100/2069/NP

NEW WORK ITEM PROPOSAL

	Proposer Japan	Date of proposal 2012-10
	TC/SC TC 100	Secretariat Japan
	Date of circulation 2012-10-19	Closing date for voting 2013-01-25

A proposal for a new work item within the scope of an existing technical committee or subcommittee shall be submitted to the Central Office. The proposal will be distributed to the P-members of the technical committee or subcommittee for voting on the introduction of it into the work programme, and to the O-members for information. The proposer may be a National Committee of the IEC, the secretariat itself, another technical committee or subcommittee, an organization in liaison, the Standardization Management Board or one of the advisory committees, or the General Secretary. Guidelines for proposing and justifying a new work item are given in ISO/IEC Directives, Part 1, Annex C (see extract overleaf). **This form is not to be used for amendments or revisions to existing publications.**

The proposal (to be completed by the proposer)

Title of proposal

Wireless Power Transfer - multiple sources control management

☒ Standard	☐ Technical Specification

Scope (as defined in ISO/IEC Directives, Part 2, 6.2.1)

This International Standard specifies methods of formation of multiple groups on a spatial wireless power transfer system. A group on spatial wireless power transfer system, which is responsible for power transfer to receiving devices, has multiple power sources.

This International Standard also specifies within a group methods of setting, sharing and controlling power transfer conditions among multiple power sources in order to achieve efficient power transfer to multiple receiving devices.

Purpose and justification, including the market relevance, whether it is a proposed horizontal standard (Guide 108)[1)] and relationship to Safety (Guide 104), EMC (Guide 107), Environmental aspects (Guide 109) and Quality assurance (Guide 102) . (attach a separate page as annex, if necessary)

Multimedia products with wireless power transfer, which makes a use of electromagnetic induction technology, are spreading in the market. The wireless power transfer system enables users to remove difficulty of connecting power line cable. Electromagnetic induction technology requests that users put a power source and a receiving device at a short distance in order to charge a battery in its device.

On the other hand, magnetic resonance technology on power transfer system is also being developed. Magnetic resonance technology would give a spatial effect on power transfer. A spatial effect on wireless power transfer means that multiple power sources deliver power to multiple receiving devices at a distance in spatial space. In order to efficiently manage and support the wireless power transfer in spatial space, power sources need to communicate and coordinate each other.

This specification would provide the methods of the communication and the coordination among power sources on the basis of situations of receiving devices, and it helps users to put their receiving devices in a free position within a spatial space.

Target date	for first CD 2013-05	for IS/ TS 2014-08
Estimated number of meetings	Frequency of meetings: per year	Date and place of first meeting:
Proposed working methods	☒ E-mail	☐ Collaboration tools

Relevant documents to be considered

Relationship of project to activities of other international bodies

Liaison organizations	**Need for coordination within ISO or IEC**

Preparatory work

Ensure that all copyright issues are identified. Check one of the two following boxes

☐ A draft is attached for comment* ☒ An outline is attached

* Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

We nominate a project leader as follows in accordance with ISO/IEC Directives, Part 1, 2.3.4 (name, address, fax and e-mail): Mr. Hironori Sakakihara, Fujitsu Limited, 1-1,kamikodanaka 4-chome, Nakahara-ku, Kawasaki, Japan,
Tel: +81-44-754-3050, Fax:+81-44-754-3842, E-mail: sakakihara.hiro@jp.fujitsu.com

Concerns known patented items (see ISO/IEC Directives, Part 2)	**Name and/or signature of the proposer**
☐ Yes. If yes, provide full information as an annex ☒ no	Hiroshi Yasuda

Comments and recommendations from the TC/SC officers

1) Work allocation

☒ Project team ☐ New working group ☐ Existing working group no:

2) Draft suitable for direct submission as

☐ CD ☐ CDV/ DTS

3) General quality of the draft (conformity to ISO/IEC Directives, Part 2)

☐ Little redrafting needed ☐ Substantial redrafting needed ☒ no draft (outline only)

4) Relationship with other activities

In IEC

In other organizations

5) Proposed horizontal standard

☐ [1)]

Remarks from the TC/SC officers

If accepted, communication with JTC 1 and internal harmonization with PT 62827 in TC 100 will be necessary.

