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IEEE

Wireless Power Transfer Conference 2014

May 8 ~ 9, 2014

Ramada Plaza Jeju Hotel, Jeju, Korea

Final Program



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Conference Chair's Message

Wireless power transfer technology is becoming one of the most emerging and promising technology with most highly expected market impacts in mobile and automotive industries. It can be widely applied to commercial products including wireless charging for smart phone, note PC, home appliance, automotive vehicle, and implanted medical device. It will enable us to be free from inconvenient wiring and charging overheads in battery-based operating systems.

In order to provide a platform to share the research activities and visions as well as to build friendship among the colleagues in the wireless power transfer technology, we are organizing IEEE Wireless Power Transfer Conference (WPTC 2014) 2014, in Jeju Island, Korea from May 8th to 9th. By the great supports and dedications of the TPC, organizing committee, and international advisory board members, we have about 80 outstanding presentations from 19 different countries from all over the world.

May in Jeju Island is the most beautiful season in a year with lovely flowers, great atmosphere, and warm weather. Please join us to enjoy the technical sessions and meetings, as well as the delicious foods. I am looking forward to meeting you soon at the IEEE Wireless Power Transfer Conference (WPTC 2014) 2014.



Joung-ho Kim (KAIST)

Conference Chair, WPTC 2014

TPC Chair's Message

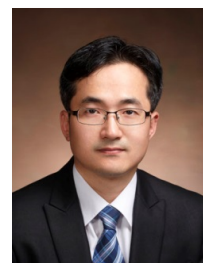
On behalf of Technical Program Committee (TPC), I am very pleased to welcome you to the 2nd IEEE MTT-S Wireless Power Transfer Conference (WPTC) 2014.

The TPC received 103 technical papers from 19 countries, and they are reviewed by qualified professionals. The final decisions regarding the technical papers and program were made at a TPC meeting held in Daejeon last February. Paper submissions for the WPTC 2014 covered a wide range of hot topics related with the wireless power transfer (WPT) and energy harvesting technologies. Strictly chosen papers on Automotive Applications, Microwave-based WPT, Mobile Applications, Circuits & Devices, System Design, and Resonating Coils will be presented.

In IEEE WPTC 2014, the TPC organized useful and helpful program for the researchers from all over the world. Especially, the exhibition program is newly arranged along with the technical session to shorten the distance between industry and academia.

We believe that WPTC 2014 will provide you of the good opportunity to exchange ideas and to communicate each other.

Please enjoy the WPTC 2014 in beautiful Jeju Island in Korea.



Seungyoung Ahn (KAIST)

TPC Chair, WPTC 2014

Conference Committee Members

Conference General Chair

- Joung-ho Kim (KAIST)

TPC Chair

- Seungyoung Ahn (KAIST)

TPC Members

- Ikuo Awai (Ryutech Corporation)
- Nuno Borges Carvalho (University of Aveiro)
- Debabani Choudhury (Intel Corporation)
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- Alessandra Costanzo (University of Bologna)
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- Toshio Ishizaki (Ryukoku University)
- Masaaki Kuzuhara (University of Fukui)
- Hai-Young Lee (Ajou University)
- Jenshan Lin (University of Florida)
- Andrea Massa (University of Trento)
- Milos Mazanek (University of Prague)
- Junji Miyakoshi (Kyoto University)
- Amir Mortazawi (University of Michigan)
- Kenjiro Nishikawa (Kagoshima University)
- Koichi Ogawa (Toyama University)
- Zoya Popovic (University of Colorado)
- Peter Russer (Technical Univ. of Munich)
- Tomohiro Seki (NTT)
- Satoshi Shimokawa (Fujitsu Laboratory)
- Naoki Shinohara (Kyoto University)
- Hiroki Shoki (Toshiba co.)
- Ken Takei (Hitachi, Ltd.)
- Manos Tentzeris (Georgia Tech)
- Yoshiyuki Fujino (NICT)
- Young Jin Park (KERI)
- In-Kui Cho (ETRI)
- Kang Yoon Lee (Sungkyunkwan University)
- Masao Taki (Tokyo Metropolitan University)
- Stepan Lucyszyn (Imperial College London)

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- Chul Hun Seo (Soongsil University)
- Dong-Ho Cho (KAIST)

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- George Ponchak (NASA)
- Naoki Shinohara (Kyoto University)
- Luca Roselli (University of Perugia)
- Zoya Popovic (University of Colorado)

Conference at a Glance

May 7 (Wed), 2014		
18:00-20:00	Welcome Reception	
May 8 (Thu), 2014		
08:30-09:00	Opening	
09:00-09:30	Keynote Speech 1	
09:30-10:00	Keynote Speech 2	
10:00-10:20	Break (20m)	
10:20-10:40	Technical Session (Th1) Automotive Applications of Wireless Power Transfer Technology	T-Th1-1
10:40-11:00		T-Th1-2
11:00-11:20		T-Th1-3
11:20-11:40		T-Th1-4
11:40-12:00		T-Th1-5
12:00-13:20	Lunch (1h 20m)	
13:20-13:40	Technical Session (Th2) Microwave-based Wireless Power Transfer Technology	T-Th2-1
13:40-14:00		T-Th2-2
14:00-14:20		T-Th2-3
14:20-14:40		T-Th2-4
14:40-15:00		T-Th2-5
15:00-15:20		T-Th2-6
15:20-15:40	Break (20m)	
15:40-16:00	Technical Session (Th3) Mobile Applications of Wireless Power Transfer Technology	T-Th3-1
16:00-16:20		T-Th3-2
16:20-16:40		T-Th3-3
16:40-17:00		T-Th3-4
17:00-17:20		T-Th3-5
17:20-18:40	Poster Session I	
19:00-21:00	Banquet	

May 9 (Fri), 2014		
08:30-09:00	Keynote Speech 3	
09:00-09:30	Keynote Speech 4	
09:30-09:50	Technical Session (Fr1) High-power Transmitter and Receiver Circuits and Devices	T-Fr1-1
09:50-10:10		T-Fr1-2
10:10-10:30		T-Fr1-3
10:30-10:50	Break (20m)	
10:50-11:10	Technical Session (Fr2) Design, Simulation, and Analysis of Wireless Power Transfer Systems	T-Fr2-1
11:10-11:30		T-Fr2-2
11:30-11:50		T-Fr2-3
11:50-12:10		T-Fr2-4
12:10-13:30	Lunch (1h 20m)	
13:30-13:50	Technical Session (Fr3) Coil and Resonator I	T-Fr3-1
13:50-14:10		T-Fr3-2
14:10-14:30		T-Fr3-3
14:30-14:50		T-Fr3-4
14:50-15:10		T-Fr3-5
15:10-15:30		T-Fr3-6
15:30-16:30	Poster Session II	
16:30-16:50	Technical Session (Fr4) Coil and Resonator II	T-Fr4-1
16:50-17:10		T-Fr4-2
17:10-17:30		T-Fr4-3
17:30-17:50		T-Fr4-4
17:50-18:10		T-Fr4-5
18:10-18:30		T-Fr4-6
18:30-18:50	Closing Remark	
19:00-20:00	International Advisory Committee Meeting (Mara Hall 2F)	

Keynote Speeches

Keynote Speech 1

KAIST On-line Electric Vehicle (OLEV) Wireless Charging Technology for Transportation Systems

Ramada Ballroom 1, 09:00 ~ 09:30 May 8 (Thu), 2014

Speaker : Prof. Dong-Ho Cho, KAIST, Korea

Session Chair: Prof. In Gwun Jang, KAIST, Korea

Abstract

In the keynote speech, first of all, OLEV project overview including motivation, necessity, problem solving strategy and project progress history are introduced. Also, shaped magnetic field in resonance (SMFIR) technology which is core technology shaping magnetic fluxes in resonance by using core structures is explained. Then, the basic structures of 20kHz or 60kHz resonant power line and pickup module are suggested. Moreover, bus application of SMFIR technology is presented in view of concept, configuration and operation principle. And, train application of SMFIR technology is explained with respect to concept, necessity, and wireless charging for tram and high speed train. In addition, commercialization of OLEV systems in Seoul Grand Park, KAIST campus and Gumi urban city is introduced. Finally, business competition analysis and application areas of SMFIR technology are illustrated.

