IEC 63245-1

Edition 1.0 2021-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Spatial wireless power transfer based on multiple magnetic resonances – Part 1: Requirements

Transfert d'énergie sans fil dans l'espace reposant sur des résonances magnétiques multiples – Partie 1: Exigences

IEC 63245-1:2021-03(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 29.240.99; 35.200

ISBN 978-2-8322-9470-3

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SPATIAL WIRELESS POWER TRANSFER BASED ON MULTIPLE MAGNETIC RESONANCES –

Part 1: Requirements

FOREWORD

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

FDIS	Report on voting
100/3548/FDIS	100/3564/RVD

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

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

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.

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

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- withdrawn,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

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INTRODUCTION

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

– IEC 63245-1: *Spatial wireless power transfer based on multiple magnetic resonances – Part 1: Requirements*, which describes requirements of SWPTs with multiple magnetic resonances; and

– IEC 63245-2: *Spatial wireless power transfer based on multiple magnetic resonances – Part 2: Reference model*, which describes a reference model for SWPTs with multiple magnetic resonances.

SPATIAL WIRELESS POWER TRANSFER BASED ON MULTIPLE MAGNETIC RESONANCES –

Part 1: Requirements

1 Scope

This part of IEC 63245 specifies requirements for spatial wireless power transfer based on multiple magnetic resonances (SWPT-MMR), which is a non-radiative wireless power transfer (WPT). This document contains two categories of requirements: general requirements and functional requirements. The general requirements cover charging procedures and charging zones. The functional requirements cover each component of a SWPT-MMR system, such as transmitter coils.

2 Normative references

There are no normative references in this document.

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the following terms and definitions 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
null point
point or area in the charging zone where the magnetic field cancels out almost entirely or is below a certain specified minimum

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

3.1.3
spatial wireless power transfer
concept of wireless power transfer between multiple sources and multiple receiving devices placed at a certain distance in various positions and postures within a 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 the power source and are freely rearranged.

[SOURCE: IEC 62827-3:2016, 3.1.2, modified – In the definition, "receiving devices placed at a certain distance in various positions and postures within a space" replaces "receiving devices 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, 3.1.48]

3.2 Abbreviated terms

2D	two-dimensional
3D	three-dimensional
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

IEC TR 62869 describes types of WPT physical layer technologies. Among the technologies, electromagnetic induction and magnetic resonance technologies are dominantly used in recent industries. The IEC PAS 63095 and WPC Qi series specifies WPT based on electromagnetic induction technology, whereas IEC 63028 specifies WPT based on magnetic resonance technology.

A spatial wireless power transfer (SWPT) system delivers the electronic power to one or more receivers within a spatial space. Figure 1 shows a conceptual image of SWPT described in IEC 62827-3.

