Alas, so be our lot.

But every once in awhile, a chance to have a glimpse into another world is afforded our lonely existences. This is the tale of one small story: My Lunch with Vinny.

In the mid 1990s I was called to investigate some noise problems in an office in mid-town Manhattan. The organization was (is) the publisher of many top-rated and well-known national magazines, the kind with the perfumed pages and drop-dead gorgeous models displaying the icons of the fashionistas. Entering the lobby, one is greeted, as would be expected, by shiny polished floors and a room-wide reception station; a modern swooping sculpture in glass hangs in the windowed atrium which echoed with the clicks of Bruno Magli high heels.

I hauled my folding cart, loaded with equipment, over to the receptionist, who was turning pages in a magazine. "I'm here to work with Ms. Brady."

The receptionist looked down from her perch at my battered blue Samsonite suitcase (containing a set of antennas) and the odd machine with a black-green display and dozens of buttons. I had on my clean plaid shirt which I painstakingly matched with my best brown corduroys.

"Hold on. Ah'll ring hurh." She looked at her console and jabbed a few buttons. "Ms. Brady? Yur man is here." She then hung up the phone and went back to her magazine.

After a few moments, Ms. Brady came down. She was pert and trim, signed me in and led me to the inner sanctum. We jammed into an elevator with a hundred other people, all suited, smart and elegant. I swooned with the atmosphere of Chanel and Yves Saint Laurent. There was certainly no opportunity for small talk in this hussle-town elevator.

At the forty-eighth floor, we exited and turned down the hall and into a suite of cubicles, tight with workstations, humans and glossy stacks of magazines.

"The problem is here. These computers aren't working right."

"Ok…anything else you can tell me?"

"Well, these machines here are new and they are the same as the setup on the other side of the building where everything is working correctly." Ms. Brady, obviously pressed for time, didn't have a lot of information to share. "We think it's some kind of noise. That's what our computer guy said. So we called you guys." She glanced at her watch. "Listen, Mark, is it?" I nodded. What the hell. "Mark, I've got meetings all morning. I'm sending Vinny down to look after you. He'll be here in a while."

She started walking away, but suddenly turned and looked back over her shoulder, her face softening a little, like she was talking to a stray, "Vinny will take you to lunch, too." She turned and clicked efficiently down the hall. "I'll see you at four pm," she added, waving four fingers in the air; this time not turning.

I unpacked, took out the antennas - which is always good for a few laughs - once I was walking down Third Avenue with a fully-extended bicon. People parted like the Red Sea, and I was Moses with his staff. Anyway, the rest of the morning went by uneventfully. I clipped on current probes and made meaningless measurements of the radiated spectrum. The problem could have been solved by inspection. The CAT 5 cable was unshielded and there was enough incidental noise to corrupt the data. The prescription was going to be pretty easy. This was in the days of plotters and printers (what's a JPG?); each plot was hard-copy.

At about 11:45 am, the door to the room swung open and a trim, clean, sharp jawed Italian-American guy, about

five foot six in a natty three piece gabardine suit stepped in, looking everything like a young Al Pacino. He surveyed the room, as if checking out the venue for a cock-fight, walked over to me a tipped his chin up.

"Yo! You the consultant?"

"Yes. Are you Vinny?"

"Yep. Getchya coat. We're going out for *lunch*!" He paused. "And it goes like this, OK: I pick the place. You pick up the check."

Well this should be good. I flipped off my spectrum analyzer and followed Vinny into the elevator.

He pressed G and the elevator whooshed downwards.

Chicago

Jerry Meyerhoff, Chapter Secretary, reports that the Chicago Chapter IEEE EMC-S Fall 2011 season opened on Wednesday, September 21 with an evening technical program hosted on the IIT Rice campus in Wheaton, IL. The Chapter provided pizza dinner for the 25 attendees.

The talk "EMC Testing for Cables" was delivered by Louann Devine of Panduit who is also a Chapter officer. Louann explained that copper is still effective as an interconnect to 20 GHz. The challenge is to make the entire cable assembly work for EMC as a system, including the connectors on the cables as well as their receptacles, the PCB cards and boxes. Furthermore, existing standards from CISPR, FCC and the like do not fully address the technical design requirement for success. As a result, Louann performed some unique mode-stirred shielding effectiveness tests to identify and correct the weakest link in the designs. In short,

Speaker Louann Devine and Roy Leventhal discuss "Cable EMC" at the Chicago Chapter's September meeting.

Louann Devine of Panduit receives a speaker's plaque from Chicago Chapter Chair Jack Black of DLS Electronic Systems.

Bill Kimmel was the featured speaker on the topic of grounding at the Chicago Chapter's OktoberFest meeting hosted by ELITE Electronic Engineering.

Bill Kimmel makes a point about grounding to the Chicago Chapter at its October meeting.

it is all about the mechanical integrity of contacts, particularly the grounds. Testing using realistic and real-world applications of the connectors was crucial.

Louann walked attendees through a large amount of data, interpreting it, to point out the best design performance. She also described practical near-field probe methods to pin-point the weak connection areas.

The annual OktoberFest meeting on Thursday, October 13 was again hosted by ELITE Electronic Engineering in Downers Grove, IL. They provided complimentary traditional German food and drink to the crowd of 75 attendees. Chapter members finally pushed away from the banquet table and conversation to enjoy Bill Kimmel of www.emiguru.com present on "Mysteries of Grounding." Bill explained that there are a lot of misconceptions about grounding and carefully led us through the hierarchy of requirements from the core of safety up through EMC. He emphasized analysis methodology, focusing on sources, victims, amplitude, time duration, frequency, impedance, pathways and loops. Bill offered useful rules of thumb and rapid approximations to sort through problems. He illustrated the principles through several case studies and highlighted general design guidelines and best practices for success.

For the next meeting, the Chapter chose to support the Chicago Section's November 15 Technical Conference and Exposition titled "2011 – Today's Engineering Challenges." This is a full day two-track program at the Argonne National Laboratories, in suburban Argonne, IL. Speakers will address the theme "Today's Challenges, Tomorrow's Solutions." The conference will offer insights into the latest in energy topics, new information on engineering issues from a personal level, development of new technology and thought provoking engineering skills enhancement. Chicago EMC-S members are eligible for a limited supportive stipend applied to the conference fee. www.ieeechicago.org/2011conf.

Germany

Shortly after the summer break, the German EMC Chapter invited students to meet at the coastline of the Baltic Sea in Schloss Noer, an 18th century country estate turned into a youth hostel. The Chapter, along with the Helmut-Schmidt-Universität/Universität der Bundeswehr Hamburg and the Summa Foundation HPE 201-2011, organized a short course on High-Power Electromagnetics from September 18 to 24, 2011. The course director, Dr. D. V. Giri, and the organizer, Dr. Lars Ole Fichte, dedicated the HPE 201–2011 course to the memory of Dr. Carl Baum, head of the Summa Foundation courses, who died in November 2010 and who had previously served as the course director of all former HPE short courses.

The fundamental concept of the course was to bring young engineers starting to work in the field of HPEM together with the veteran engineers in a place without any interference from the outside. The outstanding hospitality of the venue and the small number of students guaranteed the success of this concept. The faculty encompassed well recognized colleagues in the field of High-Power Electromagnetics, including Dr. D. V. Giri, Dr. R. Gardner, Dr. F. Tesche, Dr. J.-P. Parmantier, Dr. A. Kaelin and Dr. F. Sabath.

During the one week duration of the course, 15 students from seven countries attended lectures from six of the leading scientists in the field of High Power Microwave and Electromagnetic Pulse. The students actively contributed to the course by solving a set of exercises in cooperation with the staff. In the historic environment of Schloss Noer, these activities usually took place in the late evenings; the record for the last student leaving the lecture room being 1:30 a.m.

In addition to lectures and practical problems, the participants faced the challenge of composing Limericks on matters or other aspects of the short course. Finally, all students were able to reach the goal of the course.

Participants and staff of the HPE 201-2011 short course in front of the Schloss Noer, Germany. The course was dedicated to the memory of the late Dr. Carl Baum.

Students are shown discussing a topology problem with Jean-Phillipe Parmantier in an evening session of the High-Power Electromagnetics short course held in Germany.

Mrs. Melanie Deperschmidt of the University of Applied Sciences Hannover was awarded the prize for the best student presentation. All participants as well as members of the faculty agreed that the one week in Schloss Noer was of value and worth the time.

The week after the course in Schloss Noer, several members of the German EMC Chapter attended EMC Europe 2011 which took place at the University of York in the United Kingdom. Following tradition, Germany Chapter members met in a local pub to discuss matters of the Germany Chapter as well as exchange interesting news.

Hong Kong

The IEEE Hong Kong EMC Chapter and Professor Sergio Pignari (IEEE EMC Society Chapter Coordinator) held a meeting at the City University of Hong Kong (CityU) on September 21, 2011. During the meeting, they discussed and exchanged some ideas on both the current status and future development strategies of the EMC Society and Hong Kong EMC Chapter. Professor Pignari and his colleague, Dr. Flavia Gassi, were also invited to visit the Applied Electromagnetic Laboratory of City University.

Professor Sergio Pignari (IEEE EMC-S Chapter Coordinator) and the committee members of the Hong Kong EMC Chapter took a group photo after the meeting. Front row from left are Dr. Flavia Gassi, Dr. Duncan Fung (Chairman of the Hong Kong EMC Chapter), Professor Sergio Pignari, and Dr. Brian Chan. Back row from left are Stanton Lui, K. W. Chen, Wai Leong, Dr. Patrick Wong, Jacky Tang, Dr. K C Lee, George Chan, and Steven Tsang.

Italy

The IEEE Italy EMC Chapter held a successful event on September 22, 2011 at the Politecnico di Torino. Professor Mark Steffka of the University of Michigan – Dearborn spoke on "Effective and Efficient Methods for EMC Pre-Compliance Evaluation of Automotive Components and Systems." Professor Steffka discussed the basic issues facing vehicle level automotive EMC and how these issues can be identified at a component level to provide valuable insight and maximize the number of possible solutions at the

A seminar entitled "Effective and Efficient Methods for EMC Pre-Compliance Evaluation of Automotive Components and Systems" was held at the Politecnico di Torino, Italy with speaker Professor Mark Steffka of the University of Michigan – Dearborn.

earliest stages. A total of 20 participants attended this excellent technical seminar, which was chaired by Professor Flavio Canavero of the Politecnico di Torino.

Nanjing

Professor Xiaowei Zhu, Ph.D., Chapter Secretary, reports that in September Dr. Keren Li from the National Institute of Information and Communications Technology (NiCT), Japan visited the Southeast University in Nanjing, China. During his visit, the IEEE MTT/AP/EMC Joint Nanjing Chapter invited him to give a technical talk titled "60 GHz-Millimeter-Wave Wideband Devices, Circuits, and Antennas," to Chapter members well as students.

Dr. Keren Li from the National Institute of Information and Communications Technology (NiCT) speaks to the Nanjing Chapter in September.

Oregon and SW Washington

Alee Langford, Chapter Vice-Chair, reports that the Oregon and SW Washington Chapter resumed their fall program by welcoming Blake Dietze for the September meeting. With 30 attendees, nine of whom were students from the University of Portland, they enjoyed a great meal consisting of smoked pulled pork sandwiches, chips and slaw. The presentation provided a history of the evolution of tubes from triode to pentode and so on. The speaker brought several radios representing the era from 1910 and 1940. When asked who developed the first radio for cars, the audience was stumped. The answer was so obvious. It was "Motor" ola.

For the October meeting, Charles F. Bunting (Distinguished Lecturer) will present a discussion on the use of reverberation chambers for radiated emissions testing. The following month, Darren McCarthy of Tektronix will present

Blake Dietze gave a history based presentation to the Oregon and SW Washington Chapter on the evolution of tubes from triode to pentode and on.

new measurement advances in the field of multi-domain measurement correlation for embedded wireless devices. The Chapter will end the year with the winter social event at Who Song and Larry's overlooking the Columbia River.

Meeting details and additional information can be found by visiting the Chapter website at http://ewh.ieee.org/r6/oregon/emc/.

Philadelphia

Larry Lederer reports that the Philadelphia Chapter held a meeting on September 20 at AR RF/Microwave Instrumentation, in Souderton, PA. Nearly 40 attendees were present for networking, dinner and technical presentations. Gary Fenical of Laird Technologies spoke on "Shielding Basics" and George Barth and Mike Hannon of AR spoke on "Testing Faster."

The Chapter also held an executive committee meeting on October 4, 2011. The committee discussed future meeting topics, speakers and locations for the 2011/2012 time frame. In attendance were Dean Landers of Retlif Labs, Finbarr O'Connor of Alion Sciences, Gil

PHOTO BY LARRY LEDERER OF IMAGITRON SALES

Dean Landers of Retlif Labs (back to camera) and (clockwise from left) Finbarr O'Connor of Alion Sciences, Gil Condon of Lockheed-Martin, Chapter Chairman Graham Kilshaw of Interference Technologies Magazine, and Rafik Stepanian of LCR attended the Philadelphia Chapter's executive committee meeting on October 4.

Condon of Lockheed-Martin, Chapter Chairman Graham Kilshaw of Interference Technologies Magazine, and Rafik Stepanian of LCR.

Pittsburgh

A joint technical meeting of the IEEE Pittsburgh Women in Engineering (WIE) Affinity Group and the EMC Chapter was conducted on August 11, 2011 at the Westinghouse Facility in Monroeville, PA. Dr. Rin Burke, Chairman of the WIE Affinity Group, and EMC-S Chapter Chair Mike Oliver, along with Co-Chair Harry Godlewski, hosted the technical meeting with approximately 15 people in attendance.

At the onset of the meeting, Rin and Mike discussed WIE and the EMC Chapter of IEEE along with upcoming technical meetings and presentations. The meeting started with a dinner at 6:30 pm prior to a 7:00 pm technical presentation. The Chapter had the privilege of having Paul R. Ohodnicki, Jr. as the technical speaker.

A well deserved plaque was presented to Dr. Ohodnicki by the Pittsburgh Chapter.

The Women in Engineering Affinity Group and the Pittsburgh EMC-S Chapter held a joint technical meeting on August 11.

Dr. Ohodnicki is employed by the National Energy Technology Laboratory (NETL), Chemistry and Surface Division. His presentation was entitled, "Advanced Nanostructured Materials for Energy Applications: Optical Thin Films for High Temperature Gas Sensing and Magnetic Nanocomposites for High Frequency Power Electronics." Advanced nanostructured materials are playing an increasingly important role in a wide range of energy related applications including catalysts for fossil energy generation, semiconductor and metallic nanostructures for solar energy generation and energy efficiency, advanced energy storage and batteries, and higher frequency power electronics for grid-scale power conditioning and grid integration. Research at the National Energy Technology Laboratory (NETL) is targeted towards improving energy efficiency and reducing greenhouse gas emissions through development of the next generation of advanced fossil energy technologies for large-scale centralized power plants including coal gasification, oxy-fuel combustion, solid oxide fuel cells, gas turbines, and CO2 capture and sequestration. The talk focused on two areas in which nanostructured materials play an important role in areas of interest to NETL's core mission: (1) Advanced high temperature gas sensor materials for fossil energy process monitoring and control, and (2) Magnetic nanocomposites for grid integration of fuel cells in high frequency power conditioning systems.

Santa Clara Valley

On September 13, the Santa Clara Valley Chapter gathered at Applied Materials in Santa Clara for dinner, networking and an excellent technical presentation. Lee Ritchey spoke to the Chapter on "Designing PCB Stackups to Balance Signal Integrity vs. Manufacturability."

Mr. Ritchey's session covered all of the aspects of PCB stackup design from materials choices to arrangement of signal layers and power planes to take the most advantage of the fabrication process. It was taught by an engineer who has been designing PCB stackups for the workstation and super computer marketplace since these products began to be designed and is currently designing stackups for a wide range of products including terabit routers and other products employing signaling protocols to as high as 20 GB/S. Mr. Ritchey has worked with PCB fabricators from the inception of multilayer PCB manufacture and currently works with both fabricators and laminate suppliers to achieve the highest performance from the overall process at the lowest cost.

PHOTO BY JERRY RAMIE

Lee Ritchey gave an excellent presentation to the Santa Clara Valley Chapter regarding "PCB Design and Manufacturability" issues in September.

Sendai

The Chapter is saddened by the passing away of Professor Emeritus Risaburo Sato who was the founder of the Chapter. As a memorial to him, the Sendai Chapter held a meeting, the Risaburo Sato Memorial Colloquium, on October 5, 2011 in Sendai. After a memorial address by Chapter Chair Hiroshi Inoue, a lecture was by given by Professor Tetsuo Ikeda in memory of Professor Sato. Professor Ikeda joined Professor Sato's lab in Tohoku University in 1960. His talk included descriptions of the wide-spread research activity of the lab, memories of daily life in the lab and the life lessons he received from Professor Sato.

Following the memorial lecture, Past-Chairs Tasuku Takagi, Hiroshi Echigo, and Akira Sugiura gave talks on the history of

A total of 43 participants attended the Sendai Chapter's Risaburo Sato Memorial Colloquium held on October 5.

An invited lecture was given by Tetsuo Ikeda who was a member of Risaburo Sato's lab at the Tohoku University.

the Sendai Chapter and research work in the Sendai Chapter. Presentations on current research activities and future views on EMC research in the Chapter area were given by Chapter Chair Hiroshi Inoue and twelve other speakers representing 43 participants from EMC research groups in Akita University, Akita Prefectural University, Hachinohe Institute of Technology, Oi Electric, EMC Research Laboratory, NEC Tokin, Alps Electric, Tohoku Gakuin University, and Tohoku University.

After the Colloquium, Chapter members gathered for a banquet and shared memories of Risaburo Sato. The Chapter also discussed future perspectives on collaborative activity of the Chapter and member development. The banquet was concluded by Past Vice-Chair of the Sendai Section, Professor Kunio Sawaya.

Serbia-Montenegro – Welcome New Chapter!

Vesna Javor, Chair of the newly formed Serbia and Montenegro (S&M) EMC Chapter, reports the Chapter actively participated in the Jubilee 10th International Conference on Applied Electromagnetics, ΠEC 2011. In fact, Dr. Javor was also the Conference Chair of ΠEC 2011. The event was held at the Faculty of Electronic Engineering of the University of Niš, from September 25–29, 2011. During ΠEC 2011, there were nine oral and two poster sessions with presentations of papers by 167 authors from 20 countries: Austria, Bosnia & Herzegovina, Bulgaria, China, Croatia, France, Germany, Greece, Hungary, Iran, Italy, Macedonia, Montenegro, Portugal, Romania, Russia, Serbia, Slovenia, Sweden and USA. ΠEC 2011 gathered scientists and researchers, students and engineers in the fields of applied electromagnetics, electromagnetic compatibility, computation of electromagnetic fields, coupled field problems, electric circuits and systems, measurement techniques, computer programs and simulations in electromagnetics. Being a scientific and professional meeting aimed at the efficient exchange of research results, ideas and knowledge, so as information about new development trends in this area, the

IEEE EMC Society Distinguished Lecturer Mark Steffka of the University of Michigan-Dearborn, USA spoke at the ΠEC 2011 conference.

ΠEC 2011 Conference contributes to international collaboration of universities and institutions, together with improvements of the quality of education and training at these universities. Selected papers from ΠEC 2011 will be published in the scientific journals: Elektrotechnica&Elektronica E+E (Bulgaria), Facta Universitatis (Serbia), and the international open-access online journal IJES (International Journal of Emerging Sciences).

(From left to right) Organizers of ΠEC 2011 included Danijel Danković, IEEE Serbia and Montenegro (S&M) Student Branch Chair; Mirjana Perić, S&M EMC Chapter Secretary; Vladimir Katić, S&M PES Chapter Chair; Vesna Javor, S&M EMC Chapter Chair; Nataša Nešković, S&M Section Chair; Vera Marković, S&M Section Vice Chair; and Mladen Koprivica, S&M Section Secretary.

ΠEC 2011 participants are shown in front of the Faculty of Electronic Engineering of Niš.

This year ΠEC 2011 had a Special Session on Green Energy, "New technologies for improving energy efficiency," devoted to the late Professor Dr. Predrag Rančić, who was a member of the ΠEC Scientific Committee. Papers on this topic, as well as of other ΠEC sessions, had many inspiring and novel ideas. There was also an interesting presentation of 3D computer models of the inventions of Nikola Tesla. It is the result of the Joint Project of the Faculty of Electronic Engineering of Niš and the Museum of Nikola Tesla in Belgrade (http://www.tesla-museum.org/meni_en.htm). Nikola Tesla, the great inventor, scientist and electrical engineer, as well as a genius far ahead his time, was of Serbian origin. For more information about ΠEC 2011, see http://ΠEC2011.elfak.ni.ac.rs.

The new EMC Society Chapter of Serbia and Montenegro was founded on April 8, 2011, and—what a coincidence – it was also the Jubilee 10th Year of ΠEC. ΠEC Chairman and EMC Chapter

Nataša Nešković, IEEE S&M Section Chair with the University of Belgrade in Serbia, provides an overview of the Serbia and Montenegro Section's Student Branches at ΠEC 2011.

Mark Steffka and his wife Becky (center foreground) attended the opening ceremony of the ΠEC 2011 conference.

Milena Lukić (left) a student at Niš in Serbia and Bojana Nikolić, a member of the conference organizing committee at Niš in Serbia, staffed the ΠEC 2011 registration desk.

At the social event following ΠEC 2011, attendees enjoyed an evening of polka dancing, including Professor Miroslav Prša from the Technical Faculty of Novi Sad, Serbia and Becky Steffka (couple at left).

Chair Dr. Vesna Javor initiated the first activities of the EMC Chapter meeting together with the visit of an IEEE EMC Society Distinguished Lecturer. On September 26, 2011, Professor Mark Steffka, from the University of Michigan-Dearborn (USA), gave a lecture on two very important topics of interest to the EMC Society members of the region and to ΠEC 2011 participants. The IEEE EMC Society fully supported this event, and colleagues from the Italy EMC Chapter collaborated on rearranging dates of his visit to Italy to make it possible. Thus, Professor Steffka gave an invited lecture at the University of Turin in September as well.

A great number of ΠEC participants attended the very interesting lecture given by Professor Mark Steffka on two topics. The first was on antennas and transmission lines, explaining how electromagnetic energy transferred to and from an antenna or transmission line is responsible for EMC issues, and giving an overview of computer methods to assist in antenna design and "real-life" examples. The second was titled, "Process and Benefits of Industry/Academic Linkage in EMC Education." As bridging the gap between the knowledge in academia and the application in industry is critical to any successful EMC work, this topic examined methods needed to be considered when trying to fill in this gap, and highlighted examples of successes.

The visit of Professor Mark Steffka was very successful in many ways. He also supported the newly founded IEEE EMC Society Chapter of Serbia and Montenegro and showed great willingness to help professionally, as much as possible, in all the planned activities.

Since October 6 is IEEE Day throughout the world, the ΠEC Conference, together with the IEEE Serbia and Montenegro Section, held a Board meeting and EMC Chapter organized lecture. These were marked as IEEE events to celebrate IEEE Day (see http://www.ieeeday.org/local-event/upcoming-events). The year 2011 is also the 40th anniversary of IEEE S&M Section (http://www.ieee.uns.ac.rs). Section Chair, Dr. Nataša Nešković, spoke about the Section development at the ΠEC opening ceremony. The local IEEE Student branch also joined the ΠEC events.

ΠEC 2011 participants enjoyed warm hospitality at the Faculty of Electronic Engineering and in the host town of Niš, and shared a very friendly atmosphere not only during the ΠEC Conference sessions, but also in between. They enjoyed being with their colleagues at social program events as well. Niš is the birth place of the Roman Emperor Constantine the Great, who legalized Christianity in the entire Roman Empire in the year 313 by the Milan Edict. The year 2013 will be the celebration of 17 centuries from this event. ΠEC participants visited the remains of Constantine's residence Mediana near the city, such as the unique Scull-Tower. After the ΠEC working days, participants visited the Resava cave, and the monasteries of Manasija and Ravanica.

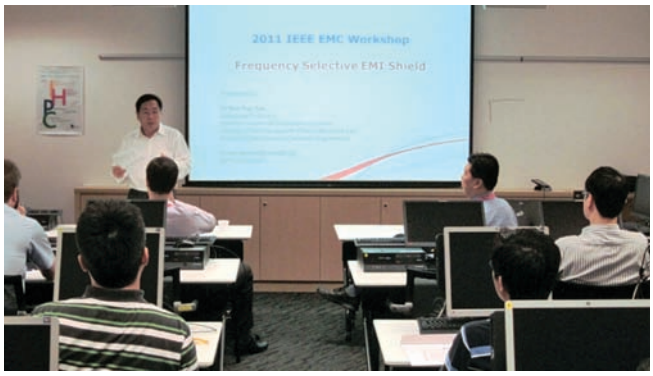
ΠEC participants and IEEE EMC Society members attending ΠEC 2011 used this opportunity to build on existing projects and partnerships, and to start the new ones. In this way, ΠEC achieved its goal which benefitted not only the universities and institutions, but the scientific society as well. This conference might not be among the greatest and the most famous, but it is still growing every year, in fact – every second year. The main reason for growth is the progress in the quality of the conference papers, new events following this conference, hospitality of the hosts, as well as warm and sunny Septembers, great food and entertaining national dances. We are grateful to all participants and guests for their scientific contributions and efforts to come this year; the ΠEC Organizing Committee invites you all to attend the ΠEC Conference in 2013!

Singapore

Dr. Richard Gao Xianke, Chairman of the IEEE EMC Singapore Chapter, reported on the Singapore Chapter's recent activity.

*Professor Arnulf Kost from the Technical University of Berlin in Germany delivered a technical talk at the A*STAR Institute of High Performance Computing in Singapore on July 20.*

Dr. Richard Gao Xianke, Professor Er-Ping Li and Dr. Zhang Yaojiang (from left) staffed an exhibition booth to promote APEMC 2012 at the 2011 IEEE EMC Symposium in Long Beach, California in August.



*Professor Er-Ping Li from A*STAR IHPC of Singapore gave a welcome speech at the 2011 IEEE EMC Workshop in Singapore on August 23–24.*

Professor Arnulf Kost, president of the international COMPUNAG Society, from the Technical University of Berlin, Germany, was invited by the Singapore EMC Chapter to deliver a talk with the title, "Characteristics of Microstrip Antennas, Calculated by a Finite Element-Boundary Integral Procedure" at the Institute of High Performance Computing (IHPC) of A*STAR, Singapore, on July 20, 2011. In this talk, a finite element-boundary integral method has been developed to investigate the impedance and radiation characteristics of planar and conformal cavity backed microstrip patch antennas. The case studies showed that the simulated results are in good agreement with the measured results. A total of 11 attendees (seven were IEEE members) attended the seminar. On July 29, 2011, Professor Robert Lee from The Ohio State University gave a presentation entitled, "A Hybrid Finite Element/Rigorous Coupled Wave Analysis for Scattering from 3-D Doubly Periodic Structures" at DSO National Laboratories. There were a total of 21 attendees of which 11 were IEEE members. On August 2–3, 2011, Dr. Wenhua Yu from 2COMU of USA delivered two technical

Professor See Kye Yak from the Nanyang Technological University of Singapore delivered a technical talk at the 2011 IEEE EMC Workshop in Singapore.

Dr. Klaus Krohne (right) appreciated the speaker gift of a plaque, certificate and tie with the EMC logo presented by Dr. Enxiao Liu, treasurer of the Singapore EMC Chapter.

Dr. Lock Kai Sang (left) appreciated the speaker gift of a plaque, certificate and tie with EMC logo presented by Dr. Richard Gao Xianke, Chairman of Singapore EMC Chapter.

talks entitled, "A Novel Hardware Acceleration Technique for Parallel FDTD Method" at the Nanyang Technological University (NTU) of Singapore and "High Performance Parallel FDTD Method" at the National University of Singapore (NUS), respectively. There were a total of 31 attendees, of which 17 were IEEE members.

Dr. Richard Gao Xianke, Chairman of the Singapore Chapter, together with Professor Er-Ping Li, attended the 2011 IEEE EMC Symposium in Long Beach, California, USA during August 15–19, 2011. Dr. Gao also attended the Chapter Chair training session and presented the activities organized by the Singapore Chapter at the annual Chapter Chair meeting organized by the IEEE EMC Society.

During August 23–24, 2011, the Singapore EMC Chapter organized a successful two-day EMC workshop. The objective was to bring industry, government, research institutions and universities together to share experiences and knowledge via presentations on the latest development and work in EMC/EMI/ESD. The workshop had an overwhelming response and over 30 attendees participated in the two-day event of which the majority was from industrial companies. Professor Er-Ping Li from A*STAR IHPC initiated the workshop with a welcome speech to all invited speakers and attendees. On the first day, Professor See Kye Yak from NTU delivered a talk entitled, "Frequency Selective EMI Shield"; Dr. Klaus Krohne from CST Singapore, gave the second technical talk with the title of "Passing the Limits of Radiated Emissions Analysis"; Dr. Richard Gao Xianke from the Singapore EMC Chapter delivered a talk entitled, "Characterization of Electromagnetic Immunity for ESD"; Dr. Junhong Deng from TUV-SUD-PSB presented "EMC Troubleshooting for Conducted Emissions Test." On the second day, Dr. Lock Kai Sang from PQR Technologies (S) Pte Ltd, Chairman of Engineering Accreditation Board of Singapore, delivered a talk entitled, "Power Quality and Low Frequency EMC Issues"; Mr. Michael Chu and Mr. Loi Boon Toon from Land Transport Authority of Singapore, delivered talks entitled, "General Railway Electromagnetic Environment" and "EMC Management Process in Railway," respectively. Professor Wen-Yan Yin from Zhejiang University of China, IEEE EMC Society Distinguished Lecturer, delivered two talks entitled, "EMP Effects and Protection" and "Time-domain CEM and its Application in EMC and EMI Reduction," respectively. The participants, including speakers and the audience, provided excellent comments on the workshop and expressed the desire to have more workshops in the future.

On August 26, 2011, Professor Wen-Yan Yin from Zhejiang University delivered a technical talk entitled, "Multiphysics Solution for Nanoelectronics," at NUS with a total of 14 attendees of which six were IEEE members. On September 2 and 5, 2011, Professor R. Mittra from Pennsylvania State University of the USA presented two talks – "A Novel Technique for Efficient Analysis of Microwave Circuits Etched in Layered Media" and "The Exciting World of Future Communications." The response was very positive as these two talks were held at NUS. The total attendees were 219, of which 30 were IEEE members.

EMC

Professor Wen-Yan Yin from the Zhejiang University of China, IEEE EMC Society Distinguished Lecturer, delivered two technical talks at the 2011 IEEE EMC Workshop in Singapore.

EMC Chapters Recognized at the 2011 IEEE EMC Annual Awards Luncheon

PHOTOS BY KEN WYATT

Franz Schlagenhaufer accepted the "Chapter Founder" Award on behalf of Hongmei Fan. He received the award from EMC Society President Francesca Maradei.

Hiroshi Inoue accepts the "Chapter of the Year" Award on behalf of the Sendai Chapter. He received the award from EMC Society President Francesca Maradei.

Jamal Shafii accepts the "Most Improved Chapter" Award on behalf of the Rock River Valley Chapter. He received the award from EMC Society President Francesca Maradei.

Congratulations to the Following EMC Chapters for Awards Received in Absentia at the Awards Luncheon

Tunde Salihu was honored for his efforts in founding the IEEE EMC Nigeria Chapter.

Hongmei Fan was honored for her efforts in founding the IEEE EMC Sendai Chapter.

EMC-S Chapter Coordinator Sergio Pignari (right) is shown at the 2011 IEEE International Symposium in Long Beach following the Chapter Chair Training Session & Dinner. His colleague from the Politechnico di Milano, Flavia Grassi, joined him for a tour of the exhibition.

Save the Date!

2012 IEEE EMC Chapter Chair Training Session & Dinner

The IEEE EMC Society is pleased to wholeheartedly extend an invitation to all IEEE EMC Chapter Chairs to attend the Chapter Chair Training Session & Dinner taking place in conjunction with the 2012 IEEE International Symposium on EMC in Pittsburgh, Pennsylvania during August 5–10 at the David L. Lawrence Convention Center.

Chapter Chair Training Session
The Training Session is intended to help Chapter Officers to be aware of the services provided to chapters by the IEEE and EMC Society.

Chapter Chair Dinner
This dinner is a chance for the Chapter Chairs or their representatives to gather and share what they have been doing for the past year.

Exact dates and times for the Chapter Chair Training Session & Dinner will be announced in the near future at www.emc2012.ISEMC.org

Contact Information:

EMC-S Chapter Coordinator, Sergio A. Pignari, sergio.pignari@polimi.it

2011 IEEE EMC Annual Chapter Chair Training and Dinner

Chapter Chairs and representatives from many of the EMC Chapters worldwide convened in Long Beach for the annual Chapter Chair Training and Dinner organized by the EMC Society Membership Services team of Bob Davis, Vice-President for Member Services, and Sergio Pignari, EMC Chapter Coordinator.

PHOTO BY RICHARD GEORGERIAN

A dinner buffet followed the formal Chapter training and provided a good opportunity for continued networking amongst the Chapter chairs.

PHOTO BY RICHARD GEORGERIAN

Over 30 people attended the 2011 IEEE EMC Annual Chapter Chair Training and Dinner in Long Beach.

Peter Landgren, one of the founders of the EMC Sweden Chapter and a former Chapter Chair, enjoyed his last symposium in Long Beach. An IEEE Life Member since 2009, he is now retired and attended the symposium to say goodbye to his many long time IEEE colleagues and represent the Sweden Chapter at the annual Chapter Chair Training and Dinner.

PHOTO BY DICK FORD

Chapter Representatives participate in the Society Symposium, front row from left: Peter Landgren, Sweden; Sam Connor, North Carolina; Jerry Meyerhoff, Chicago; Caroline Chan, Santa Clara; 2nd row: Prof. Hiroshi Inoue, Sendai, Japan; Prof. Heyno Garbe, Germany; Dr. Qiubo Ye, Ottawa; Mark Frankfurth, San Diego; 3rd row: Paul Duxbury, UK Rep of Ireland; Dr. Frank Leferlink, Netherlands; Henry Benitez, Oregon & SW Washington; Dr. Richard Gao, Singapore; back row: Qun Wu, China; Giulio Antonini, Italy; and Dr. Marco Klingler, France.

PHOTO BY RICHARD GEORGERIAN

Hiroshi Inoue gave a presentation on the activities of the Sendai EMC Chapter. Chapters are encouraged to share "best practices" at the annual training to inspire other Chapters in their future planning efforts.

EMC Personality Profile

Frank Sabath, Associate Editor

Introducing Moshe Netzer

With this personality profile I will stay in Asia, but in contrast to my last profile I would like to draw your attention to a colleague who lives in the Asia part of the Mediterranean Region. In particular, I would like to introduce you to the chair of the Israel EMC Chapter, Moshe Netzer. Our past president, Elya Joffe, introduced me to Moshe at the Santa Clara EMC Symposium in 2004. Since then, I have met him regularly at our annual symposium.

Moshe was born some 60 years ago in Rambam Hospital, where two of his children were born too and where his son, a gynecologist at the Gynecological Ward, currently works.

Moshe's interest in engineering started early in his life. During his first year, as told by his mother, Moshe used to turn over his pram and rotate the wheels with his tiny hands to learn about the adorable mechanics of spinning wheels. Upon growing up and reaching high-school, Moshe studied airborne instrumentation. According to him, most of the studies were a waste of time, but life in the boarding school was a corrective experience, as were the struggles against management to improve the food served to the students.

In the army, Moshe served in an armored brigade and was trembling with fear whenever Colonel Gorodish (Shmuel Gonen), the strict brigade commander, would pass through the base gate, and Moshe – the rookie – had to open the barrier and salute, with seven exact folds of the shirt sleeve and a starched neck-cutting collar. After an officers course, Moshe was sent to the War of Attrition and served as a logistics officer in a regiment of Brigade 14. At the end of that war, he was drawn to the subject of ammunition and explosives, and was soon appointed a weapons and ammunitions officer of Brigade 14. His responsibilities included replenishment of the entire ammunition at the Suez Canal posts. By then he drew unreserved pleasure from detonating tons of disqualified ammunition throughout the post line along the Suez Canal. One of the deep "moon" craters he created in the dunes near the midpoint of Suez Canal saved his life when he was approaching the bridges on the Canal during the Yom Kippur War and a heavy Katyusha bombardment caught him and his soldiers off guard. The nearest shelter was a crater, which had been created two years earlier in a controlled detonation of disqualified ammunition. Later during his military service, Moshe was appointed an HQ company commander, and was released at the rank of Army Major after a voluntary service of several additional years in the Ordnance Corps' Army Proving Ground, Unit 5000.

On completing the army service, Moshe studied electrical engineering and electronics at the Technion, Haifa. In the fourth year of his studies, Moshe happened to meet the young Oren Hartal who interviewed him as a possible candidate for Rafael. That meeting changed his life forever. Right then and there, during the fourth year, Moshe was recruited to the field of electromagnetic compatibility without having the foggiest notion of what it was all about. The term electromagnetic compatibility sounded then like fitting parts of plumbing (like adjusting a connector onto a receptacle). Only when joining Rafael on April 1, 1976, a month after his first son was born, did Moshe understand that it was more about physics than electrical engineering, with no connection whatsoever to plumbing. Moshe allowed himself two years of experience to consider whether to stay in the field of electromagnetic compatibility or seek his vocation as an engineer in another pleasant subject, such as electronic communication or control systems.

After two years of activity, it became clear to Moshe that he had found his mission in electromagnetic compatibility, especially as he was appointed then to be engaged in two explosive materials-related subjects: static electricity discharge (ESD) associated with explosives and radiation hazards (RADHAZ) connected to explosives and electrical initiators (HERO). Soon Moshe was

Moshe Netzer received the Fellow Award of the Society of Electronic and Electrical Engineers in Israel (SEEEI) for his significant contributions assimilating EMC engineering into many engineering projects in Israel. Dr. Ozi Landau, Minister of the Infrastructure office (foreground left), presented the award.

appointed a Radiation Safety Engineer and Chairman of the Static Electricity Safety Committee – two nominations, which had been pushed and promoted by Rafael's Chief Safety Engineer.

Apparently, choosing Moshe proved to be successful and wise, since he started deciphering – one after the other – accidents and explosion events in the defense industry which were connected, as it turned out, to coupling of radio-frequency radiation onto firing lines and ESD through explosive/HAZMAT materials.

In 1984 Moshe was appointed head of a project for establishing an automated system for the IDF radio frequency management (the Cherokee Project). The project was successful but "the patient died" because until it ended, great progress had already been made in both available software programs and hardware systems. It taught Moshe then that engaging in the establishment of a software program that takes a number of years is perhaps suitable for Bill Gates, so he stopped taking part in such things. Anyway, Moshe's accumulated experience in analyzing and simulating communication disruptions between radio transmission systems and receiving systems enabled him in 1990 – in cooperation with a trainee from Singapore – Lu Yeow Leong – to develop a unique software called CULLING, which made it possible to optimize the antenna layout of transmission and receiving antennae deployed on naval ships, as well as many other military platforms. The software was developed mainly in his residential house after work hours, despite the feeble protests of his wife, Hanna, who claimed that nothing good could come out of such work into the wee hours of the night. Luckily, she was wrong! That software is still being used by Rafael in the field of electromagnetic compatibility in every major project, such as developing the simulator for a Far East Country observation balloon, positioning the antennae on the balloon itself, and many other classified projects which should not even be mentioned.

Over the years Moshe has supported all major developments of the Israeli Navy projects. He also assisted in developing the Mark 3 and Mark 4 Merkava tank and wrote, inter alia, the Electromagnetic Compatibility Specification for the Merkava, which is being used today by developers of systems and assemblies of this state-of-the-art tank.

Moshe celebrated receipt of his Fellow Award with his wife Hanna following the ceremony held in Eilat – the most Southern city in Israel on the Red Sea – on November 24, 2011. Congratulations Moshe!

Thanks to connections Moshe had developed while spending sabbaticals in the USA, he became a distinguished lecturer on subjects of radiation and electromagnetic-compatibility by the USA Department of Defense, the Singapore MOD and the Republic of Korea MOD. Moshe gave dozens of courses in these and other countries, with which Rafael had connections, on professional subjects where his name became increasingly well known.