[1)] Other TC/SCs are requested to indicate their interest, if any, in this NP to the TC/SC secretary.

Approval criteria:

- Approval of the work item by a simple majority of the P-members voting;
- At least 4 P-members in the case of a committee with 16 or fewer P-members, or at least 5 P-members in the case of committees with more than 17 P-members, have nominated or confirmed the name of an expert and approved the new work item proposal.

Elements to be clarified when proposing a new work item

Title

Indicate the subject matter of the proposed new standard or technical specification.

Indicate whether it is intended to prepare a standardor a technical specification.

Scope

Give a clear indication of the coverage of the proposed new work item and, if necessary for clarity, exclusions.

Indicate whether the subject proposed relates to one or more of the fields of safety, EMC, the environment or quality assurance.

Purpose and justification

Give details based on a critical study of the following elements wherever practicable.

a) The specific aims and reason for the standardization activity, with particular emphasis on the aspects of standardization to be covered, the problems it is expected to solve or the difficulties it is intended to overcome.

b) The main interests that might benefit from or be affected by the activity, such as industry, consumers, trade, governments, distributors.

c) Feasibility of the activity: Are there factors that could hinder the successful establishment or general application of the standard?

d) Timeliness of the standard to be produced: Is the technology reasonably stabilized? If not, how much time is likely to be available before advances in technology may render the proposed standard outdated? Is the proposed standard required as a basis for the future development of the technology in question?

e) Urgency of the activity, considering the needs of the market (industry, consumers, trade, governments etc.) as well as other fields or organizations. Indicate target date and, when a series of standards is proposed, suggest priorities.

f) The benefits to be gained by the implementation of the proposed standard; alternatively, the loss or disadvantage(s) if no standard is established within a reasonable time. Data such as product volume of value of trade should be included and quantified.

g) If the standardization activity is, or is likely to be, the subject of regulations or to require the harmonization of existing regulations, this should be indicated.

If a series of new work items is proposed, the purpose and justification of which is common, a common proposal may be drafted including all elements to be clarified and enumerating the titles and scopes of each individual item.

Relevant documents

List any known relevant documents (such as standards and regulations), regardless of their source. When the proposer considers that an existing well-established document may be acceptable as a standard (with or without amendments), indicate this with appropriate justification and attach a copy to the proposal.

Cooperation and liaison

List relevant organizations or bodies with which cooperation and liaison should exist.

Preparatory work

Indicate the name of the project leader nominated by the proposer.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Wireless Power Transfer - multiple sources control management

FOREWORD

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IEC xxxx, which is an International Standard, has been prepared by technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard is based on the following documents:

Enquiry draft	Report on voting
100/xxx/CDV	100/XX/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date[2] indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

[2] The National Committees are requested to note that for this publication the maintenance result date is .

INTRODUCTION

Multimedia products with wireless power transfer, which makes a use of electromagnetic induction technology, are spreading in the market. The wireless power transfer system enables users to remove difficulty of connecting power line cable. Electromagnetic induction technology requests that users put a power source and a receiving device at a short distance in order to charge a battery in its device.

On the other hand, magnetic resonance technology on power transfer system is also being developed. Magnetic resonance technology would give a spatial effect on power transfer. A spatial effect on wireless power transfer means that multiple power sources deliver power to multiple receiving devices at a distance in spatial space.

In order to efficiently manage and support the wireless power transfer in spatial space, power sources need to communicate and coordinate each other.

Wireless Power Transfer - multiple sources control management

1 Scope

This International Standard specifies methods and procedures of formation of multiple groups on a spatial wireless power transfer system. A group on spatial wireless power transfer system, which is responsible for power transfer to receiving devices, has multiple power sources.

This International Standard also specifies within a group methods of setting, sharing and controlling power transfer conditions among multiple power sources in order to achieve efficient power transfer to multiple receiving devices.

2 Normative references

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1.1 Spatial wireless power transfer

a concept of wireless power transfer between multiple sources and multiple receiving devices which are placed at a distance within a spatial space.

NOTE: As a special case, spatial wireless power transfer is allowed to have only single power source and single power receiving device.

3.1.2 Spatial wireless power transfer system

a group on spatial wireless power transfer, in which power source can deliver power and data to power receiving device

NOTE: spatial wireless power transfer system includes the case in which a power source has ability to access a power receiving device via any other power sources when the power source attempts to deliver data to the receiving device.