Biography



Dong-Ho Cho, PhD, received the B.S. degree in electrical engineering from Seoul National University, Seoul, Korea, in 1979 and the M.S. and Ph.D. degrees in electrical engineering from the Korea Advanced Institute of Science and Technology (KAIST), Korea, in 1981 and 1985, respectively. From 1987 to 1997, he was a Professor in the Department of Computer Engineering at Kyunghee University, Korea. Since 1998, he has been a Professor in the Department of Electrical Engineering of KAIST, and he was a Director of KAIST Institute for Information Technology Convergence from 2007 to 2011. He has been a director of KAIST Online Electric Vehicle Project since 2009 and he is serving as a head of The Cho Chun Shik Graduate School for Green Transportation since 2010. He was also an ICC(IT Convergence Campus) vice president of KAIST from 2011 to 2013. His research interests include mobile communication, Online Electric Vehicle System based on Wireless Power Transfer, and bio informatics.

Keynote Speech 2

Electric Road Systems for Commercial Vehicles

Ramada Ballroom 1, 09:30 ~ 10:00 May 8 (Thu), 2014

Speaker : Dr. Håkan Gustavsson, Scania, Sweden

Session Chair: Prof. In Gwun Jang, KAIST, Korea

Abstract

The challenge of the transport industry is to deliver its value sustainably – above all by decoupling transport growth from CO2 emissions. Electric power from the roadway for vehicle operations offers promising opportunities. With conductive power transfer through overhead lines or inductive power transfer from the road, heavy vehicles can be completely electrically powered on electrified road sections. Scania is therefore preparing for an electrified future, conducting extensive research and development into how electricity will be used in the trucks and buses of tomorrow and is positioned at the leading edge when it comes to research on future vehicle electrification. Dr. Gustavsson will present research results from vehicle tests using both conductive power transfer through overhead lines and inductive power transfer. He will also give an overview of the research activities within this field in Sweden where Scania is actively engaged in preparations to start full-scale demonstrations on selected electrified roads in Sweden. The aim is to open electrified segments of public roads next year.

Biography



Dr. Håkan Gustavsson is senior researcher and project manager within hybrid technology development at Scania. He is currently evaluating the concept of electric roads both Inductive Power Transfer and Conductive Power Transfer. He has been working with vehicle electronic systems integration and architecture since 2002. He received his B.Sc. in Electrical Engineering at the Royal Institute of Technology 2002 after completing his studies with a final year at Fachhochschule Zentral Schweiz. His research area is systems engineering of vehicle electronics. His licentiate thesis was accepted in 2008, where a method was presented on how to improve the decisions made during the early phases of E/E-system development. His PhD thesis investigates how Lean thinking can be applied to system architecting and was defended in March 2011.

Keynote Speech 3

Wireless Energy Transfer and Conversion: the Wireless Power in 21st Century

Ramada Ballroom 1, 08:30 ~ 09:00 May 9 (Fri), 2014

Speaker : Prof. Jenshan Lin, University of Florida, USA

Session Chair: Prof. Jonghoon Kim, KAIST, Korea

Abstract

In recent years, the interest in wireless power or wireless charging has been growing rapidly. Many researchers and engineers who used to work on different fields are now focusing on this topic. Because of the strong interest within the IEEE Microwave Theory and Techniques Society, the technical committee MTT-26 Wireless Energy Transfer and Conversion and the IEEE Wireless Power Transfer Conference were created to forward the growth in this area. As a result, we now see many new ideas being presented and published. In this talk, I will present an overview of wireless power technologies including far-field microwave power transmission, wireless energy harvesting, and near-field magnetic coupling. The advantages and disadvantages of different technologies as well as their applications will be discussed.

Biography



Jenshan Lin received PhD in Electrical Engineering from the University of California at Los Angeles (UCLA) in 1994. From 1994 to 2003, he worked for the AT&T/Lucent Bell Labs and its spin-off Agere Systems in New Jersey. In July 2003, he joined University of Florida, where he is now a Professor. His research interests include sensors and biomedical applications of microwave and millimeter-wave technologies, wireless energy transfer, RF system-on-chip integration, and integrated antennas. Dr. Lin has authored or co-authored over 230 technical publications in refereed journals and conference proceedings, and has graduated 17 PhD students. He holds 11 US patents. Dr. Lin is a Fellow of IEEE. He served as an elected IEEE Microwave Theory and Techniques

Society (MTT-S) Administrative Committee (AdCom) member from 2006 to 2011, with the last two years serving as the Chair of Technical Coordinating Committee. He was an Associate Editor for the IEEE Transactions on Microwave Theory and Techniques 2006-2010, and is now the Transactions' Editor-in-Chief. He has been serving on several conference steering committees and technical program committees. He was the General Chair of 2008 IEEE RFIC Symposium and the Technical Program Co-Chair of the same conference in 2006 and 2007. He was the General Co-Chair of 2012 Asia-Pacific Microwave Conference (APMC). He received 1994 UCLA Outstanding Ph.D. Award, 1997 ETA KAPPA NU Outstanding Young Electrical Engineer Honorable Mention Award, and 2007 IEEE MTT-S N. Walter Cox Award.

Keynote Speech 4

Smart Surfaces: An Example of Large Area Electronics (LAE) System Enabled by Concurrent WPT, Energy Harvesting and RFID Technologies

Ramada Ballroom 1, 09:00 ~ 09:30 May 9 (Fri), 2014

Speaker : Prof. Luca Roselli, University of Perugia, Italy

Session Chair: Prof. Jonghoon Kim, KAIST, Korea

Abstract

The presentation will deal with “Smart Surfaces”; first a brief historical introduction and an explanation of how smart surfaces can be seen as a particular evolutionary branch within the wider field of Large Area Electronics (LAE) for IoT development will be given. Then the presentation will focus on the technological implications behind Smart Surfaces and will show some proposals to cope with the most relevant challenges. Mostly three technologies will be considered and described (Wireless Power Transfer, Energy Harvesting and RFID) that, along with eco-friendly material adoption, concurrently provide solutions for Smart Surface development. Eventually some examples of Smart Surfaces (smart floors for instance) and Smart Surface elements, foreseeable at the present state of the development will be shown and discussed.

Biography



Luca Roselli graduated in electronic engineering at the University of Florence, Italy, in 1988. In 1991 he joined the University of Perugia, Italy, where he is currently teaching Applied Electronics. Since 2000 he has been coordinating the research activity of the High Frequency Electronics (HFE) Lab. He founded two spin-off companies (in 2000 and 2005); he chaired two IEEE conferences (CEM-TD 2007 and WPTC 2013).

