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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Spatial wireless power transfer based on multiple magnetic resonances – Part 2: Reference model

Transfert d'énergie sans fil dans l'espace reposant sur des résonances magnétiques multiples – Partie 2: Modèle de référence

IEC 63245-2:2022-12(en-fr)

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SPATIAL WIRELESS POWER TRANSFER BASED ON MULTIPLE MAGNETIC RESONANCES –

Part 2: Reference model

FOREWORD

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The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3839/FDIS	100/3864/RVD

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

The language used for the development of this International Standard is English.

A list of all parts in the IEC 63245 series, published under the general title *Spatial wireless power transfer based on multiple magnetic resonances*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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- amended.

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INTRODUCTION

The IEC 63245 series (Spatial wireless power transfer based on multiple magnetic resonances, SWPT-MMR) provides requirements and a reference model for implementing spatial wireless power transfer systems. The IEC 63245 series consists of the following parts:

– Part 1: Requirements, and
– Part 2: Reference model

IEC 63245-1 describes requirements of SWPT-MMR.

IEC 63245-2 (this document) describes the reference model of SWPT-MMR.

SPATIAL WIRELESS POWER TRANSFER BASED ON MULTIPLE MAGNETIC RESONANCES –

Part 2: Reference model

1 Scope

This document specifies a reference model for spatial wireless power transfer based on multiple magnetic resonances (SWPT-MMR), which is a type of non-radiative wireless power transfer (WPT). The document contains an overview of SWPT-MMR and a reference model.

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 63245-1:2021, *Spatial wireless power transfer based on multiple magnetic resonances – Part 1: Requirements*

3 Terms, definitions, and abbreviated terms

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

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

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

3.1 Terms and definitions

3.1.1
null point
point or area in the charging zone where the magnetic field cancels out almost entirely or is below a certain specified minimum

[SOURCE: IEC 63245-1:2021, 3.1.1]

3.1.2
quiet zone
magnetic field having an equalized energy density corresponding to each of the magnetic fields formed on the transmitter coils

[SOURCE: IEC 63245-1:2021, 3.1.2]

3.1.3
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 percent. This situation can occur when receiving devices are placed far apart from power source and freely rearranged.

[SOURCE: IEC 62827-3:2016, 3.1.2, modified – "placed at a certain distance in various positions and postures within a space" has been replaced with " which are placed at a distance within a spatial space"]

3.1.4
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.

[SOURCE: IEC 62827-3:2016, 3.1.3]

3.1.5
transmitter coil
component of a wireless power transmitter that converts electric current to magnetic flux

[SOURCE: IEC 63006:2019, 3.48]

3.2 Abbreviated terms

SWPT	spatial wireless power transfer
SWPT-MMR	spatial wireless power transfer based on multiple magnetic resonances
WPT	wireless power transfer

4 Overview of spatial wireless power transfer based on multiple magnetic resonances

A spatial wireless power transfer (SWPT) system delivers the electronic power to one or more receivers within a specific space. As a specific implementation of SWPT, spatial wireless power transfer based on multiple magnetic resonances (SWPT-MMR) includes multiple magnetic resonances to generate the specific space, namely a charging zone. In the charging zone, electric power is transferred to one or more receivers regardless of the position and the direction of the receiver(s). Figure 1 shows a conceptual image of SWPT-MMR.

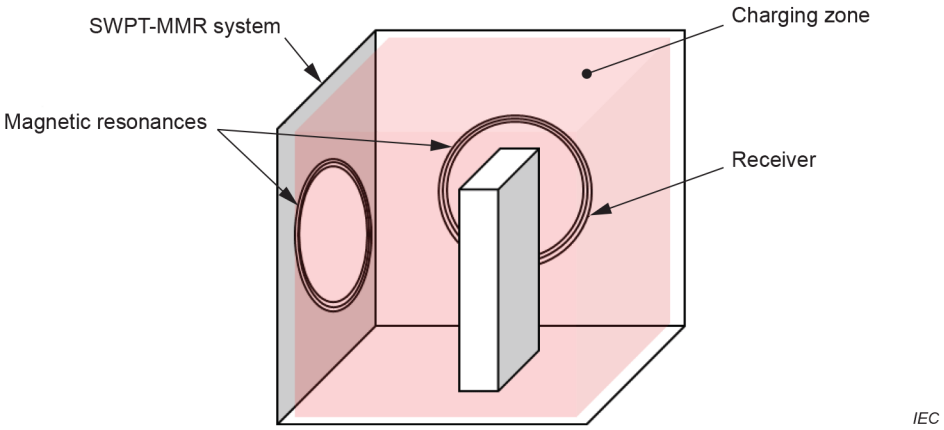

Figure 1 – Conceptual image of SWPT-MMR [IEC 63245-1]

5 Reference model

5.1 Overview

The reference model of an SWPT-MMR system provides essential components of an SWPT-MMR system. Every essential component is based on the requirements of SWPT-MMR defined in IEC 63245-1. Thus, the reference model defined in this document shall comply with IEC 63245-1. Figure 2 shows the reference model of an SWPT-MMR system.