3.1.3 Wireless power transfer system-source

a power transmitter in spatial wireless power transfer system

3.1.4 Wireless power transfer system-source network

a group of power sources which can communicate each other via network connection, such as wired LAN, wireless LAN, Bluetooth and so on.

NOTE: As a special case, spatial wireless power transfer system-source network is allowed to consist of only single source.

3.1.5 Power transfer area

an area in which a power source can deliver power to a power receiving devices wirelessly

3.1.6 Communication area

an area in which a power source can communicate with a power receiving devices via network connection, such as wired LAN, wireless LAN, Bluetooth and so on.

3.1.7 Power transfer level

power strength which a power source produce to its receiving device

3.1.8 Wireless power transmitting condition

power transfer strength and phase calculated for power transmitting on power source

3.1.9 Wireless power receiving condition

power transfer level and phase calculated on power receiving device which receives or has received power from power source

3.2 Abbreviations

SWPTS	Spatial Wireless Power Transfer System
SWPTS-n	The number of SWPTS
SWPTS-SN	SWPTS–Source Network
SWPTS-D	SWPTS-Device

4 Basic overview

SWPTS is a system to deliver power to multiple SWPTS-Ds within a spatial space on the basis of magnetic resonance technology. SWPTS consists of multiple SWPTS-Ss and multiple SWPTS-Ds as shown in Figure 1, Figure 2 and Figure 3. A SWPTS is allowed to consist of only a SWPT-S as shown in Figure 1.