He is currently member of several panels, committees and boards: list of experts of Italian Ministry of Research and University (MIUR), European Research Council (ERC) Panel PE7, IEEE Technical Committees MTT-24 – RFID Technologies (past chair); MTT-25 – RF nanotechnologies; MTT-26 – Wireless Power Transfer; Sub Committee 32 – RFID of the TPRC of IEEE-IMS (past chair), Advisory Committee of IEEE-WPT Conference, Reviewing boards of several conferences (RWCOM, RFID-TA, EuCAP, MAREW, EuMC...), Reviewing boards of: Proceedings of the IEEE, IEEE-MTT, IEEE-MWCL, ACES Journal, Radioengineering Journal, Elsevier Organic Electronics, ASP Nanoscience and nanotechnology letters, Substitute Representative Member of Italy in the COST ACTION IC1301 WIPE (Wireless Power transmission for sustainable Electronics), PI of ENIAC projects EnLIGHT and IDEAS and Co-PI of ARTEMOS, and unit responsible of MIUR PRIN project GRETA.

His research interests are in the area of high frequency electronics, RFID-NFC systems, new materials for sustainable electronics and far field wireless power transfer. In these fields he published more than 220 contributions to international reviews and peer reviewed conferences, the interest in which is testified by an HF index of 20 (Scholar font) and more than 1350 citations.

Technical Session

Technical Session T-Th1 Automotive Applications of Wireless Power

Ramada Ballroom 1, 10:20-12:00

Session Chair: Chulhun Seo (Soongsil Univ., Korea) and Dongho Cho (KAIST, Korea)

10:20~10:40 | T-Th1-1

- Analysis of Two-Coil Coupling Structures for WPT Charging of an Electric Vehicle
Kishore Naik Mude, Manuele Bertoluzzo, and Giuseppe Buja
University of Padova, Italy

10:40~11:00 | T-Th1-2

- Electromagnetic Interference Reduction Method from Handheld Resonant Magnetic Field Charger (HH-RMFC) for Electrical Vehicle
Chiuk Song, Hongseok Kim, Eunseok Song, Yeonje Cho, Jonghoon Kim and Joungho Kim
Korea Advanced Institute of Science and Technology (KAIST), Korea

11:00~11:20 | T-Th1-3

- Power Source Evaluation of a Wireless Power Transfer System
Guillaume Vigneau^{1,2,3}, Mohamed Cheikh¹, Rachid Benbouhout², Said Bouguern¹, and Alexandru Takacs^{2,3}
¹Continental Automotive SAS France, ²CNRS, France, ³Université de Toulouse, France

11:20~11:40 | T-Th1-4

- Magnetic Field Emission Comparison at Different Quality Factors with Series-Series Compensation Network for Inductive Power Transfer to Vehicles
Tushar Batra and Erik Schaltz
Aalborg University, Denmark

11:40~12:00 | T-Th1-5

- Magnetic Design of a Three-Phase Wireless Power Transfer System for EMF Reduction
Minho Kim, Hongseok Kim, and Seungyoung Ahn
Korea Advanced Institute of Science and Technology (KAIST), Korea

Technical Session T-Th2 Microwave-based Wireless Power Transfer

Ramada Ballroom 1, 13:20-15:20

Session Chair: Bomson Lee (Kyunghee Univ., Korea) and Shigeo Kawasaki (JAXA, Japan)

13:20~13:40 | T-Th2-1

- The 20W C-Band Lightweight GaN HPA for Wireless Sensor and Power Transmission in a Spacecraft
Naoki Hasegawa¹, Satoshi Yoshida², Shigeki Furuta³, Yukio Moriguchi³, and Shigeo Kawasaki²
¹Kyoto University, ²Japan Aerospace Exploration Agency, ³NEC Network and Sensor Systems, Ltd., Japan

13:40~14:00 | T-Th2-2

- Harmonic Chipless Sensor Exploiting Wireless Autonomous Communication and Energy Transfer
Chiara Mariotti, Federico Alimenti, Marco Virili, Giulia Orecchini, Paolo Mezzanotte, and Luca Roselli
University of Perugia, Italy

14:00~14:20 | T-Th2-3

- Estimation of Beam Forming Accuracy for Satellite Experiment toward SPS
Junki Yoshino, Naoki Shinohara, and Tomohiko Mitani
Kyoto University, Japan

14:20~14:40 | T-Th2-4

- Efficient Transmitters and Receivers for High-Power Wireless Powering Systems
Zoya Popovic, Tibault Reveyrand, Scott Schafer, Michael Litchfield, Ignacio Ramos, and Sean Korhummel
University of Colorado, United States

14:40~15:00 | T-Th2-5

- Wireless Power Beam Device Using Microwave Power Transfer
Toshio Ishizaki and Kenta Nishikawa
Ryukoku University, Japan

15:00~15:20 | T-Th2-6

- Study and Development of an Intermittent Microwave Power Transmission System for a ZigBee Device
Takuya Ichihara, Tomohiko Mitani, and Naoki Shinohara
Kyoto University, Japan

Technical Session T-Th3 Mobile Applications of Wireless Power Transfer Technology**Ramada Ballroom 1, 15:40-17:20**

Session Chair: Young Jin Park (KERI, Korea) and Heng-Ming Hsu (National Chung Hsing Univ., Taiwan)

15:40~16:00 | T-Th3-1

- Fast Charging Method for Wireless and Mobile Devices using Double-Pulse Charge Technique
Nurcan Keskin and Huaping Liu
Oregon State University, United States

16:00~16:20 | T-Th3-2

- Design of an Inductively Coupled Wireless Power System for Moving Receivers
Bart Thoen, Stijn Wielandt, Jeroen De Baere, Jean-Pierre Goemaere, Lieven De Strycker, and Nobby Stevens
KU Leuven, Belgium

16:20~16:40 | T-Th3-3

- Wireless Power Receiver for Mobile Devices Supporting Inductive and Resonant Operating Modes
Anand Satyamoorthy¹, Patrick Riehl¹, Hasnain Akram¹, Yung-Chih Yen¹, J.-C. Yang², Brian Juan², Chi-Min Lee², and Fu-Chi Lin
¹MediaTek, United States, ²MediaTek, Taiwan

16:40~17:00 | T-Th3-4

- Microwave Near-Field Capacitive Coupling System for Wireless Powering Applications
Chong-Yi Liou, Xi-Sheng Lin, Chun-Han Tai, and Shau-Gang Mao
National Taiwan University, Taiwan

17:00~17:20 | T-Th3-5

- Free-Positioning Wireless Charging system for Hearing Aids using a Bowl-shaped Transmitting coil
Jinwook Kim, Do-Hyeon Kim, Kwan-Ho Kim, and Young-Jin Park
University of Science & Technology (UST) and Korea Electrotechnology Research Institute, Korea

Technical Session T-Fr1 High-power Transmitter and Receiver Circuits and Devices**Ramada Ballroom 1, 09:30-10:30**

Session Chair: Kang Yoon Lee (Sungkyunkwan Univ., Korea) and Jenshan Lin (Univ. of Florida, USA)

09:30~09:50 | T-Fr1-1

- High Efficient Bridge Rectifiers in 100MHz and 2.4GHz bands

Motoki Ito¹, Kohei Hosodani¹, Kenji Itoh¹, Shin-ichi Betsudan¹, Shigeru Makino¹, Tetsuo Hirota¹, Keisuke Noguchi¹, and Eiji Taniguchi²¹Kanazawa Institute of Technology, ²Mitsubishi Electric Corporation, Japan**09:50~10:10 | T-Fr1-2**

- Design of 57% Bandwidth Microwave Rectifier for Powering Application

Defu Wang, Xuan Anh Nghiem, and Renato Negra

RWTH Aachen University, Germany

10:10~10:30 | T-Fr1-3

- Integration of a Class-E Low dv/dt Rectifier in a Wireless Power Transfer System