Moshe's last appointment in Rafael, which occurred at about the same time of receiving a Level-A Researcher (equivalent in the academic world to an associate professor), was "System Engineer of Electromagnetic Environmental Effects." It meant that Moshe was actually responsible for non-ionizing radiation on both humans and weapon systems in Rafael. Within this function, Moshe was able to prevent radiation accidents in Rafael, while throughout the Israeli security industry people wanted to know how it was done in Rafael and learn the safety procedures, which helped prevent and mitigate HERP incidents.

Following fire and explosion accidents and events in the chemical industry due to ESD through hazardous flammable materials, Moshe studied the subject of chemical processes in chemical plants and the special jargon used by process engineers and chemical engineers. He managed to discover the causes of fires and explosions which occurred in a number of plants in Israel and worldwide, especially in Teva's pharmaceutical plants. The lessons he extracted assisted in significantly reducing such cases which, undoubtedly, prevented injuries and suffering that might have been caused as a result of fire and explosions in chemical production plants in and outside Rafael.

Moshe continued to be vigorously active both by writing articles and books (yielding so far some 50 articles and five books) and by participating in professional associations representing compatibility engineers. He has been serving as the Chairman of the IEEE Israel EMC Chapter for the last 11 years, and was the Chairman of the EMC Chapter in the Israeli Society of Electrical and Electronics Engineers (IEEES) for the last five years. In the course of these years, Moshe has organized countless conferences, tutorials and workshops. He also served in 1998 as the Vice Chair of an important international workshop in Crete dealing with radiation effects on biological systems.

Moshe still continues with this type of public activity and has many more years of professional occupation ahead of him. By the way, this year he has been recognized as an excelling in-house lecturer of Rafael for courses on work safety in handling hazardous materials and received the title award of Fellow SEEEI.

Almost over, but not done with, Moshe has established a consulting company called "Electromagnetic Compatibility & Safety Engineering Ltd." where some eight technicians and engineers are hired for the abovementioned subjects. It seems unlikely for Moshe to ever be out of work or bored.

To sum up, I wish Moshe good health and success down the road, and I hope to continue seeing him among EMC colleagues as long as possible. It might be time for him to slow down and even sunbathe on a sunny beach, with a cocktail in one hand. He surely deserves many years of such recreation.

EMC

DISCOVER THE LATEST TITLES FROM WILEY AND WILEY-IEEE PRESS!

Discontinuities in the Electromagnetic Field

M. Mithat Idemen

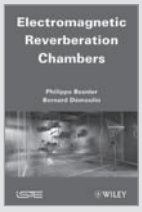
9781118034156, Cloth, 240pp, $110.00, September 2011, Wiley-IEEE Press

Filled with new approaches and basic results connected with the discontinuities of the electromagnetic field, this new book offers an important resource for graduate and undergraduate students. The discontinuities in question may be one of three things: The bounded jump discontinuities on the interfaces between two media or on the material sheets which model very thin layers or; Unbounded values at the edge of wedge type structures; Unbounded values at the tips of conical structures. The book contains many examples as well as problems and exercises that challenge the readers.

Electromagnetic Reverberation Chambers

B. Démoulin

9781848212930, Cloth, 432pp, $195.00, August 2011, Wiley-ISTE



Dedicated to a complete presentation on all aspects of reverberation chambers, this book provides the physical principles behind these test systems in a very progressive manner. The detailed panorama of parameters governing the operation of electromagnetic reverberation chambers details various applications such as radiated immunity, emissivity, and shielding efficiency experiments. In addition, the reader is provided with the elements of electromagnetic theory and statistics required to take full advantage of the basic operational rules of reverberation chambers, including calibration procedures. Comparisons with other testing systems (TEM cells, anechoic chambers) are also discussed.

The Power and Beauty of Electromagnetic Fields

Frederic R. Morgenthaler

9781118057575, Cloth, 678pp, $135.00, October 2011, Wiley-IEEE Press

In this text, the author develops alternate representations of electromagnetic power and energy that differ from the familiar Maxwell-Poynting theorem values (S and W) - yet are fully equivalent. The particular choice focused on features highly-localized power and energy components and emphasizes the circuit rather than the wave nature of these quantities. Moreover, unlike the Poynting vector, this exact representation merges smoothly with well-known quasistatic approximations that have long been used to calculate power flows in both lumped and distributed circuits operating at low-frequencies.

Transmission Lines in Digital Systems for EMC Practitioners

Clayton R. Paul

9781118143995, Cloth, 288pp, $85.00, November 2011, Wiley

This brief but comprehensive book covers the set of electromagnetic compatibility skills that EMC practitioners today require in order to be successful in high-speed, digital electronics. Using a minimum amount of mathematics, the book examines a number of key issues, including crosstalk, one of the main problems occurring in transmission lines. The appendix provides a brief tutorial on PSPICE, which is used extensively throughout the book.

Understanding Geometric Algebra for Electromagnetic Theory

John W. Arthur

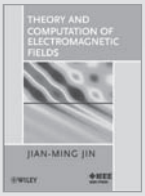
9780470941638, Cloth, 320pp, $125.00, August 2011, Wiley-IEEE Press

Offering a less formal tutorial approach on the subject, this practical book approaches geometric algebra as a straightforward mathematical toolset for working with and understanding classical electromagnetic theory. Designed for anyone with some knowledge of electromagnetic theory, including scientists and engineers who use it in the course of their work, or postgraduate students and senior undergraduates seeking to broaden their understanding of the subject, this book offers new insight into the fundamentals of classical electromagnetic theory through the use of geometric algebra, the clearly superior mathematical toolset to traditional vector analysis.

Theory and Computation of Electromagnetic Fields

Jian-Ming Jin

9780470533598, Cloth, 600pp, $140.00, November 2010, Wiley-IEEE Press

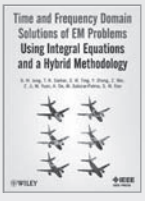


This book serves as a textbook for both an entry-level graduate course on electromagnetics and an advanced-level graduate course on computational electromagnetics. No textbook is available for the advanced course; this book fills that void and presents electromagnetic theory in a systematic manner so that students can advance from the first course to the second without much difficulty. Accompanied by an instructor's guide, it covers both fundamental theories and advanced topics.

Time and Frequency Domain Solutions of EM Problems Using Integral Equations and a Hybrid Methodology

B. H. Jung, T. K. Sarkar, Y. Zhang, Z. Ji, M. Yuan, M. Salazar-Palma, S. M. Rao, S. W. Ting, Z. Mei, A. De

9780470487679, Cloth, 485pp, $89.95, October2010, Wiley-IEEE Press

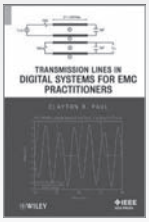


Numerical solutions of electromagnetic field problems is an area of paramount interest in academia, industry and government. This book provides a compendium of solution techniques dealing with integral equations arising in electromagnetic field problems in time and frequency domains. Written by leading researchers in the field, it documents the authors' unique space/time separation approach using Laguerre polynomials. Numerous examples that illustrate the various methodologies and user-friendly computer codes make this volume highly accessible for engineers, researchers, and scientists.

Transmission Lines in Digital and Analog Electronic Systems: Signal Integrity and Crosstalk

Clayton R. Paul

9780470592304, Cloth, 298pp, $99.95, August 2010, Wiley



This book grew out of the realization that most of today's EE and CpE graduates lack a critically important skill: the analysis of transmission lines. This text prepares readers for increasingly difficult design problems in a high-speed digital world, arming them with the basic though intricate knowledge they need to succeed.

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EMC Society History

Daniel D. Hoolihan, Associate Editor,
Chair of the EMC Society History Committee

Introduction to the EMC Society History Section

In this Newsletter we have three articles for the History Section.

Our look back into the history of the EMC Society starts with two EMC Society Newsletters from late 1961, October and December; the Fall of 1986 (Issue No. 131), and the Fall of 2001 (Issue No. 191). As the History Chair, I have collected our old Newsletters from a variety of sources; one of those sources was one of our Past-Presidents, Edwin (Ed) Bronaugh. As I was paging through the 1986 Issue (which I had received from Ed); I ran across a large yellow piece of notebook paper with a phone memo stapled to it. The phone memo was dated November 11 and was taken at 3 pm; it was a phone call from Ed Nucci with a short message saying "Wants to speak with you about the EMC Society Newsletter. He's an IEEE Fellow." Additional notes on the yellow pad said that Ed Nucci could be reached at 202-457-4965 and that he works for EIA. He publishes an EIA news bulletin every two months listing standards and related articles. He was interested in reprinting the Frank Rock Paper from the 1986 EMC-S Newsletter because he liked "the ideas that were presented." I don't know if Ed Nucci and Ed Bronaugh ever connected on this request; the yellow sheet of paper was silent on the outcome. However, knowing how organized Ed Bronaugh was, I am optimistic that they did connect and that the Frank Rock article on "The DoD Acquisition Streamlining Initiative Program and EMC" was republished by the EIA.

The second article is another reprint of the "Quasies and Peaks" Newsletter. This one is from June of 1955; for those of you who are counting, it is the fourth Q&P Newsletter we have republished since starting this effort. As you may remember, the "Quasies and Peaks" Newsletter was a private Newsletter that was edited by Rexford Daniels who became the first official editor of the Professional Group on Radio Frequency Interference (RFI's) Newsletter in 1957. As we stated previously, we are reprinting these for your reading enjoyment and for archival purposes.

The third article is written by Gene Taylor of Altamont Technical Services, the Exhibits Chair for the 2011 IEEE International Symposium on EMC. Gene put together a special historical exhibit on the exhibit floor displaying prominent members of the EMC Society who have been Pioneers in exhibiting their company's products and services for at least 25 years.

Happy Reading and keep those cards and e-mails coming!

EMC

EMC Society Newsletter Articles 50–25–10 Years Ago

Fifty Years Ago – October 1961 – Newsletter Number 18 – Institute of Radio Engineers – Professional Group on Radio Frequency Interference

The cover page of the Newsletter included a Message from the Chairman, and Reports from the Chairman of the Membership Committee, the Chairman of the Awards Committee, the Chairman of the Technical Papers Committee, and the Chairman of the Liaison Committee.

The Membership Report highlighted the fact that the Group had grown to over 1,000 members in a period of four years.

The Administrative Committee was deciding whether to raise the Membership Fee from $2.00 to $3.00.

The Administrative Committee consisted of Sam Burruano, Rexford Daniels, Harold Dinger, John Egli, Robert Fairweather, Herman Garlan, Hal Gauper, Zigmund Grobowski, Leonard Milton, W. E. Pakala, Henry Randall, Otmar Schreiber, Ralph Showers, Richard Schulz, and Leonard Thomas.

It was reported in the August 16, 1961 issue of *Electronic Design* that "Deception Island, in the Falklands off the southern coast of Argentina, will be used as a long-wave antenna. As an antenna, the island would test the characteristics of interference in the very low-frequency region."

The Newsletter reported that "Samuel J. Burruano, a member of the PGRFI Administrative Committee and past Vice-Chairman, has formed his own company, Burruano Associates, Inc., 51 Sullivan Street, Westwood, New Jersey, telephone number North 6-1234. This new company is specializing in the field of systems interference prediction, control and analysis, mutual interference, radiation hazards, jamming and ECM, and shielding and grounding systems. Mr. Burruano was formerly Manager of Systems Engineering Division of Filtron, Co., Inc., New York and was also formerly associated with RCA in Camden and formed its first company-wide RFI Group."

Fifty Years Ago – December 1961 – Newsletter Number 19 – Institute of Radio Engineers – Professional Group on Radio Frequency Interference

The cover page of the Newsletter had "Highlights of the Seventh Armour Conference" as its lead article. It stated that the November 24 issue of *Electronics* carried a two-page article, with four illustrations, of the Seventh Armour Conference.

A short article on the upcoming "Fourth National PGRFI Symposium" was also on the cover page. It said "Advance information on the Fourth National PGRFI Symposium is available; it will be held in San Francisco on the 28th and 29th of June in 1962. Five-hundred word summaries of papers are requested and may be submitted to the Technical Program Committee immediately. The theme for the conference will be 'Design – the Answer to RFI.' It is felt that after having several symposia where the central theme was interference prediction and control, the time has come once again to highlight the design – the ultimate solution. The development of this theme will, it is hoped, serve the following purposes: (1) Establish some requirements for interference-free design, at the circuit, equipment, and system levels; (2) Bring to the attention of designers of high-performance and highly sensitive devices, the importance of freedom from interference as a design criterion and its importance in preliminary design; (3) Bring new applications in communications and control to the attention of active workers in the field of RFI so that some new problems can be anticipated; (4) Bring to the attention of workers in the field new components and material and to encourage their use in eliminating interference; and (5) Help in making useful the results of current efforts in interference prediction and data collection such as the DoD Radio Frequency Compatibility Program."

It was announced that there would be a CISPR Meeting in the USA. The Plenary Assembly of the International Special Committee on Radio Frequency Interference will be held at the University of Pennsylvania on October 2–7, 1962.

It was highlighted that "The Institute of Radio Engineers Committee 27 on Radio Frequency Interference had S. I. Cohn as its Chairman and Sam Burruano as its Vice-Chairman. Sub-committee 27.1 on Basic Measurements was chaired by Ralph Showers, SC 27.3 on Radio and TV Receivers was chaired by F. G. Cole, SC 27.4 on Radio Transmitters was chaired by Vince Mancino, SC 27.5 on Industrial Electronics was chaired by C. W. Frick, and SC 27.7 on Mobile Communications Equipment was chaired by J. F. Chappell.

An article announced a "FCC Notice of Proposed Rule Making." It went on to say: "The FCC has sent out a Notice of Proposed Rule Making, Docket No. 14376, in the matter of amendment of Part 15 of the FCC Rules to provide for telemetering devices and wireless microphones."

The editor of the PGRFI Newsletter was Rexford Daniels.

25 Years Ago – IEEE Electromagnetic Compatibility Society Newsletter – Issue No. 131 – Fall 1986

The cover story was titled "A Tribute to the 1986 EMC Symposium Committee." It went on to say: "The 1986 International Symposium on EMC, sponsored by the IEEE EMC Society, was a huge success. Held in San Diego from September 16–18, it attracted nearly 2,000 people who came from all over the world to hear more than 105 technical papers, attend informative workshops, enjoy entertaining luncheons and to see the wares displayed in 143 exhibit booths. It was a job well done by the Chairman, Herb Mertel, and a competent staff of organizing committee workers."

The Newsletter had a picture of the 1986 EMC Society Board of Directors, as shown on page 28.

The EMC Personality Profile was Michel Mardiguian as handled by Associate Editor William G. Duff.

The Practical Papers, Articles, and Application Notes part of the Newsletter highlighted "The DoD Acquisition Streamlining Initiative Program and EMC" by Frank E. Rock. The article was edited by Edwin Bronaugh.

Book Reviews were done by Jim Hill and it included a review of "Electrostatic Discharge – Understand, Simulate, and

1986 ELECTROMAGNETIC COMPATIBILITY SOCIETY BOARD OF DIRECTORS

From left to right: George Kunkel, Gene Knowles, Don Clark, Bob Haislmaier, Don Heirman, Bob Hofmann, Bob Goldblum, Henry Ott, Dick Ford, Len Carlson, Charlotte Tyson, Dick Shulz, Chet Smith, Fred Nichols, Risaburo Sato, Art Wall, Bob Brook, Gene Cory and Jim Hill.

Fix ESD Problems" by Michel Mardiguian and "Antennas and Radiowave Propagation" by Robert E. Collins.

The Editor of the Newsletter was Robert Goldblum.

Ten Years Ago – IEEE EMC Society Newsletter – Issue No. 191 – Fall 2001

The cover of the "Ten-Year" Newsletter was a collage of photos from the EMC 2001 Symposium (International Rendez-Vous) held in Montreal, Canada.

The President's Message was found on the inside cover of the Newsletter and it was highlighted by a picture of Joe Butler, the President of the Society, and his daughter Christie, who joined him for the festivities at the 2001 IEEE International Symposium on EMC – the International Rendez-Vous.

The Chapter Chatter Column, edited by Todd Robinson, reviewed reports from the France, Germany, Israel, Nanjing, Central New England, Phoenix, Rocky Mountain, Singapore, Seattle, and Southeastern Michigan Chapters.

Bob Olsen, the Associate Editor for Practical Papers, Articles, and Application Notes discussed a paper titled "A Different Antenna for the Mode-Stirred Chamber" by Matthew R. Wills of Cessna Aircraft Company.

The Personality Profile by Associate Editor Bill Duff was done on Donald R. Bush, a long-time member of the EMC Society with a colorful Kentucky personality.

EMC Society Award winners were prominently displayed in the middle of the Newsletter; they included Fred Bauer with the Stoddart Award, Marcello D'Amore with the Best Transactions Paper Award, and David Staggs with the Laurence G. Cumming Award.

Four pages of the Newsletter were devoted to great pictures of the people in attendance at the 2001 IEEE International Symposium on EMC in Montreal.

The Newsletter was edited by Janet O'Neil. **EMC**

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Quasies and Peaks – The Precursor to the EMC Society Newsletter-June 1955

Interference Testing and Research Laboratory, Inc.; 150 Causeway Street, Boston 14, Massachusetts.

Editorial

Wanted—Present Terms

Our editorial of last month "Wanted – New Terms" seems to have touched several tender spots. From letters which have come in, the consensus of opinion seems to be that there is a more immediate need for the standardization of "present" terms – while the field is still young – rather than confining our efforts to new terms. As a result, we are reprinting the available lists of definitions as used by the Air Force and Signal Corps, together with a list kindly submitted by the Radio Interference Laboratories of the Burroughs Corporation and reference to the Institute of Radio Engineers (IRE) Standards.

Several correspondents suggested that we try to get a Discussion Group together to talk this – and other problems in the Interference Field—over. We would like to make an additional suggestion that Area Groups be organized—for the East, Middle-West and Pacific Coast—in order to broaden the viewpoints. The recommendations of these Groups could then be collated and the results presented to the IRE for inclusion in any definitions which they might contemplate for the Interference Field.

We would be very glad to attempt to start such Groups and would welcome hearing from those who would like to serve – and suggestions as to who might act as temporary chairman of each. It will, of course, require time and effort on the parts of those interested but, on the other hand, the effort would be most valuable and rewarding.

There will be new problems constantly being put up to these Groups, many of which manufacturers will be most interested in. Take, for example, the problem which would seem to be facing the Metal Textile Corporation, makers of electronic weather-stripping and RF gaskets.

In their new brochure "Suppressing Radio Interference with Metex Electronic Weather-strips and RF Gaskets," they have used the term "Insertion Loss" to describe the db attenuation resulting from the use of their shielding products. This is truly an applicable descriptive term in as much as it gives a measure of the amount of loss which can be expected when a voltage on one side of the shielding is referred to the voltage on the other side. However, it can be confusing to a person – not well versed in the art when he looks up the definition of the term – who finds only reference to filters and condensers. This leads to the conclusion that the definition of "insertion loss" should be broadened to include the above-mentioned category or others which may fall in with the idea of loss of voltage when passing through a medium – or a new term should be coined to include all these cases, exclusive of filters and condensers.

As another example, the term "impedance" is normally used to define that which retards the flow of alternating current, whereas the term "resistance" is normally used to describe that which retards the flow of direct current. It appears that our present definition should take into account the type of current which is flowing when we describe the term "impedance." Burroughs comes closest to it.

We would appreciate hearing from you as to whether something should be done.

Articles of Interest—from the Journal of Applied Physics

January 1955:

Measurements of Electrical Polarization in Thin Dielectric Materials, by R.W. Tyler, J.H. Webb, and W.C. York; Research Laboratories, Eastman Kodak Company, Rochester, N.Y.

Relaxation Oscillations and Noise from Arc Discharge, by M.I. Skolnik and H.R. Puckett, Jr.; Radiation Laboratory, The Johns Hopkins University, Baltimore, Md.

February 1955:

Radiation of Plasma Noise from Arc Discharge, by T. Takakura, K.Baba, K. Nunogaki and H. Mitani; Osaka City University, Kitaku, Osaka, Japan.

Short-Time Frequency Measurement of Narrow-Band Random Signals by Means of a Zero Counting Process, by H. Steinberg, P.M. Schultheiss, C.R. Wogrin and F. Zweig; Dunham Laboratory of Electrical Engineering, Yale University, New Haven, Conn.

March 1955:

Barkhausen Noise from a Cylindrical Core, by D.Haneman; University of Sydney, Sydney, Australia.

April 1955:

Theory of Frequency Modulation Noise in Tubes Employing Phase Focusing, by John L. Stewart; Department of Electrical Engineering, University of Michigan, Ann Arbor, Mich.

Variation of Noise with Ambient in Germanium Filaments by T.J. Maple, L. Bess and H.A.Gebbie; Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Mass.

May 1955:

Noise in One-Dimensional Electron Beams, by Herman A. Haus; Research Laboratory of Electronics, M.I.T., Cambridge, Mass.

Arcing at Electrical Contacts on Closure, Part VI, The Anode Mechanism of Extremely Short Arcs, by W.S. Boyle and L.H. Germer,

Noise at the Potential Minimum in the High-Frequency Diode, by D.A. Watkins; Stanford University, Stanford, Calif.

Papers to be given:

1955 Toronto Meeting of American Physical Society, June 22–24, 1955:

U8. *Noise Characteristics of Silicon Photovoltaic Junctions*, by U.F. Gianola; Bell Telephone Laboratories.

U11. *Noise Fluctuations and Irreversible Processes*, by D.L. Falkoff; Brandeis University, Waltham, Mass.

Glossary of Radio-Interference Terms

(The following glossary of interference terms is submitted by Sylvester Pelowski, Burroughs Corp. Radio Interference Laboratories, due to "the necessity of defining terms to non-initiated personnel.")

Ambient Interference. The interference level resulting from sources other than that being measured. This includes atmospherics, man-made interference and the internal noise of the measuring set.

Bond. An electrical path of low impedance at radio frequencies.

Bulkhead-Mounted Filter. A filter which is installed so that a metal wall isolates the filter input terminals from the filter output terminals.

Conducted Interference. Interference transmitted along an electrical conductor.

Feed-Through Condenser. A condenser with capacity between a metal case and a lead passing through the case; effectively, a lead-less container.

Field-Intensity Value of Interference. Interference measured in terms of its average value.

Filter. A network which reduces the amount of radio interference transmitted away from the interference source by current-carrying conductors. Usually a configuration of condensers and inductors enclosed in a single container.

Frequency. The number of cycles completed each second.

Ground. A chassis, housing or other equipotential system used as a reference potential.

Ground Plane. A large copper plate that is bonded to the earth or screen room shielding. Used as a voltage reference level for interference measurements taken in a screen room.

Impedance. The opposition to current flow that is offered by an electrical path at a particular frequency.

Impedance Stabilization Network. A network which properly terminates the radio-interference measuring set cable at the line where conducted interference is being measured and isolates the effect of the screen room filter.

Impulsive Interference. Discontinuous interference consisting of sharp pulses which are relatively infrequent and clearly separated.

Indicated Microvolts. The interference measurement that is given by the radio-interference measuring set before conversion to standard units.

Internal Noise of Meter. A very low interference level originating in the circuit of the radio-interference measuring set.

Kilocycle (kc). A frequency of a thousand cycles per second.

Megacycle (Mc). A frequency of a million cycles per second.

Metal-to-Metal Contact. Intimate contact between two metallic surfaces with no non-conducting layer such as paint, corrosion, or anodized surfaces, separating them.

Microvolt. One millionth of a volt.

Peak Value of Interference. Interference measured in terms of its maximum value.

Quasi-Peak Value of Interference. Interference measured in terms of a value weighted to indicate the nuisance effect of interference.

Radiated Interference. Interference measured in terms of a valued weighted to indicate the nuisance effect of interference.

Radio Interference. An electrical disturbance which can affect the satisfactory operation of electrical or electronic equipment.

Radio-Interference Measuring Set. A highly sensitive radio receiver of special design which is calibrated and operated as a radio-frequency voltmeter at various frequencies.

Radio Interference Tests. Measurements conducted in an area of low ambient interference to determine how the magnitude of interference from a test item varies over a range of frequencies.

Screen Room. An area enclosed by shielding where the ambient interference is at a very low level, usually less than one microvolt per meter.

Shield. A metallic structure which reduces the radiated interference leaving or entering a specified region.

Shielded Cable. One or more insulated conductors enclosed by shielding.

Trace. An interference measurement too small for an accurate scale reading.

Definitions

From: Radio Interference Suppression Techniques, Coles Signal Laboratory, Fort Monmouth, New Jersey, pages 222–224.

Application Approved Suppression Component. Any capacitor, filter, etc., not covered in all respects by applicable subsidiary specifications having been properly submitted to and approved by the designated agency for a specific suppression application.

Battery Timer. A distributor and ignition coil combined physically as a single shielded electrical subassembly.

Bond. A low-impedance connection between two points.

Bonding. The process of connecting two points through a low-impedance path.

Conducted Interference. Radio-interference transmitted through metallic leads.

Corona Discharge. A high-voltage discharge between a conductor and the surrounding atmosphere.

Decibel. A unit of the ratio of two powers. The ratio of powers, P_1 and P_2, in decibels is equal to $10 \log_{10}(P_1/P_2)$.

Effective Bandwidth. The area divided by the Peak Height of the voltage-versus-frequency curve, measured from antenna to peak detector.

Electrical Accessory Unit. Any electric motor or electromechanical device, such as electric windshield wipers, electric heaters, relay mechanisms, etc., capable of operation independent of the unit or its electrical subassemblies except for the power source, and which is not associated with the basic functioning of the equipment.

Electrical Subassembly. Any engine or engine generator electrical sub-assembly such as spark plugs, generator, regulator, distributor, etc., associated with the basic functioning of the unit or its electrical system, which is supplied, stored and issued as a complete operating assembly.

Energy Spectrum. The energy-versus-frequency curve of any disturbance.

Faraday Shield. An electrostatic shield between the windings of a transformer.

Filter. A network designed to freely transmit currents or voltages of certain frequencies while attenuating all others.

Ground. A point of "zero" or "reference" potential, equipotential with all other ground points of the system such as frame, housing, chassis, etc.

Harmonic. A sinusoidal component of a periodic quantity whose frequency is an integral multiple of the fundamental frequency.

Ignitor. See: Battery Timer.

Impedance. The ratio of voltage to current.

Insertion Loss. The ratio of the voltage across a load impedance before and after insertion of the network under test.

Interference-Free Area. A test site suitable for radio-interference investigations, 1200 feet or more from buildings, trees, power and communication lines, underground cables, and similar natural or man-made obstructions.

Laboratory Tests. Radiated or conducted radio-interference measurements or a test item in a screened laboratory room or confined area of low ambient interference under controlled conditions.

Microvolt per kilocycle. Interference intensity in microvolts per kilocycle is equal to the number of rms sinewave microvolts (unmodulated), applied to the input of the measuring circuit at its center frequency, which will result in peak response in the circuit equal to that resulting from the interference pulse being measured, divided by the effective bandwidth of the circuit in kilocycles.

Microvolt per Megacycle. Interference intensity in microvolts per megacycle is equal to the number of rms sinewave microvolts (unmodulated), applied to the input of the measuring circuit at its center frequency, which will result in peak response in the circuit equal to that resulting from the interference pulse being measured, divided by the effective bandwidth of the circuit in megacycles.

Non-Sinusoidal Wave. A wave whose form differs from that of a sine wave and which hence contains harmonics.

Parasitic Oscillations. Unintended self-sustaining oscillations at a frequency different from the operating frequency or its harmonics or outside a tank circuit.

Radio Interference. Any electrical disturbance which causes undesirable response or malfunctioning in any receiver.

Shield. A metallic enclosure surrounding a source of interference or a circuit sensitive to interference.

Suppression. The reduction of interference by means applied to or at the source.

Suppression System. All components, materials, and their application used for suppression of radio interference.

Transient. A disturbance of short duration during an interval of readjustment of current or voltage in a circuit.

Type Approved Suppression Component. A component for which samples of the same make and type have previously been submitted and tested and approved as being suitable for suppression purposes in accordance with the applicable subsidiary specification.

Undesirable Response. Any audible, visible, or otherwise measurable response of a receiver not produced by a desired signal, provided that either its duration is longer than ten seconds or its highest recurrence rate is great than once every sixty seconds.

Institute of Radio Engineers (IRE) – Definitions – Index

Master Index of IRE Definitions, Issue 3, February 1953.

"…It covers all terms which have been defined and standardized by IRE and all terms which are presently in the process of being defined. The list is intended for distribution to all members of the IRE technical committees and its main purpose is to form a quick reference for members who are working on definitions. It will be made available also to Definitions committees of other societies such as AIEE, ASA, etc."

List of the IRE Standards which are available in printed form – selected subjects.

52 IRE 17.S1 Standards on Receivers: Definitions of terms, 1952 Reprinted from the December 1952, Proceedings $0.60

51 IRE 20.S1 Standards on Pulses: Definitions of Terms – Part I, 1951 Reprinted from June 1951, Proceedings $0.50

52 IRE 20.S1 Standards on Pulses: Definitions of Terms – Part II, 1952 Reprinted from the May 1952, Proceedings $0.50

48 IRE 21.S1 Standards on Abbreviations, Graphical Symbols, Letter Symbols, and Mathematical Signs, 1948 $0.75

49 IRE 21.S1 Standards on Designations for Electrical, Electronic, and Mechanical Parts and their Symbols, 1949 Reprinted from February 1950, Proceedings $0.60

51 IRE 21.S1 Standards on Abbreviations of Radio-Electronic Terms, 1951 Reprinted from April 1951, Proceedings $0.50

50 IRE 8.S1 Standards on Electronic Computers: Definitions of Terms, 1950 Reprinted from March 1951, Proceedings $0.75

Definitions

From: Design Techniques for Interference-Free Operation of Airborne Electronic Equipment, U.S. Air Force, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio. Appendix II.

Atmospheric Disturbances. Interference generated by thunderstorms and similar electronic disturbances.

Blooming. The destruction of focus on visual indicator caused by excessive beam intensity.

Break Transient. Transients produced by the opening of a switch.

Characteristic Impedance. The ratio of voltage to current along a transmission line on which no reflected wave is present.

Conducted Interference. Any interference transmitted through metallic leads.

Corona Discharge. A high voltage discharge occurring at the surfaces of conductors, accompanied by bluish-reddish light.

Coupling Factor (referring to receivers). The ratio of antenna input voltage to the voltage input required at the various coupling paths to produce the same output.

Decibel. A measure of the ratio of two powers. Power ratio (decibels) is equal to 10 $\log_{10} P_1/P_2$.

Depth of Penetration. The distance from the surface of a metal at which and electromagnetic wave or current has decreased to l/e times its value at the surface.

Dielectric Strength. The ratio of breakdown voltage to the thickness of the dielectric between contacts.

Faraday Shield. Is a set of grounded metallic prongs, somewhat like the teeth of a comb, placed between two coils for the prevention of capacitive coupling.

Ferrites (Ferrospinels). Mixtures of crystalline iron oxides of ceramic like structure.

Field Fixes. The modification of existing equipment and installations to insure comparative freedom from radio interference.

Field Tests. Are those conducted in an "open space" under actual operating and load conditions. Tests of conducted interference performed at the actual site of permanent installation meet the requirements of Field Tests.

Filter. A four-terminal network designed to freely transmit currents or voltages of certain frequencies while attenuating all others.

Frequency Translation. The production of new frequencies in a non-linear element.

Ground. A point of "zero" or "reference" electrical potential, often used in the following sense: (1) To connect to the aircraft structure through a low impedance path, (2) To make equipotential with all other "ground points" in the system.

Impedance Concept. Consideration of impedance as the ratio of cause to effect leads to the idea which regards the entire aircraft as a single network.

Impedance (referring to networks). The ratio of voltage to current.

Impedance (referring to media). The ratio of electric to magnetic field intensity.

Improvement Threshold. The minimum signal-to-interference ratio necessary at the input to produce an intelligible signal at the output.

Insertion Loss. The amount, usually expressed in decibels, by which the current in a transmission line, on the load side of the network, has been changed by the insertion of the network.

Interference-Voltage Reduction Factor. The ratio of the signal-to-interference ratio at the output to that as the input of a receiver.

Intrinsic Impedance. The ratio of electric to magnetic field intensity in a medium in which no reflected wave is present.

Laboratory Tests. Are measurements of radiated or conducted radio interference in which the test item is placed in a screened laboratory room or in a confined area of low ambient interference under controlled conditions.

Major Unit. In an assembly of parts, connected mechanically or electrically, such as a radar transmitter or a power pack, to perform a specific function.

Microvolts per kc. Interference intensity in microvolts per kc is equal to the number of r.m.s. sine wave microvolts (unmodulated), applied to the input of the measuring circuit at its center frequency, which will result in peak response in the circuit equal to that resulting from the interference pulse being measured, divided by the effective bandwidth of the circuit in kilocycles. The effective bandwidth is the area divided by the height, of the voltage-response-versus-radio-frequency selectivity curve, from antenna to peak detector.

Mismatch Ratio. The ratio of impedances looking to the right and to the left of the pair of terminals.

Non-linear Impedances. Impedances that vary with current through them or voltage across them.

Open Space. In a site ideally in open, flat terrain, 100 feet or more from buildings, trees, power lines or communication lines, underground cables and similar obstructions.

Parasitic Oscillations. Oscillations which occur at other than a desired frequency or its harmonics, or outside a tank circuit.

Precipitation Static. Radio interference experienced when the flight path is through precipitation.

Radiation. The phenomenon of electromagnetic waves spreading out in space from a source according to the laws of wave propagation.

Radio Interference. Any electrical disturbance which causes an undesirable response or malfunctioning in any electronic equipment.

Random Noise. An electrical disturbance that is completely without regularity in its detailed properties.

Receiver. Any electronic equipment in which unwanted signals may cause an undesirable response.

Shield. A partition between two regions of space such that electric and magnetic fields of interest are attenuated in passing from one region to the other.

Shot Effect. The irregularity of plate current in a vacuum tube due to variations in cathode emission.

Skin Effect. The crowding of current toward the surface, or skin, of a conductor.

Spurious Response. To minimize cross modulation and overloading, good engineering practice requires that one or more tuned circuits shall be placed ahead of the first RF amplifier stage of an interference meter. The meter should also be capable or rejecting spurious responses resulting from combinations with the fundamental or harmonics of the conversion oscillator system of the super-heterodyne section of the meter. The degree of rejection is measured in terms of attenuation in db relative to the desired signals. This spurious response rejection should be at least 40 db.

Surface Contact Transients. Transients resulting from the variation in contact resistance across sliding surfaces of rotating electrical machines.

Surface Transfer Impedance. The ratio of longitudinal voltage drop along the outside of a tubular shield to the current carried by the shield.

System. Contains two or more Sets or Major Units located at different positions but accomplishing their objective through interdependent or interrelated operations, as for example a Propeller Control System.

Thermal Agitation. The thermal motion of the conduction electrons in a resistor causing minute interfering currents.

To Bond. To connect between two points through a low impedance path.

Transmission Factor (referring to networks). The ratio of the voltage in the transmitted wave to that in the incident wave at a point of discontinuity.

Transmission Factor (referring to media). The ratio of the electric field intensity in the transmitted wave to that in the incident wave at a surface of discontinuity.

Transmit-Receive (TR) Box. A device used in radar sets to prevent the transmitted pulse from entering the receiver.

Undesirable Response. Any audible, visible, or otherwise measurable response of a receiver not produced by a desired signal provided that either its duration is longer than one second or its highest recurrence rate is during normal operation of the aircraft is greater than once every three minutes.

Wave Trap. A circuit designed to attenuate greatly one frequency or a very narrow band of frequencies while passing without appreciable attenuation all other frequencies. **EMC**

PHOTOS BY JANET O'NEIL

A Tribute to EMC Pioneers

By Gene Taylor, EMC 2011 Symposium Exhibits Chair

Our 2011 IEEE International Symposium on EMC in Long Beach, California has disappeared into history now, along with that one week of the year when EMC experts and friends from all over the world get together for the exchanging of ideas. This year, the symposium committee tried a few new things on the exhibit floor that were intended to enhance the experience of all our attendees and exhibitors. One experiment that Symposium Chairman Ray Adams encouraged the Exhibits Chair to try was a unique attempt to honor some important members of our Society by telling the stories of about a dozen "Pioneers of EMC" (POE).

Bob Dockey admires the tribute display to Joe Fischer of Fischer Custom Communications, part of the EMC Pioneers exhibit at the EMC 2011 symposium. From lifeguard on the beaches of southern California to EMC engineer – what a career for Mr. Fischer!

Those readers who attended the symposium in Long Beach will surely recall the attitude of unusual excitement as we all got to meet and shake hands with engineers within our Society who, collectively, are singularly responsible for what our industry looks like today.

One of the new ideas tried at the Long Beach Symposium had rather impressive results and is worthy of a special mention. Our "Pioneers of EMC" (POE) event appears to have been thoroughly enjoyed and supported by our entire membership.

While I was driving between account calls one day, sometime during the month of March, I had the 'bright idea' of putting together our POE display. After attending dozens of IEEE EMC Society events over the last decade, I was struck by the thought that there was a pretty important class of people that our Society does not generally have a good track record of recognizing, such as our pioneers in the EMC industry.

Any attendee at an IEEE EMC Symposium event can visit Dan Hoolihan's Historical display and discover when our Society was founded and a host of other related information. We often put old EMC test and measurement equipment on display for educational purposes. It is pretty amazing what 'we' used to do with some pretty rudimentary hardware… and that was before "software" was even a word, much less a reality!!! Well, there's another thing that new engineers and members of our profession can learn from visiting the EMC Society's History booth, but it is a bit on the subtle side. EMC test standards always drove test equipment development and there were usually market leaders who drove the standards and then designed the necessary test equipment and procedures to satisfy the standards.

Our 'rule of thumb' in looking for POE nominations from symposium committee members and others was including individuals who met the following criteria:

- They left the corporate world 30–40 years ago because they had a 'better idea';
- They risked it all (at the time) with no guarantees, but they were successful;
- They focused on some specialty niche area within the EMC industry;
- They went back to their garage and developed that 'better idea' into a marketable product;
- They turned that marketable product into a company that impacted our industry;

- Their product/expertise has had a significant impact on our industry;
- Their company (or a version thereof) still exists today and is critical to our industry;
- They became (and remain to this day) a bit of a 'guru' both to their own company as well as to others; and,
- They remained 'true' to our EMC industry throughout and still contribute to it today.

I leave it to future symposia and exhibits chairpersons to decide whether our POE honoring exhibit of 2011 was a new tradition worth repeating or whether it was simply a one-time 'transient'. Regardless, it is with great pleasure that I introduce our Society to the Pioneers of EMC who were nominated for our 2011 Symposium on EMC. The people that we honored and introduced on the exhibit floor at our 2011 Long Beach Symposium are responsible for the gainful employment (within our industry) of at least 1,000 people. They represent and/or support several hundred small businesses and have products in literally hundreds of EMC test labs around the world.

Mr. Art C. Cohen – AH Systems, Inc – Art 'unofficially' started his work long before he established AH Systems in 1974. However, once he graduated and moved beyond modifying 'Pringles' cans in his basement, he developed a complete set of antennas that came to be depended upon by many people for whom EMC testing was 'the great unknown'. Now, his company manufactures a complete line of affordable, reliable EMC test equipment including Test Antennas, Preamplifiers, Current Probes and Low-Loss Cables that are used to satisfy almost every possible test standard.

Mr. Paul Bender – AR Receiver Systems – Paul started Carnel Labs in his garage in November, 1961, as a calibration laboratory. He quickly became the key West Coast service center for the servicing of receivers, spectrum analyzers and other EMI instruments ranging from DC to 40 GHz. Paul and his team put their hands on (and repaired or calibrated) equipment used by the US Navy and Air Force, NASA, JPL, Hughes, General Dynamics, Rockwell and Litton Data Systems, just to name a few. In 1992, Carnel began manufacturing its own EMI product offerings based on their purchase and consolidation of the old Eaton line. Carnel Labs became the Receiver Systems Division of AR in 2002. Paul likes to say that he is still an employee in the field after 50 years and he still continues to enjoy the many challenges that it brings to him. He adds that he is happy to still have a nice head of hair in spite of pulling out many of them due to those many frustrating challenges!

