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BSI Standards Publication

Wireless power transfer — Management

Part 3: Multiple source control management

bsi.

National foreword

This British Standard is the UK implementation of EN 62827-3:2017. It is identical to IEC 62827-3:2016.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, video and multimedia systems and equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Wireless power transfer - Management - Part 3: Multiple source control management (IEC 62827-3:2016)

Transfert de puissance sans fil - Gestion - Partie 3: Gestion du contrôle de sources multiples (IEC 62827-3:2016)

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European foreword

The text of document 100/2604/CDV, future edition 1 of IEC 62827-3, prepared by Technical Area 15 "Wireless power transfer" of IEC/TC 100 "Audio, video and multimedia systems and equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62827-3:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-10-18
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-01-18

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In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 62827-2	NOTE	Harmonized as EN 62827-2 [1].

[1] At draft stage.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 62827-1	-	Wireless power transfer - Management - Part 1: Common components	EN 62827-1	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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WIRELESS POWER TRANSFER – MANAGEMENT –

Part 3: Multiple source control management

FOREWORD

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International Standard IEC 62827-3 has been prepared by technical area 15: Wireless power transfer, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

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

CDV	Report on voting
100/2604/CDV	100/2724/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.

A list of all parts in the IEC 62827 series, published under the general title *Wireless power transfer – Management*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Wireless power transfer technology transmits electric power from the power source to the power-consuming device without the use of wire. The most widely used technology is electromagnetic induction technology and magnetic resonance technology. The wireless power transfer system eliminates the need for the user to connect a power cable to the electrical outlet. Through electromagnetic induction technology, users place the power-receiving device within a short distance from the power source in order to charge a battery without removing it from its device.

In parallel to this, magnetic resonance technology for wireless power transfer systems is also being developed. Magnetic resonance technology gives a spatial effect to power transfer. A spatial effect on wireless power transfer enables multiple power sources to deliver electric power to multiple receiving devices at a distance in the same vicinity.

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

WIRELESS POWER TRANSFER – MANAGEMENT –

Part 3: Multiple source control management

1 Scope

This document specifies methods and procedures to form groups for a spatial wireless power-transfer system. The group of spatial wireless power-transfer systems that include multiple power sources provides power transfer to receiving devices based on magnetic resonance technology.

In order to achieve efficient power transfer to multiple receiving devices, this document also specifies methods and procedures to set, share, and control the conditions of power transfer between multiple power sources and receiving devices.

NOTE Expected power-receiving devices are audio, video and multimedia equipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62827-1, *Wireless power transfer – Management – Part 1: Common components*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms, definitions and abbreviated terms given in IEC 62827-1, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1
magnetic resonance
subset of electromagnetic induction methods utilizing non-radiative, near-field or mid-field resonance coupling between two electromagnetic resonators where the coupling coefficient between the primary or source coil and the secondary or receiving coil is low (k much less than 1)

3.1.2
spatial wireless power transfer
concept of wireless power transfer between multiple sources and multiple receiving devices which are placed at a distance within a spatial space

Note 1 to entry: "Spatial" means that receiving devices will take various positions and postures, and will lead to variable transfer efficiency including almost zero per cent. This situation may occur when receiving devices are placed far apart from the power source and are freely rearranged.

3.1.3
spatial wireless power transfer system
group implementing spatial wireless power transfer in which the power source can deliver power and data to the power-receiving device

Note 1 to entry: In special cases, a spatial wireless power transfer system can consist of only a single power source and only a single power-receiving device.

Note 2 to entry: Spatial wireless power transfer system includes the case in which a power source has the ability to access a power-receiving device through a relay from other power sources when the power source attempts to deliver data to the receiving device. In this document, "data" means control and management data for wireless power transfer.

3.1.4
wireless power management system-source network
WPMS-SN
group of power sources which can communicate with each other via a network connection, such as wired LAN, wireless LAN, Bluetooth and so on

Note 1 to entry: As a special case, spatial wireless power transfer system-source network can consist of only a single source.

3.1.5
power transfer area
area in which a power source can deliver power to power-receiving devices wirelessly

3.1.6
communication area
area in which a power source can communicate with power-receiving devices via a network connection, such as wired LAN, wireless LAN, Bluetooth and so on

3.1.7
power transfer level
power strength of a power source transfer to the receiving device

3.1.8
wireless power transmitting condition
condition for transmitting power such as power strength and phase

3.1.9
wireless power receiving condition
condition for receiving power such as the received power, the relative value for required power and the voltage after receiving the required power which are calculated on the power-receiving device which receives or has received power from the power source

3.1.10
wireless power transfer mode
distinct methods of transferring power from sources to receiving devices

3.1.11
wireless power distribution
effective power delivery based on power required by the receiving devices