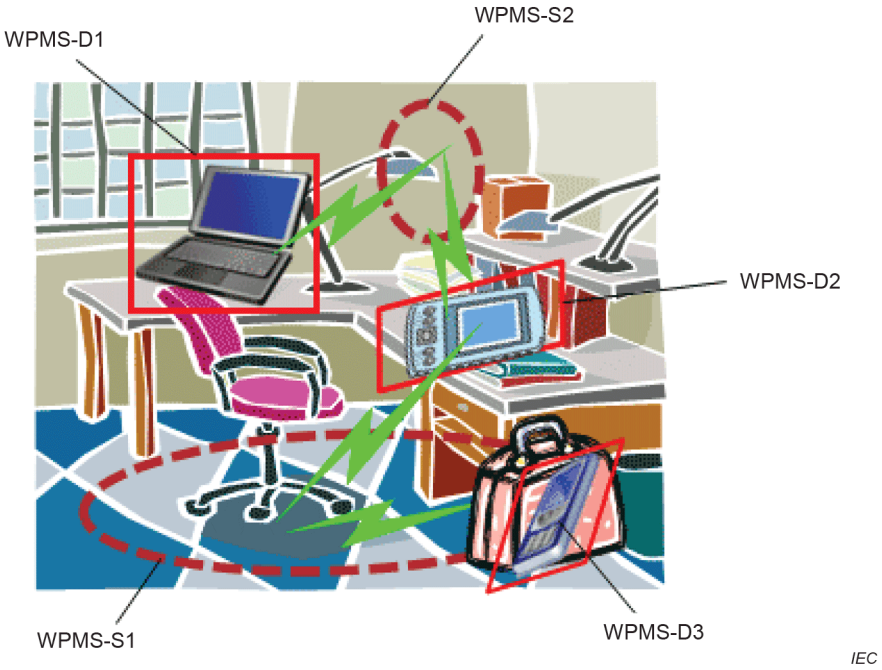


Figure 1 – Conceptual image of SWPT [IEC 62827-3]

Spatial wireless power transfer based on multiple magnetic resonances (SWPT-MMR) is a specific implementation of SWPT. Similar to IEC 63028, SWPT-MMR is based on magnetic resonance. However, SWPT-MMR includes multiple magnetic resonances to generate a charging zone. In the charging zone, electric power is transferred to one or more receivers regardless of the position and direction of the receiver(s). Figure 2 shows a conceptual image of SWPT-MMR. As shown in Figure 2, an SWPT-MMR system generates a charging zone in a specific space with multiple magnetic resonances.

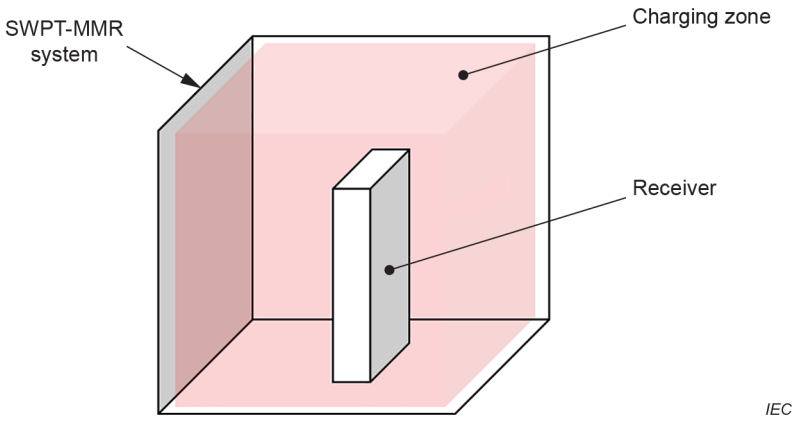


Figure 2 – Conceptual image of SWPT-MMR

5 General requirements

5.1 Requirements on charging zone

5.1.1 Three-dimensional charging zone

An SWPT-MMR system generates a three-dimensional charging zone for SWPT. In the charging zone, the power-receiving device has an increased degree of freedom in a 3D space to expand a range of wireless power transmission in a process of performing wireless charging when compared to a pad structure corresponding to a two-dimensional (2D) area. Figure 3 depicts various positionings of a receiver in a charging zone.

