IEC TC100

Control Protocol for Wireless Power Transfer Interface to Multi-devices

2011. 10. 25.

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Outline

- Background
- Needs & Market Analysis
- Technical & Standard Trends
- Proposed Work Item
- Conclusion

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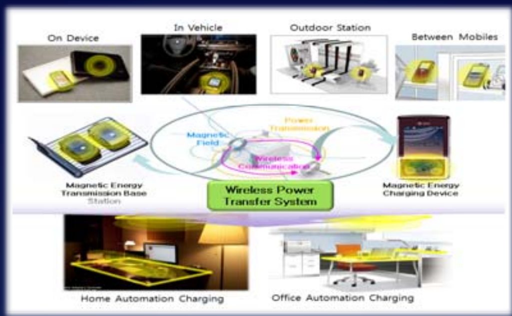
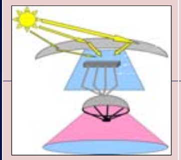
Wireless Power Transfer Technology

- Enables to transmit power wirelessly to various multimedia devices in indoors & outdoors



Wireless Power Transfer Technology

- Methods of Wireless Power Transfer

EM Wave	Magnetic Induction	Magnetic Resonance
		
▪ Long distance charging with huge power (several tens kW) ▪ Vulnerable to obstacles ▪ Not suitable for portable device charging	▪ Contact charging with small power (several W) ▪ Not vulnerable to obstacles ▪ Suitable for one portable device charging	▪ Short distance charging with small power (several W) ▪ Not vulnerable to obstacles ▪ Suitable for multi portable devices charging

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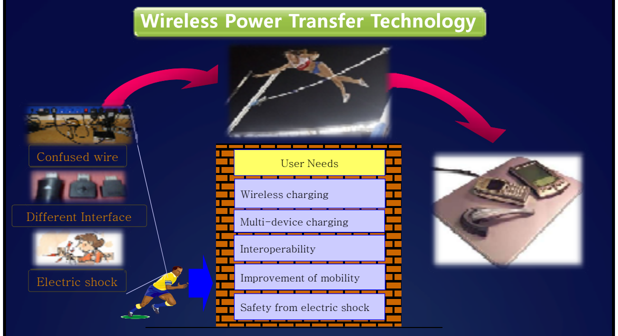
Needs

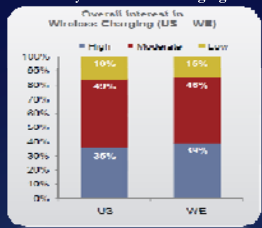


7

Needs

- Wireless power transfer technology has significant appeal in both North America & Western Europe. The level of interest in the two continents are nearly identical.

< Survey for Wireless Charging >

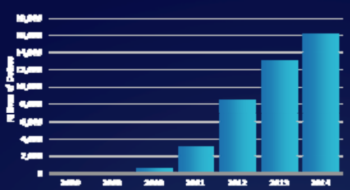


Source: Qualcomm Omnibus Study (Base n=2531 in Western Europe, n=783 in US)

8

Market

- Market Analysis



Expected growth in revenue from 2008 -2014 of Wireless Charging Market

(Source: iSuppli 2010)

Table 4. Total Wireless Charging Market, 2009–2014 (Units and US$ in Millions)

(Units in Millions and Million USD)	2009	2010	2011	2012	2013	2014
Units (Transmitters and Receivers)	2	8	26	68	132	208
Revenues	$102	$380	$1,078	$1,864	$3,003	$4,279

Source: In Stat, 7/10

9

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10

Technical & Standard Trends

- Trends Summary

EM Wave	Magnetic Induction	Magnetic Resonance
Technical Trends		
▪ Development of WPT sender & power harvester receiver ▪ Powercast	▪ Release of products for wireless charger ▪ LS Cable, Hanrim Postech, Fulton, Palm Pre, Powermat, etc.	▪ Developing of technology for magnetic resonance ▪ KETI, KAIST, MIT, Intel, Qualcomm, Sony, etc.
Standard Trends		
▪ Not active	▪ WPC : Development of specification	▪ TTA : Developing standard ▪ MFAN forum : Analyzing user requirement and market trends ▪ CEA : Establishment of WG