3.2 Abbreviated terms

WPMSn	the n-th WPMS if n is specified
WDCZn	the n-th WDCZ if n is specified
WPTZn	the n-th WPTZ if n is specified
WPMS-Sn	the n-th WPMS-S if n is specified
WPMS-SN	wireless power management system-source network
WPMS-SNn	the n-th WPMS-SN if n is specified
WPMS-Dn	the n-th WPMS-D if n is specified

4 Basic overview of WPMS

Wirelss power management system (WPMS) is a system to deliver power to WPMS-Ds within a spatial space on the basis of wireless power transfer technology, such as magnetic resonance. In this document, WPMS is regarded as spatial wireless power transfer system. A WPMS consists of multiple WPMS-Ss and multiple WPMS-Ds as shown in Figure 1, Figure 2 and Figure 3. In special cases, WPMS is allowed to consist of only one WPMS-S as shown in Figure 1.

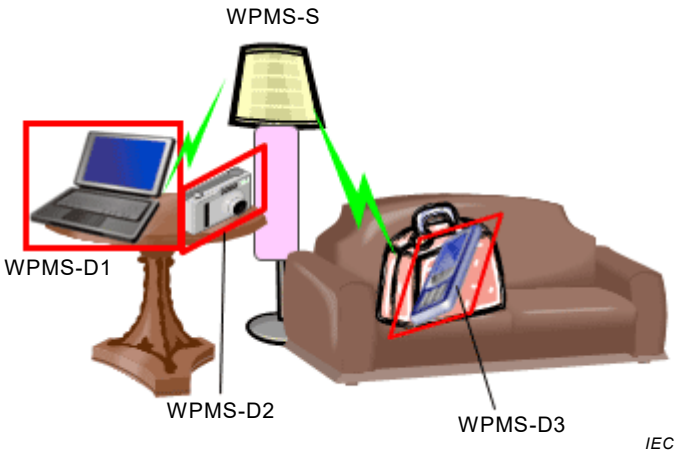

Figure 1 – Conceptual image of WPMS: Example 1

Figure 2 and Figure 3 illustrate that multiple WPMS-Ss transfer power to multiple WPMS-Ds at a distance. With magnetic resonance technology, a spatial wireless power transfer can have a wide range and cover more space, as shown in Figure 3.