George Kkelis¹, James Lawson¹, David C. Yates¹, Manuel Pinuela², and Paul D. Mitcheson¹¹Imperial College London, ²Drayson Racing Technologies, United Kingdom**Technical Session T-Fr2 Design, Simulation, and Analysis of Wireless Power Transfer Systems****Ramada Ballroom 1, 10:50-12:10**

Session Chair: In-Kui Cho (ETRI, Korea) and George Ponchak (NASA, USA)

10:50~11:10 | T-Fr2-1

- Performance Evaluation of Multilevel ASK Communication for a Multi-hop Wireless Resonance System

Ryosuke Kobayashi, Yoshiaki Narusue, Wei Wei, Yoshihiro Kawahara, and Tohru Asami

The University of Tokyo, Japan

11:10~11:30 | T-Fr2-2

- A Software-based Wireless Power Transfer Platform for Power Control Experimentation

Sun-han Hwang, Yong-ho Son, and Byung-jun Jang

Korea Communications Agency, Korea

11:30~11:50 | T-Fr2-3

- Optimal Load Analysis for a Two-Receiver Wireless Power Transfer System

Tong Zhang, Minfan Fu, Chengbin Ma, and Xinen Zhu

Shanghai Jiao Tong University, China

11:50~12:10 | T-Fr2-4

- Development of the Optimization Framework for Wireless Power Transfer Systems

Seung Beop Lee, Seungyoung Ahn, and In Gwon Jang

Korea Advanced Institute of Science and Technology (KAIST), Korea

Technical Session T-Fr3 Coil and Resonator I**Ramada Ballroom 1, 13:30-16:10**

Session Chair: Franklin Bien (UNIST, Korea) and Ikuo Awai (Ryutech Corp., Japan)

13:30~13:50 | T-Fr3-1

- Experimental Investigation of 3D Metamaterial for Mid-range Wireless Power Transfer
A.L.A.K. Ranaweera, Thuc Phi Duong, Byoung-Suk Lee, and Jong-Wook Lee
Kyunghee University, Korea

13:50~14:10 | T-Fr3-2

- Lightweight Coil for Efficient Wireless Power Transfer
S. Prengel, M. Helwig, and N. Modler
Technische Universität Dresden, Germany

14:10~14:30 | T-Fr3-3

- The Feasibility of Using Resonant Inductive Power Transfer to Recharge Wireless Sensor Network Nodes
Gerhard P Hancke and Nicolaas A Vorster
University of Pretoria, South Africa

14:30~14:50 | T-Fr3-4

- Choice of Resonators for a WPT System in Lossy Materials
Ikuo Awai¹, Yuichi Sawahara², and Toshio Ishizaki²
¹Ryutech Corporation, Japan, ²Ryukoku Univ., Japan

14:50~15:10 | T-Fr3-5

- A New Configuration of Coil Antennas for Efficient Wireless Power Transmission Systems Compatible with Different Loads
Shi Pu^{1,2}, Hon Tat Hui², Cheng-Guo Liu¹, and Zhi-Peng Wu^{1,3}
¹Wuhan University of Technology, China, ²National University of Singapore, Singapore, ³The University of Manchester, United Kingdom

15:10~15:30 | T-Fr3-6

- Application of a Novel Disk Repeater
Ikuo Awai¹, Yuya Ikuta², Yuichi Sawahara², Yangjun Thang², and Toshio Ishizaki²
¹Ryutech Corporation, ²Ryukoku University, Japan

Technical Session T-Fr4 Coil and Resonator II**Ramada Ballroom 1, 16:30-18:30**

Session Chair: Jinguok Kim (UNIST, Korea) and Luca Roselli (Univ. of Perugia, Italy)

16:30~16:50 | T-Fr4-1

- Behavior of Resonant Electrical Coupling in Terms of Range and Relative Orientation
Ricardo Dias Fernandes, Joao Nuno Matos, and Nuno Borges Carvalho
Instituto de Telecomunicacoes, Portugal

16:50~17:10 | T-Fr4-2

- Capacitor Connected Grids for Wireless Power Transfer
Yue Li and Christopher J. Stevens
University of Oxford, United Kingdom

17:10~17:30 | T-Fr4-3

- Spatial Visualization of Inductive Coupling Parameter for Optimization of Wireless Power Transfer Coils
Sangyeong Jeong¹, Seungyoung Ahn², and Jinguook Kim¹,

¹Ulsan National Institute of Science and Technology, ²Korea Advanced Institute of Science and Technology (KAIST), Korea

17:30~17:50 | T-Fr4-4

- Study on a Purely Electric-field Coupled Resonator for WPT Systems

Yuichi Sawahara¹, Toshio Ishizaki¹, and Ikuo Awai²

¹Ryukoku University, Japan, ²Ryutech Corporation, Japan

17:50~18:10 | T-Fr4-5

- Wireless Power Transfer System Applied to an Active Implantable Medical Device

Tommaso Campi¹, Silvano Cruciani¹, Mauro Feliziani¹, and Akimasa Hirata²

¹University of L'Aquila, Italy, ²Nagoya Institute of Technology, Japan

18:10~18:30 | T-Fr4-6

- Electromagnetic Radiated Emissions from a Repeating-Coil Wireless Power Transfer System using a Resonant Magnetic Field Coupling

Sunkyu Kong, Bumhee Bae, Jonghoon J. Kim, Sukjin Kim, Daniel H. Jung, and Jounggho Kim

Korea Advanced Institute of Science and Technology (KAIST), Korea

Poster Session

Poster Session I

Convention Lobby 2F, Thursday May 8, 17:20-18:40

Session Chair: Nam Kim (Chungbuk National Univ., Korea) and Toshio Ishizaki (Ryukoku Univ., Japan)

P-Th-1

- Mobile Wireless Power Transfer System for Electric Vehicles
Toshio Ishizaki, Genta Kitano, and Keisuke Mikami
Ryukoku University, Japan

P-Th-2

- Study on Direction Detection in a Microwave Power Transmission System for a Mars Observation Airplane
Masashi Iwashimizu¹, Tomohiko Mitani¹, Naoki Shinohara¹, Gaku Sasaki², Kei Hiraoka², Koyo Matsuzaki², and Koichi Yonemoto²
¹Kyoto University, ²Kyushu Institute of Technology, Japan

P-Th-3

- Study on Microwave Power Transfer to Sensors in Car Engine Compartment
Hiroaki Goto¹, Naoki Shinohara¹, Tomohiko Mitani¹, Hiroyuki Dosho², and Mitsuhiko Mizuno²
¹Kyoto University, ²Denso, Japan

P-Th-4

- A Design of Wide Input Range, High Efficiency Rectifier for Mobile Wireless Charging Receiver
Ji-Hun Kang, Hyung-Gu Park, Jae-Hyeong Jang, and Kang-Yoon Lee
Sungkyunkwan University, Korea

P-Th-5

- Optimization of the wireless power transfer system in an electric railway
Seung Beop Lee¹, Seungyoung Ahn¹, Jun Ho Lee², and In Gwun Jang¹,
¹Korea Advanced Institute of Science and Technology (KAIST), ²Korea Railroad Research Institute, Korea

P-Th-6

- Wireless Power Transfer Techniques for Cell Balancing of Battery Management Systems
Heecheol Yang and Jungwoo Lee
Seoul National University, Korea

P-Th-7

- A Proposal on Wireless Power Transfer for Medical Implantable Applications Based on Reviews
Je-Dok Kim, Chuanbowen Sun, and In-Soo Suh
Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Th-8