Mr. Don Shepherd – AR RF/Microwave Instrumentation – "Shep" started work in his garage. He and his partner began work in an era when RF amplifiers were expensive, unreliable, difficult to work with, very touchy in performance, and hard to find. One of Shep's founding principles was to provide exceptional customer support. Over the last 40+ years, he has been persistent and has turned those dreams into reality with a worldwide reach. No EMC lab in the world is unfamiliar with the wide orange stripe and the quality and service record that it represents.

Mr. Don Sweeney – DLS Electronic Systems, Inc. – Today, Don is the president of DLS. However, his career has been varied and included stints at Extel, Teletype, Gates Radio and Collins Radio along with specialized consulting contracts. He has devoted the last 40 years of his career to solving problems in electromagnetic engineering. Through his formal educational

Walter Poggi started Retlif over 30 years ago to provide a qualified, knowledgeable site for EMC compliance testing to FCC Parts 15 and 18. He recognized the great need for these services and rose to the occasion.

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Don Shepherd of AR RF/Microwave Instrumentation also started his company in his garage. He and his partner began work in an era when RF amplifiers were expensive, unreliable, difficult to work with, very touchy in performance, and hard to find.

courses at various universities along with other teaching venues, Don has educated hundreds of people in EMC theory and practice.

Mr. Alwyn Broaddus – DNB Engineering, Inc. – DNB is a full service test lab and world leader and an expert provider of EMC testing. Alwyn Broaddus originally founded the company in 1979 to provide an EMC test facility with engineering support. Alwyn was always noted for his interest in and willingness to solve unique or unusual EMC test problems and DNB has retained that ability through the years. Today, DNB Engineering provides unrivaled EMC, Lightning, High Intensity Radiated Fields (HIRF), and Regulatory Testing to customers around the world. The company goal is to provide an accredited facility for customers where they will be able to obtain a qualified third-party product evaluation.

Mr. Jim Klouda – Elite Electronic Engineering Inc. – In many ways, Elite began aboard a USAF bomber sometime in the early 1950s. An on-board camera system started to interfere with the bomber's autopilot when it was turned on. An urgent call was placed to the camera manufacturer's new young engineer – Jim Klouda. With a little sleuthing – and a little shielding – Klouda fixed the problem and saved the day. Shortly after that experience, Jim founded Elite labs. In 1954, Elite had two employees and a 2,500 sq ft storefront. By 1973, the company had grown 10 times. Today, in 2011, they are three times larger yet, with 60 employees and more than 45,000 square feet of modern facilities. Located in the heart of the USA, its Illinois facility serves as both headquarters and the primary testing site with 27 RF test chambers in various configurations that can be tailored to meet a customer's exact testing needs. One thing hasn't changed in 50 years: Elite remains dedicated to serving its customers and ensuring their complete satisfaction.

Pioneers of EMC attending the EMC 2011 Symposium in Long Beach included (front row from left) Ray Klouda, Judy Ware (daughter of Paul Bender), George Kunkel of Spira Manufacturing Corporation, Richard Parker of Fair-Rite Products Corp, Art Cohen of AH Systems, and Tom Klouda. Tom and Ray are the sons of Jim Klouda, founder of Elite Electronic Engineering. (Back row from left) Richard Janiec of Retlif (representing Walter Poggi), Don Shepherd of AR RF/Microwave Instrumentation, Joe Fischer of Fischer Custom Communications, Brian Lawrence of iNARTE, Alwyn Broaddus of DNB Engineering, and Don Sweeney of DLS Electronic Systems rounded out the pioneers present in Long Beach.

The "Pioneers of EMC" display created by Gene Taylor of Altamont Technical Services attracted much attention during the 2011 IEEE International Symposium on EMC. The respected pioneers profiled featured Don Sweeney (foreground) of DLS Electronic Systems and George Kunkel of Spira Manufacturing Corporation (rear), to name a few.

Mr. Richard Parker – Fair-Rite Products Corp – For over fifty years Fair-Rite has been the first choice in cost effective ferrite components. The history of ferrites (magnetic oxides) began centuries ago with the discovery of stones that would attract iron. However, Richard came sometime after that and he focused his early efforts on using ferrites for EMI energy attenuation. He was a pioneer and a pathfinder in that area. The company he founded so many years ago now offers a comprehensive product line that includes a wide range of materials and geometries for EMI Suppression, Power Applications and RFID Antennas. It would be hard to find any other product on the market today that can offer such a fast, simple and effective way to suppress unwanted EMI energy.

Mr. Joe Fischer – Fischer Custom Communications – FCC has been a stable supplier to our industry for almost forty years now. During that entire time, FCC has consistently been a reliable source for specialized transient protection devices, RF test and measurement instruments and EMP test systems. Joe 'got the bug' many years ago and has never looked back. His indomitable partner Virginia (congratulations on a marriage of over 50 years!) has always been by his side and provided just the 'push' or encouragement that he needed! He and she are still right there at FCC providing innovative high technology products that meet the specialized needs of our industry.

Mr. Brian Lawrence – iNARTE, Inc. – Brian Lawrence began his EMC career designing "Stealth" materials for the British armed services. In 1973, he moved to the USA and established a facility providing these materials to the US Navy. In 1980, he joined Rayproof to develop their Anechoic Chamber product line. Rayproof later merged into Lindgren RF Enclosures and then into ETS-Lindgren. Brian retired as Managing Director of ETS-Lindgren UK in 2006. He is now Executive Director at iNARTE, the International Association of Radio, Telecommunications and Electromagnetics. iNARTE has expanded its personnel credentialing programs and is today affiliated with RABQSA, a part of the American Society for Quality.

Mr. Walter Poggi – Retlif Testing Laboratories – Walter started Retlif over 30 years ago to provide a qualified, knowledgeable site for EMC compliance testing to FCC Parts 15 and 18. He recognized the great need and rose to the occasion. In the years since, Retlif expanded their test offerings, but Walter did a lot more than that for our industry. He was a key driver and contributor for the first EMC laboratory accreditation program through NVLAP and was similarly effective in working with the ACIL. Walter's 'fingerprints' are sprinkled throughout many of our standards bodies and within many of our internationally recognized and accepted trade agreements.

Mr. George Kunkel – Spira Manufacturing Corporation – In his earlier years, George was a ubiquitous writer. He was always extremely active within the EMI/RFI and electromagnetic industry and has authored and presented over 100 papers internationally. His papers, inventions and products are invariably focused nicely around his own area of particular interest – EMI gasketing. The unique gasketing that Spira markets has had an impact on many other manufacturers and users. George has taught several courses on applied electromagnetic theory at UCLA. He held the position of chairman of the Technical Committee on Interference Control of the EMC Society of the IEEE for seventeen years.

To close this article, I'd like to thank those pioneers listed above for their perseverance, individualism, entrepreneurial spirit and innovations through the years.

I'd also like to offer my thanks and recognition to the following people who played a key role in assisting to help make our POE event a success: Mark Frankfurth, Dan Hoolihan, Janet O'Neil and Ray Adams. Without their assistance and able support, this event would not have occurred and those people shown above would have – once again – not been singled out for this recognition. Hopefully, the POE idea will be further refined and again presented to our community in the future.

EMC

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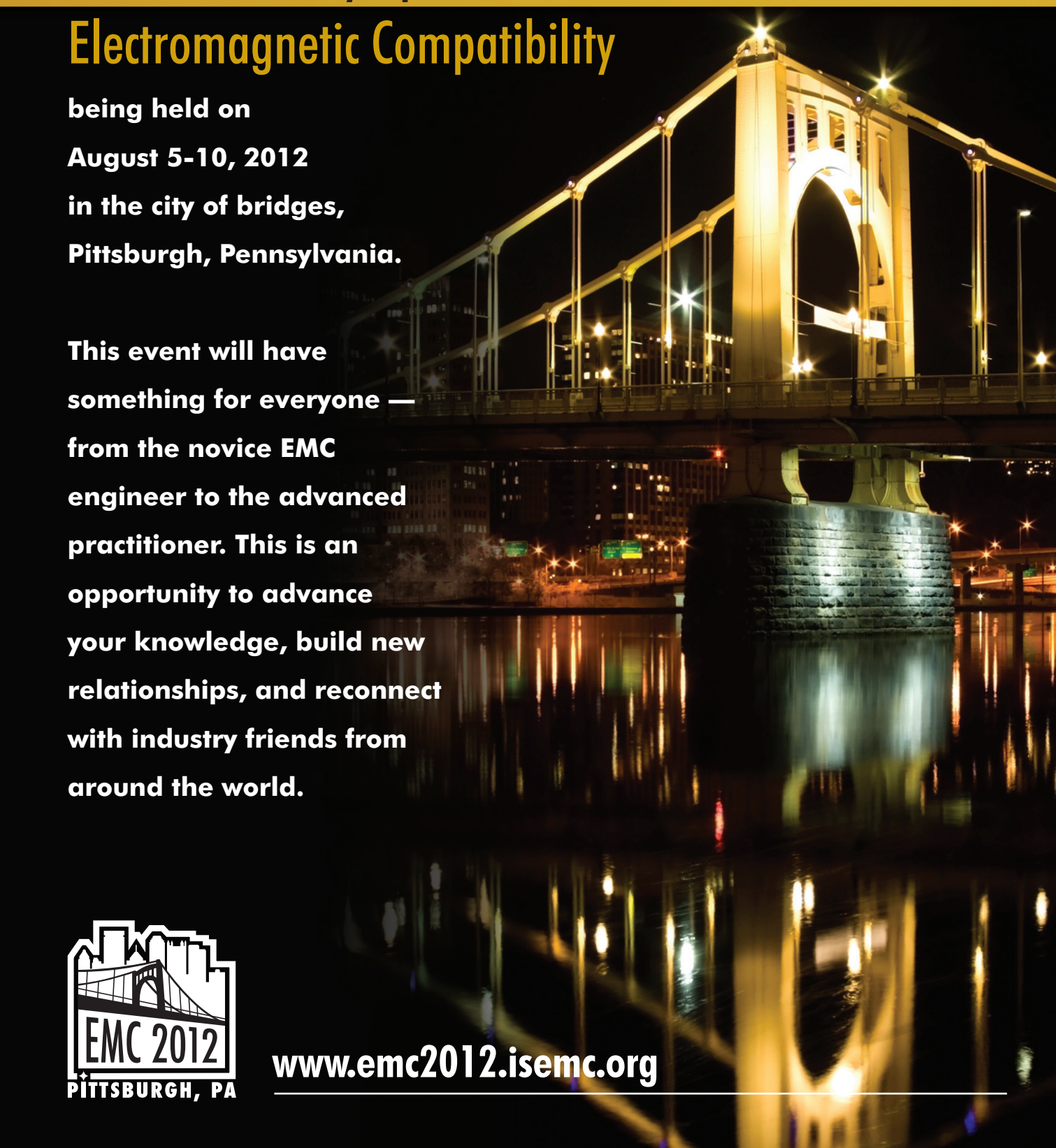

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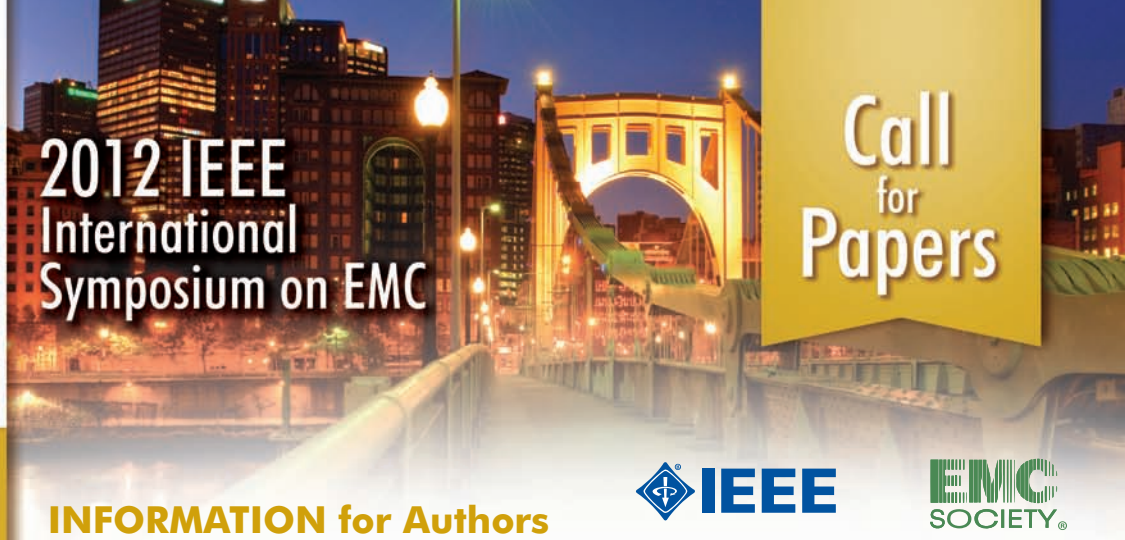

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INFORMATION for Authors

The IEEE EMC Society seeks original, unpublished papers covering all aspects of EMC and in technologies that are affected by EMC (including but not limited to shielding, ESD, automotive, broadcast, military, wireless, smart grid, and power transmission.)

Join your colleagues in Pittsburgh where you can share your insight, ask questions, learn from the experts/innovators and see new products at the 2012 IEEE International Symposium on Electromagnetic Compatibility. Your published paper will be seen by thousands in the global EMC community via IEEE *Xplore* as well as by those attending the symposium. This is a unique opportunity for your paper to receive unlimited exposure and be read by those, across a wide array of disciplines, that look to the IEEE EMC Society for technical guidance.

PAPER TOPICS of Interest

Topics include and are not limited to the following technical areas.

TC-1 EMC Management
- EMC Personnel Accreditation
- Laboratory Accreditation
- EMC Education
- EMC Legal Issues

TC-2 EMC Measurements
- Test Instrumentation
- Measurement Techniques
- Emissions and Immunity
- Standards and Regulations
- Test Facilities

TC-3 EM Environment
- EM Signal Environment
- Atmospheric Noise
- Man-Made Noise

TC-4 EM Interference
- Shielding, Gasketing & Filtering
- Cables and Connectors
- Coupling
- System EMC Analysis
- Grounding
- PCB Issues

TC-5 High Power Electromagnetics
- ESD & Transients
- EMP, IEMI & Lightning
- Information Leakage
- Electric Power EMC

TC-6 Spectrum Management
- Spectrum Management
- Spectrum Monitoring

TC-9 Computational Electromagnetics
- Computer Modeling
- Model Validation
- Statistical Analysis

TC-10 Signal Integrity
- Packaging
- Model Parameter Determination
- Device Modeling
- Crosstalk

TC-11 Nanotechnology & Advanced Materials
- Nanomaterials
- Nanostructures
- Carbon Nanotubes
- Nanofibers
- Smart Materials

SC1: Smart Grid EMC

SC2: Low Frequency EMC

SC3: Transportation System EMC

Author Submission Schedule

Preliminary Full Paper Manuscript:
November 1, 2011 - January 15, 2012
(late papers will not be accepted)

See web site for more details
www.emc2012.ISEMC.org

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Practical Papers, Articles and Application Notes

Kye Yak See, Technical Editor

I am just back from the EMC Europe 2011 conference in York, United Kingdom. It was a pleasant surprise for me as I did not expect an unusual sunny September in Europe where the temperature could shoot up to 29°C during the day time. Some delegates joked that I brought the sunny weather from Singapore to Europe! It was a great conference with new technologies on display in the exhibit hall and excellent research papers presented during the technical program. Of course, I enjoyed the social networking with delegates in the closely knitted EMC community as well.

Without fail, in this issue, we have three very interesting papers authored by three relatively young researchers, which is an encouraging sign as it shows that EMC continues to draw interest from the young engineers and researchers. The first paper, "Field Distribution in a Stripline and Its Influence on Immunity Testing," is contributed by Huadong Li from Caterpillar Inc. I have known Huadong for more than 10 years. He did his Master course at my unviersity and later moved to the USA for further career development. With his rich EMC test experience in the industry, Huadong shares with us some findings of field distribution in a stripline using transmission line analysis. He shows that the standing waves due to the impedance mismatch between the stripline and the load end can lead to non-repeatable results in immunity testing. Other factors such as the harness length, the location and the equivalent impedance of the peripheral and their impacts on field distribution and test results are also addressed.

The next paper "EMI Filter Design Part I: Conducted EMI Generation Mechanism," is authored by Vuttipon Tarateeraseth from Srinakharinwirot University, Thailand. Two years ago, Vuttipon came to my university as an exchange Ph.D. student from the Politecnico di Torino, Italy. During his one year exchange in my university, I noticed his research and design experiences in switched-mode power supplies (SMPS), especially in the EMI filter design aspect. I encouraged him to contribute a three-part series on EMI filter design and he has kindly agreed to do so. The three-part series will provide the readers a systematic EMI filter design approach for SMPS without the usual trial-and-error method. This paper is the first part of the series and it explains the generation mechanisms of common mode (CM) and differential mode (DM) conducted emissions and the measurement setup for conducted emission compliance. In the subsequent papers in this series, he will describe a method to extract noise source impedances of a SMPS and proper selection of filter topology for optimal performance. I believe the series of papers will benefit design engineers in the switching convertors industries.

The last paper "Extended Ground Pin as ESD Protection on Automatic Document Feeder Door Sensor," is a short article contributed by Keng Kok Khoo from Hewlett Packard, Singapore. Keng Kok is an active committee member of the IEEE EMC Society Singapore Chapter. During one of the chapter meetings, he told me that he discovered a relatively simple solution to imrpove the ESD immunity of a printer. With the agreement of his company, in this paper, he illustrates that an extended ground pin serving as an ESD arrestor, placed near the automatic document feeder door sensor of a printer, can act as a simple and cost effective ESD solution. The proposed solution eliminates the need of having additional ESD protection components on the sensor or the circuit.

I hope you will find these three papers informative and useful. I encourage more engineers involved in EMC design and measurement to consider sharing your experience in this column. Please email me your thoughts at ekysee@ntu.edu.sg.

Field Distribution in a Stripline and Its Influence on Immunity Testing

Huadong Li, Caterpillar Inc., Peoria, IL; li_huadong@hotmail.com

Abstract—This paper analyzes the field distribution in a stripline. Under the assumption that only transverse electromagnetic (TEM) waves travels in it, the field in a stripline is found to be nonuniform along its longitude at high frequencies because of its unmatched impedance with the termination loads and typical standing waves exist in it. Immunity tests with the stripline method are theoretically analyzed. It is found that the test results depend on the field distribution. Many factors such as the harness length, the location and the equivalent impedance of the peripheral may affect the test results. The nonuniform field distribution in a stripline causes the test results unrepeatable.

Index Terms—Immunity testing, stripline, common-mode response.

1. Introduction

Several types of test facilities are used today to measure the immunity of electronic equipment and systems to radiated fields. They are (semi-) anechoic chambers, mode-stirred reverberating chambers (MSRC) and various TEM cells. A stripline is a test fixture which can be used for testing the immunity of automotive electronic devices to radiated radio frequency (RF) electromagnetic fields. The test procedures are described in SAE J-1113-23[1] and ISO 11452-5 [2].

A stripline for radiated field immunity tests, shown in Fig. 1, is a non-shielded version of a TEM cell consisting of an active conductor separated from the ground plane by air. It is usually built to have a characteristic impedance of either 50 Ω or 90 Ω and this is determined by the ratio between the width of the active conductor and the height of the active conductor above the ground plane. The advantages of a stripline for immunity tests are low cost, high field intensity and exposure of devices under test (DUT) plus wire harness to the interfering field, as well as good access to the test area. Since TEM waves are assumed inside striplines, striplines have limited working frequency ranges for immunity tests. [1] specifies the frequency range as 10 KHz to 200 MHz and [2] specifies it as 10 KHz to 400 MHz. Compared with the immunity test method in an absorber-lined shielded enclosure as prescribed in ISO 11452-2 [3] the stripline method doesn't need antenna polarization change. This makes the stripline method more convenient.

A 50 Ω stripline is thought to be easier to be matched with the driving system. However, it has a lower height and more stringent limits on the DUT size. 90 Ω striplines are often used for large size DUT. A stripline with characteristic impedance other than 50 Ω needs impedance matching, like lump circuit elements and tapered transmission lines, to reduce the voltage standing wave ratio (VSWR) inside and the power reflection at the ends. Due to the non ideal features of matching units like component frequency characteristics, designing and manufacturing tolerances, most real striplines do not perfectly match the driving systems and the load. Considerable standing waves can exist inside. In [4] the VSWR in a well designed stripline is measured to be above 1.5 at 130 MHz. Impedance mismatch also exists between a 50 Ω stripline test section and its feed/load points. [5] shows that the VSWR in a 50 Ω commercial stripline can be above 1.8 around 250 MHz.

Strictly speaking, the electromagnetic wave traveling in a stripline is not a TEM wave since the stripline has two open sides and may have large distance between the active conductor and the ground plane. According to [6] we can assume that TEM waves dominate the fields inside a stripline under a few hundred mega Hz which is the typical use frequency range. However; the existing standing wave inside a stripline indicates the fields are not uniform. Its effect on the test results needs to be investigated. This paper will investigate the field distribution in a stripline. A theoretical model based on transmission line theory is used to analyze the generation mechanisms of standing waves. The root causes of the non uniform electric fields in a stripline are analyzed. To evaluate the stripline immunity test method, the coupling of a standing wave electromagnetic field to a transmission line is analyzed. Parameters affecting the test results are extracted.

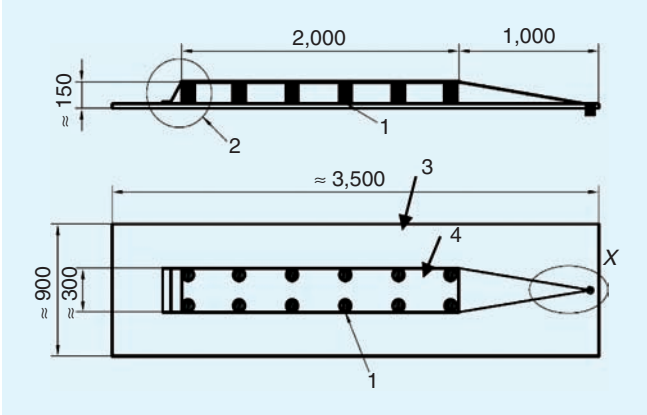

Fig. 1. A design for 90 Ω stripline. (1. Dielectric rods; 2. Resistive load; 3. Ground plane; 4. Active conductor. Unit in mm).

2. Field Distribution in a Stripline

Fig. 2 gives a circuit model for the stripline method test setup. The stripline is represented as a 3 m long lossless transmission line with a characteristic impedance Z_0. Its value can be either 50 Ω, 90 Ω or others and is given as [2]

$$Z_0 = \frac{120\pi}{\frac{b}{h} + 2.42 - 0.44\frac{h}{b} + \left(1 - \frac{h}{b}\right)^6} \tag{2}$$

where b is the width of the active conductor and h is the height of the active conductor above the ground plane.

This transmission line is terminated by a load Z_L and driven by a source V_S with an internal impedance Z_S. Their values can be different to Z_0. From the standpoint of the source, the stripline can be represented by its input impedance, Z_{in}, and V_{in} appearing across the input terminal is given by

$$V_{in} = V_s \frac{Z_{in}}{Z_s + Z_{in}}. \tag{3}$$

The input impedance, Z_{in}, seen by the source feeding the lossless transmission line can be calculated as

$$Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan \beta l}{Z_0 + jZ_L \tan \beta l}, \tag{4}$$

where l is the length of the line and the propagation constant

$$\beta = k_0 = \omega\sqrt{\mu_0\varepsilon_0} = 2\pi f\sqrt{\mu_0\varepsilon_0},$$

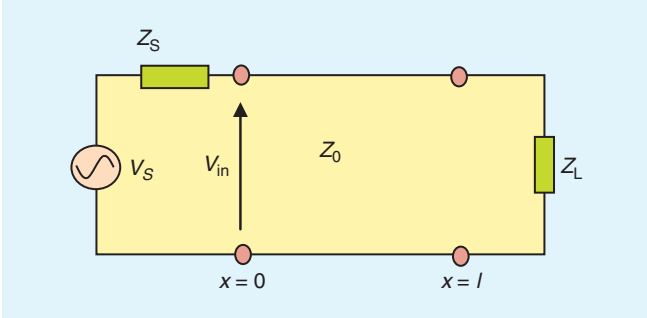

Fig. 2. A circuit model of the TPL method test setup.

where μ_0 and ε_0 are the permeability and permittivity of free space; f is the signal frequency. Once the input impedance is determined, the incident voltage at the input of the transmission line can be calculated as

$$V_0^+ = V_s \frac{Z_{in}}{Z_{in} + Z_s} \frac{1}{1 + \Gamma_L e^{-j2\beta l}}, \tag{5}$$

where Γ_L is the load reflection coefficient and is defined to be

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0}. \tag{6}$$

The total voltage at any point along a transmission line can be solved to be

$$V(x, f) = V_0^+ e^{-j\beta x}(1 + \Gamma_L e^{j2\beta(x-l)}). \tag{7}$$

Now that the voltage has been determined along the line, the magnitude of electric field strength can be determined to be

$$E(x, f) = V_0^+ e^{-j\beta x}(1 + \Gamma_L e^{j2\beta(x-l)})/h \tag{8}$$

If $\Gamma_L \neq 0$, it is obvious that the electric field along the stripline changes with frequency and location. Fig. 3 gives the electric field distribution along the center of a stripline with an input signal $V_S = 10$ V at the frequency of 200 MHz. The other parameters used in the simulation are $Z_0 = 90\ \Omega$; $Z_S = 50\ \Omega$; $Z_L = 70\ \Omega$ and $h = 0.155$ m. The mismatch considers the non ideal termination characteristics at high frequencies. The result shows a typical standing wave with VSWR = 1.29. It is worth noting that this is only the field amplitude distribution. Besides that the electric fields also have different phases at different positions. This makes the analyses of immunity tests more complicated.

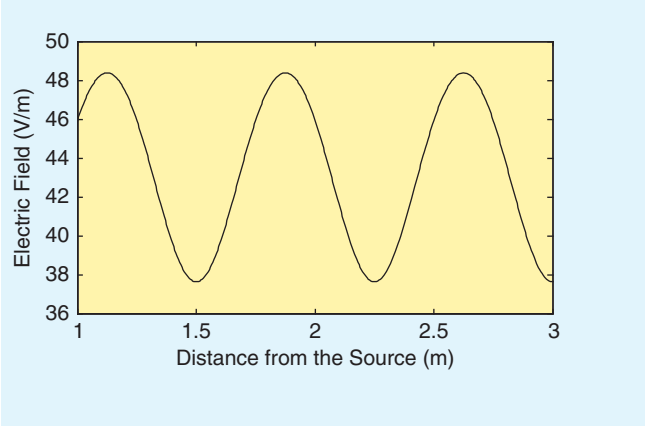

Fig. 3. Calculated field distribution at 200 MHz in a stripline.

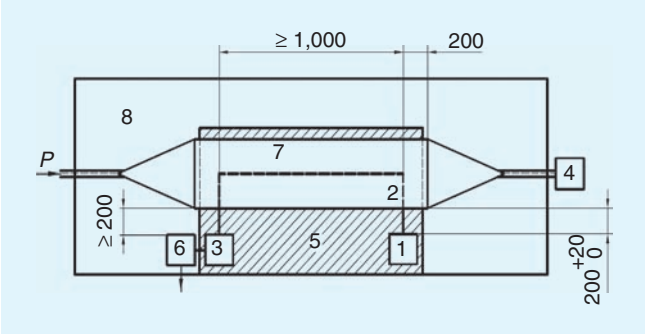

Fig. 4. Example of stripline test configuration (1. Device under test; 2. Wiring harness; 3. Peripheral; 4, Termination resistance; 5. Insulating base; 6. Artificial network(s); 7. Active conductor; 8. Ground plane. Unit in mm).

3. Analysis of Stripline Immunity Test

A typical immunity test setup with stripline method is shown in Fig. 4. During the test, the DUT and its peripheral are placed outside the stripline with the attached cable harness running at least 1 m inside the stripline along the length and exiting the stripline at 90° to the active conductor. A 50 mm high non conductive fixture is used for positioning the wiring harness in the center of the stripline, parallel to its major axis. According to [2], field calibration shall be conducted without DUT setup before stripline testing. The field strength inside the stripline can be calculated as

$$|E| = \frac{\sqrt{P \times Z_0}}{h} \tag{9}$$

where P is the net power.

Alternatively, the relation between the field strength and the net power may be determined by placing a calibrated field probe as close as possible to the center of the stripline. During the testing the field strength generated inside the stripline is determined by monitoring the net power. Once P is given, E is determined. The ideal situation is that this value shall have a direct relationship with the equivalent disturbance implemented on the DUT when it is tested. If the field distribution in the stripline is uniform, it is may be easy to understand that there exists a fixed relationship between the field strength and the equivalent disturbance on the DUT. However; if the field distribution is non uniform in the stripline, the relationship between the calibrated filed strength and the equivalent disturbance is not necessarily unique since with the same nominal field strength there can be many possible different field distributions. Besides the calibrated field strength value, the field distribution has direct influence on the equivalent disturbance on the DUT. It is useful to investigate how the field distribution affects the immunity test.

If only the common-mode disturbance is considered, the harness under test can be treated as one conductor. It forms a transmission line with the ground plane of the stripline and is exposed to the electromagnetic field generated by the stripline. In the use frequency range of a stripline up to a few hundred MHz, the effective noise receivers are long cables and wires. In this paper we assume that the disturbance induced to the DUT is mainly contributed to by the noise picked up by the harness. The noises picked by the harness accumulate and work as an equivalent noise voltage V_{L1} to interfere with the DUT at its input/output interface connectors. It is reasonable to use the voltage, V_{L1}, to indicate the severity level of the immunity test that the DUT is subject to.

Fig. 5 gives a diagram for a stripline immunity test. Z_{L1} represents the equivalent impedance between the DUT and the ground plane; Z_{g1} represents the equivalent impedance between the peripheral and the ground plane. $E_Z(x)$, directed along z axis, is the external field generated by the stripline. The harness, located at a distance of h_1 above the ground, forms a transmission

line with the ground plate. Its characteristic impedance is Z_C. The currents and voltages induced along a transmission line by the external fields are generally obtained by the solution of the telegrapher's equations. If only the terminal response V_{L1} is required, the solution can be cast into the following form [7][8].

$$V_{L1strip} = \frac{1}{e^{j2\beta l_1} - \rho_0\rho_{L1}}(1+\rho_{L1})(\rho_0 S_2 + e^{j\beta l_1}S_1), \quad (10)$$

where $\rho_{0,L1}$ are the reflection coefficients of the peripheral and the DUT and are defined as

$$\rho_{0,L1} = \frac{Z_{g1,L1} - Z_C}{Z_{g1,L1} + Z_C}, \quad (11)$$

where l_1 is the length of the harness inside the stripline. The line propagation constant β is defined to be the same as in (4) and

$$\begin{pmatrix} S_1 \\ S_2 \end{pmatrix} = \frac{1}{2}\begin{pmatrix} \nu_0 + \nu_x^+ - \nu_{L1}e^{j\beta l_1} \\ -\nu_0 e^{j\beta l_1} - \nu_x^- e^{j\beta l_1} + \nu_{L1} \end{pmatrix}, \quad (12)$$

with

$$\nu_0 = \int_0^{h_1} E_z(x_0)\mathrm{d}z = E_z(x_0)h_1 \quad (13)$$

$$\nu_{L1} = \int_0^{h_1} E_z(x_0+l_1)\mathrm{d}z = E_z(x_0+l_1)h_1 \text{ and} \quad (14)$$

$$\nu_x^{\pm} = \int_{x_0}^{x_0+l_1} E_x(x)e^{\pm j\beta x}\,\mathrm{d}x = 0 \text{ V}. \quad (15)$$

Here (15) comes from the assumption of $E_x(x) = 0$ V/m.

After some math work (10) is rewritten as

$$V_{L1strip} = \frac{1}{e^{j2\beta l_1} - \rho_0\rho_{L1}}\frac{V_0^+ h_1}{2h}(1+\rho_{L1}) (-2j\rho_0 \sin(\beta l_1)e^{-j\beta x_0} + \Gamma_L e^{j\beta(l_1-2l)}(1-e^{2j\beta l_1})). \quad (16)$$

The measurement results depend on several parameters. The term V_0^+/h is related to the calibrated field strength and is defined by the test level. h_1 is defined to be 50 cm in the standards. l_1 is the length of the harness under test. Its value can change, but can be defined. ρ_0 and ρ_{L1} depend on the peripheral and DUT setup. Their values depend on the projects. x_0 reflects the location of the position of the DUT and its peripheral in the stripline and it is not specified by the standard. Γ_L and l are related to the stripline. They will be of the same values for tests conducted in the same stripline, but may be of different values for tests with different striplines. At a nominal test level the equivalent disturbance applied to a DUT can vary with x_0, Γ_L and l.

Let us consider a special case. If the stripline is perfectly matched at the load end then $\Gamma_L = 0$. The magnitude of (16) won't be related with x_0 and l. The test result will have a good repeatability.

Conclusion

Measurements in the literature show that standing waves exist in striplines. Transmission line theory shows that the standing waves result from the characteristic impedance mismatch between the stripline and the load end and the calibrated field distribution does not have unique relationship with the input power. The existence of the standing waves makes the stripline immunity test results depend on the position of the DUT setup, reflection coefficient of the stripline load end and the stripline line length. This causes the stripline immunity tests non repeatable.

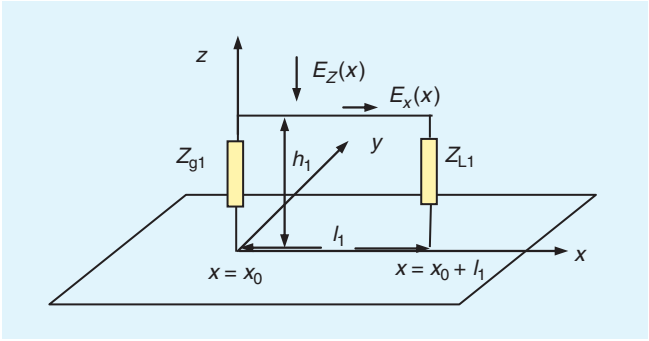

Fig. 5. A diagram for a stripline immunity test.

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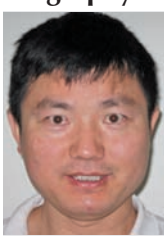
Biography



Huadong Li *received the B.S. degree in Microwave Engineering from East China Normal University in 1989, the M. E. degree in Electrical Engineering from Nanyang Technological University in 1999, and the Ph.D. in Electrical Engineering from the University of Dayton in 2008. He worked as an Electronic Engineer with Shanghai Space Bureau, China from 1989 to 1996. Between 1999 and 2001, he was with Thomson Multimedia, Singapore working as an EMC Engineer. From 2001 to 2003, he was an EMC Engineer with Met Laboratories, Inc., Union City, CA. He then joined Pioneer Automotive Technologies, Inc., in Springboro, OH, as a Senior EMC Engineer. He is currently working as an EMC Specialist with Caterpillar Inc., Peoria, IL. His current research interests are signal integrity, EMC testing, simulation and design.*

EMC

EMI Filter Design Part I: Conducted EMI Generation Mechanism

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Abstract—An electromagnetic interference (EMI) filter design procedure for switched-mode power supplies will be described in three parts: Part I) conducted EMI generation mechanism, Part II) measurement of noise source impedances, and Part III) a selection of passive filter topology for optimal performance. This article is the first part of the three-part series.

1. Introduction

Switched-Mode Power Supplies (SMPS) -also known as Switching Power Supplies (SPS) or Isolated DC-DC converters- are of widespread use in modern days because there are significant benefits in reduction of the physical sizes and high efficiency comparing to the linear power supplies [1]. The main function of the SMPS is to convert the AC input power to different level of regulated DC output voltages. Although there are several types of SMPS, all of them can be derived from the three basic DC-DC converters namely buck converter, boost converter, and buck-boost converter [2]. The main difference between SMPS and DC-DC converters is that the SMPS uses the high frequency transformer to make an isolation. For the sake of simplicity, to understand why SMPS generate significant noise, the boost converter and its switching waveforms are shown in Fig. 1 for explanation. In order to obtain the required DC output voltage, the semiconductor switch e.g. Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) of the boost converter must be switched "ON" and "OFF" by varying its duty-cycle at the switching frequency. Since the boost converter operates under extremely high switching frequency, the fast-transition voltage and current waveforms at the switching devices are resulted, as shown in Fig. 1. These fast-transition voltage and current waveforms are main noise sources and generate a wide spectrum of electromagnetic disturbance (EMD) [3]–[4]. Such electromagnetic noise propagates through the power cord connected to it and can also radiate in open space [5].

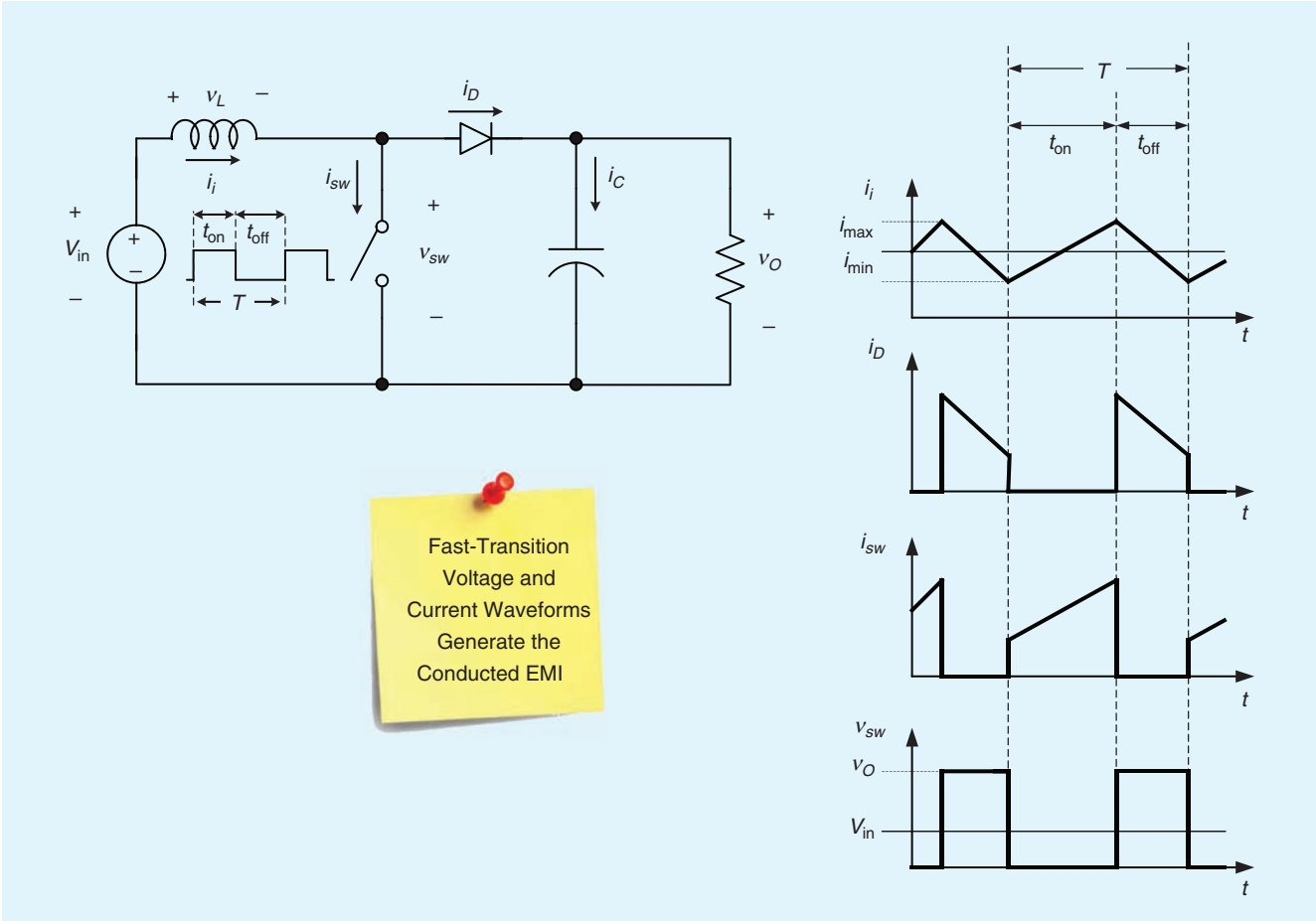

Fig. 1. Noise Source: switching operation of the converter.