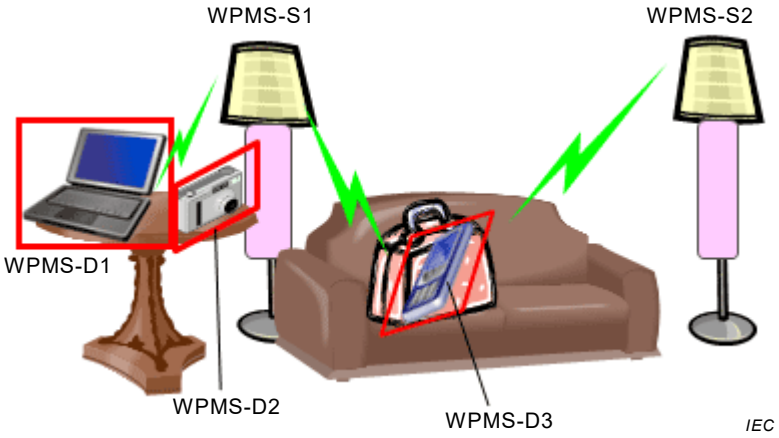

Figure 2 – Conceptual image of WPMS: Example 2

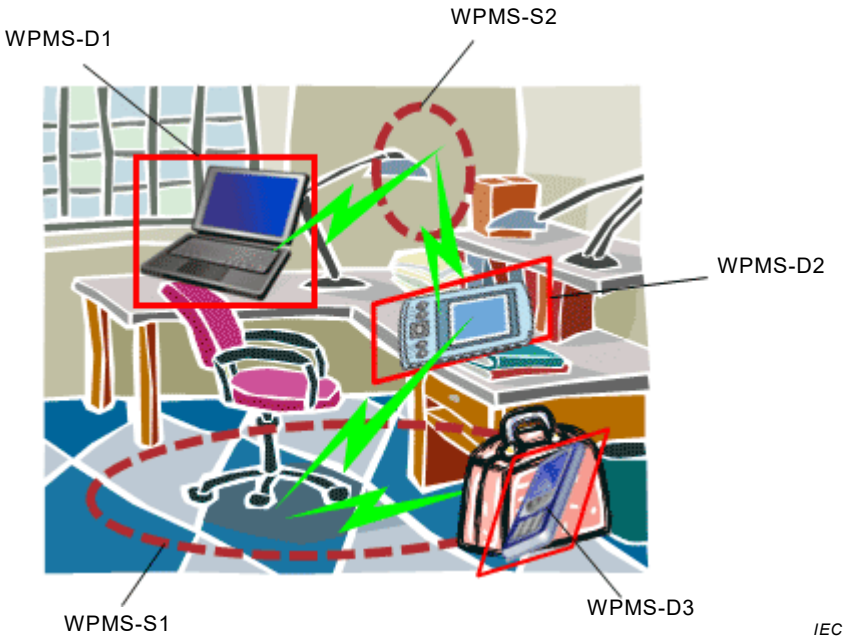

Figure 3 – Conceptual image of WPMS: Example 3

WPMS-Ss collect authentication information and wireless power receiving conditions from WPMS-Ds, and communicate this information with other WPMS-Ss. After that, each WPMS-S decides which power transfer mode to use and sets up power transmitting conditions. According to the power transfer mode, the power transmitting conditions and the wireless power receiving conditions which are decided by the WPMS-Ss, power is transferred to WPMS-Ds. When "simultaneous power-transfer mode" or "mixed simultaneous and time-division mode" is selected, effective wireless power distribution is carried out to control the receiving power based on the required power. See 6.3 for power transfer modes.

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

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

5 Requirements in WPMSs

5.1 General model for WPMSs

In Figure 4, two WPMSs in the same special vicinity shows the basic structure of multiple WPMSs, i.e. WPMS1 and WPMS2. Each WPMS-S in a WPMS forms its WPMS-S-centred star topology network with WPMS-Ds in the communication area of the WPMS-S. In addition, the WPMS-Ss form mesh or star topology network in the WPMS. Multiple WPMS-Ss set up the union of spatial power transfer areas which is WDTZ and the union of communication areas which is WPTZ. The communication area includes the power transfer area.

In one WPMS, one WPMS-S is selected as master WPMS-Ss and the remaining WPMS-Ss become slave WPMS-S. The master WPMS-S sends instructions about communication and power transfer conditions to slave WPMS-Ss. The master WPMS-S can communicate with all WPMS-Ds via the slave WPMS-Ss and control the entire behaviour, such as communication and power transfer situations, within the WPMS.

NOTE A single WPMS-S cannot belong to multiple WPMSs at the same time. In that case, WPMS1 and WPMS2 will be merged into one WPMS. Similarly, a WPMS-D cannot belong to both WPMS1 and SPWS2 at the same time. In that case, WPMS1 and WPMS2 will be merged into one WPMS.

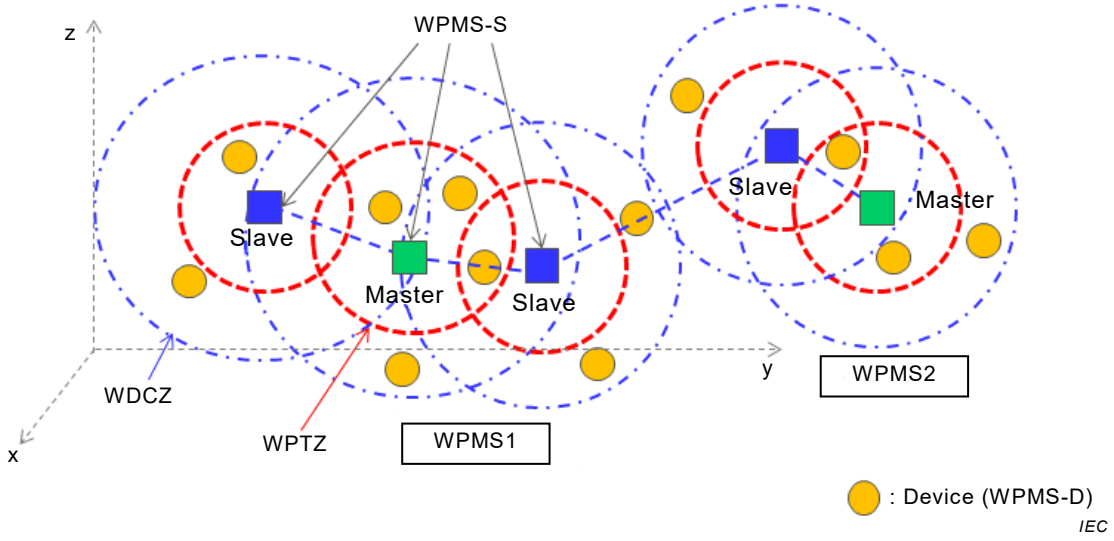

Figure 4 – Structure of a WPMS

5.2 Required functionalities

5.2.1 General

WPMS-Ss in a WPMS communicate and coordinate with each other to efficiently deliver power within a spatial power transfer area. 5.2 describes the required procedure for coordination among WPMS-Ss.