- Subsystem-Level Efficiency Analysis of a Wireless Power Transfer System
Minfan Fu, Tong Zhang, Chengbin Ma, and Xinen Zhu
Shanghai Jiao Tong University, China

P-Th-9

- Wireless Power Transfer System Suitable for Wristwatch Type Equipment
Dong-Su Lee¹, Dong-Nam Lim¹, Seong-Jeub Jeon¹, and Kwang Seob Lee²
¹Pukyong National University, ²Hanla IMS, Korea

P-Th-10

- Reductions in Power Noise and System Area Burden using Wireless Power Transfer Scheme in 3D Package

Eunseok Song, Hongseok Kim, Jonghoon J. Kim, Chiuk Song, Hyunsuk Lee, and Joungho Kim
Korea Advanced Institute of Science and Technology (KAIST), Korea**P-Th-11**

- Design and performance of Wireless Power Transfer with High Temperature Superconducting Resonance Antenna

Yoon Do Chung¹, Dae Wook Kim², and Seong Woo Yim³¹Suwon Science College, ²Yonsei University, ³Korea Electric Power Corporation Research Institute, Korea**P-Th-12**

- Contactless Power and Data Transfer for Variable Distributed Loads

Andreas Fuchs and Hans-Peter Schmidt

Technical University of Applied Sciences, Germany

P-Th-13

- An Analysis on Power Variance of SMFIR Structure

Hyung-Wook Shim, Jong-Woo Kim, and Dong-Ho Cho

Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Th-14

- System Level Power Control Algorithm in Wireless Power Transmission for Reducing EMF

Seong-Min Kim, I.K. Cho, J.I. Moon, J.H. Yoon, W.J.Byun, and H.D.Choi

Electronics and Telecommunication Research Institute, Korea

P-Th-15

- Improve the Efficiency-Load Characteristic of Rectifying Circuit Using a Self-Powered DC-DC Converter

Yong Huang, Naoki Shinohara, and Tomohiko Mitani

Kyoto University, Japan

P-Th-16

- Implementation of V-band Power Amplifier with High Linearity in 90nm CMOS Technology

Heng-Ming Hsu, and Meng-Syun Chen

National Chung-Hsing University, Taiwan

P-Th-17

- High efficiency GaN Class E Power Amplifier at 5.8GHz with Harmonic Control Network

Wenli Fu, Shiwei Dong, Chaoyue Yang, Ying Wang, and Yazhou Dong

China Academy of Space Technology, China

P-Th-18

- Performance of 5.8-GHz Multi-Polarization Rectenna for Linearly/Circularly Polarized Wave Reception

Ryuichi Nakashima, Eisuke Nishiyama, and Ichihiko Toyoda

Saga University, Japan

P-Th-19

- Optimization of a 5.8-GHz Rectifier Considering Ripple Amplitude and Dc-voltage Pattern

Hyunwook Lee and Jong-Chul Lee

Kwangwoon University, Korea

P-Th-20

- Numerical Analysis of Human Exposure to Electromagnetic Fields from Wireless Power Transfer Systems

Seon-eui Hong¹, In-Kui Cho¹, Hyung-Do Choi¹, and Jeong-Ki Park²¹Electronics and Telecommunications Research Institute, ²Chungnam National University, Korea

Poster Session II**Convention Lobby 2F, Friday May 9, 15:30-16:30**

Session Chair: Byungjun Jang (Kookmin Univ., Korea) and Naoki Shinohara (Kyoto Univ.)

P-Fr-1

- Design of a Novel Resonant Reactive Shield for Wireless Charging System in Electric Vehicle
Hwansoo Moon¹, Seungyoung Ahn¹, and Yangbae Chun²
¹Korea Advanced Institute of Science and Technology (KAIST), ²Dongwon OLEV, Korea

P-Fr-2

- Multi-Band Design of Matched Wireless Power Transfer Links
Marco Dionigi, Mauro Mongiardo, and Luca Roselli
University of Perugia, Italy

P-Fr-3

- Angular Expression of Maximum Power Transfer Efficiency in Reciprocal Two-Port Systems
Takashi Ohira
Toyohashi University of Technology, Japan

P-Fr-4

- Analysis of Magnetically Coupled Wireless Power Transfer between Two Resonators Based on Power Conservation
Gunyoung Kim and Bomson Lee
Kyunghee University, Korea

P-Fr-5

- A Novel Shielding Coil for Electromagnetic Field (EMF) Reduction of Wireless Power Transfer in Laptop Computer
Jaehyoung Park¹, Seungyoung Ahn²
¹Ajou University, ²Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Fr-6

- Analysis and Performance Improvement of Independent Electric Coupled Resonance WPT System with Impedance Transformer
Cheng Yang and Koichi Tsunekawa
Chubu University, Japan

P-Fr-7

- Study of Wireless Power Systems with Two-Dimensionally Moving Receivers
Stijn Wielandt, Jean-Pierre Goemaere, Lieven De Strycker, and Nobby Stevens
KU Leuven, Belgium

P-Fr-8

- Investigation of Near-Field Wireless Energy Transfer for Through Metal-Wall Applications
Sai Kiran Oruganti and Franklin Bien
Ulsan National Institute of Science and Technology, Korea

P-Fr-9

- Modeling Method of Coil Module for Wireless Power Transfer System by Two-port S-parameter Measurement in Frequency Domain
Justine Jihyun Kim¹ and Jonghoon Kim²
¹Duke University, United States, ²Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Fr-10

- Analysis on Number and Adaptive Ranges of Resonators for Efficient Resonant Coupling Wireless Power Transmission

Ching-Wen Yang and Chin-Lung Yang
National Cheng Kung University, Taiwan

P-Fr-11

- Power Transfer via Magnetic Resonant Coupling for Implantable Mice Telemetry Devices
- Basem M. Badr, Robert Somogyi-Gsizmazia, Nikolai Dechev, and Kerry R. Delaney
University of Victoria, Canada

P-Fr-12

- Investigation of Dual-band Coil Module for Near-Field Wireless Power Transfer Systems
- Ming-Lung Kung and Ken-Huang Lin
National Sun Yat-sen University, Taiwan

P-Fr-13

- Polarization Modulation RF Power Transport for Sensor Network
- Soo-Ji Lee, Dong-Jin Lee, In-June, Hwang, Duk-Soo Kwon, and Jong-won Yu
Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Fr-14

- Modeling of Electromagnetic Interference Shielding Materials in Wireless Power Transfer for Board-to-Board Level Interconnections
- Sukjin Kim, Daniel H. Jung, Jonghoon J. Kim, Bumhee Bae, Sunkyu Kong, and Joungho Kim
Korea Advanced Institute of Science and Technology (KAIST), Korea

P-Fr-15

- A New Design of Wireless Power Transfer System Using Helical Resonators Applicable to Multi-Channel Power Transmission
- Young-do Kim, Hee-Jin Lee, Jin-Young Bang, and Chin-Wook Chung
Hanyang University, Korea

P-Fr-16

- Optimization of Geometric Parameters for Circular Loop Antenna in Magnetic Coupled Wireless Power Transfer
- Hyo-Jin Choi¹, Sangbin Lee¹, and Cheolung Cha²
¹Korea University, ²Korea Electronics Technology Institute, Korea

P-Fr-17

- High Q Inductor Design Using Modified Magnetic Substrate Structure
- Chia-Chu Wu, Hung-Wei Chiu, Da-Sheng Lee, Min-Hsiang Chang, Chien-Chi Lu, and Chao-Ning Chang
National Taipei University of Technology, Taiwan