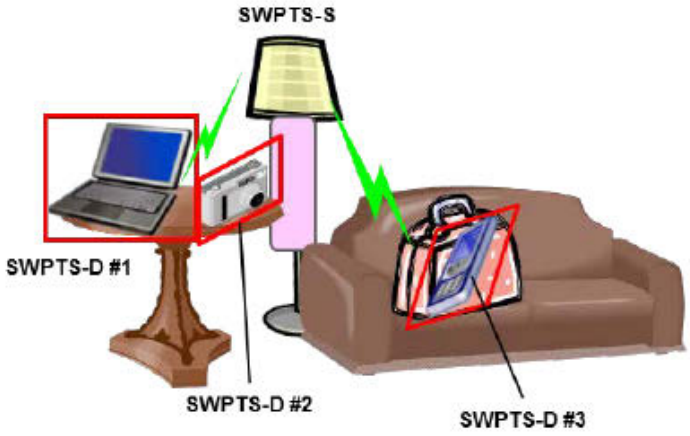

Figure 1 - Concept image of SWPTS: Example 1

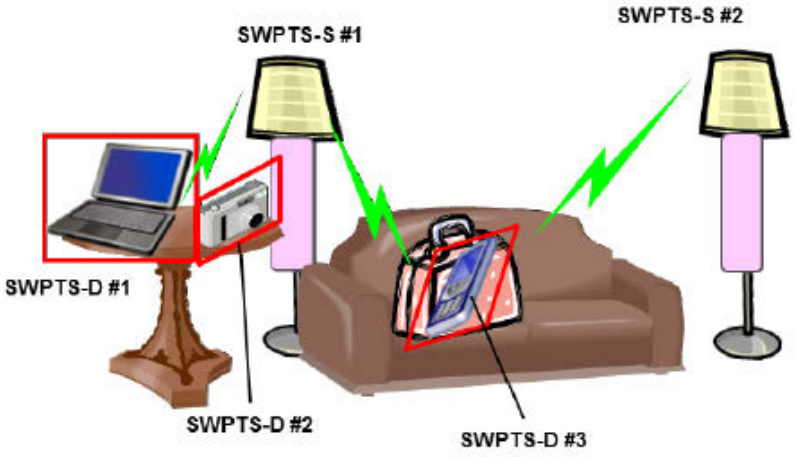

Figure 2 - Concept image of SWPTS: Example 2

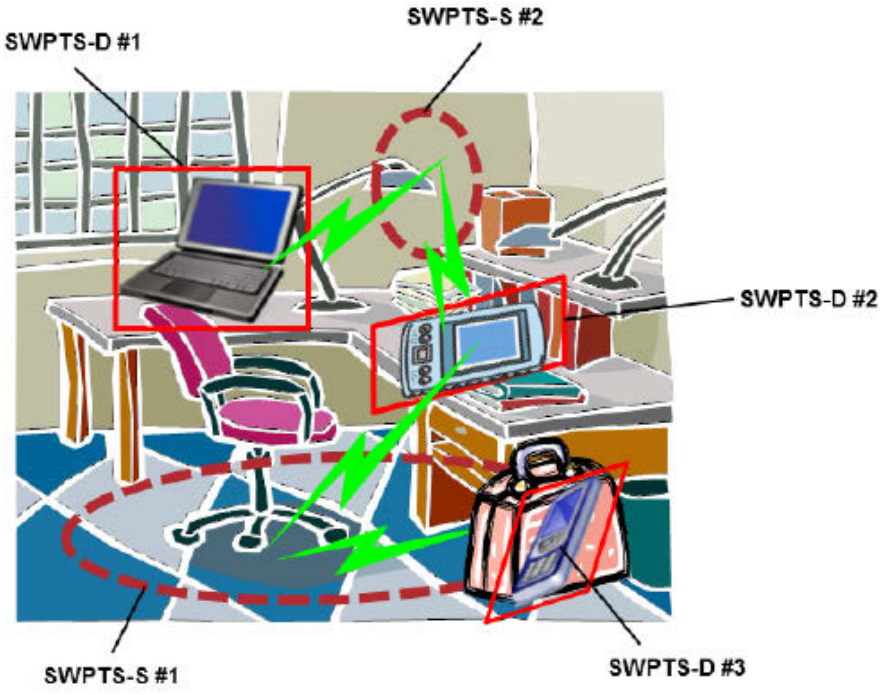

Figure 3 - Concept image of SWPTS: Example 3

Based on exchange of information on authentication and power transmitting conditions among SWPTS-Ss, power transfer group SWPTS is formed.

SWPTS-Ss can collect the authentication information and receiving conditions from SWPTS-Ds, and communicate the receiving conditions of SWPTS-Ds. After that, each SWPTS-S decides power transfer mode and sets up power transmitting conditions. According to power transfer mode and power transmitting conditions which are decided by SWPTS-Ss, power is transferred to SWPTS-Ds.

Therefore, if SWPTS-Ds enter a SWPTS, the SWPTS-Ss within its SWPTS can provide those SWPTS-Ds of various positions and posture with efficient power transfer according to control management based on collected information on transmitting and receiving conditions by network communications and sensors.

In spatial power transfer area, power transfer level is flexible and dependent on the type and the power receiving conditions of SWPTS-Ds.

5 Requirements on SWPTS

5.1 General model for SWPTS

Figure 4 shows the basic structure of SWPTS. Each SWPTS-S configures a SWPTS-S-centered star topology network with SWPTS-Ds in the communication area of SWPTS-S. In addition, SWPTS-Ss configure mesh or star topology network. Multiple SWPTS-Ss set up a spatial power transfer area and communication area. The communication area includes the power transfer area. In one SWPTS, one SWPTS-S is selected as Master from multiple SWPTS-Ss and the remaining SWPTS-Ss become Slave. Master SWPTS-S sends instructions

on communication and power transfer conditions to Slave SWPTS-S. Master SWPTS-S can communicate with all SWPTS-Ds via Slave SWPTS-Ss and control the entire behavior, such as entire communication and power transfer situations, within its SWPTS.