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

a) Configure a group by communication among WPMS-Ss.

b) Identify and authenticate WPMS-Ds by WPMS-Ss.

c) Prepare wireless power delivery.

d) Transfer power to WPMS-Ds.

e) Manage and monitor WPMS.

f) Terminate power transfer.

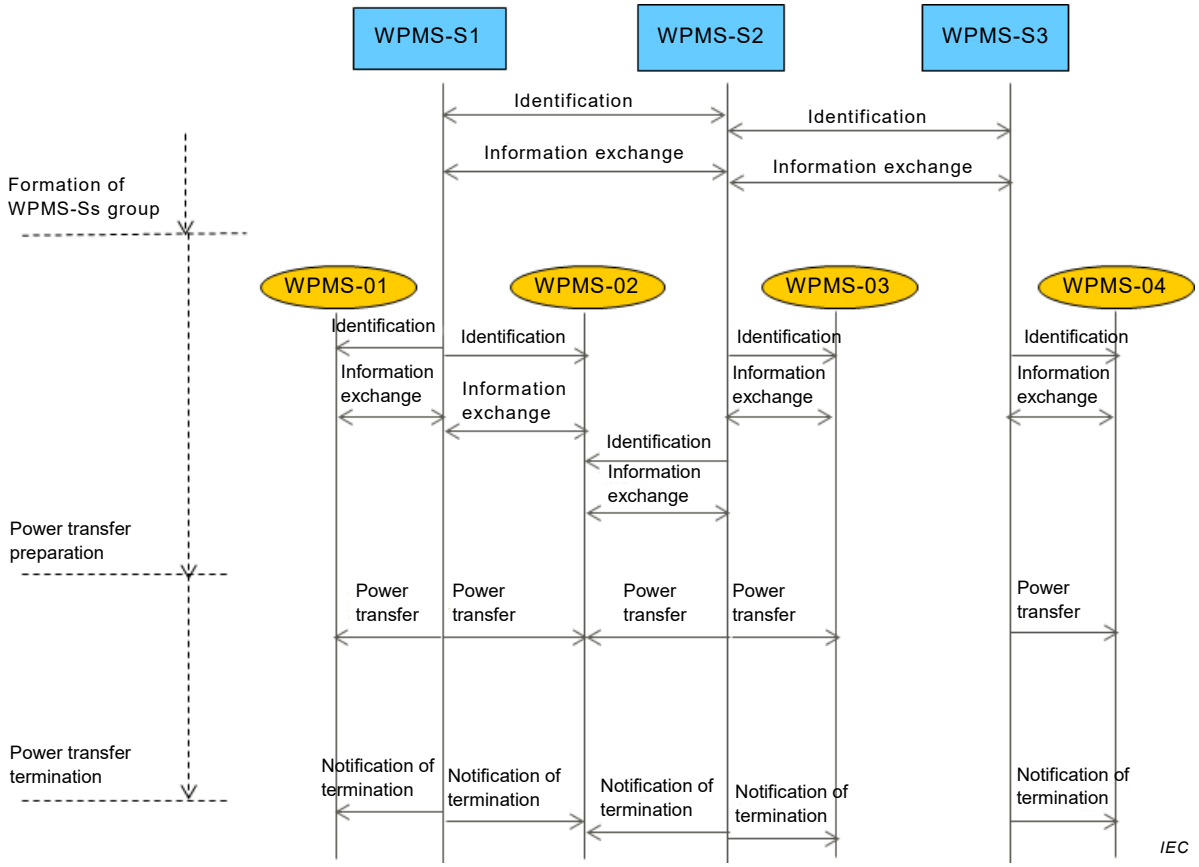

Figure 5 – Overall procedure of WPMSs

In this document, it is assumed that each WPMS-S and WPMS-D have an ID allocation mechanism and are identified by their IDs.

NOTE This document does not specify how to create an ID. WPMS-Ss and WPMS-Ds can hold their own IDs in advance or create their own IDs in some way, such as distributed network computing.

For fast authentication and preparation of wireless power transfers, the master WPMS-S recognizes the ID of the slave WPMS-Ss and WPMS-Ds, and exchanges the required data with WPMS-Ss and WPMS-Ds before serving wireless power transfer services. Multiple slave WPMS-Ss are controlled by the master WPMS-S, and they configure the power transfer area of the WPMS so that any of the WPMS-Ss can deliver power to each WPMS-D in the WPMS. Based upon identification and authentication between WPMS-Ss and WPMS-Ds, one or multiple WPMS-Ss select the target WPMS-D(s) and deliver power wirelessly. Each WPMS-D receives power from multiple WPMS-Ss. In special cases, WPMS-Ds can also receive power from only one WPMS-S. The master WPMS-S determines how much power each WPMS-S should transmit.