P-Fr-18

- Efficiency Enhancement using Beam Forming Array Antenna for Microwave-based Wireless Energy Transfer
- Jin-Hyoung Kim¹, Hyon-Youn Yu¹, and Cheolung Cha²
¹Korea University, ²Korea Electronics Technology Institute, Korea

Venue



Ramada Plaza Jeju

Website : <http://www.ramadajeju.co.kr/>
 Address : 1255 Samdo 2-dong, Jeju City, Jeju-do, Korea
 Tel : 82-64-729-8100, Fax : 82-64-729-8554

The Ramada Plaza Jeju Hotel was established on July 1, 2003. This internationally renowned deluxe resort-style business hotel was opened to raise management and its accommodation facilities to world class standards. The hotel is located within five minutes ride from both Jeju harbor and Jeju international airport. It can be reached within an hour wherever you are on the Jeju Island. Visitors from home and abroad can experience the essence of Jeju culture enjoying the nearby spectacles of Chilsung-Ro street, Tap-dong outdoor performance hall, Sanjicheon, Yongduam, and Yongyeon bridge especially during the night time.

Transportation : Shuttle Bus

During the Conference, free shuttle bus services will be provided for participants to commute between the Jeju Airport and Ramada Plaza Jeju Hotel (Conference Venue.)

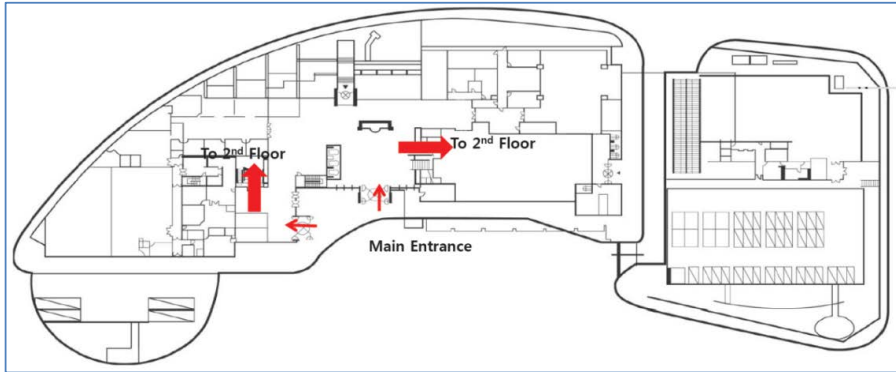
*Required time : 10~15 min

Shuttle Bus Schedule

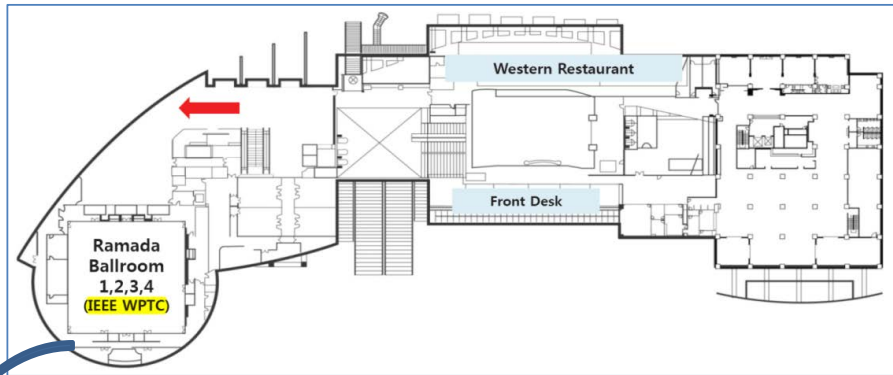
	Date	Time
Jeju Airport to Hotel (Parking lot B1)	5.7(Wed)	14:00
		15:00
		17:00
	5.8(Thu)	09:00
Hotel to Airport (Hotel Main Entrance)	5.9(Fri)	18:20
		19:00
	5.10(Sat)	10:00

Venue Plans

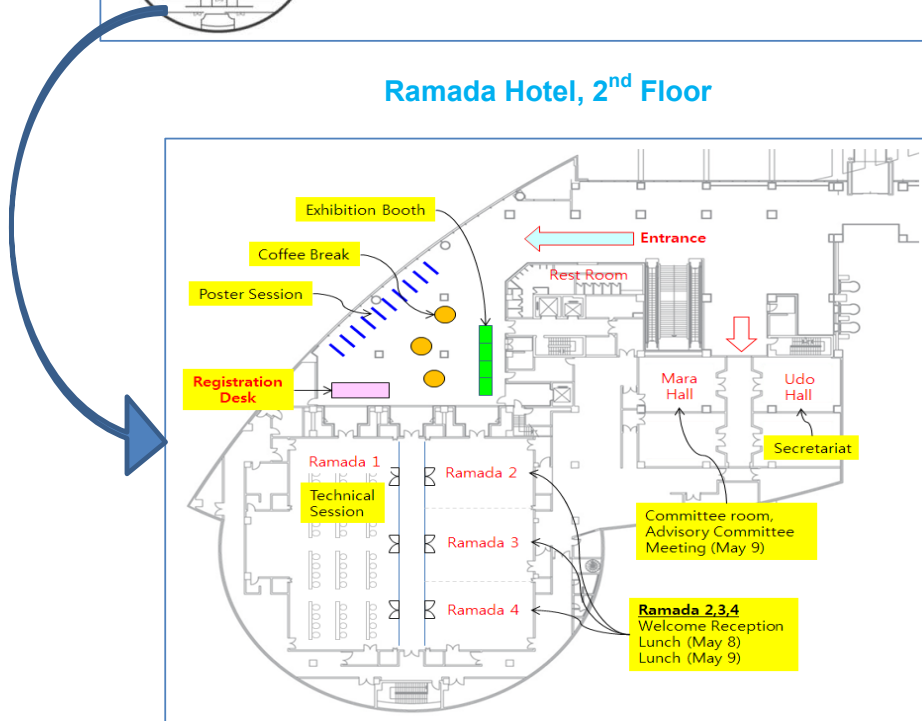
Ramada Hotel, 1st Floor



Ramada Hotel, 2nd Floor



Ramada Hotel, 2nd Floor



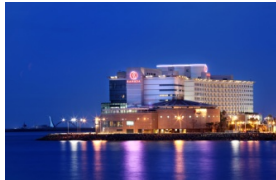
Accommodations

Hotels & Rates


As all rooms will be booked on a first come, first served basis, once the room blocks at these hotels have been filled, we may not be able to secure further rooms with the hotels at the special rates quoted. Therefore, early reservation through the online procedure is highly recommended.