Moreover, the cause of EMD is not only the switching operation of SMPS but also the parasitic elements of the passive components such as capacitor, resistor, inductor, transformer and power cord as shown in Fig. 2. In addition, the parasitic elements also come from the device leads, printed circuit board (PCB) traces, and device installations. For example, a heat sink is usually connected to the body of the MOSFET, which introduces a parasitic capacitance between the MOSFET and the heat sink as shown in Fig. 3. Those parasitic elements can cause a ringing voltage and current superimposed on the original switching waveforms which tend to enhance certain region of the original EMD [6]. The parasitic elements cause a ringing voltage across the switching device, during turn-off periods, while the diode reverse recovery causes a ringing current passing through the switching device during turn-on periods, as shown in Fig. 4. Therefore, it can be concluded that it is not only high *dv/dt* and *di/dt* during turn-off and turn-on periods having great influence on EMD problems, but the ringing voltage and current too.

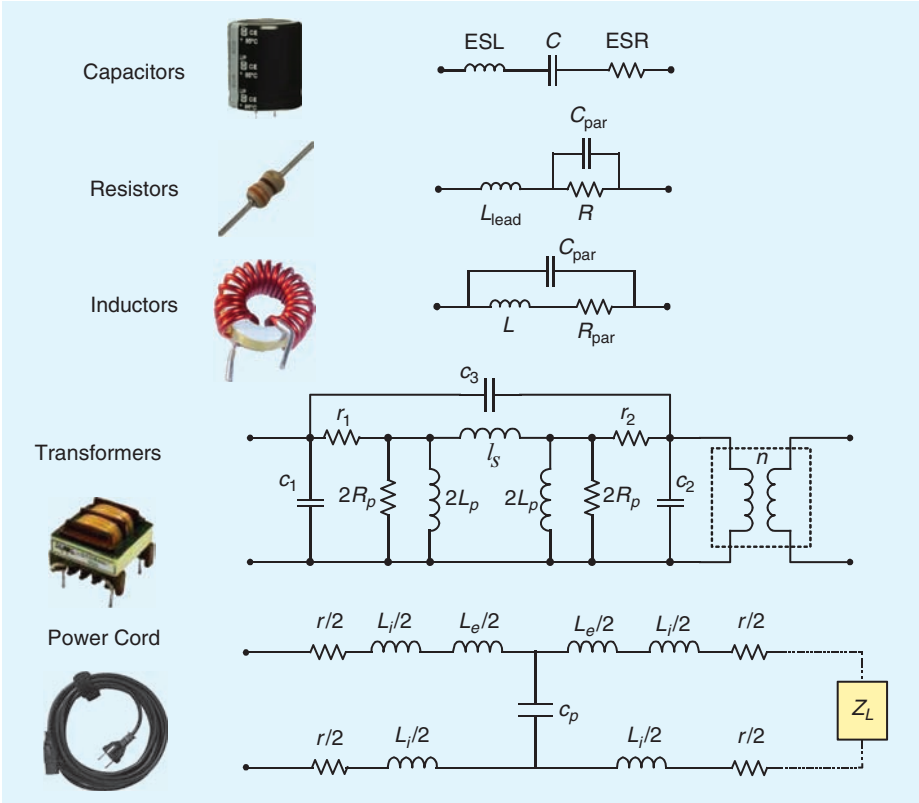

Fig. 2. Noise Source: parasitic elements of passive components.

The generated EMD might degrade the performance at device, equipment, or system level, either because the apparatus is powered by the same commercial power system and/or its location is very close to the power supply. If the performance of a device, an equipment, or a system is degraded by EMD, we commonly talk of electromagnetic interference (EMI).

To meet the EMC requirements, the EMD must be classified and analyzed because different EMC solutions are applicable to different frequency ranges. The EMD generated by any power electronic systems can be classified by frequency spectrum contents as shown in Fig. 5. The frequency spectrum contents from the power frequency (50 Hz or 60 Hz) to 2 kHz is defined as "harmonics" which can strongly distort the input current and voltage waveforms of the systems; in other words, it can decrease the power factor of the system and degrade the "quality" of power. The International Electrotechnical Committee (IEC) has issued the IEC-1000-3-2 standard to limit the harmonic contents of the electrical and electronic appliances. Generally, to comply with the given standard, there are two approaches: passive power factor correction (passive PFC) and active power factor correction (active PFC) [5]. Practically, the passive PFC is used for high power applications while the active PFC is applied for low power applications. Both approaches might be used to counteract the distortion and raise power factor. However, the PFC solutions will not be addressed in this article.

The frequency spectrum contents from 150 kHz to 30 MHz are defined as "conducted electromagnetic disturbance (conducted EMD)" or "conducted electromagnetic interference (conducted EMI)", as shown in Fig. 6. Typically, the conducted

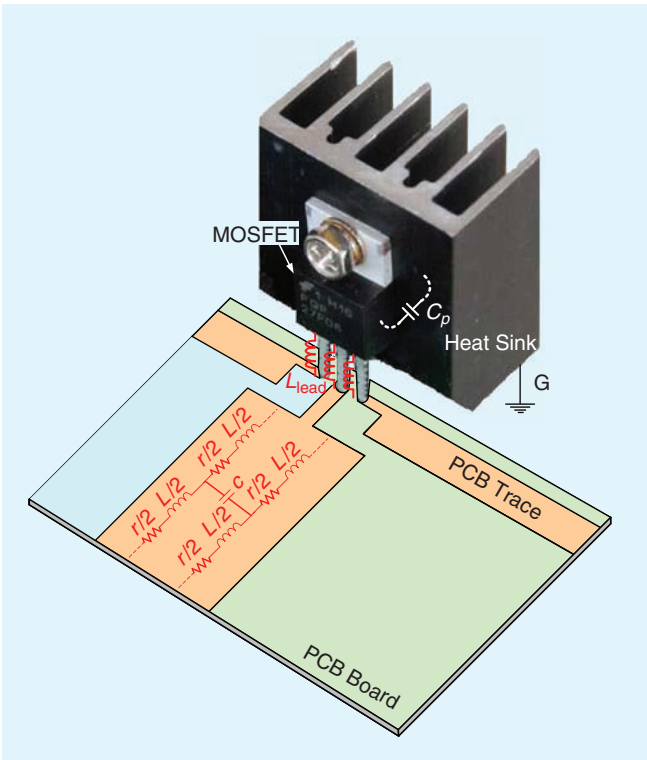

Fig. 3. Noise Source: parasitic elements of the circuit layout [8].

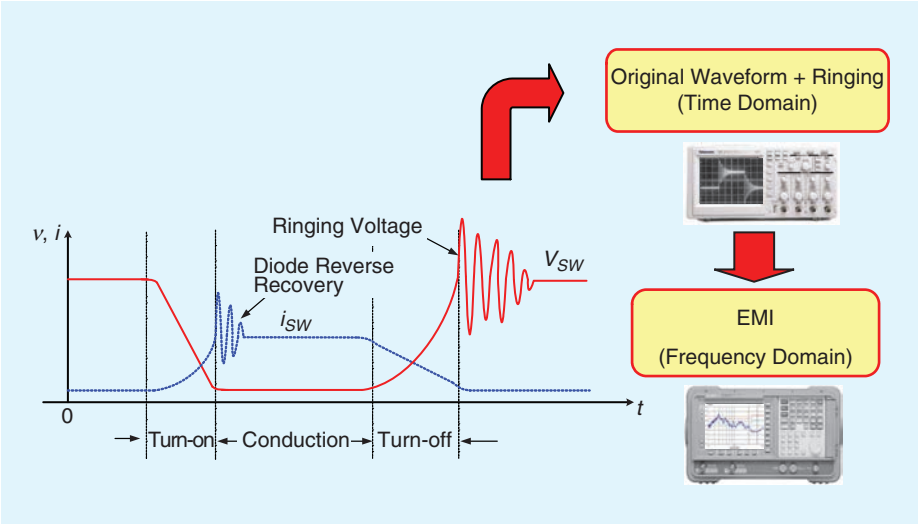

Fig. 4. Noise Source: fast-transition of switching devices.

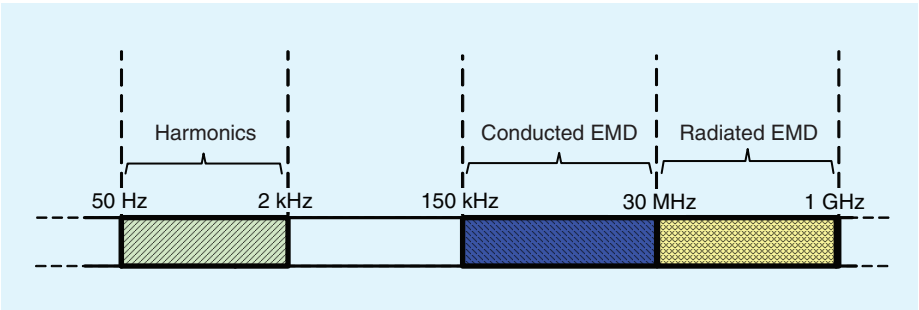

Fig. 5. Classification of electromagnetic disturbance by frequency {9}.

EMI produced by electrical and electronic appliances can be minimized if EMC principles are taken into account at the design stage. However, to ensure that the products can comply with the conducted EMI limits, the filtering techniques (passive filtering and/or active filtering) are normally used to suppress the conducted EMI. The different solutions between the PFC and the conducted EMI are illustrated in Fig. 7.

The "radiated electromagnetic disturbance (radiated EMD)" or "radiated electromagnetic interference (radiated EMI)" is from frequency above 30 MHz. In this frequency range, the product begins to radiate electromagnetic interference in space. Similar to the conducted EMI problem, the radiated EMI can be minimized at the design stage if the product is designed based on EMC principles. This subject is out of scope of this article. In this article, the filter design to suppress the conducted EMI generated by a switched-mode power supply (SMPS) will be the main focus.

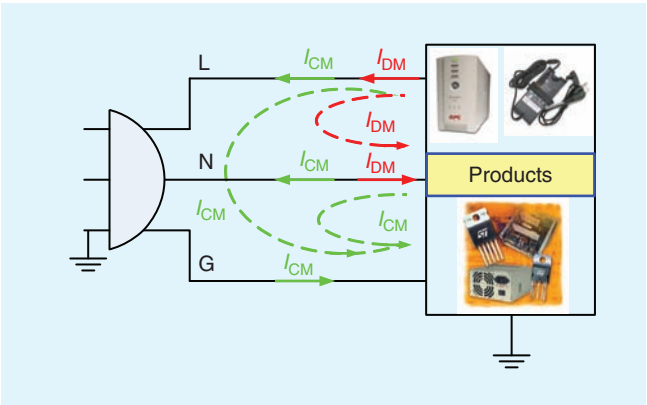

Fig. 6. Conducted EMI emission definition.

2. Common-mode and Differential-mode Conducted EMI Generation Mechanisms

Generally, the conducted EMI can be categorized into two conduction modes: the differential mode (DM) emission and common mode (CM) emission as shown in Fig. 6 [9]. The DM current flows out of the live wire and returns via the neutral wire. The CM current takes the live and neutral wires as one outgoing conductor and returns via the ground wire. Hence, the DM currents in the live and neutral wires are equal in magnitude but opposite in phase, while the CM currents are equal in both magnitude and phase as shown in Fig. 8 (a) and Fig. 9 (a), respectively [10].

Although many different SMPS topologies exist as discussed earlier, the flyback converter is presented as an example of the DM and CM noise coupling paths associated with the SMPS. In the flyback converter, as shown in Fig. 8 (b) and Fig. 9 (b), a diode bridge rectifies the ac voltage which is filtered by a bulk capacitor C_B producing a dc voltage. The required DC output voltage is chopped by the MOSFET, which is controlled by the pulse width modulation (PWM) controller. The MOSFET switches on and off at switching frequency but the duty-cycle is varied to regulate the output voltage. Due to the switching operation, the DM and CM noise currents are resulted. The normal operation of the circuit causes a DM noise, whereas the CM noise results from of the circuit's parasitic capacitances [7]. Fig. 8 (b) and Fig. 9 (b) show the DM and CM emissions propagating in an off-line flyback converter, respectively.

The objective of the conducted EMI test is to measure the total noise currents generated by the electrical and electronic appliances which are powered through a Line Impedance Stabilization Network (LISN). For measurement repeatability, CISPR 16-1 requires a LISN to prevent external conducted EMI on the ac mains from contaminating the measurement and to stabilize the ac mains impedances (line-to-ground and neutral-to-ground) at 50 Ω over the frequency range 150 kHz–30 MHz [11]. The noise currents across the 50 Ω instrument, which are the combination of the DM and CM disturbances, are measured as the conducted EMI. The DM noise depends on the equivalent series resistance (ESR) and equivalent series inductance

(ESL) of the bulk capacitor (C_B); the CM noise, instead, is coupled through the parasitic capacitance (C_p) of the switching devices due to their switching phenomena and transformer interwinding capacitance [7]. The measured total disturbances (combination of the DM and CM noises) at a line-to-ground and neutral-to-ground ports of a LISN are monitored by a spectrum analyzer as shown in Figs. 8 (b) and 9 (b).

Although either DM or CM noise measurements are not required by the EMI regulations, the total noises should be decomposed into the DM noise and the CM noise not only for facilitating the systematic EMI filter design but also for a noise diagnosis purpose. Many noise discrimination techniques have been developed, either by frequency domain measurement [12]–[14] or by time domain measurement [15].

3. Why Do We Need EMI Filters?

Since SMPS can produce the DM and CM noises in a wide frequency range, to suppress the conducted EMI effectively, the typical conducted EMI characteristic of SMPS must be analyzed. Typical emissions of SMPS, as shown in Fig. 10, are composed of the switching frequency of switching devices which is about 70 kHz–100 kHz [1]. Below 2 MHz, it is dominated by the DM noise. For frequency above 2 MHz, it is mainly contributed by the CM noise, and the self-resonant-frequency (SRF) of the components and PCB layout resonances occur at higher frequency [10]. In order to comply with the conducted EMI regulations, various conducted EMI reduction techniques for SMPS have been proposed [16]–[17]. However, there are virtually no electronic products today that can comply with the conducted EMI emission regulatory requirements without an EMI filter inserted [6]. The EMI filter needs to attenuate both DM and CM noises with good attenuation with reliability.

As a result, an EMI filter remains a very important part of SMPS to

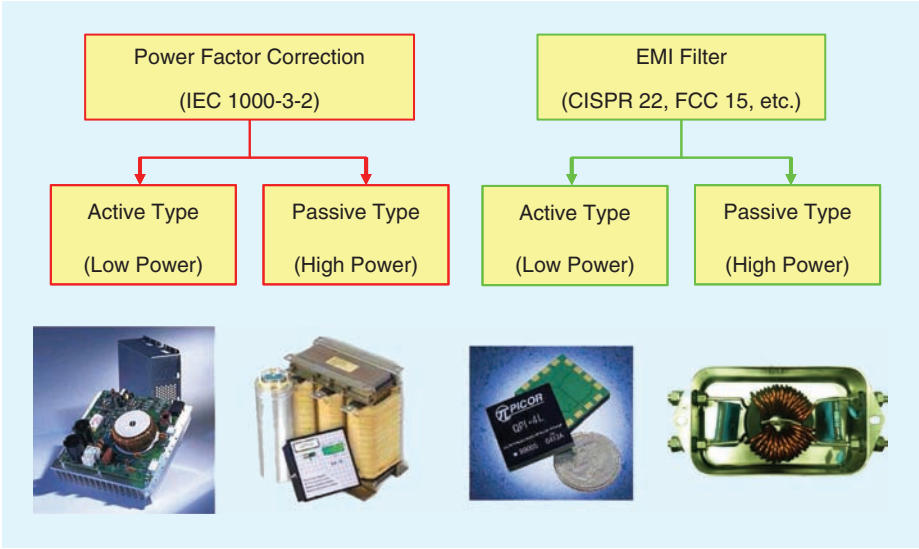

Fig. 7. The different solutions between PFC and conducted EMI.

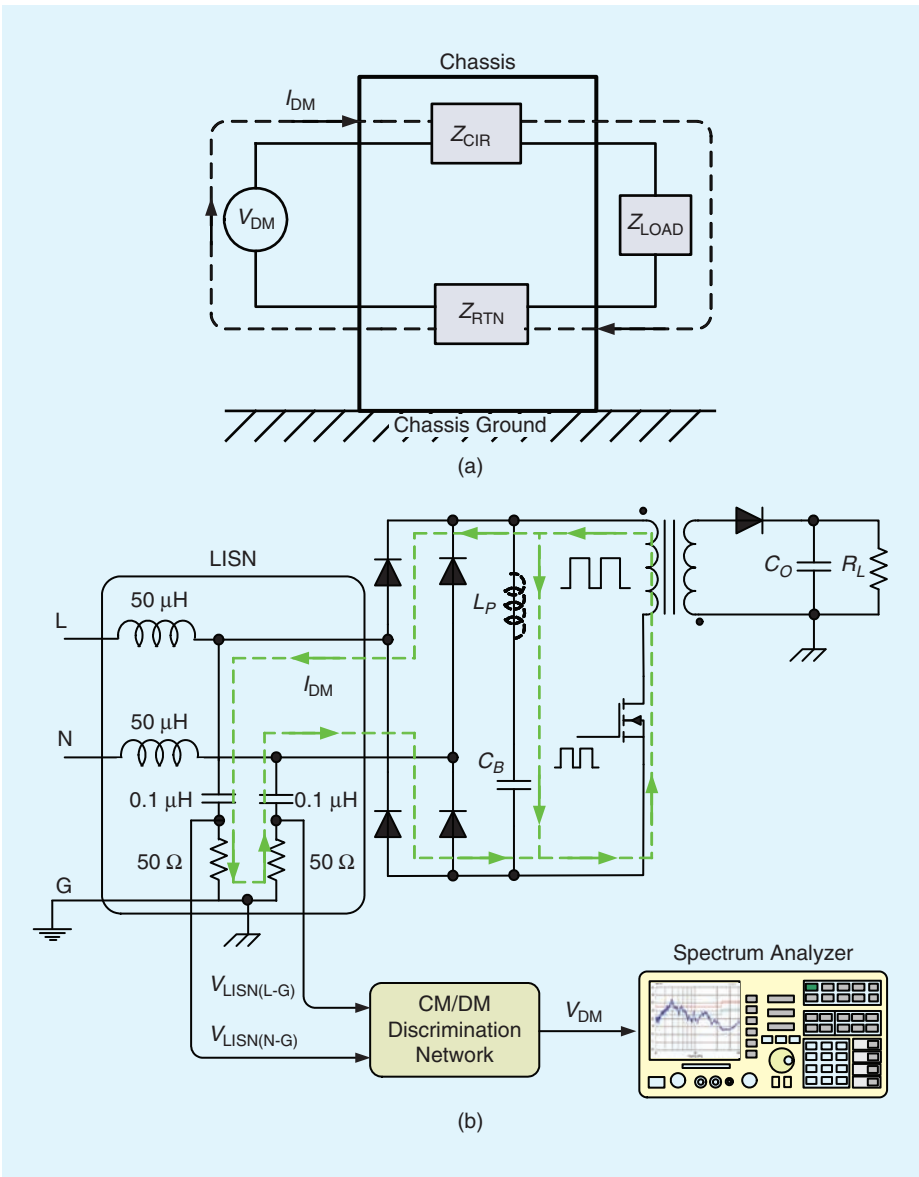

Fig. 8. Conducted EMI conduction modes. (a) DM path; (b) DM path in SMPS.

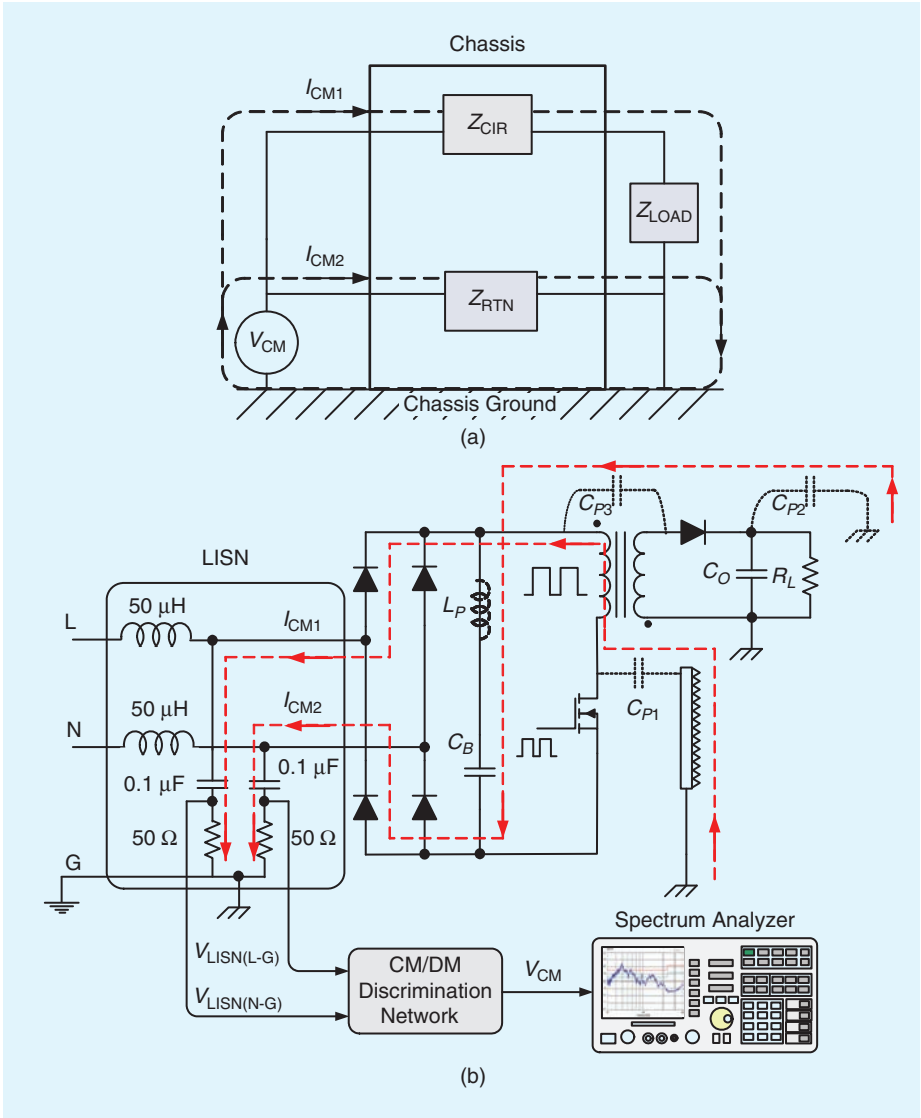

Fig. 9. Conducted EMI conduction modes. (a) CM path; (b) CM path in SMPS.

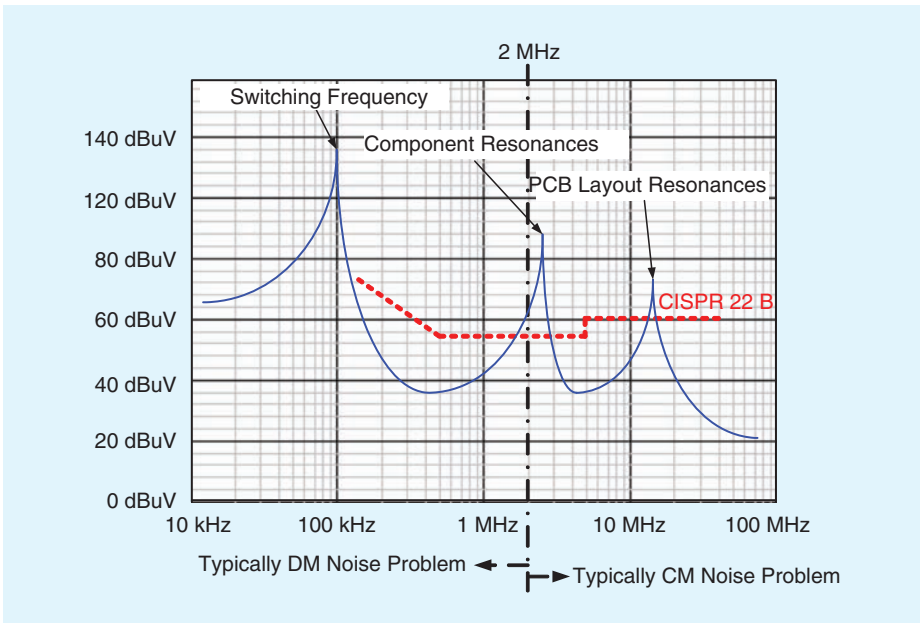

Fig. 10. Typical conducted EMI problem areas of the SMPS [10].

suppress the conducted EMI [6]. To prevent the disturbances of SMPS emitting through the ac power line, the EMI filter is always located right at the AC input of SMPS as shown in Figs. 11 (a) and (b).

EMI filters can be categorized into three types: active, passive, and hybrid EMI filters [20]–[21]. Although an active EMI filter is an alternative choice to mitigate the conducted EMI with a compact size, it is not extensively used in SMPS because several unsolved limitations still exist. For example, since the operational amplifier bandwidth is limited, the active EMI filter alone is ineffective at high frequency [18]. In addition, for a good attenuation, the types of active EMI filter must be chosen appropriately, i.e. a voltage canceling for a low impedance DM noise source and a current canceling for a high impedance CM noise source [19].

Existing research has demonstrated the benefit of an active EMI filter by integrating it with the passive EMI filter, thus producing a "hybrid EMI filter" [20]–[21]. An active EMI filter is used not only to improve the passive EMI filter performance but also to reduce the size of the passive EMI filter components by replacing large passive components (i.e. common mode chokes) with smaller passive components and some active control circuitry [22].

Unlike an active EMI filter and a hybrid EMI filter, a passive EMI filter is bulky and heavy, but it presents the advantages of suppressing both DM and CM noises with very good attenuation [16]. A passive EMI filter is a superposition of the CM and DM equivalent filters. The CM noise propagating through the parasitic capacitances within the SMPS is eliminated by the CM equivalent filter while the DM equivalent filter suppresses the DM noise which propagates between the line and neutral wires [9], [2]. However, we should point out at the limitations on the maximum inductance of series inductor to prevent the excessive voltage drop and maximum capacitance

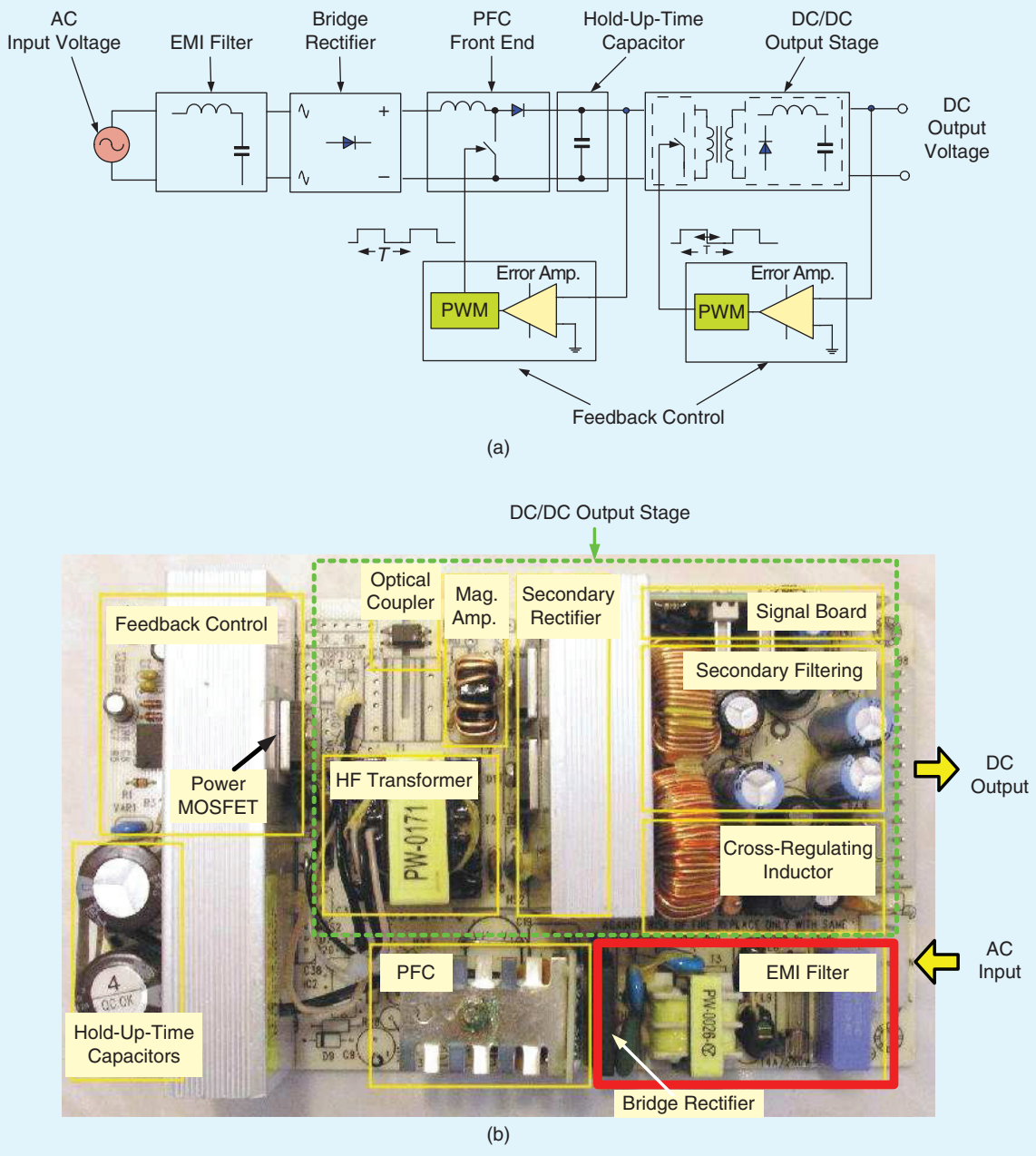

Fig. 11. Typical SMPS. (a) Block diagram of general SMPS; (b) SMPS prototype {http://www.convectron.com/smps/LambdaSMPS.htm}.

of parallel capacitor connected to ground for safety hazard consideration.

To meet the conducted EMI limitations, the passive EMI filter is still popular in SMPS design. However, one challenging task is to design the EMI filter effectively, optimally and systematically with a minimum guess. A few papers exist on a systematic design procedure of SMPS EMI filters [23]–[24]. The main difference between the two approaches is that in [23] the noise source and load impedances are taken into account in the EMI filter design procedure, but they are not considered in [24]. Without the noise source and load impedances in the design process, the EMI filter might lead to an overdesign because the filter performance is strongly dependent on the connecting impedances [25]–[26]. Although reference [23] proposes a systematic EMI filter design procedure, the method to extract the noise source and load impedances is not accurate enough and some a-priori assumptions must be made. Without precise information of the noise source and load impedances, it makes designing EMI filter optimally a difficult task.

Conclusion

In this article, we present conducted EMI generation mechanisms and the need of EMI filters. In the second paper, we will present a method to extract the DM and CM impedances of noise source and termination load impedances under actual

operating conditions by means of a direct clamping two-probe approach. Finally, in the third paper, a systematic design procedure for single-stage passive power line EMI filters to be used in SMPS applications by applying the insertion loss concept with the accurate amplitude and phase information of the SMPS and LISN impedances will be presented. The effectiveness of the proposed procedure will be validated and demonstrated by various practical design examples.

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Biography

Vuttipon Tarateeraseth *received the B. Eng. (second-class honors) and M. Eng. degree both in electrical engineering from King's Mongkut Institute of Technology Ladkrabang (KMITL), Thailand, and Ph.D. in electronics and communications engineering from Politecnico di Torino, Italy. Since 2011, he is a lecturer at Department of Electrical Engineering, Srinakharinwirot University, Thailand. From 2010–2011, he was a lecturer at College of Data Storage Innovation, KMITL. Prior to 2007, he worked as a head of environment testing laboratory at Delta Electronics (Thailand) for three years. He also worked as an EMC engineer for 2 years under the Joint Development of Teaching Materials to Improve EMC Skills of Academic Staff and Postgraduate Electronic Designers Project funded by European Commission. He was a lecturer for 2 years at Department of Electrical Engineering, Srinakharinwirot University, Thailand. His research interests are mainly in the fields of EMI reduction techniques, EMC/EMI modeling, EMC instruments and measurements and EMI filter design. He is author or coauthor of more than 40 technical papers published in international journals and conference proceedings and one book chapter.*

EMC

Extended Ground Pin as ESD Protection on Automatic Document Feeder Door Sensor

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Abstract—To improve ESD immunity, an extended ground pin functioning as an electrostatic discharge (ESD) arrestor is placed near the Automatic Document Feeder (ADF) door sensor of a printer. It diverts ESD away from the ADF sensor and its associated electronic circuitry [1]. Backed by ESD immunity measurement results, it has been demonstrated to be a simple and yet effective ESD solution. With the proposed solution, it eliminates the need of having additional ESD protection components on the sensor's circuitry.

1. Introduction

To meet electromagnetic compatibility (EMC) regulatory requirement, practically all consumer electronics have to meet specific emission and immunity standards. For example, products classified under the Information Technology Equipment (ITE) need to comply with EN55024 immunity requirement [2], that also covers ESD testing in accordance with IEC/EN 61000-4-2 ESD standard [3]. The test points of the product to be subjected to ESD testing are those locations or areas accessible to users under its normal use. Detailed guidelines and definition of test points and surfaces of which to apply the contact or air discharge can be found in the ESD immunity testing standard [3].

With the increasing popularity of multi-function printer with scan, copy, print and fax capabilities, the risk of damage due to ESD increases as user accessible areas under normal use have increased. For examples, user interventions are needed for paper jam removal, supplies replacement and regular maintenance. The areas that are accessible to user can expose the electronics circuit and functional sensor to ESD events. A common part of a printer is the automatic document feeder (ADF) sensor to detect opening and closing of the access door. Therefore, it is always chosen as one of the common test points for ESD compliance testing. It is in the interest of the printer manufacturer to evaluate these user accessible areas for ESD testing so that the final product can be designed with higher ESD robustness, which will lead to lower warranty cost.

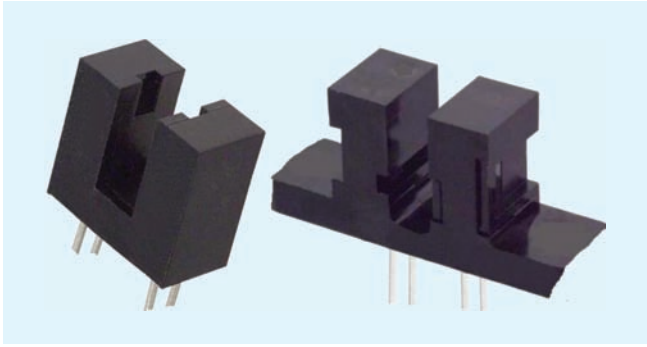

Fig. 1. Example of optical sensor.

The optical door sensor is one of the most simple and cost effective designs for access door operation detection. Figure 1 shows some typical optical sensors available commercially. For design simplicity, it is usually placed on the outer side of the product, with small opening in the plastic parts allowing a moveable interceptor usually on the case cover to intercept the sensor. This provides the function of detecting if the access door is opened or closed. With such design, the sensor is one of the most vulnerable components subjected to ESD. Component damage due to ESD or not able to comply with regulatory ESD test level could be a potential problem during product testing and development phase.

Table 1 show the comparison of ESD risk to the optical sensor for various placement and design methodology.

As an example in the ADF door sensing design, a simple and cost effective design will place the sensor on the outer edge of the product; the optical sensor is exposed with a small opening to allow the short extension from the cover to intercept the optical sensor providing signaling for access door opened or door closed. When ESD get close to the sensor, discharge is random without a predetermine path, hardware

TABLE 1. ESD RISK PROFILE FOR VARIOUS DESIGN METHODOLOGY.

Sensor design and placement	ESD risk	Implementation complexity	ESD Protection
1. Placed embedded far away from opening, not accessible by user	Low	• High • Require extra mechanical parts, arms, space etc…	• Usually not required • Limited or no discharged
2. Placed near opening, accessible to user	High	• Little or no mechanical design required • Extra electrical design for signal protection	• Discharge may occur • Component level protection (diodes, extra grounding etc.)

damage can occur if high level of ESD get discharged to the sensor or its circuitry.

ESD protection around the optical door sensor and its circuitry can be applied a few ways

1) ESD protection on printed circuit board level. When ESD discharge to the sensor circuit occur, we can use ESD protection components (ESD diode) to protect the sensor circuitry. It is a straight forward method protecting each line with components but it will require extra PCB space and incur additional cost
2) Optical sensor is placed away from opening to create insulation acting as air barrier to prevent discharge. Use the general guide of 1kV/mm air breakdown. Or use non conductive mechanical extension for this application. Some of the disadvantages are a.)Need to create extra space between sensor and door opening. b.) Additional product cost for extra mechanical parts
3) Select an optical sensor with high ESD rating. Available in the market but may not be able to meet design costing for large volume products

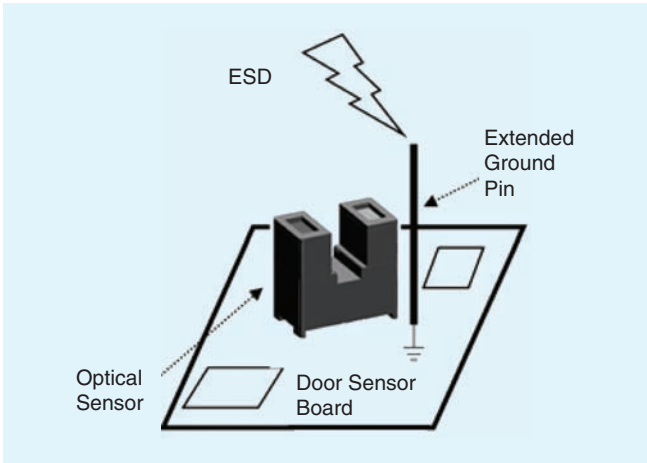

Fig. 2. Illustration of the placement and construction of the extended ground pin.

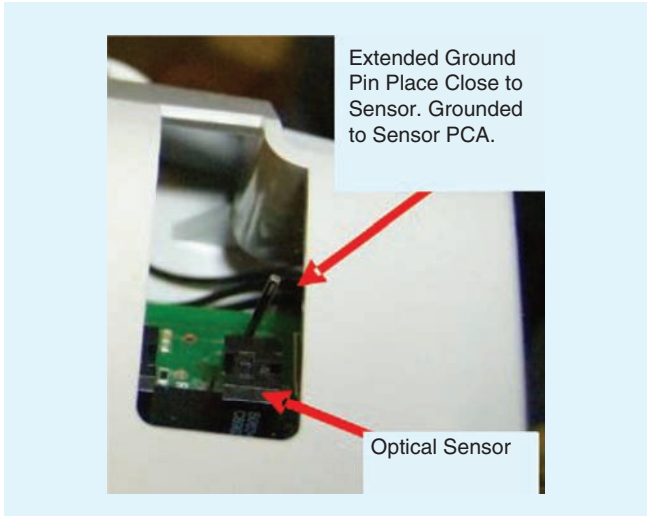

Fig. 3. Prototype of extended ground pin placed near to an optical sensor.

2. Proposed Solution

By placing an extended ground pin as an ESD arrestor near the vicinity of the optical sensor, it creates a dedicated discharge path for the on coming ESD. The ESD arrestor is made of extended jumper pin connected to the digital ground of the Printed Circuit Assembly (PCA). Which in turn it is connected to the chassis ground of the product for best ESD drainage. The pin will be 2–3mm higher than the optical sensor and be placed next to the sensor for optimal protection. A simple PCA routing with wide ground trace or plain can easily accommodate the additional jumper pin on the sensor PCA without interfering with the optical sensor operation with the access door.

The extended ground pin will be the highest point of contact on the sensor PCA for the approaching ESD. This created a dedicated discharge path to ground ensuring ESD current is diverted away from the electronics components. The advantage of this solution is its ability to create a dedicated discharge path to ground, withstand high level of ESD without damage and therefore providing ESD protection to the sensor and the PCA.