A WPMS has three kinds of power transfer modes:

- simultaneous power transfer mode;
- time-division power transfer mode;

- mixed simultaneous and time-division mode.

In the case of "simultaneous power transfer mode" or "mixed simultaneous and time-division mode", multiple receiving devices will be charged simultaneously with wireless power distribution.

The power delivery can be terminated on the condition that all WPMS-Ds have received the power they requested or if the user demands to stop the power transfer.

5.2.2 Consideration for mismatch of receiving power and required power

In the case of a spatial wireless power transfer, mismatching of receiving power and required power may become a problem.

The receiving power can be calculated as follows:

receiving power = transfer power × efficiency.

In the case of a single power-receiving device, it is easy to match the receiving power and required power by setting the transfer power as follows:

transfer power = required power / efficiency.

However, in the case of multiple power-receiving devices, the variety of required power and efficiency makes it difficult. In the case of two receiving devices A and B, the below equations need to be satisfied:

receiving power A = transfer power × efficiency A;

receiving power B = transfer power × efficiency B.

Distinct power requirements and efficiency will cause the following result:

required power A / efficiency A ≠ required power B / efficiency B

which leads to the mismatch of receiving power and required power, and difficulties in setting the transfer power.

5.2.3 Wireless power distribution

To solve the mismatch problem given in 5.2.2, effective wireless power distribution is necessary. Effective power distribution shall decrease the efficiency of at least one of receiving devices. The least loss method is recommended. The method corresponding to the mismatch is described in 6.3.2.

5.3 Message type by WPMS-S

There are several kinds of message types sent out by WPMS-Ss, as shown in Table 1.

Table 1 – Message type

Usage	Sent from	Sent to
Notice of WPMS-S: A WPMS-S notifies the other WPMS-Ss of its existence	Master WPMS-S	Slave WPMS-S
	Slave WPMS-S	Slave WPMS-S
Configuration on mutual work areas: A WPMS-S notifies other WPMS-Ss of its own communication area, power transfer area or maximum power transfer.	Slave WPMS-S	Master WPMS-S
	Slave WPMS-S	Slave WPMS-S
Find WPMS-D: A WPMS-S searches WPMS-Ds which the WPMS-S can transfer power to.	Master WPMS-S	WPMS-D
	Slave WPMS-S	WPMS-D
Request for sending power information: A WPMS-S requests WPMS-Ds to send its position, device type or needed power.	Master WPMS-S	WPMS-D
	Slave WPMS-S	WPMS-D
Exchange manageable WPMS-D: A WPMS-S sends other WPMS-Ss' IDs or position of WPMS-Ds which the WPMS-S can transfer power to.	Slave WPMS-S	Master WPMS-S
	Slave WPMS-S	Slave WPMS-S
Notify power transfer setting: Master WPMS-S notifies slave WPMS-S to set wireless power transmitting condition	Master WPMS-S	Slave WPMS-S
Suspend power transfer: Master WPMS-S requests slave WPMS-S to suspend power transfer	Master WPMS-S	Slave WPMS-S

6 Control and management method on WPMS

6.1 Formation of WPMS-S group

A WPMS-S sends out ID periodically or at the timing interval set by the user, and recognizes WPMS-Ss which can communicate mutually by receiving ID. One wireless power management system-source network (WPMS-SN) consists of WPMS-Ss which can communicate with each other or relay information via one of the WPMS-Ss.

Each WPMS-S exchanges information such as position, wireless power transfer area, wireless communication area, and maximum transfer power via the WPMS-SN. If the power transfer area of the WPMS-Ss overlaps based on the received information through the wireless communication area, WPMS-Ss form a group. One of the WPMS-Ss included in each group is allocated as the master WPMS-S, and the others are allocated as slave WPMS-Ss. The master WPMS-S controls the communication and the wireless power transfer of all WPMS-Ss which belong to the WPMS. Table 2 shows the structure of the message used in order to form the WPMS-S group.

Table 2 – Notices of WPMS-S

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Intermediate WPMS-S ID	O	Intermediate source ID for relaying/routing
Reserved	O	
Key M: mandatory O: optional		

6.2 Preparation of wireless power transfer for multiple WPMS-Ds

6.2.1 WPMS-D identification and authentication

According to the instruction of the master WPMS-S, each WPMS-S included in one WPMS group sends the signal at the interval of a predetermined time, and WPMS-Ds which receive the signal reply with their IDs to the WPMS-S. The WPMS-Ss estimate whether each WPMS-D is ready and suitable for wireless power transfer based on IDs the WPMS-S received. A WPMS-D may respond to multiple WPMS-Ss in the same WPMS.