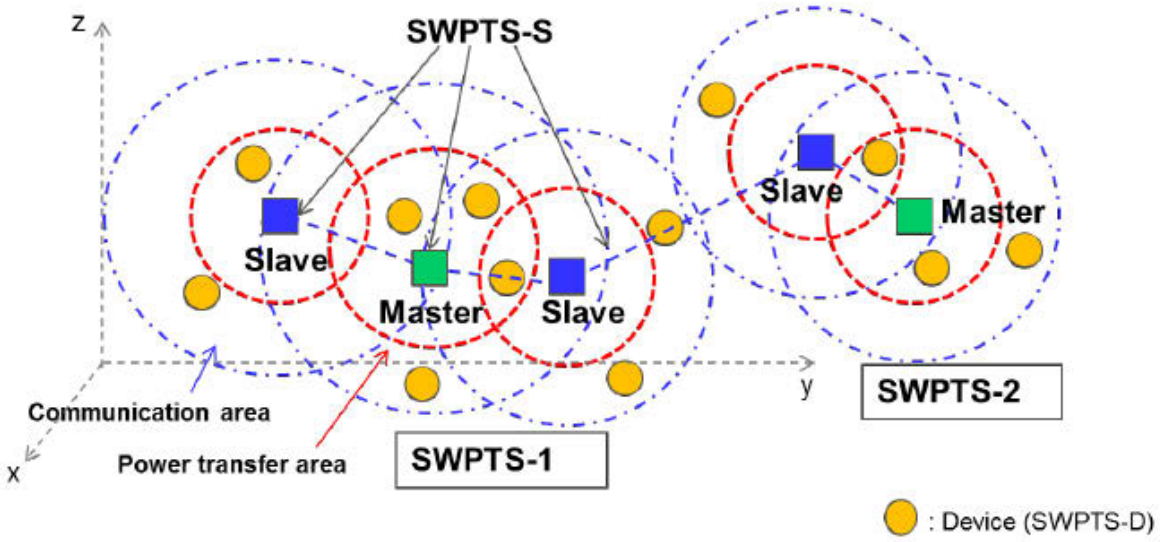

Figure 4 - Structure of SWPTS

5.2 Required functionalities

SWPT-Ss in a SWPTS communicate and coordinate each other to efficiently deliver power within a spatial power transfer area. This section 5.2 describes the required procedure to communicate among SWPT-Ss.

As shown in Figure 5, the following functionalities are required to set up and control SWPTS.

a) Configure a group by communication among SWPTS-Ss
b) Identify and authenticate SWPTS-Ds by SWPTS-Ss
c) Prepare wireless power delivery
d) Transfer power to SWPTS-Ds
e) Manage and monitor SWPTS
f) Terminate power transfer