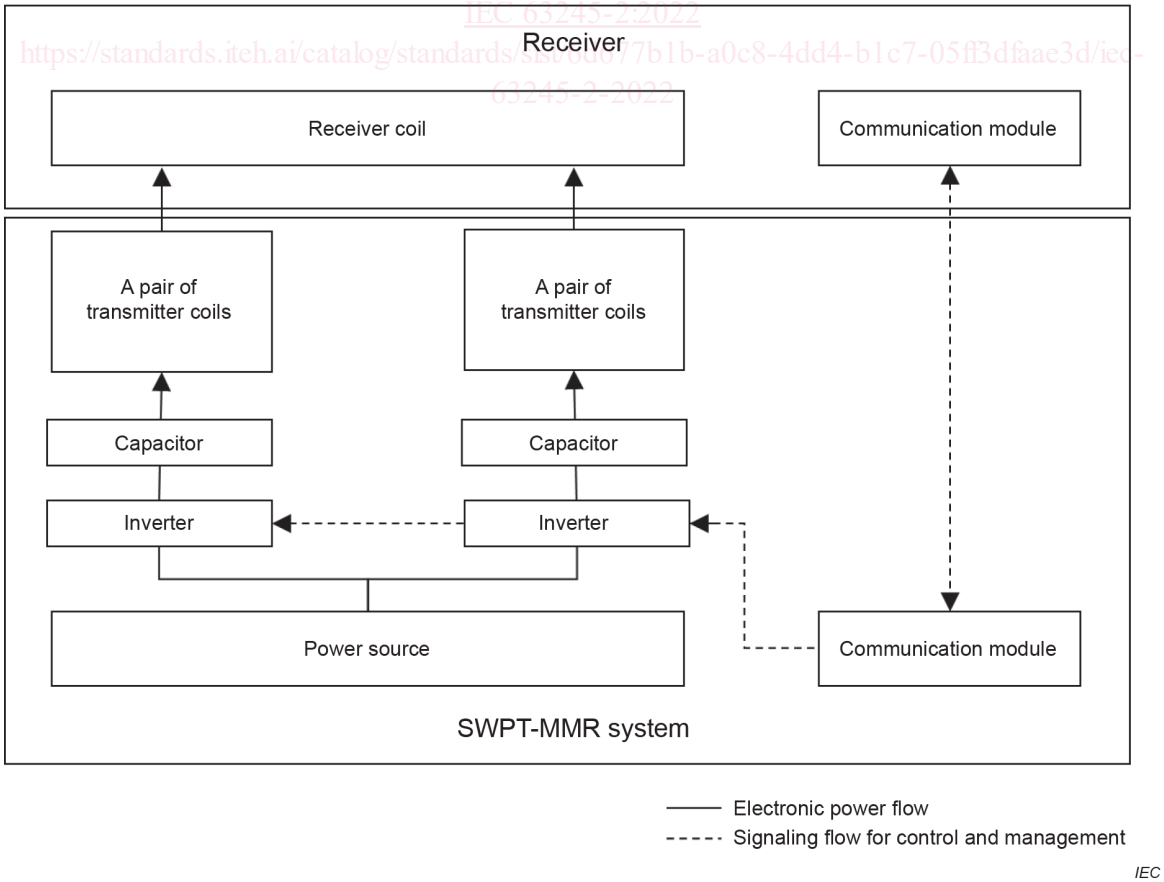

Figure 2 – The reference model of an SWPT-MMR system

5.2 Components of an SWPT-MMR system

5.2.1 Power source

As an essential component of a power transfer system, an SWPT-MMR system shall have at least one power source configured to supply a current to all the transmitter coils. Figure 3 shows an example configuration of an SWPT-MMR system with two power sources. Table 1 lists the requirements related to power source, which IEC 63245-1 defines.