6.2.2 Reception of power transfer information of WPMS-Ds

As shown in Figure 6, the master WPMS-S requests the authenticated WPMS-D to send the necessary information for wireless power transfer, such as device type (2-dimensional or 3-dimensional), electrical energy demand, and device posture information. The WPMS-D which receives the request shall send the information, and the WPMS-S relays information which the WPMS-D sends to the master WPMS-S.

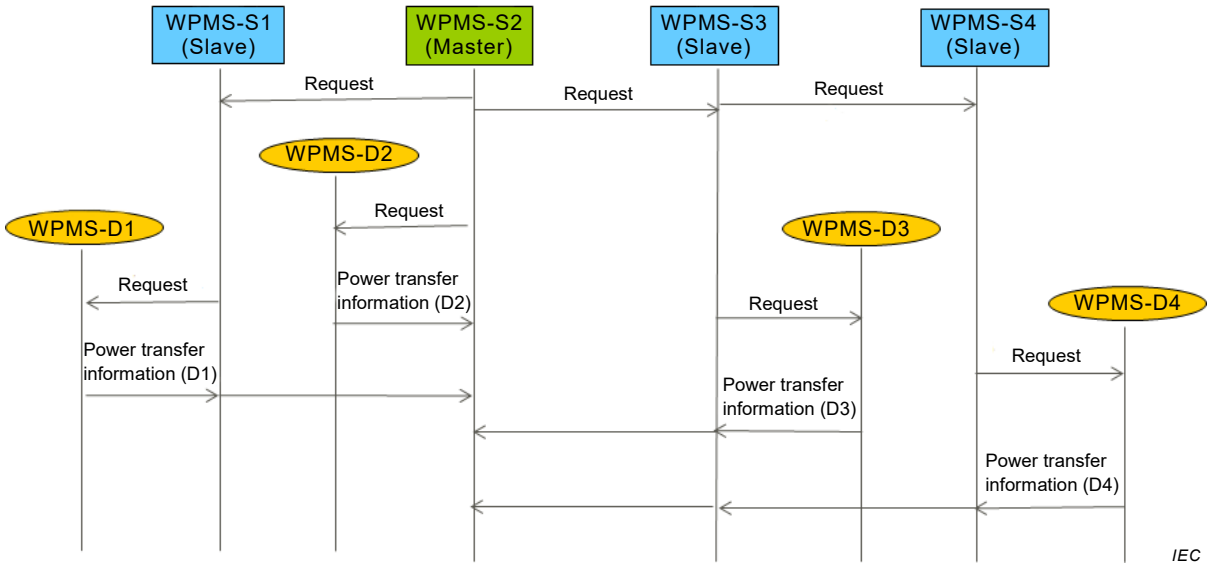

Figure 6 – Reception of power transfer information of WPMS-Ds

Table 3 shows the structure of the message relayed to the master WPMS-S.

Table 3 – Configuration on mutual work areas

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Intermediate WPMS-S ID	O	Intermediate source ID for relaying/routing
WPMS-S ID	M	Destination source ID
Position	M	
Power transfer area	M	
Communication area	M	
Maximum transfer power	M	
Reserved	O	
Key M: mandatory O: optional		

6.2.3 Detection of WPMS-D positions

The WPMS-S detects WPMS-Ds which exist in its wireless power transfer area by the position sensor of the WPMS-Ds and sends their position information and ID to the master WPMS-S. Table 4 shows the structure of the message sent out by the WPMS-S to detect the WPMS-D.

Table 4 – Find WPMS-D

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Reserved	O	
Key M: mandatory O: optional		

6.2.4 Setting of the WPMS-S power transmitting condition

The master WPMS-S collects the information on position and posture of WPMS-Ds in the wireless power transfer area of the WPMS, and calculates the expected power transfer efficiency to each WPMS-D on the basis of the relative position and posture information of the WPMS-D. The master WPMS-S determines the wireless power transmitting condition of all WPMS-Ss in the WPMS based on the information of both the wireless power receiving condition of each WPMS-D and the wireless power transmitting condition of each WPMS-S, and then sends the determined wireless power transmitting condition to each WPMS-S. Table 5 shows the structure of the message for collecting the information on position and posture of WPMS-Ds.

Table 5 – Request for sending power information

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	sender source ID
Reserved	O	
Key M: mandatory O: optional		

Table 6 shows the structure of the message to inform the master WPMS-S about the information on position and posture of WPMS-Ds handled by each WPMS-S.