11

Technical Trends– Magnetic Induction

Cell Phone Chargers (Korea)

- LSCable
  - Induction type developed in 2007
  - WPC Standard Qi-compliant
  - Conducts research on resonance type

- HanrimPostech
  - Regular member of WPC as of 2010
  - Commercialization expected 1Q 2011
  - Conducts research on resonance type

- Wisepower
  - Technical partnership with Seiko Epson
  - Induction type “Willy Willy” released

12

Technical Trends- Magnetic Induction

Cell Phone Chargers (International)

- Palm Pre Touchstone
  - Palm Pre Smartphone Accessory type
  - Composed of wireless power transmitter & cover type receiver
  - Contact type
  - Retails at $70~90 USD

- Fulton Innovation (WPC)
  - Composed of wireless power transmitter & cover type receiver
  - WPC StandardQi-compliant

- Powermat
  - Released in 2009
  - Composed of wireless power transmitter &cover type receiver
  - One base station with multiple coils capable of charging multiple devices

13

Standard Trends – Magnetic Induction

WPC (Wireless Power Consortium)

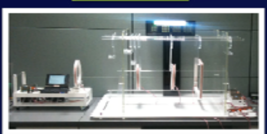
- 99 regular and associate members as of Oct 2011
- Standardization target: magnetic inductive charging system
- Standard Qi 1.0 released in July 2010
  - Interface
  - Compliance test

Profile	Current Regular Members
Wireless Power Technology	ConvenientPower, Fulton Innovation, Hanrim
Semiconductor / components	Atmel, Freescale Semiconductor, National Semiconductors, ST-Ericsson, Texas Instruments
Broad Electronics	Haier, Philips
Mobile Phone	Nokia, Sangfei
Battery	Sanyo, Energizer
Manufacturers of mobile computers, net books and tablets. Manufacturers of power supplies for mobile computers. ODMs of mobile computers	Delta
Other (camera, infrastructure, power tools, etc.)	Leggett & Platt, Powerkiss
total	17

14

Technical Trends- Magnetic Resonance

KETI



- Resonance type developing from 2009
- Standardization activities in KS, and TTA
- Size, efficiency, and outage region needs improvement

KAIST

- Resonance type for charging vehicles
- Applied to four buses in Korea
- Size, efficiency, and outage region needs improvement

15

Technical Trends- Magnetic Resonance

- WiTricity-Haire
  - Utilizes WiTricity, technology based on MIT research
  - Transferred power to Full HD TV at CES 2010

- Intel
  - Transferred 12W of power to netbook3 ft. away
  - Receiver coils located in the cover of the netbook
  - Independent standardization activity on 100W wireless power transfer

- Sony
  - Transferred 60W of power to 22"LCD TV
  - Charging distance increases by repeaters

16

Technical Trends- Magnetic Resonance

- Qualcomm
  - Announced eZone, a wireless power transfer system, at CES 2009
  - Multiple devices charging supported

- Qualcomm-WiPower
  - Acquired WiPower in 2010 to develop a wireless power transfer system
  - Vehicle-based power transfer system in development

- Fujitsu
  - Simultaneous charging technology for two mobile phones announced in Sep. 2010
  - Simulator used for the analysis of magnetic fields among multiple coils in development

17

Standard Trends – Magnetic Resonance

USA : CEA (Consumer Electronics Association)

Consumer Electronics Association

<Working Group>
√ R6.3 WG1 Wireless Power Nomenclature
√ R6.3 WG2 Wireless Power Safety & Emissions
√ R6.3 WG3 Wireless Power Transfer Efficiency & Standby Power
√ R6.3 WG4 Mid Range Near Field Wireless Power
√ R6.3 WG5 Short Range Near Field Wireless Power

- Consists of more than 2,000 corporate members including those listed below:

CEA Member List	
Audiovox Corporation	Mojo Mobility Inc.
Belkin Corporation	Motorola Mobile Devices - Companion Products
Brilliance Audio	National Semiconductor Corporation
Consumer Electronics Association	Nielsen Media Research
Dell, Inc.	Panasonic Corporation of North America
Delphi	Philips Electronics N.A. Corp.
Duracell	Pioneer Research Center, USA, Inc.
EchoStar Corp.	PowerMat LLC
Energizer Battery Company	Pure Energy
Foxconn International Inc.	Qualcomm Incorporated
Fulton Innovation	Samsung Elec Co., Ltd.
General Motors Corporation	Scosche Industries Inc.
Gill Industries	Sima Products Corporation
GoldLantern, LLC	SIRIUS XM Radio, Inc.
Intel Corporation	SMSC -Standard Microsystems Corporation
Lawrence Berkeley National Laboratory	Superior Communications
Leggett & Platt	Visteon Corporation
Mercedes-Benz Research & Development North America, Inc.	W W Johnston Technologies, LLC
Microsoft Corporation	WiPower Inc.