Figure 2 provides a simple illustration of the placement and construction of the extended ground pin on a typical optical sensor PCA.

The ITE EN55024 ESD regulatory requirement is 4 kV Contact Discharge and 8 kV Air Discharge, it mandates ITE products to meet Performance Criteria B up to and including those test level/. Detail pass fail criteria for various classes of products can be found in the Annex of the standard [3].

For a typical multifunction printer with scan, copy, print and fax functions, Performance Criteria B within the regulatory test voltage can be interpreted generally as a temporary lost of function and self recoverable after the disturbance is removed. Hardware damage due to ESD will be considered as a test failure.

In some cases, some manufacture may conduct ESD testing and evaluation beyond the regulatory voltage. This allows them to make assessment on the product's ESD margin performance. Testing beyond the regulatory level may also help to improve product ESD reliability and therefore reduce the product warranty cost related to damage cause by ESD.

An experiment had been conducted on a typical multifunction printer Automatic Document Feeder (ADF) door sensor with this solution. In this ADF design, with the access door opened, the optical sensor can be seen exposed from a small plastic opening. The opening is required for the top cover to intercept the center of the sensor for electrical signaling of ADF door opened or closed. In this example, the opening is visible and accessible to user and therefore may be subjected to ESD event while under normal use or maintenance.

The sensor PCA had been modified to add an extended ground pin. The pin was positioned near to the sensor, not obstructing the interceptor operation and it is the tallest object on the sensor PCA. It was connected to the ground of the PCA which was in turn connected to the product chassis ground.

Figure 3 show a photo of the prototype for ESD testing.

In a typical multifunction printer construction as shown in Figure 4, the ADF is generally placed at the top of the printer allowing easy access to the ADF. For larger system, metallic chassis provide structural and functional support, stability for faster scanning and printing speed. The system selected for this experiment has a large metallic structure as the chassis base supporting the ADF. The system has a 3-pin power supply with a

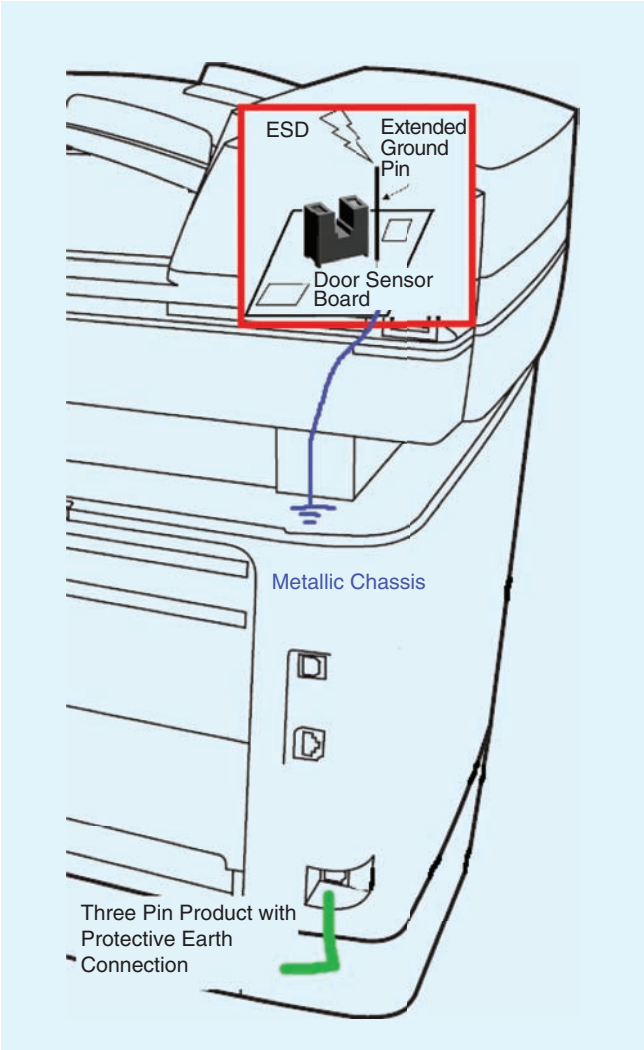

Fig.4. A typical multifunction printer with ADF placed on top of a metallic structure. Product's exterior is usually plastic with industrial design look and feel.

Protective Earth (Yellow/Green wire) connection. The extended ground pin was connected to the sensor PCA digital ground which was also grounded to the metallic chassis. This has the advantage of providing good ground return path to the ESD current discharge to the grounded pin.

3. Experimental Results

The test (Air Discharge) had been conducted up to 8 kV and the results showed that the extended ground pin was able to repeatedly attract ESD charges without any discharge to the optical sensor or any other electronics components on the PCA. In coming ESD charges are being grounded via the extended ground pin providing ESD protection to the optical sensor. With reference to ESD standard requirement, there was no anomaly found during the test, therefore the product meets the performance criteria requirement for this test point. Discharge and arching to the ground pin is understandably more noticeable as test level increased beyond 8kV (non regulatory requirement for ITE products) and hence able to provide ESD protection beyond just passing the regulatory requirement.

4. Conclusion

Test results had shown that the extended ground pin is extremely successful in attracting and grounding in coming ESD charges to the optical sensor providing very effective ESD protection. As for implementation, hardware requirement is minimal, it does not need a lot of PCB space and it is easier to implement than most other ESD protection methods. Most importantly, it is a low cost and effective solution.

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Biography

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Call for Papers!

Signal Integrity Column to Debut in the New IEEE Electromagnetic Compatibility Magazine

Signal and power integrity are an integral part of high-speed design to address electromagnetic compatibility issues in modern electronic, computer, and communication systems. Technical Committee 10, Signal Integrity, has grown into one of the largest and the most active technical committees of the EMC Society. Accordingly, the Technical Advisory Committee has decided to start a special column for signal integrity, starting with the first issue of the new EMC Magazine in the first quarter 2012. I cordially invite researchers, engineers, and students in the field of signal and power integrity to submit papers to this column. All submissions will be subject to peer review. The accepted papers will be uploaded into the IEEE Xplore database and become refereed journal publications.

Both new contributions and review papers are welcome. There's no strict page limit, but a length of four pages in the standard IEEE format is preferred. Potential topics include, but are not limited to, the following technical areas:

- High-speed channel characterization, jitter and bit-error-rate
- Passive channel modeling in multilayer packages and PCBs
- Material extraction and characterization
- Power distribution network
- Model extraction and model order reduction
- Signal/power integrity and EMI co-design
- IC EMC and SI models
- 3D packaging and TSV
- High-speed connectors and cables
- New simulation and measurement techniques

Ideal papers for this new column are practical in nature. The goal is to provide a resource of practical papers on signal integrity topics that engineers can use on the job, in the "real world" so to speak. Keep in mind that papers describing new research, or those that are theoretical in nature, are better suited for publication in the *IEEE Transactions on EMC*.

Meet Our Associate Editor for the New Signal Integrity Column

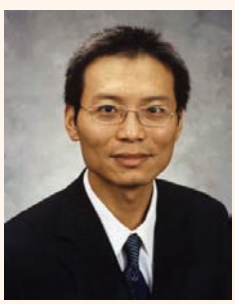

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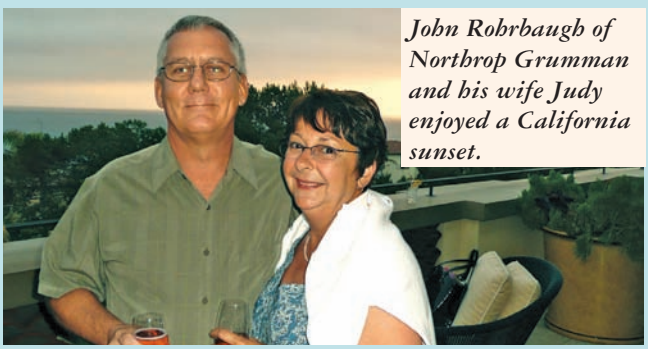
PHOTO COLLAGE BY DICK FORD

Scenes from the 2011 IEEE International Symposium on EMC

(From left) Jeremy Campbell of GM; Henry Ott of Henry Ott Consultants; Becky Steffka; Dale Sanders, Sandra and Jim Muccioli – all with Jastech EMC Consulting; Mark Steffka of the University of Michigan-Dearborn and GM; Ron Young of GM; and Yeong Yoon of HRL enjoyed the Symposium Gala event.

T. R. Suresh Kumar (left) of the Muthayammal Engineering College traveled from India to present his paper. Bob Hofmann facilitated his travel thanks to the IEEE EMC-S symposium financial assistance committee.

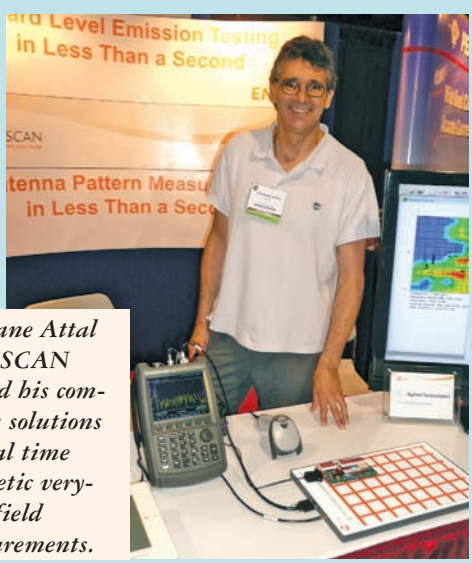


John Rohrbaugh of Northrop Grumman and his wife Judy enjoyed a California sunset.

Gene Taylor (in Hawaiian shirt) of Altamont Technical Services visited with Heather Stehman, Tom Eichelberger, and Doug Spepherd (from left) of AR RF/Microwave Instrumentation.

Wayne Medeiros and Diane Cupples staffed the Schurter booth and promoted their connectors, filters, and more during the exhibition.

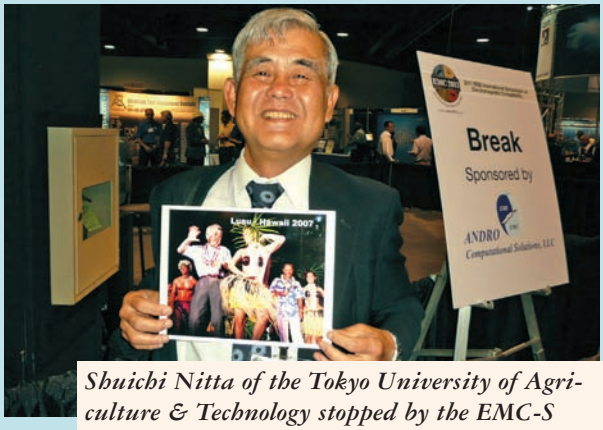
Bob Davis of Lockheed chaired a panel that discussed the usage of cell phones on airplanes. Expert speakers included (from left) Dave Walen of the FAA, Dr. Thiemo Stadtler of Airbus, Manny Rodriguez of the US Air Force and Bruce Donham of Boeing.



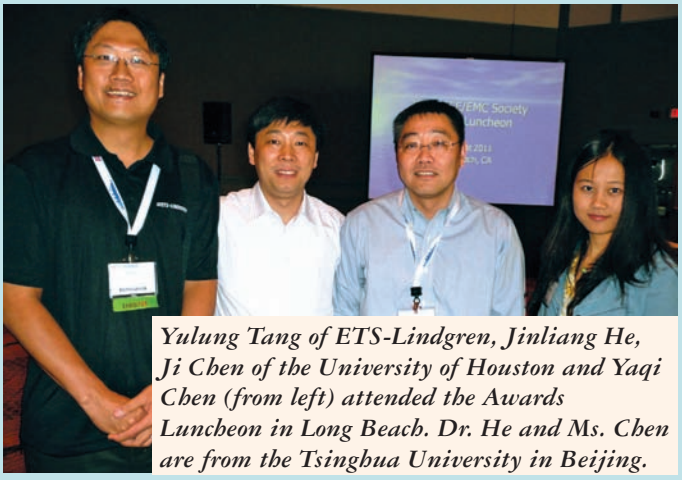
Stephane Attal of EMSCAN showed his company's solutions for real time magnetic very-near-field measurements.

PHOTOS BY THE EMC 2011 PHOTOGRAPHY TEAM OF KENNETH WYATT, RICHARD GEORGERIAN, TOM FAGAN AND JANET O'NEIL

Mats Backstrom of Combitech joined fellow Swedes Magnus Olofsson of Elforsk AB and Magnus Höijer (from left) of the Swedish Defense Research Agency FOI at the Tuesday Welcome Reception.



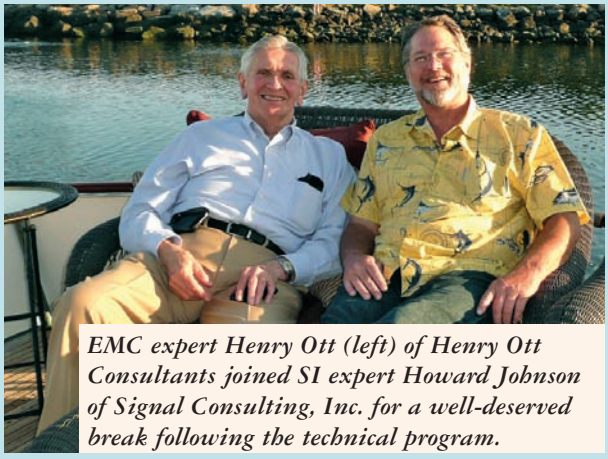
Shuichi Nitta of the Tokyo University of Agriculture & Technology stopped by the EMC-S History booth and picked up a photo of him dancing at the EMC 2007 Symposium Gala.



Yulung Tang of ETS-Lindgren, Jinliang He, Ji Chen of the University of Houston and Yaqi Chen (from left) attended the Awards Luncheon in Long Beach. Dr. He and Ms. Chen are from the Tsinghua University in Beijing.

EMC-S President Francesca Maradei (center) is all smiles after winning a raffle prize from Andro Computational Solutions. The company's Andy Drozd and Irina Kasperovich celebrated her lucky day.

Kenneth Wyatt (in tie) of Wyatt Technical Services provided helpful advice during the "EMC Consultant's Toolkit" workshop.



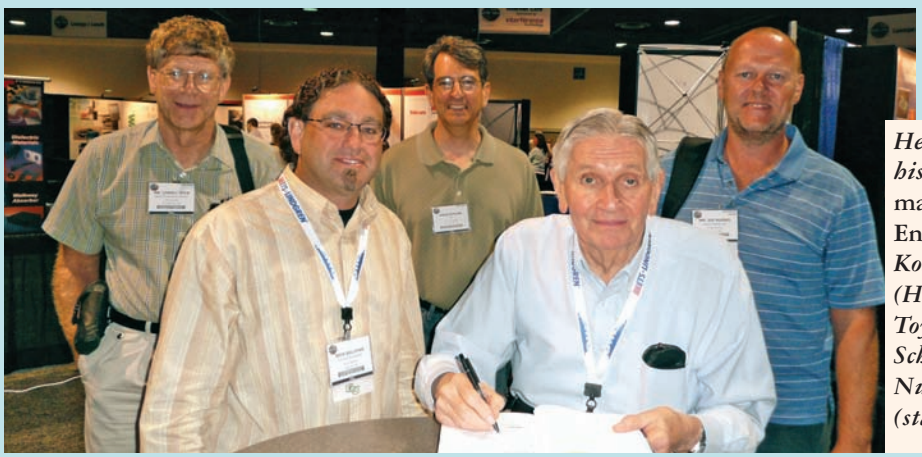
EMC expert Henry Ott (left) of Henry Ott Consultants joined SI expert Howard Johnson of Signal Consulting, Inc. for a well-deserved break following the technical program.

Mr. Sunny Personality, a.k.a. Jim Lukash of Lockheed, and his wife Leslie attended the Symposium Gala on board the Queen Mary.

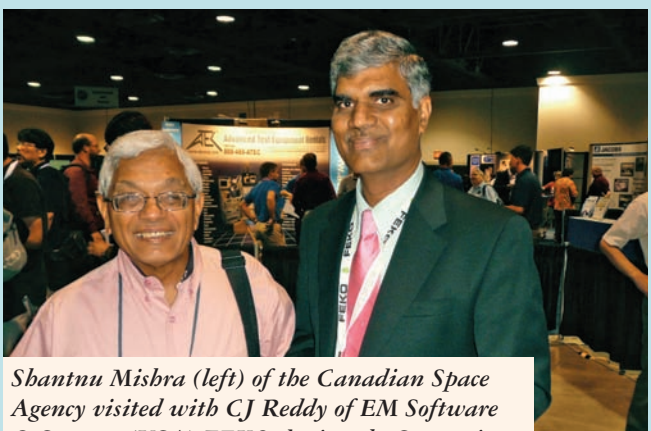
EMC 2011 Symposium Chair Ray Adams of Boeing and his wife Sylvia thoroughly enjoyed the Symposium.

Dr. Robert Smolenski (left) of the University of Zielona Gora in Poland presented a poster paper. Victor Kuczynski of Vican Electronics appreciated the personal review.

Alee Langford, Dan Haas and Jeremiah Darden (from left) of Northwest EMC greeted visitors to their booth during the EMC 2011 exhibition.



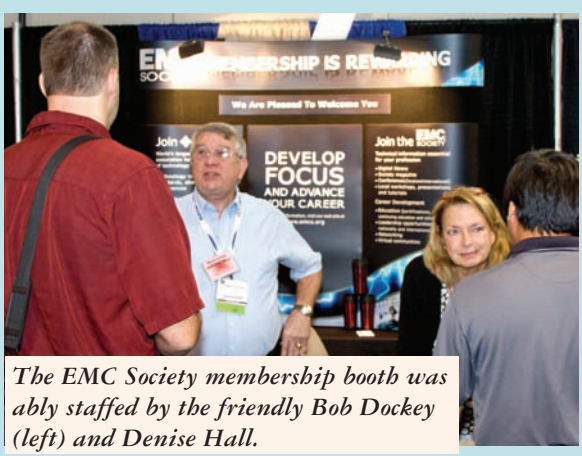
Henry Ott signed copies of his popular book, Electromagnetic Compatibility Engineering, *for Lowell Kolb of Hewlett-Packard (HP), Rich Sullivan of Toyota Tech Center, Doug Schlam of HP and Joe Nuebel of Oracle America (standing from left).*



Shantnu Mishra (left) of the Canadian Space Agency visited with CJ Reddy of EM Software & Systems (USA)-FEKO during the Symposium.

Darryl Ray (left) of Covidien and Steve Cabral of Apple reminisced about the good old days in the Silicon Valley during the Symposium Gala.

Don Heirman of Don HEIRMAN Consultants, Marco Klinger of Peugeot Citroen Automobiles, Frank Leferink of Thales - University Twente, and Heyno Garbe of Leibniz University Hannover (from left), enjoyed a lighter moment in Long Beach.



The EMC Society membership booth was ably staffed by the friendly Bob Dockey (left) and Denise Hall.

The Rohde & Schwarz booth was well-staffed during the Symposium by the popular Achim Gerstner, Hans-Peter Bauer and Chris Golding (from left).

David Pommerenke (far right) of the Missouri University of Science and Technology takes a moment to educate attendees on the finer points of his paper.

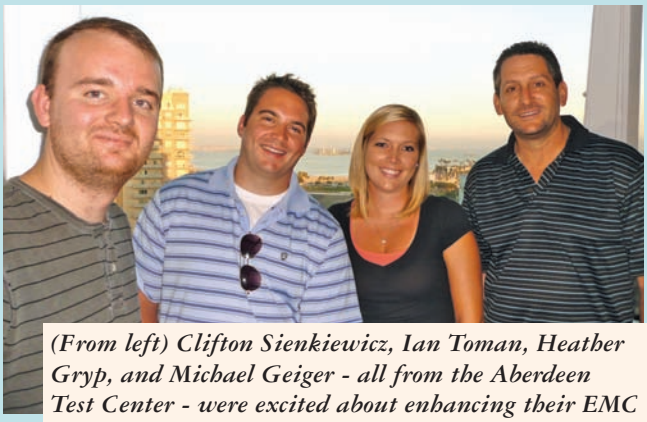
The Symposium Gala was a family affair for Dr. Axel Junge of ESA – ESTEC, his son Nicolas and wife Angelika.

Interference Technology sent their best and brightest to the Symposium, including (from left) Daryl McFadyen, Sarah Long, Eileen Ambler, and Bob Poust.

Vincent Keyser of ETS-Lindgren (left) visited with fellow Europeans Francesca Maradei of the University of Rome and Luigi Caputo of ASEA SISTEMI on the exhibit floor.

Alex Cox of Leader Tech was all smiles for visitors to his booth at the Long Beach Symposium.

A special event was held for IEEE Graduates of the Last Decade (GOLD) during the Symposium. Attendees enjoyed learning about the career opportunities that GOLD offers.



(From left) Clifton Sienkiewicz, Ian Toman, Heather Gryp, and Michael Geiger - all from the Aberdeen Test Center - were excited about enhancing their EMC education in Long Beach.

Howard Johnson (right) of Signal Consulting signed his book, High Speed Digital Design - A Handbook of Black Magic, *for Monte Chan of Computeractive, located in Australia.*

Neill Harlen (left) and Jan Eriksson of Detectus appreciated the good booth traffic at the Symposium exhibition.

John Fessler (right) and Keith Hardin of Lexmark traveled from Kentucky to Long Beach to attend the Symposium.

Haefely EMC's Dan Orza (left) from New York and Andreas Lestin from Switzerland enjoyed meeting in Long Beach.

EMC Society luminaries Bill Radasky (left) of Metatech and Flavio Canavero of the Politecnico di Torino connected in Long Beach.

Greg Kiemel (left) of Northwest EMC and Dan Sigouin of Industry Canada talked shop about ANSI C63® EMC test standards.

Hong Xie (left) of Safety and EMC Magazine visited with Yimin Xu of Shanghai ViewTran Exhibition Service Co.

Francesca Maradei, Federico Centola of Apple, Ariane Wahrmann of emv, Thiemo Stadtler of Airbus, and Lena Thiele of TU Braunschweig (from left) gathered at a social event.

(From left) Lorie Nichols, Erin C. Feeney, Shellie Johnson, Nancy Borowicz and Sharon Smith staffed the In Compliance booth.

Marilyn Monroe and Groucho Marx "posed" with Sylvia and Ray Adams during the Symposium Gala.

Attending EMC 2011 were Nick Grilliot of Delta Technology, Rob Kado of Chrysler, Keith Frazier of Ford and Lee Hill (from left) of SILENT Solutions.

H.J. Song (center) of HRL presented a poster paper titled "A Method for Measuring Partial Inductance."

Mike Violette (right) showed Glen Watkins of ETS-Lindgren the unique services provided by Espresso Engineering.

Tzong-Lin Wu (left) of National Taiwan University visited with Jim Drewniak of the Missouri University of Science and Technology.

Members of the EMC 2011 Committee celebrated a great Symposium, including (from left) Jun Fan of the Missouri University of Science and Technology, John Maas and Bruce Archambeault of IBM, Dennis Lewis of Boeing, Bob Scully of NASA and Colin Brench of Amphenol-HIS.

EMC Annual Awards

EMC Society President Francesca Maradei presented numerous awards at the Annual Awards Luncheon held during the 2011 IEEE International Symposium on EMC in Long Beach, California. She is shown below with some of the awards recipients. For a complete listing of the awards presented in Long Beach, please see pages 64–65.

Songping Wu received the President's Memorial Award for his outstanding work in the area of crosstalk modeling and estimation in high-speed printed circuit boards. He received the award in memory of the late Edward F. Vance.

Francesco De Paulis received the second year follow on award for his outstanding work in the area of EMC associated with high-speed digital systems in the classroom and laboratory.

David Allen Hill received the Richard R. Stoddart Award for outstanding contributions to the electromagnetic theory of complex cavities, radiated field coupling and shielding, and wave propagation.

Herbert K. Mertel received the Hall of Fame Award for significant contributions to the EMC Society including 50 years of outstanding service and Laurence G. Cumming Award recipient.

Joseph (Joe) F. Fischer, Jr. received the Hall of Fame Award for significant contributions to the EMC Society as President, Laurence G. Cumming Award recipient, and Distinguished Lecturer.

Andy Marvin received the IEEE Fellow Award for contributions to metrology techniques for electromagnetic compatibility.

Robert T. Johnk received the Technical Achievement Award for contributions in the development of free-space time-domain measurement techniques.

Ji Chen received the Technical Achievement Award for significant contributions in applied and computational electromagnetics in biomedical instruments and periodic structures.

John Ladbury received the Technical Achievement Award for significant contributions in the development of reverberation chamber techniques for EMC applications.

PHOTOS BY KEN WYATT

Robert Scully received the Technical Achievement Award for contributions to the protection of space flight systems from electromagnetic interference and the deleterious effects of lightning.

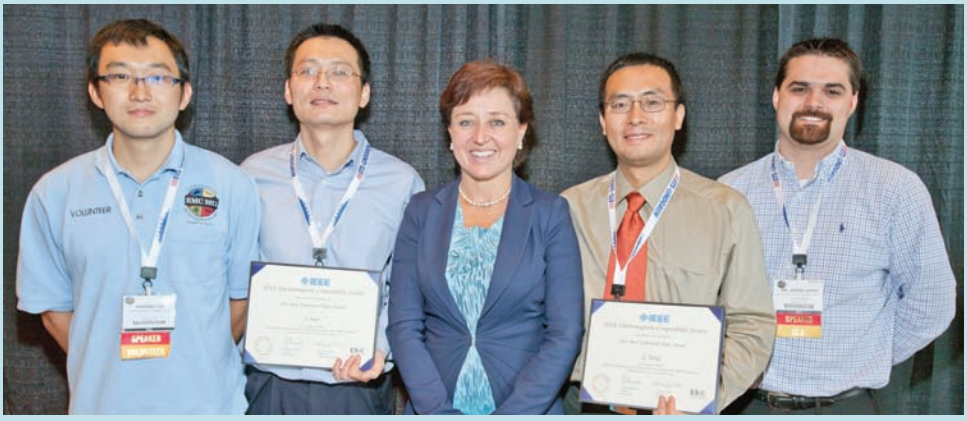
Sergio Amedeo Pignari received the Technical Achievement Award for contributions to the theory and practice of bulk current injection (BCI) methods for immunity characterization.

Er-Ping Li received the Sustained Service to the EMC Society Award for significant contribution to, initiation and promotion of EMC activities.

Shinobu Ishigami of the National Institute of Information and Communications Technology received the Richard B. Schulz Transactions Prize Paper Award for the paper titled, "A New Method of Interference Evaluation between an Ultrawideband System and a Wireless LAN Using a Gigahertz Transverse Electromagnetic Cell."

Kaoru Gotoh of the National Institute of Information and Communications Technology received the Richard B. Schulz Transactions Prize Paper Award for the paper titled, "A New Method of Interference Evaluation between an Ultrawideband System and a Wireless LAN Using a Gigahertz Transverse Electromagnetic Cell."

Fred Heather received the Symposium Chair Award for his leadership of the EMC 2010 Symposium.



PHOTOS BY KEN WYATT

Dazhao Liu and Jun Fan (on left) from the Missouri University of Science and Technology along with Z. Tang (second from right) from Cisco Systems received the Best Symposium Paper Award for their paper, "Statistical Estimation of Root Mean Square Crosstalk in SFP+ Cable Evaluations." Jason Coder (far right) from the National Institute of Standards and Technology (NIST) received the Best Symposium Paper Award for his paper, "A Novel Method for Determining the Lower Bound of Antenna Efficiency."

EMC Society President's Memorial Award
(Presented in memory of Edward F. Vance)

Songping Wu, Missouri University of Science and Technology
For his outstanding work in the area of crosstalk modeling and estimation in high-speed printed circuit boards.

Second Year follow on Award
Francesco De Paulis, University of L'Aquila

For his outstanding work in the area of EMC associated with high-speed digital systems in the classroom and laboratory as well as his positive impact on the students around him as a team contributor and team leader.

Richard R. Stoddart Award for Outstanding Performance

David Allen Hill
For outstanding contributions to the electromagnetic theory of complex cavities, radiated field coupling and shielding, and wave propagation.

Hall of Fame Award

Herbert K. Mertel
For significant contributions to the EMC Society including 50 years of service, member of the EMC-S Board for 12 years, winner of the Laurence G. Cumming Award (2005), Chairman of the 1986 IEEE International Symposium on EMC (San Diego), liaison service to the Zurich EMC Symposium, Associate Editor of the EMC-S Newsletter, service to the Standards Committee, and leadership of the San Diego Chapter of the EMC Society.

Clayton Paul
For a lifetime of contributions to the field of electromagnetic compatibility and to the IEEE EMC Society, advancements in the understanding and quantifying of electromagnetic interference phenomena in digital electronics, winner of the IEEE Electromagnetics Award (2006), and outstanding performance as a university professor emphasizing real-world EMC problems in the classroom.

Joseph (Joe) F. Fischer, Jr.
For significant contributions to the EMC Society including 50 years of outstanding service, President of the EMC-S (1972), member of the EMC-S Board for six years, winner of the Laurence G. Cumming Award (2006), Distinguished Lecturer (1989 - 1991), and leadership of the Los Angeles and San Diego Chapters of the EMC Society.

IEEE Fellow Award

Andy Marvin
For contributions to metrology techniques for electromagnetic compatibility.

Technical Achievement Award

Robert T. Johnk
For significant contributions to the development of free-space time-domain measurement techniques.

Ji Chen
For significant contributions to applied and computational electromagnetics in biomedical instruments and periodic structures.

John Ladbury
For significant contributions to the development of reverberation chamber techniques for EMC applications.

Robert Scully
For significant contributions to the protection of space flight systems from electromagnetic interference and the deleterious effects of lightning.

Sergio Amedeo Pignari
For significant contributions to the theory and practice of bulk current injection (BCI) methods for immunity characterization.

Richard B. Schulz Transactions Prize Paper Award

S. Ishigami[1], M. Yamada[2], H. Kamiya[2], K. Gotoh[1], Y. Matsumoto[1], and M. Tokuda[3]
"A New Method of Interference Evaluation between an Ultrawideband System and a Wireless LAN Using a Gigahertz Transverse Electromagnetic Cell", Transactions on EMC, 2010, No.3.
[1]National Institute of Information and Communications Technology, [2]Institute of Technology, [3]Tokyo City University

Best Symposium Paper Award

"Statistical Estimation of Root Mean Square Crosstalk in SFP+ Cable Evaluations"
D. Liu[1], J. Chen[2], Z. Yang[2], J. Fan[1],
[1]Missouri University of Science and Technology,
[2]Cisco Systems, Inc.

"Shielding Performance of Transparent Thin Films Loading Apertures in Metallic Enclosures Excited by Inner Dipole Sources"
R. Araneo, G. Lovat, S. Celozzi, M. D'Amore, University of Rome, "La Sapienza"

"A Novel Method for Determining the Lower Bound of Antenna Efficiency"
J. B. Coder, J. M. Ladbury, M. Golkowski, National Institute of Standards and Technology (NIST)

Best Student Symposium Paper Award

First Place
"Electromagnetic Field Radiation from MWCNTs and SWCNT Bundles: A Comparative Analysis"
A.G. D'Aloia, M.S. Sarto, and A. Tamburrano
Dept. of Electrical Engineering, Research Center on Nanotechnology Applied to Engineering, University of Rome, "La Sapienza"

First Runner Up
"Compact Configuration of a Planar EBG Based CM Filter and Crosstalk Analysis"
F. De Paulis[1], L. Raimondo[1], B. Archambeault[2], S. Connor[2], A. Orlandi[1],
[1]University of L'Aquila, [2]IBM

Second Runner Up
"Analytical Expressions for Maximum Transferred Power in Wireless Power Transfer Systems"
Sunkyu Kong, Myunghoi Kim, Kyoungchoul Koo, Seungyoung Ahn, Bumhee Bae and Joungho Kim, Korea Advanced Institute of Science and Technology (KAIST)

Best Student Design Award

Tianqi Li, Jun Wu and Hengsi Qin, Missouri University of Science and Technology

University Grant

University of British Columbia
Dave Michelson

Sustained Service to the EMC Society Award

Er-Ping Li
For significant contribution to, initiation and promotion of EMC activities.

Certificate of Acknowledgement

Jinliang He
For outstanding contribution to and leadership of the 2010 Asia-Pacific International Symposium on Electromagnetic Compatibility in Beijing, China.

AWARDS LUNCHEON

August 18, 2011
Long Beach Convention Center

Chapter Founder Award

Tunde Salihu
For founding the Nigeria EMC Chapter.

Hongmei Fan
For founding the Shanghai EMC Chapter.

Chapter of the Year Award

Sendai Chapter

Most Improved Chapter Award

Rock River Valley Chapter

Symposium Chair Award

Fred Heather
For his leadership and dedication as General Chairman of the 2010 IEEE International Symposium on Electromagnetic Compatibility.

Certificate of Recognition

Sue Archambeault
For outstanding service as the Companion Program Chair for the 2011 IEEE International Symposium on EMC.

Bonnie Brench
For outstanding service as the Registration Chair for the 2011 IEEE International Symposium on EMC.

Gayla Burns
For outstanding service as the Junior Technical Program Chair for the 2011 IEEE International Symposium on EMC.

Janet Nichols
For outstanding service as an Editor and Special Event Chair for the 2011 IEEE International Symposium on EMC.

Rhonda Rodriguez
For outstanding service on the Arrangements Committee for the 2011 IEEE International Symposium on EMC.

Jason Harshbarger
For outstanding service as Webmaster for the 2011 IEEE International Symposium on EMC.

Certificate of Appreciation

Ji Chen
For outstanding service to the EMC Society as a Distinguished Lecturer, 2009-2010.

Sergui Radu
For outstanding service to the EMC Society as a Distinguished Lecturer, 2009-2010.

Joungho Kim
For outstanding service to the EMC Society as a Distinguished Lecturer, 2009-2010.

Colin Brench
For outstanding service to the EMC Society as a member of the EMC Society Board of Directors, 2005-2010.

Fred Heather
For outstanding service to the EMC Society as a member of the EMC Society Board of Directors, 2005-2010.

Randy Jost
For outstanding service to the EMC Society as a member of the EMC Society Board of Directors, 2008-2010.

Werner Schaefer
For outstanding service to the EMC Society as a member of the EMC Society Board of Directors, 2008-2010.

Robert Neff
For outstanding service in creating the EMC Society's new marketing brochure.

Janet O'Neil
For outstanding service as the Vice Chair for the 2011 IEEE International Symposium on EMC.

Mark Frankfurth
For outstanding service as the Secretary for the 2011 IEEE International Symposium on EMC.

John LaSalle
For outstanding service as the Treasurer for the 2011 IEEE International Symposium on EMC.

Bob Davis
For outstanding service as the Volunteer Chair for the 2011 IEEE International Symposium on EMC.

Bruce Archambeault
For outstanding service as the Technical Program Chair for the 2011 IEEE International Symposium on EMC.

Jun Fan
For outstanding service as the Technical Paper Chair for the 2011 IEEE International Symposium on EMC.

John Maas
For outstanding service as the Workshops/Tutorial Coordinator for the 2011 IEEE International Symposium on EMC.

Alee Langford
For outstanding service as the Marketing Chair for the 2011 IEEE International Symposium on EMC.

Certificate of Appreciation (cont'd)

Colin Brench
For outstanding service as the Special Sessions Chair for the 2011 IEEE International Symposium on EMC.

Sam Connor
For outstanding service as the Demonstrations/Experiments Chair for the 2011 IEEE International Symposium on EMC.

Bob Scully
For outstanding service as the Demonstrations/Experiments Chair for the 2011 IEEE International Symposium on EMC.

John Rohrbaugh
For outstanding service as the Publications and Promotions Chair for the 2011 IEEE International Symposium on EMC.

Gene Taylor
For outstanding service as the Exhibits Chair for the 2011 IEEE International Symposium on EMC.

Dennis Lewis
For outstanding service as the Arrangements Chair for the 2011 IEEE International Symposium on EMC.

Chuck Bunting
For outstanding service as the Global University Chair for the 2011 IEEE International Symposium on EMC.

Randy Flinders
For outstanding service as the Publications Content Coordinator for the 2011 IEEE International Symposium on EMC.

Dan Hoolihan
For outstanding service as the Special Liaison/Advisor for the 2011 IEEE International Symposium on EMC.

James Drewniak
For outstanding service to the Transactions on Electromagnetic Compatibility as Associate Editor, 2008 – 2011.

Pierre Degauque
For outstanding service to the Transactions on Electromagnetic Compatibility as a member of the Advisory Board, 2003 – 2011.

In Memoriam

Bill Rhoades, 1930-2010

John Howard, 1940-2010

Roger Sudbury, 1938-2010

Carl Baum, 1940-2010

Paul Cardinal, 1954-2010

Risaburo Sato, 1921-2011

Robert E. Howland, 1938-2011

Ruediger Vahldieck, 1951-2011

iNARTE Review of EMC 2011

By Brian Lawrence, Executive Director, iNARTE

The 2011 EMC-S symposium was one of the best in recent years. The convenience of the Hyatt hotel and the Convention Center was much appreciated, and the entire Long Beach experience was very enjoyable. Once again the iNARTE examination day was poorly attended with just five candidates registering. After all, it must have been a tough choice between another day inside for an eight hour exam or a final day outside to enjoy Long Beach.

This year iNARTE offered not only our traditional **EMC Engineer and Technician** exams, but also a new exam for **MIL STD Specialists,** and another new exam for **EMC Design Engineers** wishing to be credentialed for their electronic "Design for Compliance" knowledge, as compared to EMC testing and mitigating engineering skills. We received a lot of interest in the new EMC Design Program, but not one person was willing to be examined at the symposium.

Booth traffic in the exhibition hall was very encouraging. We were busy most of the time and all our literature was snapped up, so we hope candidates will be coming forward for certification over the next few months.

As predicted after the 2010 symposium, iNARTE now has more EMC certified Engineers and Technicians in Japan than in the USA. The new EMC Design Engineer program is predicted to attract many more candidates from Japan. Let's hope it is as popular in the US once we get it fully released with the three different grade levels: **Engineer, Senior Engineer and Master Engineer**.

The introduction of this major new program by iNARTE includes a **Grandfather** period, and this offer did attract considerable interest at our booth. One of the requirements for Grandfather applicants is a reference from academia or from an engineering institute officer. So the week of the symposium became an opportunity for Grandfather applicants to catch up with some referees and get these commitments arranged.

Kathy Lawrence of iNARTE debates the merits of iNARTE certification with EMC Consultant Dan Hoolihan (right). Bruce Archambeault moderated the informal debate held on the Queen Mary.

Following the debate, Ms. Lawrence headed to the sun deck of the historic Queen Mary. The first voyage of this grand ocean liner took place in 1936, during the heyday of cruising.

Grandfathering for the **Master EMC Design Engineer** certification ends on December 31, 2011, so time is running out. In 2012, all applicants, regardless of experience and references, will need to pass an iNARTE examination. It is expected that examinations at the EMC Design Engineer and Senior EMC Design Engineer levels will be available during the first quarter of 2012. The Master EMC Design Engineer examination will be ready for the EMC 2012 symposium, but how many experienced EMC Master Engineers have the time or desire to take an eight hour examination? Not many we guess! So download your Grandfather application at http://www.narte.org/d/emcdegrfapp.pdf and get it back to us, your references and other documentation can come later, we just need the application and fee paid by December 31 to open your file. **EMC**


CERTIFIED
ELECTROMAGNETIC COMPATIBILITY
MASTER DESIGN ENGINEER
Bruce R Archambeault

Our first Master EMC Design Engineer application was received from Bruce Archambeault, who now owns certificate number, EMCD-00001-ME.

Save the Date!

The following iNARTE events will take place during the 2012 IEEE International Symposium on EMC in Pittsburgh, Pennsylvania:

August 6, 2012
iNARTE Exam Prep Workshop

August 10, 2012
iNARTE Exam

For more information: www.narte.org

EMC EUROPE 2012

International Symposium on Electromagnetic Compatibility

September 17-21, 2012, Rome, Italy

FIRST CALL FOR PAPERS

The Symposium

EMC Europe, the leading EMC Symposium in Europe, will be held at the "Sapienza" University of Rome, Italy, in September 17-21, 2012. We wish to invite and encourage all those working in electromagnetic compatibility to participate in this prestigious event.