For further enquires of hotel reservation, please contact to
WPTC 2014 Secretariat: Sejong Convention Services Ltd.
 E-mail : secretariat@wptc2014.org

Ramada Plaza Jeju Hotel ★★★★★ (Main Hotel) <https://www.ramadajeju.co.kr/index.asp>
 Tel: +82-64-729-8100

Hotel	Room Type		Special Rate (KRW)		Breakfast (KRW)	Distance From Venue
			Weekdays	Weekend		
	Superior (Mountain View)	Double	140,000	170,000	20,000	Main Hotel
		Twin				
	Deluxe (Ocean View)	Double	160,000	190,000		
		Twin				


Jeju Oriental Hotel ★★★★★ (Sub Hotel) <http://english.oriental.co.kr>
 Tel: +82-64-752-8222

Hotel	Room Type		Special Rate (KRW)		Breakfast (KRW)	Distance From Venue
			Weekdays	Weekend		
	Superior	Double	110,000	140,000	17,000	5 minutes' walk
		Twin				

Ocean Suites Hotel ★★★★★ (Sub Hotel) <http://www.oceansuites.kr/eng>
 Tel: +82-64-720-6000

Hotel	Room Type		Special Rate (KRW)		Breakfast (KRW)	Distance From Venue
			Weekdays	Weekend		
	Standard	Double	110,000	140,000	18,000	10 minutes' walk
		Twin				

Jeju Palace Hotel ★★★★★ (Sub Hotel) <http://www.cipalace.co.kr/>
Tel: +82-64-753-8811

Hotel	Room Type		Special Rate (KRW)		Breakfast (KRW)	Distance From Venue
			Weekdays	Weekend		
	Twin	Twin	80,000	100,000	8,000	10 minutes' walk 5 minutes' by car

- **Weekdays:** Sunday, Monday, Tuesday, Wednesday, Thursday
Weekend: May 2, 3, 4, 5, 6, 9, 10, 2014 (Friday, Saturday, and National Holiday)
- All room rates above are per room per night and do not include breakfasts.
- 10% service charges and 10% taxes are included in the room rates.
- Please note that all room rates are fixed in Korean Won (KRW).
- In case of payment by credit card, it will not be charged until Check-out.
- To secure your reservation, your credit card information (card number, expiry date, card holder's name) is required.

Cancellation Policy

Cancellation Condition	Penalty
2 days before check-in	50% of one night will be charged
1 day before check-in	70% of one night will be charged
On check-in date	100% of one night will be charged
No-Show	100% of one night will be charged

- Any cancellation or charge must be received and confirmed by the Conference Secretariat in official written notice via letter, fax or e-mail.
- Please let Secretariat know cancellation of your hotel reservation at least three days in advance.

Registration

On-line registration is available on website. (www.wptc2014.org)
 Registrations without appropriate payment will not be honored until the full payment is received.
 A confirmation of registration will be sent upon full payment.

Registration Fee

Category	By Apr 11, 2014			After Apr 12, 2014		
	IEEE Members	Non IEEE Members	Student	IEEE Members	Non IEEE Members	Student
Full Registration	☐\$380 ☐KRW 418,000	☐\$440 ☐KRW 484,000	☐\$100 ☐KRW 110,000	☐\$440 ☐KRW 484,000	☐\$500 ☐KRW 550,000	☐\$150 ☐KRW 165,000
Accompanying Person(s)	Additional Welcome Reception Ticket ☐\$70 x ()person(s)			☐KRW 77,000 x ()person(s)		
	Additional Banquet Ticket ☐\$80 x ()person(s)			☐KRW 88,000 x ()person(s)		

- ▶ **Full-Registration Fee** includes Technical Session, Proceeding USB, Final Program Book, Welcome Reception, Banquet, 2-days lunch, and Coffee Break.
- ▶ **Accompanying Person Fee** only includes Welcome Reception and Banquet.

Registration Hours

Admission to all session and hosted functions requires identification.
 Please wear your name badge at all times.
 Registration Desk is composed Pre-Registration Desk and On-Site Registration Desk in front of Ramada Ballroom.

- Wednesday, May 7 15:00~18:00
- Thursday, May 8 08:00~18:00
- Friday, May 9 08:00~15:00

▶ Conference Kit

The conference kit will be served when you are registered. Please swap conference kit which contains a final program book and proceeding (USB Flash Memory). Welcome reception, Banquet and Lunch Coupon will be in the name badge.

▶ Name Badges

You are kindly requested to wear your name badge during all the session. Please note that admission to the all session rooms is strictly restricted to the registered participants wearing their badges. If you lose your badge, ask the registration desk for a new one.

Official & Social Program

Keynote Speech

Place : Ramada Ballroom 1

K-Th1 - Time & Date : 09:00~09:30, Thursday, May 8, 2014 | Speaker : Prof. Dong-Ho Cho
K-Th2 - Time & Date : 09:30~10:00, Thursday, May 8, 2014 | Speaker: Dr. HåkanGustavsson
K-Fr1 - Time & Date : 08:30~09:00, Friday, May 9, 2014 | Speaker : Prof. Jenshan Lin
K-Fr2 - Time & Date : 09:00~09:30, Friday, May 9, 2014 | Speaker : Prof. Luca Roselli

Welcome Reception

Place : Ramada Ballroom 2,3,4, 2F / Time & Date : 18:00~20:00, Wednesday, 7 May, 2014
Conference participants are invited to mingle while enjoying the light food and drinks during the opening welcome reception.

Lunch

Place : Ramada Ballroom 2,3,4, 2F
Time & Date : 12:00~13:20, Thursday, May 8, 2014 / 12:10~13:30, Friday, May 9, 2014

Coffee Break

Place : Convention Lobby, 2F
Time & Date : 10:00~10:20, Thursday, May 8, 2014 / 15:20~15:40, Thursday, May 8, 2014
10:30~10:50, Friday, May 9, 2014

Banquet & Awards

Place : Ramada Ballroom 1 / Time & Date : 19:00~21:00, Thursday, May 8, 2014
The highlight of the official & social program will be "Banquet". Also, the awards will be presented during the banquet.

Speaker Guide

Oral Presentation

1. Prepare your Presentation

- 1) All oral presentation materials should be prepared in English.
- 2) Each oral presentation is limited to 20 minutes including Q&A's and changeover to the next speaker.
- 3) Power Point format or Adobe Acrobat format (PDF) is highly recommended.
- 4) Each oral presentation materials should be uploaded to the equipped computer of each session room before the session starts. (USB memory stick is acceptable)
- 5) All presentation materials will be deleted after the session finishes.

2. Equipments in the session room

- 1) 1-Screen, 1-LCD Projector, 1-Window-based Laptop Computer, and 1-Laser Pointer
- 2) MS Windows 7 OS and MS Office 2010 are installed in the computer.
- 3) Private Laptop computers are not recommended for keeping each allocated time.

Poster Presentation

1. Prepare your poster

- 1) Available poster board size for each poster speaker is 110cm (height) x 90cm (width).
- 2) Each poster should have the title, all author names, and corresponding author's contact information of your paper.
- 3) There is no poster template, but it is recommended that 'IEEE WPTC 2014' is included in your poster.

2. Mount and demount your poster

- 1) Poster boards will be prepared at the convention lobby (2F) in front of Registration desk.
- 2) Each poster should be mounted and demounted following the designated times.
- 3) Your paper ID number will be posted on Poster boards.
- 4) The designated times are referred to the below time table.

3. Prepared materials for mounting your poster

- 1) Cellular tapes, pushpins, scissors, and etc.
- 2) Staffs around Poster board and Registration desk will help you if you are in trouble during mounting your poster.
- 3) After demounting time, all posters on poster boards will be discarded without notice.