18

Standard Trends – Magnetic resonance

Korea : TTA (Telecommunications Technology Association)

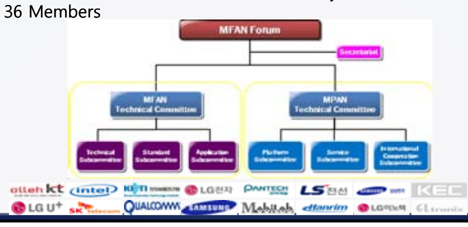
- TTA PG 709 (Wireless Charging and Application)
  - Project Group 709 established in Mar. 2011
  - Scope:
    - Standard roadmap
    - Power transfer interface
    - Control protocol
- 12 members

19

Standard Trends – Korea

Korea : MFAN (Magnetic Field Area Network) Forum

- Wireless Power Transfer Technical committee
  - Established in Sep. 2009
  - Scope: Wireless power transfer systems
    - Develop wireless power transfer system and interface
    - Address regulatory issues
  - Released Standards: Service scenario, Use case, & User requirements MPAN of MAC/PHY Layer
- 36 Members



20

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21

Strong Needs – Multi-devices Charging

Based on a Qualcomm study, 81% of consumers want to charge multiple devices (and types) at the same time

The red and bluebars in the graph to the right indicate that consumers prefer charging multiple devices despite the varying speed of charge.

< Survey for Multiple Charging >

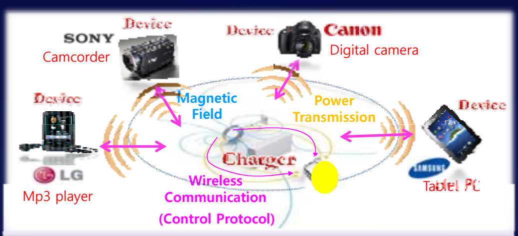
Source: Qualcomm Omnibus Study (Base n=2531 in Western Europe, n=783 in US)

- Multiple devices charging
  - by charging area expansion of magnetic resonance
  - by multiple device management of control protocol

22

Proposed Work Item

- Control protocol for wireless power transfer interface



To provide interoperability for various multimedia devices and chargers

International Standardization of control protocol

23

Proposal Scope

- Scope
  - The proposed work item defines control protocol for wireless power transfer interface to multiple multimedia devices
    - Control protocol for efficient management
      - Functional requirement of control protocol
      - Frame format of control protocol
      - Functional Procedure of control protocol