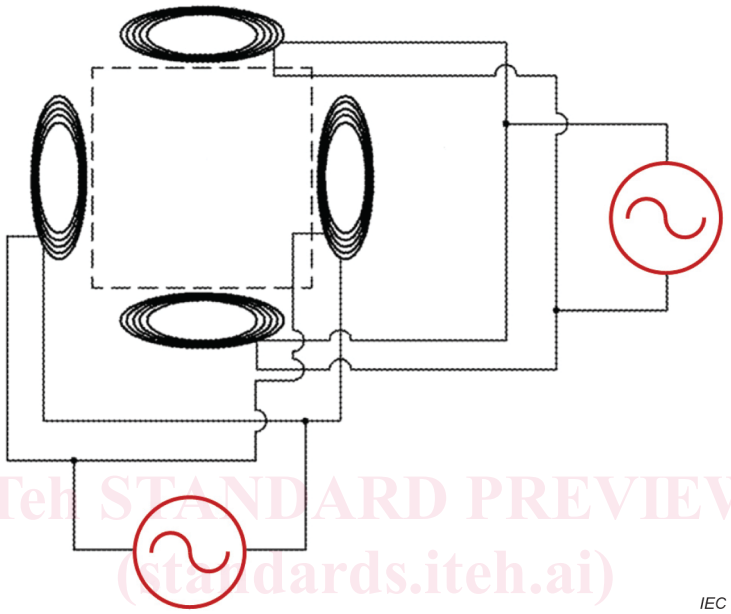

Figure 3 – Example configuration of an SWPT-MMR system with power sources

Table 1 – Power source-related requirements defined in IEC 63245-1

Tag	Description
REQ-ZONE1	It is required that an SWPT-MMR system be capable of generating a 3D charging zone.
REQ-PROC1	It is recommended that an SWPT-MMR system follow the basic charging procedure comprised of a standby state, charging zone generation, optimization, power transmission, and transmission termination.

5.2.2 Capacitor

To reduce the size of transmitter coils or reduce resonance frequencies of transmitter coils, an SWPT-MMT system shall have one or more capacitors that are in between each transmitter coil and the power source connected to each transmitter coil. Figure 4 shows an example configuration of an SWPT-MMR system with transmitter coils connected to capacitors. Table 3 lists the requirements related to the capacitors and which are defined in IEC 63245-1.

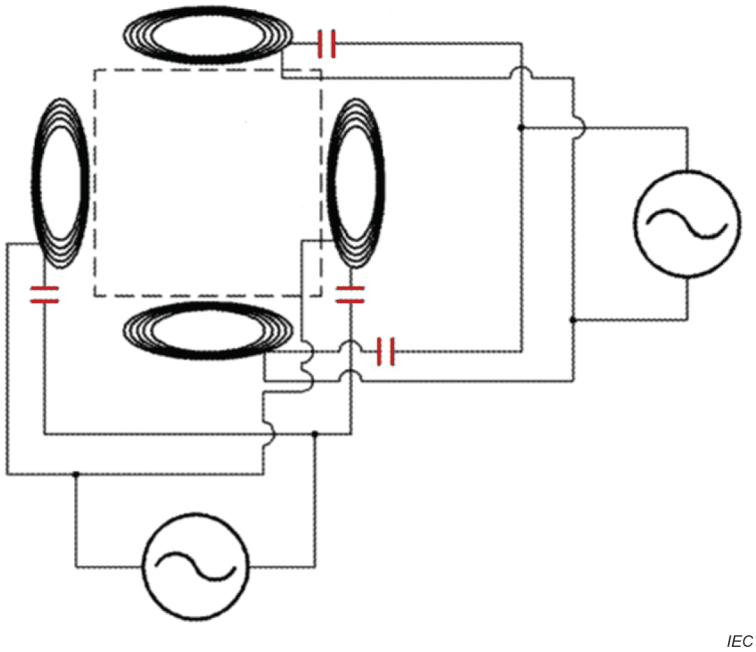

Figure 4 – Configuration on an SWPT-MMR system with transmitter coils connected to capacitors

Table 2 – Capacitor-related requirements defined in IEC 63245-1

Tag	Description
REQ-ZONE1	It is required that an SWPT-MMR system be capable of generating a 3D charging zone.
REQ-ZONE2	It is required that an SWPT-MMR system be capable of generating a quiet zone indicating a magnetic field having an equalized energy density in the charging zone
REQ-ZONE3	It is required that an SWPT-MMR system be capable of controlling multiple transmitter coils to generate multiple quiet zones.
REQ-ZONE4	It is required that an SWPT-MMR system be capable of dealing with null points in a charging zone.
REQ-PROC1	It is recommended that an SWPT-MMR system follow the basic charging procedure comprised of standby state, charging zone generation, optimization, power transmission, and transmission termination.
REQ-FREQ1	It is required that an SWPT-MMR system be capable of adjusting resonance frequencies of the transmitting coils.
REQ-FREQ2:	It is required that the transmitting coils of a SWPT-MMR system use the same resonance frequency.
REQ-FREQ3	It is recommended that an SWPT-MMR system be capable of selecting the resonance frequency that results in the most efficiency in power transfer.

5.2.3 Inverter

An SWPT-MMR system shall have an inverter to control the phase of a magnetic field formed on transmitter coils. Figure 5 and Figure 6 show two different example configurations of an SWPT-MMR system with an inverter included in a power source. The phase of the current adjusted by the inverter is determined by the angle between the pairs of transmitter coils. When an SWPT-MMR system has two pairs of transmitter coils that are orthogonally placed, one pair of transmitter coils is supplied the current that is phase shifted by 90° relative to the other. By supplying the current with the adjusted phase to the pairs of transmitter coils, a rotating magnetic field will be formed in the charging zone. Table 3 lists the requirements related to the inverter and which are defined in IEC 63245-1.