Session	Session Day	Mounting time	Presentation time	Demounting Time
Poster Session I	May 8, 2014	14:20 – 17:20	17:20 – 18:40	18:40 – 19:10
Poster Session II	May 9, 2014	12:30 – 15:30	15:30 – 16:30	16:30 – 17:00

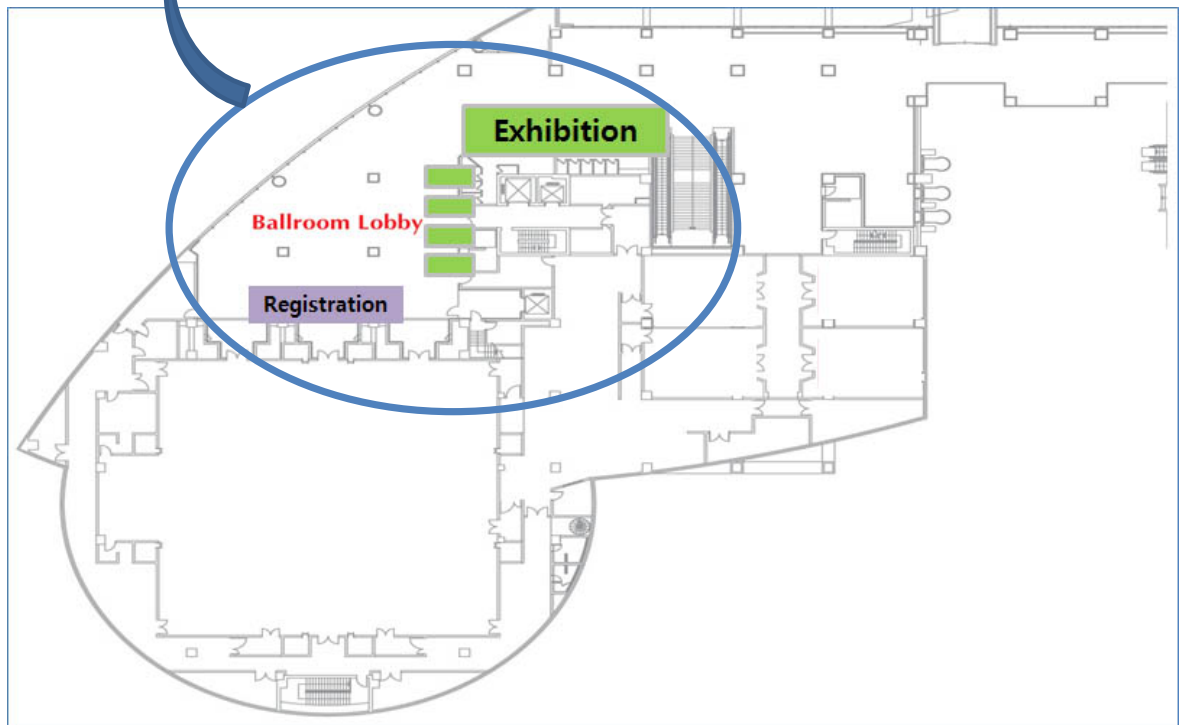
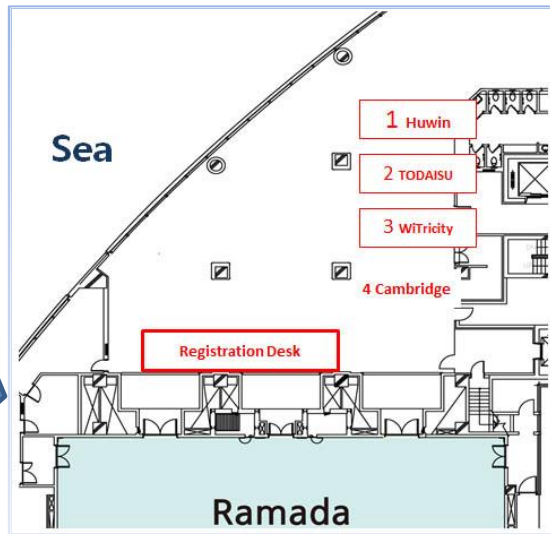
Exhibition

The exhibition will be held in the 2F Ramada Ballroom Lobby in Ramada Plaza Jeju Hotel.

Exhibition Hours

09:00 ~ 18:00 | Thursday, May 8

09:00 ~ 18:00 | Friday, May 9



Exhibitor & Sponsor Profiles

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We, at Hanrim Postech have been involved in an energy-related business for more than 30 years and expects that clean energy-based business will lead the other industries in the near future. Base on this expectation we were able to attain a small success by focusing on research and development of wireless power technology and its application since 2002. We have joined the WPC (Wireless Power Consortium) in 2011, and the following year we have been elevated to a regular member for the first in Korea. The company, having its original wireless power technology, has been the one of 4 companies which design and lead standards and regulations in the WPC. This kind of leadership comes from more than 10 year-long investment on the new technology and the world class intellectual properties which are now registered worldwide. Also, in collaboration with Toshiba, Hanrim has recently developed three system ICs which is complied to WPC Qi standards. Now ICs are being under mass production in Toshiba since 2012, using Hanrim's non-contact charging technology.

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<http://www.agilent.com>

Tel: +82 2-2004-5143

Address: 25-12, Yeouido-dong, Yeongdeungpogu, Seoul Korea

Agilent Technologies Inc. (NYSE: A) is the world's premier measurement company and a technology leader in chemical analysis, life sciences, diagnostics, electronics and communications. The company's 20,600 employees serve customers in more than 100 countries. Agilent had revenues of \$6.8 billion in fiscal 2013. Information about Agilent is available at www.agilent.com. On September 19, 2013 Agilent announced plans to separate into two industry-leading public companies, one in life sciences, diagnostics and applied markets (LDA) that will retain the Agilent name, and the other comprised of the electronic measurement businesses that has been named Keysight Technologies. Bill Sullivan will be president and CEO of Agilent. Ron Nersesian has assumed those roles for Keysight. The separation is expected to take place through a tax-free spinoff of Keysight to Agilent shareholders and is targeted to be completed in early November 2014.

WISTEK

<http://www.wistek.co.kr>

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Address : #207, Ace High-end Tower 8Cha, 345-4, Gasan-dong, Geumcheon-gu, Seoul, Korea

(1) It used a high voltage control and discharge technique development and provision of Plasma Source (2) Provision of core technique and system of energy conversion solutions (WPT & Plasma) shoes industry sectors (3) Creation of the shoes business segment it will be able to prepare a future Company (4) It used electric power conversion techniques new engineering technical background advance (5) Rise and substitution energy shoes business segment advance chance security of environmental matter (6) Wireless Power transfer and plasma applications with motivation one energy relation enterprising advance

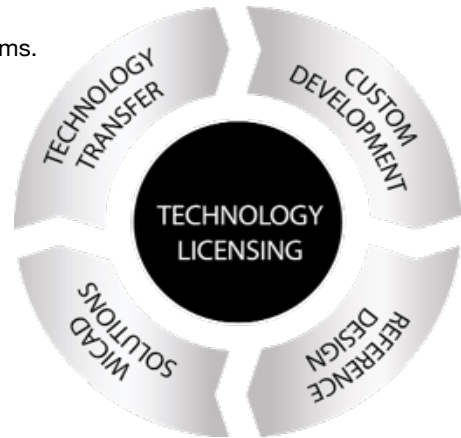
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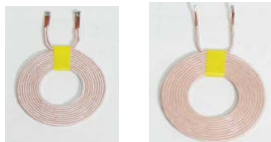
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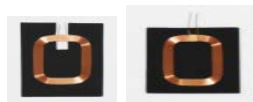


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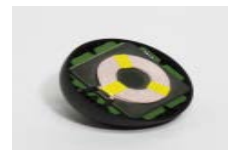
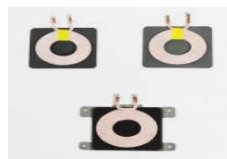
We have grand scale production line to manufacture from coil to assembly and provide WPC transmitters and receivers to Nokia, Nexus and Made4.



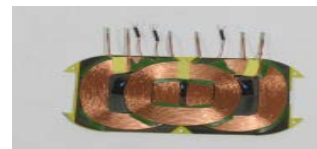
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Other product development corresponding



Nexus4 application



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