24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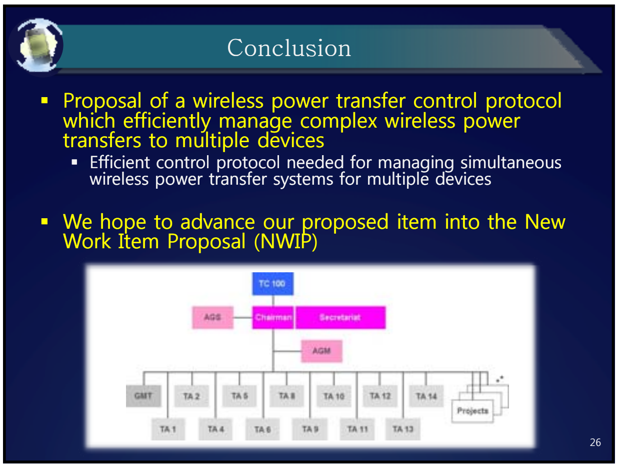
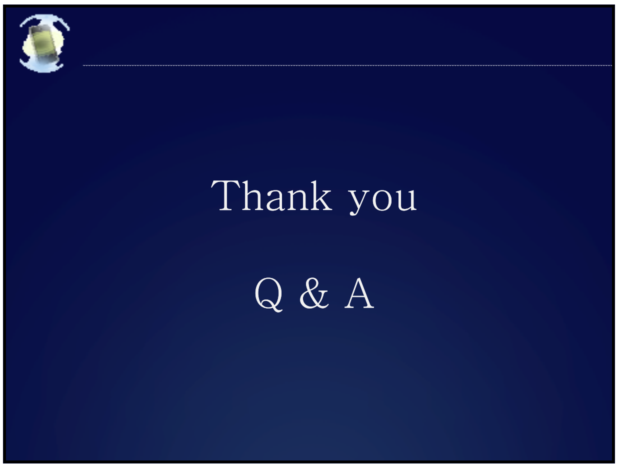
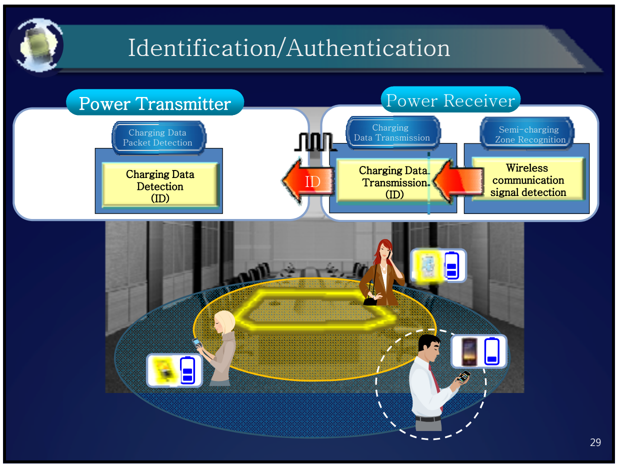
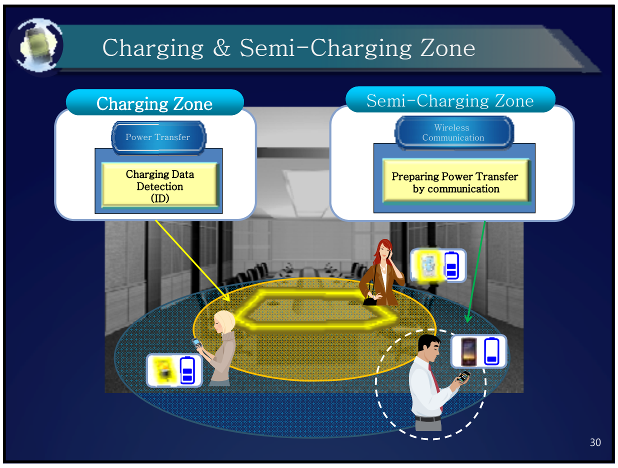
25

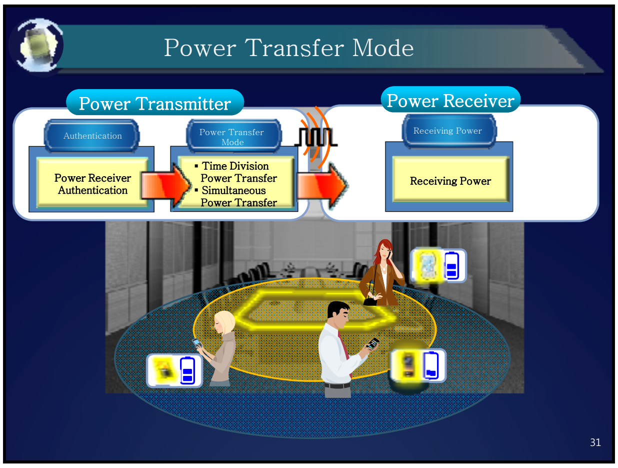

Conclusion
Proposal of a wireless power transfer control protocol which efficiently manage complex wireless power transfers to multiple devices
Efficient control protocol needed for managing simultaneous wireless power transfer systems for multiple devices
We hope to advance our proposed item into the New Work Item Proposal (NWIP)
TC 100
AGS
Chairman
Secretariat
AGM
GMT
TA 2
TA 5
TA 8
TA 10
TA 12
TA 14
Projects
TA 1
TA 4
TA 6
TA 9
TA 11
TA 13
26