Table 6 – Exchange manageable WPMS-D

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Intermediate WPMS-S ID	O	Intermediate source ID for relaying/routing
WPMS-S ID	M	Destination source ID
Information on manageable WPMS-D		
WPMS-S ID	M	ID of power source in charge of the WPMS-Ds below
WPMS-D ID	M	ID of receiving device which is managed by WPMS-S
Reserved	O	
Key M: mandatory O: optional		

Table 7 shows the structure of the message to set the wireless power transmitting condition on each WPMS-S.

Table 7 – Notify power transfer setting

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Intermediate WPMS-S ID	O	Intermediate source ID for relaying/routing
WPMS-S ID	M	Destination source ID
Information on power transfer setting		
WPMS-D ID	M	Targeted receiving device
Reserved	O	
Key M: mandatory O: optional		

6.3 Wireless power transfer mode

6.3.1 General

The three power transfer modes for power receiving devices are as follows.

a) Simultaneous power transfer mode:

power shall be transferred to all receiving devices simultaneously.

b) Time-division power transfer mode:

power shall be transferred to each receiving device one by one.

c) Mixed simultaneous and time-division mode:

receiving devices are divided into groups, and power shall be transferred to each group one by one.

The master WPMS-S shall calculate the wireless power-transmitting condition of all WPMS-Ss and the resonance condition of all WPMS-Ds with the method described in 6.2.4, and send the conditions to the WPMS-Ss and the WPMS-Ds.

6.3.2 Wireless power distribution

6.3.2.1 Effective wireless power distribution

A WPMS, which is controlled by the (master) WPMS-S, can decrease the power transfer efficiency on each WPMS-D. The WPMS-S shall select at least one WPMS-D which does not decrease its transfer efficiency, and set others so that they decrease their power transfer efficiency. WPMS-Ds can match their receiving power to the required power.

6.3.2.2 Wireless power distribution method

As far as possible, it is recommended to decrease power transfer efficiency without producing a new loss factor. When there is no new loss factor, total power transfer efficiency can remain stable or can be similar to the power transfer efficiency without the wireless power distribution.

One concrete example of the wireless power distribution method is to use a variable condenser as a resonant condenser. By changing the capacity of the variable condenser in a given WPMS-D, the resonant frequency will change from the transfer frequency, and the effective Q factor at the transfer efficiency of the device will decrease. The decrease of the effective Q factor will cause the decrease of the transfer efficiency. But since there is no new loss factor, the power which was to be transferred to the given WPMS-D will go to the other WPMS-Ds, and total transfer efficiency will be almost the same. The above loss factor indicates mainly the coil resistance and the dielectric tangent of the capacitance.

6.3.2.3 Wireless power distribution procedure

The wireless power distribution shall proceed in the following order.

a) The WPMS-S shall select at least one WPMS-D which does not decrease its power transfer efficiency.

To achieve high total transfer efficiency, the selection of a WPMS-D which requires the maximum transfer power (receiving power / transfer efficiency) is suitable.

b) The WPMS-S shall set the low efficiency level for unselected WPMS-Ds owing to the required power and wireless power receiving conditions.

c) The WPMS-S shall transfer power to the WPMS-Ds simultaneously.

6.3.3 Synchronizing method of magnetic fields in WPMS

Alternating magnetic fields generated by multiple WPMS-Ss need to be synchronized so that multiple WPMS-Ss coordinate and provide efficient wireless power transfer.

As an example, the wired or wireless communication among WPMS-Ss can be used to synchronize the generated alternating magnetic field.

6.4 Reconfiguration of WPMS

6.4.1 General

To calculate the total amount of electric energy received by WPMS-Ds, the WPMS monitors the transfer conditions of WPMS-Ss and WPMS-Ds. The WPMS may be reconfigured, if needed.

6.4.2 Completion and resumption of wireless power transfer

When a WPMS-D receives its required electric energy, the WPMS-D notifies WPMS-Ss by sending a signal and the completion information, which is then relayed to the master WPMS-S. Then, the master WPMS-S suspends all power transfer in the WPMS. The WPMS-D confirms the termination of power transfer and sets its required electrical energy as the value "0". The WPMS resumes the power transfer to the rest of the WPMS-Ds after the preparation process shown in 6.2 is done.

Figure 7 shows the operating sequences when WPMS-D, which is illustrated as WPMS-D4, receives the necessary electric energy.