EMC research and conferences in Europe have a long tradition. From the series of independent EMC Symposia based in Wroclaw, Zurich and Rome running every second year, has now emerged EMC Europe which will be organised every year in a European city to provide an international forum for the exchange of technical information on EMC.

Technical Scope

Authors are invited to submit original contributions on all EMC-related aspects in the technical areas listed in the following. Only full papers 4-6 pages in length, in IEEE format, will be considered by the deadlines (see important dates). In addition, Workshop, Tutorial, Short-Courses and other Special Sessions will be organised to provide up-to-date practical help to those new to the subject or requiring an update, as well as to address in more depth topical subjects. Normal preliminary paper submission should be done electronically through the EMC Europe 2012 website (www.emceurope2012.it).

There will be a technical exhibition held in parallel with the conference. Sponsorship opportunities will also be available.

Conference registration will be done at the Symposium website where further details will become available in due course. All queries to: **info@emceurope2012.it.** The Organisers aim at making this a technically rewarding conference and your stay in Rome a very pleasant one.

Marcello D'Amore, *Chairman*
Mauro Feliziani, *Vice-Chairman*

The Venue, where it all began

The EMC Europe 2012 Symposium will be held at the Faculty of Engineering of "Sapienza" University of Rome which is located in the centre of Rome, very close to the Coliseum. The middle of September is a very popular season in Rome, and early hotel reservations are recommended. Hotel reservation forms will appear in the web pages.

The Symposium will consist of 5-day oral and poster presentations, workshops, tutorials, special sessions, short-courses, industrial forum, and exhibits. The Preliminary Program, registration form, information on accommodation and social activities will be available on the website (www.emceurope2012.it).

Technical Areas

- Electromagnetic Environment, Lightning, Intentional EMI & EMP, High Power Electromagnetics, ESD, UWB
- Transmission Lines, Cables, Crosstalk, Coupling
- Shielding, Gasketing & Filtering, Grounding
- Measurement & Instrumentation, Emission and Immunity, Chambers & Cells, Antennas
- Advanced Materials, Nanotechnology, NEMS & MEMS, Smart Sensors
- Computational Electromagnetics, Model Validation
- Semiconductors, PCB, Electronic Packaging & Integration, Power & Signal Integrity
- Power Systems, Power Quality, Power Electronics
- Wired & Wireless Communications, UWB Communications, Power Line Communications
- Automotive, Railway Systems, Naval Systems, Aircraft & Space Systems
- Human exposure to EM fields, Biological Effects, Medical Devices & Hospital Equipment
- Standards and Regulations, EMC Management, EMC Education
- Any other relevant topics

Important Dates

Paper Submission: **15 February 2012**
Proposals for Workshops, Tutorials, Special Sessions, Short-Courses: **15 March 2012**
Notification of Acceptance: **15 April 2012**
Final Paper Submission: **15 May 2012**

Exhibits

During the Conference, an exhibition of software, hardware, equipment, materials, services and literature is planned. This will be an excellent opportunity for companies to present their latest developments to a world-wide public of researchers and engineers. Companies, institutions, research centres and universities are welcomed within the limits of the available boots.

International Steering Committee

J. L. ter Haseborg, Chairman (Germany)
H. Garbe, Vice-Chairman (Germany)
P. Besnier (France)
F. G. Canavero (Italy)
J. Catrysse (Belgium)
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C. Christopoulos (United Kingdom)
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Global EMC University in Long Beach at EMC 2011

By Chuck Bunting, Oklahoma State University

The Global EMC University was held in conjunction with the 2011 IEEE International Symposium on EMC in Long Beach, California. This was the fifth consecutive year that the Global EMC University was held during the symposium; this year it was attended by 47 students (a record!).

The Global EMC University offers high level instruction to engineers who already have some experience in EMC and who have an interest in developing an advanced footing in key EMC topics in order to appreciate more completely the symposium technical sessions. Several new features of the fifth consecutive running of the Global EMC University included active learning exercises that were designed to promote deeper learning and to remain engaged with the general activities of the symposium. The exercises were very well received by the students at the symposium this year and helped create high level dialog with our speakers.

Classes are taught by an international panel of educators, whose selection is based upon their reputation for excellence in both instruction and in their ability to communicate the sometimes complex array of issues related to EMC engineering. Students receive Continuing Education Units (CEUs) for their participation in the class and are encouraged to attend symposium workshops, exhibits and social activities when they are not in class.

A "Meet and Greet" reception was once again held this year on Monday evening where participants got together with the lecturers for great food and drinks.

The lectures presented during the 2011 Global EMC University included:

- *Transmission Lines* – Jim Drewniak, Missouri Institute of Standards and Technology
- *PCB Layout for EMC Compliance* – Bruce Archambeault, IBM
- *Conducted Emissions and Power Supply Filters* – Mark Steffka, GM and University of Michigan – Dearborn
- *Antennas and Radiation EMC Standards* – Andy Marvin, University of York
- *EM Shielding Theory and Practice* – Colin Brench, Amphenol High Speed Interconnect
- *Signal Integrity and Crosstalk Analysis of High Speed Interconnects* – Giulio Antonini, University of L'Aquila
- *Overview of Numerical Methods* – Chuck Bunting, Oklahoma State University
- *Standards for EMC Compliance* – Don Heirman, Don HEIRMAN Consultants
- *How to Understand, Identify, and Reduce Radiated Emissions from Electronic Products During Design* – Lee Hill, Silent Solutions

PHOTOS BY RICHARD GEORGERIAN

The 2011 Global EMC University in Long Beach, California was attended by a record 47 students.

Bruce Archambeault of IBM provided one of the extended lectures during the 2011 Global EMC University.

An informal reception was held following the first day of the Global EMC University to facilitate conversation between the lecturers and the students.

In making the Global EMC University 2011 a success, Professor Mark Steffka served as Vice-Chair and his assistance was critical in making sure that the changes under consideration were well balanced and that the best speakers could be attracted.

In 2012 there are some exciting changes being explored, including a more intense focus on Signal Integrity issues. Watch the website as these developments become solidified in the coming months! **EMC**

Save the Date!

Global EMC University Offered in 2012

The Global EMC University will be offered again over August 6–9 at the 2012 IEEE International Symposium on EMC in Long Beach, California. The Chair is Chuck Bunting from Oklahoma State University. The Vice-Chair is Mark Steffka from the University of Michigan – Dearborn. Participants are encouraged to register early, because enrollment is limited.

The Global EMC University is several hours of instruction on basic EMC-related topics that is run in parallel with the traditional technical sessions at the annual IEEE EMC Symposium. Classes are taught by an international panel of educators, who are selected for this program based on their reputation for excellence in areas of practical importance to EMC engineers and their demonstrated ability to communicate effectively with students who are new to the field.

Continuing Education Units (CEUs) are awarded to the students who successfully complete the course.

For more information, visit www.emc2012.isemc.org

Letter from the Editor *continued from page 3*

The Wednesday Symposium Gala attracted a sold out crowd, including from left, EMC 2011 Symposium Chair Ray Adams of Boeing and his wife Sylvia, Todd Hubing of Clemson University, Francesca Maradei of the University of Rome "La Sapienza", John LaSalle of Northrop Grumman, Janet O'Neil of ETS-Lindgren, and Jerry Trepanier of GE Healthcare.

This issue is filled with great photos from the Long Beach Symposium, thanks to the efforts of stellar photographers Ken Wyatt, Tom Fagan and Richard Georgerian, shown here from left with Francesca Maradei following the Awards Luncheon. Dick Ford (not pictured) also provided several great photos. Thank you to these photographers for bringing the Symposium to life in this issue!

(From left) Jorge Benitez of Continental Automotive Guadalajara, Francisco Sepulveda of Sistemas e Ingenieria de EMC, and Facundo Dominguez from Argentina's National Metrology Lab (INTI) in Buenos Aires traveled from IEEE Region 9 (Mexico and South America) to attend EMC 2011.

EMCABS

EMC Abstracts

Osamu Fujiwara, Associate Editor

EMCABS Committee

Bob Hunter, Consultant
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"How Can I Get a Copy of an Abstracted Article?"

Engineering college/university libraries, public libraries, company or corporate libraries, National Technical Information Services (NTIS), or the Defense Technical Information Center (DTIC) are all possible sources for copies of abstracted articles or papers. If the library you visit does not own the source document, the librarian can probably request the material or a copy from another library through interlibrary loan, or for a small fee, you can order it from NTIS or DTIC. Recently it became clear that EMCABs were more timely than publications which were being listed in data files. Therefore, additional information will be included, when available, to assist in obtaining desired articles or papers. Examples are: IEEE, SAE, ISBN, and Library of Congress identification numbers.

As the EMC Society becomes more international, we will be adding additional worldwide abstractors who will be reviewing articles and papers in many languages. We will continue to set up these informal cooperation networks to assist members in getting the information or contacting the author(s). We are particularly interested in symposium proceedings which have not been available for review in the past. Thank you for any assistance you can give to expand the EMCS knowledge base. **EMC**

EMCABS: 01-11-2011

INFLUENCE OF NON-DESTRUCTIVE SHORTENING OF CABLES ON EMI MEASUREMENT

Mikulas Bittera, Viktor Smiesko
Slovak University of Technology, Institute of Electrical Engineering, Bratislava, Slovakia

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 29–32.

Abstract: Effect of non-destructive shortening of long cables of devices using low-inductive bundles on EMI measurement results is examined in this paper. Two-wire models for simulation and measurement were created and their behavior in term of EMI was compared. Based on obtained results, the radiation of three main types of cables was examined using numerical simulation. Given results are described in this paper.

Index terms: EMI measurement, two-wire cable, low-inductive bundle, non-destructive shortening.

EMCABS: 02-11-2011

RELATION BETWEEN RECEIVING ANTENNA CHARACTERISTICS AND MEASURING DISTANCE AND ITS EFFECT ON EMI MEASUREMENT

Mikulas Bittera, Viktor Smiesko
Slovak University of Technology, Institute of Electrical Engineering, Bratislava, Slovakia

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 33–37.

Abstract: Influence of measuring distance on directivity error of commonly used broadband antennas is examined in this paper. Since broadband antennas do not have the same radiation pattern as dipole antenna, incidence disturbance may be measured with an error. Angle of incidence varies with the antenna height and also with measuring distance. Models of the broadband antennas for numerical simulations were created and verified. Using these models we obtained the relation between the receiving antenna directivity and measuring distance that leads into the directivity error and also affects uncertainty of the measurement.

Index terms: EMI measurement, broadband antenna, directivity, measuring distance.

EMCABS: 03-11-2011

VALIDITY OF LONG WIRE ARRANGEMENT OF EMC IMMUNITY TEST

Jozef Hallon, Mikulas Bittera, Karol Kovac, Rene Hartansky, Viktor Smiesko
Slovak University of Technology, Institute of Electrical Engineering, Bratislava, Slovakia

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 83–85.

Abstract: This paper deals with analysis of influence of geometrical arrangement of long cables on the validity of immunity test against disturbing RF electromagnetic fields according to standard EN 61000-4-3. The goal of this work is to find the suitable configuration of long cablings which ensures similar results in immunity tests such as the basic standardized configuration. The results presented in this paper were obtained using numerical simulations as well as measurements of wire models situated in electromagnetic field.

Index terms: Electromagnetic compatibility, immunity testing, transmission lines, influence of electromagnetic field, numerical electromagnetic simulation.

EMCABS: 04-11-2011

ON A SHIELDING EFFECT OF MAGNETIC-COUPLED RESONANT WIRELESS POWER TRANSFER

+ Hiroshi Hirayama, ++ Syun Asakura, + Nobuyoshi Kikuma and + Kunio Sakakibara

+ Nagoya Institute of Technology, ++ Nagoya University, Japan

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 90–93.

Abstract: A shielding effect of magnetic-coupled resonant wireless power transfer (WPT) is examined. At first, the self-resonant type WPT system is analyzed by method of moment (MoM) calculation. This system has helical structure for resonance, whose resonant frequency is determined by its self-inductance and stray capacity. When the shield is set at the top and the bottom of the WPT system, far-field radiation not only for upward and downward direction, but also horizontal direction is decreased. The helical resonator is decomposed into a small loop and small dipole. Since the image current due to the shield has opposite polarity for small loop, far-field radiation for horizontal direction was decreased. Next, external resonant type WPT system is discussed. This model consists of loop structure and discrete capacitor. It is shown that far-field emission of this type is smaller than self-resonant type because the electric field is concentrated between the plates of the capacitor.

Index terms: Wireless power transfer, magnetic coupled resonant, shield.

EMCABS: 05-11-2011

ELECTROMAGNETIC DISTURBANCES SUPPRESSION IN MICROPROCESSOR SYSTEMS

Andrzej Holiczer

Bialystok University of Technology, Poland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 94–95.

Abstract: The paper deals with noise suppression methods in microprocessor systems. Two methods are presented: hardware (LC decoupling) and software (microcontroller digital clock sources management). Advantages and disadvantages of each method are presented. The tests are conducted on a real, battery operated mobile device with an AVR microcontroller onboard. Better noise suppression efficiency for proposed methods is proven. The presented data is based upon the author's experience over a few years designing and programming measurement, microprocessor based systems.

Index terms: Digital noise, ripple, noise suppression, decoupling, internal ADC, microcontroller.

EMCABS: 06-11-2011

MEASUREMENT OF RADIATED ELECTROMAGNETIC FIELD INTENSITY DUE TO LOW VOLTAGE ESD IN SPHERICAL ELECTRODE

+ Ken Kawamata, ++ Shigeki Minegishi, +++ Osamu Fujiwara

+ Hachinohe Institute of Technology, ++ Tohoku Gakuin University, +++ Nagoya Institute of Technology, Japan

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 127–130.

Abstract: The micro-gap discharge as the low voltage ESD shows very fast transition duration of about 32 ps or less. Furthermore, the breakdown field strength in the gap was very high of about 80 MV/m in low voltage discharging of below 400. The relationship between the breakdown field strength in the gap and radiated electromagnetic field intensity was examined in experimental study. The relative radiated electromagnetic field intensity was proportional to the breakdown field strength at the gap in the resonance experimental system using the discharge electrode with dipole configuration. In this paper, we present an improved experimental system to measure the radiated electromagnetic field intensity in a more wideband region using spherical electrodes and a horn antenna. As a result, the radiated electromagnetic field intensity is proportion to the charged voltage from 300V to 620V, and the amplitude of electromagnetic field intensity was according to the ratio of surface area using the spherical electrode.

Index terms: ESD, micro gap discharge, low voltage discharge, electromagnetic noise, radiation, spherical electrode.

EMCABS: 07-11-2011

INFLUENCE OF LIGHTNING OVERVOLTAGE SHAPE ON SPD CHARACTERISTICS FOR TELECOMMUNICATIONS AND SIGNALLING NETWORKS

+ Tomasz Kisilewicz, + Fabio Fiamingo, + Carlo Mazzfetti, ++ Bolesław Kuca, ++ Dominik Krasowsk

+ University of Rome "La Sapienza", Via Eudossiana 18, 00-184 Roma, Italy

++ Warsaw University of Technology, ul. Koszykowa 75, 00-662 Warsaw, Poland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 136–140.

Abstract: A lightning strike consists of one or more different strokes with positive or negative polarity. The influence of lightning current in each case results in overvoltages, which may be particularly dangerous for the apparatus of telecom and signaling networks within modern structures. To reduce the probability of electrical equipment damage and potential consequential loss, the surge protective devices (SPD) can be used as a protection measure. The paper deals with influence of lightning overvoltage shape on SPD characteristics for telecommunication and signaling

networks. For this goal, several laboratory tests were performed in order to ascertain this influence. The laboratory setup was formed by an impulse voltage generator with peak value of 450V whose electrical parameters were selected in order to obtain different voltage shapes: 1,2/50ms, 12/50ms, 0,25/50ms, 12/500ms, 8/20ms; typical low voltage limiting SPDs with different protection levels: UP = 40V, 80V, 100V; telecommunication wires of different length, ranging from 5 to 30 m, connecting SPD to equipment characterized with a high value of input resistance. The voltage was measured at SPD and equipment terminals and the influence of front steepness of incoming overvoltage and of telecom wire lengths was recorded and analyzed. The results could be useful to obtain (or verify) reliable mathematical models of SPD.
Index terms: Lightning protection, surge protective device, SPD protection level.

EMCABS: 08-11-2011

ELECTRICAL VEHICLE IMPACT ON DISTRIBUTION NETWORK POWER QUALITY

Sampsa Kupari
Metropolia, Helsinki University of Applied Sciences, Finland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 149–151.

Abstract: The amount of electrical vehicles will increase a great degree in the future. The only question is when. That is dependant mainly on battery technology and when batteries with high energy capacity and moderate price will be introduced. These cars together form a huge load (and occasionally a generator as well) that is not resistive but possibly of nonlinear character. This may have an effect on distribution network power quality and possibly disturb seriously other consumers. If this is not taken care of before expansion of the electric vehicles boom, serious damage may occur.

Index terms: Power quality, THD, rectifier, harmonic.

EMCABS: 09-11-2011

DANGER OF FLASHOVERS TO ELECTRIC EQUIPMENT LOCATED ON ROOFS OF BUILDINGS STRUCK BY LIGHTNING

Renata Markowska
Bialystok University of Technology, Faculty of Electrical Engineering, Poland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 176–180.

Abstract: This paper presents theoretical analyses connected with danger of flashovers to electric equipment located on roofs of buildings struck by lightning. The possibilities of emergence of such flashovers as well as application of different methods for estimation of separation distances for protection of the equipment are analyzed and compared. Large, however not very high, few-story buildings with electrical equipment located on their roofs and with different external LPS (Lightning Protection Systems) are taken into consideration. The analyses are based on the results of numerical calculations, confronted with the results of approximate procedures proposed in the European and international standards for lightning protection EN 62305-3:2011 (IEC 62305-3:2010). The numerical calculations have been performed using the standardized short-duration lightning current waveforms of 10/350 and 0.25/100, which represent the first and subsequent return strokes respectively. In the calculations concerning the first lightning stroke, an exact numerical method based on electromagnetic field theory has been used. The numerical calculations for the subsequent stroke, due to large computation time, have been performed only approximately based on the calculation results for the first stroke.

Index terms: Flashovers, lightning strike to a building, numerical calculation, separation distance.

EMCABS: 10-11-2011

ON THE LIGHTNING HAZARD AND ITS REDUCTION MEASURES IN NUCLEAR PLANTS

+ Carlo Mazzetti, + Tomasz Kisielewicz, + Fabio Fiamingo, ++ Boleslaw Kuca, ++ Zdobyslaw Flisowski
+ University of Roma "La Sapienza", Via Eudossiana 18, 00-184 Roma, Italy;
++ Warsaw University of Technology, ul. Koszykowa 75, 00-662 Warsaw, Poland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 183–188.

Abstract: A nuclear power plant (NPP) contains structures, systems, and components that are sensitive to lightning influences. Dangerous effects of such influences can include reactor trips, actuation of safety systems, loss of fire protection and so on. With an increasing involvement of electronic and digital devices into safety systems, lightning protection becomes more important to the plant operations. A damage type within a plant depends both on lightning activity at different locations and on features of involved systems. Due to expected serious consequences of lightning damages to NPPs there is no doubt that they should be protected. The problem consists in selection and application of adequate protection measures. This problem should be solved in terms of the risk and its monitoring procedures, which are based on the equilibrium between the efficiency of the selected protection measure and the resulting level of risk decrease in respect to its tolerable level. The paper deals with such approaches to the risk assessment in a NPP.

Index terms: Lightning protection, risk management, lightning risk, nuclear power plant.

EMCABS: 11-11-2011

CALCULATIONS AND MEASUREMENTS OF SHIELDING EFFECTIVENESS OF SLOTTED ENCLOSURE WITH BUILT-IN CONDUCTIVE STIRRER

Andrzej Rusiecki
Bialystok University of Technology, Poland

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp. 231–234.

Abstract: Numerical analysis of shielding effectiveness (SE) of a slotted enclosure with a built-in conductive stirrer has been presented. SE was calculated using two different methods: the Finite Element Method (FEM) and the Method of Moments (MoM). Results of calculations using two different electromagnetic simulators, COMSOL and FEKO, have been compared and experimentally validated using a GTEM cell test setup.

Participants at the XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, included (seated from left) Professor Robert Ziemba, Ph.D. student Grzegorz Karnas and his Professor Grzegorz Maslowski – all from the Rzeszow University of Technology in Poland – (standing from left) Renata Markowska, Professors Andrzej Sowa and Karol Aniserowicz – all from the Bialystok University of Technology, Poland – Professor Osamu Fujiwara from the Nagoya Institute of Technology, Japan and Professor Stanislaw Wojtas from the Gdansk University of Technology, Poland. One of the conference excursions included a dinner at Tykocin castle which the participants shown greatly enjoyed.

Index terms: GTEM cell, shielding effectiveness, slotted enclosure, stirrer.

EMCABS: 12-11-2011

MODELLING OF ELECTROMAGNETIC PULSE PROPAGATION OVER THE BUILDING GROUNDING SYSTEM

+, ++ Nerijus Bagdanavicius, + Anatolijus Drabattiukas, ++ Vitalijus Gvozas, + Sarunas Kilius, ++ Alius Noreika
+ Kaunas Technical College, Lithuania
++ Kaunas University of Technology, Lithuania

Proceedings of XXI International Conference on Electromagnetic Disturbances, Bialystok, Poland, September 28–30, 2011, pp.274–278.

Abstract: In various objects before installing the computerized systems of control, alarm and security, automation and similar, it is necessary to determine the specifics of the electromagnetic environment in the area of installation during the lightning impact in order to ensure the reliability of such equipment. The analysis of electromagnetic environment, which also spans the injection of electric potentials over the object grounding system, is accomplished by the way of simulation measurements using weak current generators. Later, such analysis is also verified by respective computations. In this paper, the peculiarities of the grounding system modeling under the impact of lightning discharge and distribution of potentials in the grounding system in respect of its configuration and type are analyzed.

Index terms: Grounding system, potential distribution, pulse registering device.

EMC

Our Three New Distinguished Lecturers for 2012

By Bruce Archambeault, Ph.D., IEEE Fellow, EMC Society Distinguished Lecturer Chair

Professor Christian Schuster, Sam Connor, Professor Madhavan Swaminathan, and Professor Jong-Gwan Yook will begin their two-year terms as the newest Distinguished Lecturers (DLs) of the IEEE EMC Society on 1 January 2012. They replace Professor Giulio Antonini, Professor Omar Ramahi and Mark Steffka, whose terms expired at the end of 2011 after many successful presentations to local Chapters around the globe. Our other three DLs, Professor Chuck Bunting, Jerry Meyerhoff, and Professor Wen-Yan continue their terms through December of 2012.

Before introducing the newest DLs, I want to acknowledge the contributions of Giulio, Omar and Mark over the past two years. During their terms, they volunteered to spend many days away from home, family, familiar food, and familiar people. They traveled by airplane, car, and busses in order to give presentations in the Unites States, Americas, Asia and Europe. Our Society's local Chapter meetings have benefited from the in-person contributions of these bright and learned volunteers. For those of you who have attended one of their presentations, I am sure you know what a very fun and educational experience these folks provide. Please join me in thanking our retiring DLs, and welcoming our new expert speakers.

If you haven't seen a DL at your Chapter meeting, you are really missing one of the most popular benefits that our Society offers. I am certain that this year's new speakers will continue the DL tradition of offering excellent technical education, advice, and entertainment. Chapter Chairs can request any of the Distinguished Lecturers to come to their local Chapter meeting. Once the schedule details are agreed upon by both parties, the EMC Society pays for the travel costs, so the local Chapter gets expert speakers, on a wide range of topics, at no cost to the local Chapter!

Below are our new Distinguished Lecturers for 2012–2013. Please feel free to contact them directly by phone or email to discuss hosting them at your next Chapter meeting, university class, or other special event. You can find contact information under the Distinguished Lecturer section of the EMC Society web site (www.emcs.org).

Christian Schuster is a Professor and head of the Institute of Electromagnetic Theory at the Hamburg University of Technology (TUHH), Germany. Prior to that he was with the IBM T. J. Watson Research Center, Yorktown Heights, NY, where he was involved in high-speed optoelectronic package and backplane interconnect modeling and signal integrity design for new server generations. Christian's topics will be:

1) **Fundamentals of Signal Integrity and Power Integrity**
This presentation gives an introduction to the fundamentals of signal and power integrity engineering for high-speed digital systems with a focus on packaging aspects. It is intended for an audience that has little or no formal training in electromagnetic theory and microwave engineering. Topics that will be addressed include lumped discontinuities, transmission line effects, crosstalk, bypassing and decoupling, power plane effects, return current issues, and measurement techniques.
2) **Physics and Modeling of Vias in Printed Circuit Boards**
This presentation gives an overview of the current understanding and simulation of electromagnetic fields around vias in printed circuit boards with a focus on the so called physics based via model. It is intended for an audience that has a basic knowledge of electromagnetic theory and network theory. Topics that will be addressed include the physics of parallel plane modes and their impact on via behavior, equivalent circuit models for signal vias, effect of ground vias, and the impact of floating planes on signal transmission.
3) **Using the Contour Integral Method for EMC Problems**
This presentation summarizes recent advances in the application of the so called contour integral method to EMC problems with a focus on the modeling of wave propagation in parallel plane structures. It is intended for an audience that has some knowledge of electromagnetic theory and its numerical methods. Topics that will be addressed include a review of the basic formulation of the contour integral method, the application to via coupling within parallel planes, the combination with the so called physics based via model, and the hybridization with the method of moments for computation of radiation effects.

Sam Connor is a Senior Technical Staff Member at IBM in Research Triangle Park. He has published many papers in the area of EMC research and computational modeling. Sam's topics include:

1) **Automated EMC Design Rule Checking: Past, Present, and Future**
The complexity of circuit boards and systems has risen dramatically over the last couple decades, along with the data rates of the signals being used. At the same time, development cycles have compressed, and teams have been divided across time zones and continents. In the past, manual reviews of circuit boards and system wiring were possible in the time available, and EMC engineers could share design guidelines with board designers down the hall. Nowadays, design guidelines must be accessible worldwide, instantaneously, and they

2012 Asia-Pacific EMC Week

May 21 - 24, 2012, Singapore

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Call for Papers

2012 Asia-Pacific International Symposium on Electromagnetic Compatibility in Singapore

After the resounding success of 2006 EMC-Zurich in Singapore, 2008 APEMC Singapore, 2010 APEMC Beijing and 2011 APEMC Korea, it was decided to hold the **2012 Asia-Pacific EMC Symposium in Singapore** from May 21 to 24, 2012. The event will continue in the spirit of APEMC and at the same time address the EMC community of the Asia-Pacific region and its link to the world.

So come and join the 2012 Asia Pacific Week in Singapore! We will offer a rich scientific program of highest quality with invited speakers from all over the world and provide a broad forum of exchange both for academia and industry alike.

The Symposium will cover the entire scope of electromagnetic compatibility. Prospective authors are invited to submit original papers on their latest research results.

Symposium Topics

- EMC Management
- EMC Measurement Techniques
- Lightning
- Electromagnetic Environment
- High Power EMC
- Power System EMC
- System-Level EMC and PCB EMC
- 3D integration EMC
- Electronic Packaging and Integration EMC
- IC EMC
- Communication EMC
- Computational Electromagnetics
- Nanotechnology in EMC
- Microwave Electronics and Components
- Semiconductor EMC
- Bio-Medical Electromagnetics
- EMC Material

Important Dates

Proposals for special /focused sessions & Proposals for workshops and tutorials	**Oct. 25, 2011**
Preliminary paper submissions (4 pages)	**Dec. 15, 2011**
Notification of acceptance	**Feb. 05, 2012**
Final paper submission	**Mar. 15, 2012**

Symposium website:

www.apemc2012.org

need to be checked in a repeatable manner to ensure quality. As technology changes, new rules must be developed quickly based on lessons learned and simulation results. These demands have driven the need for automated, customizable rule checking applications. Up until now, these applications have focused on electrical designs, as this is typically viewed as the source of EMC problems. Looking ahead, though, this methodology needs to be applied to all aspects of a system design if it is going to identify the system-level integration issues that often derail products during certification testing.

2) **Differential Signaling is the Opiate of the Masses**
A large concern with the proliferation of differential signaling is the false sense of security that comes along with its usage. Differential signals are hailed for their immunity to noise coupling and for their propagation characteristics. Differential receivers have great common mode rejection, and with equalization, receivers can pull meaningful signals out of a closed eye diagram. But with all of these benefits, the often forgotten drawback is that differential signals on PCBs are not truly differential and they do not perfectly cancel. The various asymmetries in the routing of the differential pair and the impedance discontinuities of vias and connectors and the imbalance and skew of the drivers all create a common mode signal on the differential pair that can cause serious EMC problems when coupled to other nets or radiated from cables and connectors.

3) **Effective Use of Full-wave Models to Evaluate Design Tradeoffs**
The demands of schedule and cost for most electronic products do not allow for multiple design iterations, so EMC engineers can no longer wait for hardware to be built and measured in the EMC lab before making design change recommendations. EMC engineers can participate sooner in the product development process if they are comfortable with the full-wave modeling tools available today and if they understand the tools' limitations. This presentation discusses various modeling approaches and gives many practical examples of how simulations can help one understand the impact of specific design features on the overall EMC performance of a system. It will also show how the results can add credibility to their design change

Madhavan Swaminathan is a Professor at the Georgia Institute of Technology, Atlanta. He is well known for his work in Power Integrity and Signal Integrity. He has published numerous papers and received a number of professional awards. Professor Swaminathan's topics include:

1) **Designing for Power Integrity: Status, Challenges and Opportunities**
Since the mid-1990s, designers have been developing sophisticated methods for managing power integrity in packages and printed circuit boards which has had a direct impact on the signal integrity of systems. These have included items such as developing design parameters, for example target impedance, developing repeatable frequency domain characterization methods, pushing the EDA vendors to improve the capability of the design tools, developing new devices such as EBGs to improve isolation, and developing embedded capacitance layers, to name a few. However, the designers are continuing to face challenges where the noise on the power distribution is beginning to overshadow the signals in fast switching environments arising in high speed computing systems. These challenges are opportunities for university research that can lead to interesting and often times innovative solutions. This talk will cover a review of the past developments in this area and will focus on the present challenges and potential solutions in the area of power delivery.

2) **Multi-scale and Multi-physics Modeling: Their Role in 3D Integration**
Over the last several years, the buzzword in the electronics industry has been "More than Moore", referring to the embedding of components into the package substrate and stacking of ICs and packages using wire bond and package on package (POP) technologies. This has led to the development of technologies that can lead to the ultra-miniaturization of electronic systems with coining of terms such as SIP (System in Package) and SOP (System on Package). More recently, the semiconductor industry has started focusing more on 3D integration using Through Silicon Vias (TSV). This is being quoted as a revolution in the electronics industry by several leading technologists. 3D technology, an alternative solution to the scaling problems being faced by the semiconductor industry, provides a third dimension for connecting transistors, ICs and packages together with short interconnections, with the possibility for miniaturization, as never before. The semiconductor industry is investing heavily on TSVs as it provides opportunities for improved performance, bandwidth, lower power, reduced delay, lower cost and overall system miniaturization. A major bottleneck today for 3D system implementation is in the Electronic Design Automation (EDA) area. In this talk, challenges in the design of 3D ICs and packages with a focus on design automation relating to multi-scale and multi-physics effects will be presented.

3) **Micro and Nano Miniaturization of Systems**
The main driver for the semiconductor industry has been Moore's law where the doubling of transistors has led to a phenomenal increase in functionality of the integrated circuit (IC). Today, microprocessors support a billion transistors, run at a frequency that is 250X higher than two decades ago and provide performance close to a super computer in a handheld device. However, integrating a System on Chip (SOC) has still not been possible due to technical and business reasons. This has led to highly integrated ICs but bulky systems. Today, the need for including sensing and energy harvesting devices for biomedical and other electronic applications is becoming necessary. These require the integration of nano-materials, nano-sensors and nano-generators into the SOP platform.

Jong-Gwan Yook is a Professor at Yonsei University in Seoul, Korea. He has published numerous technical papers and is well known for his work in the areas of computational electromagnetics, electromagnetic modeling of high speed mixed signal circuits, and signal and power integrity issues for GHz printed circuits and systems. Professor Yook's topics include:

1) **Computational Electromagnetics Tools for EMI/EMC/PI/SI Problems**
   There are various computational electromagnetics tools around for EMI/EMC/PI/SI analysis and each tool has its own pros and cons. In this talk, time as well as frequency domain tools are introduced with their capabilities and limitations.
2) **Electromagnetic Modeling of High Speed Mixed Signal Circuits and Interconnects**
   Accurate and real time modeling of high speed mixed signal circuits and systems as well as high performance interconnects are crucial for system design. In this talk, systems level simulation schemes are introduced for high frequency mixed signal analysis.
3) **Signal and Power Integrity Issues for GHz Printed Circuits and Systems**
   EMC regulations now reach a few Giga hertz region while conventional discrete component approaches for SI/PI problems met big hurdles. Thus, new innovative approaches are absolutely necessary for PCB level SI/PI improvement. This issue and some new ideas will be discussed in this talk.
4) **Localized EBG/meta-material for Improvement of Signal and Power Integrity**
   There are various ideas to minimize PCB level SSN by employing the meta-material concept. However, the majority are not suitable for practical applications. Recently, it is demonstrated that localized meta-material-inspired geometries greatly improve SI/PI performances and these ideas will be discussed in this talk.

EMC

More about Technical Resources for EMC Chapters: Distinguished Lecturers, Respected Speakers Bureau, Video DL Program

The EMC Society's Distinguished Lecturer Program provides speakers for Society Chapter meetings and similar functions. Each Distinguished Lecturer (DL) can offer one of several pre-prepared presentations on various EMC topics. DLs are appointed by the EMC Society Board of Directors for a two-year term. In 2012, the Society will have six Distinguished Lecturers serving on alternating terms.

Distinguished Lecturers may give up to six talks per year under the program, which reimburses the DL for their approved traveling expenses up to a recommended limit of $1,500 per engagement within the region where they reside, or $2,500 for external region travel. To provide as many opportunities to as many members as possible, the Society encourages hosting Chapters whenever possible to absorb some part of the speaker's costs, such as by providing or paying for local transportation, meals, and lodging.

For more information about the EMC Society's Distinguished Lecturer Program, visit our web site at http://www.emcs.org/dl-main.html. You can also contact Bruce Archambeault at 919-486-0120, or via email at bruce.arch@ieee.org.

Please also note the **Respected Speakers Bureau** (RSB) which is comprised of past DLs and other notable speakers. Information on the RSB can be found on the DL web site.

Also, remember to take a look at the **Video DL program** information. These DVDs can be used at Chapter meetings. Information is available on www.emcs.org.

Outgoing Distinguished Lecturers Ji Chen (left photo) and Sergui Radu (right photo) received Certificates of Appreciation from EMC Society President Francesca Maradei at the Annual Awards Luncheon held during the 2011 IEEE International Symposium on EMC in Long Beach, California. Joungho Kim also received a certificate in absentia as an outgoing Distinguished Lecturer.

Outgoing Distinguished Lecturer Joungho Kim is shown at the APEMC 2011 conference he helped organize on Jeju Island, Korea. We missed you in Long Beach, Professor Kim!

EMC Standards Activity

Don Heirman, Associate Editor,
EMC Society Vice President for Standards

Standards Meetings in Long Beach, California Generate Much Activity

Our Standards Committee meetings filled the Monday morning start of the Long Beach symposium week on August 15. The meetings moved into the annual luncheon with the Representative Advisory Committee (RAC) as well.

We started Monday morning bright and early with the first part of the Standards Development Committee (SDCom) meeting, followed by the Standards Education and Training Committee meeting and ending with the Standards Advisory and Coordination Committee (SACCom) meeting, chaired by John Norgard (NASA). You will recall that John replaced Werner Schaefer, the previous chair. The SACCom then met with the RAC and the EMC-S Board of Directors at the SACCom-RAC annual luncheon. The luncheon gives those members of SACCom and RAC an opportunity to update the Board on their respective activities and concerns.

SDCom Activity

We start by highlighting the SDCom meeting which reports on each of our EMC-S standards. The full title is found on the EMC-S web site under http://grouper.ieee.org/groups/emc/emc/ieee_emcs_-_sdcom_mainpage.htm

Note that since the SDCom also met on Wednesday morning, this report below covers both meetings. Also, there were four working groups that met to progress their standards work for these standards:

- P1309 Probe Calibration
- P1688 Line Replaceable Modules
- P299.1 Small Chamber Evaluation
- P473 Site Survey

P473 is restarting work as the project has stalled. EMC-S Technical Committee 3 (TC3) on electromagnetic environments is responsible now for the publication of the next edition of this standard.

The meeting was chaired by Andy Drozd (Andro Computational Solutions) and was again well attended including a presentation by the IEEE Standards Association identified staff supporting our EMC-S standards activity. Here is a summary of the meeting:

- Eleven of the 16 members of SDCom attended the meetings with 12 guests on Monday morning. There were four guests at the Part 2 meeting on Wednesday morning.
- Malia Zaman of the IEEE staff gave a presentation on changes to the IEEE ballot process, effective 2012. Reaffirmations will no longer occur, but various levels of revisions to standards will occur when a standard reaches the end of its life cycle. Interpretations will no longer be permitted. Finally, project authorization requests (PARs) shall be submitted for all changes to a standard even to re-ballot an expired standard without changes.

Below is the update of our EMC-S standards that was reported at the two SDCom meetings:

- **ISM Measurements (Std. 139) -** Current to end of 2011. Recirculation of reaffirmation ballot in progress.
- **TV Emission Measurements (HDTV) (Std. 187) -** Current until 2013, but consensus was that it needs updating for digital TV. Recirculation of reaffirmation ballot in progress.
- **Shielding Effectiveness (large) (Std. 299) -** Current to end of 2011. Recirculation of reaffirmation ballot in progress.
- **Shielding Effectiveness (P299.1) -** Awaiting outcome of IEEE MEC (mandatory editorial comments). Balloting group being formed.
- **Land Mobile Emissions (Std. 377) -** Current until 2013.
- **EM Site Survey (Std. 473) -** Project turned over to TC3. TC3 will hold web meeting to finalize proposed PAR and to gather all existing text. Secretary will work with TC3 and continue to monitor closely.
- **Field Disturbance Sensors (Std. 475)** - Current to end of 2011. Want to apply below 300 MHz. Recirculation of reaffirmation ballot in progress.
- **RF Absorber Evaluation (Std. 1128)** - Current to end of 2011. Interest in work up to 18 GHz. Recirculation of reaffirmation ballot in progress.
- **Video Display Terminal (VDT) Emissions (Std. 1140)** - Current to end of 2011. Dave Traver took action item to look at standard and recommend what material should be saved and repurposed.
- **Gasket Characterization (Std. 1302)** - Current until 2013.
- **Probe Calibration (Std. 1309)** - PAR extended to 2012. Passed IEEE MEC and ready for ballot. Balloting group being formed.
- **RF Filter Performance (P1560)** - Current to end of 2011. Recirculation of reaffirmation ballot in progress.
- **Computational EM (1597.1)** - Current until 2014. WG may submit PAR at Fall 2011 SDCom meeting.
- **Computational EM Practices (1597.2)** - Current until 2015.
- **Intentional EMI to Computers (P1642)** - Awaiting outcome of IEEE MEC. Balloting group being formed. PAR expires December 2011, so SDCom may need to seek extension of PAR.

– **Line Replaceable Module Testing for Product Compliance (P1688)** - Conversion of document to IEEE template complete. WG has outlined an aggressive schedule. PAR extended to 2012. Expect to be in ballot in 2011.
– **Power Line Harmonics (P1836/1837)** - Report received. Work is proceeding on draft.
– **Power-line Noise Complaints (PXXXX)** - Ed Hare and Phil Keebler (EPRI) met to plan ways to move this forward.

In addition, representatives of SDCom are closely following and actively engaged in the guideline document for **Smart Grid interoperability (P2030)** which is sponsored by SCC21.

For more information on SDCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/sdcomindex.html

SETCom Activity

The SETCom meeting was chaired by Qiubo Ye. It met on Monday immediately following the conclusion of the SDCom Part 1 meeting. Below is a summary of the meeting:

- Thirteen people attended (two members and 11 guests).
- Tom Jerse, chair of the EMC-S Education and Student Activities Committee (ESAC) attended.
- It was noted that the vice chair can no longer take that role – this is a vacancy needing to be filled. Note: Subsequent to the meeting, EMC-S Board member Alistair Duffy agreed to take over as vice chair.