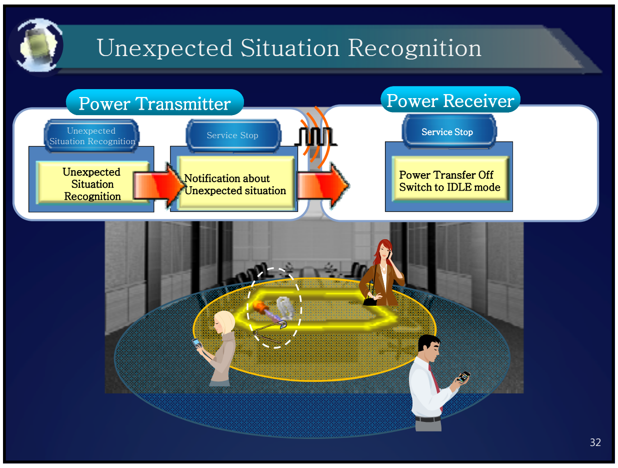

Thank you
Q & A

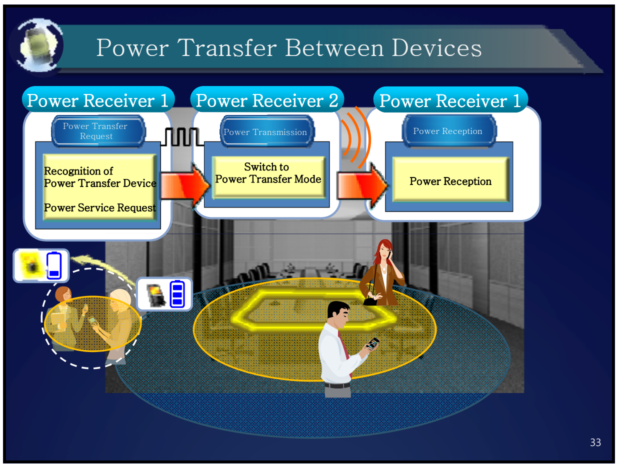

Appendix
28


Identification/Authentication
Power Transmitter
Charging Data Packet Detection
Charging Data Detection (ID)
Power Receiver
Charging Data Transmission
Semi-charging Zone Recognition
ID
Charging Data Transmission (ID)
Wireless communication signal detection
29


Charging & Semi-Charging Zone
Charging Zone
Power Transfer
Charging Data Detection (ID)
Semi-Charging Zone
Wireless Communication
Preparing Power Transfer by communication
30







ICNIRP Guidelines

- GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC AND MAGNETIC FIELDS (1 Hz TO 100 kHz), June 2010
- Reference levels - Spatial averaging of external electric and magnetic fields

<general public exposure>

Frequency Band	Electric Field (kV/m)	Magnetic Field (A/m)	Magnetic Flux Density (T)
1Hz ~ 8Hz	5	$3.2 \times 10^4/f^2$	$4 \times 10^{-2}/f^2$
8Hz ~ 25Hz	5	$4 \times 10^3/f$	$5 \times 10^{-3}/f$
25Hz ~ 50Hz	5	1.6×10^2	2×10^{-4}
50Hz ~ 300Hz	$2.5 \times 10^2/f$	1.6×10^2	2×10^{-4}
300Hz ~ 3kHz	$2.5 \times 10^2/f$	$6.4 \times 10^4/f$	$8 \times 10^{-2}/f$
3kHz ~ 10 MHz	8.3×10^{-2}	21	2.7×10^{-5}

<occupational exposure>

Frequency Band	Electric Field(kV/m)	Magnetic Field(A/m)	Magnetic Flux Density (T)
1Hz ~ 8Hz	20	$1.63 \times 10^5/f^2$	$0.2/f^2$
8Hz ~ 25Hz	20	$2 \times 10^4/f$	$2.5 \times 10^{-2}/f$
25Hz ~ 300Hz	$5 \times 10^2/f$	8×10^2	1×10^{-3}
300Hz ~ 3kHz	$5 \times 10^2/f$	$2.4 \times 10^5/f$	$0.3/f$
3kHz ~ 10 MHz	1.7×10^{-1}	80	1×10^{-4}

34