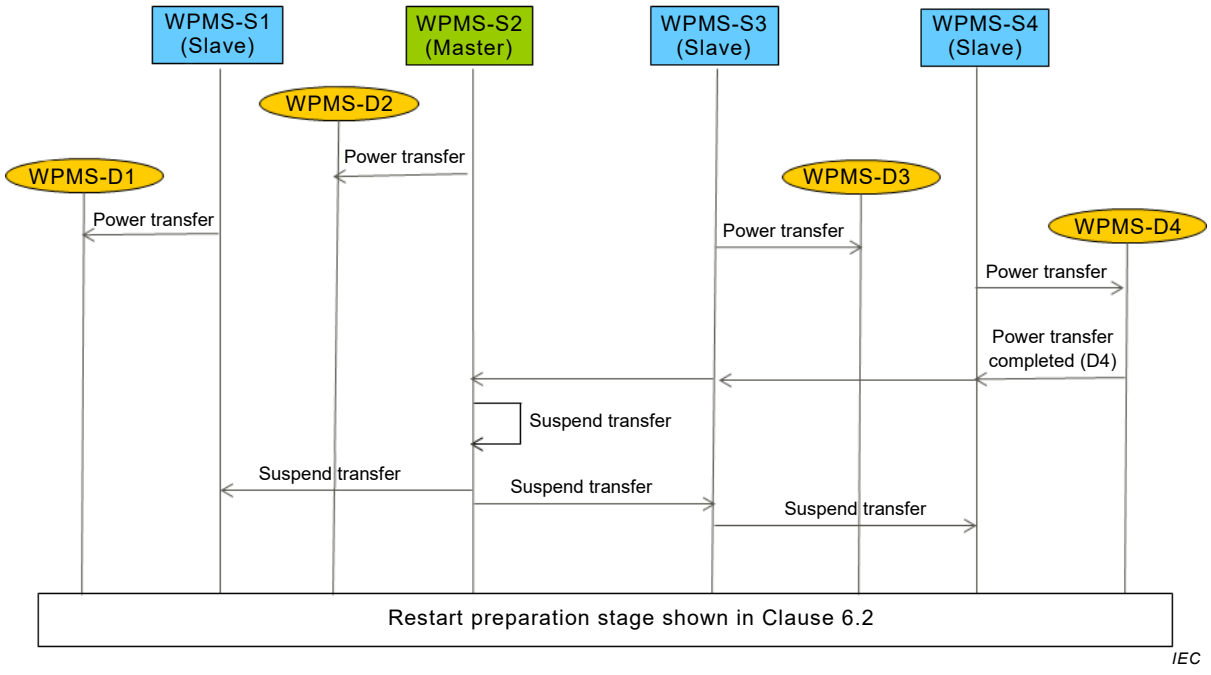

Figure 7 – Completion and resumption of wireless power transfer

Table 8 shows the structure of the message to instruct each WPMS-S to suspend power transfer.

Table 8 – Suspend power transfer

Parameter	Mandatory/optional	Special notes
Message ID	M	
Message type	M	
WPMS-S ID	M	Sender source ID
Intermediate WPMS-S ID	O	Intermediate source ID for relaying/routing
WPMS-S ID	M	Destination source ID
Key M: mandatory O: optional		

6.4.3 Appearance and disappearance of WPMS-D

During the power transfer phase, a new WPMS-D may appear or the existing WPMS-D may disappear. In that case, the master WPMS-S recognizes the appearance or the disappearance of the WPMS-D. Then, wireless power transfer is resumed after the preparation process shown in 6.2

6.4.4 Appearance and disappearance of WPMS-S

During the power transfer phase, a new WPMS-S may appear or the existing WPMS-S may disappear. In that case, the master WPMS-S recognizes the appearance or the disappearance of the WPMS-S. Then, wireless power transfer is suspended and the WPMS moves back to the process on the formation of a WPMS-S group shown in 6.1.

6.5 Power transfer to WPMS-D with a flat battery

In the case of a dead battery, the WPMS-D cannot join the WPMS because the WPMS-D cannot communicate with any WPMS-Ss via network connection.

If the user wants to wirelessly charge the dead battery of the WPMS-D in WPMS, the WPMS-D needs to be set on the predetermined location. Then, the user notifies the WPMS-Ss of the user's intention to charge the WPMS-D and the master WPMS-S suspends the power transfer once in order to readjust the WPMS.

After that, the WPMS-S which is located near the WPMS-D takes charge of the power transmitting conditions on the WPMS-D and starts the lower-level power transfer. Little by little, the WPMS-S accelerates the power strength until the charged WPMS-D is able to communicate with the WPMS-S via a network connection. If the WPMS-D is charged enough to communicate, the user can put the WPMS-D within a power transfer area in the WPMS. As shown in 6.4.3, the preparation process shown in 6.2 will be restarted.

6.6 Termination of wireless power transfer

There are two types of termination of wireless power transfer:

a) there is no WPMS-D which demands power in the WPMS;

b) a user intends to stop the wireless power transfer.

Upon termination of wireless power transfer, WPMS-Ss terminate wireless power transfer and will be in idle mode.

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1 Under preparation. Stage at the time of publication: IEC CCDV 62827-2:2016.

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