The chair then presented the SETCom recent activities:

- Establish EMC standard education and training workshops in European area with the assistance of Andy Marvin and Alistair Duffy.
- Workshops in the Pacific area will be assisted by R. Koga
- Soliciting EMC Standards tutorial articles from experts to be published in EMC Newsletter.

Future activities include:

- Coordination with ESAC
  – EMC standards topics for Global University
  – Develop course on subject
- Need ways to improve the SETCom workshop proposals so that they are accepted.
- Continue to organize Standards Workshops at annual EMC Symposia.
- Mobilize standards related activities in local EMC chapters.
- Create posters for use at the SETCom booth of the several (international) EMC symposia; Qiubo is in need of volunteers for booth duty.
- At the booth, provide a set of the actual IEEE EMC standards or electronic versions.
- Improve SETCom web page to link to the list of standards on the SDCom site and articles on the IEEE SA web site.
- Create PPT presentations identifying standards development for general use.
- Formalize SETCom operating procedures.

For more information on SETCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/setcomindex.html

SACCom Activity

After the close of the SETCom meeting, John Norgard, chair of SACCom, held a brief meeting as the major activity extended into the SACCom-RAC luncheon where those SACCom members present gave an update of their EMC standards activities. At the formal meeting before the luncheon, following are the details:

- Ten people attended (four members).
- It was recorded that there are 17 organizations identified that represent non-EMC-S standards writers on EMC subjects.
- The rest of the short meeting was used to prepare for SACCom-RAC luncheon presentations that immediately followed the close of the SACCom meeting.

Below is a short summary of the luncheon meeting with the EMC-S Board of Directors:

- Twenty people attended (eight were Board members).
- Short reports/PP slides were presented by the attending RAC and SACCom members.
- For SACCom, these presentations/reports were given:
  – CISPR A (measurement methods, instrumentation and statistical techniques)
  – CISPR B (industrial, scientific, and medical EMC)
  – CISPR I (information technology and multimedia EMC)
  – AIAA (American Institute of Aeronautics and Astronautics)
  – SAE (Society of Automotive Engineers)
- For the RAC, these presentations were made:
  – ITIC TG5 (Information Technology Industry Committee)
  – ACIL (American Council of Independent Laboratories); this report was an in-depth review on ACIL's proficiency testing activity

For more information on SACCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/saccomindex.html

Below is the latest list of SACCom representatives:

SACCom Representatives

Representative	Represented Committee
Sargent, Noel	ISO TC20 SC14
Lukash, James	AIAA S-121-2009
Petersen, Ron	IEEE SCC-39 (ICES)
Peterson, Ron	IEC TC106
Smith, Doug	Electrostatic Discharge Society
Heirman, Don	AAMI
Heirman, Don	IEC CISPR/A
Pettit, Ghery	IEC CISPR/I
Pettit, Ghery	ITI TC5
Moy, Kin	ISO TC22/SC3/WG3
Williams, Kimball	IEEE Vehicular Technology Society
Williams, Kimball	Society of Automotive Engineers
Hurst, Bill	Federal Communications Commission
Brumbaugh, David	SAE AE4
Hoolihan, Dan	IEC CISPR/B
Jones, Brian	CENELEC TC210
Schaefer, Werner	IEC CISPR/H

These standards meetings will again be held at the 2012 EMC-S symposium in Pittsburgh, Pennsylvania. Before then, there will be interim meetings. See the Calendar Section of this Newsletter for the listing of upcoming meeting dates and locations. All standards committee meetings are open to anyone with an interest in EMC standards. For more information, please contact Don Heirman at d.heirman@ieee.org. **EMC**

Standards Workshops Introduce Proficiency Testing

Don Heirman, Associate Editor

Considering training that started the Thursday before the start of the 2011 IEEE International Symposium on EMC in Long Beach, California, over a half dozen standards committee meetings during the symposium, and finally all the exchanges on the subjects of our standards held during the symposium, we could hardly take a breath!

As is the case for well over a dozen years, the standards activity started even before the start of the symposium – in fact the Thursday, Friday and Saturday before, August 11–13. Accredited Standards Committee C63® held its usual workshops with a new twist. This year a half day workshop on proficiency testing (PT) for radiated emission measurements was introduced on Thursday. The focus was not only on following the testing protocol, but how to rigorously handle the statistics needed to show trends. On Friday, the workshop on C63.4 which is the FCC referenced emission measurement standard for information technology equipment continued its long run as the most attended workshop on an EMC standard with hundreds of attendees over the many years that it has been presented. On Saturday, the workshop on antenna calibration per ANSI C63.5 and the use of time domain techniques for antenna calibration as well as investigating test site anomalies in the site validation process was held. For more info on C63® visit the web site on www.c63.org.

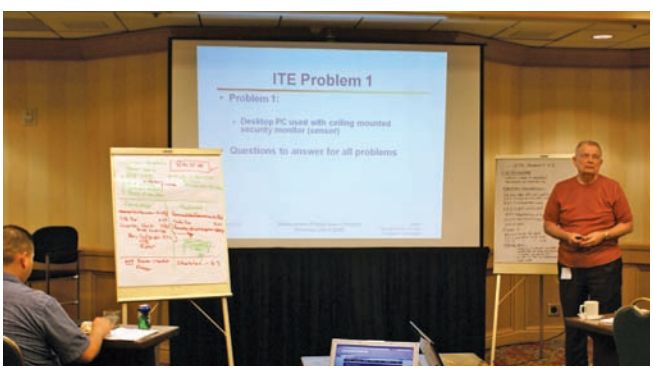
The new proficiency testing workshop was presented by Harry Hodes of Acme Testing. The work was part of the PT program that is being used by the American Council of Independent Labs (ACIL). ACIL is a member of C63® where there is a cooperative agreement on sharing information. This was the first time this subject was covered. There were several examples of how to handle the statistics. From the present ACIL PT program, it was found that significant differences in radiated emission measurement results occurred. This of course is what needs to be resolved or at least understood. The attendees then were given a chance to investigate presented PT results.

The next day, the C63.4 workshop was presented by Don Heirman of Don HEIRMAN Consultants and Bob Hofmann of Hofmann EMC Engineering. It was focused on further describing what is contained in the 2009 edition of the standard. The 2009 edition now has the following:

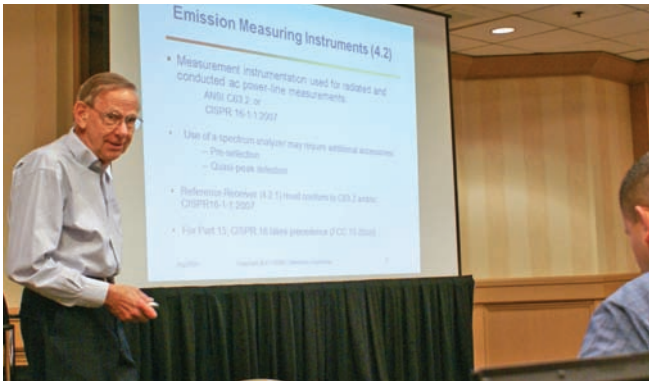
- Tables of LISN impedances (in addition to the plots in the 2003 edition) with and without the use of extension cords between the EUT power connection of the LISN and the end of the extension cord where the EUT connects its power plug.
- Clarifying in Annex B the LISN calibration process.
- What must appear on video displays during emission testing.
- Variation in antenna cable loss as a function of significant temperature variation at the test site.
- Precautions in using spectrum analyzers, which appear in clause 4.2.2 and Annex H.
- Informative annexes for step-by-step testing procedures have been omitted, because those were mostly duplicative of the normative procedures in the main text.
- Ensured that the standards not under the control of Accredited Standards Committee (ASC) C63® were dated to guarantee the acceptance of the versions that are referenced, whereas the ASC C63® standards were undated because ASC C63® would be voting their acceptance.
- Added information on the effects of materials used to construct EUT support tables and antenna masts.
- Condensed the information about absorbing clamp calibration and use, as well as the artificial hand, as these continue to be in limited use.
- Retained the Clause 13 requirements for emission measurements of intentional radiators.
- Introduced site validation specifications above 1 GHz from CISPR 16-1-4:2007, while still allowing use of absorber material on the ground plane for an open-area test site (OATS) and semi-anechoic chambers (in a particular configuration and with particular absorber performance without any further site validation measurements).
- There was no change in measurement methods above 1 GHz.

PHOTOS BY RICHARD GEORGERIAN

Instructor Harry Hodes (standing left) of Acme Testing Company discusses an exercise solution with attendees during the proficiency testing workshop.



The ANSI C63® Series Workshop Director Don Heirman of Don HEIRMAN Consultants presents a problem related to C63.4 for the class to solve.



Instructor Bob Hofmann of Hofmann EMC Engineering describes conducted emission testing requirements during the C63.4 workshop.

C63.4 workshop student Kermit Phipps of AMS presents a practical problem solution for his team.

The workshop then presented the proposed changes being considered for the next edition in 2012 which are the following:

- Removal of measurement methods for intentional radiators (clause 13) since they are now covered by the 2009 edition of C63.10 (measurement of unlicensed transmitters).
- Revision of the measurement method for emissions above 1 GHz; this would not be limited to unintentional radiators.
- Retain the site validation method above 1 GHz contained in CISPR Pub 16-1-4 (so called Site VSWR method).
- Further described scrolling H pattern requirements for large screen TV receivers as well as those used as computer monitors.
- Add measurement uncertainty similar to that in CISPR 22.
- Move most antenna calibration requirements to C63.5 (if not picked up in the next edition of C63.5, they will be kept in C63.4 until then).
- Move site validation requirements to new standard if one is published covering different approaches (potential publication is C63.25).
- Add information on the various versions of the average detectors and review average measurement method using a reduced VBW.

The next day Don, Zhong Chen of ETS-Lindgren, Dennis Camell of NIST, and Greg Kiemel of Northwest EMC presented what is covered in C63.5 on antenna calibration, proposed changes for a 2012 edition and then the use of Time Domain techniques to determine antenna calibration as well as test site validation, especially above 1 GHz.

Items included in the C63.5 portion of the day included:

- General test conditions for calibrating an antenna.
- Standards site method (SSM) also known as the three antenna method.
- Reference antenna method where specific construction techniques give predictable antenna factors.
- Calibration geometry specifics that differ for antennas calibrated for use in compliance testing and those used in test site validation.
- Specific biconical antenna calibration and the differences in those with 50 or 200 ohm baluns.
- Determining the measurement uncertainty for the various antenna calibration methods in the standard.

Also indicated were the areas being investigated for the next edition of the standard expected to be published by mid 2012. Here is a sample of those considerations presented:

The C63.4 workshop class poses for a group photo with instructors Harry, Bob and Don (left to right in front row). Janet O'Neil of ETS-Lindgren, workshop registrar and arrangements facilitator, is shown at far left in the second row.

C63.4 workshop students Dan Sigouin of Industry Canada, Harry Hodes, and Victor Kuczynski of Vican Electronics (from left) discuss a challenging problem.

Team 1 discusses solution to a measurement problem related to C63.4.

- Clarify text as needed in annex H in section 5.1 on the use of free space antenna factor (FSAF) and near-FSAF in section 5 and annex G.
- New text covering standard gain horns above 1 GHz which either use the physical dimensions for reference with some S11 electrical check to assure working horn or incorporate what cal labs use for horns above 1 GHz (extrapolation, etc).
- Add free space corrections for dipoles similar to the Japan Voluntary Control for Interference (VCCI) and the International Electrotechnical Commission (IEC).
- Add vertical Ed_max to annex A.
- Add limits to vertical vs. horizontal 1m ratio for hybrid antennas.
- Add minimum frequency resolution for calibrations.
- Re-instate sentence on biconicals – "Antenna factors obtained for biconical dipole antennas using the SSM that are used for either product testing or NSA testing shall be corrected to free space values using the correction factors provided in Annex G" as in the 2004 edition.
- Develop text for complex fit of log periodic antennas.
- Develop text for time-domain gating for free-space AFs (i.e. reduction of reflections).
- Measurement uncertainty estimates (either this document or in the uncertainty document).
- Expand reference antenna options.

The time domain method portion of the workshop focused on site validation in addition to antenna calibration. Note that the site validation work is now part of the standards work on the subject given in the draft of C63.25. In advance of publication, the following information was presented to show the usefulness of this technique.

- Measurements can be done with a swept frequency vector network analyzer.
- Converting from frequency to time domain using the inverse Fourier transform is extremely easy and fast with modern computational hardware and software.
- Conversions are done "on the fly" using time domain reflectometry (TDR) equipped Vector Network Analyzers (VNAs).
- Procedure is basically analogous to testing of products:
  - Place a transmitting antenna on the turntable with a receiving antenna at the 3-meter measurement location
  - Measure the response (voltage and phase converted to voltage and time) every 6 degrees of turntable azimuth
- The proposed TDR method is similar to taking a radar measurement of your site.
- The results are the amplitude, distance and angle of any reflections.
- The amplitude of the reflections is measured relative to the direct path thus making them a direct measurement of error introduced by the site!

Site of C63.5 workshop at Northwest EMC in Irvine, California, just south of Long Beach where the IEEE EMC Symposium was held.

Don Heirman introduces the topic and the agenda for the C63.5 and time domain workshop.

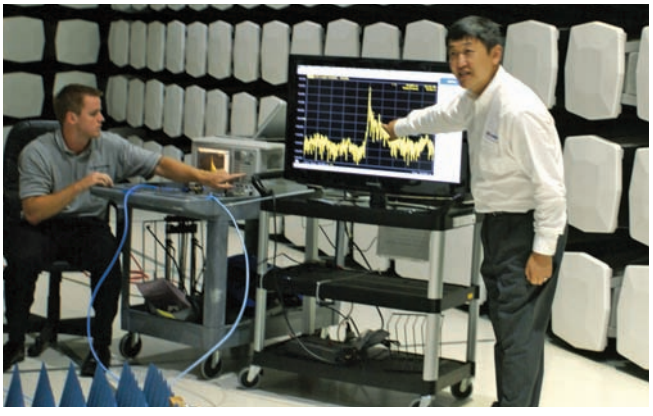
Dennis Camell of NIST, lead instructor for the C63.5 workshop, presents general antenna calibration test conditions.

Zhong Chen of ETS-Lindgren discusses the modeling of biconical antennas during the C63.5 workshop.

Jeff Poole of Agilent Technologies discusses the use of a vector network analyzer (VNA) used in the time domain process.

Greg Kiemel of Northwest EMC shows comparison between site validation using CISPR and that using time domain techniques during the C63.5 workshop.

C63.5 workshop attendees view the time domain site validation process in Northwest EMC's 10 meter semi-anechoic chamber.



Zhong Chen points out the VNA display that shows how to pick out site irregularities.

The workshop then concluded with the following:

- The same test site will have the same performance when measured with TDR and the IEC/CISPR Site VSWR (SVSWR) technique in CISPR 16-1-4 if the SVSWR measurement is done with continuous antenna movement (not in specific increments now in the SVSWR procedure).
- The TDR method will be faster and will yield diagnostic information (frequency, azimuth and distance to reflections – and hence show where the test site has to be improved to meet the validation specification) that SVSWR does not.

These workshops are planned for the week before the 2012 IEEE International Symposium on EMC in Pittsburgh, Pennsylvania. The venue will be either at the convention center or at the host hotel. For more information, please contact Janet O'Neil at j.n.oneil@ieee.org. **EMC**

Please check the C63® website – www.C63.org – after January 2012 for more information about scheduled ANSI C63® workshops in 2012.

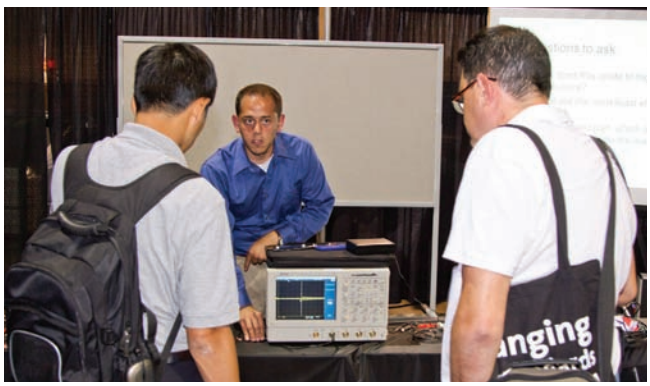
Education and Student Activities Committee (ESAC)

Tom Jerse, Associate Editor, ESAC Chair
Professor of Electrical and Computer Engineering
The Citadel, Charleston, South Carolina

The Education and Student Activities Committee (ESAC) held its annual meeting at the 2011 IEEE International Symposium on EMC this summer. It was attended by educators from many different institutions and by other engineers with an interest in EMC education. ESAC strives to cultivate programs that develop EMC skills in engineers ranging from those new to the field to experienced practitioners seeking to expand their knowledge. The many educational activities coordinated by the ESAC are described below.

Experiments Manual

ESAC is responsible for maintenance of the EMC-S Experiments Manual. Originally begun by Dr. Clayton Paul over twenty years ago, it is designed to assist those teaching and developing EMC courses that reinforce the theory with practice. The experiments manual can be located under the ESAC page on the EMC-S website. It has been maintained for several years by Dr. Ed Wheeler of Rose-Hulman Institute of Technology who has now finished his term. At the ESAC meeting this summer, Dr. Bogdan Adamczyk of Grand Valley State University in Michigan was elected to carry on the work of collecting and publishing experiments. The work of graduate student Chris Semanson of the University of Michigan – Dearborn (featured in the Summer 2010 EMC-S Newsletter) in developing experiments that complement Henry Ott's book, *Electromagnetic Compatibility Engineering* (reviewed in the Spring 2010 EMC-S Newsletter) will be included. The revised experiments manual will be posted on the EMC-S website.



The popular Chris Semanson (center) with the University of Michigan – Dearborn presented the experiment "The Effect of Circuit Impedance on Field-Coupled Crosstalk" at the Long Beach Symposium. Chris worked tirelessly in developing several experiments that complement Henry Ott's recent book, **Electromagnetic Compatibility Engineering.**

University Grant Program

John Howard founded the EMC-S University Grant program in the 1990s to promote the development of original university-level courses in the principles of EMC, and administered it until 2006. Sadly, John perished in an airplane accident in the summer of 2010. At its annual meeting, ESAC voted to recommend to the EMC-S Board of Directors that the annual University Grant award be named in his memory. The funds made available for the last grant period were $5,000. The award for this year, the sixteenth in the history of the program, went to the University of British Columbia in Victoria for the development of an EMC fundamentals course by Dr. Dave Michelson. Tom Jerse has been administering the program since 2006, and this year Daryl Beetner of the Missouri University of Science and Technology will begin his tenure as program chairman. Anyone interested in applying for a future course development grant is encouraged to visit the ESAC page of the EMC-S website or contact the chairman at daryl@mst.edu

Student Paper Contest

ESAC sponsors two student competitions to foster student interest in EMC and the Symposium. Again this year, the student paper competition had a sizeable number of entrants.

The "Fundamentals of EMC" full day tutorial in Long Beach was exceptionally well attended this year, thanks to the popularity of featured speakers Henry Ott, Andy Marvin, Mark Steffka, Don Sweeney, and Bruce Archambeault. Henry chaired the tutorial and presented "Dipoles for Dummies (as well as all the rest of us without a Ph.D. in electromagnetics).

Three student papers were recognized for the Best Student Paper Award, including:

First Place

"Electromagnetic Field Radiation from MWCNTs and SWCNT Bundles: A Comparative Analysis" by A.G. D'Aloia, M.S. Sarto, and A. Tamburrano, Department of Electrical Engineering, Research Center on Nanotechnology Applied to Engineering, University of Rome, "La Sapienza"

First Runner Up

"Compact Configuration of a Planar EBG Based CM Filter and Crosstalk Analysis" by F. De Paulis[1], L. Raimondo[1], B. Archambeault[2], S. Connor[2], and A. Orlandi[1] [1]University of L'Aquila, [2]IBM

Second Runner Up

"Analytical Expressions for Maximum Transferred Power in Wireless Power Transfer Systems" by Sunkyu Kong, Myunghoi Kim, Kyoungchoul Koo, Seungyoung Ahn, Bumhee Bae and Joungho Kim, Korea Advanced Institute of Science and Technology (KAIST)

Student Design Contest

This year the ESAC-sponsored hardware design contest was restarted after a two-year hiatus. The project chosen for this year was to layout a linear feedback shift register circuit for minimum radiated emissions. The entrants were provided with the necessary integrated circuits and clock generator and were tasked with designing and building the circuit layout. They were also free to add any dc filtering components to the circuit as they saw fit. The assembly was powered by a 9-V battery. The submitted entries were taken to the state-of-the-art EMC test facility at Lexmark in Lexington, KY, who graciously donated their time and facilities. The winning entry with the lowest radiated emissions was realized by Tianqi Li, Jun Wu and Hengsi Qin with the Missouri University of Science and Technology under the supervision of Dr. David Pommerenke. Check the ESAC page of the EMC-S website for details and the rules of the competition for 2012.

New ESAC Officers

New ESAC officers were elected at the meeting. Bogdan Adamczyk, the current secretary, was elected to the position of vice-chair and Mark Steffka was elected to replace him as secretary. The current chair, Tom Jerse, will step down after completing a four year term at the 2012 Symposium, and a new chair will be appointed by the EMC-S Board of Directors.

ESAC invites anyone with an interest in EMC education to join us at our next annual meeting during the 2012 EMC Symposium in Pittsburgh. **EMC**

Students Shine in Sunny Southern California!

EMC Society President Francesca Maradei is shown below presenting the student awards during the 2011 IEEE International Symposium on EMC held in Long Beach, California.

Congratulations to these outstanding students from around the world!

Student A.G. D'Aloia from the University of Rome, "La Sapienza", was the first place recipient of the Best Student Paper Award for his paper, "Electromagnetic Field Radiation from MWCNTs and SWCNT Bundles: A Comparative Analysis."

PHOTOS BY KEN WYATT

Student Sunkyu Kong from the Korea Advanced Institute of Science and Technology (KAIST) was the second runner up for the Best Student Paper Award for his paper, "Analytical Expressions for Maximum Transferred Power in Wireless Power Transfer Systems."

Student F. De Paulis from the University of L'Aquila was the first runner up for the Best Student Paper Award for his paper, "Compact Configuration of a Planar EBG Based CM Filter and Crosstalk Analysis."

Student Tianqi Li of the Missouri University of Science and Technology won the Best Student Design Award. His design to layout a linear feedback shift register circuit had the lowest radiated emissions of all designs submitted.

EMC Experiments and Demonstrations at EMC 2011

By Sam Connor, IBM, and Bob Scully, NASA
Co-chairs for Experiments and Demonstrations at EMC 2011

Back by popular demand, the Hardware Experiments and Computer Modeling and Simulation Demonstrations session of the 2011 IEEE International Symposium on EMC in Long Beach offered attendees an exciting array of topics and an alternative to classroom-style lectures. For 19 years running, the Experiments and Demonstrations session has provided an interactive forum for discussing electromagnetic phenomena, as presenters perform live experiments or demonstrate how computer software can solve a particular EMC-related problem. Attendees are able to have discussions with the presenters and often come away with a deeper understanding of the fundamental theory underlying the experiment or demonstration.

This year's session was organized by teammates Sam Connor and Bob Scully. Sam and Bob were able to recruit presenters for nine hardware experiments and 10 computer software demonstrations. Four of the hardware experiments were selected and presented by Chris Semanson, a former student of Mark Steffka at the University of Michigan at Dearborn. Chris chose his experiments from the EMC Education Manual, originally written and compiled by Henry Ott and Clayton Paul. Chris deserves a special tip of the hat for building and presenting these four experiments, which drew excellent crowds and lively discussions!

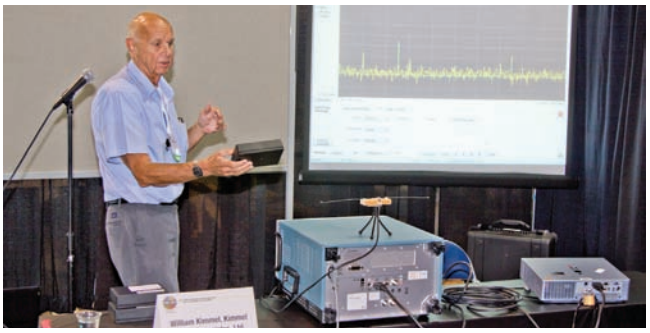
The Experiments and Demonstrations booths were nestled deep in the back of the exhibit hall, but those who made their way back there were well-rewarded with four concurrent presentations from which to choose. While in the area, attendees could also check out a new attraction: a Video Demonstrations booth which showed a loop of recorded experiments that demonstrated extreme electromagnetic phenomena such as Tesla coils, rail guns, and levitation.

The Experiments and Demonstrations presentations made as part of this year's symposium included:

- **Circuit Techniques to Reduce EMI in an Electronic System.** Using a test board, spectrum analyzer and near-field probes, Harihara Subramanian of ON Semiconductor demonstrated the benefits of the use of spread-spectrum clocking and noise cancelling signals as a means to aid in the improvement of EMI performance of a product.
- **Seam Leakage in Coated Plastic Enclosures.** Ever wonder why your conductive plastic enclosure fails radiated EMI testing miserably? William Kimmel of Kimmel Gerke Associates, Ltd. showed how well various seam closure techniques work.
- **Improving EMC Test Productivity with Automated EMC Test Software.** Joe Tannehill, EMC Software Engineer, ETS-Lindgren, Cedar Park, Texas showed how to improve the productivity of EMC testing with automation software, which helps increase the throughput of a lab and lowers cost.
- **Effective 3D Full-Wave Simulations.** How can I tell if this will work before I build it? A set of live demonstrations by Alex Razmadze of the Missouri Institute of Science and Technology showed how full-wave simulations can be used to study real-world problems.
- **Noise Measurement by Induction.** This classic experiment demonstrated how a square loop probe can be used to trace noise signals in a circuit back to their source. Chris Semanson brought this experiment straight from the labs of the University of Michigan Dearborn to Long Beach and deftly explained the principle of induction involved.
- **Efficient Testing Using a Reverberation Chamber – with "Real Time" Examples.** This crowd-pleaser featured a working reverberation chamber with a transparent wall so attendees could "see" the impact of the fields during testing. Dennis Lewis from Boeing and Garth D'Abreu from ETS-Lindgren teamed up to cover the fundamentals concepts and benefits of reverberation chamber testing.
- **Hybrid MoM/MTL Approaches for the Calculation of EMC Problems of Complex Systems.** Modeling of large, complex systems, such as aircraft and naval vessels, requires hybrid, optimized techniques like MoM/MTL. Dr. Roman

PHOTOS BY KEN WYATT

Dr. Arturo Mediano of the University of Zaragoza, Spain demonstrated the usefulness of near-field probes in finding EMI problems and in tuning circuits. His collection of probes was quite impressive!



Ever wonder why your conductive plastic enclosure fails radiated EMI testing miserably? William Kimmel of Kimmel Gerke Associates, Ltd. showed how well various seam closure techniques work.

Garth D'Abreu (standing left) of ETS-Lindgren and Dennis Lewis (standing right) of Boeing showed the fundamentals concepts and benefits of reverberation chamber testing.

Modeling of large, complex systems requires hybrid, optimized techniques such as MoM/MTL. Dr. Roman Jobava from EMCoS Ltd. traveled from Tbilisi, Georgia to explain how this approach can solve large EM problems.

Gopinath Gampala of EM Software & Systems (FEKO) presented "Simulation of Complex EMC Problems Involving Cables Using Combined Field and Transmission Line Approach." This was particularly helpful for automotive and aircraft applications.

Chris Semanson (far left) of the University of Michigan – Dearborn presented four demonstrations at the Long Beach Symposium. EMC experts Lee Hill of SILENT (far right) and Tom Van Doren of the Missouri University of Science and Technology (second from right) stopped by to see Chris's handiwork.

Jobava from EMCoS Ltd. traveled from Tbilisi, Georgia to explain how this approach can solve large EM problems.

- **Modeling the Coupling to Cables in a 3D Environment.** Paul Duxbury of CST UK was on hand to show attendees how to study EMI susceptibility problems with cable bundles and harnesses, where the dimensions of the cable cross-section are much smaller than the length of the cables and the dimensions of the shielding enclosure.
- **The Thinking Engineer's Voltage Measurement.** The second classic experiment presented by Chris Semanson illustrated cleanly and simply how the placement of probes in an electronic circuit can affect the results of the measurement.
- **Effectiveness of Shielding Materials and Impact of Slots and Bonding of Shields on PCB Radiation and Immunity.** The shielding performance of enclosures is always a popular topic at the symposium, and Professor Bogdan Adamczyk, Grand Valley State University, Grand Rapids, MI joined Jim Teune, Lead EMC Engineer, Gentex Corporation, Zeeland, MI to explore the shielding performance of various materials and slot geometries.
- **Modeling and Simulation for Cosite EMI Analysis.** Predicting cosite interference in complex RF environments with multiple emitters and receivers is a challenging problem for system designers, which requires numerical simulation tools. Fred German, Delcross Technologies, Champaign, IL, demonstrated the process of combining models to predict EMI margin and how the quality of the component models can impact the results.
- **2D Cross-Sectional Analysis in Signal Integrity.** When studying the signal integrity of a data link, accurate transmission line models are a key component, and this relies on a 2D cross-sectional analysis engine. Alex Razmadze of the Missouri Institute of Science and Technology explained how this 2D cross-sectional analysis works, and demonstrated how the inductance and capacitance matrices can offer important insight into coupling mechanisms and crosstalk.
- **The Effect of Circuit Impedance on Field-Coupled Crosstalk.** Chris Semanson's third experiment highlighted a phenomenon which is a powerful debugging tool: the termination impedance of a circuit determines which coupling mechanism (electric field or magnetic field) dominates. With the well-designed test circuit from the EMC Education Manual, the effect was shown very clearly.
- **Near Field Probes in EMI/EMC/RF Design and Troubleshooting.** Dr. Arturo Mediano of the University of Zaragoza, Spain demonstrated the usefulness of near-field probes in finding EMI problems and in tuning circuits. His collection of probes was quite impressive.
- **Simulation of Complex EMC Problems Involving Cables Using Combined Field and Transmission Line Approach.**

Haribara Subramanian (right) of ON Semiconductor in Bangalore, India demonstrated the benefits of the use of spread-spectrum clocking and noise cancelling signals to improve EMI performance of a product.

Dipanjan Gope (far right) of Nimbic showed how one can model a complex system package on a PCB in his demonstration "Real World EMI Correlation Challenges and Techniques."

Chris Semanson of the University of Michigan – Dearborn described his work in developing experiments that complement Henry Ott's book,* Electromagnetic Compatibility Engineering, *in his article "Creating Practical Experiments on EMC" from the Summer 2010 issue of the EMC Newsletter. He attended the Long Beach Symposium to personally show several experiments.

Brendon Berg of Advanced Test Equipment Rentals was a tremendous help to the Experiments and Demonstrations Committee for EMC 2011. They loaned equipment and made all the arrangements to have it on site and on time for the Symposium. Kudos for a job well done!

The problems posed by cables affect so many of us that this topic drew a second demonstration. Gopinath Gampala and C.J. Reddy of EM Software & Systems demonstrated a MoM/MTL approach to solving these cable problems.

- **EMC Issues on Printed Circuit Boards.** Since we know that unintended current return paths cause many of the EMI noise issues on printed circuit boards, software can be developed to check circuit board designs for problems in return paths. When problems are found, they can either be corrected or modeled if further study is needed. Matthias Troescher of CST AG, Munich, Germany presented this design methodology, from design rule checking to full-wave modeling of the violations.
- **Ground Noise in Digital Logic.** What effect do self-inductance and mutual inductance have on a digital circuit? This experiment from the Education Manual explored these questions as Chris Semanson took attendees through his fourth experiment exploring the various permutations.
- **Real World EMI Correlation Challenges and Techniques.** Dipanjan Gope of Nimbic, Bellevue, Washington showed attendees how one can model a complex system package on a PCB. The use of optimized techniques and parallel processing in a cloud environment were both discussed.
- **Full-wave EM Simulation of High-Speed PCB/Package Designs.** Darryl Kostka of CST, San Mateo, California presented on the topic of an integrated design, analysis and simulation workflow for high-speed IC/Package/PCB development. Examples were shown and important considerations such as boundary conditions and package truncation were discussed.

By all measures, the Experiments and Demonstrations were a valuable and exciting portion of the technical program, thanks to the contributions of all of the presenters. Be sure to stop by the Experiments and Demonstrations booths next year in Pittsburgh at the 2012 IEEE International Symposium on EMC, or better yet, propose an experiment yourself. **EMC**

Call for Hardware Experiments and Software Demonstrations

For Presentation at the 2012 IEEE International Symposium on EMC

Pittsburgh, Pennsylvania

August 6–10

Proposals Due: May 1, 2012

Ever wanted to describe something to someone, but just couldn't get the point across with mere words? And you just KNEW that if you could somehow show it to that person, they would "get it" instantly? Well, here's your big chance! Make your Boss proud and justify your Symposium trip all in one swell foop*! Impress your friends and fellow practitioners! Contact Sam and Bob, get a copy of the EMC Experiments Manual, pick the experiment that whets your appetite, and go for it! Or, if you have something to show that isn't in the book, that's even better!

For more information, visit www.emc2012.isemc.org or contact:

Bob Scully: bob.scully@ieee.org
Sam Connor: sconnor@ieee.org

*"Swell foop" is a spoonerism of Shakespeare's phrase "one fell swoop" from Macbeth. The phrase "swell foop" is generally acknowledged as being first spoken by Peter Sellers in "The Pink Panther" movie of 1964.

European Conference and Exhibition on Electromagnetics

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2-6 July 2012 - Toulouse, France

EUROEM 2012 will continue the EUROEM/AMEREM tradition of bringing together the:

- 18th High-Power Electromagnetics Conference (**HPEM18**)
- 11th Ultra-Wideband, Short-Pulse Electromagnetics Conference (**UWB SP11**)
- 11th Unexploded Ordnance Detection and Range Remediation Conference (**UXO11**)

IMPORTANT DATES

3 October 2011: Start of abstract submission
9 January 2012: Deadline for abstract submission
5 March 2012: Notification of acceptance
7 May 2012: Deadline for early registration

See instructions and templates for **paper submission** at www.euroem.org/node/23
Exhibition registration is available at www.euroem.org/node/22

Please regularly visit our home page of EUROEM 2012.
We look forward to seeing you in the beautiful city of Toulouse!

EMC Society Board of Directors Meeting

The Hyatt Regency Hotel
Long Beach, CA
August 14 and 18, 2011

The President's Opening Remarks

President Maradei called the meeting to order at 9:00 am. A round of introductions was made. Board members present included B. Archambeault, H. Benitez, C. Bunting, L. Cohen, R. Davis, A. Duffy, R. Ford, D. Heirman, D. Hoolihan, T. Hubing, R. Koga, J. LaSalle, F. Maradei, A. Marvin, J. Norgard, M. Oliver, J. O'Neil, G. Pettit, K. Phipps, R. Scully, D. Sweeney, K. Williams, P. Wilson, and T. Yoshino. Absent Board members included E. Joffe and V. Roje. Guests attending included H. Garbe, F. Heather, H. R. Hofmann, M. Montrose, S. Pignari, and Q. Ye. She reviewed Board meeting protocol, the IEEE code of ethics, and upcoming activities. She reminded Board members of the material on the Board FTP site and asked that everyone remember to review this prior to the Board meetings (ftp://ewh.ieee.org). Ms. Maradei welcomed the new Board members present and thanked them for their interest in the Board activities.

Consent Agenda

The agenda was presented for review. The consent agenda included approval of several motions. Secretary Janet O'Neil requested that the March meeting minutes be removed so that Board members can review the amendments made to the minutes for voting on at the Thursday Board meeting. The Board approved the balance of the motions remaining on the consent agenda, including approval of the August 14, 2011 meeting agenda, the $40,000 interest free loan to the committee for the 2013 IEEE International Symposium on EMC, and the $1,000 interest free loan to the committee for the 2016 IEEE International Symposium on EMC.

President's Report

Francesca Maradei reviewed the activity of the Excom meeting held the previous evening. The meeting addressed administrative points including the agenda review, motions to be presented, etc. All items discussed were included on the meeting agenda. Regarding Global Outreach, Ms. Maradei reported on the two regional events held in Buenos Aires (April 1, 2011) and Brasilia (April 4, 2011). Over 90 people attended the Buenos Aires event she attended and gave a presentation. Over 70 people attended the event in Brasilia. Ms. Maradei attended the IEEE Workshop on Signal Propagation on Interconnects (SPI'2011) which was technically co-sponsored by the EMC-S for the first time. She plans to attend EMC Europe over September 26–30, 2011. She noted the Asia Pacific EMC Committee would like to see more involvement from the Board. This will be held from May 21–24, 2012 in Singapore.

Ms. Maradei asked Ghery Pettit to speak about the June IEEE TAB meeting series in Bellevue, WA which he attended as her representative. Mr. Pettit mentioned that there is a plan within TAB to offer Society memberships at a consistent discounted fee. Mr. Pettit noted that a committee should be formed to address what should be included in the Society membership at an initial and enhanced level. Todd Hubing, Dick Ford, Kimball Williams, and Bob Davis volunteered to be members of this committee.

Ms. Maradei reported that the EMC Society has successfully completed the periodic five-year Society review on behalf of the TAB Society Review Committee (SRC). Several best practices of the EMC Society were commended, including having a strategic plan for the Society, having a detailed procedure for technical co-sponsorship of conferences, conducting the Global

PHOTOS BY JANET O'NEIL

(From left) Takeo Yoshino of the University of Electro-Communications, Perry Wilson of NIST, Dick Ford, and Bob Davis of Lockheed enjoyed the lunch break during the Sunday, August 14 meeting of the EMC Society Board of Directors.

(From left) IEEE Transactions on EMC Editor, Heyno Garbe of the University of Hannover, joined Chuck Bunting of Oklahoma State University, and Larry Cohen of the Naval Research Lab for the Board luncheon at the Hyatt Hotel in Long Beach.

EMC University Program, having an effective chapter database (this was recommended to IEEE MGA) and retreat for chapter chairs, to name a few.

Regarding the status of electronic motions made since the last Board meeting in March, the Board approved a 10% surplus ($10K Cap) distribution to the IEEE International Symposium Steering Committee. This is applicable when the symposium committee does not have a specific hosting chapter/section.

Treasurer's Report

John LaSalle presented a report on EMC Society finances. IEEE Operations are strong and this will impact spending from Society reserves. As of the end of June, operations are considered to be "normal" with an actual year-to-date surplus of $300.5K; this is considerably higher than the planned budget of $21,000. The Society is tracking toward the budgeted $21.0K positive net income. IEEE is currently forecasting a net positive $23.5K, indicating an overall positive position. The result is a $2.5K favorable position. Angel Funds approved included UKRI (United Kingdom & Republic of Ireland) – Paul Vertannes, Shanghai - Hongmei Fan, and Germany – Frank Sabath. The EMC 2010 Symposium (Ft Lauderdale) is currently undergoing audit. The surplus is expected to be some 19.5% or $200K. The report concluded with a comparison of two conference management bids.

The Board approved a new domestic travel expense subsidy in addition to the financial policy detailed in Mr. LaSalle's report.

Communication Services

Perry Wilson, Vice-President for Communication Services, presented his report. Mr. Wilson discussed the *IEEE Transactions on EMC* and expanding the number of issues per year to keep up with the paper submittals and to expedite time to publication. The Board approved the transition of the *IEEE Transactions on Electromagnetic Compatibility* from 4 issues per year to 6 issues per year (proposed Feb., April, June, Aug., Oct., and Dec.). Regarding implementation, the Board approved initiating the extra issues as soon as possible and not waiting until 2012.

Janet O'Neil presented four slides on the newsletter transition to a magazine. The Board suggested greater promotion of the transition to the general membership via the web and an email blast.