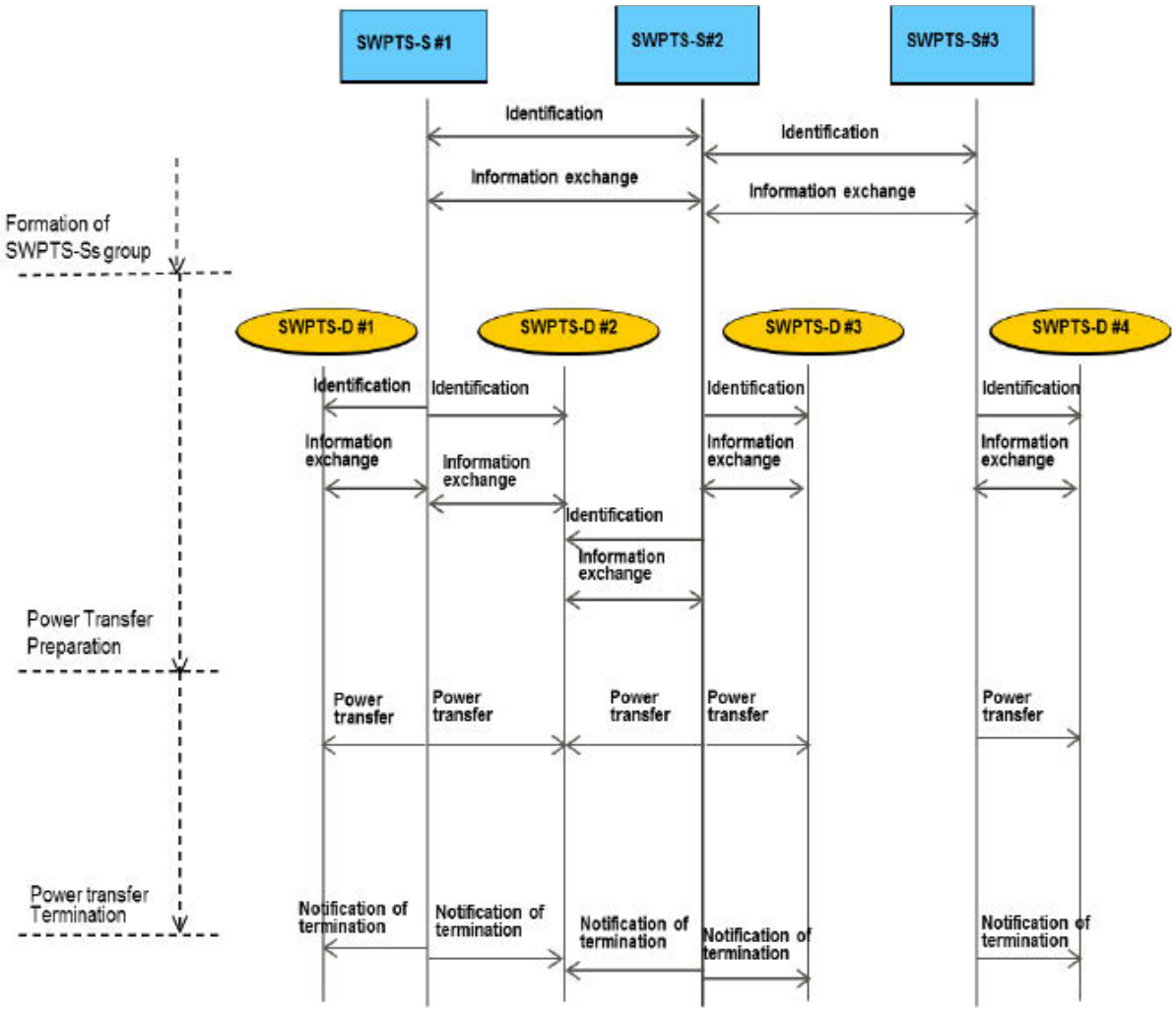

Figure 5 - Overall procedure of SWPTS

For fast authentication and preparation of wireless power transfer, Master SWPTS-S recognizes ID of Slave SWPTS-Ss and SWPTS-Ds, and exchanges required data with SWPTS-Ss and SWPTS-Ds before serving wireless power transfer service. Multiple Slave SWPTS-Ss are controlled by the instructions of Master SWPTS-S and configure power transfer area of the SWPTS so that any of SWPTS-Ss can deliver power to each SWPTS-D in the SWPTS. According to identification and authentication between SWPTS-Ss and SWPTS-Ds, one or multiple SWPTS-Ss select the target SWPTS-D(s) and deliver power wirelessly.

SWPTS has three kinds of power transfer modes:

- Simultaneous power transfer mode
- Time-division power transfer mode
- Mixed simultaneous and time-division mode

The power deliver can be terminated on the condition that all SWPTS-Ds receive power which they requested or a user intends to stop the power transfer.

6 Control and management method on SWPTS

6.1 Formation of SWPTS-Ss Group

SWPTS-S sends ID periodically or at the timing of user specification, and recognizes SWPTS-Ss which can be communicated mutually by receiving ID. One network SWPTS-SN consists of SWPTS-Ss which can be communicated mutually. Each SWPTS-S exchanges information such as position, wireless power transfer area, wireless communication area, and maximum transfer power. Each SWPTS-S recognizes SWPTS-Ss with which the power transfer area overlaps mutually based on received information, and the groups of SWPTS-Ss with which the power transfer area overlaps continuously are formed. One of SWPTS-Ss included in each group is allocated as Master SWPTS-S, and the others are allocated as Slave SWPTS-Ss. The Master SWPTS-S will control the communication and the wireless power transfer of all SWPTS-Ss which belong to the SWPTSs group.

6.2 Preparation of Wireless power transfer for multiple SWPTS-Ds

6.2.1 SWPTS-Ds identification and authentication

Each SWPTS-S included in one SWPTS-Ss group sends the signal at the interval of a predetermined time according to the instruction of Master SWPTS-S, and SWPTS-Ds which received the signal reply their IDs. Master SWPTS-S estimates whether each SWPTS-D is ready and applicable for wireless power transfer based on received ID.

6.2.2 Reception of power transfer information of SWPTS-Ds

Master SWPTS-S requests information necessary for wireless power transfer to the qualified SWPTS-D, such as device type (2-dimension or 3-dimension), demand electric energy, and device posture information. SWPTS-D which receives the request sends the information, and SWPTS-S relays information received from SWPTS-D to Master SWPTS-S.

6.2.3 Detection of SWPTS-D’s position

SWPTS-S detects SWPTS-Ds which exist in its wireless power transfer area by SWPTS-D position sensor, and sends its position information on the SWPTS-D and ID to Master SWPTS-S.