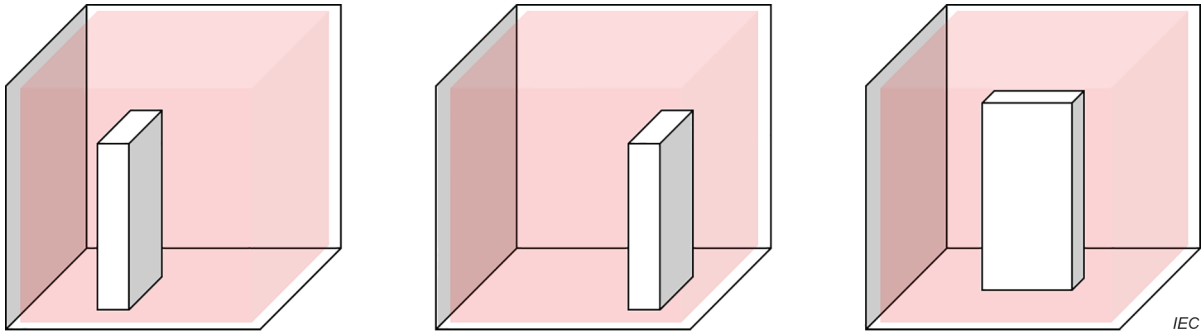


Figure 3 – Free positioning of a receiver in a charging zone

REQ-ZONE1: an SWPT-MMR system shall be capable of generating a 3D charging zone.

5.1.2 Quiet zone

For transferring electric energy to a receiver in any position within a 3D charging zone, energy density in the charging zone shall be equalized corresponding to each of the magnetic fields formed on the transmitting coils. To equalize energy density within the charging zone, at least one pair of transmitter coils are arranged to face each other and they generate a magnetic field by using the current supplied from at least one power source. The 3D space with equalized energy density is referred to as a "quiet zone". Figure 4 and Figure 5 show interaction between transmitter coils for generating a quiet zone. A pair of transmitter coils generates a quiet zone in one direction. To add a quiet zone in another direction, an additional pair of transmitter coils can be arranged.

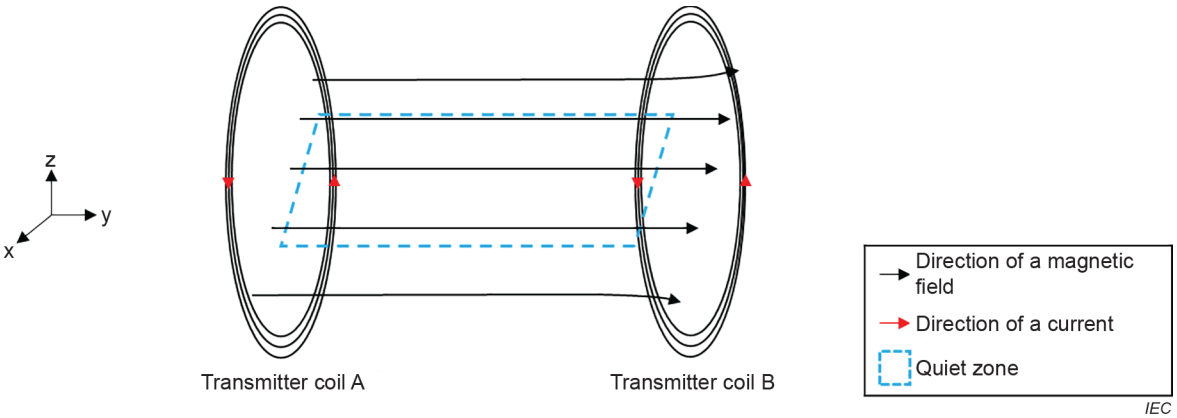
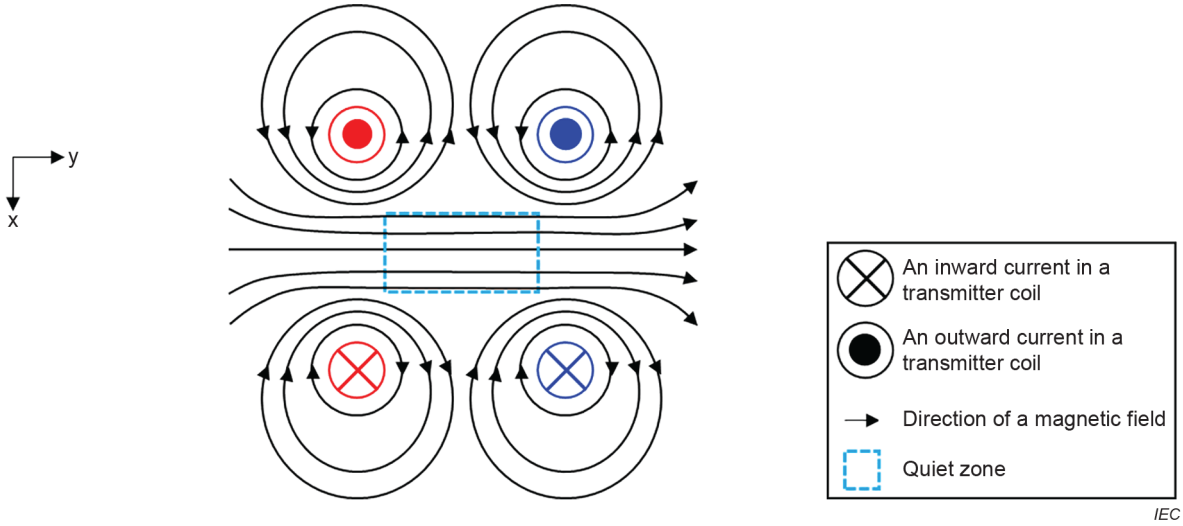


Figure 4 – Interaction between transmitter coils for generating a quiet zone



Inward and outward currents of the same colour belong to the same transmitter coil.

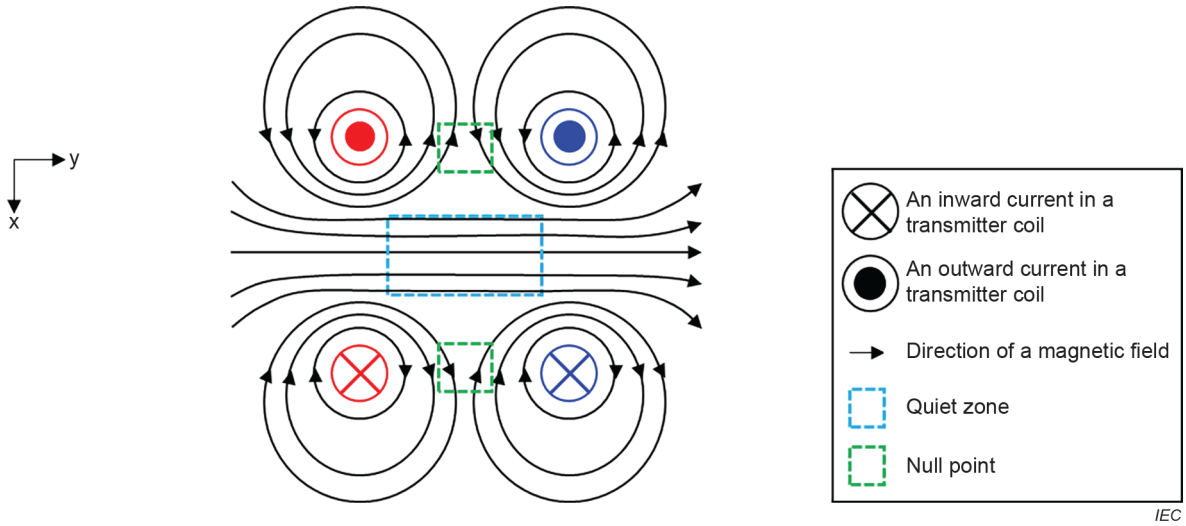
Figure 5 – Interaction between transmitter coils for generating a quiet zone (top view)

REQ-ZONE2: an SWPT-MMR system shall be capable of generating a quiet zone indicating a magnetic field having an equalized energy density in the charging zone.

REQ-ZONE3: an SWPT-MMR system shall be capable of controlling multiple transmitter coils to generate multiple quiet zones.

5.1.3 Null point

In a charging zone, a null point is a point or area where the magnetic field cancels out almost entirely or is below a certain specified minimum. Figure 6 depicts null points in a charging zone.



Inward and outward currents of the same colour belong to the same transmitter coil.

Figure 6 – Null points in a charging zone (top view)