Newsletter Editor Janet O'Neil reported on Newsletter finances for the Winter 2011 and Spring 2011. The Winter issue at 84 pages cost $19,174 for the printing and mailing of 5,396 copies. There were eight ads in the issue that generated $12,040 in billed ad revenue, of which the EMC Society received a net of $6,742. The Spring issue at 100 pages cost $19,842 for the printing and mailing of 4,674 copies. There were 21 ads in the issue that generated $26,549 in billed ad revenue, of which the EMC Society received a net of $14,867. This was the first issue with Professor Kye Yak See of the Nanyang Technical University in Singapore as the Technical Editor. Associate editor Antonio Orlandi reports that he is out of books to review. If you can help by providing suggestions of books to review, please let Ms. O'Neil or Antonio know. He can be reached at Antonio.orlandi@univaq.it. On the Newsletter to Magazine transition, we are in the process of designing new graphics for the first issue of the magazine to launch in 2012. We are working with IEEE Media to develop the media kit for 2012 – our new magazine will be included in the ad sales pitched by IEEE Media representatives.

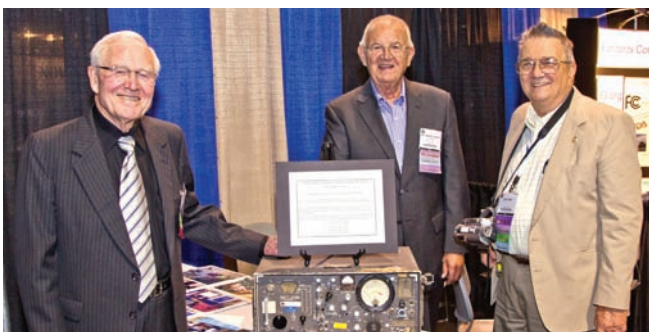
Enjoying lunch on a sunny day are (from left) Board members Andy Marvin from the University of York, Alistair Duffy from De Montfort University and Dan Hoolihan of Hoolihan EMC Consulting.

Professor Heyno Garbe, the Editor-in-Chief of the *IEEE Transactions on EMC,* reports that he is seeing a 10% increase in the number of papers submitted and has requested a 2012 page budget of 1,320 pages to handle the submission increase. An actual page budget of 1200 pages for 2012 was approved as part of the motion to increase the number of issues to six. A further increase will be considered as part of the 2013 page budgeting process. There are currently 20 Associate Editors with a resource of some 200-300 reviewers, of which 100 are active in any given year. On special issues, in 2012 the topic is "The Impact of High-Altitude Electromagnetic Pulse (HEMP) on Civil Infrastructures" with guest editor Bill Radasky. In 2013 the topic is "Model Validation and EMC" with guest editors Bruce Archambeault, Alistair Duffy, and others.

Dan Hoolihan, Chair of the EMC Society's History Committee, reported that the web page has been updated to include an improvement to the Hall of Fame page. Articles continue to be submitted to the Newsletter while the inventory of donated equipment (historical artifacts) continues to grow. How to effectively archive the records of key EMC-S members continues to be a topic for discussion.

Todd Hubing reported several routine updates continue to be made to the EMCS.org website regarding committee, chapter, conference, and awards web pages.

Ray Perez reported that there were no EMC sponsored books in progress for 2011 and none were published in 2011. Two well-advertised attempts to recruit authors did not produce



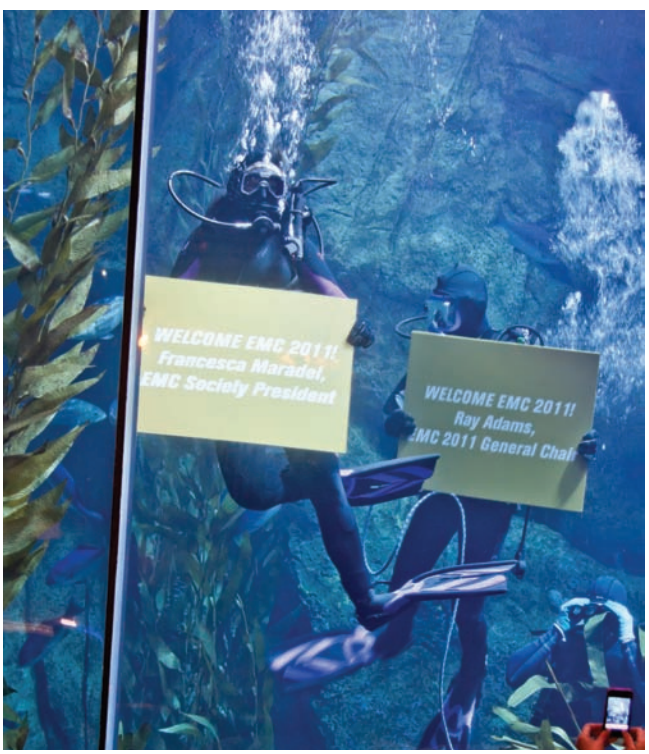
Joe Fischer, Herb Mertel and Board member Dick Ford (from left) visited the EMC Society History booth during the exhibition held at the 2011 IEEE International Symposium on EMC.

Board member Bob Davis (seated left) met with the volunteers at the Long Beach Symposium. Bob was also a member of the Symposium Steering Committee and in charge of the volunteers.

results. A new call for authors will be posted at the current symposium; one target is Aerospace EMC, a handbook is under consideration. Total royalties for EMC-S sponsored books in 2010 amounted to $1,365.34.

Member Services Report

Bob Davis, Vice-President for Member Services, presented his report. He began his report with a discussion on four motions. The Board approved the amendments to the Constitution and Bylaws presented, the appointment of Gustavo Fano as the new Region 9 Coordinator, the establishment of new membership coordinators in China with An Hao and Erping Li, and the use of existing funding to develop a Chapter website template.



Francesca Maradei from the University of Rome "La Sapienza" is a certified scuba driver, as is Ray Adams of Boeing, Chair of the EMC 2011 Symposium. Francesca and Ray offered a novel welcome at the Tuesday evening reception held at the Long Beach Aquarium.

The awards committee includes Bruce Archambeault and Mike Oliver as Co-Chairmen, Colin Brench, Christian Schuster, Tzong-Lin Wu, and Jun Fan. Mike Oliver reported that Rosanne Loyal (Senior Manager, Society Member and Committee Services) stated that the proposal for the establishment of an "IEEE EMC-S Award for Excellence in Continuing EMC Engineering Education" was approved by TAB at its June meeting. Bruce Archambeault and Mike Oliver will coordinate with Todd Hubing to incorporate the new award on the web site and with Janet O'Neil as an announcement in the Newsletter. Bruce Archambeault and Mike Oliver will create a policy regarding potential conflict of interest for the awards committee and endorsement of candidates.

Don Heirman reported the Completed Careers column of the upcoming newsletter will include remembrances on Carl Baum and Risaburo Sato as well as obituaries for Dr. Sato, Ruediger Vahldieck, and Bob Howland.

Todd Hubing reviewed the changes suggested by IEEE to the EMC-S constitution and bylaws as a result of the Society's five year review and the recommended response. This will be published in the Newsletter as required for membership review before a change can be made.

Bob Davis advised that total IEEE membership is up 1.4%, since this time last year. Total Society Membership is up 0.1% since this time last year. EMC Society Membership is down 0.5% (21) to 3862 (with Affiliates), since this time last year. EMC Society Student Membership is down 1.8% (1) to 56 since this time last year. Fifteen members have been elevated to Senior grade since March 2011. He is working on membership tracking in order to develop an approach to increase retention. Three new displays were purchased in December 2010: two are 6'x6' Pop-Up Table Top displays and one is a smaller, ShowStyle Display. The ShowStyle Display had its debut at the Regional Conferences in Argentina and Brazil in April and again in Detroit in May. This display is available to all chapters and is stored with Janet O'Neil. The Pop-Up display graphic design was completed in July, in time for the debut of the new display and graphic design at the 2011 Symposium in Long Beach. The second display will be shipped to Region 10 for use at conferences.

Bruce Archambeault reported on the Distinguished Lecturer (DL) program. The DLs for 2010–2011 include Dr. Giulio Antonini, Mark Steffka, and Dr. Omar Ramahi. The DLs for 2011–2012 include Jerry Ramie, Jerry Meyerhoff, Professor Wen-Yan Yin, and Chuck Bunting. The report includes financial data on the program as well as the number of presentations/trips per DL. A list of the current topics presented as part of the video DL library is included in his report.

Mr. Archambeault discussed the new potential DLs for 2012–2013. The Board approved the appointment of Christian Schuster, Madhavan Swaminathan, Jong-Gwan Yook and Sam Connor as Distinguished Lecturers for the term 2012–2013.

Bruce Archambeault noted three RSB talks have been presented to date in 2011. The current speaker list includes Colin Brench, Jim Drewniak, Cheung-Wei Lam, Werner Schaefer, David Pommerenke, Bruce Archambeault, Elya Joffe, Jun Fan, Chris Holloway, Tzong-Lin Wu, Eric Bogatin, Bob Scully, and Joungho Kim. The report includes presentation titles for lectures that may be given by the RSB.

Frank Sabath provided a detailed report for Region 8. Currently there are 1,202 active members in Region 8. Compared to March, this is an increase of 8% (89) active members. Due to his reminder e-mail, the number of those members that have not renewed their IEEE membership (in arrears) decreased by 48 member to 119. This is equal to the number he reported in November 2010. The number of inactive members decreased to 161. The distributions of active members are shown in his report. Within 20 sections, there are 13 EMC Chapters and seven joint/EMC Chapters. On October 24, 2011, the Benelux Section EMC chapter celebrated its ten-year anniversary.

Maria Alejandra Mora Riveros reported that EMC membership in Region 9 is constant since her last report. There is almost no variation in the number of active members in the sections with higher memberships, which are South Brazil (21 members), Argentina (20 members), Colombia (13 members), and Mexico (17 members). Mr. Davis noted that Maria has moved to France and can no longer effectively perform her responsibilities as Region 9 Membership Coordinator. Gustavo Fano has agreed to take over the position, effective immediately.

Takeo Yoshino reported on Region 10 activity. He attended the APEMC 2011 conference on Jeju Island, Korea.

The report includes a summary of activities of the new member campaign and new member applications at the IEEE EMC Society display at APEMC 2011. At the end of the conference, 38 application forms and other materials were transferred to Professor Joungho Kim, the new chairman of the Seoul Chapter, to use for increasing new EMC membership in Korea.

Sergio Pignari, Chapter Coordinator, reported that the contact information for the Chapter Chairs, as well indication of the Chapter Angels, has been updated with the new Chapter Chairs and Angels serving for 2011. The updated version has been finalized and posted in the EMC-S website. Contacts have been restored with the Chairs of the following Chapters: Rocky Mountain (Denver), Russia (North-West), Russia (Siberia), and Tucson Chapters. As a consequence, the number of non-responsive Chapters still not responding has decreased to the following four: Montreal, North-West Florida, Taipei, Ukraine (Kharkov). As part of the outreach activity, two dedicated meetings have been setup for September 2011 with the Shanghai Chapter and the Hong Kong Chapter. The petition submitted by Vesna Javor to form the IEEE Serbia and Montenegro Section Electromagnetic Compatibility Society Chapter has obtained the final approval. The official formation date is 6 May 2011. Vesna Javor is the Chapter Chair for the current year. New Chapters under construction include: Southwest Ohio (US), Waterloo (Ontario, Canada), West Michigan (US), as well as Iran, Greece, and Denmark.

Caroline Chan reports that there is a difficulty reaching out to members that are eligible to join the GOLD program but who joined IEEE after graduation. There seems to be no such database that indicates those people in membership. Bob Davis and GOLD USA are looking into how the system can be improved for a better database. Emails have been exchanged among Caroline Chan, Robert Davis, William Somerville (GOLD Representative), Soon Wan Gim, and Gigi Lau (who will be speaking during the GOLD Introduction on Tuesday night of the symposium week at the Welcome Reception GOLD session on how to promote GOLD EMC to the young engineers and the benefits from being part of the GOLD program). The target is to bring awareness to the eligible attendees in the IEEE EMC Society and bring volunteers to the group.

The Wednesday Gala was an amazing event held on the Queen Mary, now a floating hotel and museum docked in Long Beach. Board members enjoying the evening included (from left) Don Heirman of Don HEIRMAN Consultants, Todd Hubing of Clemson University, Janet O'Neil of ETS-Lindgren, John LaSalle of Northrop Grumman, and Dan Hoolihan.

Henry Benitez reported as the Sections Coordinator. Mr. Benitez continues to support Chapter development in Mexico and provide Section liaison support. He is developing good relations with the Region 9 Director in order to solicit for EMC-S Chapter or Joint Chapter formations, particularly in that region. He will attend the August Sections Congress and participate in activities to integrate MGA and TAB. He and Bob Davis will represent the EMC-S with a display at the tabletop Section Congress Exhibition for Societies and Councils. Mr. Benitez is in contact with the new EMC-S Region 9 Coordinator, Gustavo Fano.

Sister Societies Chair Chuck Bunting reported that email contact was made with Dr. Subbarao (Head EMCD, SAMEER - Centre for Electromagnetics) in India. He pointed Mr. Bunting in the direction of Dr. D.C. Pande (Chairman of the ISEMCE). Dr. Pande requested the MOU be sent and that was done. Email contact was made with Erping Li (in Singapore). He pointed Mr. Bunting in the direction of Dr. Richard Gao (Singapore EMC Chapter Chair). That follow-up has not been completed. Mr. Bunting will follow-up on the contacts already made with the India and China groups. The goal is to develop our first sister society agreement with India. The next goal will be to

Don Heirman staffed the ANSI C63® booth when he wasn't attending the Standards Committee and Board meetings or presenting in technical sessions. Bridget Budig of Hoolihan EMC Consulting also staffed the booth.

Board member John Norgard of NASA (far right) attended a social event in Long Beach where he talked about antennas with fellow gurus Vince Rodriguez (center) of ETS-Lindgren and Dennis Lewis of Boeing.

create a strategy for identifying key groups in Japan that could further the development of a sister society agreement.

Conference Services

Bruce Archambeault presented his report. The report started with a presentation by the Santa Clara Valley EMC Chapter to hold the 2015 IEEE Symposium on EMC in the spring. Next, Tom Braxton's report, as the International Conference Committee Chair, was reviewed. This highlights the status of the upcoming IEEE EMC symposiums, including EMC 2011 (Long Beach), EMC 2012 (Pittsburgh), EMC 2013 (Denver), EMC 2014 (Raleigh), EMC 2015 (Dresden), and EMC 2016 (Ottawa). For EMC 2010 in Fort Lauderdale, Mr. Archambeault noted the audit has been completed and closed with the IEEE; the symposium surplus is 19.5%

A discussion was held on future conference management services (CMS) to help future years' symposium committees. The Board approved the use of a CMS service to help future committees negotiate convention centers and hotels at the discretion of the VP of Conferences and the local committee chair.

On Global EMC Symposia Co-Sponsorship, Mr. Archambeault reported for chair Frank Sabath. The report summarizes the requests for EMC-S technical co-sponsorship requests and the status of review and approval by TAC.

The Board approved EMC-S Technical Co-Sponsorship for several conferences, including the 2012 ESA Workshop on Aerospace EMC; the 15th IEEE Workshop on Signal Propagation on Interconnections, SPI 2011; the 2012 European Conference and Exhibition on Electromagnetics, EUROEM 2012; and the 6th Asia-Pacific Conference on Environmental Electromagnetics (CEEM 2012).

Exhibitor Liaison Janet O'Neil reported that the plans are finalized for the exhibitor breakfast on Thursday, August 18. In addition to the usual reports from the outgoing (EMC 2011) and incoming (EMC 2012) symposium committees, the exhibit chair from EMC 2015 was invited to give a short "save the date" presentation. For EMC 2011, five tabletop display spaces have been sold to date. There are 177 booths sold which is higher than last year. Revenue collected to date is $488,100. The number of complimentary or bartered booths is 19. Several new exhibitors will be at EMC 2011.

Regional Conference Coordinator Janet O'Neil reported on regional events in Regions 1–7 and Region 9, including chapters who have hosted events and upcoming scheduled events. Details were provided on the Region 9 events held in March/April 2011 in Argentina and Brazil.

President-elect Ghery Pettit visited with Intel colleagues Kevin Slattery and Harry Skinner (from left) during the EMC 2011 Symposium.

Technical Services

Bob Scully, Vice President for Technical Services, presented his report.

The Board approved Mr. Scully's recommendation to purchase software for the EMC 2012 paper review process.

Education and Student Activities Committee (ESAC) Chair, Tom Jerse, reported that the EMC-S supports numerous educational outreaches and the BoD has voiced an interest for ESAC to coordinate these efforts to improve efficiency by reducing unnecessary overlap and to provide a clear, linked curriculum so that Symposium attendees can more easily understand the sequence of courses and how they fit the needs of the students. Work is still in the formative stage to develop a set of proposals to integrate the various educational outreaches, both proposed and existing, into a curriculum that gives our symposium attendees a clear picture of the various paths available to pursue EMC education. The ESAC report includes updates by the various subcommittees, including the Global University, the University Grant, Experiments and Demonstrations, Student Paper and Student Design Competitions, to name a few.

Technical Advisory Committee (TAC) Chair Bruce Archambeault noted that the committee held an in-person meeting on 14 May 2011 at the Missouri University of Science and Technology. Jun Fan was the host. During this meeting, all papers were put into sessions for EMC 2011. Sessions were scheduled. Paper review software was discussed and a set of software requirements developed. The iNARTE questions are considered in poor shape; TAC renewed its commitment to reviewing these questions for technical accuracy. Chuck Bunting was unanimously voted as the new TAC secretary, replacing Kermit Phipps.

The VP for Technical Services report also includes an adjunct report from Kimball Williams regarding the Society for the Social Implications of Technology (SSIT), the Technology Management Council (TMC), and the TC1 Ethics and Leadership Representative.

Standards Services

Don Heirman, Vice-President for Standards, presented the schedule of Standards Committee meetings during the Symposium

week. He will present a thorough report on Standards activity at the Thursday evening Board meeting.

President Elect Report

President-elect Ghery Pettit showed the planned meetings for 2012 as below:

- March 16–18, Scottsdale, AZ
- August 5 and 9, Pittsburgh, PA
- November 16–18, Raleigh, NC

New Business

Impact Factor – President Maradei discussed her presentation to IEEE TAB titled "Strategies for Increasing the IF of IEEE Journals: Best Practices and Ethics." This was given as part of the President's Forum at the November 2010 TAB meeting in New Brunswick. Her report explained the history of the "Impact Factor" (IF) and the current status of this rating for technical journals.

Suspension of Meeting

Ms. Maradei suspended the meeting at 5:15 pm. The meeting will continue on Thursday evening, August 18, at 6:00 pm.

Continuation of Board Meeting on August 18, 2011, 6:00 pm.

Call to Order

President Maradei called the meeting to order at 6:30 pm.

New Business *continued from the previous meeting*

EMC-S History – Don Sweeney talked about material he has received from Ed Bronaugh. The Board discussed how to archive this material. Dan Hoolihan suggested involving the chapters in this activity. Mike Oliver volunteered his chapter to help.

Approval of the March Meeting Minutes – Secretary O'Neil noted that some changes to the minutes were received just before the Board meeting. President Maradei advised that the amended minutes from the March Board meeting will be circulated to the Board for an electronic vote in the immediate future.

Standards Update

Don Heirman presented his report. The Standards Committees started their series of meetings during the Symposium week on Monday with the first part of the Standards Development Committee (SDCom) meeting, followed by the Standards Education and Training Committee meeting and ending with the Standards Advisory and Coordination Committee (SACCom) meeting, chaired by John Norgard (NASA). The SACCom also met with the RAC and the EMC-S Board of Directors at the SACCom-RAC annual luncheon.

The SDCom meeting was chaired by Andy Drozd and was again well attended. Malia Zaman of the IEEE staff gave a presentation on changes to the IEEE ballot process, effective 2012. Reaffirmations will no longer occur, but various levels of revisions to standards will occur when a standard reaches the end of its life cycle. Interpretations will no longer be permitted. Finally, project authorization requests (PARs) shall be submitted for all changes to a standard even to re-ballot an expired standard without changes.

The report includes an update of the EMC-S standards that was reported at the two SDCom meetings. In addition, representatives of SDCom are closely following and actively engaged in the guideline document for Smart Grid interoperability (P2030) which is sponsored by SCC21. There were also four working groups that met during the Symposium week to report their progress on their standards work for P1688 Line Replaceable Modules, P299.1 Small Chamber Evaluation and P473 Site Survey. P473 is restarting work as the project has stalled. EMC-S Technical Committee 3 (TC3) on electromagnetic environments is responsible now for the publication of the next edition of this standard. For more information on SDCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/sdcomindex.html

The SETCom meeting was chaired by Qiubo Ye. Tom Jerse, chair of the EMC-S Education and Student Activities Committee (ESAC) attended. The committee is working to create EMC standard education and training workshops in Europe with the assistance of Andy Marvin and Alistair Duffy; workshops in the Pacific area will be assisted by R. Koga. The committee is soliciting EMC Standards tutorial articles from experts to be published in the EMC Newsletter. For more information on SETCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/setcomindex.html

John Norgard, chair of SACCom, held a brief meeting as the major activity extended into the SACCom-RAC luncheon where those SACCom members present gave an update of their EMC standards activities. It was recorded that there are 17 organizations identified that represent non-EMC-S standards writers on EMC subjects.

Twenty people attended (eight were Board members) the SACCom-RAC luncheon meeting with the EMC-S Board of Directors. Short reports/PP slides were presented by the

PHOTO BY KEN WYATT

On Thursday evening of the symposium week, the Board held a second meeting to provide updates on activity during the symposium related to Standards, Conferences, Membership, Communications, and Technical Services (the five Vice President areas represented on the Board).

attending SACCom members on CISPR A, B, and I as well as on AIAA (American Institute of Aeronautics and Astronautics) and SAE (Society of Automotive Engineers). The RAC members presented on ITIC TG5 (Information Technology Industry Committee) and ACIL (American Council of Independent Laboratories); this report was an in-depth review on ACIL's proficiency testing activity.

For more information on SACCom, visit: http://www.ewh.ieee.org/soc/emcs/standards/saccomindex.html

Technical Services Update

Bob Scully presented his report. The Board approved disbanding the Representative Advisory Committee (RAC).

Member Services Update

Bob Davis, VP for Member Services, gave a verbal report. Fifty new members signed up at the symposium. Completion of the membership surveys will be promoted tomorrow. The new EMC-S booth was well received; new marketing brochures were available for the first time and were well received. The EMC-S booth will be shipped to an EMC event in Australia for display. Paul Duxbury will also display the new booth at the EMC Europe 2011 event next month. The Australia and UK chapter chairs received a PDF of the new membership brochure and application to print out locally. The Chapter chair training/dinner was well attended. Focused training sessions with speakers from IEEE on SAMEE, etc. were presented. Caroline Chan reported on the GOLD program. Public relations is needed to educate the membership about the GOLD program, as there were many questions about what the program stood for.

Conferences Update

The Board approved holding the 2015 EMC Symposium in March 2015 in Santa Clara, CA. This will be a North American symposium that does not compete with the Dresden symposium.

Ray Adams presented an update on EMC 2011. Attendance was just over 2,000 people. The financial surplus is approximately 19%. The author of one of the best paper candidates was denied a visa so he could not attend the symposium. The Board approved allowing the best symposium paper candidate or winner whose author cannot attend the symposium due to circumstances beyond their control, as evaluated by the VP of Conferences, to be published on IEEE *Xplore*.

Janet O'Neil, Vice-chair of EMC 2011 and Exhibitor Liaison, reported briefly on the symposium and exhibitor feedback. Social media – Facebook and Twitter – were used for the first time. Alcohol served in the exhibit hall was well received by the exhibitors and attendees. Ms. O'Neil will provide a thorough report on the Exhibitors Breakfast at the next Board meeting. In general though, exhibitors were happy with the symposium and the booth traffic.

Communications Update

Perry Wilson advised they held the *IEEE Transactions on EMC* Associate Editors luncheon during the symposium week. A discussion was held on the importance of the impact factor. Heyno Garbe, Editor-in-Chief of the *IEEE Transactions on EMC*, showed a few slides that discussed the impact factor.

New Business

Bruce Archambeault suggested eliminating the Thursday evening symposium Board meeting and instead holding a telecom two weeks after the symposium. Ghery Pettit advised he would take this into consideration.

Financial Impact of Approved Motions

Todd Hubing summarized the financial impact of motions made during the August 14 and 18 meetings:

$41,000	Interest-free loans to 2013 and 2016 Symposium Committees
~$5,000	Per year for transition from 4 to 6 issues per year of the Transactions on EMC
$200	Four Technical Co-sponsorships
$5,700	Development of website template for chapters
$10,900	2012 Technical Program software licensing
$62,800	

Action Item Review

Secretary O'Neil reviewed the action items discussed during the meeting. An updated, consolidated list of action items will be sent to the Board following the meeting.

Arjournment

Ms. Maradei adjourned the meeting at 10:15 pm.
Submitted by:

Janet O'Neil
Secretary, EMC Society Board of Directors

EMC

New Members of the EMC Society Board of Directors Announced!

A ballot for the election of six members to the IEEE Electromagnetic Compatibility Society Board of Directors was posted and e-mailed to all members of the EMC Society in August 2011. The ballots returned have been counted, and the following candidates have been elected for a three-year term beginning 1 January 2012:

Amy Pinchuk	Dave Staggs
Frank Sabath	Mark Montrose
Fred Heather	Colin Brench

We wish the newly elected members of the Board of Directors success and thank all candidates for their willingness to serve and for permitting their names to be included on the ballot.

Brief biographies of these candidates will be featured in the inaugural issue of the new Electromagnetic Compatibility Magazine, launching in the first quarter of 2012.

Past Presidents of the EMC Society

PHOTO BY KEN WYATT

Past Presidents of the IEEE EMC Society convened for a group photo during the symposium, including (seated from left) Joe Fischer, Don Heirman, Bill Duff, Len Carlson and Bob Hofmann. Standing from left are Dan Hoolihan, Todd Hubing, Andy Drozd, and Francesca Maradei.

Say Thanks to the EMC Society with a Legacy Gift

By Bob Davis, EMC Society Vice President for Membership Services

Members frequently share stories about the tremendous impact IEEE has had on their education, career, and life. To express their appreciation, some members make donations to the IEEE Foundation now and some leave a legacy gift to the IEEE Foundation for the benefit of the IEEE Electromagnetic Compatibility Society (EMC-S) in their estate. Giving in this manner is a meaningful way to help ensure that EMC-S will have the critical resources it needs for the next generation of engineers.

Legacy gifts typically come from assets rather than income. If you have considered leaving a legacy gift, you have several options as noted below.

Bequest - A provision in a will or living trust is the most popular form of legacy giving to the IEEE Foundation/EMC-S. There are several ways to structure a bequest. The bequest can be for a fixed dollar amount or percentage of your estate. Alternatively, it can be for part or all of the residuary of your estate or made contingent upon certain circumstances occurring.

Life Insurance - There are a couple of different ways you can use life insurance to fulfill a legacy gift. The IEEE Foundation/EMC-S can be named as the primary or contingent beneficiary of a policy. It is also possible to donate ownership of a policy that has outlived its original purpose.

Retirement Plans - If you have Individual Retirement Accounts (IRAs), 401(k) plans and other qualified retirement savings plans, you can designate the IEEE Foundation/EMC-S as the primary or contingent beneficiary of these accounts. The beneficiary designation is made by completing the account custodian's beneficiary change form. *(Note: Married persons need a spousal consent form if they wish to name anyone other than the spouse as death beneficiary of a qualified retirement plan.)*

You are invited to leave a legacy gift in your estate to the IEEE Foundation designated to EMC-S. Giving in this manner will make you *Forever Generous* and eligible to join the **IEEE Goldsmith Legacy League**. The **League,** the elite planned giving donor recognition group of the IEEE and the IEEE Foundation, is named in memory of Alfred N. and Gertrude Goldsmith whose planned gifts seeded the IEEE Foundation's ability to support the mission of the IEEE.

Members of the **IEEE Goldsmith Legacy League** are building tomorrow by leaving legacy gifts that will benefit future generations. In recognition of their special commitment, members receive a keepsake coin and certificate of membership in a custom presentation binder, an invitation to attend the annual IEEE Honors Ceremony, the ***IEEE Foundation Focus*** newsletter, periodic updates on estate and tax planning, as well as recognition in the annual ***Honor Roll of Donors*** and on the "Wall of Honor".

If you have already included IEEE, EMC-S or the IEEE Foundation in your plans, great! Please share the good news with the IEEE Foundation. This helps us plan for the future and recognize your generosity during your lifetime.

If you are deciding how best to include the IEEE Foundation for the benefit of the EMC-S in your plans, contact the IEEE Development Office by telephone at +1 732 562-3860 or by e-mail at donate@ieee.org to hold a personal and confidential discussion about how to integrate a legacy gift to the IEEE Foundation into your plans.

About the IEEE Foundation

The IEEE Foundation relies on charitable donations to provide philanthropic services in support of the IEEE core purpose to foster technological innovation and excellence for the benefit of humanity. It fulfills it mission by awarding grants to new and innovative projects and administering more than 130 donor designated funds that support a variety of educational, humanitarian, historical preservation, and peer recognition programs of the IEEE. Interdisciplinary in activities and global in scope, the IEEE Foundation helps improve lives throughout the world.

Qualified under US Internal Revenue Code 501(c)(3), the IEEE Foundation is eligible to receive tax-deductible contributions in the United States. For other countries, please check with your local tax advisor regarding tax deductibility of charitable contributions. To learn more visit http://www.ieeefoundation.org.

Mechanics for Leaving Legacy Gifts to the EMC Society

IEEE encourages members to direct their philanthropy to the IEEE Foundation. Beneficiary designations and bequests to the IEEE Electromagnetic Compatibility Society should be worded as follows:

> *"…to the IEEE Foundation, Incorporated, New York, NY for the benefit of the IEEE Electromagnetic Compatibility Society (for further designation to specific programs such as a scholarship, fellowship or EMC-S historical preservation project)."*

The information in this article is for educational purposes only and is not intended as legal, tax or investment advice. If you are considering a planned gift to the IEEE Foundation – IEEE Electromagnetic Compatibility Society, consult your tax and legal advisors to determine the best options for you. **EMC**

Junior Technical Program at EMC 2011

By Gayla Burns, Junior Technical Program Chairperson

The Junior Technical Program was a very busy workshop at the 2011 IEEE International Symposium on EMC in Long Beach, California. The first day we put together AM radios, and we had experiments setup on each table around the room for the kids to experiment with at their leisure. Below is a list of just a few experiments that we set up for them.

Magnets

The kids learned from the magnetic experiment that magnetism (the invisible force) can push and pull through some materials such as paper and plastic. By holding a paper clip close to a magnet, they could feel the magnet pulling on the paper clip with an invisible force called magnetism. They learned that all magnets have two ends or poles (North and South). If they put the poles of two magnets together, they will either pull together or push apart. They will pull (attract) each other if the poles are different. They will push (repel) each other if the poles are the same. Experiments with these magnets helped them to find out more about the way magnetism works and how it can be passed on to some objects.

Squirt Guns

The kids found out how to make a squirt gun out of a water bottle. Needless to say, the table where they made the "Big Squirter" was the busiest, the most exciting, the wettest and full of smiles. Now, that was a great ice breaker for the kids!!!

PHOTO COLLAGE BY DICK FORD

Lemon Battery

The Lemon Battery was fun to try out. We used lemons, a few inches of insulated wire, some sandpaper and a basic voltmeter. We also had a steel nail, one zinc-plated nail and stripped wires. We sanded the bottom of a nail and the copper wire, then inserted both into the lemon as close together as possible. The kids then used the leads on the voltmeter to read the electric output of the lemon. Then we switched nails and retested to see how different nails affected the output. The kids really enjoyed doing this even if some were not successful the first time.

On the second day of the Junior Technical Program, we were on the exhibit floor visiting the booths – an activity the kids totally enjoyed.

On the third day, we had 51 plus attend a tour of the Aquarium of the Pacific which was a fabulous adventure for the kids and the adults. It is definitely a "must see" attraction for anyone visiting Long Beach.

Thank you to all the volunteers that helped make the Junior Technical Program another success at EMC 2011. The volunteers were awesome!

EMC


Welcome!
2011 IEEE Symposium on EMC
IEEE
EMC 2011
EMC SOCIETY
Thanks to the 2011 Committee!
Volunteers
EMC 2011
Photos by Richard Georgarian, Tom Fagan & Kenneth Wyatt

Calendar

EMC Related Conferences & Symposia

2012

May 13-16
SPI 2012
16th IEEE Workshop on Signal and Power Integrity
Sorrento, Italy
Antonio Maffucci
Email: maffucci@unicas.it
(See ad page 97)

May 21-24
Asia Pacific EMC Symposium
Singapore
www.apemc2012.org
(See ad page 75)

May 21-23
2012 ESA Workshop on Aerospace EMC
Venice, Italy
Filippo Marliani
www.hirf-se.eu
(See ad page 73)

July 2-6
EUROEM 2012
European Conference and Exhibition on Electromagnetics
Toulouse, France
Jean-Philippe Parmantier
www.euroem.org
(See ad page 89)

September 17-21
EMC EUROPE 2012
University of Rome, "La Sapienza"
Rome, Italy
www.emceurope2012.it
(See ad page 67)

October 21-26
AMTA 2012
The 34th Annual Meeting of the Antenna Measurement Techniques Association (AMTA)
The Bellevue Hyatt Hotel on Seattle's Eastside
Bellevue, Washington
Dennis Lewis, Boeing
206.662.4209
Email: dennis.m.lewis@boeing.com
www.amta.org

November 6-9
CEEM 2012
6th Asia-Pacific Conference on Environmental Electromagnetics
Shanghai, China
Prof. Gao Yougang
www.emc2012beijing.com

EMC Annual Symposia Schedule

2012: August 6-10
Pittsburgh, Pennsylvania
Mike Oliver, 814.763.3211
(See ad pages 38-39)

2013: August 5-9
Denver, Colorado
Danny Odum, 303.693.1778

2014: August 3-7
Raleigh, North Carolina
Bruce Archambeault, 919.486.0120

2015: August 16-22
Dresden, Germany
Hans Georg Krauthäuser,
+49 (0)351.463.33357
hans_georg.krauthaeuser@tu-dresden.de

2016: July 25-29
Ottawa, Canada
Qiubo Ye, 613.998.2769

IEEE EMC Board of Directors and Standards Committee Meetings

Please note the Standards committee meetings of the IEEE EMC Society are held in conjunction with the EMC Board meetings listed below. All Standards committee meetings are open to anyone with an interest in EMC standards. To attend a Standards committee meeting at one of the locations below, contact Don Heirman at d.heirman@ieee.org. Board meetings are also open to those interested in the administration of the EMC Society. For information on the Board meetings, contact Janet O'Neil, 425.868.2558, j.n.oneil@ieee.org. Your involvement is welcome!

March 16-18, 2012
Scottsdale, Arizona

August 5 and 9, 2012
Pittsburgh, Pennsylvania

November 16-18, 2012
Raleigh, North Carolina

EMC Chapter Colloquium and Exhibition "Table-Top Shows"

2012

March 5
Williamsburg, Virginia
Advances in Antenna Test and Measurement
Various speakers, with keynote Address by Erik Vedeler, Head of Electromagnetics and Sensor Branch at NASA Langley Research Center
Colonial Williamsburg Lodge
Janet O'Neil, ETS-Lindgren
Phone: 425.868.2558
E-mail: j.n.oneil@ieee.org

March 27
Milwaukee, Wisconsin
Jeremy Campbell, PE
General Motors, Applied Technology Center
"Designing a Product to Meet Today's Emission and Immunity Requirements"
Crown Plaza Hotel – Milwaukee Airport
Jim Blaha, GE Healthcare
Phone: 262.548.2978
Email: jblaha@ieee.org

May 8
Chicago, Illinois
Speakers and topics to be announced
Itasca Country Club
Itasca, Illinois
Frank Krozel, Electronic Instruments
Phone: 630.924.1600
Email: frank@electronicinstrument.com
www.emcchicago.org

May 16
Detroit, Michigan
Todd Hubing of Clemson University on Automotive EMC Topics
Canton Summit on the Park
Scott Lytle, Yazaki North America
Phone: 734.983.6012
Email: scott@emcsociety.org
www.emcsociety.org

October 11
Santa Clara, California
With speakers Doug Smith on ESD and Dr. Ege Engin of San Diego State University on Power Integrity
Biltmore Hotel & Suites
Eriko Yamato, TechDream, Inc.
Phone: 408.483.5413
Email: eriko@tech-dream.com
www.scvemc.org

If you would like to add your name to the list of exhibitors to receive direct announcements in advance of these upcoming tabletop shows, please send an e-mail to j.n.oneil@ieee.org.

ADVERTISER'S INDEX

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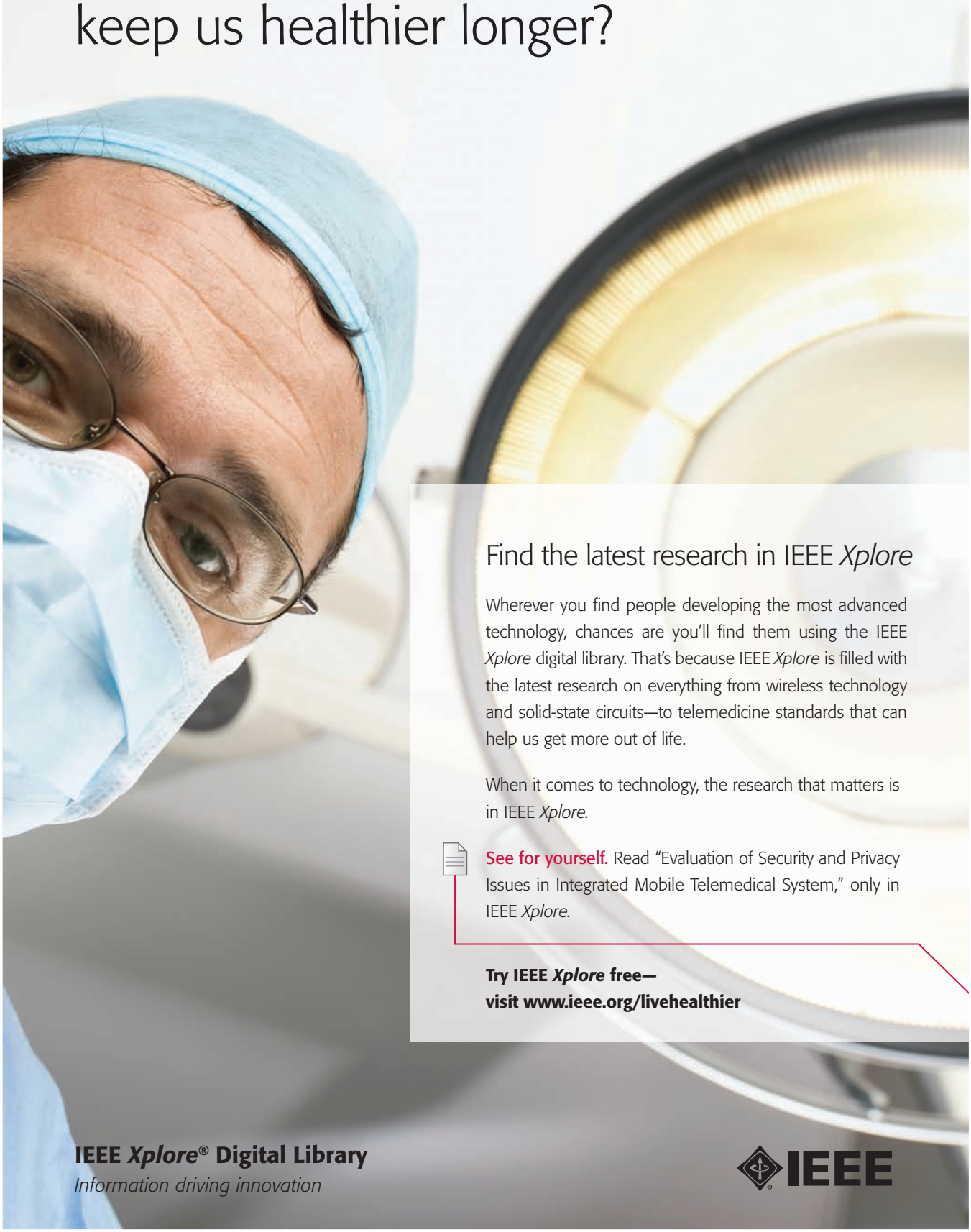

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