6.2.4 Setting of SWPTS-S’s power transmitting condition

Master SWPTS-S collects the information on position and posture of SWPTS-Ds in the wireless power transfer area of the SWPTS, and calculates the expected power transfer efficiency to each SWPTS-D on the basis of the relative position and posture information to the SWPTS-D. Master SWPTS-S determines the wireless power transmitting condition of all SWPTS-Ss in the SWPTS on the basis of the information on both power receiving condition of each SWPTS-D and wireless power transmitting condition of each SWPTS-S, and sends the information on wireless power transmitting condition to each SWPTS-S.

6.3 Wireless power transfer mode

6.3.1 General

There are three wireless power transfer mode in SWPTS: simultaneous wireless power transfer mode, time-division wireless power transfer mode and the mixed mode.

Master SWPTS-S calculates wireless power transmitting condition of all SWPTS-Ss and resonance condition of all SWPTS-Ds by the method of section 6.2.4, and sends the conditions to the SWPTS-Ss and the SWPTS-Ds.

6.3.2 Synchronizing method of magnetic field in SWPTS

Alternating magnetic field generated by multiple SWPTS-Ss need to be synchronized so that multiple SWPTS-Ss coordinate and serve efficient wireless power transfer.

As an example, the wired or wireless communication among SWPTS-Ss gives an method of how to synchronize the generated alternating magnetic field.

6.4 Reconfiguration of SWPTS

6.4.1 General

SWPTS calculates all of amount of electric energy which SWPTS-Ds have received by monitoring the transmitting and receiving situations on SWPTS-Ss and SWPTS-Ds. SWPTS may be reconfigured, if needed.

6.4.2 Completion and resumption of wireless power transfer

When a SWPTS-D received its necessary electric energy, the SWPTS-D notifies Master SWPTS-S of the completion on power transfer by sending its signaling. Then, Master SWPTS-S suspends all power transfer in the SWPTS. The SWPTS-D confirms the termination of power transfer and sets its necessary electric energy as the value “0”. SWPTS resumes the power transfer to the rest of SWPTS-Ds after the preparation process shown in 6.2 is done.

6.4.3 Appearance and disappearance of SWPTS-D

After beginning power transfer, a new SWPTS-D may appear or the existing SWPTS-D may disappear. In that case, Master SWPTS-S recognizes the appearance or the disappearance of SWPTS-D. Then, wireless power transfer is resumed after the preparation process shown in 6.2 is done again.

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6.4.4 Appearance and disappearance of SWPTS-S

After beginning power transfer, a new SWPTS-S may appear or the existing SWPTS-S may disappear. In that case, Master SWPTS-S recognizes the appearance or the disappearance of SWPTS-S. Then, wireless power transfer is suspended and SWPTS moves back to the process on the formation of SWPTS-Ss Group shown in 6.1.

6.5 Power transfer to SWPTS-D with flat battery

In the case that a SWPTS-D has no remaining battery charge, the SWPTS-D cannot join SWPTS. Because the SWPTS-D cannot communicate with any SWPTS-S via network connection.

If a user wants to wirelessly charge the battery of the SWPTS-D in SWPTS, the SWPTS-D need to be set on the predetermined location. Then, the user notifies SWPTS-S of the user's intension to charge the SWPTS-D and Master SWPTS-S suspends the power transfer once.

After that, SWPTS-S which is located near the SWPTS-D assumes the power transmitting conditions on the SWPTS-D and starts the lower power level transfer. Little by little, the SWPTS-S accelerates the power strength until that the charged SWPTS-D can communicate with SWPTS-S via network connection. If the SWPTS-D is charged enough to communicate, the user can put the SWPTS-D within a power transfer area in SWPTS. As shown in 6.5.3, the preparation process shown in 6.2 will be restarted.

6.6 Termination of wireless power transfer

There are two types of the termination of wireless power transfer as shown below.

a) There is no SWPTS-D which is required to deliver power in a SWPTS

b) A user intends to stop wireless power transfer

In the termination of wireless power transfer, SWPTS-Ss terminate wireless power transfer and will be in idle mode.

Annex A (informative)

Example of reconfiguration of SWPTS

Bibliography

The followings are referred in this standard: